Nevada
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DOE/NV--1102

National Nuclear Security Administration

Well Installation Report for Corrective Action Unit 443, Central Nevada Test Area Nye County, Nevada

Revision No.: 0

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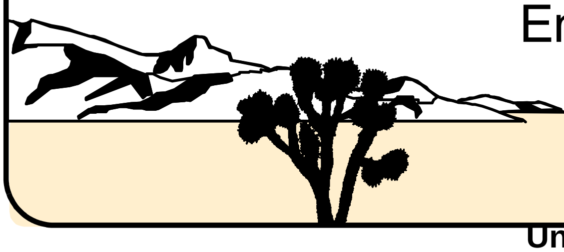

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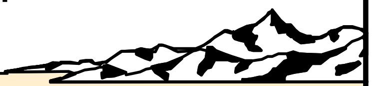

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office

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WELL INSTALLATION REPORT FOR CORRECTIVE ACTION UNIT 443, CENTRAL NEVADA TEST AREA NYE COUNTY, NEVADA

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Las Vegas, Nevada

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WELL INSTALLATION REPORT FOR
CORRECTIVE ACTION UNIT 443,
CENTRAL NEVADA TEST AREA
NYE COUNTY, NEVADA

Approved by: APPROVED SIGNATURE Date: 1/31/2006

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List of Acronyms and Abbreviations

bgs	Below ground surface
BHA	Bottom hole assembly
Br	Bromide
ºC	Degrees Celsius
CaCl	Calcium chloride
CADD	Corrective Action Decision Document
CAI	Corrective Action Investigation
CAP	Corrective Action Plan
CAU	Corrective Action Unit
cm	Centimeter
CNTA	Central Nevada Test Area
CS	Carbon steel
DDA	Data Decision Analysis
DOE	U.S. Department of Energy
DOP	Detailed operating procedure
DRI	Desert Research Institute
EPA	U.S. Environmental Protection Agency
EUE	External upset ends
FFACO	*Federal Facility Agreement and Consent Order*
FMP	Fluid Management Plan
ft	Foot
ft^3	Cubic foot
gal	Gallon
gph	Gallons per hour
gpm	Gallons per minute
HASP	Health and Safety Plan
hr	Hour

List of Acronyms and Abbreviations *(Continued)*

HSU	Hydrostratigraphic unit
id	Inside diameter
ITLV	IT Corporation Las Vegas
km	Kilometer
LiBr	Lithium bromide
m	Meter
mg/L	Milligrams per liter
mi	Mile
mm	Millimeter
mS/cm	Millisiemens per centimeter
MV	Monitoring/validation
N/A	Not applicable
m.y.	Million years
NAIL	Neutron Annular Investigation Log
NDEP	Nevada Division of Environmental Protection
NFD	Nuclear Fluid Density Log
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NPT	National Pipe Threads
od	Outside diameter
pCi/L	Picocuries per liter
PVC	Polyvinyl chloride
QTa	Quaternary and Tertiary alluvium
SNJV	Stoller-Navarro Joint Venture
SQP	Standard quality practice
SSHASP	Site Specific Health and Safety Plan
SU	Standard Unit
Tb	Tertiary Tuff between tuff of Moores Station Butte and tuff of The Needles

List of Acronyms and Abbreviations *(Continued)*

Tbu	Tertiary Tuff of Moores Station Butte
TD	Total depth
TFC	Technical field change
Tsb	Tertiary Tuff of Slanted Butte
Tol	Tertiary Tuff of Orange Lichen Creek
Tvsu	Tertiary volcanic and sedimentary undifferentiated
UGTA	Underground Test Area
USGS	U.S. Geological Survey
yd	Yard

1.0 Introduction

This Well Installation Report is being provided as part of the implementation of the *Corrective Action Decision Document/Corrective Action Plan* (CADD/CAP) *for Corrective Action Unit 443: Central Nevada Test Area-Subsurface, Central Nevada Test Area* (NNSA/NSO, 2004). This CADD/CAP is part of an ongoing U.S. Department of Energy (DOE) funded project for the investigation of Corrective Action Unit (CAU) 443 at the Central Nevada Test Area (CNTA). All work performed on this project was conducted in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) (FFACO, 1996), and all applicable Nevada Division of Environmental Protection (NDEP) policies and regulations. This report summarizes the field data collected by Stoller-Navarro Joint Venture (SNJV) on and between the dates April 8 through October 1, 2005.

The CNTA is located north of U.S. Highway 6, about 29.8 miles (mi) north of Warm Springs, in Hot Creek Valley, Nye County, Nevada. The U.S. Atomic Energy Commission (predecessor agency to the DOE) acquired CNTA to develop alternative sites to the Nevada Test Site for underground nuclear testing. Three emplacement boreholes were drilled at CNTA for nuclear weapons testing. The initial underground nuclear test, Faultless, was conducted on January 19, 1968, in borehole UC-1 at a depth of 3,200 feet (ft) below ground surface (bgs). The yield of the Faultless test was between 200 kilotons and 1 megaton. It was designed to study seismic signals generated by nuclear detonations and to determine the suitability for higher yield explosions in the same area. No further testing was conducted at CNTA, and the site was closed and abandoned in 1974.

1.1 Purpose

A Corrective Action Investigation (CAI) was performed in several stages from 1999 to 2003, as set forth in the *Corrective Action Investigation Plan for the Central Nevada Test Area Subsurface Sites, Corrective Action Unit 443* (DOE/NV, 1999). Groundwater modeling was the primary activity of the CAI. Three phases of modeling were conducted for the Faultless underground nuclear test. The first phase involved the gathering and interpretation of geologic and hydrogeologic data, and inputting the data into a three-dimensional numerical model to depict groundwater flow. The output from the groundwater flow model was used in a transport model to simulate the migration of a radionuclide release (Pohlmann et al., 2000).

The second phase of modeling (known as a Data Decision Analysis [DDA]) occurred after NDEP reviewed the first model. This phase was designed to respond to concerns regarding model uncertainty (Pohll and Mihevc, 2000). The third phase of modeling updated the original flow and transport model to incorporate the uncertainty identified in the DDA, and focused the model domain on the region of interest to the transport predictions. This third phase culminated in the calculation of contaminant boundaries for the site (Pohll et al., 2003).

Corrective action alternatives were evaluated and an alternative was submitted in the *Corrective Action Decision Document/Corrective Action Plan for Corrective Action Unit 443: Central Nevada Test Area-Subsurface* (NNSA/NSO, 2004). Based on the results of this evaluation, the preferred alternative for CAU 443 is Proof-of-Concept and Monitoring with Institutional Controls. This alternative was judged to meet all requirements for the technical components evaluated and will control inadvertent exposure to contaminated groundwater at CAU 443.

1.2 Scope of Work

In support of the proof-of-concept and monitoring decision by the DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO), Environmental Management Program, Offsite Project, three monitoring/validation wells (CNTA MV-1, CNTA MV-2 and CNTA MV-3) were drilled and completed at CNTA. The wells were drilled and completed to collect geologic, geophysical, hydrologic, and geochemical data in support of CNTA CAU 443 activities, as specified in the CNTA CADD/CAP (NNSA/NSO, 2004).

The scope of work for the investigation included:

- Constructing drill pads and fluid storage sumps for drilling fluids.
- Drilling three appropriately sized boreholes to the required depths.
- Installing an upper piezometer to monitor the upper alluvial aquifer.
- Installing a lower piezometer to monitor the lower volcanic aquifer.
- Monitoring drilling effluents for radionuclides.
- Collecting downhole geophysical data.
- Constructing the three wells.
- Developing and testing the wells.
- Monitoring development and testing effluent for radionuclides.
- Documenting well development parameters.

The technical objectives for each investigation well were defined in the *Corrective Action Decision Document/Corrective Action Plan for Corrective Action Unit 443: Central Nevada Test Area-Subsurface* (NNSA/NSO, 2004). The common scientific objectives for the CNTA monitoring/validation wells are summarized as follows:

- Validate Desert Research Institute (DRI) models including contaminant transport predictions, and install monitoring wells and piezometers for compliance issues.
- Provide detailed hydrogeologic information in the vicinity of each well in terms of hydrostratigraphic units (HSUs), geologic structures, and hydraulic properties of the HSUs; specifically, confirm the presence or absence of a densely welded tuff near the final completion depth.
- Provide a completed well that is suitable for aquifer testing to determine hydraulic properties for select HSUs.
- Measure hydraulic head in the HSUs both laterally and vertically around the Faultless test site to confirm downward-directed vertical gradients in the upper alluvial aquifer and northward-directed lateral gradients at the test horizon in the volcanic aquifer to better understand flow direction, hydraulic gradients, and preferential flow paths.
- Obtain representative groundwater samples and analyze for radionuclides.
- Obtain borehole formation samples for detailed lithologic analyses.
- Provide potential long-term monitoring point(s) for the evaluation of temporal changes in hydraulic head (water levels) to evaluate possible contaminant transport flow paths and groundwater chemistry.

The scope of work was accomplished by a team consisting of SNJV (Las Vegas, Nevada), DRI (Las Vegas and Reno, Nevada), Lang Exploratory Drilling (Elko, Nevada, and Salt Lake City, Utah), Schlumberger Well Services (Sacramento and Bakersfield, California), and COLOG Inc. (Golden, Colorado).

1.3 Drill Site and Sump Construction

Three drill pads and a command center were constructed for the installation of the CNTA wells. The individual pads were constructed with sumps, and access roads were constructed for each well site because of the distance between the proposed drilling locations (Figure 1-1). The drill pads were situated on areas of moderate to gently sloping natural terrain composed of alluvial soils covered by sage and wild grasses.

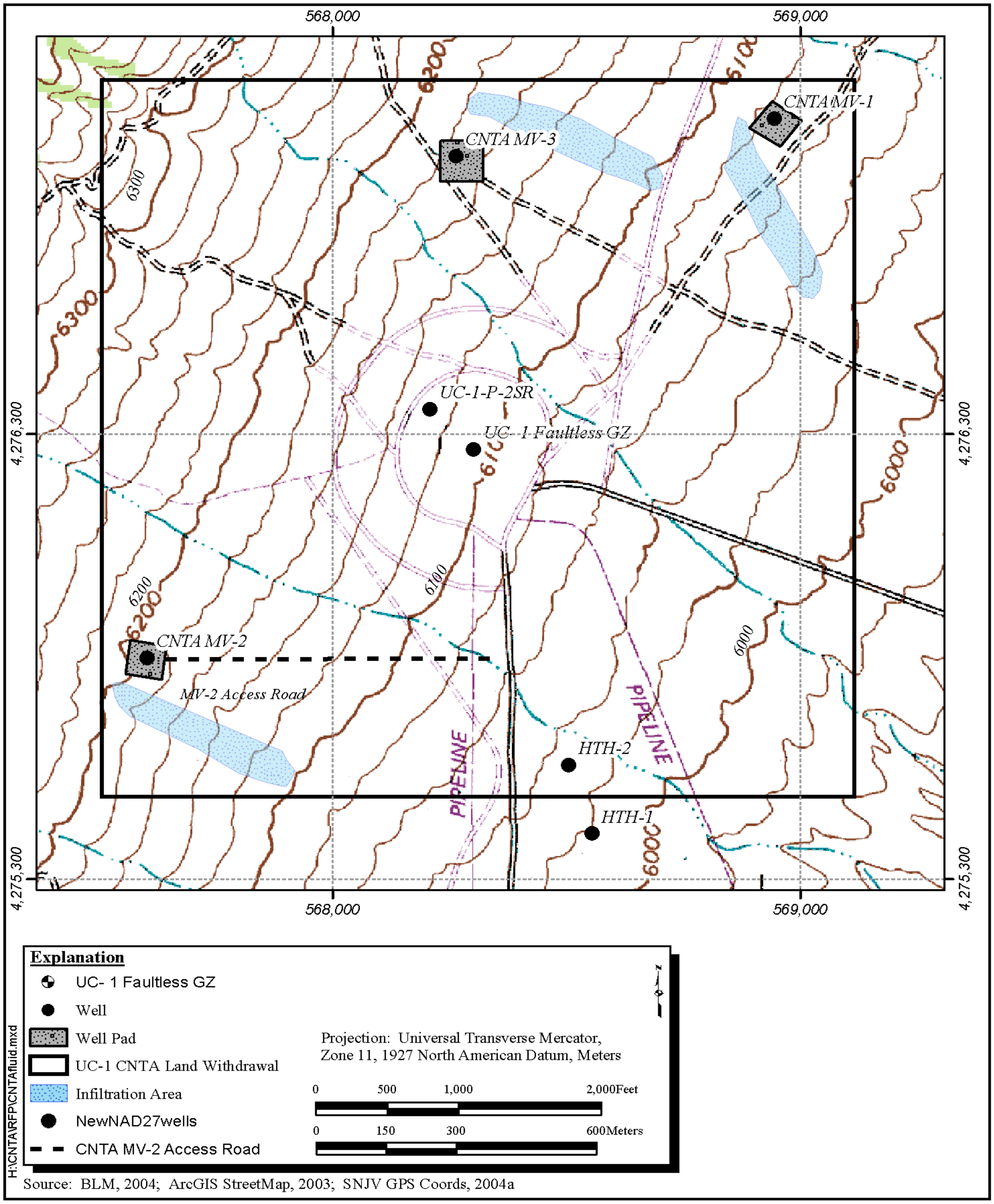
The drill pads were constructed to accommodate all of the expected equipment and materials. Sumps were constructed to be nominally five times the volume of the material displaced from the borehole. The construction of the MV-1 and MV-2 drill pads and sumps took place in September 2004, and the MV-3 drill pad and sump were constructed in June 2005.

All of the pads are approximately 240 ft by 240 ft. Both MV-1 and MV-3 contained one unlined sump approximately 50 ft by 120 ft. MV-2 contained two unlined sumps that were approximately 60 ft by 90 ft. Figure 1-1 shows the well locations at CNTA.

1.4 Summary of Drilling Methods

The location and design of the wells were based on a three-dimensional groundwater flow and transport model developed by DRI. The three wells were located within the original test area of UC-1 Faultless. The boreholes were advanced using the dual-wall flooded reverse circulation drilling method. This drilling technique uses flush-jointed double-wall drill pipe in which the air or drilling fluid moves by reverse circulation. The drilling fluid is run down between the two walls of the dual-wall pipe and only contacts the wall of the borehole near the bit. Dual-wall pipe is frequently set using a top-head drive unit. Down-the-hole air hammers and tri-cone bits can be used to penetrate the formation. Drilling fluids can consist of air, air and water with surfactants, or water with clay or polymers.

At CNTA, the dual-wall flooded reverse circulation drilling method was used. Figure 1-2 shows a schematic of dual-wall flooded reverse circulation drilling. The drilling fluid (air-fluid mix) was injected down the annulus inside the outer pipe wall and outside the inner tube. Cuttings and drilling fluid were returned to the surface via the inner tube of the dual-wall pipe and discharged through a cyclone located above the mud reservoir tank, where the entrained air was dissipated. The cuttings were separated by a shaker screen, and the fine sand, silt, and clay separated by hydro-cyclones. The water based drilling fluid (with the polymer additive Drispac™) was returned from the mud tank to the borehole outside the drill pipe flooding the borehole, aiding in stabilizing the borehole wall.



Source: BLM, 2004; ArcGIS StreetMap, 2003; SNJV GPS Coords, 2004a

Figure 1-1
Central Nevada Test Area Well Location

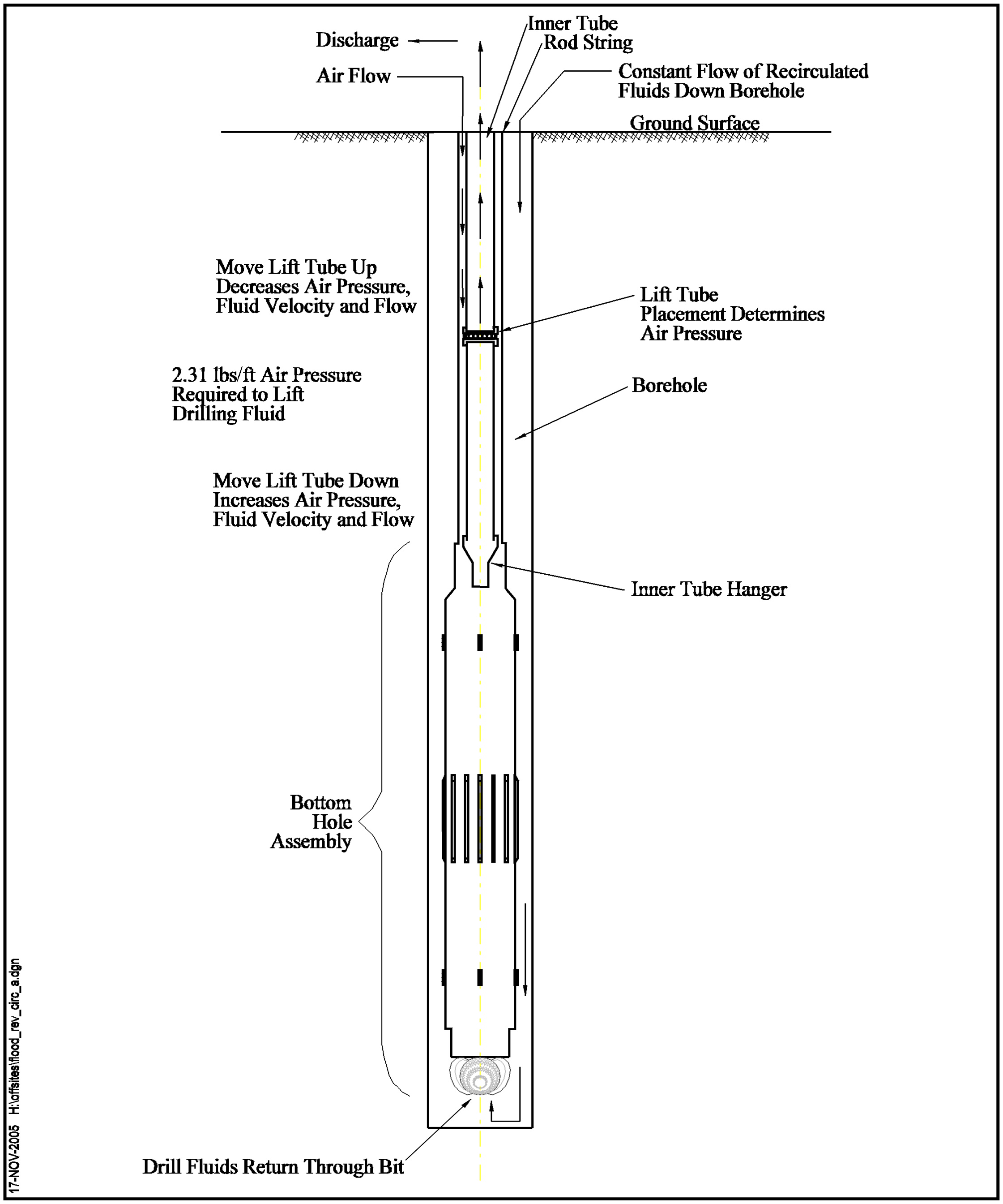


Figure 1-2
A Schematic of Dual-Wall Flooded Reverse Circulation Drilling

A total of 137 days were spent drilling and completing the wells. Operations were conducted 24 hours per day, 7 days a week for the duration of the project.

2.0 Central Nevada Test Area Geology

2.1 Regional Overview

The CNTA is located within the Hot Creek Valley of Northern Nye County, Nevada. The Hot Creek Valley is an elongated graben located east of the Hot Creek Range and west of the Squaw Hills and Halligan Mesa. Hot Creek Valley is filled with as much as 4,200 ft (1,280 meters [m]) of Quaternary and Tertiary alluvium overlying Tertiary volcanic and volcaniclastic rocks (Snyder, 1967). Near CNTA, the Hot Creek Range and the Squaw Mountains are composed of a thick sequence of Tertiary volcanic rocks deposited upon Paleozoic sedimentary rocks. Paleozoic sedimentary rocks crop out in parts of the Hot Creek Range and the Squaw Hills, but volcanic rocks dominate the exposed bedrock geology near CNTA. Surface and subsurface geologic data indicate that CNTA is located within the Hot Creek Valley caldera complex containing several nested volcanic cauldrons. This caldera complex has been disrupted by basin and range-style normal faulting that formed the Hot Creek Valley graben and the Hot Creek Range and Squaw Hills horsts.

The Squaw Hills contain abundant rhyolitic and latitic welded and nonwelded ash-flow tuffs, lava flows, bedded tuffs and ash-fall tuffs, and megabreccias associated with caldera wall collapse. In addition there are modest amounts of tuffaceous sandstone and conglomerate, lacustrine siltstone, mudstone, and limestone. Radiometric ages for the rhyolite tuffs that have been dated in the southern Squaw Hills range from 37.2 million years (m.y.) (+/-) 1.3 to 27.0 m.y. (+/-) 0.8. Exposures of ring faults and megabreccias in the Squaw Hills, and intra-caldera welded tuff thousands of feet thick in the Squaw Hills and the Hot Creek Range indicate the existence of a collapsed caldera in the region surrounding CNTA. This interpretation is supported by drill hole data from within Hot Creek Valley and Big Sand Springs Valley (Ekren et al., 1973). Minor basaltic lava flows overlie the rhyolite tuffs in the southern Squaw Hills. These basaltic lava flows (dated at 10.2 m.y. [+/-] 0.9) postdate the caldera-forming eruptions (Ekren et al., 1973), but predate basin and range-style normal faulting in this area.

The Hot Creek Range contains abundant rhyolitic to dacitic, densely welded tuff thousands of feet thick, smaller amounts of nonwelded to welded ash-flow tuffs and volcaniclastic rocks, and minor amounts of shallow intrusive dikes and plugs (Kleinhampl and Ziony, 1985). The thick, densely welded tuffs form the intra-caldera facies within a caldera formed by the eruption of the Windous Butte Tuff, and the intrusive rocks belonging to the post-caldera lava dome (Quinlivan and Rogers, 1974). The northeast part of the range contains several small-volume, post-caldera ash-flow and ash-fall tuffs. The volcanic rocks overlie Cambrian through Mississippian age limestone, dolomite, and shale in the southern part of the range, and Silurian through Mississippian age limestone and dolomite in the northern part of the range. Ages for the volcanic rocks in the Hot Creek Range that lie closest to CNTA range from 30.0 m.y. to 35.3 m.y. (Kleinhampl and Ziony, 1985; Quinlivan and Rogers, 1974; Ekren et al., 1973).

Eruption of the Windous Butte Tuff before 31.8 m.y. resulted in cauldron subsidence and subsequent cauldron wall collapse that created the megabreccias in the northern part of the Squaw Hills. Eruption of the 31.8-m.y.-old Tuff of Williams Ridge and Morey Peak filled the collapsed caldera with over 6,000 ft (1,830 m) of densely welded tuff, and the intrusive rocks within this formation formed the post-caldera lava dome exposed in the Hot Creek Range. Younger, smaller volume, caldera-forming eruptions occurred within the Windous Butte caldera, possibly related to the eruption of the Hot Creek Tuff. Lakebed deposits formed within this younger caldera before the deposition of the megabreccias associated with caldera wall collapse. The densely welded intra-caldera Tuff of The Needles filled some portion of this newer caldera, then was itself domed up by shallow intrusive rocks. Numerous smaller-volume ash-flow and ash-fall tuffs were erupted within the caldera, including (from oldest to youngest) the Tuff of Moores Station, Tuffaceous rocks of Slanted Buttes, the Tuff of Orange Lichen Creek, and the Tuff of Shingle Pass. Intercalated within this sequence of tuffs are epiclastic and volcaniclastic sedimentary rocks.

The valley-fill deposits in Hot Creek Valley reflect the way in which the Hot Creek graben became filled with regolith eroded from the adjacent mountains. The basin and range-style faulting that created the Hot Creek graben exposed the youngest volcanic rocks in the adjacent fault-block mountain ranges to erosion first. As erosion wore down the Hot Creek Range and Squaw Hills, progressively older volcanic strata were exposed to erosion and transport of the resultant detritus into the Hot Creek graben. Only during the Late Tertiary and Quaternary time did Paleozoic formations become exposed to erosion, thus adding their component to the valley-fill deposits. In this way progressively younger Hot Creek Valley deposits become dominated by fragments of progressively older rocks. These alluvial deposits lie upon preserved younger volcanic and volcaniclastic strata that have long ago disappeared from the adjacent mountain ranges. Formation of the Hot Creek graben was punctuated by seismic events that resulted in the sudden formation of steep fault scarps along range front faults adjacent to the valley. With each scarp-forming seismic event, a new local erosional gradient was established, resulting in local thickening of coarse alluvial deposits that vary laterally over short distances. Numerous boreholes drilled in the valley-fill alluvium and volcanic strata of Hot Creek have confirmed these observations.

Detailed lithologic descriptions were obtained and reviewed for drill holes UC-1 and HTH-1. These drill holes are located near CNTA MV-1, CNTA MV-2, and CNTA MV-3. The valley-fill deposits in UC-1 and HTH-1 consist of poorly sorted volcanic rock fragments and sparse Paleozoic chert, carbonate, and siltstone rock fragments within a matrix of sand-sized crystals and clay. The rock fragments are rounded to subrounded and range in size from pebbles to boulders. These valley-fill deposits range in age from Late Tertiary to Early Quaternary near the bottom of the alluvial section, up to Late Quaternary to Holocene near the top. The upper 500 to 1,000 ft (152 to 305 m) of alluvium is unconsolidated to poorly consolidated. The degree of induration of the alluvium increases downward.

Typically the volcanic strata encountered in drill holes beneath the alluvium are dominated by younger, coarse-grained epiclastic rocks, reworked tuffaceous rocks, and thin, nonwelded tuffs. These include conglomerates and conglomeratic sandstones similar in texture, grain size, and composition to the overlying alluvium, but containing altered volcanic ash. The conglomerates are interstratified with reworked, bedded ash-fall tuffs, tuffaceous sandstones and siltstones, and zeolitized nonwelded ash-flow tuffs. The younger volcanic and volcaniclastic rocks encountered in the upper Tertiary section of these older drill holes are not observed in the volcanic formations exposed in the adjacent Squaw Hills and Hot Creek Range because they have long since been removed by erosion. Densely welded tuffs were not identified in the older drill holes at CNTA, with the exception of drill hole HTH-1. This drill hole identified approximately 80 ft (24 m) of densely welded tuff near the top of the volcanic section. Unfortunately, the lithologic description from these older drill holes was usually insufficient to identify the volcanic formation to which the tuff belongs (Hoover, 1968a). However, in drill hole UCE-17 located approximately 3 mi (5 kilometers [km]) north of ground zero (UC-1), the Tuff of Orange Lichen Creek, the Tuff of Moores Station Butte, the Tuff of Needles, the Biotite Tuff of The Needles area, and the Tuff of Hot Creek Canyon, as defined by Ekren et al. (1973), were identified (Hoover, 1968b). In UCE-20, located approximately 3 mi (5 km) south of ground zero (UC-1), only the Tuff of Moores Station Butte and the Tuff of Needles were identified (Hoover, 1968c).

Detailed geologic surface mapping shows numerous northeast-striking normal faults in the Quaternary and younger Tertiary alluvium in Hot Creek Valley (Figure 2-1) near Halligan Mesa, and in Big Sand Springs Valley east of the Squaw Hills (Ekren et al., 1973). This same faulting pattern is observed in the older Tertiary volcanic rocks of Halligan Mesa. The same northeast orientation is observed in the alignment of craters, cinder cones, and fissure vents in the Lunar Crater Volcanic field, a Quaternary-age volcanic field approximately 15 mi (25 km) east and southeast of CNTA (Scott and Trask, 1971). This faulting pattern represents the latest episode of crustal deformation in the greater Hot Creek Valley and Big Sand Springs Valley area.

The Faultless test triggered numerous small earthquakes and aftershocks that resulted in surface subsidence and surface rupture along pre-existing faults, strike-slip movement along previously unknown subsurface faults, and induced seismic activity as far away as 24 mi (40 km). The Faultless test created a subsidence graben elongated to the northeast and parallel to numerous pre-existing faults in the Quaternary-age valley-fill deposits (Figure 2-1). The graben is bounded by curved faults on the southeast, south, southwest, and northwest sides, with an apparent hinge line at the northeastern end of the graben (Ekren et al., 1973). Maximum subsidence at the time of the test was 14.8 ft (4.4 m). Some of the bounding faults are calculated to dip 77 degrees to the north, based on fault intercepts in post-test drill holes and post-test map data. High-speed photography revealed that subsidence occurred immediately following the test, indicating that subsidence resulted from the immediate release of tectonic stress that was triggered by the underground test, and not from test cavity collapse (McKeown et al., 1968; McKeown and Dickey, 1969). Collapse chimneys typically extend 4 to 6 cavity radii above the working point, whereas the Faultless test occurred at a depth estimated to be about 10 cavity radii below the surface (Glasstone and Dolan, 1977). Analysis of post-test seismic data indicates that minor strike-slip movement occurred along a buried north-striking fault in Moores Station Wash 2 to 4 mi (3.2 to 6.4 km) south of the Faultless test (Ekren et al., 1973).

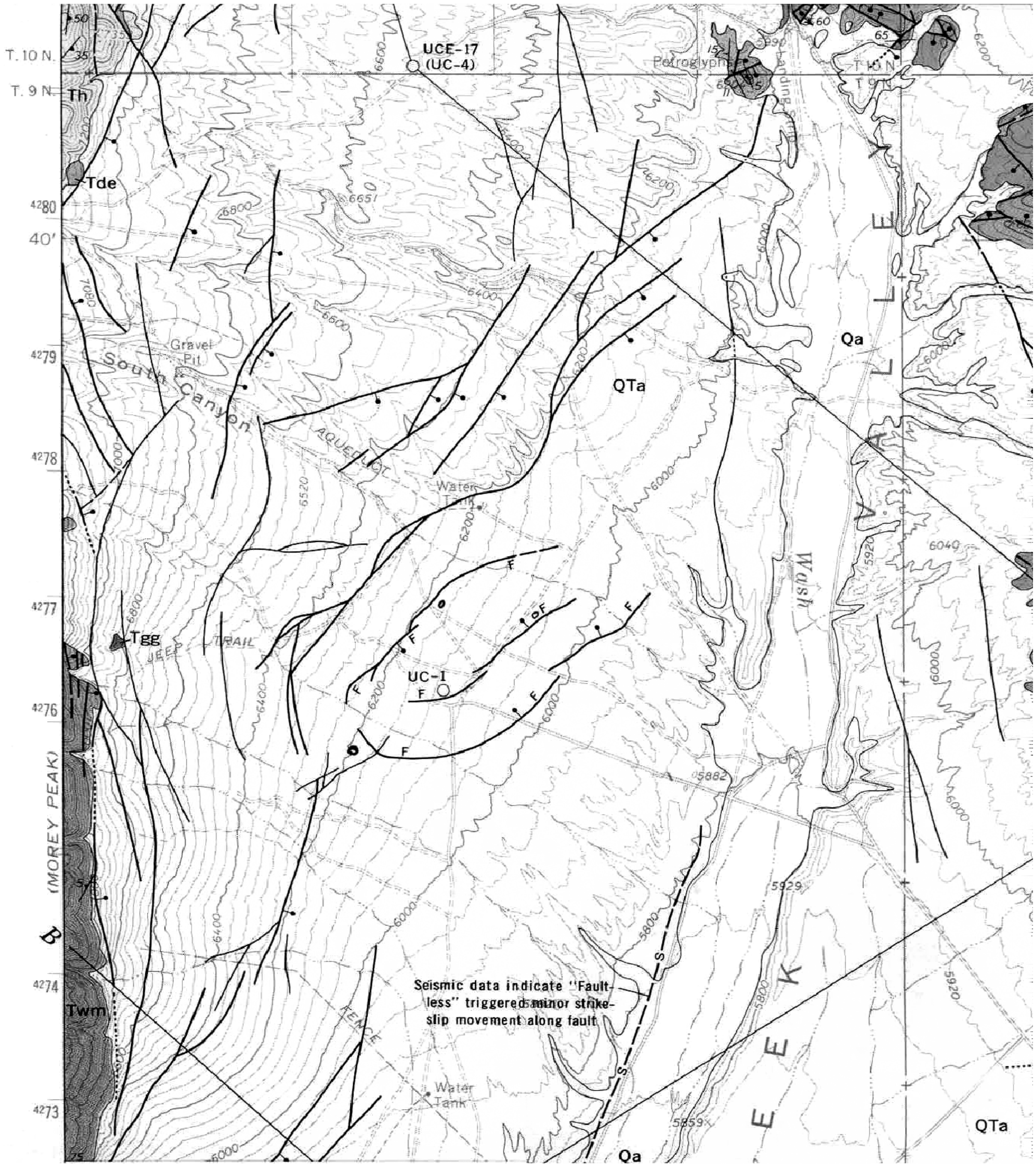


Figure 2-1
A Portion of Moores Station Geologic Quadrangle

This portion shows both the Quaternary-age faults in Hot Creek Valley, and the faults defining the collapse graben that resulted from the Faultless test (Ekren et al., 1973).

2.2 Volcanic Lithologic Sequence

The lithologic description of the volcanic and volcaniclastic stratigraphic units presented here for drill holes MV-1, MV-2, and MV-3 is based primarily on unit descriptions published on the Geologic Map of the Moores Station Quadrangle, Nye County, Nevada (Ekren et al., 1973). Drill cuttings from these boreholes were compared to hand samples collected from surface bedrock exposures of the volcanic formations mapped on the Moores Station Quadrangle. Contacts between these volcanic formations were compared in the three drill holes to their respective down-hole geophysical logs.

The Tertiary Tuff of Orange Lichen Creek (Tol) crops out northwest, northeast, east, and southeast of CNTA (Ekren et al., 1973), and is identified and described in drill hole UCE-17 2.7 mi north of MV-1 (Hoover, 1968b). This particular tuff is quite distinctive in surface exposures, with phenocryst content ranging from 30 to 40 percent, and ranging in size up to 4 millimeters (mm). In the CNTA drill holes, Tol is not observed at all in MV-2 or MV-3, but is tentatively identified in MV-1. Here, Tol is moderately welded and looks similar to the thin, moderately to densely welded tuff mapped as Tol in the Slanted Buttes area east of CNTA, and at Petroglyph Butte north of CNTA.

Tuffs associated with the tuffaceous rocks of Slanted Butte (Tsb) (Ekren et al., 1973) also crop out northwest, northeast, east, and southeast of CNTA. These rocks were accurately described in their proper stratigraphic position in drill hole UCE-17 (Hoover, 1968b), although they were not specifically identified as unit Tsb in that well report. Some of the tuffs within unit Tsb are observed and unambiguously identified in MV-1, MV-2, and MV-3. However, most of the lacustrine siltstones and mudstones, the volcaniclastic conglomerates, and the epiclastic sandstones observed in surface exposures 3 mi northeast and east of MV-1 are conspicuous by their absence in the drill hole cuttings from MV-1, MV-2, and MV-3.

In surface exposures, the Tertiary Tuff of Moores Station Butte (Tbu) typically contains a lower, slope-forming, nonwelded to partly welded tuff capped by an upper, resistant, densely welded tuff. In Jumbled Rock Canyon several miles northeast of CNTA the lower nonwelded part of Tbu manifests local, laterally restricted zones of increased welding and/or induration, whereas at Moores Station Butte the lower portion is homogeneously nonwelded. The welding characteristics observed in the lower portion of Tbu in MV-1, MV-2, and MV-3 is more similar to the surface exposures in Jumbled Rock Canyon in that there are local zones of partly welded tuff within the lower nonwelded interval of Tbu. However, the most significant change observed within these drill holes is the preservation of a second nonwelded to partly welded portion of Tbu that exists on top of the densely welded zone. This upper nonwelded tuff is not observed in the surface exposures around Moores Station Butte, where the tops of the buttes are formed by the erosionally resistant densely welded tuff. Presumably, this upper nonwelded tuff was eroded from those buttes subsequent to eruption and deposition of the overlying rocks of unit Tsb, whereas the easily eroded upper nonwelded tuff was preserved within the subsided fault blocks of the caldera at CNTA.

The tuff between the tuff of Moores Station Butte and the Tuff of The Needles (Tb) is described as containing two simple cooling units, based on the surface exposures on the Moores Station Quadrangle (Ekren et al., 1973). However, in drill hole MV-2, this unit contains three cooling units composed of a thick moderately to densely welded tuff enveloped top and bottom by nonwelded to partly welded tuff. This welding pattern is observed in the drill cuttings as well as in the geophysical logs, where the welded tuffs exhibit a characteristic increase in resistivity.

