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Subject: File Transfer: NABORS Supplemental Hydro. Investigation and Dye Test Report - Lakeshore Rec,Landfill Siting,AR

SCS ENGINEERS

Project: 27222139.01 **Lakeshore Rec,Landfill Siting,AR**

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Bill;
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Dan

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SUPPLEMENTAL SUBSURFACE INVESTIGATION REPORT NABORS LANDFILL

Permit Nos. 0249-S1-R2, 0249-S4
AFIN: 03-00051

LAKESHORE RECYCLING SYSTEMS (LRS)

SCS ENGINEERS

27222323.00 | February 2024

9780 Maumelle Blvd
North Little Rock, AR 72113
501-812-4551

Professional Geologist Certification

I certify that I am a qualified groundwater scientist who has received a baccalaureate or postgraduate degree in the natural sciences. I have sufficient training and experience in groundwater hydrology and related fields, as demonstrated by state registration and completion of accredited university courses, which enable me to make sound professional judgments regarding groundwater monitoring and contaminant fate and transport.

I further certify that this report was prepared by me or by a subordinate working under my direction.

Dan McCullough, P.G. Date

Senior Hydrogeologist #1802

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1.0 INTRODUCTION

This Supplemental Subsurface Investigation Report documents the voluntary investigation conducted by SCS Engineers on behalf of Lakeshore Recycling Systems (LRS) at NABORS Landfill. The investigation was undertaken during the Due Diligence period between LRS and the Ozark Mountain Solid Waste District for the purchase of the NABORS facility. LRS has since ceased to pursue ownership of the facility.

The NABORS Landfill (herein referred to as Landfill) originally operated under Solid Waste Disposal Permit number 0249-S, as issued to RLH, Inc. (RLH) by the Arkansas Energy & Environment Division of Environmental Quality (DEQ), formerly the Arkansas Department of Environmental Quality (ADEQ), on June 14, 1988. The solid waste permit was transferred to Northwest Arkansas Regional Solid Waste Management District (District) on August 31, 2005. The Landfill is currently under Solid Waste Disposal Permit 0249-S1-R2 issued by the DEQ on August 10, 2006. Although the permit is considered "open," the Landfill stopped receiving waste on November 30, 2012 and initiated closure of Area 1-2, Cells 1-3 of Area 1-3, and the Class 4 Landfill areas. The District (later named Ozark Mountain Regional Solid Waste Management District) operated the Landfill from 2005 to 2014, at which time DEQ assumed control of operations and closure activities at the Landfill under the Post-Closure Trust Fund. DEQ is currently managing post-closure of the site.

There have been three previous hydrogeologic and geotechnical investigations conducted at the site. The first was performed by Grubbs, Garner, and Hoskyn (GGH) in 1987 in association with the original permitting effort for RLH (GGH, 1987). The investigation covered a 1,950-acre tract. The proposed permit modification associated with this report is contained in a small portion of this original acreage investigated by GGH.

The second investigation was performed in 1994 by Genesis Environmental Consulting, Inc. (GEC) for Northstar Engineering Consultants, Inc. (Northstar). Northstar was the consulting engineering firm responsible for the initial design. The purpose of the second characterization was to determine the clay overburden thickness, the competence of the underlying dolomite bedrock, and the recommended locations for the groundwater monitoring points in Area 1-3.

The third investigation was performed in 2005 by Genesis Environmental Consulting, Inc., a Terracon company. This investigation was conducted in association with the Class 1 Major Permit Modification in which NABORS proposed expansion into Area 1-3. The purpose of the third investigation was to thoroughly characterize the hydrogeologic setting of Area 1-3. Six (6) borings were drilled throughout the expansion area during the 2005 subsurface investigation; an additional 6 borings, drilled immediately adjacent to the proposed lateral expansion area, were converted to monitoring wells. Rising head permeability tests were conducted in borings to determine groundwater characteristics.

The purpose of the current Supplemental Subsurface Investigation report is to provide further geologic and hydrogeologic information within and surrounding Area 1-3, particularly Cells 4, 5, and 6; and to verify and/or further define the site's geologic and hydrogeologic model.

1.1 BACKGROUND INFORMATION

This report is intended to build upon the previously developed hydrogeologic model and provide further characterization of the bedrock and subsurface conditions. This section provides an integrated presentation of the hydrogeologic characteristics of the site. The data presented in this

section is a compilation of the data gathered during the literature review, previous investigations and the data relating to Area 1-3 gathered during this investigation.

This data obtained in this investigation, along with findings from previous investigations, confirmed the presence of moderately-thin sequences of clay and chert overlying the Ordovician Age Cotter Formation. The underlying bedrock surface is encountered at varying depths across the site. **FIGURE 1.1** shows the observed top of bedrock elevation for Area 1-2 and Area 1-3. This figure was generated by contouring the elevations at which bedrock was observed in borings from GEC's 1994 and 2005 subsurface investigations, installation of monitoring wells by Northstar Engineering in 1998 and the borings installed as part of this investigation. As depicted in the figure, bedrock topography underlying the site typically follows the surface topography. Although the lithology of the upper clay unit is not homogeneous, the clay unit and the underlying bedrock of the site can be grouped into distinct hydrogeologic units. The hydrogeologic units are grouped based upon similar geologic, geotechnical, and hydrogeologic properties. The hydrogeologic units are presented in **TABLE 1.** A graphical representation of the proposed expansion area is illustrated in the various cross-sections presented in **FIGURES 3.1** and **3.2.**

Three distinct lithologic units are depicted in the model: 1) alternating surficial layers of fat clay and chert overburden known as the Cotter residuum, 2) a relatively thin layer of fractured and weathered dolomitic bedrock, and 3) competent dolomite-chert bedrock of the Ordovician-aged Cotter Formation. The Cotter Formation is locally composed of competent, light gray, finely crystalline dolomite and fractured, concentrically banded black and white chert.

TABLE 1 Hydrogeologic Model Units NABORS Landfill

Geologic Unit	Brief Description	Hydrologic Characteristics
1	Cotter residuum overburden. Reddish-brown to orange fat clay with thin to thick lenticular beds of black and white concentrically banded chert. Some cherty gravel and chert fragments. Some silty clay and sandy clay lenses.	Non-water bearing. Average permeability of 1×10^{-7} cm/sec
2	Fractured, argillaceous, white to buff or gray dolomite with concentrically banded black and white chert beds. Transition zone from weathered to solid dolomite. Dolomite is finely crystalline and exhibits a sugary texture under hand lens. HCL reaction to powdered or scratched surface.	Seasonal influenced groundwater at **Unit 1/Unit 2** lithologic contact.
3	Cotter Formation - Competent, white to buff or gray dolomite with occasional beds of concentrically banded black and white chert. Dolomite is medium to finely crystalline and exhibits a sugary texture under hand lens. HCL reaction to powdered or scratched surface.	Groundwater occurs as secondary porosity along joints, other fractures, bedding planes, and in cherty zones. Low yield. Estimated hydraulic conductivity of 1.47×10^{-4}cm/sec.

Hydrogeologic Unit 1 (Unit 1) consists of an orange to reddish-brown fat clay with occasional red or black stratified banding present. Silty clay and sandy clay lenses are occasionally interbedded within this clay unit. A minor amount of gray mottling is associated with Unit 1 clays. The upper clay unit contains variable amounts of bedded, black and white, concentrically banded chert. The chert occurs in the form of thin to very thick lenticular beds, rounded gravel size particles, and angular gravel, cobble, and boulder size chert fragments. As mentioned above, the cherts are generally black and white or dark gray to light gray in color. The Cotter residuum overburden clay unit encountered across the 30-acre expansion property ranged in thickness from approximately 2 to 16 feet. Previous hydrogeologic reports presented geotechnical test results indicating that the clay unit is generally high in plasticity, with an average permeability of 1.0×10^{-7} cm/sec. The mean thickness for the Cotter residuum overburden observed during GEC's 1994 and 2005 subsurface investigation is 10.2 feet.

Hydrogeologic Unit 2 consists of weathered dolomite with occasional thin chert beds. It represents a transition zone from weathered to solid dolomite observed in Unit 3. The dolomite is generally white to buff or gray, fractured, argillaceous, finely crystalline, and exhibits a sugary texture when viewed under a hand lens. The dolomite only exhibited a visible reaction to HCl when scratched or powdered during field testing. The contact between Unit 1 and Unit 2 is a potential water bearing zone.

Hydrogeologic Unit 3 consists of competent, white to buff or gray dolomite bedrock with occasional thin beds of black and white concentrically banded chert. The dolomite is medium to finely crystalline, and exhibits a sugary texture when viewed under a hand lens. The dolomite only exhibited a visible reaction to HCL when scratched or powdered during field testing. This unit is a water bearing unit at depth; however, yield is typically low.

Units 2 and 3 are essentially the same hydrogeologic unit and were characterized based primarily upon the drilling characteristics, the geophysical properties of the rock, and the degree of weathering or fracturing observed during drilling. For example, the weathered dolomite tended to grade into a more competent dolomite. The dolomite formation underlying Area 1-3 is encountered at depths ranging from approximately 2 to 16 feet bgs.

The topographic surface expression observed at Area 1-3 is typical for dolomitic bedrock. The landforms are typically very rounded, smooth, and only slightly mottled and show less solubility than that of limestone. Unlike limestone terrain, drainage in areas of dolomitic bedrock is largely surficial with relatively little internal drainage. Groundwater was not observed at the contact between the Cotter residuum overburden and the weathered dolomitic bedrock transition zone during previous subsurface investigations. However, because drilling water was lost at this contact in all but one boring during GEC's 1994 subsurface investigation, and because seasonal springs coincide with this contact, it appears that groundwater is seasonally present along this contact.

In previous hydrogeologic reports, GEC concluded that groundwater is encountered at depth in the Cotter dolomite bedrock formation (Unit 3). In addition, evidence suggests that seasonally influenced groundwater is encountered at the contact between the Cotter residuum and the weathered dolomitic bedrock at the NABORS site. The depth to groundwater in the borings advanced during the 1994 and 2005 subsurface investigations varied widely, as did the static water level elevations measured in the borings following drilling activities. Based on the field data and the observation that groundwater movement in the Cotter Formation typically concentrates along joints, other fractures, and in cherty zones, it appears that groundwater (in Unit 3 underlying Area 1-3 at NABORS Landfill) occurs in a non-connected system.

The static water levels obtained during the 2005 investigation further indicate that the groundwater is moving in an isolated system of fractures in the competent dolomite bedrock underlying Area 1-3. The overall groundwater flow direction across Area 1-3 is to the south and southeast at an estimated hydraulic gradient of 0.041 feet/foot. Based upon rising head permeability slug tests conducted at the site in 2005 and 2006, the average hydraulic conductivity of the bedrock aquifer was estimated to be 2.90 $x10^{-4}$ ft/min. The linear groundwater flow velocity was estimated to be 2.65 X 10^{-4} ft/min or 3.81 X 10^{-1} ft/day.

Evaluation of groundwater flow (at Area 1-3 of the NABORS Landfill) through subsurface exploration programs, geotechnical testing, aquifer testing, and groundwater velocity calculations using Darcy's Law, indicate that a significantly greater flux of groundwater could move through the Cotter residuum overburden (Unit 1)/weathered dolomitic bedrock transition zone (Unit 2) than through the competent dolomitic bedrock. This is based on the fact that substantial drilling water was lost at the Cotter residuum overburden (Unit 1)/weathered dolomitic bedrock transition zone (Unit 2) contact. In addition, the seasonal springs coinciding with this contact seem to indicate that groundwater is influenced by seasonal precipitation. The findings of this study show that the transition zone is not connected to the aquifer located at depth within the competent dolomite bedrock. Therefore, groundwater appears to flow (seasonally) laterally through the contact zone between the overburden Cotter residuum (Unit 1) and the weathered dolomitic bedrock transition zone (Unit 2) and would exit the hydrogeologic system at location where this contact zone surfaces usually in ravines (springs).

The Initial Subsurface Site Investigation Report presents additional information concerning the occurrence of fractures and hydraulic conditions of groundwater. This was a voluntary investigation on the part of LRS performed during the Due Diligence period between LRS and the Ozark Mountain Solid Waste District with the intent of purchasing the NABORS facility. However, LRS has since ceased to pursue the goal of purchasing the NABORS facility. The following Report satisfies the Workplan (DIN #83013) approved by DEQ on December 12, 2022 (DIN #83041).

1.2 SUBSURFACE INVESTIGATION

Field work for the supplemental investigation included the advancement of four (4) additional exploratory borings and one (1) injection well. The four exploratory borings were designated EB-1, EB-2, EB-4 and EB-5 and were advanced within and near Cells 4, 5, and 6 of Area 1-3. The purpose of these four borings was to determine the size, density, and orientation of fractures within bedrock to depths of 10 to 20 feet below the groundwater surface. Each exploratory boring has a diameter of 3 inches. The injection well (IW-1) has a 4-inch diameter and is intended to become the introduction point for the 2023 dye test. The dye test is discussed in more detail in a separate work plan that was submitted to DEQ on January 26, 2023 (DIN # 83332) and approved by DEQ on January 31, 2023 (DIN # 83340). See **FIGURE 3.1** for a map depicting the locations of the four exploratory borings and the injection well.

1.3 BOREHOLE LOCATIONS

The location of EB-1 was selected to verify previous boring information from MW-1, BH-534D, BH-509D, and NAB-2, which are located in the vicinity of the Signature Blast Demonstration conducted in August 2008. During the demonstration, a noticeable drop in groundwater levels was recorded in NAB-2. In addition, the elevation of groundwater within these wells varies, with deeper levels exhibited in BH-509D and NAB-2 than in MW-1, BH-534D, and BH-586-D.

Boring EB-2, situated north of Area 1-3 and south of area 1-2, was also located to verify previous boring information and to be a southerly detection point for the dye test conducted from March through November 2023.

The location of EB-4 was selected to provide subsurface information in Cell 5 of Area 1-3. During previous investigations, borings were not drilled in this area (See attached **FIGURE 2** for location of all previous borings drilled).

EB-5 was placed between MW-509D and NAB-2 to help delineate the effects, if any, of the 2008 Blasting Demonstration.

The injection location for the dye test was situated near MW-1 and MW-1R. A 4-inch open completion well was drilled at location IW-1 presented on **FIGURE 1**.

1.4 DRILLING ACTIVITIES

Borings EB-1, EB-2, EB-4, and EB-5 were drilled by GTS, Inc. under the supervision of an SCS geologist. The exploratory borings were advanced through the overburden using a truck-mounted CME 75 drilling rig equipped with hollow stem augers with an 8.25-inch outer diameter and 4.25-inch inner diameter. Once bedrock was encountered, 4-inch PVC pipe was grouted in place within the borehole to prevent bridging of the overburden material. A surface casing was set to the bedrock surface at EB-2, EB-4, and EB-5; each was properly sealed to avoid surface water infiltration. At EB-1, no surface casing was installed because bedrock occurred at ground surface. Rock coring with wash rotary, using a 5-foot conventional core barrel, was then performed to reach total depth. Core samples were collected and analyzed by an SCS geologist on site, who recorded

- Rock Quality Designation (RQD);
- Fracture orientation and fracture density; and
- Any bit drops or sudden gains or losses in water.

Borings were advanced to elevations 10 to 20 feet below the groundwater interface. Each boring was completed as a 3-inch open borehole with no screen or filter pack, and stabilized water levels were recorded at a minimum of 24 hours after borehole completion.

Boring IW-1 was drilled by Anderson Engineering Consultants, Inc, using a Hillyard buggy mounted drill rig. The boring for IW-1 was advanced using an air hammer with a 4-inch diameter to drill from ground surface to total depth of 91.29 feet bgs. Cuttings were sampled and analyzed by an SCS geologist on site to determine lithology.

Upon completion of the exploratory boring and injection well installations the location, top of casing and ground surface elevations were surveyed by Consolidated Land Services, Inc., an Arkansas Licensed Surveyor. See **Appendix A** for the signed and sealed survey.

1.5 DOWNHOLE GEOPHYSICAL LOGGING

Once total depth was reached, downhole geophysical logs were obtained from each of the four exploratory boreholes. Caliper, natural gamma, density, resistivity, and Optical Televiewer (OTV) logs were collected by Century Geophysical Corporation of Tulsa, Oklahoma to examine fractures and density. Downhole geophysical logging was performed by Century Geophysical Corporation personnel on October 24-25, 2022. The results are attached within **Appendix A.**

The caliper log records the changes in diameter detected by a mechanical caliper proceeding from the base to the opening of the borehole, resulting in a vertical profile of the borehole. Effective at measuring voids, fractures, and similar openings in borehole walls, calipers are often used to identify vertical zones where enlargement has occurred. These zones are qualitatively interpreted as intervals where fractures may be present, alterations of the formation along the borehole wall that occurred during drilling, or lithologic and depositional voids.

The natural gamma log measures the natural gamma radiation emitted by radioactive elements. Higher gamma readings occur in the presence of clay and shale. Gamma radiation is emitted from radioisotopes, the most common of which are potassium-40 and products of uranium and thorium decay. The occurrence of these radioisotopes are indicators of lithology. Clay minerals contain potassium, including potassium-40, weathered out of micas and feldspars. Due to their structure, clays and shales also favor ion absorption, which can concentrate uranium and thorium isotopes. Organic matter associated with shale lithology can also capture uranium isotopes. Clean silica sands typically do not contain many of these gamma emitters. In carbonate sedimentary sequences, high gamma zones tend to indicate shale layers or uranium mineralization, which can be precipitated within fractures or diagenetically induced.

Electrical resistivity logging inputs an electric current between two electrodes and logs the resulting electric potential within the interval. Resistivity values are normally high for sands and low for clays. Resistivity logs must be run in a fluid filled borehole; as such, the only information gained from the NABORS resistivity logs was depth to groundwater.

The density log measures the bulk density of the associated rocks. The gamma ray intensity arriving at the detectors is an inverse function of the bulk density. A gamma ray source irradiates a stream of gamma rays into the formation, some of which are adsorbed, some passed on through the matrix, and some scattered. The ability of the matrix to attenuate the gamma rays is recorded as the intensity of scattered gamma rays arriving at two fixed distances from the gamma ray source. The bulk density of pure dolomite is around 2.85 and the bulk density of water is 1.0. Areas where bulk density decreases may reflect greater porosity and/or the presence of groundwater.

The Optical Televiewer tool takes sequential ring-shaped images of the borehole, each image being oriented using a magnetometer and accelerometers. When displayed in processing software, the borehole imagery is cut vertically at North and rolled out left to right. Planar features intersecting the borehole wall are visible in this setting as sinusoidal traces. A log analyst with experience interpreting OTV imagery uses the data to determine the attitude (orientation) of the observed planar features. This information is used to detect fractures, bedding plane orientation, solution features, and other borehole anomalies; however, it is important to note that distinction between fractures, bedding planes, and other features is a matter of qualitative rather than quantitative judgement. Analysis includes fracture dip and strike determination and classification of anomalies, if any.

1.5.1 Downhole Geophysical Logging Discussion

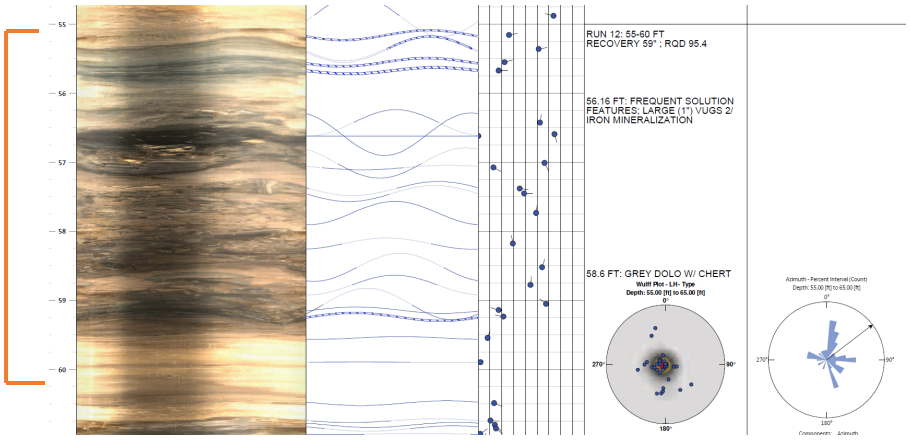
The OTV logs do not differentiate between categories of planar features. Sinusoidal traces identified to the right of the unrolled imagery were selected and measured by the log analyst, and there is no quantitative way to determine their identity. Core data and OTV imagery together, however, can lend insight into the nature and extent of observed planar features. Comparing OTV data to boring logs, field notes, and pictures shows the contributions of the OTV data to a comprehensive understanding of the subsurface.

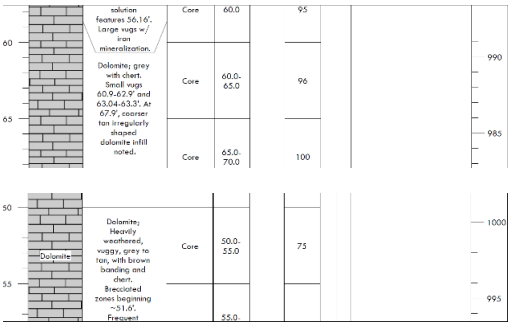
The boring data can help differentiate between types of planar features on OTV logs. For example, in Run 2 of EB-1 (10-15 ft), two intersecting, high-angle planar features are identified on the OTV logs as slightly thicker traces, followed by thinner, lower-angle traces. The core demonstrates a fracture at the site of the upper features, followed by intact core at the lower-angle features, helping to establish the difference between fractures and bedding planes as visualized by the OTV. Similarly, the 55-60 run on EB-1 demonstrates that chert nodules, whether in the context of a brecciated section or present as banding, are visible as traces. 15-20 feet of EB-2 illustrates how vuggy zones without core fractures can be traced as planar features.

Significantly, the OTV logs can qualify and contextualize the fracturing and RQD values observed in the core alone. This is illustrated by the 75.5-80.3 feet interval of EB-5. Again, intact sections of core circa 76-76.5 feet correspond with bedding plane or bedding plane microfracture sinusoidal traces. However, at the base of the core, a highly fractured zone seems not to be reflected on the geophysical logs.

These patterns are illustrated on the following Exhibits. These Exhibits and others linking specific areas of core photos, OTV imagery, and boring logs are attached as **Appendix B**.

Exhibit 2: EB-1, 55-60 Feet





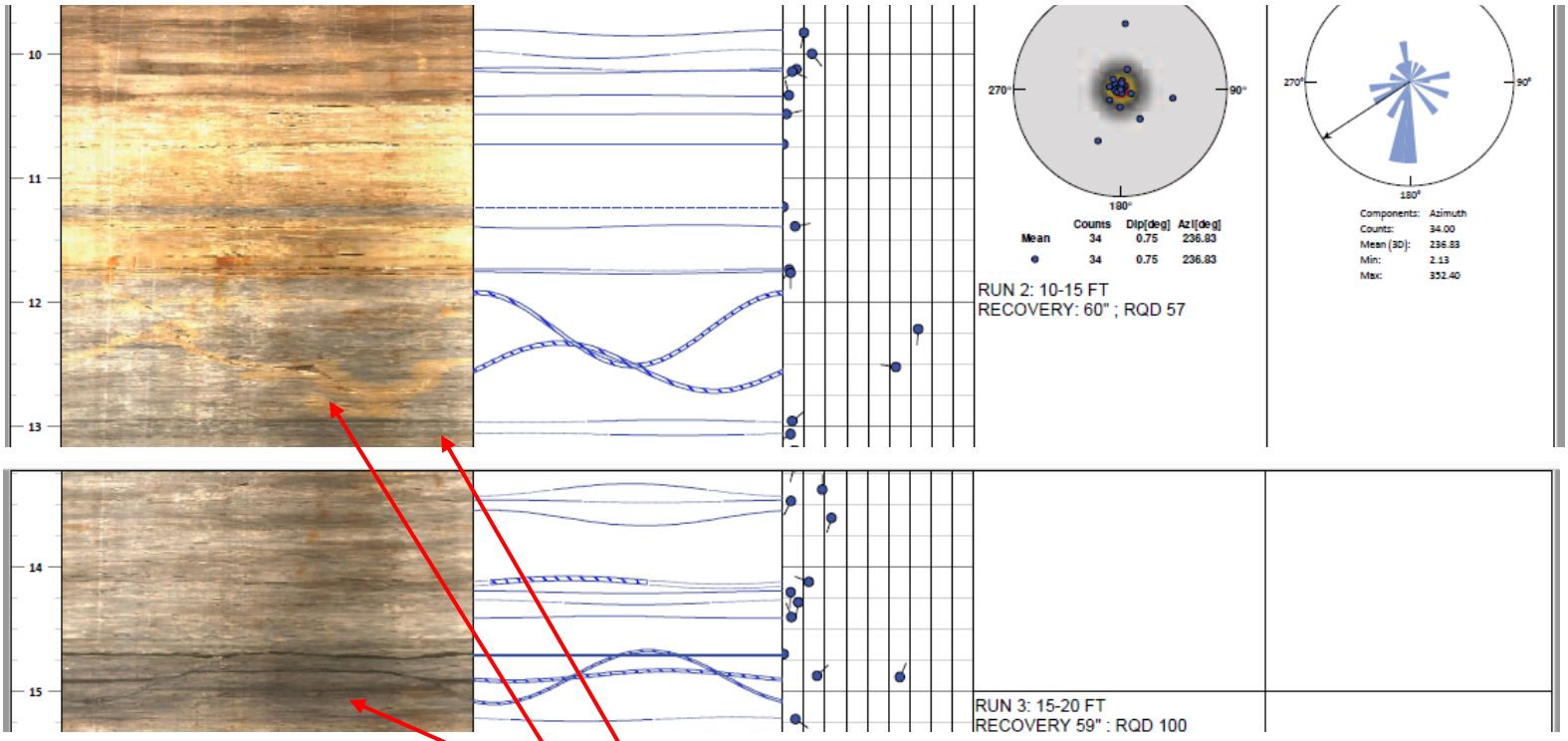


Exhibit 3: EB-2, 10-15 feet

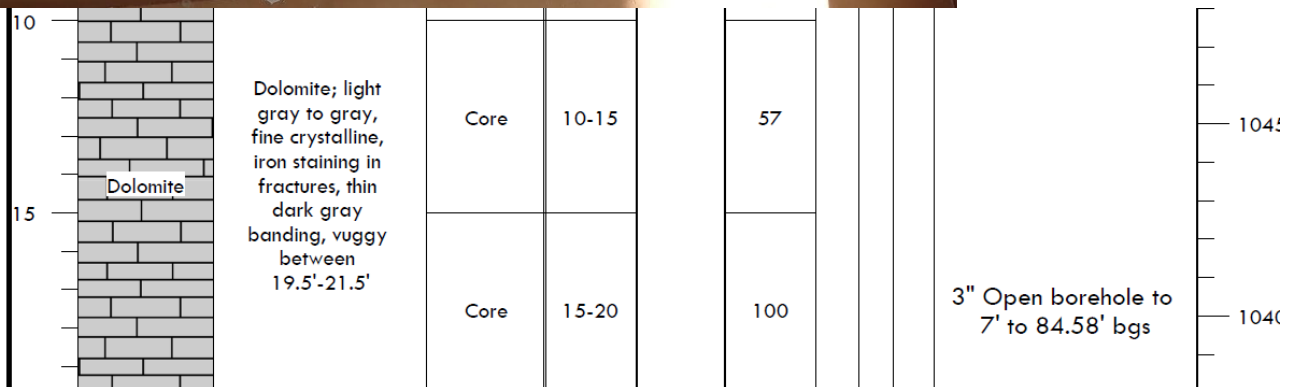
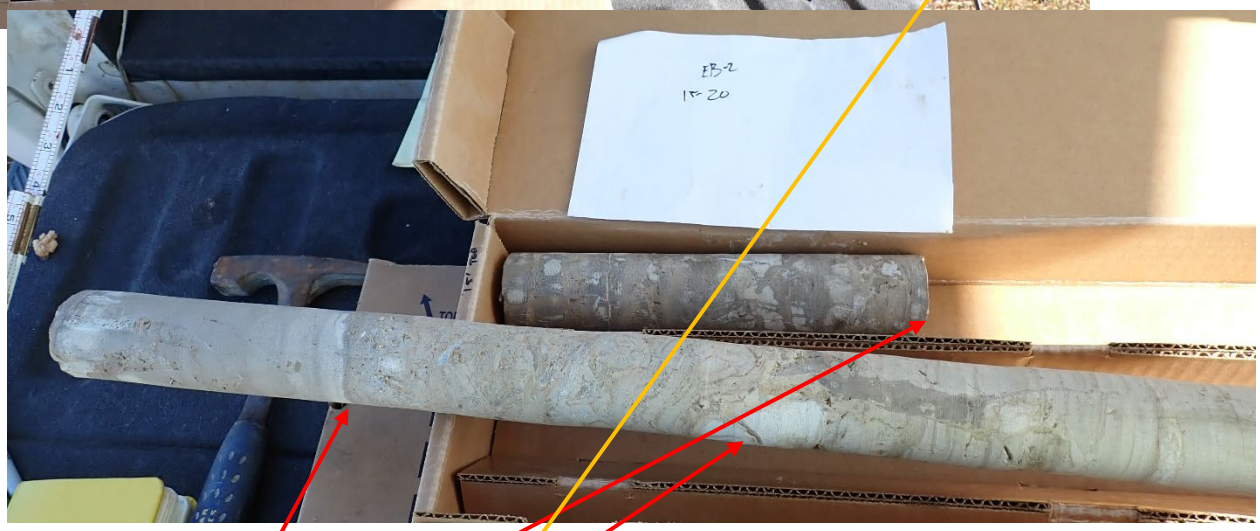
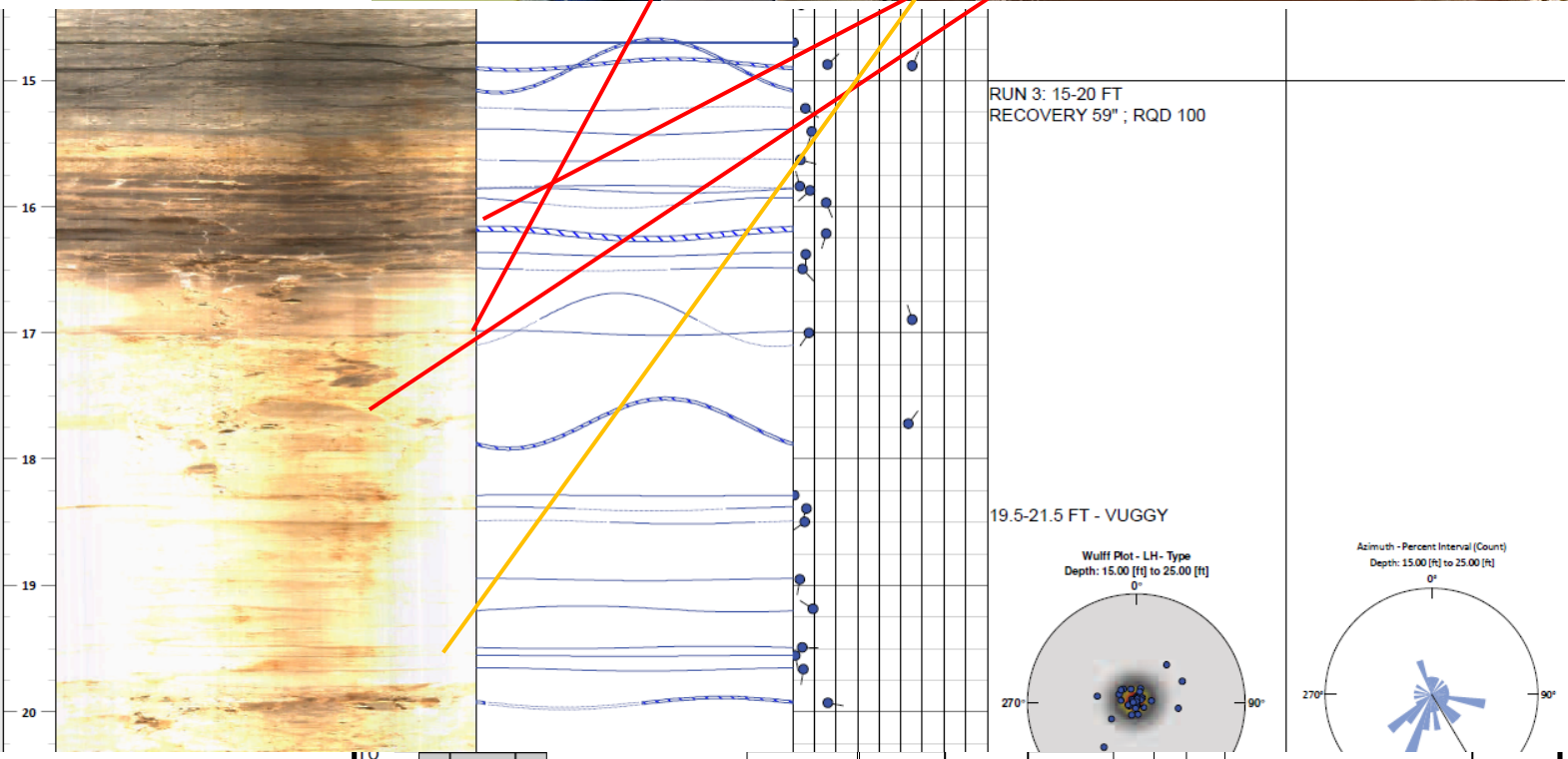


Exhibit 4: EB-2, 15-20 feet





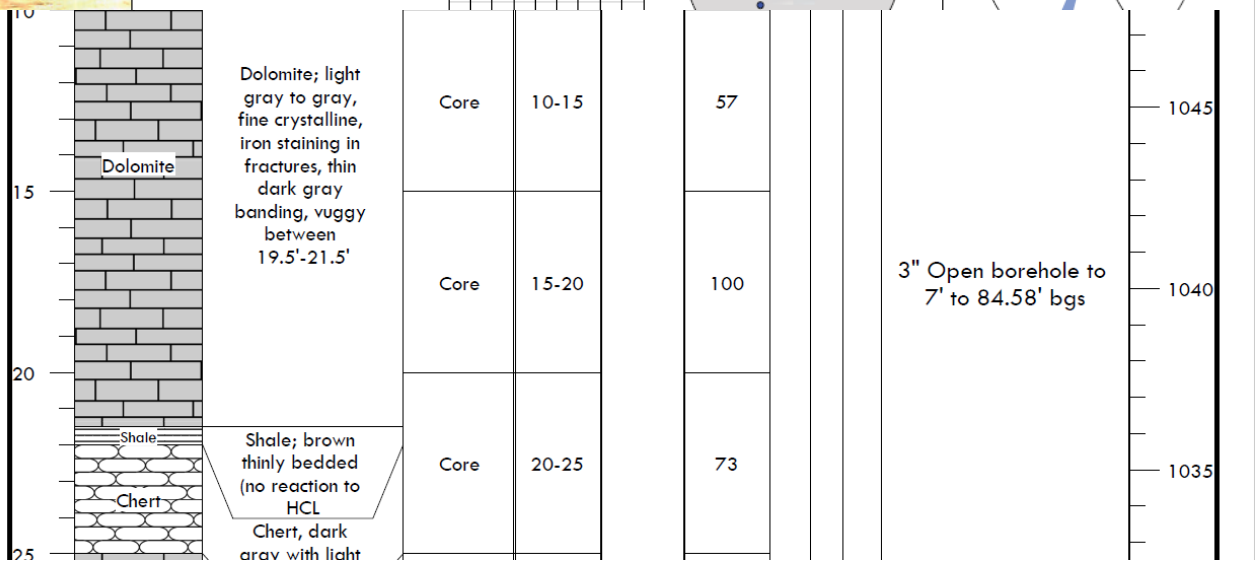
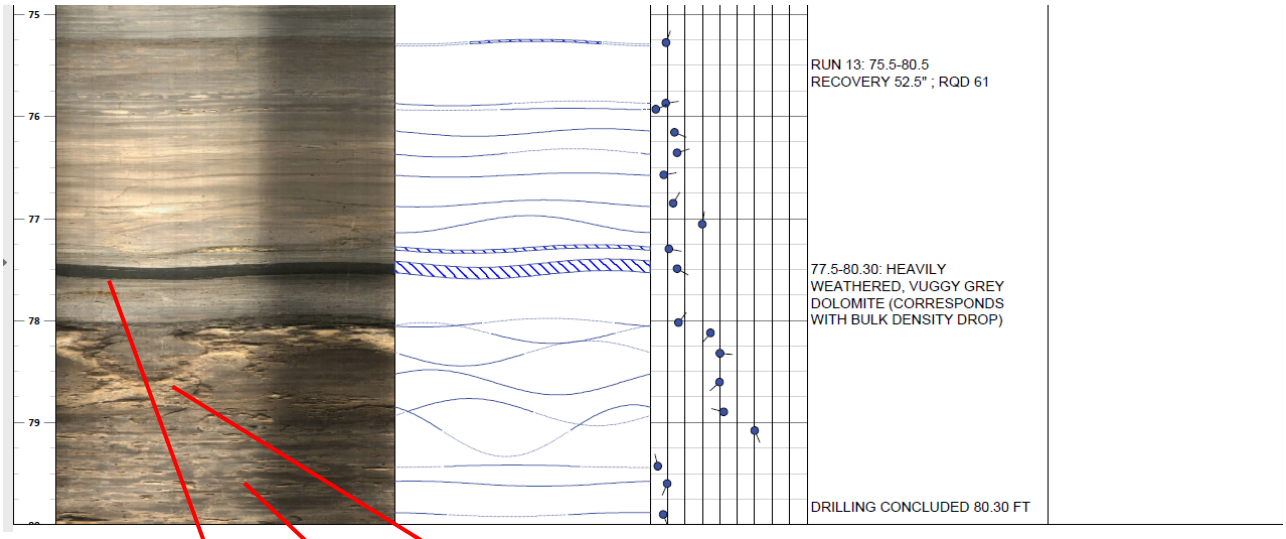
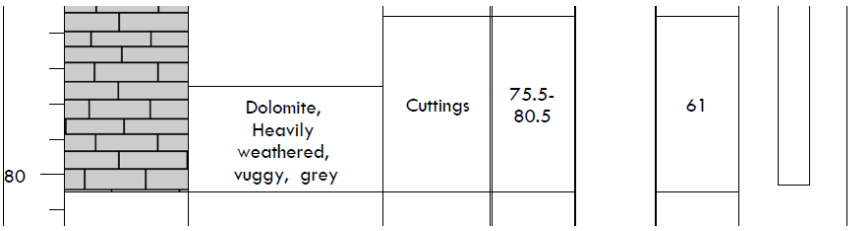


Exhibit 12: EB-5, 75-80 Feet





1.6 GROUNDWATER LEVELS

Having completed drilling and downhole geophysical logging, each open borehole was utilized for groundwater elevation determination and dye test monitoring as discussed in the Dye Test Report.

Based on the results of the borings, groundwater onsite is unconfined and is encountered within secondary porosity, either fractures or solution features in the Cotter dolomite. Typically, Dolomite has a lower solubility than calcite; however, some solution features may be present in areas of the bedrock with higher calcium carbonate contents. As further detailed in the downhole geophysical logs whose results are discussed in **Section 2.0**, these fracture zones and solution features are minor. The hydraulic conductivity within the dolomite, as further detailed in **Section 1.7,** is low.

During the current investigation, groundwater depths were noted when they were encountered during drilling. **Table 2** below shows the recorded stabilized water levels that were obtained in each boring. These approximate depths to groundwater were confirmed by the resistivity logs discussed in Section 3.0. **Figures 5.1** and **5.2** contextualize the groundwater elevations in the 2022 borings alongside groundwater elevations from established borings using water levels taken March 9, 2023.

Table 2: Observed Groundwater Elevations

Piezometer	Ground Surface Elev. (fmsl)	TOC Elev. (fmsl)	Stabilized Groundwater Level (ft bgs)	Stabilized GW Elev. (fmsl)
EB-1	1050.95	1050.95	63.11	987.84
EB-2	1057.68	1058.95	66.48	991.20
EB-4	1042.58	1044.08	54.69	987.89
EB-5	988.86	989.42	67.93	920.93
IW-1	1061.11	1062.73	62.76	998.35

1.7 AQUIFER TESTING

Packer testing was conducted to measure the permeability of selected sections of the boreholes. The first phase of the process involved geophysical logging and flow profiling of the boreholes as discussed in **Section 1.5**. Detailed borehole logging was essential in visually identifying fractures, bedding planes, vugs, and possible water producing zones. This information was used to select isolation points for a series of packer tests. An SCS qualified geologist identified, with the aid of the geophysical logs and the boring logs, two zones of interest in each exploratory borehole.

SCS professionals performed the packer tests on December 7-8, 2022. Prior to inserting the packers, depth to water was recorded in each borehole. To isolate the 2-foot vertical intervals, SCS used Solinst Model 800 Straddle Packers of 1.8" outer diameter with centralizers, connected by ½" NPT perforated pipe. A length of ¼" outer diameter (O.D.) inflation line linked the two packer balloons, and a second length of inflation line extended from the top packer to the hand pump aboveground. The appropriate depth was reached by attaching riser pipe to the packers in 5-foot increments, lowering into the borehole until the perforated interval was situated at the desired elevation. Then the riser pipe was secured at the top of casing, and the packer was inflated using the hand pump to 35-40 psi, increasing if hydrostatic pressure were present.

Once the interval was isolated, an attachment with a pressure gauge and a water pump hose was added. This hose connected to a generator-powered utility transfer pump connected to a water tank.

A valve on each connection controlled the input pressure, while a flow gauge recorded input volume. The distance from the ground surface to the pressure gage and the initial reading on the flow meter were recorded.

Each packer test lasted 5 minutes. Water was pumped into the interval at the maximum allowable pressure at which the packers remained fixed in position. When the test concluded, the final volume from the flow meter and the pressure reading from the gage were recorded. Before moving packers from their position, pressure was released so that packers relaxed to initial diameter and could be moved without damage.

The field measurements were used to calculate the permeability of the selected intervals. This information aids in identifying the various water producing zones and their correlation to the geology across the site.

Table 3: Packer Test Data & Results

	EB-1		EB-2		EB-4		EB-5	
Interval Tested (ft bgs)	**55-58**	**71-74**	**63-66**	**73-76**	**42-45**	**68-71**	**69-72**	**75-78**
Top of Packer (ft bgs)	53	69	61	71	40	66	67	73
Midpoint of Interval (ft bgs)	56.5	72.5	64.5	74.5	43.5	69.5	70.5	76.5
Depth to Water (ft bgs)	56.79	56.79	65.98	65.98	53.37	53.37	65.66	65.66
Ground Surface to Gage (ft)	5.5	6.3	2.42	2.42	2.92	2.5	1.58	5.42
Volume Water (gal)	3.24	1.47	2.26	1.59	22.68	7.37	12.78	9.79
Gage Pressure (psi)	16	13	20	20	18	18	10	19
Gage Pressure (ft)	6.88	5.59	8.6	8.6	7.74	7.74	4.3	8.17
Time (min)	5	5	5	5	5	5	5	5
Q (gal)	0.65	0.29	0.45	0.32	4.54	1.47	2.56	1.96
Head (grav)	62.29	63.09	68.40	68.40	46.42	55.87	67.24	71.08
Head (tot)	69.17	68.68	77.00	77.00	54.16	63.61	71.54	79.25

Results	EB-1		EB-2		EB-4		EB-5	
k (ft/yr)	110.55	50.34	69.27	48.73	988.27	273.43	421.64	291.67
k (in/day)	3.63	1.66	2.28	1.60	32.49	8.99	13.86	9.59
k (cm/sec)	**1.07E-04**	**4.87E-05**	**6.69E-05**	**4.71E-05**	**9.55E-04**	**2.64E-04**	**4.08E-04**	**2.85E-04**

Previous Hydraulic Conductivity Results (Rising Head)

BH No.	BH-509-D	BH-534-D	BH-586-D	BH-612-D	BH-633-D	CH-1
Oct 2005 (cm/sec)	2.91E-06	1.11E-05	7.12E-06	1.11E-05	2.13E-05	8.75E-06
June 2006 (cm/sec)				4.16E-05	2.53E-04	

It is important to note the differences in procedure when comparing results from the GEC rising head permeability tests to results from the 2022 packer tests. The October 2005 slug tests were performed in open boreholes, cased only from ground surface to the bedrock contact. During these tests, an InSitu MiniTroll Pro pressure transducer situated within the water column of the borehole collected recharge measurements after a certain water of volume was removed using a Grundfos pump. The Bouwer-Rice Method for Unconfined Aquifers (1976) was used to calculate the hydraulic conductivity; however, because the test did not meet the Bouwer-Rice assumption of instantaneous change in water level within the borehole, the resulting conductivity values were presented as estimates.

The two June 2006 rising head slug tests were performed to obtain data that met the assumptions of the Bouwer-Rice method, in accordance with ASTM D4044-96(2002) Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers. Once the pressure transducer was placed within the water column, a Schedule 40 PVC slug filled with sand was lowered into the boring and the water level allowed to equalize. The instantaneous removal of the slug, followed by the initial fall and gradual rise in water level to pre-slug conditions, were relayed by the pressure transducer.

In contrast, the intervals in the packer test were chosen and isolated to highlight areas of interest identified from the boring and geophysical logs. This allowed SCS to test different zones within the same water column, whereas the slug test could not have differentiated between them.

The hydraulic conductivity results from the 2022 packer test all fall within the range of hydraulic conductivity values found in the 2005-2006 slug test results.

1.8 DYE TRACING TEST

SCS Engineers performed a dye tracing investigation at the NABORS Landfill site. The investigation began with site reconnaissance on December 20, 2022, and collection of charcoal dye traps and water samples at dye monitoring points concluded on November 28, 2023. After two rounds of background monitoring for commonly used tracer dyes, Dye Trace 23-01 was placed into the bottom of IW-1 using a tremie pipe on March 1, 2023. An extended flush of clean water from a local residential well was conducted through April 17, 2023 to mobilize the dye.

During the subsequent monitoring events, fluorescein dye was detected in six of the 53 dye monitoring points. The results of the dye tracing test are explored in detail in the NABORS Dye Tracing Investigation Report, attached as **Appendix D**.

2.0 RESULTS SUMMARY

2.1 OBSERVATIONS EB-1

Drilled to 81.95 feet bgs, 969.00 fmsl

Overburden thickness 0 feet

Bedrock RQDs: As represented on the boring logs in Appendix A, bedrock was present at ground surface at EB-1; as such, coring commenced at ground surface. From 0 to 6 feet bgs, grey to light grey dolomite with brown and dark grey banding was encountered, followed by brown, thinly bedded, noncalcareous shale from 6 to 7 feet. Grey dolomite, with some chert and some small vugs, resumed from 7 to 14.5 feet. Rock quality designation (RQD) was fair in the initial two runs at 52 and 62, but

was poor in the third at 19. A thin layer of tan sandstone occurred at 14.5-14.6 feet, after which several runs of competent dolomite with some chert and occasional vugs were recorded with RQDs ranging from 72 to 100. Some iron staining was noted at approximately 18-20 feet.

A thin bed of brown to black shale occurred from 36.15 to 36.3 feet, followed by fairly competent dolomite. A heavily weathered zone with brecciation began at 51.6 feet, concluding near 56.16' with large vugs containing iron mineralization; RQD, however, remained fair to good at 75. From 55 feet bgs to depth, RQDs were 85 or greater. Three more thin beds of black noncalcareous shale occurred within the dolomite between 70 and 80 feet, with two more brecciated zones noted in the same interval. Boring was completed 81.95 feet bgs.

Noted Fracture Intervals: No voids or large fractures were noted on any geophysical logs. Small structural features noted on the ATV logs for each boring can likely be attributed to bedding planes, micro-fractures, or vugs. As such, the low RQD values on certain core runs below the weathered contact interval likely represent mechanical breaks due to drilling rather than existing fractures. The caliper logs showed almost no variation in borehole sizes, indicating no vertical zones with enlargement. Therefore, zones of large fractures are not indicated.

Bit Drops: No bit drops were recorded during drilling.

Groundwater Depths: The static groundwater level was obtained on October 20, 2022 at 63.11 feet bgs, or 987.84 fmls.

Geophysical Log Observations:

Natural Gamma Log: An increase in natural gamma was observed from 50 to 60 feet bgs, possibly indicating an interval of higher mineralization, which was observed in the core samples.

Bulk Density Log: Areas of lower bulk density between 50-63 feet bgs could represent greater porosity or the presence of groundwater. The initial low-density zone coincides with the weathered contact zone. These observed changes in bulk density are consistent with the boring logs and coincides with the zone noted on the boring logs that exhibited weathering, brecciation, and vugs containing iron minerals, which could suggest the presence and flow of groundwater.

Resistivity Log: Indicates that groundwater was present during logging at 58 feet bgs, which was within the weathered, brecciated, vuggy zone noted on the borehole log and consistent with the other borehole geophysical logs.

Optical Televiewer Log: Indicates vuggy texture from 50-55' consistent with heavily weathered core appearance noted on the borehole log. Solution features and banding also noted ~55.5-59.25'.

Hydraulic Conductivities: 55-58 feet — 1.07E-04; 71-74 feet — 4.87E-05

Fluorescein Detected? No

2.2 OBSERVATIONS EB-2

Drilled to 84.58 feet bgs, 973.10 fmsl

Overburden thickness 7 feet

Bedrock RQDs The core retrieved from 10 to 15 feet exhibited fair RQD at 57, as well as iron staining within fractures, but the subsequent cores all exhibited competent RQDs ranging from 73 to 100. Brown, thinly bedded, noncalcareous shale occurred from 21.5 to 22 feet, followed by dark gray chert from 22 to 25 feet, before grey dolomite with dark grey banding resumed and continued to depth. A thin sandstone layer, approximately 4 inches, was noted at 28.5 feet. Occasional chert nodules and chert interbedding were present within the dolomite, as were vuggy zones with some quartz crystallization. From 65-70 feet, brecciated dolomite was encountered. Drilling concluded at 84.58 feet.

Noted Fracture Intervals No voids or large fractures were noted on any logs. Small structural features noted on the ATV logs for each boring can likely be attributed to bedding planes, micro-fractures, or vugs. The caliper logs showed almost no variation in borehole sizes, indicating no vertical zones with enlargement. Therefore, zones of large fractures were not indicated.

Bit Drops: No bit drops were noted during drilling.

Groundwater Depth: The static water level in EB-2 was measured on October 20, 2022 at 66.48 bgs, or 991.2 fmsl.

Geophysical Log Observations:

Natural Gamma Log: A spike in natural gamma occurred ~65.5 feet.

Bulk Density Log: Fairly consistent throughout, with minor drop around 21 feet (corresponding with vuggy zone followed by shale). An overall reduction from about 55-67 feet corresponds roughly with alternating cherty and vuggy zones including areas of intense weathering. A drop at 64 feet corresponds with chert nodules and vugs and exhibits iron staining on the OTV logs.

Resistivity Log: Confirms groundwater encountered at approximately 55.5' bgs. Shape of resistivity curve mirrors shape of bulk density curve.

Optical Televiewer Log: Iron staining was observed at approximately 64 feet bgs in EB-2 during ATV geophysical logging. At this depth, vuggy texture and chert nodules were noted in the core samples. However, iron staining was not observed to that extent during drilling. The staining could be oxidation on the borehole wall from volatiles found in the groundwater. A drop in bulk density at this depth could be a further indication of increased porosity and/or groundwater transit at this depth.

Hydraulic Conductivities: 63-66 feet — 6.69E-05; 73-76 feet — 4.71E-05

Fluorescein Detected? No

2.3 OBSERVATIONS EB-4

Drilled to 81.49 feet bgs, 962.59 fmsl

Overburden thickness 6.5 feet

Bedrock RQDs: As indicated on the boring logs found in **Appendix A**, the initial run of coring at EB-4 demonstrated water loss and poor rock quality, with an RQD of 32. Tan dolomite with brown banding exhibited weathering and iron staining within fractures. Though RQD improved in subsequent runs, water loss continued throughout drilling. Runs 2-4 exhibited good rock quality, with RQD between 88

and 100, but runs 5-8 ranged from 49-63 RQD. Vugs were encountered from 12-13.3 and 18-18.75 feet; in the latter zone, vugs were filled with silty clay. Fossils, likely gastropod, were noted between 26.5 and 27.5 feet. Weathering and fracturing occurred at 29-30 feet followed by interbedded chert up to 2" thick. A brecciated zone with chert nodules occurred at 45-50 feet. Calcite precipitation was present within vugs at 50-55 feet. Two runs with poor RQD extended from 60-70 feet, but good rock quality was recorded from 70-81.49 feet.

Noted Fracture Intervals: No voids or large fractures were noted on any logs. Small structural features noted on the ATV logs for each boring can likely be attributed to bedding planes, micro-fractures, or vugs. The caliper logs showed almost no variation in borehole sizes, indicating no vertical zones with enlargement. Therefore, zones of large fractures were not indicated.

Bit Drops: Drillers noted a bit drop of approximately 4 inches at 7.5 feet bgs and a bit drop of approximately 1 inch at 9.25 feet bgs.

Water Loss: Starting run 1 of coring (6.5 feet) and continuing to total depth

Groundwater Depth: The static water level for EB-4 was recorded on October 20, 2022 at 54.69 feet bgs or 921.49 fmsl.

Geophysical Log Observations:

Natural Gamma Log: Spike at approximately 45 feet, again at 58 and 63 feet bgs. This could indicate zones of remineralization. Brecciation with remineralization was observed ~45 feet, along with iron staining in the area, suggesting a zone where occasional groundwater transit may occur or have occurred. Chert banding was observed from 57-59 feet, with a fractured zone at about 61 feet followed by thinner chert banding circa 63 feet.

Bulk Density Log: Reduced bulk density was recorded at approximately 45 feet and approximately 51 feet, a potential indicator of increased porosity or the presence of groundwater. Another drop in bulk density at 17 feet seems, in the OTV imagery, to correspond to a thin bedding plane or solution feature.

Resistivity Log: Resistivity not recorded for this boring.

Optical Televiewer Log: Iron staining was observed at approximately 43 feet bgs at EB-4 during OTV geophysical logging. Iron precipitation was noted during drilling in the 40-45 ft bgs interval; however, the staining depicted by the OTV appears more pronounced. The staining could be oxidations on the borehole wall from volatiles found in groundwater transmitted through this zone. From 43-48 feet, solution features were noted as structural features on the OTV logs, corresponding with remineralized brecciation noted in the boring logs.

Hydraulic Conductivities: 42-45 feet — 9.55E-04; 68-71 feet — 2.64E-04

Fluorescein Detected? No

2.4 OBSERVATIONS EB-5

Drilled to 80.30 feet bgs, 909.12 fmsl

Overburden thickness 16.5 feet bgs to bedrock (includes 3.25 feet of riprap)

Bedrock RQDs: As indicated on the boring logs found in Appendix A, the RQD values recorded within EB-5 were above 85, with three exceptions: 16.5-20.5 feet, 30.5-35.5 feet, and 75.5-80.3 feet. These intervals had RQDs of 50 to 68. The composition of the bedrock was fairly consistent: light grey to grey finely crystalline dolomite with dark grey banding & intervals of interbedded chert. Some small vugs were noted at 59-59.5 feet. From 75.5-80.3 feet, the dolomite was heavily weathered and vuggy.

Noted Fracture Intervals: No voids or large fractures were noted on any logs. Small structural features noted on the ATV logs for each boring can likely be attributed to bedding planes, micro-fractures, or vugs. The caliper logs showed almost no variation in borehole sizes, indicating no vertical zones with enlargement. Therefore, zones of large fractures were not indicated.

Bit Drops No bit drops were observed during drilling.

Groundwater Depths The static water level at EB-5, recorded October 20, 2022, was 67.93 feet bgs, or 921.49 fmsl.

Geophysical Log Observations

Natural Gamma Log: A spike ~21 feet bgs after initial decline after transition from clay overburden to dolomite bedrock, corresponding to solution features on OTV logs. Natural gamma elevated again at ~43 feet (likely corresponding to a chert band) and from ~51-58 feet (zone of frequent chert banding).

Bulk Density Log: Drop in bulk density at 35 ft bgs. Decline starting 75 ft bgs corresponding with heavily weathered zone seen in boring logs and OTV.

Resistivity Log: Indicates water at approximately 63.5 ft bgs at time of logging.

Optical Televiewer Log: Heavily weathered, vuggy grey dolomite corresponding with drop in bulk density 75.5-80.3 feet.

Hydraulic Conductivities: 69-72 feet — 4.08E-04; 75-78 feet — 2.85E-04

Fluorescein Detected? No

2.5 OBSERVATIONS IW-1

Drilled to 91.29 feet bgs, 969.82 fmsl

Overburden thickness 4 feet

Bedrock RQDs Not applicable – no core collected

Noted Fracture Intervals No voids or large fractures were noted on any logs. Small structural features noted on the ATV logs for each boring can likely be attributed to bedding planes, micro-fractures, or vugs. The caliper logs showed almost no variation in borehole sizes, indicating no vertical zones with enlargement. Therefore, zones of large fractures were not indicated.

Bit Drops No bit drops were observed during drilling.

Groundwater Depths: On October 20, 2022, the water level at IW-1 was recorded as 62.76 feet bgs or 998.35 fmsl.

Geophysical Log Observations: N/A

3.0 SUMMARY AND CONCLUSIONS

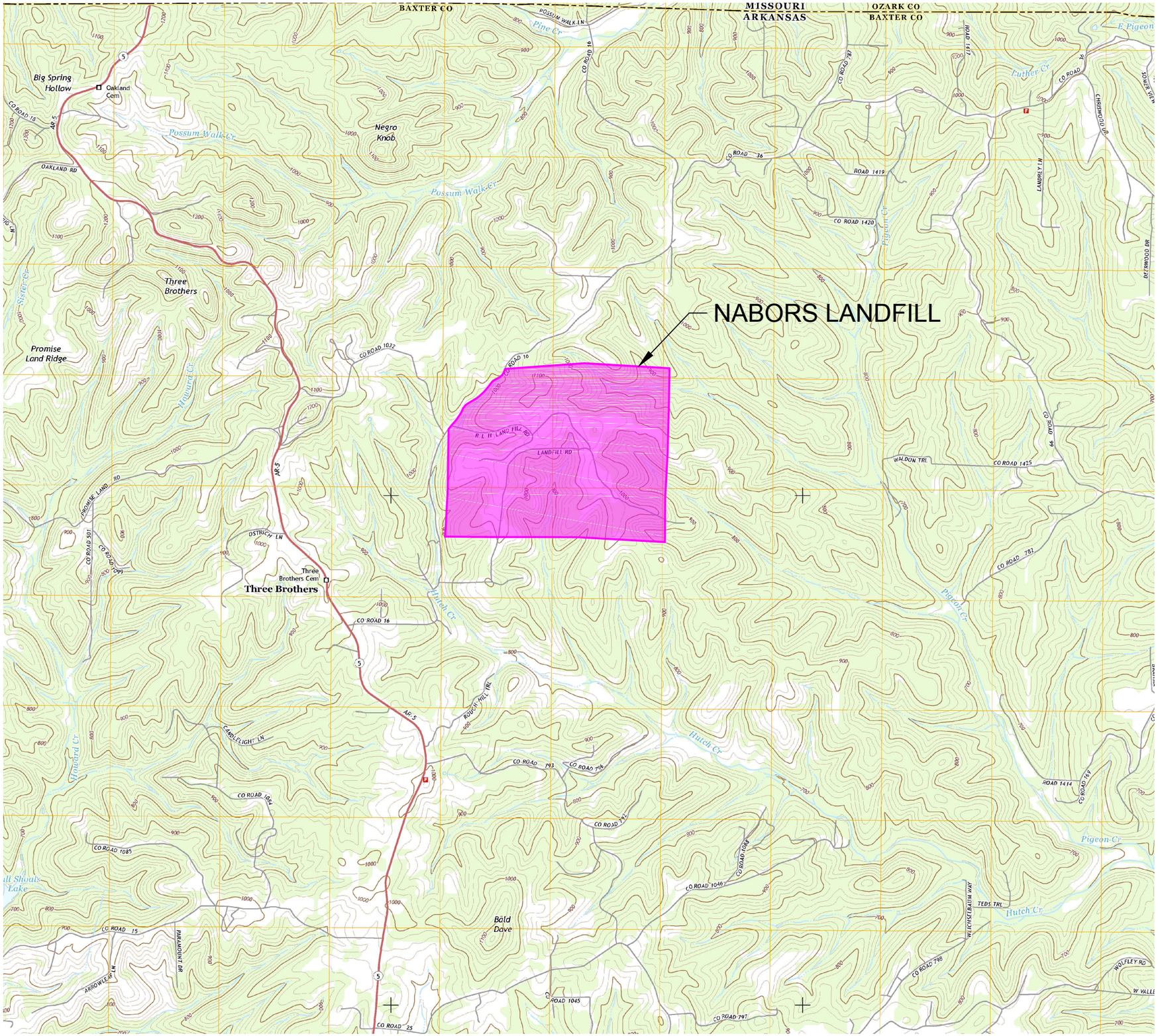
SCS Engineers has completed the supplemental subsurface investigation at the NABORS Landfill located near the town of Three Brothers in Baxter County, Arkansas. The investigation was performed with the intent of assisting in the purchase of the former NABORS Landfill by LRS, a goal which LRS has chosen no longer to pursue.

During the investigation, SCS advanced five exploratory borings, EB-1, EB-2, EB-4, EB-5, and IW-1. Downhole geophysics testing was conducted in each boring, yielding caliper, natural gamma, density, resistivity, and Optical Televiewer logs. A packer test was performed in EB-1, EB-2, EB-4, and EB-5 to determine hydraulic conductivity values of different elevations within each boring.

A dye tracing test was conducted onsite between March (time of dye placement) and the end of November 2023. Dye was detected at six of the 59 monitoring points. The dye test report is attached as **Appendix D.**

The subsurface investigation, including exploratory borings, downhole geophysics, packer testing, and dye tracing, supported the previously established hydrogeologic model for the NABORS landfill. In each boring, groundwater was encountered at depth within the dolomite bedrock, though flow seems to occur seasonally at higher elevations in the weathered transition zone between the clay residuum (Unit 1) and the fully competent bedrock (Unit 3). Hydraulic conductivities calculated from the packer test data fell within the range established by previous hydrogeologic investigation slug tests. In the dye test, discussed in detail in the Dye Test Report, dye was mobilized to six of the 53 monitoring points.

Figures



NOTES:

1. BACKGROUND IMAGERY IS THE MIDWAY QUADRANGLE ARKANSAS-MISSOURI 7.5-MINUTE SERIES TOPO MAP RETRIEVED FROM WWW.USGS.GOV ON APRIL 27, 2016.

2. LANDFILL BOUNDARY IS APPROXIMATE.

3000 0 3000 6000

SCALE FEET

FIGURE 1 - SITE LOCATION MAP
NABORS LANDFILL
BAXTER COUNTY, ARKANSAS

SCS ENGINEERS
11219 Richardson Drive
North Little Rock, Arkansas 72113
PH: (501) 503-4781

CHK. BY: KV	DWN. BY: DMB	DSN. BY: DMB	PROJ. NO. --
PROJ. MGR: DM	DATE: 4/27/16	CADD FILE: SITE LOCATION MAP.DWG	

ENTRANCE GATE
36" HDPE PIPE W/GATE VALVE FL EL=981.9'
36" OUTLET CONTROL DEVICE W/48" GRATED CAP TOP EL=992.1' FL EL=985.9'
OUTFALL 001A
SEDIMENTATION BASIN
SP-7
SPRING A
MW-7
RELOCATED LEACHATE TANK FARM
PERMITTED LEACHATE TANK PAD
36" HDPE PIPE FL EL=1002.9'
36" HDPE PIPE FL EL=1002.9'
SPRING B
NAB-7
MW-8
GP-16
36" CMP FL EL=999.6'
36" CMP FL EL=996.8'
PERMITTED LEACHATE TANK PAD
18" HDPE PIPE FL EL=1029.6'
OVERHEAD ELECTRIC WITHIN CELL BOUNDARIES TO BE RELOCATED
18" HDPE PIPE FL EL=1025.0
MW-5
CELL 2
CELL 1
CELL 6
NE-4
EXISTING FENCE WITHIN CELL BOUNDARIES TO BE RELOCATED
CELL 5
GP-17
EXISTING TANK FARM TO BE RELOCATED
CELL 3
CELL 4
AREA 1-2 (CLOSED)
MW-509-D
TSP-1
CP-5
MW-1
MW-1R
CAPPED 6" PVC PIPE
NE-2
TSP-2
MW-4
CELL 3A
36" VERTICAL SUMP PIPE
15" CMP FL EL=1022.5'
PERMITTED LEACHATE TANK PAD
CAO 1
15" CMP FL EL=1020.1'
MW-2
SP-5
24" HDPE PIPE FL EL=1021.9'
CELL 3B
CR-14
SUMP PUMP PIPES
PERMITTED LEACHATE TANK PAD
24" HDPE PIPE FL EL=1015.2'
AREA 1-3 CELLS 1-3 (CLOSED)
18' PLASTIC PIPE FL EL=1004.3'
18' PLASTIC PIPE FL EL=995.6'
MW-3
SEDIMENTATION BASIN
CELL 2
CELL 1
PERMITTED LEACHATE TANK PAD
GP-1
CAO 2
CONT. ALL 002A
36" HDPE PIPE W/GATE VALVE FL EL=974.0
GP-2
24" HDPE PIPE FL EL=1012.0'
36" OUTLET CONTROL DEVICE W/48" GRATED CAP TOP EL=980.2' FL EL=974.0'
CAO 3
CL I DRAW
NAB-8
MW-633-D
GP-5
NAB-4
24" CMP FL EL=1002.6'
GP-6
18' CMP FL EL=1033.8'
24" CMP FL EL=997.9'
CP-13
CP-11
24" HDPE PIPE FL EL=984.9'

100 0 100 200
SCALE FEET

LEGEND:

- EXISTING 2' MINOR CONTOUR
- 1000 EXISTING 10' MAJOR CONTOUR
- PROPERTY BOUNDARY
- FENCE
- OE — OE — EXISTING OVERHEAD ELECTRIC
- EXISTING ROAD
- OHE — OHE — EXISTING OVERHEAD ELECTRIC
- DISPOSAL BOUNDARY (APPROXIMATE)
- EXISTING BODY OF WATER
- EXISTING DRAINAGE PIPE/CULVERT
- MW-2 EXISTING MONITORING WELL
- GP-16 EXISTING GAS PROBE
- CP-5 EXISTING CONTROL POINT
- EB-5 PROPOSED BORING LOCATION

REV.	DATE	CK. BY
1	-	-
2	-	-
3	-	-
4	-	-
5	-	-
6	-	-

SHEET TITLE
TOP OF BEDROCK

PROJECT TITLE
NABORS ENVIRONMENTAL EVALUATION

CLIENT:
LAKESHORE RECYCLING SYSTEMS
NABORS LANDFILL
1320 LANDFILL ROAD
MOUNTAIN HOME, ARKANSAS 72653

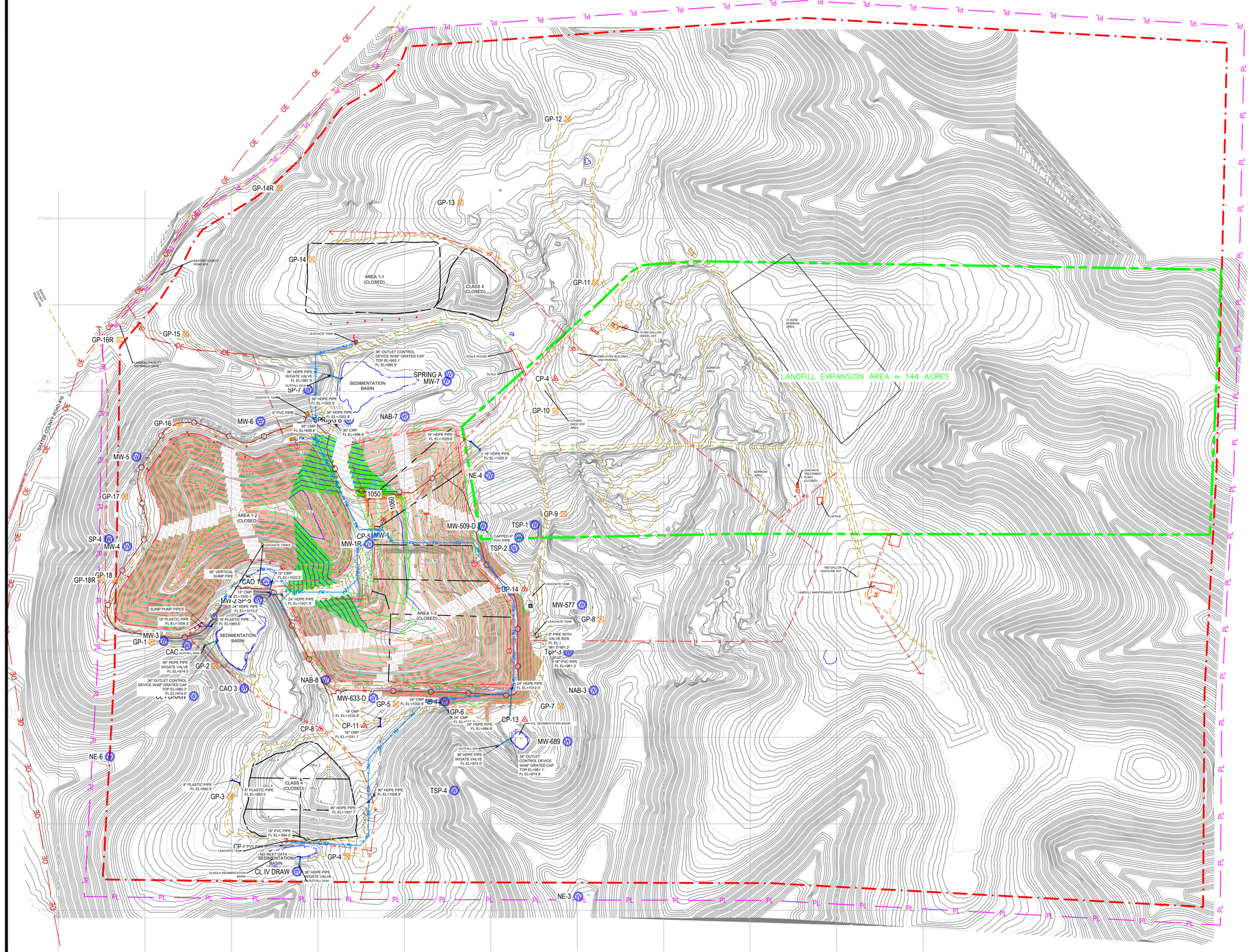
SCS ENGINEERS
11219 RICHARDSON DRIVE
NORTH LITTLE ROCK, ARKANSAS 72113
PH. (501) 812-4551

PROJ. NO. 27221139.01
DSN. BY: KHJ
DWN. BY: KHJ
CHK. BY: SW
O/A RVW BY: SW
PROJ. MGR: DM

CADD FILE:
BEDROCK EVALUATION.DWG

DATE:
12/13/22

FIGURE NO.
1


LANDFILL EXPANSION AREA ≈ 144 ACRES
GP-12
GP-13
GP-14
GP-14R
GP-15
GP-16R
GP-16
GP-17
GP-18
GP-18R
GP-1
GP-2
GP-3
GP-4
GP-5
GP-6
GP-7
GP-8
GP-9
GP-10
GP-11
CP-4
CP-5
CP-8
CP-11
CP-13
CP-14
MW-1
MW-1R
MW-2 SP-3
MW-3
MW-4
MW-5
MW-6
MW-7
MW-509-D
MW-577
MW-633-D
MW-689
NAB-7
NAB-8
NAB-3
NE-4
NE-6
NE-3
TSP-1
TSP-2
TSP-3
TSP-4
SP-4
SP-7
SPRING A
SPRING D
CAO
CAO 3
CL IV DRAW
AREA 1-1 (CLOSED)
AREA 1-2 (CLOSED)
AREA 1-3 (CLOSED)
CLASS 4 (CLOSED)
CLASS 4 SEDIMENTATION BASIN
SEDIMENTATION BASIN
LEACHATE TREATMENT PLANT (CLOSED)
LEACHATE TANK
10,000 GALLON DIESEL AST
500 GALLON GASOLINE AST
LANDFILL MAINTENANCE SHOP
OFFICE
SCALE HOUSE
EMPLOYEE BUILDING AND PARKING
CITIZEN DROP OFF AREA
10 ACRE BORROW AREA
BORROW AREA
WASTE COUNTY ROAD #18
MASTER COUNTY ROAD #18
1050
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
-50
-100
-150
-200
-250
-300
-350
-400
-450
-500
-550
-600
-650
-700
-750
-800
-850
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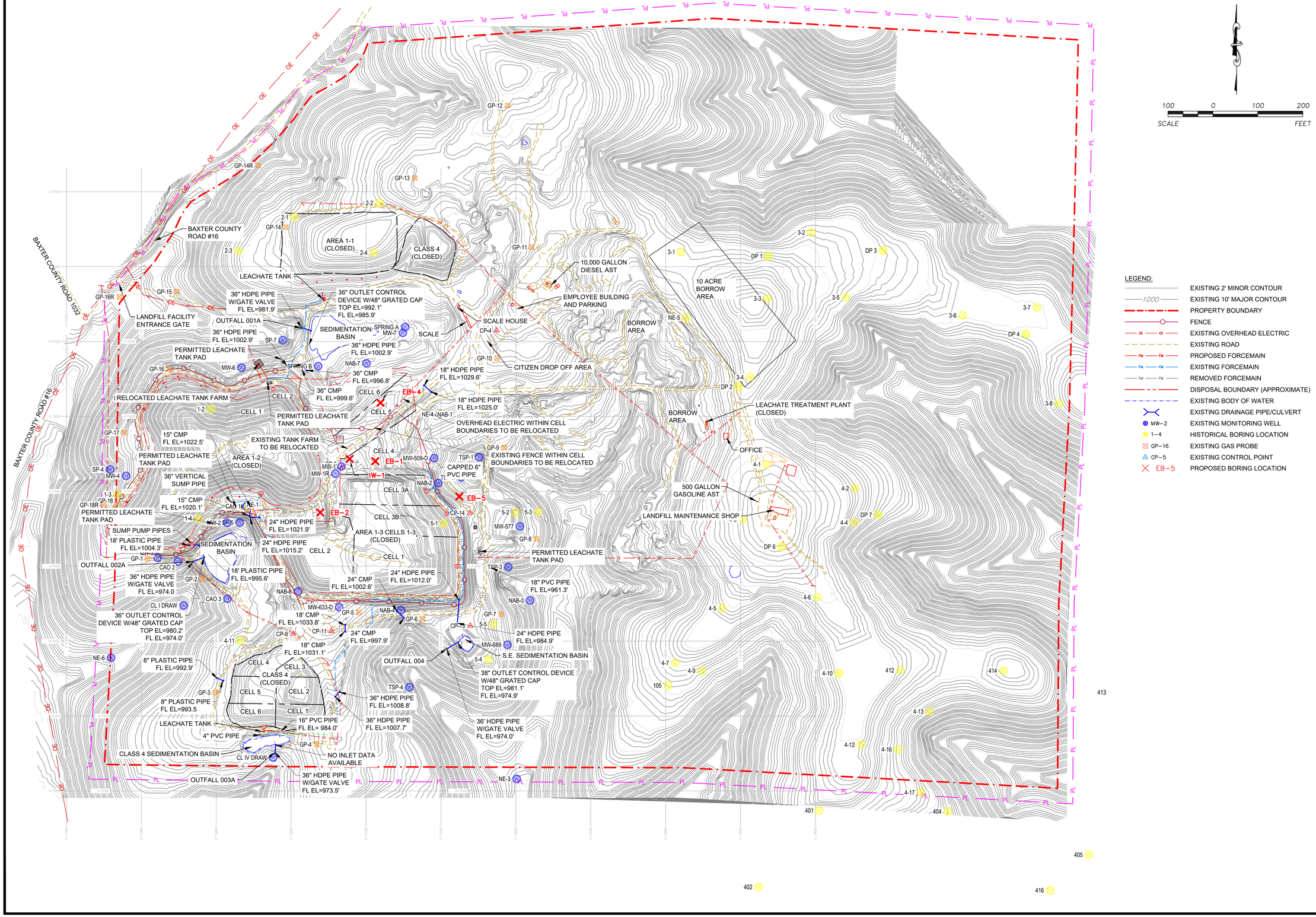
-1900
-1950
-2000



100 0 100 200
SCALE FEET

LEGEND:

