9/17/19

NOTICE TO CONTRACTORS

GEOTECHNICAL WORKSHOP

R60140
Hwy. 70 East – Hwy. 7 North (F)

A geotechnical workshop has been scheduled for

Thursday, October 3, 2019 at 1:00 P.M.

at the Materials Annex of the Arkansas Department of Transportation.

The purpose of this meeting is to allow Contractors to review soil and rock samples, review geotechnical findings and to receive information on how to interpret geophysical data contained in the geotechnical report.

For more information contact the Department's Materials Division.
11301 West Baseline
Little Rock, Arkansas 72209
Phone: (501) 569-2185
Paul.Tinsley@ardot.gov

ARDOT
ARKANSAS DEPARTMENT OF TRANSPORTATION

ARKANSAS DEPARTMENT OF TRANSPORTATION

SUBSURFACE INVESTIGATION

STATE JOB NO. R60140

FEDERAL AID PROJECT NO. STPF-9210(38)

HWY. 70 EAST – HWY. 7 NORTH (F)

STATE HIGHWAY 7 **SECTION** 10

IN GARLAND **COUNTY**

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.

ARKANSAS DEPARTMENT OF TRANSPORTATION
ArDOT.gov | IDriveArkansas.com | Scott E. Bennett, P.E., Director
MATERIALS DIVISION
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September 3, 2019

TO: Mr. Rick Ellis, Bridge Engineer

SUBJECT: Job No. R60140
Hwy. 70 East – Hwy. 7 North (S)
Garland County
Route TBD, Section TBD

Transmitted herewith is a brief summary of the geology and site conditions, rock mass rating summary (RMR), unconfined compressive strength test results, and the logs of the borings conducted for the structures and approaches of the above referenced project. The samples obtained by the Standard Penetration Tests were brought to the laboratory and visually classified by experienced lab personnel. The rock cores are available for inspection at the Materials Division.

The purpose of this project is to construct a new extension of the Hot Springs bypass. It will extend north from the existing Highway 70/270 interchange and will tie in at the intersection of Highways 5 and 7. It is located on a new alignment and will traverse extreme topography and diverse geology. The bridges included in this project, in order from south to north, are as follows: Main Lanes over Spring Street, Main Lanes over Highway 70 East / West, Main Lanes over Grand Avenue (Frontage Road), West-North Ramp over Grand Avenue (Frontage Road), Promise Land Road Overpass, Main Lanes over Covenant Trail Road, Mill Creek Road Overpass, Denise Lane over Main Lanes, Main Lanes over Quarry Mountain Road, and Main Lanes over Saline River.

Main Lanes over Spring Street

There are two bridges proposed for the main lanes over Spring Street, one for northbound and one for southbound travel lanes. However, only the northbound bridge will be constructed in this phase of the project. Two borings were obtained in the vicinity of the southbound bridge.

Based on the depth at which bedrock was encountered it is anticipated that end bents will be founded on piling. Piling should be tipped in competent Shale to Shale with Sandstone. Preboring may be necessary in order to achieve minimum pile penetration requirements.

Main Lanes over Highway 70 East / West

The main lanes over Highway 70 has two proposed structures, one for travel in each direction. However, only the northbound bridge will be constructed in this phase. The proposed structure is to be constructed west of the existing Highway 70 eastbound off-ramp to Highway 70B west.

Based on conversations with Bridge Design and the depth at which bedrock was encountered it is anticipated that all bents will be founded on piling. Piling should be tipped in competent Shale to Shale with Sandstone. Preboring may be necessary in order to achieve minimum pile penetration requirements.

Main Lanes over Grand Avenue (Frontage Road)

The proposed Main Lane Bridge over Grand Avenue (Frontage Road) will be a single structure, constructed full-width for northbound and future southbound travel lanes.

Based on plans provided by Bridge Design and the findings from this subsurface investigation, it is anticipated that end bents will be founded on piling and all interior bents will be founded on spread footings. Spread Footings founded in competent Shale to Shale with Sandstone should be designed based on the values provided in Table 1.

TABLE 1 – Bearing Capacity Recommendations for Spread Footings

Presumptive Bearing Resistance at Service Limit State (ksf)
12

West-North Ramp over Grand Avenue (Frontage Road)

This proposed bridge is a northbound on-ramp. It will carry traffic over Grand Ave. (Frontage Road) and will allow vehicles traveling west on Highway 70 to transition to northbound travel on this new section of Highway.

Based on plans provided by Bridge Design and the findings from this subsurface investigation, it is anticipated that end bents will be founded on piling and interior bents will be founded on spread footings. Spread Footings founded in competent Shale to Shale with Sandstone should be designed based on the values provided in Table 2.

TABLE 2 – Bearing Capacity Recommendations for Spread Footings

Presumptive Bearing Resistance at Service Limit State (ksf)
12

Promise Land Road Overpass

The proposed Promise Land Road Overpass will extend over the large rock cut for the main lanes traveling through this area. The proposed structure is located downslope and south of the existing roadway. No borings were obtained in the vicinity of the proposed bridge due to steep slopes and rough terrain. However, there were borings obtained upslope from the bridge, in the existing roadway, during the subsurface exploration for the cut slope area. The rock encountered in these borings is expected to be similar enough that bearing resistance recommendations can be made. During construction, the Materials Division should be provided access by the contractor to advance borings and confirm design assumptions.

Based on plans provided by Bridge Design, it is anticipated that end bents will be founded on piling and interior bents will be founded on spread footings. Preboring may be necessary to achieve minimum pile penetration requirements. Spread Footings founded in competent Novaculite or Sandstone should be designed based on the values provided in Table 3.

TABLE 3 – Bearing Capacity Recommendations for Spread Footings

Presumptive Bearing Resistance at Service Limit State (ksf)
20

Main Lanes over Covenant Trail Road

The main lanes over Covenant Trail Road has two proposed structures, one for travel in each direction. However, only the northbound bridge will be constructed in this phase. This proposed bridge will carry traffic over Covenant Trail Road.

There were a total of six borings requested for this proposed structure. However, landowner permission was only granted for three of these borings. The borings that were not obtained were located at: 718+25 23' Rt. of Const. C.L., 719+75 23' Rt. of Const. C.L., and 720+52.5 23' Rt. of Const. C.L.. No borings were obtained in the vicinity of the future southbound bridge due to time constraints, rough terrain, and landowner permissions.

Based on plans provided by Bridge Design and the findings from this subsurface investigation, it is anticipated that all bents will be founded on piling. Piling should be tipped in competent Shale to Shale with Sandstone. Preboring may be necessary in order to achieve minimum pile penetration requirements.

Mill Creek Road Overpass

The proposed Mill Creek Road Overpass is to be built just south of the existing Mill Creek Road and will extend over the main lanes of the proposed bypass. It will connect the existing Mill Creek Road on both sides of the proposed bypass travel lanes and will allow traffic to flow unimpeded over the new bypass. It will also provide access points for vehicles entering or exiting the proposed bypass.

There were a total of five boring locations requested for this proposed structure but only four borings were obtained. Some borings had to be offset due to unfavorable field conditions. The only boring not obtained was located at 115+22 C.L. Construction.

Based on plans provided by Bridge Design and the findings from this subsurface investigation, it is anticipated that all bents will be founded on piling. Piling should be tipped in competent Shale. Preboring may be necessary in order to achieve minimum pile penetration requirements. Artesian pressure was encountered in all four boring locations. It is recommended that a rock layer wrapped in Type 10 separation fabric be utilized to catch and funnel this water away from the foundation locations.

Denise Lane over Main Lanes

The proposed Denise Lane Bridge will extend over the main lanes of the proposed bypass. It will be built in a new location and will connect to the existing Denise Lane to maintain access from Mill Creek Road.

There were a total of three borings requested for this bridge. All three borings were obtained but two of them had to be offset due to unfavorable field conditions.

Based on plans provided by Bridge Design and the findings from this subsurface investigation, it is anticipated that all bents will be founded on piling. Piling should be tipped in competent Shale or Sandstone. Preboring may be necessary in order to achieve minimum pile penetration requirements.

Main Lanes over Quarry Mountain Road

The proposed main lane bridges in this location will carry traffic over the existing Quarry Mountain Road. There are two proposed structures at this location, one for travel in each direction. However, only the northbound bridge will be constructed at this time.

There were a total of 8 requested borings, four for each bridge. Only four borings were obtained due to time restraints, conflicts with utilities, and unfavorable field conditions.

Based on plans provided by Bridge Design and the findings from this subsurface investigation, it is anticipated that all bents will be founded on piling. Piling should be tipped in competent Shale or Sandstone. Preboring may be necessary in order to achieve minimum pile penetration requirements.

Main Lanes over Saline River

The proposed bridges at this location will carry the main lanes of the proposed bypass over the Saline River Tributary. There are two proposed structures at this location, one for travel in each direction. However, only the northbound bridge will be constructed in this phase.

There were a total of 6 borings requested at this site, three for each bridge. Only two borings for the northbound bridge were obtained but they had to be offset due to conflicts with utilities, traffic, and unfavorable field conditions.

Based on plans provided by Bridge Design and the findings from this subsurface investigation, it is anticipated that all bents will be founded on piling. Piling should be tipped in competent Shale. Preboring may be necessary in order to achieve minimum pile penetration requirements

MSE Walls

There are several MSE walls throughout this project. However, no borings were obtained specifically for the MSE walls due to the time constraints placed on this project. Listed below in Table 4 is a minimum factored bearing resistance pertaining to the foundation material for all of the MSE walls on this project.

TABLE 4 – Bearing Capacity Recommendations for M.S.E. Walls

Factored Bearing Resistance (ksf)
4

If the required bearing pressure for any of the MSE walls on this project exceeds the recommended bearing capacity, Materials Division personnel should be notified and the foundation material will be evaluated in the field and a recommendation will be provided at that time.

Upgraded Embankment Fill

The attached Special Provision: Compacted Embankment Special details the material and testing requirements for the utilization of upgraded embankment fill material. Upgraded fill material shall be placed in the bottom 20 feet of embankments 40 feet tall or taller. Bridge approach embankments that require 2H:1V side slopes shall be constructed of upgraded fill for full depth. Upgraded fill shall also be placed in natural drainage areas that are being filled with embankment material and require the use of a cross drain.

If you have any questions concerning these recommendations, please contact the Geotechnical Section.

Michael C. Benson
Materials Engineer

MCB:rpt:mlg

cc: State Construction Engineer - Master File Copy
District 6 Engineer
G.C. File

GEOLOGY AND SITE CONDITIONS
Job No. R60140
Hwy. 70 East – Hwy. 7 North (S)
Garland County
Route TBD Section TBD

Site Conditions

There are 10 bridge sites and 11 bridges associated with this project that will complete the Hot Springs Bypass connecting Route 70 to Route 7. The generalized subsurface conditions for the bridges are described below.

Bridges 1 through 4 and 8

The first four bridges will be **Main Lanes Over Spring Street**, **Main Lanes Over Highway 70,** and **Main Lanes and Northbound Ramp Over Grand Avenue**. These bridges are being constructed to add two additional lanes to the existing bridges that cross Spring Street, Highway 70, and Grand Avenue Frontage Road. An on-ramp that crosses Grand Avenue is also being constructed. Bridge 8 will be **Denise Lane Over Main Lanes** Frontage Road.

The project alignment for these five bridges is located in the mapped outcrop of the Stanley Group of Mississippian age (Ms) in the Ouachita Mountain region. The Stanley is composed of dark-gray shale interbedded with fine-grained sandstone. Minor amounts of tuff, chert, and conglomerate have been noted in various parts of the sequence. The tuffs seem to be restricted to the lower part with the cherts sometimes being found in middle and upper parts of the formation. The total thickness of the Stanley Group is hard to ascertain due to intense folding and faulting, but has been measured to be approximately 3,500 feet. Area outcrops are cut by quartz veins and igneous dikes. Numerous quartz veins were observed, but no igneous dikes were encountered in local outcrops or in borings; however, igneous dikes could be encountered during excavation.

Subsurface Conditions for **Main Lanes Over Spring Street** borings (Stations 617+20 to 618+08) may be generalized as follows:

0 to 9.5 Feet:	Varies from moist, very stiff, reddish brown **sandy clay** to moist, very dense, reddish brown **sand and gravel**.
9.5 to 15.3 Feet:	Consists of highly weathered, soft, reddish gray **shale.**
15.3 to 49.0 Feet:	Consists of weathered to unweathered, medium hard, slickensided, frequently fractured gray **shale** with frequent to occasional interbedded **sandstone and quartz layers**, **partings and seams**.

Subsurface conditions for **Main Lanes over Highway 70** borings (Stations 624+25 to 628+23) may be generalized as follows:

0.0 to 11.1 Feet: Varies from moist to wet, soft to very hard, brown and gray **clay with gravel (rock fragments)**.

11.1 to 23.8 Feet: Varies from highly weathered to unweathered, very soft to medium hard, gray slickensided **shale** with frequent fractures and frequent **sandstone partings, layers, seams, and mineral veins** to moist, medium stiff gray **clay** with gravel to moist, medium dense, **clayey sand with gravel**.

23.8 to 59.4 Feet: Consists of slightly weathered to unweathered, very soft to medium hard, gray slickensided **shale** with frequent fractures and frequent **sandstone partings, layers, seams, and mineral veins**.

The boring drilled at station 625+10 encountered shale at the surface. This is likely due to the low elevation of this boring in relation to the other borings. The boring drilled at station 628+23 encountered concrete, most likely the edge of the existing bridge footings of concrete spoils left from previous construction, at approximately 8.7 to 11.1 feet below ground level.

Subsurface Conditions for **Main Lanes Over Grand Avenue Frontage Road** and the **Northbound Ramp Over Grand Avenue Frontage Road** borings (Stations 635+34 to 638+46) may be generalized as follows:

0.0 to 5.0 Feet: Varies from moist, very hard, light-brown and gray **clay with gravel and cobbles** to highly weathered to weathered, slickensided, gray to dark-gray **shale** with frequent to occasional fractures, **mineral veins, and sandstone partings, layers and seams**.

5.0 to 44.0 Feet: Consists of weathered to unweathered, medium hard to hard, slickensided, gray to dark-gray **shale** with frequent to occasional fractures, **mineral veins, and sandstone partings, layers and seams**.

The borings drilled at 636+43, 638+13, and 638+46 encountered thick layers of **quartz and calcite**.

Subsurface Conditions for **Denise Lane Over Main Lanes** borings (Stations 102+74 to 105+67) may be generalized as follows:

0.0 to 4.5 Feet: Varies from moist, stiff, brown **clay with gravel** to dry to moist, very dense, gray **sand with clay and some gravel (rock fragments)**.

4.5 to 28.8 Feet: Consists of highly weathered to slightly weathered, frequently fractured, steeply dipping, slickensided, gray to dark gray **shale** with frequent to occasional **sandstone and quartz layers and seams**.

28.8 to 43.8 Feet: Varies from weathered to unweathered, medium hard, frequently fractured, steeply dipping, slickensided, gray to dark-gray **shale** with frequent to occasional **sandstone and quartz layers and seams** to weathered to slightly weathered, cemented, frequently to occasionally fractured, gray **sandstone** with frequent to occasional **shale layers and seams**.

Some of the borings for this bridge contained thick mineral veins. The boring at station 105+67 had considerably more sandstone than the other two borings. The driller noted a possible 1.4 feet thick void at approximately 29.8 feet below ground level, however, based on the nature of this particular formation, it is likely that this "void" can be interpreted as a highly weathered or highly fractured layer within the surrounding formation.

Bridge 5

The fifth bridge is the **Promise Land Road Overpass.** This part of the project consists of shifting a section of the existing Promise Land Road south and converting it into an overpass over the main lanes of the proposed bypass. No borings were made along the proposed alignment do to access restrictions, but based on borings made to the north of the proposed bridge location; it can be assumed that the proposed bridge footings will be founded in Arkansas Novaculite.

The Arkansas Novaculite is the main ridge former in this area and throughout the Ouachitas due to its resistance to erosion. In general, the overburden above the novaculite observed was between 4 and 10 feet thick. Based on core and outcrop evaluation, novaculite in this section is hard, massive, and extremely fractured. It is highly variable in texture, bed thickness, and weathering; but overall, the rock quality tended to improve with depth. Some sections of the novaculite in this area have a glassy texture and composition. The Arkansas Novaculite consists of three recognized divisions. The lower division is a white, massive-bedded novaculite with some interbedded gray shales near its base. The middle division consists of greenish to dark gray shales interbedded with many thin beds of dark novaculite. The upper division is a white, thick-bedded, often calcareous novaculite. The formation rests conformably on the Missouri Mountain Formation in most places. The formation may attain a thickness of up to 900 feet in its southern outcrops, but thins rapidly to about 60 feet to the north.

No borings were drilled for the **Promise Land Overpass**. Based on existing geologic maps of the area and borings made for cut slopes nearby, the subsurface conditions may be generalized as follows:

0.0 to 5.0 Feet: Consists of **clayey sand with gravel (**weathered **novaculite)**.
5.0 to 100 Feet: Likely consists of weathered, hard, frequently fractured **novaculite**.

Bridge 6 and 8

Bridge 6 and 8 are **Main Lanes Over Covenant Trail** and the **Mill Creek Road Overpass.** The project alignment for these bridges is located in the mapped outcrop of Ordovician aged Bigfork Chert. Drilling for these bridges yielded poor sample return due to the extremely fractured nature of the rock.

The Bigfork Formation consists of thin-bedded, light-brown to dark-gray, cryptocrystalline chert interbedded with varying amounts of black siliceous shale, calcareous siltstone, and dense, bluish-gray limestone. The cherts normally occur in thin to medium beds and are usually highly fractured. The contact between the Bigfork Chert and the underlying Womble Shale is conformable. The Bigfork Chert in Arkansas ranges in thickness from about 450 feet in the northern Ouachitas to about 750 feet in the southern Ouachitas. This formation tends to be extremely fractured and folded resulting in inconsistent bed dips.

Subsurface Conditions for **Main Lanes Over Covenant Trail** borings (Stations 721+53 to 722+64) may be generalized as follows:

0.0 to 7.2 Feet: Varies from moist to wet, very dense, brown and gray **gravel (rock fragments) with sand and clay** to moist, very hard, brown and gray **sandy clay with gravel (rock fragments)**.

7.2 to 12.2 Feet: Varies from moist to wet, very dense, brown and gray **gravel (rock fragments) with sand and clay** to moist, very hard, brown and gray **sandy clay with gravel (rock fragments)** to highly weathered to slightly weathered, medium hard to hard, light to dark-gray **shale** with frequent fractures and **quartz veins**.

12.2 to 42.2 Feet: Consists of slightly weathered to unweathered, medium hard to hard, gray to dark-gray **shale** with frequent to occasional fractures, **quartz veins, and sandstone layers**.

Subsurface Conditions for **Mill Creek Road Overpass** borings (Stations 112+41 to 114+85) may be generalized as follows:

0.0 to 9.2 Feet: Consists of wet, loose, medium dense, brown to light-gray **clayey sand with gravel and occasional silt, cobbles, and boulders**.

9.2 to 14.6 Feet: Varies from wet, loose to very dense, **clayey sand with gravel and silt** to highly weathered to weathered, siliceous, frequently fractured, dark-gray **shale**.

14.6 to 50.0 Feet: Consists of weathered to unweathered, siliceous, frequently fractured, dark gray **shale with traces of chert and quartz**.

Bridges 9 and 10

These bridges are **Main Lanes Over Quarry Mountain Road** and **Main Lanes Over Saline River**. The alignment for the Quarry Mountain Road Bridge is slightly north of the mapped contact between the Bigfork Formation and older Ordovician aged rock. It is likely that this bridge is located in the Ordovician aged Womble shale and sandstone due to the high sandstone content and the reduced structural deformation of the shales observed in the core. The proposed alignment for the Saline River Bridge is also most likely located in the Womble Formation due to the presence of limestone in the core.

The Womble Formation is mostly black shale with thin layers of limestone, silty sandstone, and some chert. Cleavage, at an angle to bedding, frequently displays ribboned cleavage surfaces. The sandstones are dark-gray, compact, fine-grained, occasionally conglomeratic, and may be phosphatic. These sandstones are generally present in the lower part of the formation. Dense, blue-gray limestones usually occur near the top of the formation in thin to medium beds. Black chert is also present as thin layers at the top of the formation. Large milky quartz veins often fill fractures in the formation. The formation rests conformably on the underlying Blakely Sandstone and ranges from 500 to 1200 feet in thickness.

Main Lanes Over Quarry Mountain Road borings (Stations 854+67 to 856+42) may be generalized as follows:

0.0 to 4.8 Feet: Varies from **clayey sand with gravel** to highly weathered, medium hard, light-brown to light-gray **shale**.

4.8 to 33.9 Feet: Varies from highly weathered to weathered, medium hard, gray to dark-gray **shale** with occasional fractures and occasional **sandstone and mineral layers**.

33.9 to 54.2 Feet: Varies from weathered to slightly weathered, medium hard, gray to dark-gray **shale** with frequent to occasional fractures and occasional sandstone, siltstone, and mineral layers.

It is likely that this bridge is located exclusively in the Womble Formation due to the high sandstone content and the reduced structural deformation of the shales observed in the core.

Subsurface Conditions for **Main Lanes Over Saline River** borings (Stations 921+82 to 923+29) may be generalized as follows:

0.0 to 4.6 Feet: Consists of moist, medium dense, brown **silty sand with gravel**.

4.6 to 10.4 Feet: Varies from moist, medium dense, brown **silty sand with gravel** to slightly weathered to weathered, medium hard, gray **shale with** frequent **calcite layers and seams**.

10.4 to 37.8 Feet: Varies from weathered to unweathered, medium hard, gray **shale with frequent to occasional calcite and limestone layers and seams** to unweathered, moderately hard, gray **limestone** with frequent fractures and frequent to occasional **shale and calcite layers and seams**.

The proposed alignment for this bridge lies close to the mapped contact between the Bigfork Formation and the underlying Womble Formation. It is likely that this bridge is located exclusively in the Womble Formation due to the presence of limestone in the core and the absence of silt and chert typically observed in the Bigfork Formation.

ARKANSAS DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

JOB NO. R60140

COMPACTED EMBANKMENT SPECIAL

Description. This Special Provision shall be supplementary to Section 210, Excavation and Embankment, of the Standard Specifications, Edition of 2014.

Materials and Construction Requirements. Material for areas shown on the plans as Compacted Embankment Special shall include stone obtained from on-site cuts or an approved source and shall consist of hard and durable limestone, sandstone, dolomite, chert, novaculite, or rock-like shale. Shale shall have a minimum slake durability index (SDI) of 95% as tested according to AHTD Test Method 399. The SDI shall be determined by the Contractor using the above method at least once per 3000 cubic yards. The stone shall be greater than 1 1/2" and less than 30", angular, with fractured faces on at least 75% of the surface and shall not contain more than 10% overburden or fines less than 1 1/2" in maximum cross-section. The stone shall weigh not less than 140 pounds per solid cubic foot and shall have a percent of wear not greater than 45 by Los Angeles Test (AASHTO T 96).

The benching requirements stated in SubSection 210.09 of the Standard Specifications shall be strictly enforced. These requirements apply to all fill compacted against hill sides including cut to fill transitions along the alignment.

Quality Control and Acceptance Testing. In addition to the required test, the Engineer may require the Contractor to test any location that, by visual inspection appears different from previously approved material. If the material source is consistent, the Engineer may modify the standard lot size for slake durability and to one test for each material type encountered.

Method of Measurement. All embankments constructed as described above will be measured as Compacted Embankment in accordance with Section 210 of the Standard Specifications.

Basis of Payment. All embankments constructed as described above shall be paid in accordance with section 210.13 of the Standard Specifications.

Payment will be made under:

Pay Item	**Pay Unit**
Compacted Embankment	Cubic Yard

Rock Core Unconfined Compression Test Summary

Project Number: R60140
Project Name: Hwy. 70 East - Hwy. 7 North (S)
Date Tested: 5/2/2019

Station	Location	Sample No.	Depth (ft.)	Diameter (in)	Height (in)	Total Load (lbs.)	Correction Factor	Stress (psi)	Remarks
617+20	26' Lt.	1	23.0	1.75	3.55	7,070	1.00	2,939	SH
617+20	26' Lt.	2	31.3	1.75	3.45	16,500	1.00	6,860	SH w/ Freq. SS L & S
617+20	26' Lt.	3	32.0	1.75	4.10	11,510	1.00	4,785	SH w/ Freq. SS L & S
617+20	26' Lt.	4	43.3	1.75	3.40	22,720	1.00	9,446	SH w/ Interbedded SS
617+20	26' Lt.	5	46.4	1.75	3.95	5,140	1.00	2,137	SH w/ Freq. SS L & S
618+08	26' Lt.	6	21.4	1.75	3.60	20,680	1.00	8,598	SH w/ Intbd SS L & S
618+08	26' Lt.	7	25.7	1.75	3.65	40,490	1.00	16,834	SH
618+08	26' Lt.	8	28.4	-	Broke	-	N/A	No Test	SH w/ Intbd SS L & S
618+08	26' Lt.	9	32.6	1.75	3.65	28,840	1.00	11,990	SH w/ Intbd SS L & S
618+08	26' Lt.	10	35.8	1.75	4.45	39,170	1.00	16,285	SH
618+08	26' Lt.	11	39.7	1.75	4.05	12,740	1.00	5,297	SH w/ SS P & S
618+08	26' Lt.	12	43.0	1.75	4.25	13,850	1.00	5,758	SH w/ SS P & S

Spring Street Overpass

Terminology

SS = Sandstone
SH = Shale
WTD = Weathered
L & S = Layers and Seams
Freq. = Frequent
Occ. = Occasional
Intbd = Interbedded
P & S = Partings and Seams

ROCK MASS RATING SUMMARY

JOB # R60140

Spring Street Overpass

SAMPLE #1

Station/Location	617+20, 26' LT
Depth (ft)	23
	Relative Rating
Uniaxial Compressive Strength	2
RQD	3
Spacing of Joints	20
Condition of Joints	20
Groundwater Conditions	7
Sum	*52*
Class Number	III
Description	FAIR ROCK

SAMPLE #1

Station/Location	617+20, 26' LT
Depth (ft)	31.3
	Relative Rating
Uniaxial Compressive Strength	4
RQD	3
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*30*
Class Number	IV
Description	POOR ROCK

SAMPLE #3

Station/Location	617+20, 26' LT
Depth (ft)	32
	Relative Rating
Unlaxial Compressive Strength	4
RQD	3
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*30*
Class Number	IV
Description	POOR ROCK

SAMPLE #4

Station/Location	617+20, 26' LT
Depth (ft)	43.3
	Relative Rating
Uniaxial Compressive Strength	7
RQD	8
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	*48*
Class Number	III
Description	FAIR ROCK

SAMPLE #5

Station/Location	617+20, 26' LT
Depth (ft)	46.4
	Relative Rating
Uniaxial Compressive Strength	4
RQD	8
Spacing of Joints	20
Condition of Joints	12
Groundwater Conditions	7
Sum	*51*
Class Number	III
Description	FAIR ROCK

SAMPLE #6

Station/Location	618+08, 26' LT
Depth (ft)	21.4
	Relative Rating
Uniaxial Compressive Strength	7
RQD	13
Spacing of Joints	20
Condition of Joints	12
Groundwater Conditions	7
Sum	*59*
Class Number	III
Description	FAIR ROCK

SAMPLE #7

Station/Location	618+08, 26' LT
Depth (ft)	25.7
	Relative Rating
Uniaxial Compressive Strength	12
RQD	17
Spacing of Joints	25
Condition of Joints	12
Groundwater Conditions	7
Sum	*73*
Class Number	II
Description	GOOD ROCK

SAMPLE #8

Station/Location	618+08, 26' LT
Depth (ft)	28.4
	Relative Rating
Uniaxial Compressive Strength	N/A
RQD	20
Spacing of Joints	25
Condition of Joints	20
Groundwater Conditions	7
Sum	*72*
Class Number	II
Description	GOOD ROCK

SAMPLE #9

Station/Location	618+08, 26' LT
Depth (ft)	32.6
	Relative Rating
Uniaxial Compressive Strength	7
RQD	20
Spacing of Joints	25
Condition of Joints	20
Groundwater Conditions	7
Sum	*79*
Class Number	II
Description	GOOD ROCK

SAMPLE #10

Station/Location	618+08, 26' LT
Depth (ft)	35.8
	Relative Rating
Uniaxial Compressive Strength	12
RQD	20
Spacing of Joints	25
Condition of Joints	20
Groundwater Conditions	7
Sum	*84*
Class Number	I
Description	VERY GOOD ROCK

SAMPLE #11

Station/Location	618+08, 26' LT
Depth (ft)	39.7
	Relative Rating
Uniaxial Compressive Strength	4
RQD	20
Spacing of Joints	25
Condition of Joints	20
Groundwater Conditions	7
Sum	*76*
Class Number	II
Description	GOOD ROCK

SAMPLE #12

Station/Location	618+08, 26' LT
Depth (ft)	43
	Relative Rating
Uniaxial Compressive Strength	4
RQD	20
Spacing of Joints	25
Condition of Joints	20
Groundwater Conditions	7
Sum	*76*
Class Number	II
Description	GOOD ROCK

Rock Core Unconfined Compression Test Summary

Project Number: R60140
Project Name: Hwy. 70 East - Hwy. 7 North (S)
Date Tested: 5/9/2019

Station	Location	Sample No.	Depth (ft.)	Diameter (in)	Height (in)	Total Load (lbs.)	Correction Factor	Stress (psi)	Remarks
624+25	27' Lt.	1	37.1	1.75	3.50	16,570	1.00	6,889	SH
624+25	27' Lt.	2	42.9	1.75	-	-	N/A	Broke	SH
624+25	27' Lt.	3	52.0	1.75	3.47	35,280	1.00	14,668	SH w/ Intbd SS
624+25	27' Lt.	4	52.9	1.75	3.45	17,530	1.00	7,288	SS w/ Intbd SH
624+25	27' Lt.	5	55.3	1.75	3.54	14,950	1.00	6,215	SH w/ Intbd SS
625+10	27' Lt.	6	18.3	1.75	3.25	11,450	1.00	4,760	SH w/ some SS P & S
625+10	27' Lt.	7	19.0	1.75	3.52	23,750	1.00	9,874	SH w/ freq. SS P & S
625+10	27' Lt.	8	21.3	1.75	4.25	22,390	1.00	9,309	SH w/ Intbd SS
625+10	27' Lt.	9	28.6	1.75	4.05	29,650	1.00	12,327	SH
625+10	27' Lt.	10	31.3	1.75	3.80	17,390	1.00	7,230	SH
625+10	27' Lt.	11	36.7	1.75	3.95	3,500	1.00	1,455	SH w/ Intbd SS
625+10	27' Lt.	12	41.9	1.75	3.76	5,500	1.00	2,287	SH w/ Intbd SS
625+10	27' Lt.	13	45.8	1.75	-	-	N/A	Broke	SH
626+35	27' Lt.	14	28.1	1.75	3.56	4,620	1.00	1,921	SH
626+35	27' Lt.	15	32.2	1.75	3.54	7,080	1.00	2,944	SH w/ SS P & S
626+35	27' Lt.	16	37.2	1.75	3.49	7,680	1.00	3,193	SH w/ freq. SS P & S
626+35	27' Lt.	17	43.5	1.75	3.52	16,780	1.00	6,976	SH w/ freq. SS L & S
626+35	27' Lt.	18	50.5	1.75	3.46	18,610	1.00	7,737	SH & SS (lower part)
626+35	27' Lt.	19	52.1	1.75	3.50	4,600	1.00	1,912	SH w/ Intbd SS
627+32	26' Lt.	20	16.8	1.75	3.54	40,150	1.00	16,692	SH
627+32	26' Lt.	21	24.9	1.75	3.25	8,470	1.00	3,521	SH w/ SS L & S & Quartz seam
627+32	26' Lt.	22	39.4	1.75	3.40	5,550	1.00	2,307	SH w/ Intbd SS
627+32	26' Lt.	23	48.0	1.75	3.67	10,000	1.00	4,157	SH w/ freq. SS L & S

