National Aeronautics and
Space Administration

White Sands Test Facility
P.O. Box 20
Las Cruces, NM 88004-0020

February 25, 2026

Reply to Attn of: RE-26-029

Mr. JohnDavid Nance, Bureau Chief
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Response to Approval with Modifications NASA WSTF Submittal of Well Completion Report (WCR) for NASA WSTF 400-001-GW

NASA submitted the *Submittal of Well Completion Reports (WCR) for NASA WSTF 400-001-GW*, on August 30, 2024. NMED approved the report with modifications on January 22, 2026 and directed NASA to address the two NMED comments and submit replacement pages for the report no later than March 9, 2026.

This submittal provides a response table of NMED's comments and NASA's response as Enclosure 1. Printed replacement pages for the comments are provided as Enclosure 2. A CD-ROM is provided as Enclosure 3 and includes electronic copies of the response table, redline-strikeout report, and final report.

I certify under penalty of law that this document and all attachments were prepared under my supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for known violations.

If you have any questions or comments concerning this submittal, please contact Antonette Doherty at 575-202-5406.

Amanda Skarsgard
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Amanda G. Skarsgard
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3 Enclosures

cc: (with enclosures)

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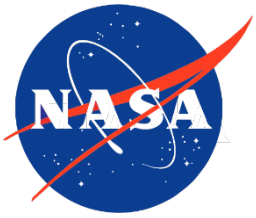
National Aeronautics and Space Administration



400-001-GW Well Completion Summary Report

August 2024

Revised February 2026

NM8800019434

NASA Johnson Space Center White Sands Test Facility

400-001-GW Well Completion Summary Report

August 2024

Revised February 2026

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

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List of Acronyms

amsl	Above Mean Sea Level
AWP	Abbreviated Work Plan
bgs	Below Ground Surface
COC	Contaminant of Concern
DP	Discharge Permit
EPA	Environmental Protection Agency
ft	Foot/feet
gal	Gallon(s)
GMP	Groundwater Monitoring Plan
HWMU	Hazardous Waste Management Unit
in.	Inch(es)
JSC	Johnson Space Center
mi	Mile(s)
MPITS	Mid-plume Interception Treatment System
MSVGM	Multiport Soil Vapor Groundwater Monitoring
MSVM	Multiport Soil Vapor Monitoring
NASA	National Aeronautics and Space Administ
NDMA	N-nitrosodimethylamine
NMED	New Mexico Environment Department
NMOSE	New Mexico State Engineer
NLCID	No Longer “Contained-In” Determination
NTU	Nephelometric Turbidity Units
PCC	Post-Closure Care
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
TSDF	Treatment, Storage, and Disposal Facility
WSTF	Johnson Space Center White Sands Test Facility
YJD	Yellow Jacket Drilling Services

1.0 Introduction and Purpose

The National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) White Sands Test Facility (WSTF) has supported testing of space flight equipment and hazardous materials from 1964 to the present. The facility contains five closed hazardous waste management units (HWMUs) that are under post-closure care (PCC). They are located within the 200, 300, 400, and 600 Areas. PCC requirements are specified by the WSTF Hazardous Waste Permit (Permit) issued by the New Mexico Environment Department (NMED, 2023). The Permit requires that historical releases of hazardous waste or hazardous constituents from the former HWMUs be investigated to determine if continuing sources of contamination are present.

A groundwater contamination plume consisting of n-nitrosodimethylamine (NDMA), trichloroethene, tetrachloroethene, and Freons[1] has been identified at WSTF. To characterize and monitor the horizontal and vertical extent of contamination, a monitoring well network consisting of single zone (referred to as conventional) and multi-zone (referred to as multiport) wells has been established. In the contaminant source areas, in addition to groundwater monitoring wells, soil vapor wells are used to monitor and evaluate the vadose zone. NASA utilizes multiport soil vapor monitoring (MSVM) wells to monitor the vadose zone and multiport soil vapor and groundwater monitoring (MSVGM) wells to monitor both the vadose zone and the underlying groundwater.

In June of 2020, NASA attempted to remove the dedicated low-flow bladder pump from WSTF groundwater monitoring well NASA 9 to extend the tubing and lower the bladder pump intake due to observed declining water levels. During removal activities, the tubing bundle separated from the pump, and the pump then dropped into the 5-foot (ft) well sump. During attempts to recover the pump, NASA discovered that the inside of the 2-inch (in.) stainless-steel casing was obstructed with small roots just above and below the static water level. Numerous attempts to lock onto the top of the pump with the fishing tool were unsuccessful and the pump could not be retrieved. On November 15, 2021, the NMED approved the 2021 Groundwater Monitoring Plan (GMP) with a modification stating that "[d]ue to reported damage associated with root growth at monitoring well NASA 9, a Work Plan for abandonment and replacement of the monitoring well must be submitted to NMED for approval. N-nitrosodimethylamine (NDMA) has historically been reported at concentrations that exceed the respective cleanup level at the sampling location; therefore, the replacement of NASA 9 will allow for continued groundwater data collection at this location down-gradient from the 400 Area Closure" (NMED, 2021). NASA then submitted an *Abbreviated Work Plan (AWP) for Abandonment of NASA WSTF NASA 9 and Replacement with Monitoring Well 400-001-GW* to NMED (NASA, 2022a). NASA 9 was then subsequently plugged and abandoned January 7, 2023.

Data collected from replacement well 400-001-GW will provide groundwater quality analysis for WSTF contaminants of concern (COCs) as well as water level data for the quarterly NASA WSTF Periodic Monitoring Reports. This report provides a summary of field activities associated with the drilling and installation of WSTF groundwater monitoring well 400-001-GW. Field activities were conducted between June 11, 2024 and June 27, 2024 and included borehole drilling, geophysical logging, installation of the well, and well development.

[1] Freon is a registered trademark of The Chemours Company CF, LLC.

2.0 Location and Description

2.1 Facility

WSTF is located in Doña Ana County, New Mexico, 16 miles (mi) northeast of Las Cruces, New Mexico, and 65 mi north of El Paso, Texas (Figure 2.1). WSTF was constructed in 1964 at a remote location adjacent to the San Andres Mountains. The land occupied by WSTF is owned by the Department of the Army and is used by NASA under a land use agreement with the Army (Department of Defense, 1982). Access to the site is provided by a paved road that intersects U.S. Highway 70, 1 mi west of Organ, New Mexico and leads 6 mi north to the test areas.

WSTF's primary activities in support of the United States space program are:

1. Development, qualification, refurbishment, and testing of spacecraft propulsion systems, subsystems, and ground support equipment.
2. Investigation of flight hardware anomalies.
3. Testing of materials and components.
4. Performance of hazard and failure analyses.

Following the completion of construction of WSTF in 1964, many wastes were historically managed in hazardous waste management units, including surface impoundments, within the WSTF industrial area. These hazardous waste management units contributed to groundwater contamination. As a result of the groundwater contamination, NASA operates a network of groundwater monitoring wells throughout the site.

2.2 400-001-GW Well Location

The 400 Area HWMU Closure is located at the 400 Area within the industrialized portion of WSTF. The location of the 400 Area relative to other WSTF areas is shown in Figure 2.2, and the location of well 400-001-GW relative to other infrastructure in the 400 Area is shown in Figure 2.3. The 400 Area is currently used for propulsion testing in altitude chambers and on engine test stands.

3.0 Regulatory Timeline

On November 15, 2021, the New Mexico Environment Department (NMED) approved the 2021 GMP with a modification stating that "[d]ue to reported damage associated with root growth at monitoring well NASA 9, a Work Plan for abandonment and replacement of the monitoring well must be submitted to NMED for approval. N-nitrosodimethylamine (NDMA) has historically been reported at concentrations that exceed the respective cleanup level at the sampling location; therefore, the replacement of NASA 9 will allow for continued groundwater data collection at this location down-gradient from the 400 Area Closure." (NMED, 2021).

NASA subsequently prepared and submitted the *Abbreviated Work Plan for Abandonment of NASA WSTF NASA 9 and Replacement with Monitoring Well 400-001-GW* (NASA, 2022a) on April 27, 2022. Monitoring well NASA 9 was then plugged and abandoned per the NMED directive on January 7, 2023. Construction of 400-001-GW began June 11, 2024, and final development was completed on June 27, 2024. The *400-001-GW Well Completion Summary Report* (NASA, 2024) was then prepared and submitted for NMED review August 28, 2024.

4.0 Plugging and Abandonment of Well NASA 9

NASA and the subcontract drilling company, Yellow Jacket Drilling (YJD), completed plugging activities in accordance with the New Mexico State Engineer (NMOSE)-approved well plugging plan for monitoring well NASA 9 (Appendix A). Well NASA 9 is located in the 400 Area (Figure 2.3). Plugging activities were completed using a Boart Longyear®[2] BK-81 heavy-duty drill rig. Equipment used included a 1,500-gallon (gal) water tank, 20-ft sections of 2-in. steel tremie pipe or 10-ft sections of 1-in. polyvinyl chloride (PVC) tremie pipe, air compressor, diaphragm pump, grout tank, and a power drill fitted with a mixing attachment. YJD personnel removed well surface features using a pneumatic jack hammer, cutting blades on an electric grinder, and a Bobcat®[3] S300 skid steer.

The following process was utilized in the decommissioning of the well where:

1. Bollards surrounding the well pad were pulled from the ground using the skid steer and staged on the edge of the well pad. Ground disturbed by removal was levelled to reduce potential trip hazards.

2. The rig was backed into place over the well, the mast was raised, and tremie pipe was lowered into the well casing to within 20 ft of the bottom of casing.

3. Grout was hand mixed onsite using Phoenix Cement®[4] Portland Type II cement, mixed with 5% by weight Halliburton®[5] Quick Gel bentonite and approximately 4.5 gals of water per 50-pound bag of cement.

4. Grout was pumped downhole via diaphragm pump and tremie pipe to approximately 5 ft below ground surface (bgs). Tremie was removed incrementally as grout filled the casing.

5. After grouting was complete, it was left to cure multiple days before the well pad was removed, casing cut to a minimum of 6 in. below surrounding ground surface, and the hole topped off to the top of cut casing.

6. A concrete cap was placed on top of the cut casing of the abandoned well and a brass cap was set in the middle of the concrete. The brass cap will be inscribed with the permanent well name and its final surveyed ground surface elevation.

4.1 NASA 9 Well Summary

Well NASA 9 was completed in 1985 and is registered with the NMOSE as LRG-18480-POD1. The well is located within the footprint of the known NDMA groundwater contaminant plume at WSTF. The well was completed with a nominal 2-in. Schedule 80 PVC casing to a depth of 119.5 ft bgs and Schedule 40 stainless-steel casing from 119.5 to 154.5 ft bgs. The well was equipped with a 20-ft well screen from 129.5 to 149.5 ft bgs. The screened zone within this well had become inundated with root growth into the well casing at or near the static water level. The roots obstructed the ability to successfully obtain representative analytical samples.

[2] Boart Longyear is a registered trademark of The Boart Longyear Company.
[3] Bobcat is a registered trademark of Doosan Bobcat North America Inc.
[4] Phoenix Cement is a registered trademark of Salt River Pima-Maricopa Indian Community.
[5] Halliburton is a registered trademark of Halliburton Energy Services, Inc.

4.2 Plugging and Abandonment

A Plugging Plan of Operations for well NASA 9 was approved by the NMOSE on October 19, 2022 (NASA, 2022b; Appendix A). Plugging and abandonment activities including the surface completion were performed at well NASA 9 between January 7 and 21, 2023. Tremie pipe was lowered into the casing to a depth of approximately 150 ft bgs. Plugging was completed by pumping grout down tremie pipe to fill the well casing from the bottom up. An estimated 75 gals of grout was used to plug well NASA 9, which was more than the estimated 25 gals calculated prior to plugging. Grout in excess of the calculated casing volume was likely displaced into the filter pack around the 20-ft screened interval. Although there was potential to displace a small amount of groundwater, there was no displacement up the well casing. No groundwater was discharged during plugging activities.

Fourteen days after grouting, the concrete pad was demolished using a pneumatic jack hammer. Concrete from the pad was removed and placed near the edge of the well pad for removal and recycling. The area around the well casing was excavated to more than 1 ft bgs to allow room for cutting of the casing. Surface casing and well casing were then cut to approximately 6 in. bgs using a cutting wheel. Casings were removed from the well area and placed with the previously removed bollards for removal and recycling or reuse. After the top of the casing was removed, the well was topped off with grout, bringing the grout to approximately top of the cut casing. After additional grout curing time, a concrete cap was placed on top of the well on January 28, 2023 and equipped with a brass cap. Uneven ground around the work area was levelled. YJD submitted the Well Plugging Record for well NASA 9 to the NMOSE on January 31, 2023 (Appendix A).

5.0 Drilling of Well 400-001-GW

Drilling at the 400-001-GW location (Figure 2.3) began on June 11, 2024 and the borehole was completed to a total depth of 173 ft bgs on June 15, 2024. There were no issues or problems during drilling activities.

5.1 Drilling Methods Utilized

YJD were subcontracted to perform drilling services at WSTF for 400-001-GW. It was decided well 400-001-GW would be drilled using the rotary sonic method of drilling. The decision to use rotary sonic drilling was based primarily on cost and time estimates to complete the well. Additionally, the method has been used successfully previously to drill and complete many WSTF wells in the 300 and 400 Area. The total amount of water used during drilling, well construction and development of 400-001-GW was 3,600 gal and is provided in Table 5.1.

5.2 Sampling During Drilling

Grab samples of soil and bedrock cuttings were collected and examined by qualified geologists as they were extruded from sonic core barrels over 5-ft intervals, and a lithologic log compiled. Lithologies were determined from recovered drill cuttings, and representative samples were placed in chip trays for subsequent detailed characterization using a binocular microscope. Soil descriptions were completed in accordance with ASTM D2488-17, “Standard Practice for Description and Identification of Soils,”. Lithologic descriptions are documented on the lithologic log included in (Appendix B). No groundwater samples were collected during drilling activities.

5.3 Lithology

The 400 Area is situated on a large coalescent alluvial fan sequence. The apex of the primary fan is located approximately 1 mi east of the western end of Bear Canyon. The fan was sourced by sediments derived from erosion within the canyon that is cut into the southern San Andres Mountains. It is lined by rock units which include Precambrian basement, a suite of Paleozoic formations common in this part of Southern New Mexico, and Tertiary intrusive and extrusive igneous rocks (Seager, 1981).

The unconsolidated alluvium encountered in the vadose zone in the 400 Area comprises Tertiary to Quaternary intercalated fan, interfan valley, and erosion surface veneer deposits. The majority of the sand, gravel, and cobble sized clasts/cuttings in the fan debris were limestones. However, there are numerous other sedimentary, igneous, and metamorphic lithologies representing the diverse suites of rocks in the source area. The heterogeneous alluvial soil consists of a mix of particles from silt and clay, to sand, pebbles, and cobbles that was encountered from ground surface to the top of bedrock.

Beneath the unconsolidated alluvium at a depth of 110 ft bgs, a layer of cemented conglomerate composed of strongly indurated alluvium (lithified primarily with calcite cement) was present. This conglomerate layer was noted as being approximately 37 ft thick in the 400-001-GW boring. The conglomerate appeared to be generally unfractured and impermeable, aside from occasional small, solution cavities. It most likely correlates with the Pliocene cemented fanglomerate facies of the Camp Rice Formation of West Texas and Southern New Mexico (Seager and others, 1987). Cemented alluvium has also been encountered in other borings within the 400 Area, and in the 300 Area to the east and upgradient of the 400 Area. As in the overlying unconsolidated alluvium, the most common lithology in the cemented alluvium is limestone, but the full range of sedimentary, igneous and metamorphic rocks were observed. At the base of the conglomerate unit, a layer of mudstone was found to be present with a thickness of approximately 5-7 ft. This layer likely represents a weathered surface included within the cemented conglomerate and directly above the andesite bedrock.

Finally, Orejon andesite was encountered at a depth of 147 ft bgs below the cemented conglomerate unit. This andesite varies in color from light lavender to purple, primarily massive in texture, with occasional minor flow banding and small dark crystals. The andesite bedrock surface appears highly weathered and brecciated with numerous fractures many filled with calcite cementing with iron staining present implying a high degree of in-situ fracturing and healing. Core pieces that were recovered indicate that approximately 18 ft of brecciated andesite were encountered before more competent andesite bedrock was noted. Evidence of fault zone associated breccia along with visible slicken lines was also noted by field geologists at approximately 160 ft bgs. Beneath the brecciated andesite, 13 ft of more competent andesite was then cored to the borehole's total depth of 173 ft bgs. The lithologic log for the 400-001-GW borehole is provided in Appendix B.

5.4 Geophysical Logging

Geophysical logging was conducted at 400-001-GW by Jet West Geophysical Services, LLC on June 15, 2024. Downhole logs included gamma ray, 3-arm caliper, temperature, resistivity, neutron, density, deviation, and spontaneous logs. The logger's total depth recorded was 173 ft bgs. The geophysical logs were used in conjunction with the drill cuttings to confirm changes in lithology, the bedrock contact, and to identify depths favorable for the placement of well screens. Geophysical logs are provided in Appendix C.

6.0 Well Construction

6.1 Planned Well Design

In the approved 400-001-GW Work Plan (NASA, 2022a) a single monitoring zone was proposed for the well with the intention to approximate the previous screened interval at recently plugged and abandoned well NASA 9 following a review of the geophysical logs. The 400-001-GW well completion diagram was then designed in accordance with the Work Plan directive and information gathered from geophysical logging. This resulted in placement of the wells screened interval from 140-155 ft bgs (Figure 5.1).

6.2 Well Completion Casing

Well 400-001-GW was completed with conventional 4-in. nominal Schedule 80 PVC flush joint casing with one 15 ft x 0.020-in. slotted screen between 140 – 155 ft bgs to a total depth of 160 ft bgs within the borehole drilled to 173 ft bgs. Cage-type stainless steel centralizers were installed on the casing above and below the slotted screen, and 50 ft bgs along the length of the casing to prevent the casing and screen from contacting the borehole walls and providing a uniform thickness of the annular materials. The 400-001-GW Well Completion Diagram (Figure 5.1) provides locations of centralizers and the final configuration of the well completion casing and screen location as well as a summary of well construction materials used.

6.3 Annular Materials Installation

Annular materials installation for 400-001-GW began June 16, 2024 and was completed June 17, 2024. Annular completion materials were installed as follows:

- 4 bags of Bentonite chips were added to backfill the borehole from 173 ft bgs to 165 ft bgs and to provide a lower seal.
- 17 bags of 10/20 sand for the wells filter pack were then added from 165 ft bgs to 137 ft bgs.
- 1 ¼ bags of 20/40 fine sand were then added atop the filter pack from 137 ft bgs to 135 ft bgs.
- 3 ½ bags of Bentonite chips were added atop the fine sand for the wells upper Bentonite seal from 135 ft bgs to 125 ft bgs.
- A total of 40 bags of Portland Type II cement and 1 bag of Quick Gel bentonite were used to grout the borehole from 135 ft bgs to 3 ft bgs. The grout was emplaced in four (4) equal batches; 10 bags of bentonite and ¼ bag of Quick Gel bentonite. Approximately 3 bags of Portland Type II neat cement then made up the last 3 ft and surface completion.

Completion materials were emplaced using a pneumatic diaphragm pump. All materials were installed using a 2-in. OD tremie pipe maintained at a level approximately 10 to 20 ft above the top of completion materials in the well. Water was only added to hydrate the emplaced Bentonite chips, and during the mixing of the bentonite grout and neat cement. The bentonite grout was mix by an experienced driller per standard with the ratio of 5% bentonite added by weight and 8.5 gallons of non-chlorinated water per 94 pound sack of Portland cement used. The neat Portland cement was mixed by an experienced driller per standard with a ratio of 6 gallons of water per 94 pound sack of Portland cement used.

7.0 Hydraulic Conditions

The 400-001-GW borehole was drilled using the rotary sonic method, and water was not observed until the cessation of drilling activities suggesting a relatively low production rate. Water was first identified, and a water level recorded during preparation of the borehole for geophysical logging activities.

Initial water level was tagged at 91.2 ft bgs (4,730.18 ft above mean sea level [amsl]) June 14, 2024, a day prior to geophysical logging. The water level was then tagged at 88 ft bgs (4,733.38 ft amls) during geophysical logging on June 15, 2024. Prior to development activities on June 26, 2024, the water level was located at 135.7 ft bgs (4,685.68 ft amsl) The final static water level of 400-001-GW after development was located at 129.8 ft bgs (4,691.58 ft amsl). Results from the geophysical logs (Appendix C) indicate that the interval below approximately 148 ft bgs is the most likely to yield water. Based on the final static water level in the well, the aquifer is interpreted to be semi-confined.

Replacement well 400-001-GW is located approximately 90 ft to the east northeast of plugged and abandoned well NASA 9 (Figure 2.3). The last reported depth to groundwater in well NASA 9 was measured on 4/8/2020 at 134.7 ft bgs (4,691.3 ft amsl). The aquifer in well NASA 9 was also reported to be semi-confined.

8.0 Well Development

Low production and recharge rates are historically not uncommon in the shallower 400 Area wells. YJD initiated development of well 400-001-GW on June 26, 2024. The open well was bailed and swabbed from June 26 until June 27, 2024 to remove mud from the well casing and develop the well in preparation for sampling. The relatively small water column was found to be inadequate for sustained pumping activities so this well was only swabbed and bailed. During development activities, environmental contractor personnel monitored discharged development water for groundwater parameters including pH, specific conductance (conductivity), temperature, and turbidity. Well development is considered complete when measured water quality parameters are relatively stable (vary less than 10%) and turbidity is found to be below 5 nephelometric turbidity units.

Due to the inability to pump 400-001-GW during initial development due to the relatively small water column and slow established recharge rate of approximately 1 gal/hour, a relatively limited total volume of 46.45 gal of were bailed from the well during the development activities. Flow and saturation in these wells are primarily fracture channel dominated often leading to poor production rates. Groundwater parameters were observed to stabilize and a turbidity of 4.73 nephelometric turbidity units (NTUs) was obtained early in the day June 27, 2024. This turbidity was observed to have increased up to 250 NTUs by the cessation of development activities (Appendix D).

9.0 Sampling

Based on groundwater monitoring and sampling performed at existing well NASA 9, the aquifer at the proposed 400-001-GW location is anticipated to be within the northern edge of the WSTF groundwater contaminant plume with respect to NDMA concentrations. Following well development, an initial set of groundwater characterization samples were collected using a dedicated Teflon bailer on August 16, 2024 for the analysis of volatile organic compounds by the current revision of SW-846 Method 8260D, semi-volatile organic compounds by the current revision of SW-846 Method 8270C, NDMA by Modified Environmental Protection Agency (EPA) Method 607M, or an acceptable low-level analytical method, and a variety of metals by the most effective laboratory-selected analytical method. Samples will be collected and managed in accordance with the WSTF GMP (NASA, 2023).

9.1 Survey

During surface completion of the wells, a brass cap was permanently installed in the cement well pad. The cap was installed to serve as a survey point to represent the location of the well.

The location and elevation of well 400-001-GW was preliminarily surveyed by NASA GPS personnel and is pending confirmation by a New Mexico Professional Surveyor. The New Mexico State Plane Central Zone North American Datum 83 coordinate system in U.S. survey ft above mean sea level is utilized. This professional survey data will be input into all NASA project documentation requiring survey data. The lithologic log (Appendix B) and Well Completion Diagram (Figure 5.1) currently include only the preliminary survey data. In addition, the top of the well casing will be surveyed using the same methods. The brass cap will be inscribed with the permanent well name and its final surveyed ground surface elevation.

10.0 Work Plan Deviations

The following list provides deviations from the *Abbreviated Work Plan for Abandonment of NASA WSTF NASA 9 and Replacement with Monitoring Well 400-001-GW* (NASA, 2022a), submitted by NASA on April 22, 2022 and approved by NMED on October 31, 2022 (NMED, 2022).

- In the **Drilling Approach** section, it is stated that the borehole will be 8-in. in diameter by air rotary casing advance. Based on preceding drilling activities performed in the WSTF 300 Area and the available equipment on-site, a 9-in. borehole was instead advanced using the rotary sonic drilling method.

- In the **Well Completion** section, it was stated that 3-in. nominal Schedule 80 PVC casing would be used. A 4-in. nominal Schedule 80 PVC was used instead during the well's completion to facilitate easier access to well development equipment and a permanent pump if feasible.

- In the **Well Completion** section, it was stated that the drive casing would be removed to a depth of 20 ft bgs and cut to leave the remaining surface casing in place. Due to relatively stable conditions in the upper alluvial formation during well construction activities, all surface casing was removed during well completion.

- In the **Well Completion** section, it was stated a ten-foot length 0.020-in. slotted Schedule 80 PVC screen would be installed. After establishing relatively low groundwater production at this location and the evaluation of geophysical logs, it was determined that a 15 ft screen of 0.020-in. slotted Schedule 80 PVC would be more appropriate for the well design.

- In the **Well Completion** section, it was stated that the upper 10 ft of the borehole and well pad would be completed with Type II Portland neat cement. During completion activities only the upper 3 ft and the well pad were completed using Type II Portland neat cement. The remaining 7 ft interval was completed using the cement and Quick Gel grout mix.

- In the **Well Development** section, it was stated that the well development will be considered complete when measured water quality parameters are relatively stable (vary less than 10%) and turbidity is below 5 NTUs. Poor well bore volumes and recharge rates precluded the use of a pump, and development activities were limited to swabbing and bailing. As a result, although 5 NTUs was achieved during development, the final parameter measurement of 250 NTUs indicates that additional development of this well is warranted.

11.0 Investigation-Derived Waste Management, Characterization, and Disposal

Investigation Work Plan Waste characterization will be conducted in accordance with Section II.C (Waste Characterization) and Attachment 12 (Waste Analysis Plan) of the WSTF Hazardous Waste Permit (NMED, 2023). All waste was properly managed and disposed of in accordance with NASA procedures

and state and federal regulations. The waste streams that were generated during drilling and installation of groundwater monitoring well 400-001-GW included:

- **Drill cuttings.** Unsaturated drill cuttings are defined as soil cuttings or rock fragments generated from the vadose zone that have not come into contact with groundwater. Unsaturated cuttings were characterized as non-hazardous solid waste. Saturated drill cuttings are defined as soil cuttings or rock fragments generated from below the water table that may have come into contact with potentially contaminated groundwater. This environmental media potentially contains listed hazardous waste constituents from the WSTF groundwater plume was initially characterized as hazardous waste.

- **Drilling fluids.** Limited amounts of non-chlorinated water were introduced into the circulated material during rotary sonic drilling. Drilling fluid generated above the water table was characterized as non-hazardous solid waste. Drilling fluid generated below the water table potentially contain listed hazardous waste constituents that are present in the WSTF groundwater plume and was initially characterized as hazardous waste.

- **Groundwater.** Groundwater produced from within the WSTF groundwater plume during well drilling and development was characterized as environmental media containing listed hazardous waste with the F001 and F002 hazardous waste codes.