2.2.1 MV-1 Lithology

QTa (Quaternary and Tertiary alluvium)

<u>0 – 2352:</u> This section is composed of an upper interval dominated by alluvium and a lower portion dominated by reworked volcanic rocks. All color callouts in lithology descriptions are from the Munsell Color Chart (Munsell, 1990). The alluvium, moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6), consists of boulders, cobbles, and gravel composed predominantly of light to dark gray, and reddish brown rhyolite, with subordinate dark gray to black limestone and dolomite, and tan and dark gray siltstone, in a matrix of sand, silt, and clay. Concentrations of lithic clasts vary, with silty and clayey layers interbedded with sandy layers and beds of gravel, cobbles, and boulders. The reworked volcanic rocks, pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6), consists of clasts of argillically altered nonwelded tuff, partly welded tuff, and densely welded tuff in a matrix of clay to coarse sand; and conglomerates composed of subrounded fragments of welded tuff.

QTa/Tvsu contact (2352): This contact is based on the clast size and lithic content above the contact, and the appearance of a mono-lithologic sample of argillically altered, nonwelded tuff, grayish orange (10YR 7/4) to very light gray (N8), that contains 20 to 25 percent phenocrysts of feldspar, quartz, and prominent biotite just below the contact. On the geophysical logs there is a negative spike in the neutron porosity log at the contact with a commensurate spike in the gamma ray log.

Tvsu (Tertiary volcanic and sedimentary rocks, undifferentiated).

<u>2352 – 2950:</u> This section is composed of tuff and reworked tuff that have no lateral counterparts exposed in the surrounding hills and mountains, interbedded tuffaceous sandstone and conglomerate, and lacustrine siltstone and mudstone. This section includes the following lithologies:

- ***Conglomerate:*** yellowish gray (5Y 7/2); subangular to subrounded pebbles as large as 4 centimeters (cm) of light gray to gray, and pale yellowish orange rhyolite in a matrix of fine- to coarse-grained, subangular to subrounded sand and argillically altered ash.

- ***Reworked Tuff:*** grayish orange (10YR 7/4) to pale yellowish brown (10YR 6/2); as much as 35 percent quartz, feldspar, and biotite crystals and argillically altered volcanic ash; locally zeolitized; locally contains lithic fragments of rhyolite as large as 15 mm.

- ***Volcaniclastic sandstone:*** very pale orange (10R 8/2) to grayish orange (10YR 7/4); poor to well sorted, fine to very coarse grain, angular to subrounded quartz and feldspar crystals and rock fragments.

- ***Ash-flow Tuff:*** pale yellowish brown (10YR 6/2) to grayish orange (10YR 7/4), very light gray (N8); nonwelded to moderately welded; locally argillically altered; phenocrysts content varies from tuff to tuff, from 10 to 30 percent of quartz, sanidine, plagioclase, and biotite; locally contains rhyolitic lithic fragments as large as 8 mm.

- ***Ash-fall tuff:*** light gray (N7) to medium gray (N6), light greenish gray (5GY 8/1); nonwelded, very well sorted with no lithic fragments, with zeolitic and argillic alteration; phenocrysts equal 5 to 6 percent feldspar, biotite, and quartz.

Tvsu/Tol contact (2950): This contact is not as distinctive in the cuttings as many of the other contacts. The tuff below this contact is fairly uniform in phenocryst content and color, whereas there appears to be greater variability in the volcanic lithologies above this contact.

However, this contact is tentative, owing to the subtle nature of the changes observed. The geophysical logs show an increase in neutron porosity, and a decrease in density at the contact.

Tol (Tertiary Tuff of Orange Lichen Creek)

2950 – 3005: Ash-flow tuff; yellowish gray (5Y 7/2) to pale red (5R 6/2); nonwelded to moderately welded, devitrified, with zeolitic and argillic alteration; phenocrysts equal 20 percent, quartz, sanidine, plagioclase, and biotite; lithic fragments less than 5 percent, medium gray to black rock fragments. The moderately welded rocks in this interval are very similar in their phenocryst content and lithic content to the welded portion of this unit in surface exposures at Petroglyph Butte north of CNTA. In contrast, both the percent of phenocrysts and the size of the phenocrysts observed in MV-1 appear to be smaller than that observed in surface exposures of the nonwelded tuff of Tol at Orange Lichen Creek. However, the nonwelded to partly welded tuffs of Tol in MV-1 were pervasively altered, whereas the surface exposures were unaltered.

2955 – 3005: Nonwelded to moderately welded tuff.

Tol/Tsb contact (3005): This contact is also not as distinctive in the cuttings as many of the other contacts. The tuffs on either side of the contact are fairly uniform in phenocryst content, with a subtle diminishing of phenocryst content from Tol to Tsb at the contact. Additionally, there is greater color variability in Tsb below the contact than in Tol above the contact. The geophysical logs show conspicuous spikes or peaks at the contact, and may be related to a void or fracture as shown by the caliper log.

Tsb (Tertiary tuffaceous rocks of Slanted Butte)

3005 – 3140: Ash-flow tuff; grayish red (5R 5/2) to pale reddish brown (10R 5/4) to reddish brown (10R 4/4), very light gray (N8) to light gray (N7); nonwelded to partly welded, devitrified, with extensive argillic alteration and minor zeolitic alteration; phenocrysts equal 15 to 30 percent, plagioclase, sanidine, quartz, and biotite, with phenocrysts ranging in size from less than 1 to 2 mm; locally contains light gray to dark gray and black lithic fragments as large as 3 mm; locally contains minor white, zeolitically altered pumice clasts. Ash-fall tuff; light gray (N7); nonwelded, ash-rich, extensive argillic alteration with some local zeolitic alteration; phenocrysts equal 10 plagioclase, sanidine, locally contains quartz, plus or minus minor biotite, ranging in size from less than 1 to 2 mm. Surface exposures of unit Tsb northeast of the CNTA drill holes exhibit more lacustrine, volcaniclastic rocks and rhyolite-pebble conglomerates than are present in the subsurface within these drill holes. However, the phenocryst content and lithic content of the Tsb nonwelded tuffs exposed at Petroglyph Butte a few km north-northeast of CNTA matches that seen in this unit in MV-1.

<u>3005 – 3050:</u> Altered nonwelded to partly welded tuff.

<u>3050 – 3060:</u> Pale reddish-brown partly welded tuff.

<u>3060 – 3114:</u> Altered nonwelded tuff.

<u>3114 – 3130:</u> Argillically altered ash-fall tuff.

<u>3130 – 3140:</u> Nonwelded tuff.

> **Tsb/Tbu contact (3140):** There is an abrupt color change at this contact, with light gray (N7) Tsb overlying grayish orange pink (10YR 8/2) Tbu. There is a significant change in the geophysical logs. Above the contact all of the logs show a much higher signal-to-noise ratio than is displayed below the contact. Additionally, the signal for the neutron porosity is lower below the contact, density is uniformly higher (positive shift), and there is a large spike in the gamma ray log.

Tbu (Tertiary Tuff of Moores Station Butte)

<u>3140 – 4088:</u> Ash-flow tuff; very light gray (N8) to grayish pink (5R 8/2) to pinkish gray (5YR 8/1), pale yellowish brown (10YR 6/2); nonwelded to densely welded, devitrified, with locally pervasive argillic alteration; phenocrysts equal 20 to 32 percent, quartz, sanidine, plagioclase, and biotite, with phenocrysts ranging in size from 1 to 3 mm (phenocrysts increase in size downward through this tuff); locally some white, altered pumice; distinctive reddish brown siltstone, light gray chert, and light to dark gray rhyolite xenoliths throughout this tuff (size and number of xenoliths increases downward), as well as a distinctive mustard yellow chert associated with the base of the densely welded tuff. Here, Tbu comprises three distinct zones based on welding characteristics, as phenocryst

content, pumice content, and lithic content is fairly uniform throughout this formation. The upper portion of Tbu is nonwelded to partly welded, the middle portion is moderately to densely welded, and the lower portion is partly welded. This contrasts to surface exposures of Tbu around Moores Station Butte in that the upper nonwelded to partly welded portion has been removed by erosion, and only the middle densely welded portion and the lower partly welded portion have been preserved in the surface exposures.

3140 – 3680: Nonwelded tuff.

3680 – 3770: Partly welded tuff.

3770 – 3812: Moderately welded tuff.

3812 – 3888: Densely welded tuff.

3888 – 4088: Partly welded tuff.

> **Tbu/Tb contact (4088):** The contact is at the top of the dark gray (N3) argillically altered ash bed. The phenocryst content above this altered ash is consistently like that of Tbu, whereas the phenocryst content below the altered ash is consistently higher, similar to the phenocryst content in hand samples of unit Tb collected in the vicinity of The Needles about 5 km east of MV-1. There is no geophysical data for this contact because the contact is too close to the bottom of the hole to be detected by the instrument as it was configured for the logging run.

Tb (Tertiary tuff between tuff of Moores Station Butte and tuff of The Needles)

4088 – 4100 (TD): Ash-flow tuff; very light gray (N8) to light gray (N7); nonwelded, argillically altered; phenocrysts equal 30 to 35 percent, feldspar, quartz, and biotite; lithic clasts of welded tuff, as large as 1 cm. This unit is capped by a thin, dark gray (N3) clay layer that looks like an altered ash-fall deposit.

2.2.2 MV-2 Lithology

QTa (Quaternary and Tertiary alluvium)

0 – 1960: This section is composed of an upper interval dominated by alluvium and a lower portion dominated by reworked volcanic rocks. The alluvium, moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6), consists of boulders, cobbles, and gravel composed predominantly of light to dark gray, and reddish brown rhyolite, with subordinate dark gray to black limestone and dolomite, and tan and dark gray siltstone, in a matrix of sand, silt, and clay. Concentrations of lithic clasts vary, with silty and clayey layers interbedded with sandy layers and beds of gravel, cobbles, and boulders. The reworked volcanic rocks, pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6), consists of clasts of argillically altered nonwelded tuff, partly welded tuff, and densely welded tuff in a matrix of clay to coarse sand; and conglomerates composed of subrounded fragments of welded tuff.

> **QTa/Tvsu contact (1960):** This contact is based on a very heterogeneous mixture of lithologies and clast sizes above the contact, and the appearance of a mono-lithologic sample of grayish orange (10YR 7/4), argillically altered, nonwelded and possibly reworked tuff, that contains numerous darker gray lithic clasts. The degree of argillic alteration makes it difficult to determine phenocryst content, but it is estimated to be less than 20 percent. Below this contact samples remain consistently more mono-lithologic than the samples above it. There is nothing distinctive about the contact on the geophysical logs, and this contact is based solely on the drill cuttings.

Tvsu (Tertiary volcanic and sedimentary rocks, undifferentiated).

1960 – 2632: This section is composed of tuff and reworked tuff that have no lateral counterparts exposed in the surrounding hills and mountains, interbedded tuffaceous sandstone and conglomerate, and lacustrine siltstone and mudstone. This section includes the following lithologies:

- ***Ash-flow Tuff:*** pale red (5R 6/2), pale yellowish orange (10YR 8/6), grayish orange pink (5YR 7/2), pale brown (5YR 5/2); nonwelded to partly welded, and moderately to densely welded; varying amounts of phenocrysts ranging from 15 to 35 percent (varies from tuff to tuff) of quartz, sanidine, plagioclase, and biotite; locally contains small white altered pumice clasts.

- ***Reworked Tuff:*** grayish orange (10YR 7/4); quartz and feldspar phenocrysts and white, altered pumice clasts in a matrix of argillically altered volcanic ash.

- ***Volcaniclastic sandstone:*** grayish orange (10YR 7/4); poorly sorted, fine to coarse grain, angular to subangular quartz and feldspar crystals and rock fragments in a clay-rich matrix.

- ***Lacustrine Mudstone:*** grayish orange (10YR 7/4); well sorted mudstone and siltstone, locally laminated.

- ***Siltstone:*** pale yellowish gray (5Y 8/2), well sorted, subrounded silt.

Tvsu/Tsb contact (2632): This contact is not as distinctive in the cuttings as many of the other contacts. The tuff below this contact is fairly uniform in phenocryst content, though it varies in color, whereas there appears to be greater variability in the volcanic lithologies above this contact. However, this contact is tentative, owing to the subtle nature of the changes observed. The geophysical logs are characterized by a higher signal-to-noise ratio (or positive shifts) in the neutron porosity log above this contact relative to the lower signal-to-noise ratio (or negative shifts) below it.

Tsb (Tertiary tuffaceous rocks of Slanted Butte)

<u>2632 – 2824:</u> Ash-flow tuff; grayish orange pink (5YR 7/2) to very pale orange (10YR 8/2), grayish orange (10YR 7/4) to pale red (5R 6/2); partly to moderately welded and devitrified, and nonwelded with argillic alteration; phenocrysts equal 15 to 25 percent, plagioclase, sanidine, quartz, and biotite, with phenocrysts ranging in size from less than 1 to 2 mm.

<u>2632 – 2700:</u> Partly welded tuff.

<u>2700 – 2710:</u> Nonwelded tuff.

<u>2710 – 2760:</u> Partly welded tuff.

<u>2760 – 2798:</u> Partly to moderately welded tuff.

<u>2798 – 2804:</u> Nonwelded tuff.

<u>2804 – 2824:</u> Partly welded tuff.

Tsb/Tbu contact (2824): This contact is quite subtle in MV-2, and locating it was assisted by using the geophysical logs. The tuff above this contact in MV-2 appears similar to hand samples of the nonwelded to partly welded tuff of unit Tsb exposed at Petroglyph Butte northeast of CNTA. This contact shows up quite well on the geophysical logs. There is a notable negative shift in the density log and a corresponding positive shift in the neutron porosity signal for Tbu at the contact. Additionally, the resistivity curve has a notable negative shift.

Tbu (Tertiary Tuff of Moores Station Butte)

2824 – 3287: Ash-flow tuff; very light gray (N8) to yellowish gray (5R 7/2), light brownish gray (5YR 6/1) to very pale red (5R 7/2); nonwelded to densely welded, devitrified with some local argillic alteration; phenocrysts equal 22 to 32 percent, quartz, sanidine, plagioclase, and biotite, with phenocrysts ranging in size from 1 to 3 mm; some white, devitrified and/or altered pumice; minor xenoliths of light gray (N7) chert, moderate reddish brown (10R 4/6) siltstone, and light to dark gray rhyolite. The geophysical logs display a much higher resistivity for the densely welded tuff from 3046 to 3200.

2824 – 3046: Nonwelded to partly welded tuff.

3046 – 3200: Densely welded tuff.

3200 – 3287: Nonwelded to partly welded tuff.

> **Tbu/Tb contact (3287):** The contact is below a distinctive grayish orange (10YR 7/4) nonwelded tuff. This tuff has a phenocryst content similar to that of the rest of the overlying Tbu. Below this tuff the phenocryst content changes abruptly, with an increase in the amount of biotite and a distinctive decrease in the size of feldspar crystals below the contact. In MV-2 Tbu contains larger feldspar phenocrysts and less biotite than Tb. The geophysical logs are fairly non descript for this contact pick with the lithologic descriptions more definitive.

Tb (Tertiary tuff between tuff of Moores Station Butte and tuff of Needles)

3287 – 3660 (TD): Ash-flow tuff; grayish orange pink (5YR 7/2)to grayish orange (10YR 7/4), pale red (10R 6/2), and very pale orange (10YR 8/2); nonwelded to densely welded; devitrified, minor argillic alteration; phenocrysts equal 28 to 35 percent, quartz, sanidine, plagioclase, biotite; minor very light gray (N8) to white altered pumice clasts up to 5 mm; characteristic black mudstone and dark brown chert lithic fragments. Ekren et al. (1973) describe Tb as containing two simple cooling units, but geophysical logs and well cuttings from MV-2 indicate that three simple cooling units are present here.

3287 – 3290: Nonwelded to partly welded tuff.

3290 – 3420: Moderately welded tuff.

3420 – 3428: Nonwelded to partly welded tuff.

3428 – 3495: Moderately welded tuff.

3495 – 3508: Nonwelded to partly welded tuff.

3508 – 3600: Partly to moderately welded tuff.

3600 – 3660: Partly welded tuff.

2.2.3 MV-3 Lithology

QTa (Quaternary and Tertiary alluvium)

0 – 2410: This section is composed of an upper interval dominated by alluvium and a lower portion dominated by reworked volcanic rocks. The alluvium, moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6), consists of boulders, cobbles, and gravel composed predominantly of light to dark gray, and reddish brown rhyolite, with subordinate dark gray to black limestone and dolomite, and tan and dark gray siltstone, in a matrix of sand, silt, and clay. Concentrations of lithic clasts vary, with silty and clayey layers interbedded with sandy layers and beds of gravel, cobbles, and boulders. The reworked volcanic rocks, pale yellowish brown (10YR 6/2) to moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6), consists of clasts of argillically altered nonwelded tuff, partly welded tuff, and densely welded tuff in a matrix of clay to coarse sand; and conglomerates composed of subrounded fragments of welded tuff.

QTa/Tvsu contact (2410): This contact is based on the heterogeneity of lithic type and clast size above the contact, and the appearance of a mono-lithologic sample of argillically altered, nonwelded tuff, grayish orange (10YR 7/4) to very light gray (N8), that contains about 18 percent phenocrysts of feldspar, quartz, and biotite just below the contact. The QTa/Tvsu contact in MV-3 looks very similar to this contact in MV-1. There is very little that is distinctive about this contact on the geophysical logs. The contact is based primarily on the drill cuttings.

Tvsu (Tertiary volcanic and sedimentary rocks, undifferentiated).

<u>2410 – 3540:</u> This section is composed of tuff and reworked tuff that have no lateral counterparts exposed in the surrounding hills and mountains, interbedded tuffaceous sandstone and conglomerate, and lacustrine siltstone and mudstone. This section includes the following lithologies:

- ***Conglomerate:*** yellowish gray (5Y 7/2); subangular to subrounded pebbles as large as 4 cm of light gray to gray, and pale yellowish orange rhyolite in a matrix of fine- to coarse-grained, subangular to subrounded sand and argillically altered ash.

- ***Reworked Tuff:*** grayish orange (10YR 7/4) to pale yellowish brown (10TR 6/2); as much as 35 percent quartz, feldspar, and biotite crystals and argillically altered volcanic ash; locally zeolitized; locally contains lithic fragments of rhyolite as large as 15 mm.

- ***Volcaniclastic sandstone:*** very pale orange (10R 8/2) to grayish orange (10YR 7/4); poor to well sorted, fine to very coarse grain, angular to subrounded quartz and feldspar crystals and rock fragments.

- ***Ash-flow Tuff:*** pale yellowish brown (10YR 6/2) to grayish orange (10YR 7/4), very light gray (N8); nonwelded; locally argillically altered; phenocrysts content varies from tuff to tuff, from 10 to 30 percent of quartz, sanidine, plagioclase, and biotite; locally contains rhyolitic lithic fragments as large as 8 mm.

- ***Ash-fall tuff:*** light gray (N7) to medium gray (N6), light greenish gray (5GY 8/1); nonwelded, very well sorted with no lithic fragments, with zeolitic and argillic alteration; phenocrysts equal 5 to 6 percent feldspar, biotite, and quartz.

Tvsu/Tsb contact (3540): This contact is not as distinctive in the cuttings as many of the other contacts. The tuff below this contact is fairly uniform in phenocryst content, though it varies in color, whereas there appears to be greater variability in the volcanic lithologies above this contact. However, this contact is tentative, owing to the subtle nature of the changes observed. There are no distinctive changes on the geophysical logs at this contact either, although a subtle increase in the uranium/thorium ratio is noted.

Tsb (Tertiary tuffaceous rocks of Slanted Butte)

3540 – 3690: Ash-flow tuff; grayish orange (10YR 7/4) to light brown (5YR 5/6) to yellowish gray (5Y 8/1); nonwelded to moderately welded, devitrified, with local argillic alteration and minor zeolitic alteration; phenocrysts equal 20 to 28 percent, plagioclase, sanidine, quartz, and biotite, with phenocryst size equal to or smaller than 1 mm; locally contains gray and reddish brown lithic fragments as large as 3 mm; locally contains minor white, zeolitically altered pumice clasts. Surface exposures of unit Tsb located northeast of the CNTA drill holes exhibit more lacustrine mudstone and siltstone, volcaniclastic sandstone, and rhyolite-pebble conglomerates than are present in the subsurface within these drill holes. However, the phenocryst content and lithic content of the Tsb nonwelded tuffs exposed at Petroglyph Butte a few km north-northeast of CNTA matches that seen in this unit in MV-3.

3540 – 3550: Moderately welded tuff.

3550 – 3615: Nonwelded to partly welded tuff.

3615 – 3635: Altered partly welded tuff.

3635 – 3670: Altered nonwelded tuff.

3670 – 3690: Altered light gray nonwelded tuff.

Tsb/Tbu contact (3690): There is an abrupt color change at this contact, with light gray (N7) Tsb overlying grayish orange pink (10YR 8/2) Tbu. This contact looks nearly identical in MV-3 to the way it looks in MV-1. This contact shows up quite well on the geophysical logs. There is a notable spike and shift in the resistivity curve, a notable uniformity in the density as well a notable corresponding uniformity and shift in the sonic and porosity logs for Tbu at the contact.

Tbu (Tertiary Tuff of Moores Station Butte)

<u>3690 – 4200:</u> Ash-flow tuff; very light gray (N8) to light gray (N7) to grayish pink (5R 8/2) to pinkish gray (5YR 8/1), pale yellowish brown (10YR 6/2); nonwelded to densely welded, devitrified, with locally pervasive argillic alteration; phenocrysts equal 20 to 32 percent, quartz, sanidine, plagioclase, and biotite, with phenocrysts ranging in size from 1 to 3 mm (phenocrysts increase in size downward through this tuff); locally some white, altered pumice; distinct reddish brown siltstone, light gray chert, and light to dark gray rhyolite xenoliths throughout this tuff (size and number of xenoliths increases downward), as well as distinctive mustard yellow chert associated with the base of the densely welded tuff. Here, Tbu comprises three distinct zones based on welding characteristics, as phenocryst content, pumice content, and lithic content is fairly uniform throughout this formation. The upper portion of Tbu is nonwelded to partly welded, the middle portion is moderately to densely welded, and the lower portion is partly welded. This contrasts to surface exposures of Tbu around Moores Station Butte in that the upper nonwelded to partly welded portion has been removed by erosion, and only the middle densely welded portion and the lower partly welded portion have been preserved. The Tbu sequence in MV-3 looks very similar to the Tbu sequence in MV-1, except that MV-3 contains a 20 ft thick, moderate pink (5R 7/4) to grayish orange pink (10R 8/2) colored tuff in the bottom of the formation. However, phenocryst content and lithic content remain the same.

<u>3690 – 4050:</u> Nonwelded to partly welded tuff.

<u>4050 – 4150:</u> Densely welded tuff.

<u>4150 – 4200:</u> Partly welded tuff.

> **Tbu/Tb contact (4200)**: The contact is at the top of the dark gray (N3) argillically altered ash bed. The phenocryst content above this altered ash is consistent with that of Tbu, whereas the phenocryst content below the altered ash is consistently higher, similar to the phenocryst content in hand samples of unit Tb collected in the vicinity of The Needles about 6 km east of MV-3. There is no geophysical data for this contact because the contact is too close to the bottom of the hole to be detected by the instrument as it was configured for the logging run.

Tb (Tertiary tuff between tuff of Moores Station Butte and tuff of The Needles)

4200 – 4220 (TD): Ash-flow tuff; very light gray (N8) to light gray (N7); nonwelded, argillically altered; phenocrysts equal 30 to 35 percent, feldspar, quartz, and biotite; lithic clasts of welded tuff, as large as 1 cm. This unit is capped by a thin, dark gray (N3) clay layer that looks like an altered ash-fall deposit.

3.0 Central Nevada Test Area MV-1 Summary of Operations

Central Nevada Test Area MV-1, the first of three monitoring wells constructed under CAU 443, 2005 Offsites program, was drilled and completed to approximately 4,102 ft bgs, approximately 3,000 ft northeast of the UC-1 Faultless test (ground zero). Figure 1-1 shows the location of MV-1 and ground zero and Table A.1-1 in Appendix A gives the exact coordinates of the well. MV-1 was constructed with multiple casing sets: a surface casing set to 95 ft bgs, a 20-in. intermediate casing set to 1,050 ft bgs, a 13 3/8-in. intermediate casing set to 2,500 ft bgs, and the final well string. Drilling began April 9, 2005, and was completed to a total depth (TD) of 4,102 ft bgs on May 14, 2005, using a dual-tube flooded reverse circulation drilling method. The final well completion of CNTA MV-1 included an internal-coated epoxy 5-in. inside diameter (id) carbon-steel well casing. This final string of casing contains approximately 160 ft of 0.078-in. slotted screen installed to a depth of 3,954 ft bgs, including the sump. The 5-in. slotted casing interval was set at 3,750 ft to 3,909 ft bgs. See Figure 3-1 and Table B.1-9 and Table B.1-10 for well construction details.

Final completion also included both an upper and a lower piezometer string. The upper piezometer was set at 959 ft bgs (including a sump) with the slotted interval from 879 to 939 ft bgs. The lower piezometer was set at 3,082 ft bgs (including a sump) with the slotted interval from 3,002 ft to 3,062 ft bgs. All the slotted intervals were completed with graded filter packs in the borehole annulus. Well construction details are provided in the CNTA MV-1 Well Construction Diagram (Figure 3-1). Figure A.1-1 shows the layout of the well from the ground surface.

Construction completion occurred May 22, 2005, when the 5.5-in. outside diameter (od) main well casing was cemented to the surface. A total of 43 days were spent drilling and constructing the well. Table B.1-1 in Appendix B illustrates the chronology of MV-1 operations.

Initial well development of the main well string consisted of conventional airlifting using the LM 300 drill rig in downward progressive stages to the top of the screened interval. Well development started May 23, 2005, and continued for 34.75 hours. A second phase of airlift development was conducted August 19 and 20, 2005, using an 1100 CFM compressor attached to a constructed wellhead using HQ and AQ tremie pipe (refer to Figure 3-2 for a schematic on dual-tube airlifting).

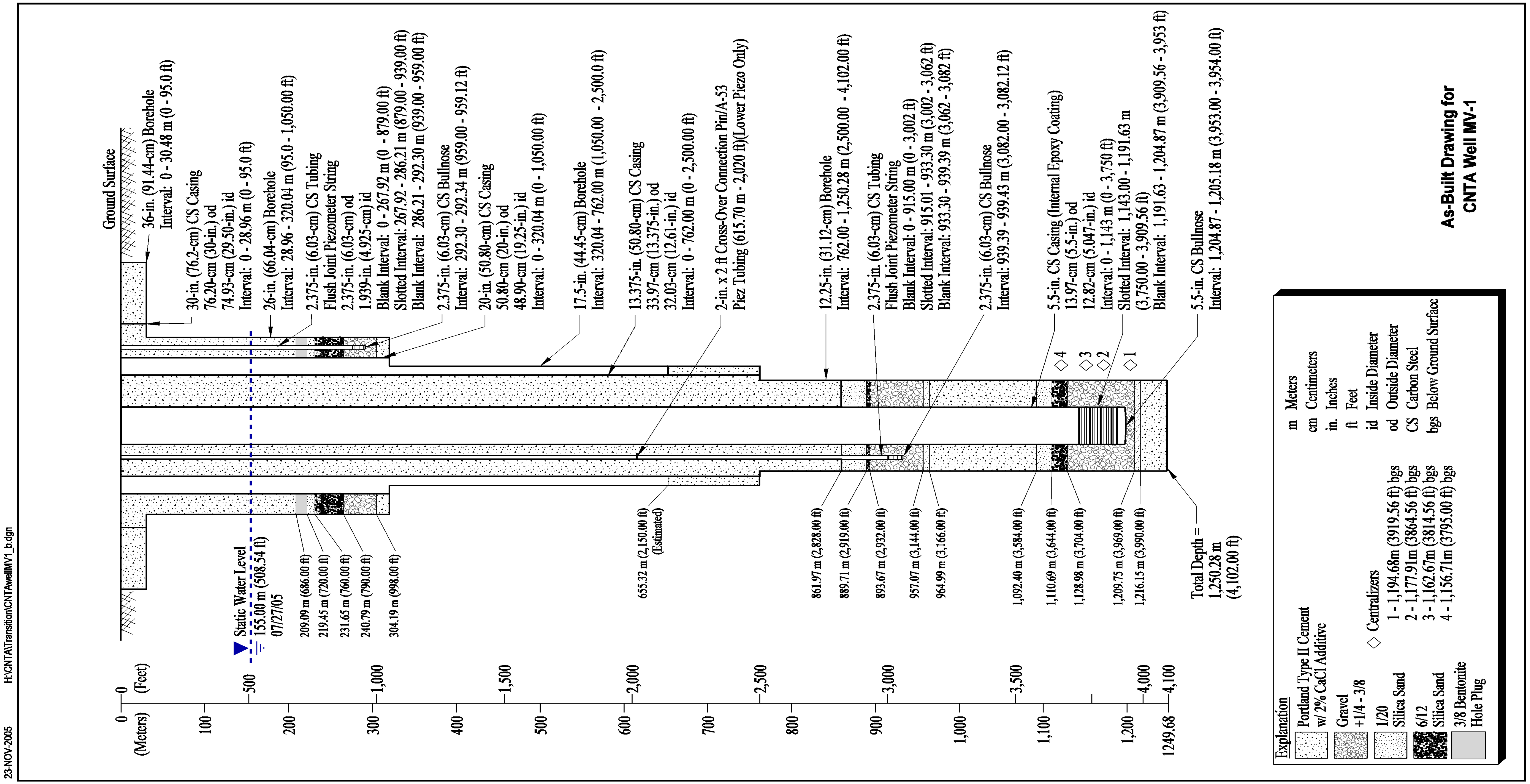


Figure 3-1
As-Built Drawing for CNTA Well MV-1

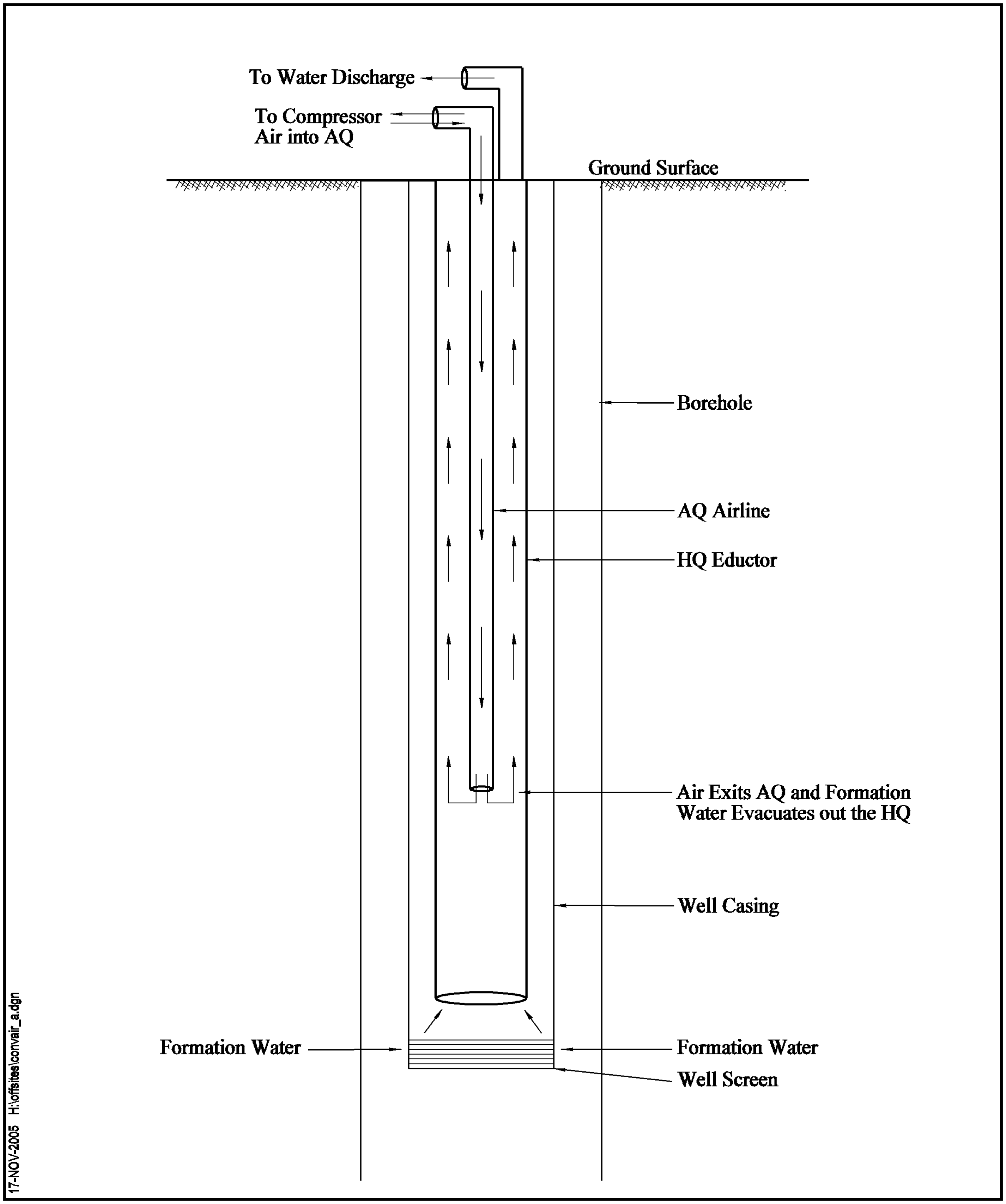


Figure 3-2
A Schematic of Dual-Tube Airlifting

A Grundfos 10S50-58DS pump was set on September 29, 2005. The top of the pump was placed at 3,714.5 ft below the wellhead using reduced diameter discharge (1-in. id) external upset ends (EUE) riser pipe. The intake was set at 3,719.15 ft. Functional pump testing and well evacuation of storage capacity occurred September 30 and October 1, 2005. Further development occurred October 12 and 19, 2005, and will continue throughout the next few months until the DOE accepts parameter criteria for well development. A 1.25-in. water access tube was installed to a depth of approximately 1,750 ft below the wellhead for discharge and recovery data monitoring.

3.1 Well Construction

Drilling of CNTA well MV-1 began on April 9, 2005. The drilling began by advancing a 36-in. diameter borehole to a depth of 95 ft bgs. This portion of the borehole was advanced using conventional mud rotary with Quik-Gel ™ (bentonite mud) added to the drilling fluid with a tricone over-reamer bit. A 30-in. diameter carbon-steel surface casing was set for surface seal and wellhead control. The 30-in. casing was cemented in place to the surface with Portland Type II cement with a 2 percent calcium chloride (CaCl) additive.

Dual-tube flooded reverse circulation drilling began at 160 ft bgs. A 26-in. diameter borehole was drilled to approximately 1,050 ft bgs using a carbide tricone bit. This portion of the borehole was completed with a 20-in. diameter, carbon-steel intermediate casing to a depth of 1,050 ft bgs. An upper piezometer was constructed April 18, 2005, between the 20-in. casing and the borehole annulus. The upper piezometer was constructed with a sump to a depth of 959 ft bgs and had a 60-ft slotted interval, with the bottom of the screen at approximately 939 ft bgs. All stemming materials (graded filter pack) were gravity fed through a tremie with the cement seal emplaced by pumping to the surface. The depths of the stemming materials for the upper piezometer were tagged with a tremie and wireline. Construction of the upper piezometer was completed April 21, 2005.

Upon completion of the upper piezometer a 17.5-in. diameter borehole was then drilled to approximately 2,500 ft bgs with a carbide tricone bit. The second intermediate casing, a 13 3/8-in. diameter carbon-steel casing was then installed and anchored in place with Portland Type II cement with 2 percent CaCl additive. The casing set used approximately 48 yards (yd) of cement, anchoring the casing approximately 790 ft up the borehole.