- EXISTING 2' MINOR CONTOUR
- 1000 EXISTING 10' MAJOR CONTOUR
- PROPERTY BOUNDARY
- FENCE
- OE OE EXISTING OVERHEAD ELECTRIC
- EXISTING ROAD
- FM FM PROPOSED FORCEMAIN
- FM FM EXISTING FORCEMAIN
- FM FM REMOVED FORCEMAIN
- DISPOSAL BOUNDARY (APPROXIMATE)
- EXISTING BODY OF WATER
- EXISTING DRAINAGE PIPE/CULVERT
- MW-2 EXISTING MONITORING WELL
- 1-4 HISTORICAL BORING LOCATION
- GP-16 EXISTING GAS PROBE
- CP-5 EXISTING CONTROL POINT
- EB-5 PROPOSED BORING LOCATION

REV.	DATE	CK. BY
0	-	-
1	-	-
2	-	-
3	-	-
4	-	-
5	-	-

SHEET TITLE: **HISTORICAL BORING LOCATIONS**

PROJECT TITLE: **INITIAL SITE SUPPLEMENTAL SUBSURFACE INVESTIGATION**

CLIENT: **LAKESHORE RECYCLING SYSTEMS OZH**
1320 LANDFILL RD.
THREE BROTHERS, AR. 72653

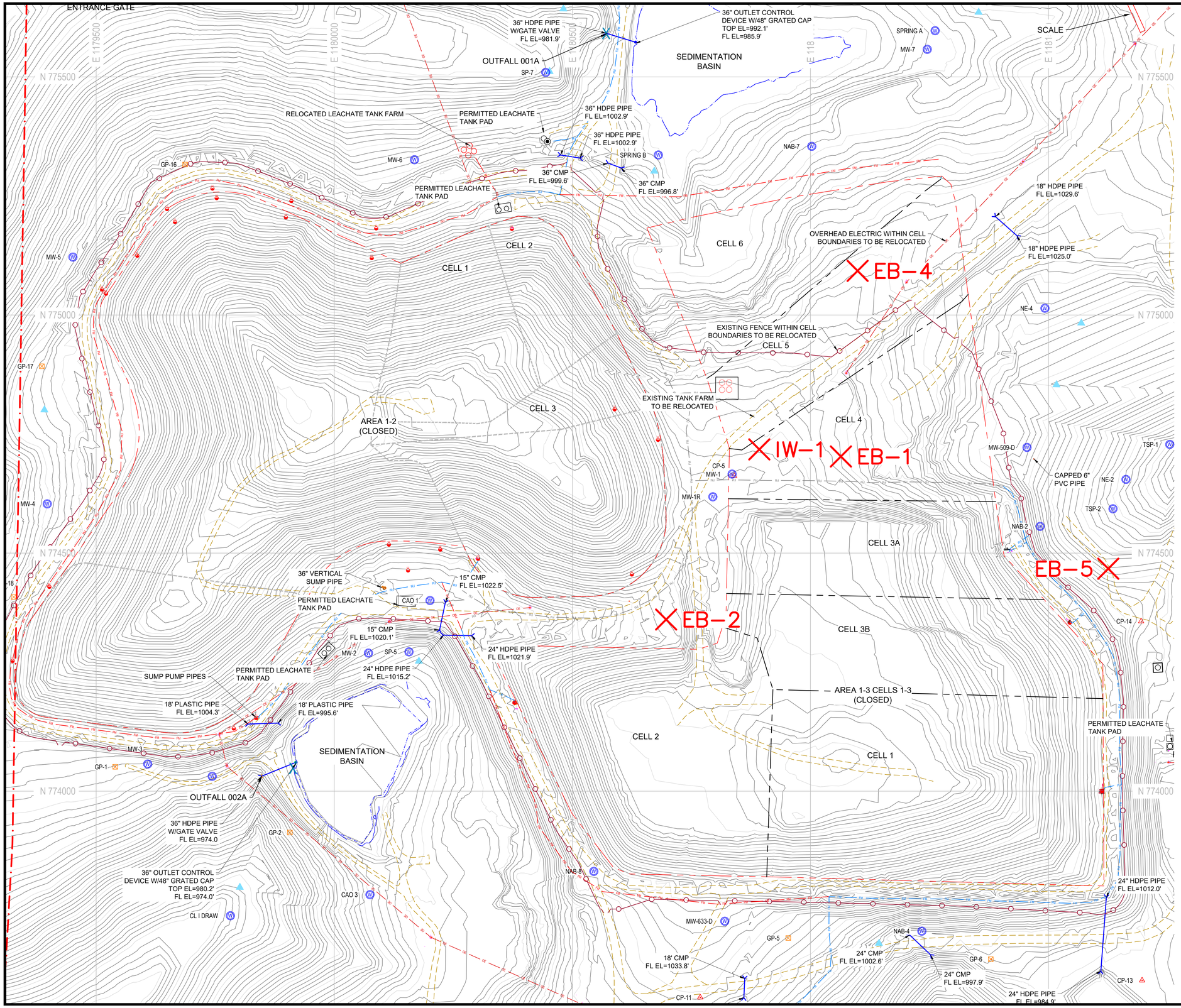
SCS ENGINEERS
STEARNS, CONRAD, AND SCHMIDT
CONSULTING ENGINEERS, INC.
9780 MAUMELLE BLVD.
NORTH LITTLE ROCK, ARKANSAS 72113
PH: (501) 812-4551

PROJ. NO. 27221139.01
DSN. BY: KHJ
DWN. BY: KHJ
CHK. BY: SW
Q/A RVW BY:
PROJ. MGR: DM

CADD FILE: FIGURE 3 – HISTORICAL BORING LOCATIONS.DWG

DATE: 1/22/24

FIGURE NO. **3**



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2	—	—
3	—	—
4	—	—
5	—	—
6	—	—

SHEET TITLE
BORING LOCATIONS

PROJECT TITLE
INITIAL SITE SUPPLEMENTAL SUBSURFACE INVESTIGATION

CLIENT
LAKESHORE RECYCLING SYSTEMS
OZH
1320 LANDFILL RD.
THREE BROTHERS, AR. 72653

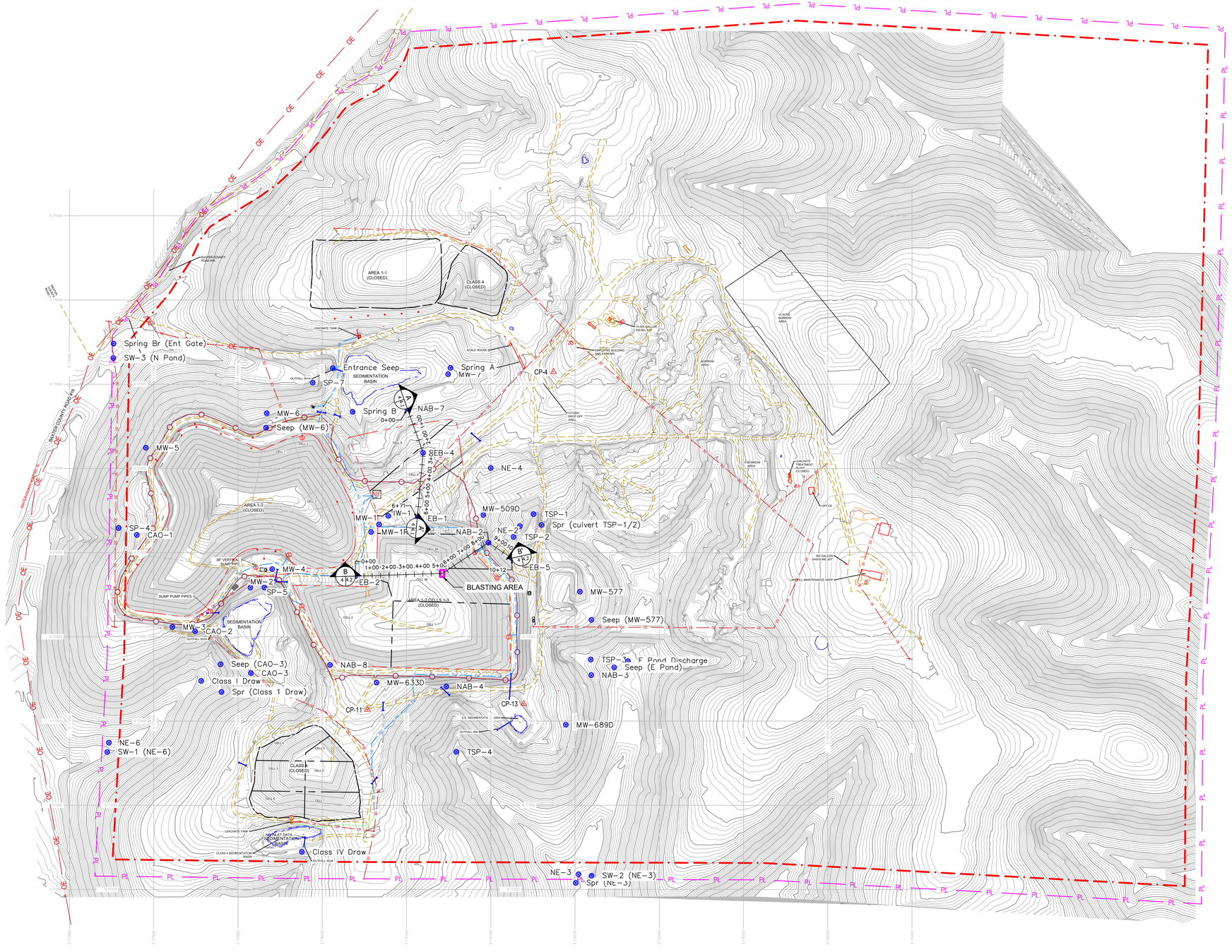
SCS ENGINEERS
STEARNS, CONRAD, AND SCHMIDT
CONSULTING ENGINEERS, INC.
9780 MAUMELLE BLVD.
NORTH LITTLE ROCK, ARKANSAS 72113
PH: (501) 812-4551

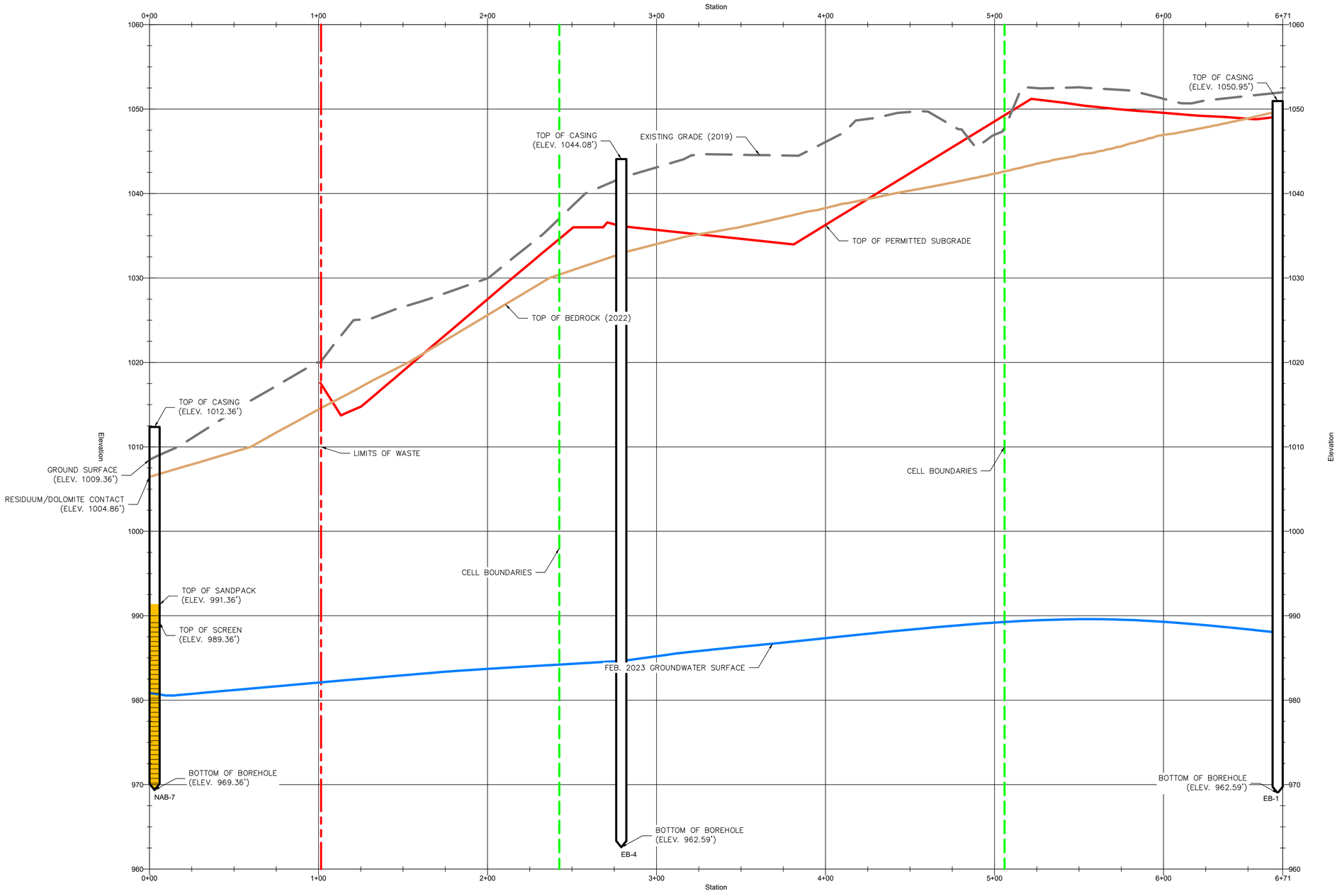
PROJ. NO. 27221539.01
DSN. BY: KHJ
DWN. BY: KHJ
CHK. BY: SW
Q/A RVW BY: SW
PROJ. MGR: DM

CADD FILE:
FIGURE 3.1 – BORING LOCATIONS.DWG

DATE:
1/18/24

FIGURE NO.
3.1


Spring Br (Ent Gate)
SW-3 (N Pond)
Entrance Seep
SEDIMENTATION BASIN
Spring A
MW-7
SP-7
CP-4
Spring B
0+00
NAB-7
MW-6
Seep (MW-6)
MW-5
SEB-4
NE-4
SP-4
CAO-1
MW-1
6+71
IW-1
EB-1
MW-1R
NAB-2
MW-509D
TSP-1
Spr (culvert TSP-1/2)
NE-2
TSP-2
EB-5
MW-4
MW-2
SP-5
EB-2
BLASTING AREA
MW-577
Seep (MW-577)
MW-3
CAO-2
TSP-3
E Pond Discharge
Seep (E Pond)
NAB-3
Seep (CAO-3)
CAO-3
NAB-8
Class I Draw
Spr (Class 1 Draw)
MW-633D
NAB-4
CP-11
CP-13
MW-689D
NE-6
SW-1 (NE-6)
TSP-4
Class IV Draw
NE-3
SW-2 (NE-3)
Spr (NE-3)
AREA 1-1 (CLOSED)
CLASS 4 (CLOSED)
AREA 1-3 (CLOSED)
AREA 1-3 CELLS 1-3 (CLOSED)
CLASS 5 (CLOSED)
LEACHATE TANK
SCALE HOUSE
OUTFALL 001
OUTFALL 002
OUTFALL 003
OUTFALL 004
SUMP PUMP PIPES
36" VERTICAL SUMP PIPE
MARKET DATA RECLAMATION BASIN
CLASS 4 SEDIMENTATION BASIN
10,000 GALLON DIESEL UST
DUMPSTER BUILDING RECYCLING
CITIZEN DROP OFF AREA
10 ACRE BORROW AREA
BORROW AREA
LEACHATE TREATMENT PLANT (CLOSED)
OFFICE
500 GALLON GASOLINE UST
LANDFILL MAINTENANCE SHOP
MASTERS COUNTY ROAD 6/6
MASTERS COUNTY ROAD 6/7
BASIN (CLOSED) W/ ALUM
CELL 1
CELL 2
CELL 3
CELL 4
CELL 5
CELL 6
CELL 7
CELL 8
CELL 9
CELL 10
CELL 11
CELL 12
CELL 13
CELL 14
CELL 15
CELL 16
CELL 17
CELL 18
CELL 19
CELL 20
CELL



SECTION A–A'

A
4 | 4.1

30 0 30 60
SCALE FEET

HORIZONTAL SCALE 1" = 30'
VERTICAL SCALE 1" = 6'
VERTICAL EXAGGERATION = X5

LEGEND:

- *EXISTING GRADE*
- *PERMITTED SUBGRADE*
- *BEDROCK*
- *POTENTIOMETRIC SURFACE*
- *LIMITS OF WASTE*
- *CELL BOUNDARY*
- *LIMITS OF BLASTING AREA*
- *SAND*
- *SCREEN*

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
CROSS SECTION A-A'

PROJECT TITLE
INITIAL SITE SUPPLEMENTAL SUBSURFACE INVESTIGATION

CLIENT
LAKESHORE RECYCLING SYSTEMS
OZH
1320 LANDFILL RD.
THREE BROTHERS, AR. 72653

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
11219 RICHARDSON DRIVE
NORTH LITTLE ROCK, ARKANSAS 72113
PH. (501) 812-4551

DWN. BY: KHJ
CHK. BY: FEC
Q/A RVW BY:
APP. BY: FEC
PROJ. NO. 27222323.0
DSN. BY: KHJ

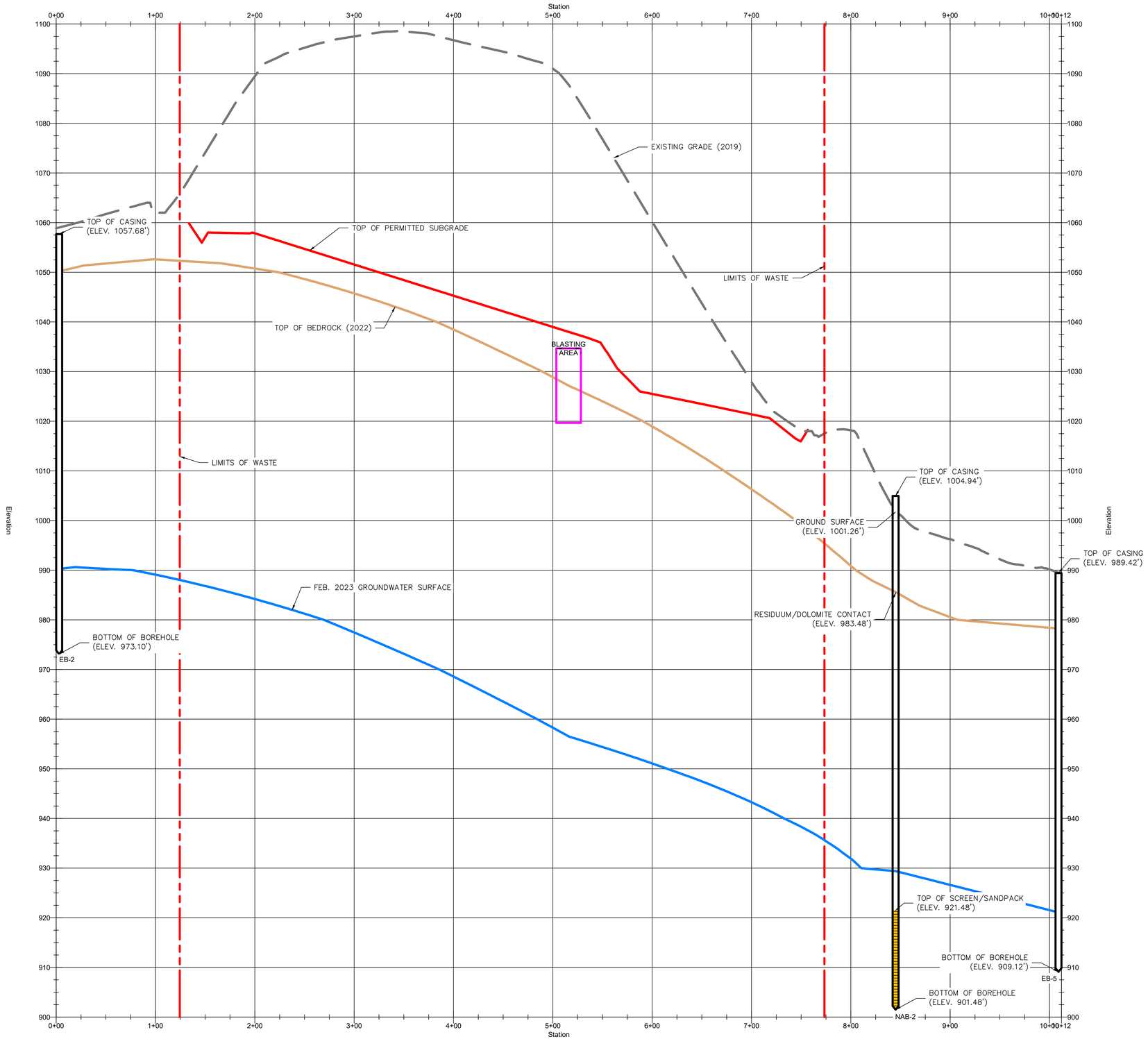
CADD FILE: 001

DATE: FEBRUARY 2023

SCALE: AS SHOWN

FIGURE NO. **4.1**

C:\Users\SJobin\Desktop\27222139.01\AutoCAD\Sheet\SUBSURFACE INVESTIGATION\FIGURES 4-4.2 - CROSS SECTIONS.dwg



SECTION B–B'

B
4 4.2

50 0 50 100
SCALE FEET

HORIZONTAL SCALE 1" = 50'
VERTICAL SCALE 1" = 10'
VERTICAL EXAGGERATION = X5

LEGEND:

- EXISTING GRADE
- PERMITTED SUBGRADE
- BEDROCK
- POTENTIOMETRIC SURFACE
- LIMITS OF WASTE
- CELL BOUNDARY
- LIMITS OF BLASTING AREA
- SAND
- SCREEN

REV.	DATE	DESCRIPTION	CK. BY
1			
2			
3			
4			
5			
6			

SHEET TITLE
CROSS SECTION B-B'

PROJECT TITLE
INITIAL SITE SUPPLEMENTAL SUBSURFACE INVESTIGATION

CLIENT
LAKESHORE RECYCLING SYSTEMS
OZH
1320 LANDFILL RD.
THREE BROTHERS, AR. 72653

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
11219 RICHARDSON DRIVE
NORTH LITTLE ROCK, ARKANSAS 72113
PH. (501) 812-4551

PROJ. NO. 27222323.0
DWN. BY: KHJ
CHK. BY: FEC
Q/A R/W BY: FEC
APP. BY: FEC

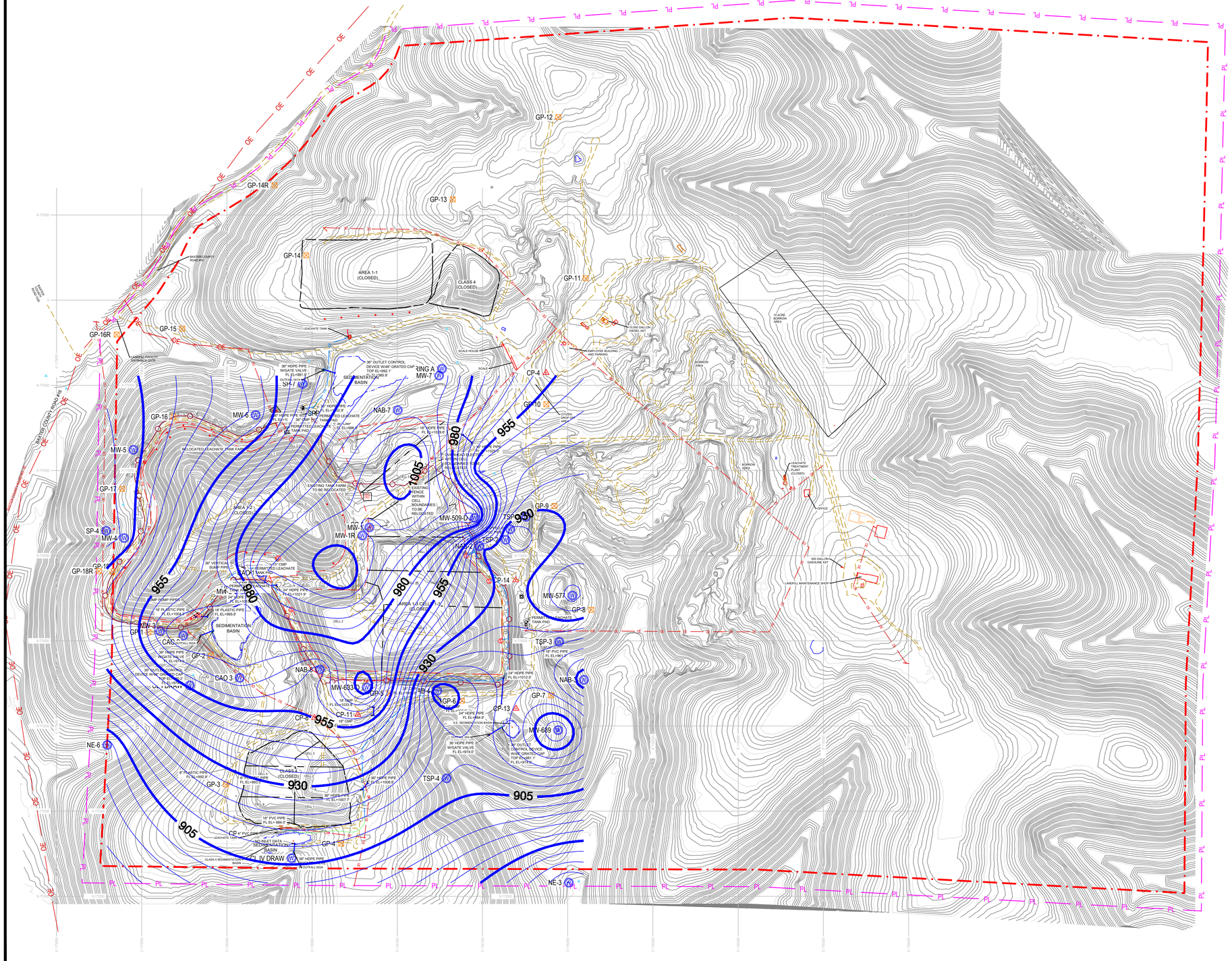
CADD FILE: 001

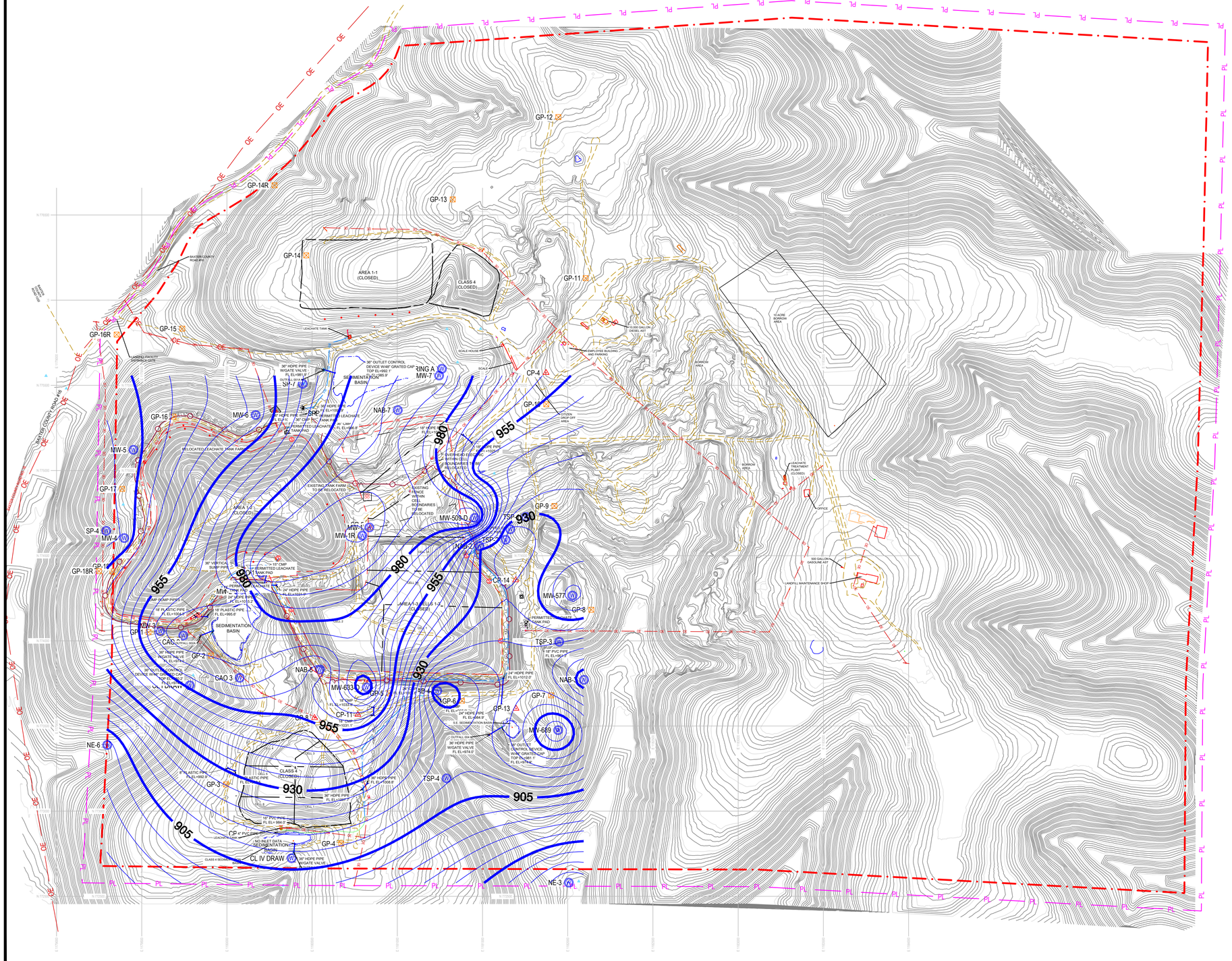
DATE: FEBRUARY 2023

SCALE: AS SHOWN

FIGURE NO. **4.2**

C:\Users\53609kh\Desktop\27222139.01\Arch\CAD\Sheets\SUBSURFACE INVESTIGATION\FIGURES 4-4.2 - CROSS SECTIONS.dwg


GP-12
GP-13
GP-14R
GP-14
GP-11
GP-15
GP-16R
GP-16
GP-17
GP-18R
GP-1
GP-2
GP-3
GP-4
GP-5
GP-6
GP-7
GP-8
GP-9
GP-10
CP-4
CP-5
CP-11
CP-13
CP-14
MW-1
MW-1R
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-509-D
MW-577
MW-633-D
MW-689
NAB-7
NAB-8
NE-3
NE-6
SP-4
SP-5
TSP-1
TSP-2
TSP-3
TSP-4
AREA 1-1 (CLOSED)
CLASS 4 (CLOSED)
AREA 1-2 (CLOSED)
CLASS 3 (CLOSED)
AREA 1-3 CELL 1 (CLOSED)
CELL 2
CELL 3
CELL 4
CELL 5
SEDIMENTATION BASIN
LEACHATE TANK
SCALE HOUSE
EMPLOYEE BUILDING AND PARKING
10,000 GALLON DIESEL AST
15 ACRE BORROW AREA
LEACHATE TREATMENT PLANT (CLOSED)
OFFICE
500 GALLON GASOLINE AST
LANDFILL MAINTENANCE SHOP
EXISTING TANK FARM TO BE RELOCATED
RELOCATED LEACHATE TANK FARM
EXISTING FENCE WITHIN PROPERTY BOUNDARIES TO BE RELOCATED
PERMITTED LEACHATE TANK PAD
CAO 1
CAO 2
CAO 3
CAO 4
SUMP PIPING
SUMP PUMP PIPING
36" OUTLET CONTROL DEVICE W/48" GRATED CAP TOP EL=992.1' FL EL=985.9'
36" OUTLET CONTROL DEVICE W/48" GRATED CAP TOP EL=992.1' FL EL=985.9'
36" OUTLET CONTROL DEVICE W/48" GRATED CAP TOP EL=1012.1' FL EL=1005.9'
36" OUTLET CONTROL DEVICE W/48" GRATED CAP TOP EL=1027.1' FL EL=1020.9'
36" OUTLET CONTROL DEVICE W/48" GRATED CAP TOP EL=1042.1' FL EL=1035.9'
36" OUTLET CONTROL DEVICE W/48" GRATED CAP TOP



300 0 300 600

SCALE FEET

LEGEND:

- EXISTING 2' MINOR CONTOUR
- 1000 EXISTING 10' MAJOR CONTOUR
- 1000 POTENTIOMETRIC SURFACE 10' MAJOR CONTOUR
- PROPERTY BOUNDARY
- FENCE
- OE — OE EXISTING OVERHEAD ELECTRIC
- EXISTING ROAD
- OHE — OHE EXISTING OVERHEAD ELECTRIC
- DISPOSAL BOUNDARY (APPROXIMATE)
- EXISTING BODY OF WATER
- EXISTING DRAINAGE PIPE/CULVERT
- MW-2 EXISTING MONITORING WELL
- GP-16 EXISTING GAS PROBE
- CP-5 EXISTING CONTROL POINT

REV.	DATE	CK. BY
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1	1	1
1	1	1

SHEET TITLE
POTENTIOMETRIC SURFACE MAP WITHOUT 2022 BORINGS

PROJECT TITLE
NABORS ENVIRONMENTAL EVALUATION

CLIENT
LAKESHORE RECYCLING SYSTEMS
NABORS LANDFILL
1320 LANDFILL ROAD
MOUNTAIN HOME, ARKANSAS 72653

SCS ENGINEERS
9780 MAUMELLE BLVD.
NORTH LITTLE ROCK, ARKANSAS 72113
PH. (501) 812-4551

PROJ. NO.	27213901
DSN. BY:	KHJ
DWN. BY:	KHJ
CHK. BY:	SW
Q/A RVW BY:	SW
PROJ. MGR.	DM

CADD FILE:
FIGURE 5.2 – POTENTIOMETRIC SURFACE MAP WITHOUT 2022 BORINGS.DWG

DATE:
2/9/24

FIGURE NO.
5.2

Appendices

Appendix A

Workplan and Approvals

ARKANSAS
ENERGY & ENVIRONMENT

December 12, 2022

Electronic Mail Only

Dan McCullough, P.G.
SCS Engineers
11219 Richardson Drive
North Little Rock, AR 72113

RE: NABORS Landfill
DEQ Review of Work Plan for Supplemental Subsurface Investigation
Permit No: 0249-S1-R2 **AFIN: 03-00051**
Document ID: 83041 **Cross Reference: 83013**

Dear Mr. McCullough,

The Division of Environmental Quality Office of Land Resources (DEQ) has reviewed the Work plan for Supplemental Subsurface Investigation at Nabors Landfill submitted on December 5th, 2022. After review, DEQ approves the work plan.

If you have any questions or need any additional information, please contact me at 501-607-7215 or travis.atwood@adeq.state.ar.us.

Sincerely,

Travis Atwood
Geologist, Division of Environmental Quality
5301 Northshore Drive, North Little Rock, AR 72118-5317

cc: Bill Sadler, P.G., DEQ
Blake Whittle, P.G., DEQ
Annette Cusher, P.E., DEQ

AFIN: 03-00051
PMT#: 0249-S1-R2
Received
By Kacy Murillo at 12:33 pm, Dec 6, 2022
DOC ID#: 83013
TO: BS>FILE <KM

WORK PLAN FOR SUPPLEMENTAL SUBSURFACE INVESTIGATION NABORS LANDFILL

Permit Nos. 0249-S1-R2, 0249-S4
AFIN: 03-00051

LAKESHORE RECYCLING SYSTEMS (LRS)

SCS ENGINEERS

27222323.00 | October 2022

11219 Richardson Drive
North Little Rock, AR 72113
501-812-4551

Professional Geologist Certification

I certify that I am a qualified groundwater scientist who has received a baccalaureate or postgraduate degree in the natural sciences. I have sufficient training and experience in groundwater hydrology and related fields, as demonstrated by state registration and completion of accredited university courses, which enable me to make sound professional judgments regarding groundwater monitoring and contaminant fate and transport.

I further certify that this report was prepared by me or by a subordinate working under my direction.

12/5/2022

Dan McCullough, P.G. Date

Senior Hydrogeologist #1802

Table of Contents

Section Page

1.0 INTRODUCTION 1
2.0 SUBSURFACE INVESTIGATION DETAILS 1
2.1 Depth of Borings 1
2.2 Drilling Activities 2
2.3 Downhole Geophysical Logging 2
2.4 Aquifer Testing 3
3.0 RESULTS 3

Figures

FIGURE 1 Boring Locations
FIGURE 2 Historical Boring Locations

1.0 INTRODUCTION

The NABORS Landfill (herein referred to as Landfill) originally operated under Solid Waste Disposal Permit number 0249-S, as issued to RLH, Inc. (RLH) by the Arkansas Energy & Environment Division of Environmental Quality (DEQ), formerly the Arkansas Department of Environmental Quality (ADEQ), on June 14, 1988. The solid waste permit was transferred to Northwest Arkansas Regional Solid Waste Management District (District) on August 31, 2005. The Landfill is currently under Solid Waste Disposal Permit 0249-S1-R2 issued by the DEQ on August 10, 2006. Although the permit is considered "open", the Landfill stopped receiving waste on November 30, 2012 and initiated closure of Area 1-2, Cells 1-3 of Area 1-3, and the Class 4 Landfill areas. The District (later named Ozark Mountain Regional Solid Waste Management District) operated the Landfill from 2005 to 2014 at which time DEQ assumed control of operations and closure activities at the Landfill under the Post Closure Trust Fund. DEQ is currently managing post closure of the site.

The purpose of this Work Plan is to present a scope of work to gather additional information concerning the occurrence of fractures and hydraulic conditions of groundwater. This a voluntary investigation on the part of LRS to be performed during the Due Diligence period between LRS and the Ozark Mountain Solid Waste District for the purchase of the NABORS facility. However, DEQ's input will be welcome and LRS intends to keep DEQ apprised of the results as they become available in hopes of accelerating the approval process for future permitting efforts.

2.0 SUBSURFACE INVESTIGATION DETAILS

2.1 DEPTH OF BORINGS

LRS is proposing to drill four (4) borings and an injection well during this investigation. The four borings (EB-1, EB-2, EB-4 and EB-5) will be advanced to determine the size, density, and orientation of fractures within bedrock . See **FIGURE 1** for the location of these borings. The anticipated bottom of boring elevations will be 75 to 90 feet below ground surface (bgs). The plan is to advance each boring a minimum of 10 to 20 feet below the groundwater surface identified from surrounding wells. The boring size for EB-1, EB-2, EB-4, and EB-5 will be 3-inches in diameter. A surface casing will be set to the bedrock surface at each location. The casing will be properly sealed to avoid surface water infiltration. Each boring will be open hole completion with no screen or filter pack.

The location of EB-1 was selected to verify previous boring information from MW-1, BH-534D, BH-509D, and NAB-2 which are located in the vicinity of the Signature Blast Demonstration conducted in August 2008. During the demonstration, a noticeable drop in groundwater levels was recorded in NAB-2. In addition, the elevation of groundwater within these wells varies with levels being deeper in BH-509D and NAB-2, when compared to MW-1, BH-534D, and BH-586-D. As will be discussed later in this plan, additional testing will be performed to determine the fractured and permeable zones in each boring.

Boring EB-2 was also located to verify previous boring information and to be a southerly detection point for the dye test discussed later in this Work Plan. The same information discussed in this Work Plan will also be collected from this boring.

The location of EB-4 was selected to provide subsurface information in Cell 5 of Area 1-3. During previous investigations, borings were not drilled in this area (See attached FIGURE 2 for location of all previous borings drilled). The location of EB-5 will be between MW-509D and NAB-2 to help delineate the effects, if any of the 2008 Blasting Demonstration.

As will be discussed later in the Dye Test Work Plan, the proposed injection location for the dye test will be near MW-1 and MW-1R. A 4-inch open completion well will be drilled at the location presented on FIGURE 1. The surface construction of this injection locations will be include a surface casing that will be grouted into bedrock.

2.2 DRILLING ACTIVITIES

The borings will be advanced using a drilling rig equipped with hollow stem augers. Once bedrock is encountered, and rock coring with wash rotary will be utilized to total depth. During drilling, The following information will be recorded:

(1.) Rock Quality Designation (RQD);
(2.) Fracture density and fracture orientation; and
(3.) Bit drop and sudden gains or losses in water.

The borings will be logged by a qualified geologist.

Once total depth has been reached, downhole geophysical logs will be obtained from each of the four boreholes and the injection well. The logs will include natural gamma, Acoustic Televiewer for fractures and nuclear density.

Once the downhole geophysical logging has been completed, each open borehole will be utilized for groundwater elevation determination and dye test monitoring as discussed in a separate Work Plan.

Following the completion of field activities, a surveyor will determine the positions of all boring locations. All boring locations will be surveyed horizontally to the nearest 0.1 foot and tied to the State Plane Coordinate System. The ground surface reference elevation will be measured to the nearest 0.1 foot relative to mean sea level (MSL).

3.0 DOWNHOLE GEOPHYSICAL LOGGING

Downhole geophysical logs will be obtained from each of the boreholes. The logs will include ntural gamma, Acoustic Televiewer for fractures and nuclear density. It is anticipated that 4" PVC pipe will be placed in the borehole to the depth that bedrock is encountered, and the borehole logs will be run inside this pipe within the overburden to avoid the borehole bridging.

The Acoustic Televiewer tool takes an oriented "picture" of the borehole using high-resolution sound waves. This acoustic picture is displayed in both amplitude and travel time. This information is used to detect fractures, bedding plane orientation, and other borehole anomalies. Analysis includes fracture dip and strike determination and classification of anomalies, if any.

The nuclear density testing provides formation density by determining the density of electrons in the formation. Gamma rays emitted by the source experience Compton scattering, which involves the transfer of energy from gamma rays to the electrons in the formation via elastic collision. The number of scattered gamma rays that reach the detector is directly related to the number of electrons in the formation, which in turn is related to bulk density. Density logs typically display a gradual increase with depth due to compaction.

3.1 AQUIFER TESTING

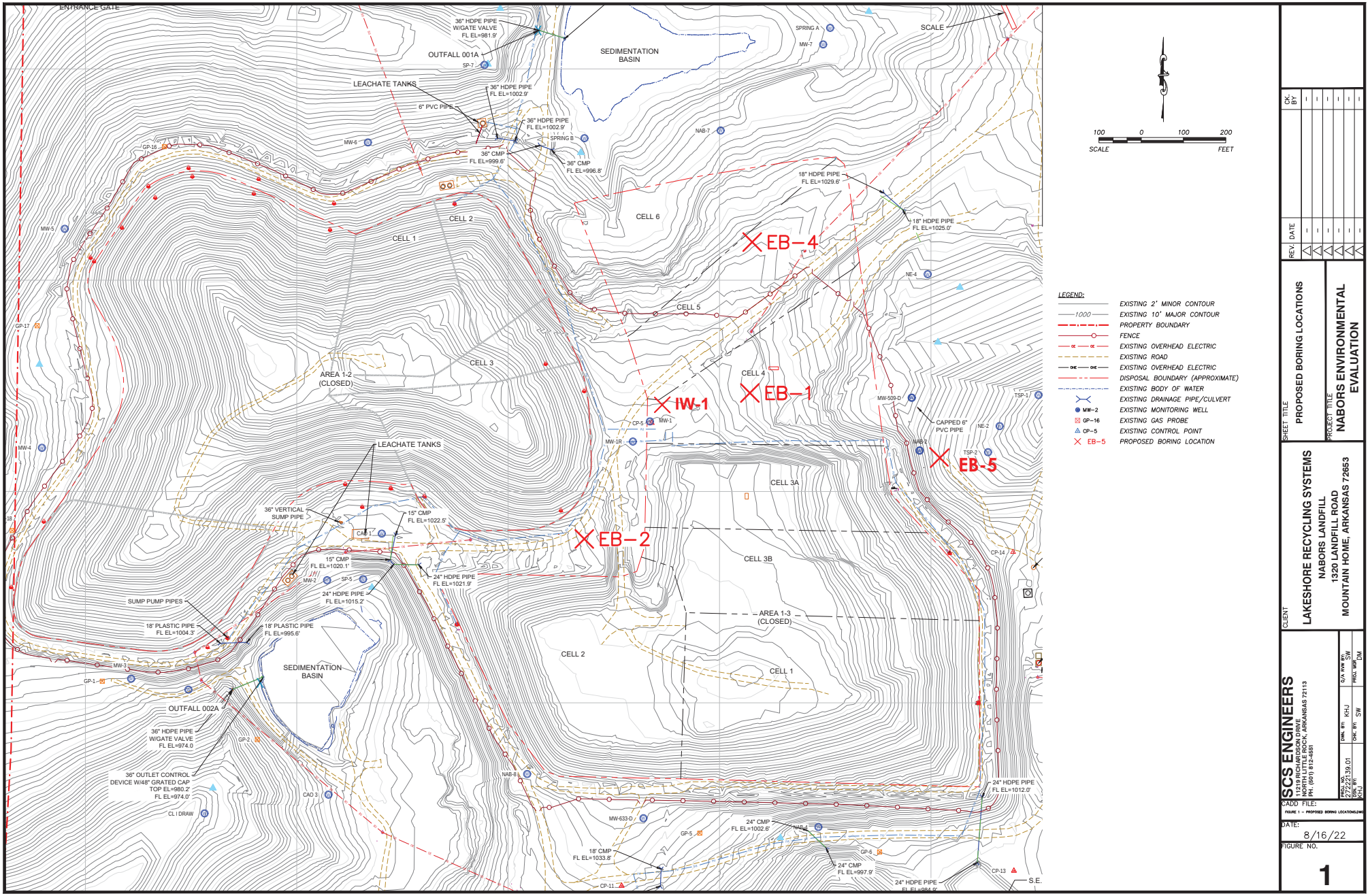
Packer testing will be conducted to measure the permeability of sections of the boreholes. The first phase of the process will involve geophysical logging and flow profiling of the boreholes as discussed in the Section 2.4 of this Work Plan. Detailed borehole logging is essential in visually identifying fractures and possible water producing zones. This information will then be used to select isolation points for a series of packer tests.

This information aids in identifying the various water producing zones and their correlation to the geology across the site. This, in turn, helps to determine the necessary course of action for resolving potential groundwater issues. Monitoring water levels in nearby wells while pumping packed intervals can also identify permeable intervals within the aquifer. Information from these packer tests can be used to properly place the future location of monitoring wells.

4.0 RESULTS

This a voluntary investigation on the part of LRS being performed during a 90-day Due Diligence period prior to the purchase of the NABORS facility from the Ozark Mountain Solid Waste District. However, as previously stated, DEQ's input is welcome and LRS will share results with DEQ as they become available. This study should accelerate future permitting efforts and the approval process to be undertaken at a future date.

Figures



REV.	DATE	CK BY

SHEET TITLE
PROPOSED BORING LOCATIONS

PROJECT TITLE
NABORS ENVIRONMENTAL EVALUATION

CLIENT
LAKESHORE RECYCLING SYSTEMS
NABORS LANDFILL
1320 LANDFILL ROAD
MOUNTAIN HOME, ARKANSAS 72653

SCS ENGINEERS
11219 RICHARDSSON DRIVE
NORTH LITTLE ROCK, ARKANSAS 72113
PH. (501) 812-4561

PROJ. NO. 27213139.01
DSN. BY: KHJ
DWN. BY: KHJ
CHK. BY: SW
S/A RVW BY: SW
PROJ. MGR: DM

CADD FILE:
FIGURE 1 – PROPOSED BORING LOCATIONS.DWG

DATE:
8/16/22

FIGURE NO.
1

Legend

- Existing Borings
- Property Boundary

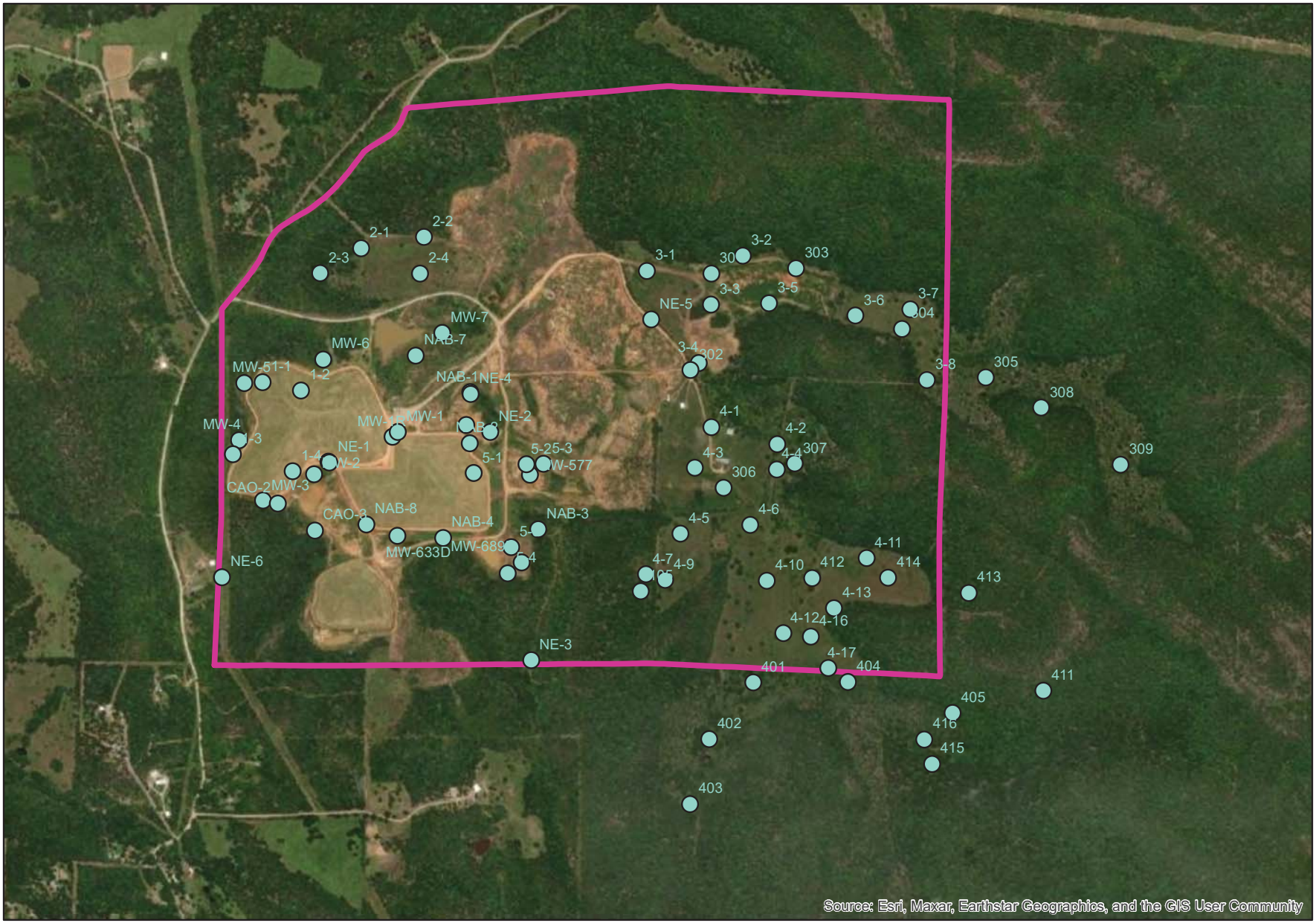


FIGURE 2

Appendix B

Boring Logs, Completion Diagrams & Geophysical Logs (by boring)

SCS ENGINEERS

LOG OF BORING NO.: **EB-1**

SHEET NUMBER: 1 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1051 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-55	TOC ELEVATION: 1051 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 81.95 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1181061.5 EASTING: 774701.35
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 63.11 fbgs
START DATE: 10/5/2022	BORING DIAMETER: 3"	WATER ELEVATION: 987.84 ft
FINISH DATE: 10/14/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
0	Dolomite	Dolomite; grey to light grey with brown and dark grey banding	Core	0-5		52			1055
5	Shale	Shale; brown, thinly bedded, non calcareous	Core	5.0-10.0		62			1050
10	Dolomite	Dolomite; grey with brown & dark grey banding. Some chert layers & small vugs.	Core	10.0-15.0		19			1045
15		Sandstone; tan							1040
		Dolomite; coarse, gray to tan, with occasional chert layers	Core	15.0-20.0		79		3" Open borehole GS to 81.95' bgs	1035
20		Dolomite; dark grey with some chert layers. Some large vugs (1" diam) ~16.3-17'							1030
		Dolomite; tan with small vugs ~18.1'	Core	20.0-25.0		100			
25	Dolomite	Dolomite; grey with iron staining							1025
		Dolomite; grey							

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-1**

SHEET NUMBER: 2 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1051 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-55	TOC ELEVATION: 1051 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 81.95 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1181061.5 EASTING: 774701.35
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 63.11 fbgs
START DATE: 10/5/2022	BORING DIAMETER: 3"	WATER ELEVATION: 987.84 ft
FINISH DATE: 10/14/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
		to tan with brown banding & some chert. Zones of small vugs. Large vugs (1" diam) noted from 25.4-25.75' and 31-31.3'.	Core	25.0-30.0		72			
30			Core	30.0-35.0		73			1020
35		Shale; thinly bedded, brown to black	Core	35.0-40.0		86			1015
40		Dolomite; grey to tan, vuggy, with brown banding and chert. Increased chert ~37.04'. Vuggy. At 39.05' and 41.6-41.8, larger vuggy cavities w/ precipitate including iron minerals	Core	40.0-45.0		100			1010
45			Core	45.0-50.0		91			1005
50		Dolomite; Heavily weathered, vuggy, grey to tan, with brown banding and chert. Brecciated zones beginning ~51.6'. Frequent	Core	50.0-55.0		75			1000
55				55.0-					995

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-1**

SHEET NUMBER: 3 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1051 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-55	TOC ELEVATION: 1051 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 81.95 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1181061.5 EASTING: 774701.35
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 63.11 fbgs
START DATE: 10/5/2022	BORING DIAMETER: 3"	WATER ELEVATION: 987.84 ft
FINISH DATE: 10/14/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
		solution features 56.16'. Large vugs w/ iron mineralization.	Core	60.0		95			
60		Dolomite; grey with chert. Small vugs 60.9-62.9' and 63.04-63.3'. At 67.9', coarser tan irregularly shaped dolomite infill noted.	Core	60.0-65.0		96			990
65			Core	65.0-70.0		100			985
70	Dolomite	Shale; black, non calcareous.	Core	70.0-75.0		85			980
	Dolomite	Dolomite; grey w/ chert							
		Shale; black, non calcareous.							
75	Dolomite	Dolomite; grey w/ chert. Brecciated zones, notably at 72.7'.	Core	75.0-80.0		90			975
		Shale; black, non calcareous.							
80		Dolomite; grey w/ chert. Brecciated/vuggy zone at 78.13'.							970
85									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-1**

11219 Richardson Drive North Little Rock, AR	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1051 ft
	DRILLING RIG: CME-55	TOC ELEVATION: 1051 ft
CLIENT: LRS	DRILLING METHOD:	WELL DEPTH COMPLETION: 81.95 fbgs
PROJECT NAME: NABORS	DRILLING CONTRACTOR: GTS	LOCATION:
PROJECT NUMBER: 27222139.01		NORTHING: 1181061.5
PROJECT LOCATION: Three Brothers, AR		EASTING: 774701.35
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 63.11 fbgs
START DATE: 10/5/2022	BORING DIAMETER: 3"	WATER ELEVATION: 987.84 ft
FINISH DATE: 10/14/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
90									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

Century GEOPHYSICAL CORP.

century-geo.com

BAXTER COUNTY LANDFILL
GAMMA-RES-DENSITY
DB1

COMPANY	: SCS ENGINEERS
WELL	: DB1
FIELD	:
COUNTY	: BAXTER
STATE	: ARKANSAS
LOCATION	:
SECTION	: N/A
TOWNSHIP	: N/A
RANGE	: N/A
API NO.	:
UNIQUE WELL ID.	:
PERMANENT DATUM	: GL
LOG MEASURED FROM	: GL
DRL MEASURED FROM	: GL
DATE	: 10/24/22
DEPTH DRILLER	: 82
BIT SIZE	: 3.5"
LOG TOP	: -2.80
LOG BOTTOM	: 79.50
CASING OD	:
CASING BOTTOM	:
CASING TYPE	:
BOREHOLE FLUID	: WATER
RM TEMPERATURE	:
MUD RES	:
MUD WEIGHT	: 8.3
WITNESSED BY	: R FOWLER
RECORDED BY	: J. FLEMING
REMARKS 1	: N- N/A
REMARKS 2	: E- N/A
ELEVATION KB	: N/A
ELEVATION DF	: N/A
ELEVATION GL	: N/A
RIG NUMBER	:
LOGGER TD	:
ARRIVAL TIME	: 10:30
DEPARTURE TIME	:
CIRC STOPPED	:

OTHER SERVICES: N/A

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

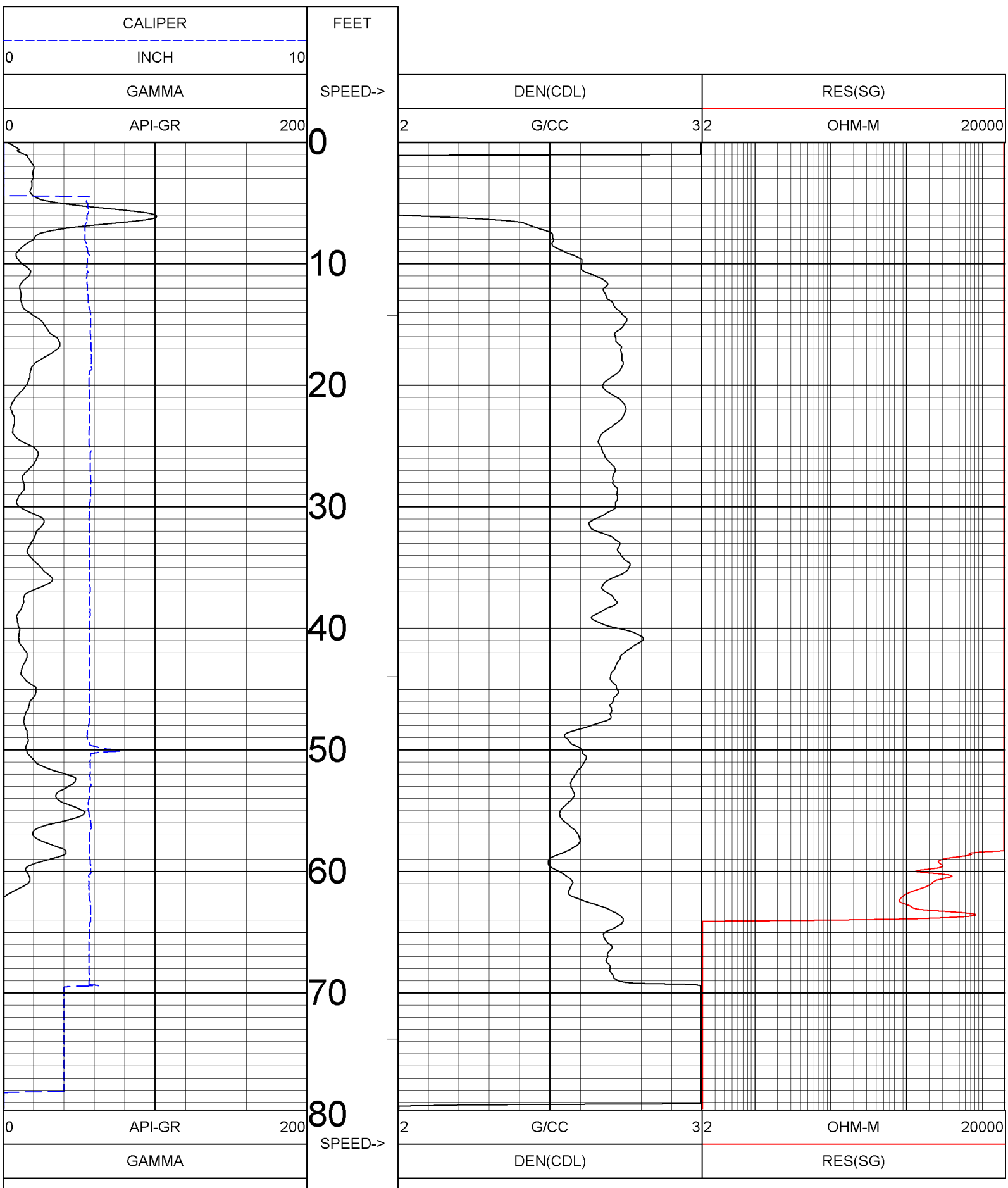
10 INCH LOG, GAMMA-RES-DEN DB1 10/24/22

LOG PARAMETERS

MATRIX DENSITY : 2.65 | NEUTRON MATRIX : SANDSTONE | MATRIX DELTA T : 54

MAGNETIC DECL : 0 | ELECT. CUTOFF : 99999 | BIT SIZE : 3.5"

PRESENTATION NAME/DATE = 9239C.0 10/24/2022 | VERSION = 3.64IQ



10 INCH LOG, GAMMA-RES-DEN DB1 10/24/22

LOG PARAMETERS

MATRIX DENSITY : 2.65 | NEUTRON MATRIX : SANDSTONE | MATRIX DELTA T : 54

MAGNETIC DECL : 0 | ELECT. CUTOFF : 99999 | BIT SIZE : 3.5"

PRESENTATION NAME/DATE = 9239C.0 10/24/2022 | VERSION = 3.64IQ

TOOL CALIBRATION DB1 10/24/22 17:24
TOOL 9239C TM VERSION 5026
SERIAL NUMBER 4443

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Aug22,07	13:48:04	GAMMA	0.000	[API-GR]	3.000	[CPS]
	Aug22,07	13:48:04	GAMMA	320.000	[API-GR]	304.000	[CPS]
2	Oct07,22	07:38:54	VOLTAGE	0.000	[MV]	11754.000	[CPS]
	Oct07,22	07:38:54	VOLTAGE	2013.000	[MV]	277811.000	[CPS]
3	Oct11,22	15:39:28	CALIPER	4.000	[INCH]	214224.203	[CPS]
	Oct11,22	15:39:28	CALIPER	6.000	[INCH]	325924.313	[CPS]
4	Oct12,22	08:52:40	DEN(LS)	1.728	[G/CC]	3534.930	[CPS]
	Oct12,22	08:52:40	DEN(LS)	2.673	[G/CC]	662.800	[CPS]
5	Oct12,22	08:48:17	DEN(SS)	1.775	[G/CC]	14025.170	[CPS]
	Oct12,22	08:48:17	DEN(SS)	2.638	[G/CC]	6683.030	[CPS]
6	Aug21,07	11:46:00	CALIPERL	4.000	[INCH]	111180.000	[CPS]
	Aug21,07	11:46:00	CALIPERL	12.000	[INCH]	354930.000	[CPS]
7	Oct07,22	07:50:19	CURRENT	0.000	[UA]	4843.000	[CPS]
	Oct07,22	07:50:19	CURRENT	288.400	[UA]	28763.000	[CPS]
8	Aug20,07	17:08:26	F	Default	[CPS]		
9	Aug20,07	17:08:26	X	Default	[CPS]		

OTV TELEVIEWER PROCESSING 1:10

SCS ENGINEERS

EB1

JOB NUMBER :	**EB1**	PLATFORM:		DRILL COMPANY:		SERVICE COMP.:	**Century Wireline Services**
PROJECT:		EASTING:		DRILL START DATE:		WELL AZIM (deg):	
FIELD:		NORTHING:		DRILL END DATE:		WELL INCL (deg):	
PROVINCE:	**BAXTER, AR**	ELEVATION(m):		RIG NUMBER:			

BOREHOLE RECORD			
BIT SIZE (IN)	DEPTH FROM (FT)	DEPTH TO (FT)	FLUID TYPE
3.5	**5**	**75**	**WATER / AIR**

CASING RECORD			
TYPE	I.D. (IN)	DEPTH FROM (FT)	DEPTH TO (FT)

REMARKS

DEPTH

MEAS. DEPTH

1ft:10ft

GEOLOGICAL STRUCTURE

OPTICAL IMAGE: 0° 90° 180° 270°

STRUCTURE PICKS: 0° 90° 180° 270°

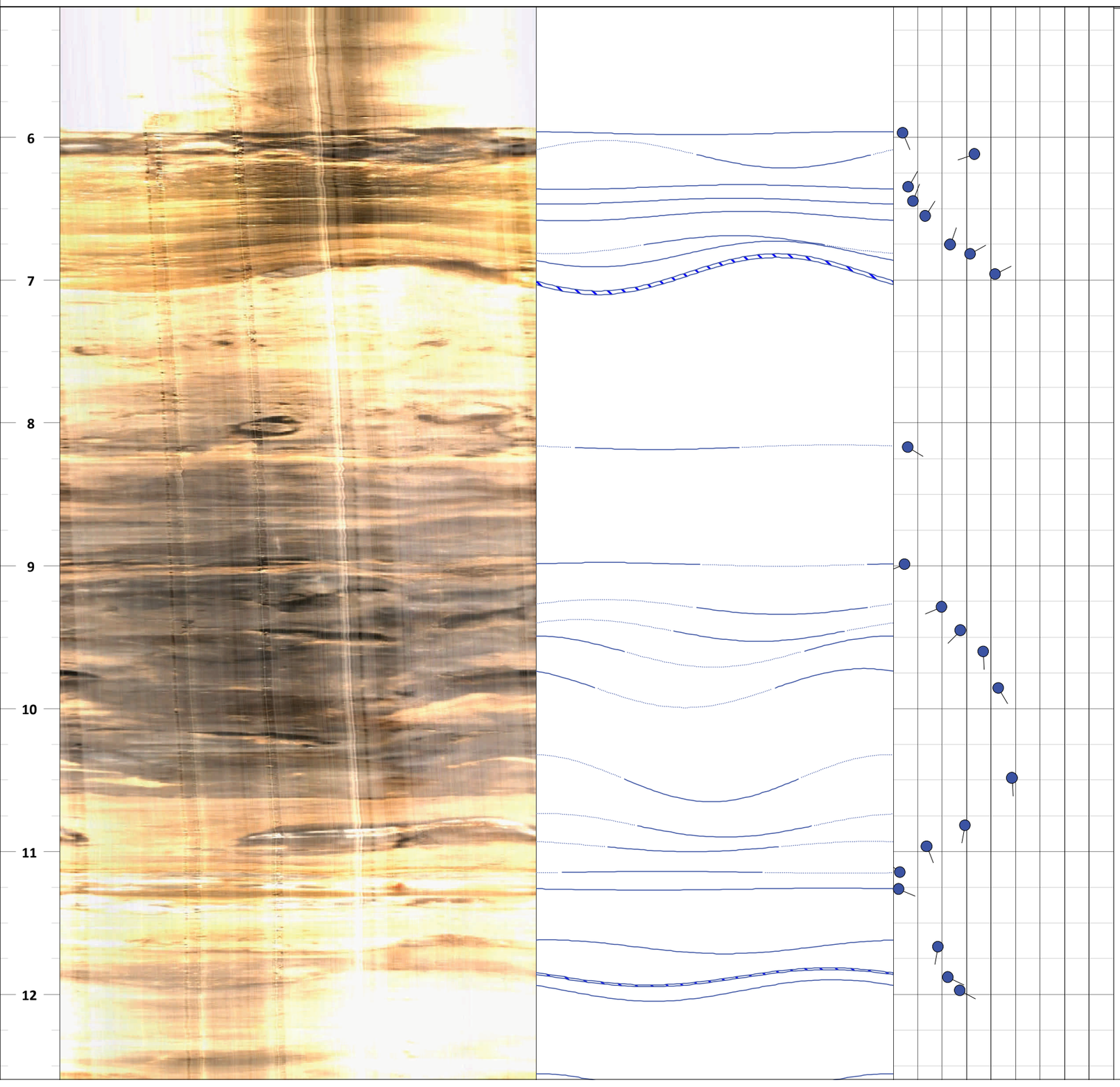
TADPOLES: 0° 90°

POLAR PLOT

Wulff Plot - LH - AGA

STRIKE PLOT

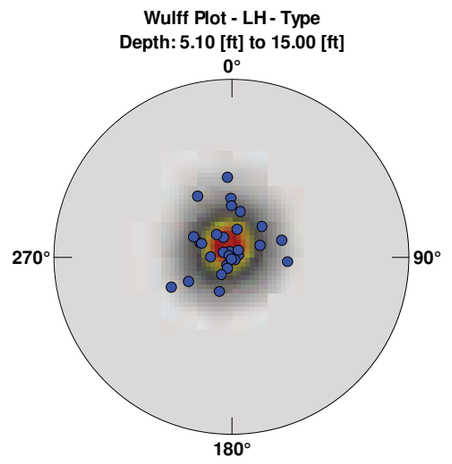
Strike - Percent Interval



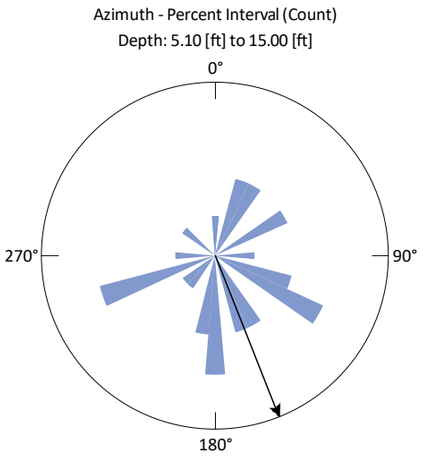
RUN 2 : 5-10 FT
RECOVERY 45.5" ; RQD 62
0 FT: GREY DOLOMITE WITH BROWN & DARK GREY BANDING

6 FT:
SHALE, THINLY BEDDED, NONCALCAREOUS

7 FT: GREY DOLOMITE WITH BROWN & DARK GREY BANDING; SOME CHERT LAYERS & SOME SMALL VUGS



	Counts	Dip[deg]	Azi[deg]
Mean	29	8.30	158.39
	29	8.30	158.39



Components:	Azimuth
Counts:	29.00
Mean (3D):	158.39
Min:	4.37
Max:	307.48

RUN 3 : 10-15 FT
RECOVERY 53.2" ; RQD 19

14.5 - 14.6 FT: TAN SANDSTONE

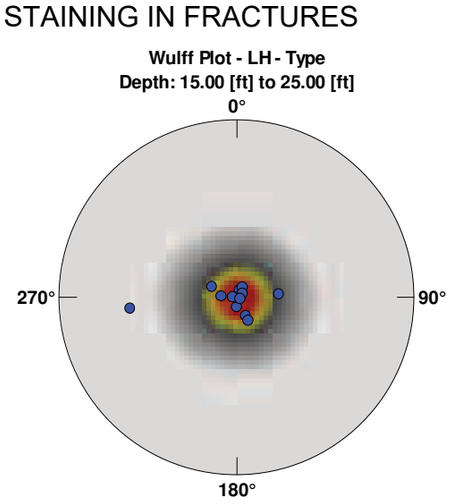
RUN 4: 15-20 FT
RECOVERY 58.8" ; RQD 79

16.3 - 17 FT: SOME 1" VUGS NOTED

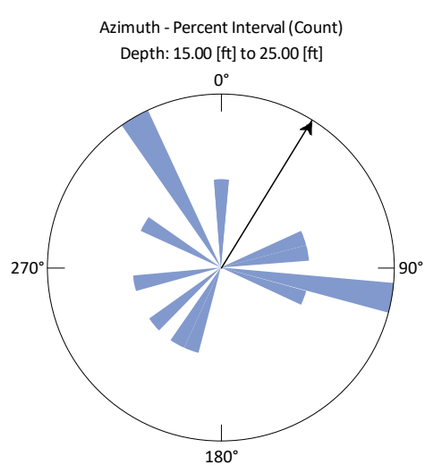
17 FT: TAN DOLO W IRON STAINING IN FRACTURES

18.1 FT: SMALL VUGS

18.3 FT: GREY DOLO W IRON STAINING IN FRACTURES



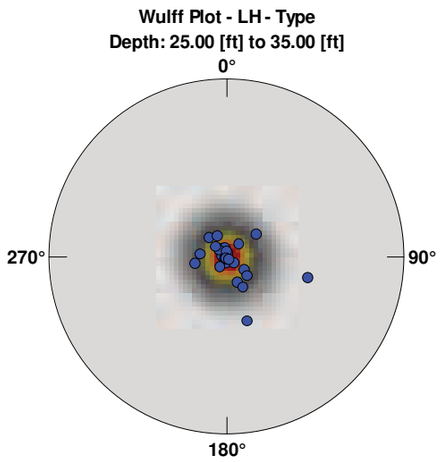
	Counts	Dip[deg]	Azi[deg]
Mean	13	1.10	31.66
	13	1.10	31.66



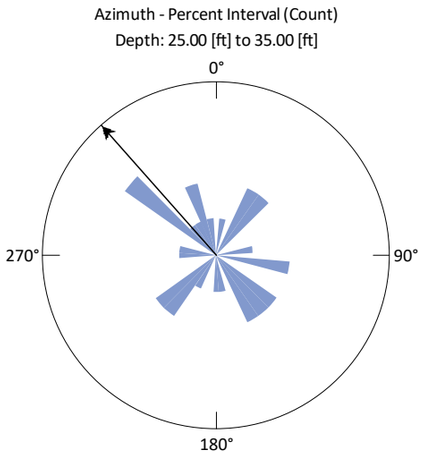
Components:	Azimuth
Counts:	13.00
Mean (3D):	31.66
Min:	3.85
Max:	334.03

RUN 5: 20-25 FT
RECOVERY 62.75" ; RQD 100
GREY TO TAN DOLO WITH BROWN BANDING & SOME CHERT; OCCASIONAL SMALL VUGS

RUN 6: 25-30 FT
RECOVERY 57.25" ; RQD 72
25.4-25.75: 1" DIAM CALCITE FILLED VUGS; OTHER OCCASIONAL ZONES OF SMALL VUGS CONTINUE DOWNSECTION



	Counts	Dip[deg]	Azi[deg]
Mean	31	1.64	318.42
●	31	1.64	318.42



Components:	Azimuth
Counts:	31.00
Mean (3D):	318.42
Min:	7.47
Max:	350.10

RUN 7: 30-35 FT
RECOVERY 57.75" ; RQD 73
31-31.3 FT: 1" VUGS WITH QTZ PRECIPITATE

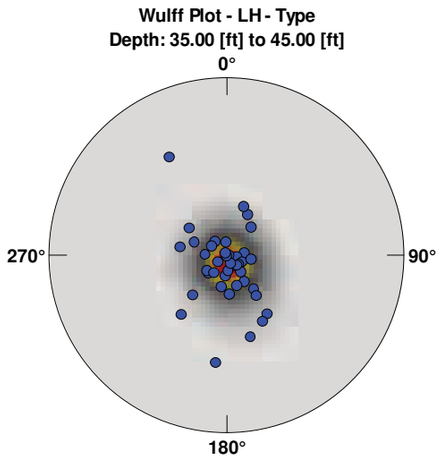
RUN 8: 35-40 FT
RECOVERY 58.75" ; RQD 86

36.15-36.3 FT: SHALE, THINLY BEDDED, BROWN TO BLACK
36.3 FT: GREY TO TAN DOLO, VUGGY, WITH BROWN BANDING

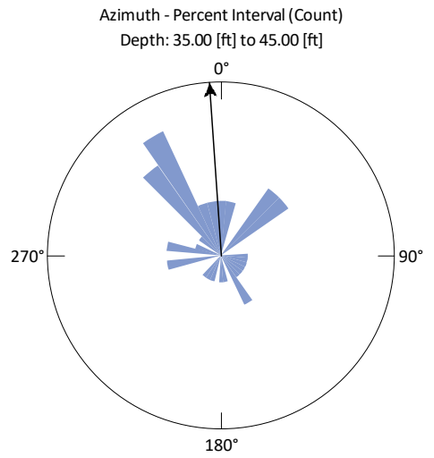
37.04 FT: INCREASED CHERT

38
39
40
41
42
43
44
45
46
47
48
49

39.05 FT: 1" VUGS WITH PRECIPITATE INCLUDING IRON MINERALS



	Counts	Dip[deg]	Azi[deg]
Mean	42	7.47	355.89
●	42	7.47	355.89

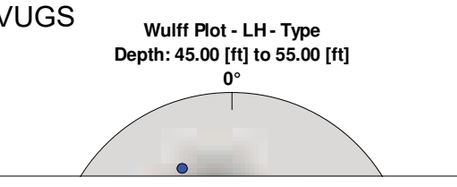


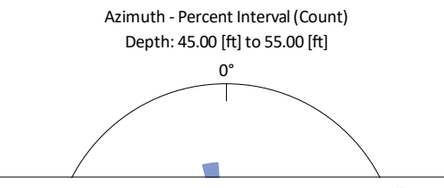
Components:	Azimuth
Counts:	42.00
Mean (3D):	355.89
Min:	4.71
Max:	355.64

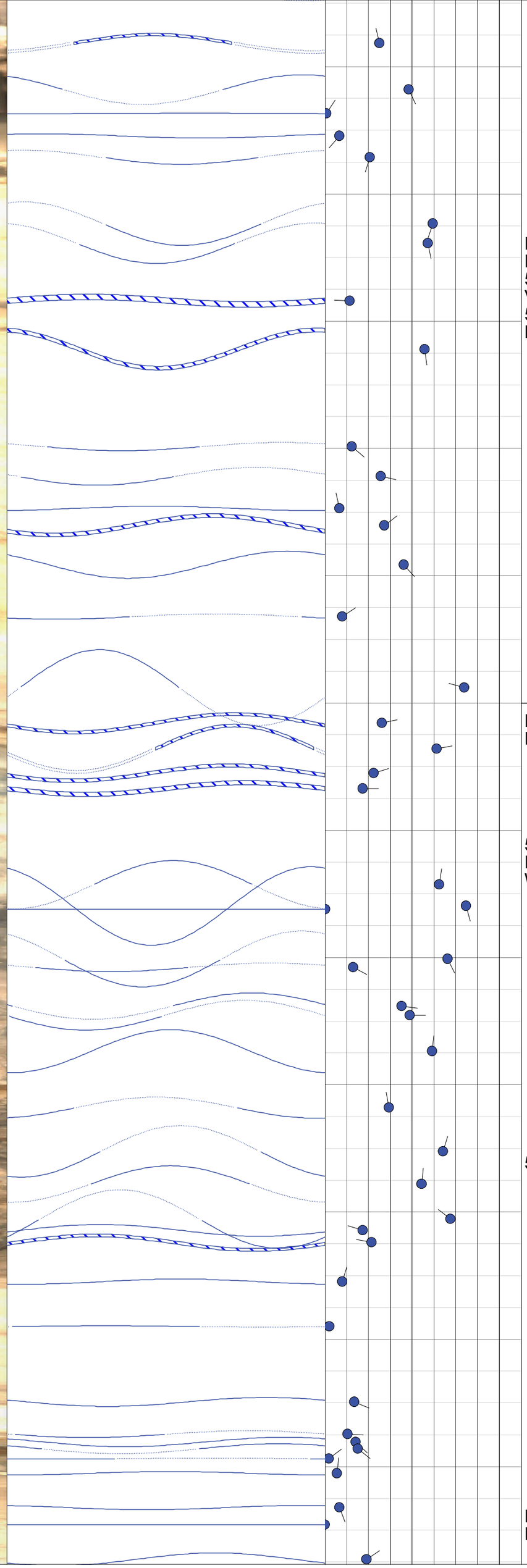
RUN 9: 40-45 FT
RECOVERY 58.5" ; RQD 100
41.6-41.8 FT: 1" VUGS WITH PRECIPITATE INCLUDING IRON MINERALS

RUN 10: 45-50 FT
RECOVERY 54.25" ; 91 RQD

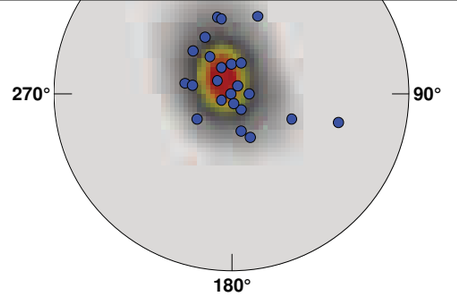
48.77 FT: MORE WEATHERING & VUGS



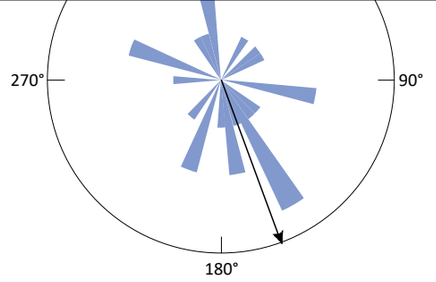




RUN 11: 50-55 FT
RECOVERY 54.3" ; RQD 75
50 FT: HEAVILY WEATHERED, VUGGY, GREY TO TAN DOLO
51.6 FT: BRECCIATED ZONES BEGIN



	Counts	Dip[deg]	Azi[deg]
Mean	24	10.90	159.69
	24	10.90	159.69



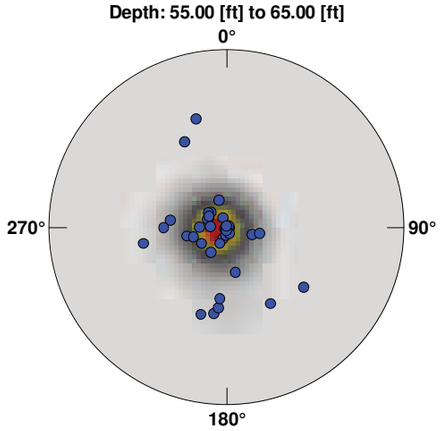
Components:	Azimuth
Counts:	24.00
Mean (3D):	159.69
Min:	33.86
Max:	348.18

RUN 12: 55-60 FT
RECOVERY 59" ; RQD 95.4

56.16 FT: FREQUENT SOLUTION FEATURES; LARGE (1") VUGS W IRON MINERALIZATION

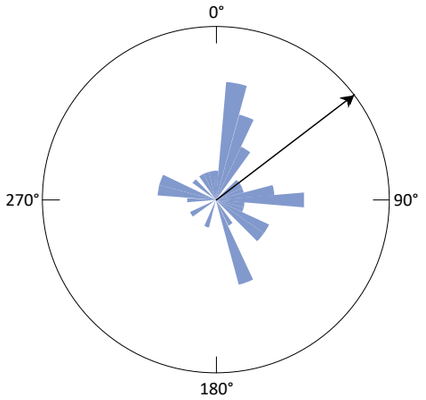
58.6 FT: GREY DOLO W/ CHERT

Wulff Plot - LH - Type
Depth: 55.00 [ft] to 65.00 [ft]



	Counts	Dip[deg]	Azi[deg]
Mean	39	8.74	52.59
	39	8.74	52.59

Azimuth - Percent Interval (Count)
Depth: 55.00 [ft] to 65.00 [ft]



Components:	Azimuth
Counts:	39.00
Mean (3D):	52.59
Min:	4.55
Max:	349.12

RUN 13: 60-65 FT
RECOVERY 61.25" ; 96% RQD

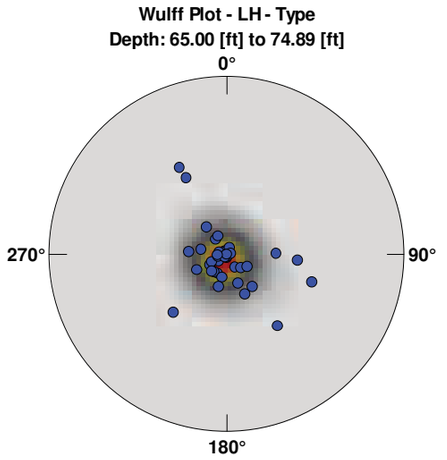
60.9-62.9 FT: ZONE OF SMALL VUGS

63.04-63.3 FT: ZONE OF SMALL VUGS

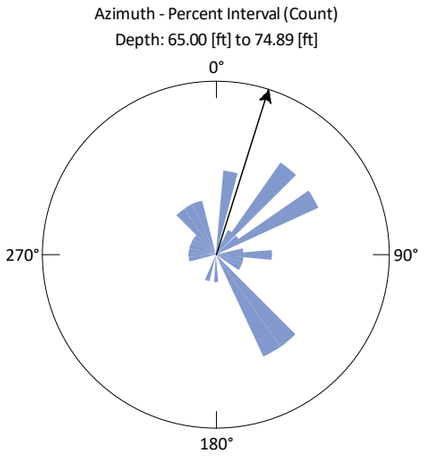
RUN 14: 65-70 FT
RECOVERY 59"; RQD 100

67.9 FT: COARSER TAN IRREGULARLY SHAPED DOLO INFILL

70-70.04 FT: SHALE, BLACK, NONCALCAREOUS



	Counts	Dip[deg]	Azi[deg]
Mean	41	4.29	17.56
●	41	4.29	17.56

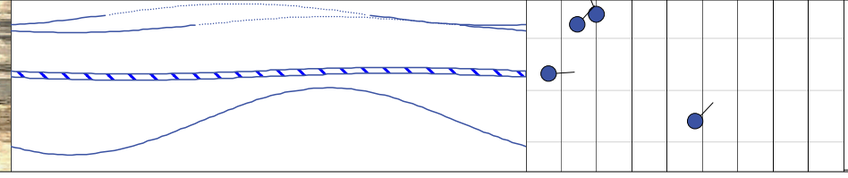


Components:	Azimuth
Counts:	41.00
Mean (3D):	17.56
Min:	7.25
Max:	338.62

RUN 15: 70-75 FT
RECOVERY 58.25" ; RQD 85
71.17-71.2 FT: SHALE, BLACK, NON CALCAREOUS

72.7 FT: BRECCIATED ZONE

74.04-74.08 FT: SHALE, BLACK, NONCALCAREOUS



IMAGERY ENDS AT 75'; LAST RUN 75-80 FT; BORING TERMINATED 81.95 FT BGS

DISCLAIMER

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CWS does not know and cannot determine the performance, profitability or viability of any particular site for commercial purpose. The client must conduct its own investigations and research and form its own conclusions as to the commercial viability of any site.