- **Decontamination fluids.** Decontamination fluids such as water and soap solutions used to wash and decontaminate equipment generated during drilling above the water table were characterized as non-hazardous solid waste. Decontamination fluids generated by cleaning equipment that has contacted potentially contaminated soil, cuttings, or fluids generated when drilling below the water table was characterized as hazardous waste.

- **Contact waste.** Contact waste, or debris, such as used disposable sampling equipment, personal protective equipment, plastic sheeting, and other debris generated during drilling above the water table is non-hazardous solid waste. Contact debris contaminated with soil, cuttings, or fluids that were generated when drilling below the water table was characterized as hazardous waste.

- **Petroleum Contaminated Debris and Environmental Media.** Debris such as rags and wipes may be contaminated with petroleum products during routine drilling equipment maintenance. Though not expected, petroleum contaminated environmental media may also be generated during an unexpected drilling equipment failure. The petroleum contaminated debris and environmental media was characterized as hazardous waste with the D018 hazardous waste code.

Groundwater at the proposed location of well 400-001-GW may be contaminated with low concentrations of listed hazardous waste constituents that are present in the WSTF groundwater plume. Actively managed groundwater sourced from the WSTF groundwater contaminant plume is characterized as listed hazardous waste with the F001 and F002 hazardous waste codes through application of the EPA "Contained-In" Policy. The EPA "Contained-In" Policy states that groundwater, soil, and other environmental media is not solid waste but is subject to regulation as hazardous waste when it contains listed waste (EPA, 1998). Because groundwater and other environmental media is subject to regulation when it contains listed hazardous waste, waste generated after reaching the water table was managed as hazardous waste.

Drill cuttings and drilling fluids (water) generated above and below the water table were managed as hazardous waste in intermediate bulk or bulk containers. Drill cuttings and drilling fluids generated from the vadose zone do not contain listed hazardous waste and do not meet the definition of a hazardous waste. Hazardous waste generated below the water table was containerized and managed in accordance

with 20.4.1.300 NMAC and 40 CFR 262.17. The as-generated waste from below the water table was sampled and the analytical data further used to characterize the waste. Waste characterization samples were analyzed for volatile organic compound by the current revision of SW-846 Method 8260 and NDMA by Modified EPA Method 607M.

NASA has requested a “contained-in” determination from the NMED for waste generated below the water table if the analytical data indicate drill cuttings and drilling fluids generated below the water table do not contain listed hazardous waste or exhibit characteristics of a hazardous waste. If the analytical data indicate the presence of listed waste or the waste exhibits characteristics of a hazardous waste, the waste is properly treated and disposed of at a RCRA permitted treatment, storage, and disposal facility (TSDF). On July 11th, 2024, NASA submitted a *Request for a ‘No Longer Contained-in’ Determination for Drilling Mud and Cuttings Associated with the Expanded Scope Proposed for the 300 Area Supplemental Abbreviated Drilling Work Plan* (NASA, 2024) supporting our Request for a "No Longer Contained-In" Determination from NMED. On July 24th, 2024, NASA received an NMED-Approval for our No Longer Contained-In Determination for this particular waste stream (NMED, 2024). Free standing water was decanted from this waste stream prior to shipment off-site and transferred to the Mid-plume Interception and Treatment System (MPITS) for treatment and discharge in accordance with Discharge Permit (DP)-1255 (NMED, 2017).

Contaminated groundwater generated during drilling, development, and purging, and the associated contaminated water generated during decontamination of equipment that came into contact with contaminated groundwater or hazardous debris from below the water table was accumulated in appropriately sized containers and managed as hazardous waste. The containers were managed in accordance with requirements of 20.4.1.300 NMAC and 40 CFR 262.17. Within permissible accumulation time limits, contaminated water will be transferred to the MPITS for treatment and discharge.

Contact waste, or hazardous debris, that has come into contact with contaminated groundwater was collected at the end of each working shift and transferred to an appropriate container. All hazardous waste containers were managed on-site in accordance with the requirements of 20.4.1.300 NMAC and 40 CFR 262.17. If analytical results from drill cuttings and fluids indicate they are non-hazardous, this waste stream may be included in a “contained-in” determination request. If analytical results indicate the drill cuttings and fluids contain hazardous waste, or NMED determines the waste still contains hazardous waste, this debris will be shipped off-site for treatment and disposal at a Resource Conservation and Recovery Act (RCRA) permitted TSDF within the permissible accumulation time limits. As discussed previously, NASA may request a “contained-in” determination for individual waste streams initially characterized as containing listed hazardous wastes, should analytical data from the as-generated waste support such a request. If NMED finds contaminant concentrations do not pose an unacceptable risk, then NMED may allow the wastes included in the request to be managed as non-hazardous solid waste that no longer contains listed waste and does not exhibit the characteristic of hazardous waste. On July 24, 2024, NASA has received from NMED a separate letter document such a determination (NMED, 2024).

For any waste that may be characterized as hazardous waste, land disposal restriction notifications, disposal facility profiles, and hazardous waste manifests will be completed as required. Hazardous waste manifested off-site will be transported for treatment and disposal at a permitted RCRA TSDF. Contaminated groundwater and decontamination water generated during the project will be managed at the MPITS. If that system is not capable of receiving the waste, it will be disposed of at a permitted RCRA TSDF.

12.0 References

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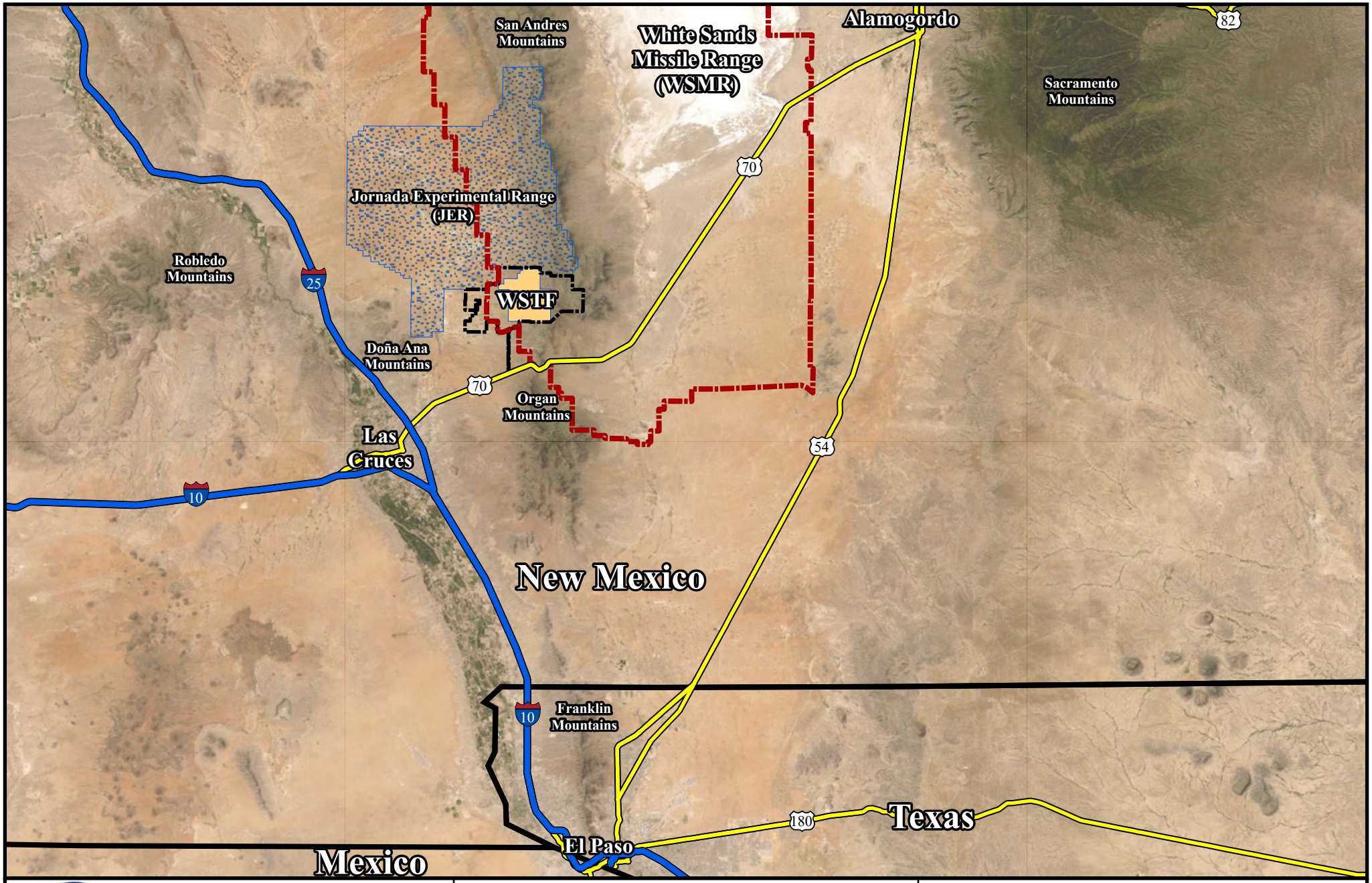
Figures

Figure 2.1 **WSTF Location Map**

(SEE NEXT PAGE)



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August 2024
Edited by: srees

- WSMR Boundary
- WSTF Boundary
- Jornada Experimental Range (JER)
- WSTF Industrial Area

WSTF Location Map

NASA Johnson Space Center
White Sands Test Facility
Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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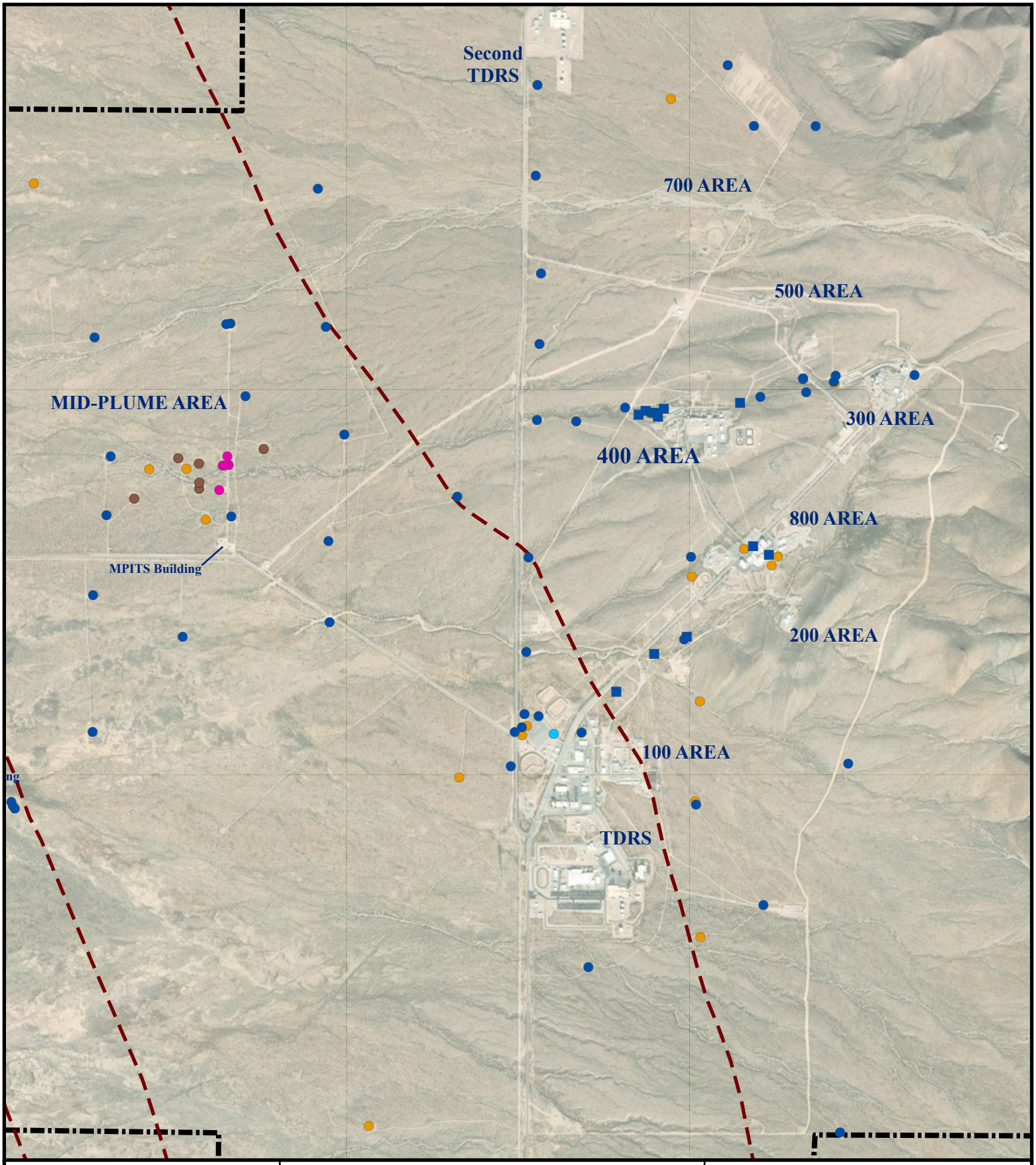
Figure 2.2 **400 Area Location Map**

(SEE NEXT PAGE)



White Sands Test Facility
400 Area Location

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 HARN StatePlane New Mexico Central FIPS 3002 Feet

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Figure 2.3 **Well 400-001-GW Location Map**

(SEE NEXT PAGE)



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August 2024

0 200 400 Feet

Prepared by: srees

New Well Installation
Multiport Well
Conventional Well
MSVGM Well
MSVM Well
Plugged and Abandoned

Monitoring Well 400-001-GW Location

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 HARN StatePlane New Mexico Central FIPS 3002 Feet

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Figure 5.1 Well 400-001-GW Well Completion Diagram

(SEE NEXT PAGE)

WELL COMPLETION DIAGRAM
MONITORING WELL

Location ID: **400-001-GW** Site ID: **NASA-WSTF, Doña Ana County, NM**

Township and Range: **NE 1/4 NE 1/4 SW 1/4 Sec 35, T20S, R3E**
NM State Plane Coordinates (NAD 83)(ft): **554,959.017 N, 1,530,435.611 E**
Elevation (Brass Cap): **4821.38 ft.**
Elevation (Top of Casing): **4826.38 ft.**
Drilling Contractor: **Yellow Jacket Drilling**
Driller: **J. Munguia**
Method of Drilling: **Sonic / Air Rotary**
Total Depth of Borehole (bgs): **173 ft.**
Borehole Diameter: **9-in. to 173 ft. bgs**
Depth to Bedrock (bgs): **110 ft; Cemented Conglomerate**
Depth to Groundwater: **129.8 ft. bgs (6/27/24)**
Diameter and Type Surface Casing: **N/A**

Dates Borehole Drilled: **6/11 - 6/15/24**
Date(s) Well Installed: **6/16 - 6/17/24**
Date(s) Well Developed: **6/26 - 6/27/24**
Field Representative(s): **S. Rees, P. Bolen**
Total Depth Well Casing (bgs): **160 ft.**
Type of Casing: **SCH 80 PVC**
Diameter Well Casing: **4-in. nominal**
Screened Zone (bgs): **140-155 ft.**
Comments: NASA 9 Replacement Well

bgs = below ground surface TOC=Top of Casing
ags= above ground surface
ID = Inner Diameter OD= Outer Diameter

Casing Explanation

Surface Casing
N/A

Completion Casing
SCH 80 PVC
4-in nominal

Well Screen
SCH 80 PVC
SCH 80 PVC 0.020-in Slot Screen

Steel Centralizer
Steel End Cap
Water Table

Annular Materials Explanation

Neat Cement
Bentonite Grout
Bentonite Seal
20/40 Filter Pack Sand
10/20 Sand
Slough

Elevation (ft amsl) / Depth (ft bgs)	**Borehole/Well Casing Descriptions** All depths are below ground surface	**Annular Materials Descriptions** All depths are below ground surface
4820 / 0	Note: Sampling system is currently NOT installed Stick-Up = 5 ft. ags	
4810 / 10	The well was completed with a 4 ft x 4ft cement pad, barrier posts, and a locking steel well cap surrounding the casing at ground surface.	Top of Surface Seal (3x 47 lbs bags Portland II Cement) = 0-3 ft. Top of Cement Grout (40x 47 lbs bags Portland II Cement with 5% Bentonite added) = 3.0 ft.
4800 / 20		Formation is Santa to Fe Group alluvium from surface to 110 ft bgs.
4790 / 30		
4780 / 40		
4770 / 50	Three steel cage centralizers bolted together around casing at 50 ft.	
4760 / 60		

WELL COMPLETION DIAGRAM
MONITORING WELL

Location ID: **400-001-GW** Site ID: **NASA-WSTF, Doña Ana County, NM**

Township and Range: **NE 1/4 NE 1/4 SW 1/4 Sec 35, T20S, R3E**
NM State Plane Coordinates (NAD 83)(ft): **554,959.017 N, 1,530,435.611 E**
Elevation (Brass Cap): **4821.38 ft.**
Elevation (Top of Casing): **4826.38 ft.**
Drilling Contractor: **Yellow Jacket Drilling**
Driller: **J. Munguia**
Method of Drilling: **Sonic / Air Rotary**
Total Depth of Borehole (bgs): **173 ft.**
Borehole Diameter: **9-in. to 173 ft. bgs**
Depth to Bedrock (bgs): **110 ft; Cemented Conglomerate**
Depth to Groundwater: **129.8 ft. bgs (6/27/24)**
Diameter and Type Surface Casing: **N/A**

Dates Borehole Drilled: **6/11 - 6/15/24**
Date(s) Well Installed: **6/16 - 6/17/24**
Date(s) Well Developed: **6/26 - 6/27/24**
Field Representative(s): **S. Rees, P. Bolen**
Total Depth Well Casing (bgs): **160 ft.**
Type of Casing: **SCH 80 PVC**
Diameter Well Casing: **4-in. nominal**
Screened Zone (bgs): **140-155 ft.**
Comments: NASA 9 Replacement Well

bgs = below ground surface TOC=Top of Casing
ags= above ground surface
ID = Inner Diameter OD= Outer Diameter

Casing Explanation

- Surface Casing: **N/A**
- Completion Casing: **SCH 80 PVC**, **4-in nominal**
- Well Screen: **SCH 80 PVC**, **SCH 80 PVC 0.020-in Slot Screen**
- Steel Centralizer
- Steel End Cap
- Water Table

Annular Materials Explanation

- Neat Cement
- Bentonite Grout
- Bentonite Seal
- 20/40 Filter Pack Sand
- 10/20 Sand
- Slough

Elevation (ft amsl) / Depth (ft bgs)	**Borehole/Well Casing Descriptions** All depths are below ground surface	**Annular Materials Descriptions** All depths are below ground surface
4750 / 70 4740 / 80 4730 / 90 4720 / 100 4710 / 110 4700 / 120 4690 / 130	Water Table Depth = 129.8 ft. bgs (6/27/24)	Conglomerate bedrock depth = 110 ft. 9-in. Borehole grouted to 125 ft. Top of Upper Bentonite Seal (3 1/2 x 50 lbs buckets Bentonite chips) = 125 ft.

WELL COMPLETION DIAGRAM
MONITORING WELL

Location ID: **400-001-GW** Site ID: **NASA-WSTF, Doña Ana County, NM**

Township and Range: **NE 1/4 NE 1/4 SW 1/4 Sec 35, T20S, R3E**
NM State Plane Coordinates (NAD 83)(ft): **554,959.017 N, 1,530,435.611 E**
Elevation (Brass Cap): **4821.38 ft.**
Elevation (Top of Casing): **4826.38 ft.**
Drilling Contractor: **Yellow Jacket Drilling**
Driller: **J. Munguia**
Method of Drilling: **Sonic / Air Rotary**
Total Depth of Borehole (bgs): **173 ft.**
Borehole Diameter: **9-in. to 173 ft. bgs**
Depth to Bedrock (bgs): **110 ft; Cemented Conglomerate**
Depth to Groundwater: **129.8 ft. bgs (6/27/24)**
Diameter and Type Surface Casing: **N/A**

Dates Borehole Drilled: **6/11 - 6/15/24**
Date(s) Well Installed: **6/16 - 6/17/24**
Date(s) Well Developed: **6/26 - 6/27/24**
Field Representative(s): **S. Rees, P. Bolen**
Total Depth Well Casing (bgs): **160 ft.**
Type of Casing: **SCH 80 PVC**
Diameter Well Casing: **4-in. nominal**
Screened Zone (bgs): **140-155 ft.**
Comments: NASA 9 Replacement Well

bgs = below ground surface TOC=Top of Casing
ags= above ground surface
ID = Inner Diameter OD= Outer Diameter

Casing Explanation

Surface Casing
N/A

Completion Casing
SCH 80 PVC
4-in nominal

Well Screen
SCH 80 PVC
SCH 80 PVC 0.020-in Slot Screen

Steel Centralizer

Steel End Cap

Water Table

Annular Materials Explanation

Neat Cement

Bentonite Grout

Bentonite Seal

20/40 Filter Pack Sand

10/20 Sand

Slough

Elevation (ft amsl) / Depth (ft bgs)	**Borehole/Well Casing Descriptions** All depths are below ground surface	**Annular Materials Descriptions** All depths are below ground surface
4680 — 140 4670 — 150 4660 — 160 4650 — 170	Three steel cage centralizer bolted together around casing at 140 ft. Top of 4-in nominal Schedule 80 PVC w/ 0.020-in - Slot PVC Screen = 140 ft. Bottom of 4-in nominal Schedule 80 PVC w/ 0.020-in - Slot PVC Screen = 155 ft. Three steel cage centralizer bolted together around casing at 155 ft. Sump consists of 5 ft blank riser and end cap 4-in nominal Schedule 80 PVC Casing TD = 160 ft.	Top of 20/40 Upper Sand Pack (1 1/4x 47 lbs bags 20/40 sand) = 135 ft. Top of 10/20 Sand Filter Pack (17x 47 lbs bags 10/20 sand) = 137 ft. Bentonite Backfill (4x 50 lbs buckets Bentonite chips) = 165-173 ft. 9-in Borehole TD= 173 ft.

Tables

Table 4.1 Water Usage Log

Drilling			Well Construction		
Date	**Water (gal.)**	**Cumulative Water (gal.)**	**Date**	**Water (gal.)**	**Cumulative Water (gal.)**
6/12/24	300	300	6/16/24	300	300
6/12/24	600	900			
6/13/24	600	1500			
6/13/24	600	2100			
6/13/24	600	2700			
6/14/24	600	3300			
	Drilling Total:	3300		Well Construction Total:	300
Combined Total Volume (gal.):_3600_____					

Appendix A NASA 9 Plugging Plan and Record

PLUGGING RECORD

NOTE: A Well Plugging Plan of Operations shall be approved by the State Engineer prior to plugging - 19.27.4 NMAC

I. GENERAL / WELL OWNERSHIP:

State Engineer Well Number: NASA 9 / LRG-19480 POD1

Well owner: NASA Johnson Space Center White Sands Facility Phone No.: (575)-524-5024

Mailing address: P.O. BOX 20

City: Las Cruces State: NM Zip code: 88004

II. WELL PLUGGING INFORMATION:

1) Name of well drilling company that plugged well: Yellow Jacket Drilling Services, LLC

2) New Mexico Well Driller License No.: WD-1458 Expiration Date: 10/31/24

3) Well plugging activities were supervised by the following well driller(s)/rig supervisor(s): Sean Carrigan

4) Date well plugging began: 1/7/23 Date well plugging concluded: 1/7/23

5) GPS Well Location: Latitude: 32 deg, 31 min, 30.05 sec
Longitude: -106 deg, 26 min, 25.49 sec, WGS 84

6) Depth of well confirmed at initiation of plugging as: 154 ft below ground level (bgl), by the following manner: Tremie Pipe

7) Static water level measured at initiation of plugging: 129 ft bgl

8) Date well plugging plan of operations was approved by the State Engineer: 9/9/22

9) Were all plugging activities consistent with an approved plugging plan? YES If not, please describe differences between the approved plugging plan and the well as it was plugged (attach additional pages as needed):

10) Log of Plugging Activities - Label vertical scale with depths, and indicate separate plugging intervals with horizontal lines as necessary to illustrate material or methodology changes. Attach additional pages if necessary.

For each interval plugged, describe within the following columns:

Depth (ft bgl)	Plugging Material Used (include any additives used)	Volume of Material Placed (gallons)	Theoretical Volume of Borehole/ Casing (gallons)	Placement Method (tremie pipe, other)	Comments ("casing perforated first", "open annular space also plugged", etc.)
0	CEMENT GROUT 5% BETONITE	75 GAL	25.21 GAL	TREMIE PIPE	ABANDON
154'					

MULTIPLY		BY		AND OBTAIN
cubic feet	x	7.4805	=	gallons
cubic yards	x	201.97	=	gallons

III. SIGNATURE:

I, Richard LeBlanc, say that I am familiar with the rules of the Office of the State Engineer pertaining to the plugging of wells and that each and all of the statements in this Plugging Record and attachments are true to the best of my knowledge and belief.

R. LeBlanc. — Signature of Well Driller

1/31/23 — Date

Mike A. Hamman, P.E.
State Engineer

Las Cruces Office- District 4
1680 HICKORY LOOP, SUITE J
LAS CRUCES, NM 88005

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

October 19, 2022

File No. LRG-18480

NASA Johnson Space Center White Sands Test Facility
Attention: Timothy Davis
PO Box 20
Las Cruces, NM 88004

RE: Plugging Plan Approval for well LRG-18480 POD1

Greetings:

Enclosed is your copy of the Well Plugging Plan of Operations for well LRG-18480 POD1, approved subject to the attached conditions. You are responsible for submitting a properly completed Plugging Record to the office within thirty (30) days after plugging is completed. The Plugging record is available at:

http://www.ose.state.nm.us/STST/Forms/WD-11%20Plugging%20Record_2009-09-08_final.pdf

Please let us know if you have any questions.

Sincerely,

Cheryl S. Thacker
Water Resources Manager
WRAP, District IV

Encl (2): Well Plugging Plan of Operations and Conditions of Approval

WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging. This form may be used to plug a single well, or if you are plugging multiple monitoring wells on the same site using the same plugging methodology.

Alert! Your well may be eligible to participate in the Aquifer Mapping Program (AMP)-NM Bureau of Geology geoinfo.nmt.edu/resources/water/cgmn/ if within an area of interest and meets the minimum construction requirements, such as there is still water in your well, and the well construction reflected in a well record and log is not compromised, contact AMP at 575-835-5038 or -6951, or by email nmbg-waterlevels@nmt.edu, prior to completing this prior form. Showing proof to the OSE that your well was accepted in this program, may delay the plugging of your well until a later date.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP: ☐ Check here if proposing one plan for multiple monitoring wells on the same site and attaching WD-08m

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: LRG-18480 POD1 N/A; NASA Well NASA 9

Name of well owner: NASA Johnson Space Center White Sands Test Facility (Contact: Timothy Davis)

Mailing address: P.O. Box 20 County: Dona Ana

City: Las Cruces State: NM Zip code: 88004

Phone number: (575) 524-5024 E-mail: timothy.j.davis@nasa.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10/31/22 Renewal Pending

IV. WELL INFORMATION: ☐ **Check here if this plan describes method for plugging multiple monitoring wells on the same site and attach supplemental form WD-08m and skip to #2 in this section.**

Note: A copy of the existing Well Record for the well(s) to be plugged should be attached to this plan.