The completion of the borehole to total depth consisted of drilling a 12 1/4-in. diameter borehole from approximately 2,500 ft bgs to the final depth of 4,102 ft bgs using both carbide and steel-tooth tricone bits. The main well construction consisted of 5.5-in. od internally epoxy coated carbon-steel casing. The screened interval consisted of approximately 160 ft of 0.078-in. slotted casing from 3,750 to 3,909 ft bgs. A sump was installed below the screened/slotted interval that consisted of 45 ft of blank casing and end cap. Centralizers were placed around the 5.5-in. od main well casing at approximately 3,919 ft bgs, 3,864 ft bgs, 3,814 ft bgs, and 3,795 ft bgs. These centralizers were secured in place to ensure proper annulus space for stemming materials within the borehole annulus and well casing. A bottom cement seal was emplaced from TD to near the bottom of the main well string filter pack.

The lower piezometer was installed without centralizers to a depth of 3,082 ft bgs with a screened interval from 3,002 to 3,062 ft bgs. A graded filter pack was constructed around the screened intervals of the main well and lower piezometer (see Figure 3-1 for well construction details). A cement seal was emplaced between the main well filter pack and the lower piezometer filter pack to ensure integrity of monitoring data. Figure 3-3 provides a diagram of the MV-1 well construction details

Stemming materials for MV-1 included a bottom seal of Portland Type II cement with a 2 percent CaCl additive, 1/4 x 3/8-in. clean gravel around the main well slotted interval, 1/20 clean silica sand, 6/12 clean silica sand, and another cement seal. The Portland Type II cement seal also contained 2 percent CaCl additive. All stemming materials were pump fed into the borehole annulus through a BQ tremie pipe, which was raised in stages to help ensure proper placement of material without plugging or bridging. The depths of the stemming material for the main well screen and lower piezometer were determined by a real-time nuclear annular investigation log (NAIL), conducted by Schlumberger Well Services. Figure 3-3 provides a summary of material volumes placed in the MV-1 borehole.

Several complications developed during the emplacement of the stemming materials:

- The 1/4 x 3/8-in. gravel was a size problem in the upper piezometer screen interval while being gravity fed due to size constraints of the borehole annulus and the size of the tremie used to feed the gravel pack.

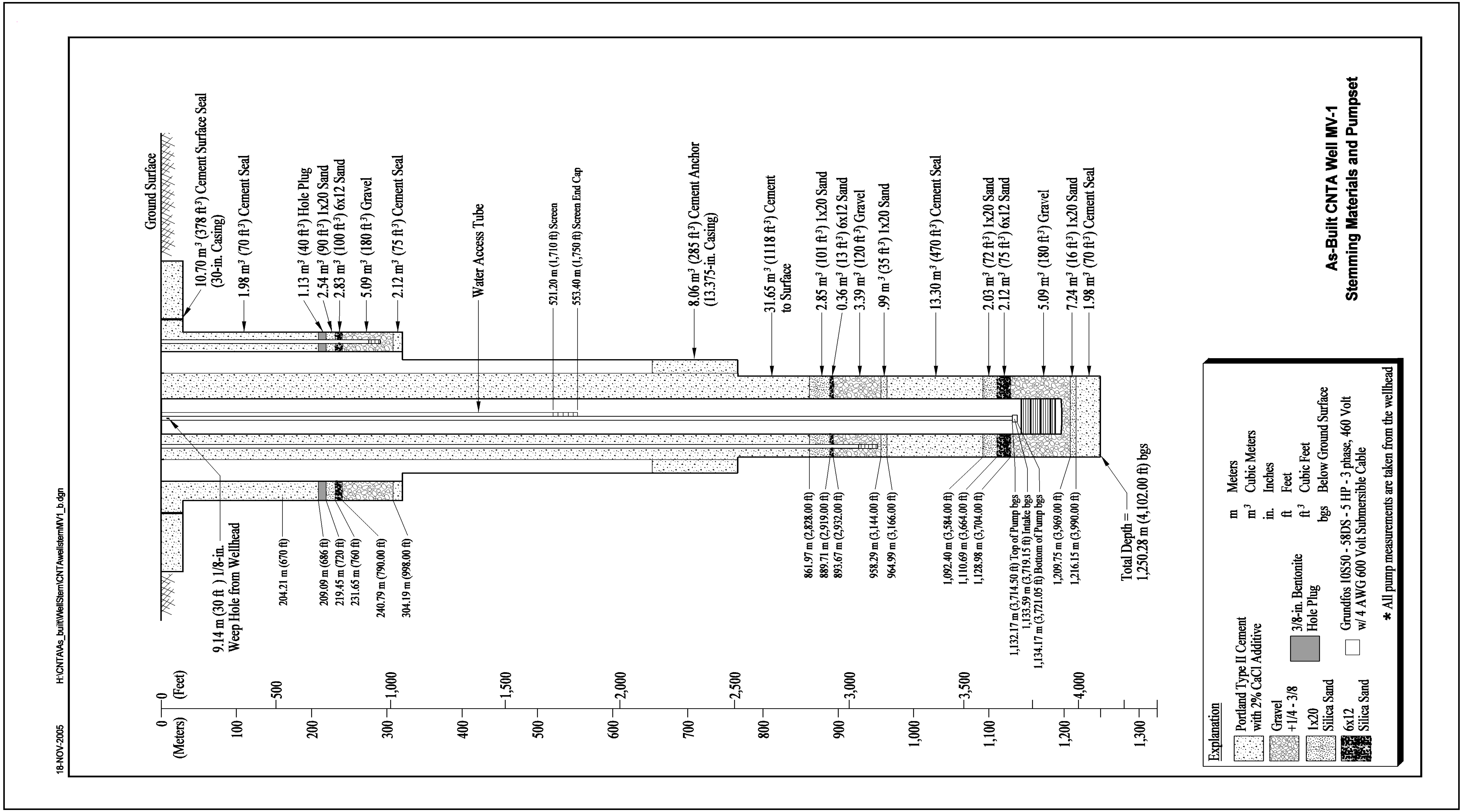


Figure 3-3
As-Built CNTA Well MV-1 Stemming Materials and Pump Set

- The 1 x 20 clean silica sand used to cap screen filter packs and cement seals had inadequate density to properly sink through the more viscous drilling fluid and remained in suspension during well construction. This created depth tagging problems and eventually construction problems, the 1 x 20 sand infiltrated the slotted screen intervals. Also, the increased viscosity of the sandy fluid made the cement slow to settle and difficult to tag.

- Two bridges were present on Schlumberger's Nuclear Fluid Density (NFD) log; one at 828 ft and the other consisted of a cave-in of natural fill for 42 ft at 1,078 ft. The bridges occurred due to size constriction complications while emplacing the stemming materials. The decision was made by DOE, DRI, and SNJV to pump the stemming materials rather than gravity feed during emplacement. It is assumed that borehole instability was the cause of the cave-in, the actual cause is unknown.

3.2 Geophysical Surveys

Geophysical surveys were conducted during the advancement of the CNTA MV-1 borehole in four phases using the subcontractor Schlumberger. Logging suites were collected from the surface to approximately 1,050 ft bgs during the first phase in the 26-in. diameter borehole. The first phase of logging was completed April 15, 2005. Geophysical logging data were acquired from 1,050 ft bgs to approximately 2,500 ft bgs in the 17.5-in diameter borehole during the second phase with logging completed May 4, 2005. The third phase of logging occurred on May 15, 2005, from TD of the well to approximately 2,500 ft bgs. The first three geophysical logging suites consisted of temperature, density, caliper, resistivity (long and short normal), spontaneous potential, neutron porosity, sonic porosity, spectral gamma, natural gamma, and magnetic deviation.

The borehole deviation survey, conducted in the open borehole, indicated the bottom of the borehole had deviated less than three degrees from vertical in a northeast direction. The borehole deviation survey placed the bottom of the borehole 65 ft northeast of the collar and resulted in a true vertical depth of 4,101.5 ft bgs. Figure 3-4 provides a plot of the deviation of CNTA MV-1.

The fourth phase of geophysical logging consisted of an NFD log that was performed on May 19, 2005. The NFD log was used for real-time tagging of stemming material emplacement, while the main well and lower piezometer filter packs and cement seal were being constructed.

Table B.1-2 in Appendix B provides a summary of the geophysical data collected for CNTA MV-1. Figures B.1-1 through B.1-4 in Appendix B provide a condensed version of the geophysical signatures for CNTA MV-1.

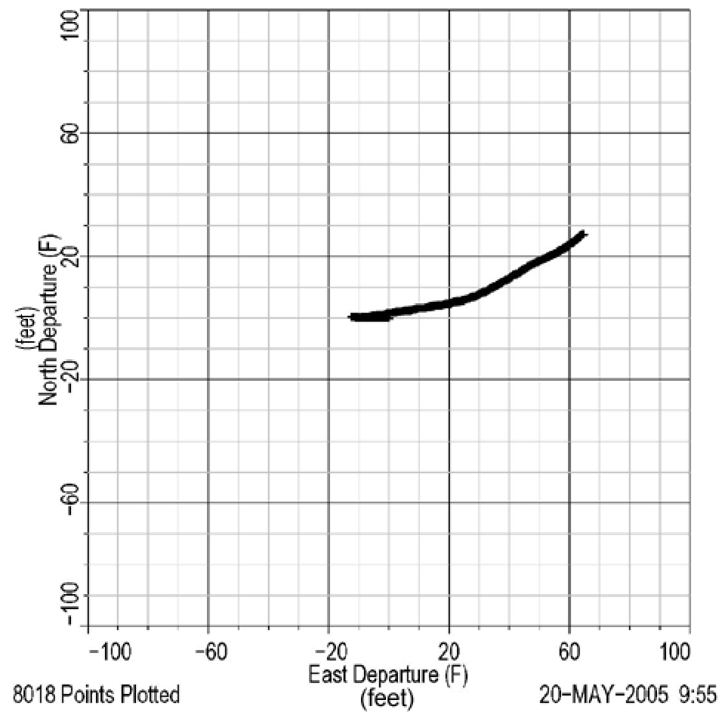


Figure 3-4
Deviation Plot of CNTA MV-1 from 2,500 ft to Total Depth

3.3 Sampling

Drill cutting samples were collected under the direction of the Field Sampling Plan (Detailed Operating Procedure [DOP] ITLV-UGTA-318, "Cuttings Sample Collection, Handling, and Oversight," [IT, 1993a]) from the shaker screen every 10 ft throughout the drilling operation. An aggregate or composite of samples from each 10 ft interval of cuttings during borehole advancement were placed into three separate pint-size ice cream-type cartons. The samples, with chain-of-custody protocol, established under Standard Quality Practice (SQP) ITLV-0402, "Chain of Custody" (IT, 1993b), were sent to the U.S. Geological Survey (USGS) Core Library in Mercury, Nevada. Two samples were to be washed and archived; one was archived as received. A small portion of the cuttings were washed and placed in a chip tray at the drill site. The chip tray cuttings were briefly described at the time of collection and were described in further detail using an optical light microscope. The grain size, mineralogy, alteration, color, degree of welding, and other notable characteristics were documented according to DOP ITLV-UGTA-304, "Geologic Description of Cuttings and Core" (IT, 1993a).

A lithium bromide (LiBr) tracer was added to the drilling fluids via frac tank or water truck. All drilling fluid was recirculated through the mud reservoir. Lithium bromide spiking was also maintained and added to the makeup fluids during all well construction. Typical bromide (Br) concentrations of makeup water were maintained between 20 and 40 milligrams per liter (mg/L) in each truckload of water obtained from the HTH-2 production well. The proposed purpose of introducing a tracer into the drilling fluid and makeup water was to:

- Assist in detection of the perched water zones.
- Determine the static groundwater table during drilling.
- Establish groundwater production during drilling.
- Provide a monitoring parameter to establish the effectiveness of well development.

Fluid samples for Br analysis were collected from the discharge line in the drilling fluid mix tank at the shaker screen. The samples were analyzed using an Orion 290A ion-specific meter. Collection of these samples occurred every three hours during borehole advancement and three times per 12-hour shift during airlifting. The samples were analyzed on a continuous basis throughout the entire MV-1 field campaign. The Br concentrations in the discharge fluid ranged from 5.79 to 102 mg/L during drilling operations and 1 to 88.8 mg/L during airlifting activities (Figure 3-5). A Br concentration of 1,700 mg/L was detected during the airlifting of MV-1 on May 23, 2005. This concentration, however, appears to be an anomaly and was not plotted on Figure 3-5. Refer to Appendix B, Tables B.1-3 through B.1-5, and Figure 3-5 for Br data of MV-1 throughout the drilling and airlifting operation.

Factors affecting water quality, including pH, temperature, and conductivity were also measured during drilling and airlifting operations. Fluid samples for water quality analysis were collected from the discharge line and were analyzed using a YSI-63 water quality meter Hydrolab multiprobe (see Appendix B, Tables B.1-6 through B.1-8). Only one water quality sample was taken from MV-1 as no instruments were available on the site during the initial phase of the drilling operation. Nineteen water quality samples were collected in the upper piezometer. The pH values for acidity or alkalinity ranged between 7.96 and 10.8; the temperature ranged between 18.60 and 24.90 degrees Celsius (ºC). Conductivity (an indicator of total dissolved solids) ranged between 0.1 and 0.9 millisiemens per centimeter (mS/cm). Ten water quality samples were collected for the lower

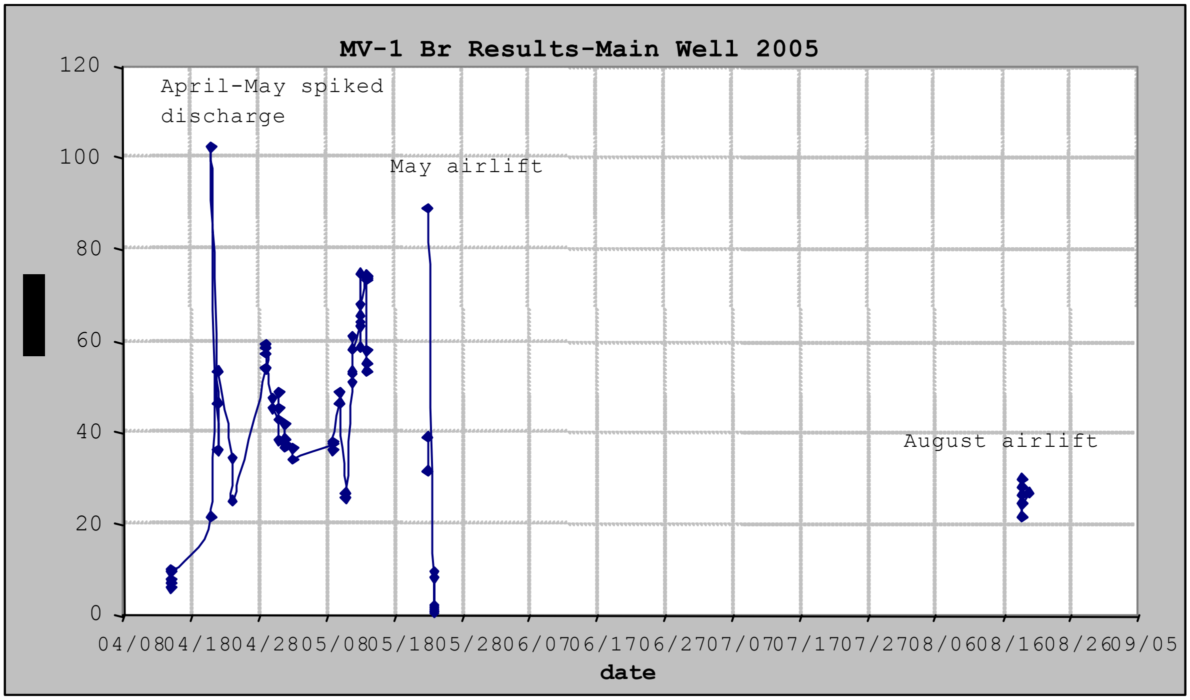


Figure 3-5
Bromide Data for CNTA MV-1 During Drilling and Airlift Operations

piezometer. The pH values ranged between 8.89 and 11.20, the temperature was 18.60 ºC, and the water conductivity ranged between 0.6 and 1.8 mS/cm. Refer to Appendix B, Tables B.1-6 through B.1-8, for a complete list of water quality data for MV-1.

3.4 Radiological Monitoring

The U.S. Environmental Protection Agency (EPA) radiological action level for groundwater is 20,000 picocuries per liter (pCi/L). Under the direction of the Fluid Management Plan (FMP) (SNJV, 2005b) and the Field Sampling Plan (DOP ITLV-UGTA-301, “Fluid Sample Collection and Processing,” and DOP ITLV-UGTA-307, “Tritium Monitoring” [IT, 1993a]) fluid discharge radiological samples were collected from the discharge screen on the mixing tank hourly during drilling operations, and approximately every four hours during airlift operations

Tritium analysis of discharge fluid samples collected during the field campaign were within the background range throughout the duration of MV-1 drilling and airlifting activities using HTH-2 production well as a baseline. Alpha and beta activity measurements of drill cuttings analyzed were also within the historically established background ranges. The tritium data from CNTA is kept on file at SNJV.

3.5 *Well Development and Testing*

The initial development of the main well consisted of airlifting using the LM 300 drill rig with HQ eductor and AQ airline in downward progressive stages. Well development began on May 23, 2005, and continued for approximately 34.75 hours. Approximately 12,000 gallons (gal) of fluid were evacuated from the well, which included makeup water for flushing and cleaning the main well casing. The formation produced approximately 1 gallon per minute (gpm) after flushing had ceased. The initial Br concentrations detected during airlifting was 38.8 mg/L but generally decreased in concentration to below spiked levels as purging proceeded. The final samples collected during this phase of the development indicated concentrations of Br below 10 mg/L. Figure 3-6 summarizes the initial airlifting operations performed in May on MV-1.

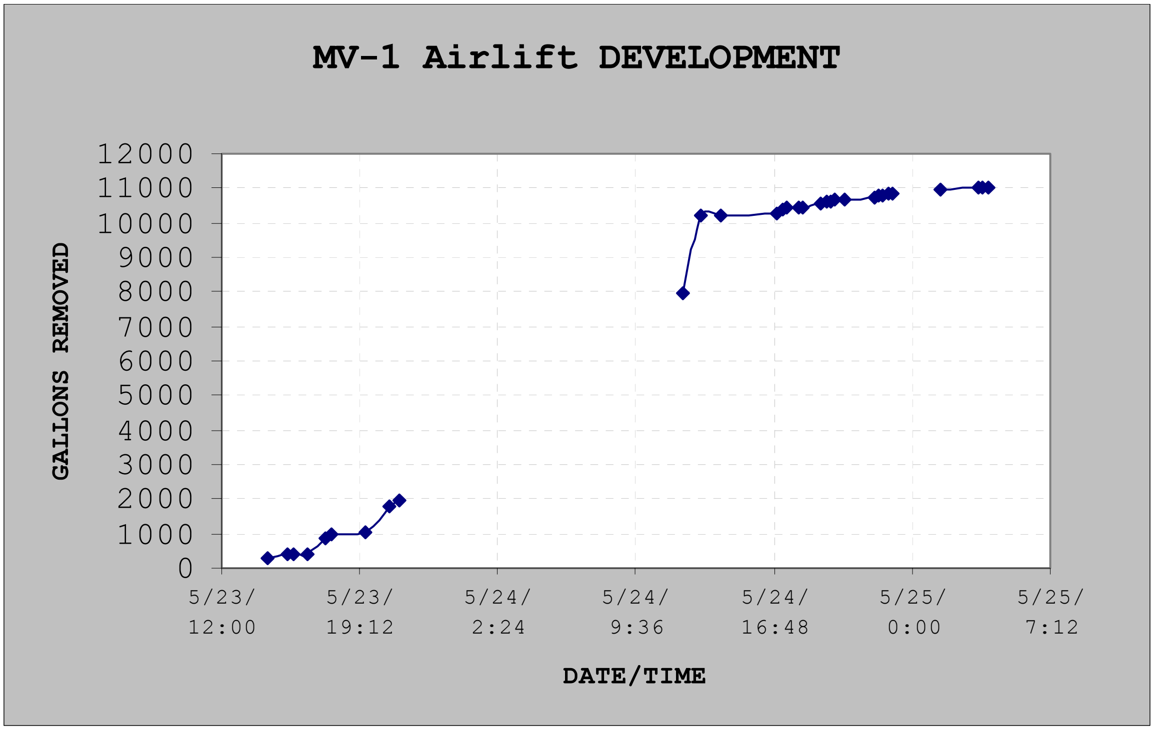


Figure 3-6
Summary of CNTA MV-1 Airlift Operations

Airlifting of MV-1 resumed on August 19, 2005, using the HQ eductor and AQ airline method attached to an 1100 CFM compressor. The production flow only averaged 1 gpm and Br results ranged from 21.3 to 29.6 mg/L. This phase of development rermoved approximately 417 gal and was completed on August 20, 2005. Figure 3-2 provides a schematic of dual-tube airlifting.

Upper piezometer development started June 3 through June 4, 2005, using a bailer with a total of 130 gal removed. Conventional airlift development was conducted June 13 through June 14, 2005, with a total of 5,800 gal removed.

Lower piezometer development started June 5, 2005, using the wire line bailer method with a total of 140 gal removed. Conventional airlift development began June 14, 2005, but was determined to be non-productive; formation fluid recharge could not maintain airlift discharge levels and therefore, airlifting was only run on two-hour intervals until June 17, 2005. From June 18 to June 19, 2005, development by bailing resumed with a total of 49.5 gal removed. On June 20 and June 21, 2005, airlifting was resumed again with only approximately 40 gal removed. Efficiency of the airlift method and cost effectiveness were prohibitive and discontinued as a development method for this piezometer.

A Grundfos 10S50-58DS submersible pump was installed September 29, 2005. The top of the pump is set at 3,714.5 ft, the bottom of the pump is set at 3,721.05 ft, and the intake is at 3,719.15 ft. These depth measurements are referenced from below the wellhead flange and include the 2 ft crossover from National Pipe Threads (NPT) to the EUE riser. The Grundfos MS 4000 motor uses a 4 AWG-600 volt submersible cable, banded and clamped to the 1-in. id EUE carbon-steel riser (discharge pipe). The discharge line has a 1/8-in. weep hole approximately 30 ft below the wellhead. Also banded to the discharge line is a 1.25-in. id polyvinyl chloride (PVC) water access tube. The water access tube was set at approximately 1,750 ft including 40 ft of slotted interval with an end cap. A brass check valve was used to replace the original check valve, which was drilled before delivery.

The functional pump test was conducted September 30, 2005, with approximately 366 gal of well storage capacity evacuated (Appendix B, Figure B.1-1). A second phase of functional pump testing took place October 1, 2005. A total of 779 gal were purged from MV-1 during less than two hours of pumping. The control panel/motor-saver tripped the motor off due to under current, indicating well storage capacity had been reached and formation fluid recharge was inadequate to allow continued discharge testing. Further development will continue for the next few months until the DOE accepts parameter criteria for well development.

4.0 Central Nevada Test Area MV-2 Summary of Operations

Central Nevada Test Area well MV-2 was constructed under CAU 443, 2005 Offsites program, and was completed to a depth of 3,660 ft bgs, approximately 1/2 mi. southwest of ground zero. Figure 1-1 shows the location of MV-2 and ground zero, and Table A.1-1 in Appendix A illustrates the exact coordinates of the well. MV-2 was constructed with multiple casing sets: a surface casing set at 95 ft bgs, a 20-in. intermediate casing set to 1,050 ft bgs, a 13 3/8-in. intermediate casing set to 2,149 ft bgs, and the final well string. Drilling began May 27, 2005, and was completed to a TD of 3660 ft bgs on June 29, 2005, using a dual-tube flooded reverse circulation drilling method. Final well completion of CNTA MV-2 included internal coated epoxy 5-in. id carbon-steel well casing. This final string of casing contains 163 ft of 0.078-in. slotted screen and a sump installed to a depth of 3,244 ft bgs. The 5-in. slotted casing interval was set at 3,039 ft to 3,202 ft bgs. See Figure 4-1 and Tables C.1-9 and C.1-10 for well construction details.

Final completion included an upper and lower piezometer string. The upper piezometer was set at 1,015 ft bgs (including a sump) with the slotted interval from 960 ft to 1,010 ft bgs. The lower piezometer was set at 3,646 ft bgs (including a sump) with the slotted interval from 3,546 ft to 3,606 ft bgs. All the slotted intervals were completed with graded filter packs in the borehole annulus. Well construction details are provided on Figures 4-1 and 4-2. Figure A.1-1 shows the layout of the well from the ground surface.

Construction completion occurred July 6, 2005, when the 5.5-in. od main well casing was cemented to the surface. A total of 41 days were spent drilling and constructing the well. Table C.1-1 in Appendix C illustrates the chronology of MV-2 operations.

Initial well development of the main well string consisted of conventional airlifting using the LM 300 drill rig with HQ and AQ in downward progressive stages to the top of the screened interval. Well development started July 5, 2005, and continued for 28.5 hours. A second phase of airlift development was conducted July 14, 2005, using an 1100 CFM compressor and booster attached to a constructed well head using a tremie pipe (refer to Figure 3-2 for a schematic on conventional airlifting).

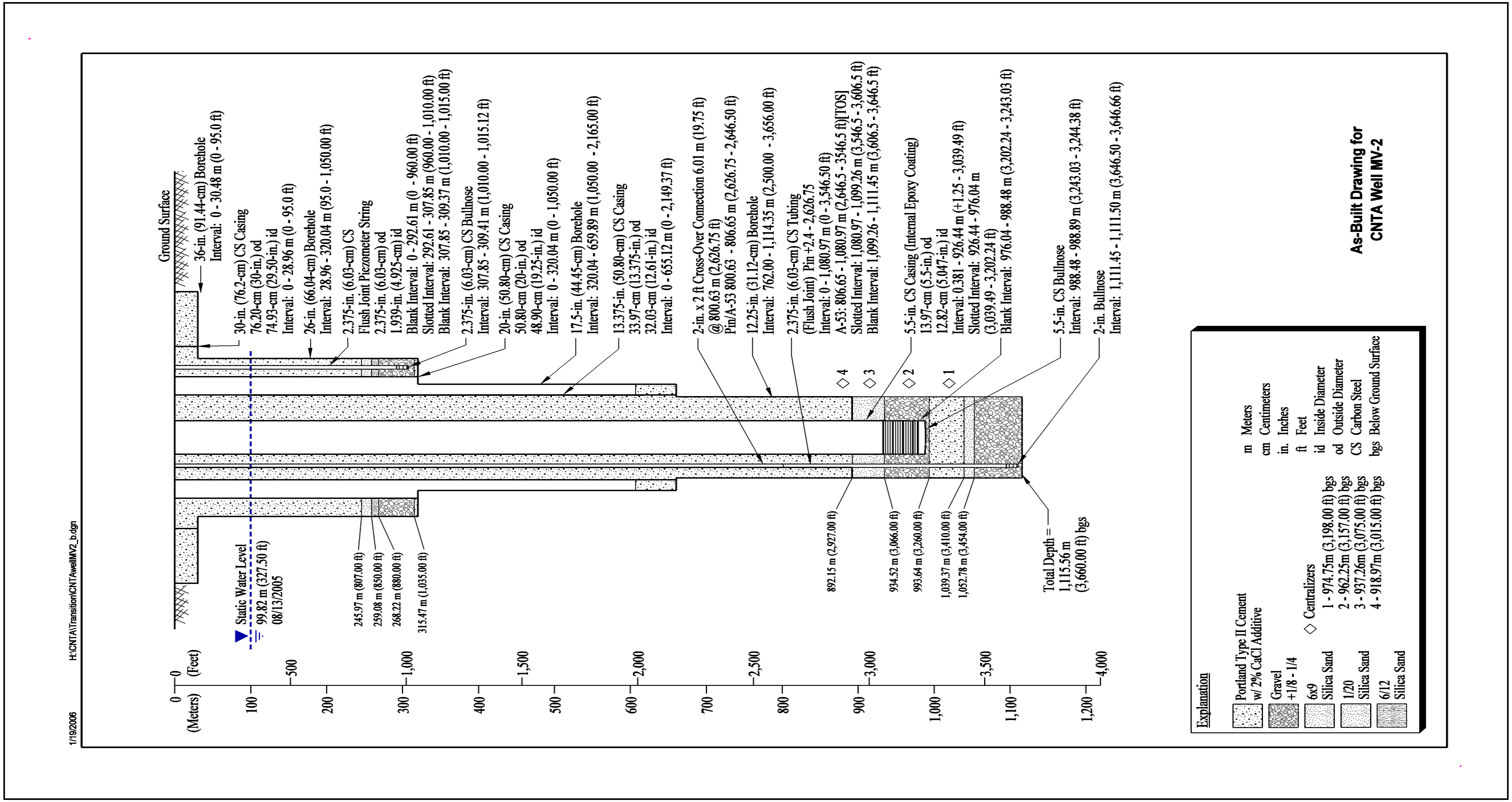


Figure 4-1
As-Built Drawing for CNTA Well MV-2

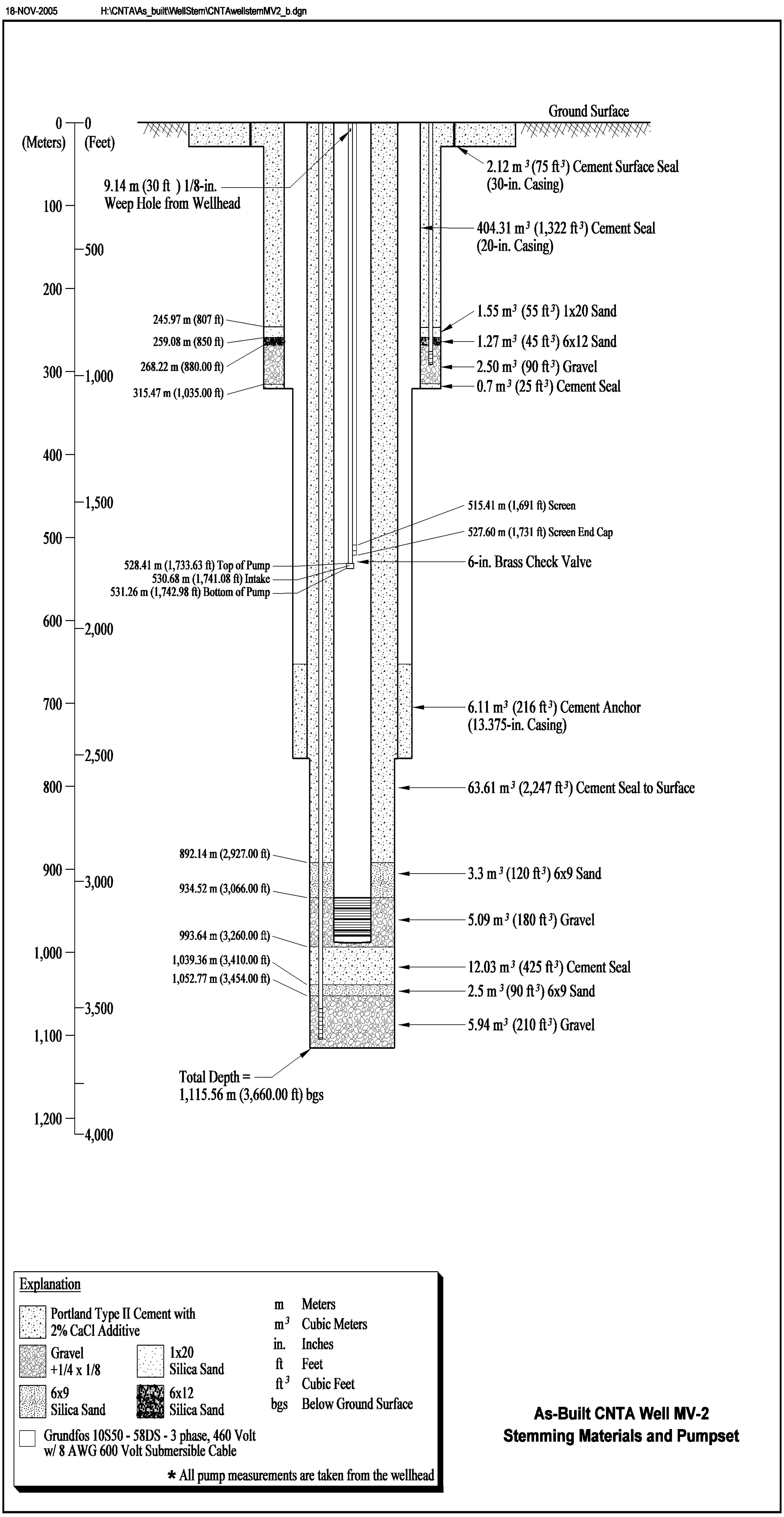


Figure 4-2
As-Built CNTA Well MV-2 Stemmimg Materials and Pump Set

A Grundfos 10S50-58DS pump was set on September 23, 2005. The top of the pump was placed at 1,733 ft below the wellhead using oversized diameter discharge (1.5-in. id) EUE riser pipe. The intake was set at 1,741.08 ft and the bottom of the pump/motor was set at 1,742.98 ft below the well head. A 1/8-in weep hole was drilled into the riser pipe approximately 30 ft below the well head. A 1.25-in. water access tube was installed to approximately 1,731 ft below the wellhead for discharge and recovery data monitoring. Functional pump testing and well evacuation of the storage capacity occurred September 24, 2005, with a total of 1,670 gal removed. Further development occurred October 12, 13, and 19, 2005, and will continue the next few months until the DOE accepts parameter criteria for well development.

4.1 Well Construction

Drilling of CNTA well MV-2 began on May 27, 2005. The drilling began by advancing a 36-in. diameter borehole to a depth of 95 ft bgs. This portion of the borehole was advanced using conventional mud rotary with Quik-Gel™ (bentonite mud) added to the drilling fluid with a tricone over-reamer bit. A 30-in. diameter carbon-steel surface casing was set for surface seal and wellhead control. The 30-in. casing was cemented in place to the surface with Portland Type II cement with a 2 percent CaCl additive. Refer to Figures 4-1 and 4-2 for well construction materials.

Dual-tube flooded reverse circulation drilling began at 180 ft bgs. A 26-in. diameter borehole was then drilled to 1,052 ft bgs using a carbide tricone bit. This portion of the borehole was completed with a 20-in. diameter, carbon-steel intermediate casing to a depth of 1,050 ft bgs. An upper piezometer was constructed June 3, 2005, between the 20-in. casing and borehole annulas. The upper piezometer was constructed with a sump to a depth of 1,015 ft bgs. All stemming materials (graded filter pack) were gravity fed through NQ tremie with the cement seal emplaced by pumping to the surface. Stemming material depths for the upper piezometer were tagged, using both a tremie and wireline. Construction of the upper piezometer was completed June 6, 2005.

Upon completion of the upper piezometer, a 17.5-in. diameter borehole was drilled to approximately 2,165 ft bgs with a carbide tricone bit. The second intermediate casing, a 13 3/8-in. diameter carbon-steel casing was installed and anchored at a depth of approximately 2,149 ft bgs with Portland Type II cement with 2 percent CaCl additive. The casing was set using approximately 45 yd of cement, anchoring the casing approximately 807 ft up the borehole.

The completion of the borehole to total depth consisted of drilling a 12 1/4-in. diameter borehole from 2,165 ft bgs to 3,660 ft bgs using both carbide and steel-tooth tricone bits. The main well construction consisted of 5.5-in. od internally coated epoxy carbon-steel casing. The screened interval consisted of 163 ft of slotted casing with 0.078-in. slots set from 3,039 to 3,202 ft bgs. A sump was installed below the screened/slotted interval that consisted of 41 ft of blank casing and end cap. Centralizers were placed around the 5.5-in. od main well casing at 3,198 ft bgs, 3,157 ft bgs, 3,075 ft bgs, and 3,015 ft bgs. The centralizers were secured in place to ensure proper annulus space for stemming materials between the borehole annulus and well casing. A bottom cement seal was emplaced between the lower piezometer filter pack and the main well filter pack.

The lower piezometer was installed without centralizers to a depth of 3,646 ft bgs with a screened interval from 3,546 to 3,606 ft bgs. A graded filter pack was constructed around the screened intervals (see Figure 4-1and 4-2 for well construction details). A cement seal was emplaced between the main well filter pack and the lower piezometer filter pack to ensure integrity of monitoring data.

Stemming materials for MV-2 include 1/8 x 1/4-in. clean gravel around the main well slotted interval and lower piezometer slotted interval, 6x9 clean silica sand cap, and cement seal. The Portland Type II cement seal also contained 2 percent CaCl additive. All lower hole stemming materials were pump fed into the borehole annulus through a NQ tremie pipe, raised in stages to help ensure proper placement of material without plugging or bridging. The depths of the stemming material for the main well screen was determined by real-time NFD log, conducted by Schlumberger Well Services.