The client hereby acknowledges that it has not and will not act or rely upon any opinion, interpretation or analysis made by CWS, its employees or agents.

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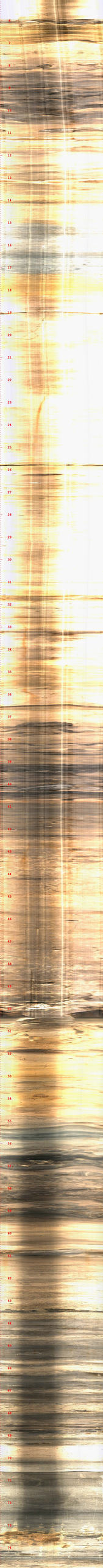

SCS ENGINEERS

LOG OF BORING NO.: **EB-2**

SHEET NUMBER: 1 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1057.7 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-75	TOC ELEVATION: 1059 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 84.58 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1180694.47 EASTING: 774358.91
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 66.48 fbgs
START DATE: 9/27/2022	BORING DIAMETER: 3"	WATER ELEVATION: 991.2 ft
FINISH DATE: 9/29/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
0	Silty Clay	Silty Clay; reddish brown to orange with chert gravels						Sch 40 PVC Casing (grouted) 0'-7' bgs	1060
5									1055
			SPT (50/2")	7-10		50/2"			1050
10	Dolomite	Dolomite; light gray to gray, fine crystalline, iron staining in fractures, thin dark gray banding, vuggy between 19.5'-21.5'	Core			85			
			Core	10-15		57			1045
15			Core	15-20		100		3" Open borehole from 7' to 84.58' bgs	1040
20	Shale	Shale; brown thinly bedded (no reaction to HCL	Core	20-25		73			1035
	Chert	Chert, dark gray with light gray banding							
25									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-2**

SHEET NUMBER: 2 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1057.7 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-75	TOC ELEVATION: 1059 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 84.58 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1180694.47 EASTING: 774358.91
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 66.48 fbgs
START DATE: 9/27/2022	BORING DIAMETER: 3"	WATER ELEVATION: 991.2 ft
FINISH DATE: 9/29/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
			Core	25-30		74			1030
30			Core	30-35		100			1025
35		Dolomite, light gray to gray with dark gray banding, a thin sandstone layer(approx 4") noted at 28.5, chert nodules noted between 35'-40', vuggy between 45-47.5	Core	35-40		100			1020
	Dolomite		Core	40-45		78			1015
40									
45			Core	45-50		86			1010
50			Core	50-53		82			1005
	Chert	Chert, dark gray with light gray and brown banding	Core	53-55		83			
55		Dolomite, light gray to gray, vuggy with							

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-2** SHEET NUMBER: 3 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1057.7 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-75	TOC ELEVATION: 1059 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 84.58 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1180694.47 EASTING: 774358.91
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 66.48 fbgs
START DATE: 9/27/2022	BORING DIAMETER: 3"	WATER ELEVATION: 991.2 ft
FINISH DATE: 9/29/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
		interbedded Chert to 55, sporadic vuggs with quartz present at 59', vuggy at 62 aprox 4" and between 63'-64' with chert nodules noted at 64'	Core	55-60		100			1000
60			Core	60-65		97			995
65		Dolomite; gray, brecciated with chert nodules	Core	65-70		95			990
70	Dolomite	Dolomite; gray with dark gray banding, some chert nodules, vuggy 80.5'-83'	Core	70-75		98			985
75			Core	75-80		98			980
80			Core	80-85		90			975
85									970

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-2**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1057.7 ft
	DRILLING RIG: CME-75	TOC ELEVATION: 1059 ft
CLIENT: LRS	DRILLING METHOD:	WELL DEPTH COMPLETION: 84.58 fbgs
PROJECT NAME: NABORS	DRILLING CONTRACTOR: GTS	LOCATION:
PROJECT NUMBER: 27222139.01		NORTHING: 1180694.47
PROJECT LOCATION: Three Brothers, AR		EASTING: 774358.91
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DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
90									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

Century GEOPHYSICAL CORP.
century-geo.com

BAXTER COUNTY LANDFILL
GAMMA-RES-DENSITY
EB2

COMPANY	: SCS ENGINEERS
WELL	: EB2
FIELD	:
COUNTY	: BAXTER
STATE	: ARKANSAS
LOCATION	:
SECTION	: N/A
TOWNSHIP	: N/A
RANGE	: N/A
API NO.	:
UNIQUE WELL ID.	:
PERMANENT DATUM	: GL
LOG MEASURED FROM	: GL
DRL MEASURED FROM	: GL
DATE	: 10/24/22
DEPTH DRILLER	: 58
BIT SIZE	: 3.5"
LOG TOP	: -2.70
LOG BOTTOM	: 84.00
CASING OD	:
CASING BOTTOM	:
CASING TYPE	:
BOREHOLE FLUID	: WATER
RM TEMPERATURE	:
MUD RES	:
MUD WEIGHT	: 8.3
WITNESSED BY	: R FOWLER
RECORDED BY	: J. FLEMING
REMARKS 1	: N- N/A
REMARKS 2	: E- N/A

ELEVATION KB	: N/A
ELEVATION DF	: N/A
ELEVATION GL	: N/A
RIG NUMBER	:
LOGGER TD	:
ARRIVAL TIME	: 10:30
DEPARTURE TIME	:
CIRC STOPPED	:

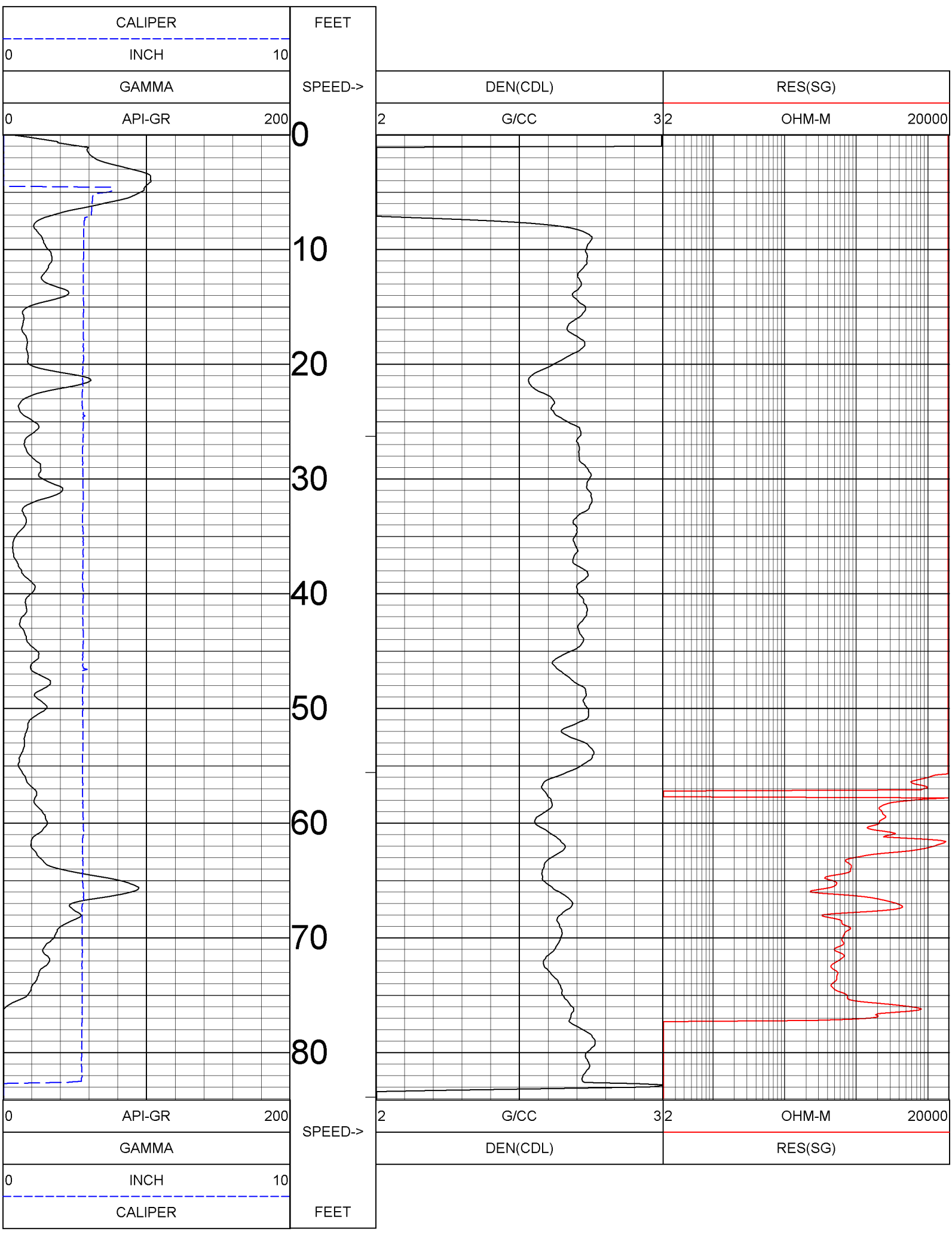
OTHER SERVICES:
N/A

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

10 INCH LOG, GAMMA-RES-DEN EB2 10/24/22

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54
MAGNETIC DECL : 0 ELECT. CUTOFF : 99999 BIT SIZE : 3.5"
PRESENTATION NAME/DATE = 9239C.0 10/24/2022 VERSION = 3.64IQ



10 INCH LOG, GAMMA-RES-DEN EB2 10/24/22

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54
MAGNETIC DECL : 0 ELECT. CUTOFF : 99999 BIT SIZE : 3.5"
PRESENTATION NAME/DATE = 9239C.0 10/24/2022 VERSION = 3.64IQ

TOOL CALIBRATION EB2 10/24/22 18:22
TOOL 9239C TM VERSION 5026
SERIAL NUMBER 4443

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Aug22,07	13:48:04	GAMMA	0.000	[API-GR]	3.000	[CPS]
	Aug22,07	13:48:04	GAMMA	320.000	[API-GR]	304.000	[CPS]
2	Oct07,22	07:38:54	VOLTAGE	0.000	[MV]	11754.000	[CPS]
	Oct07,22	07:38:54	VOLTAGE	2013.000	[MV]	277811.000	[CPS]
3	Oct11,22	15:39:28	CALIPER	4.000	[INCH]	214224.203	[CPS]
	Oct11,22	15:39:28	CALIPER	6.000	[INCH]	325924.313	[CPS]
4	Oct12,22	08:52:40	DEN(LS)	1.728	[G/CC]	3534.930	[CPS]
	Oct12,22	08:52:40	DEN(LS)	2.673	[G/CC]	662.800	[CPS]
5	Oct12,22	08:48:17	DEN(SS)	1.775	[G/CC]	14025.170	[CPS]
	Oct12,22	08:48:17	DEN(SS)	2.638	[G/CC]	6683.030	[CPS]
6	Aug21,07	11:46:00	CALIPERL	4.000	[INCH]	111180.000	[CPS]
	Aug21,07	11:46:00	CALIPERL	12.000	[INCH]	354930.000	[CPS]
7	Oct07,22	07:50:19	CURRENT	0.000	[UA]	4843.000	[CPS]
	Oct07,22	07:50:19	CURRENT	288.400	[UA]	28763.000	[CPS]
8	Aug20,07	17:08:26	F	Default	[CPS]		
9	Aug20,07	17:08:26	X	Default	[CPS]		

OTV TELEVIEWER PROCESSING 1:10

SCS ENGINEERS

EB2

JOB NUMBER :	**EB2**	PLATFORM:		DRILL COMPANY:		SERVICE COMP.:	**Century Wireline Services**
PROJECT:		EASTING:		DRILL START DATE:		WELL AZIM (deg):	
FIELD:		NORTHING:		DRILL END DATE:		WELL INCL (deg):	
PROVINCE:	**BAXTER, AR**	ELEVATION(m):		RIG NUMBER:			

BOREHOLE RECORD

BIT SIZE (IN)	DEPTH FROM (FT)	DEPTH TO (FT)	FLUID TYPE
3.5	**8**	**83.8**	**WATER / AIR**

CASING RECORD

TYPE	I.D. (IN)	DEPTH FROM (FT)	DEPTH TO (FT)

REMARKS

DEPTH

MEAS. DEPTH

1ft:10ft

GEOLOGICAL STRUCTURE

OPTICAL IMAGE: 0° 90° 180° 270°

STRUCTURE PICKS: 0° 90° 180° 270°

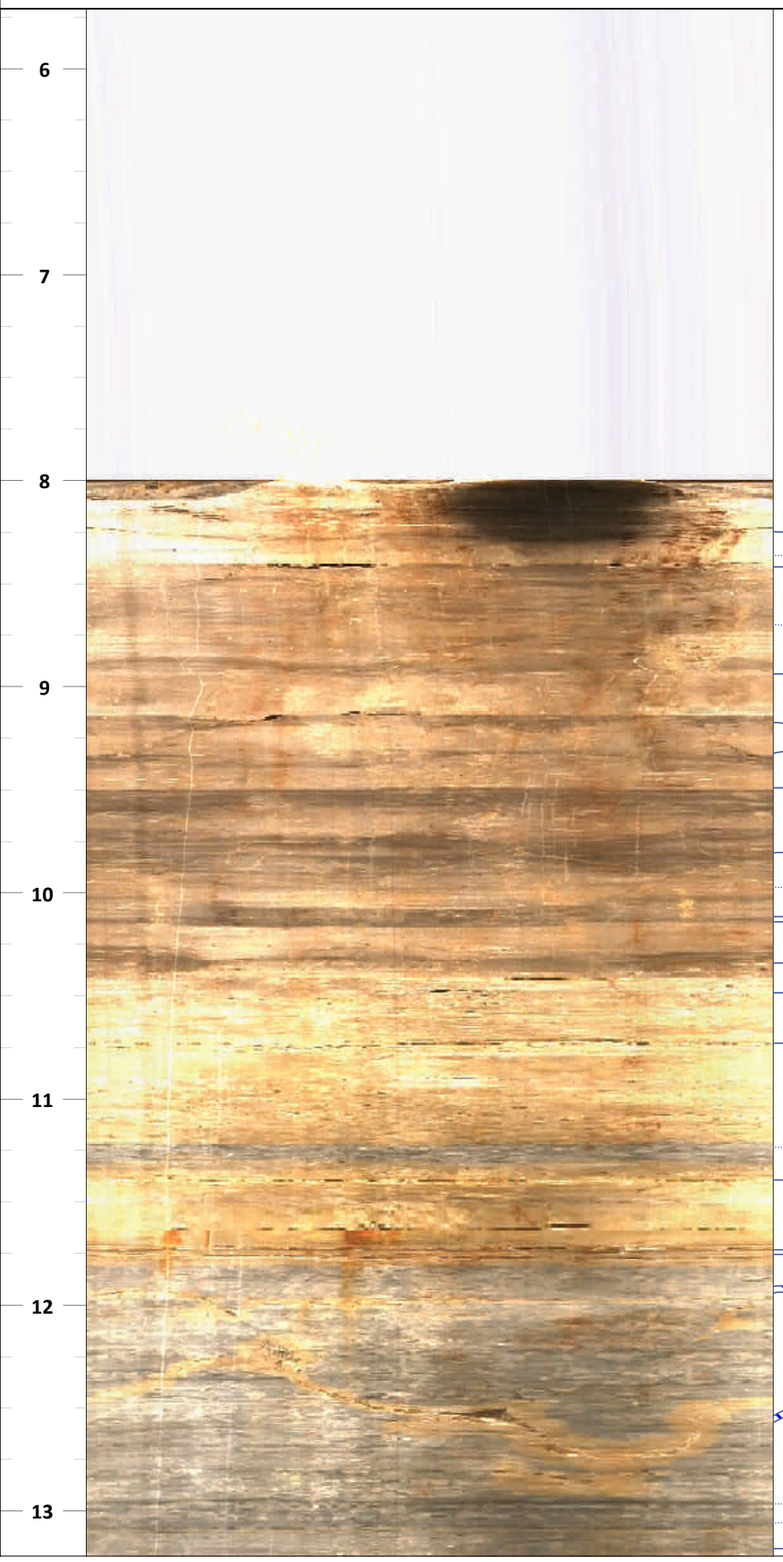
TADPOLES: 0° 90°

POLAR PLOT

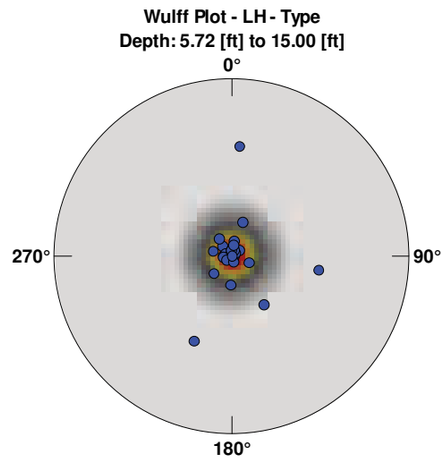
Wulff Plot - LH - AGA

STRIKE PLOT

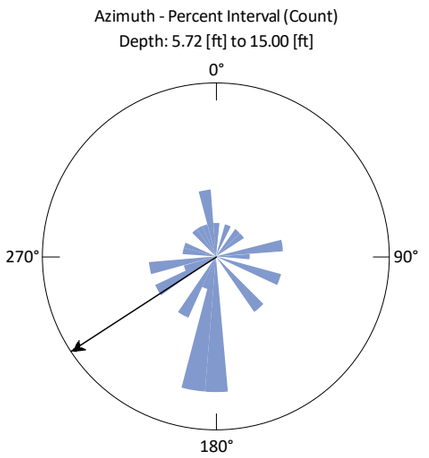
Strike - Percent Interval



RUN 1: 7-10 FT
RECOVERY 35" ; RQD 85
LT GREY TO GREY DOLO, FINELY XTALLINE, W DARK GREY BANDING & IRON STAINING IN FRACTURES

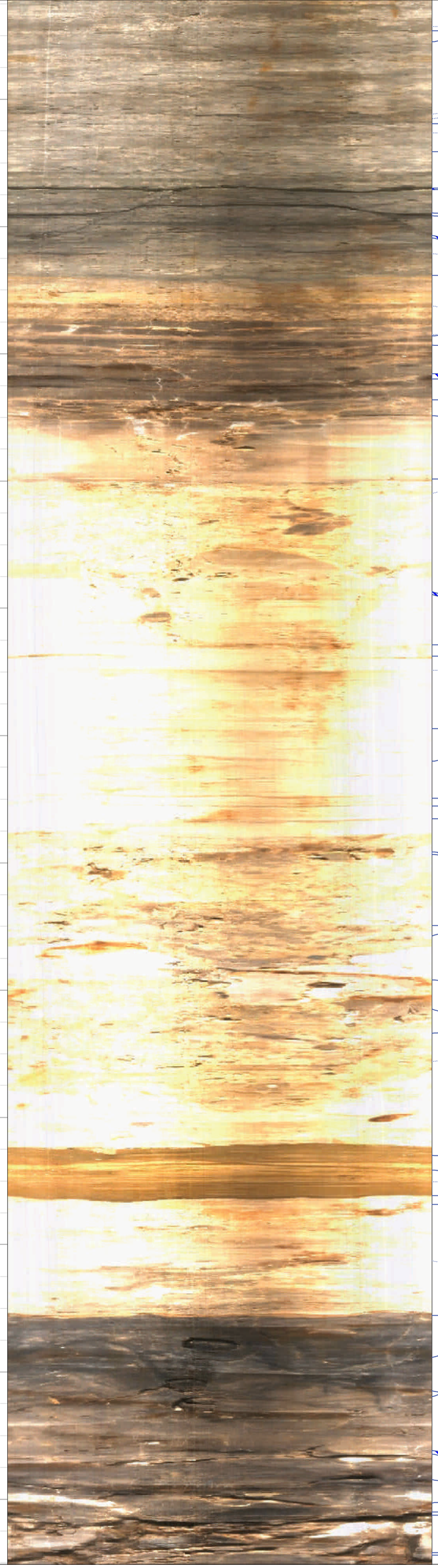


	Counts	Dip[deg]	Azi[deg]
Mean	34	0.75	236.83
	34	0.75	236.83



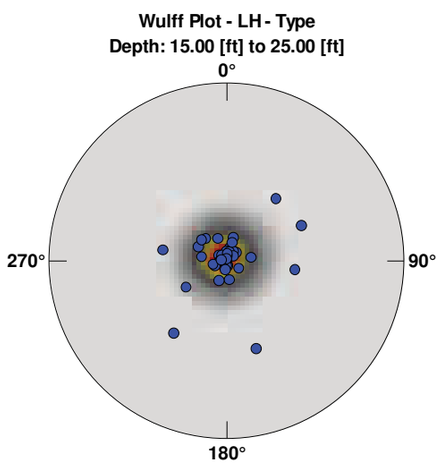
Components:	Azimuth
Counts:	34.00
Mean (3D):	236.83
Min:	2.13
Max:	352.40

RUN 2: 10-15 FT
RECOVERY: 60" ; RQD 57

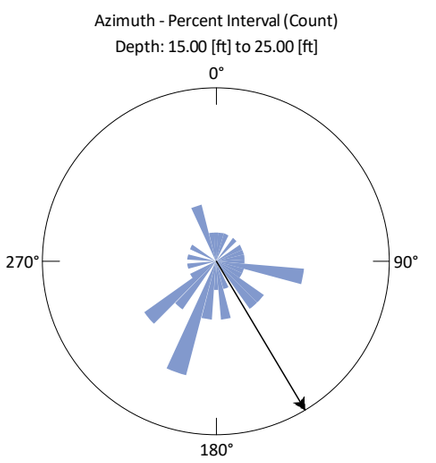


RUN 3: 15-20 FT
RECOVERY 59" ; RQD 100

19.5-21.5 FT - VUGGY



	Counts	Dip[deg]	Azi[deg]
Mean	39	2.23	149.15
	39	2.23	149.15



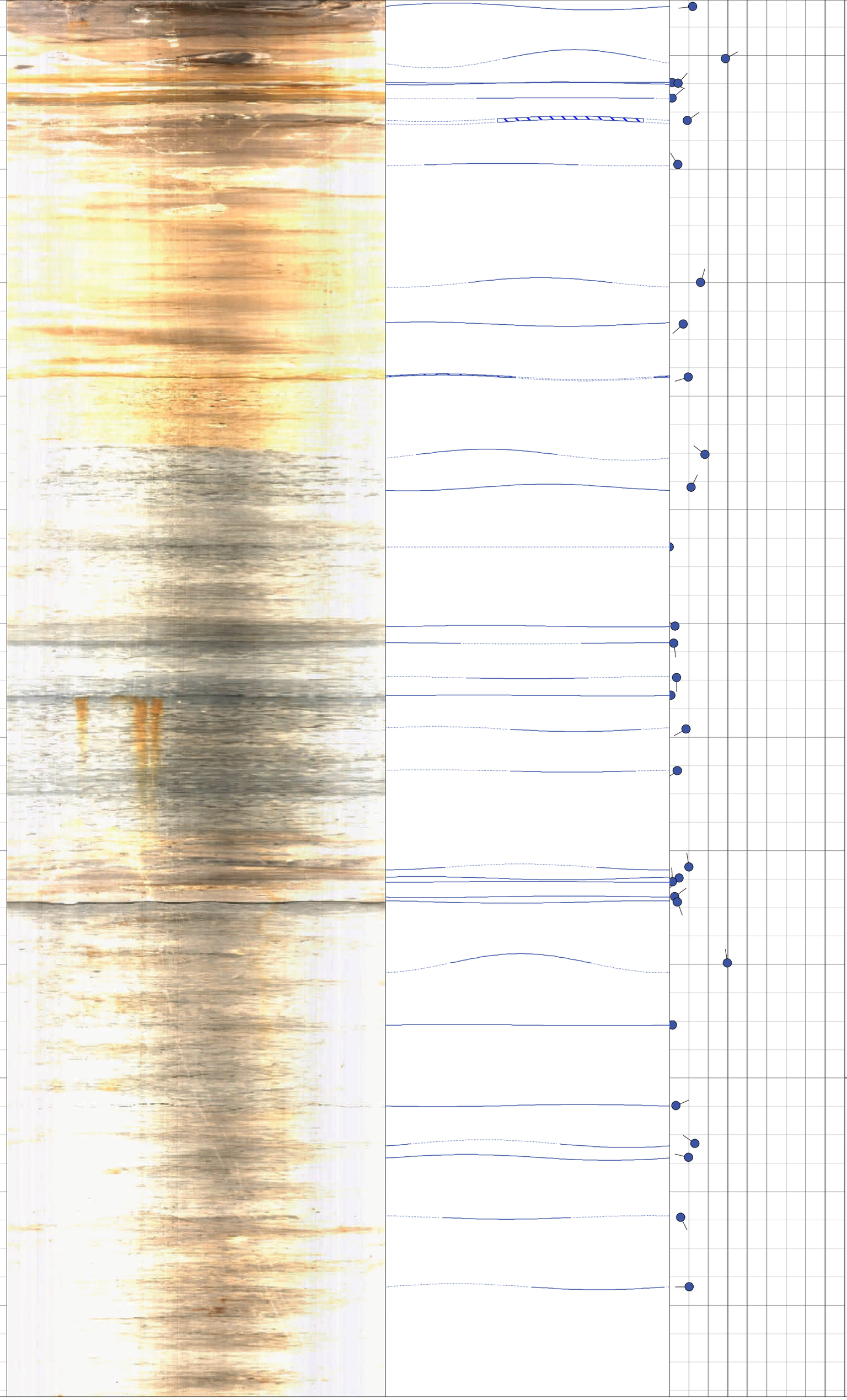
Components:	Azimuth
Counts:	39.00
Mean (3D):	149.15
Min:	4.66
Max:	351.19

RUN 4: 20-25 FT
RECOVERY: 53" ; RQD 73

21.5-22 FT: SHALE, BROWN, THINLY BEDDED, NONCALCAREOUS

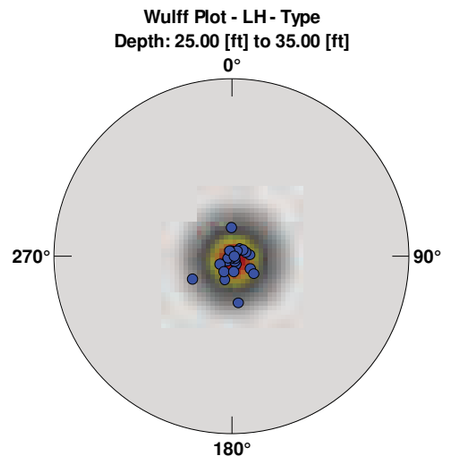
22-25 FT: CHERT, DARK GREY W LT GREY BANDING

RUN 5: 20-25 FT
RECOVERY 63" ; RQD 74

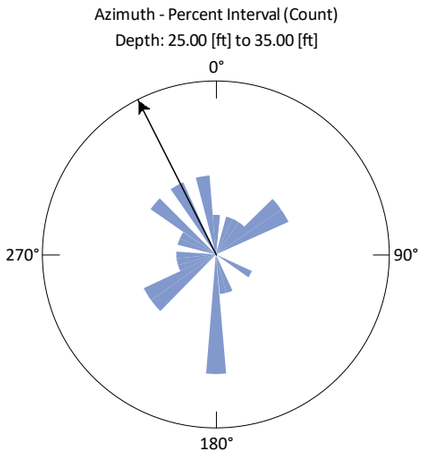


LT GREY TO GREY DOLO W DARK GREY BANDING

28.5 FT: SANDSTONE (4" THICK)



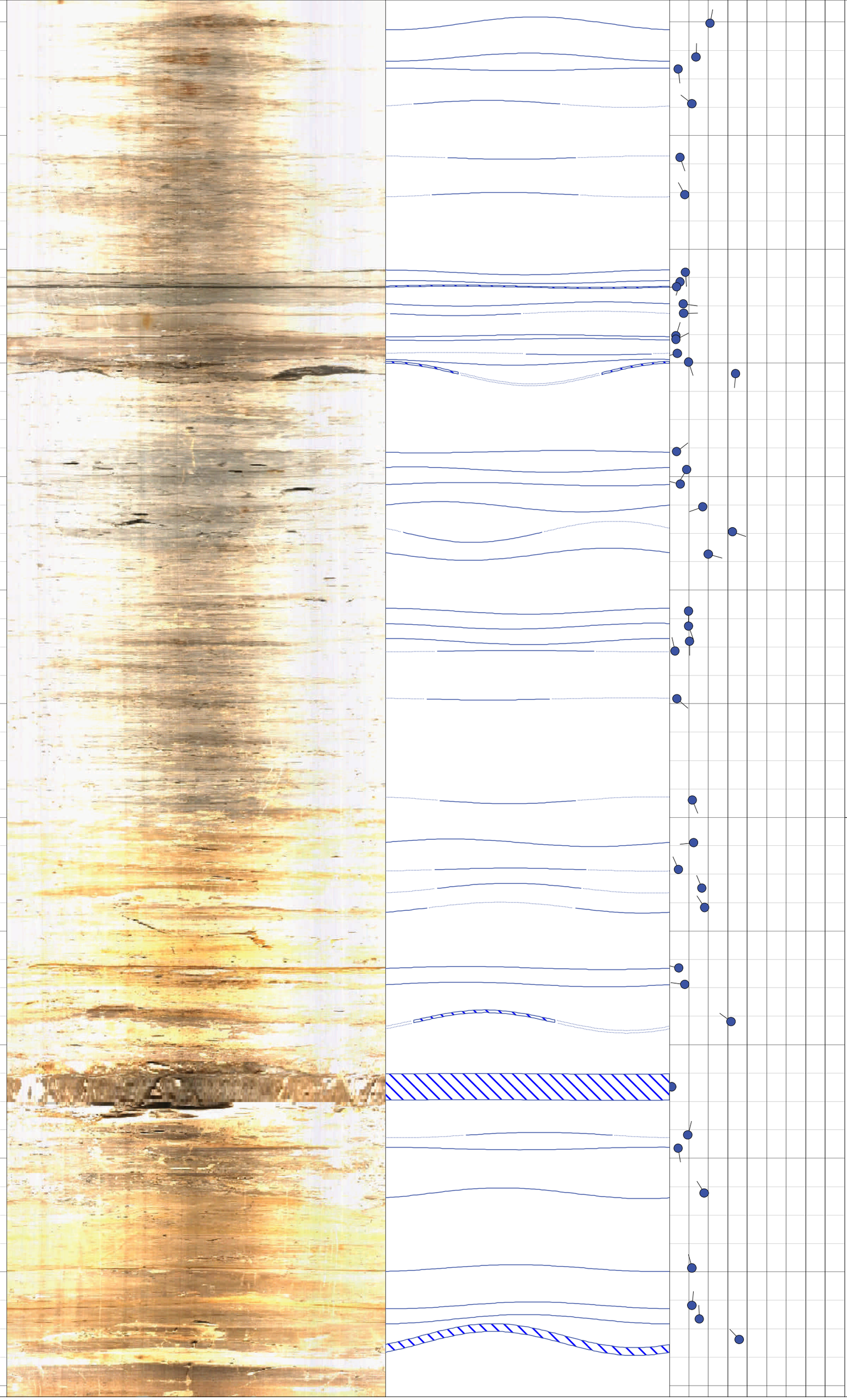
	Counts	Dip[deg]	Azi[deg]
Mean	29	2.77	333.14
	29	2.77	333.14

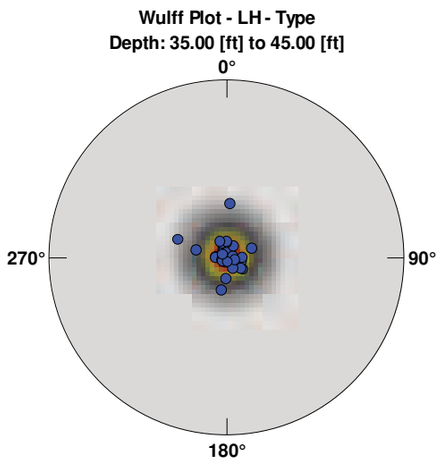


Components:	Azimuth
Counts:	29.00
Mean (3D):	333.14
Min:	16.20
Max:	355.75

RUN 6: 30-35 FT
RECOVERY 60.25" ; RQD 100

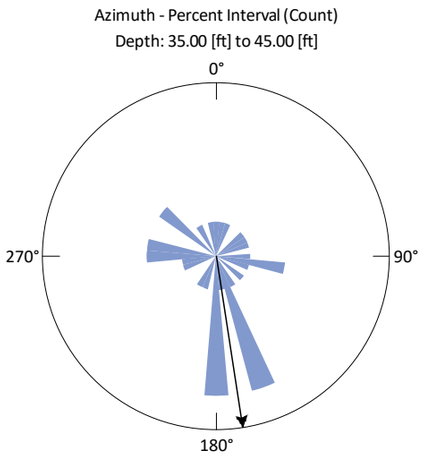
RUN 7: 35-40 FT
RECOVERY 59.25" ; RQD 100
35-40 FT: CHERT NODULES OBSERVED





	Counts	Dip[deg]	Azi[deg]
Mean	33	2.18	171.23
	33	2.18	171.23

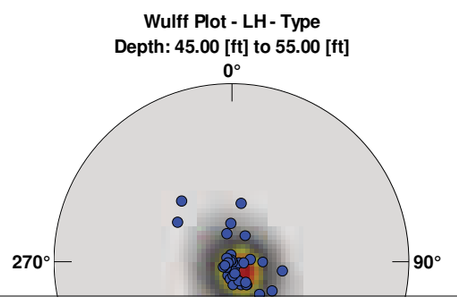
RUN 8: 40-45 FT
RECOVERY 60"; RQD 78

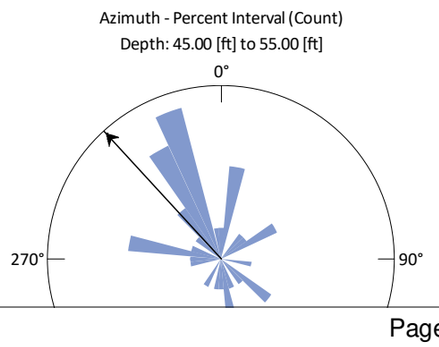


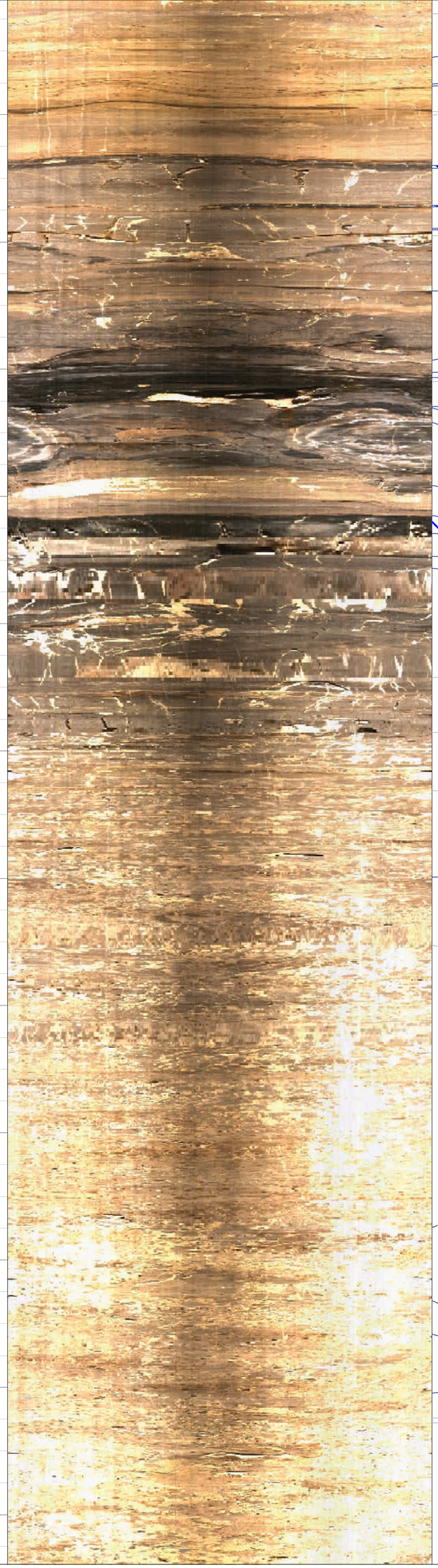
Components:	Azimuth
Counts:	33.00
Mean (3D):	171.23
Min:	1.89
Max:	345.59

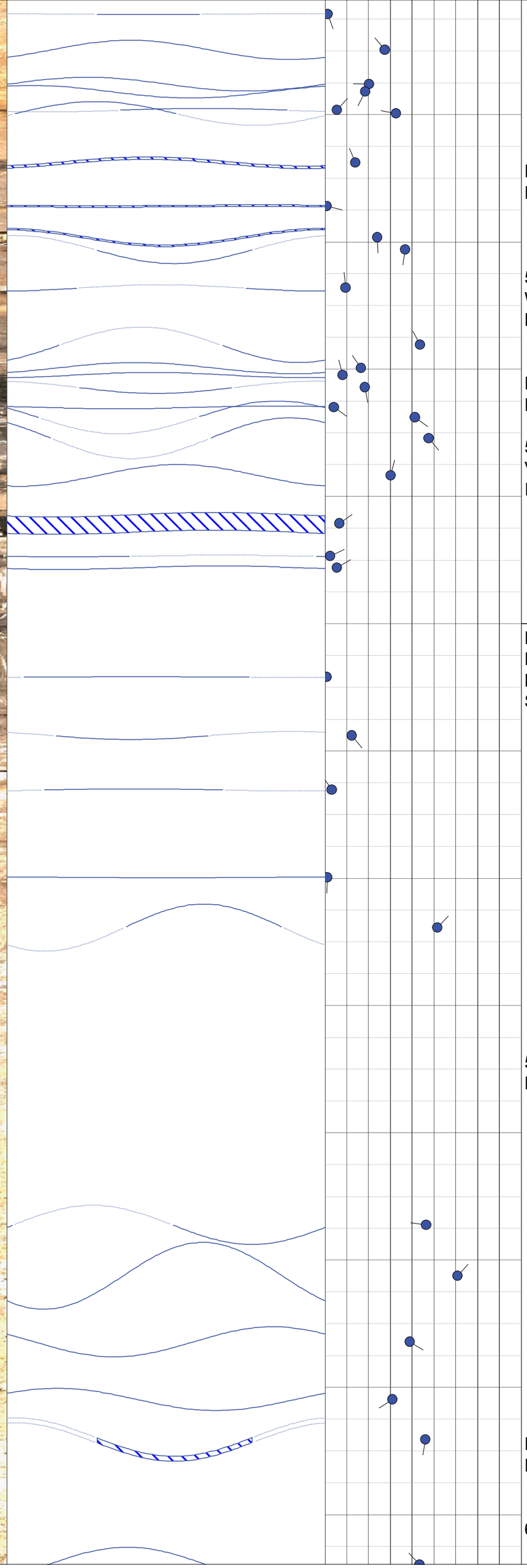
RUN 9: 45-50 FT
RECOVERY 55.5" ; RQD 86

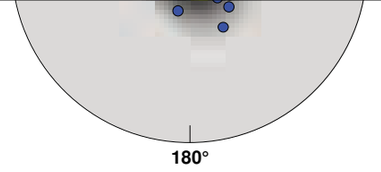
45-47.5 FT: VUGS NOTED











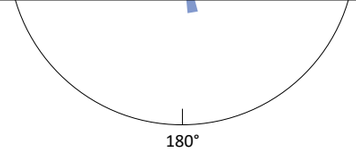
	Counts	Dip[deg]	Azi[deg]
Mean	37	6.01	317.49
●	37	6.01	317.49

RUN 10: 50-53 FT
RECOVERY 32.75" ; RQD 82

52.5 FT: CHERT, DARK GREY WITH LT GREY AND BROWN BANDING

RUN 11: 53-55 FT
RECOVERY 25" ; RQD 83

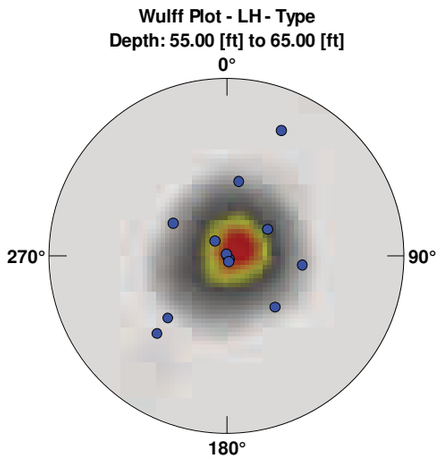
53.5 FT: LT GREY TO GREY DOLO. VUGGY WITH CHERT INTERBEDDING



Components:	Azimuth
Counts:	37.00
Mean (3D):	317.49
Min:	6.38
Max:	356.75

RUN 12: 55-60 FT
RECOVERY: 60" ; RQD 100
LT GREY TO GREY DOLO WITH SPORADIC VUGS

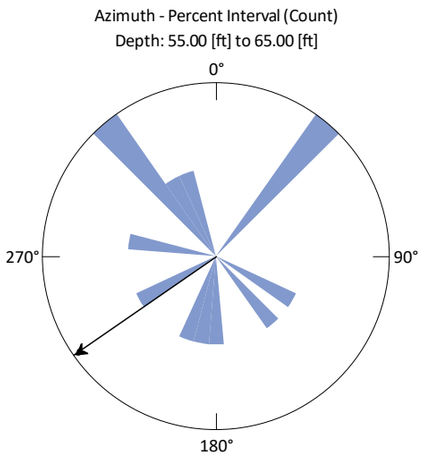
59 FT: VUGS WITH QUARTZ PRECIPITATE



	Counts	Dip[deg]	Azi[deg]
Mean	13	3.43	235.25
●	13	3.43	235.25

RUN 13: 60-65 FT
RECOVERY 59.5" ; RQD 97

62 FT: VUGGY



Components:	Azimuth
Counts:	13.00
Mean (3D):	235.25
Min:	41.98
Max:	342.06

63

64

63-64 FT: VUGGY

64 FT: CHERT NODULES NOTED

65

66

67

RUN 14: 65-70 FT
RECOVERY 60" ; RQD 95
GREY DOLO, BRECCIATED, W
CHERT NODULES

68

69

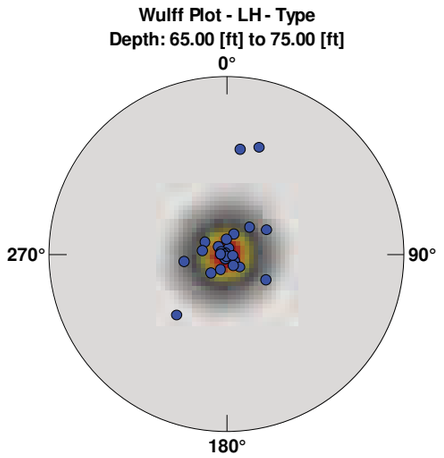
70

71

72

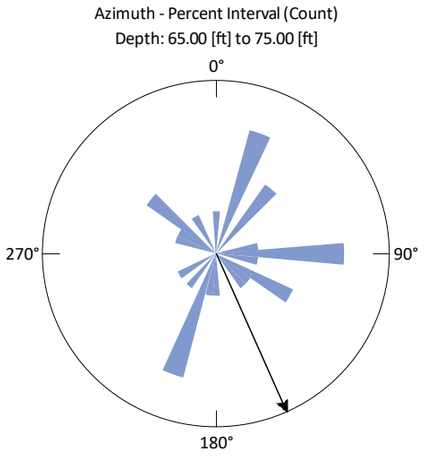
73

74

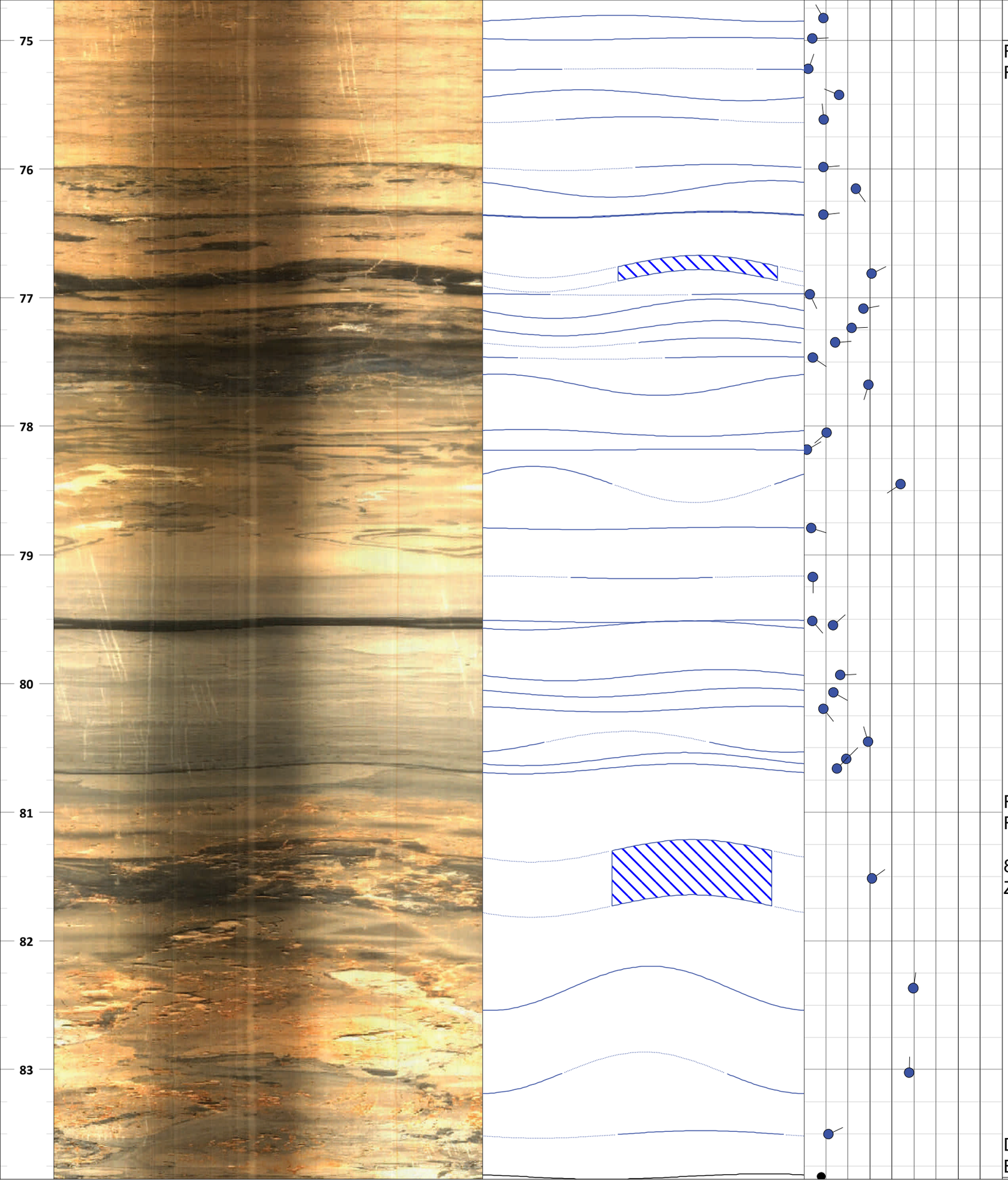


	Counts	Dip[deg]	Azi[deg]
Mean	27	1.32	156.04
	27	1.32	156.04

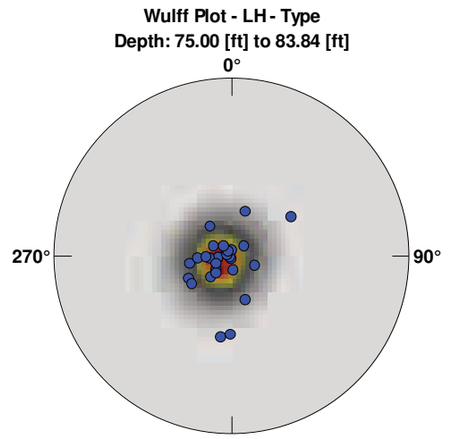
RUN 15: 70-75 FT
RECOVERY 59.5" ; RQD 98
GREY DOLO W DARK GREY
BANDING & SOME CHERT
NODULES
SOME THIN BLACK
CHERT BANDING.



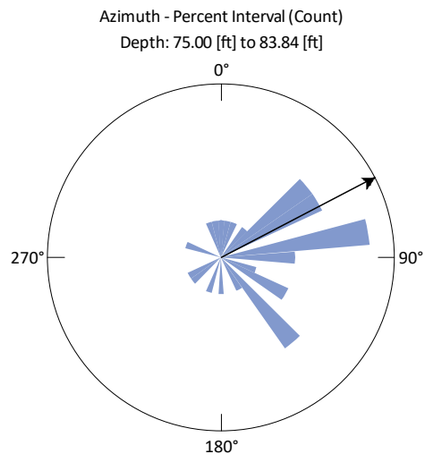
Components:	Azimuth
Counts:	27.00
Mean (3D):	156.04
Min:	3.60
Max:	329.40



RUN 16: 75-80 FT
RECOVERY 57.5" ; RQD 98



	Counts	Dip[deg]	Azi[deg]
Mean	30	7.32	62.25
●	30	7.32	62.25



Components:	Azimuth
Counts:	30.00
Mean (3D):	62.25
Min:	1.13
Max:	353.73

RUN 17: 80-85 FT
RECOVERY 60" ; 90% RQD

80.5-83 FT: VUGGY, FRACTURED ZONE

DRILLING CONCLUDED 84.58 FT BGS

DISCLAIMER

Century Wireline Services (CWS) takes all due care to ensure that the data, measurements and interpretations supplied to the client are correct and accurate. CWS makes no representation and gives no warranty as to the use which may be made of the data, measurements or interpretations and expresses no opinion as to the conclusions, interpretation or analysis of the data and measurements supplied.

CWS does not know and cannot determine the performance, profitability or viability of any particular site for commercial purpose. The client must conduct its own investigations and research and form its own conclusions as to the commercial viability of any site.

The client hereby acknowledges that it has not and will not act or rely upon any opinion, interpretation or analysis made by CWS, its employees or agents.

Liability is excluded for the loss suffered by any party resulting in any way from the use of or reliance on any opinion, interpretation or analysis given by CWS, its employees or agents.

SCS ENGINEERS

LOG OF BORING NO.: **EB-4**

SHEET NUMBER: 1 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1044.1 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-75	TOC ELEVATION: 1044.1 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 81.49 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1181096.52 EASTING: 775091.15
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 54.69 fbgs
START DATE: 9/29/2022	BORING DIAMETER: 3"	WATER ELEVATION: 989.39 ft
FINISH DATE: 10/4/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
0	Silty Clay	Silty Clay; reddish brown to orange with chert gravels						Sch 40 PVC Casing (grouted) 0'-6.5' bgs	1045
5									1040
			Core	6.5-10		32			
10		Dolomite, tan with brown banding, iron staining in fractures, some vuggy 12'-13.3' and 18'-18.75 (vuggs filled with silty clay 18'-18.75')							1035
			Core	10-15		93			
15									1030
			Core	15-20		88		3" Open borehole 6.5' to 81.49' bgs	
20									1025
			Core	20-25		100			
25									1020

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-4** SHEET NUMBER: 2 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1044.1 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-75	TOC ELEVATION: 1044.1 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 81.49 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1181096.52 EASTING: 775091.15
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 54.69 fbgs
START DATE: 9/29/2022	BORING DIAMETER: 3"	WATER ELEVATION: 989.39 ft
FINISH DATE: 10/4/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
30	Dolomite	Dolomite, light gray to gray with some chert nodules, vuggy with brown and dark gray banding 22'-25, gastropod fossils noted 26.5'-27.5', appears weahtered and fractured at 29'-30', some interbedded chert 30'-35 up to 2" thick, some brown banding	Core	25-30		51			1015
			Core	30-35		49			1010
35			Core	35-40		63			1005
40			Core	40-45		62			1000
45		Dolomite; gray, brecciated with chert nodules	Core	45-50		75			995
50			Core	50-55		86			990
55									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-4**

SHEET NUMBER: 3 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1044.1 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-75	TOC ELEVATION: 1044.1 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 81.49 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1181096.52 EASTING: 775091.15
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 54.69 fbgs
START DATE: 9/29/2022	BORING DIAMETER: 3"	WATER ELEVATION: 989.39 ft
FINISH DATE: 10/4/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
60		Dolomite; tan to gray with dark gray and brown banding, 50-55 some vugs with calcite present in vugs., chert bands up to 1" from 55-60	Core	55-60		86			985
			Core	60-60 .5		0			
			Core	60.5-65.5		31			980
65			Core	65.5-70.5		50			
70			Core	70.5-75.5		81			975
75			Core	75.5-80.5		93			970
80									
85									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-4**

11219 Richardson Drive North Little Rock, AR	DRILLER: Kevin Murphy	SURFACE ELEVATION: 1044.1 ft
	DRILLING RIG: CME-75	TOC ELEVATION: 1044.1 ft
CLIENT: LRS	DRILLING METHOD:	WELL DEPTH COMPLETION: 81.49 fbgs
PROJECT NAME: NABORS	DRILLING CONTRACTOR: GTS	LOCATION:
PROJECT NUMBER: 27222139.01		NORTHING: 1181096.52
PROJECT LOCATION: Three Brothers, AR		EASTING: 775091.15
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 54.69 fbgs
START DATE: 9/29/2022	BORING DIAMETER: 3"	WATER ELEVATION: 989.39 ft
FINISH DATE: 10/4/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
90									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

Century GEOPHYSICAL CORP.

century-geo.com

BAXTER COUNTY LANDFILL
GAMMA-RES-DENSITY
EB4

COMPANY	: SCS ENGINEERS
WELL	: EB4
FIELD	:
COUNTY	: BAXTER
STATE	: ARKANSAS
LOCATION	:
SECTION	: N/A
TOWNSHIP	: N/A
RANGE	: N/A
API NO.	:
UNIQUE WELL ID.	:
PERMANENT DATUM	: GL
LOG MEASURED FROM	: GL
DRL MEASURED FROM	: GL
DATE	: 10/24/22
DEPTH DRILLER	: 80
BIT SIZE	: 3.5"
LOG TOP	: -3.30
LOG BOTTOM	: 79.40
CASING OD	:
CASING BOTTOM	:
CASING TYPE	:
BOREHOLE FLUID	: WATER
RM TEMPERATURE	:
MUD RES	:
MUD WEIGHT	: 8.3
WITNESSED BY	: R FOWLER
RECORDED BY	: J. FLEMING
REMARKS 1	: N- N/A
REMARKS 2	: E- N/A

OTHER SERVICES:
N/A

ELEVATION KB	: N/A
ELEVATION DF	: N/A
ELEVATION GL	: 1042'
RIG NUMBER	:
LOGGER TD	:
ARRIVAL TIME	: 10:30
DEPARTURE TIME	:
CIRC STOPPED	:

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

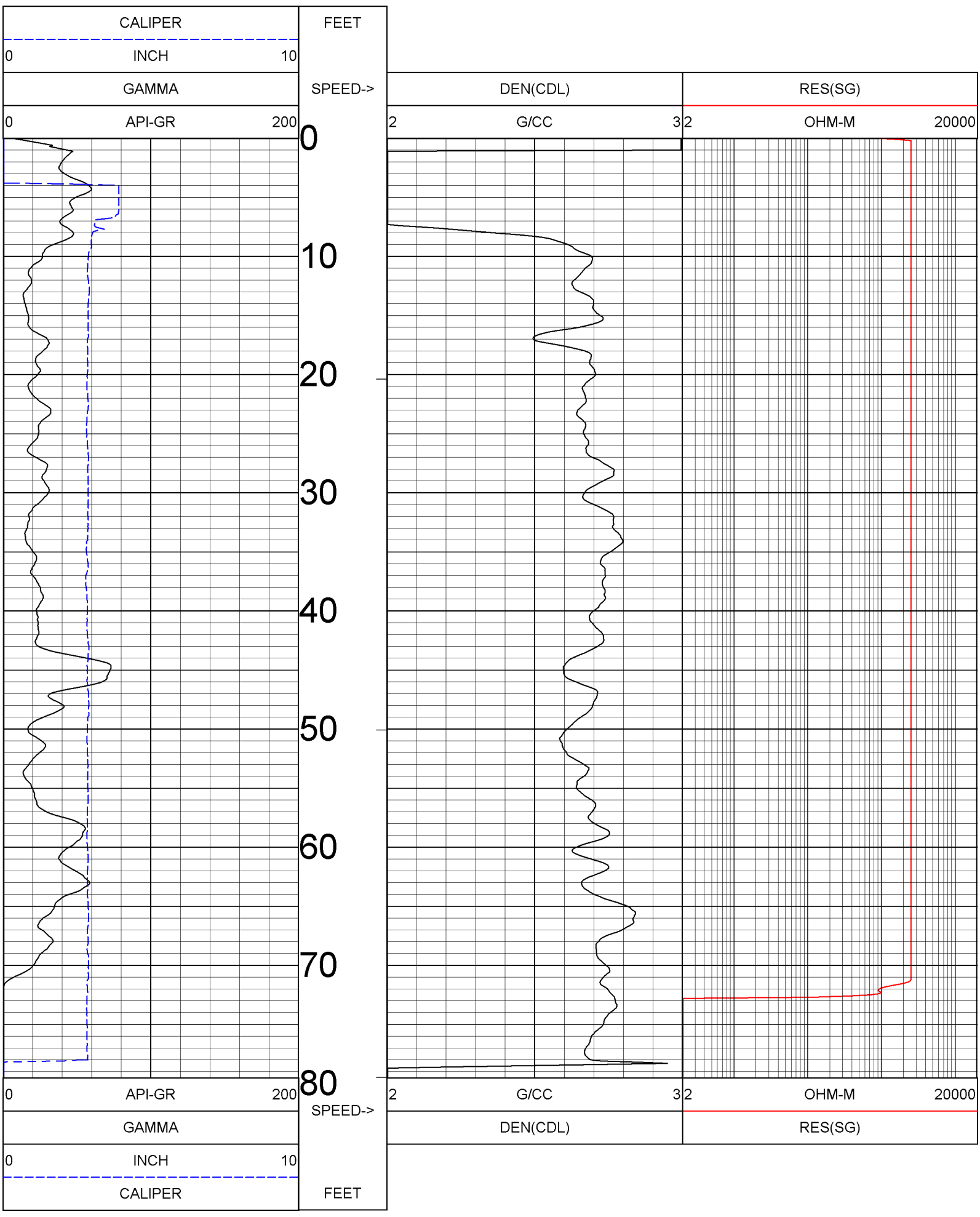
10 INCH LOG, GAMMA-RES-DEN EB4 10/24/22

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54

MAGNETIC DECL : 0 ELECT. CUTOFF : 2500 BIT SIZE : 3.5"

PRESENTATION NAME/DATE = 9239C.0 10/24/2022 VERSION = 3.64IQ



10 INCH LOG, GAMMA-RES-DEN EB4 10/24/22

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54

MAGNETIC DECL : 0 ELECT. CUTOFF : 2500 BIT SIZE : 3.5"

PRESENTATION NAME/DATE = 9239C.0 10/24/2022 VERSION = 3.64IQ

TOOL CALIBRATION EB4 10/24/22 14:58
TOOL 9239C TM VERSION 5026
SERIAL NUMBER 4443

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Aug22,07	13:48:04	GAMMA	0.000	[API-GR]	3.000	[CPS]
	Aug22,07	13:48:04	GAMMA	320.000	[API-GR]	304.000	[CPS]
2	Oct07,22	07:38:54	VOLTAGE	0.000	[MV]	11754.000	[CPS]
	Oct07,22	07:38:54	VOLTAGE	2013.000	[MV]	277811.000	[CPS]
3	Oct11,22	15:39:28	CALIPER	4.000	[INCH]	214224.203	[CPS]
	Oct11,22	15:39:28	CALIPER	6.000	[INCH]	325924.313	[CPS]
4	Oct12,22	08:52:40	DEN(LS)	1.728	[G/CC]	3534.930	[CPS]
	Oct12,22	08:52:40	DEN(LS)	2.673	[G/CC]	662.800	[CPS]
5	Oct12,22	08:48:17	DEN(SS)	1.775	[G/CC]	14025.170	[CPS]
	Oct12,22	08:48:17	DEN(SS)	2.638	[G/CC]	6683.030	[CPS]
6	Aug21,07	11:46:00	CALIPERL	4.000	[INCH]	111180.000	[CPS]
	Aug21,07	11:46:00	CALIPERL	12.000	[INCH]	354930.000	[CPS]
7	Oct07,22	07:50:19	CURRENT	0.000	[UA]	4843.000	[CPS]
	Oct07,22	07:50:19	CURRENT	288.400	[UA]	28763.000	[CPS]
8	Aug20,07	17:08:26	F	Default	[CPS]		
9	Aug20,07	17:08:26	X	Default	[CPS]		

OTV TELEVIEWER PROCESSING 1:10

SCS ENGINEERS

EB4

JOB NUMBER :	**EB4**	PLATFORM:		DRILL COMPANY:		SERVICE COMP.:	**Century Wireline Services**
PROJECT:		EASTING:		DRILL START DATE:		WELL AZIM (deg):	
FIELD:		NORTHING:		DRILL END DATE:		WELL INCL (deg):	
PROVINCE:	**BAXTER, AR**	ELEVATION(m):		RIG NUMBER:			

BOREHOLE RECORD			
BIT SIZE (IN)	DEPTH FROM (FT)	DEPTH TO (FT)	FLUID TYPE
3.5	**0**	**80**	**WATER / AIR**

CASING RECORD			
TYPE	I.D. (IN)	DEPTH FROM (FT)	DEPTH TO (FT)

REMARKS

DEPTH

MEAS. DEPTH

1ft:10ft

GEOLOGICAL STRUCTURE

OPTICAL IMAGE: 0° 90° 180° 270°

STRUCTURE PICKS: 0° 90° 180° 270°

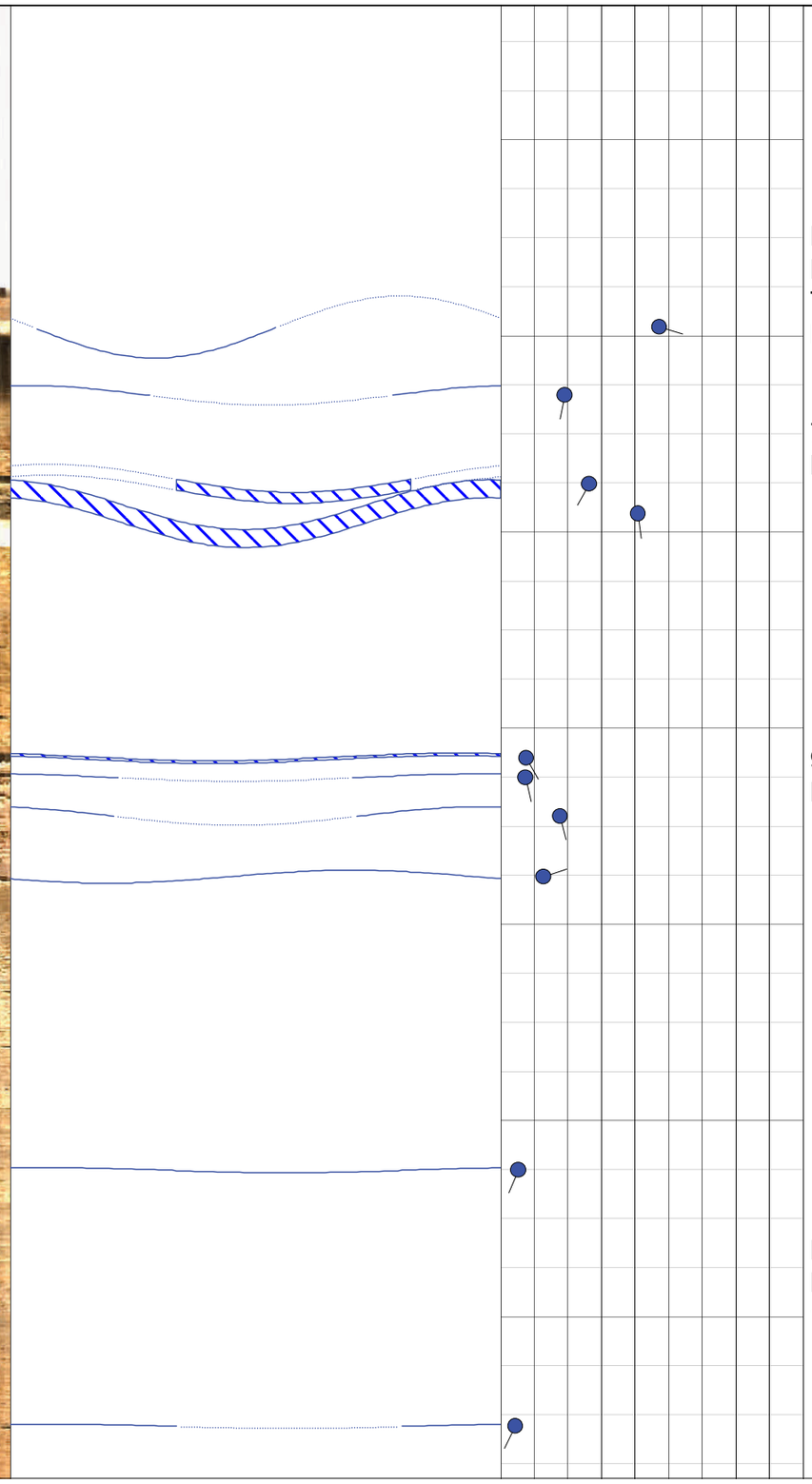
TADPOLES: 0° 90°

POLAR PLOT

Wulff Plot - LH - AGA

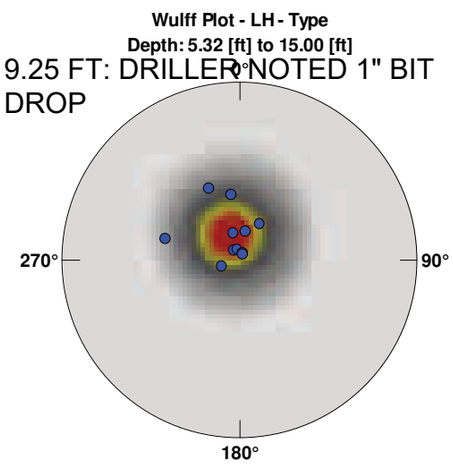
STRIKE PLOT

Strike - Percent Interval



RUN 1: 6.5-10 FT
RECOVERY 27.75" ; RQD 32
TAN DOLO W BROWN BANDING, IRON STAINING IN FRACTURES

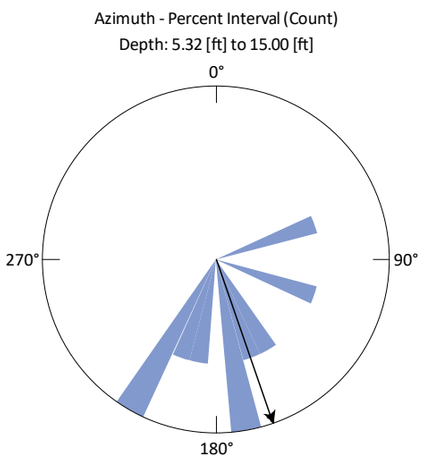
7.5 FT: DRILLER NOTED 4" BIT DROP



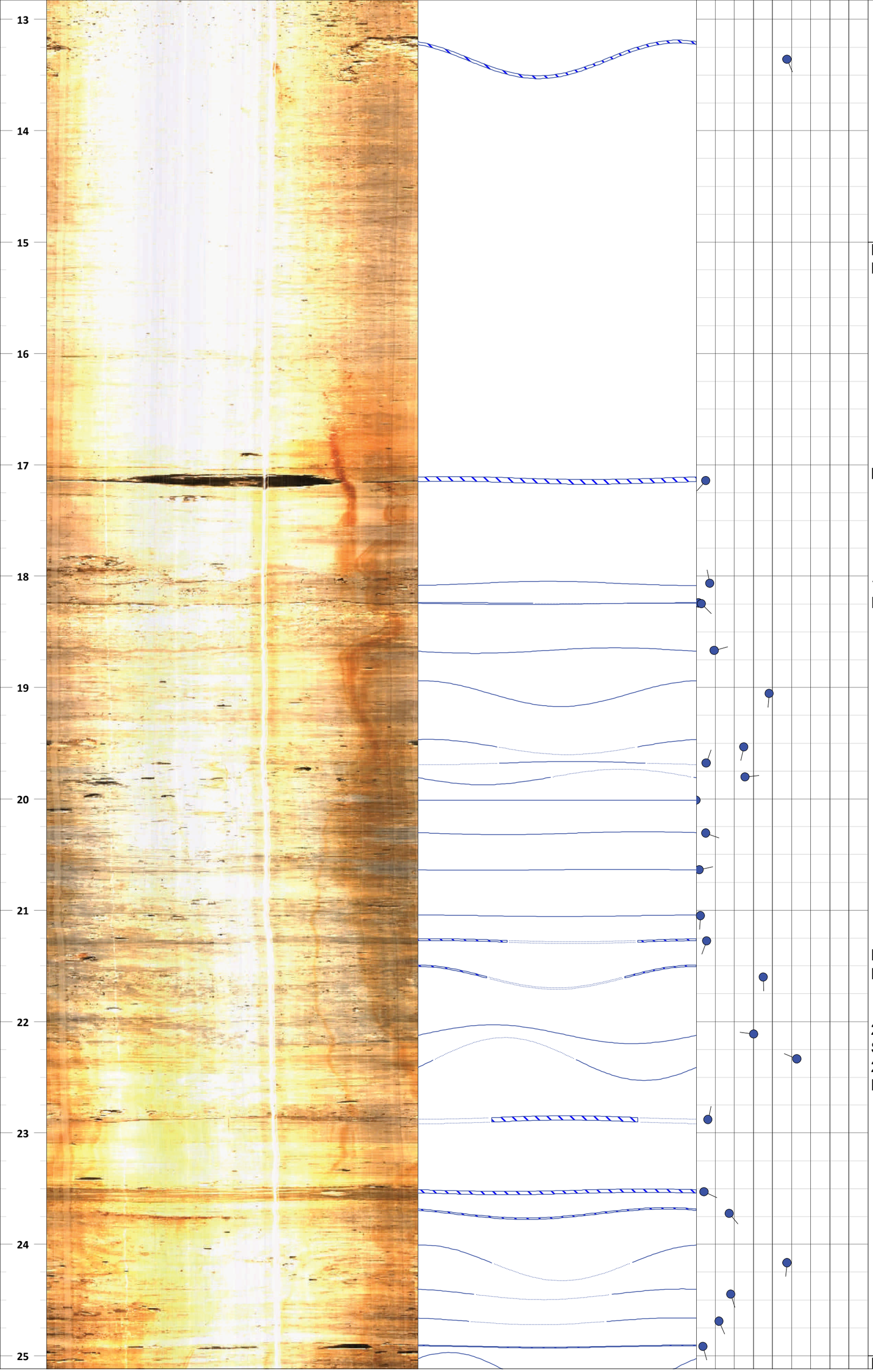
	Counts	Dip[deg]	Azi[deg]
Mean	11	16.68	160.69
	11	16.68	160.69