Main Lanes over Hwy. 70 East/West

Terminology

SS = Sandstone
SH = Shale
WTD = Weathered
L & S = Layers and Seams
Freq. = Frequent
Occ. = Occasional
Intbd = Interbedded
P & S = Partings and Seams

ROCK MASS RATING SUMMARY

JOB # R60140

Main Lanes over Hwy. 70 East/West

SAMPLE #1

Station/Location	624+25, 27' LT
Depth (ft)	37.1
	Relative Rating
Uniaxial Compressive Strength	4
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*35*
Class Number	IV
Description	POOR ROCK

SAMPLE #2

Station/Location	624+25, 27' LT
Depth (ft)	42.9
	Relative Rating
Uniaxial Compressive Strength	N/A
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*31*
Class Number	IV
Description	POOR ROCK

SAMPLE #3

Station/Location	624+25, 27' LT
Depth (ft)	52
	Relative Rating
Uniaxial Compressive Strength	7
RQD	20
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*50*
Class Number	III
Description	FAIR ROCK

SAMPLE #4

Station/Location	624+25, 27' LT
Depth (ft)	52.9
	Relative Rating
Uniaxial Compressive Strength	4
RQD	20
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	*57*
Class Number	III
Description	FAIR ROCK

SAMPLE #5

Station/Location	624+25, 27' LT
Depth (ft)	55.3
	Relative Rating
Uniaxial Compressive Strength	4
RQD	20
Spacing of Joints	25
Condition of Joints	6
Groundwater Conditions	7
Sum	*62*
Class Number	II
Description	GOOD ROCK

SAMPLE #6

Station/Location	625+10, 27' LT
Depth (ft)	18.3
	Relative Rating
Uniaxial Compressive Strength	4
RQD	13
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	*50*
Class Number	III
Description	FAIR ROCK

SAMPLE #7

Station/Location	625+10, 27' LT
Depth (ft)	19
	Relative Rating
Uniaxial Compressive Strength	7
RQD	17
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*47*
Class Number	III
Description	FAIR ROCK

SAMPLE #8

Station/Location	625+10, 27' LT
Depth (ft)	21.3
	Relative Rating
Uniaxial Compressive Strength	7
RQD	13
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*43*
Class Number	III
Description	FAIR ROCK

SAMPLE #9

Station/Location	625+10, 27' LT
Depth (ft)	28.6
	Relative Rating
Uniaxial Compressive Strength	7
RQD	13
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	53
Class Number	III
Description	FAIR ROCK

SAMPLE #10

Station/Location	625+10, 27' LT
Depth (ft)	31.3
	Relative Rating
Uniaxial Compressive Strength	4
RQD	17
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	54
Class Number	III
Description	FAIR ROCK

SAMPLE #11

Station/Location	625+10, 27' LT
Depth (ft)	36.7
	Relative Rating
Uniaxial Compressive Strength	1
RQD	13
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	47
Class Number	III
Description	FAIR ROCK

SAMPLE #12

Station/Location	625+10, 27' LT
Depth (ft)	41.9
	Relative Rating
Uniaxial Compressive Strength	2
RQD	17
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	52
Class Number	III
Description	FAIR ROCK

SAMPLE #13

Station/Location	625+10, 27' LT
Depth (ft)	45.8
	Relative Rating
Uniaxial Compressive Strength	N/A
RQD	17
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	50
Class Number	III
Description	FAIR ROCK

SAMPLE #14

Station/Location	626+35, 27' LT
Depth (ft)	28.1
	Relative Rating
Uniaxial Compressive Strength	2
RQD	13
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	48
Class Number	III
Description	FAIR ROCK

SAMPLE #15

Station/Location	626+35, 27' LT
Depth (ft)	32.2
	Relative Rating
Uniaxial Compressive Strength	2
RQD	8
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	43
Class Number	III
Description	FAIR ROCK

SAMPLE #16

Station/Location	626+35, 27' LT
Depth (ft)	37.2
	Relative Rating
Uniaxial Compressive Strength	2
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	33
Class Number	IV
Description	POOR ROCK

SAMPLE #17

Station/Location	626+35, 27' LT
Depth (ft)	43.5
	Relative Rating
Uniaxial Compressive Strength	4
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	35
Class Number	IV
Description	POOR ROCK

SAMPLE #18

Station/Location	626+35, 27' LT
Depth (ft)	50.5
	Relative Rating
Uniaxial Compressive Strength	7
RQD	13
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	43
Class Number	III
Description	FAIR ROCK

SAMPLE #19

Station/Location	626+35, 27' LT
Depth (ft)	52.1
	Relative Rating
Uniaxial Compressive Strength	2
RQD	17
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	42
Class Number	III
Description	FAIR ROCK

SAMPLE #20

Station/Location	627+32, 27' LT
Depth (ft)	16.8
	Relative Rating
Uniaxial Compressive Strength	12
RQD	3
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	38
Class Number	IV
Description	POOR ROCK

SAMPLE #21

Station/Location	627+32, 27' LT
Depth (ft)	24.9
	Relative Rating
Uniaxial Compressive Strength	2
RQD	3
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	28
Class Number	IV
Description	POOR ROCK

SAMPLE #22

Station/Location	627+32, 27' LT
Depth (ft)	39.4
	Relative Rating
Uniaxial Compressive Strength	2
RQD	13
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	38
Class Number	IV
Description	POOR ROCK

SAMPLE #23

Station/Location	627+32, 27' LT
Depth (ft)	48
	Relative Rating
Uniaxial Compressive Strength	4
RQD	13
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	50
Class Number	III
Description	FAIR ROCK

Rock Core Unconfined Compression Test Summary

Project Number: R60140
Project Name: Hwy. 70 East - Hwy. 7 North (S)
Date Tested: 6/12/2019

Station	Location	Sample No.	Depth (ft.)	Diameter (in)	Height (in)	Total Load (lbs.)	Correction Factor	Stress (psi)	Remarks
636+42	22' Rt	1	13.3	1.75	---	Broke before testing			SH
636+42	22' Rt	2	13.8	1.75	---	Broke before testing			SH w/ SS Seams
637+06	22' Lt	3	16.7	1.75	4.33	1,000	1.00	416	SH w/ Freq. SS L & S
637+37	22' Rt	4	13.2	1.75	2.98	15,170	0.976	6,156	SH w/ Freq. SS L & S
637+37	22' Rt	5	14.9	1.75	---	Broke before testing			SH w/ Freq. SS L & S
637+37	22' Rt	6	15.9	1.75	4.72	36,480	1.00	15,167	SH w/ Occ. SS P & S
637+86	22' Lt	7	10.4	1.75	3.98	8,910	1.00	3,704	SH w/ SS L & P (Crack in Seam)
637+86	22' Lt	8	12.4	1.75	3.45	4,040	1.00	1,680	SH
637+86	22' Lt	9	13.2	1.75	4.89	10,960	1.00	4,557	SH

Main Lanes over Grand Ave. Frontage Road

Terminology

SS = Sandstone
SH = Shale
WTD = Weathered
L & S = Layers and Seams
Freq. = Frequent
Occ. = Occasional
Intbd = Interbedded
P & S = Partings and Seams

ROCK MASS RATING SUMMARY

JOB # R60140

Main Lanes over Grand Ave. Frontage Road

SAMPLE #1

Station/Location	636+42, 22'Rt
Depth (ft.)	13.3
	Relative Rating
Uniaxial Compressive Strength	N/A
RQD	3
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*26*
Class Number	IV
Description	POOR ROCK

SAMPLE #2

Station/Location	636+42, 22'Rt
Depth (ft.)	13.8
	Relative Rating
Uniaxial Compressive Strength	N/A
RQD	3
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*26*
Class Number	IV
Description	POOR ROCK

SAMPLE #3

Station/Location	637+06, 22'Lt
Depth (ft.)	16.7
	Relative Rating
Uniaxial Compressive Strength	4
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*35*
Class Number	IV
Description	POOR ROCK

SAMPLE #4

Station/Location	637+37, 22'Rt
Depth (ft.)	13.2
	Relative Rating
Uniaxial Compressive Strength	4
RQD	17
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*44*
Class Number	III
Description	FAIR ROCK

SAMPLE #5

Station/Location	637+37, 22'Rt
Depth (ft.)	14.9
	Relative Rating
Uniaxial Compressive Strength	N/A
RQD	17
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	*50*
Class Number	III
Description	FAIR ROCK

SAMPLE #6

Station/Location	637+37, 22'Rt
Depth (ft.)	15.9
	Relative Rating
Uniaxial Compressive Strength	12
RQD	17
Spacing of Joints	20
Condition of Joints	6
Groundwater Conditions	7
Sum	*62*
Class Number	II
Description	GOOD ROCK

SAMPLE #7

Station/Location	637+86, 22'Lt
Depth (ft.)	10.4
	Relative Rating
Uniaxial Compressive Strength	4
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*35*
Class Number	IV
Description	POOR ROCK

SAMPLE #8

Station/Location	637+86, 22'Lt
Depth (ft.)	12.4
	Relative Rating
Uniaxial Compressive Strength	2
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*33*
Class Number	IV
Description	POOR ROCK

SAMPLE #9

Station/Location	637+83, 22'Lt
Depth (ft.)	13.2
	Relative Rating
Uniaxial Compressive Strength	4
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*35*
Class Number	**IV**
Description	**POOR ROCK**

Rock Core Unconfined Compression Test Summary

Project Number: R60140
Project Name: Hwy. 70 East - Hwy. 7 North (S)
Date Tested: 6/11/2019

Station	Location	Sample No.	Depth (ft.)	Diameter (in)	Height (in)	Total Load (lbs.)	Correction Factor	Stress (psi)	Remarks
636+79	CL	1	12.8	1.75	3.38	18,970	1.00	7,887	SH
636+79	CL	2	18.9	1.75	3.57	26,620	1.00	11,067	SH
636+08	CL	3	8.5	1.75	3.60	25,290	1.00	10,514	SH
636+08	CL	4	9.8	1.75	3.61	13,533	1.00	5,626	SH
637+58	CL	5	15.8	1.75	---	Broke before testing			SH w/ SS Seams

NB Ramp over Grand Ave. (Frontage Road)

Terminology

SS = Sandstone
SH = Shale
WTD = Weathered
L & S = Layers and Seams
Freq. = Frequent
Occ. = Occasional
Intbd = Interbedded
P & S = Partings and Seams

ROCK MASS RATING SUMMARY

JOB # R60140

NB Ramp over Grand Ave. Frontage Road

SAMPLE #1

Station/Location	636+79, CL
Depth (ft.)	12.8
	Relative Rating
Uniaxial Compressive Strength	7
RQD	3
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*33*
Class Number	IV
Description	POOR ROCK

SAMPLE #2

Station/Location	636+79, CL
Depth (ft.)	18.9
	Relative Rating
Uniaxial Compressive Strength	7
RQD	3
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*33*
Class Number	IV
Description	POOR ROCK

SAMPLE #3

Station/Location	636+08, CL
Depth (ft.)	8.5
	Relative Rating
Uniaxial Compressive Strength	7
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*38*
Class Number	IV
Description	POOR ROCK

SAMPLE #4

Station/Location	636+08, CL
Depth (ft.)	9.8
	Relative Rating
Uniaxial Compressive Strength	4
RQD	8
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*35*
Class Number	IV
Description	POOR ROCK

SAMPLE #5

Station/Location	637+58, CL
Depth (ft.)	15.8
	Relative Rating
Uniaxial Compressive Strength	N/A
RQD	13
Spacing of Joints	10
Condition of Joints	6
Groundwater Conditions	7
Sum	*36*
Class Number	IV
Description	POOR ROCK

Rock Core Unconfined Compression Test Summary

Project Number: R60140
Project Name: Hwy. 70 East - Hwy. 7 North (S)
Date Tested: 7/8/2019

Station	Location	Sample No.	Depth (ft.)	Diameter (in)	Height (in)	Total Load (lbs.)	Correction Factor	Stress (psi)	Remarks
102+75	C.L.	1	14.0	1.75	3.95	1,070	1.00	445	SH
103+96	60' Lt	2	14.0	1.75	4.38	1,230	1.00	511	SH
105+17	C.L.	3	15.6	1.75	Too Small to Test				SS
Denise Lane over Main Lanes									

Terminology

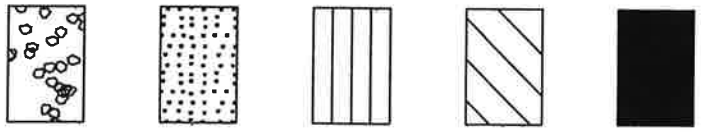
SS = Sandstone
SH = Shale
WTD = Weathered
L & S = Layers and Seams
Freq. = Frequent
Occ. = Occasional
Intbd = Interbedded
P & S = Partings and Seams

LEGEND

SOIL TYPES

(SHOWN IN SYMBOL COLUMN)

(PREDOMINANT TYPE SHOWN HEAVY)



GRAVEL | SAND | SILT | CLAY | ORGANIC MATTER

ROCK TYPES

(SHOWN IN SYMBOL COLUMN)



SANDSTONE | SHALE or SILTSTONE | LIMESTONE or DOLOMITE | ALTERNATING LAYERS of SHALE and SANDSTONE | OTHER

SAMPLER TYPES

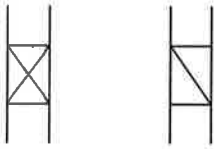
(SHOWN IN SAMPLE COLUMN)

SHELBY TUBE



UNDISTURBED SAMPLE RECOVERY | DISTURBED SAMPLE RECOVERY | NO RECOVERY

SPLIT SPOON



SAMPLE RECOVERY | NO RECOVERY

ROCK CORING



% RECOVERY INDICATED ON LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

GRANULAR SOIL		CLAY		CLAY-SHALE		SHALE	
"N" Value	Density	"N" Value	Consistency	"N" Value	Consistency	"N" Value	Consistency
0-4	Very Loose	0-1	Very Soft	0-1	Very Soft		
5-10	Loose	2-4	Soft	2-4	Soft	31-60	Soft
11-30	Medium Dense	5-8	Medium Stiff	5-8	Medium Stiff	Over 60	
31-50	Dense	9-15	Stiff	9-15	Stiff	More than 2"	
Over 50	Very Dense	16-30	Very Stiff	16-30	Very Stiff	Penetration	
		31-60	Hard	31-60	Hard	in 60 Blows:	Medium Hard
		Over 60	Very Hard	Over 60	Very Hard	Less than 2"	
						Penetration	
						in 60 Blows:	Hard

1. Ground water elevations indicated on boring logs represent ground water elevations at date or time shown on boring log. Absence of water surface implies that no ground water data is available but does not necessarily mean that ground water will not be encountered at locations or within the vertical reaches of these borings.
2. Borings represent subsurface conditions at their respective locations for their respective depths. Variations in conditions between or adjacent to boring locations may be encountered.
3. Terms used for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System.

Standard Penetration Test – Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 1.0 foot into undisturbed soil with a 140-pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6.0 inches to seat into undisturbed soil, and then perform the test. The number of hammer blows for seating the spoon and performing the test are recorded for each 6 inches of penetration on the drill log. The field "N" Value (N_f) can be obtained by adding the bottom two numbers for example: $\frac{6}{8-9} \Rightarrow 8+9=17 blows/ft$. The "N" Value corrected to 60% efficiency (N_{60}) can be obtained by multiplying N_f by the hammer correction factor published on the boring log.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Spring Street
STATION: 617+20
LOCATION: 27' Left of Construction Centerline
LOGGED BY: Tracy Henderson

DATE: April 3, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 49

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 479.2	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
5		X	Moist, Very Stiff, Reddish Brown Sandy Clay						4 10-14		
10		X	SHALE - Highly Weathered, Medium Hard, Red and Gray						12 36-60		
15		X							33 60 (4")		
			SHALE - Slightly Weathered, Medium Hard, Occasional Sandstone Partings and Fractures, Gray							45	8
20			SHALE - Unweathered, Medium Hard, Occasional Sandstone Partings and Fractures, Gray							62	36
25			SHALE - Unweathered, Medium Hard, Frequent Fractures, Slickensides, and Quartz Layers and Seams, Gray							50	8
30			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Gray							97	36
35											

REMARKS: *Poor sample recovery due to core barrel malfunction.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Spring Street
STATION: 617+20
LOCATION: 27' Left of Construction Centerline
LOGGED BY: Tracy Henderson

DATE: April 3, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 49

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 479.2	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Frequent Fractures and Quartz Veins, Gray*							56	0
40										96	10
45			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Gray							94	48
50			Boring Terminated								
55											
60											
65											
70											

REMARKS: *Poor sample recovery due to core barrel malfunction.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Spring Street
STATION: 618+08
LOCATION: 26' Left of Construction Centerline
LOGGED BY: Daniel Dickerson

DATE: April 1, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 480.7								
5			Moist, Very Dense, Reddish Brown Sand and Gravel						17 28-28		
10			SHALE - Highly Weathered, Medium Hard, Gray						13 37-60 (10")		
15			SHALE - Weathered, Medium Hard, Occasional Sandstone Partings and Seams, Gray							60	0
20			SHALE WITH INTERBEDDED SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Occaional Fractures, Gray							80	52
25										99	46
30			SHALE WITH INTERBEDDED SANDSTONE LAYERS AND SEAMS - Unweathered, Medium							99	78
35										99	99

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Spring Street
STATION: 618+08
LOCATION: 26' Left of Construction Centerline
LOGGED BY: Daniel Dickerson

DATE: April 1, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 480.7								
			Hard, Gray							99	99
40			SHALE - Unweathered, Medium Hard, Occasional Sandstone Partings, Layers, and Seams, Gray							98	88
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 624+25
LOCATION: 27' Left Construction Centerline
LOGGED BY: Daniel Dickerson

DATE: March 26, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 59.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 486.0								
5			Moist, Very Dense, Sand with Gravel (Rock Fragments)						17 29-34		
10									23 37-41		
15									26 37-34		
20			Moist, Medium Dense, Clayey Sand and Gravel (Shale Fragments)						11 10-11		
25			SHALE - Highly Weathered, Medium Hard, Gray						27 60 (5")		
			SHALE - Highly Weathered, Medium Hard, Frequent Fractures, Slickensided, Gray							50	0
30			SHALE - Unweathered, Medium Hard, Occasional Fractures, Slickensided, Gray							84	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 624+25
LOCATION: 27' Left Construction Centerline
LOGGED BY: Daniel Dickerson

DATE: March 26, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 59.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 486.0	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE - Unweathered, Medium Hard, Slickensided, Occasional Mineral Veins, Gray							100	32
40			SHALE - Unweathered, Medium Hard, Frequent Fractures, Occasional Mineral Veins, Slickensided, Gray							96	22
45			SHALE - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray								
			SANDSTONE WITH INTERBEDDED SHALE - Well Cemented, Frequent Fractures, Slickensided, Occasional Quartz Layers, Gray							96	62
50			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Slickensided, Gray							99	80
55										100	100
60			Boring Terminated								
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 625+10
LOCATION: 27' Left Construction Centerline
LOGGED BY: Daniel Dickerson

DATE: March 26, 2017
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 49.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 471.6								
5		X	SHALE - Highly Weathered, Very Soft, Gray						4 5-3		
10		X							3 2-2		
15		X	SHALE - Weathered, Medium Hard, Gray						5 10 (1")		
20			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Calcareous In Part, Frequent Fractures, Gray							99	46
25			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Occasional Fractures, Slickensided, Calcareous, Gray							100	86
30			SHALE - Unweathered, Medium Hard, Occasional Fractures, Slickensided, Gray SANDSTONE - Unweathered, Well Cemented, Gray SHALE - Unweathered, Medium Hard, Occasional Sandstone Nodules, Gray							100	58
35			SHALE WITH OCCASIONAL CALCAREOUS SANSTONE LAYERS - Unweathered, Medium Hard, Slickensided, Gray							100	84

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 625+10
LOCATION: 27' Left Construction Centerline
LOGGED BY: Daniel Dickerson

DATE: March 26, 2017
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 49.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 471.6	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Occasional Fractures, Calcareous, Gray							100	50
40											
			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Occasional Fractures and Mineral Veins, Gray							100	78
45											
										100	80
50			Boring Terminated								
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 626+35
LOCATION: 27' Left of Construction Centerline
LOGGED BY: Tracy Henderson

DATE: April 3, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 58.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 482.1								
5			Moist, Medium Stiff, Gray Clay with Gravel (Rock Fragments)						4 4-3		
10									4 2-3		
15			Moist, Stiff, Gray Sandy Clay with Gravel (Rock Fragments)						2 5-5		
20			Moist, Very Stiff, Gray Sandy Clay with Gravel (Shale Fragments)						5 9-11		
25			SHALE SHALE - Slightly Weathered, Medium Hard, Gray SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Occasional Fractures, Gray						60 (5")	47	22
30			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Trace Quartz Veins, Gray							99	76
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 626+35
LOCATION: 27' Left of Construction Centerline
LOGGED BY: Tracy Henderson

DATE: April 3, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 58.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 482.1								
			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Occasional Fractures, Gray							87	23
40			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures and Quartz Veins, Slickensided, Gray							99	46
45			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Slickensided, Frequent Quartz Veins, Gray							96	24
50										92	55
55			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Occasional Fractures, Slickensided, Gray								
			SHALE - Unweathered, Medium Hard, Gray							100	88
60			Boring Terminated								
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 627+32
LOCATION: 27' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: April 15 and 16, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 48.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 479.3	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Sandy Clay								
			Sandy Clay with Gravel (Shale Fragments)								
5			Moist, Medium Dense, Gray Gravel (Shale Fragments)						11 9-7		
10			Moist, Stiff, Brown Clay with Gravel						6 5-6		
15			SHALE - Highly Weathered, Medium Hard, Gray						100 (6")		
			SHALE - Unweathered, Medium Hard, Slickensided, Occasional Quartz Layers, Gray							95	15
20			SHALE - Unweathered, Medium Hard, Frequent Fractures and Mineral Veins, Slickensided, Gray							68	0
25			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							94	7
30										86	30
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 627+32
LOCATION: 27' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: April 15 and 16, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 48.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 479.3	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Frequent Fractures and Mineral Veins, Slickensided, Gray							94	40
40										97	52
45			SHALE WITH FREQUENT SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Occasional Fractures and Mineral Veins, Slickensided, Gray							100	68
50			Boring Terminated								
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 628+23
LOCATION: 68' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: April 16, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 47.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 476.0								
5			Gravel (Rock Fragments)								
		X	Wet, Soft, Gray Clay with Gravel (Rock Fragments)						3 1-2		
10			Wet, Very Hard, Gray Clay with Gravel (Rock Fragments)						13 (1")		
			CONCRETE								
			SHALE WITH FREQUENT SANDSTONE PARTINGS AND SEAMS - Weathered, Medium Hard, Frequent Fractures, Slickensided, Gray							61	0
15			SHALE WITH FREQUENT SANDSTONE PARTINGS AND SEAMS - Slightly Weathered, Medium Hard, Frequent Fractures, Slickensided, Gray							54	0
20			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							33	0
25										83	0
30			SHALE WITH FREQUENT SANDSTONE PARTINGS AND LAYERS - Unweathered, Medium Hard, Occasional Fractures, Slickensided, Gray							80	40
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Hwy. 70 East/West
STATION: 628+23
LOCATION: 68' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: April 16, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 47.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 476.0								
			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS- Unweathered, Medium Hard, Occasional Fractures and Mineral Veins, Slickensided, Gray							91	22
40			SHALE WITH FREQUENT SANDSTONE LAYERS - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							57	0
45			SHALE WITH FREQUENT SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							90	24
50			Boring Terminated								
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 635+34
LOCATION: 26' Left Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 21, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 502.2								
5			HIGHLY WEATHERED SHALE								
10			SHALE - Highly Weathered, Medium Hard, Gray						30 51-60 (11")		
			SHALE - Weathered, Medium Hard, Gray						100 (5")		
15			SHALE WITH FREQUENT SANDSTONE PARTINGS AND SEAMS - Slightly Weathered, Medium Hard, Frequent Fractures, Slickensided, Gray							73	0
20			SHALE - Slightly Weathered, Medium Hard, Occasional Sandstone Partings and Seams, Frequent Fractures, Slickensided, Gray							92	44
25			SHALE - Unweathered, Medium Hard, Occasional Sandstone Partings and Seams, Occasional Mineral Veins, Frequent Fractures, Slickensided, Gray							100	71
30			SHALE - Unweathered, Medium Hard, Frequent Fractures and Mineral Veins, Slickensided, Gray							100	58
35										56	19

REMARKS: Bulldozer work was done on this location before elevations were measured. Lat: 34.50756, Long: -92.974793

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 635+34
LOCATION: 26' Left Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 21, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 502.2	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							88	10
40			SHALE WITH FREQUENT SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Slickensided, Gray							94	82
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: Bulldozer work was done on this location before elevations were measured. Lat: 34.50756, Long: -92.974793

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 635+61
LOCATION: 17' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 20 and 21, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 493.0	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Clay with Gravel and Cobbles								
			SHALE								
5			SHALE - Weathered, Medium Hard, Gray						26 60 (5")		
10									83 60 (4")		
			SHALE - Slightly Weathered, Medium Hard, Frequent Fractures, Slickensided, Gray							61	18
15			SHALE - Unweathered, Medium Hard, Occasional Sandstone Partings and Seams, Slickensided, Gray							77	32
20			SHALE - Unweathered, Medium Hard, Slickensided, Gray							94	85
25			SHALE WITH OCCASIOINAL SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Occasional Pyrite and Fractures, Slickensided, Gray							100	62
30			SHALE WITH OCCASIONAL SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Occasional Fractures, Slickensided, Gray							99	75
35											

REMARKS: Bulldozer work was done on this location before elevations were measured. Lat: 34.507593, Long: -92.974665

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 635+61
LOCATION: 17' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 20 and 21, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 493.0								
			SHALE - Unweathered, Medium Hard, Occasional Sandstone Partings and Seams, Slickensided, Gray							96	96
40			SHALE - Unweathered, Medium Hard, Frequent Fractures, Occasional Mineral Veins, Slickensided, Gray							100	81
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: Bulldozer work was done on this location before elevations were measured. Lat: 34.507593, Long: -92.974665

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 636+04
LOCATION: 21' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 22, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 496.2	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Clay with Gravel (Shale Fragments)								
5			SHALE - Weathered, Medium Hard, Dark Gray						21 39-60		
10									29 60 (5")		
			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Weathered, Medium Hard, Frequent Fractures, Dark Gray							74	0
15			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Weathered, Medium Hard, Frequent Fractures, Occasional Mineral Veins, Dark Gray							12	0
20			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Unweathered, Medium Hard, Frequent Fractures and Mineral Veins, Dark Gray							93	46
25			SHALE - Unweathered, Medium Hard, Frequent Fractures, Dark Gray							55	10
30										92	13
35											

REMARKS: Bulldozer work was done on this location before elevations were measured. Lat: 34.5077716, Long: -92.974765

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 636+04
LOCATION: 21' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 22, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 496.2								
			SHALE WITH OCCASIONAL SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Frequent Fractures, Occasional Mineral Veins, Dark Gray							89	44
40										65	7
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: Bulldozer work was done on this location before elevations were measured. Lat: 34.5077716, Long: -92.974765

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 636+43
LOCATION: 21' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 15 and 16, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 488.7								
			SHALE								
5			SHALE - Weathered, Medium Hard, Dark Gray						23 48-46		
			SHALE - Weathered, Medium Hard, Frequent Fractures, Dark Gray							30	0
10			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Weathered, Medium Hard, Frequent Fractures, Dark Gray							36	0
15			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Slightly Weathered, Medium Hard, Frequent Fractures, Dark Gray							58	26
20			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Unweathered, Medium Hard, Frequent Fractures, Dark Gray							64	8
25			SHALE WITH FREQUENT SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Frequent Fractures, Occasional Thick Mineral Veins, Dark Gray							86	33
			SANDSTONE - Unweathered, Well Cemented, Dark Gray								
30			SHALE WITH FREQUENT SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Frequent Fractures, Occasional Thick Mineral Veins, Dark Gray							98	46
			SHALE WITH FREQUENT SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Occasional Fractures, Dark Gray								
35											

REMARKS: Lat: 34.507824, Lat: -92.974576

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 636+43
LOCATION: 21' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 15 and 16, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 488.7								
			SHALE WITH FREQUENT SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Frequent Fractures, Dark Gray							88	28
40			Boring Terminated								
45											
50											
55											
60											
65											
70											

REMARKS: Lat: 34.507824, Lat: -92.974576

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 5
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 637+09
LOCATION: 19' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: April 30, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 492.1	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE								
5			SHALE - Weathered, Medium Hard, Gray						100 (4")		
			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Weathered, Medium Hard, Frequent Fractures, Gray							43	0
10			SHALE WITH INTERBEDDED SANDSTONE - Slightly Weathered, Medium Hard, Frequent Fractures, Slickensided, Gray							90	26
15			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							85	44
20			SHALE - Unweathered, Medium Hard, Frequent Fractures and Mineral Veins, Slickensided, Gray							90	32
25			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Frequent Fractures, Slickensided, Gray							98	52
30										82	10
35											

REMARKS: Lat: 34.5080343, Long: -92.97475033

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 5
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 637+09
LOCATION: 19' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: April 30, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 492.1								
			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Frequent Fractures and Mineral Veins, Slickensided, Gray							100	50
40			Boring Terminated								
45											
50											
55											
60											
65											
70											

REMARKS: Lat: 34.5080343, Long: -92.97475033

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 6
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 637+48
LOCATION: 35' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: April 24, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 486.6	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Moist, Very Hard, Light Brown Clay								
5			SHALE - Highly Weathered, Medium Hard, Gray						25 60 (2")		
			SHALE WITH OCCASIONAL SANDSTONE PARTINGS - Slightly Weathered, Medium Hard, Slickensided, Gray							71	38
10			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							80	32
15			SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Unweathered, Medium Hard, Occasional Fractures, Slickensided, Gray							100	82
20			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Occasional Fractures, Slickensided, Gray							100	64
25										100	76
30			SHALE WITH OCCASIONAL SANDSTONE PARTINGS - Unweathered, Medium Hard, Occasional Fractures, Slickensided, Gray							96	70
35											