1) GPS Well Location: Latitude: 32 deg, 31 min, 30.05 sec
Longitude: -106 deg, 36 min, 25.49 sec, NAD 83

2) Reason(s) for plugging well(s):

Damage associated with root growth into the well casing at or near static water level has obstructed the ability to successfully obtain representative samples.

3) Was well used for any type of monitoring program? Yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? Yes If yes, provide additional detail, including analytical results and/or laboratory report(s): See NASA 9 analytical data enclosed

5) Static water level: 129.1 feet (below land surface) / feet above land surface (circle one)

6) Depth of the well: 154.46 feet

LRG-18480 TRN: 735978

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: Schedule 80 PVC; Schedule 40 Stainless-Steel

9) The well was constructed with:

☐ an open-hole production interval, state the open interval: _____

☒ a well screen or perforated pipe, state the screened interval(s): 129.46 - 149.46

10) What annular interval surrounding the artesian casing of this well is cement-grouted? NA

11) Was the well built with surface casing? Yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? Yes If yes, please describe:

Nominal 6-inch surface casing set to 30 ft in a borehole of unknown diameter and cemented to surface.

12) Has all pumping equipment and associated piping been removed from the well? No If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

☐ **If plugging method differs between multiple wells on same site, a separate form must be completed for each method.**

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal. Attach a copy of any signed OSE variance to this plugging plan.

Also, if this planned plugging plan requires a variance to 19.27.4 NMAC, attach a detailed variance request signed by the applicant.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well:

The well casing will be cemented from bottom up using tremie pipe, including all screened intervals and blank casing.

2) Will well head be cut-off below land surface after plugging? Yes, 6 inches below ground surface

2022 SEP 2 AM 10:2

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant. Attach a copy of the batch mix recipe from the cement company and/or product description for specialty cement mixes or any sealant that deviates from the list of OSE approved sealants.

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 25.21 gallons (3.37 cubic ft)

4) Type of Cement proposed: Portland Type II neat cement with 5% bentonite by weight

5) Proposed cement grout mix: 8.7 gallons of water per 94 pound sack of Portland cement.

6) Will the grout be: _____ batch-mixed and delivered to the site

X mixed on site

7) Grout additives requested, and percent by dry weight relative to cement:

5% by weight Bentonite powder (~4.7 lbs/94 lb bag of Portland Type II cement)

8) Additional notes and calculations:

The mix of neat cement and 5% bentonite will require 8.7 gallons of water per 94 lb bag of cement; 5.2 gallons per 94 lb bag of cement and 0.7 gallons per percent of bentonite.

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

Well NASA 9 was equipped with a low-flow bladder pump sampling system. In an attempt to remove the sampling system and extend the tubing to accommodate the declining water levels, the pump was disconnected from the tubing and dropped into the 5 foot sump. Attempts to retrieve the pump were unsuccessful and it was discovered the inside of the 2 inch stainless-steel casing was obstructed by root growth at or near static water level. The last two successful sampling events at well NASA 9 occurred in 2018 and 2019.

VIII. SIGNATURE:

I, Michael Zigmond for: Timothy Davis, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

MICHAEL ZIGMOND Digitally signed by MICHAEL ZIGMOND Date: 2022.09.07 12:49:04 -06'00'

Signature of Applicant

See Electronic Signatur

Date

2022 SEP -9 AM 10: 2

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

__✓__ Approved subject to the attached conditions.

_____ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 19th day of October, 2022

STATE OF NEW MEXICO STATE ENGINEER

Mike A. Hamman, STATE ENGINEER

ngineer

BY Cheryl S. Thacker

Cheryl Thacker
Water Resource Manager

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)			Ground Surface
Bottom of proposed interval of grout placement (ft bgl)			154.56
Theoretical volume of grout required per interval (gallons)			25.21 gal
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement			8.7 gallons of water per 94 lb bag of Portland Type II cement with 5% bentonite powder.
Mixed on-site or batch-mixed and delivered?			On Site
Grout additive 1 requested			Powdered bentonite
Additive 1 percent by dry weight relative to cement			5%
Grout additive 2 requested			NA
Additive 2 percent by dry weight relative to cement			NA

2022 SEP -9 AM 10:2

TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)			NA
Bottom of proposed sealant of grout placement (ft bgl)			NA
Theoretical volume of sealant required per interval (gallons)			NA
Proposed abandonment sealant (manufacturer and trade name)			NA

2022 SEP -9 AM 10: 2

Attachment
Conditions of Approval

Well Plugging Plan of Operations
Well Number LRG-18480 POD1

File No.: LRG-18480

1) Well LRG-18480 POD1 shall be plugged using the methods and materials identified in the State Engineer approved Well Plugging Plan of Operations filed on September 9, 2022.

2) In addition, well LRG-18480 POD1 shall be plugged completely using the following method per Rules and Regulations Governing Well Driller Licensing, Construction, Repair and Plugging of Wells; Subsection C of 19.27.4.30 NMAC:

   All pumping appurtenances shall be removed from the well prior to plugging. To plug a well, the entire well shall be filled from the bottom upwards to ground surface using a tremie pipe. The bottom of the tremie shall remain submerged in the sealant throughout the entire sealing process; other placement methods may be acceptable and approved by the State Engineer

   The well shall be plugged with an Office of the State Engineer approved sealant for use in the plugging of non-artesian wells.

   The well driller shall cut the casing off at least four (4) feet below ground surface and fill the open hole with at least two (2) vertical feet of approved sealant.

   Wells that do not encounter a water bearing stratum shall at a minimum be plugged by filling the well with drill cuttings or clean native fill to within 10 feet of land surface and by plugging the remaining 10 feet of the well to ground surface with a plug of the office of the state engineer approved sealant.

   The driller must fill or cover any open annulus with sealant. Once the sealant has cured, the well driller or well owner may cover the seal with soil.

   A plugging report for said well shall be filed with the Office of the State Engineer in the District IV office in Las Cruces within thirty (30) days of completion of the plugging.

2) A licensed well driller shall keep a record of the plugging work as it progresses and file a complete Plugging Record (Office of the State Engineer Form No.: WR-20) with the State Engineer no later than thirty (30) days after completion of plugging.

3) New Mexico Office of the State Engineer (NMOSE) witnessing of the plugging will not be required unless artesian conditions are encountered but shall be facilitated if a NMOSE observer is onsite. NMOSE witnessing may be requested during normal

work hours by calling the District IV NMOSE office at 575-524-6161 at least 48 hours in advance. NMOSE inspection will occur dependant of personnel availability.

4) Should another regulatory agency sharing jurisdiction of the project authorize or by regulation require more stringent requirements than stated herein, the more stringent procedure shall be followed. This in part includes provisions regarding preauthorization to proceed, type of methods and materials used, inspection, or prohibition of free discharge of any fluid or other material to or from the well that is related to the plugging process.

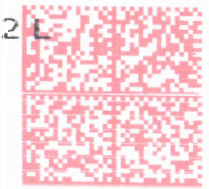
Date: 10/19/2022

Cheryl S. Thacker
Water Resources Manager
WRAP District IV

OFFICE OF THE STATE ENGINEER
1680 HICKORY LOOP, SUITE J
LAS CRUCES, NM 88005

EL PASO TX 798
21 OCT 2022PM 2 L





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Appendix B Lithologic Logs

SOIL BORING LITHOLOGIC LOG

LOCATION MAP:



SITE ID: NASA-WSTF **BOREHOLE ID: 400A-001-GW**
SITE COORDINATES (ft.) N: 554959.017 E: 1530435.611
GROUND ELEVATION (ft. MSL): 4821.382
STATE: New Mexico **COUNTY:** Doña Ana
DRILLING METHOD: Rotary Sonic
SAMPLING METHOD: From coring barrels
DRILLING CONTR./DRILLER: Yellow Jacket Drilling/Jose M.
DATE STARTED: 6/11/24 **DATE COMPLETED:** 6/14/24
FIELD REPS.: P. Bolen, S. Rees
TOTAL DEPTH: 178 ft (TOC 5 ft. stickup)
COMMENTS: NASA 9 Replacement Well

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	SOIL SAMPLE TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	LITHOLOGIC DESCRIPTION USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
0 5		4	5		100			ML	Matrix is silty with some clay, and a trace of sand. Clast fraction predominantly limestone, small pebbles to cobbles in size.
10		9	10		100			ML	Same as above.
15		14	15		100			GM	Same as above with increased clasts.
20		19	20		100			SM	Silty sand with gravel. Tannish brown in color.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
20		24	25		100			SM	Same as above but with reduced clasts. Clast diameter ¼-in to ½-in. Angular and broken.
25									
		29	30		100			SM	Same as above.
30									
		34	35		100			GM	Silty gravel with a trace of sand. Broken clasts ¼ -in to 1-in diameter.
35									
		39	40		100			GM	Same as above.
40									
		44	45		100			SM	Silty clay with some sand. Larger broken and angular clasts 4-in to 6-in diameter.
45									

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
45		49	50		100			SM	Same as above.
50									
55		54	55		100			GM	Silty with some gravel. Clasts ½ - 1-in diameter. Pinkish tan color. Dry.
60		59	60		100			GM	Same as above.
65		64	65		100			GM	Same as above but becoming moist.
70		69	70		100			GM	Same as above.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
70		74	75		100			GM	Same as above with rare 2-in clasts of limestone. Caliche coated. Silt is fine and uniform.
75									
80		79	80		100			GM	Same as above.
85		84	85		100				Poorly cemented conglomerate. Mixed clast lithologies of limestone, greenish andesite, and other volcanics. Matrix crumbly, light pink to tan. Up to 50% fine materials in cemented matrix.
90		89	90		100				Same as above.
95		94	95		100				Color change to gray, with clasts predominantly composed of andesite. Other clast lithologies comprise sandstone, limestone, and some rhyolite.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
95		99	100		100				Same as above.
100									
105		104	105		100				Light brown to gray. Mostly Limestone clasts up to 2-in diameter, subrounded to rounded. Clast size up to 2-in diameter. Matrix comprises 30% fines with some caliche.
110		109	110		100				
115		114	115		100				Top of cemented conglomerate unit. Reddish brown in color. Very well cemented large 4-in clasts in caliche cement. Limestone, rhyolite, and sandstone lithologies predominate in the clast fraction.
120		119	120		100				Same as above.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
120		124	125		100				Cemented conglomerate. Clasts are angular to rounded sedimentary and igneous lithologies up to 2-in diameter.
125									
130		129	130		100				Same as above. Clasts are angular to rounded well consolidated. Clast size 1-in to 2-in diameter.
135		134	135		100				Same as above.
140		139	140		90				Mudstone unit at base of cemented conglomerate. Retains reddish brown color.
145		144	145		100				Same as above. Mudstone unit continues to a depth of 147 ft bgs.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
145		149	150		100				At 147 ft andesite bedrock. Many healed and open fractures with calcite and iron staining. Bedrock surface appears highly weathered.
150									
155		154	155		100				
160		159	160		100				Heavily weathered andesite, transitioning to andesitic breccia. Calcite cement, bimodal color part greyish purple contacting dark red. Inferred to be a fault zone.
165		164	165		100				Highly weathered and brecciated andesite.
170		169	170		100				Same as above.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
170		174	175		100				Heavily weathered and fractured andesite, partially cemented/ consolidated with calcite and clay present.
175									
180		177	178		100				Same as above. Borehole total depth (TD) = 178 ft
185									
190									
195									

Appendix C Geophysical Logs

JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	Navarro Research & Engineering
WELL ID	400-001-GW
FIELD	NASA/WSTF
COUNTY	Dona Ana STATE New Mexico

TYPE OF LOG: Composite Max

OTHER SERVICES
Deviation

LOCATION:

NAD:
Northing:
Easting:

SEC TWP RGE

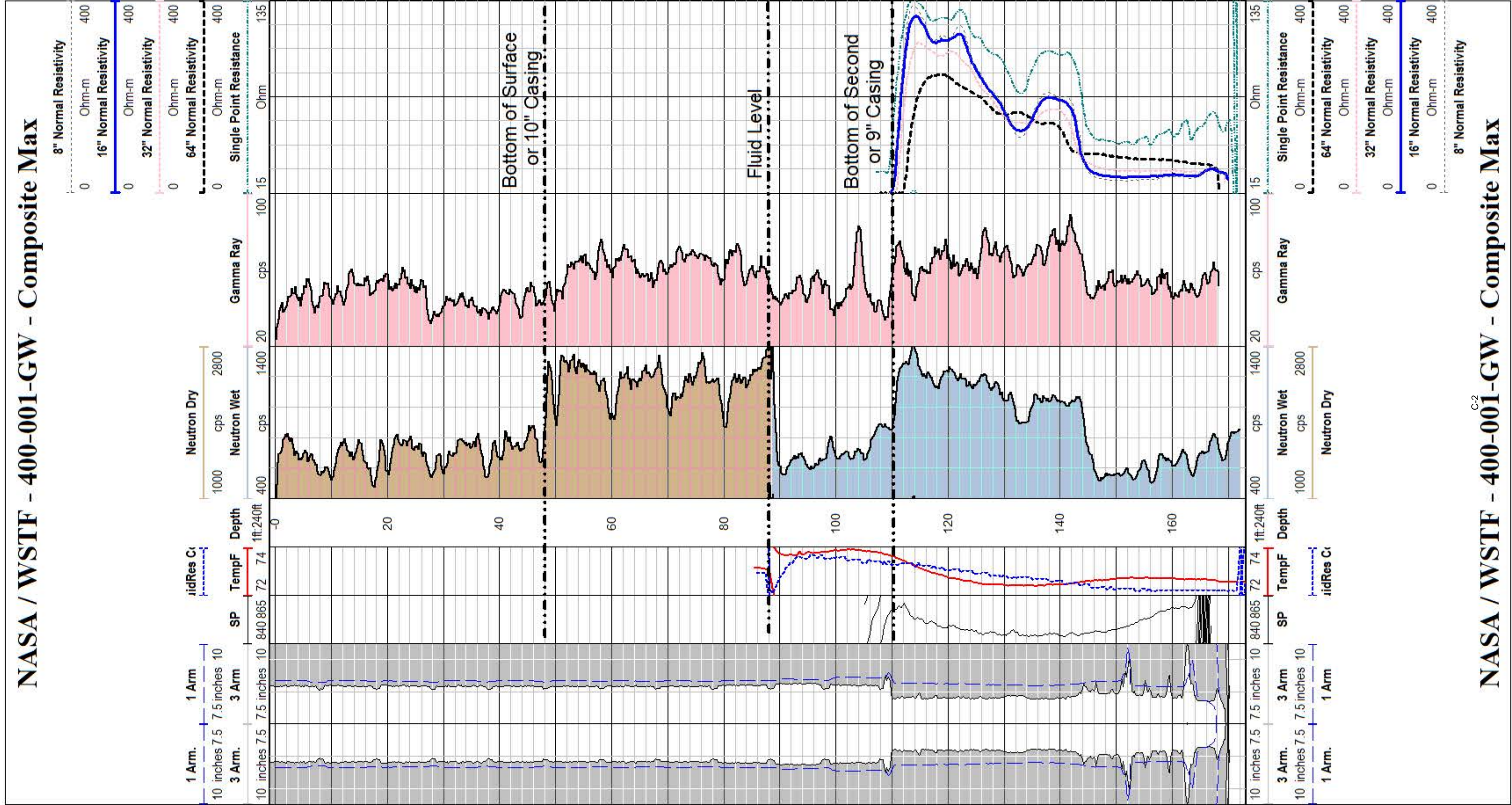
API No.

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.

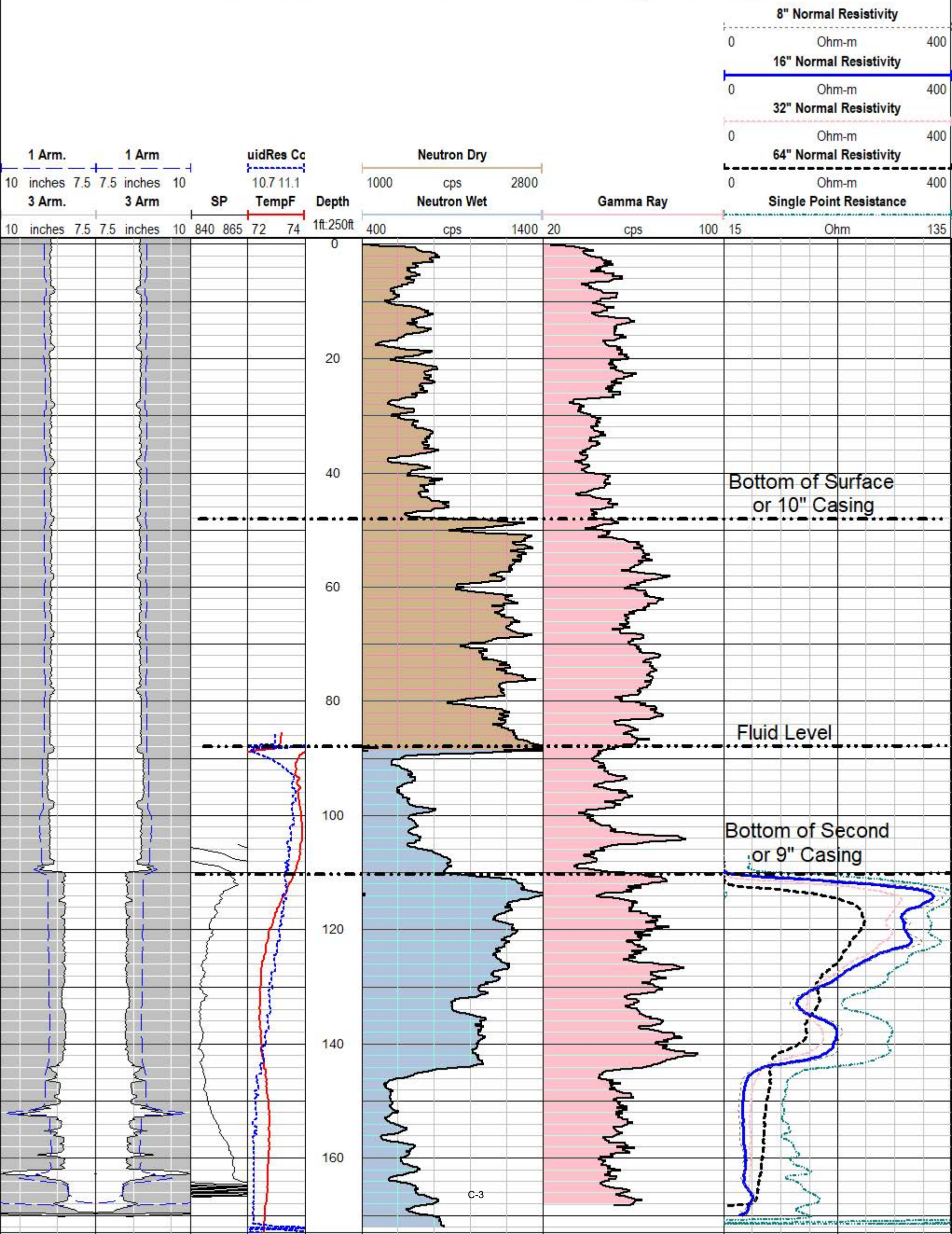
DATE	06-15-2024	TYPE FLUID IN HOLE	water
RUN No.	One, Two, Five	SALINITY	
TYPE LOG	MSI - Poly / 3 Arm	DENSITY	
DEPTH-DRILLER	178 ft.	LEVEL	89 ft.
DEPTH-LOGGER	173.2 ft.	MAX. REC. TEMP	
BTM LOGGED INTERVAL	173.2 ft.	DIGITIZE INTERVAL	0.4 - 0.1 ft.
TOP LOGGED INTERVAL		OPERATING RIG TIME	
DRILLER - RIG	Yellow Jacket	DRILLER	Jose / Jacob
RECORDED BY	T.Staatz		
WITNESSED BY	P. Bolen /T.Cassidy	FIRM	Navarro

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE		FROM	TO
1				* 10 in.	Steel	2.3 ft.	48 ft.
2				* 9 in	Steel	2.7 ft.	110 ft.
3	8.0 in. Core	110 ft.	178 ft.				

REMARKS: * Sonic Driven Casing



NASA / WSTF - 400-001-GW - Composite Max



Depth	Tilt	Azimuth	Easting	Northing	TVD	Close Dist	Close Ang
ft	deg	deg	[ft]	[ft]	[ft]	[ft]	deg
0	0.4	16.1	0.01	-0.02	-0.45	0.02	150.97
10	0.6	67.7	0.02	-0.02	10.39	0.03	135.85
20	0.5	165.4	0.05	-0.04	20.25	0.07	124.04
30	0.5	225.9	0.06	-0.03	30.11	0.07	116.61
40	0.5	309.4	0.09	-0.04	39.97	0.1	114.32
50	0.4	210.1	0.09	-0.03	49.82	0.09	107.84
60	0.3	189.4	0.1	-0.02	59.68	0.1	99.21
70	0.3	279.1	0.1	-0.01	69.54	0.1	96.19
80	0.1	228.3	0.08	-0.01	80.39	0.08	99.45
90	0.3	156.1	0.08	-0.01	90.25	0.08	99
100	0.7	158.6	0.05	-0.04	100.1	0.07	124.74
110	1	142.4	0.09	-0.07	109.96	0.11	129.8
120	1.3	97.1	0.28	-0.13	119.82	0.31	115.63
130	1.5	96.6	0.51	-0.19	129.68	0.54	110.8
140	1.8	94.1	0.77	-0.26	139.53	0.81	108.79
150	1.8	99.9	1.07	-0.34	150.37	1.12	107.81
160	1.5	106.4	1.34	-0.44	160.23	1.41	108.14
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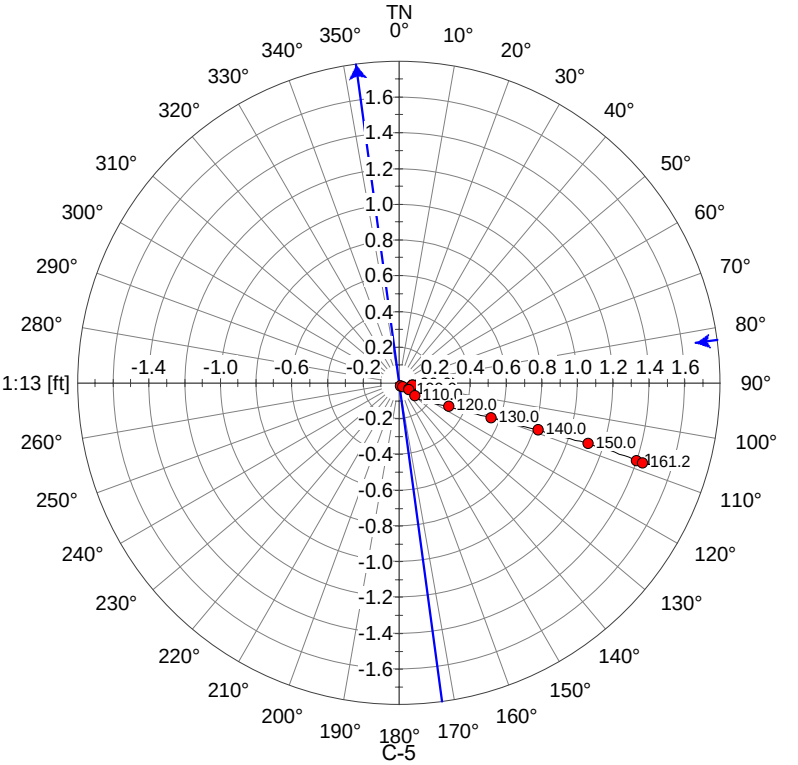
Depth	Tilt	Azimuth	Easting	Northing	TVD	Close Dist	Close Ang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40°
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90°
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110°
120°
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180°
190°
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320°
330°
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350°
1:13 [ft]
1.6
1.4
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1.0
0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
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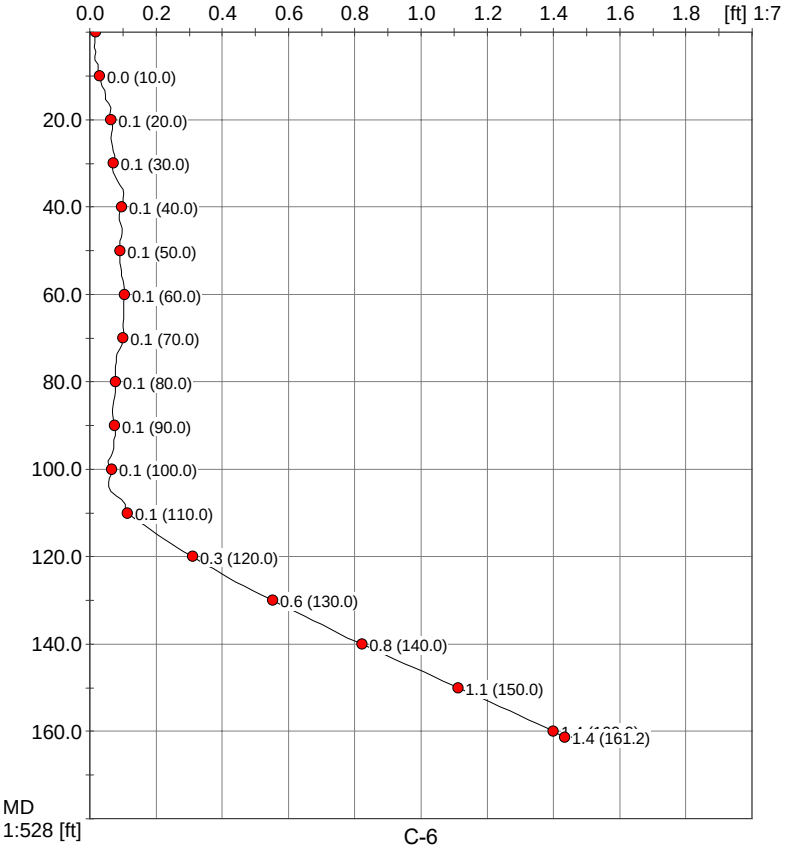
110.0
120.0
130.0
140.0
150.0
161.2
C-5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0.3 (120.0)
0.6 (130.0)
0.8 (140.0)
1.1 (150.0)
1.4 (161.2)
MD
1:528 [ft]
C-6

JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	Navarro Research & Engineering
WELL ID	400-001-GW
FIELD	NASA/WSTF
COUNTY	Dona Ana STATE New Mexico

NAD:
Northing:
Easting:

TYPE OF LOG: Deviation

LOCATION:

SEC TWP RGE

OTHER SERVICES
Neutron
Calipers
Electrics
Temperature
Fluid Resistivity

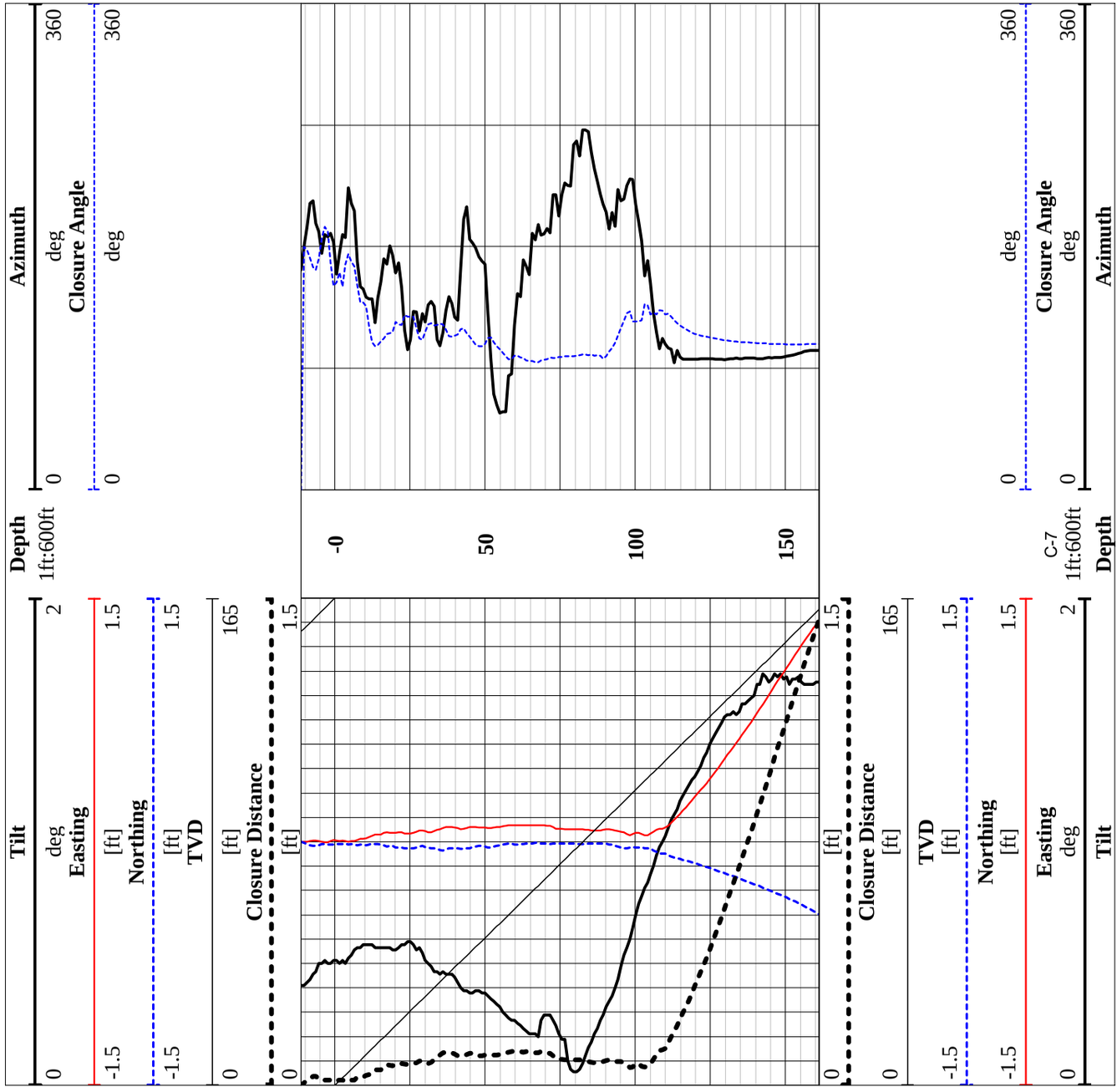
API No.