9.25 FT: DRILLER NOTED 1" BIT DROP

RUN 2: 10-15 FT
RECOVERY 60" ; RQD 93
12-13.3 FT: VUGS NOTED



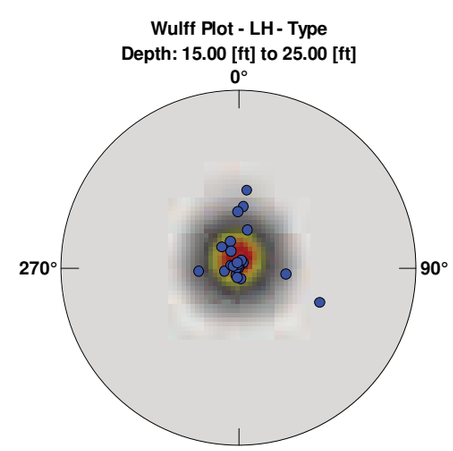
Components:	Azimuth
Counts:	11.00
Mean (3D):	160.69
Min:	71.23
Max:	208.23



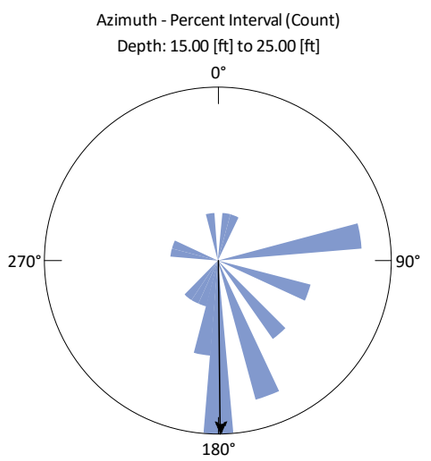
RUN 3: 15-20 FT
RECOVERY 59" ; RQD 88

Bulk density drops to ~2.5 g/cc

18-18.75 FT: VUGS W SILTY CLAY INFILL NOTED



	Counts	Dip[deg]	Azi[deg]
Mean	24	6.51	179.15
	24	6.51	179.15

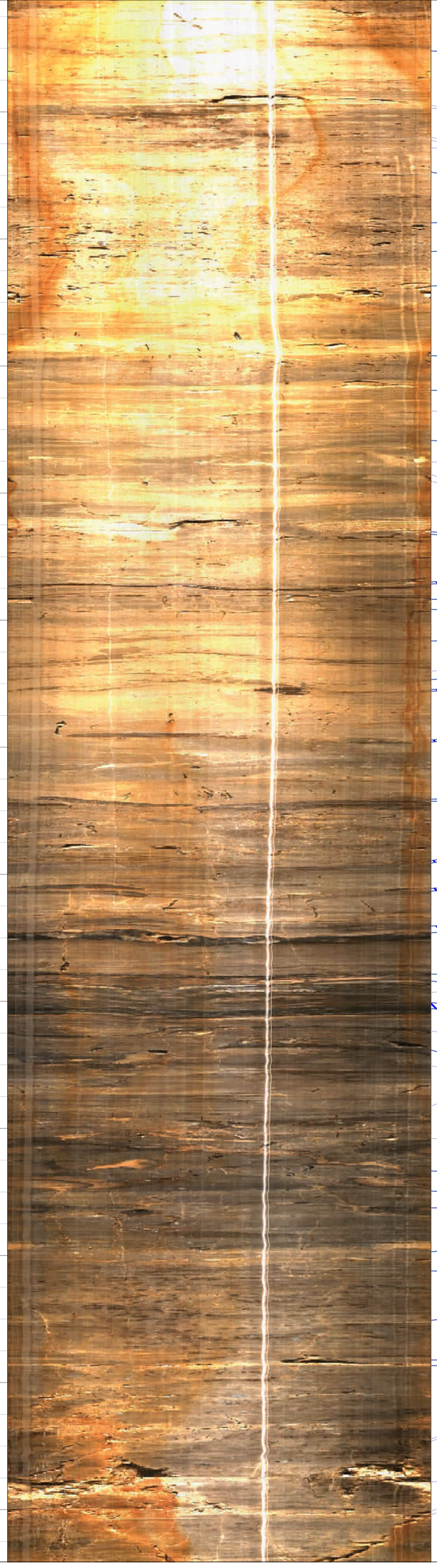


Components:	Azimuth
Counts:	24.00
Mean (3D):	179.15
Min:	11.50
Max:	348.38

RUN 4: 20-25 FT
RECOVERY 53" ; RQD 100

22 FT: LT GREY TO GREY DOLO W SOME CHERT NODULES
22-25 FT: VUGGY WITH BROWN & DARK GREY BANDING

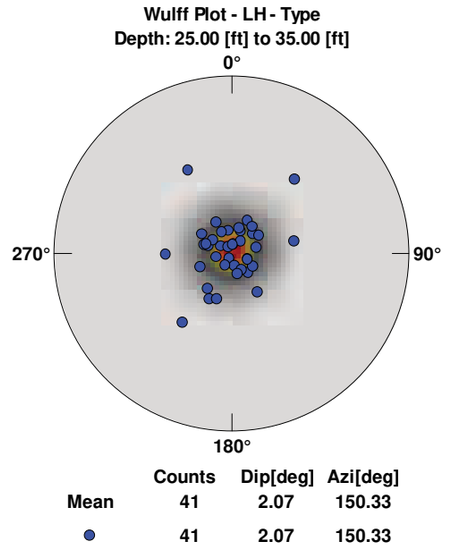
RUN 5: 25-30 FT



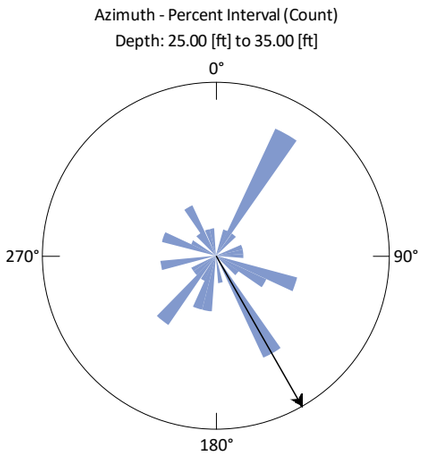
RECOVERY 63" ; RQD 51

26.5-27.5 FT: FOSSILIFEROUS (GASTROPODS)

29-30 FT: APPEARS WEATHERED & FRACTURED



	Counts	Dip[deg]	Azi[deg]
Mean	41	2.07	150.33
	41	2.07	150.33

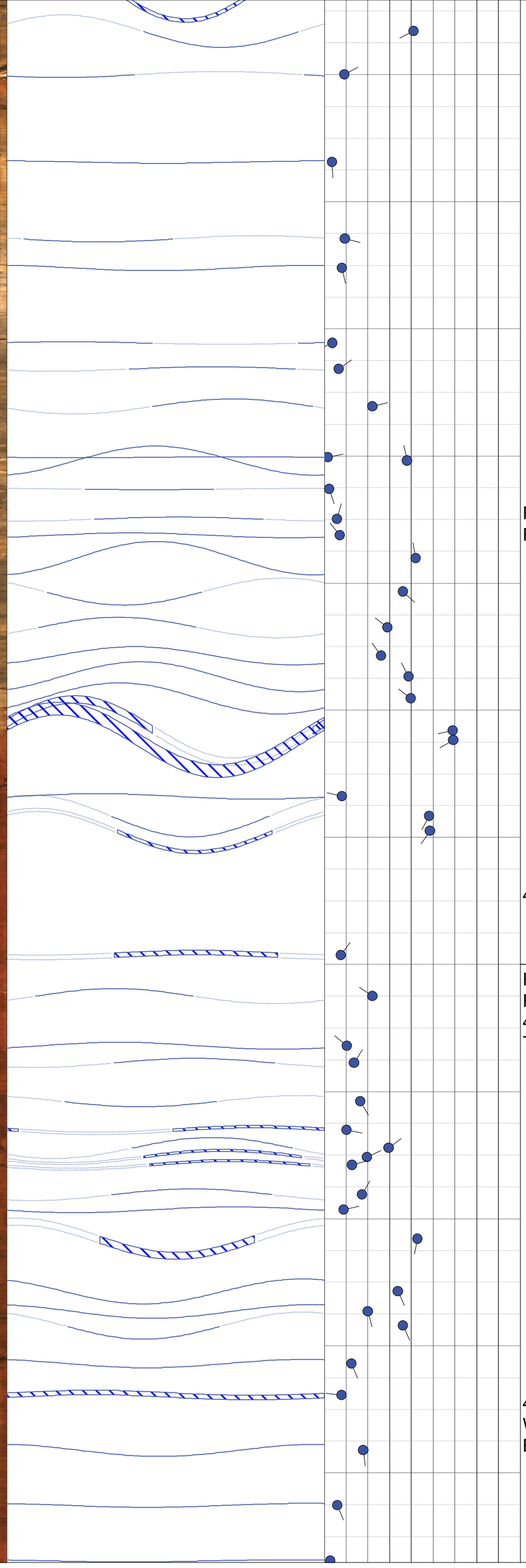


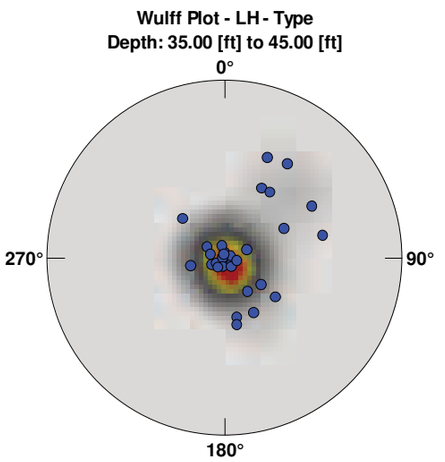
Components:	Azimuth
Counts:	41.00
Mean (3D):	150.33
Min:	18.79
Max:	346.71

RUN 6: 30-35 FT
RECOVERY 58.75" ; RQD 49
30-35 FT: SOME INTERBEDDED CHERT UP TO 2" THICK; SOME BROWN BANDING

RUN 7: 35-40 FT
RECOVERY 56.5" ; RQD 63

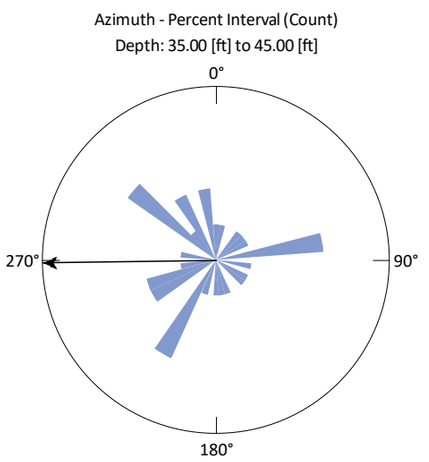
37-38.25 FT: HIGHLY FRACTURED ZONE W IRON STAINING NOTED IN FIELD LOGS





	Counts	Dip[deg]	Azi[deg]
Mean	32	7.02	269.31
	32	7.02	269.31

RUN 8: 40-45 FT
RECOVERY 62.5" ; RQD 61

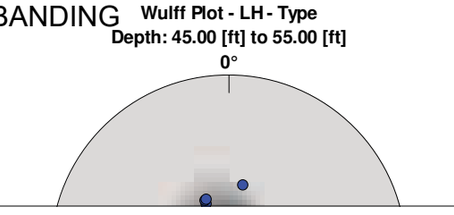


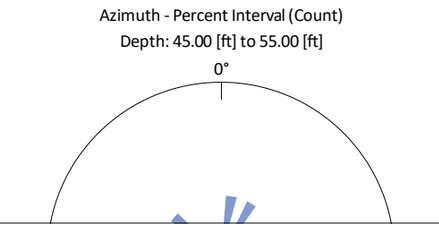
Components:	Azimuth
Counts:	32.00
Mean (3D):	269.31
Min:	4.28
Max:	349.24

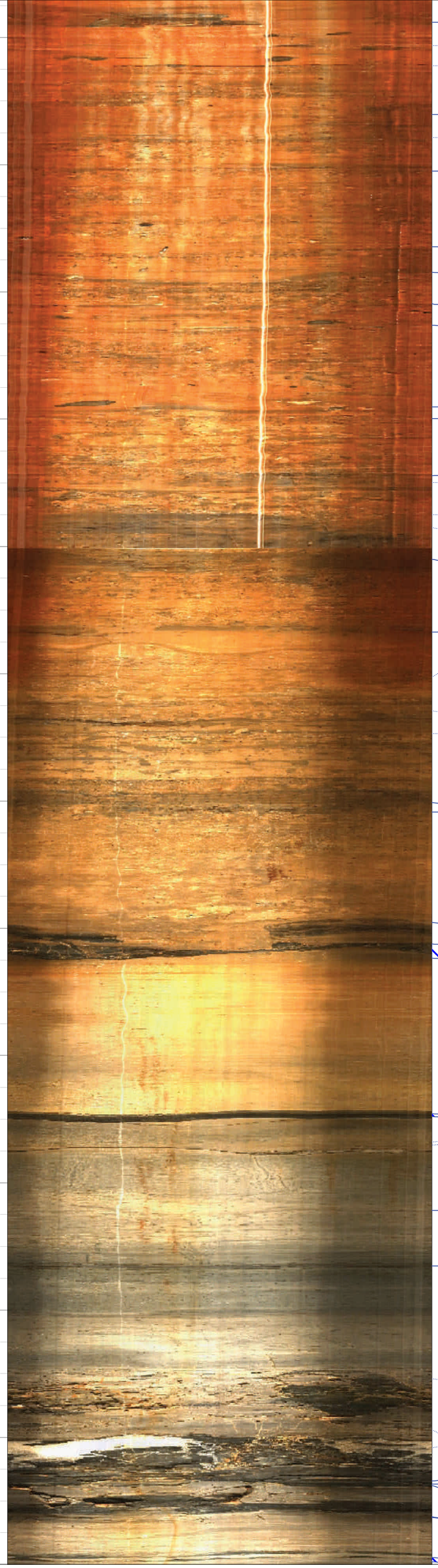
44.75-45 FT: SOME CHERT BANDS

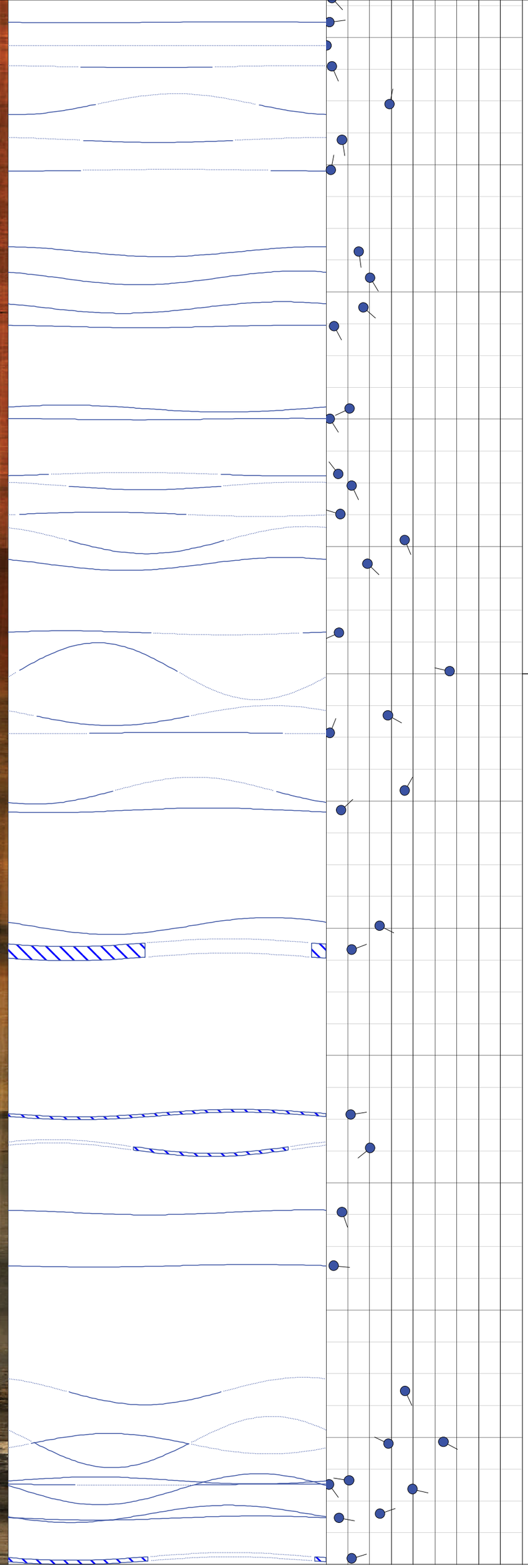
RUN 9: 45-50 FT
RECOVERY 58.75" ; RQD 75
45-48.5 FT: BRECCIATED GREY TO BROWN DOLO

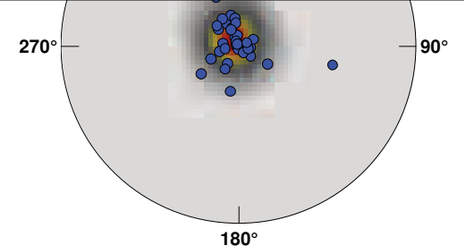
48.5 FT: TAN TO GREY DOLO WITH DARK GREY & BROWN BANDING



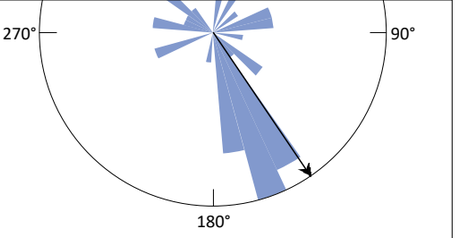








	Counts	Dip[deg]	Azi[deg]
Mean	38	5.63	145.69
●	38	5.63	145.69



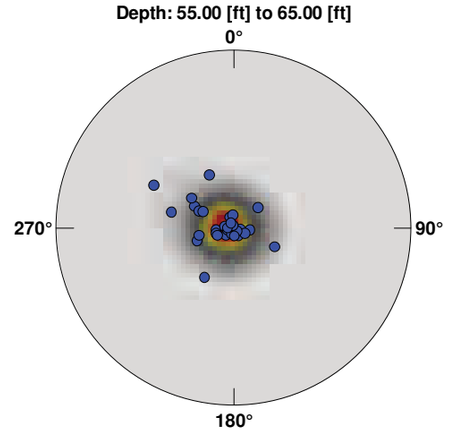
Components:	Azimuth
Counts:	38.00
Mean (3D):	145.69
Min:	10.19
Max:	323.10

RUN 10: 50-55 FT
RECOVERY 61" ; RQD 75
50-55 FT: SOME VUGS W CALCITE PRECIPITATE

RUN 11: 55-60 FT
RECOVERY 58.75" ; RQD 86
55-56 FT: SMALL VUGS

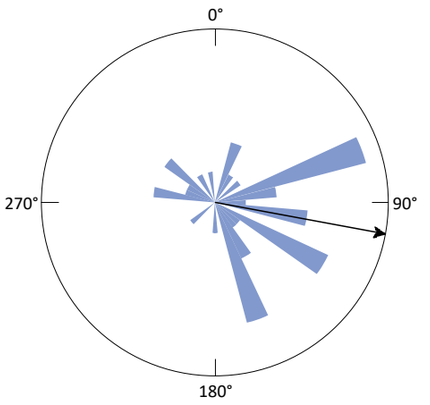
56-60 FT: OCCASIONAL CHERT BANDS UP TO 1.5" THICK

Wulff Plot - LH - Type
Depth: 55.00 [ft] to 65.00 [ft]



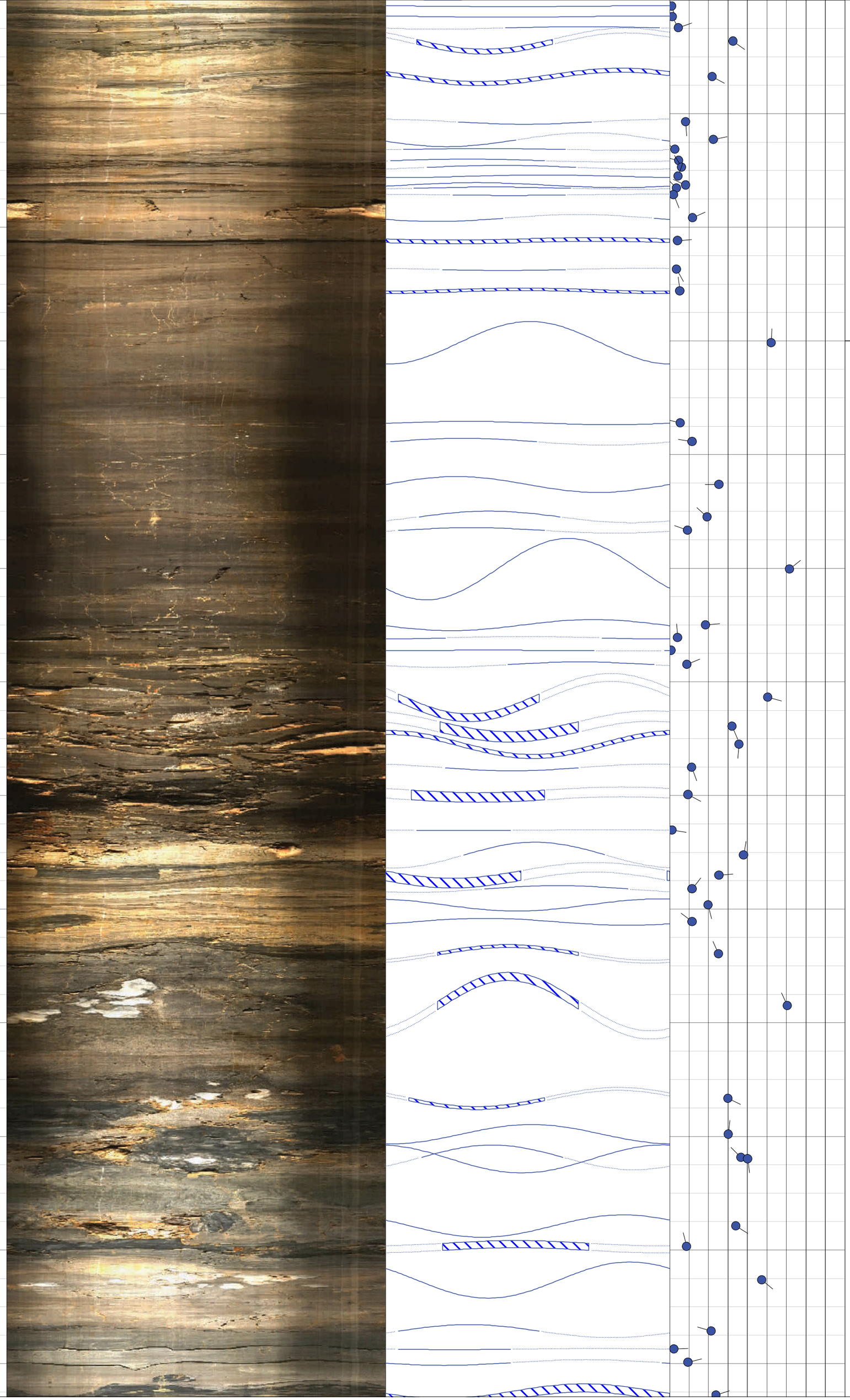
	Counts	Dip[deg]	Azi[deg]
Mean	37	6.65	100.37
●	37	6.65	100.37

Azimuth - Percent Interval (Count)
Depth: 55.00 [ft] to 65.00 [ft]



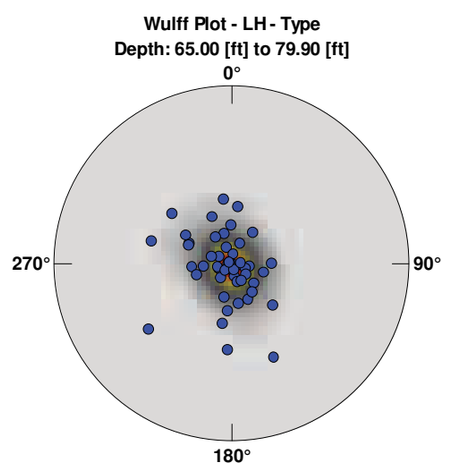
Components:	Azimuth
Counts:	37.00
Mean (3D):	100.37
Min:	20.78
Max:	352.91

RUN 12: 60-60.5 FT
RECOVERY 6" ; RQD 0
RUN 13: 60.5-65.5 FT
RECOVERY 56" ; RQD 31

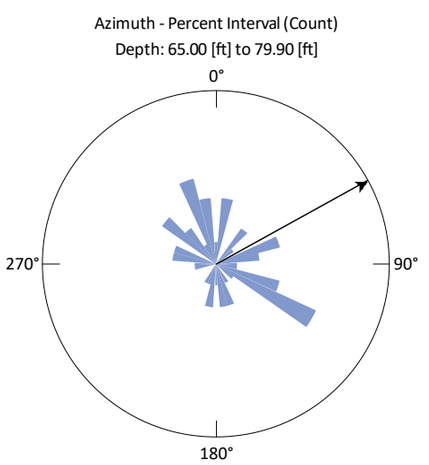


RUN 14: 65.5-70.5 FT
RECOVERY 50" ; RQD 50

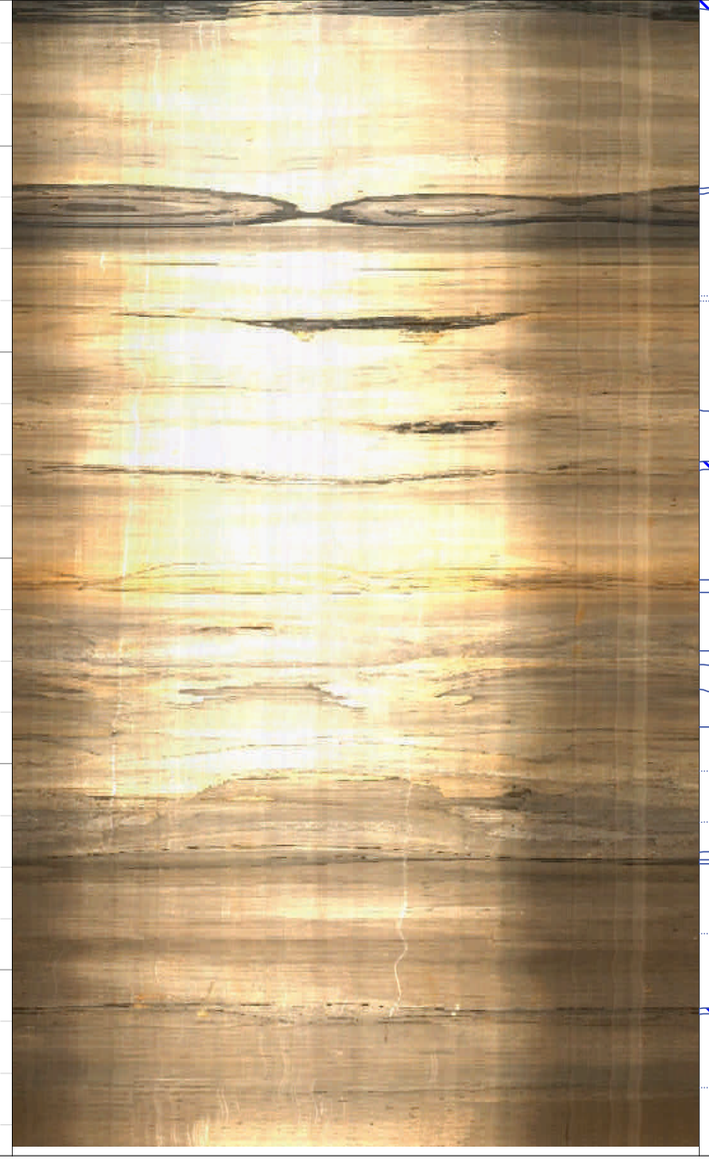
RUN 15: 70.5-75.5
RECOVERY 59.5" ; RQD 81



	Counts	Dip[deg]	Azi[deg]
Mean	52	3.20	60.97
●	52	3.20	60.97



Components:	Azimuth
Counts:	52.00
Mean (3D):	60.97
Min:	3.08
Max:	354.76



RUN 16: 75.5-80.5
RECOVERY 56.5" ; RQD 93

DRILLING CONCLUDED AT 81.49 FT BGS

DISCLAIMER

Century Wireline Services (CWS) takes all due care to ensure that the data, measurements and interpretations supplied to the client are correct and accurate. CWS makes no representation and gives no warranty as to the use which may be made of the data, measurements or interpretations and expresses no opinion as to the conclusions, interpretation or analysis of the data and measurements supplied.

CWS does not know and cannot determine the performance, profitability or viability of any particular site for commercial purpose. The client must conduct its own investigations and research and form its own conclusions as to the commercial viability of any site.

The client hereby acknowledges that it has not and will not act or rely upon any opinion, interpretation or analysis made by CWS, its employees or agents.

Liability is excluded for the loss suffered by any party resulting in any way from the use of or reliance on any opinion, interpretation or analysis given by CWS, its employees or agents.

SCS ENGINEERS

LOG OF BORING NO.: **EB-5**

SHEET NUMBER: 1 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 989.42 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-55	TOC ELEVATION: 989.42 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 80.3 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1181622.96 EASTING: 774465.66
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 67.93 fbgs
START DATE: 10/17/2022	BORING DIAMETER: 3"	WATER ELEVATION: 921.49 ft
FINISH DATE: 10/18/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
0	Silty Clay / Rip Rap	Silty clay; overburden with minor chert Rip rap							990
	Clay Loam	Clay loam - brown, with some coarse sand							
5	Silty Clay	Silty Clay; Yellowish brown							985
10	Clay	Clay, red, stiff with occasional chert pebbles							980
15									975
			Cuttings	16.5-20.5		68		3" Open borehole 16.5' to 80.30' bgs	
20			Cuttings	20.5-25.5		88			970
25		Dolomite; grey with dark grey							

Sch 40 PVC Casing (grouted) 0'-16.5' bgs

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS	LOG OF BORING NO.: **EB-5**	SHEET NUMBER: 2 of 4
11219 Richardson Drive North Little Rock, AR	DRILLER: Kevin Murphy	SURFACE ELEVATION: 989.42 ft
	DRILLING RIG: CME-55	TOC ELEVATION: 989.42 ft
CLIENT: LRS	DRILLING METHOD:	WELL DEPTH COMPLETION: 80.3 fbgs
PROJECT NAME: NABORS	DRILLING CONTRACTOR: GTS	LOCATION:
PROJECT NUMBER: 27222139.01		NORTHING: 1181622.96
PROJECT LOCATION: Three Brothers, AR		EASTING: 774465.66
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 67.93 fbgs
START DATE: 10/17/2022	BORING DIAMETER: 3"	WATER ELEVATION: 921.49 ft
FINISH DATE: 10/18/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
		banding & interbedded chert.	Cuttings	25.5-30.5		92			
30			Cuttings	30.5-35.5		90			
35		Dolomite; light grey with dark grey banding; some interbedded chert beginning 40.5'	Cuttings	35.5-40.5		85			
40			Cuttings	40.5-45.5		80			
45		Dolomite	Cuttings	45.5-50.5		100			
50			Cuttings	50.5-55.5		100			
55									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-5**

SHEET NUMBER: 3 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Kevin Murphy	SURFACE ELEVATION: 989.42 ft
PROJECT NAME: NABORS	DRILLING RIG: CME-55	TOC ELEVATION: 989.42 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 80.3 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: GTS	LOCATION: NORTHING: 1181622.96 EASTING: 774465.66
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 67.93 fbgs
START DATE: 10/17/2022	BORING DIAMETER: 3"	WATER ELEVATION: 921.49 ft
FINISH DATE: 10/18/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
60		Dolomite; grey with dark grey banding. Some small vugs 59-59.5'	Cuttings	55.5-60.5		100			
			Cuttings	60.5-65.5		100			
65			Cuttings	65.5-70.5		88			
70			Cuttings	70.5-75.5		97			
75									
		Dolomite, Heavily weathered, vuggy, grey	Cuttings	75.5-80.5		61			
80									
85									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **EB-5**

11219 Richardson Drive North Little Rock, AR	DRILLER: Kevin Murphy	SURFACE ELEVATION: 989.42 ft
	DRILLING RIG: CME-55	TOC ELEVATION: 989.42 ft
CLIENT: LRS	DRILLING METHOD:	WELL DEPTH COMPLETION: 80.3 fbgs
PROJECT NAME: NABORS	DRILLING CONTRACTOR: GTS	LOCATION:
PROJECT NUMBER: 27222139.01		NORTHING: 1181622.96
PROJECT LOCATION: Three Brothers, AR		EASTING: 774465.66
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Core	WATER LEVEL: 67.93 fbgs
START DATE: 10/17/2022	BORING DIAMETER: 3"	WATER ELEVATION: 921.49 ft
FINISH DATE: 10/18/2022	WELL DIAMETER: 3"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
90									

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

Century GEOPHYSICAL CORP.

century-geo.com

BAXTER COUNTY LANDFILL
GAMMA-RES-DENSITY
EB5

COMPANY	: SCS ENGINEERS
WELL	: EB5
FIELD	:
COUNTY	: BAXTER
STATE	: ARKANSAS
LOCATION	:
SECTION	: N/A
TOWNSHIP	: N/A
RANGE	: N/A
API NO.	:
UNIQUE WELL ID.	:
PERMANENT DATUM	: GL
LOG MEASURED FROM	: GL
DRL MEASURED FROM	: GL
DATE	: 10/24/22
DEPTH DRILLER	: 80
BIT SIZE	: 3.5"
LOG TOP	: -3.50
LOG BOTTOM	: 79.60
CASING OD	:
CASING BOTTOM	:
CASING TYPE	:
BOREHOLE FLUID	: WATER
RM TEMPERATURE	:
MUD RES	:
MUD WEIGHT	: 8.3
WITNESSED BY	: R FOWLER
RECORDED BY	: J. FLEMING
REMARKS 1	: N- N/A
REMARKS 2	: E- N/A
ELEVATION KB	: N/A
ELEVATION DF	: N/A
ELEVATION GL	: N/A
RIG NUMBER	:
LOGGER TD	:
ARRIVAL TIME	: 10:30
DEPARTURE TIME	:
CIRC STOPPED	:

OTHER SERVICES: N/A

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

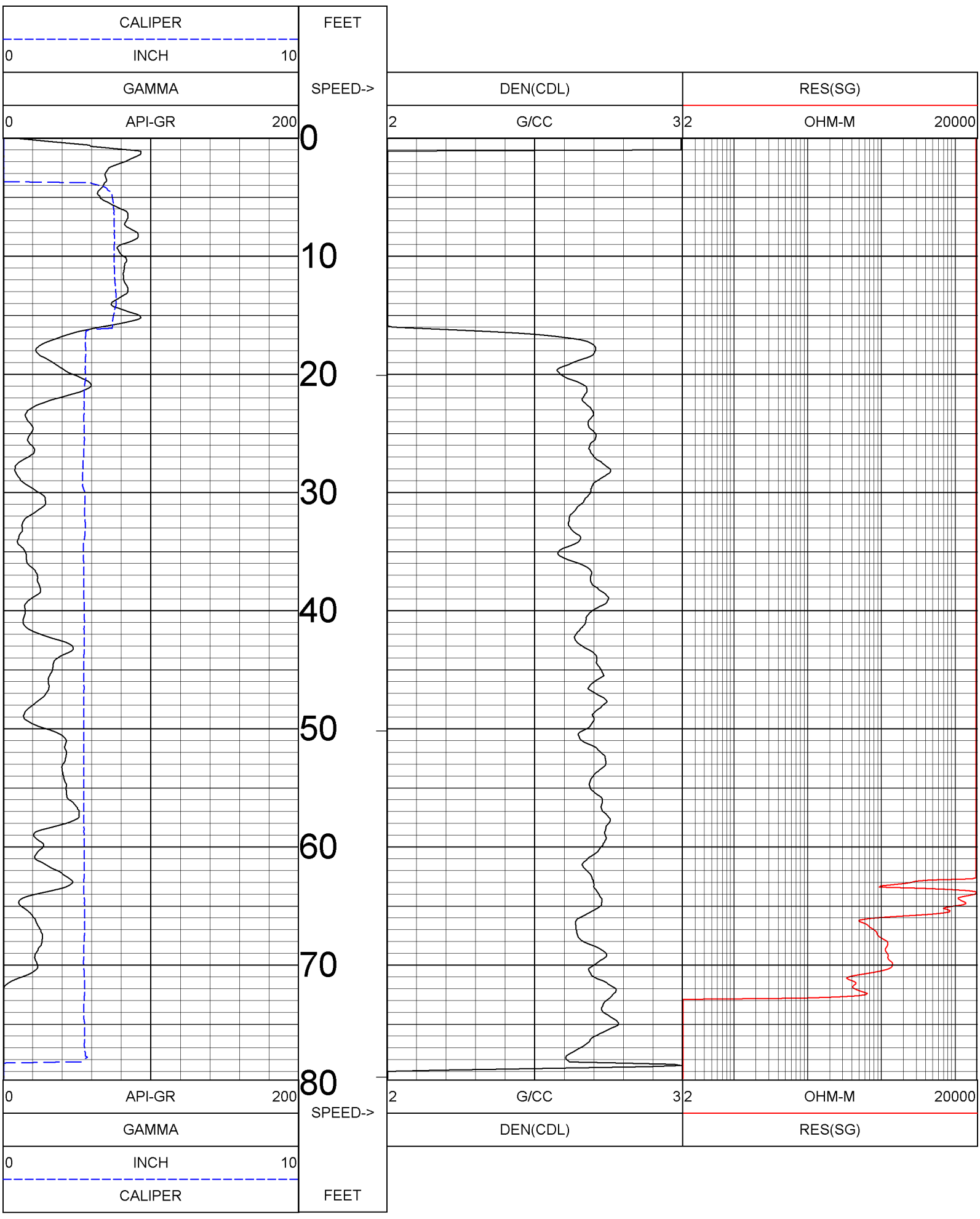
10 INCH LOG, GAMMA-RES-DEN EB5 10/24/22

LOG PARAMETERS

MATRIX DENSITY : 2.65 | NEUTRON MATRIX : SANDSTONE | MATRIX DELTA T : 54

MAGNETIC DECL : 0 | ELECT. CUTOFF : 99999 | BIT SIZE : 3.5"

PRESENTATION NAME/DATE = 9239C.0 10/24/2022 | VERSION = 3.64IQ



10 INCH LOG, GAMMA-RES-DEN EB5 10/24/22

LOG PARAMETERS

MATRIX DENSITY : 2.65 | NEUTRON MATRIX : SANDSTONE | MATRIX DELTA T : 54

MAGNETIC DECL : 0 | ELECT. CUTOFF : 99999 | BIT SIZE : 3.5"

PRESENTATION NAME/DATE = 9239C.0 10/24/2022 | VERSION = 3.64IQ

TOOL CALIBRATION EB5 10/24/22 16:48
TOOL 9239C TM VERSION 5026
SERIAL NUMBER 4443

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	Aug22,07	13:48:04	GAMMA	0.000	[API-GR]	3.000	[CPS]
	Aug22,07	13:48:04	GAMMA	320.000	[API-GR]	304.000	[CPS]
2	Oct07,22	07:38:54	VOLTAGE	0.000	[MV]	11754.000	[CPS]
	Oct07,22	07:38:54	VOLTAGE	2013.000	[MV]	277811.000	[CPS]
3	Oct11,22	15:39:28	CALIPER	4.000	[INCH]	214224.203	[CPS]
	Oct11,22	15:39:28	CALIPER	6.000	[INCH]	325924.313	[CPS]
4	Oct12,22	08:52:40	DEN(LS)	1.728	[G/CC]	3534.930	[CPS]
	Oct12,22	08:52:40	DEN(LS)	2.673	[G/CC]	662.800	[CPS]
5	Oct12,22	08:48:17	DEN(SS)	1.775	[G/CC]	14025.170	[CPS]
	Oct12,22	08:48:17	DEN(SS)	2.638	[G/CC]	6683.030	[CPS]
6	Aug21,07	11:46:00	CALIPERL	4.000	[INCH]	111180.000	[CPS]
	Aug21,07	11:46:00	CALIPERL	12.000	[INCH]	354930.000	[CPS]
7	Oct07,22	07:50:19	CURRENT	0.000	[UA]	4843.000	[CPS]
	Oct07,22	07:50:19	CURRENT	288.400	[UA]	28763.000	[CPS]
8	Aug20,07	17:08:26	F	Default	[CPS]		
9	Aug20,07	17:08:26	X	Default	[CPS]		

OTV TELEVIEWER PROCESSING 1:10

SCS ENGINEERS

EB5

JOB NUMBER :	**EB5**	PLATFORM:		DRILL COMPANY:		SERVICE COMP.:	**Century Wireline Services**
PROJECT:		EASTING:		DRILL START DATE:		WELL AZIM (deg):	
FIELD:		NORTHING:		DRILL END DATE:		WELL INCL (deg):	
PROVINCE:		ELEVATION(m):		RIG NUMBER:			

BOREHOLE RECORD			
BIT SIZE (IN)	DEPTH FROM (FT)	DEPTH TO (FT)	FLUID TYPE
3.5	**16**	**80**	**WATER / AIR**

CASING RECORD			
TYPE	I.D. (IN)	DEPTH FROM (FT)	DEPTH TO (FT)

REMARKS

DEPTH

MEAS. DEPTH

1ft:10ft

GEOLOGICAL STRUCTURE

OPTICAL IMAGE: 0° 90° 180° 270°

STRUCTURE PICKS: 0° 90° 180° 270°

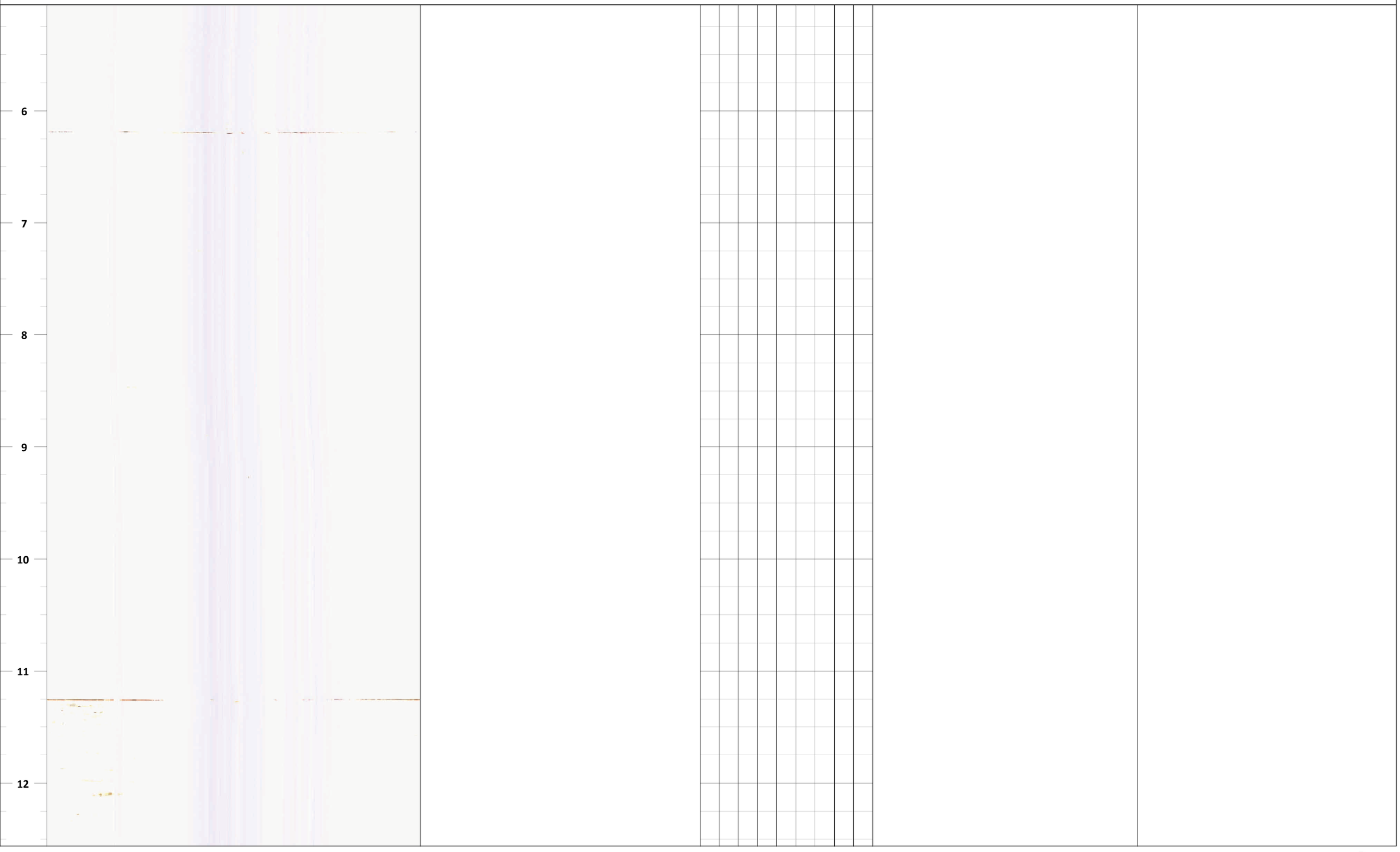
TADPOLES: 0° 90°

POLAR PLOT

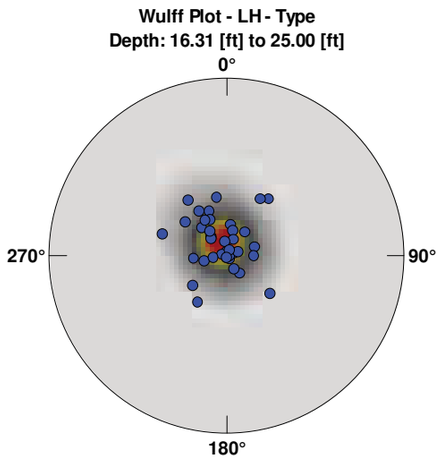
Wulff Plot - LH - AGA

STRIKE PLOT

Strike - Percent Interval

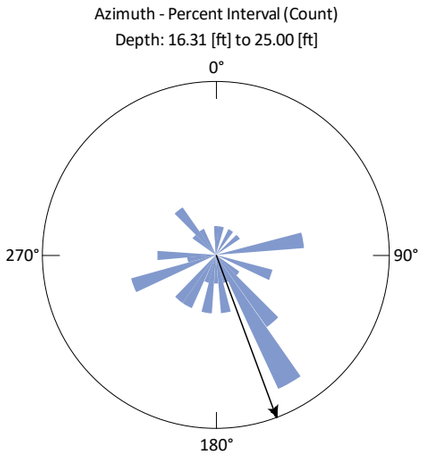


RUN 1: 16.5-20.5 FT
RECOVERY 47" ; RQD 68
GREY DOLOMITE W DARK GREY BANDING & INTERBEDDED CHERT

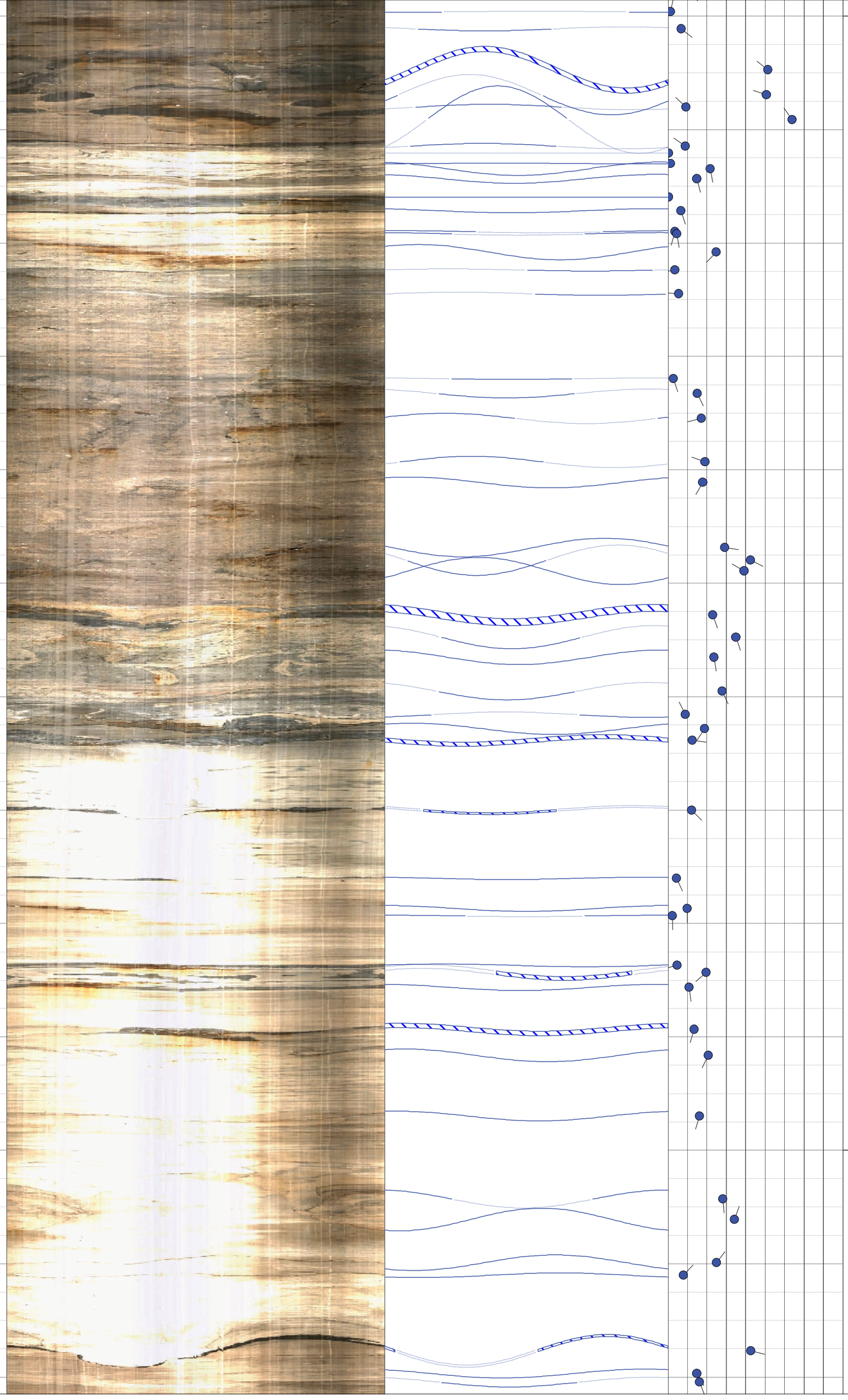


	Counts	Dip[deg]	Azi[deg]
Mean	39	8.93	159.58
	39	8.93	159.58

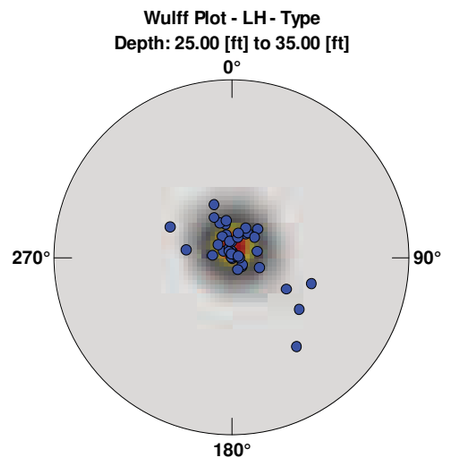
RUN 2: 20.5-25.5 FT
RECOVERY 59.5" ; RQD 88



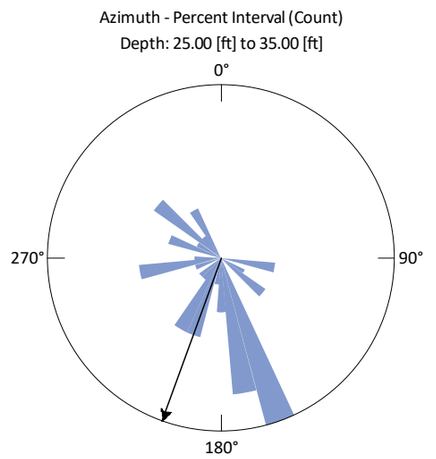
Components:	Azimuth
Counts:	39.00
Mean (3D):	159.58
Min:	0.90
Max:	330.65



RUN 3: 25.5-30.5 FT
RECOVERY 60" ; RQD 92



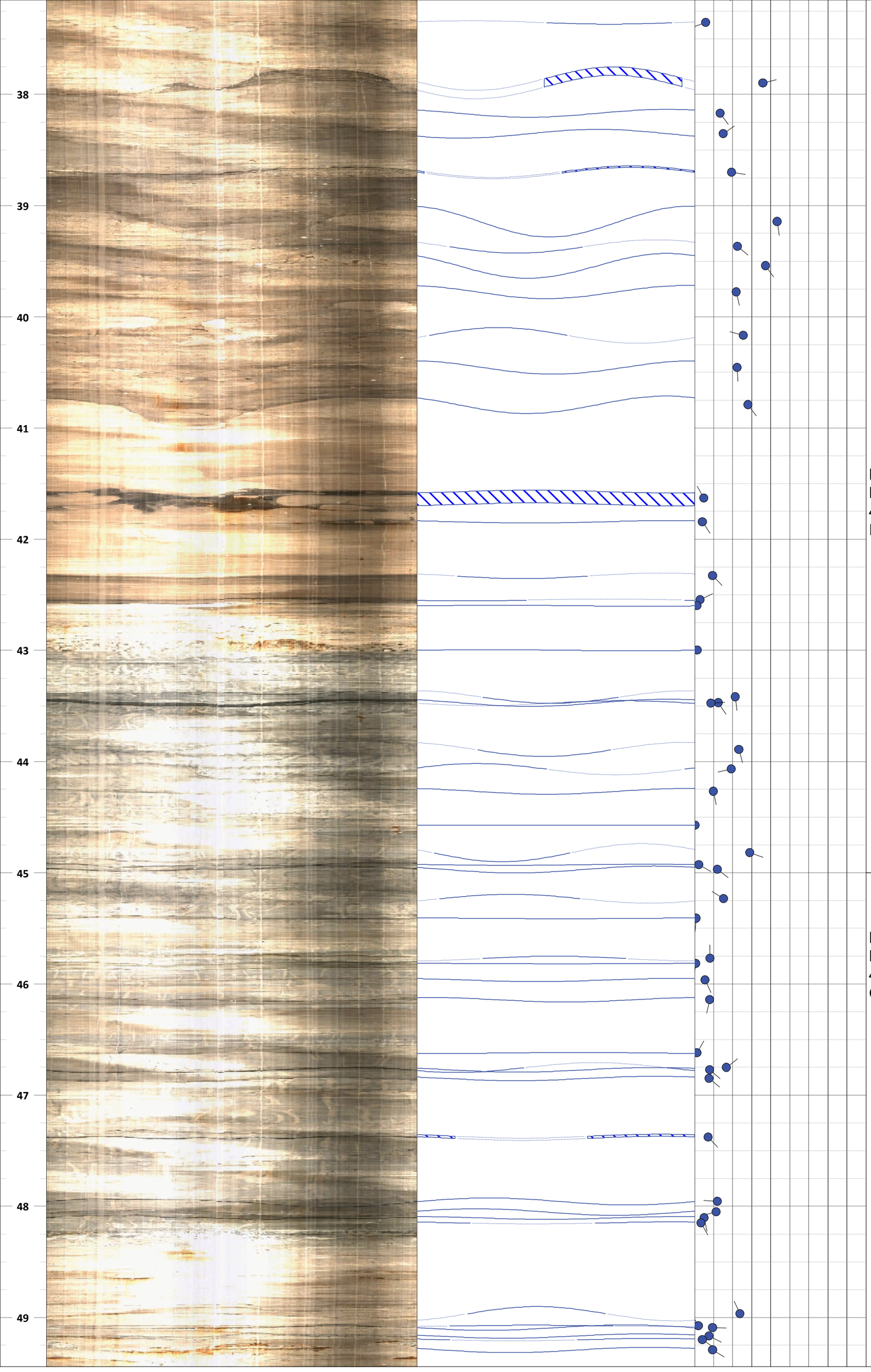
	Counts	Dip[deg]	Azi[deg]
Mean	42	7.02	200.15
	42	7.02	200.15

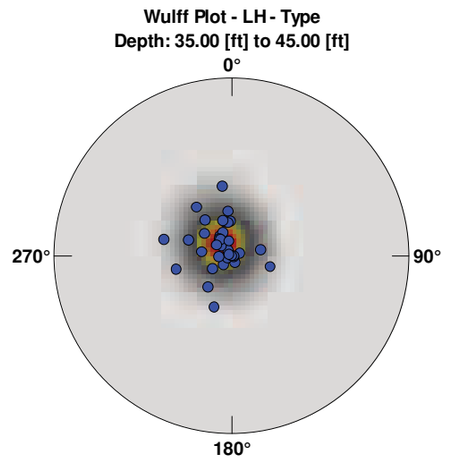


Components:	Azimuth
Counts:	42.00
Mean (3D):	200.15
Min:	97.73
Max:	333.66

RUN 4: 30.5-35.5 FT
RECOVERY 61" ; RQD 90

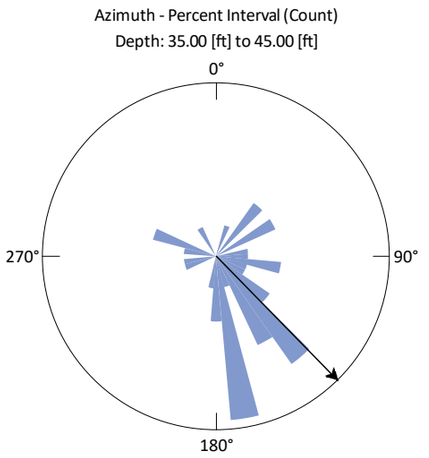
RUN 5: 35.5-40.5 FT
RECOVERY 58.5 ; RQD 85
35.5 FT: LT GREY DOLO W DARK GREY BANDING





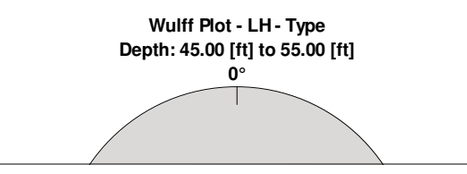
	Counts	Dip[deg]	Azi[deg]
Mean	35	10.21	135.46
	35	10.21	135.46

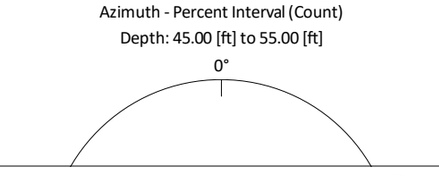
RUN 6: 40.5-45.5 FT
RECOVERY 60" ; RQD 80
40.5 FT: SOME CHERT INTERBEDDING BEGINS

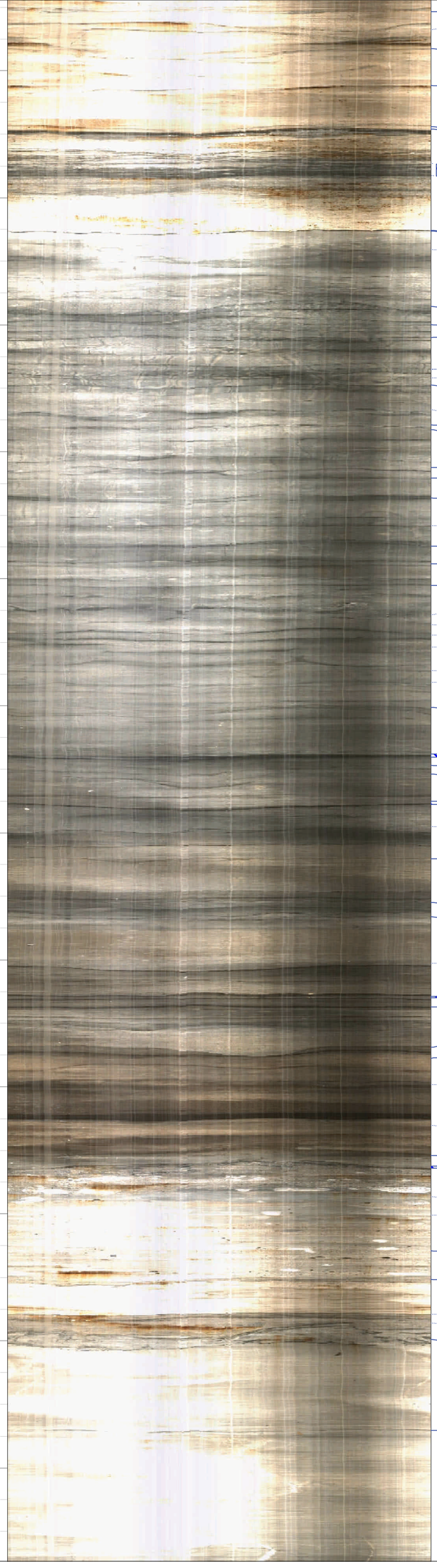


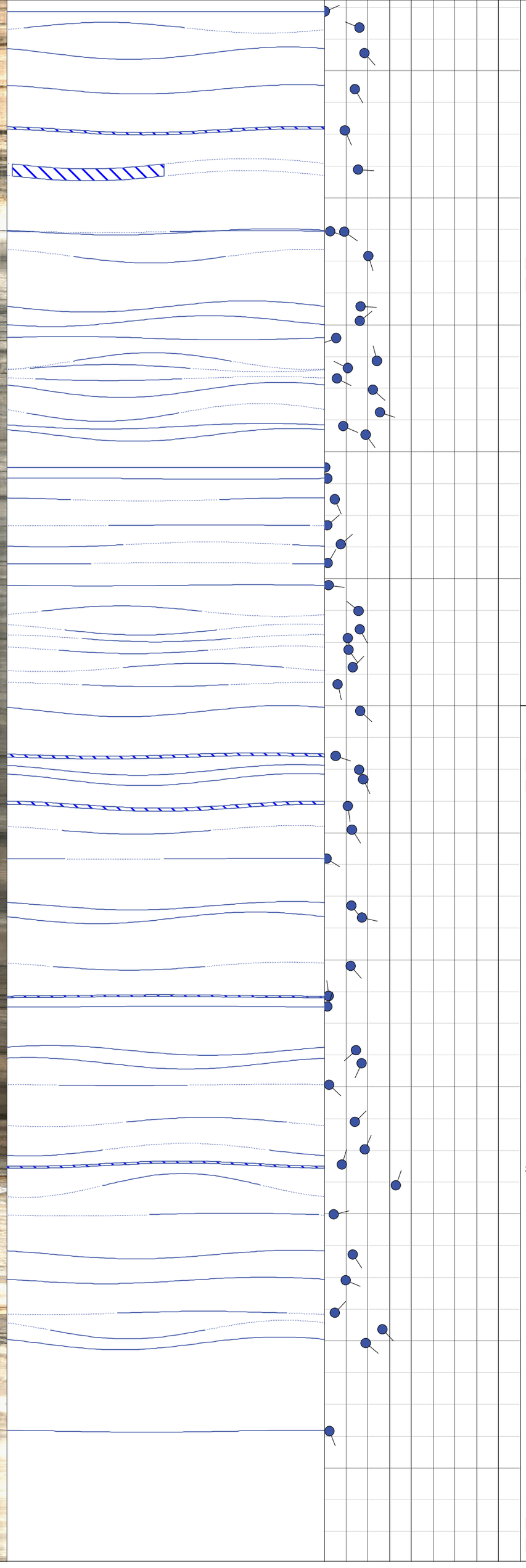
Components:	Azimuth
Counts:	35.00
Mean (3D):	135.46
Min:	19.28
Max:	330.73

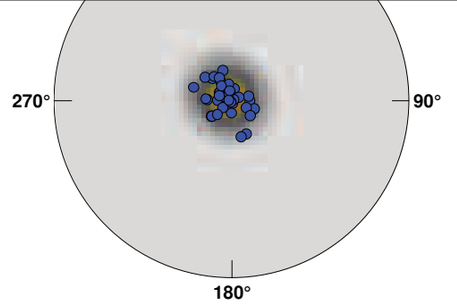
RUN 7: 45.5-50.5 FT
RECOVERY 59.5" ; RQD 100
45.5 FT: GREY DOLO W DARK GREY BANDING





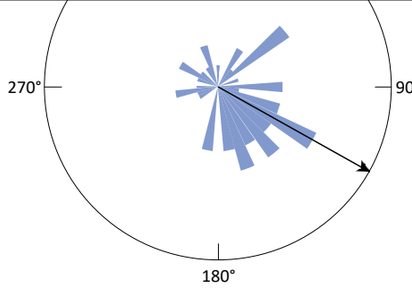






	Counts	Dip[deg]	Azi[deg]
Mean	53	3.39	119.12
●	53	3.39	119.12

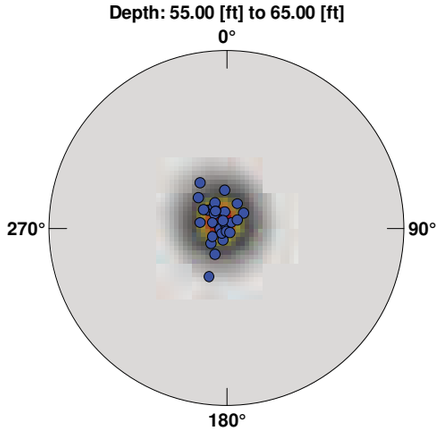
RUN 8: 50.5-55.5 FT
RECOVERY 60" ; RQD 100



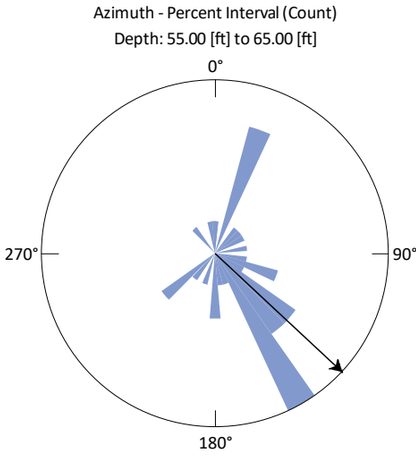
Components:	Azimuth
Counts:	53.00
Mean (3D):	119.12
Min:	29.19
Max:	358.18

RUN 9: 55.5-60.5 FT
RECOVERY 61.5" ; RQD 100

59-59.5 FT: SOME SMALL VUGS

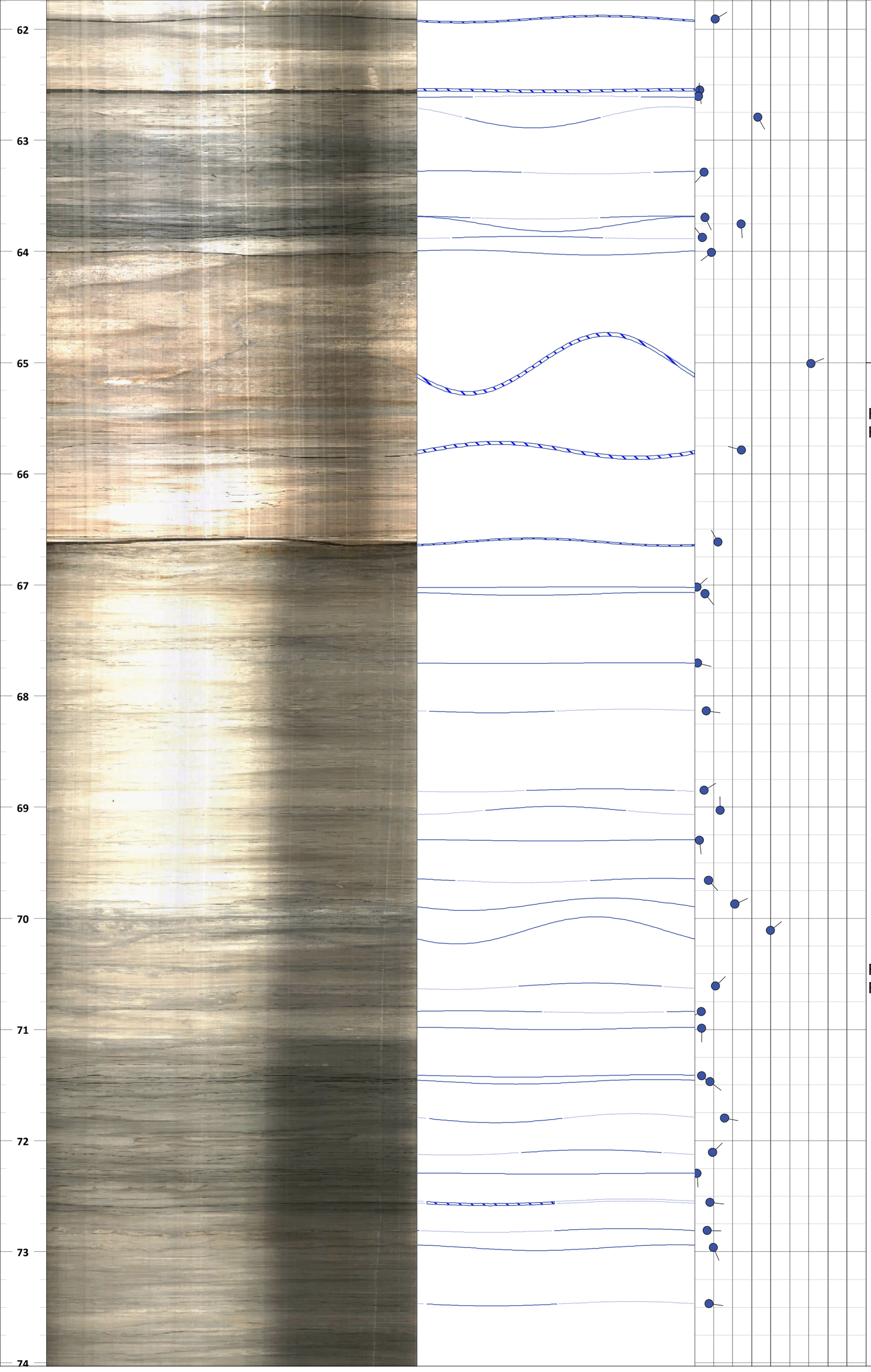


	Counts	Dip[deg]	Azi[deg]
Mean	35	6.42	132.92
●	35	6.42	132.92



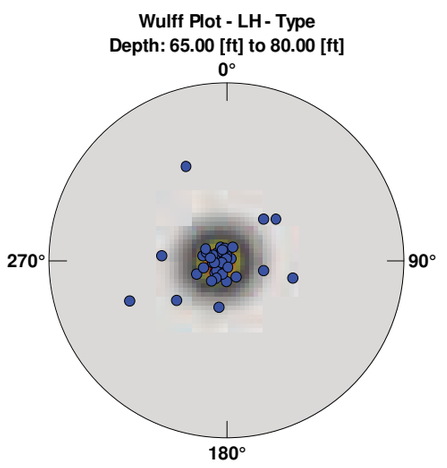
Components:	Azimuth
Counts:	35.00
Mean (3D):	132.92
Min:	3.06
Max:	352.80

RUN 10: 60.5-65.5 FT
RECOVERY 58.5" ; RQD 100

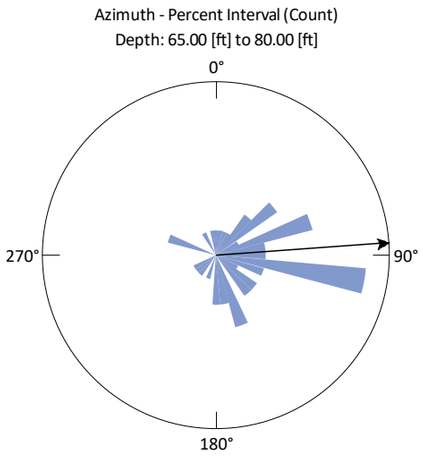


RUN 11: 65.5-70.5 FT
RECOVERY 59" ; RQD 88

RUN 12: 70.5-75.5 FT
RECOVERY: 60" ; RQD 97



	Counts	Dip[deg]	Azi[deg]
Mean	46	4.97	85.55
●	46	4.97	85.55



Components:	Azimuth
Counts:	46.00
Mean (3D):	85.55
Min:	9.27
Max:	358.77

75
76
77
78
79
80

RUN 13: 75.5-80.5
RECOVERY 52.5" ; RQD 61

77.5-80.30: HEAVILY WEATHERED, VUGGY GREY DOLOMITE (CORRESPONDS WITH BULK DENSITY DROP)

DRILLING CONCLUDED 80.30 FT

DISCLAIMER

Century Wireline Services (CWS) takes all due care to ensure that the data, measurements and interpretations supplied to the client are correct and accurate. CWS makes no representation and gives no warranty as to the use which may be made of the data, measurements or interpretations and expresses no opinion as to the conclusions, interpretation or analysis of the data and measurements supplied.

CWS does not know and cannot determine the performance, profitability or viability of any particular site for commercial purpose. The client must conduct its own investigations and research and form its own conclusions as to the commercial viability of any site.

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Liability is excluded for the loss suffered by any party resulting in any way from the use of or reliance on any opinion, interpretation or analysis given by CWS, its employees or agents.