REMARKS: Lat: 34.508057, Long: -92.974578

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 6
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 637+48
LOCATION: 35' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: April 24, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 486.6								
			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							96	45
40			Boring Terminated								
45											
50											
55											
60											
65											
70											

REMARKS: Lat: 34.508057, Long: -92.974578

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 7
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 637+87
LOCATION: 23' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 7, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 490.4								
			SHALE								
5			SHALE - Slightly Weathered, Medium Hard, Dark Gray						40 (1")		
			SHALE - Slightly Weathered, Hard, Frequent Fractures, Dark Gray							75	0
10										100	48
15			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Unweathered, Hard, Occasional Mineral Veins, Frequent Fractures, Dark Gray							96	7
20										90	26
25			SANDSTONE WITH INTERBEDDED SHALE - Unweathered, Well Cemented, Frequent Fractures, Gray							88	0
30										72	0
35											

REMARKS: Lat: 34.5082466, Long: -92.974735

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 7
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 637+87
LOCATION: 23' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 7, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 490.4								
			SHALE WITH FREQUENT SANDSTONE LAYERS - Unweathered, Hard, Frequent Fractures, Dark Gray							72	0
40			SHALE WITH FREQUENT SANDSTONE LAYERS - Unweathered, Hard, Frequent Mineral Veins, Frequent Fractures, Dark Gray							87	9
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: Lat: 34.5082466, Long: -92.974735

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 8
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 638+13
LOCATION: 22' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 7, 2019
TYPE OF DRILLING: Hollow Stem Auger, Diamond Core
EQUIPMENT: Acker 1779
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 492.4	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE								
5			SHALE - Weathered, Medium Hard, Dark Gray						100 (4")		
										48	0
10			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Slightly Weathered, Medium Hard, Frequent Fractures, Dark Gray							66	0
15										46	0
20										71	0
25			SHALE - Unweathered, Hard, Occasional Mineral Layers, Frequent Fractures, Dark Gray							97	11
30			SHALE - Unweathered, Hard, Frequent Fractures and Thick Mineral Layers, Dark Gray								
			SHALE - Unweathered, Hard, Frequent Fractures, Dark Gray							98	12
			SANDSTONE WITH OCCASIONAL SHALE LAYERS - Unweathered, Well Cemented, Frequent Fracture, Gray								
35											

REMARKS: Lat: 34.5083266, Long: -92.974605

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 8
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Grand Avenue
STATION: 638+13
LOCATION: 22' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 7, 2019
TYPE OF DRILLING: Hollow Stem Auger, Diamond Core
EQUIPMENT: Acker 1779
HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 492.4								
			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Unweathered, Hard, Frequent Fractures, Dark Gray							64	0
40			SHALE - Unweathered, Hard, Frequent Fractures, Dark Gray							98	0
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: Lat: 34.5083266, Long: -92.974605

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. NB Ramp 1
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Northbound Ramp Over Grand Avenue
STATION: 636+08
LOCATION: 2' Left of Centerline Northbound Ramp
LOGGED BY: Connor Bunton

DATE: May 15, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 39.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 479.3	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
5			SHALE								
		X	SHALE - Weathered, Medium Hard, Dark Gray						72 60 (5")		
10			SHALE - Slightly Weathered with Occasional Highly Weathered Seams, Medium Hard, Occasional Fractures, Dark Gray							100 99	19 36
15			SHALE WITH OCCASIONAL SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Dark Gray							100	83
20			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Unweathered, Medium Hard, Occasional Fractures, Dark Gray							97	60
25			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Unweathered, Medium Hard, Occasional Mineral Veins, Dark Gray							100	77
30			SHALE WITH OCCASIONAL SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Frequent Fractures, Frequent Thick Mineral Veins, Dark Gray							87	41
35											

REMARKS: Lat: 34.50784445, Long: -92.973933533

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. NB Ramp 1
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Northbound Ramp Over Grand Avenue
STATION: 636+08
LOCATION: 2' Left of Centerline Northbound Ramp
LOGGED BY: Connor Bunton

DATE: May 15, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 39.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 479.3								
			SHALE WITH OCCASIONAL SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Frequent Fractures, Occasional Mineral Veins, Dark Gray							88	10
40			Boring Terminated								
45											
50											
55											
60											
65											
70											

REMARKS: Lat: 34.50784445, Long: -92.973933533

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. NB Ramp 2
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Northbound Ramp Over Grand Avenue
STATION: 636+79
LOCATION: Centerline Northbound Ramp
LOGGED BY: Connor Bunton

DATE: May 14, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 484.7	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE								
5			SHALE - Weathered, Medium Hard, Dark Gray						80 60 (2")		
			SHALE WITH FREQUENT SANDSTONE SEAMS - Slightly Weathered, Medium Hard, Frequent Fractures, Dark Gray							34	0
10			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Slightly Weathered, Medium Hard, Frequent Fractures, Dark Gray							81	0
15			SHALE - Unweathered, Medium Hard, Frequent Fractures, Dark Gray							32	0
20										76	7
25			SHALE - Unweathered, Medium Hard, Frequent Fractures, Occasional Mineral Veins, Dark Gray							40	0
30										47	0
35											

REMARKS: Lat: 34.507959, Long: -92.974041

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. NB Ramp 2
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Northbound Ramp Over Grand Avenue
STATION: 636+79
LOCATION: Centerline Northbound Ramp
LOGGED BY: Connor Bunton

DATE: May 14, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 484.7								
			SHALE WITH FREQUENT SANDSTONE SEAMS AND LAYERS - Unweathered, Medium Hard, Frequent Fractures, Occasional Mineral Veins, Dark Gray							32	7
40										98	30
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: Lat: 34.507959, Long: -92.974041

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. NB Ramp 3
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Northbound Ramp Over Grand Avenue
STATION: 637+57
LOCATION: 2' Left of Centerline Northbound Ramp
LOGGED BY: Connor Bunton

DATE: April 23, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 485.3	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Highly Weathered Shale								
5			SHALE - Weathered, Medium Hard, Gray SHALE WITH OCCASIONAL SANDSTONE PARTINGS AND SEAMS - Slightly Weathered, Medium Hard, Occasional Sandstone Partings and Seams, Frequent Fractures, Slickensided, Gray						30 (1")	62	0
10			SHALE - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							58	0
15			SHALE - Unweathered, Medium Hard, Frequent Fractures, Slickensided, Gray							72	13
20			SHALE - Unweathered, Medium Hard, Frequent Fractures and Calcite Veins, Slickensided, Gray							87	0
25			SHALE - Unweathered, Medium Hard, Frequent Fractures and Mineral Veins, Slickensided, Gray							48	0
30			SHALE WITH FREQUENT SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent to Occasional Fractures,							100	50
35											

REMARKS: Lat: 34.50819783, Long: -92.974174766

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. NB Ramp 3
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Northbound Ramp Over Grand Avenue
STATION: 637+57
LOCATION: 2' Left of Centerline Northbound Ramp
LOGGED BY: Connor Bunton

DATE: April 23, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 485.3								
			Slickensided, Gray							100	64
40			Boring Terminated								
45											
50											
55											
60											
65											
70											

REMARKS: Lat: 34.50819783, Long: -92.974174766

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. NB Ramp 4
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Northbound Ramp Over Grand Avenue
STATION: 638+46
LOCATION: 1' Right of Centerline Northbound Ramp
LOGGED BY: Connor Bunton

DATE: May 6, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 506.7								
			Clay with Gravel								
5											
			SHALE - Medium Hard, Weathered, Gray						18 30-53		
10											
			SHALE - Slightly Weathered, Medium Hard, Frequent Fractures, Dark Gray						18 60 (4")	76	14
			SANDSTONE - Slightly Weathered, Well Cemented, Frequent Fractures, Gray								
15			SHALE - Slightly Weathered, Hard, Fractured Fractures, Dark Gray							54	13
			SANDSTONE - Slightly Weathered, Well Cemented, Frequent Fractures, Gray								
20			SHALE - Unweathered, Hard, Frequent Fractures, Dark Gray							72	7
25										96	26
			SANDSTONE WITH INTERBEDDED SHALE AND FREQUENT THICK MINERAL VEINS - Unweathered, Well Cemented, Frequent Fractures, Gray								
30			SHALE - Unweathered, Hard, Frequent Fractures, Dark Gray							66	0
35											

REMARKS: Lat: 34.5083691, Long: -92.974247866

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. NB Ramp 4
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Northbound Ramp Over Grand Avenue
STATION: 638+46
LOCATION: 1' Right of Centerline Northbound Ramp
LOGGED BY: Connor Bunton

DATE: May 6, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 506.7								
			SHALE - Unweathered, Hard, Frequent Quartz/ Calcite Seams and Layers, Frequent Fractures, Dark Gray							71	0
40			SHALE WITH FREQUENT SANDSTONE LAYERS - Unweathered, Hard, Dark Gray							100	69
			SANDSTONE - Unweathered, Well Cemented, Gray								
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: Lat: 34.5083691, Long: -92.974247866

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Covenant Trail
STATION: 721+53
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: July 11 and 17, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 37.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 596.1								
			Sandy Clay with Gravel								
5			Wet, Very Dense, Brown and Gray Gravel with Sand and Clay						15 24-54		
10			SHALE - Slightly Weathered, Medium Hard, Dark Gray						100 (6")	35	0
15										20	0
20										20	0
25			SHALE - Unweathered, Hard, Siliceous, Frequent Fractures, Dark Gray*							22	0
30										26	0
35											

REMARKS: * Bit failure resulting in no recovery from 32.8 to 37.8' below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Covenant Trail
STATION: 721+53
LOCATION: 25' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: July 11 and 17, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 37.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 596.1								
			Boring Terminated								
40											
45											
50											
55											
60											
65											
70											

REMARKS: * Bit failure resulting in no recovery from 32.8 to 37.8' below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Covenant Trail
STATION: 722+28
LOCATION: 40' Right of Centerline
LOGGED BY: Connor Bunton

DATE: July 22 and 23, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 42.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 599.8	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Sand with Gravel and Cobbles								
5			Moist, Very Dense, Light Gray Sand with Gravel (Sandstone Fragments)						20 25-40 (11")		
10			SHALE - Highly Weathered to Slightly Weathered, Medium Hard, Frequent Fractures and Quartz Veins, Gray*							13	0
15			SHALE - Slightly Weathered, Medium Hard, Frequent Fractures, Gray							11	0
20										9	0
25										8	0
30			SHALE - Unweathered to Weathered, Medium Hard, Frequent Fractures, Gray							7	0
35										4	0

REMARKS: *Partial water loss from 7.2 feet to 42.2 feet below ground level. Poor sample recovery throughout due to rock fractures.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Covenant Trail
STATION: 722+28
LOCATION: 40' Right of Centerline
LOGGED BY: Connor Bunton

DATE: July 22 and 23, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 42.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 599.8								
40			No recovery							0	0
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: *Partial water loss from 7.2 feet to 42.2 feet below ground level. Poor sample recovery throughout due to rock fractures.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Covenant Trail
STATION: 722+64
LOCATION: 12' Right of Construction Centerline
LOGGED BY: Stanley Bates

DATE: July 17, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 600.0								
5			Moist, Very Hard, Brown and Gray Sandy Clay with Gravel						60 (5")		
10			SANDSTONE WITH INTERBEDDED SHALE - Unweathered, Well Cemented, Frequent Fractures, Dark Gray						10 (0")	20	0
15										16	0
20										12	0
25			SHALE - Unweathered, Hard, Siliceous, Frequent Fractures, Occasional Mineral Veins, Dark Gray							6	0
30										0	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Covenant Trail
STATION: 722+64
LOCATION: 12' Right of Construction Centerline
LOGGED BY: Stanley Bates

DATE: July 17, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 600.0								
										5	0
40			Boring Terminated								
45											
50											
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Mill Creek Rd. Overpass
STATION: 112+41
LOCATION: 3' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 25, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 549.1								
			Sandy Clay with Gravel								
5			Wet, Medium Dense, Light Gray Silty Sand with Gravel						9 10-16		
10			SHALE - Highly Weathered, Medium Hard, Dark Gray						30 60 (5")		
										24	0
15										8	0
20										8	0
25			SHALE - Unweathered, Medium Hard, Siliceous, Dark Gray							21	0
30										9	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Mill Creek Rd. Overpass
STATION: 112+41
LOCATION: 3' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 25, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 549.1								
										21	0
40											
										30	0
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Mill Creek Rd. Overpass
STATION: 113+16
LOCATION: 10' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 19, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 50

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 546.3								
			Gravel and Cobbles								
			Clayey Sand with Gravel								
5			Wet, Medium Dense, Brown Clayey Sand with Gravel						7 5-7		
10			Wet, Very Dense, Brown Clayey Sand with Gravel						9 60 (4")		
			SHALE - Weathered, Medium Hard, Siliceous, Dark Gray							50	0
15										14	0
20										20	0
25			SHALE - Weathered, Medium Hard, Siliceous, Frequent Fractures, Dark Gray							52	0
30										10	0
35											

REMARKS: * Catastrophic bit failure at 39.0' below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Mill Creek Rd. Overpass
STATION: 113+16
LOCATION: 10' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 19, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 50

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 546.3								
										12	0
										0	0
40											
			SHALE - Weathered, Medium Hard, Siliceous, Frequent Fractures, Dark Gray*								
45											
50											
			Boring Terminated								
55											
60											
65											
70											

REMARKS: * Catastrophic bit failure at 39.0' below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Mill Creek Rd. Overpass
STATION: 113+71
LOCATION: Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 20 and 24, 2019
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 546.1								
5			Wet, Medium Dense, Brown Clayey Sand with Gravel						15 9-9		
			Clayey Sand with Gravel and Cobbles								
10			SHALE - Weathered, Medium Hard, Siliceous, Dark Gray						100 (5")		
15									48 60 (4")		
20			SHALE - Unweathered, Medium Hard, Siliceous, Dark Gray						76 60 (4")		
25									3 4-60 (11")		
30											
35			SHALE - Unweathered, Medium Hard,						3 4-4		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Mill Creek Rd. Overpass
STATION: 113+71
LOCATION: Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 20 and 24, 2019
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 44

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 546.1								
			Siliceous, Trace Chert, Dark Gray								
40											
			SHALE - Unweathered, Medium Hard, Siliceous, Trace Quartz, Dark Gray						4 / 1-1		
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Mill Creek Rd. Overpass
STATION: 114+85
LOCATION: 6' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 26, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 50

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 547.4								
			Gravel and Cobbles with Sand								
5									8 7-3		
			Wet, Loose, Brown Clayey Sand with Gravel								
10									20 33-60 (10")		
			SHALE - Highly Weathered, Medium Hard, Dark Gray								
15									3 28-60		
			SHALE - Weathered, Medium Hard, Siliceous, Dark Gray								
20									10 (0")		
			SHALE - Unweathered, Hard, Siliceous, Trace Quartz, Dark Gray								
25											
30									100 (4")		
			SHALE - Unweathered, Medium Hard,								
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Mill Creek Rd. Overpass
STATION: 114+85
LOCATION: 6' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 26, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 50

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 547.4								
			Siliceous, Dark Gray								
40											
45			SHALE - Unweathered, Medium Hard, Siliceous, Trace Quartz, Dark Gray								
50											
			Boring Terminated								
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy 70 East - Hwy 7 North (S)
Denise Lane Over Main Lanes
STATION: 102+74
LOCATION: Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 29, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 53.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 557.1								
			Clay with Gravel								
5									7 18-36		
			SHALE - Highly Weathered, Soft, Dark Gray								
10									44 56 (4")		
			SHALE - Highly Weathered, Medium Hard with Soft Layers, Frequent Fractures, Dark Gray							59	0
15											
			SHALE - Weathered, Medium Hard, Frequent Fractures, Dark Gray							56	16
20										64	8
25			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Weathered, Medium Hard, Frequent Fractures, Occasional Mineral Veins, Dark Gray							22	0
30			SHALE							0	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
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JOB NO. R60140 Garland County
JOB NAME: Hwy 70 East - Hwy 7 North (S)
Denise Lane Over Main Lanes
STATION: 102+74
LOCATION: Construction Centerline
LOGGED BY: Connor Bunton

DATE: May 29, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 53.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 557.1	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SHALE - Weathered, Medium Hard, Frequent Fractures, Occasional Thick Mineral Veins, Dark Gray							20	0
40										40	0
45			SHALE - Weathered, Medium Hard, Frequent Fractures, Dark Gray							48	0
50			SHALE WITH OCCASIONAL SANDSTONE SEAMS - Weathered, Medium Hard, Frequent Fractures, Dark Gray							40	12
55			Boring Terminated								
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy 70 East - Hwy 7 North (S)
Denise Lane Over Main Lanes
STATION: 103+63
LOCATION: 52' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 3 and 4, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 54

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 549.9								
			Moist, Brown Clay with Gravel								
5			Moist, Stiff, Brown Clay						3 5-5		
10			SHALE - Weathered, Medium Hard, Gray						85 60 (2")		
										69	0
15			SHALE - Slightly Weathered, Medium Hard, Frequent Fractures, Steeply Dipping, Slickensided, Gray							68	21
20										22	0
25										34	0
30										13	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
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JOB NO. R60140 Garland County
JOB NAME: Hwy 70 East - Hwy 7 North (S)
Denise Lane Over Main Lanes
STATION: 103+63
LOCATION: 52' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 3 and 4, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 54

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 549.9								
			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Frequent Fractures, Steeply Dipping, Slickensided, Gray							54	0
40										81	52
45										36	12
50			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Steeply Dipping, Slickensided, Gray							61	46
55			Boring Terminated								
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy 70 East - Hwy 7 North (S)
Denise Lane Over Main Lanes
STATION: 105+67
LOCATION: 53' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 4 and 5, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 545.9	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Moist, Redish Brown Clay with Gravel								
5			Dry, Very Dense, Gray Sand with Gravel (Rock Fragments)						100 (5")		
			SANDSTONE - Weathered, Cemented, Frequent Fractures, Gray							40	0
10			SHALE - Slightly Weathered, Medium Hard, Occasional Sandstone Layers and Seams, Frequent Fractures, Steeply Dipping, Slickensided, Gray							56	0
15										66	27
20			SHALE - Unweathered, Medium Hard, Steeply Dipping, Occasional Quartz Layers, Slickensided, Gray							68	66
25			SHALE - Weathered, Medium Hard, Frequent Fractures, Slickensided, Gray							10	0
30			SANDSTONE WITH FREQUENT SHALE LAYERS AND SEAMS - Weathered, Cemented, Frequent Fractures, Gray*							30	0
35											

REMARKS: * Driller noted a possible 1.4 feet thick void at approximately 29.8 feet below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy 70 East - Hwy 7 North (S)
Denise Lane Over Main Lanes
STATION: 105+67
LOCATION: 53' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 4 and 5, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 545.9	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SANDSTONE - Slightly Weathered, Cemented, Occasional Shale Layers, Occasional Fractures, Gray							72	38
40			SANDSTONE - Slightly Weathered, Cemented, Frequent Fractures, Gray							74	36
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: * Driller noted a possible 1.4 feet thick void at approximately 29.8 feet below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Quarry Mountain Road
STATION: 854+67
LOCATION: 9' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 12, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 694.1	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Sandy Clay with Gravel								
5			SHALE - Highly Weathered, Medium Hard, Light Brown to Light Gray						30 35-60 (10")		
10			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Highly Weathered, Medium Hard, Brown						60 18 (0")	21	0
15			SANDSTONE - Highly Weathered, Cemented, Frequent Fractures, Light Gray							16	0
20										9	0
25			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Highly Weathered, Medium Hard, Frequent Fractures, Dark Gray							21	0
30			SANDSTONE WITH FREQUENT SHALE LAYERS - Highly Weathered, Cemented, Frequent Fractures, Dark Gray							11	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Quarry Mountain Road
STATION: 854+67
LOCATION: 9' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 12, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 43.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 694.1								
			SHALE - Weathered, Medium Hard, Frequent Fractures, Dark Gray							22	0
40										18	7
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Quarry Mountain Road
STATION: 855+16
LOCATION: 17' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 11 and 12, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 54.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 689.3								
5			SHALE - Highly Weathered, Soft, Brown and Light Gray						39 60 (4")		
10			CLAY (SHALE) WITH OCCASIONAL SANDSTONE LAYERS - Highly Weathered, Soft, Reddish Brown and Gray						63 60 (1")	21	0
15			CLAY (SHALE) OCCASIONAL SANDSTONE LAYERS - Highly Weathered, Soft, Reddish Brown							8	0
20										30	0
25			SHALE - Weathered, Medium Hard, Frequent Fractures, Dark Gray							22	0
30										58	35
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Quarry Mountain Road
STATION: 855+16
LOCATION: 17' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 11 and 12, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 54.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 689.3								
			SHALE - Weathered, Medium Hard, Occasional Fractures, Dark Gray							74	48
40										24	0
45										54	0
50			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Slighty Weathered, Medium Hard, Occasional Fractures, Dark Gray							85	47
55			Boring Terminated								
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Quarry Mountain Road
STATION: 855+79
LOCATION: 19' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 18, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Asphalt								
			SHALE								
5			SHALE - Highly Weathered, Medium Hard, Gray						57 / 20 (0")		
			SANDSTONE - Weathered with Highly Weathered Seams, Cemented, Occasional Fractures, Gray							100	29
10										94	69
15			SHALE - Slightly Weathered, Medium Hard, Occasional Mineral Veins, Occasional Fractures, Dark Gray							100	86
20										100	71
25										98	84
30			SHALE - Slightly Weathered, Medium Hard, Occasional Mineral Layers, Occasional Fractures, Dark Gray							98	64
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Quarry Mountain Road
STATION: 855+79
LOCATION: 19' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 18, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 38.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 683.7								
			SHALE - Unweathered, Medium Hard, Occasional Mineral Veins, Occasional Fractures, Dark Gray							100	75
40			Boring Terminated								
45											
50											
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Quarry Mountain Road
STATION: 856+42
LOCATION: 25' Lt of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 11, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 49.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 687.0	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Clay with Gravel								
5			Sand with Gravel								
			SHALE - Highly Weathered, Medium Hard, Light Gray						40 (4")		
10									40 (6")		
			SHALE WITH OCCASIONAL SILTSTONE LAYERS - Highly Weathered, Medium Hard, Brown and Gray							48	0
15										70	8
20			SHALE WITH OCCASIONAL SILTSTONE LAYERS - Weathered, Medium Hard, Frequent Fractures, Gray							28	0
25										22	0
30			SANDSTONE - Weathered, Cemented, Frequent Fractures, Gray								
			SHALE - Weathered, Medium Hard, Occasional Fractures, Dark Gray							34	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Quarry Mountain Road
STATION: 856+42
LOCATION: 25' Lt of Construction Centerline
LOGGED BY: Connor Bunton

DATE: June 11, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 49.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 687.0	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
										64	14
40			SHALE - Slightly Weathered, Medium Hard, Occasional Fractures, Occasional Mineral Veins, Dark Gray							98	43
45										94	7
50			Boring Terminated								
55											
60											
65											
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 1 OF 1

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Saline River
STATION: 921+82
LOCATION: 23' Right of Construction Centerline
LOGGED BY: Paul Campbell / Donnie Thornton

DATE: July 9, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 2094

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 26.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 552.5	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Moist, Brown Sandy Silt with Gravel								
5			SHALE - Weathered, Medium Hard, Gray						23 60-40 (7")		
10			SHALE - Slightly Weathered, Medium Hard, Frequent Fractures, Frequent Calcite Layers and Seams, Gray							72	0
15			SHALE WITH FREQUENT TO OCCASIONAL LIMESTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Calcite Veins, and Slickensides, Gray							58	10
20			SHALE WITH FREQUENT TO OCCASIONAL LIMESTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures, Frequent Calcite Layers and Seams, Gray							98	52
25										84	40
30			Boring Terminated								
35											

REMARKS: Latitude: 34.577873, Longitude: -92.981484

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Saline River
STATION: 923+29
LOCATION: 30' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: July 10, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 8400

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 37.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Aspalt								
5			Moist, Medium Dense, Brown Silty Sand with Gravel						5 9-18		
10			SHALE - Highly Weathered, Soft, Gray						2 3-15		
15			LIMESTONE - Unweathered, Moderately Hard, Frequent Fractures, Frequent Calcite Layers and Seams, Gray						20 (0")	50	9
20										66	12
25			LIMESTONE - Unweathered, Moderately Hard, Frequent Fractures, Frequent Calcite and Shale Layers and Seams, Gray							92	52
30			LIMESTONE WITH INTERBEDDED SHALE - Unweathered, Moderately Hard, Frequent Calcite Layers and Seams, Gray							100	92
35											

REMARKS: Latitude: 34.578172, Longitude: -92.981996

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)
Main Lanes Over Saline River
STATION: 923+29
LOCATION: 30' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: July 10, 2019
TYPE OF DRILLING:
Hollow Stem Auger - Diamond Core
EQUIPMENT: CME 8400

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 37.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 565.2								
										94	88
			Boring Terminated								
40											
45											
50											
55											
60											
65											
70											

REMARKS: Latitude: 34.578172, Longitude: -92.981996

ARKANSAS DEPARTMENT OF TRANSPORTATION
ArDOT.gov | IDriveArkansas.com | Scott E. Bennett, P.E., Director
MATERIALS DIVISION
11301 West Baseline Road | P.O. Box 2261 | Little Rock, AR 72203-2261 | Phone: 501.569.2185 | Fax: 501.569.2368

June 18, 2019

TO: Mr. Trinity D. Smith, Engineer of Roadway Design

SUBJECT: Job No. R60140
Hwy. 70 East-Hwy. 7 North (F)
Route 70 Section 9
Garland County

The Department is planning an extension of Highway 70 north of Hot Springs on new location alignment. The proposed alignment traverses extreme topography and geology. This report is intended to provide subsurface information related to the excavated material that will be encountered during the project construction. Fifteen conventional geotechnical borings were conducted to evaluate cut slope configurations. An additional eleven borings were advanced utilizing a shot hole "air" drill and evaluated by Geovision Geophysical Services. Boring logs, unconfined compressive strength test results of rock cores, and the report produced by Geovision are included in Appendix A. Figure 1 and Figure 2 show the recommended cut slope configurations for the major cut areas shown on the current cross sections. These configurations are based on material encountered in the borings and extensive evaluation of the existing cut slopes as described in the Geology section of this report. Material variation should be expected and cut slope configurations may require alteration during construction.

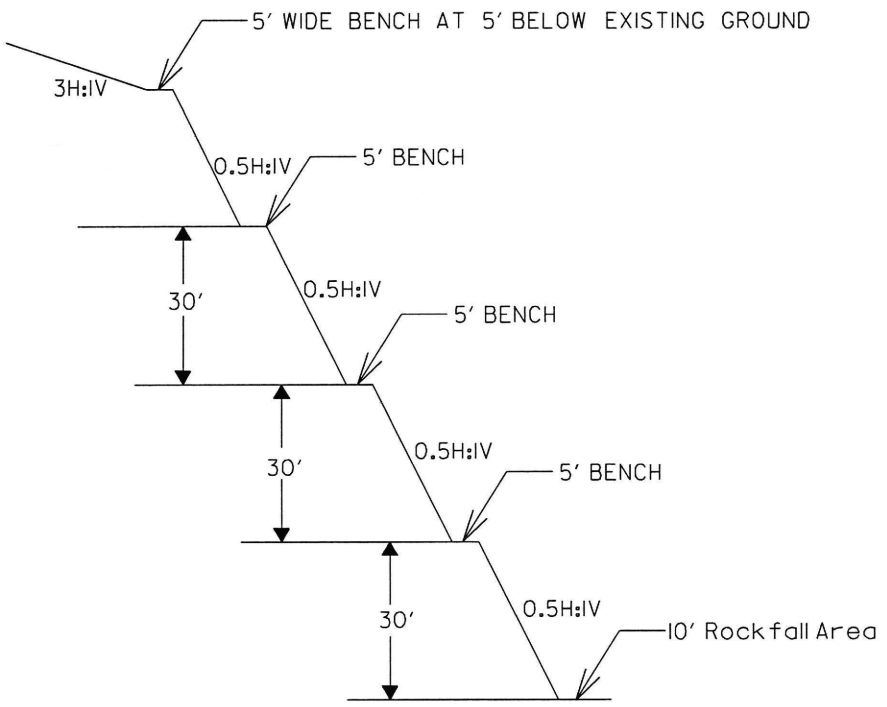
The project has several locations where fill heights exceed 40'. The included draft Compacted Embankment Special SP is intended to require less degradable material from cut locations be placed in the bottom twenty feet of high fill areas. Generally, Compacted Embankment Special should be required in the bottom twenty feet of embankments greater than forty feet in height. Additionally, compacted Embankment Special should be required within stations that include a cross drain from the bottom of the fill to the flow line.

A draft report from Department sponsored TRC project 1803 is included in Appendix B. The project was conducted with the goal of mapping subsurface conditions, particularly depth to bedrock and rock rippability across the project area. The information included with this report to ensure it is available to the Contractors for bid preparation. Contractors should be fully aware that is information should be utilized cautiously, understanding that R60140 will be used as a "proving ground" for the geophysical methods employed.

If you have any questions concerning these recommendations, please contact the Geotechnical Section.