The rate of penetration in densely welded tuffs encountered in the lower sections of the borehole slowed sufficiently to create a cost-effective issue and the borehole total depth was halted at 3,660 ft bgs rather than the proposed TD of 4,100 ft bgs. In addition to the slow drilling, the drill twisted off above the bottom hole assembly (BHA) while drilling in the densely welded tuffs of the lower section of the borehole. This twist-off occurred on June 24, 2005. The BHA was successfully retrieved with an overshot tool from a depth of 3,460 ft, and drilling resumed on June 26, 2005.

4.2 Geophysical Surveys

Geophysical surveys were conducted during the advancement of the CNTA MV-2 borehole using the subcontractor Schlumberger. Logging suites were collected from the surface to a depth of approximately 1,050 ft bgs during the first phase in the 26-in. diameter borehole. The first phase of logging was completed June 2, 2005. Geophysical logging suites were run from a depth of approximately 1,050 ft to approximately 2,165 ft bgs in the 17.5-in. diameter borehole during the second phase and was completed June 15, 2005. The third phase of logging conducted by Schlumberger occurred June 30, 2005, from TD of the well to approximately 2,165 ft bgs. The first three geophysical logging suites consisted of temperature, density, caliper, resistivity (long and short normal), spontaneous potential, neutron porosity, sonic porosity, spectral gamma, natural gamma, and magnetic deviation.

The borehole deviation survey, conducted in the open borehole, indicated the bottom of the borehole had deviated less than three degrees from vertical, in a southeast direction. The borehole deviation survey placed the bottom of the borehole approximately 55 ft southeast of the collar and resulted in a true vertical depth of 3,655.59 ft bgs. Figure 4-3 illustrates the deviation of CNTA MV-2.

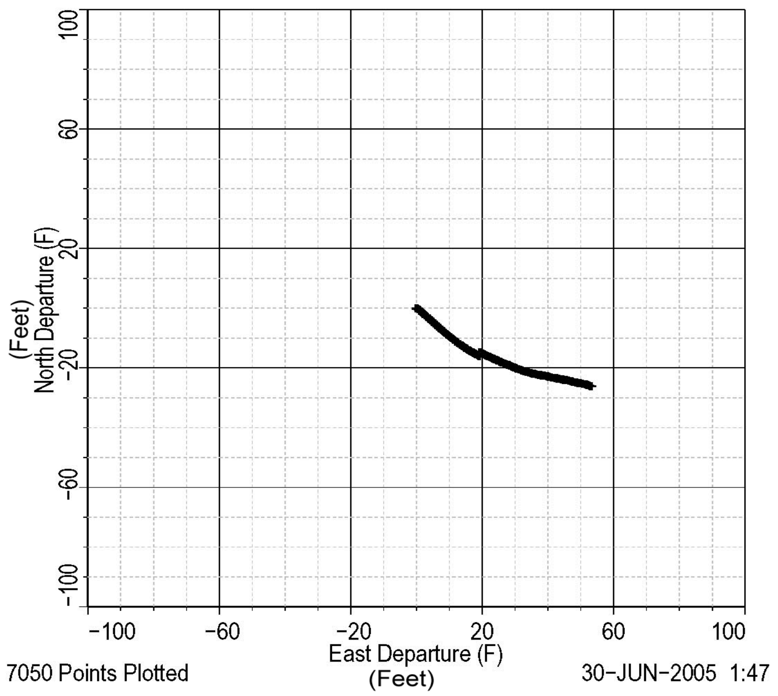


Figure 4-3
Deviation Plot of CNTA MV-2 from 2,152 ft to Total Depth

The fourth phase of geophysical logging consisted of NFD Log. The density log was used for real-time tagging of stemming material emplacement, while the main well filter pack and cement seal were being constructed. Table C.1-2 in Appendix C provides a summary of the geophysical data collected for CNTA MV-2. Figure C.1-1 through C.1-4 in Appendix C provide a condensed version of the geophysical signatures for CNTA MV-2.

4.3 Sampling

Drill cutting samples were collected under the direction of the Field Sampling Plan (DOP ITLV-UGTA-318, "Cuttings Sample Collection, Handling, and Oversight" [IT, 1993a]) from the shaker screen every 10 ft throughout the drilling operation. An aggregate or composite of samples from each 10 ft interval of cuttings during borehole advancement were placed into three separate pint-size ice cream-type cartons. The samples, with the chain-of-custody protocol, established under SQP ITLV-0402, "Chain of Custody" (IT, 1993b), were sent to the USGS Core Library in Mercury, Nevada. Two samples were to be washed and archived; one sample was archived as collected. A small portion of the cuttings were washed and placed in a chip tray at the drill site. The chip tray cuttings were briefly described at the time of collection and were described in further detail using an optical light microscope. The grain size, mineralogy, alteration, color, degree of welding, and other notable characteristics were documented according to DOP ITLV-UGTA-304, "Geologic Description of Cuttings and Core" (IT, 1993a).

A LiBr tracer was added to the drilling fluids from the frac tank and recirculated through the mud reservoir. Lithium bromide spiking was also maintained and added to the makeup fluids during all well construction. Typical Br concentrations of makeup water were maintained between 20 and 40 mg/L in each truckload of water obtained from the HTH-2 production well.

Fluid samples for Br were obtained from the main well for analysis and were collected from the discharge line at the drilling fluid mix tank and the makeup water, frac tank, and/or water truck. The samples were analyzed using an Orion 290A ion-specific meter. Collection of these samples occurred every three hours during borehole advancement and three times per 12-hour shift during airlifting. The samples were analyzed on a continuous basis throughout the drilling project. The Br concentrations in the discharge fluid ranged from 4.26 to 94.5 mg/L during drilling operations and

2.27 to 35.5 mg/L during airlifting activities (Figure 4-4). Refer to Appendix C, Table C.1-3 through C.1-5, and Figure 4-4 for the Br data of MV-2 throughout the drilling and airlifting operation.

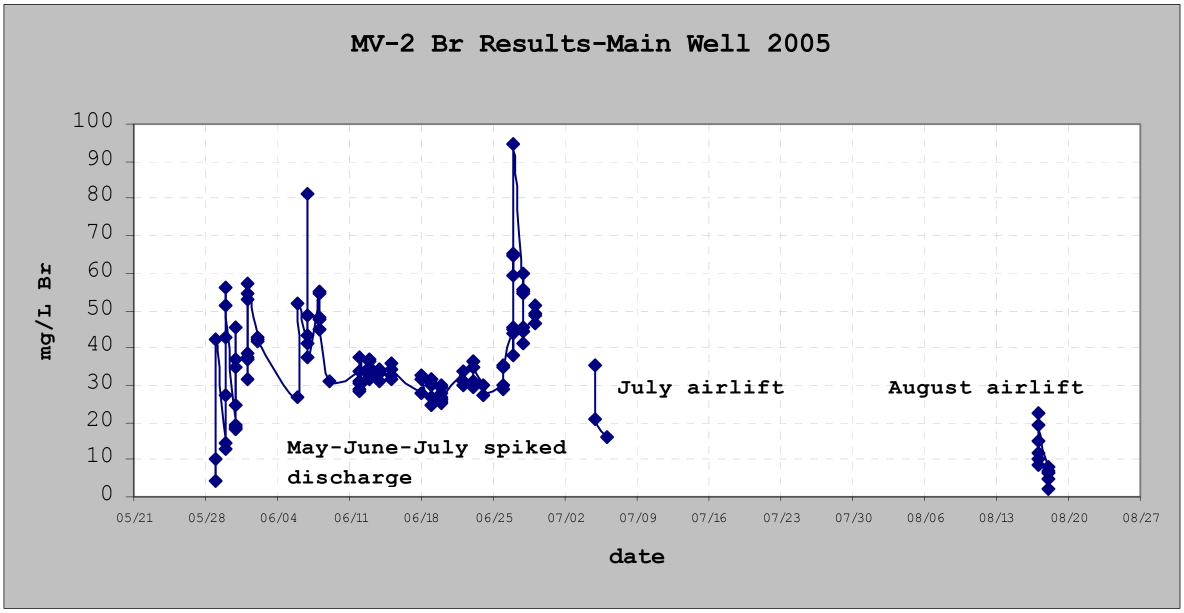


Figure 4-4
Bromide Data for CNTA MV-2 During Drilling and Airlift Operations

Factors affecting water quality, including pH, temperature, and conductivity were also measured during drilling and airlifting operations. Fluid samples for water quality analysis were collected from the discharge line and were analyzed using a YSI-63 water quality meter Hydrolab multiprobe (see Appendix C, Table C.1-6through C.1-8). Fourteen water quality samples were collected from MV-2. Six water quality samples were collected in the upper piezometer. The pH values for acidity or alkalinity ranged from 10.02 to 12.25; the temperature ranged from 22.3 to 24.1 ºC. Conductivity ranged from 0.3 to 0.6 mS/cm. Fourteen water quality samples were collected from the lower piezometer. The pH values ranged from 8.9 to 10.81, the conductivity ranged from 0.7 to 3.0 mS/cm. Refer to Appendix C, Table C.1-6through C.1-8, for a complete list of water quality data for MV-2.

4.4 Radiological Monitoring

The EPA radiological action level for groundwater is 20,000 pCi/L. Under the direction of the FMP (SNJV, 2005b) and the Field Sampling Plan (DOP ITLV-UGTA-301, "Fluid Sample Collection and Processing," and DOP ITLV-UGTA-307, "Tritium Monitoring" [IT, 1993a]) fluid discharge radiological samples were collected from the discharge screen on the mixing tank hourly during drilling operations, and approximately every four hours during airlift operations.

Tritium analysis of discharge fluid samples collected during the field operation were all within the background range throughout the duration of MV-2 drilling and airlifting activities using HTH-2 production well as a baseline. Alpha and beta activity measurements of drill cuttings analyzed were also within the historically established background ranges. The tritium data records are kept on file at SNJV.

4.5 Well Development and Testing

The initial development of the main well consisted of airlifting using the LM 300 drill rig with HQ eductor and AQ airline in downward progressive stages. Well development was initiated on July 5, 2005, and continued for approximately 18.5 hours. Approximately 11,742 gal of fluid were evacuated from the well, which included water added for flushing and cleaning the main well casing. The formation produced approximately 1 gpm after flushing. The initial Br concentrations detected during airlifting was 35.5 mg/L but continually decreased in concentration to below spiked levels as purging proceeded. At the completion of this phase of the development, Br concentrations were approximately 16 mg/L.

Upper piezometer development began July 14 through July 17, 2005, using the airlift method with a total of 150 gal removed. During this development, gravel pack material was observed in the purge water. Depth measurements within the piezometer confirmed the presence of filter pack material above the screen interval. Attempts to remove the material through continued development were not successful. It was theorized that the piezometer screen may have been damaged or separated during the placement of the 20-in. casing. Water level data has been collected from the piezometer; however, recovery has been slow as a result of the material in the piezometer. No further actions have been taken to investigate the condition of the piezometer.

Lower piezometer development began July 20 through August 5, 2005, using the wire line bailer method with a total of 745 gal removed. Airlift development began again July 18 to July 19, 2005, but was determined to be non-productive; formation fluid recharged could not maintain airlift discharge levels.

Airlifting of MV-2 resumed August 17, 2005, using the HQ eductor and AQ tremie method attached to an 1100 CFM compressor. The production flow still only averaged 1.5 to 2 gpm and Br results ranged from 15.9 mg/L to 35.5 mg/L. This phase of the development removed approximately 7,300 gallons and was completed on August 18, 2005. Figure 4-5 provides a summary of the August airlifting operations on well MV-2.

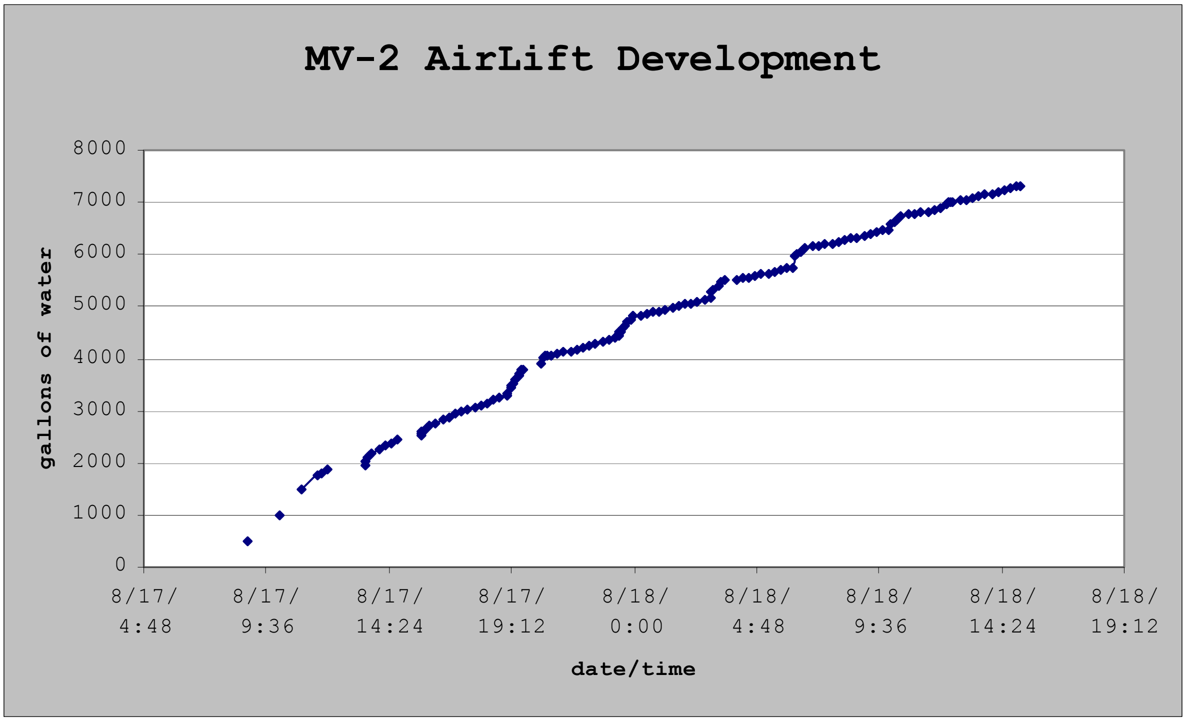


Figure 4-5
Summary of CNTA MV-2 Airlift Development

A Grundfos 10S50-58DS submersible pump was installed September 23, 2005. The top of the pump is set at 1,733 ft, the bottom of the pump is set at 1,742.98 ft, and the intake is set at 1,741.08 ft below the wellhead flange (Figure 4-2). The Grundfos MS 4000 motor uses an 8 AWG-600 volt submersible cable, banded and clamped to a 1.5-in. id EUE carbon-steel riser (discharge pipe). Also banded to the discharge line is a 1.25-in. id PVC water access tube. The water access tube was completed with 40 ft of slotted screen and endcap at a depth of 1,731 ft bgs.

The initial functional pump test was conducted September 24, 2005, and lasted 4.5 hours with approximately 1,670 gal of well storage capacity evacuated (Appendix A, Figure A.1-2). A second phase of functional pump testing took place October 12, 13, and 20, 2005. A total of 3,788 gal were purged from MV-2 during pumping. The control panel/motor-saver tripped the motor off due to under current in both the initial and second phase, indicating well storage capacity had been reached and formation fluid recharge was inadequate to allow continued discharge testing. Further development will continue for the next few months until the DOE accepts parameter criteria for well development.

5.0 Central Nevada Test Area MV-3 Summary of Operations

Central Nevada Test Area MV-3 was the final well constructed under CAU 443, 2005 Offsites program, and was drilled to a total depth of 4,220 ft bgs. MV-3 was located approximately 2,000 ft north of ground zero. Figure A.1-1 shows the location of MV-3 in relation to ground zero, and Table A.1-1 in Appendix A gives the exact coordinates of the well. MV-3 was constructed with multiple casing sets: a surface casing set at 95 ft bgs, a 20-in. intermediate casing set to 1,053 ft bgs, a 13 3/8-in. intermediate casing set to 2,515 ft bgs, and the final well string. Drilling began on July 9, 2005, and was completed to a TD of 4,220 ft bgs on August 6, 2005, using a dual-tube flooded reverse circulation drilling method. Final well completion of CNTA MV-3 included an internal coated epoxy 5-in. id carbon-steel well casing. The final string of casing contains approximately 161 ft of 0.078-in. slotted screen installed to a depth of 4,207 ft bgs. The 5-in. slotted casing interval was set at 4,046 ft to 4,207 ft bgs. See Figure 5-1 and Tables D.1-9 and D.1-10 for well construction details.

Final completion also included an upper and lower piezometer string. The upper piezometer was set at 960 ft bgs (including a sump) with the slotted interval from 880 to 940 ft bgs. The lower piezometer was set at 3,420 ft bgs (without a sump) with the slotted interval from 3,300 ft to 3,420 ft bgs. All the slotted intervals were completed with graded filter packs in the borehole annulus. Well construction details are provided on Figure 5-1 and 5-2. Figure A.1-1 illustrates the layout of the well from the ground surface.

Construction was completed on August 15, 2005, when the 5.5-in. od main well casing was cemented to the surface. A total of 38 days were spent drilling and constructing the well. Refer to Table D.1-1 in Appendix D for a chronology of MV-3 operations.

Initial well development of the main well consisted of conventional airlifting using the LM 300 drill rig with HQ and AQ in downward progressive stages to the top of the screened interval. Well development began on August 13, 2005, and continued for 56.5 hours with 10,064 gal evacuated. A second phase of airlift development was conducted August 18, 2005, using an 1100 CFM compressor attached to a constructed well head using HQ and AQ tremie pipe (refer to Figure 3-2 a schematic on conventional airlifting).

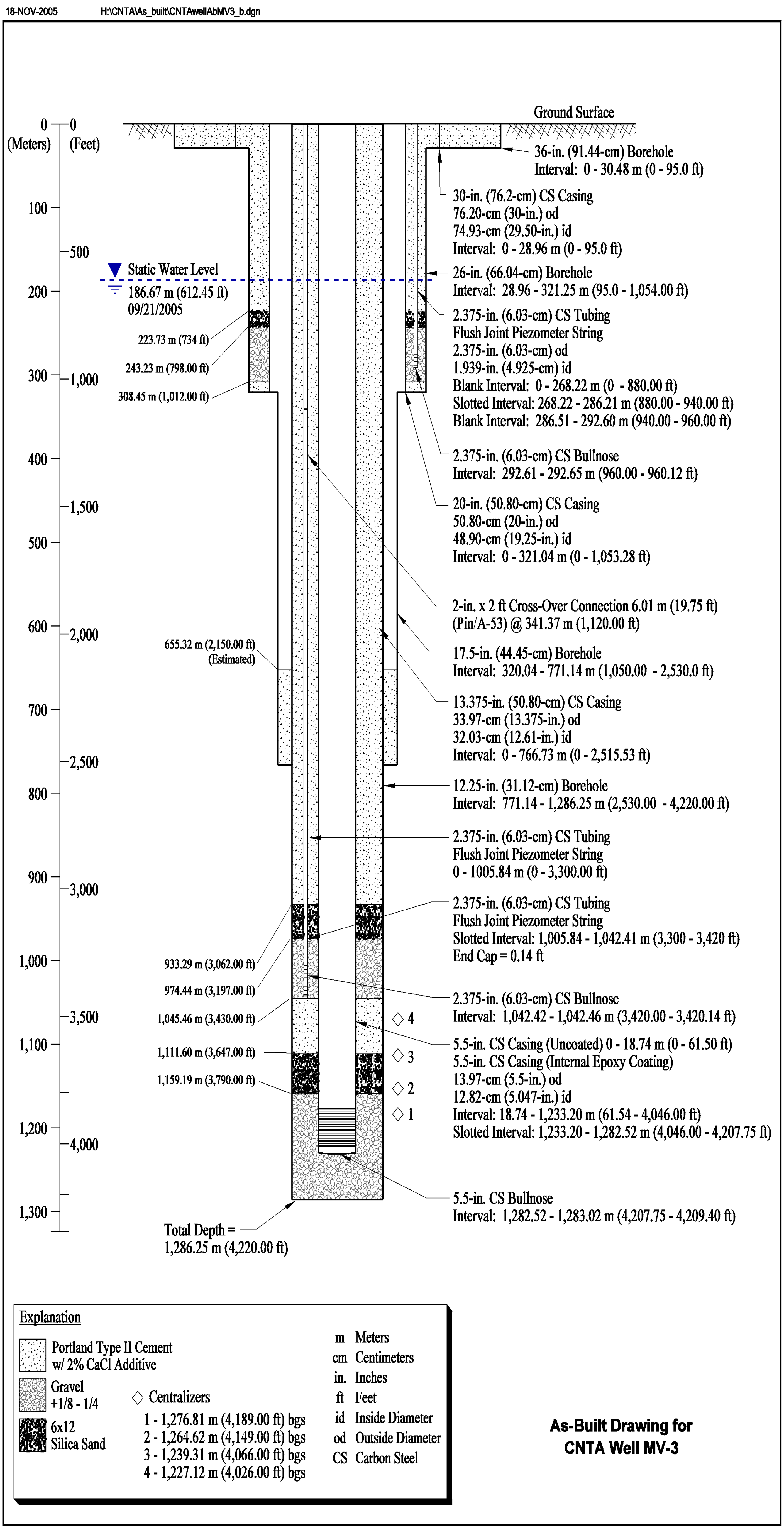


Figure 5-1
As-Built Drawing for CNTA Well MV-3

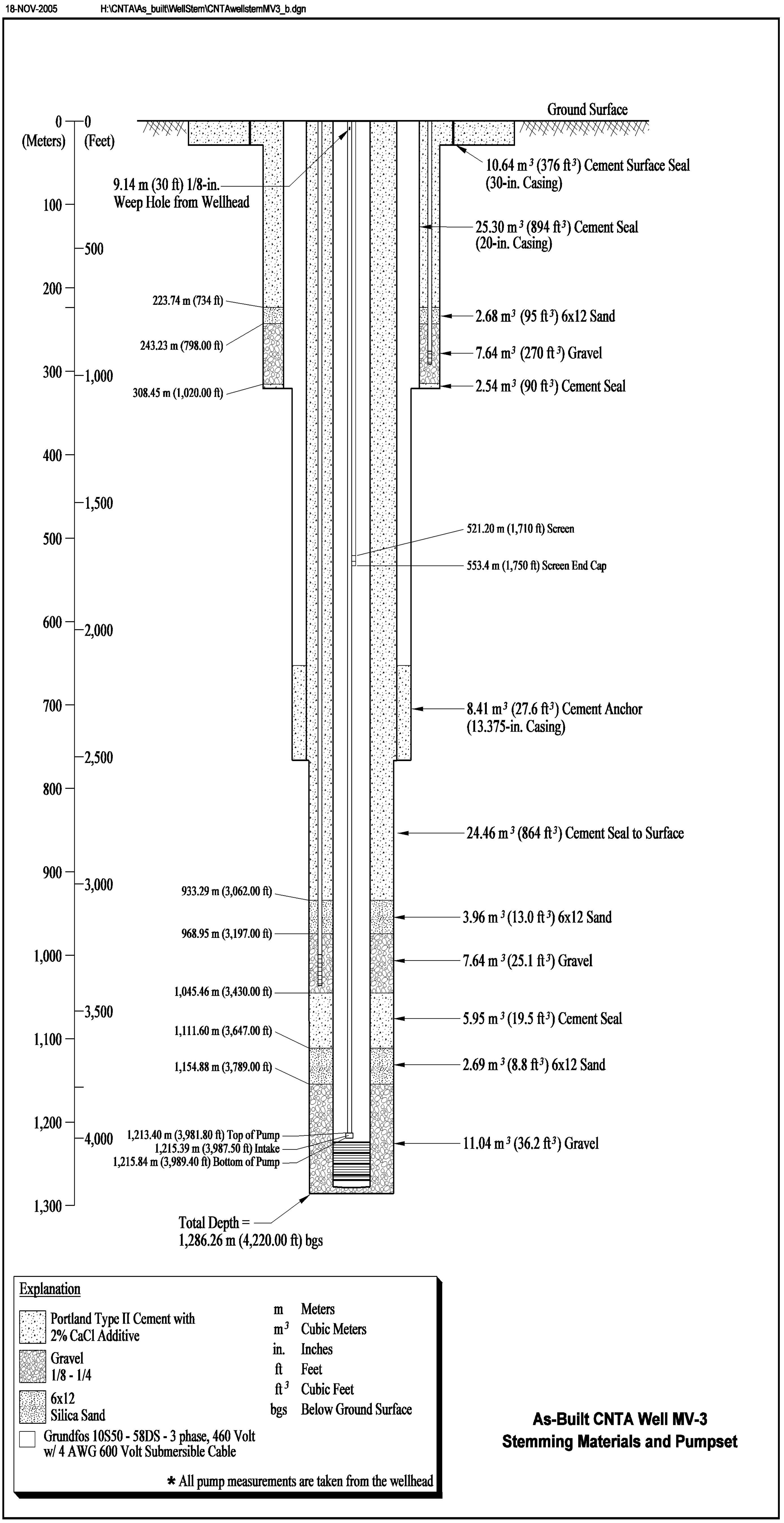


Figure 5-2
As-Built CNTA Well MV-3 Stemming Material and Pump Set

A Grundfos 10S50-58DS pump was set on September 27, 2005. The top of the pump was placed at 3,981.8 ft below the well head. This includes a brass check valve, which replaces the original check valve that was drilled prior to delivery. A 2-ft crossover from NPT threads to EUE threads is part of the riser string above the check valve. The intake is at 3,987.5 ft with the bottom of the pump set at 3,989.5 ft bgs. A 1.25-in. water access tube with end cap was installed to a depth of approximately 1,750 ft below the wellhead. The undersized 1-in. riser has a 1/8-in. weep hole approximately 30 ft below the wellhead. Functional pump testing and well evacuation of the storage capacity occurred September 28, 2005. The functional pump tests lasted approximately 3 hours and 1,107 gal were evacuated.

5.1 Well Construction

Drilling of CNTA well MV-3 began on July 9, 2005. The drilling began by advancing a 36-in. diameter borehole to a depth of 220 ft bgs. This portion of the borehole was advanced using conventional mud rotary with Quik-Gel™ (bentonite mud) added to the drilling fluid with a tricone over-reamer bit. A 30-in. diameter carbon-steel surface casing was set for surface seal and wellhead control. The 30-in. casing was cemented in place to the surface with Portland Type II cement with a 2 percent CaCl additive.

Dual-tube flooded reverse circulation drilling began at 220 ft bgs. A 26-in. diameter borehole was then drilled to a depth of approximately 1,054 ft bgs using a carbide tricone bit. This portion of the borehole was completed with a 20-in. diameter, carbon-steel intermediate casing to a depth of approximately 1,053 ft bgs. An upper piezometer was constructed July 17, 2005, between the 20-in. casing and borehole annulus. The upper piezometer was constructed with a sump to a depth of 960 ft bgs. All the stemming materials (graded filter pack) were pump fed through NQ tremie with the cement seal emplaced by pumping to the surface. The depth of the stemming materials for the upper piezometer was tagged using both tremie and wireline. Construction of the upper piezometer was completed July 17, 2005.

Upon completion of the upper piezometer, a 17.5-in. diameter borehole was then drilled to a depth of approximately 2,530 ft bgs with a carbide tricone bit. The second intermediate casing, a 13 3/8-in. diameter carbon-steel casing was then installed and anchored in place with Portland Type II cement with 2 percent CaCl additive at 2,515 ft bgs. The casing set used approximately 43 yd of cement, anchoring the casing approximately 734 ft up the borehole.

The completion of the borehole to total depth consisted of drilling a 12 1/4-in. diameter borehole from approximately 2,530 ft bgs to the final depth of 4,220 ft bgs using both carbide and steel-tooth tricone bits. The main well construction consisted of 5.5-in. od internally coated epoxy carbon-steel casing. The screened interval consisted of 163 ft of slotted casing with 0.078-in. slots set from 4,046 to 4,207 ft bgs. A sump was not installed at the bottom of the 5.5-in. casing. Centralizers were placed around the 5.5-in. od main well casing at 4,189 ft bgs, 4,149 ft bgs, 4,066 ft bgs, and 4,026 ft bgs. These centralizers were secured in place to ensure proper annulus space for stemming materials within the borehole annulus and well casing.

The lower piezometer was installed without a sump or centralizers to a depth of 3,420 ft bgs with a screened interval from 3,300 to 3,420 ft bgs. A graded filter pack was constructed around the screened intervals of the main well and lower piezometer (see Figure 5-1 and 5-2 for well construction details). A cement seal was emplaced between the main well filter pack and the lower piezometer filter pack to ensure integrity of monitoring data.

The MV-3 stemming materials around the slotted intervals include 1/8 x 1/4-in. clean gravel, 6 x 12 clean silica sand, and cement seal. The Portland Type II cement seal also contained 2 percent CaCl additive. All stemming materials were pump fed into the borehole annulus through a NQ tremie pipe, which was raised in stages to help ensure proper placement of material without plugging or bridging. The depths of the stemming material for the main well screen and lower piezometer were determined by a real-time NAIL, conducted by COLOG Inc. Figure 5-2 provides a summary of material volumes placed in the MV-3 borehole.

5.2 Geophysical Surveys

Geophysical surveys were conducted during the advancement of the CNTA MV-3 borehole in three phases using subcontractor Schlumberger and COLOG Inc. The first phase of logging from the surface to 1,054 ft was cancelled due to scheduling conflicts. Geophysical logging data were acquired from approximately 1,054 ft to approximately 2,530 ft in the 17.5-in. diameter borehole and was completed July 24, 2005. The second phase of logging conducted by Schlumberger occurred

August 5, 2005, from TD of the well to approximately 2,530 ft. All of the logging suites consisted of temperature, density, caliper, resistivity (long and short normal), spontaneous potential, neutron porosity, sonic porosity, spectral gamma, natural gamma, and magnetic deviation.

The borehole deviation survey, conducted in the open borehole, indicated the bottom of the borehole had deviated less than 3 degrees from vertical in a northeast direction. The borehole deviation survey placed the bottom of the borehole 40 ft northeast from the collar and resulted in a true vertical depth of 4,219.72 ft bgs. Figure 5-3 illustrates the deviation of MV-3.

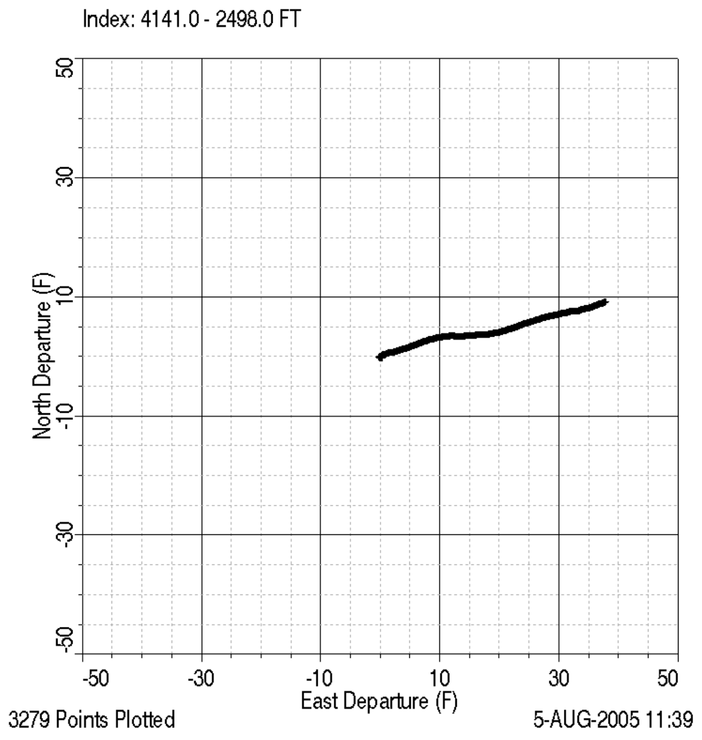


Figure 5-3
Deviation Plot of CNTA MV-3 from 2,530 ft to Total Depth

The final phase of geophysical logging consisted of COLOG's NAIL log. The NAIL log was used for real-time tagging of stemming material emplacement, while the main well and lower piezometer filter packs and cement seal were constructed.

Table D.1-2 in Appendix D provides a summary of the geophysical data collected for CNTA MV-3. Figure D.1-1through D.1-4 in Appendix D provide a condensed version of the geophysical signatures for CNTA MV-3.

5.3 Sampling

Drill cutting samples were collected under the direction of the Field Sampling Plan (DOP ITLV-UGTA-318, "Cuttings Sample Collection, Handling, and Oversight" [IT, 1993a]) from the shaker screen every 10 ft throughout the drilling operation. An aggregate or composite of samples from each 10 ft interval of cuttings during borehole advancement were placed into three separate pint-size ice cream-type cartons. The samples, with the chain-of-custody protocol, established under SQP ITLV-0402, "Chain of Custody" (IT, 1993b), were sent to the USGS Core Library in Mercury, Nevada. Two samples were washed and archived; one sample was archived as collected. A small portion of the cuttings were washed and placed in a chip tray at the drill site. The chip tray cuttings were briefly described at the time of collection and were described in further detail using an optical light microscope. The grain size, mineralogy, alteration, color, degree of welding, and other notable characteristics were documented according to DOP ITLV-UGTA-304, "Geologic Description of Cuttings and Core" (IT, 1993a).

A LiBr tracer was added to the drilling fluid from the frac tank and recirculated through the mud reservoir. Lithium bromide spiking was maintained and added to the makeup fluids during all well construction. Typical Br concentrations of makeup water were maintained between 20 to 40 mg/L in each truckload of water obtained form the HTH-2 production well.

Fluid samples for Br analysis were collected from the discharge line at the drilling fluid mix tank and at the makeup water frac tank. The samples were analyzed using an Orion 290A ion-specific meter. Collection of these samples occurred every three hours during borehole advancement and three times per 12-hour shift during airlifting. The samples were analyzed on a continuous basis throughout the drilling project. The Br concentrations in the discharge fluid ranged from 15.30 to 67.30 mg/L during drilling operations and 10.80 to 113 mg/L during airlifting activities (Figure 5-4). Refer to Appendix D, Tables D.1-3 through D.1-5, and Figure 3-5 for Br data on MV-3.

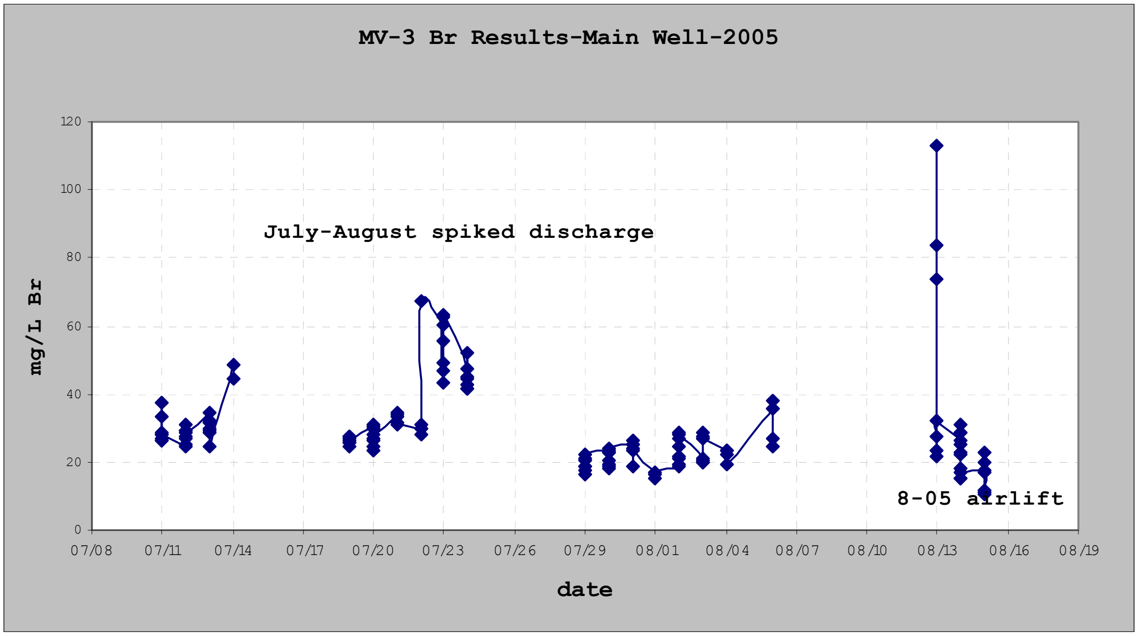


Figure 5-4
Bromide Data for CNTA MV-3 During Drilling and Airlift Operations

Factors affecting water quality, including pH, temperature, and conductivity were also measured during drilling and airlifting operations. Fluid samples for water quality analysis were collected from the discharge line and analyzed using a YSI-63 water quality meter Hydrolab multiprobe (see Appendix D, Table D.1-6 through Table D.1-8). Eighteen water quality samples were collected from MV-3. Two water quality samples were collected in the upper piezometer. The pH values for acidity or alkalinity ranged from 7.25 to 7.88; conductivity ranged from 0.2 to 0.4 mS/cm. Four water quality samples were collected from the lower piezometer. The pH values ranged from 8.7 to 9.36, the temperature was not recorded, and the conductivity ranged from 0.8 to 2.2 mS/cm. Refer to Appendix D, Table D.1-6 through Table D.1-8, for a complete list of water quality data for MV-3.