SCS ENGINEERS

LOG OF BORING NO.: **IW-1**

SHEET NUMBER: 1 of 4

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Wayne Johnson	SURFACE ELEVATION: 1061.1 ft
PROJECT NAME: NABORS	DRILLING RIG: Hillyard	TOC ELEVATION: 1062.7 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 91.29 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: Anderson Engineering	LOCATION: NORTHING: 1181622.96 EASTING: 774716.18
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 62.76 fbgs
START DATE: 10/20/2022	BORING DIAMETER: 4.25"	WATER ELEVATION: 998.35 ft
FINISH DATE: 10/20/2022	WELL DIAMETER: 4.25"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
0	Silty Clay	Silty Clay; Reddish brown to orange with gravels						Sch 40 PVC Casing 0'-3' bgs	1065
5									1060
10									1055
15									1050
20								4.25" Open borehole GS to 91.29' bgs	1045
25									1040
									1035

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **IW-1**

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Wayne Johnson	SURFACE ELEVATION: 1061.1 ft
PROJECT NAME: NABORS	DRILLING RIG: Hillyard	TOC ELEVATION: 1062.7 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 91.29 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: Anderson Engineering	LOCATION: NORTHING: 1181622.96 EASTING: 774716.18
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START DATE: 10/20/2022	BORING DIAMETER: 4.25"	WATER ELEVATION: 998.35 ft
FINISH DATE: 10/20/2022	WELL DIAMETER: 4.25"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
30									1030
35									1025
40									1020
45			Cuttings						1015
	Dolomite	Dolomite; less dust around 60' below ground							
50									1010
55									1005

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **IW-1**

11219 Richardson Drive
North Little Rock, AR

CLIENT: LRS	DRILLER: Wayne Johnson	SURFACE ELEVATION: 1061.1 ft
PROJECT NAME: NABORS	DRILLING RIG: Hillyard	TOC ELEVATION: 1062.7 ft
PROJECT NUMBER: 27222139.01	DRILLING METHOD:	WELL DEPTH COMPLETION: 91.29 fbgs
PROJECT LOCATION: Three Brothers, AR	DRILLING CONTRACTOR: Anderson Engineering	LOCATION: NORTHING: 1181622.96 EASTING: 774716.18
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 62.76 fbgs
START DATE: 10/20/2022	BORING DIAMETER: 4.25"	WATER ELEVATION: 998.35 ft
FINISH DATE: 10/20/2022	WELL DIAMETER: 4.25"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
60									1000
65									995
70									990
75									985
80									980
85									975

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

LOG OF BORING NO.: **IW-1**

11219 Richardson Drive
North Little Rock, AR

	DRILLER: Wayne Johnson	SURFACE ELEVATION: 1061.1 ft
	DRILLING RIG: Hillyard	TOC ELEVATION: 1062.7 ft
CLIENT: LRS	DRILLING METHOD:	WELL DEPTH COMPLETION: 91.29 fbgs
PROJECT NAME: NABORS	DRILLING CONTRACTOR: Anderson Engineering	LOCATION:
PROJECT NUMBER: 27222139.01		NORTHING: 1181622.96
PROJECT LOCATION: Three Brothers, AR		EASTING: 774716.18
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 62.76 fbgs
START DATE: 10/20/2022	BORING DIAMETER: 4.25"	WATER ELEVATION: 998.35 ft
FINISH DATE: 10/20/2022	WELL DIAMETER: 4.25"	WATER LEVEL DATE: 10/20/2022

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
90									970

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

CONSOLIDATED LAND SERVICES, INCORPORATED
ENGINEERING, SURVEYING & MATERIALS TESTING
http://www.clsi-mtnhome.com

5667 HIGHWAY 62 EAST
MOUNTAIN HOME, AR 72653

TELEPHONE (870) 425-6161
FAX (870) 424-3884

Monitoring Well Survey
Nabors Landfill, Landfill Road off Co. Rd. 16
CLSI Project # 22090

Notes:

1. Northing and Easting locations were measured on the top/center of the well. Adjacent ground elevations were taken on the lowest side of the well.
2. Field measurements were taken on November 15, 2022.
3. All horizontal and vertical coordinates are based on Control point #4. Control Point #4 coordinates are based off of Arkansas State Plane Grid North Zone 1983 (0301), which were determined by processing GPS static sessions on local CORS monuments. This point was also used on previous field work for this site.

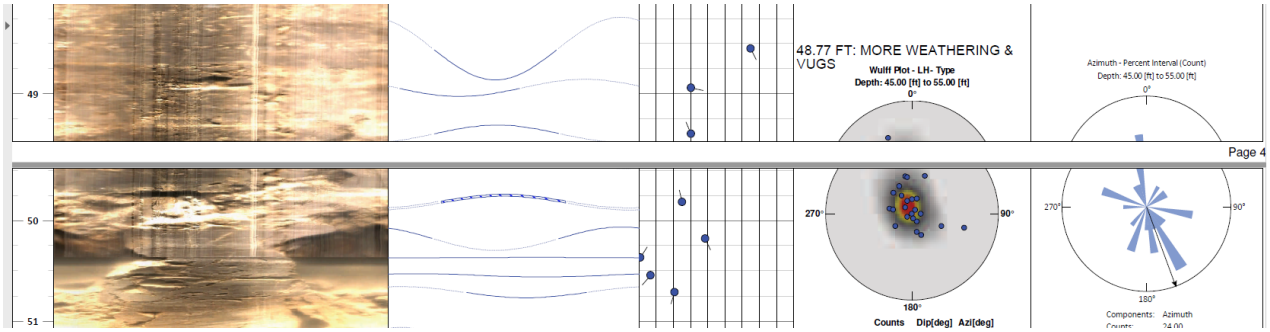
Surveyed Location of Monitoring Wells:

CONTROL POINTS				
CONTROL POINT ID	NORTHING	EASTING	ELEVATION	
4	775573.55	1181872.79	1054.93	CTL
WELL SITES				
WELL ID NUMBER	NORTHING	EASTING	TOP OF CASING ELEVATION	ADJACENT GROUND ELEVATION
EB-5	774465.66	1181622.96	989.42	988.86
EB-4	775091.15	1181096.52	1044.08	1042.58
IW-1	774716.18	1180890.13	1062.73	1061.11
EB-1	774701.35	1181061.5	1050.95	1050.95
EB-2	774358.91	1180694.47	1058.95	1057.68

Appendix C

Exhibits of Correlations between Boring Logs, Core Photos, and OTV Logs

Exhibit 1: EB-1, 45-50 Feet



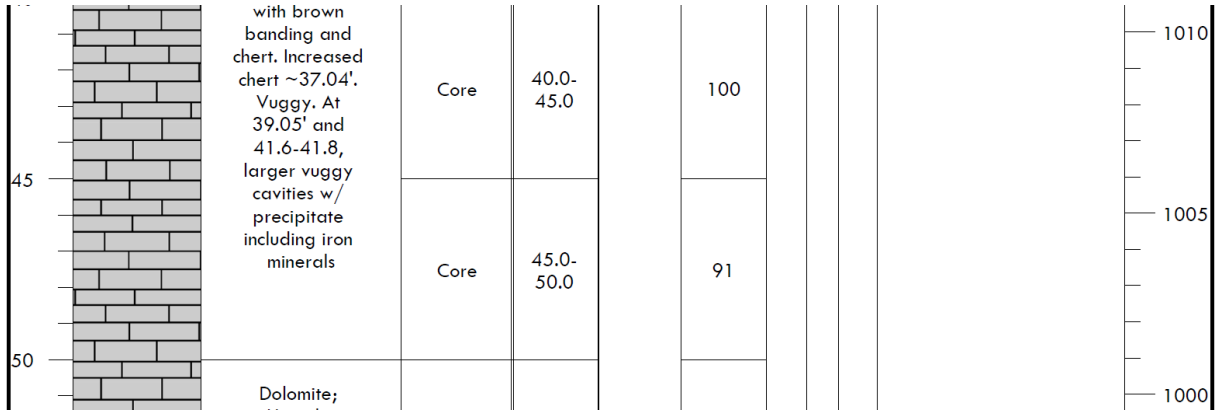
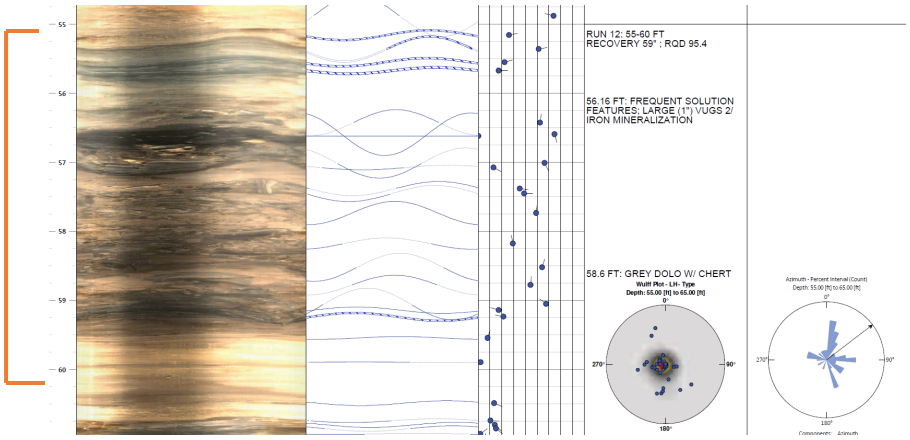
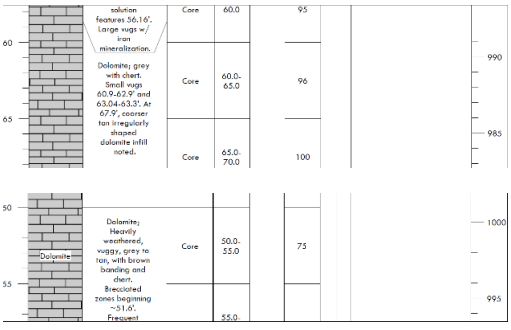


Exhibit 2: EB-1, 55-60 Feet





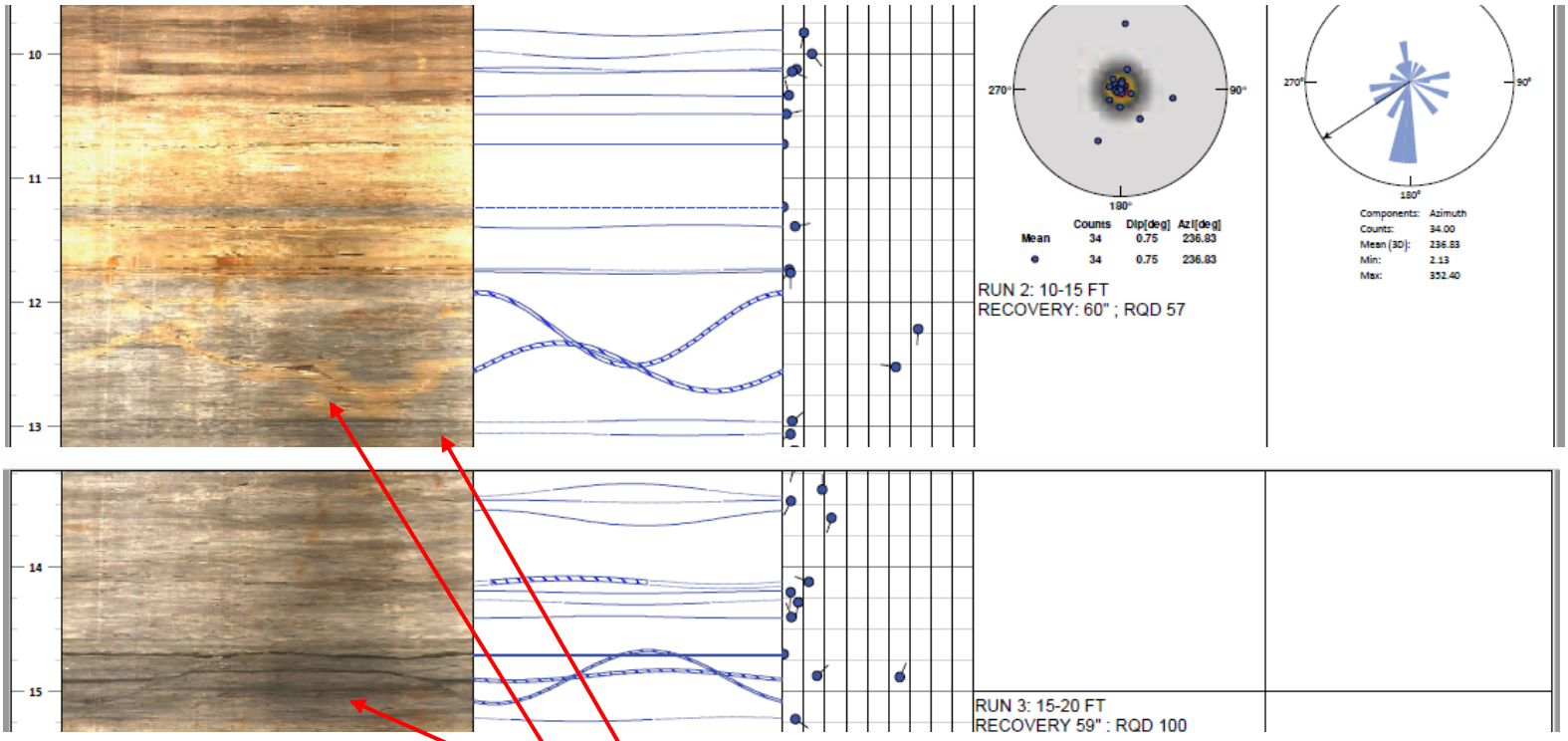


Exhibit 3: EB-2, 10-15 feet

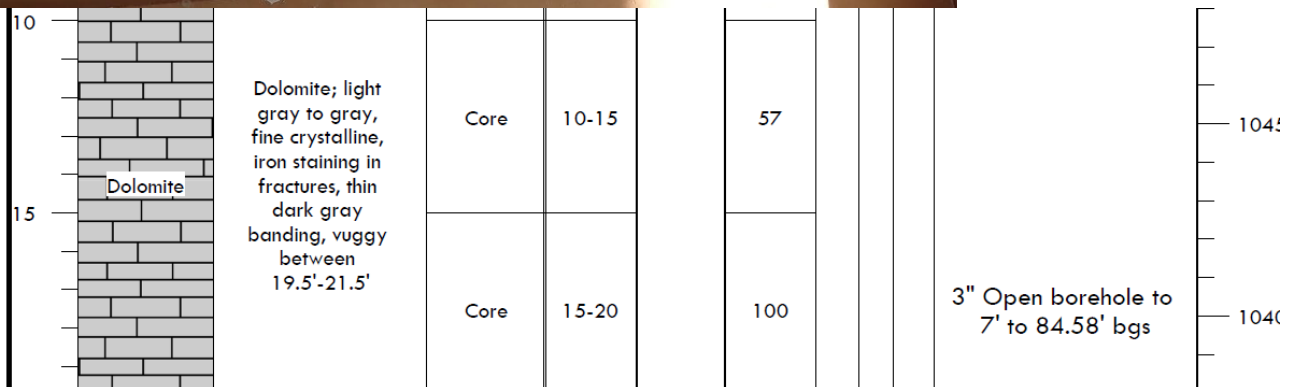
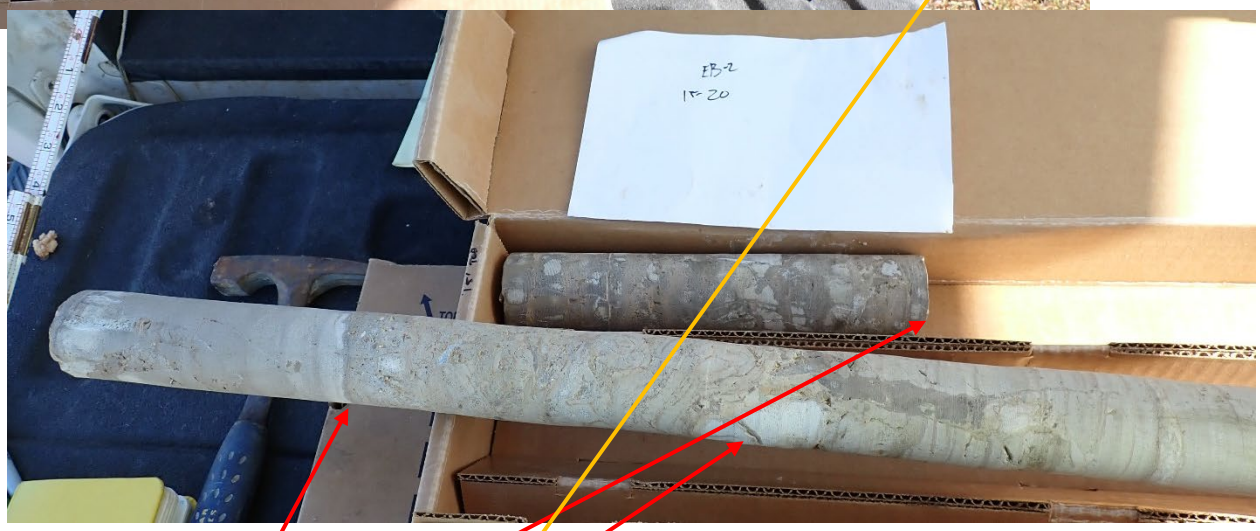
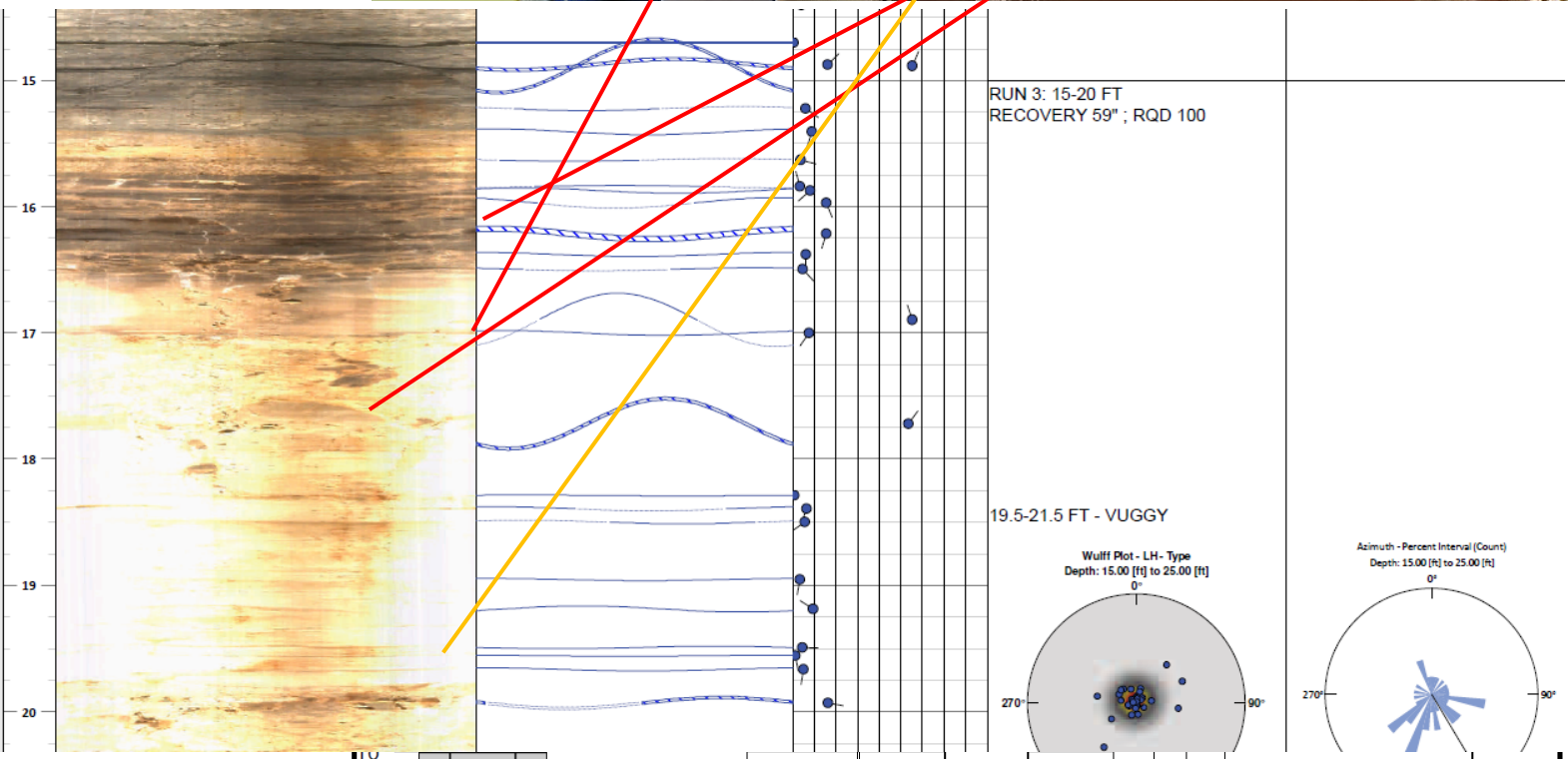
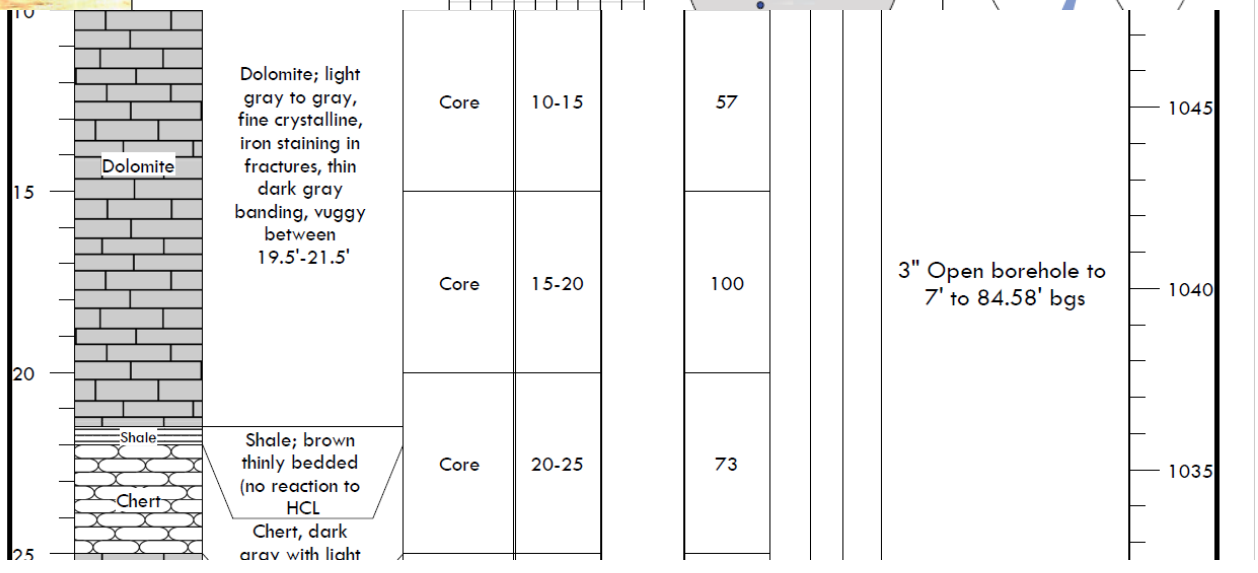
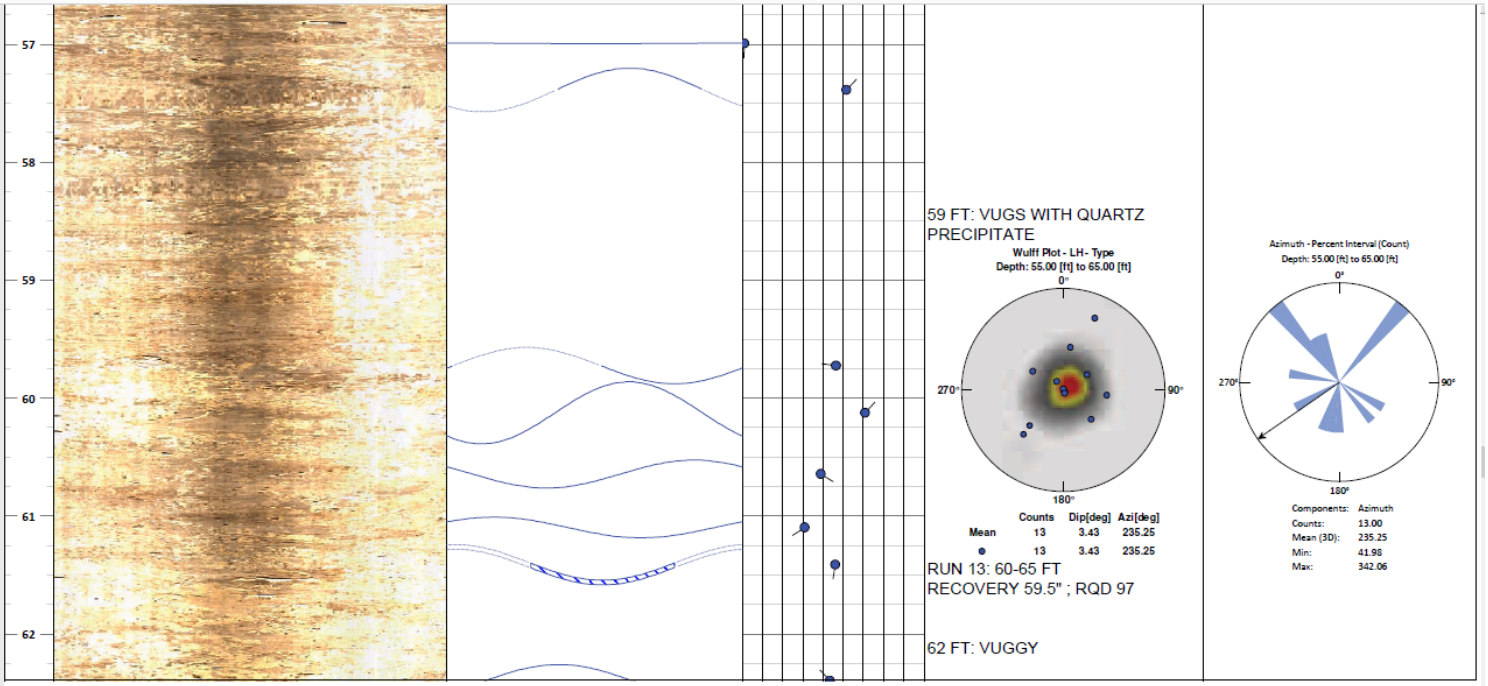


Exhibit 4: EB-2, 15-20 feet









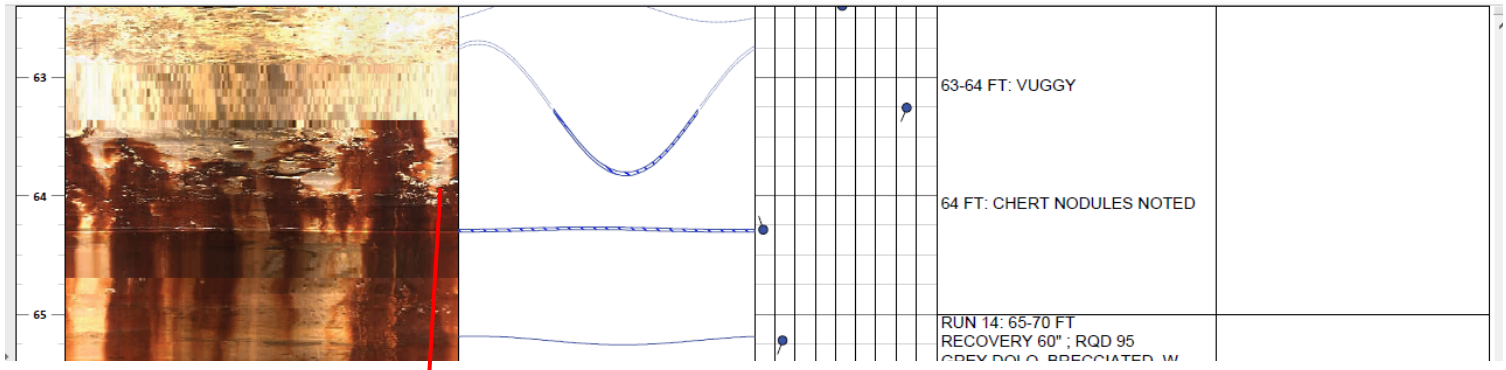


Exhibit 5: EB-2, 60-65 Feet

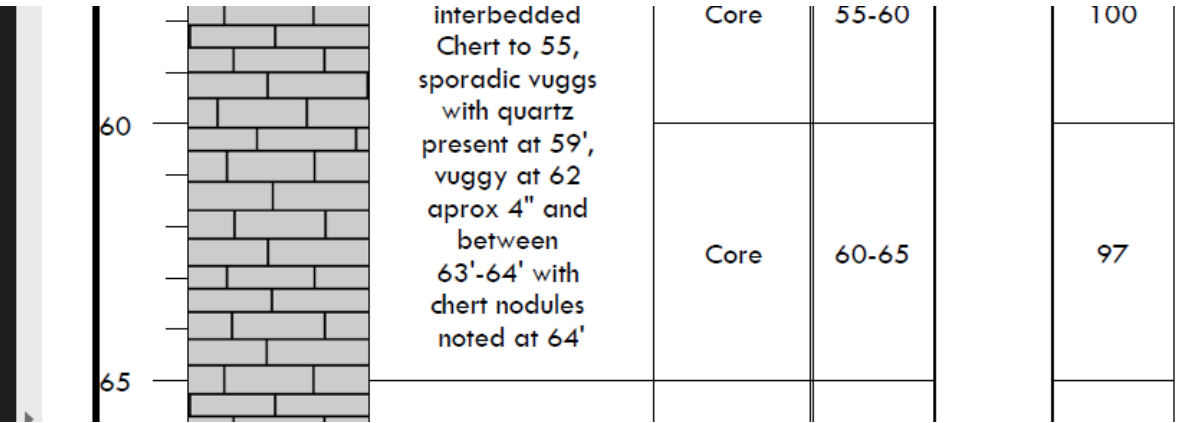
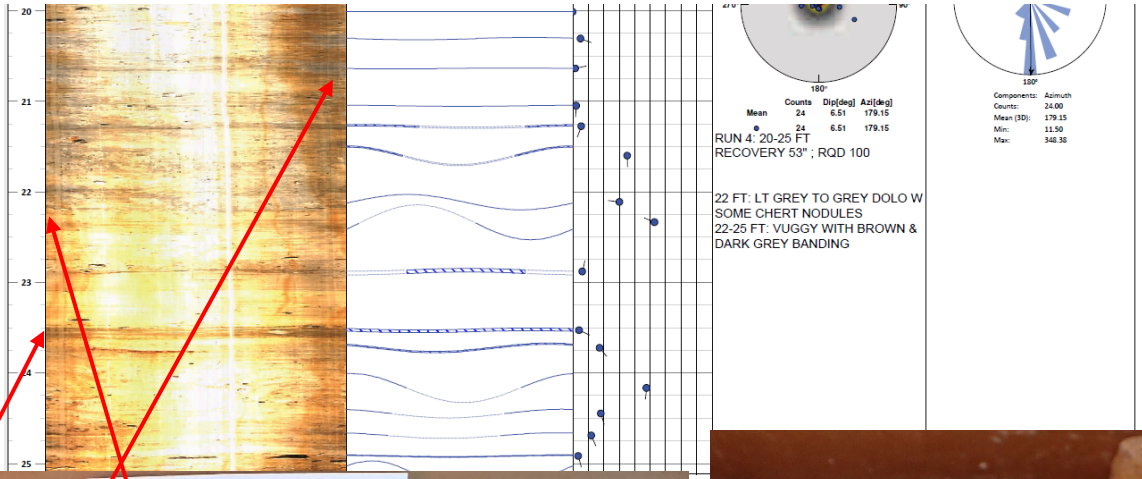
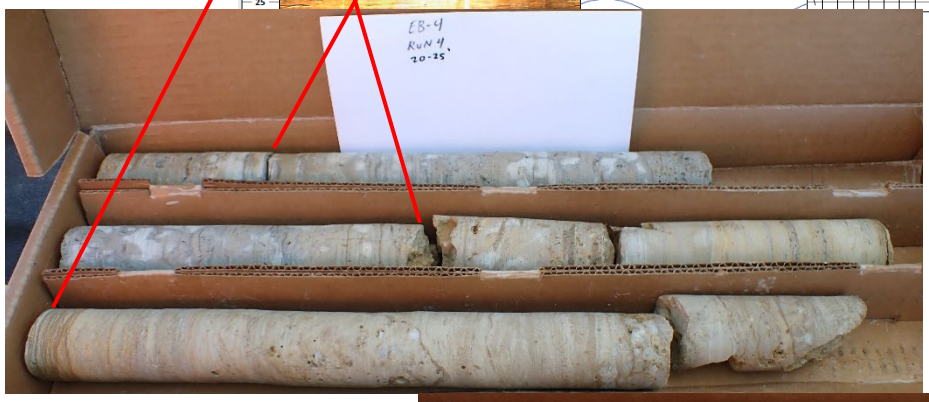
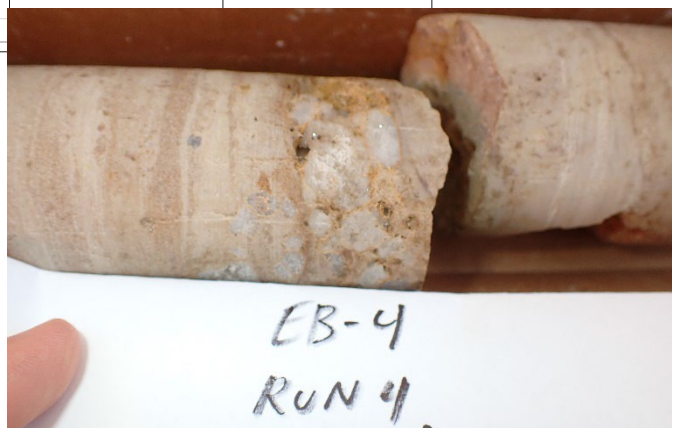


Exhibit 6: EB-4, 20-25 Feet







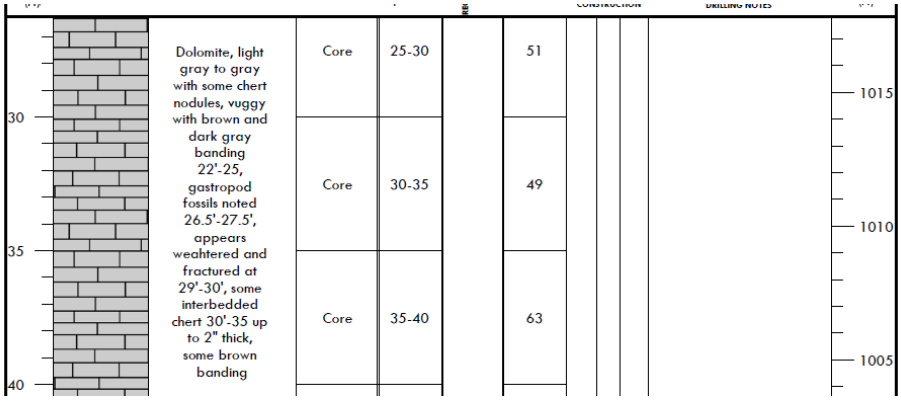
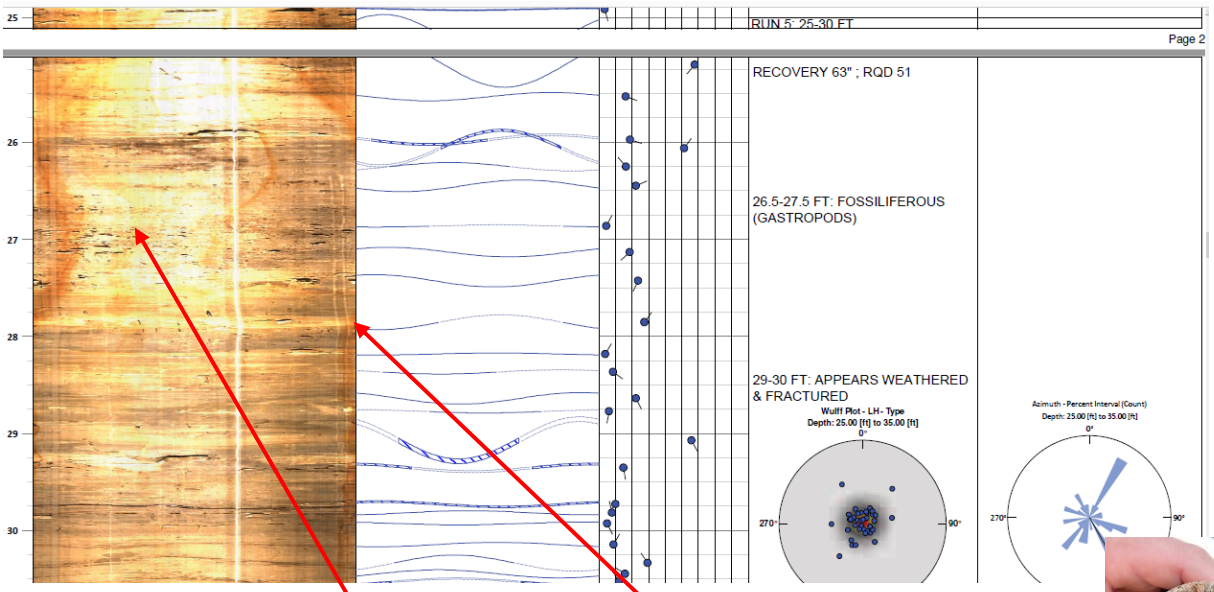


Exhibit 7: EB-4, 25-30 Feet



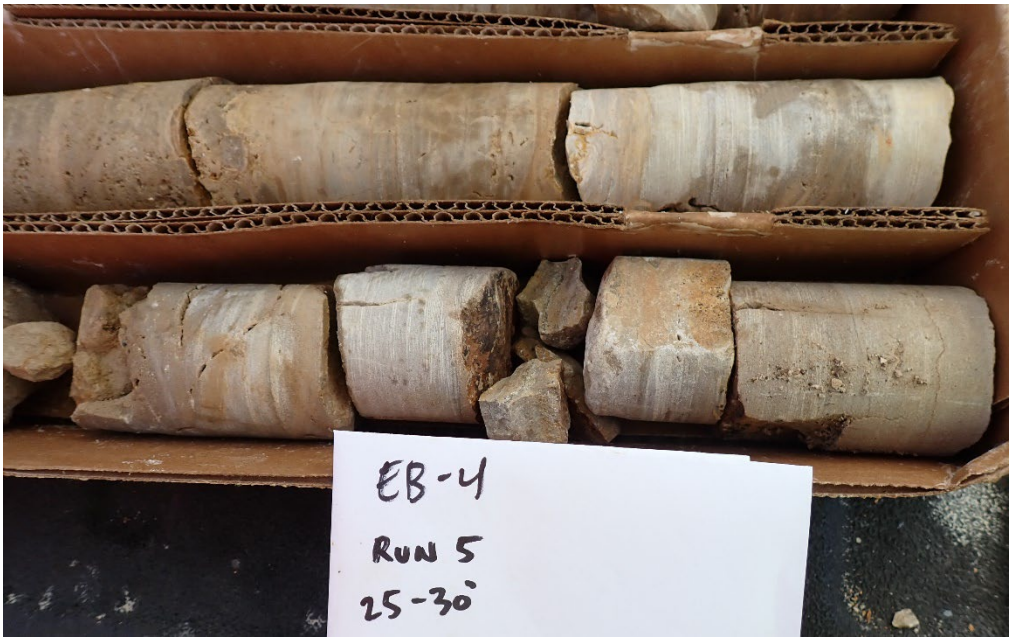


Exhibit 8: EB-4, 40-45 Feet

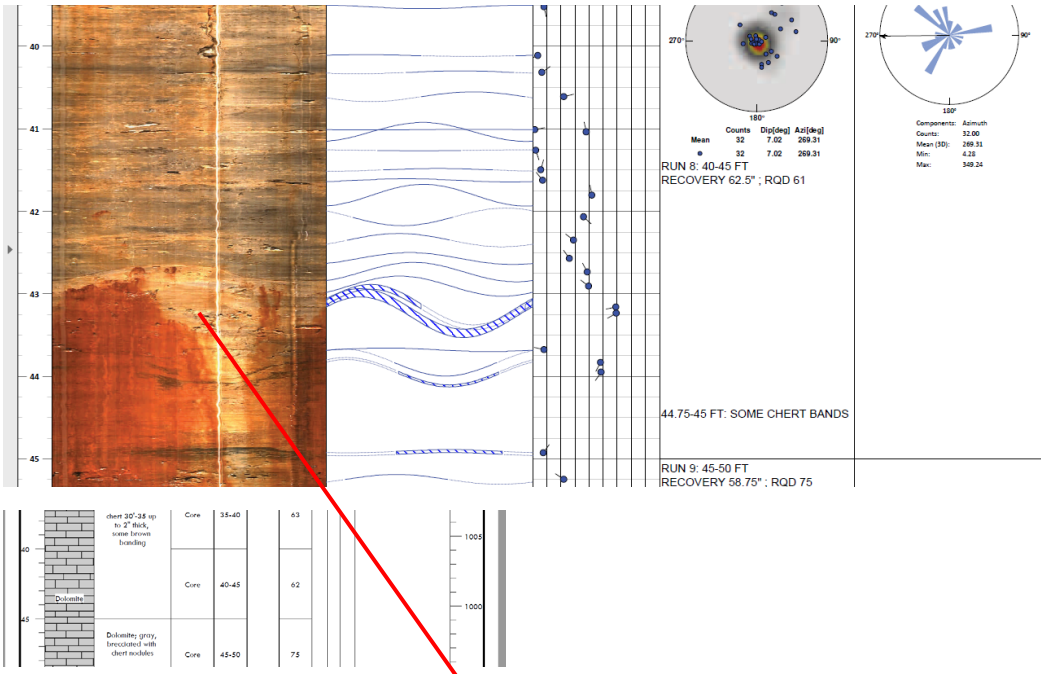
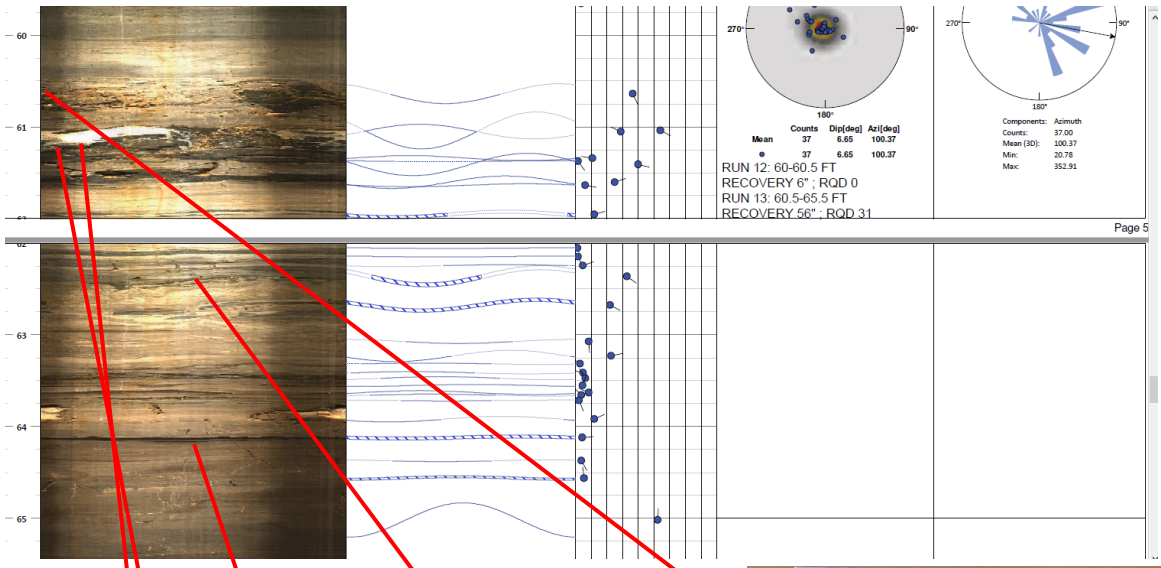


Exhibit 9: EB-4, 60-65 Feet



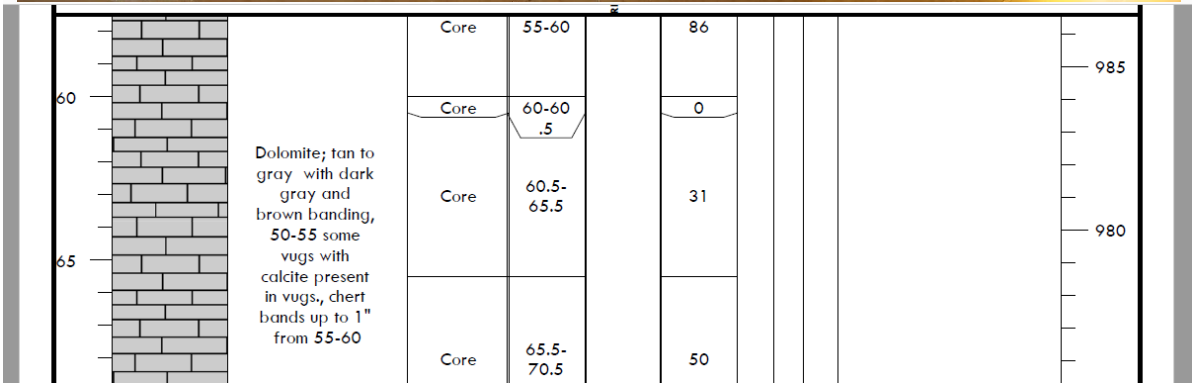
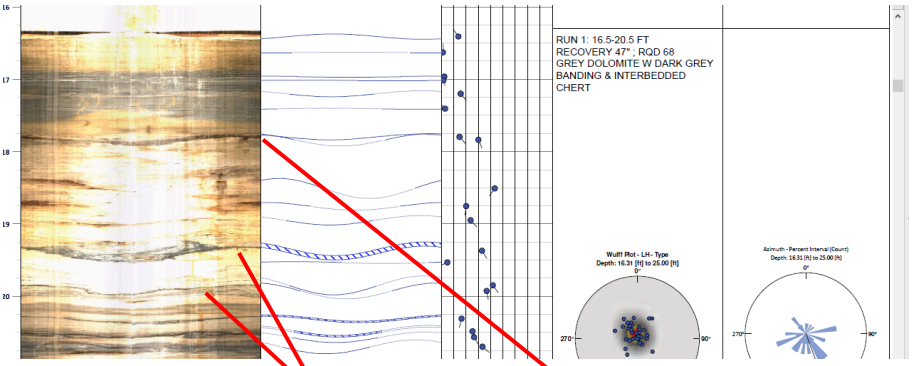


Exhibit 10: EB-5, 16-20 Feet



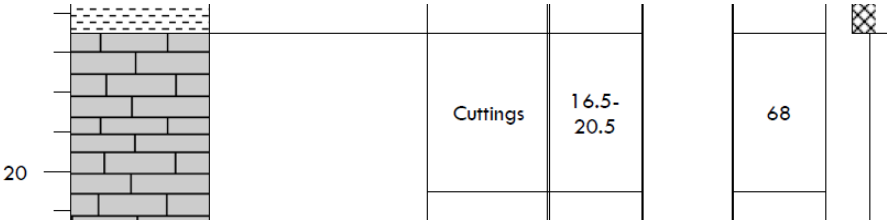
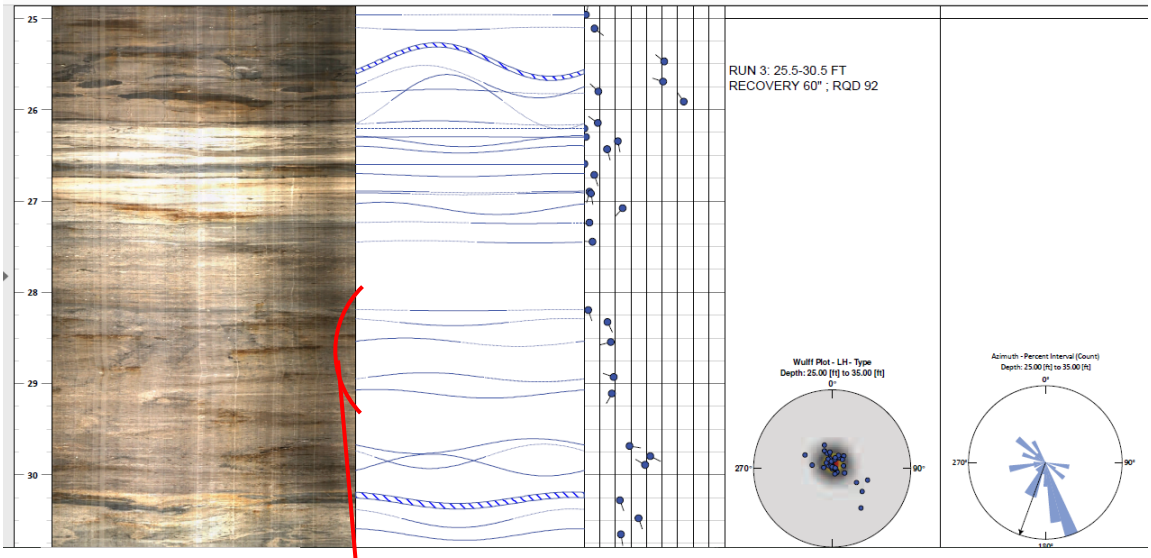


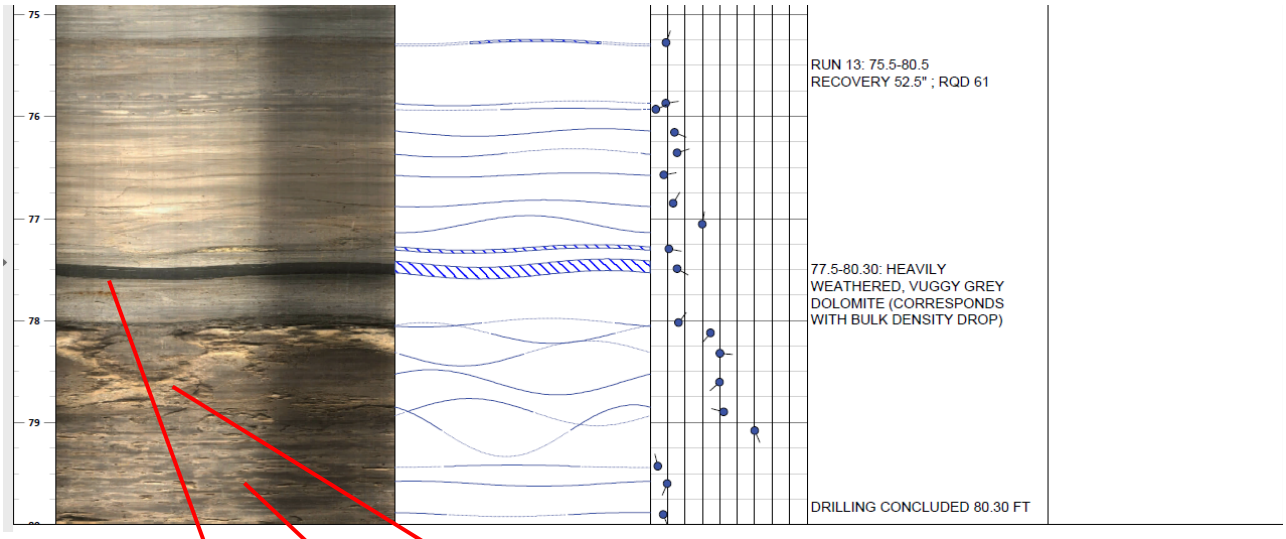
Exhibit 11: EB-5, 25-30 Feet

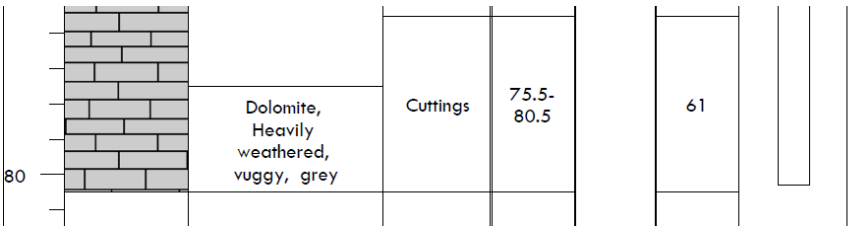


25		Dolomite; grey with dark grey								

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	RECOVERY (in)	Blow Counts	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION/ DRILLING NOTES	ELEVATION (FT)
30		banding & interbedded chert.	Cuttings	25.5-30.5		92			

Exhibit 12: EB-5, 75-80 Feet



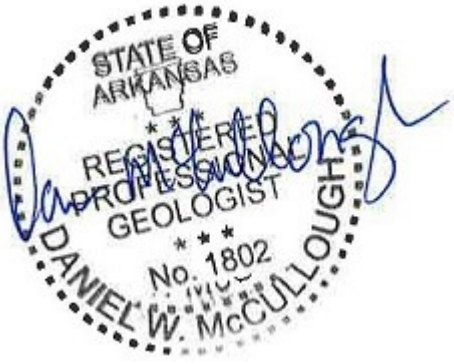


Appendix D

Dye Test Report

Dye Tracing Investigation Report
NABORS Landfill, Baxter County, Arkansas

NABORS Landfill
1320 Landfill Road
Three Brothers, AR 72653



SCS ENGINEERS

27222323.00 | February 29, 2024

9780 Maumelle Blvd
North Little Rock, AR 72113
501-812-4551

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1.0 INTRODUCTION

This investigation was conducted by Stearns, Conrad and Schmidt Engineers, Inc. (SCS) under a contract with Lakeshore Recycling Services (LRS). The investigation involved groundwater tracing with fluorescent tracer dye to identify groundwater flow paths at the former NABORS Landfill ("site") in northwestern Baxter County, Arkansas.

1.1 PURPOSE AND SCOPE OF INVESTIGATION

The purpose of the dye trace investigation was to characterize groundwater flow and discharge on the north side of the existing landfill at the site under the flow conditions present at the time of the investigation.

Objectives of this work include developing fundamental data about the hydrology of the NABORS site surficial groundwater system and discharge locations through the following tasks:

- Field reconnaissance to identify appropriate dye introduction and sampling stations;
- Introduction of appropriate dye(s) at an appropriate location(s) within the study area;
- Sampling for tracer dyes at appropriate locations using activated carbon samplers and grab water samples; and
- Documenting the hydrologic connections and groundwater discharge locations.

Data gathered during the investigation are summarized in this summary report. Accompanying maps have also been included.

1.2 STUDY AREA

The former NABORS Landfill is located on 56 acres near the rural community of Three Brothers in Baxter County, Arkansas. The permitted Class 1 area lies within the Southeast half of Section 26, Township 21 North, Range 14 West and the Northern half of Section 35, Township 21 North, Range 14 West. The property has historically been used and operated as a solid waste disposal site (See Figure 1).

1.3 PHYSICAL SETTING OF THE STUDY AREA

The study area described in this report is located in the Salem Plateau of the larger Ozark Plateaus physiographic province. This region consists of highly dissected plateaus developed within relatively flat-lying sedimentary rocks. The predominant rock types in the study area consist of Ordovician-aged dolomite of the Cotter Dolomite (Haley, revised 1993).

The site geology consists of a sandy silt to silty clay residuum overlying Cotter Dolomite bedrock. The residuum, which contains chert fragments, occurs with the greatest thickness at ridge tops, narrowing to 6 feet or less in areas of lower elevation. The Cotter Dolomite consists of two types of dolostone: one fine-grained and white to light gray locally called "cotton rock," and the other darker gray, medium-grained, and more massive. Chert, minor shale beds, and infrequent thinly interbedded sandstone also characterize the Cotter formation.

In the Cotter Dolomite, groundwater flow tends to occur along joints, fractures, bedding planes, or within cherty zones in areas that are often widened by solutional weathering. Boring logs and previous excavations indicate the presence of a weathered zone in the uppermost 10 feet of bedrock. The presence of this epikarstic layer suggests seasonal groundwater flow in this area of the unit primarily occurs within this weathered zone. Although the bedrock is primarily competent, karst features are present at the site at and below the ground surface, including the following: springs present on the landfill property; voids that have been recorded in boring logs of investigative drilling; and possible fast groundwater flow via conduits, which has been inferred in previous investigations.

1.4 PREVIOUS INVESTIGATIONS

In 1987, a limited dye trace was performed at the landfill site as part of a larger geotechnical and hydrogeologic investigation at the NABORS Landfill (Grubbs et al., 1987). The purpose of the dye tracing in the 1987 investigation was to evaluate the source of groundwater flow to a series of springs identified at or near the site. Dye was introduced into a borehole approximately 165 feet north of "Spring A" located on the northern portion of the project site within a ravine. The drilled borehole was approximately 19 feet in depth. A weathered zone of broken chert and clay with some voids was encountered in the borehole from 14 to 18 feet below ground surface (bgs) with bedrock consisting of hard gray dolomite encountered at a depth of 18 feet to the total depth of 19 feet bgs. Fluorescein dye was introduced into the borehole and flushed with 500 gallons of water. Dye was visually observed at Spring A two hours following the dye introduction and visually observed at Spring B approximately 24 hours later. Analysis of passive charcoal packet samplers indicated dye detections in Springs A, B and C.

No other tracer investigations are known to have been performed at the site.

2.0 METHODOLOGY

Groundwater tracing using fluorescent dyes is the most appropriate method for developing site hydrogeological models in areas with the potential for complex subsurface drainage patterns (Aley et al., 2012). Field reconnaissance was conducted to identify locations where monitoring wells, boreholes, springs, seeps, and streams were accessible for sampling. Next, a dye introduction borehole, IW-1, was drilled on the north side of the existing landfills near the center of the site. A clean water test was performed at the dye introduction borehole to ensure the location would allow tracer dye to enter the subsurface groundwater system. Background monitoring was performed for the commonly used tracer dyes prior to final dye selection and introduction of the dye.

The day before the dye introduction, new activated carbon samplers were placed at all sampling locations. Flush water for the dye introduction was obtained from a nearby residential well completed into the surficial aquifer. A weighted two-inch flexible hose was lowered into the bottom of the borehole to act as a tremie pipe. Tracer dye was added to the bottom of the borehole through the hose by gravity flow followed by clean water to flush the dye out of the borehole and into the aquifer. Flush water was added slowly so that the water level in the borehole was raised no more than approximately 15 feet above the static water level on the morning of the dye introduction.

Monitoring wells, boreholes, springs, seeps, and streams were continuously sampled for the subsequent presence of the dyes following the dye introduction. By careful selection of dye introduction and sampling locations, valuable insight can be gained into the groundwater flow regime.

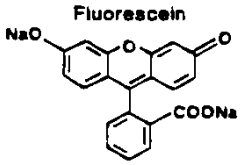
2.1 DYE INTRODUCTION

Fluorescein dye was selected for the dye introduction during the groundwater tracing investigation. This dye is environmentally safe (Smart, 1984; Field et al., 1995) and poses no risk to humans, livestock, or aquatic life in the concentrations used in professionally directed groundwater tracing work. This dye is among the most detectable of the commonly used fluorescent tracer dyes. It can be adsorbed onto activated carbon samplers for cumulative sampling and can also be detected in water samples. Exhibit 1 summarizes the more common properties of the selected tracer dye.

Exhibit 1. Tracer Dye Properties

Fluorescein Dye

- Also known as Acid Yellow 73
- Color Index Constitution Number 45350
- Brilliant fluorescent yellow-green dye
- Most commonly used tracer dye
- Most easily detectable dye



The dye introduction was made specifically for this investigation. The trace is numbered sequentially with the first two digits indicating the year and the last pair of digits indicating the serial number of the trace. Table 1 summarizes the dye introduction location and the amount and type of dye used for each trace. Figure 2 illustrates the dye introduction location.

Table 1. Dye Introduction Location for NABORS Landfill Dye Trace Investigation.

Trace No.	Coordinates (SPC)	Land-Based Description S-T-R	Elevation ft msl	Dye Type and Quantity
23-01	774716.18, 1180890.13	Secs. 26 & 35; Township 21 N; Range 14 W	1061.11	Fluorescein 10 pounds powder, (75% dye mixture, 25% diluent)

A four-inch open borehole was drilled in November 2022 in the area near monitoring wells MW-1 and MW-1R (see Figure 2). This dye introduction borehole, identified as IW-1, is 91.29 feet in total depth. Groundwater was encountered at a depth of 62.76 ft bgs. A general description of the borehole lithology is summarized as follows:

0 to 4 ft bgs silty clay with gravel

4 to 91 ft bgs dolomite bedrock

A clean water test was performed in November 2022 to verify the borehole would transmit water and dye into the subsurface at a rate adequate to introduce the dye to the groundwater system. Flush water was obtained from a nearby residential water well.

Ten pounds of powdered fluorescein dye was mixed with approximately 10 gallons of water prior to the dye introduction. The initial water level in the borehole at the time of dye introduction was approximately 62 feet bgs.

At approximately 10:00 AM on March 1, 2023, the liquid dye was added to the bottom of the borehole via a weighted tremie hose. Clean flush water was added to the bottom of the borehole via the tremie hose to flush the dye out of the borehole and into the aquifer. Flush water was added by tremie to the bottom of the borehole to ensure the dye was flushed into the aquifer and to prevent the denser dye solution from settling in the bottom of the borehole. The dye and flush water acceptance rate was approximately 40 gallons per minute (gpm) at the time of the dye introduction. The water level in the borehole during the flush water addition was targeted at approximately 47 feet bgs (approximately 15 feet above the static water level).

Flush water was added frequently over the first two months following the dye introduction to a water level of approximately 15 feet above the static water level. A tank was set up to add water at a slow rate to keep the water level in the borehole at the maximum the target water level. The tank was refilled during sampling events. Approximately 1350 gallons of flush water were added to the dye introduction borehole in total between March 1 and May 7, 2023.

2.2 SAMPLING FOR TRACER DYES

This section describes the types of tracer dye sampling performed during this study. All samples were collected by SCS staff and analyzed by the Ozark Underground Laboratory (OUL) in Protem, Missouri. A summary of sample results and laboratory reports are provided in Appendix A. The OUL analysis procedures and criteria document is included in Appendix B.

2.2.1 Types of Samples

Two kinds of samples were collected during the project: activated carbon samplers and grab water samples. Primary reliance was placed upon the activated carbon samplers. The activated carbon samplers consisted of screen wire packets filled with 4.25 grams of laboratory-grade activated coconut shell carbon. These samplers adsorb, retain, and concentrate the tracer dyes. When eluted in the laboratory, samples routinely yield dye concentrations one to two orders of magnitude greater than the mean dye concentrations in the water. Activated carbon samplers are continuous and accumulating samplers.

Grab samples of water provide dye concentrations at a particular point in time. Water samples are routinely collected at all sampling stations where practical and are archived. The water samples were analyzed if any of the dyes were detected in the associated activated carbon sampler, if an activated carbon sampler was lost or was not collected if fluorescence peaks in the associated carbon sampler suggested that the water sample should be analyzed, or if the data would be useful for the study. Water samples were collected in 50-milliliter plastic sample vials.

All sample collection procedures followed the protocols found in OUL's Procedures and Criteria document found in Appendix B (Aley and Beeman, 2015).

2.2.2 Sampling Locations

Fifty-four (54) sampling stations were established for this project. Sampling locations consisted of monitoring wells, exploratory borings, surface water, springs, and seeps. Figure 2 illustrates the locations of the sampling stations. Table 2 provides a summary of the sampling station locations.

Table 2. Dye Trace Monitoring Locations

Location No.	SPC Northing (ft)	SPC Easting (ft)	Elevation (GS)	Location Name	Description
001	774716.18	1180890.13	1061.11	IW-1	Dye introduction borehole – background only
002	--	--	--	Flush water	Background only
101	774701.35	1181061.50	1050.95	EB-1	Geotechnical borings installed 2022
102	774358.91	1180694.47	1057.68	EB-2	
103	775091.15	1181096.52	1042.58	EB-4	
104	774465.66	1181622.96	988.86	EB-5	
201	774665.59	1180834.95	1065.81	MW-1	Existing site monitoring wells
202	774615.55	1180790.30	1065.44	MW-1R	
203	774290.12	1180071.70	998.31	MW-2	
204	774057.04	1179608.33	997.44	MW-3	
205	774603.37	1179397.41	1008.71	MW-4	
206	775121.22	1179450.96	1001.38	MW-5	
207	775325.87	1180168.40	997.09	MW-6	
208	775557.84	1181245.10	996.66	MW-7	
209	774400.39	1180200.85	1023.40	CAO-1	
210	774031.04	1179743.71	988.79	CAO-2	
211	773782.77	1180074.51	981.20	CAO-3	
212	Number not used (well damaged)				
213	774557.30	1181484.26	1001.26	NAB-2	

Location No.	SPC Northing (ft)	SPC Easting (ft)	Elevation (GS)	Location Name	Description
214	773771.34	1182094.69	918.49	NAB-3	
215	773706.01	1181233.71	1012.28	NAB-4	
216	775354.05	1181002.60	1009.36	NAB-7	
217	773831.32	1180543.89	1046.98	NAB-8	
218	774721.21	1181454.46	1009.30	MW-509D	
219	774266.10	1182027.19	981.00	MW-577	
220	773726.78	1180820.05	1047.60	MW-633D	
221	773476.20	1181943.37	963.15	MW-689D	
222	774658.72	1181679.86	973.98	NE-2	
223	772588.55	1182018.89	861.91	NE-3	
224	775000.66	1181498.01	1007.55	NE-4	
225	773369.70	1179231.93	898.42	NE-6	
301	775593.22	1180561.06	986.08*	Entrance seep	Springs, seeps, and surface streams
302	775595.39	1181259.16	999.59*	Spring A	
303	775334.34	1180678.11	991.59*	Spring B	
304	774726.62	1181751.93	964.57*	TSP-1	
305	774591.43	1181632.73	974.97*	TSP-2	
306	773863.46	1182091.40	915.17*	TSP-3	
307	773315.15	1181292.86	916.16*	TSP-4	
308	773736.82	1179779.47	923.94*	Class 1 Draw	
309	772721.93	1180377.04	976.10*	Class IV Draw	
310	774644.25	1179288.84	988.65*	SP-4 (previously identified spring)	
311	774290.92	1180154.40	992.87*	SP-5 (previously identified spring)	
312	775507.67	1180441.59	922.96*	SP-7 (previously identified spring)	
313	772537.06	1182002.10	861.52*	Spring near NE-3	
314	773835.53	1179894.66	948.12*	Spring near CAO-3	
315	773670.57	1179900.08	945.09*	Seep below southwest pond	
316	773314.09	1179221.68	891.22*	SW-1 (stream near NE-6)	
317	775239.68	1180164.30	1016.69*	Seep near MW-6	
318	774662.85	1181799.36	963.68*	Spring at culvert downstream of TSP-1 and TSP-2	
319	774098.65	1182095.82	960.48*	Seep near MW-577	
320	772579.97	1182095.82	863.50*	SW-2 (stream near NE-3)	
321	773853.81	1182311.80	897.65*	East pond discharge	
322	773816.56	1182230.18	898.27*	Seep- below east pond	
323	775653.67	1179258.38	923.47*	SW-3 (stream from north pond)	
324	775739.07	1179259.31	927.73*	Spring Branch from entrance gate	
325	773672.69	1178772.85	883.39*	Hutch Creek at CR 16	

* = Elevation estimated using ArcGIS Pro (2018 1M DEM, Arkansas GIS Office)

2.2.3 Sampling Events

Background sampling was performed to detect and quantify the presence of tracer dyes or fluorescent compounds with characteristics similar to tracer dyes at any of the sampling stations. Background sampling was performed with charcoal sampler and water samples. The initial background sampling was initiated in December 2022 and continued through February 28, 2023.

Sampling for tracer dyes was performed following dye introductions. The sampling period was based on the results of the field reconnaissance, previous sample analysis, and precipitation events. During the first two weeks of monitoring, cumulative samplers were collected and replaced twice a week; during weeks 2 through 4, once a week; weeks 4 through 8, once every two weeks; weeks 8 through 17, once per month; with a final sampling event occurring during week 38. Sampling events following dye introductions occurred from March to November 2023.

2.2.4 Sample Collection Procedures

Activated Carbon Samplers and Grab Water Samples Activated carbon samplers were placed within groundwater monitoring wells, exploratory boreholes, seeps, surface water, and springs. At each subsurface sampling location (well and borehole), a single sampler was attached with plastic-coated tie wire to the top of the bailer. The bailer was then lowered into the well/borehole using twine until completely submerged; to maintain the bailer's position, the twine was secured to the well cap or the well cover. To retrieve and replace the sampler, SCS personnel spooled up the twine to raise the bailer to the top of casing. At the time of collection, a grab water sample was collected using the bailer prior to replacement of a new sampler.

At surface water monitoring locations, samplers were placed into flowing water or locations anticipated to have flowing water following storm events. Packets were firmly anchored with plastic-coated tie wire, and weighted in place. Cords were sometimes run from the packets to trees along the banks or other stationary objects so that samplers could be recovered even during or after relatively high-flow events. Samplers were concealed to minimize disturbance from high flow event or animal activities. A minimum of two samplers were placed at each surface water sampling location. Placement of multiple samplers allows for the analysis of duplicate samples if needed and provides a spare in case a sampler is lost or damaged. When carbon samplers were collected, new samplers were replaced. Collected samplers were placed in sterile plastic bags. The bags were labeled on the outside with the station name and the date and time of collection. Grab water samples were also collected at the same time as the activated carbon samplers.

Samples collected in the field were maintained under refrigeration until delivery to the laboratory. Upon arrival at OUL, samplers were refrigerated until analysis. All sampler placement and collection work was performed by SCS staff and all analytical work was performed by the OUL. Field procedures and analyses conformed to the protocol in Appendix B (Aley and Beeman, 2015).

Specific Conductance Measurements Specific conductance is a measurement of the ability of water to conduct electricity. Water flowing through soluble rock units such as dolomite dissolves calcium carbonate and, to a lesser extent, other compounds. In karst settings, surface waters tend to have lower specific conductivity values than waters flowing through the groundwater system.

During this study, a number of specific conductance measurements were made of water at sampling stations. The purpose of the measurements was to assess the similarities of the waters being

sampled. All measurements were made with a YSI ProQuatro, which measures in micromhos/centimeter (µmhos/cm). These units are equivalent to microSiemens.

Flow Rate Estimates Estimates of flow rates were made at the surface water sampling stations whenever possible. These estimates can help explain variations in specific conductance values at particular sampling stations. All flow rate estimates were expressed in gallons per minute (gpm).

2.3 LABORATORY ANALYSIS

Laboratory analysis was performed at the Ozark Underground Laboratory, Inc. (OUL) in Protem, Missouri. Activated carbon samplers were rinsed under a relatively strong jet of water and eluted in a standard eluting solution. Water samples were pH adjusted to raise the pH of the water to 9.5 or higher. Elutant and pH-adjusted water samples were analyzed on a Shimadzu RF-5301 spectrofluorophotometer under a synchronous scanning protocol. All dye concentrations were based on the as-sold mixtures of the dyes.

It is not uncommon to have some fluorescence background in the range of fluorescein dye present at some of the stations used in groundwater tracing studies. Background sampling prior to the introduction of any tracer dyes is routinely performed to characterize this background fluorescence and to identify the existence of any tracer dyes that may be present in the area.

The OUL has established normal emission fluorescence wavelength ranges for the tracer dye used in this project (fluorescein). The normal acceptable range equals mean values plus and minus two standard deviations. These values are derived from actual groundwater tracing studies conducted by the OUL.

The detection limits are based on concentrations of dye necessary to produce emission fluorescence peaks where the signal-to-noise ratio is 3. The detection limits are realistic for most field studies since they are based upon results from actual field samples rather than being based upon values from spiked samples in a matrix of reagent water or the elutants from unused activated carbon samplers. In some cases, detection limits may be smaller than reported if the water being sampled has very little fluorescent material in it. In some cases, detection limits may be greater than reported; this most commonly occurs if the sample is turbid due to suspended material or a coloring agent such as tannic compounds. Turbid samples are typically allowed to settle, centrifuged, or, if these steps are not effective, diluted prior to analysis.

Table 3 provides normal emission wavelength ranges and detection limits for the two dyes used in this study when analyzed on the OUL's RF-5301 spectrofluorophotometer. Detailed procedures and criteria used during the tracer study are found in the OUL's Procedures and Criteria Document found in Appendix B (Aley and Beeman, 2015).

Table 3. RF-5301 Spectrofluorophotometer – Laboratory Limits

Dye and Matrix	Normal Acceptable Emission Wavelength Range nanometers (nm)	Detection Limit (ppb)
Fluorescein in Elutant	514.5 to 519.6	0.025
Fluorescein in Water	506.8 to 510.6	0.002

Note: Detection limits are based on the as-sold weight of the dye mixture used by the OUL.

3.0 DYE TRACING RESULTS

This section summarizes findings from the site visits and dye tracing work performed from December 20, 2022 through November 28, 2023.

3.1 SITE DESCRIPTION AND FIELD RECONNAISSANCE

Much of the study area lies within the approximately 56-acre permitted Class 1 area and approximately 5.65-acre permitted Class 4 area of the former NABORS Landfill. The NABORS Landfill property is located east of County Road 16 near the community of Three Brothers, Baxter County, Arkansas.

The topography of the area is characterized by steep ravines carved into ridge tops, resulting in a dissected landscape. Ephemeral streams flow in the ravines in response to precipitation in the immediate watershed. Hutch Creek is located on the southern edge of the study area and Pigeon Creek to the east, situating much of the permitted landfill area in the upper reaches of the Hutch Creek and Pigeon Creek watersheds. The closed landfill cells were constructed on the crests of ridges in the Western portion of the site. Four ponds, three of which are designated as sedimentation basins in the landfill site design, lie within the study area.

Thin layers of Cotter residuum, orange to red clay with variable amounts of chert, are present primarily on hilltops. The underlying Cotter Dolomite bedrock is exposed in several places onsite, both on hillslopes and in stream valleys. Multiple groundwater monitoring wells were established over several years of the NABORS Landfill operation; they were drilled into the competent Cotter dolomite bedrock and screened to represent the aquifer located within the unit at depth.

Seasonal springs have been observed to coincide with the contact between the residuum and the weathered dolomite zone overlying the competent bedrock, although groundwater is consistently encountered at depth within the Cotter dolomite. Investigations performed at the NABORS Landfill suggest that the predominantly horizontal seasonal flow within the transition zone is not connected to the aquifer located at depth within the competent bedrock. Rather, water exits the hydrogeologic system in surface features such as springs and seeps where the contact zone is exposed.

Multiple springs and seeps have been recorded within the study area, some with consistent and some with intermittent flow. Most emerge within ravines or along hillslopes. A number are located within an area of lower elevation bounded to the north and east by the entrance road and to the south by landfill area 1-2.

SCS Engineers completed site reconnaissance in late 2022 to select a comprehensive set of locations to use for background sampling and dye trace monitoring. The final plan involved monitoring wells, exploratory borings, seeps and springs, and surface water including streams.

3.2 BACKGROUND FLUORESCENCE STUDY

A background fluorescence study was conducted from late December 2022 through February 28, 2023. Some of the sampling stations were located in the tributary valleys that do not support perennial flow, and therefore background samples could not be obtained. Background fluorescence in or near the range of fluorescein detected during the background study is displayed in the Table 4.

Table 4. Background Fluorescence

Sampling Period	Station Name	Peak Emission Wavelength in Charcoal (nm)	Fluorescein Concentration	
			Charcoal Sampler (ppb)	Corresponding Water Sample (ppb)
12/28/22 - 02/28/23	201 MW-1	515.5	0.751	ND
12/20/22 - 12/28/22	302 Spring A	514.9*	0.591	ND
12/28/22 - 02/28/23	302 Spring A	518.1	0.762	ND

Notes: ND = not detected

* Not all criteria were met for a positive dye detection, but the peak was quantified for background purposes.

3.3 GROUNDWATER TRACING RESULTS

One dye introduction was performed during this investigation to provide a better understanding of groundwater flow in the area of the landfill. The results of this trace are described in this section. Diagrammatic groundwater tracing flow paths are illustrated in Figure 3.

Tables within the text include dye analysis results for all sampling stations where dyes from groundwater traces conducted as part of this investigation were detected. The results are reported in parts per billion (ppb). With the tables, the following abbreviations are routinely encountered: "ND" means that no dye was detected; "NS" means that the category was not sampled; "NA" means not analyzed; and "nm" is an abbreviation for nanometers. All sampling results are tabulated in Appendix A.

Charcoal samplers are continuous and accumulating samplers left in place for a period of time (often one to four weeks). A grab sample of water is collected when the charcoal samplers are collected. The corresponding water sample concentration is provided for the collection date of each charcoal sampler.