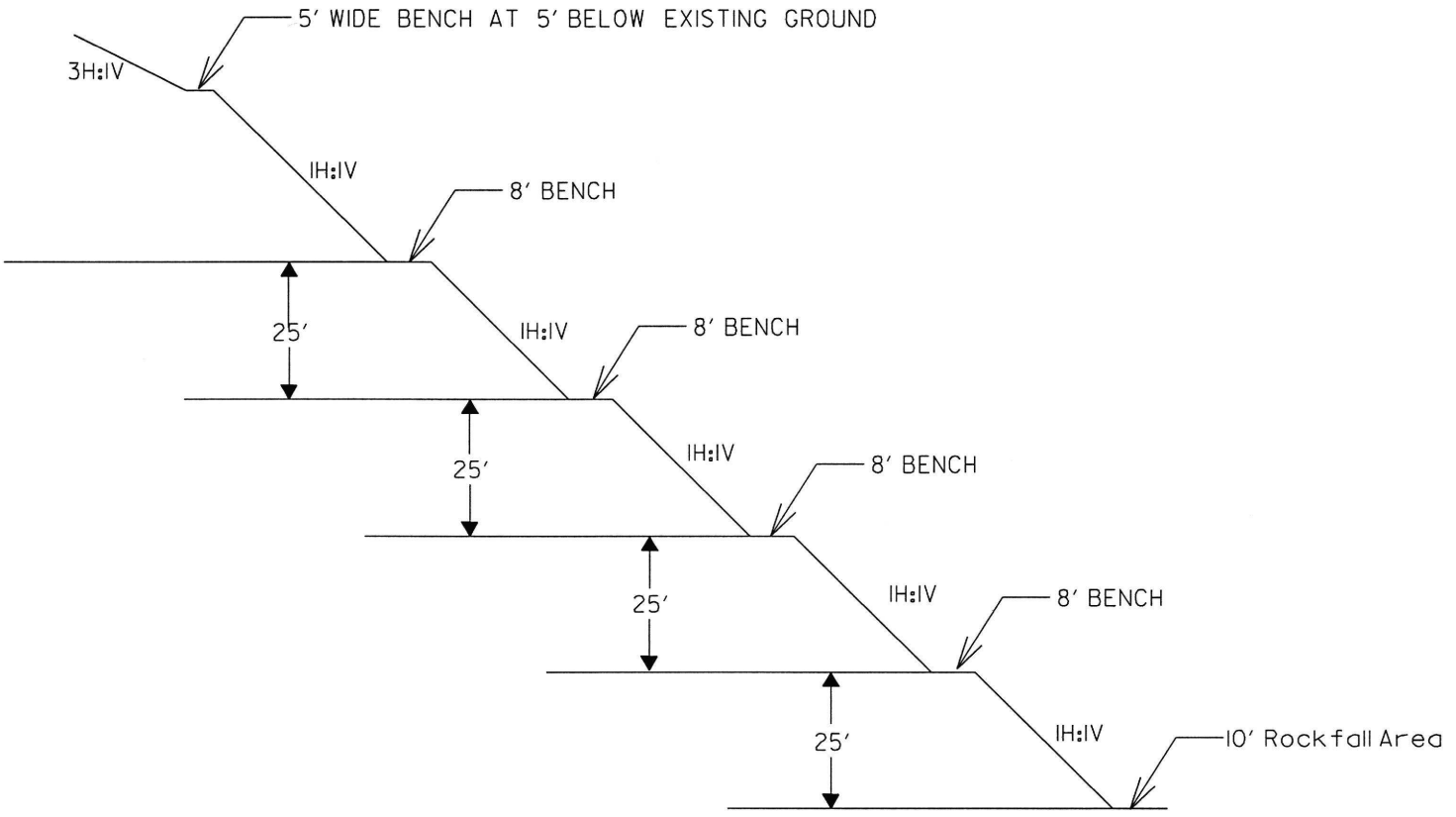
Michael C. Benson
Materials Engineer

MCB:rpt:mlg
cc: State Construction Engineer - Master File Copy
Bridge Design
District 6 Engineer
G.C. File



STA. 669+00 TO 697+00
STA. 832+00 TO 850+00

FIGURE 1-NOVACULITE AND SANDSTONE CUT SLOPES



STA. 660+00 TO 669+00
STA. 697+00 TO 736+00
STA. 779+00 TO 807+00
STA. 832+00 TO 838+50
STA. 871+00 TO 878+00
STA. 895+00 TO 912+00

FIGURE 2-SHALE AND CHERT CUT SLOPES

GEOLOGY AND SITE CONDITIONS
Job No. R60140

Garland County

The proposed Hot Springs Bypass will traverse through an extensive section of the Ouachita Mountains in Garland County. These mountains consist of generally east to west trending valleys and ridges of extensively folded, faulted, and occasionally metamorphosed rock. The valleys are typically composed of softer more erodible rocks such as shale and the ridges are formed by the more resistant rock such as novaculite and sandstone. The bypass crosses several geologic units. From youngest to oldest, these include the Mississippian aged Stanley Shale which includes the Hot Springs Sandstone and the Hatton Tuff members, the Devonian and Mississippian aged Arkansas Novaculite, the Silurian aged Missouri Mountain Shale, Blaylock Sandstone, and Polk Creek Shale, and the Ordovician aged Bigfork Chert and Womble Shale.

The Stanley Shale is composed of dark gray shale interbedded with fine-grained sandstone. A thick sandstone member, the Hot Springs Sandstone, is found near the base of the sequence and an equivalent thin conglomerate/breccia occurs at the base of the unit in many other places. Stratigraphically minor amounts of tuff, chert, bedded and vein barite, and conglomerate have also been noted in various parts of the sequence. Silty sandstones outside the Hot Springs Sandstone Member are normally found in thin to massive beds separated by thick intervals of shale. The tuffs (Hatton Tuff Lentil and others) seem to be restricted to the lower part of the Stanley Shale. Cherts are sometimes present in the middle and upper parts of the formation. The total thickness of the Stanley Formation varies from 3,500 feet to over 10,000 feet. The Hot Springs Sandstone may be as much as 200 feet thick in the area around Hot Springs.

The Arkansas Novaculite consists of three recognized divisions. The lower division is a white, massive-bedded novaculite with some interbedded gray shales near its base. The middle division consists of greenish to dark gray shales interbedded with many thin beds of dark novaculite. The upper division is a white, thick-bedded, often calcareous novaculite. The formation rests conformably on the Missouri Mountain Formation at most places. The formation may attain a thickness of up to 900 feet in its southern outcrops, but thins rapidly to about 60 feet to the north.

The Missouri Mountain Formation consists of shale interbedded with various amounts of conglomerate, novaculite, and sandstone. The shales are usually gray, green, black, or red and weather to buff, green, yellow, or reddish-brown. Conglomerate is normally present at or near the base of the unit and may be up to 4 feet thick. Thin beds of novaculite are present in the upper part of the unit. Thin quartzitic sandstones occur throughout the unit, but are more common in the upper and lower parts. The formation rests conformably on the Blaylock Sandstone to the south and on the Polk Creek Shale in the northern part of its outcrop range. It reaches a maximum of about 300 feet in thickness.

The Blaylock Sandstone consists of fine- to medium-grained sandstone of tan, dark-gray, or greenish color, interbedded with dark-colored to black, fissile shale in the southern Ouachita Mountains. The sandstones are usually thin-bedded, but some intervals consist of fairly thick beds. The shales, which may dominate thick sequences, are usually dark-gray and micaceous. The unit rests conformably on the Polk Creek Shale. The formation ranges from as much as 1200 feet thick along the southwestern part of its outcrop area in Arkansas, but thins dramatically to the north where it is frequently represented by only 5 to 20 feet of olive-gray shale.

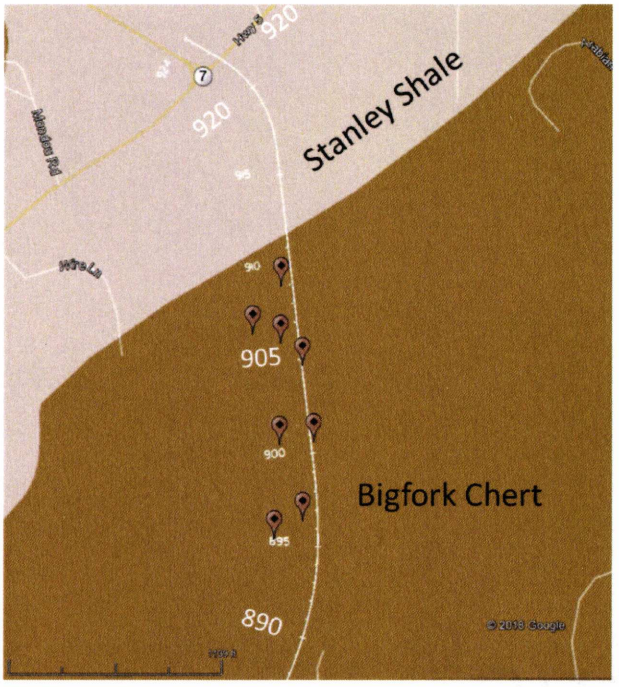
The Polk Creek Shale consists of black, sooty, fissile shale with minor black chert and traces of gray quartzite and limestone. The Polk Creek Shale rests conformably on the Bigfork Chert. Its thickness ranges from about 50 to 225 feet.

The Bigfork Chert consists of thin-bedded, dark-gray, cryptocrystalline chert interbedded with varying amounts of black siliceous shale, calcareous siltstone, and dense, bluish-gray limestone. The cherts normally occur in thin to medium beds and are usually highly fractured. The contact between the Bigfork Chert and the underlying Womble Shale is conformable. The Bigfork Chert in Arkansas ranges in thickness from about 450 feet in the northern Ouachitas to about 750 feet in the southern Ouachitas. This formation tends to be extremely fractured and folded resulting in inconsistent bed dips.

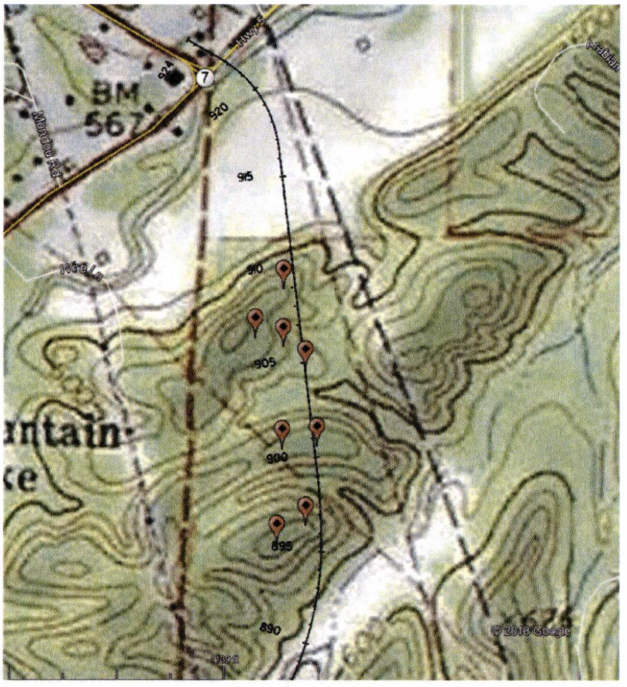
The Womble Shale is mostly black shale with thin layers of limestone, silty sandstone, and some chert. Cleavage, at an angle to bedding, frequently displays ribboned cleavage surfaces. The sandstones are dark-gray, compact, fine-grained, occasionally conglomeratic, and may be phosphatic. These sandstones are generally present in the lower part of the formation. Dense, blue-gray limestones usually occur near the top of the formation in thin to medium beds. Black chert is also present as thin layers at the top of the formation. Large milky quartz veins often fill fractures in the formation. The formation rests conformably on the underlying Blakely Sandstone and ranges from 500 to 1200 feet in thickness.

Stations 900+00 to 924+00

Geology



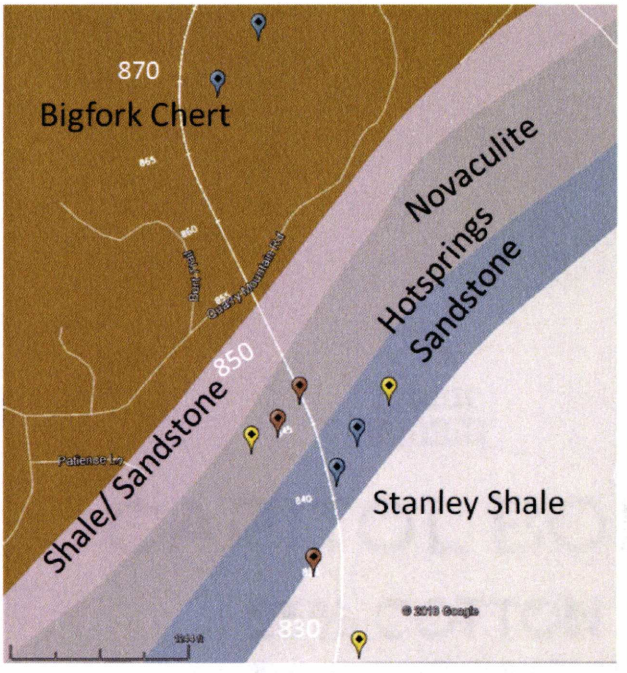
Topography



Stations 900+00 to 924+00 consists primarily of Bigfork Chert. Field evaluation of this formation adjacent to the project alignment was consistent with the above formation description with emphasis on the extremely fractured and folded nature of this rock. Multiple Igneous dikes were observed cutting through this formation along Highway 70 and are likely to be encountered during excavation for the bypass. One of these dikes can be observed in Figure 1. These igneous dikes tend to weather more easily than the surrounding cherts and siliceous shales of the Bigfork. This weathering typically results in clayey sections of soil cutting through the surrounding consolidated rock. Local quarries in the area have been able to remove the Bigfork Chert with standard excavation equipment. Figure 2 depicts recently ripped rock in this formation at a quarry close to the project alignment. It is not anticipated that blasting will be needed to remove this formation for cut slopes. Due to its extremely fractured nature, water easily permeates this formation resulting in many springs and creating the potential for groundwater fluctuations. Consideration should be taken when attempting to select fill material for road construction in this formation.

Stations 825+00 to 880+00

Geology



Topography



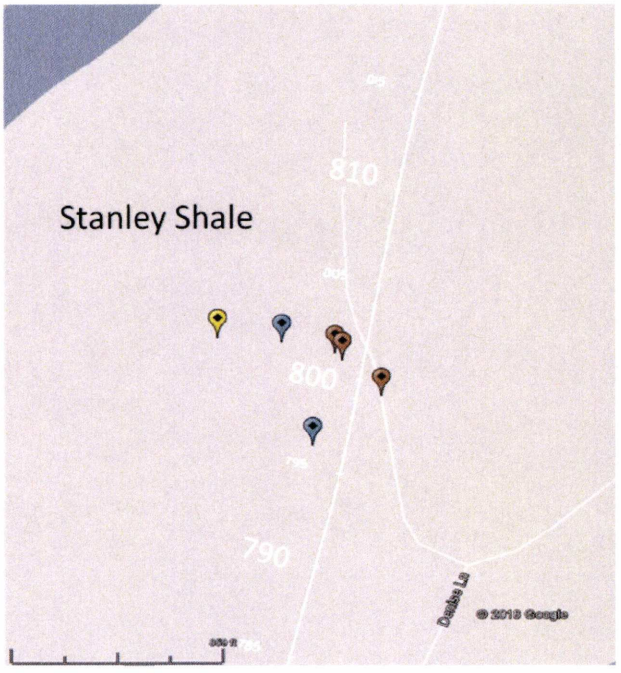
The proposed alignment between stations 825+00 and 880+00 has cut slopes planned through at least two different formations. These formations include the Arkansas Novaculite and the Stanley Shale (including the Hot Springs Sandstone Member of the Stanley). Outcrops in this particular section tend to be vertically bedded and massive. The Hot Springs Sandstone is not well exposed around the project alignment, but one outcrop on route 70 was examined (See Figure 10). At this location the rock seemed capable of holding a fairly steep slope despite being extremely fractured. Based on core evaluation of the boring at station 836+24, 113' left of the proposed construction centerline, it is anticipated that the sandstone encountered in this section will be massive and extremely fractured. Several thin shale layers within the sandstone were encountered in this boring. The degree of weathering in the sandstone tends to be quite variable throughout the formation. This is most likely due to water permeating through the numerous fractures in the rock.

The Arkansas Novaculite is the main ridge former in this area and throughout the Ouachitas due to its resistance to erosion. In general, the overburden above the novaculite observed in the field and in the core was less than 4 feet thick. Based on core and outcrop evaluation, novaculite in this section is very hard, massive, and extremely fractured. It is highly variable in texture, bed thickness, and weathering; but overall, the rock quality tended to improve with depth. Some sections of the novaculite in this area tended to have a glassy texture and composition. Several excavation sites located adjacent to the proposed project alignment were evaluated in the field (See figures 5 and 6). The novaculite at these sites seemed capable of holding steep faces. Large piles of novaculite boulders and cobbles were observed at the

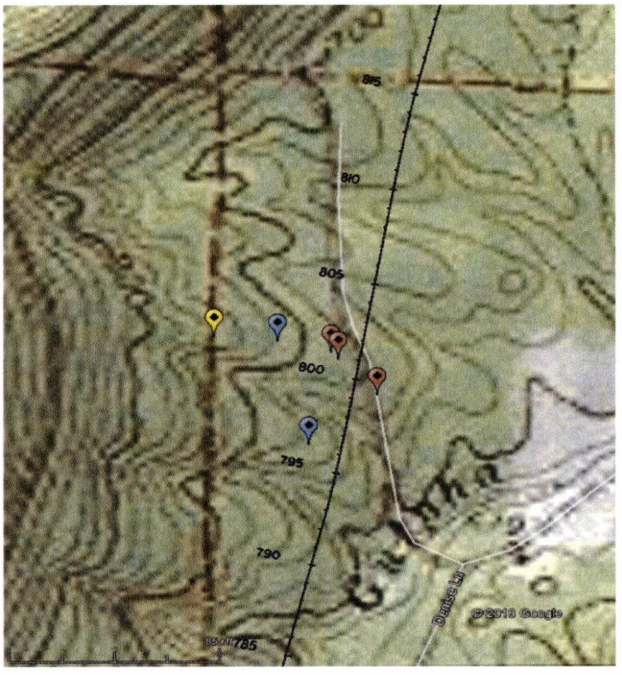
base of these excavation sites, but it is unclear whether these piles were due to the continual raveling of the rock face or to the excavation. It is anticipated that the novaculite will be capable of holding steep slopes; however, isolated failures due to existing fractures, joints, bedding dips, and destabilized vegetation are possible. One of these failures is located along the project alignment at the intersection of Higher Ground and Promise Land Drive (See figure 7). Several igneous dikes were identified cutting through the Novaculite outcrops along Highway 70. These dikes appeared as clayey seams cutting vertically through the surrounding rock. It is anticipated that these dikes will weather much faster than the surrounding rock.

Stations 790+00 to 815+00

Geology



Topography



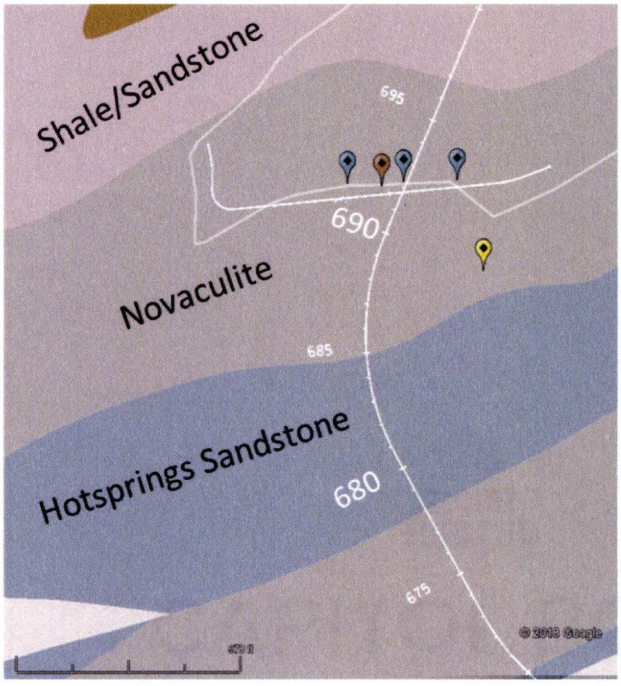
The project alignment in this section consists almost exclusively of Stanley shale. Observed outcrops in the field appeared to be capable of holding fairly steep slopes (See figures 12 and 13); however, isolated failures in this formation are possible. This is due to the large number of joints and fractures in the rock. One recent example of a failed slope in this formation can be observed in figure 11. This failure is located approximately 0.4 miles east of the intersection of Shane Lane and Route 70 on the north side of the road. At this location it appears that the slope was destabilized when the toe of the slope was excavated for ditch paving.

A unit that is believed to be a lentil of the Hatton Tuff Member of the Stanley Shale was encountered at station 800+75, 184 feet left of the proposed construction centerline at approximately 53 feet below ground level. The Hatton in this boring appears to be much softer than exposures found in western Arkansas and Eastern Oklahoma. Based on core evaluation,

the rock encountered better fit the description of poorly cemented tuffaceous sandstone than a typical tuff. It is possible that this formation will be encountered during excavation for the bypass, but due to the lack of visible exposures, it is unknown how this rock will respond to excavation and erosion.

Stations 669+00 to 700+00

Geology



Topography

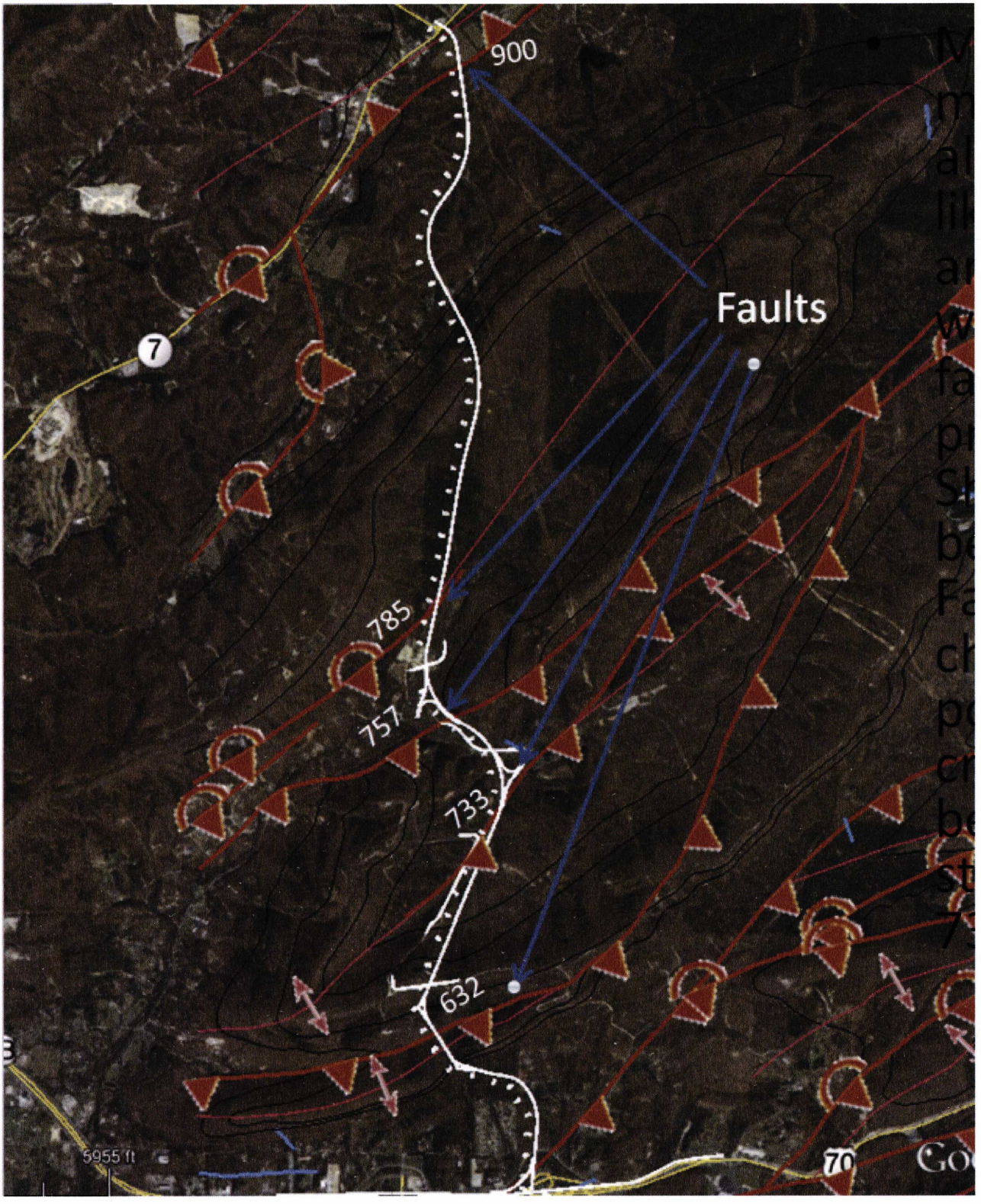


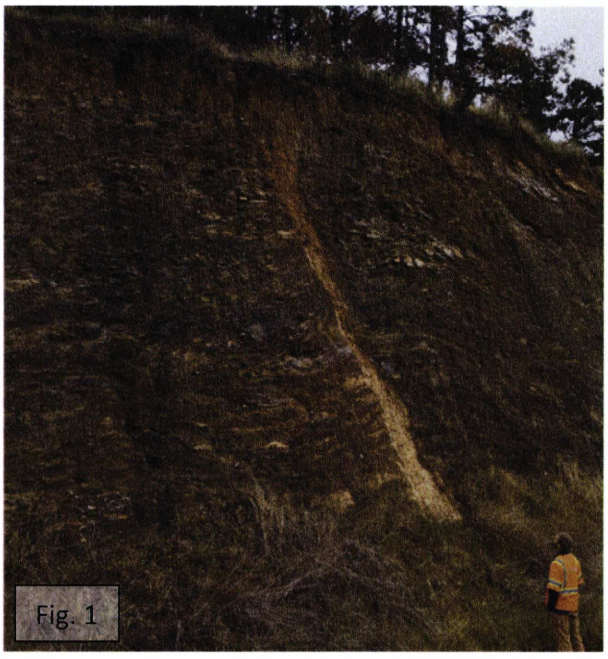
In this section, the planned alignment passes through mapped outcrops of the Hot Springs Sandstone, the Arkansas Novaculite, the Missouri Mountain Shale, the Blaylock Sandstone, and the Polk Creek Shale. Multiple borings were drilled into the novaculite along Promise Land Drive for deep cut slopes planned between stations 690+00 and 697+00. No borings were made into the Hot Springs Sandstone in this section, but it is anticipated that the rock encountered will be similar to the Hot Springs Sandstone between stations 825+00 and 880+00. Planned cuts in this section are up to 160 feet deep into the novaculite and blasting will likely be needed to remove this material. It is possible that the Polk Creek Shale, the Blaylock Sandstone/Shale Formation, and the Missouri Mountain Shale will be encountered during excavation for the bypass between stations 696+00 and 703+00. These three formations are not expected to be very thick along the project alignment and are more likely to be encountered in low lying areas. The Missouri Mountain Shale evaluated in the field along Promise Land Drive was very soft and easily eroded (See Figure 15). This formation lies adjacent to the much harder novaculite. Road cuts passing through the contact between these

two formations could result in rock falls if the shales erode away faster than the novaculite. The contact between these two formations can be observed just east of the intersection of Route 70 and Cloud 9 Drive (See figure 14). Due to access restrictions, no borings were made into the Blaylock and Polk Creek formations and no outcrops were available for field observation. Therefore, it is unknown how the Polk Creek Shale and the Blaylock Sandstone will respond to excavation or what type of slopes they will be capable of maintaining.

Faults Along the Project Alignment

Multiple thrust faults have been mapped crossing the proposed project alignment and unmapped faults are likely to be encountered. It is anticipated that only one of these faults will be exposed during excavation. This fault is overturned and has been previously mapped within the Stanley Shale to the west of Denise Lane between stations 784+00 and 785+00. Faults can potentially produce abrupt changes in lithology and increase the potential for erosion. Other faults crossing the project alignment have been mapped in close proximity to stations 632+00, 733+00, 757+00, 767+50, and 912+00 (See the Figure below).


900
Faults
7
785
757
733
632
5955 ft
70



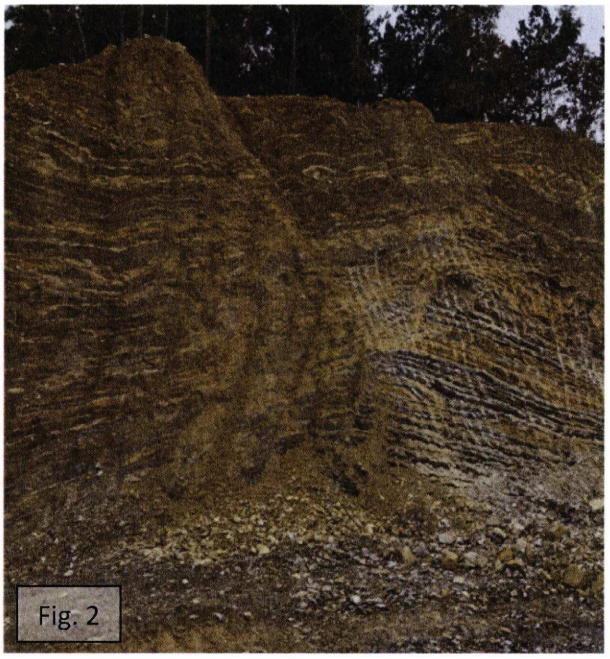
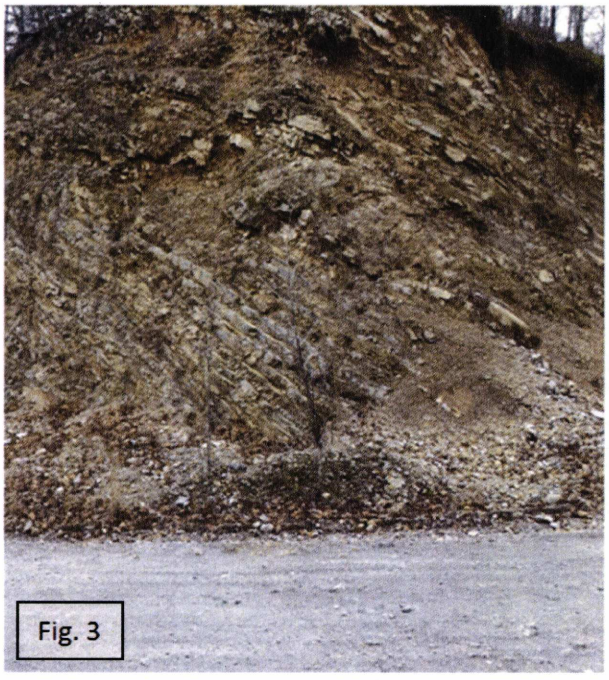


Figure 1 - Igneous dike cutting through the Bigfork Chert on Route 70 (34.553829, -92.853262).
Figure 2 - Recently ripped bigfork chert located at a quarry west of the proposed project alignment (34.616696, -93.039426).