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.

DATE	06-15-2024	TYPE FLUID IN HOLE	water
RUN No.	Two	SALINITY	
TYPE LOG	MSI - Poly / 3 Arm	DENSITY	
DEPTH-DRILLER	178 ft.	LEVEL	89 ft.
DEPTH-LOGGER	173.2 ft.	MAX. REG. TEMP	
BTM LOGGED INTERVAL	173.2 ft.	DIGITIZE INTERVAL	0.4 - 0.1 ft.
TOP LOGGED INTERVAL		OPERATING RIG TIME	
DRILLER - RIG	Yellow Jacket	DRILLER	Jose / Jacob
RECORDED BY	T.Staatz		
WITNESSED BY	P. Bolen /T.Cassidy	FIRM	Navarro

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE		FROM	TO
1				* 10 in.	Steel	2.3 ft.	48 ft.
2	8.0 in.	110 ft.	178 ft.	* 9 in	Steel	2.7 ft.	110 ft.
3							

REMARKS: * Sonic Driven Casing



JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	Navarro Research & Engineering
WELL ID	400-001-GW
FIELD	NASA/WSTF
COUNTY	Dona Ana STATE New Mexico

TYPE OF LOG: Electrics, Caliper, Gamma Ray Temp, Fluid Res.

LOCATION:

NAD: Northing: Easting:

SEC TWP RGE

OTHER SERVICES
Deviation
Neutron

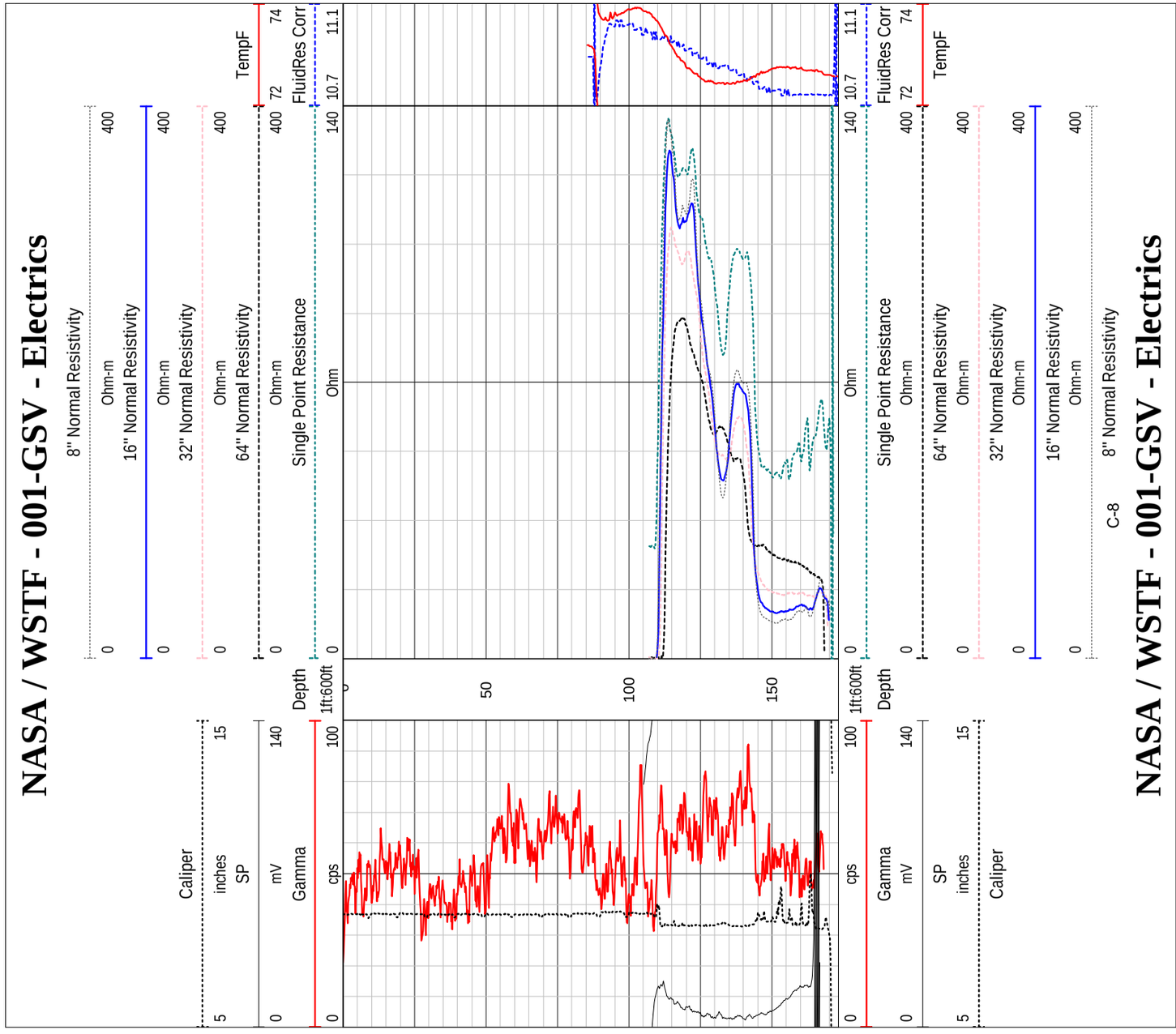
API No.

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.

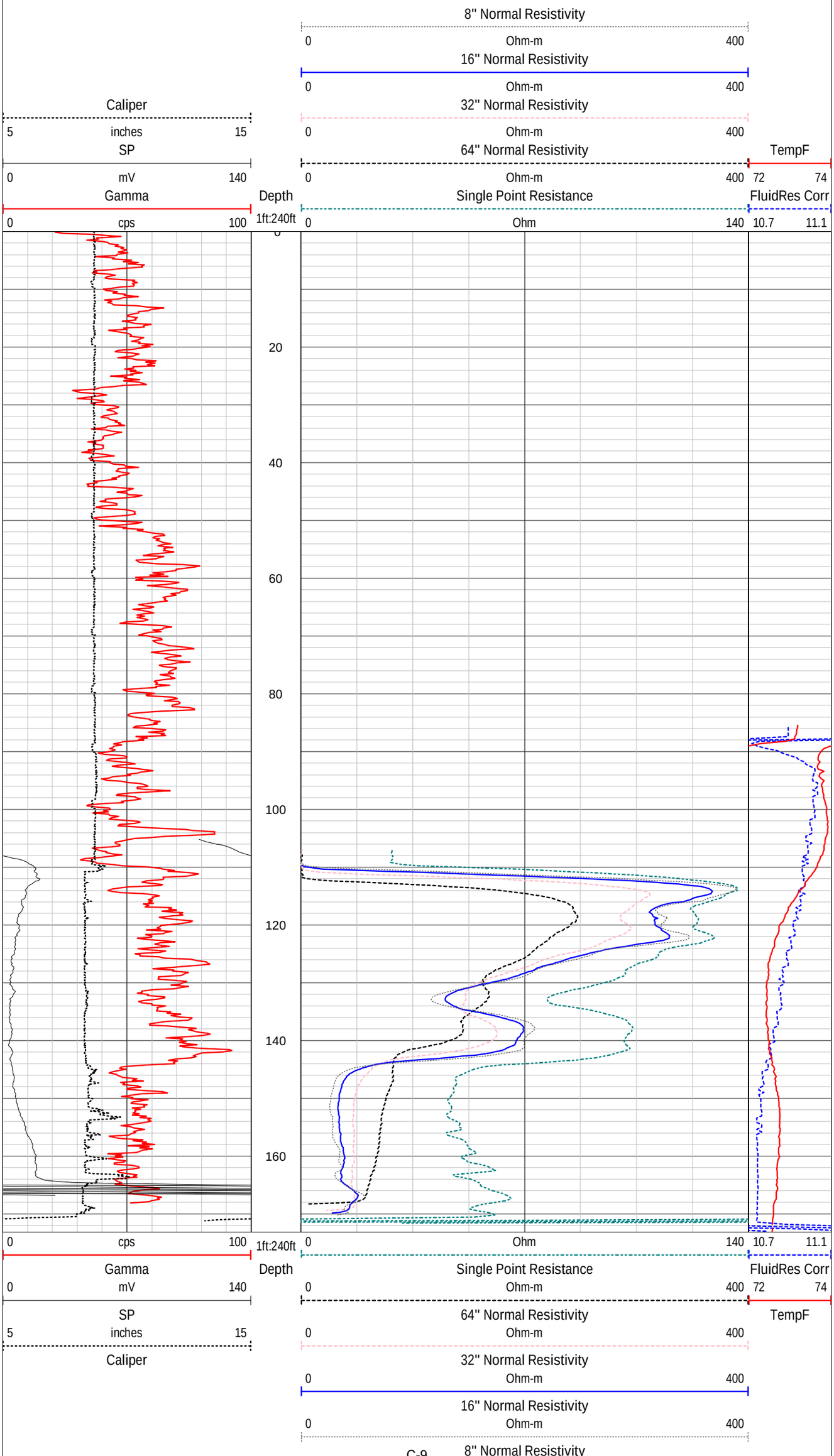
DATE	06-15-2024	TYPE FLUID IN HOLE	water
RUN No.	One, Five	SALINITY	
TYPE LOG	MSI - Poly / 3 Arm	DENSITY	
DEPTH-DRILLER	178 ft.	LEVEL	123 ft.
DEPTH-LOGGER	173.2 ft.	MAX. REG. TEMP	
BTM LOGGED INTERVAL	173.2 ft.	DIGITIZE INTERVAL	0.4 - 0.1 ft.
TOP LOGGED INTERVAL		OPERATING RIG TIME	
DRILLER - RIG	Yellow Jacket	DRILLER	Jose / jacob
RECORDED BY	T.Staatz		
WITNESSED BY	P. Bolen /T.Cassidy	FIRM	Navarro

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE		FROM	TO
1				* 10 in.	Steel	2.3 ft.	48 ft.
2	8.0 in.	110 ft.	178 ft.	* 9 in	Steel	2.7 ft.	110 ft.
3							

REMARKS: * Sonic Driven Casing



NASA / WSTF - 400-001-GW - Electrics



NASA / WSTF - 400-001-GW - Electrics

JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	Navarro Research & Engineering
WELL ID	400-001-GW
FIELD	NASA/WSTF
COUNTY	Dona Ana STATE New Mexico

NAD:
Northing:
Easting:

TYPE OF LOG: Neutron, Gamma Ray Caliper

LOCATION:

SEC TWP RGE

OTHER SERVICES
Deviation
Electrics
Temperature
Fluid Resistivity

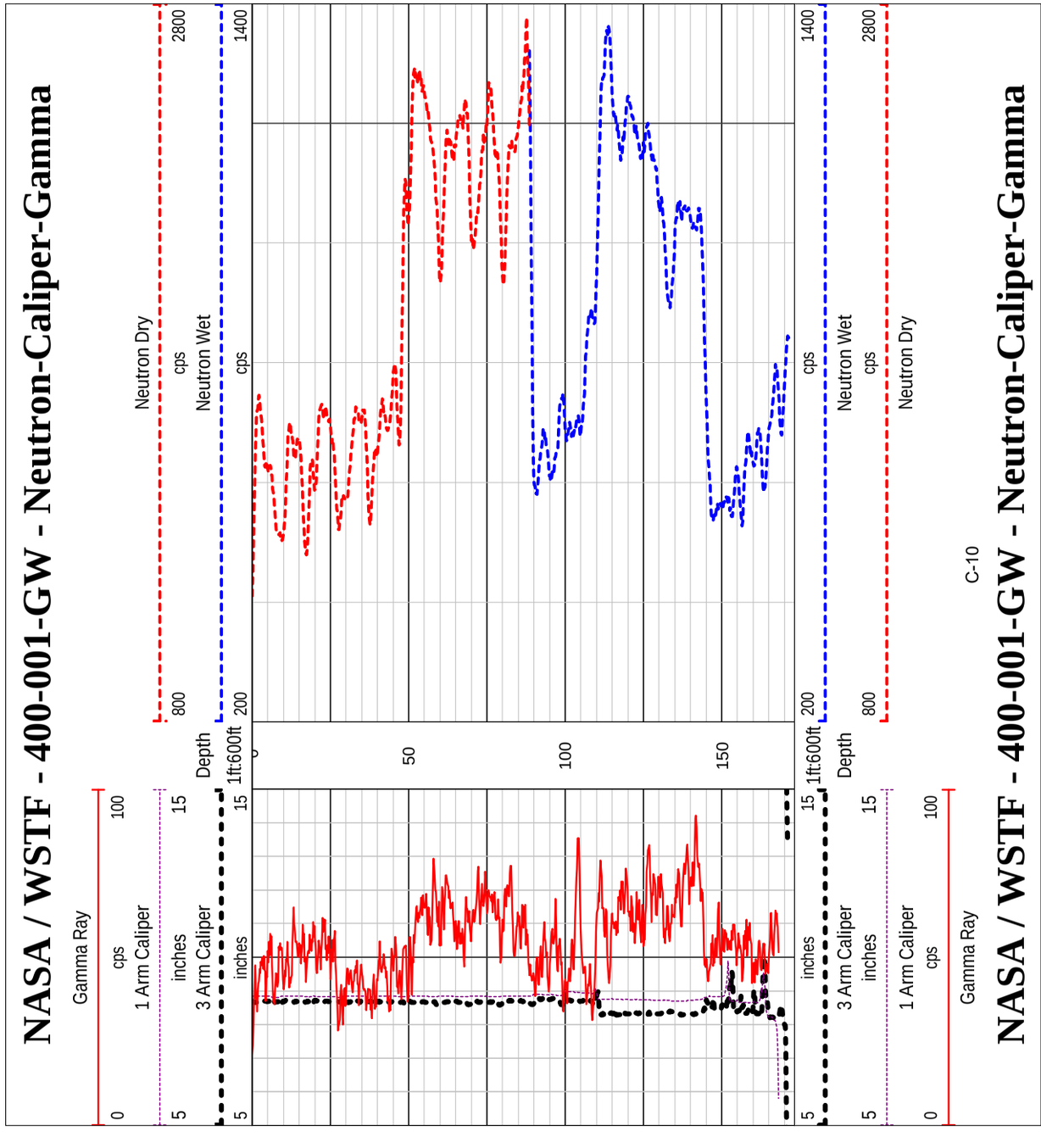
API No.

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.

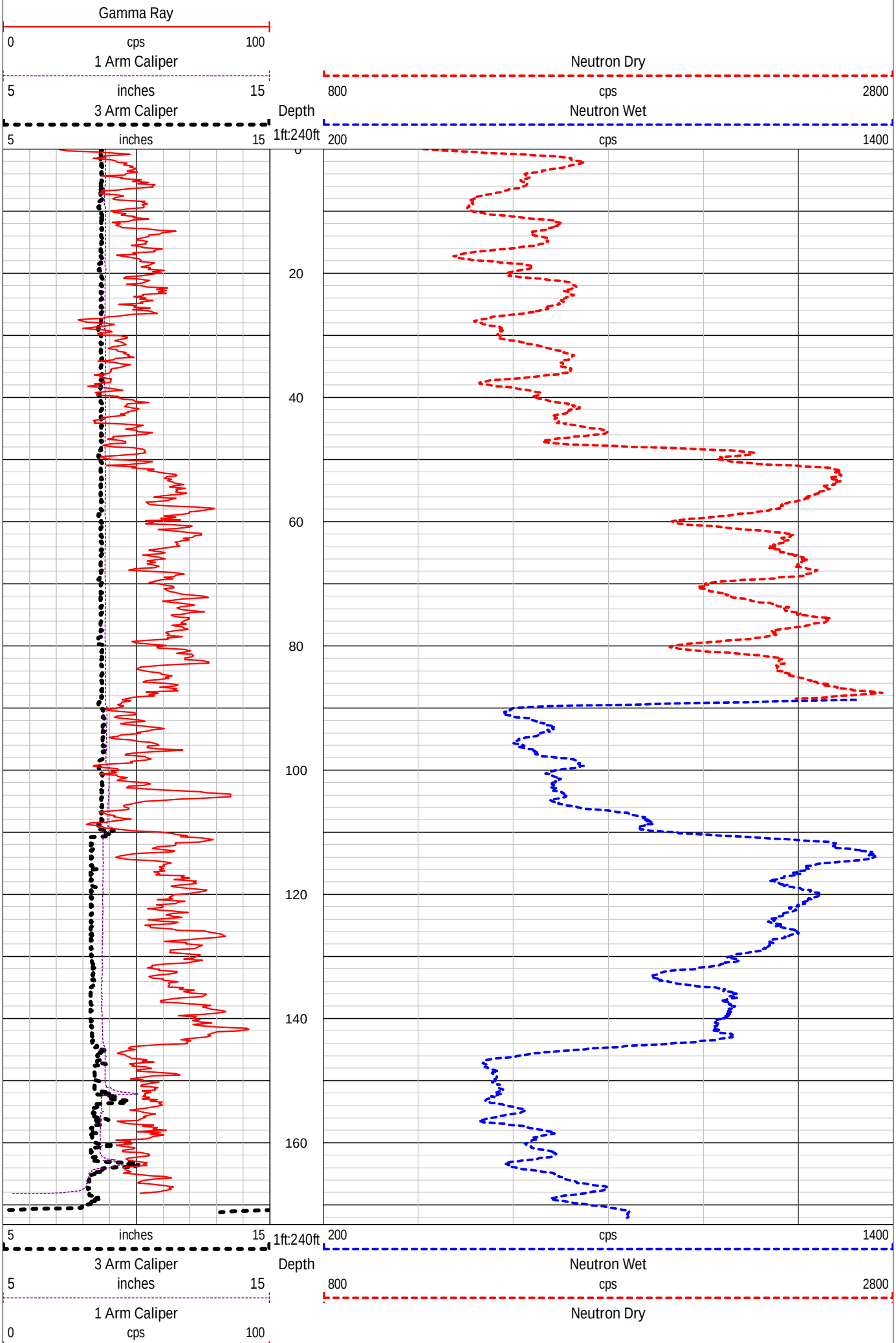
DATE	06-15-2024	TYPE FLUID IN HOLE	water
RUN No.	One, Two, Five	SALINITY	
TYPE LOG	MSI - Poly / 3 Arm	DENSITY	
DEPTH-DRILLER	178 ft.	LEVEL	89 ft.
DEPTH-LOGGER	173.2 ft.	MAX. REG. TEMP	
BTM LOGGED INTERVAL	173.2 ft.	DIGITIZE INTERVAL	0.4 - 0.1 ft.
TOP LOGGED INTERVAL		OPERATING RIG TIME	
DRILLER - RIG	Yellow Jacket	DRILLER	Jose / Jacob
RECORDED BY	T.Staatz		
WITNESSED BY	P. Bolen /T.Cassidy	FIRM	Navarro

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE		FROM	TO
1				* 10 in.	Steel	2.3 ft.	48 ft.
2	8.0 in.	110 ft.	178 ft.	* 9 in	Steel	2.7 ft.	110 ft.
3							

REMARKS: * Sonic Driven Casing



NASA / WSTF - 400-001-GW - Neutron-Caliper-Gamma



NASA / WSTF - 400-001-GW - Neutron-Caliper-Gamma

Appendix D Borehole Well Development Log

BOREHOLE / WELL DEVELOPMENT

Cover Page

Provide all depth measurements with respect to ground surface

Site/Screen Name:	400-001-GW	Project No.:	24EEHWMU
Location:	White Sands Test Facility	Field Personnel:	P. Bolen S. Rees
Lead Company:	Navarro	Document Reviewer:	
Supporting Company:	Yellow Jacket Drilling	Review Complete:	

FINAL DEVELOPMENT PARAMETERS

Borehole / Well Total Depth: 160 ft bgs

Screened Intervals: 140 and 155 ft bgs

Total Volume Withdrawn: (Airlifting/Swabbing/Jetting) 46.45 gals

Total Volume Withdrawn: (Development Pumping) NA gals

DEVELOPMENT TOOLS

Tool: Swab Description: 4-in Cup Used from: 133 ft to 155 ft

Tool: Bailer Description: Steel 2-in Used from: 140 ft to 155 ft

DEVELOPMENT DATA

METER CALIBRATION / VERIFICATION:

Date	Time	Meter Type	Totalizer Reading	Cumulative Withdrawn (gal)	Drawdown (ft bgs)	Pumping Rate (gpm)	pH	Temp (°C)	SC (µS/cm)	Turbidity (NTU)	Pump Intake (ft bgs)
6/26/24	1552			0	133 (Start)						
6/26/24	1552	Bailer		18.7	151.7						
6/27/24	0755			0	147 (Start)		8.62	22.9	1126	4.73	
6/27/24	0820	Swab			145.6 (After)						
6/27/24	830	Bailer		18.25	162.3		8.5	22.4	1073	off scale	
6/27/24	930				157.65	(4.65 ft/hr recharge)					
6/27/24	1245	Bailer		9.5	153.17		8.06	25.5	1093	250	

BOREHOLE / WELL DEVELOPMENT

BOREHOLE / WELL DEVELOPMENT (Continued)

Provide all depth measurements with respect to ground surface

Site/Screen Name: _____ Project No.: _____

Location: _____ Field Personnel: _____

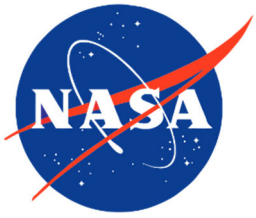
DEVELOPMENT DATA (Continued)

Date	Time	Meter Type	Totalizer Reading	Cumulative Withdrawn (gal)	Drawdown (ft bgs)	Pumping Rate (gpm)	pH	Temp (°C)	SC (µS/cm)	Turbidity (NTU)	Pump Intake (ft bgs)

Comments for Approval with Mods for NASA WSTF 400-001-GW Well Completion Report

NMED Comment Number	NMED Comments	NASA Revisions/Responses/Discussion
1. Section 8.0, Well Development, page 7 and Figure 5.1, Well Completion Diagram	**Permittee Statement:** "YJD initiated development of well 400-001-GW on June 25, 2019." **NMED Comment:** Update Section 8.0 to align with the dates provided on the Well Completion Diagram: June 26-27, 2024.	NASA updated the text in Section 8.0, page 7 to correspond with the dates detailed on the Well Completion Diagram and in Appendix D Borehole Well Development Log.
2. Section 7.0, Hydraulic Conditions, page 7 and Figure 5.1, Well Completion Diagram	**Permittee Statement:** "Initial water level was tagged at 91.2 ft bgs…[t]he water level was then tagged at 88 ft bgs…. the water level was located at 135.7 ft bgs…The final static water level…was located at 129.8 ft bgs." The water levels were taken in June 2024. **NMED Comment:** The well completion diagram shows a water table depth of 98 ft bgs, taken on August 13, 2023. The well was installed in June 2024, and the reported water table depth on the diagram does not align with the information presented in Section 7.0. Please update the well completion diagram to reflect information in Section 7.0.	NASA revised the Well Completion Diagram to show water table depth of 129.8 ft bgs, measured on June 27, 2024.