3.3.1 Trace 23-01

Ten pounds of powdered fluorescein dye mixture containing approximately 75% dye equivalent and 25% diluent was mixed into approximately 10 gallons of water and was introduced into boring IW-1 on March 1, 2023, at 10:00 AM hours. The dye was added to the bottom of the borehole via a tremie hose.

Water level in this boring at the time of the dye introduction was approximately 62 feet bgs, which increased to approximately 47 ft bgs with the addition of the dye solution. The dye introduction point is located at an elevation of approximately 1061.11 feet within the southern portion of S26, T21 N, R14 W, Baxter County, Arkansas.

Following the dye introduction, clean water was slowly added to the borehole to flush the dye into out of the borehole and into the aquifer. As with the dye introduction, flush water was added to the bottom of the borehole via tremie pipe. The borehole accepted water at approximately 40 gallons per day. Due to the relatively slow water acceptance rate from the borehole, the flush water introduction was extended so that the maximum depth to water in the borehole remained more than 40 feet bgs on the day of the dye introduction. The dye introduction borehole interval exposed to the dye mixture and flush water on the day of the dye introduction was approximately 929.82 fmsl to

1021.11 fmsl. Between March 1 and May 7, 2023, a total of approximately 1350 gallons of water were added to the borehole with a target water level of 47 feet bgs (15 feet above static water level).

During the post-dye introduction monitoring period, which extended from March through November 2023, fluorescein dye was detected in the following samples collected at 6 (six) monitoring locations: Stations 201, 202, 301, 302, 304, and 318. Diagrammatic tracing flow paths are illustrated in Figure 3. Dye results at each of these sampling stations are summarized below.

Station 302, Spring A, was located north-northeast of the dye introduction borehole. Dye was detected in Spring A during the 1987 dye trace. During both sampling intervals of the background period, fluorescein dye was detected in charcoal samplers placed at Spring A. Background water samples were non-detect. Dye was detected in charcoal samplers collected at this station following dye introduction as summarized below:

Table 5. Station 302 - Spring A Analytical Results

Sampling Period	Peak Emission Wavelength in Charcoal (nm)	Fluorescein Concentration	
		Charcoal Sampler (ppb)	Corresponding Water Sample (ppb)
12/20/22 - 12/28/22	*514.9**	*0.591*	*ND*
12/28/22 - 2/28/23	*518.1*	*0.762*	*ND*
3/1/23	**Dye Introduction**		
2/28/23 - 3/6/23	516.6	0.966	ND
3/6/23 - 3/9/23	516.7	0.776	ND
3/9/23 - 3/13/23	516.7	0.912	ND
3/13/23 - 3/16/23	516.4	0.688	ND
3/16/23 - 3/20/23	517.1	1.04	ND
3/20/23 - 3/27/23	516.8	1.15	ND
3/27/23 - 4/3/23	516.9	1.50	ND
4/3/23 - 4/17/23	517.6	1.10	ND
4/17/23 - 5/1/23	517.5	1.78	ND
5/1/23 - 5/30/23	518.8	0.833	ND
5/30/23 - 7/5/23	519.1	1.08	ND
7/5/23 - 11/28/23	517.5	0.733	ND

Note: ND = No dye detected; NS = no charcoal packet sample collected (lost) or no water (dry); NA = not analyzed.
* Not all criteria were met for a positive dye detection, but the peak was quantified for background purposes.

Station 304, Temporary Sampling Point (TSP)-1, was located east of the dye introduction borehole. No dye was detected at TSP-1 during the background sampling events. Fluorescein was first detected in a charcoal sampler collected from Station 304 during Monitoring Event 1 on March 6, 2023. Dye was detected in charcoal samplers collected at this station following dye introduction as summarized below:

Table 6. Station 304 – TSP-1 Analytical Results

Sampling Period	Peak Emission Wavelength in Charcoal (nm)	Fluorescein Concentration	
		Charcoal Sampler (ppb)	Corresponding Water Sample (ppb)
12/20/22 – 12/28/22	*ND*	*ND*	*NA*
12/28/22 – 2/28/23	*ND*	*ND*	*NA*
3/1/23	**Dye Introduction**		
2/28/23 - 3/6/23	514.6	0.50	ND
3/6/23 - 3/9/23	512.4*	0.534	ND
3/9/23 - 3/13/23	514.9	0.249	ND
3/13/23 - 3/16/23	ND	ND	NA
3/16/23 - 3/20/23	ND	ND	NA
3/20/23 - 3/27/23	ND	ND	NA
3/27/23 - 4/3/23	ND	ND	NA
4/3/23 - 4/17/23	ND	ND	NA
4/17/23 - 5/1/23	ND	ND	NA
5/1/23 - 5/30/23	ND	ND	NA
5/30/23 - 7/5/23	ND	ND	NA
7/5/23 - 11/28/23	ND	ND	NA

Notes: ND = No dye detected; NS = no charcoal packet sample collected (lost) or no water (dry); NA = not analyzed.
*=A fluorescence peak is present that does not meet all criteria for a positive dye result. However, it has been calculated as though it were the tracer dye.

Station 318, Spring at Culvert downstream of TSP-1 and 2 [Spr (Culvert TSP 1/2)], is located east of the dye introduction borehole, slightly southeast of TSP-1. Water was discharging from the ground at this location. However, sampling locations TSP-1 and TSP-2 were upstream of this sampling location, and thus any dye discharged upgradient had the potential to impact the results at this sampling location.

No dye was detected at this station during background sampling. Fluorescein was first detected in a charcoal sampler collected from Station 318 during Monitoring Event 1 on March 6, 2023. Dye was detected in charcoal samplers collected at this station following dye introduction as summarized below:

Table 7. Station 318 - Spring (culvert downstream TSP-1 and TSP 2) Analytical Results

Sampling Period	Peak Emission Wavelength in Charcoal (nm)	Fluorescein Concentration	
		Charcoal Sampler (ppb)	Corresponding Water Sample (ppb)
12/20/22 - 12/28/22	*ND*	*ND*	*NA*
12/28/22 - 2/28/23	*ND*	*ND*	*NA*
3/1/23	**Dye Introduction**		
2/28/23 - 3/6/23	515.1	1.20	ND
3/6/23 - 3/9/23	ND	ND	NA
3/9/23 - 3/13/23	ND	ND	NA
3/13/23 - 3/16/23	ND	ND	NA
3/16/23 - 3/20/23	ND	ND	NA
3/20/23 - 3/27/23	ND	ND	NA
3/27/23 - 4/3/23	ND	ND	NA
4/3/23 - 4/17/23	ND	ND	NA
4/17/23 - 5/1/23	ND	ND	NA
5/1/23 - 5/30/23	ND	ND	NA
5/30/23 - 7/5/23	ND	ND	NA
7/5/23 - 11/28/23	ND	ND	NA

Note: ND = No dye detected; NS = no charcoal packet sample collected (lost) or no water (dry); NA = not analyzed.

Station 201, MW-1, is located southwest of the dye introduction borehole. A background fluorescence peak was detected at this sampling location during the second background event (the day before the dye introduction). The corresponding water sample yielded non-detect results. Dye was detected in charcoal samplers collected at this station following dye introduction as summarized below:

Table 8. Station 201 - MW-1 Analytical Results

Sampling Period	Peak Emission Wavelength in Charcoal (nm)	Fluorescein Concentration	
		Charcoal Sampler (ppb)	Corresponding Water Sample (ppb)
12/20/22 - 12/28/22	*ND*	*ND*	*NA*
12/28/22 - 2/28/23	*515.5*	*0.751*	*ND*
3/1/23	**Dye Introduction**		
2/28/23 - 3/6/23	ND	ND	NA
3/6/23 - 3/9/23	ND	ND	NA
3/9/23 - 3/13/23	ND	ND	NA
3/13/23 - 3/16/23	ND	ND	NA
3/16/23 - 3/20/23	ND	ND	NA
3/20/23 - 3/27/23	ND	ND	NA
3/27/23 - 4/3/23	ND	ND	NA
4/3/23 - 4/17/23	ND	ND	NA
4/17/23 - 5/1/23	515.0**	0.252	ND
5/1/23 - 5/30/23	ND	ND	NA
5/30/23 - 7/5/23	514.3	0.782	ND
7/5/23 - 11/28/23	514.9	1.31	ND

Note: ND = No dye detected; NS = no charcoal packet sample collected (lost) or no water (dry); NA = not analyzed.
**=A fluorescence peak is present that does not meet all the criteria for this dye. However, it has been calculated as a positive dye result.

In order for a dye detection to be confirmed, the OUL indicates the magnitude of the detection should be ten times greater than a background fluorescence detection. Although this criterion was not met at this sampling location, the detections of dye in this well are interpreted to be positive dye detections from this trace based upon the proximity of this location to the dye introduction location and the conclusive results at sampling Station 202 MW-1R, discussed below.

Station 202, MW-1R, is located southwest of the dye introduction borehole, beyond monitoring well MW-1. No dye was detected at this station during background sampling. Fluorescein dye was first detected in a charcoal packet placed at MW-1R during Monitoring Event 11, on July 5, 2023. Dye was detected in charcoal samplers at this station following dye introduction as summarized below:

Table 9. Station 202 - MW-1R Analytical Results

Sampling Period	Peak Emission Wavelength in Charcoal (nm)	Fluorescein Concentration	
		Charcoal Sampler (ppb)	Corresponding Water Sample (ppb)
12/20/22 - 12/28/22	*ND*	*ND*	*NA*
12/28/22 - 2/28/23	*ND*	*ND*	*NA*
3/1/23	**Dye Introduction**		
2/28/23 - 3/6/23	ND	ND	NA
3/6/23 - 3/9/23	ND	ND	NA
3/9/23 - 3/13/23	ND	ND	NA
3/13/23 - 3/16/23	ND	ND	NA
3/16/23 - 3/20/23	ND	ND	NA
3/20/23 - 3/27/23	ND	ND	NA
3/27/23 - 4/3/23	ND	ND	NA
4/3/23 - 4/17/23	ND	ND	NA
4/17/23 - 5/1/23	ND	ND	NA
5/1/23 - 5/30/23	ND	ND	NA
5/30/23 - 7/5/23	514.1	0.816	ND
7/5/23 - 11/28/23	514.1	0.528	ND

Note: ND = No dye detected; NS = no charcoal packet sample collected (lost) or no water (dry); NA = not analyzed.

These results indicate a conclusive dye detection at monitoring well MW-1R.

Station 301 (Entrance Seep) is located north-northwest of the dye introduction borehole. No dye was detected at this station during background sampling.

Table 10. Station 301 - Entrance Seep Analytical Results

Sampling Period	Peak Emission Wavelength in Charcoal (nm)	Rhodamine WT Concentration	
		Charcoal Sampler (ppb)	Corresponding Water Sample (ppb)
12/20/22 - 12/28/22	ND	ND	NA
12/28/22 - 2/28/23	ND	ND	NA
3/1/23	**Dye Introduction**		
2/28/23 - 3/6/23	ND	ND	NA
3/6/23 - 3/9/23	ND	ND	NA
3/9/23 - 3/13/23	ND	ND	NA
3/13/23 - 3/16/23	ND	ND	NA
3/16/23 - 3/20/23	ND	ND	NA
3/20/23 - 3/27/23	ND	ND	NA
3/27/23 - 4/3/23	ND	ND	NA
4/3/23 - 4/17/23	ND	ND	NA
4/17/23 - 5/1/23	ND	ND	NA
5/1/23 - 5/30/23	514.4	0.419	ND
5/30/23 - 7/5/23	514.5	0.423	ND
7/5/23 - 11/28/23	NS	NS	NA

Note: ND = No dye detected; NS = no charcoal packet sample collected (lost) or no water (dry); NA = not analyzed.

3.3.2 Quality Control Samples

Duplicate samples are collected in the field and analyzed as a measure of quality control. Duplicate samples were collected at the following three sampling stations:

- Station 301, Spring A
- Station 302, Spring B
- Station 316, SW-1 near MW-6

The relative percent difference (RPD) is calculated as the difference of a duplicate sample concentration result divided by the mean of the duplicate concentration result. All sample results are included in Appendix A. The only duplicate sampling location with dye detections was Station 301, Spring A. No dye was detected in any of the water samples collected corresponding to the duplicate charcoal samplers.

The RPD for each duplicate charcoal sampler result at Spring A was calculated and is shown in Table 11. Activated carbon samplers routinely exhibit mean RPD values of 29 to 36% for fluorescein in charcoal samplers, based upon literature values available for a wide range of studies (Aley, 2016). In this groundwater investigation, the mean RPD value for fluorescein in charcoal samplers at Spring A, excluding non-detection results, was 12.5%, which is well within the standard range for sampling with activated carbon samplers.

Table 11. Comparison of Duplicate Activated Carbon Sampler Results at Spring A

OUL No.	Date/Time Placed	Date/Time Collected	Fluorescein		
			Peak nm	Conc. ppb	RPD
G3153	2/28/23 1326	3/6/23 1230	516.6	0.966	35.6%
G3177	2/28/23 1326	3/6/23 1230	516.9	0.674	
G3323	3/6/23 1230	3/9/23 1325	516.7	0.776	NA
G3348	3/6/23 1230	3/9/23 1325	ND	ND	
G3382	3/9/23 1325	3/13/23 1310	516.7	0.912	11.5%
G3407	3/9/23 1325	3/13/23 1310	516.7	0.813	
G3533	3/13/23 1310	3/16/23 1300	516.4	0.688	5.4%
G3558	3/13/23 1310	3/16/23 1300	518.3	0.726	
G3637	3/16/23 1300	3/20/23 1440	517.1	1.04	13.5%
G3663	3/16/23 1300	3/20/23 1440	516.9	1.19	
G3857	3/20/23 1440	3/27/23 1450	516.8	1.15	14.0%
G3883	3/20/23 1440	3/27/23 1450	516.8	1.00	
G4268	3/27/23 1450	4/3/23 1440	516.9	1.50	2.6%
G4292	3/27/23 1450	4/3/23 1440	516.9	1.54	
G4917	4/3/23 1440	4/17/23 1340	517.6	1.10	12.8%
G4941	4/3/23 1440	4/17/23 1345	518.1	1.25	
G5071	4/17/23 1340	5/1/23 1600	517.5	1.78	4.4%
G5094	4/17/23 1345	5/1/23 1600	517.7	1.86	
G5590	5/1/23 1600	5/30/23 1430	518.8	0.833	NA
G5615	5/1/23 1600	5/30/23 1430	ND	ND	
G6071	5/30/23 1430	7/5/23 1345	519.1	1.08	NA
G6096	5/30/23 1430	7/5/23 1345	ND	ND	
G9181	7/5/23 1345	11/28/23 1323	517.5	0.733	12.6%
G9197	7/5/23 1345	11/28/23 1323	518.6	0.646	

Notes: ND = No dye detected
NA = Not applicable

Seventeen duplicate samples were collected at Spring A throughout the dye trace. Calculated RPD values ranged from 2.6% to 35.6%, except for the three sampling events during which at least one of the duplicate results were not detected.

It is noteworthy that activated carbon samplers will adsorb more dye when exposed to greater dye mass. Activated carbon samplers adsorb dye rather than filter it from the flow. Sampler results were generally greater in the primary sample collected from the western outlet during most sampling events under lower flow conditions. Most exceptions occurred under higher flow conditions where there was higher flow in the main channel of the spring outlet.

3.4 HYDROLOGY

Precipitation data, specific conductance data collected during sampling events, and flow rate observations and measurements have been evaluated to create a better overall understanding of groundwater hydrology in the study area. Table 12 provides a summary of precipitation data in the study area during the 11-month study.

Precipitation was greater than normal in at the beginning of the study period in January through March 2023. In April, May, and June, precipitation was below normal for the area. Late in the study period during July through October, precipitation again increased to greater than normal.

Table 12. Summary of Daily Precipitation Data (January to December 2023)

Day	Jan 2023	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023	Sept 2023	Oct 2023	Nov 2023
1	0	0.18	0	0.15	0	0	0	0	0	0	0
2	0.01	0	0	0	0	0	0.37	0	0	0	0
3	0.97	0	2.77	0	0	0	0	0	0	0	0
4	0	0	0.36	0	0	0	0	0	0	0	0
5	0	0	0	0.01	0.55	0	0	0	0.47	2.20	0
6	0	0	0	0.46	0	0	0.44	0.09	01.25	0.02	0
7	0	0	0	0	0.01	0	0.05	0	0	0	0
8	0	0.89	0.54	0	0	0	0.71	0	0.11	0	0
9	0	2.54	0.03	0	0.02	0.27	0.04	0.01	0.01	0	0
10	0	0	0.18	0	0.64	0.02	0.45	4.50	0	0	0.16
11	0	0	0	0	0.58	0.62	0	0	0	0	0
12	0.55	0	0.42	0	0.94	0.24	0	0.01	0.83	0	0
13	0.02	0	0	0	0	0.01	0.88	0.96	0.10	0	0
14	0	0.02	0	0	0.02	0.08	0.46	1.81	0	0	0
15	0	0.29	0	0	1.10	0.07	1.46	0	0	0.01	0
16	0	0.40	0	0.03	0.07	0	0	0	0	0.01	0
17	0.33	0	0.79	0	0	0.08	0	0	0	0	0
18	0.33	0	0	0	0	0.29	0.84	0	0	0	0
19	0.50	0	0	0	0	0.08	0	0	0	0.02	0
20	0.01	0	0	0	1.29	0	0	0	0.58	0	0.57
21	0	0	0.04	0.55	0	0	0	0	0.01	0	0.51
22	0.03	0	0.57	0	0	0	0.71	0	0.93	0	0
23	0.03	0.3	0	0	0	0	0	0	0	0	0
24	0	0	0.61	0	0	0	0	0	1.26	0	0
25	1.53	0	1.99	0	0	0	0	0	0.01	0	0
26	0	0.35	0	0	0	0	0	0	0	0	0.10
27	0	0.06	0.050	0	0	0	0	0.01	0	0.03	0
28	0	0	0	0.47	0	0	0	0	0	0.01	0
29	0	--	0	0.13	0	0	0	0	0	2.47	0
30	T	--	0	0.01	0	0	0.03	0	0	0	0
31	0.25	--	0.46	--	0	--	0.84	0	--	0	--
Total	4.46	5.03	8.81	1.81	5.22	1.76	7.28	7.39	5.56	4.77	1.34
Normal	3.30	3.26	5.03	5.60	5.68	3.88	4.15	3.74	3.66	3.99	4.80
Departure from Normal	1.16	1.77	3.78	-3.79	-0.46	-2.12	3.13	3.65	1.90	0.78	-3.46

Notes: National Weather Service, Mountain Home NNW (Midway, Arkansas)
T = Trace

Data summarized from the National Weather Service Station in Midway, AR, located approximately 10 miles south of the site.

Specific conductance readings were taken during the February 8, April 3, and May 1 sampling events. Table 12 summarizes the ranges of specific conductance measurements and flow rate estimates made in the study area during the study period.

Table 13. Summary of Specific Conductance Measurements and Flow Rate Estimates

Monitoring Well and Borings Sampling Stations	Specific Conductance min/max (µmhos/cm)		Water Level Elevation (Wells): Min/Max/Avg		
101 EB-1	632	759	996.60	1002.59	999.90
102 EB-2	493	955	1002.64	1023.66	1011.59
103 EB-4	635	717	991.83	1009.76	1004.09
104 EB-5	555	749	922.41	929.32	926.82
201 MW-1	557	1102	997.42	1001.97	1000.4
202 MW-1R	1162	1262	998.23	1001.66	999.20
203 MW-2	593	754	965.78	969.92	968.46
204 MW-3	941	1048	966.52	968.58	968.38
205 MW-4	736	1210	924.18	926.14	925.28
206 MW-5	762	844	926.62	938.8	928.62
207 MW-6	751	806	943.55	945.81	944.78
208 MW-7	526	745	992.06	994.09	993.07
209 CAO-1	1296	1387	999.56	999.86	999.70
210 CAO-2	400	798	962.77	968.68	966.72
211 CAO-3	371	534	970.48	974.49	972.62
213 NAB-2	630	726	924.06	932.27	929.08
214 NAB-3	457	699	896.47	900.02	898.41
215 NAB-4	847	988	898.23	899.67	899.21
216 NAB-7	523	819	988.76	991.88	990.42
217 NAB-8	630	772	957.53	968.5	966.63
218 MW-509D	572	653	994.52	999.1	997.39
219 MW-577	712	793	935.82	943.4	941.98
220 MW-633D	577	730	985.01	987.54	986.93
221 MW-689D	417	516	939.66	941.98	941.18
222 NE-2	1107	1233	922.58	926.87	923.67
223 NE-3	528	627	857.92	859.62	858.71
224 NE-4	537	631	940.28	952.36	946.98
225 NE-6	639	733	891.91	897.54	895.16
Springs & Surface Water Sampling Stations	**Specific Conductance min/max (µmhos/cm)**		**Est. Flow Rate (Springs/Surface Water): Min/Max/Avg**		
301 Entrance Seep	490	618	0.05	15	--
302 Spring A	430	565	0.3	100	--
303 Spring B	634	716	Dry	10	--
304 TSP-1	504	600	0.05	150	--
305 TSP-2	456	679	Dry	500	--
306 TSP-3	553	746	Dry	75	--
307 TSP-4	660	735	Dry	3	--
308 Class 1 Draw	92.7	121	0.5	500	--
309 Class IV Draw	108	197	Dry	30	--
310 SP-4 *(previously identified spring)*	534	727	0	5	--

Monitoring Well and Borings Sampling Stations	Specific Conductance min/max (µmhos/cm)		Water Level Elevation (Wells): Min/Max/Avg		
311 SP-5 *(previously identified spring)*	Dry	Dry	Dry	Dry	--
312 SP-7 *(previously identified spring)*	292	306	5	35	--
313 Spring near NE-3	335	441	0	200	--
314 Spring (Class I draw)	361	430	1	500	--
315 Seep below southwest pond	318	375	0	5	--
316 SW-1 (stream near NE-6)	172	203	1	50	--
317 Seep near MW-6	638	644	Dry	1	--
318 Spring culvert downstream TSP-1 & TSP-2	483	601	0	600	--
319 Seep near MW-577	70	405	Dry	3.75	--
320 SW-2 (stream near NE-3)	342	440	2.5	600	--
321 East pond discharge	296	398	1	300	--
322 Seep- below east pond	493	620	Dry	10	--
323 SW-3 *(stream from north pond)*	316	365	0.5	50	--
324 Spring Branch from entrance gate	402	537	0.1	40	--
325 Hutch Creek at CR16	364	463	5	1000	--

Notes: gpm = gallons per minute; cfs = cubic feet per second; 1 cfs = 450 gpm

In general, the higher the specific conductance values the longer water has been in contact with the carbonate bedrock. The following observations are made based on a review of specific conductance measurements and flow rate estimates made during the study:

- High flows were observed in both springs and surface water features during the first two monitoring events following the dye injection and were attributable to precipitation above average during January, February, and March followed by below-average precipitation in April, May, and June 2023.

- Specific conductance values were typically lowest in surface water and higher at monitoring points connected to groundwater.

3.4.1 Discussion

Fluorescein dye was detected at 6 monitoring locations: MW-1, MW-1R, Spring A, TSP-1, Spring (culvert TSP 1/2), and the Entrance Seep.

The spatial relationship of these points is illustrated in Figure 3. Table 14 displays the sand pack interval (monitoring wells) and ground surface elevations (springs/seeps) of the detected locations compared to the elevation of the interval exposed to the dye mixture in the dye introduction borehole.

Table 14. Elevation Summary of Dye Detection Locations

Station Name	Latitude	Longitude	Elevation (feet MSL) – MW Transmissive Interval or Spring/Seep Discharge
IW-1	774716.18	1180890.13	929.82 - 1021.11
Spring A	775595.39	1181259.16	999.59
Spr (TSP 1/2)	774662.85	1181799.36	963.68
TSP-1	774726.62	1181751.93	964.57
Entrance Seep	775593.22	1180561.06	986.08
MW-1	774665.59	1180834.95	990.81 - 1005.81
MW-1R	774621.16	1180787.62	990.44 - 1002.44

Notes: Elevations given in feet above mean sea level (MSL)
Spring and stream elevation estimated using ArcGIS Pro (2018 1M DEM, Arkansas GIS Office)

Tracer dye was not detected in sampling stations on the east or south side of the landfill, in Hutch Creek, or in monitoring wells other than MW-1 and MW-1R located closest to the dye introduction borehole.

4.0 SUMMARY AND CONCLUSIONS

A tracer dye investigation was performed at the former NABORS landfill, located near the community of Three Brothers in northern Baxter County, Arkansas. Site geology consists of residuum overlying Cotter Dolomite bedrock. A weathered zone occupying approximately the top 10 feet of the bedrock exhibits epikarstic features. This tracer investigation used groundwater tracing methods to define groundwater flow paths on the north side of the existing landfills.

Field reconnaissance was performed to identify appropriate dye monitoring points. Two background sampling events were performed to identify and quantify existing background fluorescence monitoring locations prior to the introduction of tracer dye.

Ten pounds of powdered fluorescein dye mixture was mixed into solution and introduced to the bottom of borehole IW-1 through tremie pipe on March 1, 2023. The tracer dye was flushed with clean water followed dye introduction to induce movement of the dye out of the borehole and into the aquifer. A total of 1350 gallons of flush water was added over 10 weeks following the dye introduction with a targeted maximum water level of 15 feet above the static water level. Ten monitoring events, performed by SCS staff, followed the dye introduction.

Dye from this introduction was subsequently detected in 6 (six) monitoring locations, including monitoring wells MW-1 and MW-1R and the following springs/surface water locations: Spring A, Entrance Seep, Temporary Sampling Point (TSP)-1, and the Spring at culvert downstream of TSP 1 and TSP-2. Tracer dye was not detected in sampling stations on the east or south side of the landfill, in Hutch Creek, or in monitoring wells other than MW-1 and MW-1R located closest to the dye introduction borehole.

The final sampling event occurred on November 28, 2023.

5.0 REFERENCES

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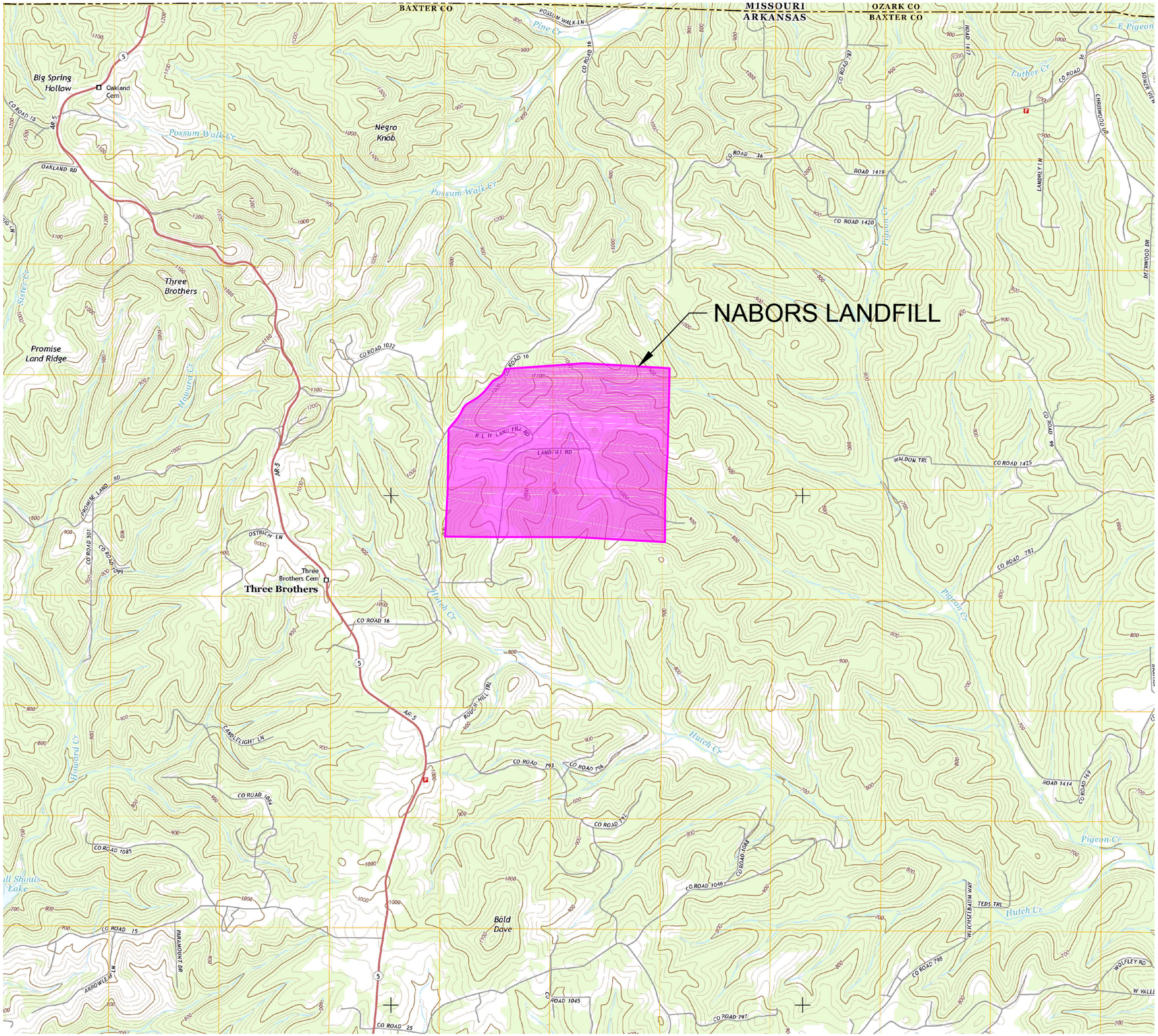
Figures

Figure 1 – Site Location Map
Figure 2 – Tracer Dye Investigation Map
Figure 3 – Tracer Results Map



NOTES:

1. BACKGROUND IMAGERY IS THE MIDWAY QUADRANGLE ARKANSAS-MISSOURI 7.5-MINUTE SERIES TOPO MAP RETRIEVED FROM WWW.USGS.GOV ON APRIL 27, 2016.

2. LANDFILL BOUNDARY IS APPROXIMATE.

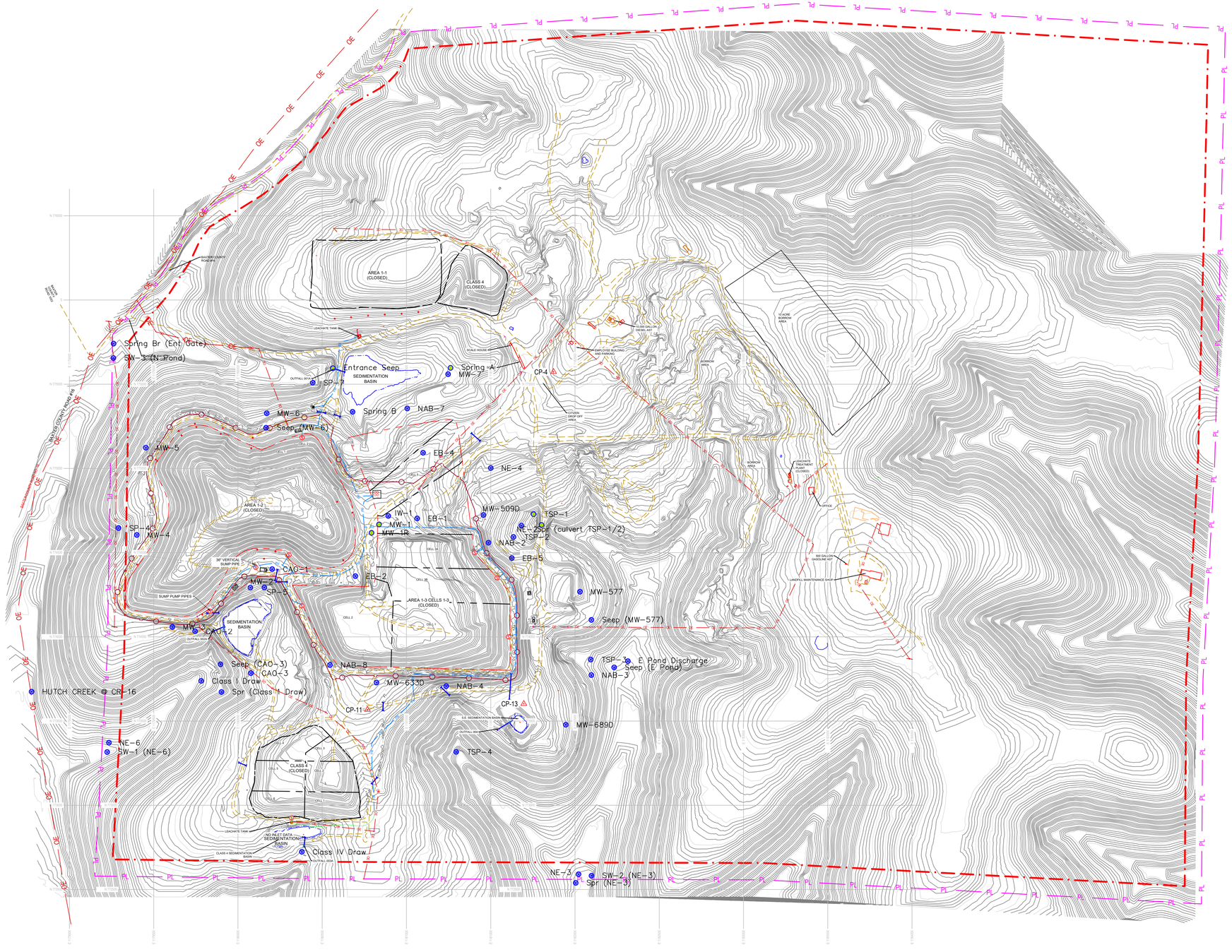
3000 0 3000 6000

SCALE FEET

FIGURE 1 - SITE LOCATION MAP
NABORS LANDFILL
BAXTER COUNTY, ARKANSAS

SCS ENGINEERS
11219 Richardson Drive
North Little Rock, Arkansas 72113
PH: (501) 503-4781

CHK. BY: KV	DWN. BY: DMB	DSN. BY: DMB	PROJ. NO. --
PROJ. MGR: DM	DATE: 4/27/16	CADD FILE: SITE LOCATION MAP.DWG	



300 0 300 600
SCALE FEET

LEGEND:

- EXISTING 2' MINOR CONTOUR
- 1000 EXISTING 10' MAJOR CONTOUR
- PL PROPERTY BOUNDARY
- 100' PROPERTY BOUNDARY OFFSET
- FENCE
- OE OE EXISTING OVERHEAD ELECTRIC
- EXISTING ROAD
- OHE OHE EXISTING OVERHEAD ELECTRIC
- DISPOSAL BOUNDARY (APPROXIMATE)
- EXISTING BODY OF WATER
- EXISTING DRAINAGE PIPE/CULVERT
- MW-2 EXISTING MONITORING WELL
- GP-16 EXISTING GAS PROBE
- CP-5 EXISTING CONTROL POINT
- DYE INTRODUCTION

WELL LOCATION TABLE

Point #	Northing	Easting	Description
1	774716.18	1180890.13	IW-1
101	774701.35	1181061.50	EB-1
102	774358.91	1180694.47	EB-2
103	775091.15	1181096.52	EB-4
104	774465.66	1181622.96	EB-5
201	774665.59	1180834.95	MW-1
202	774615.55	1180790.30	MW-1R
203	774290.12	1180071.70	MW-2
204	774057.04	1179608.33	MW-3
205	774603.37	1179397.41	MW-4
206	775121.22	1179450.96	MW-5
207	775325.87	1180168.40	MW-6
208	775557.84	1181245.10	MW-7
209	774400.39	1180200.85	CAO-1
210	774031.04	1179743.71	CAO-2
211	773782.77	1180074.51	CAO-3
213	774557.30	1181484.26	NAB-2
214	773771.34	1182094.69	NAB-3
215	773706.01	1181233.71	NAB-4
216	775354.05	1181002.60	NAB-7
217	773831.32	1180543.89	NAB-8
218	774721.21	1181454.46	MW-509D
219	774266.10	1182027.19	MW-577
220	773726.78	1180820.05	MW-633D
221	773476.20	1181943.37	MW-689D
222	774658.72	1181679.86	NE-2
223	772588.55	1182018.89	NE-3
224	775000.66	1181498.01	NE-4
225	773369.70	1179231.93	NE-6
301	775593.22	1180561.06	Entrance seep
302	775595.39	1181259.16	Spring A
303	775334.34	1180678.11	Spring B
304	774726.62	1181751.93	TSP-1
305	774591.43	1181632.73	TSP-2
306	773863.46	1182091.40	TSP-3
307	773315.15	1181292.86	TSP-4
308	773736.82	1179779.47	Class 1 Draw
309	772721.93	1180377.04	Class IV Draw
310	774644.25	1179288.84	SP-4 (previously identified spring)
311	774290.92	1180154.40	SP-5 (previously identified spring)
312	775507.67	1180441.59	SP-7 (previously identified spring)
313	772537.06	1182002.10	Spring near NE-3
314	773835.53	1179894.66	Spring near CAO-3
315	773670.57	1179900.08	Seep below southwest pond
316	773314.09	1179221.68	(stream near NE-6)
317	775239.68	1180164.30	Seep near MW-6
318	774662.85	1181799.36	Spring at culvert downstream of TSP-1 and TSP-2
319	774098.65	1182095.82	Seep near MW-577
320	772579.97	1182095.82	(stream near NE-3)
321	773853.81	1182311.80	East pond discharge
322	773816.56	1182230.18	Seep- below east pond
323	775653.67	1179258.38	SW-3 (stream from north pond)
324	775739.07	1179259.31	Spring Branch from entrance gate
325	773672.69	1178772.85	Hutch Creek at CR 16

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE
DYE STUDY WELL LOCATION MAP

PROJECT TITLE
DYE STUDY

CLIENT
LAKESHORE RECYCLING SYSTEMS
OZH
1320 LANDFILL RD.
THREE BROTHERS, AR. 72653

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
9780 MAUMELLE BLVD.
NORTH LITTLE ROCK, ARKANSAS 72213
PH. (501) 812-4551

PROJ. NO. 27222230.0
DWN. BY: KHJ
CHK. BY: FEC
Q/A RVW BY: FEC
APP. BY: FEC

CADD FILE: 001

DATE: FEBRUARY 2024

SCALE: AS SHOWN

DRAWING NO. **1**

C:\Users\53508k3\Desktop\27222139.01 - NAB\DBS\AutoCAD\Sheets\Dye Study\DYE STUDY WELL LOCATION MAP.dwg

150 0 150 300

SCALE FEET

LEGEND:

- DISPOSAL BOUNDARY (APPROXIMATE)
- EXISTING BODY OF WATER
- EXISTING DRAINAGE PIPE/CULVERT
- MW–2 EXISTING MONITORING WELL
- GP–16 EXISTING GAS PROBE
- CP–5 EXISTING CONTROL POINT
- MW–1 DYE INTRODUCTION
- MW–1 SAMPLING STATION
- DIAGRAMMATIC TRACE PATHS

REV.	DATE	DESCRIPTION	CK. BY

SHEET TITLE: OBSERVED DYE

PROJECT TITLE: DYE STUDY

CLIENT: LAKESHORE RECYCLING SYSTEMS
OZH
1320 LANDFILL RD.
THREE BROTHERS, AR. 72653

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
9780 MAUMELLE BLVD.
NORTH LITTLE ROCK, ARKANSAS 72113
PH. (501) 812-4551

PROJ. NO.	DWN. BY:	CK'A RVW BY:
27222230.00	KHJ	FEC
DSN. BY:	CHK. BY:	APP. BY:
KHJ	FEC	FEC

CADD FILE: 001

DATE: FEBRUARY 2024

SCALE: AS SHOWN

DRAWING NO. 3

C:\Users\LSKOA\Desktop\27222130.01 - NARDRES\Vol1\CAD\Sheets\Dye Study\DYE STUDY WELL LOCATION MAP.dwg

Appendix A

Analytical Results Summary

and Laboratory Data Reports

Dye Analysis

Summary Tables

December 2022 – November 2023

Ozark Underground Laboratory Dye Trace Results - NABORS Landfill, Baxter County, Arkansas.

Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

All results are for charcoal samplers.

OUL	Station	Date/Time	Date/Time	Fluorescein Results		RWT Results	
Number	Name	Placed	Collected	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G1964	001 IW-1	12/20/22 0918	12/28/22 0955	ND		ND	
G3063	001 IW-1	12/28/2022 0955	2/28/2023 1028	ND		NR	
G3064	003 tie wire	--	2/28/2023 1905	ND		NR	
G3065	004 string	--	2/28/2023 1900	ND		NR	
G3066	005 bailer	--	2/28/2023 1910	ND		NR	
G1965	101 EB-1	12/20/22 1158	12/28/22 1250	ND		ND	
G3067	101 EB-1	12/28/2022 1250	2/28/2023 1245	ND		NR	
G3123	101 EB-1	2/28/23 1245	3/6/23 1505	ND		NR	
G3292	101 EB-1	3/6/23 1505	3/9/23 1435	ND		NR	
G3351	101 EB-1	3/9/23 1435	3/13/23 1405	ND		NR	
G3503	101 EB-1	3/13/23 1405	3/16/23 1220	ND		ND	
G3607	101 EB-1	3/16/23 1220	3/20/23 1145	ND		ND	
G3827	101 EB-1	3/20/23 1145	3/27/23 1250	ND		ND	
G4237	101 EB-1	3/27/23 1250	4/3/23 1415	ND		ND	
G4887	101 EB-1	4/3/23 1415	4/17/23 1225	ND		ND	
G5041	101 EB-1	4/17/23 1225	5/1/23 1530	ND		ND	
G5559	101 EB-1	5/1/23 1530	5/30/23 1420	ND		ND	
G6041	101 EB-1	5/30/23 1420	7/5/23 1310	ND		ND	
G9153	101 EB-1	7/5/23 1310	11/28/23 1135	ND		ND	
G1966	102 EB-2	12/20/22 0940	12/28/22 1030	ND		ND	
G3068	102 EB-2	12/28/2022 1030	2/28/2023 1329	ND		NR	
G3124	102 EB-2	2/28/23 1329	3/6/23 1113	ND		NR	
G3293	102 EB-2	3/6/23 1113	3/9/23 1125	ND		NR	
G3352	102 EB-2	3/9/23 1125	3/13/23 1110	ND		NR	
G3504	102 EB-2	3/13/23 1110	3/16/23 1055	ND		ND	
G3608	102 EB-2	3/16/23 1055	3/20/23 1015	ND		ND	
G3828	102 EB-2	3/20/23 1015	3/27/23 1130	ND		ND	
G4238	102 EB-2	3/27/23 1130	4/3/23 1155	ND		ND	
G4888	102 EB-2	4/3/23 1155	4/17/23 1545	ND		ND	
G5042	102 EB-2	4/17/23 1545	5/1/23 1105	ND		ND	
G5561	102 EB-2	5/1/23 1105	5/30/23 1200	ND		ND	
G6042	102 EB-2	5/30/23 1200	7/5/23 1110	ND		ND	
G1967	103 EB-4	12/20/22 1206	12/28/22 1300	ND		ND	
G3069	103 EB-4	12/28/2022 1300	2/28/2023 1111	ND		NR	
G3125	103 EB-4	2/28/23 1111	3/6/23 1235	ND		NR	
G3294	103 EB-4	3/6/23 1235	3/9/23 1415	ND		NR	
G3353	103 EB-4	3/9/23 1415	3/13/23 1330	ND		NR	
G3505	103 EB-4	3/13/23 1330	3/16/23 1230	ND		ND	
G3609	103 EB-4	3/16/23 1230	3/20/23 1050	ND		ND	
G3829	103 EB-4	3/20/23 1050	3/27/23 1215	ND		ND	
G4239	103 EB-4	3/27/23 1215	4/3/23 1400	ND		ND	
G4889	103 EB-4	4/3/23 1400	4/17/23 1240	ND		ND	
G5043	103 EB-4	4/17/23 1240	5/1/23 1520	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G5562	103 EB-4	5/1/23 1520	5/30/23 1405	ND		ND	
G6043	103 EB-4	5/30/23 1405	7/5/23 1255	ND		ND	
G1968	104 EB-5	12/20/22 1500	12/28/22 1530	ND		ND	
G3070	104 EB-5	12/28/2022 1530	2/28/2023 1428	ND		NR	
G3126	104 EB-5	2/28/23 1228	3/6/23 1310	ND		NR	
G3295	104 EB-5	3/6/23 1310	3/9/23 1402	ND		NR	
G3354	104 EB-5	3/9/23 1402	3/13/23 1348	ND		NR	
G3506	104 EB-5	3/13/23 1348	3/16/23 0950	ND		ND	
G3610	104 EB-5	3/16/23 0950	3/20/23 1417	ND		ND	
G3830	104 EB-5	3/20/23 1417	3/27/23 1420	ND		ND	
G4241	104 EB-5	3/27/23 1420	4/3/23 1145	ND		ND	
G4890	104 EB-5	4/3/23 1145	4/17/23 1615	ND		ND	
G5044	104 EB-5	4/17/23 1615	5/1/23 1345	ND		ND	
G5563	104 EB-5	5/1/23 1345	5/30/23 1259	ND		ND	
G6044	104 EB-5	5/30/23 1259	7/5/23 1315	ND		ND	
G9154	104 EB-5	7/5/23 1315	11/28/23 1305	ND		ND	
G1969	201 MW-1	12/20/22 0921	12/28/22 1015	ND		ND	
G3071	201 MW-1	12/28/2022 1015	2/28/2023 1057	515.5	0.751	NR	
G3127	201 MW-1	2/28/23 1057	3/6/23 1455	ND		NR	
G3296	201 MW-1	3/6/23 1455	3/9/23 1530	ND		NR	
G3355	201 MW-1	3/9/23 1530	3/13/23 1445	ND		NR	
G3507	201 MW-1	3/13/23 1445	3/16/23 1230	ND		ND	
G3611	201 MW-1	3/16/23 1230	3/20/23 1125	ND		ND	
G3831	201 MW-1	3/20/23 1125	3/27/23 1240	ND		ND	
G4242	201 MW-1	3/27/23 1240	4/3/23 1435	ND		ND	
G4891	201 MW-1	4/3/23 1435	4/17/23 1206	ND		ND	
G5045	201 MW-1	4/17/23 1206	5/1/23 1540	515.0 **	0.252	ND	
G5564	201 MW-1	5/1/23 1540	5/30/23 1450	ND		ND	
G6045	201 MW-1	5/30/23 1450	7/5/23 1330	514.3	0.782	ND	
G9155	201 MW-1	7/5/23 1330	11/28/23 1530	514.9	1.31	ND	
G1970	202 MW-1R	12/20/22 0932	12/28/22 1025	ND		ND	
G3072	202 MW-1R	12/28/2022 1025	2/28/2023 1049	ND		NR	
G3128	202 MW-1R	2/28/23 1049	3/6/23 1436	ND		NR	
G3297	202 MW-1R	3/6/23 1436	3/9/23 1453	ND		NR	
G3356	202 MW-1R	3/9/23 1453	3/13/23 1421	ND		NR	
G3508	202 MW-1R	3/13/23 1421	3/16/23 1240	ND		ND	
G3612	202 MW-1R	3/16/23 1240	3/20/23 1115	ND		ND	
G3832	202 MW-1R	3/20/23 1115	3/27/23 1225	ND		ND	
G4243	202 MW-1R	3/27/23 1225	4/3/23 1430	ND		ND	
G4892	202 MW-1R	4/3/23 1430	4/17/23 1215	ND		ND	
G5046	202 MW-1R	4/17/23 1215	5/1/23 1535	ND		ND	
G5565	202 MW-1R	5/1/23 1535	5/30/23 1430	ND		ND	
G6046	202 MW-1R	5/30/23 1430	7/5/23 1320	514.1	0.816	ND	
G9156	202 MW-1R	7/5/23 1320	11/28/23 1535	514.1	0.528	ND	
G1971	203 MW-2	12/20/22 0955	12/28/22 1050	ND		ND	
G3073	203 MW-2	12/28/2022 1050	2/28/2023 1300	ND		NR	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3129	203 MW-2	2/28/23 1300	3/6/23 1035	ND		NR	
G3298	203 MW-2	3/6/23 1035	3/9/23 1050	ND		NR	
G3357	203 MW-2	3/9/23 1050	3/13/23 1038	ND		NR	
G3509	203 MW-2	3/13/23 1038	3/16/23 1025	ND		ND	
G3613	203 MW-2	3/16/23 1025	3/20/23 0950	ND		ND	
G3833	203 MW-2	3/20/23 0950	3/27/23 1105	ND		ND	
G4244	203 MW-2	3/27/23 1105	4/3/23 1120	ND		ND	
G4893	203 MW-2	4/3/23 1120	4/17/23 1630	ND		ND	
G5047	203 MW-2	4/17/23 1630	5/1/23 1040	ND		ND	
G5566	203 MW-2	5/1/23 1040	5/30/23 1125	ND		ND	
G6047	203 MW-2	5/30/23 1125	7/5/23 1050	ND		ND	
G9157	203 MW-2	7/5/23 1050	11/28/23 1612	ND		ND	
G1972	204 MW-3	12/20/22 1027	12/28/22 1115	ND		ND	
G3074	204 MW-3	12/28/2022 1115	2/28/2023 1045	ND		NR	
G3130	204 MW-3	2/28/23 1045	3/6/23 0906	ND		NR	
G3299	204 MW-3	3/6/23 0906	3/9/23 0940	ND		NR	
G3358	204 MW-3	3/9/23 0940	3/13/23 0925	ND		NR	
G3510	204 MW-3	3/13/23 0925	3/16/23 0910	ND		ND	
G3614	204 MW-3	3/16/23 0910	3/20/23 0902	ND		ND	
G3834	204 MW-3	3/20/23 0902	3/27/23 1000	ND		ND	
G4245	204 MW-3	3/27/23 1000	4/3/23 0955	ND		ND	
G4894	204 MW-3	4/3/23 0955	4/17/23 1310	ND		ND	
G5048	204 MW-3	4/17/23 1310	5/1/23 0945	ND		ND	
G5567	204 MW-3	5/1/23 0945	5/30/23 1005	ND		ND	
G6048	204 MW-3	5/30/23 1005	7/5/23 0935	ND		ND	
G9158	204 MW-3	7/5/23 0935	11/28/23 1408	ND		ND	
G1973	205 MW-4	12/20/22 1014	12/28/22 1105	ND		ND	
G3075	205 MW-4	12/28/2022 1105	2/28/2023 1233	ND		NR	
G3131	205 MW-4	2/28/23 1233	3/6/23 0948	ND		NR	
G3301	205 MW-4	3/6/23 0948	3/9/23 1005	ND		NR	
G3359	205 MW-4	3/9/23 1005	3/13/23 0954	ND		NR	
G3511	205 MW-4	3/13/23 0954	3/16/23 0935	ND		ND	
G3615	205 MW-4	3/16/23 0935	3/20/23 0915	ND		ND	
G3835	205 MW-4	3/20/23 0915	3/27/23 1020	ND		ND	
G4246	205 MW-4	3/27/23 1020	4/3/23 1025	ND		ND	
G4895	205 MW-4	4/3/23 1025	4/17/23 1215	ND		ND	
G5049	205 MW-4	4/17/23 1215	5/1/23 1015	ND		ND	
G5568	205 MW-4	5/1/23 1015	5/30/23 1035	ND		ND	
G6049	205 MW-4	5/30/23 1035	7/5/23 0955	ND		ND	
G9159	205 MW-4	7/5/23 0955	11/28/23 1534	ND		ND	
G1974	206 MW-5	12/20/22 1138	12/28/22 1210	ND		ND	
G3076	206 MW-5	12/28/2022 1210	2/28/2023 1207	ND		NR	
G3132	206 MW-5	2/28/23 1207	3/6/23 1005	ND		NR	
G3302	206 MW-5	3/6/23 1005	3/9/23 1027	ND		NR	
G3361	206 MW-5	3/9/23 1027	3/13/23 1013	ND		NR	
G3512	206 MW-5	3/13/23 1013	3/16/23 0950	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3616	206 MW-5	3/16/23 0950	3/20/23 0935	ND		ND	
G3836	206 MW-5	3/20/23 0935	3/27/23 1035	ND		ND	
G4247	206 MW-5	3/27/23 1035	4/3/23 1050	ND		ND	
G4896	206 MW-5	4/3/23 1050	4/17/23 1425	ND		ND	
G5050	206 MW-5	4/17/23 1425	5/1/23 1025	ND		ND	
G5569	206 MW-5	5/1/23 1025	5/30/23 1105	ND		ND	
G6050	206 MW-5	5/30/23 1105	7/5/23 1015	ND		ND	
G9161	206 MW-5	7/5/23 1015	11/28/23 1501	ND		ND	
G1975	207 MW-6	12/20/22 1300	12/28/22 1340	ND		ND	
G3077	207 MW-6	12/28/2022 1340	2/28/2023 1400	ND		NR	
G3133	207 MW-6	2/28/23 1400	3/6/23 1148	ND		NR	
G3303	207 MW-6	3/6/23 1148	3/9/23 1255	ND		NR	
G3362	207 MW-6	3/9/23 1255	3/13/23 1210	ND		NR	
G3513	207 MW-6	3/13/23 1210	3/16/23 1155	ND		ND	
G3617	207 MW-6	3/16/23 1155	3/20/23 1035	ND		ND	
G3837	207 MW-6	3/20/23 1035	3/27/23 1145	ND		ND	
G4248	207 MW-6	3/27/23 1145	4/3/23 1310	ND		ND	
G4897	207 MW-6	4/3/23 1310	4/17/23 1410	ND		ND	
G5051	207 MW-6	4/17/23 1410	5/1/23 1450	ND		ND	
G5570	207 MW-6	5/1/23 1450	5/30/23 1305	ND		ND	
G6051	207 MW-6	5/30/23 1305	7/5/23 1205	ND		ND	
G9162	207 MW-6	7/5/23 1205	11/28/23 1254	ND		ND	
G1976	208 MW-7	12/20/22 1635	12/28/22 1420	ND		ND	
G3078	208 MW-7	12/28/2022 1420	2/28/2023 1258	ND		NR	
G3134	208 MW-7	2/28/23 1258	3/6/23 1214	ND		NR	
G3304	208 MW-7	3/6/23 1214	3/9/23 1342	ND		NR	
G3363	208 MW-7	3/9/23 1342	3/13/23 1300	ND		NR	
G3514	208 MW-7	3/13/23 1300	3/16/23 1255	ND		ND	
G3618	208 MW-7	3/16/23 1255	3/20/23 1200	ND		ND	
G3838	208 MW-7	3/20/23 1200	3/27/23 1305	ND		ND	
G4249	208 MW-7	3/27/23 1305	4/3/23 1435	ND		ND	
G4898	208 MW-7	4/3/23 1435	4/17/23 1335	ND		ND	
G5052	208 MW-7	4/17/23 1335	5/1/23 1555	ND		ND	
G5571	208 MW-7	5/1/23 1555	5/30/23 1425	ND		ND	
G6052	208 MW-7	5/30/23 1425	7/5/23 1400	ND		ND	
G9163	208 MW-7	7/5/23 1400	11/28/23 1315	ND		ND	
G1977	209 CAO-1	12/20/22 0945	12/28/22 1040	ND		ND	
G3079	209 CAO-1	12/28/2022 1040	2/28/2023 1314	ND		NR	
G3135	209 CAO-1	2/28/23 1314	3/6/23 1057	ND		NR	
G3305	209 CAO-1	3/6/23 1057	3/9/23 1111	ND		NR	
G3364	209 CAO-1	3/9/23 1111	3/13/23 1055	ND		NR	
G3515	209 CAO-1	3/13/23 1055	3/16/23 1040	ND		ND	
G3619	209 CAO-1	3/16/23 1040	3/20/23 1005	ND		ND	
G3839	209 CAO-1	3/20/23 1005	3/27/23 1115	ND		ND	
G4250	209 CAO-1	3/27/23 1115	4/3/23 1140	ND		ND	
G4899	209 CAO-1	4/3/23 1140	4/17/23 1655	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G5053	209 CAO-1	4/17/23 1655	5/1/23 1055	ND		ND	
G5572	209 CAO-1	5/1/23 1055	5/30/23 1145	ND		ND	
G6053	209 CAO-1	5/30/23 1145	7/5/23 1100	ND		ND	
G9164	209 CAO-1	7/5/23 1100	11/28/23 1348	ND		ND	
G1978	210 CAO-2	12/20/22 1035	12/28/22 1120	ND		ND	
G3081	210 CAO-2	12/28/22 1120	2/28/23 1035	ND		NR	
G3136	210 CAO-2	2/28/23 1035	3/6/23 0853	ND		NR	
G3306	210 CAO-2	3/6/23 0853	3/9/23 0925	ND		NR	
G3365	210 CAO-2	3/9/23 0925	3/13/23 0913	ND		NR	
G3516	210 CAO-2	3/13/23 0913	3/16/23 0900	ND		ND	
G3621	210 CAO-2	3/16/23 0900	3/20/23 0850	ND		ND	
G3841	210 CAO-2	3/20/23 0850	3/27/23 0950	ND		ND	
G4251	210 CAO-2	3/27/23 0950	4/3/23 0940	ND		ND	
G4901	210 CAO-2	4/3/23 0940	4/17/23 1250	ND		ND	
G5054	210 CAO-2	4/17/23 1250	5/1/23 0935	ND		ND	
G5573	210 CAO-2	5/1/23 0935	5/30/23 0955	ND		ND	
G6054	210 CAO-2	5/30/23 0955	7/5/23 0925	ND		ND	
G9165	210 CAO-2	7/5/23 0925	11/28/23 1403	ND		ND	
G1979	211 CAO-3	12/20/22 1630	12/28/22 1555	ND		ND	
G3082	211 CAO-3	12/29/22 1555	2/28/23 1015	ND		NR	
G3137	211 CAO-3	2/28/23 1015	3/6/23 0920	ND		NR	
G3307	211 CAO-3	3/6/23 0920	3/9/23 0935	ND		NR	
G3366	211 CAO-3	3/9/23 0935	3/13/23 0935	ND		NR	
G3517	211 CAO-3	3/13/23 0935	3/16/23 0720	ND		ND	
G3622	211 CAO-3	3/16/23 0720	3/20/23 1000	ND		ND	
G3842	211 CAO-3	3/20/23 1000	3/27/23 1005	ND		ND	
G4252	211 CAO-3	3/27/23 1005	4/3/23 0745	ND		ND	
G4902	211 CAO-3	4/3/23 0745	4/18/23 0855	ND		ND	
G5055	211 CAO-3	4/18/23 0855	5/1/23 1118	ND		ND	
G5574	211 CAO-3	5/1/23 1118	5/30/23 0936	ND		ND	
G6055	211 CAO-3	5/30/23 0936	7/5/23 0920	ND		ND	
G9166	211 CAO-3	7/5/23 0920	11/28/23 0840	ND		ND	
G1982	213 NAB-2	12/20/22 1452	12/28/22 1510	ND		ND	
G3083	213 NAB-2	12/28/22 1510	2/28/23 1450	ND		NR	
G3138	213 NAB-2	2/28/23 1450	3/6/23 1322	ND		NR	
G3308	213 NAB-2	3/6/23 1322	3/9/23 1412	ND		NR	
G3367	213 NAB-2	3/9/23 1412	3/13/23 1400	ND		NR	
G3518	213 NAB-2	3/13/23 1400	3/16/23 0955	ND		ND	
G3623	213 NAB-2	3/16/23 0955	3/20/23 1427	ND		ND	
G3843	213 NAB-2	3/20/23 1427	3/27/23 1435	ND		ND	
G4253	213 NAB-2	3/27/23 1435	4/3/23 1150	ND		ND	
G4903	213 NAB-2	4/3/23 1150	4/17/23 1625	ND		ND	
G5056	213 NAB-2	4/17/23 1625	5/1/23 1350	ND		ND	
G5575	213 NAB-2	5/1/23 1350	5/30/23 1250	ND		ND	
G6056	213 NAB-2	5/30/23 1250	7/5/23 1350	ND		ND	
G9167	213 NAB-2	7/5/23 1350	11/28/23 1320	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G1983	214 NAB-3	12/20/22 1550	12/29/22 1145	ND		ND	
G3084	214 NAB-3	12/29/22 1145	2/28/23 1350	ND		NR	
G3139	214 NAB-3	2/28/23 1350	3/6/23 1230	ND		NR	
G3309	214 NAB-3	3/6/23 1230	3/9/23 1300	ND		NR	
G3368	214 NAB-3	3/9/23 1300	3/13/23 1315	ND		NR	
G3519	214 NAB-3	3/13/23 1315	3/16/23 1135	ND		ND	
G3624	214 NAB-3	3/16/23 1135	3/20/23 1310	ND		ND	
G3844	214 NAB-3	3/20/23 1310	3/27/23 1305	ND		ND	
G4254	214 NAB-3	3/27/23 1305	4/3/23 1110	ND		ND	
G4904	214 NAB-3	4/3/23 1110	4/18/23 1040	ND		ND	
G5057	214 NAB-3	4/18/23 1040	5/1/23 1330	ND		ND	
G5576	214 NAB-3	5/1/23 1330	5/30/23 1103	ND		ND	
G6057	214 NAB-3	5/30/23 1103	7/5/23 1242	ND		ND	
G9168	214 NAB-3	7/5/23 1242	11/28/23 1150	ND		ND	
G1984	215 NAB-4	12/20/22 1520	12/29/22 0940	ND		ND	
G3085	215 NAB-4	12/29/22 0940	2/28/23 1205	ND		NR	
G3141	215 NAB-4	2/28/23 1205	3/6/23 1038	ND		NR	
G3310	215 NAB-4	3/6/23 1038	3/9/23 1105	ND		NR	
G3369	215 NAB-4	3/9/23 1105	3/13/23 1115	ND		NR	
G3521	215 NAB-4	3/13/23 1115	3/16/23 0820	ND		ND	
G3625	215 NAB-4	3/16/23 0820	3/20/23 1125	ND		ND	
G3845	215 NAB-4	3/20/23 1125	3/27/23 1130	ND		ND	
G4255	215 NAB-4	3/27/23 1130	4/3/23 0915	ND		ND	
G4905	215 NAB-4	4/3/23 0915	4/18/23 0940	ND		ND	
G5058	215 NAB-4	4/18/23 0940	5/1/23 1140	ND		ND	
G5577	215 NAB-4	5/1/23 1140	5/30/23 1035	ND		ND	
G6058	215 NAB-4	5/30/23 1035	7/5/23 1045	ND		ND	
G9169	215 NAB-4	7/5/23 1045	11/28/23 1010	ND		ND	
G1985	216 NAB-7	12/20/22 1350	12/28/22 1315	ND		ND	
G3086	216 NAB-7	12/28/22 1315	2/28/23 1127	ND		NR	
G3142	216 NAB-7	2/28/23 1127	3/6/23 1224	ND		NR	
G3311	216 NAB-7	3/6/23 1224	3/9/23 1358	ND		NR	
G3370	216 NAB-7	3/9/23 1358	3/13/23 1345	ND		NR	
G3522	216 NAB-7	3/13/23 1345	3/16/23 1220	ND		ND	
G3626	216 NAB-7	3/16/23 1220	3/20/23 1100	ND		ND	
G3846	216 NAB-7	3/20/23 1100	3/27/23 1205	ND		ND	
G4256	216 NAB-7	3/27/23 1205	4/3/23 1415	ND		ND	
G4906	216 NAB-7	4/3/23 1415	4/17/23 1250	ND		ND	
G5059	216 NAB-7	4/17/23 1250	5/1/23 1515	ND		ND	
G5578	216 NAB-7	5/1/23 1515	5/30/23 1350	ND		ND	
G6059	216 NAB-7	5/30/23 1350	7/5/23 1245	ND		ND	
G9170	216 NAB-7	7/5/23 1245	11/28/23 1515	ND		ND	
G1986	217 NAB-8	12/20/22 1625	12/29/22 0920	ND		ND	
G3087	217 NAB-8	12/29/22 0920	2/28/23 1130	ND		NR	
G3143	217 NAB-8	2/28/23 1130	3/6/23 1015	ND		NR	
G3312	217 NAB-8	3/6/23 1015	3/9/23 1043	ND		NR	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3371	217 NAB-8	3/9/23 1043	3/13/23 1045	ND		NR	
G3523	217 NAB-8	3/13/23 1045	3/16/23 0810	ND		ND	
G3627	217 NAB-8	3/16/23 0810	3/20/23 1058	ND		ND	
G3847	217 NAB-8	3/20/23 1058	3/27/23 1055	ND		ND	
G4257	217 NAB-8	3/27/23 1055	4/3/23 0840	ND		ND	
G4907	217 NAB-8	4/3/23 0840	4/18/23 0845	ND		ND	
G5061	217 NAB-8	4/18/23 0845	5/1/23 1115	ND		ND	
G5579	217 NAB-8	5/1/23 1115	5/30/23 0925	ND		ND	
G6061	217 NAB-8	5/30/23 0925	7/5/23 1020	ND		ND	
G9171	217 NAB-8	7/5/23 1020	11/28/23 0950	ND		ND	
G1987	218 MW-509D	12/20/22 1420	12/28/22 1450	ND		ND	
G3088	218 MW-509D	12/28/22 1450	2/28/23 1505	ND		NR	
G3144	218 MW-509D	2/28/23 1505	3/6/23 1337	ND		NR	
G3313	218 MW-509D	3/6/23 1337	3/9/23 1425	ND		NR	
G3372	218 MW-509D	3/9/23 1425	3/13/23 1500	ND		NR	
G3524	218 MW-509D	3/13/23 1500	3/16/23 1200	ND		ND	
G3628	218 MW-509D	3/16/23 1200	3/20/23 1440	ND		ND	
G3848	218 MW-509D	3/20/23 1440	3/27/23 1445	ND		ND	
G4258	218 MW-509D	3/27/23 1445	4/3/23 1200	ND		ND	
G4908	218 MW-509D	4/3/23 1200	4/17/23 1610	ND		ND	
G5062	218 MW-509D	4/17/23 1610	5/1/23 1410	ND		ND	
G5581	218 MW-509D	5/1/23 1410	5/30/23 1245	ND		ND	
G6062	218 MW-509D	5/30/23 1245	7/5/23 1410	ND		ND	
G9172	218 MW-509D	7/5/23 1410	11/28/23 1335	ND		ND	
G1988	219 MW-577	12/20/22 1508	12/28/22 1540	ND		ND	
G3089	219 MW-577	12/28/22 1540	2/28/23 1415	ND		NR	
G3145	219 MW-577	2/28/23 1415	3/6/23 1255	ND		NR	
G3314	219 MW-577	3/6/23 1255	3/9/23 1330	ND		NR	
G3373	219 MW-577	3/9/23 1330	3/13/23 1335	ND		NR	
G3525	219 MW-577	3/13/23 1335	3/16/23 1145	ND		ND	
G3629	219 MW-577	3/16/23 1145	3/20/23 1405	ND		ND	
G3849	219 MW-577	3/20/23 1405	3/27/23 1410	ND		ND	
G4259	219 MW-577	3/27/23 1410	4/3/23 1135	ND		ND	
G4909	219 MW-577	4/3/23 1135	4/17/23 1712	ND		ND	
G5063	219 MW-577	4/17/23 1712	5/1/23 1340	ND		ND	
G5582	219 MW-577	5/1/23 1340	5/30/23 1200	ND		ND	
G6063	219 MW-577	5/30/23 1200	7/5/23 1305	ND		ND	
G9173	219 MW-577	7/5/23 1305	11/28/23 1215	ND		ND	
G1989	220 MW-633D	12/20/22 1620	12/29/22 0930	ND		ND	
G3090	220 MW-633D	12/29/22 0930	2/28/23 1150	ND		NR	
G3146	220 MW-633D	2/28/23 1150	3/6/23 1028	ND		NR	
G3315	220 MW-633D	3/6/23 1028	3/9/23 1052	ND		NR	
G3374	220 MW-633D	3/9/23 1052	3/13/23 1100	ND		NR	
G3526	220 MW-633D	3/13/23 1100	3/16/23 0815	ND		ND	
G3630	220 MW-633D	3/16/23 0815	3/20/23 1110	ND		ND	
G3850	220 MW-633D	3/20/23 1110	3/27/23 1110	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G4261	220 MW-633D	3/27/23 1110	4/3/23 0900	ND		ND	
G4910	220 MW-633D	4/3/23 0900	4/18/23 0930	ND		ND	
G5064	220 MW-633D	4/18/23 0930	5/1/23 1135	ND		ND	
G5583	220 MW-633D	5/1/23 1135	5/30/23 1027	ND		ND	
G6064	220 MW-633D	5/30/23 1027	7/5/23 1035	ND		ND	
G9174	220 MW-633D	7/5/23 1035	11/28/23 1000	ND		ND	
G1990	221 MW-689D	12/20/22 1535	12/29/22 1000	ND		ND	
G3091	221 MW-689D	12/29/22 1000	2/28/23 1238	ND		NR	
G3147	221 MW-689D	2/28/23 1238	3/6/23 1112	ND		NR	
G3316	221 MW-689D	3/6/23 1112	3/9/23 1155	ND		NR	
G3375	221 MW-689D	3/9/23 1155	3/13/23 1205	ND		NR	
G3527	221 MW-689D	3/13/23 1205	3/16/23 1120	ND		ND	
G3631	221 MW-689D	3/16/23 1120	3/20/23 1150	ND		ND	
G3851	221 MW-689D	3/20/23 1150	3/27/23 1200	ND		ND	
G4262	221 MW-689D	3/27/23 1200	4/3/23 0955	ND		ND	
G4911	221 MW-689D	4/3/23 0955	4/18/23 0955	ND		ND	
G5065	221 MW-689D	4/18/23 0955	5/1/23 1205	ND		ND	
G5584	221 MW-689D	5/1/23 1205	5/30/23 1054	ND		ND	
G6065	221 MW-689D	5/30/23 1054	7/5/23 1118	ND		ND	
G9175	221 MW-689D	7/5/23 1118	11/28/23 1045	ND		ND	
G1991	222 NE-2	12/20/22 1430	12/28/22 1455	ND		ND	
G3092	222 NE-2	12/28/22 1455	2/28/23 1515	ND		NR	
G3148	222 NE-2	2/28/23 1515	3/6/23 1410	ND		NR	
G3317	222 NE-2	3/6/23 1410	3/9/23 1445	ND		NR	
G3376	222 NE-2	3/9/23 1445	3/13/23 1425	ND		NR	
G3528	222 NE-2	3/13/23 1425	3/16/23 1015	ND		ND	
G3632	222 NE-2	3/16/23 1015	3/20/23 1455	ND		ND	
G3852	222 NE-2	3/20/23 1455	3/27/23 1455	ND		ND	
G4263	222 NE-2	3/27/23 1455	4/3/23 1220	ND		ND	
G4912	222 NE-2	4/3/23 1220	4/17/23 1634	ND		ND	
G5066	222 NE-2	4/17/23 1634	5/1/23 1418	ND		ND	
G5585	222 NE-2	5/1/23 1418	5/30/23 1325	ND		ND	
G6066	222 NE-2	5/30/23 1325	7/5/23 1420	ND		ND	
G9176	222 NE-2	7/5/23 1420	11/28/23 1350	ND		ND	
G1992	223 NE-3	12/20/22 1606	12/29/22 1015	ND		ND	
G3093	223 NE-3	12/29/22 1015	2/28/23 1300	ND		NR	
G3149	223 NE-3	2/28/23 1300	3/6/23 1130	ND		NR	
G3318	223 NE-3	3/6/23 1130	3/9/23 1205	ND		NR	
G3377	223 NE-3	3/9/23 1205	3/13/23 1225	ND		NR	
G3529	223 NE-3	3/13/23 1225	3/16/23 0855	ND		ND	
G3633	223 NE-3	3/16/23 0855	3/20/23 1205	ND		ND	
G3853	223 NE-3	3/20/23 1205	3/27/23 1220	ND		ND	
G4264	223 NE-3	3/27/23 1220	4/3/23 1005	ND		ND	
G4913	223 NE-3	4/3/23 1005	4/18/23 1010	ND		ND	
G5067	223 NE-3	4/18/23 1010	5/1/23 1255	ND		ND	
G5586	223 NE-3	5/1/23 1255	5/30/23 1135	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G6067	223 NE-3	5/30/23 1135	7/5/23 1200	ND		ND	
G9177	223 NE-3	7/5/23 1200	11/28/23 1105	ND		ND	
G1993	224 NE-4	12/20/22 1400	12/28/22 1455	ND		ND	
G3094	224 NE-4	12/28/22 1455	2/28/23 1550	ND		NR	
G3150	224 NE-4	2/28/23 1550	3/6/23 1332	ND		NR	
G3319	224 NE-4	3/6/23 1332	3/9/23 1525	ND		NR	
G3378	224 NE-4	3/9/23 1525	3/13/23 1620	ND		NR	
G3530	224 NE-4	3/13/23 1620	3/16/23 1215	ND		ND	
G3634	224 NE-4	3/16/23 1215	3/20/23 1535	ND		ND	
G3854	224 NE-4	3/20/23 1535	3/27/23 1530	ND		ND	
G4265	224 NE-4	3/27/23 1530	4/3/23 1210	ND		ND	
G4914	224 NE-4	4/3/23 1210	4/17/23 1555	ND		ND	
G5068	224 NE-4	4/17/23 1555	5/1/23 1435	ND		ND	
G5587	224 NE-4	5/1/23 1435	5/30/23 1231	ND		ND	
G6068	224 NE-4	5/30/23 1231	7/5/23 1500	ND		ND	
G9178	224 NE-4	7/5/23 1500	11/28/23 1425	ND		ND	
G1994	225 NE-6	12/20/22 1115	12/28/22 1140	ND		ND	
G3095	225 NE-6	12/28/22 1140	2/28/23 1105	ND		NR	
G3151	225 NE-6	2/28/23 1105	3/6/23 0917	ND		NR	
G3321	225 NE-6	3/6/23 0917	3/9/23 0905	ND		NR	
G3379	225 NE-6	3/9/23 0905	3/13/23 0848	ND		NR	
G3531	225 NE-6	3/13/23 0848	3/16/23 0837	ND		ND	
G3635	225 NE-6	3/16/23 0837	3/20/23 0840	ND		ND	
G3855	225 NE-6	3/20/23 0840	3/27/23 0925	ND		ND	
G4266	225 NE-6	3/27/23 0925	4/3/23 0910	ND		ND	
G4915	225 NE-6	4/3/23 0910	4/17/23 1335	ND		ND	
G5069	225 NE-6	4/17/23 1335	5/1/23 0955	ND		ND	
G5588	225 NE-6	5/1/23 0955	5/30/23 0920	ND		ND	
G6069	225 NE-6	5/30/23 0920	7/5/23 0905	ND		ND	
G9179	225 NE-6	7/5/23 0905	11/28/23 1424	ND		ND	
G1995	301 Entrance Seep	12/20/22 1330	12/28/22 1345	ND		ND	
G3096	301 Entrance Seep	12/29/22 1345	2/28/23 1443	ND		NR	
G3152	301 Entrance Seep	2/28/23 1443	3/6/23 1145	ND		NR	
G3322	301 Entrance Seep	3/6/23 1145	3/9/23 1246	ND		NR	
G3381	301 Entrance Seep	3/9/23 1246	3/13/23 1227	ND		NR	
G3532	301 Entrance Seep	3/13/23 1227	3/16/23 1210	ND		ND	
G3636	301 Entrance Seep	3/16/23 1210	3/20/23 1405	ND		ND	
G3856	301 Entrance Seep	3/20/23 1405	3/27/23 1410	ND		ND	
G4267	301 Entrance Seep	3/27/23 1410	4/3/23 1335	ND		ND	
G4916	301 Entrance Seep	4/3/23 1335	4/17/23 1427	ND		ND	
G5070	301 Entrance Seep	4/17/23 1427	5/1/23 0810	ND		ND	
G5589	301 Entrance Seep	5/1/23 0810	5/30/23 1325	514.4	0.419	ND	
G6070	301 Entrance Seep	5/30/23 1325	7/5/23 1230	514.5	0.423	ND	
G1996	302 Spring A	12/20/22 1645	12/28/22 1420	514.9 *	0.591	ND	
G3097	302 Spring A	12/28/22 1420	2/28/23 1326	518.1	0.762	NR	
G3153	302 Spring A	2/28/23 1326	3/6/23 1230	516.6	0.966	NR	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3323	302 Spring A	3/6/23 1230	3/9/23 1325	516.7	0.776	NR	
G3382	302 Spring A	3/9/23 1325	3/13/23 1310	516.7	0.912	NR	
G3533	302 Spring A	3/13/23 1310	3/16/23 1300	516.4	0.688	ND	
G3637	302 Spring A	3/16/23 1300	3/20/23 1440	517.1	1.04	ND	
G3857	302 Spring A	3/20/23 1440	3/27/23 1450	516.8	1.15	ND	
G4268	302 Spring A	3/27/23 1450	4/3/23 1440	516.9	1.50	ND	
G4917	302 Spring A	4/3/23 1440	4/17/23 1340	517.6	1.10	ND	
G5071	302 Spring A	4/17/23 1340	5/1/23 1600	517.5	1.78	ND	
G5590	302 Spring A	5/1/23 1600	5/30/23 1430	518.8	0.833	ND	
G6071	302 Spring A	5/30/23 1430	7/5/23 1345	519.1	1.08	ND	
G9181	302 Spring A	7/5/23 1345	11/28/23 1323	517.5	0.733	ND	
G1997	303 Spring B	12/20/22 1315	12/28/22 1400	ND		ND	
G3154	303 Spring B	2/28/23 1555	3/6/23 1210	ND		NR	
G3324	303 Spring B	3/6/23 1210	3/9/23 1310	ND		NR	
G3383	303 Spring B	3/9/23 1310	3/13/23 1238	ND		NR	
G3534	303 Spring B	3/13/23 1238	3/16/23 1245	ND		ND	
G3638	303 Spring B	3/16/23 1245	3/20/23 1420	ND		ND	
G3858	303 Spring B	3/20/23 1420	3/27/23 1445	ND		ND	
G4269	303 Spring B	3/27/23 1445	4/3/23 1355	ND		ND	
G4918	303 Spring B	4/3/23 1355	4/17/23 1433	ND		ND	
G5072	303 Spring B	4/17/23 1433	5/1/23 1500	ND		ND	
G5591	303 Spring B	5/1/23 1500	5/30/23 1447	ND		ND	
G9182	303 Spring B	7/5/23 NT	11/28/23 1240	ND		ND	
G6072	303 Spring B	5/30/23 1447	7/5/23 NT	ND		ND	
G1998	304 TSP-1	12/20/22 1410	12/28/22 1505	ND		ND	
G3098	304 TSP-1	12/28/22 1415	2/28/23 1605	ND		NR	
G3155	304 TSP-1	2/28/23 1605	3/6/23 1314	514.6	0.550	NR	
G3325	304 TSP-1	3/6/23 1314	3/9/23 1500	512.4 *	0.534	NR	
G3384	304 TSP-1	3/9/23 1500	3/13/23 1630	514.9	0.249	NR	
G3535	304 TSP-1	3/13/23 1630	3/16/23 1045	ND		ND	
G3639	304 TSP-1	3/16/23 1045	3/20/23 1525	ND		ND	
G3859	304 TSP-1	3/20/23 1525	3/27/23 1520	ND		ND	
G4270	304 TSP-1	3/27/23 1520	4/3/23 1250	ND		ND	
G4919	304 TSP-1	4/3/23 1250	4/17/23 1640	ND		ND	
G5073	304 TSP-1	4/17/23 1646	5/1/23 1432	ND		ND	
G5592	304 TSP-1	5/1/23 1432	5/30/23 1415	ND		ND	
G6073	304 TSP-1	5/30/23 1415	7/5/23 1450	ND		ND	
G1999	305 TSP-2	12/20/22 1444	12/28/22 1518	ND		ND	
G3099	305 TSP-2	12/28/22 1518	2/28/23 1523	ND		NR	
G3156	305 TSP-2	2/28/23 1523	3/6/23 1352	ND		NR	
G3326	305 TSP-2	3/6/23 1352	3/9/23 1435	ND		NR	
G3385	305 TSP-2	3/9/23 1435	3/13/23 1435	ND		NR	
G3536	305 TSP-2	3/13/23 1435	3/16/23 1025	ND		ND	
G3641	305 TSP-2	3/16/23 1025	3/20/23 1505	ND		ND	
G3861	305 TSP-2	3/20/23 1505	3/27/23 1505	ND		ND	
G4271	305 TSP-2	3/27/23 1505	4/3/23 1230	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G4921	305 TSP-2	4/3/23 1230	4/17/23 1654	ND		ND	
G5074	305 TSP-2	4/17/23 1654	5/1/23 1420	ND		ND	
G5593	305 TSP-2	5/1/23 1420	5/30/23 1318	ND		ND	
G6074	305 TSP-2	5/30/23 1318	7/5/23 1430	ND		ND	
G9183	305 TSP-2	7/5/23 1430	11/28/23 1400	ND		ND	
G2001	306 TSP-3	12/20/22 1600	12/29/22 1155	ND		ND	
G3101	306 TSP-3	12/29/22 1155	2/28/23 1400	ND		NR	
G3157	306 TSP-3	2/28/23 1400	3/6/23 1240	ND		NR	
G3327	306 TSP-3	3/6/23 1240	3/9/23 1310	ND		NR	
G3386	306 TSP-3	3/9/23 1310	3/13/23 1320	ND		NR	
G3537	306 TSP-3	3/13/23 1320	3/16/23 0935	ND		ND	
G3642	306 TSP-3	3/16/23 0935	3/20/23 1325	ND		ND	
G3862	306 TSP-3	3/20/23 1325	3/27/23 1320	ND		ND	
G4272	306 TSP-3	3/27/23 1320	4/3/23 1120	ND		ND	
G4922	306 TSP-3	4/3/23 1120	4/18/23 1045	ND		ND	
G5075	306 TSP-3	4/18/23 1045	5/1/23 1335	ND		ND	
G5594	306 TSP-3	5/1/23 1335	5/30/23 1111	ND		ND	
G6075	306 TSP-3	5/30/23 1111	7/5/23 1250	ND		ND	
G9184	306 TSP-3	7/5/23 1250	11/28/23 1155	ND		ND	
G2002	307 TSP-4	12/20/22 1525	12/29/22 0950	ND		ND	
G3102	307 TSP-4	12/29/22 0950	2/28/23 1210	ND		NR	
G3158	307 TSP-4	2/28/23 1210	3/6/23 1100	ND		NR	
G3328	307 TSP-4	3/6/23 1100	3/9/23 1145	ND		NR	
G3387	307 TSP-4	3/9/23 1145	3/13/23 1130	ND		NR	
G3538	307 TSP-4	3/13/23 1130	3/16/23 0845	ND		ND	
G3643	307 TSP-4	3/16/23 0845	3/20/23 1125	ND		ND	
G3863	307 TSP-4	3/20/23 1135	3/27/23 1150	ND		ND	
G4273	307 TSP-4	3/27/23 1150	4/3/23 0930	ND		ND	
G4923	307 TSP-4	4/3/23 0930	4/18/23 0945	ND		ND	
G5076	307 TSP-4	4/18/23 0945	5/1/23 1145	ND		ND	
G5595	307 TSP-4	5/1/23 1145	5/30/23 1047	ND		ND	
G6076	307 TSP-4	5/30/23 1047	7/5/23 1110	ND		ND	
G9185	307 TSP-4	7/5/23 1110	11/28/23 1025	ND		ND	
G2003	308 Class I Draw	NDT	12/28/22 1610	ND		ND	
G3103	308 Class I Draw	12/28/22 1620	2/28/23 1040	ND		NR	
G3159	308 Class I Draw	2/28/23 1040	3/6/23 0948	ND		NR	
G3329	308 Class I Draw	3/6/23 0948	3/9/23 1010	ND		NR	
G3388	308 Class I Draw	3/9/23 1010	3/13/23 1005	ND		NR	
G3539	308 Class I Draw	3/13/23 1005	3/16/23 0740	ND		ND	
G3644	308 Class I Draw	3/16/23 0740	3/20/23 1030	ND		ND	
G3864	308 Class I Draw	3/20/23 1030	3/27/23 1030	ND		ND	
G4274	308 Class I Draw	3/27/23 1030	4/3/23 0810	ND		ND	
G4924	308 Class I Draw	4/3/23 0810	4/18/23 0905	ND		ND	
G5077	308 Class I Draw	4/18/23 0905	5/1/23 0735	ND		ND	
G5596	308 Class I Draw	5/1/23 0735	5/30/23 0954	ND		ND	
G6077	308 Class I Draw	5/30/23 0954	7/5/23 0942	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G2004	309 Class IV Draw	12/20/22 1130	12/28/22 1200	ND		ND	
G3104	309 Class IV Draw	12/29/22 1215	2/28/23 1116	ND		NR	
G3161	309 Class IV Draw	2/28/23 1116	3/6/23 1005	ND		NR	
G3330	309 Class IV Draw	3/6/23 1005	3/9/23 1025	ND		NR	
G3389	309 Class IV Draw	3/9/23 1025	3/13/23 1030	ND		NR	
G3541	309 Class IV Draw	3/13/23 1030	3/16/23 0800	ND		ND	
G3645	309 Class IV Draw	3/16/23 0800	3/20/23 1050	ND		ND	
G3865	309 Class IV Draw	3/20/23 1050	3/27/23 1045	ND		ND	
G4275	309 Class IV Draw	3/27/23 1045	4/3/23 0830	ND		ND	
G4925	309 Class IV Draw	4/3/23 0830	4/18/23 0920	ND		ND	
G5078	309 Class IV Draw	4/18/23 0920	5/1/23 1125	ND		ND	
G5597	309 Class IV Draw	5/1/23 1125	5/30/23 1022	ND		ND	
G6078	309 Class IV Draw	5/30/23 1022	7/5/23 1005	ND		ND	
G3105	310 SP-4	12/28/22 1200	2/28/23 1140	ND		NR	
G3162	310 SP-4	2/28/23 1140	3/6/23 1016	ND		NR	
G3331	310 SP-4	3/6/23 1016	3/9/23 0950	ND		NR	
G3390	310 SP-4	3/9/23 0950	3/13/23 0937	ND		NR	
G3542	310 SP-4	3/13/23 0937	3/16/23 0920	ND		ND	
G3646	310 SP-4	3/16/23 0920	3/20/23 1320	ND		ND	
G3866	310 SP-4	3/20/23 1320	3/27/23 1010	ND		ND	
G4276	310 SP-4	3/27/23 1010	4/3/23 1015	ND		ND	
G4926	310 SP-4	4/3/23 1015	4/17/23 1405	ND		ND	
G5079	310 SP-4	4/17/23 1405	5/1/23 1010	ND		ND	
G5598	310 SP-4	5/1/23 1010	5/30/23 1020	ND		ND	
G6079	310 SP-4	5/30/23 1020	7/5/23 0945	ND		ND	
G9186	310 SP-4	7/5/23 0945	11/28/23 1438	ND		ND	
G3106	311 SP-5	12/20/22 1000	2/28/23 1255	ND		NR	
G3163	311 SP-5	2/28/23 1255	3/6/23 1043	ND		NR	
G3332	311 SP-5	3/6/23 1043	3/9/23 1055	ND		NR	
G3391	311 SP-5	3/9/23 1055	3/13/23 1030	ND		NR	
G3543	311 SP-5	3/13/23 1030	3/16/23 1015	ND		ND	
G3647	311 SP-5	3/16/23 1015	3/20/23 1335	ND		ND	
G3867	311 SP-5	3/20/23 1335	3/27/23 1055	ND		ND	
G4277	311 SP-5	3/27/23 1055	4/3/23 1115	ND		ND	
G5599	311 SP-5	4/3/23 1115	5/30/23 1120	ND		ND	
G6081	311 SP-5	5/30/23 1120	7/5/23 1040	ND		ND	
G9187	311 SP-5	7/5/23 1040	11/28/23 1606	ND		ND	
G2005	312 SP-7	12/20/22 1325	12/28/22 1340	ND		ND	
G3107	312 SP-7	12/28/22 1340	2/28/23 1430	ND		NR	
G3164	312 SP-7	2/28/23 1430	3/6/23 1158	ND		NR	
G3333	312 SP-7	3/6/23 1158	3/9/23 1240	ND		NR	
G3392	312 SP-7	3/9/23 1240	3/13/23 1220	ND		NR	
G3544	312 SP-7	3/13/23 1220	3/16/23 1205	ND		ND	
G3648	312 SP-7	3/16/23 1205	3/20/23 1400	ND		ND	
G3868	312 SP-7	3/20/23 1400	3/27/23 1405	ND		ND	
G4278	312 SP-7	3/27/23 1405	4/3/23 1325	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G4927	312 SP-7	4/3/23 1325	4/17/23 1420	ND		ND	
G5081	312 SP-7	4/17/23 1420	5/1/23 0815	ND		ND	
G5601	312 SP-7	5/1/23 0815	5/30/23 1315	ND		ND	
G6082	312 SP-7	5/30/23 1315	7/5/23 1220	ND		ND	
G9188	312 SP-7	7/5/23 1220	11/28/23 1210	ND		ND	
G2006	313 Spr (NE-3)	12/20/22 1610	12/29/22 1020	ND		ND	
G3108	313 Spr (NE-3)	12/29/22 1020	2/28/23 1310	ND		NR	
G3165	313 Spr (NE-3)	2/28/23 1310	3/6/23 1140	ND		NR	
G3334	313 Spr (NE-3)	3/6/23 1140	3/9/23 1220	ND		NR	
G3393	313 Spr (NE-3)	3/9/23 1220	3/13/23 1232	ND		NR	
G3545	313 Spr (NE-3)	3/13/23 1232	3/16/23 0905	ND		ND	
G3649	313 Spr (NE-3)	3/16/23 0905	3/20/23 1240	ND		ND	
G3869	313 Spr (NE-3)	3/20/23 1240	3/27/23 1225	ND		ND	
G4279	313 Spr (NE-3)	3/27/23 1225	4/3/23 1015	ND		ND	
G4928	313 Spr (NE-3)	4/3/23 1015	4/18/23 1020	ND		ND	
G5082	313 Spr (NE-3)	4/18/23 1020	5/1/23 1310	ND		ND	
G5602	313 Spr (NE-3)	5/1/23 1310	5/30/23 1140	ND		ND	
G6083	313 Spr (NE-3)	5/30/23 1140	7/5/23 1207	ND		ND	
G9189	313 Spr (NE-3)	7/5/23 1207	11/28/23 1110	ND		ND	
G2007	314 Spr (Class I Draw)	12/20/22 1040	12/28/22 1125	ND		ND	
G3109	314 Spr (Class I Draw)	12/28/22 1125	2/28/23 1055	ND		NR	
G3166	314 Spr (Class I Draw)	2/28/23 1055	3/6/23 0940	ND		NR	
G3335	314 Spr (Class I Draw)	3/6/23 0940	3/9/23 1003	ND		NR	
G3394	314 Spr (Class I Draw)	3/9/23 1003	3/13/23 1015	ND		NR	
G3546	314 Spr (Class I Draw)	3/13/23 1015	3/16/23 0750	ND		ND	
G3650	314 Spr (Class I Draw)	3/16/23 0750	3/20/23 1022	ND		ND	
G3870	314 Spr (Class I Draw)	3/20/23 1022	3/27/23 1030	ND		ND	
G4281	314 Spr (Class I Draw)	3/27/23 1030	4/3/23 0820	ND		ND	
G4929	314 Spr (Class I Draw)	4/3/23 0820	4/18/23 0908	ND		ND	
G5083	314 Spr (Class I Draw)	4/18/23 0908	5/1/23 0740	ND		ND	
G5603	314 Spr (Class I Draw)	5/1/23 0740	5/30/23 1004	ND		ND	
G6084	314 Spr (Class I Draw)	5/30/23 1004	7/5/23 0950	ND		ND	
G9190	314 Spr (Class I Draw)	7/5/23 0950	11/28/23 0845	ND		ND	
G2008	315 Seep (CAO-3)	12/20/22 1047	12/28/22 1610	ND		ND	
G3110	315 Seep (CAO-3)	12/28/22 1610	2/28/23 1023	ND		NR	
G3167	315 Seep (CAO-3)	2/28/23 1023	3/6/23 0928	ND		NR	
G3336	315 Seep (CAO-3)	3/6/23 0928	3/9/23 0955	ND		NR	
G3395	315 Seep (CAO-3)	3/9/23 0955	3/13/23 0955	ND		NR	
G3547	315 Seep (CAO-3)	3/13/23 0955	3/16/23 0730	ND		ND	
G3651	315 Seep (CAO-3)	3/16/23 0730	3/20/23 1010	ND		ND	
G3871	315 Seep (CAO-3)	3/20/23 1010	3/27/23 1012	ND		ND	
G4282	315 Seep (CAO-3)	3/27/23 1012	4/3/23 0800	ND		ND	
G4930	315 Seep (CAO-3)	4/3/23 0800	4/18/23 0900	ND		ND	
G5084	315 Seep (CAO-3)	4/18/23 0900	5/1/23 0725	ND		ND	
G5604	315 Seep (CAO-3)	5/1/23 0725	5/30/23 0944	ND		ND	
G6085	315 Seep (CAO-3)	5/30/23 0944	7/5/23 0932	ND		ND	