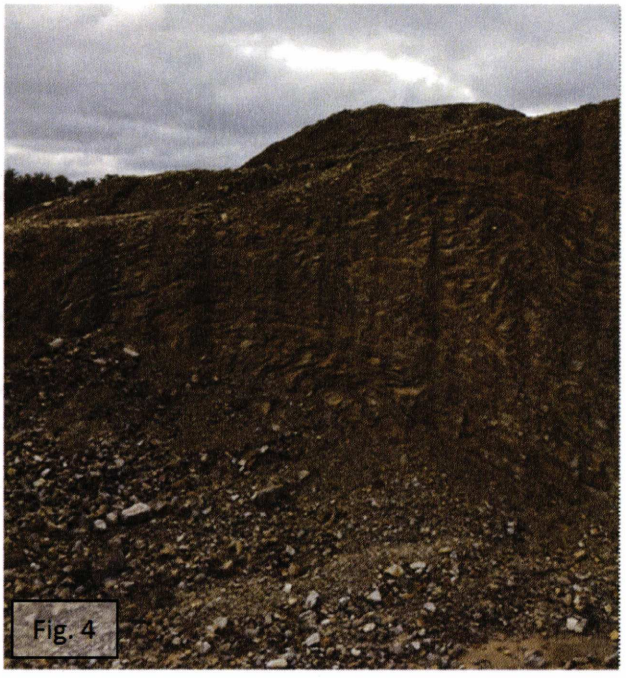
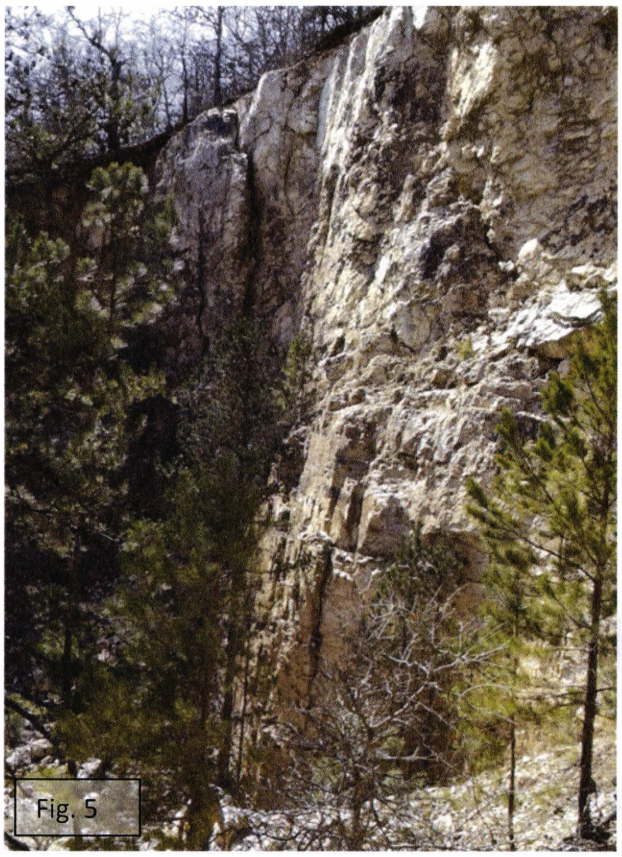
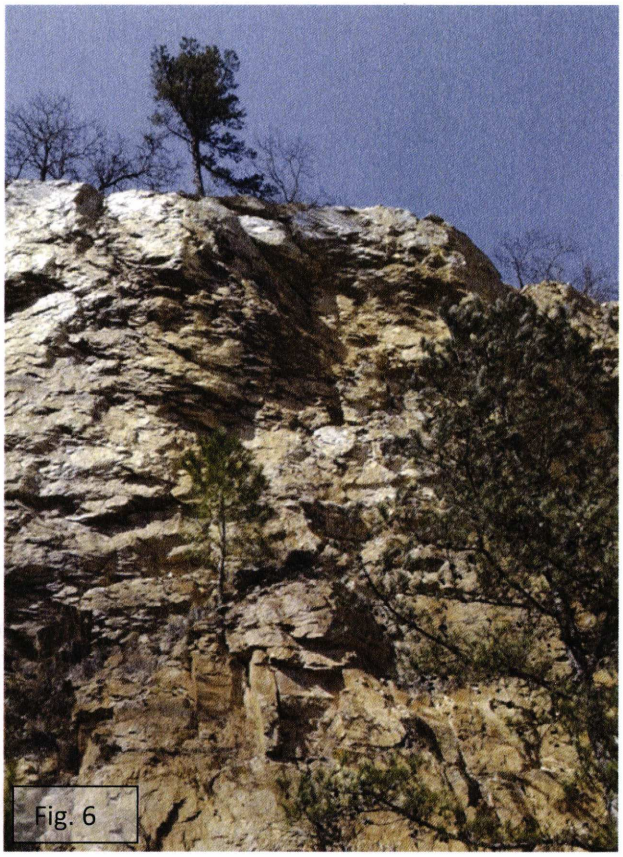


Figure 3 - Bigfork Chert on Promise Land Drive holding a steep slope (34.527805, -92.979264).
Figure 4 - Bigfork Chert at shale pit close to the proposed project alignment (34.550742, -93.022407).





Figures 5 and 6 – Novaculite outcrops at an abandoned quarry near the project alignment off of Deer Park Road (34.571584, -92.946014).



Figure 7 - Failure in Colluvial material above the Arkansas Novaculite at the intersection of Promise Land and Higher Grounds Road (34.530614, -92.983457).

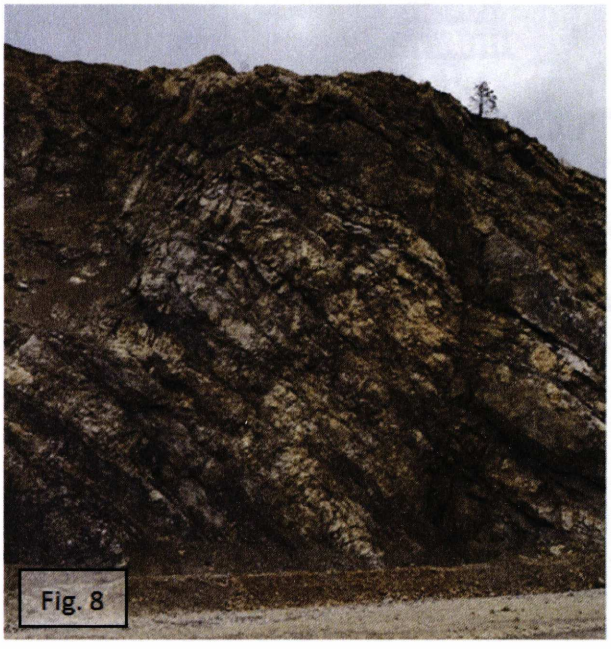




Figure 8 - Novaculite outcrop at Bismarck Gravel Mountain Quarry (34.35728193. 93.290619).
Figure 9 - Novaculite outcrop on Route 70 (34.544160, -92.873586).



Figure 10 - Hot Springs Sandstone outcrop along Route 70 east of the proposed project alignment (34.5097, -92.9461).



Figure 11 - Cut slope failure in the Stanley Shale along Route 70 (34.507040, -92.952201).



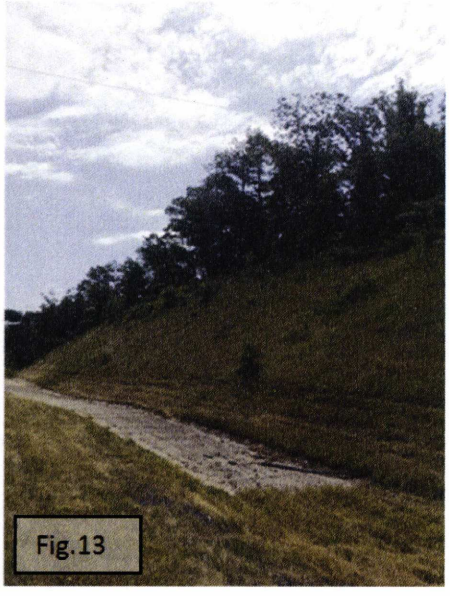


Figure 12 - Stabilized Cut Slope in the Stanley Shale along East Grand Avenue (34.507552, -92.975434). Figure 13 - Stabilized Cut Slope in the Stanley Shale along Route 70 (34.506000, -92.965746).

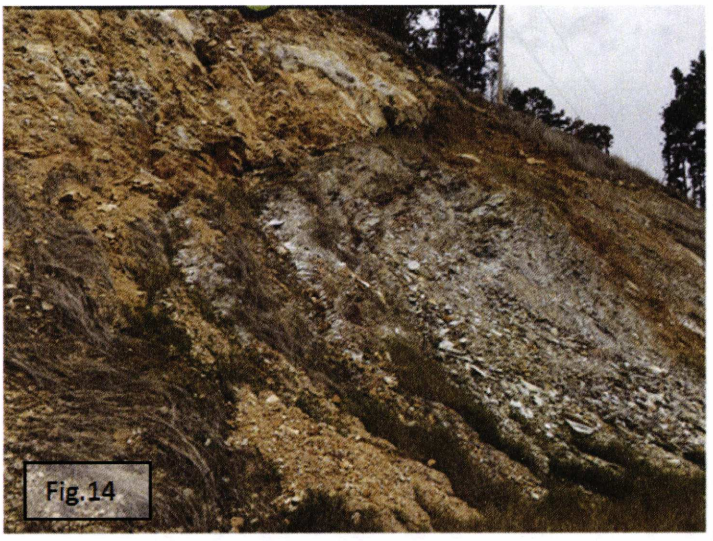




Figure 14 - The Missouri Mountain Shale underlying the Arkansas Novaculite along Route 70 (34.544199, -92.873166). Figure 15 - The Missouri Mountain Shale exposed in a drainage ditch along Promise Land Drive (34.521203, -92.984128).

ARKANSAS DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION

JOB NO. R60140

COMPACTED EMBANKMENT SPECIAL

Description. This Special Provision shall be supplementary to Section 210, Excavation and Embankment, of the Standard Specifications, Edition of 2014.

Materials and Construction Requirements. Material for areas shown on the plans as Compacted Embankment Special shall include stone obtained from on-site cuts or an approved source and shall consist of hard and durable limestone, sandstone, dolomite, chert, novaculite, or rock-like shale. Shale shall have a minimum slake durability index (SDI) of 95% as tested according to AHTD Test Method 399. The SDI shall be determined by the Contractor using the above method at least once per 3000 cubic yards. The stone shall be greater than 1 1/2" and less than 30", angular, with fractured faces on at least 75% of the surface and shall not contain more than 10% overburden or fines less than 1 1/2" in maximum cross-section. The stone shall weigh not less than 140 pounds per solid cubic foot and shall have a percent of wear not greater than 45 by Los Angeles Test (AASHTO T 96).

The benching requirements stated in SubSection 210.09 of the Standard Specifications shall be strictly enforced. These requirements apply to all fill compacted against hill sides including cut to fill transitions along the alignment.

Quality Control and Acceptance Testing. In addition to the required test, the Engineer may require the Contractor to test any location that, by visual inspection appears different from previously approved material. If the material source is consistent, the Engineer may modify the standard lot size for slake durability and to one test for each material type encountered.

Method of Measurement. All embankments constructed as described above will be measured as Compacted Embankment in accordance with Section 210 of the Standard Specifications.

Basis of Payment. All embankments constructed as described above shall be paid in accordance with section 210.13 of the Standard Specifications.

Payment will be made under:

Pay Item	**Pay Unit**
Compacted Embankment	Cubic Yard

APPENDIX A

ARDOT BORING LOGS

UNCONFINED COMPRESSIVE STRENGTH RESULTS

AIR DRILLED BORING LOGS

GEOVISION GEOPHYSICAL REPORT

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 693+15
LOCATION: 86.2' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: January 14 and 15, 2019
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 104

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 924.1								
5			Moist, Medium Dense, Brown and White Sand with Gravel						6 10-20		
10			Moist, Very Dense, Brown Sand with Gravel (Chert Fragments)						45 (4")	14	0
15										44	0
20										14	0
25										58	0
30										40	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 693+15
LOCATION: 86.2' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: January 14 and 15, 2019
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 104

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 924.1								
										1	0
40										100	48
45										94	74
50										74	0
55			NOVACULITE - Hard, Unweathered, Frequent Fractures, White							72	22
60										86	42
65										80	7
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 1
PAGE 3 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 693+15
LOCATION: 86.2' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: January 14 and 15, 2019
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 104

SURFACE ELEVATION: 924.1

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
										100	30
75										78	10
80										100	16
85										96	36
90										94	80
95										100	86
100										100	41
105			Boring Terminated								

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 800+75
LOCATION: 148.4' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: January 16, 2019
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 64.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 660.6								
5			SHALE - Highly Weathered, Medium Hard, Siliceous, Gray						60 / 60 (1")		
10			SHALE - Weathered, Medium Hard, Siliceous, Gray						70 (5")		
			SHALE WITH INTERBEDDED SANDSTONE - Slightly Weathered, Medium Hard, Frequent Fractures, Siliceous, Gray							59	0
15			SHALE - Slightly Weathered, Medium Hard, Siliceous, Gray								
			QUARTZ							95	0
			SHALE - Slightly Weathered, Medium Hard, Occasional Sandstone Layers and Seams, Frequent Fractures, Gray								
20										70	0
25										81	10
			SHALE - Unweathered, Medium Hard, Occasional Sandstone Layers and Seams, Occasional Quartz Veins, Frequent Fractures, Gray								
30										70	0
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 2
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 800+75
LOCATION: 148.4' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: January 16, 2019
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 64.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 660.6								
										64	16
40			SHALE - Unweathered, Medium Hard, Occasional Sandstone Layers and Seams, Occasional Quartz Veins, Gray							94	36
45			SHALE WITH INTERBEDDED SANDSTONE LAYERS AND SEAMS - Unweathered, Medium Hard, Frequent Fractures and Quartz Veins, Trace Pyrite, Gray							74	16
50										72	0
55			SANDSTONE - Unweathered, Poorly Cemented, Tuffaceous, Calcareous, Greenish Gray							64	0
60										86	38
65			Boring Terminated								
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 802+35
LOCATION: 56.9' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: January 23, 2019
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 69

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 688.4	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Clay with Gravel								
5			Wet, Very Stiff, Reddish-Brown Clay						8 12-15		
10			SHALE - Highly Weathered, Medium Hard, Light Brown						35 60 (5")		
15			SHALE - Weathered, Medium Hard, Frequent Fractures, Siliceous, Gray						46 60 (2")	96	24
20			SANDSTONE WITH INTERBEDDED SHALE - Slightly Weathered, Well Cemented, Frequent Fractures, Gray							100	48
25			SANDSTONE - Slightly Weathered, Well Cemented, Frequent Fractures, Occasional Shale Layers and Seems, Gray							100	25
30			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Frequent Fractures, Gray							84	33
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 3
PAGE 2 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 802+35
LOCATION: 56.9' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: January 23, 2019
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 69

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 688.4	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SANDSTONE WITH FREQUENT SHALE LAYERS AND SEAMS - Unweathered, Well Cemented, Occasional Fractures, Gray							80	42
40			SHALE - Unweathered, Medium Hard, Occasional Sandstone Layers and Seems, Frequent Fractures, Occasional Quartz Veins, Gray							64	0
45			SHALE - Unweathered, Medium Hard, Frequent Fractures, Occasional Quartz Veins, Gray							52	17
50			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Occasional Frequent Fractures, Occasional Quartz Veins, Gray							84	36
55			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Occasional Fractures and Slickensides, Gray							100	22
60			SHALE - Unweathered, Medium Hard, Siliceous, Frequent Fractures, Gray							76	10
65			SHALE WITH INTERBEDDED SANDSTONE - Unweathered, Medium Hard, Occasional Fractures, Gray							96	7
70			Boring Terminated								

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 836+24
LOCATION: 113.1' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 12 and 17, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 72.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 799.9	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			Clay with Gravel and Cobbles								
5			Moist, Very Stiff, Light Gray Clay with Some Gravel						6 12-14		
10			SANDSTONE - Weathered, Well Cemented, Steeply Dipping, Occasional Fractures, Quarts Veins, and Clay Seams, Red and Gray						10 (0")	98	68
15			SANDSTONE - Slightly Weathered with Occasional Highly Weathered Layers, Cemented with Occasional Poorly Cemented Layers, Frequent Fractures, Red and Gray							100	46
20			SANDSTONE - Slightly Weathered with Occasional Highly Weathered Layers, Well Cemented with Occasional Poorly Cemented Layers, Occasional Fractures and Quartz Veins, Reddish Brown and Gray							99	74
25			SANDSTONE - Slightly Weathered, Well Cemented, Occasional Fractures and Metamorphosed Layers, Gray							98	74
30			SANDSTONE - Slightly Weathered, Well Cemented, Gray							89	74
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 836+24
LOCATION: 113.1' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 12 and 17, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 72.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 799.9								
			SANDSTONE - Slightly Weathered with Highly Weathered Layers, Well Cemented with Poorly Cemented Layers, Frequent Fractures, Occasional Clay Layer, Light Gray							98	27
40			SANDSTONE - Slightly Weathered with Highly Weathered Seams, Well Cemented with Poorly Cemented Seams, Frequent Fractures, Occasional Clay Layer, Light Gray							88	50
45			SANDSTONE - Slightly Weathered with Weathered Seams, Well Cemented with Cemented Seams, Frequent Fractures and Slightly Metamorphosed Layers, Occasional Clay Seams, Gray							100	63
50			SANDSTONE - Slightly Weathered, Well Cemented, Occasional Open Joints and Fractures, Light Gray							100	70
55			SANDSTONE - Unweathered, Well Cemented, Steeply Dipping, Occasional Slightly Metamorphosed Layers, Gray							100	85
60			SANDSTONE - Highly Weathered, Poorly Cemented, Steeply Dipping, Occasional Fractures, Reddish Brown							98	54
65			SANDSTONE - Slightly Weathered, Well Cemented, Steeply Dipping, Occasional Quartz Veins, Occasional Fractures, Slightly Metamorphosed Layers, Gray								
			SHALE - Highly Weathered, Soft, Steeply Dipping, Dark Gray							66	32
70			SANDSTONE - Slightly Weathered, Well Cemented, Slightly Metamorphosed, Steeply Dipping, Gray								

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 4
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 836+24
LOCATION: 113.1' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 12 and 17, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 72.8

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 799.9								
			SHALE WITH OCCASIONAL SANDSTONE LAYERS - Highly Weathered, Soft, Steeply Dipping, Dark Gray							48	0
			Boring Terminated								
75											
80											
85											
90											
95											
100											
105											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 5
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 846+09
LOCATION: 145.9' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 5, 6, 10-12, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 78.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 823.0								
			NOVACULITE - Weathered, Hard, Frequent Fractures, White								
5			NOVACULITE - Slightly Weathered, Hard, Frequent Fractures, White						20 (1")	66	10
10										62	0
15										56	0
20										66	0
25										48	0
30										76	8
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 5
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 846+09
LOCATION: 145.9' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 5, 6, 10-12, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 78.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 823.0								
			NOVACULITE - Unweathered, Hard, Steeply Dipping, Frequent Fractures, White							58	0
40										47	9
45										92	16
50										34	7
55										6	0
60										97	51
65										81	7
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 5
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 846+09
LOCATION: 145.9' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 5, 6, 10-12, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 78.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 823.0								
										100	20
75										94	38
			Boring Terminated								
80											
85											
90											
95											
100											
105											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 6
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 847+47
LOCATION: 77.9' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 4 and 5, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 79.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 830.1								
5			Moist, Very Dense, White Silt with Gravel (Chert Fragments)						100 (4")		
10									100 (4")	11	0
15										50	2
20										14	0
25										24	0
30										4	0
35											

REMARKS: Lat: 34.559151 Long: -92.979829

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 6
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 847+47
LOCATION: 77.9' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 4 and 5, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 79.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 830.1								
			NOVACULITE -Unweathered, Hard, Steeply Dipping, Frequent Fractures, White							3	0
40										99	25
45										86	0
50										72	20
55										98	0
60										72	15
65										100	0
70											

REMARKS: Lat: 34.559151 Long: -92.979829

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 6
PAGE 3 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 847+47
LOCATION: 77.9' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: December 4 and 5, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 79.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 830.1								
										100	86
75										92	56
80			Boring Terminated								
85											
90											
95											
100											
105											

REMARKS: Lat: 34.559151 Long: -92.979829

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 7
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 896+92
LOCATION: 163.4' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 1, 6, and 7, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 101.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 692.1								
5			Moist, Very Dense, Light Brown Gravel with Silt and Sand.						57 / 60 (3")		
10			Moist, Very Dense, Light Gray Silt						34 / 60 (4")		
15									19 / 34-60 (10")		
20			Moist, Very Dense, Light Gray Silt with Gravel						42 / 60 (1")		
25			CHERT WITH FREQUENT TRIPOLITIC LAYERS - Highly Weathered, Poorly Cemented to Cemented, Frequent Fractures, Light Gray							13	0
30			NO SAMPLE RECOVERED TRIPOLITIC CHERT - Highly Weathered, Poorly Cemented							0	0
35			CHERT WITH FREQUENT TRIPOLITIC LAYERS - Highly Weathered, Poorly Cemented to Cemented, Frequent Fractures, Light Gray							36	0

REMARKS: Lat: 34.571365,Long: -92.980370

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 7
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 896+92
LOCATION: 163.4' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 1, 6, and 7, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 101.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 692.1	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			NO SAMPLE RECOVERED TRIPOLITIC CHERT - Highly Weathered, Poorly Cemented							0	0
40											
			CHERT WITH FREQUENT TRIPOLITIC LAYERS - Highly Weathered, Poorly Cemented to Cemented, Light Gray							40	0
45											
										6	0
50											
			Very Dense, Light Gray Silt						19 51-60 (11")		
55											
			Very Dense, Light Gray Silt with Trace Gravel						89 60 (4")		
60											
									100 (2")		
65											
									100 (2")		
70											

REMARKS: Lat: 34.571365,Long: -92.980370

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 7
PAGE 3 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 896+92
LOCATION: 163.4' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 1, 6, and 7, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 101.2

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 692.1								
			Chert						100 (2")		
75									100 (1")		
80											
			Very Dense, Light Gray Silt						100 (4")		
85											
									35 / 60 (4")		
90			Very Dense, Light Gray Silt with Gravel						100 (3")		
95											
									100 (2")		
100			Chert								
			Very Dense, Brown Silt						22 / 57-60 (8")		
			Boring Terminated								
105											

REMARKS: Lat: 34.571365,Long: -92.980370

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 8
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 897+76
LOCATION: 8.8' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 29 and 30, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 75.45

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 677.9								
5			Moist, Very Dense, Gray Silty Sand with Gravel						44 60 (3")		
10			Moist, Very Dense, Gray Silty Sand with Some Gravel						88 60 (1")		
15			Moist, Very Dense, Gray Silty Sand						100 (5")		
20			Moist, Very Dense, Gray Silt						23 60 (6")		
25			Moist, Very Dense, Gray Sand with Gravel						100 (3")		
30									100 (4")		
35											

REMARKS: Lat: 34.571607, Long: -92.979853

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 8
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 897+76
LOCATION: 8.8' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 29 and 30, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 75.45

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 677.9								
									100 (5")		
40											
			Wet, Very Dense, Gray Silty Sand with Gravel						100 (4")		
45											
									73 / 60 (2")		
50			Wet, Very Dense, Light Gray Sandy Silt						100 (4")		
55											
			No Sample						100 (2")		
60											
			Wet, Very Dense, Light Gray Sandy Silt with Gravel						80 / 50 (0")		
65											
									100 (4")		
70											

REMARKS: Lat: 34.571607, Long: -92.979853

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 8
PAGE 3 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 897+76
LOCATION: 8.8' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 29 and 30, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 75.45

SURFACE ELEVATION: 677.9

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
75			Wet, Very Dense, Gray Sand With Gravel						100 (2")		
			Wet, Very Dense, Light Gray Sandy Silt						100 (5")		
			Boring Terminated								
80											
85											
90											
95											
100											
105											

REMARKS: Lat: 34.571607, Long: -92.979853

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 9
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 901+77
LOCATION: 93.5 Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 26-28, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.65

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 667.9								
5			Moist, Very Dense, Light Gray Silt with Gravel						32 60 (5")		
10									64 60 (1")		
15									83 60 (1")		
20			Dry, Very Dense, Light Gray Silt						25 60 (4")		
25			Wet, Very Dense, Light Gray Sandy Silt with Gravel						32 60 (6")		
30			Wet, Very Dense, Light Gray Silt						21 60 (4")		
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 9
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 901+77
LOCATION: 93.5 Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 26-28, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.65

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 667.9								
40			Wet, Very Dense, Light Gray Sandy Silt with Gravel						39 60 (5")		
45			Wet, Very Dense, Light Gray Silt						25 34-32		
50			Wet, Very Dense, Light Gray Silt with Gravel						58 60 (3")		
55			Wet, Very Dense, Light Gray Sandy Silt with Gravel						21 36-36		
60			Wet, Very Dense, Light Gray Silt with Some Gravel						49 60 (4")		
65									23 26-38		
70			Wet, Very Dense, Light Gray Sandy Silt						100 (4")		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 9
PAGE 3 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 901+77
LOCATION: 93.5 Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 26-28, 2018
TYPE OF DRILLING: Hollow Stem Auger - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.65

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 667.9								
			Wet, Very Dense, Light Gray Sandy Silt with Gravel						25 25-23		
75											
			Wet, Very Dense, Light Gray Sandy Silt						57 60 (4")		
80									22 27-25		
			SHALE								
85									57 54-49		
			SHALE - Weathered, Medium Hard, Dark Gray								
90									57 60 (2")		
			Boring Terminated								
95											
100											
105											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 10
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 901+94
LOCATION: 89.4' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 19 and 20, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 80.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 662.3								
5			Moist, Very Dense, Light Gray Silt						10 14-44		
10			Moist, Dense, Light Gray Silt						7 10-31		
15			Moist, Dense, Light Gray Silt with Some Gravel						59 30-18		
20			Moist, Very Dense, Light Gray Silt with Gravel						30 60 (5")		
25									80 60 (4")		
30									82 60 (5")		
35											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 10
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 901+94
LOCATION: 89.4' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 19 and 20, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 80.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 662.3								
40			Wet, Very Dense, Light Gray Sandy Silt						100 (5")		
45			Wet, Medium Dense, Light Gray Silt with Gravel						13 13-12		
50			Wet, Very Dense, Light Gray Sandy Silt with Gravel						18 26-33		
55			Wet, Very Dense, Light Gray Silt with Gravel						26 60 (5")		
60									83 60 (4")		
65									74 57-60 (11")		
70									30 49-55		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 10
PAGE 3 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 901+94
LOCATION: 89.4' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: November 19 and 20, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 80.3

SURFACE ELEVATION: 662.3

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
75			Wet, Very Dense, Light Gray Silt with Gravel						17 47-57		
80			Wet, Very Dense, Light Gray Sand with Silt						100 (3")		
			Boring Terminated						100 (4")		
85											
90											
95											
100											
105											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 11
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 905+93
LOCATION: 85.9' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 23 and 24, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 46.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 634.4								
5			Moist, Very Dense, Gray Clayey Sand with Gravel						40 60-1"		
10									9 31-35		
15									18 37-7		
20									6 11-21		
25									11 60		
30			Moist, Very Dense, Gray Gravel with Sand						39 45-45		
35											

REMARKS: * Total water loss at approximately 46 feet below ground level, hole could not be completed .

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 11
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 905+93
LOCATION: 85.9' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 23 and 24, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 46.5

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 634.4								
			Moist, Dense, Gray Gravel with Sand						24 24-12		
40			Moist, Very Dense, Gray Clayey Gravel with Sand						25 44-35		
			SHALE								
45			SHALE - Weathered, Soft, Dark Gray*						1 12-13		
			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: * Total water loss at approximately 46 feet below ground level, hole could not be completed .

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 12
PAGE 1 OF 2

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 907+22
LOCATION: 13.7' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 22 and 23, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 60.25

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 640.9								
5			Moist, Very Dense, Gray Clayey Sand with Gravel						25 38-47		
10			Moist, Very Dense, Gray Silty Sand with Gravel						30 60 (5")		
15											
20			Moist, Very Dense, Gray Gravel with Clay and Sand						94 60 (4")		
25			Moist, Very Dense, Gray Clayey Sand with Gravel						67 60 (2")		
30									53 60 (5")		
35			Moist, Very Dense, Gray Gravel with Clay and Sand						39 30-19 (1")		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 12
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 907+22
LOCATION: 13.7' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 22 and 23, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 60.25

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 640.9								
40			Moist, Very Dense, Gray Clayey Sand with Gravel						88 60 (1")		
									22 60 (5")		
45											
50			Moist, Very Dense, Gray Clayey Sand						100 (0")		
			Moist, Very Dense, Gray Sand with Some Gravel						100 (0")		
55			SHALE								
60			SHALE - Weathered, Medium Hard, Dark Gray						100 (0")		
65			Boring Terminated						100 (0")		
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 13
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 907+90
LOCATION: 148.3' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 16 and 17, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURFACE ELEVATION: 664.9	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
5			Wet, Brown Clay with Gravel								
10			Moist, Very Dense, Reddish Brown and Light Gray Silt						21 32-50		
15			Moist, Dense, Light Brown and Reddish Gray Silt						17 18-17		
20			Wet, Very Dense, Brown and Gray Sand with Silt and Gravel						45 100-92		
25			Wet, Very Dense, Brown Silt with Gravel						29 36-102		
30			Wet, Very Dense, Brown and Gray Gravel with Sand and Silt						230 (6")		
35									100 (6")		

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 13
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 907+90
LOCATION: 148.3' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 16 and 17, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 664.9								
40			Wet, Very Hard, Brown and Light Gray Silty Clay with Gravel						68 60 (1")		
									25 48-60 (10")		
45											
									32 46-55		
50											
									23 35-31		
55			SILTSTONE - Highly Weathered, Soft, Steeply Dipping, Brown and Light Gray								
									29 41-60 (11")		
60											
									6 32-42		
65											
									66 60 (4")		
			Wet, Very Dense, Brown and Gray Clayey Sand with Gravel								
70											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 13
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JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 907+90
LOCATION: 148.3' Left of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 16 and 17, 2018
TYPE OF DRILLING: Hollow Stem Auger - Rotary Wash
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.4

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 664.9								
75									23 60 (5")		
80			Wet, Very Dense, Light Gray Silt						24 32-60		
85			SILTSTONE WITH INTERBEDDED CHERT - Highly Weathered, Soft, Brown						66 60 (5")		
90			SHALE - Highly Weathered, Medium Hard, Dark Gray						71 60 (2")		
			Boring Terminated						100 (5")		
95											
100											
105											

REMARKS:

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 14
PAGE 1 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 910+25
LOCATION: 30.0' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 8, 9, and 10, 2018
TYPE OF DRILLING: Hollow Stem Auger
Rotary Wash - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.45

SURFACE ELEVATION: 665.7

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
5			Dry, Light Brown Gravel with Clay								
10			Moist, Very Hard, Reddish Brown and Gray Sandy Clay with Gravel						39 151 (4")		
15			Moist, Very Dense, Brown and Gray Clayey Sand with Gravel						75 175 (6")		
20			Dry, Very Dense, Brown Silty Sand with Gravel						80 198 (6")		
25									100 (5")		
30			Moist, Medium Dense, Gray Silt with Sand and Some Gravel						13 13-17		
35			Moist, Very Dense, Reddish Brown and Gray Sandy Clay with Gravel						38 45-73		

REMARKS: * The material encountered was not consolidated enough to be cored. Coring was abandoned at 64.0' below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 14
PAGE 2 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 910+25
LOCATION: 30.0' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 8, 9, and 10, 2018
TYPE OF DRILLING: Hollow Stem Auger
Rotary Wash - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.45

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 665.7								
40			Moist, Very Dense, Light Gray Silt						17 41-57		
45			Moist, Dense, Light Gray Silt						9 16-21		
50			Moist, Very Dense, Light Gray Silt						26 102 (6")		
55			Silt with Occasional Chert Layers*						158 (6")	14	0
60										13	0
65										10	0
70			Wet, Very Dense, Dark Gray Silt with Some Gravel						48 51-28		

REMARKS: * The material encountered was not consolidated enough to be cored. Coring was abandoned at 64.0' below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. 14
PAGE 3 OF 3

JOB NO. R60140 Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 910+25
LOCATION: 30.0' Right of Construction Centerline
LOGGED BY: Connor Bunton

DATE: October 8, 9, and 10, 2018
TYPE OF DRILLING: Hollow Stem Auger
Rotary Wash - Diamond Core
EQUIPMENT: Acker 1779

HAMMER CORRECTION FACTOR: N/A

COMPLETION DEPTH: 90.45

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 665.7								
			Wet, Very Dense, Light Gray Silt						46 33-21		
75											
			Wet, Very Dense, Gray Silt with Some Gravel						98 75-30		
80									11 12-37		
85											
			Wet, Very Dense, Dark Brown Gravel with Sandy Clay						48 74-56		
90			SHALE - Highly Weathered, Medium Hard, Dark Gray						112 (5")		
			Boring Terminated								
95											
100											
105											

REMARKS: * The material encountered was not consolidated enough to be cored. Coring was abandoned at 64.0' below ground level.