National Aeronautics and Space Administration



400-001-GW Well Completion Summary Report

August 2024

Revised February 2026

NM8800019434

NASA Johnson Space Center White Sands Test Facility

400-001-GW Well Completion Summary Report

August 2024

Revised February 2026

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

_____ _____

Amanda G Skarsgard~~Timothy Davis~~ Date
Compliance Supervisor~~Chief~~, NASA Environmental Office

National Aeronautics and Space Administration

Johnson Space Center
White Sands Test Facility
12600 NASA Road
Las Cruces, NM 88012
www.nasa.gov/centers/white-sands-test-facility~~stf~~

www.nasa.gov

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List of Acronyms

amsl	Above Mean Sea Level
AWP	Abbreviated Work Plan
bgs	Below Ground Surface
COC	Contaminant of Concern
DP	Discharge Permit
EPA	Environmental Protection Agency
ft	Foot/feet
gal	Gallon(s)
GMP	Groundwater Monitoring Plan
HWMU	Hazardous Waste Management Unit
in.	Inch(es)
JSC	Johnson Space Center
mi	Mile(s)
MPITS	Mid-plume Interception Treatment System
MSVGM	Multiport Soil Vapor Groundwater Monitoring
MSVM	Multiport Soil Vapor Monitoring
NASA	National Aeronautics and Space Administ
NDMA	N-nitrosodimethylamine
NMED	New Mexico Environment Department
NMOSE	New Mexico State Engineer
NLCID	No Longer “Contained-In” Determination
NTU	Nephelometric Turbidity Units
PCC	Post-Closure Care
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
TSDF	Treatment, Storage, and Disposal Facility
WSTF	Johnson Space Center White Sands Test Facility
YJD	Yellow Jacket Drilling Services

1.0 Introduction and Purpose

The National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) White Sands Test Facility (WSTF) has supported testing of space flight equipment and hazardous materials from 1964 to the present. The facility contains five closed hazardous waste management units (HWMUs) that are under post-closure care (PCC). They are located within the 200, 300, 400, and 600 Areas. PCC requirements are specified by the WSTF Hazardous Waste Permit (Permit) issued by the New Mexico Environment Department (NMED, 2023). The Permit requires that historical releases of hazardous waste or hazardous constituents from the former HWMUs be investigated to determine if continuing sources of contamination are present.

A groundwater contamination plume consisting of n-nitrosodimethylamine (NDMA), trichloroethene, tetrachloroethene, and Freons[1] has been identified at WSTF. To characterize and monitor the horizontal and vertical extent of contamination, a monitoring well network consisting of single zone (referred to as conventional) and multi-zone (referred to as multiport) wells has been established. In the contaminant source areas, in addition to groundwater monitoring wells, soil vapor wells are used to monitor and evaluate the vadose zone. NASA utilizes multiport soil vapor monitoring (MSVM) wells to monitor the vadose zone and multiport soil vapor and groundwater monitoring (MSVGM) wells to monitor both the vadose zone and the underlying groundwater.

In June of 2020, NASA attempted to remove the dedicated low-flow bladder pump from WSTF groundwater monitoring well NASA 9 to extend the tubing and lower the bladder pump intake due to observed declining water levels. During removal activities, the tubing bundle separated from the pump, and the pump then dropped into the 5-foot (ft) well sump. During attempts to recover the pump, NASA discovered that the inside of the 2-inch (in.) stainless-steel casing was obstructed with small roots just above and below the static water level. Numerous attempts to lock onto the top of the pump with the fishing tool were unsuccessful and the pump could not be retrieved. On November 15, 2021, the NMED approved the 2021 Groundwater Monitoring Plan (GMP) with a modification stating that "[d]ue to reported damage associated with root growth at monitoring well NASA 9, a Work Plan for abandonment and replacement of the monitoring well must be submitted to NMED for approval. N-nitrosodimethylamine (NDMA) has historically been reported at concentrations that exceed the respective cleanup level at the sampling location; therefore, the replacement of NASA 9 will allow for continued groundwater data collection at this location down-gradient from the 400 Area Closure" (NMED, 2021). NASA then submitted an *Abbreviated Work Plan (AWP) for Abandonment of NASA WSTF NASA 9 and Replacement with Monitoring Well 400-001-GW* to NMED (NASA, 2022a). NASA 9 was then subsequently plugged and abandoned January 7, 2023.

Data collected from replacement well 400-001-GW will provide groundwater quality analysis for WSTF contaminants of concern (COCs) as well as water level data for the quarterly NASA WSTF Periodic Monitoring Reports. This report provides a summary of field activities associated with the drilling and installation of WSTF groundwater monitoring well 400-001-GW. Field activities were conducted between June 11, 2024 and June 27, 2024 and included borehole drilling, geophysical logging, installation of the well, and well development.

[1] Freon is a registered trademark of The Chemours Company CF, LLC.

2.0 Location and Description

2.1 Facility

WSTF is located in Doña Ana County, New Mexico, 16 miles (mi) northeast of Las Cruces, New Mexico, and 65 mi north of El Paso, Texas (Figure 2.1). WSTF was constructed in 1964 at a remote location adjacent to the San Andres Mountains. The land occupied by WSTF is owned by the Department of the Army and is used by NASA under a land use agreement with the Army (Department of Defense, 1982). Access to the site is provided by a paved road that intersects U.S. Highway 70, 1 mi west of Organ, New Mexico and leads 6 mi north to the test areas.

WSTF's primary activities in support of the United States space program are:

1. Development, qualification, refurbishment, and testing of spacecraft propulsion systems, subsystems, and ground support equipment.
2. Investigation of flight hardware anomalies.
3. Testing of materials and components.
4. Performance of hazard and failure analyses.

Following the completion of construction of WSTF in 1964, many wastes were historically managed in hazardous waste management units, including surface impoundments, within the WSTF industrial area. These hazardous waste management units contributed to groundwater contamination. As a result of the groundwater contamination, NASA operates a network of groundwater monitoring wells throughout the site.

2.2 400-001-GW Well Location

The 400 Area HWMU Closure is located at the 400 Area within the industrialized portion of WSTF. The location of the 400 Area relative to other WSTF areas is shown in Figure 2.2, and the location of well 400-001-GW relative to other infrastructure in the 400 Area is shown in Figure 2.3. The 400 Area is currently used for propulsion testing in altitude chambers and on engine test stands.

3.0 Regulatory Timeline

On November 15, 2021, the New Mexico Environment Department (NMED) approved the 2021 GMP with a modification stating that "[d]ue to reported damage associated with root growth at monitoring well NASA 9, a Work Plan for abandonment and replacement of the monitoring well must be submitted to NMED for approval. N-nitrosodimethylamine (NDMA) has historically been reported at concentrations that exceed the respective cleanup level at the sampling location; therefore, the replacement of NASA 9 will allow for continued groundwater data collection at this location down-gradient from the 400 Area Closure." (NMED, 2021).

NASA subsequently prepared and submitted the *Abbreviated Work Plan for Abandonment of NASA WSTF NASA 9 and Replacement with Monitoring Well 400-001-GW* (NASA, 2022a) on April 27, 2022. Monitoring well NASA 9 was then plugged and abandoned per the NMED directive on January 7, 2023. Construction of 400-001-GW began June 11, 2024, and final development was completed on June 27, 2024. The *400-001-GW Well Completion Summary Report* (NASA, 2024) was then prepared and submitted for NMED review August 28, 2024.

4.0 Plugging and Abandonment of Well NASA 9

NASA and the subcontract drilling company, Yellow Jacket Drilling (YJD), completed plugging activities in accordance with the New Mexico State Engineer (NMOSE)-approved well plugging plan for monitoring well NASA 9 (Appendix A). Well NASA 9 is located in the 400 Area (Figure 2.3). Plugging activities were completed using a Boart Longyear®[2] BK-81 heavy-duty drill rig. Equipment used included a 1,500-gallon (gal) water tank, 20-ft sections of 2-in. steel tremie pipe or 10-ft sections of 1-in. polyvinyl chloride (PVC) tremie pipe, air compressor, diaphragm pump, grout tank, and a power drill fitted with a mixing attachment. YJD personnel removed well surface features using a pneumatic jack hammer, cutting blades on an electric grinder, and a Bobcat®[3] S300 skid steer.

The following process was utilized in the decommissioning of the well where:

1. Bollards surrounding the well pad were pulled from the ground using the skid steer and staged on the edge of the well pad. Ground disturbed by removal was levelled to reduce potential trip hazards.

2. The rig was backed into place over the well, the mast was raised, and tremie pipe was lowered into the well casing to within 20 ft of the bottom of casing.

3. Grout was hand mixed onsite using Phoenix Cement®[4] Portland Type II cement, mixed with 5% by weight Halliburton®[5] Quick Gel bentonite and approximately 4.5 gals of water per 50-pound bag of cement.

4. Grout was pumped downhole via diaphragm pump and tremie pipe to approximately 5 ft below ground surface (bgs). Tremie was removed incrementally as grout filled the casing.

5. After grouting was complete, it was left to cure multiple days before the well pad was removed, casing cut to a minimum of 6 in. below surrounding ground surface, and the hole topped off to the top of cut casing.

6. A concrete cap was placed on top of the cut casing of the abandoned well and a brass cap was set in the middle of the concrete. The brass cap will be inscribed with the permanent well name and its final surveyed ground surface elevation.

4.1 NASA 9 Well Summary

Well NASA 9 was completed in 1985 and is registered with the NMOSE as LRG-18480-POD1. The well is located within the footprint of the known NDMA groundwater contaminant plume at WSTF. The well was completed with a nominal 2-in. Schedule 80 PVC casing to a depth of 119.5 ft bgs and Schedule 40 stainless-steel casing from 119.5 to 154.5 ft bgs. The well was equipped with a 20-ft well screen from 129.5 to 149.5 ft bgs. The screened zone within this well had become inundated with root growth into the well casing at or near the static water level. The roots obstructed the ability to successfully obtain representative analytical samples.

[2] Boart Longyear is a registered trademark of The Boart Longyear Company.
[3] Bobcat is a registered trademark of Doosan Bobcat North America Inc.
[4] Phoenix Cement is a registered trademark of Salt River Pima-Maricopa Indian Community.
[5] Halliburton is a registered trademark of Halliburton Energy Services, Inc.

4.2 Plugging and Abandonment

A Plugging Plan of Operations for well NASA 9 was approved by the NMOSE on October 19, 2022 (NASA, 2022b; Appendix A). Plugging and abandonment activities including the surface completion were performed at well NASA 9 between January 7 and 21, 2023. Tremie pipe was lowered into the casing to a depth of approximately 150 ft bgs. Plugging was completed by pumping grout down tremie pipe to fill the well casing from the bottom up. An estimated 75 gals of grout was used to plug well NASA 9, which was more than the estimated 25 gals calculated prior to plugging. Grout in excess of the calculated casing volume was likely displaced into the filter pack around the 20-ft screened interval. Although there was potential to displace a small amount of groundwater, there was no displacement up the well casing. No groundwater was discharged during plugging activities.

Fourteen days after grouting, the concrete pad was demolished using a pneumatic jack hammer. Concrete from the pad was removed and placed near the edge of the well pad for removal and recycling. The area around the well casing was excavated to more than 1 ft bgs to allow room for cutting of the casing. Surface casing and well casing were then cut to approximately 6 in. bgs using a cutting wheel. Casings were removed from the well area and placed with the previously removed bollards for removal and recycling or reuse. After the top of the casing was removed, the well was topped off with grout, bringing the grout to approximately top of the cut casing. After additional grout curing time, a concrete cap was placed on top of the well on January 28, 2023 and equipped with a brass cap. Uneven ground around the work area was levelled. YJD submitted the Well Plugging Record for well NASA 9 to the NMOSE on January 31, 2023 (Appendix A).

5.0 Drilling of Well 400-001-GW

Drilling at the 400-001-GW location (Figure 2.3) began on June 11, 2024 and the borehole was completed to a total depth of 173 ft bgs on June 15, 2024. There were no issues or problems during drilling activities.

5.1 Drilling Methods Utilized

YJD were subcontracted to perform drilling services at WSTF for 400-001-GW. It was decided well 400-001-GW would be drilled using the rotary sonic method of drilling. The decision to use rotary sonic drilling was based primarily on cost and time estimates to complete the well. Additionally, the method has been used successfully previously to drill and complete many WSTF wells in the 300 and 400 Area. The total amount of water used during drilling, well construction and development of 400-001-GW was 3,600 gal and is provided in Table 5.1.

5.2 Sampling During Drilling

Grab samples of soil and bedrock cuttings were collected and examined by qualified geologists as they were extruded from sonic core barrels over 5-ft intervals, and a lithologic log compiled. Lithologies were determined from recovered drill cuttings, and representative samples were placed in chip trays for subsequent detailed characterization using a binocular microscope. Soil descriptions were completed in accordance with ASTM D2488-17, “Standard Practice for Description and Identification of Soils,”. Lithologic descriptions are documented on the lithologic log included in (Appendix B). No groundwater samples were collected during drilling activities.

5.3 Lithology

The 400 Area is situated on a large coalescent alluvial fan sequence. The apex of the primary fan is located approximately 1 mi east of the western end of Bear Canyon. The fan was sourced by sediments derived from erosion within the canyon that is cut into the southern San Andres Mountains. It is lined by rock units which include Precambrian basement, a suite of Paleozoic formations common in this part of Southern New Mexico, and Tertiary intrusive and extrusive igneous rocks (Seager, 1981).

The unconsolidated alluvium encountered in the vadose zone in the 400 Area comprises Tertiary to Quaternary intercalated fan, interfan valley, and erosion surface veneer deposits. The majority of the sand, gravel, and cobble sized clasts/cuttings in the fan debris were limestones. However, there are numerous other sedimentary, igneous, and metamorphic lithologies representing the diverse suites of rocks in the source area. The heterogeneous alluvial soil consists of a mix of particles from silt and clay, to sand, pebbles, and cobbles that was encountered from ground surface to the top of bedrock.

Beneath the unconsolidated alluvium at a depth of 110 ft bgs, a layer of cemented conglomerate composed of strongly indurated alluvium (lithified primarily with calcite cement) was present. This conglomerate layer was noted as being approximately 37 ft thick in the 400-001-GW boring. The conglomerate appeared to be generally unfractured and impermeable, aside from occasional small, solution cavities. It most likely correlates with the Pliocene cemented fanglomerate facies of the Camp Rice Formation of West Texas and Southern New Mexico (Seager and others, 1987). Cemented alluvium has also been encountered in other borings within the 400 Area, and in the 300 Area to the east and upgradient of the 400 Area. As in the overlying unconsolidated alluvium, the most common lithology in the cemented alluvium is limestone, but the full range of sedimentary, igneous and metamorphic rocks were observed. At the base of the conglomerate unit, a layer of mudstone was found to be present with a thickness of approximately 5-7 ft. This layer likely represents a weathered surface included within the cemented conglomerate and directly above the andesite bedrock.

Finally, Orejon andesite was encountered at a depth of 147 ft bgs below the cemented conglomerate unit. This andesite varies in color from light lavender to purple, primarily massive in texture, with occasional minor flow banding and small dark crystals. The andesite bedrock surface appears highly weathered and brecciated with numerous fractures many filled with calcite cementing with iron staining present implying a high degree of in-situ fracturing and healing. Core pieces that were recovered indicate that approximately 18 ft of brecciated andesite were encountered before more competent andesite bedrock was noted. Evidence of fault zone associated breccia along with visible slicken lines was also noted by field geologists at approximately 160 ft bgs. Beneath the brecciated andesite, 13 ft of more competent andesite was then cored to the borehole's total depth of 173 ft bgs. The lithologic log for the 400-001-GW borehole is provided in Appendix B.

5.4 Geophysical Logging

Geophysical logging was conducted at 400-001-GW by Jet West Geophysical Services, LLC on June 15, 2024. Downhole logs included gamma ray, 3-arm caliper, temperature, resistivity, neutron, density, deviation, and spontaneous logs. The logger's total depth recorded was 173 ft bgs. The geophysical logs were used in conjunction with the drill cuttings to confirm changes in lithology, the bedrock contact, and to identify depths favorable for the placement of well screens. Geophysical logs are provided in Appendix C.

6.0 Well Construction

6.1 Planned Well Design

In the approved 400-001-GW Work Plan (NASA, 2022a) a single monitoring zone was proposed for the well with the intention to approximate the previous screened interval at recently plugged and abandoned well NASA 9 following a review of the geophysical logs. The 400-001-GW well completion diagram was then designed in accordance with the Work Plan directive and information gathered from geophysical logging. This resulted in placement of the wells screened interval from 140-155 ft bgs (Figure 5.1).

6.2 Well Completion Casing

Well 400-001-GW was completed with conventional 4-in. nominal Schedule 80 PVC flush joint casing with one 15 ft x 0.020-in. slotted screen between 140 – 155 ft bgs to a total depth of 160 ft bgs within the borehole drilled to 173 ft bgs. Cage-type stainless steel centralizers were installed on the casing above and below the slotted screen, and 50 ft bgs along the length of the casing to prevent the casing and screen from contacting the borehole walls and providing a uniform thickness of the annular materials. The 400-001-GW Well Completion Diagram (Figure 5.1) provides locations of centralizers and the final configuration of the well completion casing and screen location as well as a summary of well construction materials used.

6.3 Annular Materials Installation

Annular materials installation for 400-001-GW began June 16, 2024 and was completed June 17, 2024. Annular completion materials were installed as follows:

- 4 bags of Bentonite chips were added to backfill the borehole from 173 ft bgs to 165 ft bgs and to provide a lower seal.
- 17 bags of 10/20 sand for the wells filter pack were then added from 165 ft bgs to 137 ft bgs.
- 1 ¼ bags of 20/40 fine sand were then added atop the filter pack from 137 ft bgs to 135 ft bgs.
- 3 ½ bags of Bentonite chips were added atop the fine sand for the wells upper Bentonite seal from 135 ft bgs to 125 ft bgs.
- A total of 40 bags of Portland Type II cement and 1 bag of Quick Gel bentonite were used to grout the borehole from 135 ft bgs to 3 ft bgs. The grout was emplaced in four (4) equal batches; 10 bags of bentonite and ¼ bag of Quick Gel bentonite. Approximately 3 bags of Portland Type II neat cement then made up the last 3 ft and surface completion.

Completion materials were emplaced using a pneumatic diaphragm pump. All materials were installed using a 2-in. OD tremie pipe maintained at a level approximately 10 to 20 ft above the top of completion materials in the well. Water was only added to hydrate the emplaced Bentonite chips, and during the mixing of the bentonite grout and neat cement. The bentonite grout was mix by an experienced driller per standard with the ratio of 5% bentonite added by weight and 8.5 gallons of non-chlorinated water per 94 pound sack of Portland cement used. The neat Portland cement was mixed by an experienced driller per standard with a ratio of 6 gallons of water per 94 pound sack of Portland cement used.

7.0 Hydraulic Conditions

The 400-001-GW borehole was drilled using the rotary sonic method, and water was not observed until the cessation of drilling activities suggesting a relatively low production rate. Water was first identified, and a water level recorded during preparation of the borehole for geophysical logging activities.

Initial water level was tagged at 91.2 ft bgs (4,730.18 ft above mean sea level [amsl]) June 14, 2024, a day prior to geophysical logging. The water level was then tagged at 88 ft bgs (4,733.38 ft amls) during geophysical logging on June 15, 2024. Prior to development activities on June 26, 2024, the water level was located at 135.7 ft bgs (4,685.68 ft amsl) The final static water level of 400-001-GW after development was located at 129.8 ft bgs (4,691.58 ft amsl). Results from the geophysical logs (Appendix C) indicate that the interval below approximately 148 ft bgs is the most likely to yield water. Based on the final static water level in the well, the aquifer is interpreted to be semi-confined.

Replacement well 400-001-GW is located approximately 90 ft to the east northeast of plugged and abandoned well NASA 9 (Figure 2.3). The last reported depth to groundwater in well NASA 9 was measured on 4/8/2020 at 134.7 ft bgs (4,691.3 ft amsl). The aquifer in well NASA 9 was also reported to be semi-confined.

8.0 Well Development

Low production and recharge rates are historically not uncommon in the shallower 400 Area wells. YJD initiated development of well 400-001-GW on June 2~~5~~6, ~~2019~~2024. The open well was bailed and swabbed from June ~~25~~ 26 until June 27, 2024 to remove mud from the well casing and develop the well in preparation for sampling. The relatively small water column was found to be inadequate for sustained pumping activities so this well was only swabbed and bailed. During development activities, environmental contractor personnel monitored discharged development water for groundwater parameters including pH, specific conductance (conductivity), temperature, and turbidity. Well development is considered complete when measured water quality parameters are relatively stable (vary less than 10%) and turbidity is found to be below 5 nephelometric turbidity units.

Due to the inability to pump 400-001-GW during initial development due to the relatively small water column and slow established recharge rate of approximately 1 gal/hour, a relatively limited total volume of 46.45 gal of were bailed from the well during the development activities. Flow and saturation in these wells are primarily fracture channel dominated often leading to poor production rates. Groundwater parameters were observed to stabilize and a turbidity of 4.73 nephelometric turbidity units (NTUs) was obtained early in the day June 27, 2024. This turbidity was observed to have increased up to 250 NTUs by the cessation of development activities (Appendix D).

9.0 Sampling

Based on groundwater monitoring and sampling performed at existing well NASA 9, the aquifer at the proposed 400-001-GW location is anticipated to be within the northern edge of the WSTF groundwater contaminant plume with respect to NDMA concentrations. Following well development, an initial set of groundwater characterization samples were collected using a dedicated Teflon bailer on August 16, 2024 for the analysis of volatile organic compounds by the current revision of SW-846 Method 8260D, semi-volatile organic compounds by the current revision of SW-846 Method 8270C, NDMA by Modified Environmental Protection Agency (EPA) Method 607M, or an acceptable low-level analytical method, and a variety of metals by the most effective laboratory-selected analytical method. Samples will be collected and managed in accordance with the WSTF GMP (NASA, 2023).

9.1 Survey

During surface completion of the wells, a brass cap was permanently installed in the cement well pad. The cap was installed to serve as a survey point to represent the location of the well.

The location and elevation of well 400-001-GW was preliminarily surveyed by NASA GPS personnel and is pending confirmation by a New Mexico Professional Surveyor. The New Mexico State Plane Central Zone North American Datum 83 coordinate system in U.S. survey ft above mean sea level is utilized. This professional survey data will be input into all NASA project documentation requiring survey data. The lithologic log (Appendix B) and Well Completion Diagram (Figure 5.1) currently include only the preliminary survey data. In addition, the top of the well casing will be surveyed using the same methods. The brass cap will be inscribed with the permanent well name and its final surveyed ground surface elevation.

10.0 Work Plan Deviations

The following list provides deviations from the *Abbreviated Work Plan for Abandonment of NASA WSTF NASA 9 and Replacement with Monitoring Well 400-001-GW* (NASA, 2022a), submitted by NASA on April 22, 2022 and approved by NMED on October 31, 2022 (NMED, 2022).

- In the **Drilling Approach** section, it is stated that the borehole will be 8-in. in diameter by air rotary casing advance. Based on preceding drilling activities performed in the WSTF 300 Area and the available equipment on-site, a 9-in. borehole was instead advanced using the rotary sonic drilling method.

- In the **Well Completion** section, it was stated that 3-in. nominal Schedule 80 PVC casing would be used. A 4-in. nominal Schedule 80 PVC was used instead during the well's completion to facilitate easier access to well development equipment and a permanent pump if feasible.

- In the **Well Completion** section, it was stated that the drive casing would be removed to a depth of 20 ft bgs and cut to leave the remaining surface casing in place. Due to relatively stable conditions in the upper alluvial formation during well construction activities, all surface casing was removed during well completion.

- In the **Well Completion** section, it was stated a ten-foot length 0.020-in. slotted Schedule 80 PVC screen would be installed. After establishing relatively low groundwater production at this location and the evaluation of geophysical logs, it was determined that a 15 ft screen of 0.020-in. slotted Schedule 80 PVC would be more appropriate for the well design.

- In the **Well Completion** section, it was stated that the upper 10 ft of the borehole and well pad would be completed with Type II Portland neat cement. During completion activities only the upper 3 ft and the well pad were completed using Type II Portland neat cement. The remaining 7 ft interval was completed using the cement and Quick Gel grout mix.

- In the **Well Development** section, it was stated that the well development will be considered complete when measured water quality parameters are relatively stable (vary less than 10%) and turbidity is below 5 NTUs. Poor well bore volumes and recharge rates precluded the use of a pump, and development activities were limited to swabbing and bailing. As a result, although 5 NTUs was achieved during development, the final parameter measurement of 250 NTUs indicates that additional development of this well is warranted.

11.0 Investigation-Derived Waste Management, Characterization, and Disposal

Investigation Work Plan Waste characterization will be conducted in accordance with Section II.C (Waste Characterization) and Attachment 12 (Waste Analysis Plan) of the WSTF Hazardous Waste Permit (NMED, 2023). All waste was properly managed and disposed of in accordance with NASA procedures

and state and federal regulations. The waste streams that were generated during drilling and installation of groundwater monitoring well 400-001-GW included:

- **Drill cuttings.** Unsaturated drill cuttings are defined as soil cuttings or rock fragments generated from the vadose zone that have not come into contact with groundwater. Unsaturated cuttings were characterized as non-hazardous solid waste. Saturated drill cuttings are defined as soil cuttings or rock fragments generated from below the water table that may have come into contact with potentially contaminated groundwater. This environmental media potentially contains listed hazardous waste constituents from the WSTF groundwater plume was initially characterized as hazardous waste.

- **Drilling fluids.** Limited amounts of non-chlorinated water were introduced into the circulated material during rotary sonic drilling. Drilling fluid generated above the water table was characterized as non-hazardous solid waste. Drilling fluid generated below the water table potentially contain listed hazardous waste constituents that are present in the WSTF groundwater plume and was initially characterized as hazardous waste.

- **Groundwater.** Groundwater produced from within the WSTF groundwater plume during well drilling and development was characterized as environmental media containing listed hazardous waste with the F001 and F002 hazardous waste codes.

- **Decontamination fluids.** Decontamination fluids such as water and soap solutions used to wash and decontaminate equipment generated during drilling above the water table were characterized as non-hazardous solid waste. Decontamination fluids generated by cleaning equipment that has contacted potentially contaminated soil, cuttings, or fluids generated when drilling below the water table was characterized as hazardous waste.

- **Contact waste.** Contact waste, or debris, such as used disposable sampling equipment, personal protective equipment, plastic sheeting, and other debris generated during drilling above the water table is non-hazardous solid waste. Contact debris contaminated with soil, cuttings, or fluids that were generated when drilling below the water table was characterized as hazardous waste.

- **Petroleum Contaminated Debris and Environmental Media.** Debris such as rags and wipes may be contaminated with petroleum products during routine drilling equipment maintenance. Though not expected, petroleum contaminated environmental media may also be generated during an unexpected drilling equipment failure. The petroleum contaminated debris and environmental media was characterized as hazardous waste with the D018 hazardous waste code.

Groundwater at the proposed location of well 400-001-GW may be contaminated with low concentrations of listed hazardous waste constituents that are present in the WSTF groundwater plume. Actively managed groundwater sourced from the WSTF groundwater contaminant plume is characterized as listed hazardous waste with the F001 and F002 hazardous waste codes through application of the EPA "Contained-In" Policy. The EPA "Contained-In" Policy states that groundwater, soil, and other environmental media is not solid waste but is subject to regulation as hazardous waste when it contains listed waste (EPA, 1998). Because groundwater and other environmental media is subject to regulation when it contains listed hazardous waste, waste generated after reaching the water table was managed as hazardous waste.