5.4 Radiological Monitoring

The EPA radiological action level for groundwater is 20,000 pCi/L. Under the direction of the FMP (SNJV, 2005b) and the Field Sampling Plan (DOP ITLV-UGTA-301, “Fluid Sample Collection and Processing,” and DOP ITLV-UGTA-307, “Tritium Monitoring” [IT, 1993a]) fluid discharge radiological samples were collected from the discharge screen on the mixing tank hourly during drilling operations, and approximately every four hours during airlift operations.

Tritium analysis of discharge fluid samples collected during the field campaign were all within the background range throughout the duration of MV-3 drilling and airlifting activities using HTH-2 production well as a baseline. Alpha and beta activity measurements of drill cuttings analyzed were also within the historically established background ranges. The CNTA tritium results are kept on file.

5.5 Well Development and Testing

The initial development of well MV-3 consisted of airlifting using the LM 300 with HQ eductor and AQ airline in downward progressive stages. Well development was initiated on August 13, 2005, and continued for approximately 56.5 hours. Approximately 10,064 gal of fluid were evacuated from the well, which included added water for flushing and cleaning the main well casing. The formation produced approximately 1.5 gpm after flushing. Figure 5-5 summarizes the airlift operations for MV-3.

Upper piezometer development began August 18 through August 19, 2005, using airlift development, with a total of 2,940 gal removed. The production flow only averaged 1.5 gpm and Br concentrations ranged from 2.22 to 25.10 mg/L.

Development of the lower piezometer continued on August 18, and 19, 2005, using the wire line bailer. A total of 225 gal were removed. Airlift development began August 21, 2005. The Br concentrations ranged from 26.50 to 30.70 mg/L.

A Grundfos 10S50-58DS submersible pump was installed September 27, 2005. The top of the pump is set at 3,981 ft, the bottom of the pump is set at 3,989 ft, and the intake is set at 3,987 ft below the wellhead (Figure 4-2). The Grundfos MS 4000 motor uses a 4 AWG-600 volt submersible cable, banded and clamped to a 1-in. id EUE carbon-steel riser (discharge pipe). Also banded to the discharge line is a 1.25-in. id PVC water access tube. The water access tube was completed with 40 ft of slotted screen and end cap at approximately 1,750 ft bgs. The 1-in. riser has a 1/8-in. weep hole drilled approximately 30 ft below the wellhead. Also, a brass check-valve replaced the pump check valve, which was drilled prior to delivery.

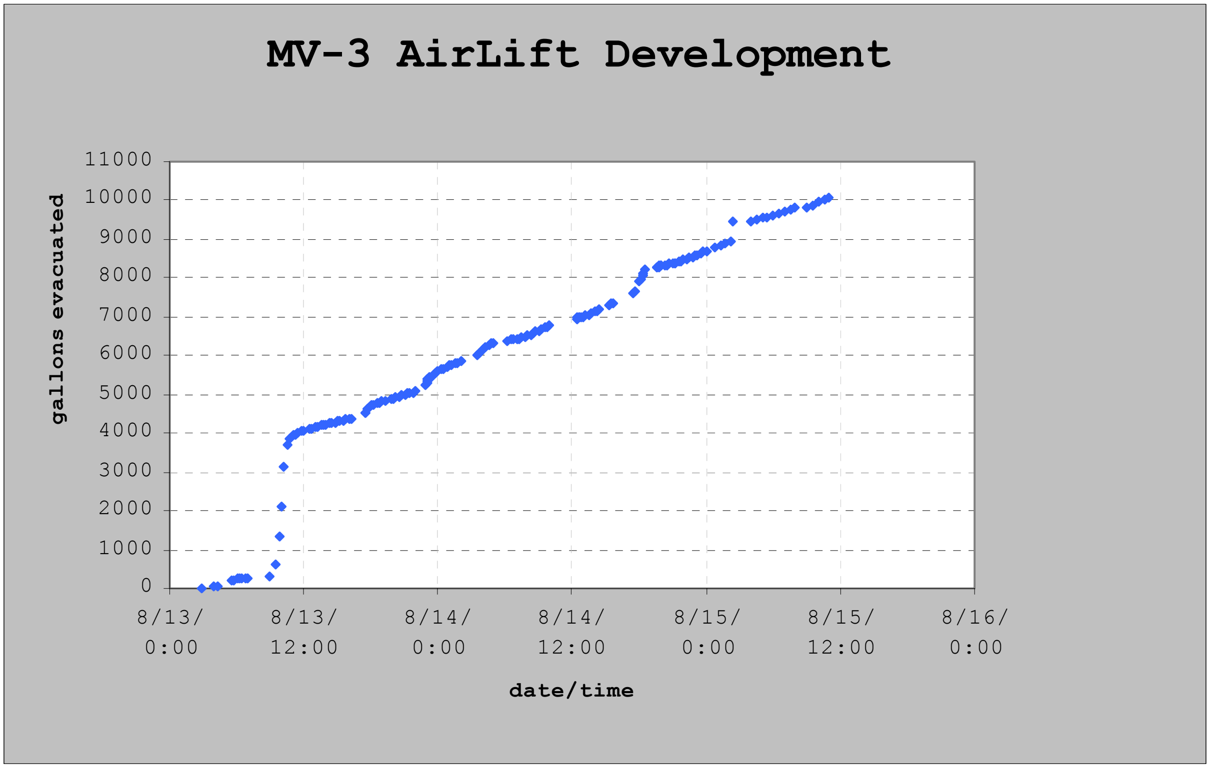


Figure 5-5
Summary of CNTA MV-3 Airlift Operations

The functional pump test was conducted September 28, 2005, and lasted three hours. Approximately 1,107 gal of well storage capacity were evacuated (Appendix A, Figure A.1-2). A second phase of functional pump testing took place October 13, 2005. A total of 789 gal were purged from MV-3 during 2.5 hours of pumping. The control panel/motor-saver tripped the motor off during both pump tests due to under current, indicating well storage capacity had been reached and formation fluid recharge was inadequate to allow continued discharge testing. Further development will continue for the next few months until the DOE accepts parameter criteria for well development.

6.0 Environmental Compliance and Waste Management

Stoller-Navarro Joint Venture had the lead responsibility for environmental compliance and waste management at CNTA. The environmental compliance elements of the CNTA investigation were addressed in the planning phases of the project by the completion and approval of a *National Environmental Policy Act* checklist, review and evaluation of state and federal regulations potentially applicable to the project, and negotiation and approval of the FMP.

6.1 Employee Awareness

Copies of the material safety data sheets and approval forms were readily accessible by site personnel. Spill response equipment was located in marked spill response kits at each well site. Spill response and reporting was guided by SQP ITLV-0513, "Spill Management" (IT, 1993b). Incidental spills occurred during drilling operations; however, no reportable spills were observed during 2005 CNTA field activities. Emergency contacts were available to all employees at the site. Archeological surveys were performed and areas delineated for project activities. All employees were briefed on the importance of protecting the archeological, biological, and Native American resources in the area.

6.2 Waste Management

Waste management involved the tracking, packaging, labeling, and storage of wastes generated during investigation activities. Waste management training was conducted for all personnel before beginning site operations, and as new personnel arrived on location. The CNTA investigation generated sanitary, hydrocarbon, and fluid waste. No hazardous or radioactive waste was generated at CNTA.

6.3 Source Water for Drilling

The source water for drilling is Well HTH-2, approximately 1/2 mi southeast of ground zero. Two lined sumps located just north of HTH-2 were used to store water. A water truck was used to transport the water from HTH-2 to the drilling location.

6.4 Fluid Management

All fluids generated during drilling, well construction, and development/test pumping activities were managed in accordance with the FMP. The FMP provided guidance for the management of fluids generated during well drilling and construction activities, well development/test pumping, and the tracer test. The fluid management strategy was based on process knowledge and verification of process knowledge through field screening and on-site monitoring. All fluids produced during the drilling and well construction activities and development/test pumping were monitored on site for tritium activities on two- to three-hour intervals.

Tritium activities of discharge fluids remained within the background range. Sumps were constructed near each well location in accordance with the FMP. The sumps were used to contain both fluids and cuttings from the drilling and well construction processes and subsequent development/testing. The sumps were surrounded by orange construction fencing and each sump was equipped with a life preserver.

6.5 Clean Air

Stoller-Navarro Joint Venture obtained air permit number 9999-1438 from the State of Nevada Department of Conservation and Natural Resources. In compliance with the permit, fugitive dust was controlled on roads and work surfaces, and disturbed land was replanted at completion of the project.

7.0 Site Health and Safety

All work activities at CNTA were conducted in accordance with Title 29 *Code of Federal Regulations* Parts 1910 and 1926 (CFR, 2003a and b); *NV/YMP Radiological Control Manual* (DOE/NV, 2000); Integrated Safety Management System (ISMS); the Industrial Sites Health and Safety Plan (HASP) (SNJV, 2004b); and the *Corrective Action Unit 443 CNTA Subsurface, Central Nevada Test Area Nye County, Nevada, Site-Specific Health and Safety Plan* (SSHASP) (SNJV, 2005a). Copies of the HASP and SSHASP were maintained on site during project activities. Additionally, all activities were conducted in compliance with DOE orders and OSHA regulations.

The SSHASP was subsequently modified by five Technical Field Changes (TFCs). The first TFC, dated April 7, 2005, states that Tyvek™ is optional when handling cuttings and during geophysical logging, and increased the wind speed necessary to shut down operations. The second TFC, dated April 21, 2005, added a shuttle for worker transportation to Tonopah after working a 12-hour shift. The third TFC, dated May 2, 2005, stated that operations should be suspended if lightning strikes within 6 mi of the worksite. The fourth TFC, dated May 27, 2005, states the hazards associated with driving on washed-out roads at the worksite. The fifth TFC, dated July 29, 2005, states that vehicle inspections should be maintained in the respective vehicle and that the emergency brake should be engaged in parked vehicles. All personnel were required to sign a Declaration of Understanding for each TFC.

All site personnel were required to read the HASP and SSHASP and sign the appropriate signature page indicating their understanding. Tailgate Safety Briefings were conducted by SNJV personnel for all site personnel at the beginning of each work shift throughout the duration of the project. All attending personnel signed the signature sheet. Visitors and delivery personnel were given a tailgate safety briefing and radiological briefing, and were given the opportunity to read the SSHASP.

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Appendix A

Well Locations and Setup

Table A.1-1
Central Nevada Test Area State Plane Coordinates

Location	Northing	Easting	Elevation (ft)
UC-1	21099344.497	1769088.789	6082.62
HTH-2	21096938.313	1769746.347	6029.69
HTH-1	21096450.971	1769879.259	6015.67
CNTA MV-1 Main Well	21101711.237	1771323.848	6073.90
CNTA MV-1 Upper Piezometer	21101710.589	1771324.681	6073.93
CNTA MV-1 Lower Piezometer	21101710.835	1771324.003	6073.87
CNTA MV-1 Concrete Pad	21101711.954	1771324.310	6073.16
CNTA MV-2 Main Well	21097738.680	1766707.252	6194.45
CNTA MV-2 Upper Piezometer	21097738.292	1766708.375	6194.68
CNTA MV-2 Lower Piezometer	21097738.860	1766707.002	6194.42
CNTA MV-2 Concrete Pad	21097739.093	1766707.497	6193.75
CNTA MV-3 Main Well	21101566.379	1768971.131	6171.64
CNTA MV-3 Upper Piezometer	21101566.950	1768972.011	6171.67
CNTA MV-3 Lower Piezometer	21101566.579	1768971.474	6171.62
CNTA MV-3 Concrete Pad	21101566.762	1768970.823	6170.99

Universal Transverse Mercator North American Datum 83, vertical Datum NAVD 88
Coordinate units: U.S. survey feet (ft)
Coordinate system: State plan, Nevada Central Zone

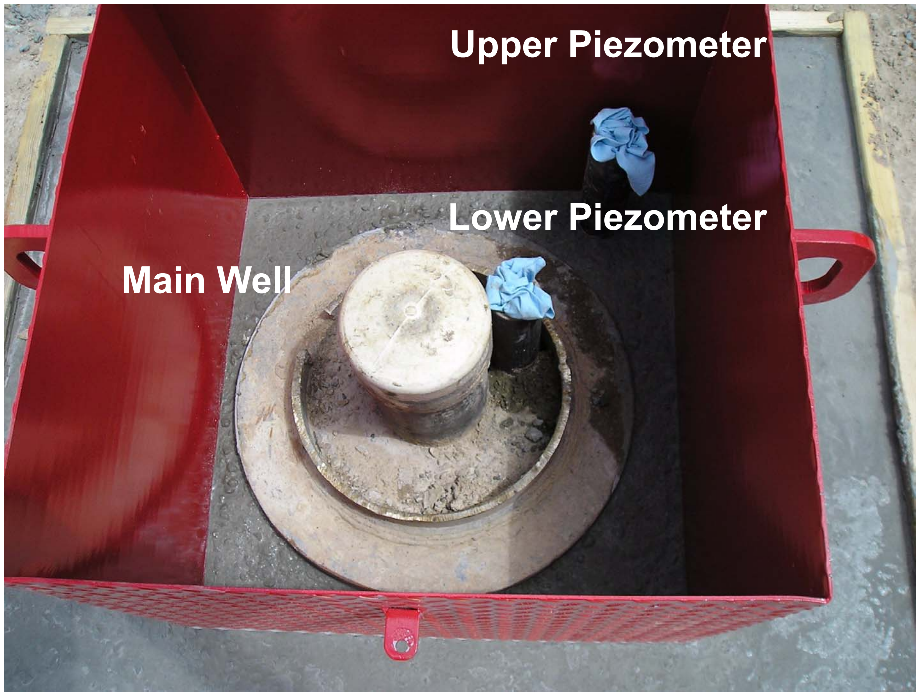


Figure A.1-1
Typical Layout of the Well and Piezometers

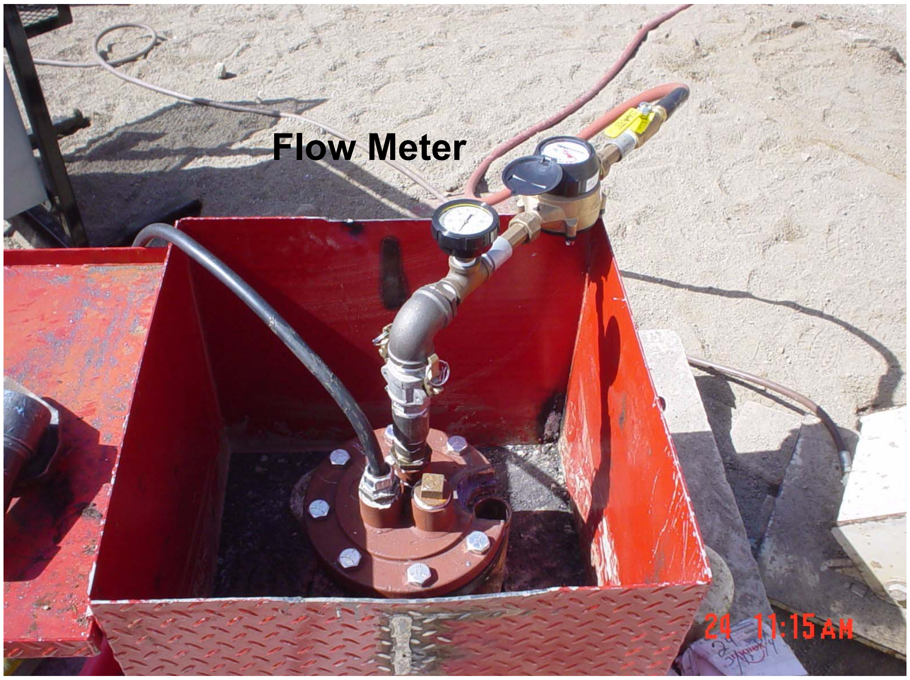


Figure A.1-2
Flow Meter
This photgraph shows the flow meter attached to the completed well head and protection box.

Appendix B

Central Nevada Test Area MV-1 Data

Table B.1-1
Central Nevada Test Area MV-1 Chronology
(Page 1 of 4)

Date and Time	Depth (ft)	Activity
04/04/2005 to 04/08/2005	N/A	Mobilization to CNTA and rig-up to drill
04/08/2005	N/A	Rig inspection and site safety walkdown, continue with preparations for drilling
04/09/2005 1637	0	Begin drilling MV-1, 36-in. borehole, using conventional mud rotary method and Quik-Gel (bentonite) mud
04/10/2005 1345	95	TD borehole for surface casing at 95 ft, trip out and commence installation of 30-in. carbon-steel casing
04/11/2005 0755	95	Complete installation and cementing to surface of 30-in. carbon-steel
04/11/2005 1721	95	Begin drilling 26-in. borehole using conventional mud rotary method, switch to flooded reverse circulation method at 160 ft
04/12/2005 1700	400	Initiate use of LiBr tracer in makeup water, drilling fluid now consists of water and Drispac (polymer)
04/15/2005 0250	1,050	TD borehole for 1st intermediate casing at 1,050 ft, tripout and prepare for Schlumberger geophysical logging
04/15/2005 1630	1,050	Schlumberger arrives to site; logging completed at 2400 hrs
04/16/2005 0430	1,050	Geophysical logs reviewed and MV-1 upper piezometer construction approved, start running tubing into borehole
04/16/2005 0820	1,050	Start running 20-in. carbon-steel intermediate casing string
04/16/2005 1500	1,050	Standby on casing installation, short 20 ft of casing, waiting on materials
04/17/2005 1645	1,050	Casing delivered to site, complete 20-in. casing installation and cement casing
04/18/2005 0430	1,050	Begin MV-1 upper piezometer construction; problems with +1/4-3/8 gravel installation through BQ tremie pipe
04/21/2005 1600	1,050	Begin drilling 17 1/2-in. borehole using flooded reverse circulation method with water and Drispac drilling fluid
04/27/2005 0840	1,920	NDEP and NNSA/NSO site inspection
05/03/2005 2000	2,500	TD borehole for 2nd intermediate casing at 2,500 ft, tripout and prepare for Schlumberger geophysical logging

Table B.1-1
Central Nevada Test Area MV-1 Chronology
(Page 2 of 4)

Date and Time	Depth (ft)	Activity
05/04/2005 1150	2,500	Schlumberger arrives to site; logging completed at 2400 hrs; overall deviation about 1 degree
05/05/2005 0354	2,500	Start running 13 3/8-in. carbon-steel intermediate casing string
05/07/2005 1500	2,500	Finish cementing 13 3/8-in. casing, trip out BQ rods and prepare to drill
05/08/2005 1700	2,500	Begin drilling 12 1/4-in. borehole using flooded reverse circulation method with water and Drispac drilling fluid
05/10/2005 1440	2,780	Stop drilling, tripout for bit change
05/11/2005 1000	2,780	Resume drilling 12 1/4-in. borehole
05/14/2005 2018	4,102	TD borehole at 4,102 ft, tripout and prepare for Schlumberger geophysical logging
05/15/2005 1230		Schlumberger arrives to site; logging completed at 2215 hrs; start running tubing for well construction
05/16/2005 1100		Final MV-1 well and lower piezometer construction design approved; continue running piezometer tubing and well casing
05/18/2005 0920		Well casing and lower piezometer hanging, bottom of borehole cemented; problems encountered with use of #1/20 sand
05/19/2005 1700		Schlumberger back onsite for gravel pack logging, resume well construction
05/20/2005 1130		Begin cementing the isolation between the well and lower piezometer
05/21/2005 1300		Isolation finished, begin stemming lower piezometer; problems encountered with #1/20 sand
05/21/2005 2330		Start cementing above lower piezometer gravel pack, Schlumberger runs final density log on MV-1
05/22/2005		Completed cementing to surface, preparing for airlift development, and mobilizing unneeded equipment to MV-2
05/23/2005 1330		Begin initial airlift development on MV-1 using HQ eductor and AQ/BQ airline, at 2100 hrs stop to finish cement to surface
05/24/2005 1245		Resume initial airlifting on MV-1
05/25/2005 0400		Finish initial airlifting on MV-1, flow <1 gpm, trip out AQ/BQ airline and HQ eductor, rig down to mobilize to MV-2

Table B.1-1
Central Nevada Test Area MV-1 Chronology
(Page 3 of 4)

Date and Time	Depth (ft)	Activity
05/26/2005 0800		Rig mobilized to MV-2, equipment mobilization complete by 2400 hrs
06/03/2005		Upper piezometer development at MV-1 initiated by bailer; 40 gal removed
06/04/2005		Upper piezometer development at MV-1 continued with bailer; 90 gal removed (130-gal cumulative)
06/05/2005		Lower piezometer development at MV-1 initiated by bailer; 140 gal removed
06/13/2005		Initiate airlift development of upper piezometer at MV-1; flow ~15 gpm for 2 hrs equals about 1,800 gal removed
06/14/2005		Finish airlift development of upper piezometer at MV-1; ~4,000 gal removed (5,800-gal cumulative)
06/14/2005		Initiate airlift development of lower piezometer at MV-1; only drilling fluid removed, no estimate on flow rate made
06/15/2005		Lower piezometer at MV-1 non-productive for airlifting, airlift on 2-hr intervals to allow potential recharge; rate <1 gpm
06/16/2005		Continue airlift on lower piezometer at MV-1 on 2-hr intervals
06/17/2005		Continue airlift on lower piezometer at MV-1 on 2-hr intervals
06/18/2005		Lower piezometer at MV-1, back to development by bailing from the bottom, ~17 gal bailed today
06/19/2005		Lower piezometer at MV-1, continue bailing, ~ 32.5 gal bailed today
06/20/2005		Resume airlift development on lower piezometer at MV-1
06/21/2005		Finish with airlift development on MV-1 lower piezometer; removed about 40 gal by airlift today
08/19/2005 0100		Start tripping-in HQ rods for 2nd airlift development on MV-1, using HQ eductor and AQ airline
08/19/2005 1235		Begin 2nd airlift development on MV-1, HQ eductor set at 3,940 ft, AQ/BQ airline advanced from 1,000 ft to 3,440 ft
08/20/2005 0100		Finish 2nd airlift development on MV-1, flow <1 gpm
09/29/2005		Install Grundfos 10S50-58DS, 5 HP, stainless-steel pump in MV-1, intake set ~3,719.15 ft

Table B.1-1
Central Nevada Test Area MV-1 Chronology
(Page 4 of 4)

Date and Time	Depth (ft)	Activity
09/30/2005		Pump MV-1- 366 gal purged
10/01/2005		Pump MV-1- 779 gal purged
10/12/2005		Pump MV-1- 824 gal purged
10/19/2005		Pump MV-1- 740 gal purged

DOE = U.S. Department of Energy
ft = Foot
gal = Gallon
gpm = Gallons per minute
hr = Hour
in. = Inch
LiBr = Lithium bromide
N/A = Not applicable
NDEP = Nevada Division of Environmental Protection
TD = Total depth

Table B.1-2
Central Nevada Test Area MV-1
Downhole Geophysical Data Collected

Geophysical Tool	Date	Top of Interval (ft bgs)	Bottom of Interval (ft bgs)	Interval (ft)	Contractor
Phase I					
Caliper, Temperature, Neutron Porosity, Sonic Porosity, Density, Resistivity (long and short normal), Spontaneous Potential, Spectral Gamma, Natural Gamma, and Magnetic Deviation	April 15, 2005	0	1,050	1,050	Schlumberger
Phase II					
Caliper, Temperature, Neutron Porosity, Sonic Porosity, Density, Resistivity (long and short normal), Spontaneous Potential, Spectral Gamma, Natural Gamma, and Magnetic Deviation	May 4, 2005	1,050	2,500	1,450	Schlumberger
Phase III					
Caliper, Temperature, Neutron Porosity, Sonic Porosity, Density, Resistivity (long and short normal), Spontaneous Potential, Spectral Gamma, Natural Gamma, and Magnetic Deviation	May 15, 2005	2,500	4,100	1,600	Schlumberger
Phase IV					
Nuclear Fluid Density	May 19, 2005	0	4,100	4,100	Schlumberger

bgs = Below ground surface
ft = Foot

Table B.1-3
Central Nevada Test Area MV-1
Bromide Data
(Page 1 of 3)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
08/20/2005	0100	N/A	Water	MV-1 Airlift	21.7	26.60
08/19/2005	2216	N/A	Water	MV-1 Airlift	23.9	24.30
08/19/2005	2115	N/A	Water	MV-1 Airlift	23.9	24.60
08/19/2005	1915	N/A	Water	MV-1 Airlift	23.9	21.40
08/19/2005	1715	N/A	Water	MV-1 Airlift	26.2	26.10
08/19/2005	1523	N/A	Water	MV-1 Airlift	26.3	21.30
08/19/2005	1355	N/A	Water	MV-1 Airlift	25.9	29.60
08/19/2005	1230	N/A	Water	MV-1 Airlift	25.9	28.10
05/24/2005	2200	N/A	Water	MV-1 Airlift	25.1	8.05
05/24/2005	2000	N/A	Water	MV-1 Airlift	25.0	7.91
05/24/2005	1900	N/A	Water	MV-1 Airlift	25.3	2.27
05/24/2005	1800	N/A	Water	MV-1 Airlift	25.4	0.72
05/24/2005	1700	N/A	Water	MV-1 Airlift	24.7	1.61
05/24/2005	1430	N/A	Water	MV-1 Airlift	24.9	9.36
05/24/2005	1330	N/A	Water	MV-1 Airlift	25.0	0.59
05/24/2005	1230	N/A	Water	MV-1 Airlift	25.0	0.48
05/24/2005	0400	N/A	Water	MV-1 Airlift	25.2	1.00
05/23/2005	2100	1,940	Water	MV-1 Airlift	23.8	88.80
05/23/2005	2000	1,960	Water	MV-1 Airlift	23.8	88.80
05/23/2005	1830	1,960	Water	MV-1 Airlift	24.9	1,700.00
05/23/2005	1530	1,500	Water	MV-1 Airlift	25.0	31.40
05/23/2005	1500	1,500	Water	MV-1 Airlift	25.0	31.40
05/23/2005	1400	1,000	Water	MV-1 Airlift	25.9	38.80
05/14/2005	1800	4,060	Water	Discharge	24.8	53.20
05/14/2005	1500	4,000	Water	Discharge	25.2	55.00
05/14/2005	1200	3,960	Water	Discharge	25.1	57.70
05/14/2005	0900	3,907	Water	Discharge	26.3	74.00

Table B.1-3
Central Nevada Test Area MV-1
Bromide Data
(Page 2 of 3)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
05/14/2005	0600	3,880	Water	Discharge	24.2	73.50
05/14/2005	0300	3,857	Water	Discharge	24.1	73.00
05/14/2005	0000	3,835	Water	Discharge	24.1	74.00
05/13/2005	2100	3,807	Water	Discharge	22.6	67.90
05/13/2005	1815	3,780	Water	Discharge	27.7	65.50
05/13/2005	1500	3,720	Water	Discharge	23.7	74.40
05/13/2005	0900	3,160	Water	Discharge	25.8	58.40
05/13/2005	0600	3,600	Water	Discharge	25.3	64.00
05/13/2005	0300	3,543	Water	Discharge	25.0	63.40
05/13/2005	0100	3,520	Water	Discharge	25.1	62.80
05/12/2005	1950	3,400	Water	Discharge	25.2	58.00
05/12/2005	1350	3,260	Water	Discharge	25.0	61.00
05/12/2005	0900	3,160	Water	Discharge	25.9	52.80
05/12/2005	0700	3,120	Water	Discharge	24.9	53.30
05/12/2005	0300	3,078	Water	Discharge	25.1	53.00
05/12/2005	0000	3,049	Water	Discharge	25.1	50.90
05/11/2005	1600	2,895	Water	Discharge	28.7	25.60
05/11/2005	1600	2,980	Water	Discharge	24.4	26.60
05/10/2005	0900	2,752	Water	Discharge	25.3	46.20
05/10/2005	0200	2,740	Water	Discharge	25.8	48.80
05/09/2005	0900	2,585	Water	Discharge	23.3	37.80
05/09/2005	0500	2,564	Water	Discharge	23.2	35.90
05/09/2005	0100	2,535	Water	Discharge	23.6	37.40
05/03/2005	0700	2,405	Water	Discharge	24.8	33.80
05/03/2005	0300	2,388	Water	Discharge	24.9	36.50
05/02/2005	2115	2,360	Water	Discharge	25.0	36.80
05/02/2005	1615	2,338	Water	Discharge	25.2	37.60

Table B.1-3
Central Nevada Test Area MV-1
Bromide Data
(Page 3 of 3)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
05/02/2005	0700	2,295	Water	Discharge	24.7	41.80
05/02/2005	0400	2,280	Water	Discharge	24.1	38.40
05/01/2005	2300	2,260	Water	Discharge	24.6	38.10
05/01/2005	0700	2,205	Water	Discharge	23.6	45.00
05/01/2005	0415	2,195	Water	Discharge	24.4	48.60
05/01/2005	0115	2,180	Water	Discharge	24.0	42.80
04/30/2005	0915	2,110	Water	Discharge	23.4	45.20
04/30/2005	0515	2,100	Water	Discharge	23.2	47.40
04/29/2005	0945	2,080	Water	Discharge	24.7	53.80
04/29/2005	0710	2,040	Water	Discharge	23.6	57.10
04/29/2005	0710	2,059	Water	Discharge	23.5	59.20
04/29/2005	0700	2,018	Water	Discharge	23.0	58.60
04/29/2005	0650	1,999	Water	Discharge	22.9	53.80
04/24/2005	0110	1,677	Water	Discharge	31.8	25.00
04/24/2005	0000	1,595	Water	Discharge	22.9	34.40
04/22/2005	2300	1,400	Water	Discharge	22.2	53.10
04/22/2005	1930	1,365	Water	Discharge	22.9	46.30
04/22/2005	0740	1,280	Water	Discharge	23.1	36.10
04/21/2005	2030	1,130	Water	Discharge	22.5	102.00
04/21/2005	1645	1,070	Water	Discharge	25.4	21.40
04/15/2005	2155	1,050	Water	Discharge	24.0	9.44
04/15/2005	2145	1,040	Water	Discharge	23.4	9.84
04/15/2005	2125	955	Water	Discharge	23.1	7.80
04/15/2005	2120	980	Water	Discharge	23.4	7.11
04/15/2005	2110	960	Water	Discharge	23.5	5.790

ºC = Degrees Celsius ft = Foot mg/L = Milligrams per liter N/A = Not applicable

Table B.1-4
Central Nevada Test Area MV-1 Upper Piezometer Bromide Data

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
06/05/2005	0300	N/A	Water	MV-1 Upper Piezometer	25.5	14.50
06/05/2005	0330	N/A	Water	MV-1 Upper Piezometer	24.5	22.20
06/05/2005	1000	N/A	Water	MV-1 Upper Piezometer	23.6	26.30

ºC = Degrees Celsius ft = Foot mg/L = Milligrams per liter N/A = Not applicable

Table B.1-5
Central Nevada Test Area MV-1 Lower Piezometer Bromide Data

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
06/20/2005	1500	N/A	Water	MV-1 Lower Piezometer	25	5.04
06/19/2005	1200	N/A	Water	MV-1 Lower Piezometer	27.4	5.26
06/18/2005	1500	N/A	Water	MV-1 Lower Piezometer	23.6	2.67
06/17/2005	0130	2,160	Water	MV-1 Lower Piezometer	24.4	6.07
06/17/2005	0130	N/A	Water	MV-1 Lower Piezometer	24.4	4.28
06/17/2005	1000	N/A	Water	MV-1 Lower Piezometer	24.4	3.87
06/05/2005	1300	N/A	Water	MV-1 Lower Piezometer	25.1	32.30
06/05/2005	1500	N/A	Water	MV-1 Lower Piezometer	22.9	37.60
06/05/2005	1700	N/A	Water	MV-1 Lower Piezometer	25.0	37.70
06/05/2005	0300	N/A	Water	MV-1 Lower Piezometer	23.7	41.10

ºC = Degrees Celsius ft = Foot mg/L = Milligrams per liter N/A = Not applicable

Table B.1-6
Central Nevada Test Area MV-1
Water Quality Data

Date	Time	Depth (ft)	pH (SU)	Temperature (°C)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
08/19/2005	1230	N/A	7.55	N/A	0.90	0.90	-1.71E+03	28.10

°C = Degrees Celsius
mg/L = Milligrams per liter
pCi/L = Picocuries per liter
mS/cm = millisiemens per centimeter
ft = Foot
N/A = Not applicable
SU = Standard unit

Table B.1-7
Central Nevada Test Area MV-1
Upper Piezometer Water Quality Data
(Page 1 of 2)

Date	Time	Depth (ft)	pH (SU)	Temperature (°C)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
06/14/2005	1045	N/A	8.38	N/A	0.30	0.30	-3.69E+03	0.93
06/14/2005	1000	N/A	8.43	N/A	0.30	0.30	-3.87E+03	0.77
06/13/2005	1900	N/A	7.96	20.50	0.30	0.30	-3.24E+03	1.96
06/13/2005	1715	N/A	8.10	21.00	0.30	0.30	-2.88E+03	4.53
06/08/2005	1740	N/A	8.99	24.10	0.50	0.50	-2.61E+03	45.00
06/08/2005	1140	N/A	8.88	24.50	0.60	0.60	-3.33E+03	55.10
06/07/2005	1845	N/A	9.10	24.90	0.70	0.70	-2.16E+03	37.70
06/07/2005	1220	N/A	8.60	24.20	0.60	0.60	-3.42E+03	81.30
06/06/2005	2020	N/A	8.52	22.00	0.10	0.10	-4.23E+03	51.90
06/06/2005	2010	N/A	7.96	22.00	0.60	0.60	-3.69E+00	27.00
06/05/2005	1700	N/A	9.14	19.30	0.80	0.80	-3.33E+03	37.70
06/05/2005	1503	N/A	8.78	20.70	0.90	0.90	-3.96E+03	37.60
06/05/2005	1300	N/A	8.42	21.30	0.90	0.90	-3.24E+03	32.30
06/05/2005	1000	N/A	10.80	19.80	0.50	0.50	-5.41E+03	26.30
06/04/2005	1840	N/A	10.60	19.50	0.50	0.50	-1.26E+03	22.20
06/04/2005	1540	N/A	10.40	20.00	0.40	0.40	-1.98E+03	21.30
06/04/2005	1405	N/A	10.40	20.00	0.40	0.40	-1.98E+03	20.50

Table B.1-7
Central Nevada Test Area MV-1
Upper Piezometer Water Quality Data
(Page 2 of 2)

Date	Time	Depth (ft)	pH (SU)	Temperature (ºC)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
06/04/2005	1253	N/A	10.20	18.60	0.40	0.40	-1.89E+03	21.80
06/04/2005	1030	N/A	10.20	20.90	0.60	0.60	1.17E+03	14.50

ºC = Degrees Celsius
ft = Foot
mg/L = Milligrams per liter
N/A = Not applicable
pCi/L = Picocuries per liter
SU = Standard unit
mS/cm = millisiemens per centimeter