Rock Core Unconfined Compression Test Summary

Project Number: R60140
Project Name: Hwy. 70 East - Hwy. 7 North (S)
Date Tested:

Station	Location	Sample No.	Depth (ft)	Diameter (in)	Height (in)	Total Load (lbs)	Correction Factor	Stress (psi)	Remarks
801+00	130' Lt	1	37.0		3.20	17,670	0.00	7,346	Highly Fractured
801+00	130' Lt	2	37.7		32.00	16,260	0.00	6,760	
801+00	130' Lt	3	41.0		4.05	580	0.00	241	
801+00	130' Lt	4	60.7		4.05	5,600	0.00	2,328	Tuffacious SS
602+60	90' Lt	5	20.5		3.80	9,630	0.00	4,003	Sh w/ SS
602+60	90' Lt	6	22.1		3.10	11,930	0.00	4,959	SS
602+60	90' Lt	7	27.3						SS
602+60	90' Lt	8	32.2		4.20	10,720	0.00	4,456	
602+60	90' Lt	9	36.5		3.80	14,290	0.00	5,941	
602+60	90' Lt	10	49.3		3.65	8,600	0.00	3,575	
602+60	90' Lt	11	55.2		3.80	22,400	0.00	9,312	
602+60	90' Lt	12	64.8						
846+00	C.L.	13	5.4		4.10	44,470	0.00	18,488	Novaculite
846+00	C.L.	14	13.8		3.40	72,970	0.00	30,753	Novaculite
846+00	C.L.	15	43.0		4.20	42,910	0.00	17,840	Novaculite
846+00	C.L.	16	63.5		3.40	60,680	0.00	25,227	Novaculite
848+00	87' Rt	17	40.2		3.50	90,590	0.00	37,663	Novaculite
848+00	87' Rt	18	51.2		4.40	57,390	0.00	23,860	Novaculite
848+00	87' Rt	19	61.5		3.55	29,550	0.00	12,285	Novaculite
848+00	87' Rt	20	76.7		3.05	22,440	0.98	9,153	Novaculite
693+00	120' Lt	21	58.4		3.85	71,210	0.00	29,605	Novaculite
693+00	120' Lt	22	70.5		3.50	82,870	0.000	34,453	Novaculite
693+00	120' Lt	23	84.1		3.55	58,030	0.000	24,126	Novaculite
693+00	120' Lt	24	96.3		3.40	17,140	0.000	7,126	Novaculite
836+00	130' Lt	25	11.1		3.40	30,530	0.000	12,692	SS
836+00	130' Lt	26	26.2		3.50	54,560	0.000	22,683	SS
836+00	130' Lt	27	36.7		3.45	40,780	0.000	16,954	SS

* Please note any broken samples, fractures or other characteristics of sample in Remarks.

Rock Core Unconfined Compression Test Summary

Project Number: R60140
Project Name: Hwy. 70 East - Hwy. 7 North (S)
Date Tested:

Station	Location	Sample No.	Depth (ft)	Diameter (in)	Height (in)	Total Load (lbs)	Correction Factor	Stress (psi)	Remarks
836+00	130' Lt	28	42.8		3.50	900	0.00	374	SS
836+00	130' Lt	29	54.1		3.45	35,330	0.00	14,688	
836+00	130' Lt	30	61.5		3.55	64,060	0.00	26,633	

* Please note any broken samples, fractures or other characteristics of sample in Remarks.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB1
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JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 694+40
LOCATION: 210' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 45

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 903.5								
			Moist, Brown, Clayey Gravel with Sand								
5			Sand with Gravel (Weathered Novaculite)								
10											
15											
20											
25			White Novaculite								
30											
35											

REMARKS: Casing Set at approximately 10 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB1
PAGE 2 OF 2

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 694+40
LOCATION: 210' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 45

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
40			SURFACE ELEVATION: 903.5								
45			Boring Terminated								
50											
55											
60											
65											
70											

REMARKS: Casing Set at approximately 10 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB2
PAGE 1 OF 4

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 693+69
LOCATION: 18' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 120

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 918.2								
5			Moist, Brown, Clayey Gravel with Sand								
10			Brown and White Weathered Novaculite								
15											
20											
25											
30											
35											

REMARKS: Casing Set at approximately 10 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB2
PAGE 2 OF 4

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 693+69
LOCATION: 18' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 120

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 918.2								
40											
45											
50											
55											
60											
65			White Novaculite								
70											

REMARKS: Casing Set at approximately 10 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB2
PAGE 3 OF 4

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 693+69
LOCATION: 18' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 120

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 918.2								
75											
80											
85											
90											
95											
100											
105											

REMARKS: Casing Set at approximately 10 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB2
PAGE 4 OF 4

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 693+69
LOCATION: 18' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 120

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
110			SURFACE ELEVATION: 918.2								
115											
120											
125			Boring Terminated								
130											
135											
140											

REMARKS: Casing Set at approximately 10 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB3
PAGE 1 OF 5

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 692+03
LOCATION: 291' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 150

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 921.7								
5			Moist, Brown, Clayey Sand with Gravel								
10			Moist, Brown, Sand and Gravel (Novaculite Fragments)								
30			White Novaculite								
35											

REMARKS: Casing Set at approximately 8 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB3
PAGE 2 OF 5

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 692+03
LOCATION: 291' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 150

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 921.7								
40											
45											
50											
55			Tan Novaculite								
60											
65											
70											

REMARKS: Casing Set at approximately 8 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB3
PAGE 3 OF 5

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 692+03
LOCATION: 291' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 150

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 921.7								
75											
80											
85											
90											
95											
100											
105											

REMARKS: Casing Set at approximately 8 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB3
PAGE 4 OF 5

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 692+03
LOCATION: 291' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 150

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 921.7								
			White Novaculite								
110											
115											
120											
125											
130											
135											
140											

REMARKS: Casing Set at approximately 8 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB3
PAGE 5 OF 5

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 692+03
LOCATION: 291' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 14, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 150

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
145			SURFACE ELEVATION: 921.7								
150			Boring Terminated								
155											
160											
165											
170											
175											

REMARKS: Casing Set at approximately 8 feet below ground level

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB4
PAGE 1 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 797+46
LOCATION: 250' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 680.0								
5			Brown Highly Weathered to Weathered Sandy Shale								
10											
15											
20			Gray Shale								
25											
30											
35											

REMARKS: Casing Set at approximately 19 feet below ground level. *Water encountered at approximately 53 feet below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB4
PAGE 2 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 797+46
LOCATION: 250' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 680.0								
40			Gray Shale (driller noted soft layer at approximately 38')*								
45											
50											
55											
60											
65											
70											

REMARKS: Casing Set at approximately 19 feet below ground level. *Water encountered at approximately 53 feet below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB4
PAGE 3 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 797+46
LOCATION: 250' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 680.0								
			Boring Terminated								
75											
80											
85											
90											
95											
100											
105											

REMARKS: Casing Set at approximately 19 feet below ground level. *Water encountered at approximately 53 feet below ground level.

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB6
PAGE 1 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 803+02
LOCATION: 362' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 716.9								
5			Brown Highly Weathered to Weathered Sandy Shale								
10											
15			Brown Shale								
20											
25											
30											
35											

REMARKS: Casing Set at approximately 6 feet below ground level. *Water encountered at approximately 50 feet below ground level. Lat: 34.547074 Long: -92.982070

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB6
PAGE 2 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 803+02
LOCATION: 362' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 716.9								
40			Gray Shale*								
45											
50											
55											
60											
65											
70											

REMARKS: Casing Set at approximately 6 feet below ground level. *Water encountered at approximately 50 feet below ground level. Lat: 34.547074 Long: -92.982070

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB6
PAGE 3 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 803+02
LOCATION: 362' Left of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 716.9								
			Boring Terminated								
75											
80											
85											
90											
95											
100											
105											

REMARKS: Casing Set at approximately 6 feet below ground level. *Water encountered at approximately 50 feet below ground level. Lat: 34.547074 Long: -92.982070

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB8
PAGE 1 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 842+20
LOCATION: 232' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 9, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 80

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 865.5								
5			Sandstone Boulders								
10											
15			Tan Sandstone								
20											
25											
30											
35			Red Sandstone								

REMARKS: Casing Set at approximately 8 feet below ground level. Lat: 34.557625 Long: -92.978905

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB8
PAGE 2 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 842+20
LOCATION: 232' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 9, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 80

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 865.5								
40			Red Sandstone (Driller noted it was softer than sandstone above)								
45			Gray Shale								
50											
55											
60											
65			Gray Sandstone								
70											

REMARKS: Casing Set at approximately 8 feet below ground level. Lat: 34.557625 Long: -92.978905

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB8
PAGE 3 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 842+20
LOCATION: 232' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 9, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 80

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
75			SURFACE ELEVATION: 865.5								
80			Boring Terminated								
85											
90											
95											
100											
105											

REMARKS: Casing Set at approximately 8 feet below ground level. Lat: 34.557625 Long: -92.978905

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB9
PAGE 1 OF 2

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 842+89
LOCATION: 329' Right of Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 60

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 876.3								
			Sandstone Boulders								
5											
10			Tan Sandstone								
15											
20											
			Gray Shale								
25											
			Gray Sandstone								
30											
35											

REMARKS: Casing Set at approximately 6 feet below ground level. Lat: 34.558321 Long: -92.978459

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB9
PAGE 2 OF 2

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 842+89
LOCATION: 329' Right of Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 60

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 876.3								
			Red Sandstone								
40											
			Brown Sandstone								
45											
50											
55											
60											
			Boring Terminated								
65											
70											

REMARKS: Casing Set at approximately 6 feet below ground level. Lat: 34.558321 Long: -92.978459

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB10
PAGE 1 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 870+30
LOCATION: 325' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 714.0								
5			Gray Silt with Chert Fragments								
10											
15											
20											
25											
30											
35											

REMARKS: Casing Set at approximately 10 feet below ground level. * Water encountered at approximately 20 feet below ground level. Lat: 34.564622 Long: -92.981751

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB10
PAGE 2 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 870+30
LOCATION: 325' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 714.0								
40			Gray and Brown Chert with Interbedded Siltstone*								
45											
50											
55											
60											
65											
70											

REMARKS: Casing Set at approximately 10 feet below ground level. * Water encountered at approximately 20 feet below ground level. Lat: 34.564622 Long: -92.981751

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB10
PAGE 3 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 870+30
LOCATION: 325' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 69.99

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 714.0								
			Boring Terminated								
75											
80											
85											
90											
95											
100											
105											

REMARKS: Casing Set at approximately 10 feet below ground level. * Water encountered at approximately 20 feet below ground level. Lat: 34.564622 Long: -92.981751

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB11
PAGE 1 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 876+59
LOCATION: 495' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 100

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 727.8								
5			Gray Silt with Chert Fragments								
10											
15											
20											
25											
30											
35											

REMARKS: Casing Set at approximately 15 feet below ground level. Lat: 34.565641 Long: -92.980829

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB11
PAGE 2 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 876+59
LOCATION: 495' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 100

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 727.8								
40											
45											
50											
55			Gray and Brown Chert with Interbedded Siltstone								
60											
65											
70											

REMARKS: Casing Set at approximately 15 feet below ground level. Lat: 34.565641 Long: -92.980829

ARKANSAS DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION - GEOTECHNICAL SEC.

BORING NO. AB11
PAGE 3 OF 3

JOB NO. R60140 Air Holes Garland County
JOB NAME: Hwy. 70 East - Hwy. 7 North (S)

STATION: 876+59
LOCATION: 495' Right of Construction Centerline
LOGGED BY: Paul Campbell

DATE: January 10, 2019
TYPE OF DRILLING: Air Hammer

EQUIPMENT: Schramm Air Drill

HAMMER CORRECTION FACTOR:

COMPLETION DEPTH: 100

DEPTH FT.	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	SOIL GROUP	PLASTIC LIMIT	% MOIST.	LIQUID LIMIT	DRY WEIGHT LBS PER CU.FT.	NO. OF BLOWS PER 6-IN.	% TCR	% RQD
			SURFACE ELEVATION: 727.8								
75											
80											
85											
90											
95											
100											
			Boring Terminated								
105											

REMARKS: Casing Set at approximately 15 feet below ground level. Lat: 34.565641 Long: -92.980829

GEOVision
geophysical services

ARKANSAS DEPARTMENT OF TRANSPORTATION

HIGHWAY 70 EAST – 7 NORTH

BOREHOLE GEOPHYSICS

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Project 18525

March 8, 2019
Report 18525-01 rev 0

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APPENDICES

APPENDIX A PROCESSED TELEVIEWER IMAGES WITH TADPOLES

INTRODUCTION

GEO*Vision* acquired optical televiewer data in nine boreholes for ARDOT Job#R60140 in Hot Springs, Arkansas. This work was performed for the University of Arkansas and the Arkansas Department of Transportation. Field work was performed by Glenn Goss, data analysis and report preparation were performed by Emily Feldman, and were reviewed by a **GEO***Vision* licensed California professional geophysicist or engineer.

SCOPE OF WORK

This report presents results of borehole geophysical data collected on January 22 and 23, 2019. Optical televiewer data were collected in nine uncased boreholes, as detailed in Table 1. The purpose of these measurements was to supplement stratigraphic and structural feature information.

A Robertson Geologging, Inc. (RG) High Resolution Optical Televiewer (OTV) were used to collect borehole deviation data and optical images of the borehole wall. Borehole images were analyzed and features, such as bedding planes and fractures, were identified and used to calculate feature dips and azimuths. Acquired data were analyzed and a profile of borehole deviation versus depth was produced.

Measurement procedures followed these ASTM standards:

- ASTM D5753-05 (Re-approved 2010), "Planning and Conducting Boring Geophysical Logging"

INSTRUMENTATION

Optical Televiewer / Boring Deviation Instrumentation

Optical televiewer data were collected using an RG OTV slimhole probe controlled by RG's OTV program.

The probe receives control signals from, and sends the digitized measurement values to, a RG MicroLogger II (MLII) unit on the surface via an armored multi-conductor cable. The cable is wound onto the drum of a winch and is used to support the probe. Cable travel is measured to provide depth using a sheave of known circumference fitted with a digital rotary encoder. The probe and depth data are transmitted by USB link from the MLII unit to a laptop computer where it is displayed and stored.

The high resolution optical televiewer system uses a unique optical system based on a fisheye lens allowing the probe to survey 360 degrees simultaneously. The probe provides a continuous high resolution image of the borehole wall using a conventional light source. The image is referenced to magnetic north, allowing the cylinder to be "unwrapped" with north as the edge of the unwrapped image. Circular resolutions of 360 to 1440 pixels are available. In order to generate the highest resolution image, a circular resolution of 1440 pixels is used by default.

The probe contains a fluxgate magnetometer to monitor magnetic north, and all raw televiewer data are referenced to magnetic north. Processed data were referenced to true north, using site and logging date-specific declination (0.75 degrees east) obtained from NOAA (http://www.ngdc.noaa.gov/geomag-web/#declination). Also, a three axis accelerometer is enclosed in the probe to record boring deviation data while logging, this permits correction of structure dip angle from apparent dip, referenced to boring axis, to true dip (referenced to a vertical axis) in non-vertical borings. The probe is centered in the boring by two sets of flat spring centralizers.

MEASUREMENT PROCEDURES

Optical Televiewer Measurement Procedures

The OTV probe does not require a fluid filled boring for proper operation. Borings were logged with the optical televiewer from the surface to either the bottom of the boring, or until an obstruction was encountered, or the borehole fluid was too opaque to clearly image the borehole wall. In accordance with the manufacturer's recommended procedures, the probe was inspected and tested prior to use.

The OTV probe was positioned with the top of the probe even with a stationary reference point, and the electronic depth counter was set to the specified length of the probe minus the height of the reference point. Once verified with a tape measure, these calculations were recorded on a field log.

Typically, image resolution is set to the maximum; 1,440 pixels for horizontal resolution. At a nominal acquisition rate of 3 feet per minute; this provides a vertical resolution of 0.0012 feet (approximately 0.0144 inches).

Upon completion of the measurements, the probe zero depth indication at the depth reference point is verified prior to removal from the boring.

DATA ANALYSIS

Optical Televiewer Analysis

Optical televiewer feature classification followed **GEO***Vision* Televiewer Feature Notes and Picking Criteria (Appendix A). The optical televiewer data were processed using WellCAD software for borehole image analysis, version 5.2. Sinusoidal projections of planar features on the boring walls were interactively picked on the un-wrapped televiewer image and presented on the logs as colored sinusoids superimposed over the televiewer image. Sinusoidal projections were processed using the standard boring gauge of 4 inches to calculate apparent dip angle. True dip was calculated, correcting for the plunge of the borings using the recorded data from the accelerometers located in the probe, and presented in arrow format, with true dip indicated by the arrow position across the plot. Azimuth of dip (not strike), is indicated by the direction of the arrow tail, with true north being "up".

RESULTS

Optical Televiewer / Boring Deviation

Optical televiewer and boring deviation data were collected and processed for nine boreholes.

Per standard procedure, televiewer feature classification followed **GEO***Vision* Televiewer Feature Notes and Picking Criteria (Appendix A). Sinusoidal features and corrected tadpoles are displayed on the multi-page combined televiewer feature log sheets in Appendix A. Corrected optical feature depth, dip, and azimuth of dip data are provided in Tables 4 through 12, respectively, as well as in Microsoft Excel® format, accompanying this report. Depths on all figures and tables are referenced to ground surface. Imagery is referenced to magnetic north while corrected feature output is referenced to true north.

Stereonet plots generated from optical televiewer data are contoured using a yellow to red gradient and are provided in Figures 2, 5, 8, 11, 14, 17, 20, 23, and 26, respectively. Associated rose diagrams are displayed Figures 3, 6, 9, 12, 15, 18, 21, 24, and 27, respectively. These figures also accompany this report as PDF.

Borehole deviation data extracted from the optical televiewer logs are presented graphically on the logs in Appendix A, in Figures 4, 7, 10, 13, 16, 19, 21, 25, and 28, and summarized in Table 3. Deviation data plots in bitmap format and deviation data tabulated at 0.1-foot intervals are included in Excel® format in the data directories that accompany this report. Azimuth in the Excel® tables are referenced to magnetic north.

SUMMARY

Discussion of Televiewer / Boring Deviation Results

Nine boreholes were logged with the optical televiewer tool above and below static water table. Data collection in one additional borehole (RB-13) was attempted, however an obstruction was encountered near the surface casing and thus could not be logged. The upper several feet of the boreholes were cased with PVC for stability. Water in the borehole was clear and optical televiewer images were of good quality above and below fluid level. Many bedding and discontinuity features are visible in the images. Lighting exposure adjustments while logging may manifest as abrupt horizontal light or dark banding. Small image gaps, visible is some logs, are manifested as white blank zones. These may have been caused by the tool slightly catching or snagging while logging, interrupting continuous data acquisition. Note planar features are often well imaged above and below these bands or zones and can be successfully identified and picked, e.g., AD-2 at approximately 109 ft and 113 ft. Fluid was cloudy in several borings, e.g., AD-8, impeding imaging. However, robust features could still be identified and picked.

Quality Assurance

These borehole geophysical measurements were performed using industry-standard or better methods for measurements and analyses. All work was performed under **GEO***Vision* quality assurance procedures, which include:

- Use of NIST-traceable calibrations, where applicable, for field and laboratory instrumentation
- Use of standard field data logs
- Independent review of calculations and results by a registered professional engineer, geologist, or geophysicist.

Televiewer Data Reliability

Depth indications are very reliable with estimated precision of +/- 0.2 feet. Estimated precision of dip is +/- 5 degrees and azimuth of dip is +/- 10 degrees. Standardized field procedures and quality assurance checks add to the reliability of these data.

CERTIFICATION

All geophysical data, analysis, interpretations, conclusions, and recommendations in this document have been prepared under the supervision and review of a **GEO***Vision* California professional geophysicist or engineer.

Prepared by:

3/8/2019

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Date

Reviewed and approved by



3/8/2019

Victor M Gonzalez
California Professional Geophysicist, PGp. 1074
GEO*Vision* Geophysical Services

Date

* This geophysical investigation was conducted under the supervision of a California Professional Geophysicist or Engineer using industry standard methods and equipment. A high degree of professionalism was maintained during all aspects of the project from the field investigation and data acquisition, through data processing, interpretation and reporting. All original field data files, field notes and observations, and other pertinent information are maintained in the project files and are available for the client to review for a period of at least one year.

  A professional geophysicist's certification of interpreted geophysical conditions comprises a declaration of his/her professional judgment. It does not constitute a warranty or guarantee, expressed or implied, nor does it relieve any other party of its responsibility to abide by contract documents, applicable codes, standards, regulations or ordinances.

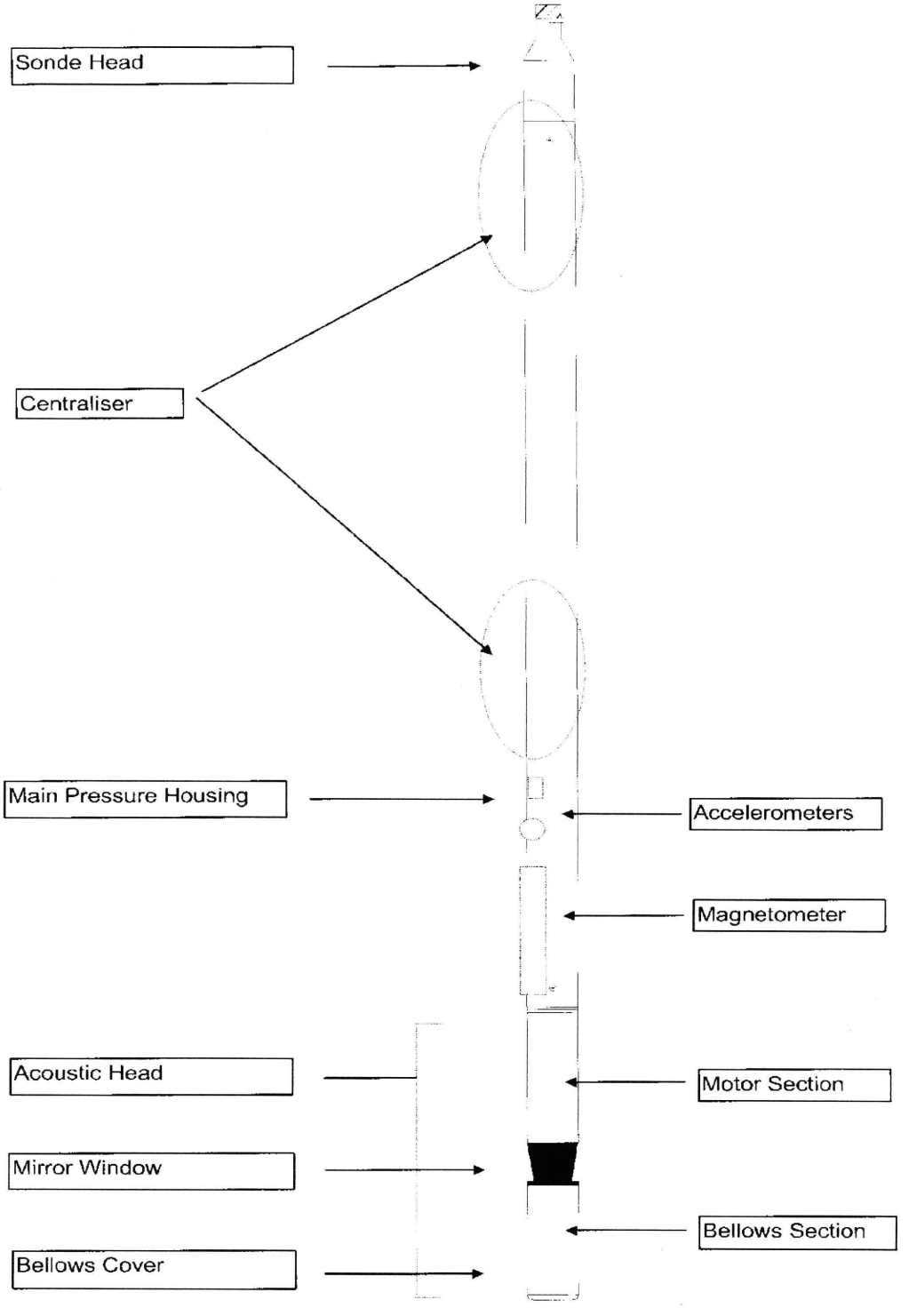


Figure 1: Concept illustration of a televiewer probe

Table 1. Boring locations and logging dates

BORING DESIGNATION	DATES LOGGED	LOCATION[1] (DEGREES)		ELEVATION (FEET)
		LATITUDE	LONGITUDE	
AD1	1/22/2019	34.51990874879757	-92.9815535074143	-
AD2	1/22/2019	34.51988721265346	-92.98232688210372	-
AD3	1/22/2019	34.51986345317587	-92.98313176146019	-
AD4	1/23/2019	34.54561574433261	-92.98160657085391	-
AD6	1/23/2019	34.547073855714	-92.98207015244213	-
AD8	1/23/2019	34.55762470858658	-92.97890454976194	-
AD9	1/23/2019	34.55832068113416	-92.97845877354337	-
AD10	1/23/2019	34.56462202947129	-92.98175103257769	-
AD11	1/23/2019	34.56564076435207	-92.9808291655211	-

[1] Coordinates provided by University of Arkansas, WGS84

Table 2. Logging dates and depth ranges

BORING NUMBER	TOOL AND RUN NUMBER	DEPTH RANGE (FEET)	CASED OR UNCASED	SAMPLE INTERVAL (FEET)	DATE LOGGED
AD1	OTV DOWN01-03	5.7 – 43.3	UNCASED	0.004	1/22/2019
AD2	OTV DOWN01-05	5.7 – 119.7	UNCASED	0.004	1/22/2019
AD3	OTV DOWN01	5.7 – 145.9	UNCASED	0.004	1/22/2019
AD4	OTV DOWN01-04	9.8 – 67.7	UNCASED	0.004	1/23/2019
AD6	OTV UP01	4.3 – 67.3	UNCASED	0.004	1/23/2019
AD8	OTV DOWN01	4.7 – 74.8	UNCASED	0.004	1/23/2019
AD9	OTV DOWN01-04	4.7 – 58.2	UNCASED	0.004	1/23/2019
AD10	OTV UP01	5.1 – 47.0	UNCASED	0.004	1/23/2019
AD11	OTV UP01	9.7 – 84.3	UNCASED	0.004	1/23/2019

Table 3. Televiewer Deviation Data Summary

BORING NUMBER	MEAN AZIMUTH (DEGREES TN)	MEAN DEVIATION (DEGREES)	SURVEY DEPTH (FEET)	VERTICAL DEPTH (FEET)	HORIZONTAL OFFSET (FEET)
AD1	137	0.4	43.320	43.319	0.16
AD2	220	0.7	119.770	119.759	0.97
AD3	224	0.7	145.948	145.937	1.50
AD4	178	0.5	67.677	67.675	0.37
AD6	263	1.4	67.297	67.277	1.46
AD8	309	1.1	74.862	74.848	1.34
AD9	195	0.4	59.196	59.194	0.26
AD10	317	2.8	47.060	47.008	1.98
AD11	196	1.0	84.278	84.263	0.75

Table 4. Boring AD1, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD1

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
8.4	160.1	60.7	0.0	Filled Joint / Fracture
8.8	338.6	63.9	0.0	Filled Joint / Fracture
9.2	180.7	52.4	0.0	Filled Joint / Fracture
9.7	353.7	63.8	0.0	Filled Joint / Fracture
10.0	176.2	63.0	0.0	Filled Joint / Fracture
10.4	20.7	34.4	0.0	Filled Joint / Fracture
12.0	354.8	64.3	0.0	Filled Joint / Fracture
12.0	164.1	58.2	0.0	Filled Joint / Fracture
12.3	185.7	67.4	0.0	Filled Joint / Fracture
13.5	57.3	79.0	0.0	Filled Joint / Fracture
13.7	352.5	65.9	0.0	Filled Joint / Fracture
13.9	174.9	56.2	0.0	Filled Joint / Fracture
14.7	169.1	50.8	0.0	Filled Joint / Fracture
14.8	172.0	62.8	0.0	Filled Joint / Fracture
15.1	358.2	55.3	0.0	Filled Joint / Fracture
15.8	175.6	56.2	0.0	Filled Joint / Fracture
16.0	64.6	73.8	0.0	Filled Joint / Fracture
16.5	61.5	65.7	0.0	Filled Joint / Fracture
16.7	257.4	68.0	0.0	Filled Joint / Fracture
17.0	55.8	71.8	0.0	Filled Joint / Fracture
17.1	66.2	75.9	0.0	Filled Joint / Fracture
17.5	67.0	70.6	0.0	Filled Joint / Fracture
18.1	62.3	72.9	0.0	Filled Joint / Fracture
18.7	349.2	60.8	0.0	Filled Joint / Fracture
19.2	167.3	55.2	0.0	Filled Joint / Fracture
19.4	20.4	53.8	0.0	Filled Joint / Fracture
20.2	60.3	52.1	0.0	Filled Joint / Fracture
20.3	83.3	64.5	0.0	Filled Joint / Fracture
20.9	168.9	59.4	0.0	Filled Joint / Fracture
21.4	162.0	62.4	0.0	Filled Joint / Fracture
21.5	25.0	66.5	0.0	Filled Joint / Fracture
23.0	56.5	66.0	0.0	Filled Joint / Fracture
24.5	51.8	76.8	0.0	Filled Joint / Fracture
25.4	68.3	74.1	0.0	Filled Joint / Fracture