Drill cuttings and drilling fluids (water) generated above and below the water table were managed as hazardous waste in intermediate bulk or bulk containers. Drill cuttings and drilling fluids generated from the vadose zone do not contain listed hazardous waste and do not meet the definition of a hazardous waste. Hazardous waste generated below the water table was containerized and managed in accordance

with 20.4.1.300 NMAC and 40 CFR 262.17. The as-generated waste from below the water table was sampled and the analytical data further used to characterize the waste. Waste characterization samples were analyzed for volatile organic compound by the current revision of SW-846 Method 8260 and NDMA by Modified EPA Method 607M.

NASA has requested a “contained-in” determination from the NMED for waste generated below the water table if the analytical data indicate drill cuttings and drilling fluids generated below the water table do not contain listed hazardous waste or exhibit characteristics of a hazardous waste. If the analytical data indicate the presence of listed waste or the waste exhibits characteristics of a hazardous waste, the waste is properly treated and disposed of at a RCRA permitted treatment, storage, and disposal facility (TSDF). On July 11th, 2024, NASA submitted a *Request for a ‘No Longer Contained-in’ Determination for Drilling Mud and Cuttings Associated with the Expanded Scope Proposed for the 300 Area Supplemental Abbreviated Drilling Work Plan* (NASA, 2024) supporting our Request for a "No Longer Contained-In" Determination from NMED. On July 24th, 2024, NASA received an NMED-Approval for our No Longer Contained-In Determination for this particular waste stream (NMED, 2024). Free standing water was decanted from this waste stream prior to shipment off-site and transferred to the Mid-plume Interception and Treatment System (MPITS) for treatment and discharge in accordance with Discharge Permit (DP)-1255 (NMED, 2017).

Contaminated groundwater generated during drilling, development, and purging, and the associated contaminated water generated during decontamination of equipment that came into contact with contaminated groundwater or hazardous debris from below the water table was accumulated in appropriately sized containers and managed as hazardous waste. The containers were managed in accordance with requirements of 20.4.1.300 NMAC and 40 CFR 262.17. Within permissible accumulation time limits, contaminated water will be transferred to the MPITS for treatment and discharge.

Contact waste, or hazardous debris, that has come into contact with contaminated groundwater was collected at the end of each working shift and transferred to an appropriate container. All hazardous waste containers were managed on-site in accordance with the requirements of 20.4.1.300 NMAC and 40 CFR 262.17. If analytical results from drill cuttings and fluids indicate they are non-hazardous, this waste stream may be included in a “contained-in” determination request. If analytical results indicate the drill cuttings and fluids contain hazardous waste, or NMED determines the waste still contains hazardous waste, this debris will be shipped off-site for treatment and disposal at a Resource Conservation and Recovery Act (RCRA) permitted TSDF within the permissible accumulation time limits. As discussed previously, NASA may request a “contained-in” determination for individual waste streams initially characterized as containing listed hazardous wastes, should analytical data from the as-generated waste support such a request. If NMED finds contaminant concentrations do not pose an unacceptable risk, then NMED may allow the wastes included in the request to be managed as non-hazardous solid waste that no longer contains listed waste and does not exhibit the characteristic of hazardous waste. On July 24, 2024, NASA has received from NMED a separate letter document such a determination (NMED, 2024).

For any waste that may be characterized as hazardous waste, land disposal restriction notifications, disposal facility profiles, and hazardous waste manifests will be completed as required. Hazardous waste manifested off-site will be transported for treatment and disposal at a permitted RCRA TSDF. Contaminated groundwater and decontamination water generated during the project will be managed at the MPITS. If that system is not capable of receiving the waste, it will be disposed of at a permitted RCRA TSDF.

12.0 References

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NMED Ground Water Quality Bureau. (2017, July 14). *Discharge Permit Renewal and Modification, DP-1255, NASA White Sands Testing Facility.* Santa Fe, NM.

NMED Hazardous Waste Bureau. (2021, November 15). *Approval with Modifications White Sands Test Facility Groundwater Monitoring Plan.* Santa Fe, NM.

NMED Hazardous Waste Bureau. (2022, October 31). *Approval Abbreviated Work Plan for Abandonment of NASA WSTF NASA 9 and Replacement with Monitoring Well 400-001-GW*. Santa Fe, NM.

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NMED Hazardous Waste Bureau. (2024, July 24). *Approval Request for a "No Longer Contained-in" Determination for Drilling Mud and Cuttings Associated with 300 Area Supplemental Investigation Work Plan.* Sante Fe, NM.

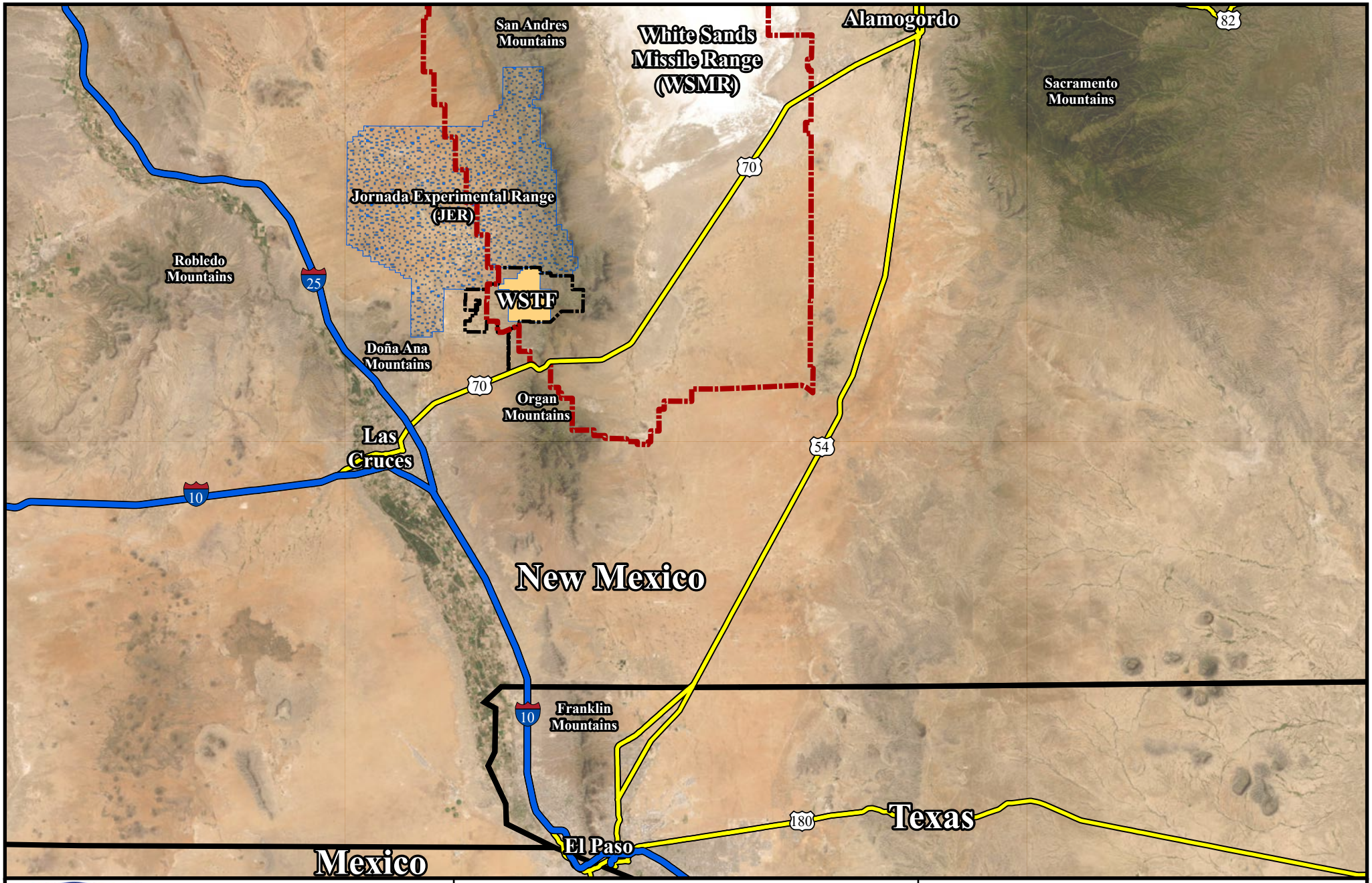
Seager, W.R. (1981). *Geology of Organ Mountains and Southern San Andres Mountains, New Mexico*. Memoir 36 - New Mexico Bureau of Mines and Mineral Resources, Socorro, NM.

Seager, W.R., Hawley, J.W., Kottlowski, F.E., and Kelley S.A. (1987). *Geology of East Half of Las Cruces and Northeast of El Paso 1°x2° Sheets.* Map. New Mexico Bureau of Mines and Mineral Resources, Socorro, NM.

Figures

Figure 2.1 **WSTF Location Map**

(SEE NEXT PAGE)



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August 2024
Edited by: srees

- WSMR Boundary
- WSTF Boundary
- Jornada Experimental Range (JER)
- WSTF Industrial Area

WSTF Location Map

NASA Johnson Space Center
White Sands Test Facility
Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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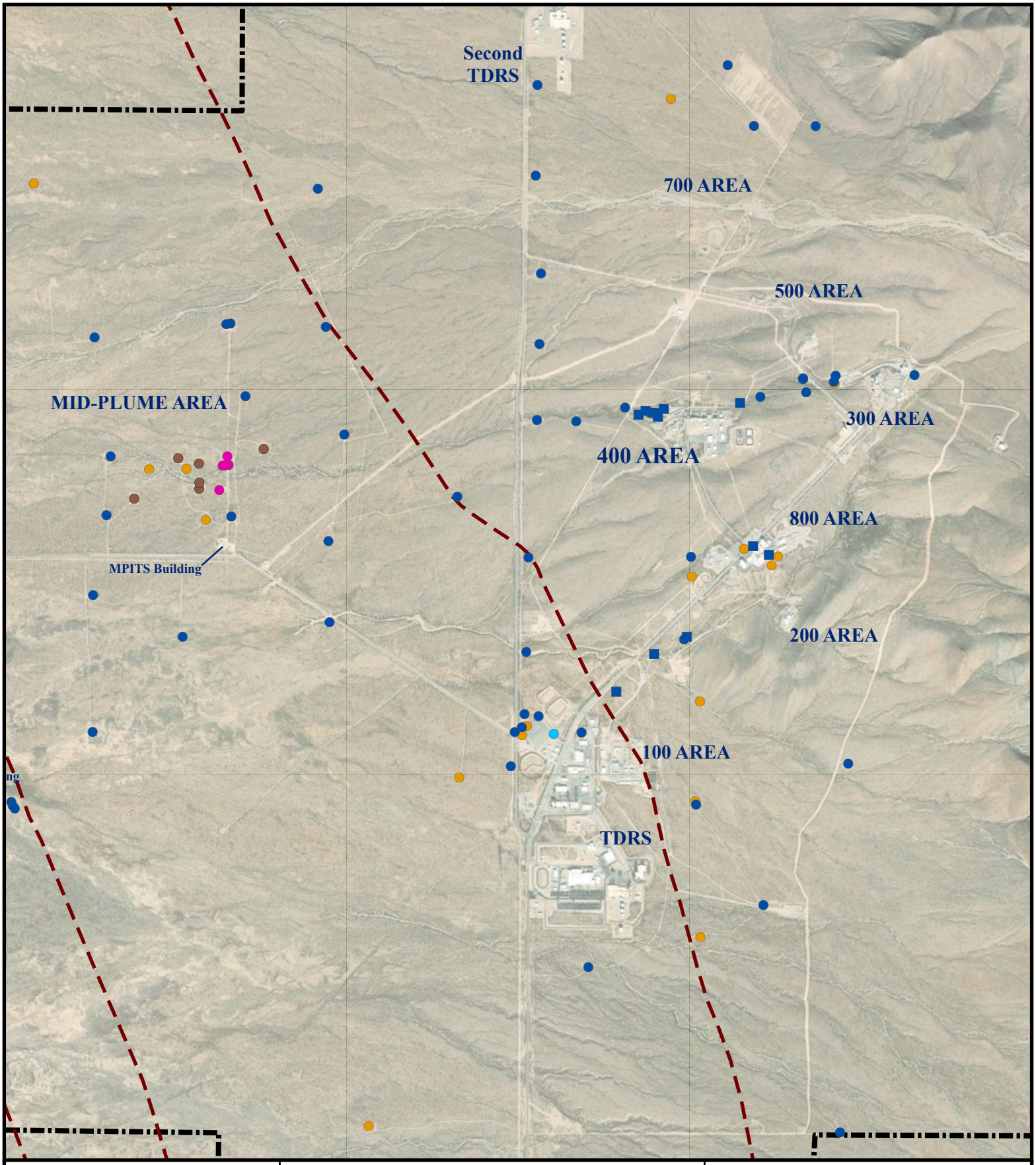
Figure 2.2 **400 Area Location Map**

(SEE NEXT PAGE)



White Sands Test Facility
400 Area Location

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 HARN StatePlane New Mexico Central FIPS 3002 Feet

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Figure 2.3 **Well 400-001-GW Location Map**

(SEE NEXT PAGE)



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August 2024

0 200 400 Feet

Prepared by: srees

New Well Installation
Multiport Well
Conventional Well
MSVGM Well
MSVM Well
Plugged and Abandoned

Monitoring Well 400-001-GW Location

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 HARN StatePlane New Mexico Central FIPS 3002 Feet

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Figure 5.1 Well 400-001-GW Well Completion Diagram

(SEE NEXT PAGE)

WELL COMPLETION DIAGRAM
MONITORING WELL

Location ID: **400-001-GW** Site ID: **NASA-WSTF, Doña Ana County, NM**

Township and Range: **NE 1/4 NE 1/4 SW 1/4 Sec 35, T20S, R3E**
NM State Plane Coordinates (NAD 83)(ft): **554,959.017 N, 1,530,435.611 E**
Elevation (Brass Cap): **4821.38 ft.**
Elevation (Top of Casing): **4826.38 ft.**
Drilling Contractor: **Yellow Jacket Drilling**
Driller: **J. Munguia**
Method of Drilling: **Sonic / Air Rotary**
Total Depth of Borehole (bgs): **173 ft.**
Borehole Diameter: **9-in. to 173 ft. bgs**
Depth to Bedrock (bgs): **110 ft; Cemented Conglomerate**
Depth to Groundwater: ~~**98 ft. bgs (6/25/19)**~~ **129.8 ft. bgs (6/27/24)**
Diameter and Type Surface Casing: **N/A**

Dates Borehole Drilled: **6/11 - 6/15/24**
Date(s) Well Installed: **6/16 - 6/17/24**
Date(s) Well Developed: **6/26 - 6/27/24**
Field Representative(s): **S. Rees, P. Bolen**
Total Depth Well Casing (bgs): **160 ft.**
Type of Casing: **SCH 80 PVC**
Diameter Well Casing: **4-in. nominal**
Screened Zone (bgs): **140-155 ft.**
Comments: NASA 9 Replacement Well

bgs = below ground surface TOC=Top of Casing
ags= above ground surface
ID = Inner Diameter OD= Outer Diameter

Casing Explanation

Surface Casing
N/A

Completion Casing
SCH 80 PVC
4-in nominal

Well Screen
SCH 80 PVC
SCH 80 PVC 0.020-in Slot Screen

Steel Centralizer
Steel End Cap
Water Table

Annular Materials Explanation

Neat Cement
Bentonite Grout
Bentonite Seal
20/40 Filter Pack Sand
10/20 Sand
Slough

Elevation (ft amsl) / Depth (ft bgs)	**Borehole/Well Casing Descriptions** All depths are below ground surface	**Annular Materials Descriptions** All depths are below ground surface
4820 / 0	Note: Sampling system is currently NOT installed Stick-Up = 5 ft. ags	
4810 / 10	The well was completed with a 4 ft x 4ft cement pad, barrier posts, and a locking steel well cap surrounding the casing at ground surface.	Top of Surface Seal (3x 47 lbs bags Portland II Cement) = 0-3 ft. Top of Cement Grout (40x 47 lbs bags Portland II Cement with 5% Bentonite added) = 3.0 ft.
4800 / 20		Formation is Santa to Fe Group alluvium from surface to 110 ft bgs.
4790 / 30		
4780 / 40		
4770 / 50	Three steel cage centralizers bolted together around casing at 50 ft.	
4760 / 60		

WELL COMPLETION DIAGRAM
MONITORING WELL

Location ID: **400-001-GW** Site ID: **NASA-WSTF, Doña Ana County, NM**

Township and Range: **NE 1/4 NE 1/4 SW 1/4 Sec 35, T20S, R3E**
NM State Plane Coordinates (NAD 83)(ft): **554,959.017 N, 1,530,435.611 E**
Elevation (Brass Cap): **4821.38 ft.**
Elevation (Top of Casing): **4826.38 ft.**
Drilling Contractor: **Yellow Jacket Drilling**
Driller: **J. Munguia**
Method of Drilling: **Sonic / Air Rotary**
Total Depth of Borehole (bgs): **173 ft.**
Borehole Diameter: **9-in. to 173 ft. bgs**
Depth to Bedrock (bgs): **110 ft; Cemented Conglomerate**
Depth to Groundwater: ~~**98 ft. bgs (6/25/19)**~~ **129.8 ft. bgs (6/27/24)**
Diameter and Type Surface Casing: **N/A**

Dates Borehole Drilled: **6/11 - 6/15/24**
Date(s) Well Installed: **6/16 - 6/17/24**
Date(s) Well Developed: **6/26 - 6/27/24**
Field Representative(s): **S. Rees, P. Bolen**
Total Depth Well Casing (bgs): **160 ft.**
Type of Casing: **SCH 80 PVC**
Diameter Well Casing: **4-in. nominal**
Screened Zone (bgs): **140-155 ft.**
Comments: NASA 9 Replacement Well

bgs = below ground surface TOC=Top of Casing
ags= above ground surface
ID = Inner Diameter OD= Outer Diameter

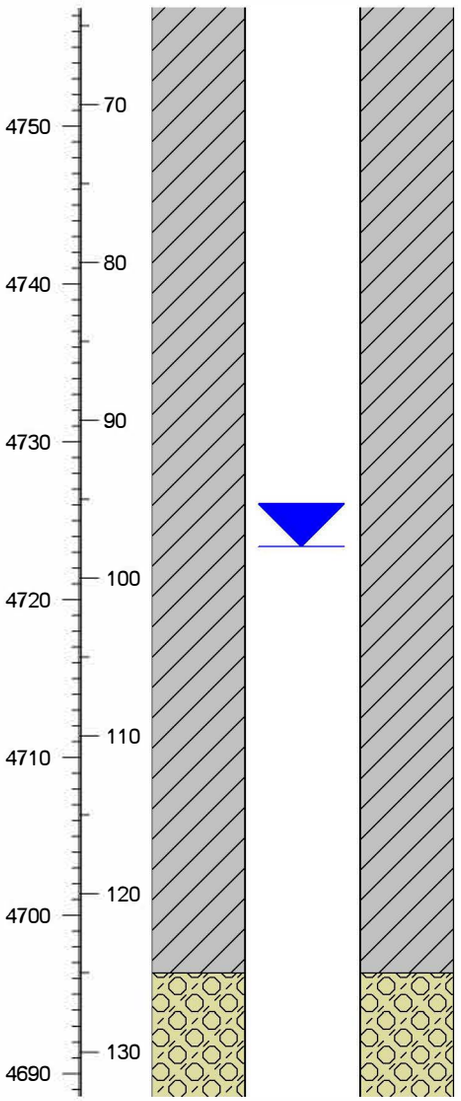
Casing Explanation

- Surface Casing: **N/A**
- Completion Casing: **SCH 80 PVC**, **4-in nominal**
- Well Screen: **SCH 80 PVC**, **SCH 80 PVC 0.020-in Slot Screen**
- Steel Centralizer
- Steel End Cap
- Water Table

Annular Materials Explanation

- Neat Cement
- Bentonite Grout
- Bentonite Seal
- 20/40 Filter Pack Sand
- 10/20 Sand
- Slough

Elevation (ft amsl) / Depth (ft bgs)	**Borehole/Well Casing Descriptions** All depths are below ground surface	**Annular Materials Descriptions** All depths are below ground surface



Water Table Depth = ~~**98 ft. bgs (6/25/19)**~~ 129.8 ft. bgs (6/27/24)

Conglomerate bedrock depth = 110 ft.

9-in. Borehole grouted to 125 ft.

Top of Upper Bentonite Seal (3 1/2 x 50 lbs buckets Bentonite chips) = 125 ft.

WELL COMPLETION DIAGRAM
MONITORING WELL

Location ID: **400-001-GW** Site ID: **NASA-WSTF, Doña Ana County, NM**

Township and Range: **NE 1/4 NE 1/4 SW 1/4 Sec 35, T20S, R3E**
NM State Plane Coordinates (NAD 83)(ft): **554,959.017 N, 1,530,435.611 E**
Elevation (Brass Cap): **4821.38 ft.**
Elevation (Top of Casing): **4826.38 ft.**
Drilling Contractor: **Yellow Jacket Drilling**
Driller: **J. Munguia**
Method of Drilling: **Sonic / Air Rotary**
Total Depth of Borehole (bgs): **173 ft.**
Borehole Diameter: **9-in. to 173 ft. bgs**
Depth to Bedrock (bgs): **110 ft; Cemented Conglomerate**
Depth to Groundwater: ~~**98 ft. bgs (6/25/19)**~~ **129.8 ft. bgs (6/27/24)**
Diameter and Type Surface Casing: **N/A**

Dates Borehole Drilled: **6/11 - 6/15/24**
Date(s) Well Installed: **6/16 - 6/17/24**
Date(s) Well Developed: **6/26 - 6/27/24**
Field Representative(s): **S. Rees, P. Bolen**
Total Depth Well Casing (bgs): **160 ft.**
Type of Casing: **SCH 80 PVC**
Diameter Well Casing: **4-in. nominal**
Screened Zone (bgs): **140-155 ft.**
Comments: NASA 9 Replacement Well

bgs = below ground surface TOC=Top of Casing
ags= above ground surface
ID = Inner Diameter OD= Outer Diameter

Casing Explanation

Surface Casing
N/A

Completion Casing
SCH 80 PVC
4-in nominal

Well Screen
SCH 80 PVC
SCH 80 PVC 0.020-in Slot Screen

Steel Centralizer

Steel End Cap

Water Table

Annular Materials Explanation

Neat Cement

Bentonite Grout

Bentonite Seal

20/40 Filter Pack Sand

10/20 Sand

Slough

Elevation (ft amsl) / Depth (ft bgs)	**Borehole/Well Casing Descriptions** All depths are below ground surface	**Annular Materials Descriptions** All depths are below ground surface
4680 — 140 4670 — 150 4660 — 160 4650 — 170	Three steel cage centralizer bolted together around casing at 140 ft. Top of 4-in nominal Schedule 80 PVC w/ 0.020-in - Slot PVC Screen = 140 ft. Bottom of 4-in nominal Schedule 80 PVC w/ 0.020-in - Slot PVC Screen = 155 ft. Three steel cage centralizer bolted together around casing at 155 ft. Sump consists of 5 ft blank riser and end cap 4-in nominal Schedule 80 PVC Casing TD = 160 ft.	Top of 20/40 Upper Sand Pack (1 1/4x 47 lbs bags 20/40 sand) = 135 ft. Top of 10/20 Sand Filter Pack (17x 47 lbs bags 10/20 sand) = 137 ft. Bentonite Backfill (4x 50 lbs buckets Bentonite chips) = 165-173 ft. 9-in Borehole TD= 173 ft.

Tables

Table 4.1 Water Usage Log

Drilling			Well Construction		
Date	**Water (gal.)**	**Cumulative Water (gal.)**	**Date**	**Water (gal.)**	**Cumulative Water (gal.)**
6/12/24	300	300	6/16/24	300	300
6/12/24	600	900			
6/13/24	600	1500			
6/13/24	600	2100			
6/13/24	600	2700			
6/14/24	600	3300			
	Drilling Total:	3300		Well Construction Total:	300
Combined Total Volume (gal.): 3600					

Appendix A NASA 9 Plugging Plan and Record

PLUGGING RECORD

NOTE: A Well Plugging Plan of Operations shall be approved by the State Engineer prior to plugging - 19.27.4 NMAC

I. GENERAL / WELL OWNERSHIP:

State Engineer Well Number: NASA 9 / LRG-19480 POD1

Well owner: NASA Johnson Space Center White Sands Facility Phone No.: (575)-524-5024

Mailing address: P.O. BOX 20

City: Las Cruces State: NM Zip code: 88004

II. WELL PLUGGING INFORMATION:

1) Name of well drilling company that plugged well: Yellow Jacket Drilling Services, LLC

2) New Mexico Well Driller License No.: WD-1458 Expiration Date: 10/31/24

3) Well plugging activities were supervised by the following well driller(s)/rig supervisor(s): Sean Carrigan

4) Date well plugging began: 1/7/23 Date well plugging concluded: 1/7/23

5) GPS Well Location: Latitude: 32 deg, 31 min, 30.05 sec
Longitude: -106 deg, 26 min, 25.49 sec, WGS 84

6) Depth of well confirmed at initiation of plugging as: 154 ft below ground level (bgl), by the following manner: Tremie Pipe

7) Static water level measured at initiation of plugging: 129 ft bgl

8) Date well plugging plan of operations was approved by the State Engineer: 9/9/22

9) Were all plugging activities consistent with an approved plugging plan? YES If not, please describe differences between the approved plugging plan and the well as it was plugged (attach additional pages as needed):

10) Log of Plugging Activities - Label vertical scale with depths, and indicate separate plugging intervals with horizontal lines as necessary to illustrate material or methodology changes. Attach additional pages if necessary.

For each interval plugged, describe within the following columns:

Depth (ft bgl)	Plugging Material Used (include any additives used)	Volume of Material Placed (gallons)	Theoretical Volume of Borehole/ Casing (gallons)	Placement Method (tremie pipe, other)	Comments ("casing perforated first", "open annular space also plugged", etc.)
0	CEMENT GROUT 5% BETONITE	75 GAL	25.21 GAL	TREMIE PIPE	ABANDON
154'					

MULTIPLY		BY		AND OBTAIN
cubic feet	x	7.4805	=	gallons
cubic yards	x	201.97	=	gallons

III. SIGNATURE:

I, Richard LeBlanc, say that I am familiar with the rules of the Office of the State Engineer pertaining to the plugging of wells and that each and all of the statements in this Plugging Record and attachments are true to the best of my knowledge and belief.

R. LeBlanc. — Signature of Well Driller

1/31/23 — Date

Mike A. Hamman, P.E.
State Engineer

Las Cruces Office- District 4
1680 HICKORY LOOP, SUITE J
LAS CRUCES, NM 88005

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

October 19, 2022

File No. LRG-18480

NASA Johnson Space Center White Sands Test Facility
Attention: Timothy Davis
PO Box 20
Las Cruces, NM 88004

RE: Plugging Plan Approval for well LRG-18480 POD1

Greetings:

Enclosed is your copy of the Well Plugging Plan of Operations for well LRG-18480 POD1, approved subject to the attached conditions. You are responsible for submitting a properly completed Plugging Record to the office within thirty (30) days after plugging is completed. The Plugging record is available at:

http://www.ose.state.nm.us/STST/Forms/WD-11%20Plugging%20Record_2009-09-08_final.pdf

Please let us know if you have any questions.