Table B.1-8
Central Nevada Test Area MV-1
Lower Piezometer Water Quality Data

Date	Time	Depth (ft)	pH (SU)	Temperature (ºC)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
06/21/2005	1200	N/A	10.56	N/A	1.20	1.20	-3.06E+03	4.61
06/21/2005	1500	N/A	10.50	N/A	1.20	1.20	-3.96E+03	4.38
06/20/2005	1500	N/A	10.95	N/A	1.30	1.30	-3.42E+03	5.04
06/19/2005	1230	N/A	10.96	N/A	1.30	1.30	-3.24E+03	5.26
06/18/2005	1500	N/A	11.20	N/A	1.80	1.80	-4.32E+03	2.67
06/17/2005	0900	N/A	10.25	N/A	1.30	1.30	-4.05E+03	3.87
06/16/2005	1600	N/A	10.33	N/A	1.30	1.30	-2.61E+03	4.28
06/15/2005	1600	N/A	9.75	N/A	1.40	1.40	-1.17E+03	6.07
06/14/2005	1600	N/A	9.66	N/A	0.60	0.60	-2.25E+03	14.70
06/05/2005	1000	N/A	8.89	18.60	0.80	0.80	-2.43E+03	41.10

ºC = Degrees Celsius
ft = Foot
mg/L = Milligrams per liter
N/A = Not applicable
pCi/L = Picocuries per liter
SU = Standard unit
mS/cm = millisiemens per centimeter

Table B.1-9
Stemming Materials Used in CNTA MV-1 Construction

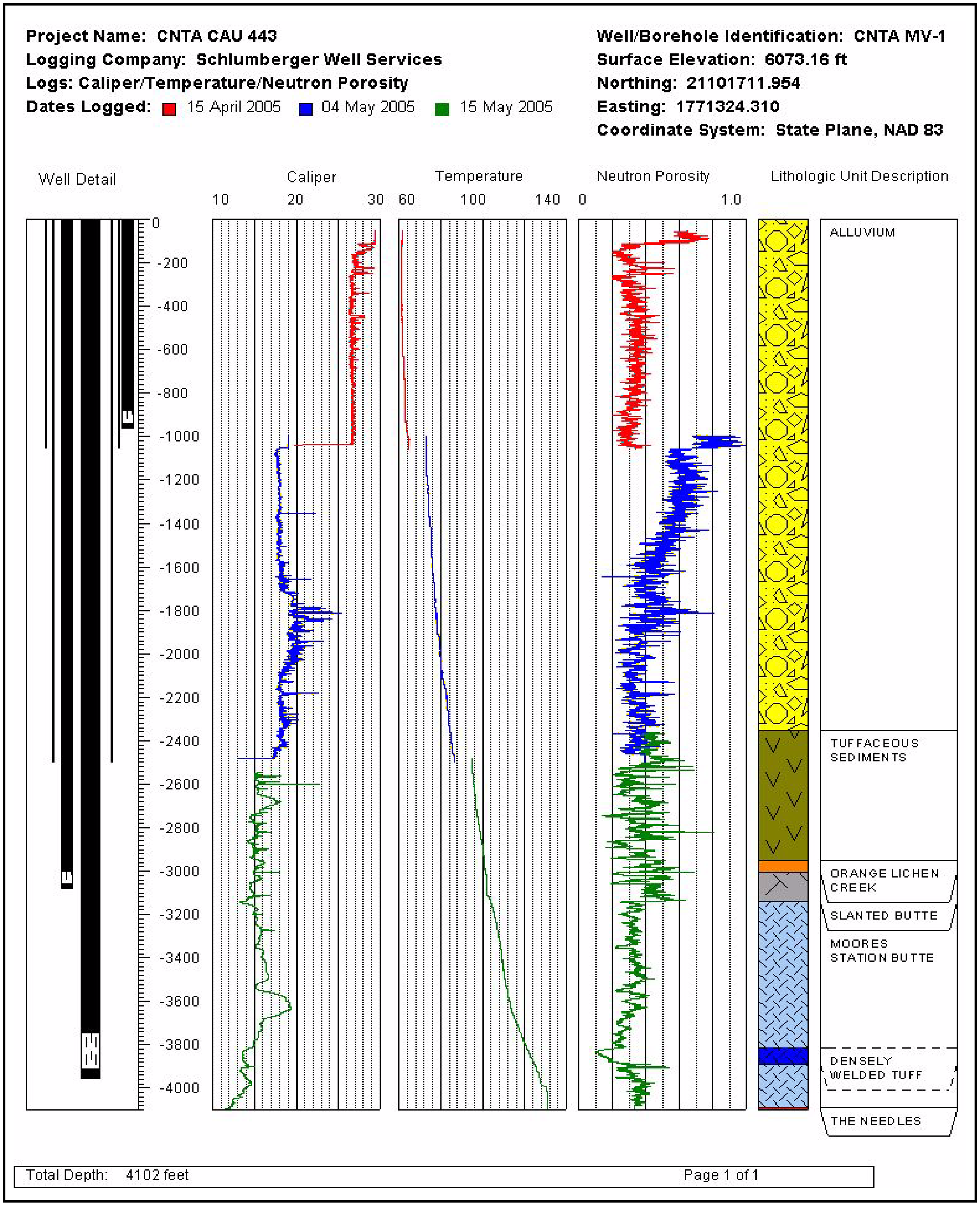
Material	Volume	Interval
Portland Type II Cement	378 ft³	0-95 ft
Portland Type II Cement	70 ft³	0-686 ft
Bentonite Hole Plug	40 ft³	686-720 ft
1x20 Sand	90 ft³	720-760 ft
6x12 Sand	100 ft³	760-790 ft
1/4 x 3/8 Gravel	180 ft³	790-998 ft
Portland Type II Cement	75 ft³	998-1,050 ft
Portland Type II Cement	285 ft³	~2,150- 2,500 ft
Portland Type II Cement	1,118 ft³	0-2,828 ft
1x20 Sand	101 ft³	2,828-2,919 ft
6x12 Sand	13 ft³	2,919-2,932 ft
1/4 x 3/8 Gravel	120 ft³	2,932-3,144 ft
1x20 Sand	35 ft³	3,144-3,166 ft
Portland Type II Cement	470 ft³	3,166-3,584 ft
1x20 Sand	72 ft³	3,584-3,664 ft
6x12 Sand	75 ft³	3,664-3,704 ft
1/4 x 3/8 Gravel	180 ft³	3,704-3,969 ft
1x20 Sand	16 ft³	3,969-3,990 ft
Portland Type II Cement	70 ft³	3,990-4,102 ft

ft = Foot
ft^3 = Cubic foot

Table B.1-10
Materials Used in CNTA MV-1 Construction

Material	Type	Interval
30-in. CS Casing	Blank	0-95 ft
2.375-in. Flush Joint Upper Piezometer String	Blank	0-879 ft
	Screen	879-939 ft
	Blank (Sump)	939-959 ft
	Bullnose	959-959.12 ft
20-in. CS Casing	Blank	0-1,050 ft
13.375-in. CS Casing	Blank	0-2,500 ft
5.5-in. CS Casing	Blank (Epoxy Coated)	0-3,750 ft
	Screen (Epoxy Coated)	3,750-3,909.56 ft
	Blank (Sump)	3,909.56-3,953 ft
	Bullnose	3,953-3,954 ft
2.375-in. Flush Joint Lower Piezometer String	Blank	0-3,002 ft
	Screen	3,002-3,062 ft
	Blank (Sump)	3,062-3,082 ft
	Bullnose	3,082-3,082.12 ft

CS = Carbon steel
ft = Foot
in. = Inch



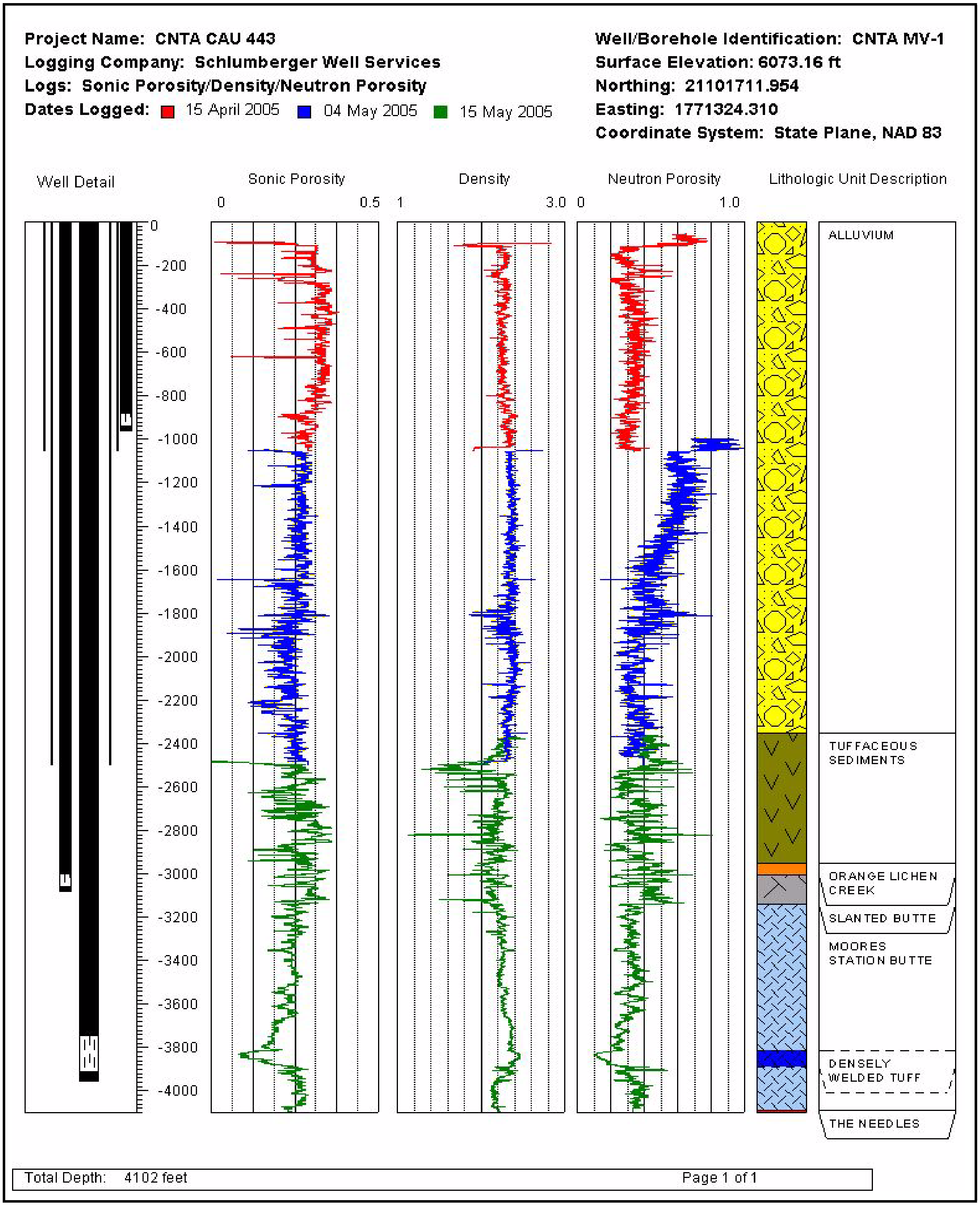
Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Caliper/Temperature/Neutron Porosity
Dates Logged: 🟥 15 April 2005 🟦 04 May 2005 🟩 15 May 2005

Well/Borehole Identification: CNTA MV-1
Surface Elevation: 6073.16 ft
Northing: 21101711.954
Easting: 1771324.310
Coordinate System: State Plane, NAD 83

Total Depth: 4102 feet

Page 1 of 1

Figure B.1-1
MV-1 Caliper/Temperature/Neutron Porosity



Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Sonic Porosity/Density/Neutron Porosity
Dates Logged: 🟥 15 April 2005 🟦 04 May 2005 🟩 15 May 2005

Well/Borehole Identification: CNTA MV-1
Surface Elevation: 6073.16 ft
Northing: 21101711.954
Easting: 1771324.310
Coordinate System: State Plane, NAD 83

Total Depth: 4102 feet

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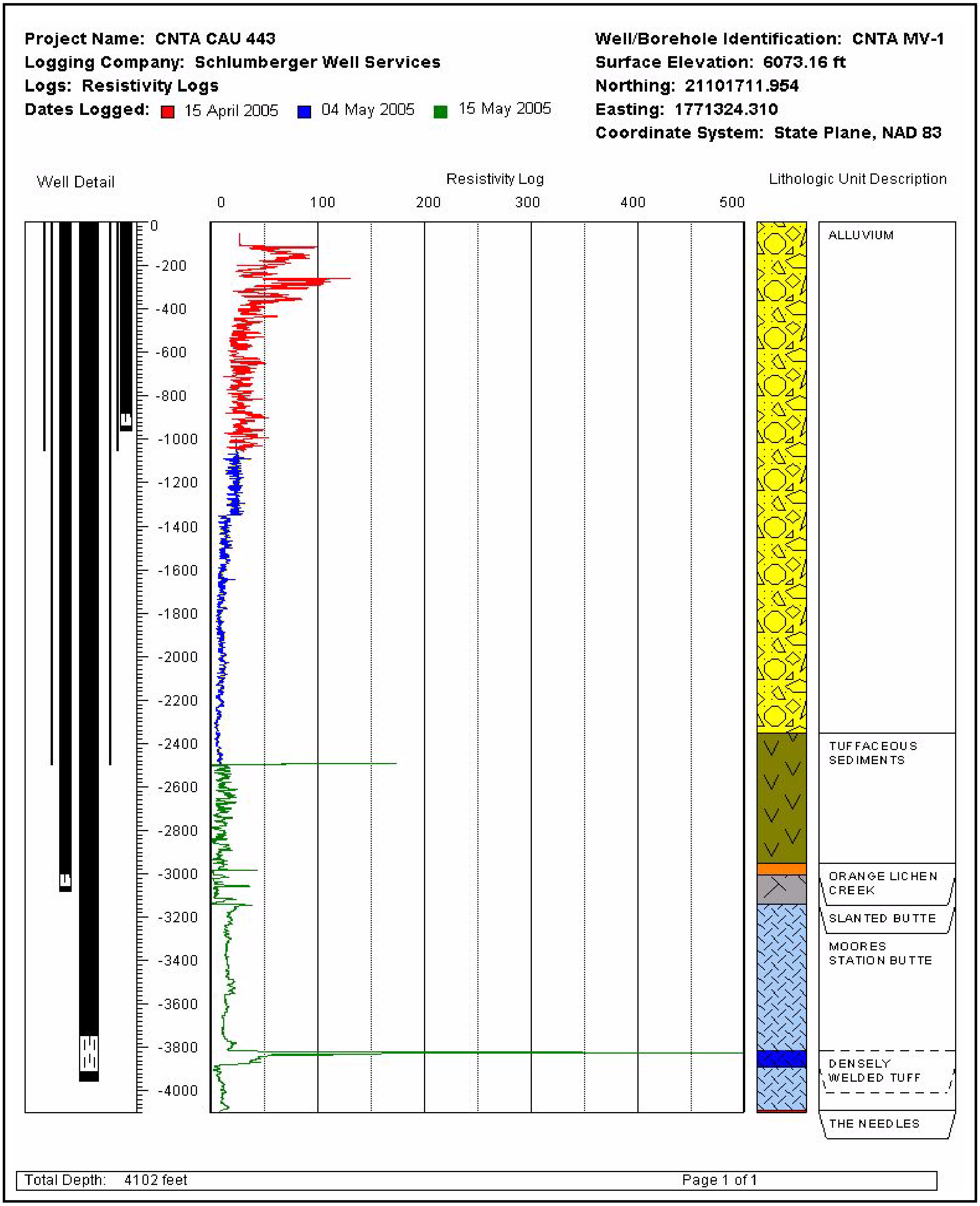
Figure B.1-2
MV-1 Sonic Porosity/Density/Neutron Porosity



Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Resistivity Logs
Dates Logged: 🟥 15 April 2005 🟦 04 May 2005 🟩 15 May 2005

Well/Borehole Identification: CNTA MV-1
Surface Elevation: 6073.16 ft
Northing: 21101711.954
Easting: 1771324.310
Coordinate System: State Plane, NAD 83

Total Depth: 4102 feet

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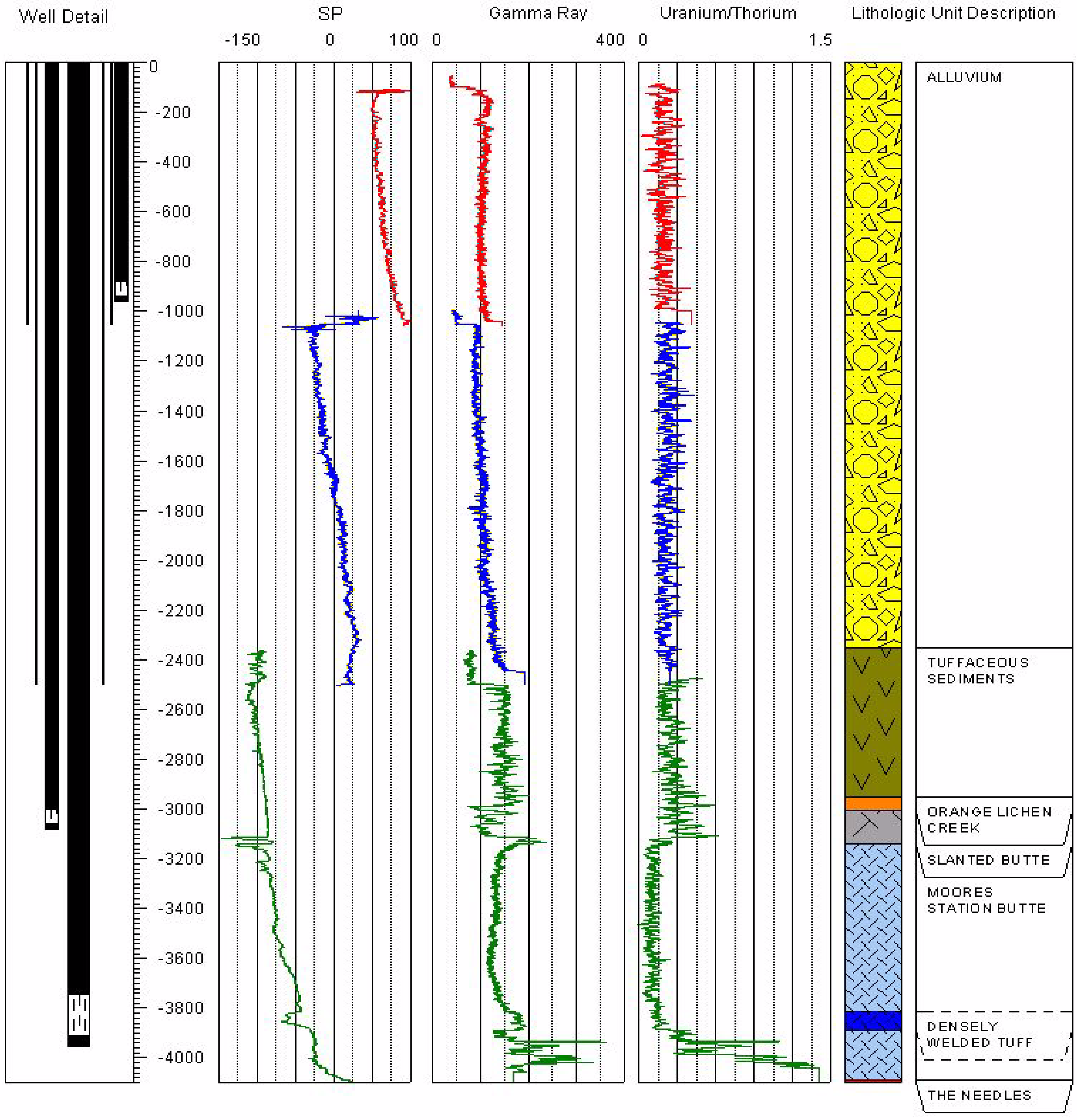
Figure B.1-3
MV-1 Resistivity Logs

Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Spontaneous Potential/Gamma Ray/Uranium-Thorium
Date Logged: 🟥 15 April 2005 🟦 04 May 2005 🟩 15 May 2005

Well/Borehole Identification: CNTA MV-1
Surface Elevation: 6073.16 ft
Northing: 21101711.954
Easting: 1771324.310
Coordinate System: State Plane, NAD 83



Total Depth: 4102 feet

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Figure B.1-4
MV-1 Spontaneous Potential/Gamma Ray/Uranium-Thorium

Appendix C

Central Nevada Test Area MV-2 Data

Table C.1-1
Central Nevada Test Area MV-2 Chronology
(Page 1 of 4)

Date and Time	Depth (ft)	Activity
05/26/2005 0800		Rig mobilized from MV-1, rig-up and prepare to drill
05/27/2005 1245		Rig walkdown conducted, deficiencies corrected, continue preparations to drill
05/27/2005 2100	0	Begin drilling MV-2, 36-in. borehole, using conventional mud rotary method and Quik-Gel (bentonite) mud
05/28/2005 0950	95	TD borehole for surface casing at 95 ft, trip out and commence installation of 30-in. carbon-steel casing
05/29/2005 0500	95	Complete installation and cementing to surface of 30-in. carbon-steel casing
05/29/2005 1300	95	Begin drilling 26-in. borehole using conventional mud rotary method, switch to flooded reverse circulation method at 180 ft
05/30/2005 1210	280	Trip out to change BHA and replace hydraulic hose on rod arm, drilling fluid is Drispac and water
05/30/2005 1608	280	Resume drilling 26-in. borehole
06/01/2005 1043	845	NNSA/NSO site walkdown
06/02/2005 0652	1,050	TD borehole for 1st intermediate casing at 1,050 ft, trip out and prepare for Schlumberger geophysical logging
06/02/2005 1245	1,050	Schlumberger arrives to site; logging completed at 2030 hrs, start running BQ tremie and piezometer tubing
06/02/2005 2230	1,050	Geophysical logs reviewed and MV-1 upper piezometer construction designed by SNJV/DRI
06/03/2005 0630	1,050	Start running 20-in. carbon-steel intermediate casing string; casing hanging at 1530 hrs; cement bottom of casing
06/03/2005 2300	1,050	Begin MV-2 upper piezometer construction; problems with +1/8-1/4 gravel installation through BQ tremie pipe
06/06/2005 1520	1,050	Begin drilling 17 1/2-in. borehole using flooded reverse circulation method with water and Drispac drilling fluid
06/09/2005 0300	1,745	Trip out for bit change; hydraulic pump on rig goes down; stand by for rig repairs
06/12/2005 0600	1,745	Resume drilling 17 1/2-in. borehole after completion of rig repairs
06/15/2005 1053	2,165	TD borehole at 2,165 ft for 2nd intermediate casing, circulate, trip out, and prepare for Schlumberger geophysical logging
06/15/2005 1900	2,165	Schlumberger arrives to site; logging completed at 0230 hrs on 06/16/05

Table C.1-1
Central Nevada Test Area MV-2 Chronology
(Page 2 of 4)

Date and Time	Depth (ft)	Activity
06/16/2005 0530	2,165	Start running 13 3/8-in. carbon-steel intermediate casing string
06/18/2005 1230	2,165	Begin drilling 12 1/4-in. borehole using flooded reverse circulation method with water and Drispac drilling fluid
06/21/2005 0000	3,160	Trip out for bit change
06/21/2005 2300	3,160	Resume drilling 12 1/4-in. borehole using carbide bit
06/24/2005 0600	3,460	Twist off downhole, trip out to fish
06/26/2005 1650	3,460	Resume drilling 12 1/4-in. borehole using carbide bit
06/29/2005 1005	3,660	TD borehole at 3,660 ft trip out and prepare for Schlumberger geophysical logging
06/29/2005 1700		Schlumberger arrives to site; logging completed at 0300 hrs on 6/30/05; start running tubing for well construction
06/30/2005 1056		Final MV-2 well and lower piezometer construction design approved; continue running piezometer tubing and well casing
07/01/2005 1630		Well casing and lower piezometer hanging, prepare to gravel pack lower piezometer
07/01/2005 2225		Start pumping gravel pack for lower piezometer of MV-2
07/03/2005 1345		Finish cementing isolation between lower piezometer and well MV-2, Schlumberger arrives to site, prepare for logging
07/04/2005 0530		Hot batch of cement placed on top of MV-2 gravel pack, Schlumberger runs final density log on MV-2 and rigs down
07/05/2005 0930		Begin initial aiirlifting on MV-2 using HQ eductor and AQ airline tubing
07/06/2005 0200		Finish initial airlifting on MV-2, flow ~2.5 gpm, trip out AQ/BQ airline and 1,700 ft of HQ eductor, prepare for final cement
07/06/2005 2400		Complete final cementing to surface of MV-2, trip out HQ rods, mobilization to MV-3 continues
07/07/2005		Rig mobilized to MV-3, equipment mobilization complete by 2400 hrs
07/14/2005		Development of upper piezometer at MV-2 initiated using airlift method; ~150 gal removed, max flow ~ 3 gpm
07/15/2005		Airlift development of upper piezometer flow ~5 gpm; 1/2-in. tubing tags bottom ~20 ft below top of screen (980 ft)

Table C.1-1
Central Nevada Test Area MV-2 Chronology
(Page 3 of 4)

Date and Time	Depth (ft)	Activity
07/16/2005		Airlift tubing in upper piezometer plugged, trip out to clean, trip in, resume airlift from 966 ft, flow rate ~4.8 gpm
07/17/2005		MV-2 upper piezometer separated/ruptured; gravel tagged inside tubing at 924 ft and rising with airlift, stop airlift and trip out tubing
07/18/2005		Development of lower piezometer at MV-2 initiated using airlift method; ~10 gal removed, recharging necessary between lifts
07/19/2005		Airlift development on lower piezometer at MV-2 is non-productive, initiate development from top by bailing; ~31 gal removed
07/20/2005		Development of lower piezometer continues with 50 gal bailed
07/21/2005		Development of lower piezometer continues with 50 gal bailed
07/25/2005		Development of lower piezometer continues with 25 gal bailed
07/26/2005		Development of lower piezometer continues with 80 gal bailed
07/27/2005		Development of lower piezometer continues with 70 gal bailed
07/28/2005		Development of lower piezometer continues with 47.5 gal bailed
07/29/2005		Development of lower piezometer continues with 60 gal bailed
07/30/2005		Development of lower piezometer continues with 60 gal bailed
07/31/2005		Development of lower piezometer continues with 57.5 gal bailed
08/01/2005		Development of lower piezometer continues with 57.5 gal bailed
08/02/2005		Development of lower piezometer continues with 57.5 gal bailed
08/03/2005		Development of lower piezometer continues with 51.25 gal bailed
08/04/2005		Development of lower piezometer continues with 48.75 gal bailed
08/05/2005		Development of lower piezometer continues with 30 gal bailed
08/16/2005 2245		Start tripping-in HQ rods for 2nd airlift development on MV-2, using HQ eductor and AQ/BQ airline

Table C.1-1
Central Nevada Test Area MV-2 Chronology
(Page 4 of 4)

Date and Time	Depth (ft)	Activity
08/17/2005 0815		Begin 2nd airlift development on MV-2
08/18/2005 1500		Finish 2nd airlift development on MV-2, flow rate ~2 gpm, removed a total of 7,300 gal
09/23/2005		Install Grundfos 10S50-58DS, 5 HP, stainless-steel pump in MV-2, intake set 1,741.08 ft
09/24/2005		Pump MV-2- 1,670 gal purged
10/12/2005		Pump MV-2- 1,571 gal purged
10/13/2005		Pump MV-2- 867 gal purged
10/20/2005		Pump MV-2- 1,350 gal purged

BHA = Bottom hole assembly
DRI = Desert Research Institute
ft = Foot
gal = Gallon
gpm = Gallons per minute
hr = Hour
in. = Inch
NNSA/NSO = National Nuclear Security Administration/Nevada Site Office
SNJV = Stoller-Navarro Joint Venture
TD = Total depth

Table C.1-2
Central Nevada Test Area MV-2
Downhole Geophysical Data Collected

Geophysical Tool	Date	Top of Interval (ft bgs)	Bottom of Interval (ft bgs)	Interval (ft)	Contractor
Phase I					
Caliper, Temperature, Neutron Porosity, Sonic Porosity, Density, Resistivity (long and short normal), Spontaneous Potential, Spectral Gamma, Natural Gamma, and Magnetic Deviation	June 2, 2005	0	1,050	1,050	Schlumberger
Phase II					
Caliper, Temperature, Neutron Porosity, Sonic Porosity, Density, Resistivity (long and short normal), Spontaneous Potential, Spectral Gamma, Natural Gamma, and Magnetic Deviation	June 15, 2005	1,050	2,165	1,115	Schlumberger
Phase III					
Caliper, Temperature, Neutron Porosity, Sonic Porosity, Density, Resistivity (long and short normal), Spontaneous Potential, Spectral Gamma, Natural Gamma, and Magnetic Deviation	June 30, 2005	2,165	3,660	1,495	Schlumberger
Phase IV					
Nuclear Fluid Density	July 4, 2005	0	3,660	3,660	Schlumberger

bgs = Below ground surface
ft = Foot

Table C.1-3
Central Nevada Test Area MV-2
Bromide Data
(Page 1 of 6)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (^oC)	Sample Conc. (mg/L)
08/18/2005	1200	N/A	Water	MV-2 Airlift	24.5	8.26
08/18/2005	1000	N/A	Water	MV-2 Airlift	25.9	2.27
08/18/2005	0800	N/A	Water	MV-2 Airlift	25.4	6.24
08/18/2005	0600	N/A	Water	MV-2 Airlift	25.4	6.28
08/18/2005	0400	N/A	Water	MV-2 Airlift	25.4	8.01
08/18/2005	0200	N/A	Water	MV-2 Airlift	25.1	5.03
08/18/2005	0000	N/A	Water	MV-2 Airlift	24.6	7.01
08/17/2005	2200	N/A	Water	MV-2 Airlift	23.6	19.00
08/17/2005	2030	N/A	Water	MV-2 Airlift	23.8	22.50
08/17/2005	1800	N/A	Water	MV-2 Airlift	23.6	15.00
08/17/2005	1600	N/A	Water	MV-2 Airlift	23.5	10.20
08/17/2005	1400	N/A	Water	MV-2 Airlift	23.6	12.00
08/17/2005	1200	N/A	Water	MV-2 Airlift	23.6	8.30
07/06/2005	0130	N/A	Water	MV-2 Airlift	24.7	15.90
07/05/2005	2200	N/A	Water	MV-2 Airlift	24.1	21.10
07/05/2005	0945	N/A	Water	MV-2 Airlift	23.7	35.50
06/29/2005	0900	3,656	Water	Discharge	26.0	46.30
06/29/2005	0600	3,645	Water	Discharge	25.0	49.20
06/29/2005	0300	3,638	Water	Discharge	24.9	51.10
06/29/2005	0000	3,622	Water	Discharge	25.7	48.70
06/28/2005	2200	3,614	Water	Discharge	25.8	44.40
06/28/2005	1900	3,594	Water	Discharge	25.5	45.30
06/28/2005	1600	3,584	Water	Discharge	24.9	41.10
06/28/2005	1300	3,577	Water	Discharge	24.1	44.50
06/28/2005	0900	3,562	Water	Discharge	23.9	60.10
06/28/2005	0600	3,554	Water	Discharge	24.2	54.40
06/28/2005	0300	3,541	Water	Discharge	24.8	55.50

Table C.1-3
Central Nevada Test Area MV-2
Bromide Data
(Page 2 of 6)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (°C)	Sample Conc. (mg/L)
06/28/2005	0000	3,536	Water	Discharge	24.5	55.00
06/27/2005	2200	3,528	Water	Discharge	25.3	94.50
06/27/2005	1900	3,519	Water	Discharge	24.8	59.40
06/27/2005	1600	3,510	Water	Discharge	25.1	64.70
06/27/2005	1300	3,501	Water	Discharge	25.3	65.20
06/27/2005	0900	3,494	Water	Discharge	25.3	38.10
06/27/2005	0600	3,488	Water	Discharge	25.1	44.00
06/27/2005	0300	3,482	Water	Discharge	25.2	44.80
06/27/2005	0000	3,480	Water	Discharge	24.7	45.40
06/26/2005	2200	3,475	Water	Discharge	25.8	34.50
06/26/2005	1900	3466	Water	Discharge	26.0	35.10
06/26/2005	1700	3,461	Water	Discharge	24.8	28.80
06/26/2005	1300	3,457	Water	Discharge	24.2	29.70
06/24/2005	0300	3,457	Water	Discharge	26.2	27.10
06/24/2005	0000	3,445	Water	Discharge	25.4	30.10
06/23/2005	2200	3,440	Water	Discharge	25.4	34.60
06/23/2005	1900	3,433	Water	Discharge	26.6	34.90
06/23/2005	1600	3,412	Water	Discharge	23.0	36.40
06/23/2005	1300	3,392	Water	Discharge	23.3	36.40
06/23/2005	0900	3,360	Water	Discharge	25.00	31.00
06/23/2005	0600	3,340	Water	Discharge	24.5	29.30
06/23/2005	0300	3,320	Water	Discharge	25.2	30.00
06/23/2005	0000	3,319	Water	Discharge	24.9	30.70
06/22/2005	2200	3,300	Water	Discharge	25.8	29.70
06/22/2005	1900	3,278	Water	Discharge	25.8	31.10
06/22/2005	1600	3,241	Water	Discharge	24.2	31.20
06/22/2005	1300	3,220	Water	Discharge	25.3	33.70

Table C.1-3
Central Nevada Test Area MV-2
Bromide Data
(Page 3 of 6)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (°C)	Sample Conc. (mg/L)
06/20/2005	2100	3,143	Water	Discharge	25.3	26.40
06/20/2005	1800	3,120	Water	Discharge	25.2	27.70
06/20/2005	1500	3,100	Water	Discharge	24.6	29.60
06/20/2005	1200	3,080	Water	Discharge	24.3	29.70
06/20/2005	0900	3,040	Water	Discharge	25	26.20
06/20/2005	0600	3,020	Water	Discharge	27	25.30
06/20/2005	0300	2,980	Water	Discharge	25	25.50
06/20/2005	0000	2,960	Water	Discharge	24.2	26.70
06/19/2005	2100	2,892	Water	Discharge	23.4	31.30
06/19/2005	1800	2,800	Water	Discharge	23.9	30.20
06/19/2005	1500	2,740	Water	Discharge	26.1	30.60
06/19/2005	1200	2,680	Water	Discharge	24.7	31.50
06/19/2005	0615	2,550	Water	Discharge	27.0	26.90
06/19/2005	0250	2,560	Water	Discharge	25.0	26.50
06/19/2005	0000	2,400	Water	Discharge	24.0	24.50
06/18/2005	2100	2,400	Water	Discharge	23.4	31.50
06/18/2005	1800	2,305	Water	Discharge	23.4	32.60
06/18/2005	1500	2,220	Water	Discharge	24.3	27.60
06/15/2005	2230	2,157	Water	Discharge	24.5	34.20
06/15/2005	1900	2,146	Water	Discharge	25.0	35.90
06/15/2005	1600	2,129	Water	Discharge	24.2	32.70
06/15/2005	1300	2,117	Water	Discharge	25.0	31.40
06/14/2005	2100	2,100	Water	Discharge	24.7	33.90
06/14/2005	1800	2,072	Water	Discharge	24.6	31.00
06/14/2005	1500	2,048	Water	Discharge	25.2	33.30
06/14/2005	1200	2,032	Water	Discharge	25.1	33.80
06/14/2005	1000	2,026	Water	Discharge	24.0	33.60