Optical Televiewer Features - Boring AD1

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
26.9	56.8	71.9	0.0	Filled Joint / Fracture
27.8	9.4	62.9	0.0	Filled Joint / Fracture
28.4	50.9	70.2	0.0	Filled Joint / Fracture
30.3	348.0	64.3	0.0	Filled Joint / Fracture
31.3	359.1	57.3	0.0	Filled Joint / Fracture
32.1	76.0	80.0	0.0	Filled Joint / Fracture
32.3	350.9	61.4	0.0	Filled Joint / Fracture
32.6	163.3	63.2	0.0	Filled Joint / Fracture
33.5	162.2	61.3	0.0	Filled Joint / Fracture
33.8	162.2	64.2	0.0	Filled Joint / Fracture
34.4	124.3	73.6	0.0	Filled Joint / Fracture
34.8	121.4	59.3	0.0	Filled Joint / Fracture
35.5	163.7	68.8	0.0	Filled Joint / Fracture
36.1	99.0	70.5	0.0	Filled Joint / Fracture
36.1	171.5	73.6	0.0	Filled Joint / Fracture
36.3	184.1	60.7	0.0	Filled Joint / Fracture
37.4	343.1	59.5	0.0	Filled Joint / Fracture
37.8	235.9	40.5	0.0	Filled Joint / Fracture
38.1	69.3	60.4	0.0	Filled Joint / Fracture
38.6	135.4	65.7	0.0	Filled Joint / Fracture
38.7	296.9	66.2	0.0	Filled Joint / Fracture
38.8	66.5	44.8	0.0	Filled Joint / Fracture
39.7	147.1	62.4	0.0	Filled Joint / Fracture
41.6	166.3	55.0	0.0	Filled Joint / Fracture

GEOVision geophysical services

LOG TYPE

OTV

CLIENT ARDOT

PROJECT	HWY 70 EAST / 7 NORTH
WELL	AD1
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/22/2019

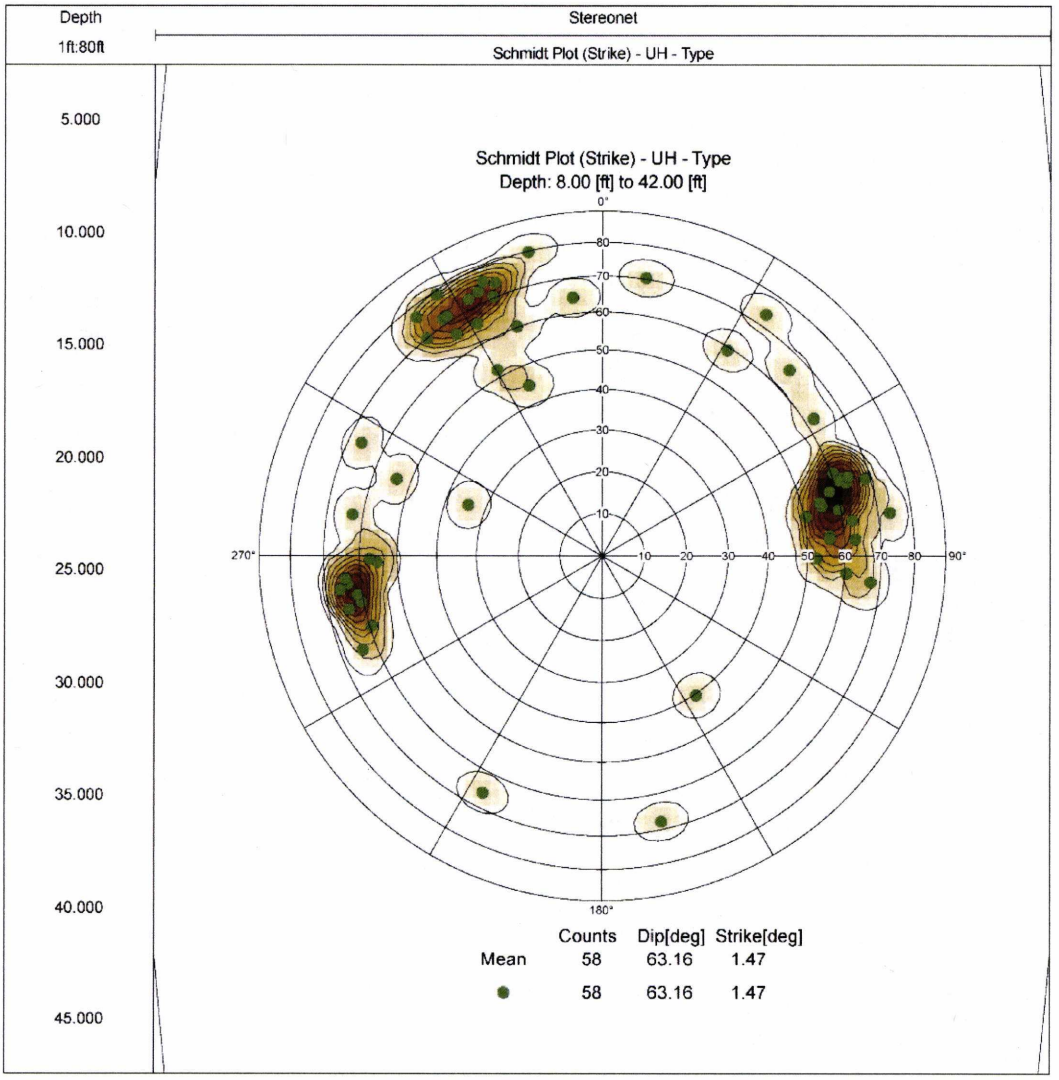


Figure 2. Boring AD1, Optical Stereonet Diagram

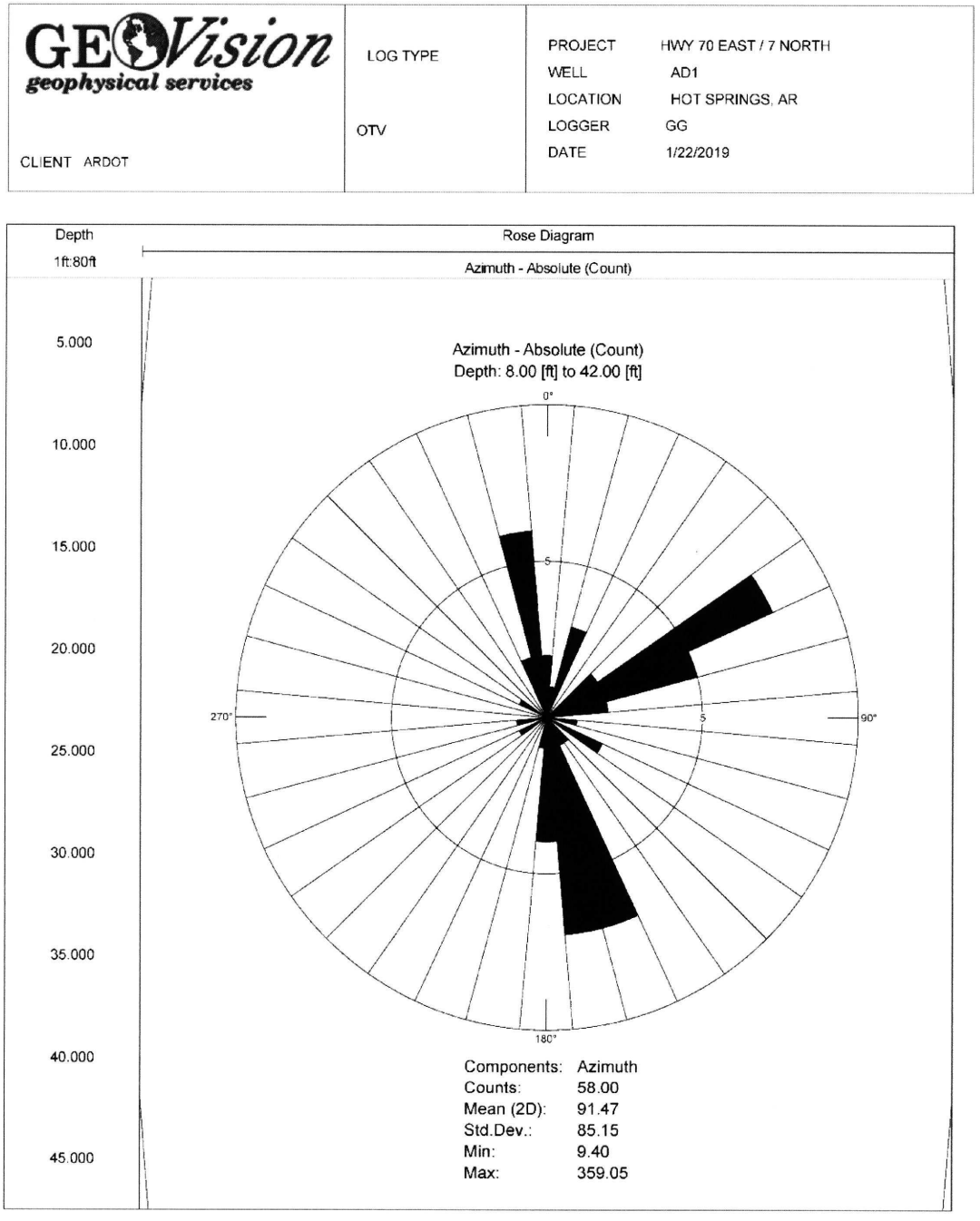
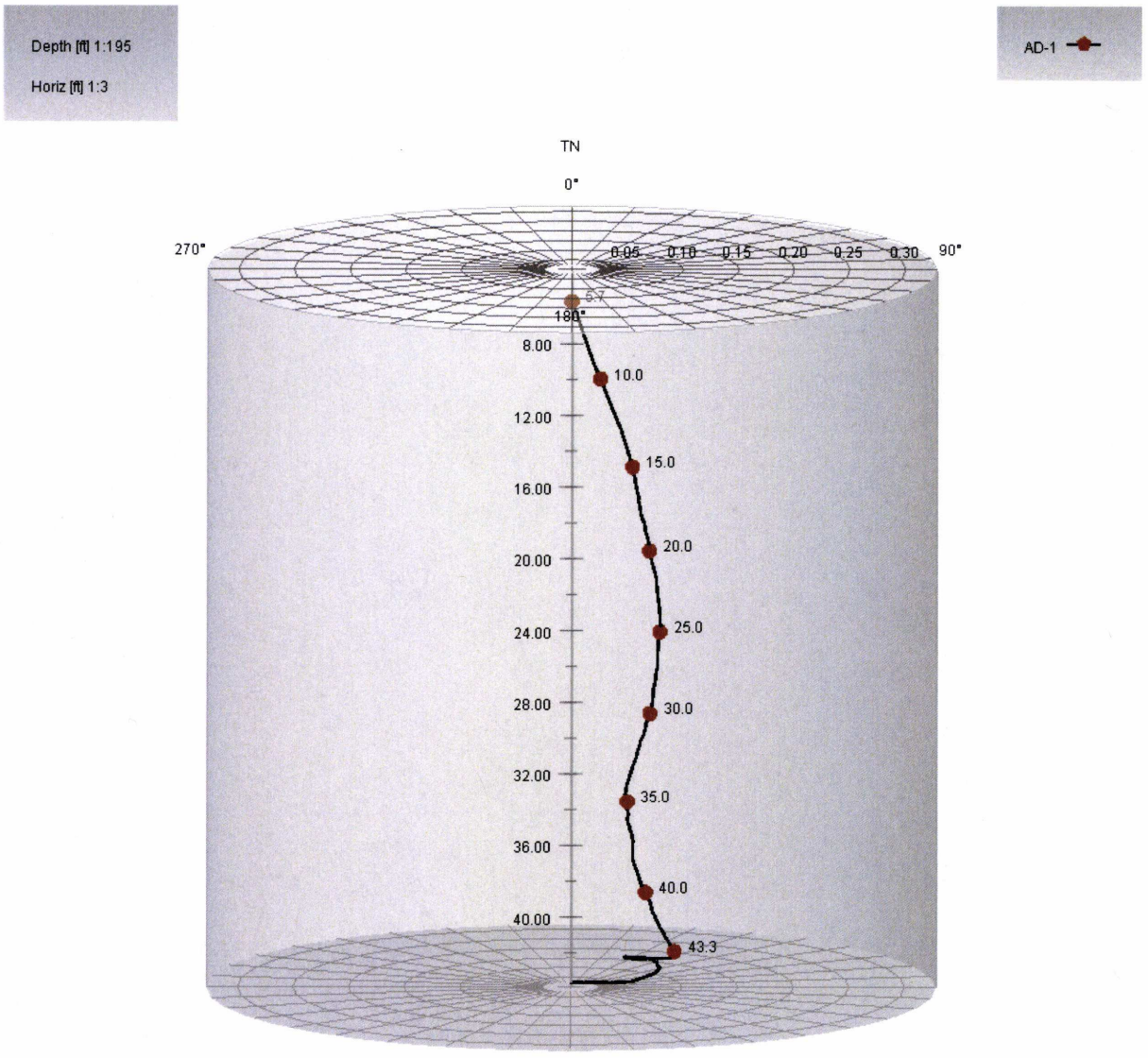


Figure 3. Boring AD1, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 0.35 feet

Figure 4. Boring AD1, Optical Deviation Projection

Table 5. Boring AD2, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD2

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
9.9	58.6	87.7	0.0	Filled Joint / Fracture
12.1	68.9	80.7	0.0	Filled Joint / Fracture
13.6	51.5	78.7	0.0	Filled Joint / Fracture
14.6	49.3	76.6	0.0	Filled Joint / Fracture
18.4	182.5	66.2	0.0	Filled Joint / Fracture
19.0	185.5	66.1	0.0	Filled Joint / Fracture
23.1	353.7	62.4	0.0	Filled Joint / Fracture
25.4	355.6	62.3	0.0	Filled Joint / Fracture
25.8	19.5	68.5	0.0	Filled Joint / Fracture
33.6	167.3	62.3	0.0	Filled Joint / Fracture
41.3	196.6	49.6	0.0	Filled Joint / Fracture
41.9	171.7	51.3	0.0	Filled Joint / Fracture
42.3	174.9	49.2	0.0	Filled Joint / Fracture
43.5	334.8	61.0	0.0	Filled Joint / Fracture
48.1	0.9	60.1	0.0	Filled Joint / Fracture
49.1	351.6	70.0	0.0	Filled Joint / Fracture
49.7	346.7	76.2	0.0	Filled Joint / Fracture
51.5	340.3	71.3	0.0	Filled Joint / Fracture
52.6	3.2	67.6	0.0	Filled Joint / Fracture
52.9	191.6	47.8	0.0	Filled Joint / Fracture
53.4	182.7	50.5	0.0	Filled Joint / Fracture
53.8	1.3	63.1	0.0	Filled Joint / Fracture
54.5	208.2	48.7	0.0	Filled Joint / Fracture
55.5	342.8	74.6	0.0	Filled Joint / Fracture
56.2	159.5	34.8	0.0	Filled Joint / Fracture
57.3	354.2	74.8	0.0	Filled Joint / Fracture
58.0	183.4	42.8	0.0	Filled Joint / Fracture
59.2	178.0	59.4	0.0	Filled Joint / Fracture
60.3	179.3	54.8	0.0	Filled Joint / Fracture
62.9	339.1	66.1	0.0	Filled Joint / Fracture
63.4	340.0	77.1	0.0	Filled Joint / Fracture
64.8	177.8	53.4	0.0	Filled Joint / Fracture
66.0	182.5	47.1	0.0	Filled Joint / Fracture
70.1	230.5	80.8	0.0	Filled Joint / Fracture
76.7	184.5	50.0	0.0	Filled Joint / Fracture

Optical Televiewer Features - Boring AD2

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
87.8	355.5	58.4	0.0	Filled Joint / Fracture
92.0	190.8	49.5	0.0	Filled Joint / Fracture
93.0	347.2	77.0	0.0	Filled Joint / Fracture
94.7	347.4	73.7	0.0	Filled Joint / Fracture
97.6	6.8	61.9	0.0	Filled Joint / Fracture
99.0	347.9	64.4	0.0	Filled Joint / Fracture
99.6	7.4	66.9	0.0	Filled Joint / Fracture
100.4	350.4	65.9	0.0	Filled Joint / Fracture
102.6	350.1	64.0	0.0	Filled Joint / Fracture
105.2	356.6	60.5	0.0	Filled Joint / Fracture
106.9	348.5	66.4	0.0	Filled Joint / Fracture
108.4	355.1	66.7	0.0	Filled Joint / Fracture
109.0	182.3	77.6	0.0	Filled Joint / Fracture
109.7	359.6	66.9	0.0	Filled Joint / Fracture
110.5	2.2	69.0	0.0	Filled Joint / Fracture
110.8	343.0	67.6	0.0	Filled Joint / Fracture
111.6	183.7	81.0	0.0	Filled Joint / Fracture
112.0	1.6	68.6	0.0	Filled Joint / Fracture
113.1	183.5	72.1	0.0	Filled Joint / Fracture
113.7	349.7	67.3	0.0	Filled Joint / Fracture
117.3	344.9	66.4	0.0	Filled Joint / Fracture
118.2	355.3	67.8	0.0	Filled Joint / Fracture
118.4	177.9	59.1	0.0	Filled Joint / Fracture
119.3	334.3	71.0	0.0	Filled Joint / Fracture

GEOVision geophysical services	LOG TYPE	PROJECT HWY 70 EAST, HWY 7 NORTH
		WELL AD2
		LOCATION HOT SPRINGS, AR
	OTV	LOGGER GG
CLIENT ARDOT		DATE 1/22/2019

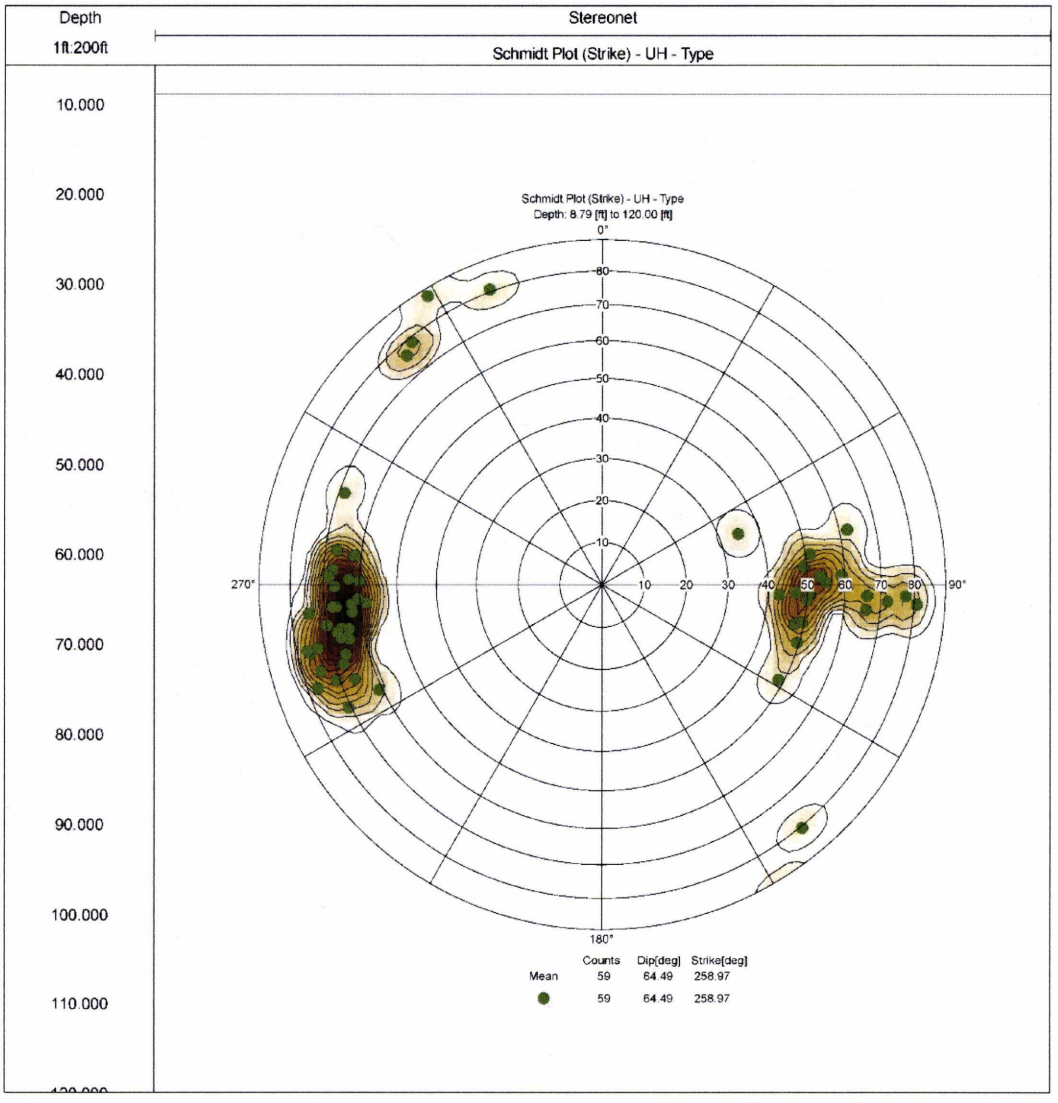


Figure 5. Boring AD2, Optical Stereonet Diagram

GEOVision geophysical services

LOG TYPE

OTV

CLIENT ARDOT

PROJECT	HWY 70 EAST, HWY 7 NORTH
WELL	AD2
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/22/2019

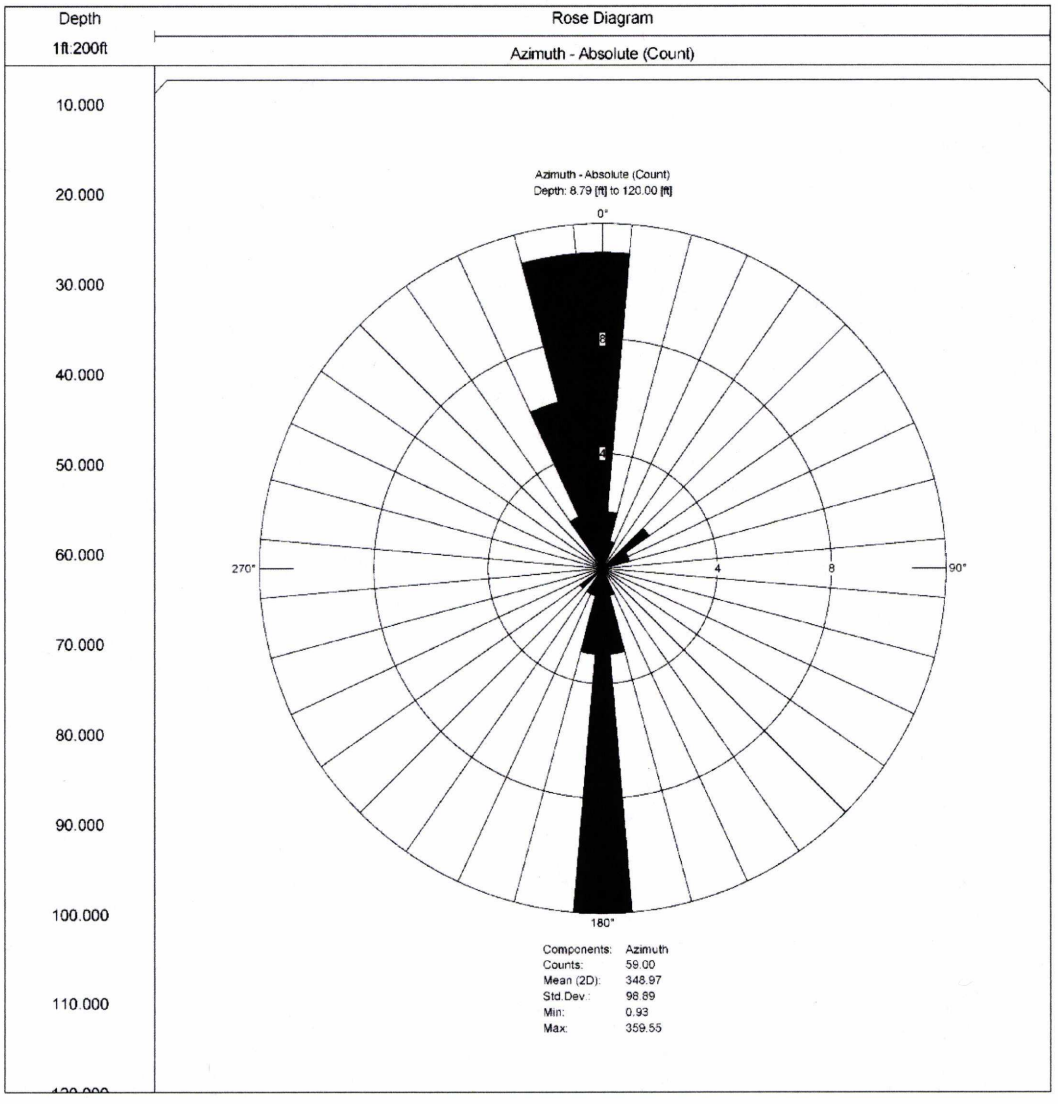
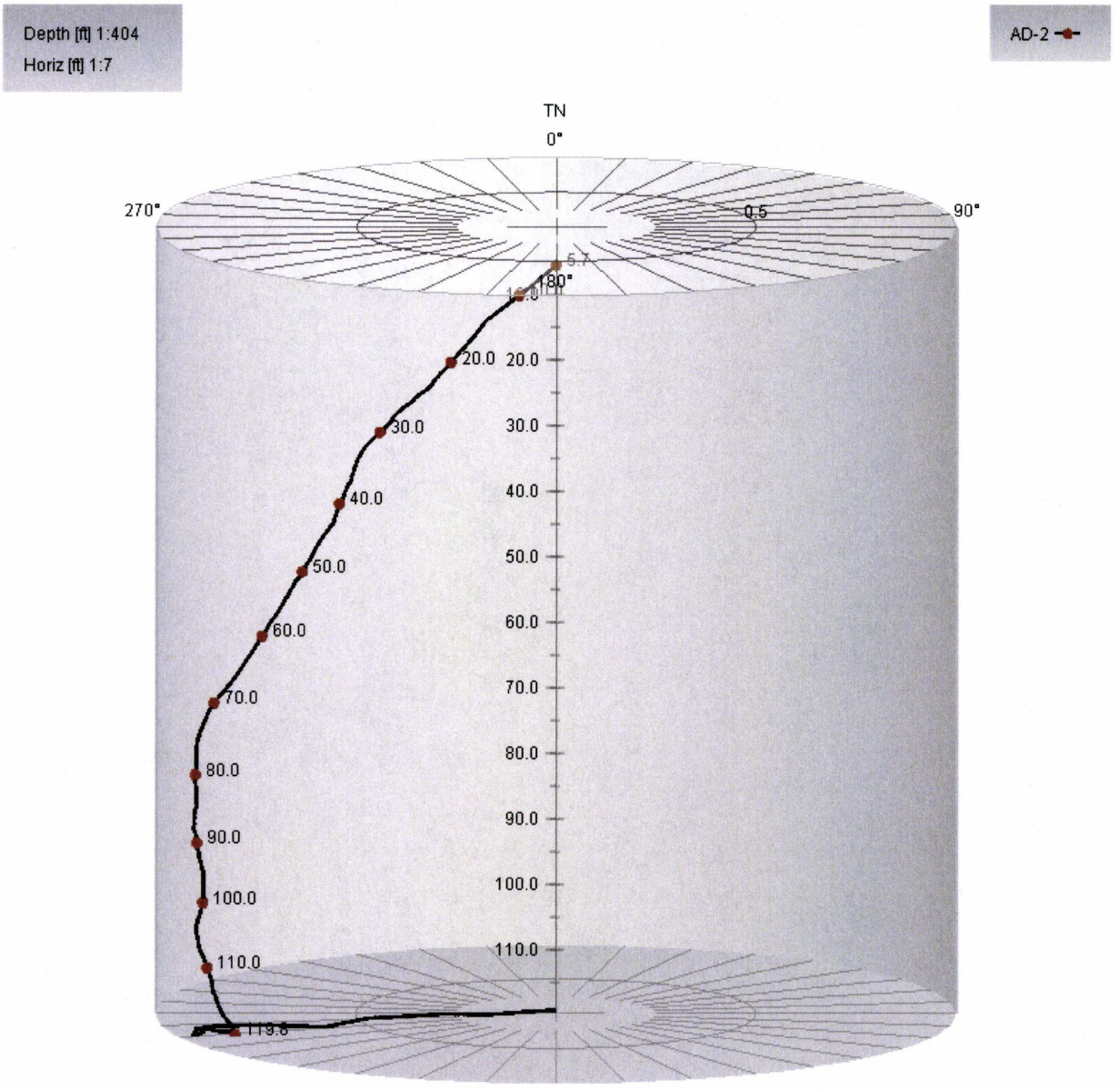


Figure 6. Boring AD2, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 1 foot

Figure 7. Boring AD2, Optical Deviation Projection

Table 6. Boring AD3, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD3

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
9.9	304.4	63.7	0.0	Filled Joint / Fracture
13.4	329.0	69.4	0.0	Filled Joint / Fracture
16.7	268.8	36.7	0.0	Open Joint / Fracture
16.8	295.6	80.1	0.0	Open Joint / Fracture
17.1	1.1	72.2	0.0	Open Joint / Fracture
19.6	336.8	77.9	0.0	Open Joint / Fracture
20.5	341.4	62.4	0.0	Open Joint / Fracture
25.1	353.9	67.2	0.0	Filled Joint / Fracture
32.3	248.2	70.3	0.0	Filled Joint / Fracture
33.3	271.8	54.0	0.0	Filled Joint / Fracture
43.4	54.4	59.8	0.0	Filled Joint / Fracture
48.5	268.9	76.1	0.0	Filled Joint / Fracture
51.4	175.0	53.3	0.0	Filled Joint / Fracture
51.7	176.6	62.5	0.0	Filled Joint / Fracture
53.8	3.2	70.3	0.0	Filled Joint / Fracture
57.6	165.3	48.4	0.0	Filled Joint / Fracture
58.6	263.3	73.7	0.0	Filled Joint / Fracture
58.7	146.5	60.9	0.0	Filled Joint / Fracture
59.2	278.3	53.9	0.0	Filled Joint / Fracture
59.8	153.2	64.3	0.0	Filled Joint / Fracture
60.7	268.5	69.1	0.0	Filled Joint / Fracture
61.3	44.4	68.4	0.0	Filled Joint / Fracture
62.3	23.7	61.7	0.0	Filled Joint / Fracture
64.3	276.0	65.7	0.0	Filled Joint / Fracture
64.4	110.6	69.4	0.0	Filled Joint / Fracture
66.4	8.8	62.6	0.0	Filled Joint / Fracture
67.0	18.1	76.7	0.0	Filled Joint / Fracture
67.5	69.4	66.3	0.0	Filled Joint / Fracture
68.2	168.4	58.4	0.0	Filled Joint / Fracture
68.5	30.4	76.0	0.0	Filled Joint / Fracture
69.2	17.7	76.6	0.0	Filled Joint / Fracture
73.6	163.2	64.9	0.0	Filled Joint / Fracture
74.9	175.5	54.1	0.0	Filled Joint / Fracture
76.6	14.8	77.0	0.0	Filled Joint / Fracture
81.2	58.3	69.0	0.0	Filled Joint / Fracture