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				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G2009	316 SW-1 (NE-6)	12/20/22 1125	12/28/22 1145	ND		ND	
G3111	316 SW-1 (NE-6)	12/28/22 1145	2/28/23 1120	ND		NR	
G3337	316 SW-1 (NE-6)	3/6/23 0929	3/9/23 0910	ND		NR	
G3396	316 SW-1 (NE-6)	3/9/23 0910	3/13/23 0856	ND		NR	
G3548	316 SW-1 (NE-6)	3/13/23 0856	3/16/23 0845	ND		ND	
G3652	316 SW-1 (NE-6)	3/16/23 0845	3/20/23 1310	ND		ND	
G3872	316 SW-1 (NE-6)	3/20/23 1310	3/27/23 0935	ND		ND	
G4283	316 SW-1 (NE-6)	3/27/23 0935	4/3/23 0920	ND		ND	
G4931	316 SW-1 (NE-6)	4/3/23 0920	4/17/23 1350	ND		ND	
G5085	316 SW-1 (NE-6)	4/17/23 1350	5/1/23 1005	ND		ND	
G5605	316 SW-1 (NE-6)	5/1/23 1005	5/30/23 0940	ND		ND	
G6086	316 SW-1 (NE-6)	5/30/23 0940	7/5/23 0915	ND		ND	
G9191	316 SW-1 (NE-6)	7/5/23 0915	11/28/23 1429	ND		ND	
G2010	317 Seep (MW-6)	12/20/22 1305	12/28/22 1325	ND		ND	
G3112	317 Seep (MW-6)	12/28/22 1325	2/28/23 1500	ND		NR	
G3168	317 Seep (MW-6)	2/28/23 1500	3/6/23 1131	ND		NR	
G3338	317 Seep (MW-6)	3/6/23 1131	3/9/23 1213	ND		NR	
G3397	317 Seep (MW-6)	3/9/23 1213	3/13/23 1153	ND		NR	
G3549	317 Seep (MW-6)	3/13/23 1153	3/16/23 1145	ND		ND	
G3653	317 Seep (MW-6)	3/16/23 1145	3/20/23 1345	ND		ND	
G3873	317 Seep (MW-6)	3/20/23 1345	3/27/23 1420	ND		ND	
G4284	317 Seep (MW-6)	3/27/23 1420	4/3/23 1245	ND		ND	
G4932	317 Seep (MW-6)	4/3/23 1245	4/17/23 1400	ND		ND	
G5606	317 Seep (MW-6)	4/17/23 1400	5/30/23 1250	ND		ND	
G6087	317 Seep (MW-6)	5/30/23 1250	7/5/23 1155	ND		ND	
G2011	318 Spr (culvert TSP-1/2	12/20/22 1435	12/28/22 1512	ND		ND	
G3113	318 Spr (culvert TSP-1/2	12/28/22 1512	2/28/23 1530	ND		NR	
G3169	318 Spr (culvert TSP-1/2	2/28/23 1530	3/6/23 1420	515.1	1.20	NR	
G3339	318 Spr (culvert TSP-1/2	3/6/23 1420	3/9/23 1455	ND		NR	
G3398	318 Spr (culvert TSP-1/2	3/9/23 1455	3/13/23 1440	ND		NR	
G3550	318 Spr (culvert TSP-1/2	3/13/23 1440	3/16/23 1030	ND		ND	
G3654	318 Spr (culvert TSP-1/2	3/16/23 1030	3/20/23 1515	ND		ND	
G3874	318 Spr (culvert TSP-1/2	3/20/23 1515	3/27/23 1515	ND		ND	
G4933	318 Spr (culvert TSP-1/2	4/3/23 1240	4/17/23 1646	ND		ND	
G5086	318 Spr (culvert TSP-1/2	4/17/23 1641	5/1/23 1425	ND		ND	
G5607	318 Spr (culvert TSP-1/2	5/1/23 1425	5/30/23 1401	ND		ND	
G6088	318 Spr (culvert TSP-1/2	5/30/23 1401	7/5/23 1440	ND		ND	
G9192	318 Spr (culvert TSP-1/2	7/5/23 1440	11/28/23 1405	ND		ND	
G2012	319 Seep (MW-577)	12/20/22 1510	12/28/22 1545	ND		ND	
G3114	319 Seep (MW-577)	12/28/22 1545	2/28/23 1410	ND		NR	
G3170	319 Seep (MW-577)	2/28/23 1410	3/6/23 1247	ND		NR	
G3341	319 Seep (MW-577)	3/6/23 1247	3/9/23 1317	ND		NR	
G3399	319 Seep (MW-577)	3/9/23 1317	3/13/23 1328	ND		NR	
G3551	319 Seep (MW-577)	3/13/23 1328	3/16/23 0945	ND		ND	
G3655	319 Seep (MW-577)	3/16/23 0945	3/20/23 1400	ND		ND	
G3875	319 Seep (MW-577)	3/20/23 1400	3/27/23 1400	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G4285	319 Seep (MW-577)	3/27/23 1400	4/3/23 1130	ND		ND	
G5087	319 Seep (MW-577)	NDT	5/1/23 1340	ND		ND	
G5608	319 Seep (MW-577)	5/1/23 1340	5/30/23 1205	ND		ND	
G6089	319 Seep (MW-577)	5/30/23 1205	7/5/23 1255	ND		ND	
G9193	319 Seep (MW-577)	7/5/23 NT	11/28/23 1210	ND		ND	
G3115	320 SW-2 (NE-3)	12/29/22 1025	2/28/23 1320	ND		NR	
G3171	320 SW-2 (NE-3)	2/28/23 1320	3/6/23 1200	ND		NR	
G3342	320 SW-2 (NE-3)	3/6/23 1200	3/9/23 1230	ND		NR	
G3401	320 SW-2 (NE-3)	3/9/23 1230	3/13/23 1240	ND		NR	
G3552	320 SW-2 (NE-3)	3/13/23 1240	3/16/23 0910	ND		ND	
G3656	320 SW-2 (NE-3)	3/16/23 0910	3/20/23 1250	ND		ND	
G3876	320 SW-2 (NE-3)	3/20/23 1250	3/27/23 1230	ND		ND	
G4286	320 SW-2 (NE-3)	3/27/23 1230	4/3/23 1030	ND		ND	
G4934	320 SW-2 (NE-3)	4/3/23 1030	4/18/23 1015	ND		ND	
G5088	320 SW-2 (NE-3)	4/18/23 1015	5/1/23 1315	ND		ND	
G5609	320 SW-2 (NE-3)	5/1/23 1315	5/30/23 1150	ND		ND	
G6090	320 SW-2 (NE-3)	5/30/23 1150	7/5/23 1215	ND		ND	
G3116	321 E pond discharge	12/29/22 1040	2/28/23 1340	ND		NR	
G3172	321 E pond discharge	2/28/23 1340	3/6/23 1223	ND		NR	
G3343	321 E pond discharge	3/6/23 1223	3/9/23 1255	ND		NR	
G3402	321 E pond discharge	3/9/23 1255	3/13/23 1255	ND		NR	
G3553	321 E pond discharge	3/13/23 1255	3/16/23 0920	ND		ND	
G3657	321 E pond discharge	3/16/23 0920	3/20/23 1300	ND		ND	
G3877	321 E pond discharge	3/20/23 1300	3/27/23 1250	ND		ND	
G4287	321 E pond discharge	3/27/23 1250	4/3/23 1100	ND		ND	
G4935	321 E pond discharge	4/3/23 1100	4/18/23 1030	ND		ND	
G5089	321 E pond discharge	4/18/23 1030	5/1/23 1325	ND		ND	
G5610	321 E pond discharge	5/1/23 1325	5/30/23 1118	ND		ND	
G6091	321 E pond discharge	5/30/23 1118	7/5/23 1230	ND		ND	
G9194	321 E pond discharge	7/5/23 1230	11/28/23 1145	ND		ND	
G3117	322 Seep (E pond)	12/29/22 1045	2/28/23 1335	ND		NR	
G3173	322 Seep (E pond)	2/28/23 1335	3/6/23 1213	ND		NR	
G3344	322 Seep (E pond)	3/6/23 1213	3/9/23 1243	ND		NR	
G3403	322 Seep (E pond)	3/9/23 1243	3/13/23 1305	ND		NR	
G3554	322 Seep (E pond)	3/13/23 1305	3/16/23 0925	ND		ND	
G3658	322 Seep (E pond)	3/16/23 0925	3/20/23 1305	ND		ND	
G3878	322 Seep (E pond)	3/20/23 1305	3/27/23 1245	ND		ND	
G4288	322 Seep (E pond)	3/27/23 1245	4/3/23 1050	ND		ND	
G4936	322 Seep (E pond)	4/3/23 1050	4/18/23 1035	ND		ND	
G5090	322 Seep (E pond)	4/18/23 1035	5/1/23 1320	ND		ND	
G5611	322 Seep (E pond)	5/1/23 1320	5/30/23 1125	ND		ND	
G6092	322 Seep (E pond)	5/30/23 1125	7/5/23 1235	ND		ND	
G3118	323 SW-3 (N pond)	12/29/22 1220	3/1/23 0935	ND		NR	
G3174	323 SW-3 (N pond)	3/1/23 0935	3/6/23 1421	ND		NR	
G3345	323 SW-3 (N pond)	3/6/23 1421	3/9/23 1155	ND		NR	
G3404	323 SW-3 (N pond)	3/9/23 1155	3/13/23 1140	ND		NR	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3555	323 SW-3 (N pond)	3/13/23 1140	3/16/23 1125	ND		ND	
G3659	323 SW-3 (N pond)	3/16/23 1125	3/20/23 1300	ND		ND	
G3879	323 SW-3 (N pond)	3/20/23 1255	3/27/23 1345	ND		ND	
G4289	323 SW-3 (N pond)	3/27/23 1345	4/3/23 1230	ND		ND	
G4937	323 SW-3 (N pond)	4/3/23 1230	4/18/23 0815	ND		ND	
G5091	323 SW-3 (N pond)	4/18/23 0815	5/1/23 0710	ND		ND	
G5612	323 SW-3 (N pond)	5/1/23 0710	5/30/23 1235	ND		ND	
G6093	323 SW-3 (N pond)	5/30/23 1235	7/5/23 1145	ND		ND	
G9195	323 SW-3 (N pond)	7/5/23 1145	11/28/23 1657	ND		ND	
G3119	324 Spring Br (Ent gate)	12/29/22 1230	3/1/23 0930	ND		NR	
G3175	324 Spring Br (Ent gate)	3/1/23 0930	3/6/23 1420	ND		NR	
G3346	324 Spring Br (Ent gate)	3/6/23 1420	3/9/23 1150	ND		NR	
G3405	324 Spring Br (Ent gate)	3/9/23 1150	3/13/23 1135	ND		NR	
G3556	324 Spring Br (Ent gate)	3/13/23 1135	3/16/23 1135	ND		ND	
G3661	324 Spring Br (Ent gate)	3/16/23 1135	3/20/23 1255	ND		ND	
G3881	324 Spring Br (Ent gate)	3/20/23 1300	3/27/23 1350	ND		ND	
G4290	324 Spring Br (Ent gate)	3/27/23 1350	4/3/23 1235	ND		ND	
G4938	324 Spring Br (Ent gate)	4/3/23 1235	4/17/23 1515	ND		ND	
G5092	324 Spring Br (Ent gate)	4/17/23 1515	5/1/23 0705	ND		ND	
G5613	324 Spring Br (Ent gate)	5/1/23 0705	5/30/23 1225	ND		ND	
G6094	324 Spring Br (Ent gate)	5/30/23 1225	7/5/23 1135	ND		ND	
G9196	324 Spring Br (Ent gate)	7/5/23 1135	11/28/23 1652	ND		ND	
G3121	325 Hutch Creek at CR1(	1/21/23 1600	3/1/23 0900	ND		NR	
G3176	325 Hutch Creek at CR1(	3/1/23 0900	3/6/23 0855	ND		NR	
G3347	325 Hutch Creek at CR1(	3/6/23 0855	3/9/23 1140	ND		NR	
G3406	325 Hutch Creek at CR1(	3/9/23 1140	3/13/23 1123	ND		NR	
G3557	325 Hutch Creek at CR1(	3/13/23 1123	3/16/23 1110	ND		ND	
G3662	325 Hutch Creek at CR1(	3/16/23 1110	3/20/23 1240	ND		ND	
G3882	325 Hutch Creek at CR1(	3/20/23 1240	3/27/23 1335	ND		ND	
G4291	325 Hutch Creek at CR1(	3/27/23 1335	4/3/23 1210	ND		ND	
G4939	325 Hutch Creek at CR1(	4/3/23 1210	4/18/23 1125	ND		ND	
G5093	325 Hutch Creek at CR1(	4/18/23 1125	5/1/23 0650	ND		ND	
G5614	325 Hutch Creek at CR1(	5/1/23 0650	5/30/23 1215	ND		ND	
G6095	325 Hutch Creek at CR1(	5/30/23 1215	7/5/23 1125	ND		ND	
G3177	401 Dup A	2/28/23 1326	3/6/23 1230	516.9	0.674	NR	
G3348	401 Dup A	3/6/23 1230	3/9/23 1325	ND		NR	
G3407	401 Dup A	3/9/23 1325	3/13/23 1310	516.7	0.813	NR	
G3558	401 Dup A	3/13/23 1310	3/16/23 1300	518.3	0.726	ND	
G3663	401 Dup A	3/16/23 1300	3/20/23 1440	516.9	1.19	ND	
G3883	401 Dup A	3/20/23 1440	3/27/23 1450	516.8	1.00	ND	
G4292	401 Dup A	3/27/23 1450	4/3/23 1440	516.9	1.54	ND	
G4941	401 Dup A	4/3/23 1440	4/17/23 1345	518.1	1.25	ND	
G5094	401 Dup A	4/17/23 1345	5/1/23 1600	517.7	1.86	ND	
G5615	401 Dup A	5/1/23 1600	5/30/23 1430	ND		ND	
G6096	401 Dup A	5/30/23 1430	7/5/23 1345	ND		ND	
G9197	401 Dup A	7/5/23 1345	11/28/23 1323	518.6	0.646	ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3178	402 Dup B	2/28/23 1555	3/6/23 1210	ND		NR	
G3349	402 Dup B	3/6/23 1210	3/9/23 1310	ND		NR	
G3408	402 Dup B	3/9/23 1310	3/13/23 1238	ND		NR	
G3559	402 Dup B	3/13/23 1238	3/16/23 1245	ND		ND	
G3664	402 Dup B	3/16/23 1245	3/20/23 1420	ND		ND	
G3884	402 Dup B	3/20/23 1420	3/27/23 1445	ND		ND	
G4293	402 Dup B	3/27/23 1445	4/3/23 1355	ND		ND	
G4942	402 Dup B	4/3/23 1355	4/17/23 1437	ND		ND	
G5095	402 Dup B	4/17/23 1437	5/1/23 1500	ND		ND	
G5616	402 Dup B	5/1/23 1500	5/30/23 1447	ND		ND	
G9198	402 Dup B	7/5/23 NT	11/28/23 1240	ND		ND	
G6097	402 Dup B	5/30/23 1447	7/5/23 NT	ND		ND	
G3122	403 Dup C	12/29/22 1025	2/28/23 1320	ND		NR	
G3179	403 Dup C	2/28/23 1320	3/6/23 1200	ND		NR	
G3350	403 Dup C	3/6/23 1200	3/9/23 1230	ND		NR	
G3409	403 Dup C	3/9/23 1230	3/13/23 1240	ND		NR	
G3561	403 Dup C	3/13/23 1240	3/16/23 0910	ND		ND	
G3665	403 Dup C	3/16/23 0910	3/20/23 1250	ND		ND	
G3885	403 Dup C	3/20/23 1250	3/27/23 1230	ND		ND	
G4294	403 Dup C	3/27/23 1230	4/3/23 1030	ND		ND	
G4943	403 Dup C	4/3/23 1030	4/18/23 1015	ND		ND	
G5096	403 Dup C	4/18/23 1015	5/1/23 1315	ND		ND	
G5617	403 Dup C	5/1/23 1315	5/30/23 1150	ND		ND	
G6098	403 Dup C	5/30/23 1150	7/5/23 1215	ND		ND	

NOTES:

Shaded rows are from Background sampling periods (before dye introduction).

Dye introduction on March 1, 2023.

ND = Not detected

NR = Not reported

* = A fluorescence peak is present that does not meet all the criteria for a positive dye result. However it has been calculated as though it was the tracer dye.

** = A fluorescence peak is present that does not meet all the criteria for this dye. However, it has been calculated as a positive dye result.

Duplicates:

Dup A is from Spring A

Dup B is from Spring B

Dup C is from SW-1 near NE-6

Ozark Underground Laboratory Dye Trace Results - NABORS Landfill, Baxter County, Arkansas.

Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

All results are for water samples

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G5113	**001 IW-1**	**Water**	**5/1/23 1620**	**507.8**	**1,510**	**ND**	
G2104	**002 Flush water**	**Water**	**12/29/22 1400**	**ND**		**ND**	
G9226	102 EB-2	**Water**	11/28/23 1620	ND		ND	
G9227	103 EB-4	**Water**	11/28/23 1630	ND		ND	
G3230	**201 MW-1**	**Water**	**2/28/23 1057**	**ND**		**NR**	
G5111	201 MW-1	**Water**	5/1/23 1540	ND		ND	
G6103	201 MW-1	**Water**	7/5/23 1330	ND		ND	
G9228	201 MW-1	**Water**	11/28/23 1530	ND		ND	
G6104	**202 MW-1R**	**Water**	**7/5/23 1320**	**ND**		**ND**	
G9229	202 MW-1R	**Water**	11/28/23 1535	ND		ND	
G5649	**301 Entrance Seep**	**Water**	**5/30/23 1325**	**ND**		**ND**	
G6105	301 Entrance seep	**Water**	7/5/23 1230	ND		ND	
G9230	301 Entrance Seep	**Water**	11/28/23 1216	ND		ND	
G3231	**302 Spring A**	**Water**	**2/28/23 1326**	**ND**		**NR**	
G3233	302 Spring A	**Water**	3/6/23 1230	ND		NR	
G3473	302 Spring A	**Water**	3/9/23 1325	ND		NR	
G3474	302 Spring A	**Water**	3/13/23 1310	ND		NR	
G3594	302 Spring A	**Water**	3/16/23 1300	ND		NR	
G3693	302 Spring A	**Water**	3/20/23 1440	ND		ND	
G3904	302 Spring A	**Water**	3/27/23 1450	ND		ND	
G4453	302 Spring A	**Water**	4/3/23 1440	ND		ND	
G4950	302 Spring A	**Water**	4/17/23 1340	ND		ND	
G5112	302 Spring A	**Water**	5/1/23 1600	ND		ND	
G5650	302 Spring A	**Water**	5/30/23 1430	ND		ND	
G6106	302 Spring A	**Water**	7/5/23 1345	ND		ND	
G9231	302 Spring A	**Water**	11/28/23 1323	ND		ND	
G3232	**303 Spring B**	**Water**	**2/28/23 1555**	**ND**		**NR**	
G3234	**304 TSP-1**	**Water**	**3/6/23 1314**	**ND**		**NR**	
G3475	304 TSP-1	**Water**	3/13/23 1630	ND		NR	
G9232	304 TSP-1	**Water**	11/28/23 1410	ND		ND	
G9233	**308 Class I Draw**	**Water**	**11/28/23 0855**	**ND**		**ND**	
G2105	**309 Class IV Draw**	**Water**	**12/29/22 1215**	**ND**		**ND**	
G9234	309 Class IV Draw	**Water**	11/28/23 0935	ND		ND	
G9235	**315 Seep (CAO-3)**	**Water**	**11/28/23 0915**	**ND**		**ND**	
G3235	**316 SW-1 (NE-6)**	**Water**	**3/6/23 0929**	**ND**		**NR**	
G3236	**318 Spr (culvert TSP-1/2)**	**Water**	**3/6/23 1420**	**ND**		**NR**	
G4573	318 Spr (culvert TSP-1/2)	**Water**	4/3/23 1240	ND		ND	
G2106	**320 SW-2 (NE-3)**	**Water**	**12/29/22 1025**	**ND**		**ND**	
G9236	320 SW-2 (NE-3)	**Water**	11/28/23 1115	ND		ND	
G9237	**322 Seep (E pond)**	**Water**	**11/28/23 1130**	**ND**		**ND**	
G2107	**323 SW-3 (N Pond)**	**Water**	**12/29/22 1220**	**ND**		**ND**	
G2108	**324 Spring Br (Ent gate)**	**Water**	**12/29/22 1230**	**ND**		**ND**	
G9238	**325 Hutch Creek at CR16**	**Water**	**11/28/23 1710**	**ND**		**ND**	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G9239	401 Dup A	Water	11/28/23 1323	ND		ND	
G9241	403 Dup C	Water	11/28/23 1115	ND		ND	

ND = Non detect

NR = Not reported

Ozark Underground Laboratory
Certificates of Analysis

Ozark UNDERGROUND LABORATORY 1572 Aley Lane • Protem, MO 65733 • (417) 785-4289 • fax (417) 785-4290 • contact@ozarkundergroundlab.com

Certificate of Analysis

Date of certificate: January 3, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person: Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: S. Beeman & A. Feldman

Date samples shipped: December 29, 2022
Date samples rec'd at OUL: December 30, 2022
Date analyzed by OUL: January 3, 2022
Included with certificate of analysis:
Table of results, copies of sample collection data sheets and discrepancy sheet

Results for Bkgd 1 charcoal and water samples analyzed for the presence of fluorescein, eosine, rhodamine WT (RWT) and sulforhodamine B (SRB) dyes.

Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).

All results are for charcoal unless otherwise indicated.

OUL	Station	Date/Time	Date/Time	Fluorescein Results		Eosine Results		RWT Results		SRB Results	
Number	Name	Placed	Collected	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G1964	001	12/20/22 0918	12/28/22 0955	ND		ND		ND		ND	
G1965	101	12/20/22 1158	12/28/22 1250	ND		ND		ND		ND	
G1966	102	12/20/22 0940	12/28/22 1030	ND		ND		ND		ND	
G1967	103	12/20/22 1206	12/28/22 1300	ND		ND		ND		ND	
G1968	104	12/20/22 1500	12/28/22 1530	ND		ND		ND		ND	
G1969	201	12/20/22 0921	12/28/22 1015	ND		ND		ND		ND	
G1970	202	12/20/22 0932	12/28/22 1025	ND		ND		ND		ND	
G1971	203	12/20/22 0955	12/28/22 1050	ND		ND		ND		ND	
G1972	204	12/20/22 1027	12/28/22 1115	ND		ND		ND		ND	
G1973	205	12/20/22 1014	12/28/22 1105	ND		ND		ND		ND	
G1974	206	12/20/22 1138	12/28/22 1210	ND		ND		ND		ND	
G1975	207	12/20/22 1300	12/28/22 1340	ND		ND		ND		ND	
G1976	208	12/20/22 1635	12/28/22 1420	ND		ND		ND		ND	
G1977	209	12/20/22 0945	12/28/22 1040	ND		ND		ND		ND	
G1978	210	12/20/22 1035	12/28/22 1120	ND		ND		ND		ND	
G1979	211	12/20/22 1630	12/28/22 1555	ND		ND		ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		Eosine Results		RWT Results		SRB Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G1980	Laboratory control charcoal blank										
G1981	212	12/20/22 1355	12/28/22 1445	ND		ND		ND		ND	
G1982	213	12/20/22 1452	12/28/22 1510	ND		ND		ND		ND	
G1983	214	12/20/22 1550	12/29/22 1145	ND		ND		ND		ND	
G1984	215	12/20/22 1520	12/29/22 0940	ND		ND		ND		ND	
G1985	216	12/20/22 1350	12/28/22 1315	ND		ND		ND		ND	
G1986	217	12/20/22 1625	12/29/22 0920	ND		ND		ND		ND	
G1987	218	12/20/22 1420	12/28/22 1450	ND		ND		ND		ND	
G1988	219	12/20/22 1508	12/28/22 1540	ND		ND		ND		ND	
G1989	220	12/20/22 1620	12/29/22 0930	ND		ND		ND		ND	
G1990	221	12/20/22 1535	12/29/22 1000	ND		ND		ND		ND	
G1991	222	12/20/22 1430	12/28/22 1455	ND		ND		ND		ND	
G1992	223	12/20/22 1606	12/29/22 1015	ND		ND		ND		ND	
G1993	224	12/20/22 1400	12/28/22 1455	ND		ND		ND		ND	
G1994	225	12/20/22 1115	12/28/22 1140	ND		ND		ND		ND	
G1995	301	12/20/22 1330	12/28/22 1345	ND		ND		ND		ND	
G1996	302	12/20/22 1645	12/28/22 1420	514.9 *	0.591	ND		ND		ND	
G1997	303	12/20/22 1315	12/28/22 1400	ND		ND		ND		ND	
G1998	304	12/20/22 1410	12/28/22 1505	ND		ND		ND		ND	
G1999	305	12/20/22 1444	12/28/22 1518	ND		ND		ND		ND	
G2000	Laboratory control charcoal blank										
G2001	306	12/20/22 1600	12/29/22 1155	ND		ND		ND		ND	
G2002	307	12/20/22 1525	12/29/22 0950	ND		ND		ND		ND	
G2003	308	NDT	12/28/22 1610	ND		ND		ND		ND	
G2004	310	12/20/22 1130	12/28/22 1200	ND		ND		ND		ND	
G2005	312	12/20/22 1325	12/28/22 1340	ND		ND		ND		ND	
G2006	313	12/20/22 1610	12/29/22 1020	ND		ND		ND		ND	
G2007	314	12/20/22 1040	12/28/22 1125	ND		ND		ND		ND	
G2008	315	12/20/22 1047	12/28/22 1610	ND		ND		ND		ND	
G2009	316	12/20/22 1125	12/28/22 1145	ND		ND		ND		ND	
G2010	317	12/20/22 1305	12/28/22 1325	ND		ND		ND		ND	
G2011	318	12/20/22 1435	12/28/22 1512	ND		ND		ND		ND	
G2012	319	12/20/22 1510	12/28/22 1545	ND		ND		ND		ND	
G2104	002	**Water**	12/29/22 1400	ND		ND		ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		Eosine Results		RWT Results		SRB Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G2105	309	**Water**	12/29/22 1215	ND		ND		ND		ND	
G2106	320	**Water**	12/29/22 1025	ND		ND		ND		ND	
G2107	323	**Water**	12/29/22 1220	ND		ND		ND		ND	
G2108	324	**Water**	12/29/22 1230	ND		ND		ND		ND	

Note: Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

Footnotes: ND = No dye detected NDT = No date or time given

* = A fluorescence peak is present that does not meet all the criteria for a positive dye result. However, it has been calculated as though it was the tracer dye.

Thomas J. Aley, PHG and RG

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Certificate of Analysis

Date of certificate: March 13, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: SB, CH, RF, MS, AF

Date samples shipped: March 6, 2023
Date samples received: March 6, 2023
Date analyzed by OUL: March 8 and 9, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets and discrepancy sheet

Results for Bkgd 2 and PDI 1 charcoal and water samples analyzed for the presence of fluorescein dye.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results	
				Peak (nm)	Conc. (ppb)
G3063	001- IW-1	12/28/2022 0955	2/28/2023 1028	ND	
G3064	003-tie wire		2/28/2023 1905	ND	
G3065	004-string		2/28/2023 1900	ND	
G3066	005-bailer		2/28/2023 1910	ND	
G3067	101-EB-1	12/28/2022 1250	2/28/2023 1245	ND	
G3068	102-EB-2	12/28/2022 1030	2/28/2023 1329	ND	
G3069	103-EB-4	12/28/2022 1300	2/28/2023 1111	ND	
G3070	104-EB-5	12/28/2022 1530	2/28/2023 1428	ND	
G3071	201-MW-1	12/28/2022 1015	2/28/2023 1057	515.5	0.751
G3072	202-MW-1R	12/28/2022 1025	2/28/2023 1049	ND	
G3073	203-MW-2	12/28/2022 1050	2/28/2023 1300	ND	
G3074	204-MW-3	12/28/2022 1115	2/28/2023 1045	ND	
G3075	205-MW-4	12/28/2022 1105	2/28/2023 1233	ND	
G3076	206-MW-5	12/28/2022 1210	2/28/2023 1207	ND	
G3077	207-MW-6	12/28/2022 1340	2/28/2023 1400	ND	
G3078	208-MW-7	12/28/2022 1420	2/28/2023 1258	ND	
G3079	209-CAO-1	12/28/2022 1040	2/28/2023 1314	ND	
G3080	Laboratory control charcoal blank				
G3081	210-CAO-2	12/28/22 1120	2/28/23 1035	ND	
G3082	211-CAO-3	12/29/22 1555	2/28/23 1015	ND	
G3083	213-NAB-2	12/28/22 1510	2/28/23 1450	ND	
G3084	214-NAB-3	12/29/22 1145	2/28/23 1350	ND	
G3085	215-NAB-4	12/29/22 0940	2/28/23 1205	ND	
G3086	216-NAB-7	12/28/22 1315	2/28/23 1127	ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results	
				Peak (nm)	Conc. (ppb)
G3087	217-NAB-8	12/29/22 0920	2/28/23 1130	ND	
G3088	218-MW-509D	12/28/22 1450	2/28/23 1505	ND	
G3089	219-MW-577	12/28/22 1540	2/28/23 1415	ND	
G3090	220-MW-633D	12/29/22 0930	2/28/23 1150	ND	
G3091	221-MW-680D	12/29/22 1000	2/28/23 1238	ND	
G3092	222-NE-2	12/28/22 1455	2/28/23 1515	ND	
G3093	223-NE-3	12/29/22 1015	2/28/23 1300	ND	
G3094	224-NE-4	12/28/22 1455	2/28/23 1550	ND	
G3095	225-NE-6	12/28/22 1140	2/28/23 1105	ND	
G3096	301-Entrance seep	12/29/22 1345	2/28/23 1443	ND	
G3097	302-Spring A	12/28/22 1420	2/28/23 1326	518.1	0.762
G3098	304-TSP-1	12/28/22 1415	2/28/23 1605	ND	
G3099	305-TSP-2	12/28/22 1518	2/28/23 1523	ND	
G3100	Laboratory control charcoal blank				
G3101	306-TSP-3	12/29/22 1155	2/28/23 1400	ND	
G3102	307-TSP-4	12/29/22 0950	2/28/23 1210	ND	
G3103	308-Class I Draw	12/28/22 1620	2/28/23 1040	ND	
G3104	309-Class IV Draw	12/29/22 1215	2/28/23 1116	ND	
G3105	310-SP-4	12/28/22 1200	2/28/23 1140	ND	
G3106	311-SP-5	12/20/22 1000	2/28/23 1255	ND	
G3107	312-SP-7	12/28/22 1340	2/28/23 1430	ND	
G3108	313-SP-NE-3	12/29/22 1020	2/28/23 1310	ND	
G3109	314-Spr (Class I Draw)	12/28/22 1125	2/28/23 1055	ND	
G3110	315-Seep (CAO-3)	12/28/22 1610	2/28/23 1023	ND	
G3111	316-SW-1 (NE-6)	12/28/22 1145	2/28/23 1120	ND	
G3112	317-Seep (MW-6)	12/28/22 1325	2/28/23 1500	ND	
G3113	318-Spr (culvert TSP-1/2)	12/28/22 1512	2/28/23 1530	ND	
G3114	319-Seep (MW-577)	12/28/22 1545	2/28/23 1410	ND	
G3115	320-SW-2 (NE-3)	12/29/22 1025	2/28/23 1320	ND	
G3116	321-E pond discharge	12/29/22 1040	2/28/23 1340	ND	
G3117	322-Seep (E pond)	12/29/22 1045	2/28/23 1335	ND	
G3118	323-SW-3 (N pond)	12/29/22 1220	3/1/23 0935	ND	
G3119	324-Spring Br (Ent gate)	12/29/22 1230	3/1/23 0930	ND	
G3120	Laboratory control charcoal blank				
G3121	325-Hutch Creek at CR16	1/21/23 1600	3/1/23 0900	ND	
G3122	403-Dup C	12/29/22 1025	2/28/23 1320	ND	
G3123	101-EB-1	2/28/23 1245	3/6/23 1505	ND	
G3124	102-EB-2	2/28/23 1329	3/6/23 1113	ND	
G3125	103-EB-4	2/28/23 1111	3/6/23 1235	ND	
G3126	104-EB-5	2/28/23 1228	3/6/23 1310	ND	
G3127	201-MW-1	2/28/23 1057	3/6/23 1455	ND	
G3128	202-MW-1R	2/28/23 1049	3/6/23 1436	ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results	
				Peak (nm)	Conc. (ppb)
G3129	203-MW-2	2/28/23 1300	3/6/23 1035	ND	
G3130	204-MW-3	2/28/23 1045	3/6/23 0906	ND	
G3131	205-MW-4	2/28/23 1233	3/6/23 0948	ND	
G3132	206-MW-5	2/28/23 1207	3/6/23 1005	ND	
G3133	207-MW-6	2/28/23 1400	3/6/23 1148	ND	
G3134	208-MW-7	2/28/23 1258	3/6/23 1214	ND	
G3135	209-CAO-1	2/28/23 1314	3/6/23 1057	ND	
G3136	210-CAO-2	2/28/23 1035	3/6/23 0853	ND	
G3137	211-CAO-3	2/28/23 1015	3/6/23 0920	ND	
G3138	213-NAB-2	2/28/23 1450	3/6/23 1322	ND	
G3139	214-NAB-3	2/28/23 1350	3/6/23 1230	ND	
G3140	Laboratory control charcoal blank				
G3141	215-NAB-4	2/28/23 1205	3/6/23 1038	ND	
G3142	216-NAB-7	2/28/23 1127	3/6/23 1224	ND	
G3143	217-NAB-8	2/28/23 1130	3/6/23 1015	ND	
G3144	218-MW-509D	2/28/23 1505	3/6/23 1337	ND	
G3145	219-MW-577	2/28/23 1415	3/6/23 1255	ND	
G3146	220-MW-633D	2/28/23 1150	3/6/23 1028	ND	
G3147	221-MW-680D	2/28/23 1238	3/6/23 1112	ND	
G3148	222-NE-2	2/28/23 1515	3/6/23 1410	ND	
G3149	223-NE-3	2/28/23 1300	3/6/23 1130	ND	
G3150	224-NE-4	2/28/23 1550	3/6/23 1332	ND	
G3151	225-NE-6	2/28/23 1105	3/6/23 0917	ND	
G3152	301-Entrance seep	2/28/23 1443	3/6/23 1145	ND	
G3153	302-Spring A	2/28/23 1326	3/6/23 1230	516.6	0.966
G3154	303-Spring B	2/28/23 1555	3/6/23 1210	ND	
G3155	304-TSP-1	2/28/23 1605	3/6/23 1314	514.6	0.550
G3156	305-TSP-2	2/28/23 1523	3/6/23 1352	ND	
G3157	306-TSP-3	2/28/23 1400	3/6/23 1240	ND	
G3158	307-TSP-4	2/28/23 1210	3/6/23 1100	ND	
G3159	308-Class I Draw	2/28/23 1040	3/6/23 0948	ND	
G3160	Laboratory control charcoal blank				
G3161	309-Class IV Draw	2/28/23 1116	3/6/23 1005	ND	
G3162	310-SP-4	2/28/23 1140	3/6/23 1016	ND	
G3163	311-SP-5	2/28/23 1255	3/6/23 1043	ND	
G3164	312-SP-7	2/28/23 1430	3/6/23 1158	ND	
G3165	313-Spr (NE-3)	2/28/23 1310	3/6/23 1140	ND	
G3166	314-Spr (Class I Draw)	2/28/23 1055	3/6/23 0940	ND	
G3167	315-Seep (CAO-3)	2/28/23 1023	3/6/23 0928	ND	
G3168	317-Seep (MW-6)	2/28/23 1500	3/6/23 1131	ND	
G3169	318-Spr (culvert TSP-1/2)	2/28/23 1530	3/6/23 1420	515.1	1.20
G3170	319-Seep (MW-577)	2/28/23 1410	3/6/23 1247	ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results	
				Peak (nm)	Conc. (ppb)
G3171	320-SW-2 (NE-3)	2/28/23 1320	3/6/23 1200	ND	
G3172	321-E pond discharge	2/28/23 1340	3/6/23 1223	ND	
G3173	322-Seep (E pond)	2/28/23 1335	3/6/23 1213	ND	
G3174	323-SW-3 (N pond)	3/1/23 0935	3/6/23 1421	ND	
G3175	324-Spring Br (Ent gate)	3/1/23 0930	3/6/23 1420	ND	
G3176	325-Hutch Creek at CR16	3/1/23 0900	3/6/23 0855	ND	
G3177	401-Dup A	2/28/23 1326	3/6/23 1230	516.9	0.674
G3178	402-Dup B	2/28/23 1555	3/6/23 1210	ND	
G3179	403-Dup C	2/28/23 1320	3/6/23 1200	ND	
G3180	Laboratory control charcoal blank				
G3230	201-MW-1	**Water**	2/28/23 1057	ND	
G3231	302-Spring A	**Water**	2/28/23 1326	ND	
G3232	303-Spring B	**Water**	2/28/23 1555	ND	
G3233	302-Spring A	**Water**	3/6/23 1230	ND	
G3234	304-TSP-1	**Water**	3/6/23 1314	ND	
G3235	316-SW-1 (NE-6)	**Water**	3/6/23 0929	ND	
G3236	318-Spr (culvert TSP-1/2)	**Water**	3/6/23 1420	ND	

Note: Dye concentrations are based upon standards used at the OUL. The standard concentrations are based upon the as sold weight of the dye that the OUL uses. If the client is not using OUL dyes, the client should provide the OUL with a sample of the dye to compare to the OUL dyes.

Footnotes: ND = No dye detected

Thomas J. Aley, PHG and RG

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Certificate of Analysis

Date of certificate: March 20, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: CH, MS, SB

Date samples shipped: March 14, 2023
Date samples received: March 14, 2023
Date analyzed by OUL: March 15 and 17, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets and discrepancy sheet

Results for PDI 2 and PDI 3 charcoal and water samples analyzed for the presence of fluorescein dye.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results	
				Peak (nm)	Conc. (ppb)
G3292	101 EB-1	3/6/23 1505	3/9/23 1435	ND	
G3293	102 EB-2	3/6/23 1113	3/9/23 1125	ND	
G3294	103 EB-4	3/6/23 1235	3/9/23 1415	ND	
G3295	104 EB-5	3/6/23 1310	3/9/23 1402	ND	
G3296	201 MW-1	3/6/23 1455	3/9/23 1530	ND	
G3297	202 MW-1R	3/6/23 1436	3/9/23 1453	ND	
G3298	203 MW-2	3/6/23 1035	3/9/23 1050	ND	
G3299	204 MW-3	3/6/23 0906	3/9/23 0940	ND	
G3300	Laboratory control charcoal blank				
G3301	205 MW-4	3/6/23 0948	3/9/23 1005	ND	
G3302	206 MW-5	3/6/23 1005	3/9/23 1027	ND	
G3303	207 MW-6	3/6/23 1148	3/9/23 1255	ND	
G3304	208 MW-7	3/6/23 1214	3/9/23 1342	ND	
G3305	209 CAO-1	3/6/23 1057	3/9/23 1111	ND	
G3306	210 CAO-2	3/6/23 0853	3/9/23 0925	ND	
G3307	211 CAO-3	3/6/23 0920	3/9/23 0935	ND	
G3308	213 NAB-2	3/6/23 1322	3/9/23 1412	ND	
G3309	214 NAB-3	3/6/23 1230	3/9/23 1300	ND	
G3310	215 NAB-4	3/6/23 1038	3/9/23 1105	ND	
G3311	216 NAB-7	3/6/23 1224	3/9/23 1358	ND	
G3312	217 NAB-8	3/6/23 1015	3/9/23 1043	ND	
G3313	218 MW-509D	3/6/23 1337	3/9/23 1425	ND	
G3314	219 MW-577	3/6/23 1255	3/9/23 1330	ND	
G3315	220 MW-633D	3/6/23 1028	3/9/23 1052	ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results	
				Peak (nm)	Conc. (ppb)
G3316	221 MW-689D	3/6/23 1112	3/9/23 1155	ND	
G3317	222 NE-2	3/6/23 1410	3/9/23 1445	ND	
G3318	223 NE-3	3/6/23 1130	3/9/23 1205	ND	
G3319	224 NE-4	3/6/23 1332	3/9/23 1525	ND	
G3320	Laboratory control charcoal blank				
G3321	225 NE-6	3/6/23 0917	3/9/23 0905	ND	
G3322	301 Entrance seep	3/6/23 1145	3/9/23 1246	ND	
G3323	302 Spring A	3/6/23 1230	3/9/23 1325	516.7	0.776
G3324	303 Spring B	3/6/23 1210	3/9/23 1310	ND	
G3325	304 TSP-1	3/6/23 1314	3/9/23 1500	512.4 *	0.534
G3326	305 TSP-2	3/6/23 1352	3/9/23 1435	ND	
G3327	306 TSP-3	3/6/23 1240	3/9/23 1310	ND	
G3328	307 TSP-4	3/6/23 1100	3/9/23 1145	ND	
G3329	308 Class I Draw	3/6/23 0948	3/9/23 1010	ND	
G3330	309 Class IV Draw	3/6/23 1005	3/9/23 1025	ND	
G3331	310 SP-4	3/6/23 1016	3/9/23 0950	ND	
G3332	311 SP-5	3/6/23 1043	3/9/23 1055	ND	
G3333	312 SP-7	3/6/23 1158	3/9/23 1240	ND	
G3334	313 Spr (NE-3)	3/6/23 1140	3/9/23 1220	ND	
G3335	314 Spr (Class I Draw)	3/6/23 0940	3/9/23 1003	ND	
G3336	315 Seep (CAO-3)	3/6/23 0928	3/9/23 0955	ND	
G3337	316 SW-1 (NE-6)	3/6/23 0929	3/9/23 0910	ND	
G3338	317 Seep (MW-6)	3/6/23 1131	3/9/23 1213	ND	
G3339	318 Spr (culvert TSP-1/2)	3/6/23 1420	3/9/23 1455	ND	
G3340	Laboratory control charcoal blank				
G3341	319 Seep (MW-577)	3/6/23 1247	3/9/23 1317	ND	
G3342	320 SW-2 (NE-3)	3/6/23 1200	3/9/23 1230	ND	
G3343	321 E pond discharge	3/6/23 1223	3/9/23 1255	ND	
G3344	322 Seep (E pond)	3/6/23 1213	3/9/23 1243	ND	
G3345	323 SW-3 (N pond)	3/6/23 1421	3/9/23 1155	ND	
G3346	324 Spring Br (Ent gate)	3/6/23 1420	3/9/23 1150	ND	
G3347	325 Hutch Creek at CR16	3/6/23 0855	3/9/23 1140	ND	
G3348	401 Dup A	3/6/23 1230	3/9/23 1325	ND	
G3349	402 Dup B	3/6/23 1210	3/9/23 1310	ND	
G3350	403 Dup C	3/6/23 1200	3/9/23 1230	ND	
G3351	101 EB-1	3/9/23 1435	3/13/23 1405	ND	
G3352	102 EB-2	3/9/23 1125	3/13/23 1110	ND	
G3353	103 EB-4	3/9/23 1415	3/13/23 1330	ND	
G3354	104 EB-5	3/9/23 1402	3/13/23 1348	ND	
G3355	201 MW-1	3/9/23 1530	3/13/23 1445	ND	
G3356	202 MW-1R	3/9/23 1453	3/13/23 1421	ND	
G3357	203 MW-2	3/9/23 1050	3/13/23 1038	ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results	
				Peak (nm)	Conc. (ppb)
G3358	204 MW-3	3/9/23 0940	3/13/23 0925	ND	
G3359	205 MW-4	3/9/23 1005	3/13/23 0954	ND	
G3360	Laboratory control charcoal blank				
G3361	206 MW-5	3/9/23 1027	3/13/23 1013	ND	
G3362	207 MW-6	3/9/23 1255	3/13/23 1210	ND	
G3363	208 MW-7	3/9/23 1342	3/13/23 1300	ND	
G3364	209 CAO-1	3/9/23 1111	3/13/23 1055	ND	
G3365	210 CAO-2	3/9/23 0925	3/13/23 0913	ND	
G3366	211 CAO-3	3/9/23 0935	3/13/23 0935	ND	
G3367	213 NAB-2	3/9/23 1412	3/13/23 1400	ND	
G3368	214 NAB-3	3/9/23 1300	3/13/23 1315	ND	
G3369	215 NAB-4	3/9/23 1105	3/13/23 1115	ND	
G3370	216 NAB-7	3/9/23 1358	3/13/23 1345	ND	
G3371	217 NAB-8	3/9/23 1043	3/13/23 1045	ND	
G3372	218 MW-509D	3/9/23 1425	3/13/23 1500	ND	
G3373	219 MW-577	3/9/23 1330	3/13/23 1335	ND	
G3374	220 MW-633D	3/9/23 1052	3/13/23 1100	ND	
G3375	221 MW-689D	3/9/23 1155	3/13/23 1205	ND	
G3376	222 NE-2	3/9/23 1445	3/13/23 1425	ND	
G3377	223 NE-3	3/9/23 1205	3/13/23 1225	ND	
G3378	224 NE-4	3/9/23 1525	3/13/23 1620	ND	
G3379	225 NE-6	3/9/23 0905	3/13/23 0848	ND	
G3380	Laboratory control charcoal blank				
G3381	301 Entrance Seep	3/9/23 1246	3/13/23 1227	ND	
G3382	302 Spring A	3/9/23 1325	3/13/23 1310	516.7	0.912
G3383	303 Spring B	3/9/23 1310	3/13/23 1238	ND	
G3384	304 TSP-1	3/9/23 1500	3/13/23 1630	514.9	0.249
G3385	305 TSP-2	3/9/23 1435	3/13/23 1435	ND	
G3386	306 TSP-3	3/9/23 1310	3/13/23 1320	ND	
G3387	307 TSP-4	3/9/23 1145	3/13/23 1130	ND	
G3388	308 Class I Draw	3/9/23 1010	3/13/23 1005	ND	
G3389	309 Class IV Draw	3/9/23 1025	3/13/23 1030	ND	
G3390	310 SP-4	3/9/23 0950	3/13/23 0937	ND	
G3391	311 SP-5	3/9/23 1055	3/13/23 1030	ND	
G3392	312 SP-7	3/9/23 1240	3/13/23 1220	ND	
G3393	313 Spr (NE-3)	3/9/23 1220	3/13/23 1232	ND	
G3394	314 Spr (Class I Draw)	3/9/23 1003	3/13/23 1015	ND	
G3395	315 Seep (CAO-3)	3/9/23 0955	3/13/23 0955	ND	
G3396	316 SW-1 (NE-6)	3/9/23 0910	3/13/23 0856	ND	
G3397	317 Seep (MW-6)	3/9/23 1213	3/13/23 1153	ND	
G3398	318 Spr (culvert TSP-1/2)	3/9/23 1455	3/13/23 1440	ND	
G3399	319 Seep (MW-577)	3/9/23 1317	3/13/23 1328	ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results	
				Peak (nm)	Conc. (ppb)
G3400	Laboratory control charcoal blank				
G3401	320 SW-2 (NE-3)	3/9/23 1230	3/13/23 1240	ND	
G3402	321 E pond discharge	3/9/23 1255	3/13/23 1255	ND	
G3403	322 Seep (E pond)	3/9/23 1243	3/13/23 1305	ND	
G3404	323 SW-3 (N pond)	3/9/23 1155	3/13/23 1140	ND	
G3405	324 Spring Br (Ent gate)	3/9/23 1150	3/13/23 1135	ND	
G3406	325 Hutch Creek at CR16	3/9/23 1140	3/13/23 1123	ND	
G3407	401 Dup A	3/9/23 1325	3/13/23 1310	516.7	0.813
G3408	402 Dup B	3/9/23 1310	3/13/23 1238	ND	
G3409	403 Dup C	3/9/23 1230	3/13/23 1240	ND	
G3473	302 Spring A	**Water**	3/9/23 1325	ND	
G3474	302 Spring A	**Water**	3/13/23 1310	ND	
G3475	304 TSP-1	**Water**	3/13/23 1630	ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%.

Footnotes: ND = No dye detected

* = A fluorescence peak is present that does not meet all the criteria for a positive dye result. However it has been calculated as though it was the tracer dye.

Thomas J. Aley, PHG and RG

Ozark UNDERGROUND LABORATORY 1572 Aley Lane • Protem, MO 65733 • (417) 785-4289 • fax (417) 785-4290 • contact@ozarkundergroundlab.com

Certificate of Analysis

Date of certificate: March 21, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: MS, SB

Date samples shipped: March 17, 2023
Date samples received: March 17, 2023
Date analyzed by OUL: March 17 and 20, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets and discrepancy sheet

Results for PDI 4 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3503	101 EB-1	3/13/23 1405	3/16/23 1220	ND		ND	
G3504	102 EB-2	3/13/23 1110	3/16/23 1055	ND		ND	
G3505	103 EB-4	3/13/23 1330	3/16/23 1230	ND		ND	
G3506	104 EB-5	3/13/23 1348	3/16/23 0950	ND		ND	
G3507	201 MW-1	3/13/23 1445	3/16/23 1230	ND		ND	
G3508	202 MW-1R	3/13/23 1421	3/16/23 1240	ND		ND	
G3509	203 MW-2	3/13/23 1038	3/16/23 1025	ND		ND	
G3510	204 MW-3	3/13/23 0925	3/16/23 0910	ND		ND	
G3511	205 MW-4	3/13/23 0954	3/16/23 0935	ND		ND	
G3512	206 MW-5	3/13/23 1013	3/16/23 0950	ND		ND	
G3513	207 MW-6	3/13/23 1210	3/16/23 1155	ND		ND	
G3514	208 MW-7	3/13/23 1300	3/16/23 1255	ND		ND	
G3515	209 CAO-1	3/13/23 1055	3/16/23 1040	ND		ND	
G3516	210 CAO-2	3/13/23 0913	3/16/23 0900	ND		ND	
G3517	211 CAO-3	3/13/23 0935	3/16/23 0720	ND		ND	
G3518	213 NAB-2	3/13/23 1400	3/16/23 0955	ND		ND	
G3519	214 NAB-3	3/13/23 1315	3/16/23 1135	ND		ND	
G3520	Laboratory control charcoal blank						
G3521	215 NAB-4	3/13/23 1115	3/16/23 0820	ND		ND	
G3522	216 NAB-7	3/13/23 1345	3/16/23 1220	ND		ND	
G3523	217 NAB-8	3/13/23 1045	3/16/23 0810	ND		ND	
G3524	218 MW-509D	3/13/23 1500	3/16/23 1200	ND		ND	
G3525	219 MW-577	3/13/23 1335	3/16/23 1145	ND		ND	
G3526	220 MW-633D	3/13/23 1100	3/16/23 0815	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3527	221 MW-689D	3/13/23 1205	3/16/23 1120	ND		ND	
G3528	222 NE-2	3/13/23 1425	3/16/23 1015	ND		ND	
G3529	223 NE-3	3/13/23 1225	3/16/23 0855	ND		ND	
G3530	224 NE-4	3/13/23 1620	3/16/23 1215	ND		ND	
G3531	225 NE-6	3/13/23 0848	3/16/23 0837	ND		ND	
G3532	301 Entrance Seep	3/13/23 1227	3/16/23 1210	ND		ND	
G3533	302 Spring A	3/13/23 1310	3/16/23 1300	516.4	0.688	ND	
G3534	303 Spring B	3/13/23 1238	3/16/23 1245	ND		ND	
G3535	304 TSP-1	3/13/23 1630	3/16/23 1045	ND		ND	
G3536	305 TSP-2	3/13/23 1435	3/16/23 1025	ND		ND	
G3537	306 TSP-3	3/13/23 1320	3/16/23 0935	ND		ND	
G3538	307 TSP-4	3/13/23 1130	3/16/23 0845	ND		ND	
G3539	308 Class I Draw	3/13/23 1005	3/16/23 0740	ND		ND	
G3540	Laboratory control charcoal blank						
G3541	309 Class IV Draw	3/13/23 1030	3/16/23 0800	ND		ND	
G3542	310 SP-4	3/13/23 0937	3/16/23 0920	ND		ND	
G3543	311 SP-5	3/13/23 1030	3/16/23 1015	ND		ND	
G3544	312 SP-7	3/13/23 1220	3/16/23 1205	ND		ND	
G3545	313 Spr (NE-3)	3/13/23 1232	3/16/23 0905	ND		ND	
G3546	314 Spr (Class I Draw)	3/13/23 1015	3/16/23 0750	ND		ND	
G3547	315 Seep (CAO-3)	3/13/23 0955	3/16/23 0730	ND		ND	
G3548	316 SW-1 (NE-6)	3/13/23 0856	3/16/23 0845	ND		ND	
G3549	317 Seep (MW-6)	3/13/23 1153	3/16/23 1145	ND		ND	
G3550	318 Spr (culvert TSP-1/2)	3/13/23 1440	3/16/23 1030	ND		ND	
G3551	319 Seep (MW-577)	3/13/23 1328	3/16/23 0945	ND		ND	
G3552	320 SW-2 (NE-3)	3/13/23 1240	3/16/23 0910	ND		ND	
G3553	321 E pond discharge	3/13/23 1255	3/16/23 0920	ND		ND	
G3554	322 Seep (E pond)	3/13/23 1305	3/16/23 0925	ND		ND	
G3555	323 SW-3 (N pond)	3/13/23 1140	3/16/23 1125	ND		ND	
G3556	324 Spring Br (Ent gate)	3/13/23 1135	3/16/23 1135	ND		ND	
G3557	325 Hutch Creek at CR16	3/13/23 1123	3/16/23 1110	ND		ND	
G3558	401 Dup A	3/13/23 1310	3/16/23 1300	518.3	0.726	ND	
G3559	402 Dup B	3/13/23 1238	3/16/23 1245	ND		ND	
G3560	Laboratory control charcoal blank						
G3561	403 Dup C	3/13/23 1240	3/16/23 0910	ND		ND	
G3594	302 Spring A	**Water**	3/16/23 1300	ND		ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected

Thomas J. Aley, PHG and RG

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Certificate of Analysis

Date of certificate: March 27, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: MS, CH

Date samples shipped:
Date samples received: March 20, 2023
Date analyzed by OUL: March 22, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets and discrepancy sheet

Results for PDI 5 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL	Station	Date/Time	Date/Time	Fluorescein Results		RWT Results	
Number	Name	Placed	Collected	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3607	101 EB-1	3/16/23 1220	3/20/23 1145	ND		ND	
G3608	102 EB-2	3/16/23 1055	3/20/23 1015	ND		ND	
G3609	103 EB-4	3/16/23 1230	3/20/23 1050	ND		ND	
G3610	104 EB-5	3/16/23 0950	3/20/23 1417	ND		ND	
G3611	201 MW-1	3/16/23 1230	3/20/23 1125	ND		ND	
G3612	202 MW-1R	3/16/23 1240	3/20/23 1115	ND		ND	
G3613	203 MW-2	3/16/23 1025	3/20/23 0950	ND		ND	
G3614	204 MW-3	3/16/23 0910	3/20/23 0902	ND		ND	
G3615	205 MW-4	3/16/23 0935	3/20/23 0915	ND		ND	
G3616	206 MW-5	3/16/23 0950	3/20/23 0935	ND		ND	
G3617	207 MW-6	3/16/23 1155	3/20/23 1035	ND		ND	
G3618	208 MW-7	3/16/23 1255	3/20/23 1200	ND		ND	
G3619	209 CAO-1	3/16/23 1040	3/20/23 1005	ND		ND	
G3620	Laboratory control charcoal blank						
G3621	210 CAO-2	3/16/23 0900	3/20/23 0850	ND		ND	
G3622	211 CAO-3	3/16/23 0720	3/20/23 1000	ND		ND	
G3623	213 NAB-2	3/16/23 0955	3/20/23 1427	ND		ND	
G3624	214 NAB-3	3/16/23 1135	3/20/23 1310	ND		ND	
G3625	215 NAB-4	3/16/23 0820	3/20/23 1125	ND		ND	
G3626	216 NAB-7	3/16/23 1220	3/20/23 1100	ND		ND	
G3627	217 NAB-8	3/16/23 0810	3/20/23 1058	ND		ND	
G3628	218 MW-509D	3/16/23 1200	3/20/23 1440	ND		ND	
G3629	219 MW-577	3/16/23 1145	3/20/23 1405	ND		ND	
G3630	220 MW-633D	3/16/23 0815	3/20/23 1110	ND		ND	

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OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3631	221 MW-689D	3/16/23 1120	3/20/23 1150	ND		ND	
G3632	222 NE-2	3/16/23 1015	3/20/23 1455	ND		ND	
G3633	223 NE-3	3/16/23 0855	3/20/23 1205	ND		ND	
G3634	224 NE-4	3/16/23 1215	3/20/23 1535	ND		ND	
G3635	225 NE-6	3/16/23 0837	3/20/23 0840	ND		ND	
G3636	301 Entrance seep	3/16/23 1210	3/20/23 1405	ND		ND	
G3637	302 Spring A	3/16/23 1300	3/20/23 1440	517.1	1.04	ND	
G3638	303 Spring B	3/16/23 1245	3/20/23 1420	ND		ND	
G3639	304 TSP-1	3/16/23 1045	3/20/23 1525	ND		ND	
G3640	Laboratory control charcoal blank						
G3641	305 TSP-2	3/16/23 1025	3/20/23 1505	ND		ND	
G3642	306 TSP-3	3/16/23 0935	3/20/23 1325	ND		ND	
G3643	307 TSP-4	3/16/23 0845	3/20/23 1125	ND		ND	
G3644	308 Class I Draw	3/16/23 0740	3/20/23 1030	ND		ND	
G3645	309 Class IV Draw	3/16/23 0800	3/20/23 1050	ND		ND	
G3646	310 SP-4	3/16/23 0920	3/20/23 1320	ND		ND	
G3647	311 SP-5	3/16/23 1015	3/20/23 1335	ND		ND	
G3648	312 SP-7	3/16/23 1205	3/20/23 1400	ND		ND	
G3649	313 Spr (NE-3)	3/16/23 0905	3/20/23 1240	ND		ND	
G3650	314 Spr (Class I Draw)	3/16/23 0750	3/20/23 1022	ND		ND	
G3651	315 Seep (CAO-3)	3/16/23 0730	3/20/23 1010	ND		ND	
G3652	316 SW-1 (NE-6)	3/16/23 0845	3/20/23 1310	ND		ND	
G3653	317 Seep (MW-6)	3/16/23 1145	3/20/23 1345	ND		ND	
G3654	318 Spr (culvert TSP-1/2)	3/16/23 1030	3/20/23 1515	ND		ND	
G3655	319 Seep (MW-577)	3/16/23 0945	3/20/23 1400	ND		ND	
G3656	320 SW-2 (NE-3)	3/16/23 0910	3/20/23 1250	ND		ND	
G3657	321 E pond discharge	3/16/23 0920	3/20/23 1300	ND		ND	
G3658	322 Seep (E pond)	3/16/23 0925	3/20/23 1305	ND		ND	
G3659	323 SW-3 (N pond)	3/16/23 1125	3/20/23 1300	ND		ND	
G3660	Laboratory control charcoal blank						
G3661	324 Spring Br (Ent gate)	3/16/23 1135	3/20/23 1255	ND		ND	
G3662	325 Hutch Creek at CR16	3/16/23 1110	3/20/23 1240	ND		ND	
G3663	401 Dup A	3/16/23 1300	3/20/23 1440	516.9	1.19	ND	
G3664	402 Dup B	3/16/23 1245	3/20/23 1420	ND		ND	
G3665	403 Dup C	3/16/23 0910	3/20/23 1250	ND		ND	
G3693	302 Spring A	**Water**	3/20/23 1440	ND		ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected

Thomas J. Aley, PHG and RG

Ozark UNDERGROUND LABORATORY 1572 Aley Lane • Protem, MO 65733 • (417) 785-4289 • fax (417) 785-4290 • contact@ozarkundergroundlab.com

Certificate of Analysis

Date of certificate: March 31, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: MS, CH

Date samples shipped:
Date samples received: March 27, 2023
Date analyzed by OUL: March 29, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets and discrepancy sheet