Table C.1-3
Central Nevada Test Area MV-2
Bromide Data
(Page 4 of 6)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (°C)	Sample Conc. (mg/L)
06/14/2005	0700	2,017	Water	Discharge	24.4	33.00
06/14/2005	0400	2,000	Water	Discharge	24.8	33.10
06/14/2005	0200	1,987	Water	Discharge	25.1	34.30
06/13/2005	2100	1,965	Water	Discharge	24.5	32.60
06/13/2005	1800	1,947	Water	Discharge	24.2	31.90
06/13/2005	1500	1,929	Water	Discharge	24.3	34.90
06/13/2005	1200	1,917	Water	Discharge	24.6	32.00
06/13/2005	1000	1,909	Water	Discharge	24.3	36.60
06/13/2005	0700	1,896	Water	Discharge	24.4	37.00
06/13/2005	0400	1,878	Water	Discharge	24.6	36.60
06/13/2005	0100	1,864	Water	Discharge	24.8	31.60
06/12/2005	2100	1,836	Water	Discharge	25.8	28.20
06/12/2005	1800	1,825	Water	Discharge	25.3	30.90
06/12/2005	1500	1,805	Water	Discharge	23.5	30.40
06/12/2005	1200	1,785	Water	Discharge	24.1	28.80
06/12/2005	1000	1,768	Water	Discharge	24.7	37.50
06/12/2005	0700	1,750	Water	Discharge	25.0	33.80
06/09/2005	0800	1,740	Water	Discharge	25.4	31.20
06/08/2005	1740	1,708	Water	Discharge	24.1	45.00
06/08/2005	1140	1,665	Water	Discharge	24.5	55.10
06/08/2005	1000	1,652	Water	Discharge	24.6	44.90
06/08/2005	0700	1,620	Water	Discharge	24.9	47.40
06/08/2005	0400	1,586	Water	Discharge	25.0	48.10
06/08/2005	0100	1,552	Water	Discharge	24.9	54.60
06/07/2005	1845	1,465	Water	Discharge	24.9	37.70
06/07/2005	1140	1,351	Water	Discharge	24.2	81.30
06/07/2005	1000	1,325	Water	Discharge	25.0	43.40

Table C.1-3
Central Nevada Test Area MV-2
Bromide Data
(Page 5 of 6)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (°C)	Sample Conc. (mg/L)
06/07/2005	0700	1,305	Water	Discharge	24.8	48.80
06/07/2005	0400	1,265	Water	Discharge	25.0	48.60
06/07/2005	0100	1,214	Water	Discharge	25.3	41.40
06/06/2005	2220	1,147	Water	Discharge	24.4	51.90
06/06/2005	1540	1,060	Water	Discharge	22.0	27.00
06/02/2005	0630	1,050	Water	Discharge	24.7	41.60
06/02/2005	0300	1,020	Water	Discharge	23.7	43.00
06/02/2005	0000	980	Water	Discharge	24.6	42.30
06/01/2005	2200	960	Water	Discharge	25.2	57.30
06/01/2005	1900	920	Water	Discharge	25.6	36.80
06/01/2005	1600	890	Water	Discharge	25.1	38.30
06/01/2005	1300	860	Water	Discharge	25.1	31.80
06/01/2005	0630	825	Water	Discharge	23.1	54.70
06/01/2005	0600	784	Water	Discharge	24.6	52.70
06/0120/05	0300	740	Water	Discharge	24.4	36.70
06/01/2005	0000	700	Water	Discharge	23.6	37.50
05/31/2005	2200	672	Water	Discharge	23.0	37.10
05/31/2005	1900	635	Water	Discharge	24.9	34.60
05/31/2005	1600	595	Water	Discharge	24.1	24.50
05/31/2005	1300	545	Water	Discharge	23.5	45.60
05/31/2005	0900	495	Water	Discharge	23.7	19.30
05/31/2005	0600	452	Water	Discharge	23.7	18.60
05/31/2005	0300	410	Water	Discharge	23.4	18.30
05/31/2005	0000	365	Water	Discharge	23.6	18.10
05/30/2005	2200	347	Water	Discharge	24.2	51.50
05/30/2005	1900	315	Water	Discharge	24.9	56.20
05/30/2005	1700	295	Water	Discharge	25.2	43.00

Table C.1-3
Central Nevada Test Area MV-2
Bromide Data
(Page 6 of 6)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
05/30/2005	0953	250	Water	Discharge	24.2	27.20
05/30/2005	0600	240	Water	Discharge	24.0	14.60
05/30/2005	0300	207	Water	Discharge	24.3	13.00
05/29/2005	1900	167	Water	Discharge	23.5	42.50
05/29/2005	1600	115	Water	Discharge	23.5	4.26
05/29/2005	1300	100	Water	Discharge	24.3	10.40

ºC = Degrees Celsius ft = Foot mg/L = Milligrams per liter N/A = Not applicable

Table C.1-4
Central Nevada Test Area MV-2
Upper Piezometer Bromide Data

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
07/17/2005	1230	N/A	Water	MV-2 Upper Piezometer	24.3	2.77
07/17/2005	0930	N/A	Water	MV-2 Upper Piezometer	24.4	2.35
07/16/2005	1730	N/A	Water	MV-2 Upper Piezometer	24.8	5.45
07/16/2005	1600	N/A	Water	MV-2 Upper Piezometer	24.8	6.67
07/15/2005	1430	N/A	Water	MV-2 Upper Piezometer	24.8	2.88
07/15/2005	1230	N/A	Water	MV-2 Upper Piezometer	24.9	3.95
07/15/2005	1030	N/A	Water	MV-2 Upper Piezometer	25.3	5.60
07/15/2005	0900	N/A	Water	MV-2 Upper Piezometer	25.3	9.37
07/14/2005	1700	N/A	Water	MV-2 Upper Piezometer	25.2	21.10

ºC = Degrees Celsius ft = Foot mg/L = Milligrams per liter N/A = Not applicable

Table C.1-5
Central Nevada Test Area MV-2
Lower Piezometer Bromide Data
(Page 1 of 2)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
08/05/2005	0700	N/A	Water	MV-2 Lower Piezometer	25.1	24.50
08/04/2005	0830	N/A	Water	MV-2 Lower Piezometer	24.3	22.60
08/03/2005	1700	N/A	Water	MV-2 Lower Piezometer	25.7	24.80
08/03/2005	0830	N/A	Water	MV-2 Lower Piezometer	25.6	21.10
08/02/2005	1700	N/A	Water	MV-2 Lower Piezometer	25.0	25.10
08/02/2005	0730	N/A	Water	MV-2 Lower Piezometer	25.2	24.40
08/01/2005	0730	N/A	Water	MV-2 Lower Piezometer	25.1	24.20
07/31/2005	1700	N/A	Water	MV-2 Lower Piezometer	25.0	30.50
07/31/2005	0830	N/A	Water	MV-2 Lower Piezometer	25.2	25.90
07/30/2005	1700	N/A	Water	MV-2 Lower Piezometer	25.4	25.80
07/30/2005	0830	N/A	Water	MV-2 Lower Piezometer	25.1	31.30
07/29/2005	1700	N/A	Water	MV-2 Lower Piezometer	25.4	26.30
07/29/2005	0800	N/A	Water	MV-2 Lower Piezometer	24.8	32.80
07/28/2005	1700	N/A	Water	MV-2 Lower Piezometer	24.4	32.80
07/28/2005	0930	N/A	Water	MV-2 Lower Piezometer	24.8	35.00
07/27/2005	1200	N/A	Water	MV-2 Lower Piezometer	23.0	31.80
07/27/2005	0830	N/A	Water	MV-2 Lower Piezometer	24.5	33.90
07/21/2005	1300	N/A	Water	MV-2 Lower Piezometer	24.3	37.00
07/21/2005	0800	N/A	Water	MV-2 Lower Piezometer	24.8	36.20
07/20/2005	1730	N/A	Water	MV-2 Lower Piezometer	24.6	32.30
07/20/2005	1300	N/A	Water	MV-2 Lower Piezometer	25.0	32.20
07/20/2005	0800	N/A	Water	MV-2 Lower Piezometer	25.0	31.50
07/19/2005	1700	N/A	Water	MV-2 Lower Piezometer	22.9	34.00
07/19/2005	1300	N/A	Water	MV-2 Lower Piezometer	25.6	34.50
07/19/2005	0800	N/A	Water	MV-2 Lower Piezometer	25.5	42.20

Table C.1-5
Central Nevada Test Area MV-2
Lower Piezometer Bromide Data
(Page 2 of 2)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
07/18/2005	0000	N/A	Water	MV-2 Lower Piezometer	25.2	50.00
07/18/2005	1600	N/A	Water	MV-2 Lower Piezometer	25.3	66.30
07/18/2005	1400	N/A	Water	MV-2 Lower Piezometer	24.8	59.30

ºC = Degrees Celsius
ft = Foot
mg/L = Milligrams per liter
N/A = Not applicable

Table C.1-6
Central Nevada Test Area MV-2
Water Quality Data

Date	Time	Depth (ft)	pH (SU)	Temperature (ºC)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
08/18/2005	1200	Airlift	8.53	N/A	0.60	0.60	-5.59E+03	8.26
08/17/2005	1200	Airlift	9.03	N/A	0.90	0.90	-1.65E+03	8.30
07/06/2005	0130	Airlift	8.35	14.90	1.10	1.10	-2.97E+03	15.90
07/05/2005	0945	Airlift	7.95	24.70	1.10	1.10	-2.70E+03	35.50
06/29/2005	0000	3,622	7.59	26.20	1.40	1.40	-2.70E+03	48.70
06/28/2005	0000	3,536	8.77	24.10	1.30	1.30	-5.23E+03	55.00
06/27/2005	0000	3,480	8.28	23.60	1.20	1.20	-3.60E+03	45.80
06/26/2005	1800	3,461	8.47	24.50	1.00	1.00	-5.14E+03	28.80
06/23/2005	1600	3,412	8.29	23.00	1.10	1.10	-3.96E+03	36.40
06/20/2005	0000	3,080	10.55	22.90	0.80	0.80	-1.98E+03	29.70
06/19/2005	0000	2,680	11.34	22.60	1.10	1.10	-4.69E+03	31.50
06/18/2005	0000	2,160	10.30	23.90	1.30	1.30	-6.40E+03	26.80
06/14/2005	0000	2,032	8.60	22.90	0.70	0.70	-4.41E+03	33.80
06/13/2005	0000	1,917	8.31	22.50	0.70	0.70	-4.23E+03	32.00

ºC = Degrees Celsius
ft = Foot
mg/L = Milligrams per liter
N/A = Not applicable
pCi/L = Picocuries per liter
SU = Standard unit
mS/cm = millisiemens per centimeter

Table C.1-7
Central Nevada Test Area MV-2
Upper Piezometer Water Quality Data

Date	Time	Depth (ft)	pH (S.U.)	Temperature (ºC)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
07/28/2005	0800	N/A	12.25	N/A	0.50	0.50	-2.16E+03	7.03
07/17/2005	1200	N/A	10.02	22.30	0.30	0.30	-5.68E+03	2.77
07/16/2005	1600	N/A	11.47	22.70	0.40	0.40	-1.71E+03	6.67
07/15/2005	1430	N/A	10.02	23.40	0.30	0.30	-4.14E+03	2.88
07/15/2005	1230	N/A	10.98	22.90	0.30	0.30	-2.52E+03	3.95
07/14/2005	1730	N/A	11.45	24.10	0.60	0.60	-3.60E+03	21.10

ºC = Degrees Celsius
ft = Foot
mg/L = Milligrams per liter
N/A = Not applicable
pCi/L = Picocuries per liter
SU = Standard unit
mS/cm = millisiemens per centimeter

Table C.1-8
Central Nevada Test Area MV-2
Lower Piezometer Water Quality Data

Date	Time	Depth (ft)	pH (SU)	Temperature (ºC)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
08/05/2005	0800	N/A	10.12	N/A	2.80	2.80	-2.88E+03	24.50
08/04/2005	0830	N/A	9.83	N/A	3.00	3.00	-3.33E+03	22.60
08/03/2005	0830	N/A	10.81	N/A	2.90	2.90	-3.78E+03	21.10
08/02/2005	0730	N/A	10.79	N/A	2.20	2.20	-3.96E+03	24.40
08/01/2005	0730	N/A	9.90	N/A	2.00	2.20	0.00E+00	24.20
07/31/2005	0830	N/A	10.22	N/A	1.70	1.70	-3.69E+03	25.90
07/30/2005	0830	N/A	10.26	N/A	0.80	0.80	-5.14E+03	31.30
07/29/2005	0800	N/A	10.05	N/A	0.80	0.80	-3.33E+03	32.80
07/28/2005	0930	N/A	9.90	N/A	0.70	0.70	-2.70E+03	35.00
07/27/2005	0830	N/A	9.90	N/A	0.80	0.80	-2.43E+03	33.90
07/21/2005	1300	N/A	9.00	N/A	1.00	1.00	-2.34E+03	37.00
07/20/2005	1730	N/A	8.90	N/A	1.00	1.00	-4.23E+03	32.30
07/19/2005	1700	N/A	9.00	N/A	1.10	1.10	-4.23E+03	34.00
07/18/2005	1200	N/A	9.70	N/A	1.20	1.20	-6.31E+03	50.00

ºC = Degrees Celsius
ft = Foot
mg/L = Milligrams per liter
N/A = Not applicable
pCi/L = Picocuries per liter
SU = Standard unit
mS/cm = millisiemens per centimeter

Table C.1-9
Stemming Materials Used in CNTA MV-2 Construction

Material	Volume	Interval
Portland Type II Cement	75 ft^3	0-95 ft
Portland Type II Cement	1,322 ft^3	0-807 ft
1x20 Sand	55 ft^3	807-850 ft
6x12 Sand	45 ft^3	850-880 ft
1/4 x 1/8 Gravel	90 ft^3	880-1,035 ft
Portland Type II Cement	25 ft^3	1,035-1,050 ft
Portland Type II Cement	216 ft^3	~2,150-2,500 ft
Portland Type II Cement	2,247 ft^3	0-2,927 ft
6x9 Sand	120 ft^3	2,927-3,066 ft
1/4 x 1/8 Gravel	180 ft^3	3,066-3,260 ft
Portland Type II Cement	425 ft^3	3,260-3,410 ft
6 x 9 Sand	90 ft^3	3,410-3,454 ft
1/4 x 1/8 Gravel	210 ft^3	3,454-3,660 ft

ft = Foot
ft^3 = Cubic foot

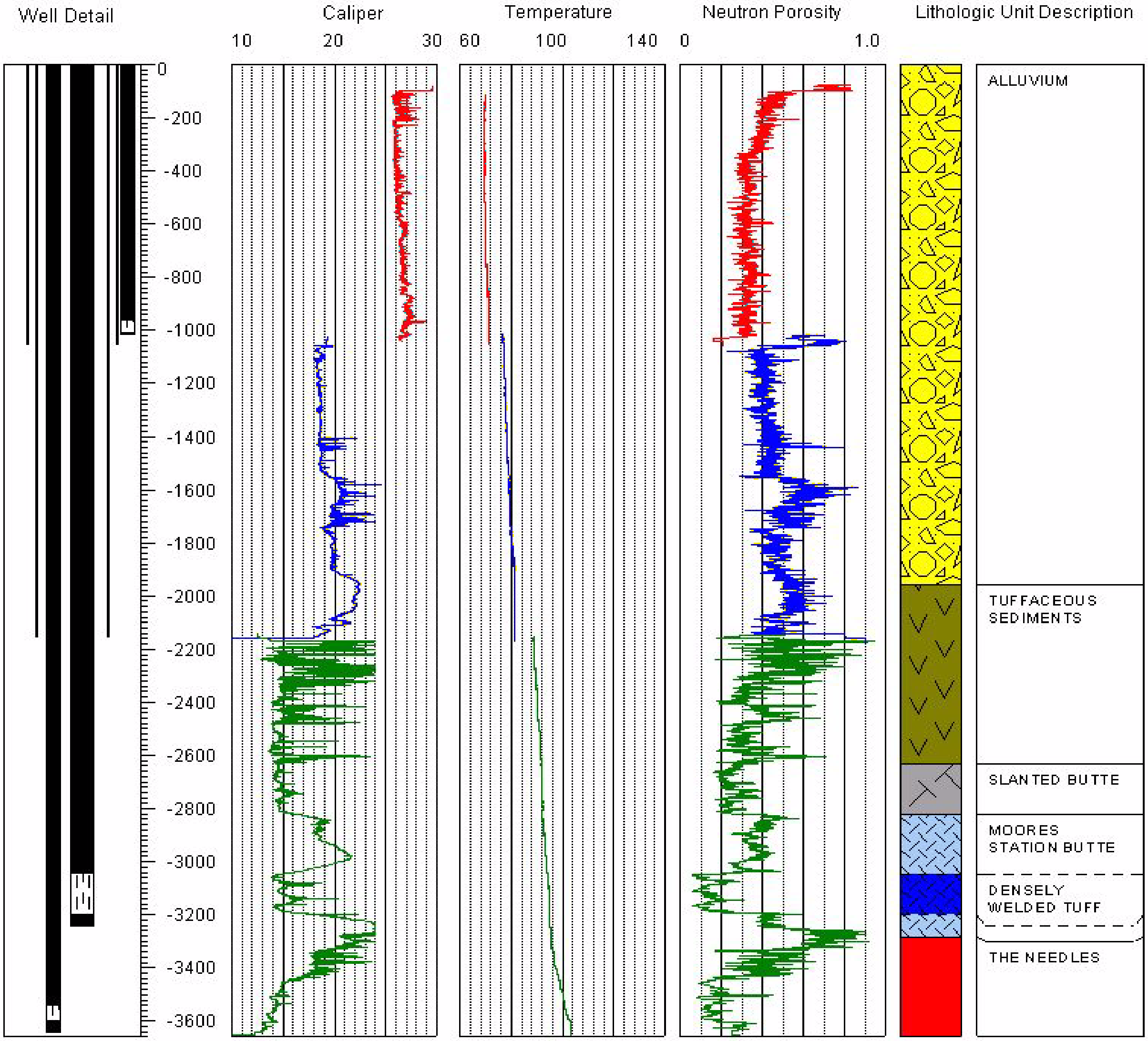
Table C.1-10
Materials Used in CNTA MV-2 Construction

Material	Type	Interval
30-in. CS Casing	Blank	0-95 ft
2.375-in. Flush Joint Upper Piezometer String	Blank	0-960 ft
	Screen	960-1,010 ft
	Blank (Sump)	1,010-1,015 ft
	Bullnose	1,015-1,015.12 ft
20-in. CS Casing	Blank	0-1,050 ft
13.375-in. CS Casing	Blank	0-2,149.37 ft
5.5-in. CS Casing	Blank (Epoxy Coated)	+1.25-3,039.49
	Screen (Epoxy Coated)	3,039.49-3,202.24 ft
	Blank (Sump/Epoxy Coated)	3,202.24-3,243.03 ft
	Bullnose	3,243.03-3,244.38 ft
2.375-in. Flush Joint Lower Piezometer String	Blank	0-3,546.5 ft
	Screen	3,546.5-3,606.5 ft
	Blank (Sump)	3,606.5-3,646.5 ft
	Bullnose	3,646.5-3,646.66 ft

CS = Carbon steel
ft = Foot
in. = Inch

Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Caliper/Temperature/Neutron Porosity
Dates Logged: 🟥 02 June 2005 🟦 16 June 2005 🟩 30 June 2005

Well/Borehole Identification: CNTA MV-2
Surface Elevation: 6193.75 ft
Northing: 21097739.093
Easting: 1766707.497
Coordinate System: State Plane, NAD 83



Total Depth: 3660 feet

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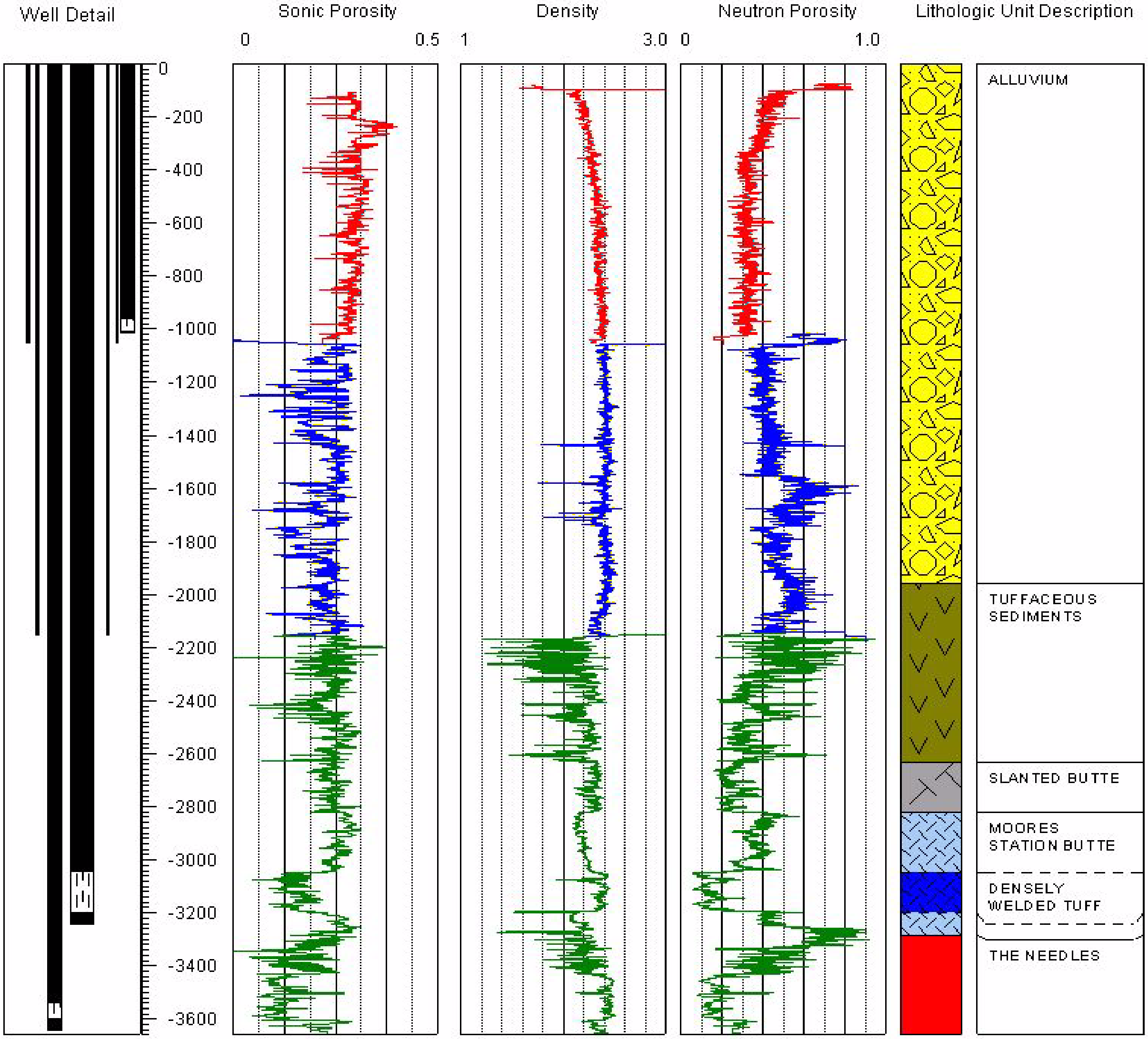
Figure C.1-1
MV-2 Caliper/Temperature/Neutron Porosity

Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Sonic Porosity/Density/Neutron Porosity
Dates Logged: 🟥 02 June 2005 🟦 16 June 2005 🟩 30 June 2005

Well/Borehole Identification: CNTA MV-2
Surface Elevation: 6193.75 ft
Northing: 21097739.093
Easting: 1766707.497
Coordinate System: State Plane, NAD 83



Total Depth: 3660 feet

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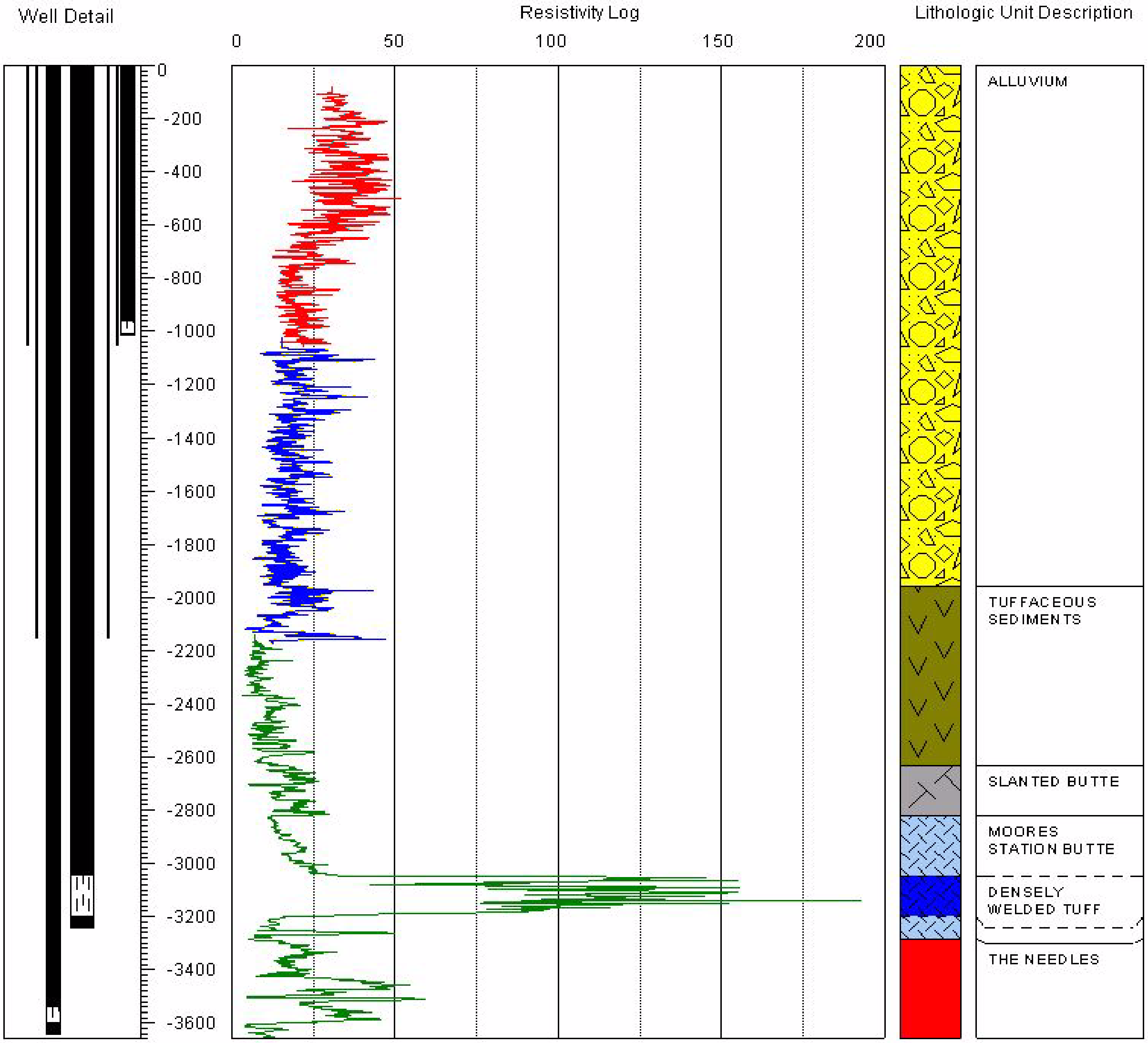
Figure C.1-2
MV-2 Sonic Porosity/Density/Neutron Porosity

Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Resistivity Logs
Dates Logged: 🟥 02 June 2005 🟦 16 June 2005 🟩 30 June 2005

Well/Borehole Identification: CNTA MV-2
Surface Elevation: 6193.75 ft
Northing: 21097739.093
Easting: 1766707.497
Coordinate System: State Plane, NAD 83



Total Depth: 3660 feet

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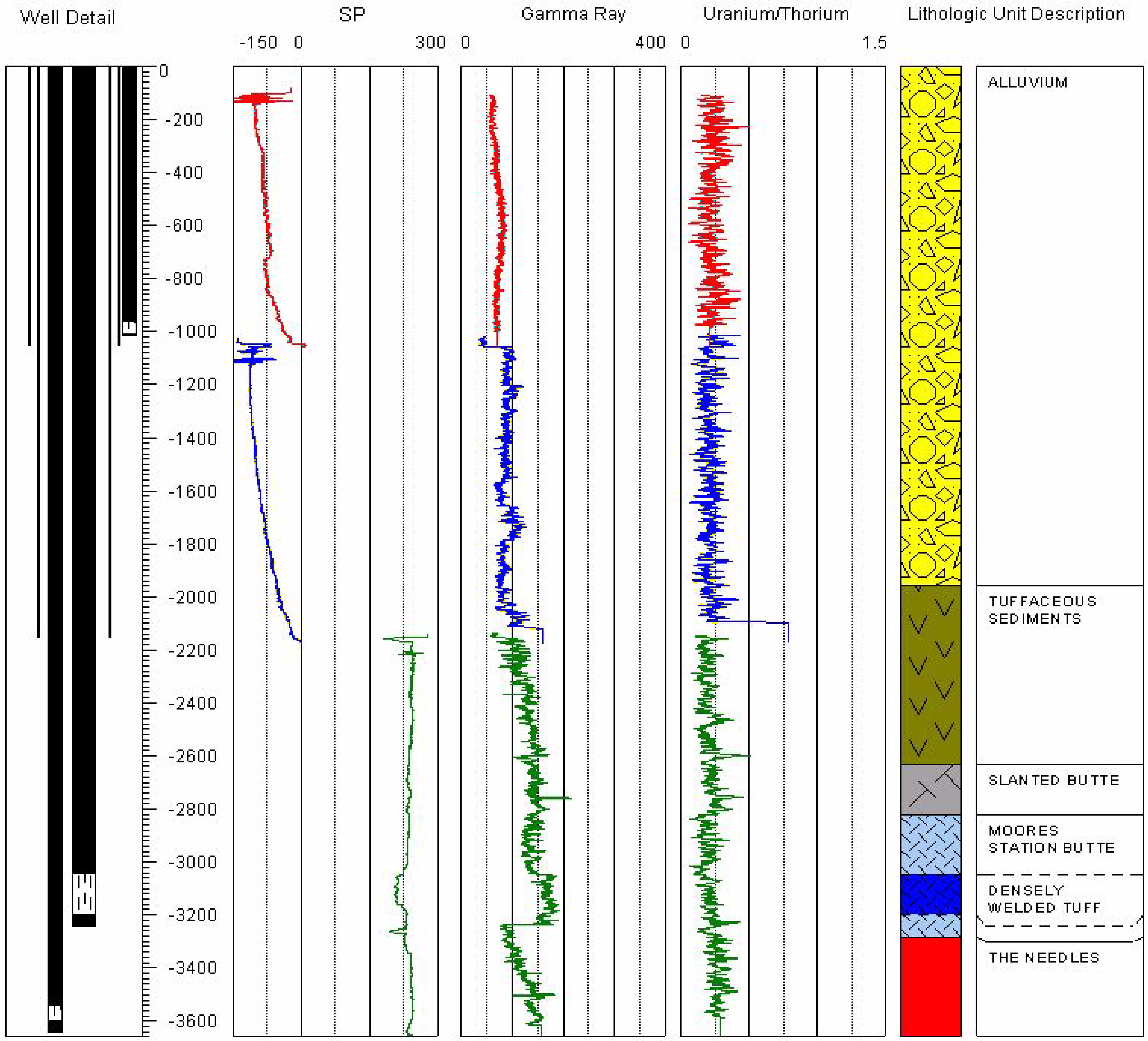
Figure C.1-3
MV-2 Resistivity Logs

Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Spontaneous Potential/Gamma Ray/Uranium-Thorium
Dates Logged: 🟥 02 June 2005 🟦 16 June 2005 🟩 30 June 2005

Well/Borehole Identification: CNTA MV-2
Surface Elevation: 6193.75 ft
Northing: 21097739.093
Easting: 1766707.497
Coordinate System: State Plane, NAD 83



Total Depth: 3660 feet   Page 1 of 1

Figure C.1-4
MV-2 Spontaneous Potential/Gamma Ray/Uranium-Thorium

Appendix D

Central Nevada Test Area MV-3 Data

Table D.1-1
Central Nevada Test Area MV-3 Chronology
(Page 1 of 3)

Date and Time	Depth (ft)	Activity
07/07/2005		Rig mobilized from MV-2, rig-up and prepare to drill
07/08/2005		Rig walkdown conducted, deficiencies corrected, continue preparations to drill
07/09/2005 0600	0	Begin drilling MV-3, 36-in. borehole, using conventional mud rotary method and Quik-Gel (bentonite) mud
07/10/2005 1245	95	TD borehole for surface casing at 95 ft, trip out and commence installation of 30-in. carbon-steel casing
07/10/2005 1400	95	Complete installation and cementing to surface of 30-in. carbon-steel casing
07/10/2005 2130	95	Begin drilling 26-in. borehole using conventional mud rotary method, switch to flooded reverse circulation method at 220 ft
07/13/2005 1230	880	Fluid loss to borehole ~4,000 gph, loss probably due to fault zone (880-920 ft) in thick coarse gravel
07/14/2005 0342	1050	TD borehole for 1st intermediate casing at 1,054 ft, trip out and prepare for Schlumberger in 20-in. casing
07/15/2005 1120	1,050	Schlumberger canceled - casing operations will commence without geophysical logging following a swab run of the borehole
07/16/2005 0930	1,050	Start running 20-in. carbon-steel intermediate casing string; casing hanging at 1530 hrs; cement bottom of casing
07/17/2005 0130	1,050	Construct upper piezometer for MV-3 and cement to surface, prepare to drill
07/18/2005 2300	1,050	Begin drilling 17 1/2-in. borehole using flooded reverse circulation method with water and Drispac drilling fluid
07/21/2005 0950	1,720	NNSA/NSO Site Inspection
07/22/2005 1400	1,920	Trip out to change bit
07/22/2005 2330	1,920	Resume drilling after bit change
07/24/2005 2130	2,530	TD borehole for 2nd intermediate casing at 2,530 ft, trip out and prepare for Schlumberger geophysical logging
07/25/2005 0730	2,530	Perform borehole geophysical survey with Schlumberger
07/25/2005 2145	2,530	Start running 13 3/8-in. carbon-steel intermediate casing string
07/28/2005 0830	2,530	Fast-feed hydraulic pump failure; repairs underway

Table D.1-1
Central Nevada Test Area MV-3 Chronology
(Page 2 of 3)

Date and Time	Depth (ft)	Activity
07/29/2005 0145	2,530	Begin drilling 12 1/4-in. borehole using flooded reverse circulation method with water and Drispac drilling fluid
07/31/2005 1815	3,460	Trip out for bit change
08/01/2005 1400	3,460	Resume drilling after bit change
08/04/2005 1110	4,160	NNSA/NSO site inspection; TD borehole at 4,160 ft, trip out and prepare for Schlumberger geophysical logging
08/05/2005 0400	4,160	Schlumberger arrives to site, logging identifies slough in borehole to 4,130 ft, logging completed at 1330 hrs
08/05/2005 0330	4,160	Trip in to clean and advance borehole prior to constructing well
08/06/2005 1715	4,220	TD borehole at 4,220 ft, trip out and prepare to construct well MV-3
08/07/2005 0900		Begin running in tubing and well casing
08/09/2005 0619		Well casing landed, continue with filter pack installation while waiting on arrival of logging subcontractor
08/10/2005 1310		Colog arrives to site to perform density (NAIL) logging; preparing to cement isolation between well and lower piezometer
08/11/2005 1100		Density logging completed to top of transition sand above lower piezometer, Colog removing tools; prepare to cement to surface
08/12/2005 1215		Start tripping HQ rods for airlift development; waiting on cement delivery
08/13/2005 0240		Begin airlifting on MV-3 using HQ eductor and AQ airline tubing
08/15/2005 1110		Finish airlift development of MV-3, flow ~ 2 gpm; trip out rods, finish cementing to surface
08/16/2005 1000		Begin rigging-down to demobilize from site; move equipment to MV-2 for more airlift development
08/18/2005		Bailer development of lower piezometer at MV-3, ~110 gal; airlift develop upper piezometer at MV-3, ~1,440 gal
08/19/2005		Bailer development of lower piezometer at MV-3, ~115 gal; finish airlift develop of upper piezometer at MV-3, ~1,500 gal
08/20/2005		Airlift develop lower piezometer at MV-3, flow rate ~1 gpm steady
08/21/2005		Continue airlift develop of lower piezometer at MV-3, flow rate 1.25 gpm

Table D.1-1
Central Nevada Test Area MV-3 Chronology
(Page 3 of 3)

Date and Time	Depth (ft)	Activity
08/22/2005		Finish airlift develop of lower piezometer at MV-3 1.0 gpm
09/27/2005		Install Grundfos 10S50-58DS, 5 HP, stainless-steel pump in MV-3, intake set 3,987.5 ft
09/28/2005		Pump MV-3 purged 1,107 gal
10/13/2005		Pump MV-3- purged 789 gal
10/19/2005		Pump MV-3- purged 770 gal