Sincerely,

Cheryl S. Thacker
Water Resources Manager
WRAP, District IV

Encl (2): Well Plugging Plan of Operations and Conditions of Approval

WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging. This form may be used to plug a single well, or if you are plugging multiple monitoring wells on the same site using the same plugging methodology.

Alert! Your well may be eligible to participate in the Aquifer Mapping Program (AMP)-NM Bureau of Geology geoinfo.nmt.edu/resources/water/cgmn/ if within an area of interest and meets the minimum construction requirements, such as there is still water in your well, and the well construction reflected in a well record and log is not compromised, contact AMP at 575-835-5038 or -6951, or by email nmbg-waterlevels@nmt.edu, prior to completing this prior form. Showing proof to the OSE that your well was accepted in this program, may delay the plugging of your well until a later date.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP: ☐ Check here if proposing one plan for multiple monitoring wells on the same site and attaching WD-08m

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: LRG-18480 POD1 N/A; NASA Well NASA 9

Name of well owner: NASA Johnson Space Center White Sands Test Facility (Contact: Timothy Davis)

Mailing address: P.O. Box 20 County: Dona Ana

City: Las Cruces State: NM Zip code: 88004

Phone number: (575) 524-5024 E-mail: timothy.j.davis@nasa.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10/31/22 Renewal Pending

IV. WELL INFORMATION: ☐ **Check here if this plan describes method for plugging multiple monitoring wells on the same site and attach supplemental form WD-08m and skip to #2 in this section.**

Note: A copy of the existing Well Record for the well(s) to be plugged should be attached to this plan.

1) GPS Well Location: Latitude: 32 deg, 31 min, 30.05 sec
Longitude: -106 deg, 36 min, 25.49 sec, NAD 83

2) Reason(s) for plugging well(s):

Damage associated with root growth into the well casing at or near static water level has obstructed the ability to successfully obtain representative samples.

3) Was well used for any type of monitoring program? Yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? Yes If yes, provide additional detail, including analytical results and/or laboratory report(s): See NASA 9 analytical data enclosed

5) Static water level: 129.1 feet (below land surface) / feet above land surface (circle one)

6) Depth of the well: 154.46 feet

LRG-18480 TRN: 735978

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: Schedule 80 PVC; Schedule 40 Stainless-Steel

9) The well was constructed with:

☐ an open-hole production interval, state the open interval: _____

☒ a well screen or perforated pipe, state the screened interval(s): 129.46 - 149.46

10) What annular interval surrounding the artesian casing of this well is cement-grouted? NA

11) Was the well built with surface casing? Yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? Yes If yes, please describe:

Nominal 6-inch surface casing set to 30 ft in a borehole of unknown diameter and cemented to surface.

12) Has all pumping equipment and associated piping been removed from the well? No If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

☐ **If plugging method differs between multiple wells on same site, a separate form must be completed for each method.**

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal. Attach a copy of any signed OSE variance to this plugging plan.

Also, if this planned plugging plan requires a variance to 19.27.4 NMAC, attach a detailed variance request signed by the applicant.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well:

The well casing will be cemented from bottom up using tremie pipe, including all screened intervals and blank casing.

2) Will well head be cut-off below land surface after plugging? Yes, 6 inches below ground surface

2022 SEP 2 AM 10:2

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant. Attach a copy of the batch mix recipe from the cement company and/or product description for specialty cement mixes or any sealant that deviates from the list of OSE approved sealants.

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 25.21 gallons (3.37 cubic ft)

4) Type of Cement proposed: Portland Type II neat cement with 5% bentonite by weight

5) Proposed cement grout mix: 8.7 gallons of water per 94 pound sack of Portland cement.

6) Will the grout be: _____ batch-mixed and delivered to the site

X mixed on site

7) Grout additives requested, and percent by dry weight relative to cement:

5% by weight Bentonite powder (~4.7 lbs/94 lb bag of Portland Type II cement)

8) Additional notes and calculations:

The mix of neat cement and 5% bentonite will require 8.7 gallons of water per 94 lb bag of cement; 5.2 gallons per 94 lb bag of cement and 0.7 gallons per percent of bentonite.

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

Well NASA 9 was equipped with a low-flow bladder pump sampling system. In an attempt to remove the sampling system and extend the tubing to accommodate the declining water levels, the pump was disconnected from the tubing and dropped into the 5 foot sump. Attempts to retrieve the pump were unsuccessful and it was discovered the inside of the 2 inch stainless-steel casing was obstructed by root growth at or near static water level. The last two successful sampling events at well NASA 9 occurred in 2018 and 2019.

VIII. SIGNATURE:

I, Michael Zigmond for: Timothy Davis, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

MICHAEL ZIGMOND Digitally signed by MICHAEL ZIGMOND Date: 2022.09.07 12:49:04 -06'00'

Signature of Applicant

See Electronic Signatur

Date

2022 SEP -9 AM 10: 2

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

__✓__ Approved subject to the attached conditions.

_____ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 19th day of October, 2022

STATE OF NEW MEXICO STATE ENGINEER

Mike A. Hamman, STATE ENGINEER

ngineer

BY Cheryl S. Thacker

Cheryl Thacker
Water Resource Manager

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)			Ground Surface
Bottom of proposed interval of grout placement (ft bgl)			154.56
Theoretical volume of grout required per interval (gallons)			25.21 gal
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement			8.7 gallons of water per 94 lb bag of Portland Type II cement with 5% bentonite powder.
Mixed on-site or batch-mixed and delivered?			On Site
Grout additive 1 requested			Powdered bentonite
Additive 1 percent by dry weight relative to cement			5%
Grout additive 2 requested			NA
Additive 2 percent by dry weight relative to cement			NA

2022 SEP -9 AM 10:2

TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)			NA
Bottom of proposed sealant of grout placement (ft bgl)			NA
Theoretical volume of sealant required per interval (gallons)			NA
Proposed abandonment sealant (manufacturer and trade name)			NA

2022 SEP -9 AM 10: 2

Attachment
Conditions of Approval

Well Plugging Plan of Operations
Well Number LRG-18480 POD1

File No.: LRG-18480

1) Well LRG-18480 POD1 shall be plugged using the methods and materials identified in the State Engineer approved Well Plugging Plan of Operations filed on September 9, 2022.

2) In addition, well LRG-18480 POD1 shall be plugged completely using the following method per Rules and Regulations Governing Well Driller Licensing, Construction, Repair and Plugging of Wells; Subsection C of 19.27.4.30 NMAC:

   All pumping appurtenances shall be removed from the well prior to plugging. To plug a well, the entire well shall be filled from the bottom upwards to ground surface using a tremie pipe. The bottom of the tremie shall remain submerged in the sealant throughout the entire sealing process; other placement methods may be acceptable and approved by the State Engineer

   The well shall be plugged with an Office of the State Engineer approved sealant for use in the plugging of non-artesian wells.

   The well driller shall cut the casing off at least four (4) feet below ground surface and fill the open hole with at least two (2) vertical feet of approved sealant.

   Wells that do not encounter a water bearing stratum shall at a minimum be plugged by filling the well with drill cuttings or clean native fill to within 10 feet of land surface and by plugging the remaining 10 feet of the well to ground surface with a plug of the office of the state engineer approved sealant.

   The driller must fill or cover any open annulus with sealant. Once the sealant has cured, the well driller or well owner may cover the seal with soil.

   A plugging report for said well shall be filed with the Office of the State Engineer in the District IV office in Las Cruces within thirty (30) days of completion of the plugging.

2) A licensed well driller shall keep a record of the plugging work as it progresses and file a complete Plugging Record (Office of the State Engineer Form No.: WR-20) with the State Engineer no later than thirty (30) days after completion of plugging.

3) New Mexico Office of the State Engineer (NMOSE) witnessing of the plugging will not be required unless artesian conditions are encountered but shall be facilitated if a NMOSE observer is onsite. NMOSE witnessing may be requested during normal

work hours by calling the District IV NMOSE office at 575-524-6161 at least 48 hours in advance. NMOSE inspection will occur dependant of personnel availability.

4) Should another regulatory agency sharing jurisdiction of the project authorize or by regulation require more stringent requirements than stated herein, the more stringent procedure shall be followed. This in part includes provisions regarding preauthorization to proceed, type of methods and materials used, inspection, or prohibition of free discharge of any fluid or other material to or from the well that is related to the plugging process.

Date: 10/19/2022

Cheryl S. Thacker
Water Resources Manager
WRAP District IV

OFFICE OF THE STATE ENGINEER
1680 HICKORY LOOP, SUITE J
LAS CRUCES, NM 88005

EL PASO TX 798
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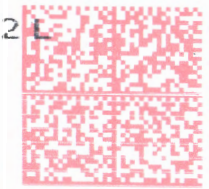

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Appendix B Lithologic Logs

SOIL BORING LITHOLOGIC LOG

LOCATION MAP:



SITE ID: NASA-WSTF **BOREHOLE ID: 400A-001-GW**
SITE COORDINATES (ft.) N: 554959.017 E: 1530435.611
GROUND ELEVATION (ft. MSL): 4821.382
STATE: New Mexico **COUNTY:** Doña Ana
DRILLING METHOD: Rotary Sonic
SAMPLING METHOD: From coring barrels
DRILLING CONTR./DRILLER: Yellow Jacket Drilling/Jose M.
DATE STARTED: 6/11/24 **DATE COMPLETED:** 6/14/24
FIELD REPS.: P. Bolen, S. Rees
TOTAL DEPTH: 178 ft (TOC 5 ft. stickup)
COMMENTS: NASA 9 Replacement Well

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	SOIL SAMPLE TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	LITHOLOGIC DESCRIPTION USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
0 5		4	5		100			ML	Matrix is silty with some clay, and a trace of sand. Clast fraction predominantly limestone, small pebbles to cobbles in size.
10		9	10		100			ML	Same as above.
15		14	15		100			GM	Same as above with increased clasts.
20		19	20		100			SM	Silty sand with gravel. Tannish brown in color.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
20		24	25		100			SM	Same as above but with reduced clasts. Clast diameter ¼-in to ½-in. Angular and broken.
25									
		29	30		100			SM	Same as above.
30									
		34	35		100			GM	Silty gravel with a trace of sand. Broken clasts ¼ -in to 1-in diameter.
35									
		39	40		100			GM	Same as above.
40									
		44	45		100			SM	Silty clay with some sand. Larger broken and angular clasts 4-in to 6-in diameter.
45									

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
45		49	50		100			SM	Same as above.
50									
55		54	55		100			GM	Silty with some gravel. Clasts ½ - 1-in diameter. Pinkish tan color. Dry.
60		59	60		100			GM	Same as above.
65		64	65		100			GM	Same as above but becoming moist.
70		69	70		100			GM	Same as above.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
70		74	75		100			GM	Same as above with rare 2-in clasts of limestone. Caliche coated. Silt is fine and uniform.
75									
80		79	80		100			GM	Same as above.
85		84	85		100				Poorly cemented conglomerate. Mixed clast lithologies of limestone, greenish andesite, and other volcanics. Matrix crumbly, light pink to tan. Up to 50% fine materials in cemented matrix.
90		89	90		100				Same as above.
95		94	95		100				Color change to gray, with clasts predominantly composed of andesite. Other clast lithologies comprise sandstone, limestone, and some rhyolite.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
95		99	100		100				Same as above.
100									
105		104	105		100				Light brown to gray. Mostly Limestone clasts up to 2-in diameter, subrounded to rounded. Clast size up to 2-in diameter. Matrix comprises 30% fines with some caliche.
110		109	110		100				
115		114	115		100				Top of cemented conglomerate unit. Reddish brown in color. Very well cemented large 4-in clasts in caliche cement. Limestone, rhyolite, and sandstone lithologies predominate in the clast fraction.
120		119	120		100				Same as above.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
120		124	125		100				Cemented conglomerate. Clasts are angular to rounded sedimentary and igneous lithologies up to 2-in diameter.
125									
130		129	130		100				Same as above. Clasts are angular to rounded well consolidated. Clast size 1-in to 2-in diameter.
135		134	135		100				Same as above.
140		139	140		90				Mudstone unit at base of cemented conglomerate. Retains reddish brown color.
145		144	145		100				Same as above. Mudstone unit continues to a depth of 147 ft bgs.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
145		149	150		100				At 147 ft andesite bedrock. Many healed and open fractures with calcite and iron staining. Bedrock surface appears highly weathered.
150									
155		154	155		100				
160		159	160		100				Heavily weathered andesite, transitioning to andesitic breccia. Calcite cement, bimodal color part greyish purple contacting dark red. Inferred to be a fault zone.
165		164	165		100				Highly weathered and brecciated andesite.
170		169	170		100				Same as above.

DEPTH (ft. bgs)	PID (ppm)	SOIL CORE				SOIL SAMPLE		LITHOLOGIC DESCRIPTION	
		Sample Depth (ft) From	To	Blow Counts per 6" Core	% Core Rec.	TYPE (Soil Grab, Soil Gas, Soil Chemical, Soil Geotechnical, Hex. Chrom.)	WSTF 10-DIGIT SAMPLE NUMBER(S) (yrmmddtttt)	USCS Group	Color, sorting/grading, consistency/density, grain size proportions (%), rounding/shape, consolidation/cementation, moisture content, distinguishing features
170		174	175		100				Heavily weathered and fractured andesite, partially cemented/ consolidated with calcite and clay present.
175									
180		177	178		100				Same as above. Borehole total depth (TD) = 178 ft
185									
190									
195									

Appendix C Geophysical Logs

JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	Navarro Research & Engineering
WELL ID	400-001-GW
FIELD	NASA/WSTF
COUNTY	Dona Ana STATE New Mexico

TYPE OF LOG: Composite Max

OTHER SERVICES
Deviation

LOCATION:

NAD:
Northing:
Easting:

SEC TWP RGE

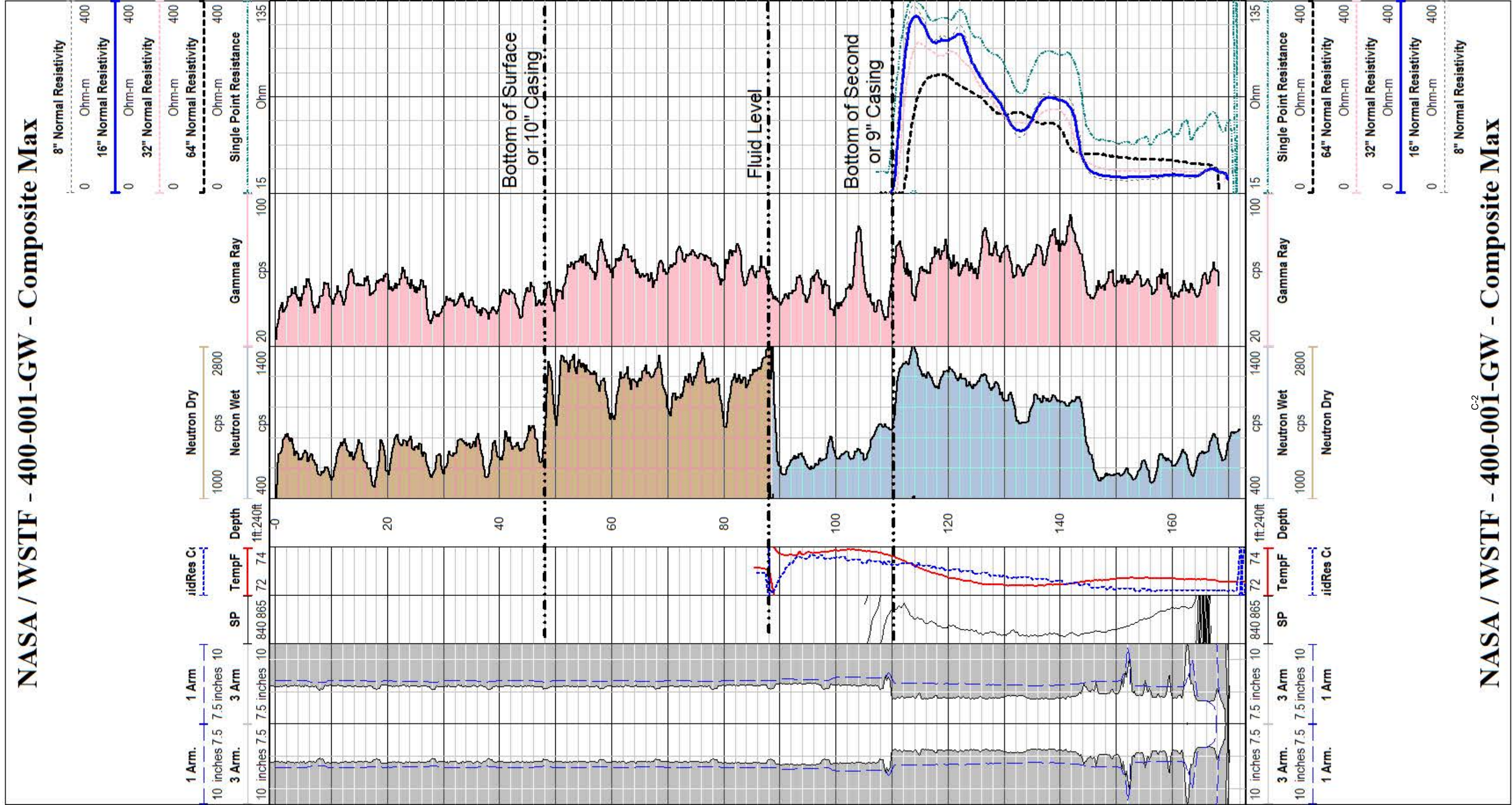
API No.

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.

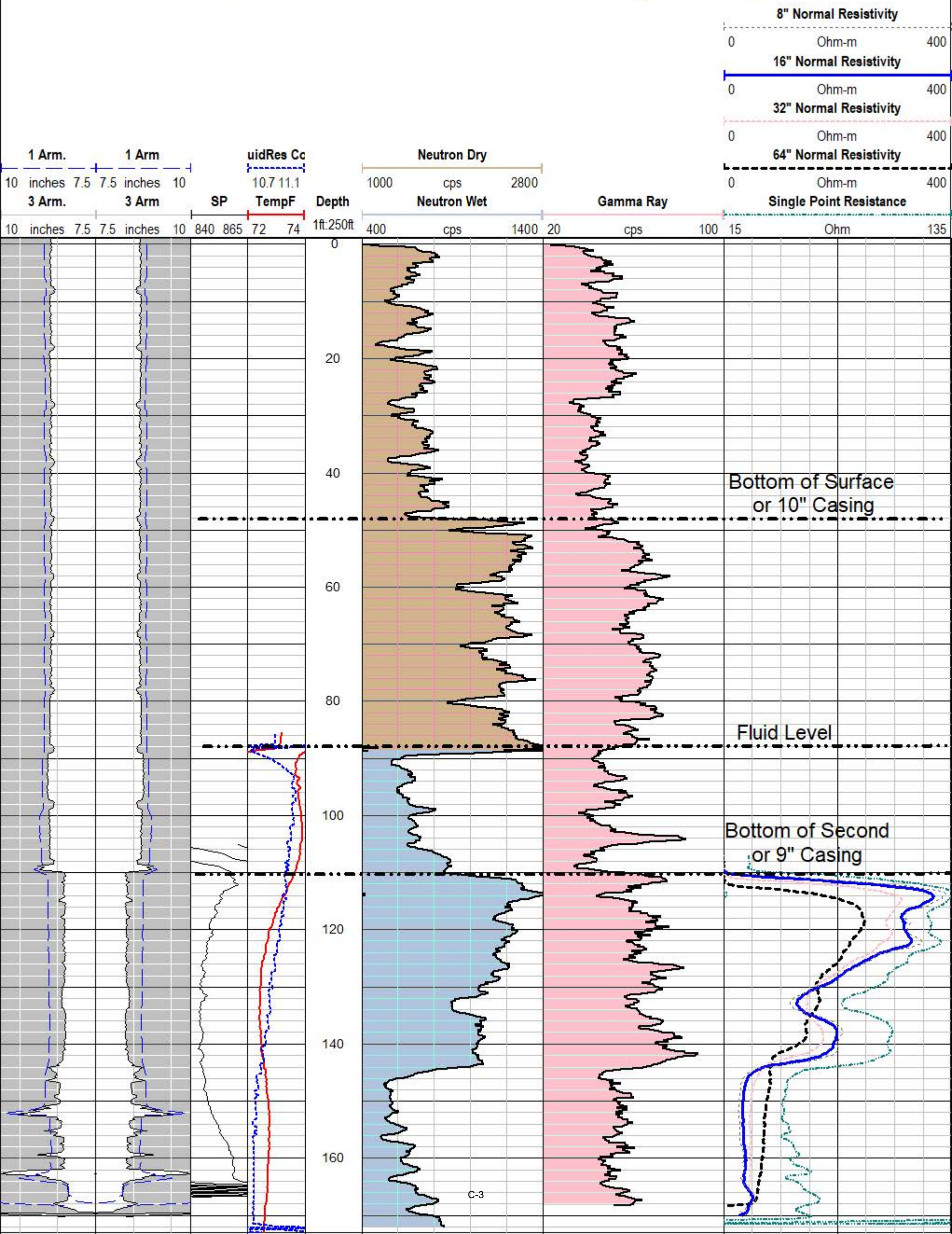
DATE	06-15-2024	TYPE FLUID IN HOLE	water
RUN No.	One, Two, Five	SALINITY	
TYPE LOG	MSI - Poly / 3 Arm	DENSITY	
DEPTH-DRILLER	178 ft.	LEVEL	89 ft.
DEPTH-LOGGER	173.2 ft.	MAX. REC. TEMP	
BTM LOGGED INTERVAL	173.2 ft.	DIGITIZE INTERVAL	0.4 - 0.1 ft.
TOP LOGGED INTERVAL		OPERATING RIG TIME	
DRILLER - RIG	Yellow Jacket	DRILLER	Jose / Jacob
RECORDED BY	T.Staatz		
WITNESSED BY	P. Bolen /T.Cassidy	FIRM	Navarro

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE		FROM	TO
1				* 10 in.	Steel	2.3 ft.	48 ft.
2				* 9 in	Steel	2.7 ft.	110 ft.
3	8.0 in. Core	110 ft.	178 ft.				

REMARKS: * Sonic Driven Casing



NASA / WSTF - 400-001-GW - Composite Max



Depth	Tilt	Azimuth	Easting	Northing	TVD	Close Dist	Close Ang
ft	deg	deg	[ft]	[ft]	[ft]	[ft]	deg
0	0.4	16.1	0.01	-0.02	-0.45	0.02	150.97
10	0.6	67.7	0.02	-0.02	10.39	0.03	135.85
20	0.5	165.4	0.05	-0.04	20.25	0.07	124.04
30	0.5	225.9	0.06	-0.03	30.11	0.07	116.61
40	0.5	309.4	0.09	-0.04	39.97	0.1	114.32
50	0.4	210.1	0.09	-0.03	49.82	0.09	107.84
60	0.3	189.4	0.1	-0.02	59.68	0.1	99.21
70	0.3	279.1	0.1	-0.01	69.54	0.1	96.19
80	0.1	228.3	0.08	-0.01	80.39	0.08	99.45
90	0.3	156.1	0.08	-0.01	90.25	0.08	99
100	0.7	158.6	0.05	-0.04	100.1	0.07	124.74
110	1	142.4	0.09	-0.07	109.96	0.11	129.8
120	1.3	97.1	0.28	-0.13	119.82	0.31	115.63
130	1.5	96.6	0.51	-0.19	129.68	0.54	110.8
140	1.8	94.1	0.77	-0.26	139.53	0.81	108.79
150	1.8	99.9	1.07	-0.34	150.37	1.12	107.81
160	1.5	106.4	1.34	-0.44	160.23	1.41	108.14
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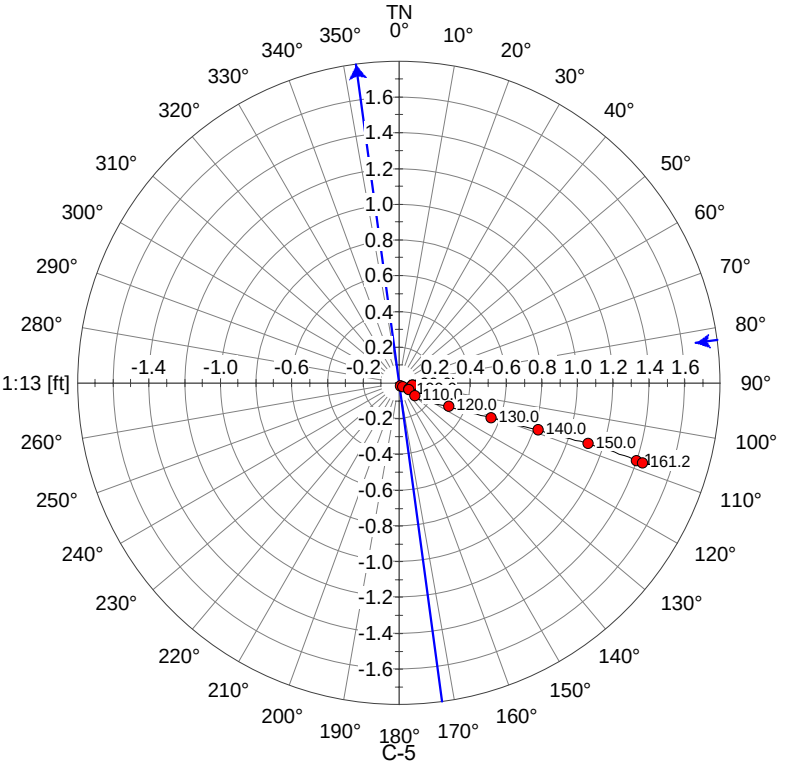
Depth	Tilt	Azimuth	Easting	Northing	TVD	Close Dist	Close Ang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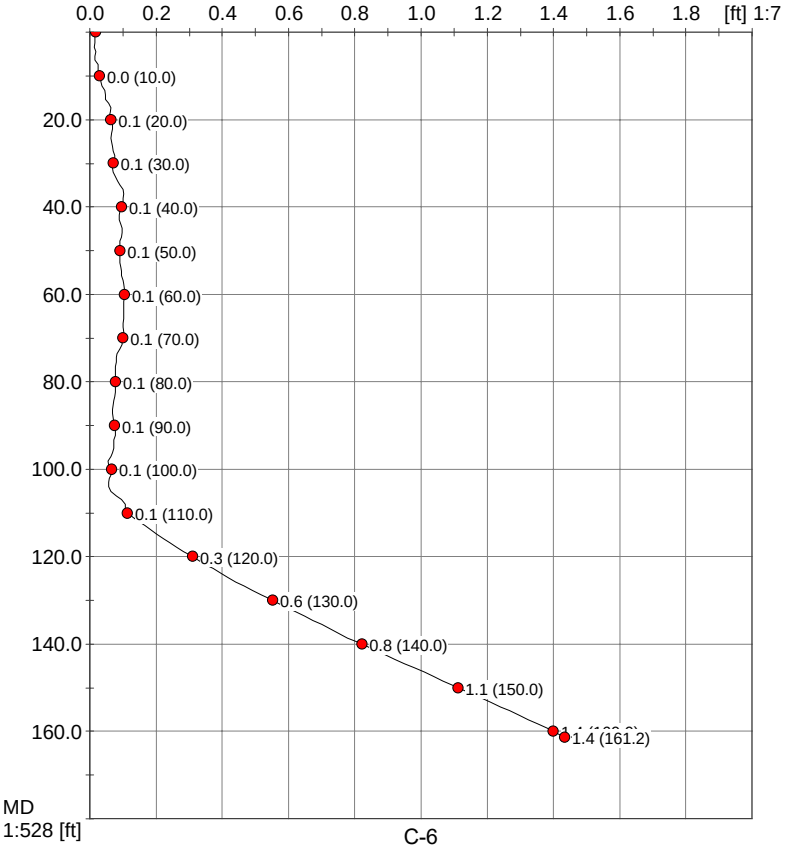
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20.0
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60.0
80.0
100.0
120.0
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0.1 (60.0)
0.1 (70.0)
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0.1 (90.0)
0.1 (100.0)
0.1 (110.0)
0.3 (120.0)
0.6 (130.0)
0.8 (140.0)
1.1 (150.0)
1.4 (161.2)
MD
1:528 [ft]
C-6

JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	Navarro Research & Engineering
WELL ID	400-001-GW
FIELD	NASA/WSTF
COUNTY	Dona Ana STATE New Mexico

NAD:
Northing:
Easting:

TYPE OF LOG: Deviation

LOCATION:

SEC TWP RGE

OTHER SERVICES
Neutron
Calipers
Electrics
Temperature
Fluid Resistivity

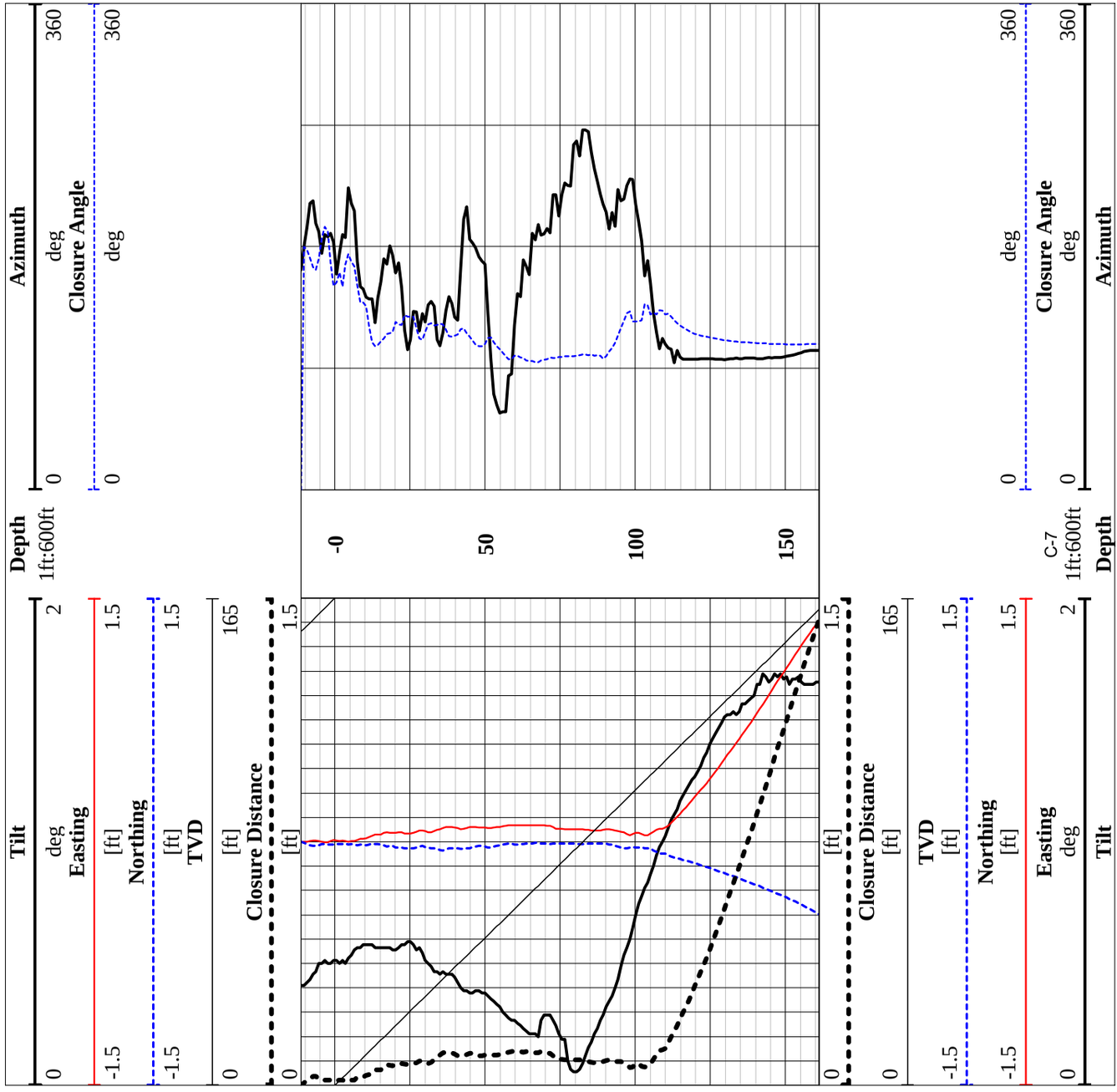
API No.

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.

DATE	06-15-2024	TYPE FLUID IN HOLE	water
RUN No.	Two	SALINITY	
TYPE LOG	MSI - Poly / 3 Arm	DENSITY	
DEPTH-DRILLER	178 ft.	LEVEL	89 ft.
DEPTH-LOGGER	173.2 ft.	MAX. REG. TEMP	
BTM LOGGED INTERVAL	173.2 ft.	DIGITIZE INTERVAL	0.4 - 0.1 ft.
TOP LOGGED INTERVAL		OPERATING RIG TIME	
DRILLER - RIG	Yellow Jacket	DRILLER	Jose / Jacob
RECORDED BY	T.Staatz		
WITNESSED BY	P. Bolen /T.Cassidy	FIRM	Navarro

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE		FROM	TO
1				* 10 in.	Steel	2.3 ft.	48 ft.
2	8.0 in.	110 ft.	178 ft.	* 9 in	Steel	2.7 ft.	110 ft.
3							

REMARKS: * Sonic Driven Casing



JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	Navarro Research & Engineering
WELL ID	400-001-GW
FIELD	NASA/WSTF
COUNTY	Dona Ana STATE New Mexico

TYPE OF LOG: Electrics, Caliper, Gamma Ray Temp, Fluid Res.

LOCATION:

NAD: Northing: Easting:

SEC TWP RGE

OTHER SERVICES
Deviation
Neutron

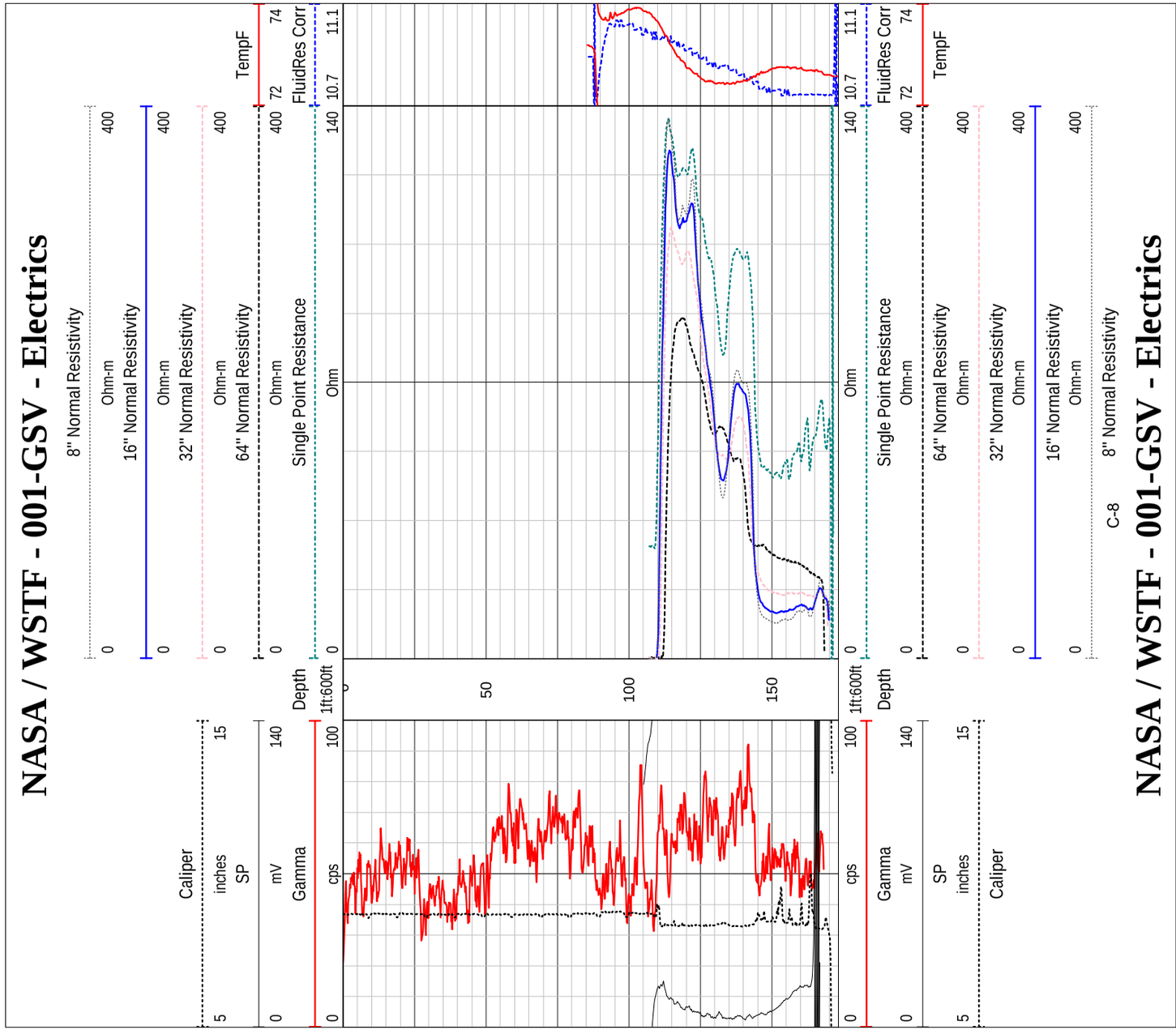
API No.

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.

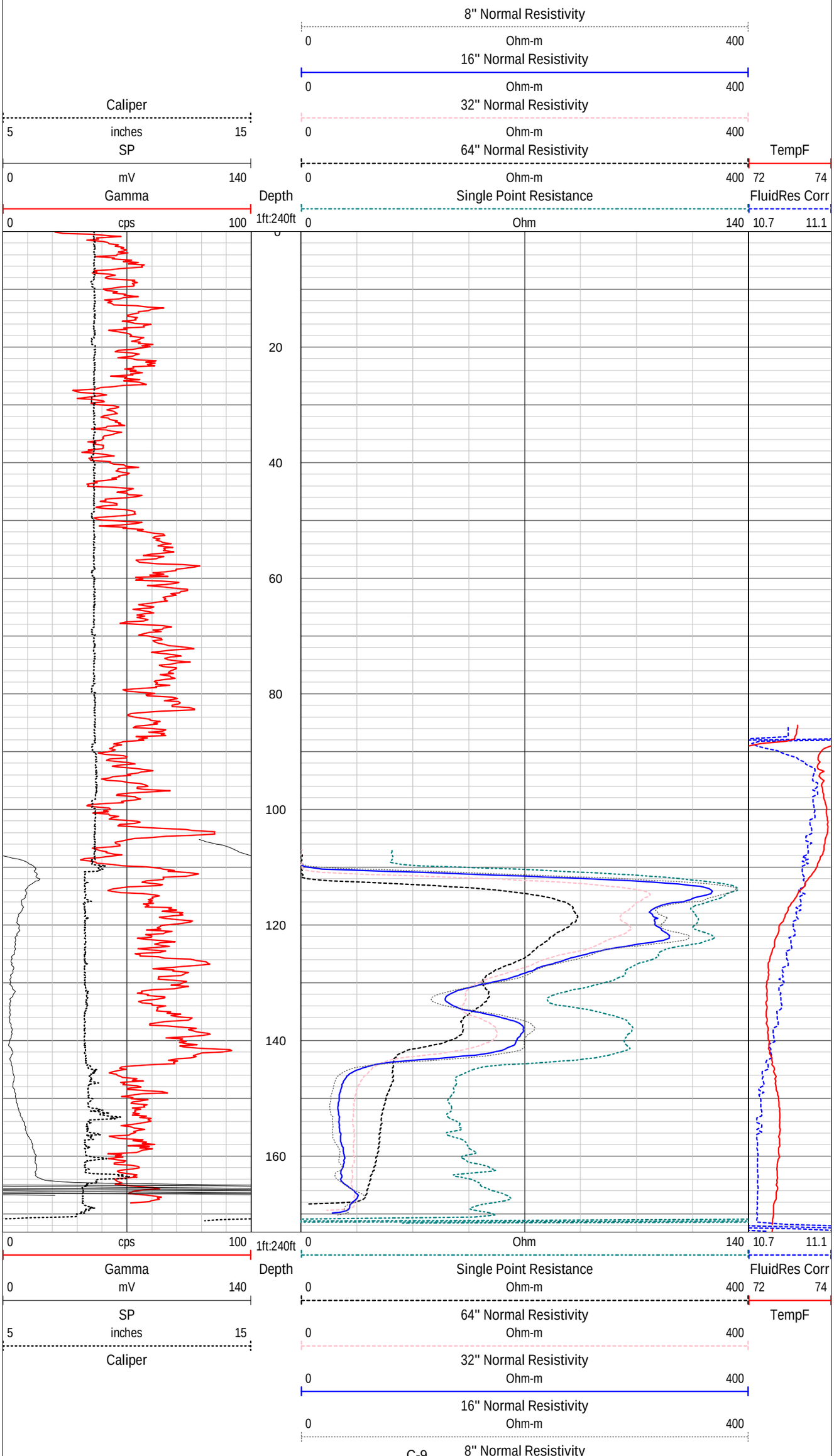
DATE	06-15-2024	TYPE FLUID IN HOLE	water
RUN No.	One, Five	SALINITY	
TYPE LOG	MSI - Poly / 3 Arm	DENSITY	
DEPTH-DRILLER	178 ft.	LEVEL	123 ft.
DEPTH-LOGGER	173.2 ft.	MAX. REG. TEMP	
BTM LOGGED INTERVAL	173.2 ft.	DIGITIZE INTERVAL	0.4 - 0.1 ft.
TOP LOGGED INTERVAL		OPERATING RIG TIME	
DRILLER - RIG	Yellow Jacket	DRILLER	Jose / jacob
RECORDED BY	T.Staatz		
WITNESSED BY	P. Bolen /T.Cassidy	FIRM	Navarro

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE		FROM	TO
1				* 10 in.	Steel	2.3 ft.	48 ft.
2	8.0 in.	110 ft.	178 ft.	* 9 in	Steel	2.7 ft.	110 ft.
3							

REMARKS: * Sonic Driven Casing



NASA / WSTF - 400-001-GW - Electrics



NASA / WSTF - 400-001-GW - Electrics

JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY	Navarro Research & Engineering
WELL ID	400-001-GW
FIELD	NASA/WSTF
COUNTY	Dona Ana STATE New Mexico

NAD:
Northing:
Easting:

TYPE OF LOG: Neutron, Gamma Ray Caliper

LOCATION:

SEC TWP RGE

OTHER SERVICES
Deviation
Electrics
Temperature
Fluid Resistivity

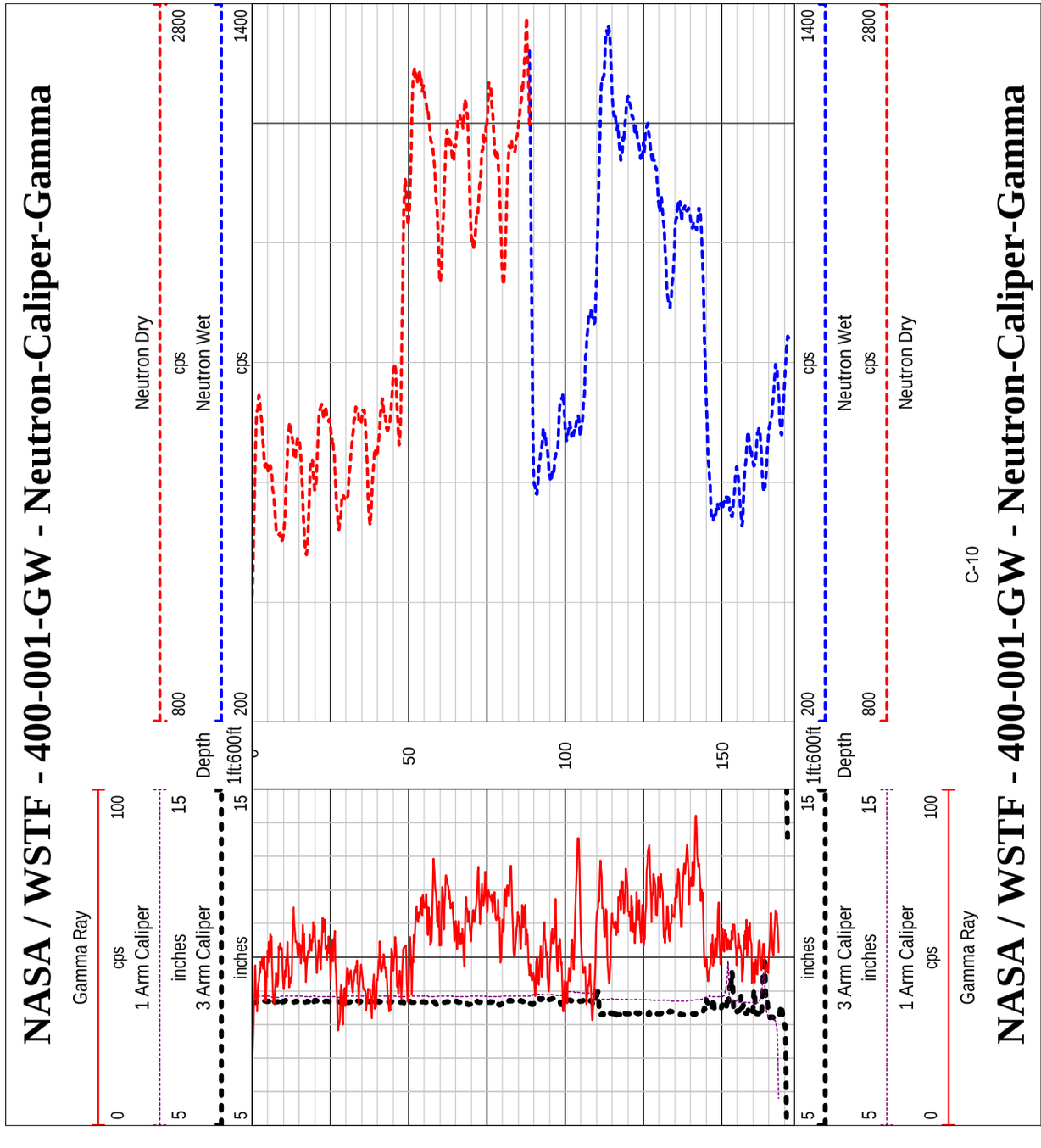
API No.

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.

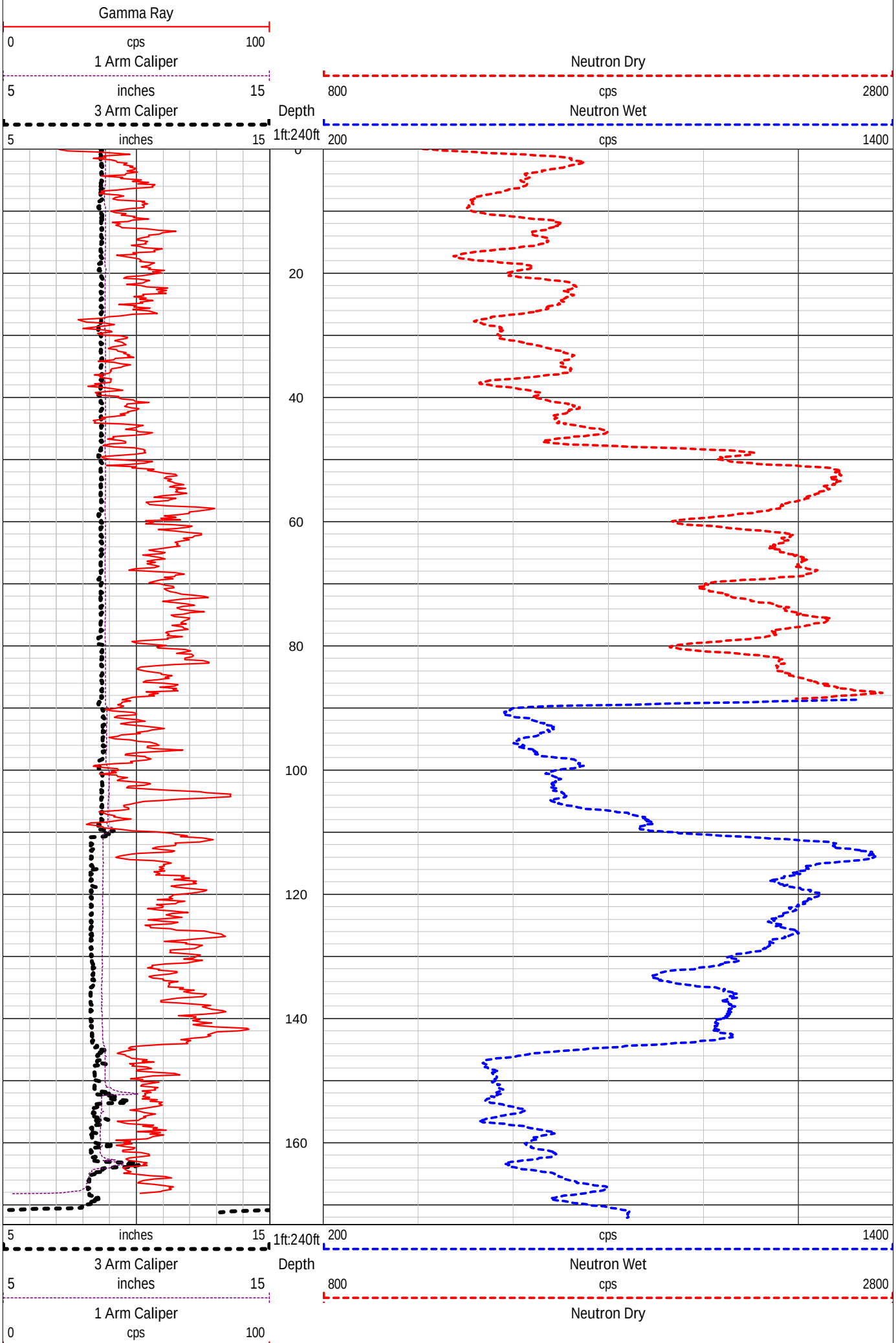
DATE	06-15-2024	TYPE FLUID IN HOLE	water
RUN No.	One, Two, Five	SALINITY	
TYPE LOG	MSI - Poly / 3 Arm	DENSITY	
DEPTH-DRILLER	178 ft.	LEVEL	89 ft.
DEPTH-LOGGER	173.2 ft.	MAX. REG. TEMP	
BTM LOGGED INTERVAL	173.2 ft.	DIGITIZE INTERVAL	0.4 - 0.1 ft.
TOP LOGGED INTERVAL		OPERATING RIG TIME	
DRILLER - RIG	Yellow Jacket	DRILLER	Jose / Jacob
RECORDED BY	T.Staatz		
WITNESSED BY	P. Bolen /T.Cassidy	FIRM	Navarro

RUN	BOREHOLE RECORD			CASING RECORD			
NO.	BIT	FROM	TO	SIZE		FROM	TO
1				* 10 in.	Steel	2.3 ft.	48 ft.
2	8.0 in.	110 ft.	178 ft.	* 9 in	Steel	2.7 ft.	110 ft.
3							

REMARKS: * Sonic Driven Casing



NASA / WSTF - 400-001-GW - Neutron-Caliper-Gamma



NASA / WSTF - 400-001-GW - Neutron-Caliper-Gamma

Appendix D Borehole Well Development Log

BOREHOLE / WELL DEVELOPMENT

Cover Page

Provide all depth measurements with respect to ground surface

Site/Screen Name:	400-001-GW	Project No.:	24EEHWMU
Location:	White Sands Test Facility	Field Personnel:	P. Bolen S. Rees
Lead Company:	Navarro	Document Reviewer:	
Supporting Company:	Yellow Jacket Drilling	Review Complete:	

FINAL DEVELOPMENT PARAMETERS

Borehole / Well Total Depth: 160 ft bgs

Screened Intervals: 140 and 155 ft bgs

Total Volume Withdrawn: (Airlifting/Swabbing/Jetting) 46.45 gals

Total Volume Withdrawn: (Development Pumping) NA gals

DEVELOPMENT TOOLS

Tool: Swab Description: 4-in Cup Used from: 133 ft to 155 ft

Tool: Bailer Description: Steel 2-in Used from: 140 ft to 155 ft

DEVELOPMENT DATA

METER CALIBRATION / VERIFICATION:

Date	Time	Meter Type	Totalizer Reading	Cumulative Withdrawn (gal)	Drawdown (ft bgs)	Pumping Rate (gpm)	pH	Temp (°C)	SC (µS/cm)	Turbidity (NTU)	Pump Intake (ft bgs)
6/26/24	1552			0	133 (Start)						
6/26/24	1552	Bailer		18.7	151.7						
6/27/24	0755			0	147 (Start)		8.62	22.9	1126	4.73	
6/27/24	0820	Swab			145.6 (After)						
6/27/24	830	Bailer		18.25	162.3		8.5	22.4	1073	off scale	
6/27/24	930				157.65	(4.65 ft/hr recharge)					
6/27/24	1245	Bailer		9.5	153.17		8.06	25.5	1093	250	

BOREHOLE / WELL DEVELOPMENT

BOREHOLE / WELL DEVELOPMENT (Continued)

Provide all depth measurements with respect to ground surface

Site/Screen Name: _____ Project No.: _____

Location: _____ Field Personnel: _____

DEVELOPMENT DATA (Continued)

Date	Time	Meter Type	Totalizer Reading	Cumulative Withdrawn (gal)	Drawdown (ft bgs)	Pumping Rate (gpm)	pH	Temp (°C)	SC (µS/cm)	Turbidity (NTU)	Pump Intake (ft bgs)