Results for PDI 6 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL	Station	Date/Time	Date/Time	Fluorescein Results		RWT Results	
Number	Name	Placed	Collected	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3827	101 EB-1	3/20/23 1145	3/27/23 1250	ND		ND	
G3828	102 EB-2	3/20/23 1015	3/27/23 1130	ND		ND	
G3829	103 EB-4	3/20/23 1050	3/27/23 1215	ND		ND	
G3830	104 EB-5	3/20/23 1417	3/27/23 1420	ND		ND	
G3831	201 MW-1	3/20/23 1125	3/27/23 1240	ND		ND	
G3832	202 MW-1R	3/20/23 1115	3/27/23 1225	ND		ND	
G3833	203 MW-2	3/20/23 0950	3/27/23 1105	ND		ND	
G3834	204 MW-3	3/20/23 0902	3/27/23 1000	ND		ND	
G3835	205 MW-4	3/20/23 0915	3/27/23 1020	ND		ND	
G3836	206 MW-5	3/20/23 0935	3/27/23 1035	ND		ND	
G3837	207 MW-6	3/20/23 1035	3/27/23 1145	ND		ND	
G3838	208 MW-7	3/20/23 1200	3/27/23 1305	ND		ND	
G3839	209 CAO-1	3/20/23 1005	3/27/23 1115	ND		ND	
G3840	Laboratory control charcoal blank						
G3841	210 CAO-2	3/20/23 0850	3/27/23 0950	ND		ND	
G3842	211 CAO-3	3/20/23 1000	3/27/23 1005	ND		ND	
G3843	213 NAB-2	3/20/23 1427	3/27/23 1435	ND		ND	
G3844	214 NAB-3	3/20/23 1310	3/27/23 1305	ND		ND	
G3845	215 NAB-4	3/20/23 1125	3/27/23 1130	ND		ND	
G3846	216 NAB-7	3/20/23 1100	3/27/23 1205	ND		ND	
G3847	217 NAB-8	3/20/23 1058	3/27/23 1055	ND		ND	
G3848	218 MW-509D	3/20/23 1440	3/27/23 1445	ND		ND	
G3849	219 MW-577	3/20/23 1405	3/27/23 1410	ND		ND	
G3850	220 MW-633D	3/20/23 1110	3/27/23 1110	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G3851	221 MW-689D	3/20/23 1150	3/27/23 1200	ND		ND	
G3852	222 NE-2	3/20/23 1455	3/27/23 1455	ND		ND	
G3853	223 NE-3	3/20/23 1205	3/27/23 1220	ND		ND	
G3854	224 NE-4	3/20/23 1535	3/27/23 1530	ND		ND	
G3855	225 NE-6	3/20/23 0840	3/27/23 0925	ND		ND	
G3856	301 Entrance Seep	3/20/23 1405	3/27/23 1410	ND		ND	
G3857	302 Spring A	3/20/23 1440	3/27/23 1450	516.8	1.15	ND	
G3858	303 Spring B	3/20/23 1420	3/27/23 1445	ND		ND	
G3859	304 TSP-1	3/20/23 1525	3/27/23 1520	ND		ND	
G3860	Laboratory control charcoal blank						
G3861	305 TSP-2	3/20/23 1505	3/27/23 1505	ND		ND	
G3862	306 TSP-3	3/20/23 1325	3/27/23 1320	ND		ND	
G3863	307 TSP-4	3/20/23 1135	3/27/23 1150	ND		ND	
G3864	308 Class I Draw	3/20/23 1030	3/27/23 1030	ND		ND	
G3865	309 Class IV Draw	3/20/23 1050	3/27/23 1045	ND		ND	
G3866	310 SP-4	3/20/23 1320	3/27/23 1010	ND		ND	
G3867	311 SP-5	3/20/23 1335	3/27/23 1055	ND		ND	
G3868	312 SP-7	3/20/23 1400	3/27/23 1405	ND		ND	
G3869	313 Spr (NE-3)	3/20/23 1240	3/27/23 1225	ND		ND	
G3870	314 Spr (Class I Draw)	3/20/23 1022	3/27/23 1030	ND		ND	
G3871	315 Seep (CAO-3)	3/20/23 1010	3/27/23 1012	ND		ND	
G3872	316 SW-1 (NE-6)	3/20/23 1310	3/27/23 0935	ND		ND	
G3873	317 Seep (MW-6)	3/20/23 1345	3/27/23 1420	ND		ND	
G3874	318 Spr (culvert TSP-1/2)	3/20/23 1515	3/27/23 1515	ND		ND	
G3875	319 Seep (MW-577)	3/20/23 1400	3/27/23 1400	ND		ND	
G3876	320 SW-2 (NE-3)	3/20/23 1250	3/27/23 1230	ND		ND	
G3877	321 E pond discharge	3/20/23 1300	3/27/23 1250	ND		ND	
G3878	322 Seep (E pond)	3/20/23 1305	3/27/23 1245	ND		ND	
G3879	323 SW-3 (N pond)	3/20/23 1255	3/27/23 1345	ND		ND	
G3880	Laboratory control charcoal blank						
G3881	324 Spring Br (Ent gate)	3/20/23 1300	3/27/23 1350	ND		ND	
G3882	325 Hutch Creek at CR16	3/20/23 1240	3/27/23 1335	ND		ND	
G3883	401 Dup A	3/20/23 1440	3/27/23 1450	516.8	1.00	ND	
G3884	402 Dup B	3/20/23 1420	3/27/23 1445	ND		ND	
G3885	403 Dup C	3/20/23 1250	3/27/23 1230	ND		ND	
G3904	302 Spring A	**Water**	3/27/23 1450	ND		ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected

Thomas J. Aley, PHG and RG

Ozark UNDERGROUND LABORATORY 1572 Aley Lane • Protem, MO 65733 • (417) 785-4289 • fax (417) 785-4290 • contact@ozarkundergroundlab.com

Certificate of Analysis

Date of certificate: April 11, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: MS, SB

Date samples shipped: April 3, 2023
Date samples received: April 3, 2023
Date analyzed by OUL: April 5, 6 and 11, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets

Results for PDI 7 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G4237	101 EB-1	3/27/23 1250	4/3/23 1415	ND		ND	
G4238	102 EB-2	3/27/23 1130	4/3/23 1155	ND		ND	
G4239	103EB-4	3/27/23 1215	4/3/23 1400	ND		ND	
G4240	Laboratory control charcoal blank						
G4241	104 EB-5	3/27/23 1420	4/3/23 1145	ND		ND	
G4242	201 MW-1	3/27/23 1240	4/3/23 1435	ND		ND	
G4243	202 MW-1R	3/27/23 1225	4/3/23 1430	ND		ND	
G4244	203 MW-2	3/27/23 1105	4/3/23 1120	ND		ND	
G4245	204 MW-3	3/27/23 1000	4/3/23 0955	ND		ND	
G4246	205 MW-4	3/27/23 1020	4/3/23 1025	ND		ND	
G4247	206 MW-5	3/27/23 1035	4/3/23 1050	ND		ND	
G4248	207 MW-6	3/27/23 1145	4/3/23 1310	ND		ND	
G4249	208 MW-7	3/27/23 1305	4/3/23 1435	ND		ND	
G4250	209 CAO-1	3/27/23 1115	4/3/23 1140	ND		ND	
G4251	210 CAO-2	3/27/23 0950	4/3/23 0940	ND		ND	
G4252	211 CAO-3	3/27/23 1005	4/3/23 0745	ND		ND	
G4253	213 NAB-2	3/27/23 1435	4/3/23 1150	ND		ND	
G4254	214 NAB-3	3/27/23 1305	4/3/23 1110	ND		ND	
G4255	215 NAB-4	3/27/23 1130	4/3/23 0915	ND		ND	
G4256	216 NAB-7	3/27/23 1205	4/3/23 1415	ND		ND	
G4257	217 NAB-8	3/27/23 1055	4/3/23 0840	ND		ND	
G4258	218 MW-509D	3/27/23 1445	4/3/23 1200	ND		ND	
G4259	219 MW-577	3/27/23 1410	4/3/23 1135	ND		ND	
G4260	Laboratory control charcoal blank						

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G4261	220 MW-633D	3/27/23 1110	4/3/23 0900	ND		ND	
G4262	221 MW-689D	3/27/23 1200	4/3/23 0955	ND		ND	
G4263	222 NE-2	3/27/23 1455	4/3/23 1220	ND		ND	
G4264	223 NE-3	3/27/23 1220	4/3/23 1005	ND		ND	
G4265	224 NE-4	3/27/23 1530	4/3/23 1210	ND		ND	
G4266	225 NE-6	3/27/23 0925	4/3/23 0910	ND		ND	
G4267	301 Entrance Seep	3/27/23 1410	4/3/23 1335	ND		ND	
G4268	302 Spring A	3/27/23 1450	4/3/23 1440	516.9	1.50	ND	
G4269	303 Spring B	3/27/23 1445	4/3/23 1355	ND		ND	
G4270	304 TSP-1	3/27/23 1520	4/3/23 1250	ND		ND	
G4271	305 TSP-2	3/27/23 1505	4/3/23 1230	ND		ND	
G4272	306 TSP-3	3/27/23 1320	4/3/23 1120	ND		ND	
G4273	307 TSP-4	3/27/23 1150	4/3/23 0930	ND		ND	
G4274	308 Class I Draw	3/27/23 1030	4/3/23 0810	ND		ND	
G4275	309 Class IV Draw	3/27/23 1045	4/3/23 0830	ND		ND	
G4276	310 SP-4	3/27/23 1010	4/3/23 1015	ND		ND	
G4277	311 SP-5	3/27/23 1055	4/3/23 1115	ND		ND	
G4278	312 SP-7	3/27/23 1405	4/3/23 1325	ND		ND	
G4279	313 Spr (NE-3)	3/27/23 1225	4/3/23 1015	ND		ND	
G4280	Laboratory control charcoal blank						
G4281	314 Spr (Class I Draw)	3/27/23 1030	4/3/23 0820	ND		ND	
G4282	315 Seep (CAO-3)	3/27/23 1012	4/3/23 0800	ND		ND	
G4283	316 SW-1 (NE-6)	3/27/23 0935	4/3/23 0920	ND		ND	
G4284	317 Seep (MW-6)	3/27/23 1420	4/3/23 1245	ND		ND	
G4285	319 Seep (MW-577)	3/27/23 1400	4/3/23 1130	ND		ND	
G4286	320 SW-2 (NE-3)	3/27/23 1230	4/3/23 1030	ND		ND	
G4287	321 E pond discharge	3/27/23 1250	4/3/23 1100	ND		ND	
G4288	322 Seep (E pond)	3/27/23 1245	4/3/23 1050	ND		ND	
G4289	323 SW-3 (N pond)	3/27/23 1345	4/3/23 1230	ND		ND	
G4290	324 Spring Br (Ent gate)	3/27/23 1350	4/3/23 1235	ND		ND	
G4291	325 Hutch Creek at CR16	3/27/23 1335	4/3/23 1210	ND		ND	
G4292	401 Dup A	3/27/23 1450	4/3/23 1440	516.9	1.54	ND	
G4293	402 Dup B	3/27/23 1445	4/3/23 1355	ND		ND	
G4294	403 Dup C	3/27/23 1230	4/3/23 1030	ND		ND	
G4453	302 Spring A	**Water**	4/3/23 1440	ND		ND	
G4573	318 Spr (culvert TSP-1/2)	**Water**	4/3/23 1240	ND		ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected

Thomas J. Aley, PHG and RG

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Certificate of Analysis

Date of certificate: April 25, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: RF, AF

Date samples shipped: April 19, 2023
Date samples received: April 20, 2023
Date analyzed by OUL: April 24, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets and discrepancy sheet

Results for PDI 8 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G4887	101 EB-1	4/3/23 1415	4/17/23 1225	ND		ND	
G4888	102 EB-2	4/3/23 1155	4/17/23 1545	ND		ND	
G4889	103 EB-4	4/3/23 1400	4/17/23 1240	ND		ND	
G4890	104 EB-5	4/3/23 1145	4/17/23 1615	ND		ND	
G4891	201 MW-1	4/3/23 1435	4/17/23 1206	ND		ND	
G4892	202 MW-1R	4/3/23 1430	4/17/23 1215	ND		ND	
G4893	203 MW-2	4/3/23 1120	4/17/23 1630	ND		ND	
G4894	204 MW-3	4/3/23 0955	4/17/23 1310	ND		ND	
G4895	205 MW-4	4/3/23 1025	4/17/23 1215	ND		ND	
G4896	206 MW-5	4/3/23 1050	4/17/23 1425	ND		ND	
G4897	207 MW-6	4/3/23 1310	4/17/23 1410	ND		ND	
G4898	208 MW-7	4/3/23 1435	4/17/23 1335	ND		ND	
G4899	209 CAO-1	4/3/23 1140	4/17/23 1655	ND		ND	
G4900	Laboratory control charcoal blank						
G4901	210 CAO-2	4/3/23 0940	4/17/23 1250	ND		ND	
G4902	211 CAO-3	4/3/23 0745	4/18/23 0855	ND		ND	
G4903	213 NAB-2	4/3/23 1150	4/17/23 1625	ND		ND	
G4904	214 NAB-3	4/3/23 1110	4/18/23 1040	ND		ND	
G4905	215 NAB-4	4/3/23 0915	4/18/23 0940	ND		ND	
G4906	216 NAB-7	4/3/23 1415	4/17/23 1250	ND		ND	
G4907	217 NAB-8	4/3/23 0840	4/18/23 0845	ND		ND	
G4908	218 MW-509D	4/3/23 1200	4/17/23 1610	ND		ND	
G4909	219 MW-577	4/3/23 1135	4/17/23 1712	ND		ND	
G4910	220 MW-633D	4/3/23 0900	4/18/23 0930	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G4911	221 MW-689D	4/3/23 0955	4/18/23 0955	ND		ND	
G4912	222 NE-2	4/3/23 1220	4/17/23 1634	ND		ND	
G4913	223 NE-3	4/3/23 1005	4/18/23 1010	ND		ND	
G4914	224 NE-4	4/3/23 1210	4/17/23 1555	ND		ND	
G4915	225 NE-6	4/3/23 0910	4/17/23 1335	ND		ND	
G4916	301 Entrance Seep	4/3/23 1335	4/17/23 1427	ND		ND	
G4917	302 Spring A	4/3/23 1440	4/17/23 1340	517.6	1.10	ND	
G4918	303 Spring B	4/3/23 1355	4/17/23 1433	ND		ND	
G4919	304 TSP-1	4/3/23 1250	4/17/23 1640	ND		ND	
G4920	Laboratory control charcoal blank						
G4921	305 TSP-2	4/3/23 1230	4/17/23 1654	ND		ND	
G4922	306 TSP-3	4/3/23 1120	4/18/23 1045	ND		ND	
G4923	307 TSP-4	4/3/23 0930	4/18/23 0945	ND		ND	
G4924	308 Class I Draw	4/3/23 0810	4/18/23 0905	ND		ND	
G4925	309 Class IV Draw	4/3/23 0830	4/18/23 0920	ND		ND	
G4926	310 SP-4	4/3/23 1015	4/17/23 1405	ND		ND	
G4927	312 SP-7	4/3/23 1325	4/17/23 1420	ND		ND	
G4928	313 Spr (NE-3)	4/3/23 1015	4/18/23 1020	ND		ND	
G4929	314 Spr (Class I Draw)	4/3/23 0820	4/18/23 0908	ND		ND	
G4930	315 Seep (CAO-3)	4/3/23 0800	4/18/23 0900	ND		ND	
G4931	316 SW-1 (NE-6)	4/3/23 0920	4/17/23 1350	ND		ND	
G4932	317 Seep (MW-6)	4/3/23 1245	4/17/23 1400	ND		ND	
G4933	318 Spr (culvert TSP-1/2)	4/3/23 1240	4/17/23 1646	ND		ND	
G4934	320 SW-2 (NE-3)	4/3/23 1030	4/18/23 1015	ND		ND	
G4935	321 E pond discharge	4/3/23 1100	4/18/23 1030	ND		ND	
G4936	322 Seep (E pond)	4/3/23 1050	4/18/23 1035	ND		ND	
G4937	323 SW-3 (N pond)	4/3/23 1230	4/18/23 0815	ND		ND	
G4938	324 Spring Br (Ent gate)	4/3/23 1235	4/17/23 1515	ND		ND	
G4939	325 Hutch Creek at CR16	4/3/23 1210	4/18/23 1125	ND		ND	
G4940	Laboratory control charcoal blank						
G4941	401 Dup A	4/3/23 1440	4/17/23 1345	518.1	1.25	ND	
G4942	402 Dup B	4/3/23 1355	4/17/23 1437	ND		ND	
G4943	403 Dup C	4/3/23 1030	4/18/23 1015	ND		ND	
G4950	302 Spring A	**Water**	4/17/23 1340	ND		ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected

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Certificate of Analysis

Date of certificate: May 5, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: SB, CH

Date samples shipped: May 1, 2023
Date samples received: May 1, 2023
Date analyzed by OUL: May 2 and 3, 2023
Included with certificate of analysis:
Table of results and copies of sample collection data sheets

Results for PDI 9 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G5041	101 EB-1	4/17/23 1225	5/1/23 1530	ND		ND	
G5042	102 EB-2	4/17/23 1545	5/1/23 1105	ND		ND	
G5043	103 EB-4	4/17/23 1240	5/1/23 1520	ND		ND	
G5044	104 EB-5	4/17/23 1615	5/1/23 1345	ND		ND	
G5045	201 MW-1	4/17/23 1206	5/1/23 1540	515.0 **	0.252	ND	
G5046	202 MW-1R	4/17/23 1215	5/1/23 1535	ND		ND	
G5047	203 MW-2	4/17/23 1630	5/1/23 1040	ND		ND	
G5048	204 MW-3	4/17/23 1310	5/1/23 0945	ND		ND	
G5049	205 MW-4	4/17/23 1215	5/1/23 1015	ND		ND	
G5050	206 MW-5	4/17/23 1425	5/1/23 1025	ND		ND	
G5051	207 MW-6	4/17/23 1410	5/1/23 1450	ND		ND	
G5052	208 MW-7	4/17/23 1335	5/1/23 1555	ND		ND	
G5053	209 CAO-1	4/17/23 1655	5/1/23 1055	ND		ND	
G5054	210 CAO-2	4/17/23 1250	5/1/23 0935	ND		ND	
G5055	211 CAO-3	4/18/23 0855	5/1/23 1118	ND		ND	
G5056	213 NAB-2	4/17/23 1625	5/1/23 1350	ND		ND	
G5057	214 NAB-3	4/18/23 1040	5/1/23 1330	ND		ND	
G5058	215 NAB-4	4/18/23 0940	5/1/23 1140	ND		ND	
G5059	216 NAB-7	4/17/23 1250	5/1/23 1515	ND		ND	
G5060	Laboratory control charcoal blank						
G5061	217 NAB-8	4/18/23 0845	5/1/23 1115	ND		ND	
G5062	218 MW-509D	4/17/23 1610	5/1/23 1410	ND		ND	
G5063	219 MW-577	4/17/23 1712	5/1/23 1340	ND		ND	
G5064	220 MW-633D	4/18/23 0930	5/1/23 1135	ND		ND	

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OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G5065	221 MW-689D	4/18/23 0955	5/1/23 1205	ND		ND	
G5066	222 NE-2	4/17/23 1634	5/1/23 1418	ND		ND	
G5067	223 NE-3	4/18/23 1010	5/1/23 1255	ND		ND	
G5068	224 NE-4	4/17/23 1555	5/1/23 1435	ND		ND	
G5069	225 NE-6	4/17/23 1335	5/1/23 0955	ND		ND	
G5070	301 Entrance Seep	4/17/23 1427	5/1/23 0810	ND		ND	
G5071	302 Spring A	4/17/23 1340	5/1/23 1600	517.5	1.78	ND	
G5072	303 Spring B	4/17/23 1433	5/1/23 1500	ND		ND	
G5073	304 TSP-1	4/17/23 1646	5/1/23 1432	ND		ND	
G5074	305 TSP-2	4/17/23 1654	5/1/23 1420	ND		ND	
G5075	306 TSP-3	4/18/23 1045	5/1/23 1335	ND		ND	
G5076	307 TSP-4	4/18/23 0945	5/1/23 1145	ND		ND	
G5077	308 Class I Draw	4/18/23 0905	5/1/23 0735	ND		ND	
G5078	309 Class IV Draw	4/18/23 0920	5/1/23 1125	ND		ND	
G5079	310 SP-4	4/17/23 1405	5/1/23 1010	ND		ND	
G5080	Laboratory control charcoal blank						
G5081	312 SP-7	4/17/23 1420	5/1/23 0815	ND		ND	
G5082	313 Spr (NE-3)	4/18/23 1020	5/1/23 1310	ND		ND	
G5083	314 Spr (Class I Draw)	4/18/23 0908	5/1/23 0740	ND		ND	
G5084	315 Seep (CAO-3)	4/18/23 0900	5/1/23 0725	ND		ND	
G5085	316 SW-1 (NE-6)	4/17/23 1350	5/1/23 1005	ND		ND	
G5086	318 Spr (culvert TSP-1/2)	4/17/23 1641	5/1/23 1425	ND		ND	
G5087	319 Seep (MW-577)	NDT	5/1/23 1340	ND		ND	
G5088	320 SW-2 (NE-3)	4/18/23 1015	5/1/23 1315	ND		ND	
G5089	321 E pond discharge	4/18/23 1030	5/1/23 1325	ND		ND	
G5090	322 Seep (E pond)	4/18/23 1035	5/1/23 1320	ND		ND	
G5091	323 SW-3 (N pond)	4/18/23 0815	5/1/23 0710	ND		ND	
G5092	324 Spring Br (Ent gate)	4/17/23 1515	5/1/23 0705	ND		ND	
G5093	325 Hutch Creek at CR16	4/18/23 1125	5/1/23 0650	ND		ND	
G5094	401 Dup A	4/17/23 1345	5/1/23 1600	517.7	1.86	ND	
G5095	402 Dup B	4/17/23 1437	5/1/23 1500	ND		ND	
G5096	403 Dup C	4/18/23 1015	5/1/23 1315	ND		ND	
G5111	201 MW-1	**Water**	5/1/23 1540	ND		ND	
G5112	302 Spring A	**Water**	5/1/23 1600	ND		ND	
G5113	001 IW-1	**Water**	5/1/23 1620	507.8	1,510	ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected NDT= No date or time provided

** = A fluorescence peak is present that does not meet all the criteria for this dye. However, it has been calculated as a positive dye result.

Thomas J. Aley, PHG and RG

Thomas Aley

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Certificate of Analysis

Date of certificate: June 6, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: Robert Fowler; Matt Stevener

Date samples shipped: May 31, 2023
Date samples received: June 1, 2023
Date analyzed by OUL: June 5 and 6, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets and discrepancy sheet

Results for PDI 10 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G5559	101 EB-1	5/1/23 1530	5/30/23 1420	ND		ND	
G5560	Laboratory control charcoal blank						
G5561	102 EB-2	5/1/23 1105	5/30/23 1200	ND		ND	
G5562	103 EB-4	5/1/23 1520	5/30/23 1405	ND		ND	
G5563	104 EB-5	5/1/23 1345	5/30/23 1259	ND		ND	
G5564	201 MW-1	5/1/23 1540	5/30/23 1450	ND		ND	
G5565	202 MW-1R	5/1/23 1535	5/30/23 1430	ND		ND	
G5566	203 MW-2	5/1/23 1040	5/30/23 1125	ND		ND	
G5567	204 MW-3	5/1/23 0945	5/30/23 1005	ND		ND	
G5568	205 MW-4	5/1/23 1015	5/30/23 1035	ND		ND	
G5569	206 MW-5	5/1/23 1025	5/30/23 1105	ND		ND	
G5570	207 MW-6	5/1/23 1450	5/30/23 1305	ND		ND	
G5571	208 MW-7	5/1/23 1555	5/30/23 1425	ND		ND	
G5572	209 CAO-1	5/1/23 1055	5/30/23 1145	ND		ND	
G5573	210 CAO-2	5/1/23 0935	5/30/23 0955	ND		ND	
G5574	211 CAO-3	5/1/23 1118	5/30/23 0936	ND		ND	
G5575	213 NAB-2	5/1/23 1350	5/30/23 1250	ND		ND	
G5576	214 NAB-3	5/1/23 1330	5/30/23 1103	ND		ND	
G5577	215 NAB-4	5/1/23 1140	5/30/23 1035	ND		ND	
G5578	216 NAB-7	5/1/23 1515	5/30/23 1350	ND		ND	
G5579	217 NAB-8	5/1/23 1115	5/30/23 0925	ND		ND	
G5580	Laboratory control charcoal blank						
G5581	218 MW-509D	5/1/23 1410	5/30/23 1245	ND		ND	
G5582	219 MW-577	5/1/23 1340	5/30/23 1200	ND		ND	
G5583	220 MW-633D	5/1/23 1135	5/30/23 1027	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G5584	221 MW-689D	5/1/23 1205	5/30/23 1054	ND		ND	
G5585	222 NE-2	5/1/23 1418	5/30/23 1325	ND		ND	
G5586	223 NE-3	5/1/23 1255	5/30/23 1135	ND		ND	
G5587	224 NE-4	5/1/23 1435	5/30/23 1231	ND		ND	
G5588	225 NE-6	5/1/23 0955	5/30/23 0920	ND		ND	
G5589	301 Entrance Seep	5/1/23 0810	5/30/23 1325	514.4	0.419	ND	
G5590	302 Spring A	5/1/23 1600	5/30/23 1430	518.8	0.833	ND	
G5591	303 Spring B	5/1/23 1500	5/30/23 1447	ND		ND	
G5592	304 TSP-1	5/1/23 1432	5/30/23 1415	ND		ND	
G5593	305 TSP-2	5/1/23 1420	5/30/23 1318	ND		ND	
G5594	306 TSP-3	5/1/23 1335	5/30/23 1111	ND		ND	
G5595	307 TSP-4	5/1/23 1145	5/30/23 1047	ND		ND	
G5596	308 Class I Draw	5/1/23 0735	5/30/23 0954	ND		ND	
G5597	309 Class IV Draw	5/1/23 1125	5/30/23 1022	ND		ND	
G5598	310 SP-4	5/1/23 1010	5/30/23 1020	ND		ND	
G5599	311 SP-5	4/3/23 1115	5/30/23 1120	ND		ND	
G5600	Laboratory control charcoal blank						
G5601	312 SP-7	5/1/23 0815	5/30/23 1315	ND		ND	
G5602	313 Spr (NE-3)	5/1/23 1310	5/30/23 1140	ND		ND	
G5603	314 Spr (Class I Draw)	5/1/23 0740	5/30/23 1004	ND		ND	
G5604	315 Seep (CAO-3)	5/1/23 0725	5/30/23 0944	ND		ND	
G5605	316 SW-1 (NE-6)	5/1/23 1005	5/30/23 0940	ND		ND	
G5606	317 Seep (MW-6)	4/17/23 1400	5/30/23 1250	ND		ND	
G5607	318 Spr (culvert TSP-1/2)	5/1/23 1425	5/30/23 1401	ND		ND	
G5608	319 Seep (MW-577)	5/1/23 1340	5/30/23 1205	ND		ND	
G5609	320 SW-2 (NE-3)	5/1/23 1315	5/30/23 1150	ND		ND	
G5610	321 E pond discharge	5/1/23 1325	5/30/23 1118	ND		ND	
G5611	322 Seep (E pond)	5/1/23 1320	5/30/23 1125	ND		ND	
G5612	323 SW-3 (N pond)	5/1/23 0710	5/30/23 1235	ND		ND	
G5613	324 Spring Br (Ent gate)	5/1/23 0705	5/30/23 1225	ND		ND	
G5614	325 Hutch Creek at CR16	5/1/23 0650	5/30/23 1215	ND		ND	
G5615	401 Dup A	5/1/23 1600	5/30/23 1430	ND		ND	
G5616	402 Dup B	5/1/23 1500	5/30/23 1447	ND		ND	
G5617	403 Dup C	5/1/23 1315	5/30/23 1150	ND		ND	
G5649	301 Entrance Seep	**Water**	5/30/23 1325	ND		ND	
G5650	302 Spring A	**Water**	5/30/23 1430	ND		ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected

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Certificate of Analysis

Date of certificate: July 10, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 270000139.01
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: Craig Hodgson; Matt Stevener

Date samples shipped: July 5, 2023
Date samples received: July 5, 2023
Date analyzed by OUL: July 7, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets

Results for PDI 11 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL	Station	Date/Time	Date/Time	Fluorescein Results		RWT Results	
Number	Name	Placed	Collected	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G6041	101 EB-1	5/30/23 1420	7/5/23 1310	ND		ND	
G6042	102 EB-2	5/30/23 1200	7/5/23 1110	ND		ND	
G6043	103 EB-4	5/30/23 1405	7/5/23 1255	ND		ND	
G6044	104 EB-5	5/30/23 1259	7/5/23 1315	ND		ND	
G6045	201 MW-1	5/30/23 1450	7/5/23 1330	514.3	0.782	ND	
G6046	202 MW-1R	5/30/23 1430	7/5/23 1320	514.1	0.816	ND	
G6047	203 MW-2	5/30/23 1125	7/5/23 1050	ND		ND	
G6048	204 MW-3	5/30/23 1005	7/5/23 0935	ND		ND	
G6049	205 MW-4	5/30/23 1035	7/5/23 0955	ND		ND	
G6050	206 MW-5	5/30/23 1105	7/5/23 1015	ND		ND	
G6051	207 MW-6	5/30/23 1305	7/5/23 1205	ND		ND	
G6052	208 MW-7	5/30/23 1425	7/5/23 1400	ND		ND	
G6053	209 CAO-1	5/30/23 1145	7/5/23 1100	ND		ND	
G6054	210 CAO-2	5/30/23 0955	7/5/23 0925	ND		ND	
G6055	211 CAO-3	5/30/23 0936	7/5/23 0920	ND		ND	
G6056	213 NAB-2	5/30/23 1250	7/5/23 1350	ND		ND	
G6057	214 NAB-3	5/30/23 1103	7/5/23 1242	ND		ND	
G6058	215 NAB-4	5/30/23 1035	7/5/23 1045	ND		ND	
G6059	216 NAB-7	5/30/23 1350	7/5/23 1245	ND		ND	
G6060	Laboratory control charcoal blank						
G6061	217 NAB-8	5/30/23 0925	7/5/23 1020	ND		ND	
G6062	218 MW-509D	5/30/23 1245	7/5/23 1410	ND		ND	
G6063	219 MW-577	5/30/23 1200	7/5/23 1305	ND		ND	
G6064	220 MW-633D	5/30/23 1027	7/5/23 1035	ND		ND	
G6065	221 MW-689D	5/30/23 1054	7/5/23 1118	ND		ND	
G6066	222 NE-2	5/30/23 1325	7/5/23 1420	ND		ND	

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G6067	223 NE-3	5/30/23 1135	7/5/23 1200	ND		ND	
G6068	224 NE-4	5/30/23 1231	7/5/23 1500	ND		ND	
G6069	225 NE-6	5/30/23 0920	7/5/23 0905	ND		ND	
G6070	301 Entrance seep	5/30/23 1325	7/5/23 1230	514.5	0.423	ND	
G6071	302 Spring A	5/30/23 1430	7/5/23 1345	519.1	1.08	ND	
G6072	303 Spring B	5/30/23 1447	7/5/23 NT	ND		ND	
G6073	304 TSP-1	5/30/23 1415	7/5/23 1450	ND		ND	
G6074	305 TSP-2	5/30/23 1318	7/5/23 1430	ND		ND	
G6075	306 TSP-3	5/30/23 1111	7/5/23 1250	ND		ND	
G6076	307 TSP-4	5/30/23 1047	7/5/23 1110	ND		ND	
G6077	308 Class I Draw	5/30/23 0954	7/5/23 0942	ND		ND	
G6078	309 Class IV Draw	5/30/23 1022	7/5/23 1005	ND		ND	
G6079	310 SP-4	5/30/23 1020	7/5/23 0945	ND		ND	
G6080	Laboratory control charcoal blank						
G6081	311 SP-5	5/30/23 1120	7/5/23 1040	ND		ND	
G6082	312 SP-7	5/30/23 1315	7/5/23 1220	ND		ND	
G6083	313 Spr (NE-3)	5/30/23 1140	7/5/23 1207	ND		ND	
G6084	314 Spr (Class I Draw)	5/30/23 1004	7/5/23 0950	ND		ND	
G6085	315 Seep (CAO-3)	5/30/23 0944	7/5/23 0932	ND		ND	
G6086	316 SW-1 (NE-6)	5/30/23 0940	7/5/23 0915	ND		ND	
G6087	317 Seep (MW-6)	5/30/23 1250	7/5/23 1155	ND		ND	
G6088	318 Spr (culvert TSP-1/2)	5/30/23 1401	7/5/23 1440	ND		ND	
G6089	319 Seep (MW-577)	5/30/23 1205	7/5/23 1255	ND		ND	
G6090	320 SW-2 (NE-3)	5/30/23 1150	7/5/23 1215	ND		ND	
G6091	321 E pond discharge	5/30/23 1118	7/5/23 1230	ND		ND	
G6092	322 Seep (E pond)	5/30/23 1125	7/5/23 1235	ND		ND	
G6093	323 SW-3 (N pond)	5/30/23 1235	7/5/23 1145	ND		ND	
G6094	324 Spring Br (Ent gate)	5/30/23 1225	7/5/23 1135	ND		ND	
G6095	325 Hutch Creek at CR16	5/30/23 1215	7/5/23 1125	ND		ND	
G6096	401 Dup A	5/30/23 1430	7/5/23 1345	ND		ND	
G6097	402 Dup B	5/30/23 1447	7/5/23 NT	ND		ND	
G6098	403 Dup C	5/30/23 1150	7/5/23 1215	ND		ND	
G6103	201 MW-1	**Water**	7/5/23 1330	ND		ND	
G6104	202 MW-1R	**Water**	7/5/23 1320	ND		ND	
G6105	301 Entrance seep	**Water**	7/5/23 1230	ND		ND	
G6106	302 Spring A	**Water**	7/5/23 1345	ND		ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected NT = No time given

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Certificate of Analysis

Date of certificate: December 5, 2023
Client: SCS Engineers
Project name/location: NABORS / Baxter Co., Arkansas
Project Number: 27222323.00
Contact person:
Shiloh Beeman (sbeeman@scsengineers.com)
Samples collected by: MS, AF

Date samples shipped: November 29, 2023
Date samples received: November 30, 2023
Date analyzed by OUL: December 4, 2023
Included with certificate of analysis:
Table of results, copies of sample collection data sheets

Results for PDI 12 charcoal and water samples analyzed for the presence of fluorescein and rhodamine WT (RWT) dyes.
Peak wavelengths are reported in nanometers (nm); dye concentrations are reported in parts per billion (ppb).
All results are for charcoal unless otherwise indicated.

OUL	Station	Date/Time	Date/Time	Fluorescein Results		RWT Results	
Number	Name	Placed	Collected	Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G9153	101 EB-1	7/5/23 1310	11/28/23 1135	ND		ND	
G9154	104 EB-5	7/5/23 1315	11/28/23 1305	ND		ND	
G9155	201 MW-1	7/5/23 1330	11/28/23 1530	514.9	1.31	ND	
G9156	202 MW-1R	7/5/23 1320	11/28/23 1535	514.1	0.528	ND	
G9157	203 MW-2	7/5/23 1050	11/28/23 1612	ND		ND	
G9158	204 MW-3	7/5/23 0935	11/28/23 1408	ND		ND	
G9159	205 MW-4	7/5/23 0955	11/28/23 1534	ND		ND	
G9160	Laboratory control charcoal blank						
G9161	206 MW-5	7/5/23 1015	11/28/23 1501	ND		ND	
G9162	207 MW-6	7/5/23 1205	11/28/23 1254	ND		ND	
G9163	208 MW-7	7/5/23 1400	11/28/23 1315	ND		ND	
G9164	209 CAO-1	7/5/23 1100	11/28/23 1348	ND		ND	
G9165	210 CAO-2	7/5/23 0925	11/28/23 1403	ND		ND	
G9166	211 CAO-3	7/5/23 0920	11/28/23 0840	ND		ND	
G9167	213 NAB-2	7/5/23 1350	11/28/23 1320	ND		ND	
G9168	214 NAB-3	7/5/23 1242	11/28/23 1150	ND		ND	
G9169	215 NAB-4	7/5/23 1045	11/28/23 1010	ND		ND	
G9170	216 NAB-7	7/5/23 1245	11/28/23 1515	ND		ND	
G9171	217 NAB-8	7/5/23 1020	11/28/23 0950	ND		ND	
G9172	218 MW-509D	7/5/23 1410	11/28/23 1335	ND		ND	
G9173	219 MW-577	7/5/23 1305	11/28/23 1215	ND		ND	
G9174	220 MW-633D	7/5/23 1035	11/28/23 1000	ND		ND	
G9175	221 MW-689D	7/5/23 1118	11/28/23 1045	ND		ND	
G9176	222 NE-2	7/5/23 1420	11/28/23 1350	ND		ND	
G9177	223 NE-3	7/5/23 1200	11/28/23 1105	ND		ND	
G9178	224 NE-4	7/5/23 1500	11/28/23 1425	ND		ND	
G9179	225 NE-6	7/5/23 0905	11/28/23 1424	ND		ND	
G9180	Laboratory control charcoal blank						

OUL Number	Station Name	Date/Time Placed	Date/Time Collected	Fluorescein Results		RWT Results	
				Peak (nm)	Conc. (ppb)	Peak (nm)	Conc. (ppb)
G9181	302 Spring A	7/5/23 1345	11/28/23 1323	517.5	0.733	ND	
G9182	303 Spring B	7/5/23 NT	11/28/23 1240	ND		ND	
G9183	305 TSP-2	7/5/23 1430	11/28/23 1400	ND		ND	
G9184	306 TSP-3	7/5/23 1250	11/28/23 1155	ND		ND	
G9185	307 TSP-4	7/5/23 1110	11/28/23 1025	ND		ND	
G9186	310 SP-4	7/5/23 0945	11/28/23 1438	ND		ND	
G9187	311 SP-5	7/5/23 1040	11/28/23 1606	ND		ND	
G9188	312 SP-7	7/5/23 1220	11/28/23 1210	ND		ND	
G9189	313 Spr (NE-3)	7/5/23 1207	11/28/23 1110	ND		ND	
G9190	314 Spr (Class I Draw)	7/5/23 0950	11/28/23 0845	ND		ND	
G9191	316 SW-1 (NE-6)	7/5/23 0915	11/28/23 1429	ND		ND	
G9192	318 Spr (culvert TSP-1/2)	7/5/23 1440	11/28/23 1405	ND		ND	
G9193	319 Seep (MW-577)	7/5/23 NT	11/28/23 1210	ND		ND	
G9194	321 E pond discharge	7/5/23 1230	11/28/23 1145	ND		ND	
G9195	323 SW-3 (N pond)	7/5/23 1145	11/28/23 1657	ND		ND	
G9196	324 Spring Br (Ent gate)	7/5/23 1135	11/28/23 1652	ND		ND	
G9197	401 Dup A	7/5/23 1345	11/28/23 1323	518.6	0.646	ND	
G9198	402 Dup B	7/5/23 NT	11/28/23 1240	ND		ND	
G9226	102 EB-2	**Water**	11/28/23 1620	ND		ND	
G9227	103 EB-4	**Water**	11/28/23 1630	ND		ND	
G9228	201 MW-1	**Water**	11/28/23 1530	ND		ND	
G9229	202 MW-1R	**Water**	11/28/23 1535	ND		ND	
G9230	301 Entrance Seep	**Water**	11/28/23 1216	ND		ND	
G9231	302 Spring A	**Water**	11/28/23 1323	ND		ND	
G9232	304 TSP-1	**Water**	11/28/23 1410	ND		ND	
G9233	308 Class I Draw	**Water**	11/28/23 0855	ND		ND	
G9234	309 Class IV Draw	**Water**	11/28/23 0935	ND		ND	
G9235	315 Seep (CAO-3)	**Water**	11/28/23 0915	ND		ND	
G9236	320 SW-2 (NE-3)	**Water**	11/28/23 1115	ND		ND	
G9237	322 Seep (E pond)	**Water**	11/28/23 1130	ND		ND	
G9238	325 Hutch Creek at CR16	**Water**	11/28/23 1710	ND		ND	
G9239	401 Dup A	**Water**	11/28/23 1323	ND		ND	
G9240	Laboratory control water blank						
G9241	403 Dup C	**Water**	11/28/23 1115	ND		ND	

Note: Fluorescein dye was provided by SCS Engineers. Reported dye concentrations are based on Ozark Underground Laboratory standards for fluorescein dye mixtures with a dye equivalency of 70%. Rhodamine WT (RWT) dye will be provided to SCS Engineers by the OUL. All RWT dye concentrations will be based upon a standard routinely used at the OUL. The RWT is a 21% solution, the concentrations are based upon the as sold weight of the dye.

Footnotes: ND = No dye detected NT = No time given

Thomas J. Aley, PHG and RG

Appendix B

Ozark Underground Laboratory, Inc.

Procedures and Criteria Document

Ozark UNDERGROUND LABORATORY 1572 Aley Lane • Protem, MO 65733 • (417) 785-4289 • fax (417) 785-4290 • contact@ozarkundergroundlab.com

PROCEDURES AND CRITERIA
ANALYSIS OF FLUORESCENT DYES
IN WATER AND CHARCOAL SAMPLERS:

FLUORESCEIN, EOSINE, RHODAMINE WT, AND SULFORHODAMINE B DYES

Revision Date:
March 3, 2015

Thomas Aley, PHG, PG
President
and
Shiloh L. Beeman, PG
Sr. Hydrogeologist

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INTRODUCTION

This document describes standard procedures and criteria currently in use at the Ozark Underground Laboratory (OUL) as of the date shown on the title page. Some samples may be subjected to different procedures and criteria because of unique conditions; such non-standard procedures and criteria are identified in reports for those samples. Standard procedures and criteria change as knowledge and experience increases and as equipment is improved or up-graded. The OUL maintains a summary of changes in standard procedures and criteria.

TRACER DYES AND SAMPLE TYPES

Dye Nomenclature

Dye manufacturers and retailers use a myriad of names for the dyes. This causes confusion among dye users and report readers. The primary dyes used at the OUL and described in this document are included in Table 1 below.

Table 1. Primary OUL Dye Nomenclature.

OUL Common Name	Color Index Number	Color Index Name	Other Names
Fluorescein	45350	Acid Yellow 73	uranine, uranine C, sodium fluorescein, fluorescein LT and fluorescent yellow/green
Eosine	45380	Acid Red 87	eosin, eosine OJ, and D&C Red 22
Rhodamine WT	None assigned	Acid Red 388	fluorescent red (but not the same as rhodamine B)
Sulforhodamine B	45100	Acid Red 52	pontacyl brilliant pink B, lissamine red 4B, and fluoro brilliant pink

The OUL routinely provides dye for tracing projects. Dyes purchased for groundwater tracing are always mixtures that contain both dye and an associated diluent. Diluents enable the manufacturer to standardize the dye mixture so that there are minimal differences among batches. Additionally, diluents are often designed to make it easier to dissolve the dye mixture in water, or to produce a product which meets a particular market need (groundwater tracing is only a tiny fraction of the dye market). The percent of dye in "as-sold" dye mixtures often varies dramatically among manufacturers and retailers, and retailers are sometimes incorrect about the percent of dye in their products. The OUL subjects all of its dyes to strict quality control (QC) testing. Table 2 summarizes the as-sold dye mixtures used by the OUL.

Table 2. As-Sold Dye Mixtures at the OUL.

OUL Common Name	Form	Dye Equivalent
Fluorescein	Powder	75% dye equivalent, 25% diluent
Eosine	Powder	75% dye equivalent, 25% diluent
Rhodamine WT	Liquid	20% dye equivalent, 80% diluent
Sulforhodamine B	Powder	75% dye equivalent, 25% diluent

Analytical results are based on the as-sold weights of the dyes provided by the OUL. The use of dyes from other sources is discouraged due to the wide variability of dye equivalents within the market. However, if alternate source dyes are used, a sample should be provided to the OUL for quality control and to determine if a correction factor is necessary for the analytical results.

Types of Samples

Typical samples that are collected for fluorescent tracer dye analysis include charcoal samplers (also called activated carbon or charcoal packets) and water samples.

The charcoal samplers are packets of fiberglass screening partially filled with 4.25 grams of activated coconut charcoal. The charcoal used by the OUL is Calgon 207C coconut shell carbon, 6 to 12 mesh, or equivalent. The most commonly used charcoal samplers are about 4 inches long by 2 inches wide. A cigar-shaped sampler is made for use in very small diameter wells (such as 1-inch diameter piezometers); this is a special order item and should be specifically requested in advance when needed. All of the samplers are closed by heat sealing.

In specialized projects, soil samples have been collected from soil cores and analyzed for fluorescent tracer dyes. Project-specific procedures have been developed for projects such as these. For additional information, please contact the OUL.

FIELD PROCEDURES

Field procedures included in this section are intended as guidance, and not firm requirements. Placement of samplers and other field procedures require adjustment to field conditions. Personnel at the OUL are available to provide additional assistance for implementation of field procedures specific to specialized field conditions.

Placement of Samplers

Charcoal samplers are placed so as to be exposed to as much water as possible. Water should flow through the packet. In springs and streams they are typically attached to a rock or other anchor in a riffle area. Attachment of the packets often uses plastic tie wires. In swifter water galvanized wire (such as electric fence wire) is often used. Other types of anchoring wire can be used. Electrical wire with plastic insulation is also good. Packets are attached so that they extend outward from the anchor rather than laying flat against it. Two or more separately anchored packets are typically used for sampling springs and streams. The placement of multiple packets is recommended in order to minimize the chance of loss during the sampling period. The use of fewer packets is discouraged except when the spring or stream is so small that there is not appropriate space for placing multiple packets.

When pumping wells are being sampled, the samplers are typically placed in sample holders made of plastic pipe fittings. Brass hose fittings can be at the end of the sample holders so that the sample holders can be installed on outside hose bibs and water which has run through the samplers can be directed to waste through a connected garden hose. The samplers can be unscrewed in the middle so that charcoal packets can be changed. The middle portions of the samplers consist of 1.5 inch diameter pipe and pipe fitting.

Charcoal packets can be lowered into monitoring wells for sampling purposes. In general, if the well is screened, samplers should be placed approximately in the middle of the screened interval. Due to the typically lower volume of water that flows through a well, only one charcoal sampler should be used per well. However, multiple packets can be placed in a single well at depths to test different depth horizons when desirable. A weight should be added near the charcoal packet to ensure that it will not float. The weight should be of such a nature that it will not affect water quality. One common approach is to anchor the packets with a white or uncolored plastic cable tie to the top of a dedicated weighted disposable bailer. We typically run nylon cord from the top of the well to the charcoal packet and its weight. ***Do not use colored cord*** since some of them are colored with fluorescent dyes. Nylon fishing line should not be used since it can be readily cut by a sharp projection in the well.

In some cases, especially with small diameter wells and appreciable well depths, the weighted disposable bailers sink very slowly or may even fail to sink because of friction and floating of the anchoring cord. In such cases a weight may be added to the top of the disposable bailer. Stainless steel weights are ideal, but are not needed in all cases. All weights should be cleaned prior to use; the cleaning approach should comply with decontamination procedures in use at the project site.

Optional Preparation of Charcoal Samplers

Charcoal packets routinely contain some fine powder that washes off rapidly when they are placed in water. While not usually necessary, the following optional preparation step is suggested if the fine charcoal powder is problematic.

Charcoal packets can be triple rinsed with distilled, demineralized, or reagent water known to be free of tracer dyes. This rinsing is typically done by soaking. With this approach,

approximately 25 packets are placed in one gallon of water and soaked for at least 10 minutes. The packets are then removed from the water and excess water is shaken off the packets. The packets are then placed in a second gallon of water and again soaked for at least 10 minutes. After this soaking they are removed from the water and excess water is shaken off the packets. The packets are then placed in a third gallon of water and the procedure is again repeated. Rinsed packets are placed in plastic bags and are placed at sampling stations within three days. Packets can also be rinsed in jets of water for about one minute; this requires more water and is typically difficult to do in the field with water known to be free of tracer dyes.

Collection and Replacement of Samplers

Samplers are routinely collected and replaced at each of the sampling stations. The frequency of sampler collection and replacement is determined by the nature of the study. Collections at one week intervals are common, but shorter or longer collection frequencies are acceptable and sometimes more appropriate. Shorter sampling frequencies are often used in the early phases of a study to better characterize time of travel. As an illustration, we often collect and change charcoal packets 1, 2, 4, and 7 days after dye injection. Subsequent sampling is then weekly.

The sampling interval in wells at hazardous wastes sites should generally be no longer than about a week. Contaminants in the water can sometimes use up sorption sites on the charcoal that would otherwise adsorb the dye. This is especially important if the dye might pass in a relatively short duration pulse.

Where convenient, the collected samplers should be briefly rinsed in the water being sampled to remove dirt and accumulated organic material. This is not necessary with well samples. The packets are shaken to remove excess water. Next, the packet (or packets) are placed in a plastic bag (Whirl-Pak® bags are ideal). The bag is labeled on the outside with a black permanent type felt marker pen, such as a Sharpie®. ***Use only pens that have black ink***; colored inks may contain fluorescent dyes. The notations include station name or number and the date and time of collection. Labels must not be inserted inside the sample bags.

Collected samplers are kept in the dark to minimize algal growth on the charcoal prior to analysis work. New charcoal samplers are routinely placed when used charcoal packets are collected. The last set of samplers placed at a stream or spring is commonly not collected.

Water Samples

Water samples are often collected. They should be collected in either glass or plastic; the OUL routinely uses 50 milliliter (mL) research-grade polypropylene copolymer Perfector Scientific vials (Catalog Number 2650) for such water samples. No more than 30 mL of water is required for analysis. The sides of the vials should be labeled with the project name, sample ID, sample date and time with a black permanent felt tip pen. ***Do not label the lid only***. The vials should be placed in the dark and refrigerated immediately after collection, and maintained under refrigeration until shipment. The OUL supplies vials for the collection of water samples.

Sample Shipment

When water or charcoal samplers are collected for shipment to the OUL they should be shipped promptly. We prefer (and in some studies require) that samples be refrigerated with frozen re-usable ice packs upon collection and that they be shipped refrigerated with frozen ice packs by overnight express. ***Do not ship samplers packed in wet ice*** since this can create a potential for cross contamination when the ice melts. Our experience indicates that it is not essential for samplers to be maintained under refrigeration; yet maintaining them under refrigeration clearly minimizes some potential problems. A product known as "green ice" should not be used for maintaining the samples in a refrigerated condition since this product contains a dye which could contaminate samples if the "green ice" container were to break or leak.

We receive good overnight and second day air service from both UPS and FedEx. The U.S. Postal Service does not typically provide next day service to us. DHL does not provide overnight service to us. FedEx is recommended for international shipments. The OUL does not receive Saturday delivery.

Each shipment of charcoal samplers or water samples ***must be accompanied by a sample custody document***. The OUL provides a sheet (which bears the title "Samples for Fluorescence Analysis") that can be used if desired. These sheets can be augmented by a client's chain-of-custody forms or any other relevant documentation. OUL's custody document works well for charcoal samplers because it allows for both the placement date and time as well as the collection date and time. Many other standard chain-of-custody documents do not allow for these types of samples. Attachment 1 includes a copy of OUL's Sample Collection Data Sheet.

Please write legibly on the custody documents and ***use black ink***. Check the accuracy of the sample sheet against the samples prior to shipment to identify and correct errors that may delay the analysis of your samples following receipt at the laboratory.

Supplies Provided by the OUL

The OUL provides supplies for the collection of fluorescent tracer dyes. Supplies provided upon request are charcoal packets, Whirl-Pak® bags (to contain the charcoal packets after collection for shipment to the laboratory), and water vials. These supplies are subjected to strict QA/QC procedures to ensure the materials are free of any potential tracer dye contaminants. The charge for these materials is included in the cost of sample analysis. Upon request, coolers and re-freezable ice packs are also provided for return shipment of samples.

The OUL also has tracer dyes available for purchase. These dyes are subject to strict QA/QC testing. All analytical work is based upon the OUL as-sold weight of the dyes.

LABORATORY PROCEDURES

The following procedures are followed upon receipt of samples at the laboratory.

Receipt of Samples

Samplers shipped to the OUL are logged in and refrigerated upon receipt. Prior to cleaning and analysis, samplers are assigned a laboratory identification number.

It sometimes occurs that there are discrepancies between the sample collection data sheet and the actual samples received. When this occurs, a "Discrepancy Sheet" form is completed and sent to the shipper of the sample for resolution. The purpose of the form is to help resolve discrepancies, even when they may be minor. Many discrepancies arise from illegible custody documents. ***Please write legibly*** on the custody documents and ***use black ink***. Check the accuracy of the sample sheet against the samples prior to shipment to identify and correct errors that may delay the analysis of your samples following receipt at the laboratory.

Cleaning of Charcoal Samplers

Samplers are cleaned by spraying them with jets of clean water from a laboratory well in a carbonate aquifer. OUL uses non-chlorinated water for the cleansing to minimize dye deterioration. We do not wash samplers in public water supplies. Effective cleansing cannot generally be accomplished simply by washing in a conventional laboratory sink even if the sink is equipped with a spray unit.

The duration of packet washing depends upon the condition of the sampler. Very clean samplers may require less than a minute of washing; dirtier samplers may require several minutes of washing.

Elution of the Charcoal

There are various eluting solutions that can be used for the recovery of tracer dyes. The solutions typically include an alcohol, water, and a strong basic solution such as aqueous ammonia and /or potassium hydroxide.

The standard elution solution used at the OUL is a mixture of 5% aqua ammonia and 95% isopropyl alcohol solution and sufficient potassium hydroxide pellets to saturate the solution. The isopropyl alcohol solution is 70% alcohol and 30% water. The aqua ammonia solution is 29% ammonia. The potassium hydroxide is added until a super-saturated layer is visible in the bottom of the container. This super-saturated layer is not used for elution. Preparation of eluting solutions uses dedicated glassware which is never used in contact with dyes or dye solutions.

The eluting solution will elute fluorescein, eosine, rhodamine WT, and sulforhodamine B dyes. It is also suitable for separating fluorescein peaks from peaks of some naturally present materials found in may be found in samplers.

Fifteen mL of the eluting solution is poured over the washed charcoal in a disposable sample beaker. The sample beaker is capped. The sample is allowed to stand for 60 minutes. After this time, the liquid is carefully poured off the charcoal into a new disposable beaker which has been appropriately labeled with the laboratory identification number. A few grains of charcoal may inadvertently pass into the second beaker; no attempt is made to remove these from the second sample beaker. After the pouring, a small amount of the elutant will remain in the initial sample beaker. After the transfer of the elutant to the second sample beaker, the contents of the first sample beaker (the eluted charcoal) are discarded. Samples are kept refrigerated until analyzed.

pH Adjustment of Water Samples

The fluorescence intensity of several of the commonly used fluorescent tracer dyes is pH dependent. The pH of samples analyzed for fluorescein, eosine, and pyranine dyes are adjust to a target pH of greater than 9.5 in order to obtain maximum fluorescence intensities.

Adjustment of pH is achieved by placing samples in a high ammonia atmosphere for at least two hours in order to increase the pH of the sample. Reagent water standards are placed in the same atmosphere as the samples. If dye concentrations in a sample are off-scale and require dilution for quantification of the dye concentration, the diluting water used is OUL reagent water that has been pH adjusted in a high ammonia atmosphere. Samples that are only analyzed for rhodamine WT or sulforhodamine B are not required to be pH adjusted.

Analysis on the Shimadzu RF-5301

The OUL uses a Shimadzu spectrofluorophotometer model RF-5301. This instrument is capable of synchronous scanning. The OUL also owns a Shimadzu RF-540 spectrofluorometers that is occasionally used for special purposes.

A sample of the elutant or water is withdrawn from the sample container using a disposable polyethylene pipette. Approximately 3 mL of the sample is then placed in disposable rectangular polystyrene cuvette. The cuvette has a maximum capacity of 3.5 mL. The cuvette is designed for fluorometric analysis; all four sides and the bottom are clear. The acceptable spectral range of these cuvettes is 340 to 800 nm. The pipettes and cuvettes are discarded after one use.

The cuvette is then placed in the RF-5301. This instrument is controlled by a programmable computer and operated by proprietary software developed for dye tracing applications.

Our instruments are operated and maintained in accordance with the manufacturer's recommendations. On-site installation of our first instrument and a training session on its use was provided by the instrument supplier. Repairs are made by a Shimadzu-authorized repairman.

Our typical analysis of an elutant sample where fluorescein, eosine, rhodamine WT, or sulforhodamine B dyes may be present includes synchronous scanning of excitation and emission spectra with a 17 nm separation between excitation and emission wavelengths. For these dyes,

the excitation scan is from 443 to 613 nm; the emission scan is from 460 to 630 nm. The emission fluorescence from the scan is plotted on a graph. The typical scan speed setting is “fast” on the RF-5301. The typical sensitivity setting used is "high."

Table 3. Excitation and emission slit width settings routinely used for dye analysis.

Parameter	**Excitation Slit (nm)**	**Emission Slit (nm)**
ES, FL, RWT, and SRB in elutant	3	1.5
ES, FL, RWT, and SRB in water	5	3

Note: ES = Eosine. FL = Fluorescein. RWT = Rhodamine WT. SRB = Sulforhodamine B.

The instrument produces a plot of the synchronous scan for each sample; the plot shows emission fluorescence only. The synchronous scans are subjected to computer peak picks using proprietary software; peaks are picked to the nearest 0.1 nm. Instrument operators have the ability to manually adjust peaks as necessary based upon computer-picked peaks and experience. All samples run on the RF-5301 are stored electronically with sample information. All samples analyzed are recorded in a bound journal.

Quantification

We calculate the magnitude of fluorescence peaks for fluorescein, eosine, rhodamine WT, and sulforhodamine B dyes in both elutant and water samples. Dye quantities are expressed in microgram per liter (parts per billion; ppb). The dye concentrations are calculated by separating fluorescence peaks due to dyes from background fluorescence on the charts, and then calculating the area within the fluorescence peak. This area is proportional to areas obtained from standard solutions.

We run dye concentration standards each day the RF-5301 is used. Six standards are used; the standard or standards appropriate for the analysis work being conducted are selected. All standards are based upon the as-sold weights of the dyes. The standards are as follows:

1) 10 ppb fluorescein and 100 ppb rhodamine WT in well water from the Jefferson City-Cotter Formation
2) 10 ppb eosine in well water from the Jefferson City-Cotter Formation
3) 100 ppb sulforhodamine B in well water from the Jefferson City-Cotter Formation.
4) 10 ppb fluorescein and 100 ppb rhodamine WT in elutant.
5) 10 ppb eosine in elutant.
6) 100 ppb sulforhodamine B in elutant.

Preparation of Standards

Dye standards are prepared as follows:

Step 1. A small sample of the as-sold dye is placed in a pre-weighed sample vial and the vial is again weighed to determine the weight of the dye. We attempt to use a sample weighing between 1 and 5 grams. This sample is then diluted with well water to make a 1% dye solution by weight (based upon the as-sold weight of the dye). The resulting dye solution is allowed to sit for at least four hours to ensure that all dye is fully dissolved.

Step 2. One part of each dye solution from Step 1 is placed in a mixing container with 99 parts of well water. Separate mixtures are made for fluorescein, rhodamine WT, eosine, and sulforhodamine B. The resulting solutions contain 100 mg/L dye (100 parts per million dye mixture). The typical prepared volume of this mixture is appropriate for the sample bottles being used; we commonly prepare about 50 mL of the Step 2 solutions. The dye solution from Step 1 that is used in making the Step 2 solution is withdrawn with a digital Finnpipette which is capable of measuring volumes between 0.200 and 1.000 mL at intervals of 0.005 mL. The calibration certificate with this instrument indicates that the accuracy (in percent) is as follows:

At 0.200 mL, 0.90%

At 0.300 mL, 0.28%

At 1.000 mL, 0.30%

The Step 2 solution is called the long term standard. OUL experience indicates that Step 2 solutions, if kept refrigerated, will not deteriorate appreciably over periods of less than a year. Furthermore, these Step 2 solutions may last substantially longer than one year.

Step 3. A series of intermediate-term dye solutions are made. Approximately 45 mL. of each intermediate-term dye solution is made. All volume measurements of less than 5 mL are made with a digital Finnpipette. (see description in Step 2). All other volume measurements are made with Rheinland Kohn Geprufte Sicherheit 50 mL capacity pump dispenser which will pump within plus or minus 1% of the set value. The following solutions are made; all concentrations are based on the as-sold weight of the dyes:

1) 1 ppm fluorescein dye and 10 ppm rhodamine WT dye.

2) 1 ppm eosine.

3) 10 ppm sulforhodamine B dye.

Step 4. A series of six short-term dye standards are made from solutions in Step 3. These standards were identified earlier in this section. In the experience of the OUL these standards have a useful shelf life in excess of one week. However, in practice, Step 4 elutant standards are made weekly, and Step 4 water standards are made daily.

Dilution of Samples

Samples with peaks that have arbitrary fluorescence unit values of 500 or more are diluted a hundred fold to ensure accurate quantification.

Some water samples have high turbidity or color which interferes with accurate detection and measurement of dye concentrations. It is often possible to dilute these samples and then measure the dye concentration in the diluted sample.

The typical dilutions are either 10 fold (1:10) or 100 fold (1:100). A 1:10 dilution involves combining one part of the test sample with 9 parts of water (if the sample is water) or elutant (if the sample is elutant). A 1:100 dilution involves combining one part of the test sample is combined with 99 parts of water or elutant, based upon the sample media. Typically, 0.300 mL of the test solution is combined with 29.700 mL of water (or elutant as appropriate) to yield a new test solution.

All volume measurements of less than 5 mL are made with a digital Finnpipette. All other volume measurements are made with Rheinland Kohn Geprufte Sicherheit 50 mL capacity pump dispenser which will pump within plus or minus 1% of the set value.

The water used for dilution is from a carbonate aquifer. All dilution water is pH adjusted to greater than pH 9.5 by holding it in open containers in a high ammonia concentration chamber. This adjustment takes a minimum of two hours.

Quality Control

Laboratory blanks are run for every sample where the last two digits of the laboratory numbers are 00, 20, 40, 60, or 80. A charcoal packet is placed in a pumping well sampler and at least 25 gallons of unchlorinated water is passed through the sampler at a rate of about 2.5 gallons per minute. The sampler is then subjected to the same analytical protocol as all other samplers.

System functioning tests of the analytical instruments are conducted in accordance with the manufacturer's recommendations. Spiked samples are also analyzed when appropriate for quality control purposes.

All materials used in sampling and analysis work are routinely analyzed for the presence of any compounds that might create fluorescence peaks in or near the acceptable wavelength ranges for any of the tracer dyes. This testing includes approximately 1% of materials used.

Project specific QA/QC samples may include sample replicates and sample duplicates. A replicate sample is when a single sample is analyzed twice. A sample duplicate is where two samples are collected in a single location and both are analyzed. Sample replicates and duplicates are run for QA/QC purposes upon request of the client. These results are reported in the Certificate of Analysis.

Reports

Sample analysis results are typically reported in a Certificate of Analysis. However, specialized reports are provided in accordance with the needs of the client. Certificates of Analysis typically provide a listing of station number, sample ID, and dye concentrations if detected. Standard data format includes deliverables in MS Excel and Adobe Acrobat (.pdf)

format. Hard copy of the data package, and copies of the analytical charts are available upon request.

Work at the OUL is directed by Mr. Thomas Aley. Mr. Aley has 45 years of professional experience in hydrology and hydrogeology. He is certified as a Professional Hydrogeologist (Certificate #179) by the American Institute of Hydrology and licenced as a Professional Geologist in Missouri, Arkansas, Kentucky, and Alabama. Additional details regarding laboratory qualifications are available upon request.

Waste Disposal

All laboratory wastes are disposed of according to applicable state and federal regulations. Waste elutant and water samples are collected in 15 gallon poly drums and disposed with a certified waste disposal facilityas non-hazardous waste.

In special cases, wastes for a particular project may be segregated and returned to the client upon completion of the project. These projects may have samples that contain contaminants that the client must account for all materials generated and disposed. These situations are managed on a case-by-case basis.

CRITERIA FOR DETERMINATION OF POSITIVE DYE RECOVERIES

Normal Emission Ranges and Detection Limits

The OUL has established normal emission fluorescence wavelength ranges for each of the four dyes described in this document. The normal acceptable range equals mean values plus and minus two standard deviations. These values are derived from actual groundwater tracing studies conducted by the OUL.

The detection limits are based upon concentrations of dye necessary to produce emission fluorescence peaks where the signal to noise ratio is 3. The detection limits are realistic for most field studies since they are based upon results from actual field samples rather than being based upon values from spiked samples in a matrix of reagent water or the elutants from unused activated carbon samplers. In some cases detection limits may be smaller than reported if the water being sampled has very little fluorescent material in it. In some cases detection limits may be greater than reported; this most commonly occurs if the sample is turbid due to suspended material or a coloring agent such as tannic compounds. Turbid samples are typically allowed to settle, centrifuged, or, if these steps are not effective, diluted prior to analysis.

Table 4 provides normal emission wavelength ranges and detection limits for the four dyes when analyzed on the OUL's RF-5301 for samples analyzed as of March 3, 2015.

Table 4. RF-5301 Spectrofluorophotometer. Normal emission wavelength ranges and detection limits for fluorescein, eosine, rhodamine WT, and sulforhodamine B dyes in water and elutant samples.

Fluorescent Dye	**Normal Acceptable Emission Wavelength Range (nm)**		**Detection Limit (ppb)**	
	Elutant	**Water**	**Elutant**	**Water**
Eosine	539.3 to 545.1	532.5 to 537.0	0.050	0.015
Fluorescein	514.1 to 519.2	505.9 to 509.7	0.025	0.002
Rhodamine WT	564.6 to 571.2	571.9 to 577.2	0.170	0.015
Sulforhodamine B	575.2 to 582.0	580.1 to 583.7	0.080	0.008

Note: Detection limits are based upon the as-sold weight of the dye mixtures normally used by the OUL.
Fluorescein and eosine detection limits in water are based on samples pH adjusted to greater than 9.5.

It is important to note that the normal acceptable emission wavelength ranges are subject to change based on instrument maintenance, a change in instrumentation, or slight changes in dye formulation. Significant changes in normal acceptable emission wavelength ranges will be updated in this document as they occur.

Fluorescence Background

Due to the nature of fluorescence analysis, it is important to identify and characterize any potential background fluorescence at dye introduction and monitoring locations prior to the introduction of any tracer dyes.

There is generally little or no detectable fluorescence background in or near the general range of eosine, rhodamine WT, and sulforhodamine B dyes encountered in most groundwater tracing studies. There is often some fluorescence background in or near the range of fluorescein dye present at some of the stations used in groundwater tracing studies.

Criteria for Determining Dye Recoveries

The following sections identify normal criteria used by the OUL for determining dye recoveries. The primary instrument in use is a Shimadzu RF-5301.

EOSINE

Normal Criteria Used by the OUL for Determining Eosine Dye Recoveries in Elutants from Charcoal Samplers

Criterion 1. There must be at least one fluorescence peak in the range of 540.0 to 545.8 nm in the sample.

Criterion 2. The dye concentration associated with the fluorescence peak must be at least 3 times the detection limit. The eosine detection limit in elutant samples is 0.050 ppb, thus this dye concentration limit equals 0.150 ppb.

Criterion 3. The dye concentration must be at least 10 times greater than any other concentration reflective of background at the sampling station in question.

Criterion 4. The shape of the fluorescence peak must be typical of eosine. Much background fluorescence yields low, broad, and asymmetrical fluorescence peaks rather than the more narrow and symmetrical fluorescence peaks typical of eosine. In addition, there must be no other factors which suggest that the fluorescence peak may not be eosine dye from our groundwater tracing work.

Normal Criteria Used by the OUL for Determining Eosine Dye Recoveries in Water Samples

Criterion 1. In most cases, the associated charcoal samplers for the station should also contain eosine dye in accordance with the criteria listed above. This criterion may be waived if no charcoal sampler exists.

Criterion 2. There must be no factors which suggest that the fluorescence peak may not be eosine dye from our groundwater tracing work. The fluorescence peak should generally be in the range of 532.8 to 537.3 nm.

Criterion 3. The dye concentration associated with the fluorescence peak must be at least three times the detection limit. Our eosine detection limit in water samples is 0.015 ppb, thus this dye concentration limit equals 0.045 ppb.

Criterion 4. The dye concentration must be at least 10 times greater than any other concentration reflective of background at the sampling station in question.

FLUORESCEIN

Normal Criteria Used by the OUL for Determining Fluorescein Dye Recoveries in Elutants from Charcoal Samplers

Criterion 1. There must be at least one fluorescence peak in the range of 514.5 to 519.6 nm in the sample.

Criterion 2. The dye concentration associated with the fluorescence peak must be at least 3 times the detection limit. The fluorescein detection limit in elutant samples is 0.025 ppb, thus this dye concentration limit equals 0.075 ppb.

Criterion 3. The dye concentration must be at least 10 times greater than any other concentration reflective of background at the sampling station in question.

Criterion 4. The shape of the fluorescence peak must be typical of fluorescein. Much background fluorescence yields low, broad, and asymmetrical fluorescence peaks rather than the more narrow and symmetrical fluorescence peaks typical of fluorescein. In addition, there must be no other factors which suggest that the fluorescence peak may not be fluorescein dye from our groundwater tracing work.

Normal Criteria Used by the OUL for Determining Fluorescein Dye Recoveries in Water Samples

Criterion 1. In most cases, the associated charcoal samplers for the station should also contain fluorescein dye in accordance with the criteria listed above. This criterion may be waived if no charcoal sampler exists.

Criterion 2. There must be no factors which suggest that the fluorescence peak may not be fluorescein dye from our groundwater tracing work. The fluorescence peak should generally be in the range of 506.8 to 510.6 nm.

Criterion 3. The dye concentration associated with the fluorescence peak must be at least three times the detection limit. Our fluorescein detection limit in water samples is 0.002 ppb, thus this dye concentration limit equals 0.006 ppb.

Criterion 4. The dye concentration must be at least 10 times greater than any other concentration reflective of background at the sampling station in question.

RHODAMINE WT

Normal Criteria Used by the OUL for Determining Rhodamine WT Dye Recoveries in Elutants from Charcoal Samplers

Criterion 1. There must be at least one fluorescence peak in the sample in the range of 565.2 to 571.8 nm.

Criterion 2. The dye concentration associated with the rhodamine WT peak must be at least 3 times the detection limit. The detection limit in elutant samples is 0.170 ppb, thus this dye concentration limit equals 0.510 ppb.

Criterion 3. The dye concentration must be at least 10 times greater than any other concentration reflective of background at the sampling station in question.

Criterion 4. The shape of the fluorescence peak must be typical of rhodamine WT. In addition, there must be no other factors which suggest that the fluorescence peak may not be dye from the groundwater tracing work under investigation.

Normal Criteria Used by the OUL for Determining Rhodamine WT Dye Recoveries in Water Samples

Criterion 1. In most cases, the associated charcoal samplers for the station should also contain rhodamine WT dye in accordance with the criteria listed above. These criteria may be waived if no charcoal sampler exists.

Criterion 2. There must be no factors which suggest that the fluorescence peak may not be rhodamine WT dye from the tracing work under investigation. The fluorescence peak should generally be in the range of 572.4 to 577.7 nm.

Criterion 3. The dye concentration associated with the fluorescence peak must be at least three times the detection limit. Our rhodamine WT detection limit in water samples is 0.015 ppb, thus this dye concentration limit is 0.045 ppb.

Criterion 4. The dye concentration must be at least 10 times greater than any other concentration reflective of background at the sampling station in question.

SULFORHODAMINE B

Normal Criteria Used by the OUL for Determining Sulforhodamine B Dye Recoveries in Elutants from Charcoal Samplers

Criterion 1. There must be at least one fluorescence peak in the sample in the range of 576.4 to 583.2 nm.

Criterion 2. The dye concentration associated with the sulforhodamine B peak must be at least 3 times the detection limit. The detection limit in elutant samples is 0.080 ppb, thus this dye concentration limit equals 0.240 ppb.

Criterion 3. The dye concentration must be at least 10 times greater than any other concentration reflective of background at the sampling station in question.

Criterion 4. The shape of the fluorescence peak must be typical of sulforhodamine B. In addition, there must be no other factors which suggest that the fluorescence peak may not be dye from the groundwater tracing work under investigation.

Normal Criteria Used by the OUL for Determining Sulforhodamine B dye Recoveries in Water Samples

Criterion 1. In most cases, the associated charcoal samplers for the station should also contain sulforhodamine B dye in accordance with the criteria listed earlier. This criterion may be waived if no charcoal sampler exists.

Criterion 2. There must be no factors which suggest that the fluorescence peak may not be sulforhodamine B dye from the tracing work under investigation. The fluorescence peak should generally be in the range of 580.8 to 584.4 nm.

Criterion 3. The dye concentration associated with the fluorescence peak must be at least three times the detection limit. The detection limit in water is 0.008 ppb, thus this dye concentration limit equals 0.024 ppb.

Criterion 4. The dye concentration must be at least 10 times greater than any other concentration reflective of background at the sampling station in question.

Standard Footnotes

Sometimes not all the criteria are met for a straight forward determination of tracer dye in a sample. For these reasons, the emission graph is scrutinized carefully by the analytical technician and again during the QA/QC process. Sometimes the emission graphs require interpretation as to whether or not a fluorescence peak represents the tracer dye or not. Background samples from each of the sampling stations aid in the interpretation of the emission fluorescence graphs. When the results do not meet all the criteria for a positive dye detection, often the fluorescence peak is quantified and flagged with a footnote to the result as not meeting all the criteria for a positive dye detection. Standard footnotes are as follows:

Single asterisk (*): A fluorescence peak is present that does not meet all the criteria for a positive dye recovery. However, it has been calculated as though it were the tracer dye.

Double asterisk (**): A fluorescence peak is present that does not meet all the criteria for this dye. However, it has been calculated as a positive dye recovery.

Other footnotes specific to the fluorescence signature are sometimes also used. These footnotes are often developed for a specific project.

The quantification of fluorescence peaks that do not meet all the criteria for a positive dye detection can be important for interpretation of the dataset as a whole.

ATTACHMENT 1

Sample Collection Data Sheet

OZARK UNDERGROUND LABORATORY, INC.

1572 Aley Lane Protem, MO 65733 (417) 785-4289 fax (417) 785-4290 email: contact@ozarkundergroundlab.com

SAMPLE COLLECTION DATA SHEET for FLUORESCENCE ANALYSIS

Project _____ **Week No:** ___ **Samples Collected By:** _____

Samples Shipped By: _____ **Samples Received By:** _____

Date Samples Shipped: _____ **Date Samples Received:** _____ **Time Samples Received:** _____ **Return Cooler? Yes** ☐ **No** ☐

Bill to: _____ **Send Results to:** _____

Analyze for: ☐ **Fluorescein** ☐ **Eosine** ☐ **Rhodamine WT** ☐ **Other** _____ **Ship cooler to:** _____

OUL use only		***Please indicate stations where dye was visible in the field*** *for field technician use - use black ink only*						*OUL use only*
# CHAR REC'D	**LAB NUMBER**	**STATION NUMBER 1-4 Numbers**	**STATION NAME**	**PLACED**		**COLLECTED**		**# WATER REC'D**
				DATE	**TIME**	**DATE**	**TIME**	

COMMENTS _____

_____

This sheet filled out by OUL staff? Yes ☐ **No** ☐ **Charts for samples on this page proofed by OUL:** _____

OUL Project No._____ **Date Analyzed:**_____ **Analyzed By:**_____

SCS ENGINEERS

Transmittal

Little Rock, AR

PROJECT:	Lakeshore Rec,Landfill Siting,AR 27222139.01	DATE:	5/7/2024
SUBJECT:	NABORS Supplemental Hydro. Investigation and Dye Test Report	TRANSMITTAL ID:	00004
PURPOSE:	For your use and distribution	VIA:	Info Exchange

FROM

NAME	COMPANY	EMAIL	PHONE
Dan McCullough Little Rock, AR	SCS Engineers	DMcCullough@scsengineers.com	+1-501-503-4778

TO

NAME	COMPANY	EMAIL	PHONE
sadler@adeq.state.ar.us		sadler@adeq.state.ar.us	

REMARKS:

Bill;
The attached are the NABORS Reports for the investigations conducted by LRS. If you have any questions let me know.

Dan

DESCRIPTION OF CONTENTS

QTY	DATED	TITLE	NOTES
1	5/7/2024	2.15 NABORS Report Final.pdf	
1	5/7/2024	NABORS Dye Test Report v.0.2 2.29.24 3.26.24.pdf	

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