BHA = Bottom hole assembly
DRI = Desert Research Institute
ft = Foot
gal = Gallon
gpm = Gallons per minute
hr = Hour
in. = Inch
NNSA/NSO = National Nuclear Security Administration/Nevada Site Office
SNJV = Stoller-Navarro Joint Venture
TD = Total depth

Table D.1-2
Central Nevada Test Area MV-3
Downhole Geophysical Data Collected

Geophysical Tool	Date	Top of Interval (ft bgs)	Bottom of Interval (ft bgs)	Interval (ft)	Contractor
Phase I					
Logging Cancelled due to Scheduling Conflict	July 15, 2005	N/A	N/A	N/A	N/A
Phase II					
Caliper, Temperature, Neutron Porosity, Sonic Porosity, Density, Resistivity (long and short normal), Spontaneous Potential, Spectral Gamma, Natural Gamma, and Magnetic Deviation	July 25, 2005	1,054	2,530	1,476	Schlumberger
Phase III					
Caliper, Temperature, Neutron Porosity, Sonic Porosity, Density, Resistivity (long and short normal), Spontaneous Potential, Spectral Gamma, Natural Gamma, and Magnetic Deviation	August 5, 2005	2,530	4,160	1,630	Schlumberger
Phase IV					
Nuclear Annular Investigation Log	August 11, 2005	0	4,220	4,220	Colog

bgs = Below ground surface
ft = Foot
N/A = Not applicable

Table D.1-3
Central Nevada Test Area MV-3
Bromide Data
(Page 1 of 5)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
08/15/2005	1100	N/A	Water	MV-3 Airlift	25.5	10.90
08/15/2005	0900	N/A	Water	MV-3 Airlift	25.5	17.70
08/15/2005	0800	N/A	Water	MV-3 Airlift	25.6	20.10
08/15/2005	0600	N/A	Water	MV-3 Airlift	25.5	23.00
08/15/2005	0400	N/A	Water	MV-3 Airlift	25.2	10.80
08/15/2005	0200	N/A	Water	MV-3 Airlift	25.3	11.60
08/15/2005	0000	N/A	Water	MV-3 Airlift	25.4	16.90
08/14/2005	2130	N/A	Water	MV-3 Airlift	23.6	17.10
08/14/2005	1930	N/A	Water	MV-3 Airlift	25.5	15.30
08/14/2005	1730	N/A	Water	MV-3 Airlift	25.0	15.00
08/14/2005	1400	N/A	Water	MV-3 Airlift	25.0	22.10
08/14/2005	1230	N/A	Water	MV-3 Airlift	24.8	18.10
08/14/2005	1000	N/A	Water	MV-3 Airlift	24.4	22.80
08/14/2005	0800	N/A	Water	MV-3 Airlift	24.8	31.10
08/14/2005	0600	N/A	Water	MV-3 Airlift	23.5	28.50
08/14/2005	0400	N/A	Water	MV-3 Airlift	24.6	25.20
08/14/2005	0200	N/A	Water	MV-3 Airlift	24.8	28.40
08/14/2005	0000	N/A	Water	MV-3 Airlift	24.7	26.60
08/13/2005	2100	N/A	Water	MV-3 Airlift	24.1	32.40
08/13/2005	1800	N/A	Water	MV-3 Airlift	24.8	27.80
08/13/2005	1500	N/A	Water	MV-3 Airlift	25.0	23.60
08/13/2005	1200	N/A	Water	MV-3 Airlift	24.9	21.90
08/13/2005	1000	N/A	Water	MV-3 Airlift	25.0	74.00
08/13/2005	0600	N/A	Water	MV-3 Airlift	25.0	83.70
08/13/2005	0300	N/A	Water	MV-3 Airlift	23.0	113.00
08/06/2005	1800	4,220	Water	Discharge	24.4	27.00
08/06/2005	1500	4,210	Water	Discharge	24.7	24.70
08/06/2005	1100	4,200	Water	Discharge	25.1	36.00

Table D.1-3
Central Nevada Test Area MV-3
Bromide Data
(Page 2 of 5)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
08/06/2005	1000	4,180	Water	Discharge	23.7	38.20
08/06/2005	0915	4,175	Water	Discharge	24.3	35.50
08/04/2005	0900	4,141	Water	Discharge	24.2	19.60
08/04/2005	0600	4,125	Water	Discharge	25.2	23.20
08/04/2005	0300	4,110	Water	Discharge	25.4	22.50
08/04/2005	0030	4,098	Water	Discharge	25.5	23.40
08/03/2005	2100	4,080	Water	Discharge	25.6	27.10
08/03/2005	1800	4,063	Water	Discharge	25.4	26.90
08/03/2005	1500	4,030	Water	Discharge	25.5	28.50
08/03/2005	1200	3,989	Water	Discharge	25.5	27.40
08/03/2005	0900	3,940	Water	Discharge	25.7	19.70
08/03/2005	0600	3,900	Water	Discharge	25.4	19.90
08/03/2005	0300	3,855	Water	Discharge	25.3	20.60
08/03/2005	0000	3,810	Water	Discharge	25.3	20.80
08/02/2005	2100	3,778	Water	Discharge	25.4	28.40
08/02/2005	1800	3,732	Water	Discharge	25.7	28.00
08/02/2005	1500	3,685	Water	Discharge	25.4	26.70
08/02/2005	1200	3,655	Water	Discharge	25.4	24.80
08/02/2005	0900	3,619	Water	Discharge	26.0	21.00
08/02/2005	0600	3,581	Water	Discharge	25.7	21.60
08/02/2005	0300	3,567	Water	Discharge	25.7	19.30
08/02/2005	0000	3,557	Water	Discharge	25.8	18.80
08/01/2005	2100	3,530	Water	Discharge	24.8	17.10
08/01/2005	1800	3,504	Water	Discharge	25.1	15.30
08/01/2005	1500	3,470	Water	Discharge	25.5	16.10
07/31/2005	1800	3,460	Water	Discharge	25.4	24.20
07/31/2005	1600	3,440	Water	Discharge	24.7	26.60
07/31/2005	1300	3,414	Water	Discharge	25.3	23.70
07/31/2005	1000	3,387	Water	Discharge	26.0	18.90

Table D.1-3
Central Nevada Test Area MV-3
Bromide Data
(Page 3 of 5)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
07/31/2005	0600	3,345	Water	Discharge	24.9	25.30
07/31/2005	0400	3,330	Water	Discharge	25.3	25.20
07/30/2005	2200	3,265	Water	Discharge	25.8	24.20
07/30/2005	1900	3,216	Water	Discharge	25.7	18.10
07/30/2005	1600	3,154	Water	Discharge	25.3	18.60
07/30/2005	1300	3,100	Water	Discharge	25.2	19.40
07/30/2005	0900	3,040	Water	Discharge	25.3	20.60
07/30/2005	0600	2,980	Water	Discharge	24.6	22.80
07/30/2005	0400	2,955	Water	Discharge	25.1	23.10
07/30/2005	0000	2,900	Water	Discharge	24.9	23.70
07/29/2005	2200	2,883	Water	Discharge	25.5	22.40
07/29/2005	1900	2,780	Water	Discharge	25.7	17.80
07/29/2005	1600	2,700	Water	Discharge	25.0	16.50
07/29/2005	1300	2,620	Water	Discharge	24.9	18.60
07/29/2005	0900	2,560	Water	Discharge	25.7	21.30
07/29/2005	0600	2,545	Water	Discharge	24.7	18.90
07/29/2005	0300	2,523	Water	Discharge	24.9	20.30
07/24/2005	2100	2,520	Water	Discharge	24.8	45.20
07/24/2005	1900	2,499	Water	Discharge	24.2	41.30
07/24/2005	1600	2,453	Water	Discharge	24.1	41.40
07/24/2005	1300	2,417	Water	Discharge	24.3	42.70
07/24/2005	0900	2,360	Water	Discharge	23.5	52.00
07/24/2005	0300	2,290	Water	Discharge	23.3	44.70
07/24/2005	0000	2,250	Water	Discharge	23.0	47.20
07/23/2005	2100	2,224	Water	Discharge	24.4	63.30
07/23/2005	1900	2,181	Water	Discharge	24.7	43.50
07/23/2005	1600	2,145	Water	Discharge	24.8	46.90
07/23/2005	1400	2,125	Water	Discharge	24.6	49.10
07/23/2005	0900	2,075	Water	Discharge	23.6	55.60

Table D.1-3
Central Nevada Test Area MV-3
Bromide Data
(Page 4 of 5)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
07/23/2005	0600	2,025	Water	Discharge	23	62.40
07/23/2005	0300	1,980	Water	Discharge	22.9	63.10
07/23/2005	0000	1,935	Water	Discharge	23.4	60.40
07/22/2005	1300	1,920	Water	Discharge	24.3	67.30
07/22/2005	0900	1,895	Water	Discharge	25.4	30.80
07/22/2005	0600	1,875	Water	Discharge	25.1	28.20
07/22/2005	0300	1,855	Water	Discharge	25.2	30.00
07/22/2005	0000	1,830	Water	Discharge	25.4	30.10
07/21/2005	2100	1,800	Water	Discharge	24.5	30.80
07/21/2005	1800	1,779	Water	Discharge	24.3	31.70
07/21/2005	1200	1,740	Water	Discharge	24.9	34.70
07/21/2005	0900	1,720	Water	Discharge	23.8	33.60
07/21/2005	0600	1,692	Water	Discharge	24.2	34.10
07/20/2005	2100	1,667	Water	Discharge	25.1	27.10
07/20/2005	1800	1,640	Water	Discharge	24.5	23.50
07/20/2005	1520	1,608	Water	Discharge	24.7	24.50
07/20/2005	1200	1,580	Water	Discharge	24.7	26.10
07/20/2005	0900	1,540	Water	Discharge	25.8	28.00
07/20/2005	0600	1,510	Water	Discharge	25.6	29.90
07/20/2005	0300	1,470	Water	Discharge	25.4	30.20
07/20/2005	0000	1,440	Water	Discharge	25.4	30.80
07/19/2005	2100	1,396	Water	Discharge	26.2	25.50
07/19/2005	1800	1,352	Water	Discharge	25.8	26.30
07/19/2005	1500	1,315	Water	Discharge	25.2	25.60
07/19/2005	1200	1,280	Water	Discharge	25.3	27.80
07/19/2005	0900	1,220	Water	Discharge	25.1	27.30
07/19/2005	0600	1,160	Water	Discharge	25.3	26.90
07/19/2005	0300	1,100	Water	Discharge	25.0	24.60
07/19/2005	0000	1,060	Water	Discharge	25.2	27.80

Table D.1-3
Central Nevada Test Area MV-3
Bromide Data
(Page 5 of 5)

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
07/14/2005	0330	1,050	Water	Discharge	24.9	44.40
07/14/2005	0100	1,032	Water	Discharge	24.6	48.70
07/13/2005	2100	980	Water	Discharge	25.1	24.40
07/13/2005	1800	940	Water	Discharge	25.1	28.50
07/13/2005	1500	905	Water	Discharge	25.4	30.00
07/13/2005	1200	880	Water	Discharge	25.3	29.50
07/13/2005	1000	845	Water	Discharge	25.5	32.10
07/13/2005	0700	792	Water	Discharge	24.7	31.70
07/13/2005	0400	740	Water	Discharge	24.8	31.90
07/13/2005	0100	680	Water	Discharge	25.4	34.60
07/12/2005	2100	618	Water	Discharge	25.2	27.50
07/12/2005	1800	567	Water	Discharge	25.1	27.20
07/12/2005	1500	526	Water	Discharge	24.8	31.30
07/12/2005	1200	500	Water	Discharge	24.0	29.30
07/12/2005	1000	474	Water	Discharge	25.3	25.40
07/12/2005	0700	460	Water	Discharge	24.0	29.20
07/12/2005	0400	432	Water	Discharge	24.8	28.40
07/12/2005	0100	400	Water	Discharge	24.8	24.70
07/11/2005	2100	360	Water	Discharge	25.2	28.30
07/11/2005	1800	330	Water	Discharge	25.1	26.80
07/11/2005	1500	296	Water	Discharge	25.4	26.30
07/11/2005	1200	250	Water	Discharge	25.0	28.10
07/11/2005	1000	220	Water	Discharge	24.8	33.40
07/11/2005	0700	207	Water	Discharge	24.3	37.20
07/11/2005	0400	160	Water	Discharge	25.1	26.40
07/11/2005	0200	121	Water	Discharge	25.9	28.50

ºC = Degrees Celsius ft = Foot mg/L = Milligrams per liter N/A = Not applicable

Table D.1-4
Central Nevada Test Area MV-3
Upper Piezometer Bromide Data

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mg/L)
08/19/2005	0800	N/A	Water	MV-3 Upper Piezometer	25.8	2.22
08/19/2005	1000	N/A	Water	MV-3 Upper Piezometer	25.8	1.91
08/18/2005	1700	N/A	Water	MV-3 Upper Piezometer	23.9	25.10
08/18/2005	2000	N/A	Water	MV-3 Upper Piezometer	25.0	4.41

ºC = Degrees Celsius   ft = Foot   mg/L = Milligrams per liter   N/A = Not applicable

Table D.1-5
Central Nevada Test Area MV-3
Lower Piezometer Bromide Data

Date	Time	Depth (ft)	Sample Type	Sample Source	Sample Temperature (ºC)	Sample Conc. (mgL)
08/18/2005	1200	N/A	Water	MV-3 Lower Piezometer	23.8	30.70
08/18/2005	1700	N/A	Water	MV-3 Lower Piezometer	23.8	31.40
08/19/2005	0700	N/A	Water	MV-3 Lower Piezometer	25.8	30.50
08/19/2005	1000	N/A	Water	MV-3 Lower Piezometer	25.8	33.30
08/19/2005	1700	N/A	Water	MV-3 Lower Piezometer	26.1	32.10
08/20/2005	1130	N/A	Water	MV-3 Lower Piezometer	23.0	34.60
08/20/2005	1745	N/A	Water	MV-3 Lower Piezometer	23.2	28.40
08/21/2005	0600	N/A	Water	MV-3 Lower Piezometer	23.4	26.00
08/21/2005	1145	N/A	Water	MV-3 Lower Piezometer	24.3	26.50

ºC = Degrees Celsius   ft = Foot   mg/L = Milligrams per liter   N/A = Not applicable

Table D.1-6
Central Nevada Test Area MV-3
Water Quality Data

Date	Time	Depth (ft)	pH (SU)	Temperature (ºC)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
08/16/2005	1100	4200'	8.24	N/A	0.90	0.90	-2.88E+03	36.00
08/15/2005	1100	Airlift	8.84	N/A	0.60	0.60	-4.05E+03	10.90
08/14/2005	1230	Airlift	8.71	N/A	0.60	0.60	-4.96E+03	18.10
08/13/2005	1200	Airlift	7.98	N/A	0.20	0.20	-4.87E+03	21.90
08/04/2005	0000	4,098	8.75	N/A	0.80	0.80	-5.41E+03	23.40
08/03/2005	0000	3,810	8.67	N/A	1.10	1.10	-4.23E+03	20.80
08/02/2005	0000	3,557	9.40	N/A	0.80	0.80	-5.59E+03	18.80
07/31/2005	1000	3,387	10.91	N/A	0.80	0.80	-1.80E+03	18.90
07/30/2005	0000	2,900	12.01	N/A	0.70	0.70	-6.23E+03	23.70
07/29/2005	0300	2,523	12.04	N/A	0.70	0.70	-3.69E+03	20.30
07/24/2005	1900	2,499	8.43	N/A	0.70	0.70	-2.70E+03	41.30
07/23/2005	0730	2,181	8.12	N/A	0.60	0.60	-4.51E+03	43.50
07/21/2005	1800	1,779	9.20	N/A	0.70	0.70	-6.22E+03	31.50
07/20/2005	1800	1,640	8.60	N/A	0.70	0.70	-4.41E+03	23.50
07/19/2005	2100	1,396	10.80	N/A	0.70	0.70	-2.97E+03	25.50
07/13/2005	1800	940	7.60	22.30	0.60	0.60	-2.97E+03	28.50
07/12/2005	1800	567	9.80	N/A	0.90	0.90	-5.68E+03	27.60
07/11/2005	0400	160	10.20	25.10	2.00	2.00	-1.80E+03	26.40

ºC = Degrees Celsius
ft = Foot
mg/L = Milligrams per liter
N/A = Not applicable
pCi/L = Picocuries per liter
SU = Standard unit
mS/cm = millisiemens per centimeter

Table D.1-7
Central Nevada Test Area MV-3
Upper Piezometer Water Quality Data

Date	Time	Depth (ft)	pH (SU)	Temperature (ºC)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
08/19/2005	0800	N/A	7.25	N/A	0.20	0.20	N/A	2.22
08/18/2005	1700	N/A	7.88	N/A	0.40	0.40	-4.69E+03	25.10

ºC = Degrees Celsius
mg/L = Milligrams per liter
pCi/L = Picocuries per liter
mS/cm = millisiemens per centimeter
ft = Foot
N/A = Not applicable
SU = Standard unit

Table D.1-8
Central Nevada Test Area MV-3
Lower Piezometer Water Quality Data

Date	Time	Depth (ft)	pH (SU)	Temperature (ºC)	Conductivity (mS/cm)		Tritium (pCi/L)	Bromide (mg/L)
					Initial Value	Corrected Value		
08/20/2005	1745	N/A	9.36	N/A	1.00	1.00	-3.87E+03	28.40
08/20/2005	1145	N/A	8.70	N/A	2.20	2.20	-2.43E+03	26.50
08/19/2005	0700	N/A	9.08	N/A	0.70	0.70	-4.41E+03	30.50
08/18/2005	0000	N/A	8.70	N/A	0.80	0.80	-2.16E+03	30.70

ºC = Degrees Celsius
mg/L = Milligrams per liter
pCi/L = Picocuries per liter
mS/cm = millisiemens per centimeter
ft = Foot
N/A = Not applicable
SU = Standard unit

Table D.1-9
Stemming Materials Used in CNTA MV-3 Construction

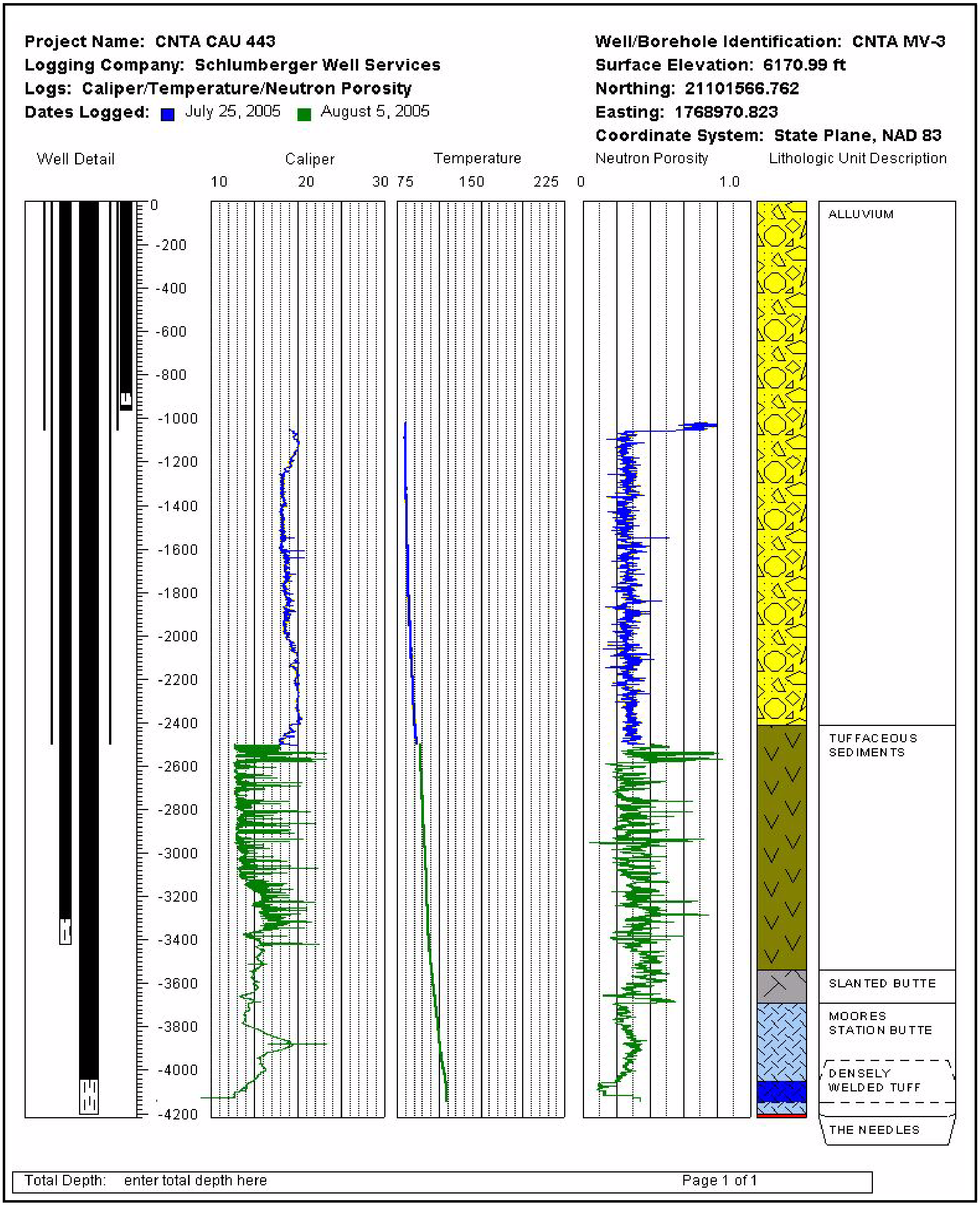
Material	Volume	Interval
Portland Type II Cement	376 ft^3	0-95 ft
Portland Type II Cement	894 ft^3	0-734 ft
6x12 Sand	95 ft^3	734-798 ft
1/4 x 1/8 Gravel	270 ft^3	798-1,020 ft
Portland Type II Cement	90 ft^3	1,020-1,053.28 ft
Portland Type II Cement	27.6 ft^3	~2,150-2,500 ft
Portland Type II Cement	864 ft^3	0-3,062 ft
6x12 Sand	13 ft^3	3,062-3,197 ft
1/4 x 1/8 Gravel	25.1 ft^3	3,197-3,430 ft
Portland Type II Cement	19.5 ft^3	3,430-3,647 ft
6 x 12 Sand	8.8 ft^3	3,647-3,789 ft
1/4 x 1/8 Gravel	36.2 ft^3	3,789-4,220 ft

ft = Foot
ft^3 = Cubic foot

Table D.1-10
Materials Used in CNTA MV-3 Construction

Material	Type	Interval
30-in. CS Casing	Blank	0-95 ft
2.375-in. Flush Joint Upper Piezometer String	Blank	0-880 ft
	Screen	880-940 ft
	Blank (Sump)	940-960 ft
	Bullnose	960-960.12 ft
20-in. CS Casing	Blank	0-1,053.28 ft
13.375-in. CS Casing	Blank	0-2,515.53 ft
5.5-in. CS Casing	Blank (Uncoated)	0-61.50 ft
	Blank (Epoxy Coated)	61.50-4,046 ft
	Screen (Epoxy Coated)	4,046-4,207.75 ft
	Bullnose	4,207.75-4,209.4 ft
2.375-in. Flush Joint Lower Piezometer String	Blank	0-3,300 ft
	Screen	3,300-3,420 ft
	Bullnose	3,420-3,420.14 ft

CS = Carbon steel
ft = Foot
in. = Inch



Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Caliper/Temperature/Neutron Porosity
Dates Logged: 🟦 July 25, 2005 🟩 August 5, 2005

Well/Borehole Identification: CNTA MV-3
Surface Elevation: 6170.99 ft
Northing: 21101566.762
Easting: 1768970.823
Coordinate System: State Plane, NAD 83

Total Depth: enter total depth here

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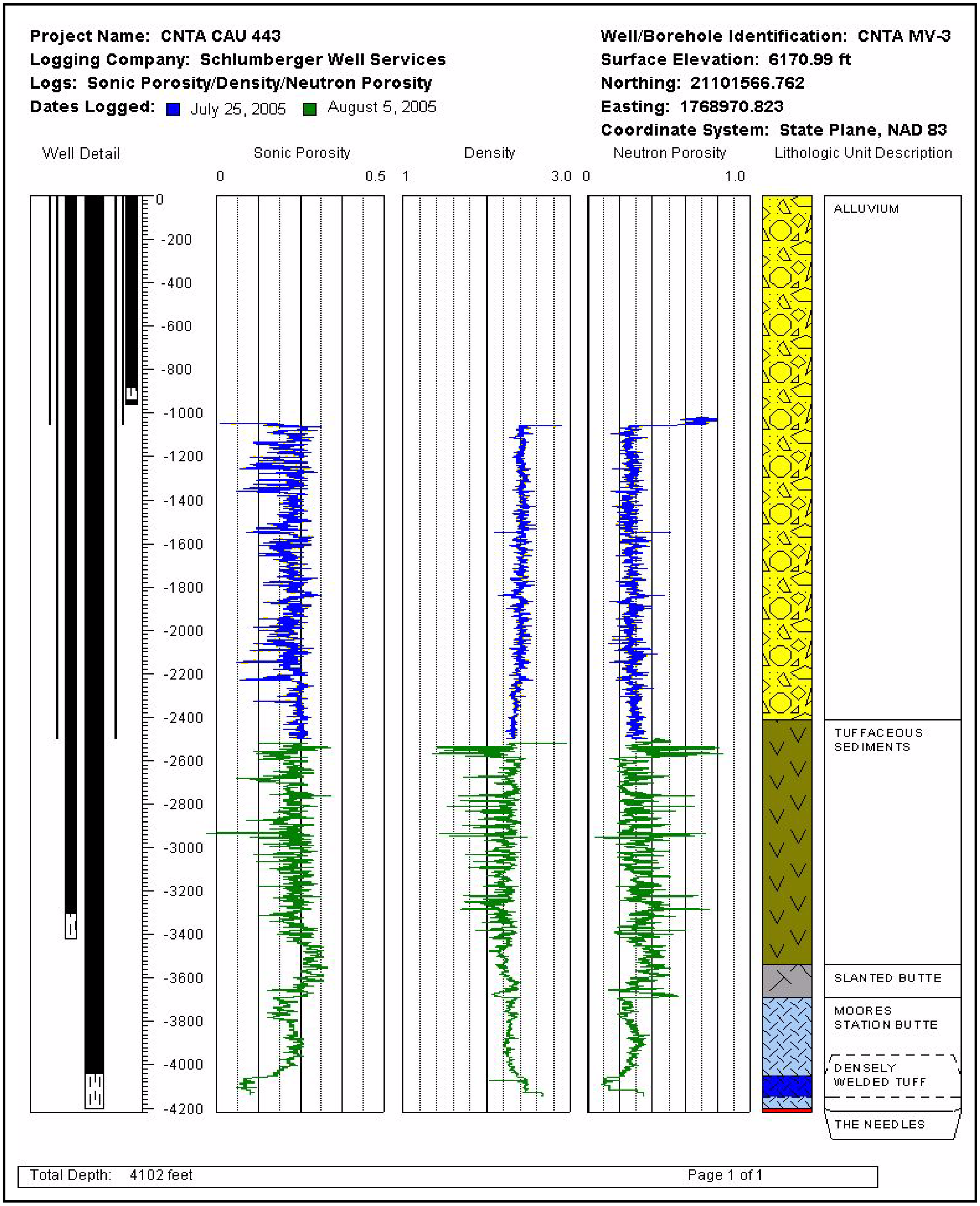
Figure D.1-1
MV-3 Caliper/Temperature/Neutron Porosity



Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Sonic Porosity/Density/Neutron Porosity
Dates Logged: 🟦 July 25, 2005 🟩 August 5, 2005

Well/Borehole Identification: CNTA MV-3
Surface Elevation: 6170.99 ft
Northing: 21101566.762
Easting: 1768970.823
Coordinate System: State Plane, NAD 83

Total Depth: 4102 feet

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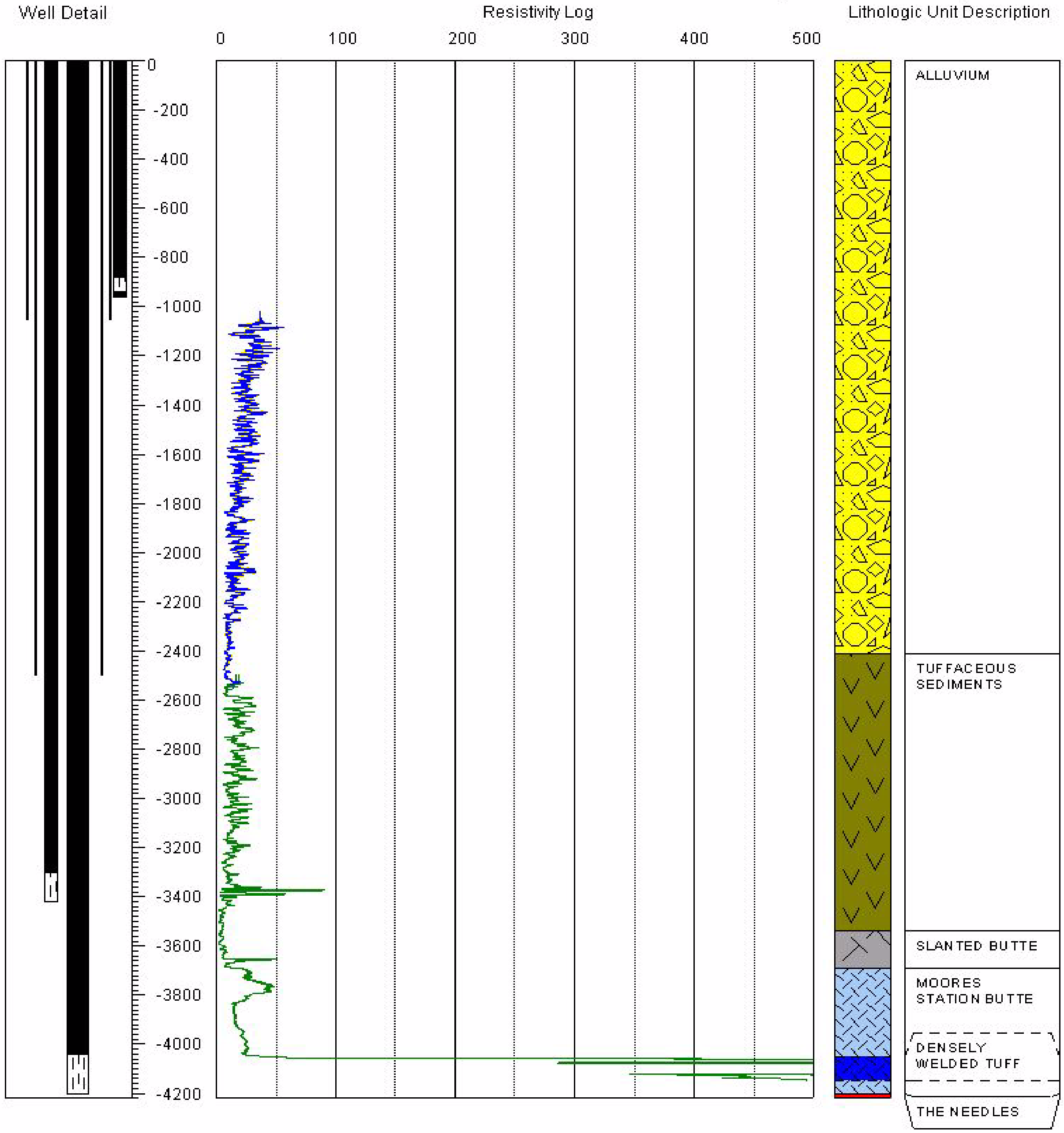
Figure D.1-2
MV-3 Sonic Porosity/Density/Neutron Porosity

Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Resistivity Logs
Dates Logged: 🟦 July 25, 2005 🟩 August 5, 2005

Well/Borehole Identification: CNTA MV-3
Surface Elevation: 6170.99 ft
Northing: 21101566.762
Easting: 1768970.823
Coordinate System: State Plane, NAD 83



Total Depth: 4102 feet

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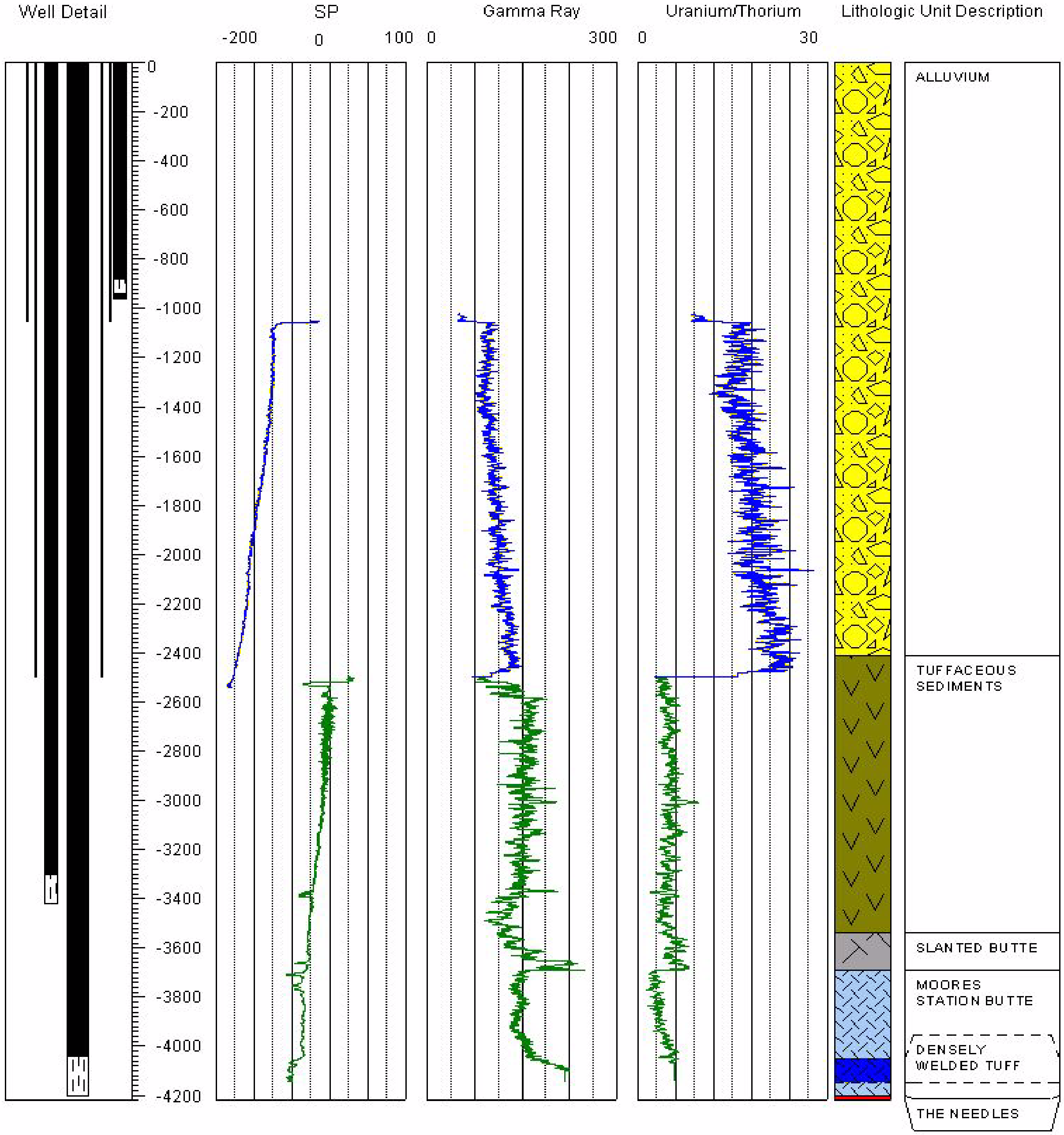
Figure D.1-3
MV-3 Resistivity Logs

Project Name: CNTA CAU 443
Logging Company: Schlumberger Well Services
Logs: Spontaneous Potential/Gamma Ray/Uranium-Thorium
Dates Logged: 🟦 July 25, 2005 🟩 August 5, 2005

Well/Borehole Identification: CNTA MV-3
Surface Elevation: 6170.99 ft
Northing: 21101566.762
Easting: 1768970.823
Coordinate System: State Plane, NAD 83



Total Depth: 4102 feet

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Figure D.1-4
MV-3 Spontaneous Potential/Gamma Ray/Uranium-Thorium

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