Optical Televiewer Features - Boring AD3

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
82.0	36.7	77.0	0.0	Filled Joint / Fracture
82.8	34.7	59.9	0.0	Filled Joint / Fracture
85.2	21.4	59.5	0.0	Filled Joint / Fracture
86.4	14.1	60.9	0.0	Filled Joint / Fracture
87.4	36.3	77.9	0.0	Filled Joint / Fracture
87.4	185.0	68.4	0.0	Filled Joint / Fracture
88.5	35.3	60.7	0.0	Filled Joint / Fracture
90.8	173.6	60.4	0.0	Filled Joint / Fracture
90.9	37.1	71.5	0.0	Filled Joint / Fracture
93.4	3.7	71.7	0.0	Filled Joint / Fracture
95.0	180.8	61.5	0.0	Filled Joint / Fracture
99.4	24.3	75.5	0.0	Filled Joint / Fracture
103.9	343.6	69.9	0.0	Filled Joint / Fracture
104.7	359.2	55.9	0.0	Filled Joint / Fracture
105.6	55.7	70.6	0.0	Filled Joint / Fracture
109.9	3.3	69.4	0.0	Filled Joint / Fracture
112.1	16.9	63.2	0.0	Filled Joint / Fracture
116.4	157.5	72.0	0.0	Filled Joint / Fracture
121.3	52.8	60.1	0.0	Filled Joint / Fracture
121.5	57.3	62.3	0.0	Filled Joint / Fracture
125.5	85.1	78.2	0.0	Filled Joint / Fracture
137.7	29.0	78.4	0.0	Filled Joint / Fracture
139.2	31.8	77.1	0.0	Filled Joint / Fracture
142.0	83.9	72.5	0.0	Filled Joint / Fracture
144.7	41.9	58.3	0.0	Filled Joint / Fracture

GEOVision geophysical services

CLIENT ARDOT

LOG TYPE

OTV

PROJECT	HWY 70 EAST / HWY 7 NORTH
WELL	AD3
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/22/2019

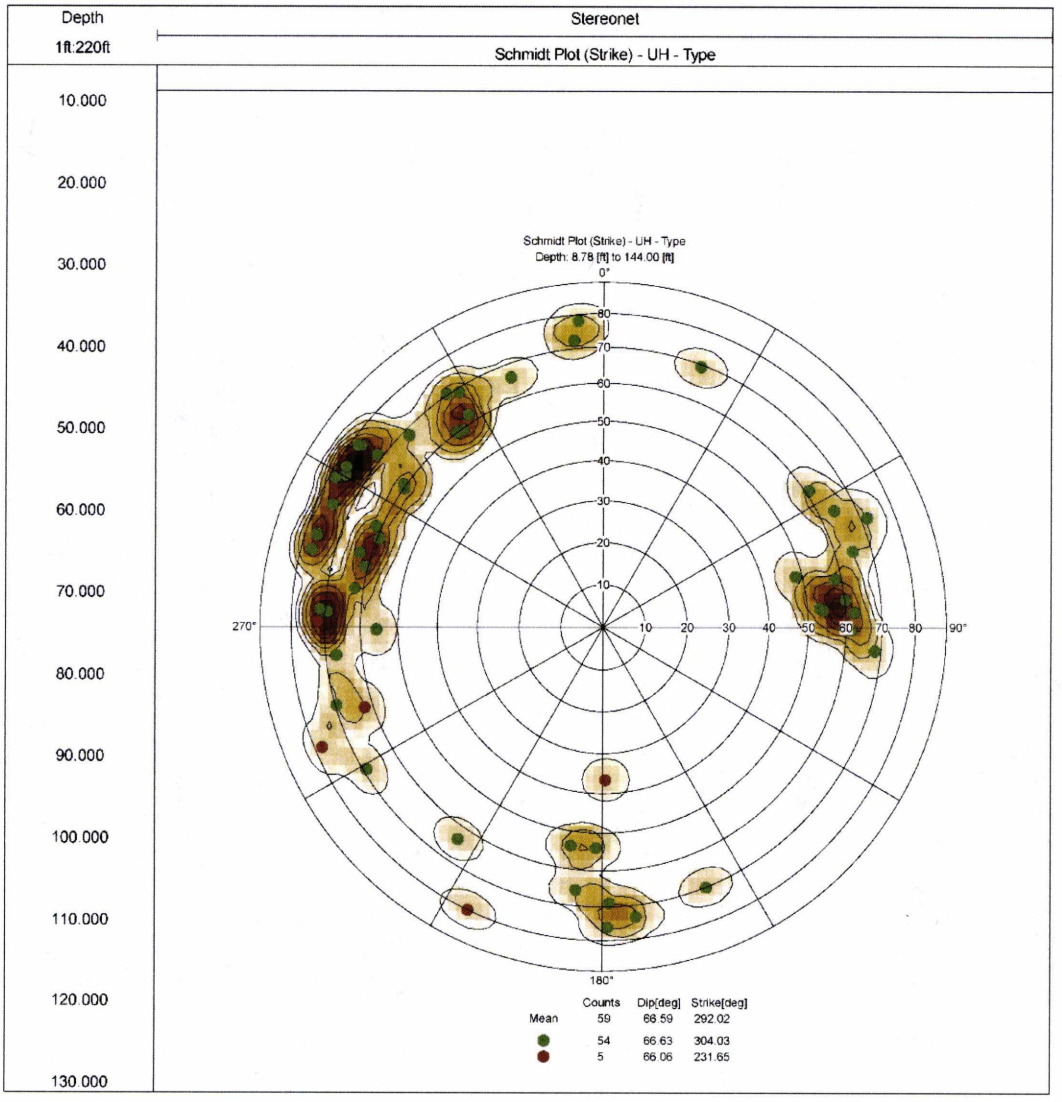


Figure 8. Boring AD3, Optical Stereonet Diagram

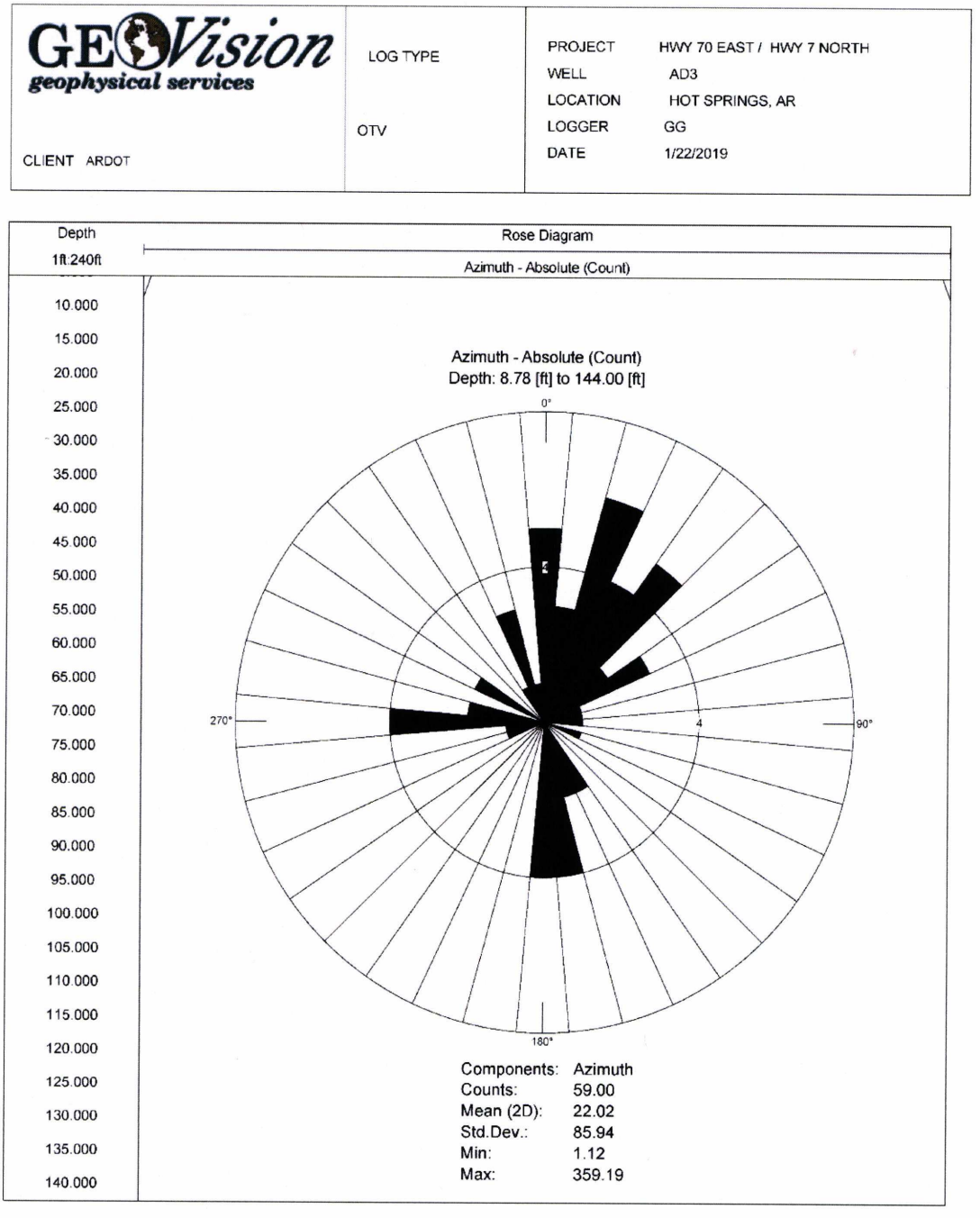
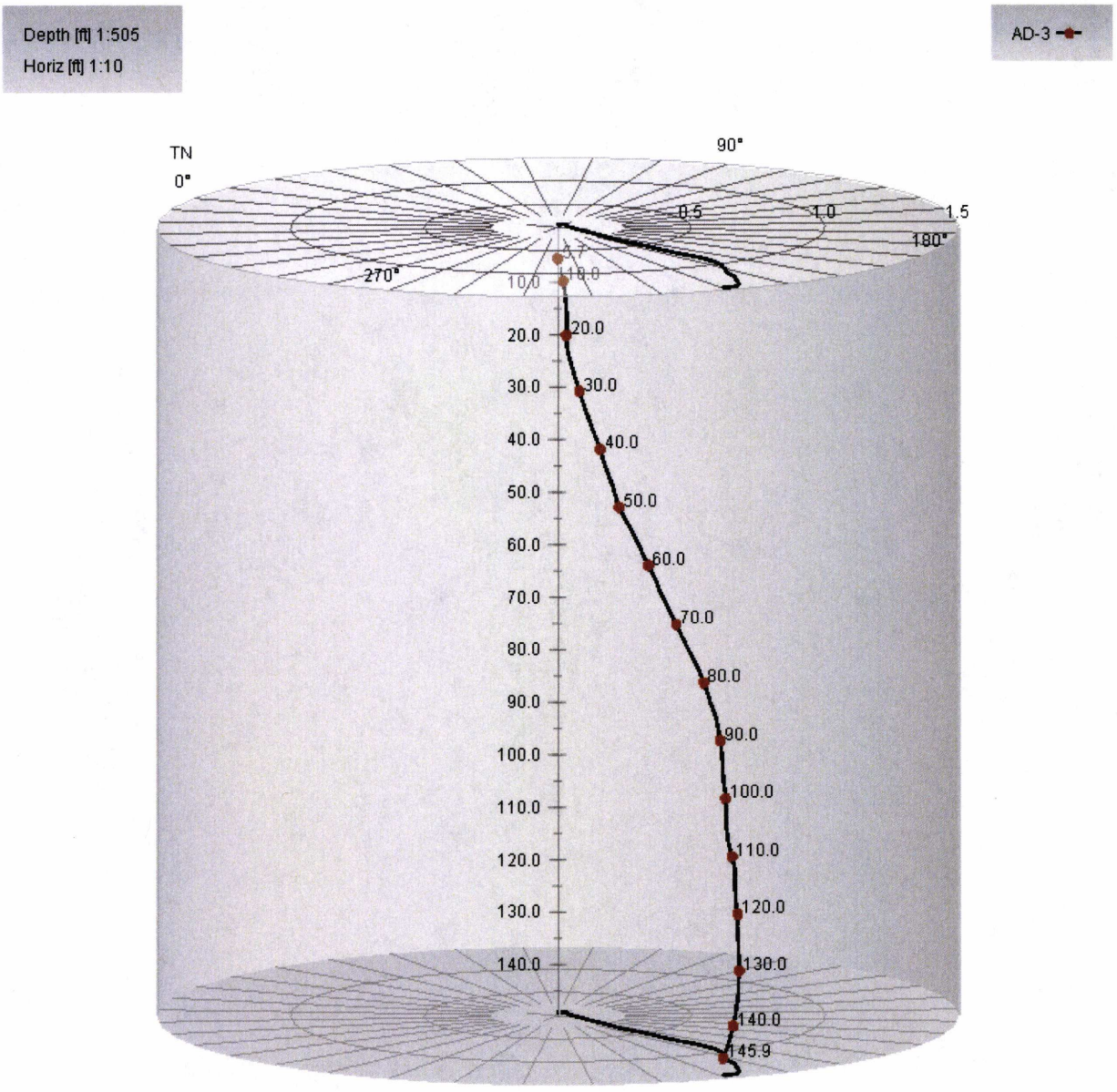


Figure 9. Boring AD3, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 1.5 feet

Figure 10. Boring AD3, Optical Deviation Projection

Table 7. Boring AD4, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD4

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
19.5	329.3	55.4	0.0	Bedding / Banding / Foliation
23.6	231.9	18.0	0.0	Bedding / Banding / Foliation
25.3	210.9	16.6	0.0	Bedding / Banding / Foliation
26.6	243.1	12.8	0.0	Bedding / Banding / Foliation
30.7	184.3	23.0	0.0	Bedding / Banding / Foliation
31.6	323.8	57.9	0.0	Filled Joint / Fracture
31.7	319.9	76.0	0.0	Filled Joint / Fracture
32.2	346.1	63.2	0.0	Filled Joint / Fracture
34.3	194.0	13.5	0.0	Bedding / Banding / Foliation
37.0	247.8	17.9	0.0	Bedding / Banding / Foliation
38.9	280.9	43.6	0.0	Bedding / Banding / Foliation
39.4	282.7	45.6	0.0	Bedding / Banding / Foliation
42.4	288.0	44.4	0.0	Bedding / Banding / Foliation
42.7	285.0	47.7	0.0	Bedding / Banding / Foliation
43.1	201.6	75.6	0.0	Filled Joint / Fracture
44.8	294.7	54.3	0.0	Bedding / Banding / Foliation
46.6	278.5	51.4	0.0	Bedding / Banding / Foliation
47.3	288.3	60.2	0.0	Filled Joint / Fracture
47.8	310.1	62.5	0.0	Filled Joint / Fracture
48.2	347.5	76.7	0.0	Filled Joint / Fracture
48.5	285.8	79.8	0.0	Filled Joint / Fracture
48.8	168.8	68.7	0.0	Filled Joint / Fracture
49.3	141.8	22.1	0.0	Bedding / Banding / Foliation
50.1	4.8	76.7	0.0	Filled Joint / Fracture
51.8	281.2	20.0	0.0	Bedding / Banding / Foliation
52.2	164.1	61.0	0.0	Filled Joint / Fracture
52.8	242.5	66.1	0.0	Filled Joint / Fracture
53.7	145.4	13.4	0.0	Bedding / Banding / Foliation
56.0	250.8	11.3	0.0	Bedding / Banding / Foliation
57.9	224.3	10.9	0.0	Bedding / Banding / Foliation
59.1	232.8	9.7	0.0	Bedding / Banding / Foliation
59.2	14.8	80.8	0.0	Filled Joint / Fracture
60.9	213.5	24.8	0.0	Bedding / Banding / Foliation
61.4	181.7	17.8	0.0	Bedding / Banding / Foliation
61.8	3.0	82.0	0.0	Filled Joint / Fracture

Optical Televiewer Features - Boring AD4

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
62.7	50.4	68.9	0.0	Filled Joint / Fracture
62.7	198.1	59.9	0.0	Filled Joint / Fracture
63.3	269.6	22.7	0.0	Bedding / Banding / Foliation
64.3	257.7	80.7	0.0	Filled Joint / Fracture
64.6	253.5	21.8	0.0	Bedding / Banding / Foliation
65.5	343.4	72.6	0.0	Filled Joint / Fracture

GEOVision geophysical services

LOG TYPE

OTV

CLIENT ARDOT

PROJECT	HWY 70 EAST / 7 NORTH
WELL	AD4
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/23/2019

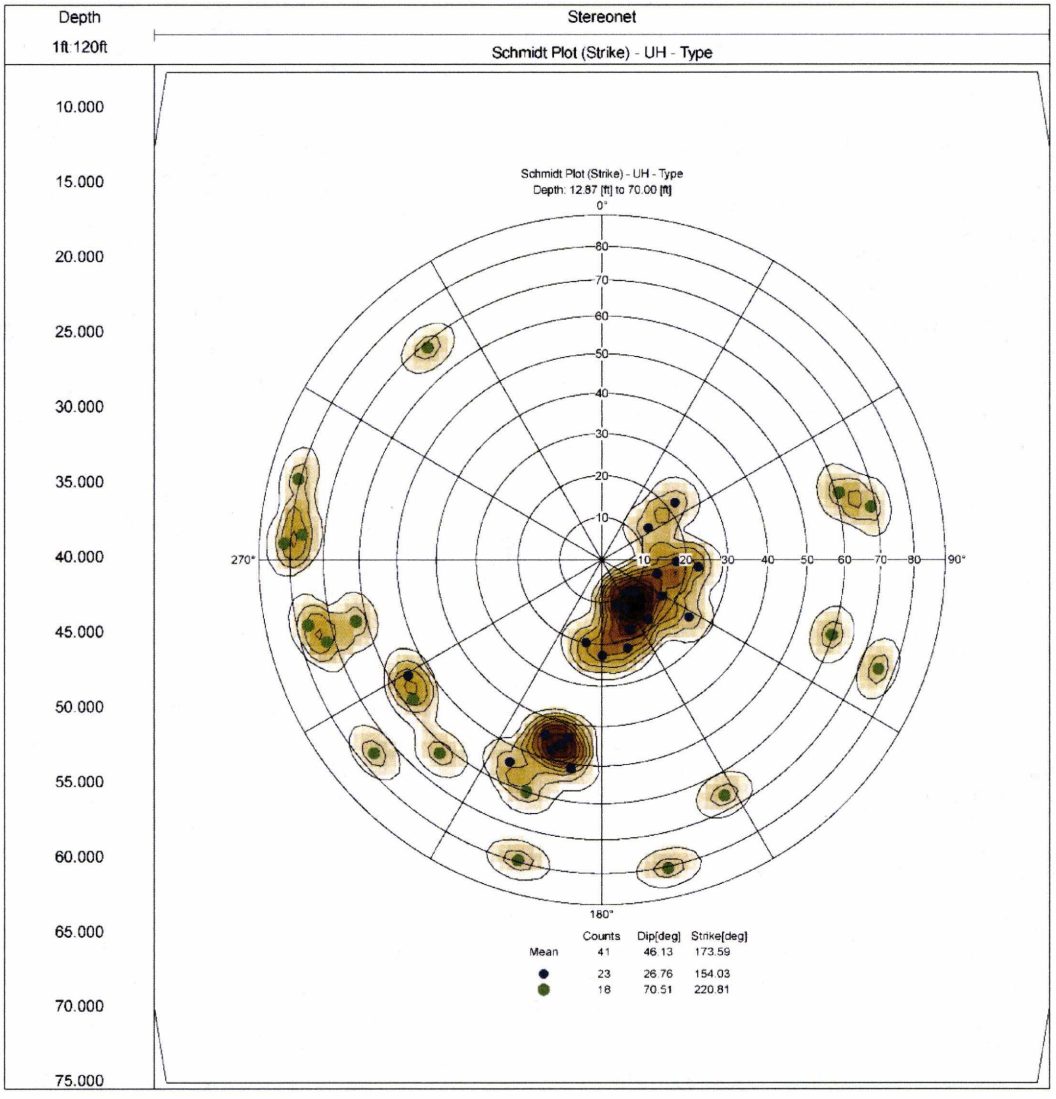


Figure 11. Boring AD4, Optical Stereonet Diagram

GEOVision geophysical services

LOG TYPE

OTV

CLIENT ARDOT

PROJECT	HWY 70 EAST / 7 NORTH
WELL	AD4
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/23/2019

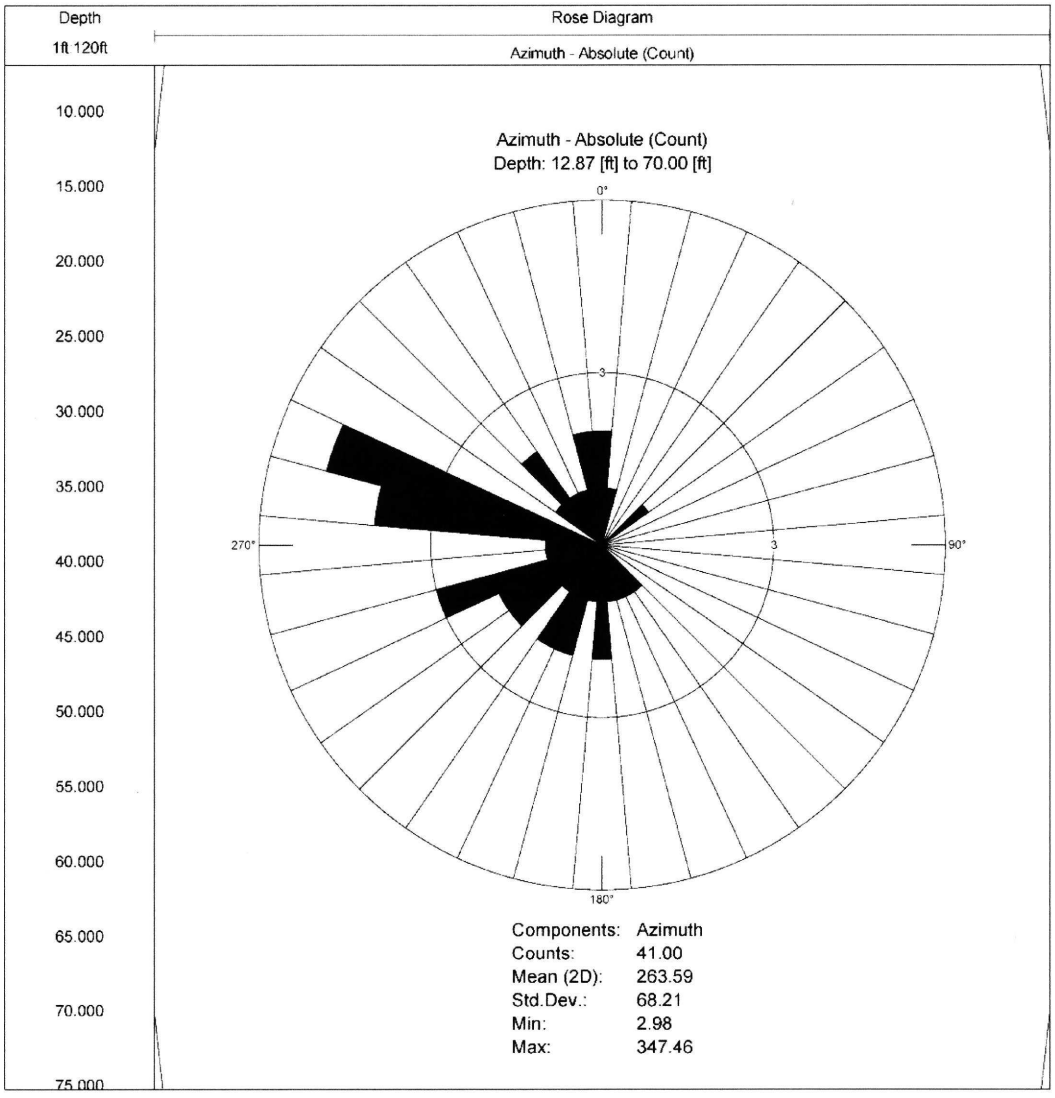
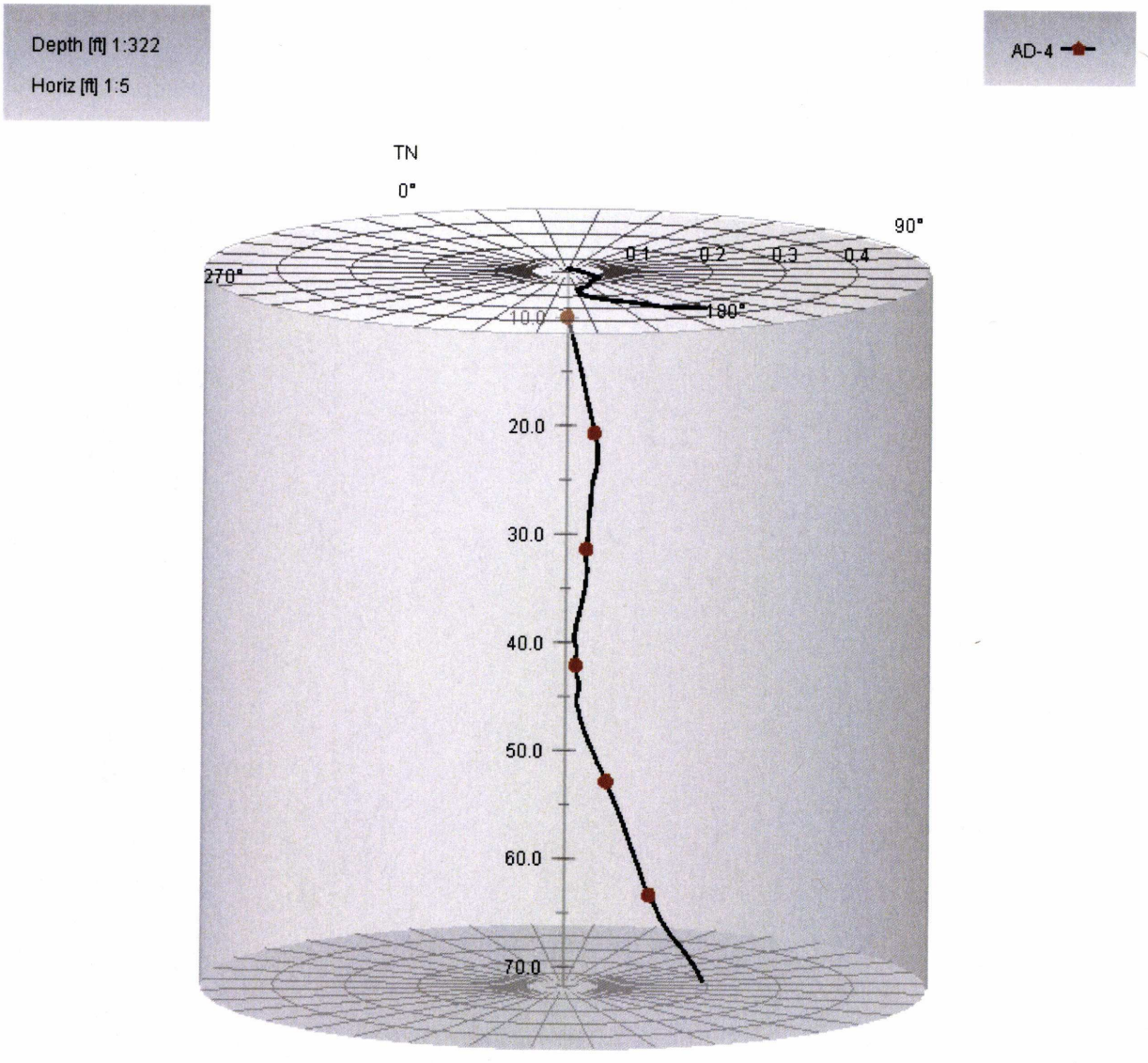


Figure 12. Boring AD4, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 0.5 feet

Figure 13. Boring AD4, Optical Deviation Projection

Table 8. Boring AD6, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD6

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
6.1	135.3	17.4	0.0	Bedding / Banding / Foliation
7.4	149.1	19.9	0.0	Bedding / Banding / Foliation
9.3	172.5	16.5	0.0	Bedding / Banding / Foliation
10.2	143.1	29.1	0.0	Bedding / Banding / Foliation
10.8	155.4	25.6	0.0	Bedding / Banding / Foliation
11.5	285.7	30.2	0.0	Filled Joint / Fracture
12.9	155.6	27.5	0.0	Bedding / Banding / Foliation
13.4	337.0	35.9	0.0	Filled Joint / Fracture
14.4	288.6	23.7	0.0	Filled Joint / Fracture
15.0	152.2	29.2	0.0	Bedding / Banding / Foliation
17.1	150.4	31.6	0.0	Bedding / Banding / Foliation
19.5	163.2	28.1	0.0	Bedding / Banding / Foliation
21.5	146.1	32.0	0.0	Bedding / Banding / Foliation
23.0	140.6	37.7	0.0	Bedding / Banding / Foliation
26.2	19.9	80.4	0.0	Filled Joint / Fracture
38.2	140.8	40.3	0.0	Bedding / Banding / Foliation
38.5	31.0	68.1	0.0	Filled Joint / Fracture
42.1	338.4	58.5	0.0	Filled Joint / Fracture
42.3	148.6	41.4	0.0	Bedding / Banding / Foliation
44.7	159.0	42.0	0.0	Bedding / Banding / Foliation
45.8	339.8	47.3	0.0	Open Joint / Fracture
46.7	15.9	31.6	0.0	Filled Joint / Fracture
47.2	14.6	40.2	0.0	Filled Joint / Fracture
48.6	146.1	38.5	0.0	Bedding / Banding / Foliation
49.1	140.1	37.9	0.0	Bedding / Banding / Foliation
50.2	153.4	32.9	0.0	Bedding / Banding / Foliation
53.8	133.3	36.6	0.0	Bedding / Banding / Foliation
54.6	18.4	76.7	0.0	Filled Joint / Fracture
56.0	136.1	28.9	0.0	Bedding / Banding / Foliation
56.9	278.5	68.8	0.0	Filled Joint / Fracture
59.4	27.4	74.5	0.0	Filled Joint / Fracture
60.0	21.2	75.8	0.0	Filled Joint / Fracture
61.9	23.8	76.6	0.0	Filled Joint / Fracture
62.1	140.5	26.7	0.0	Bedding / Banding / Foliation
63.1	134.4	23.5	0.0	Bedding / Banding / Foliation

Optical Televiewer Features - Boring AD6

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
64.2	122.7	30.0	0.0	Bedding / Banding / Foliation
66.6	139.7	28.7	0.0	Bedding / Banding / Foliation
66.7	345.9	74.9	0.0	Filled Joint / Fracture

GEOVision geophysical services

CLIENT ARDOT

LOG TYPE

OTV

PROJECT	HWY 70 EAST / 7 NORTH
WELL	AD6
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/23/2019

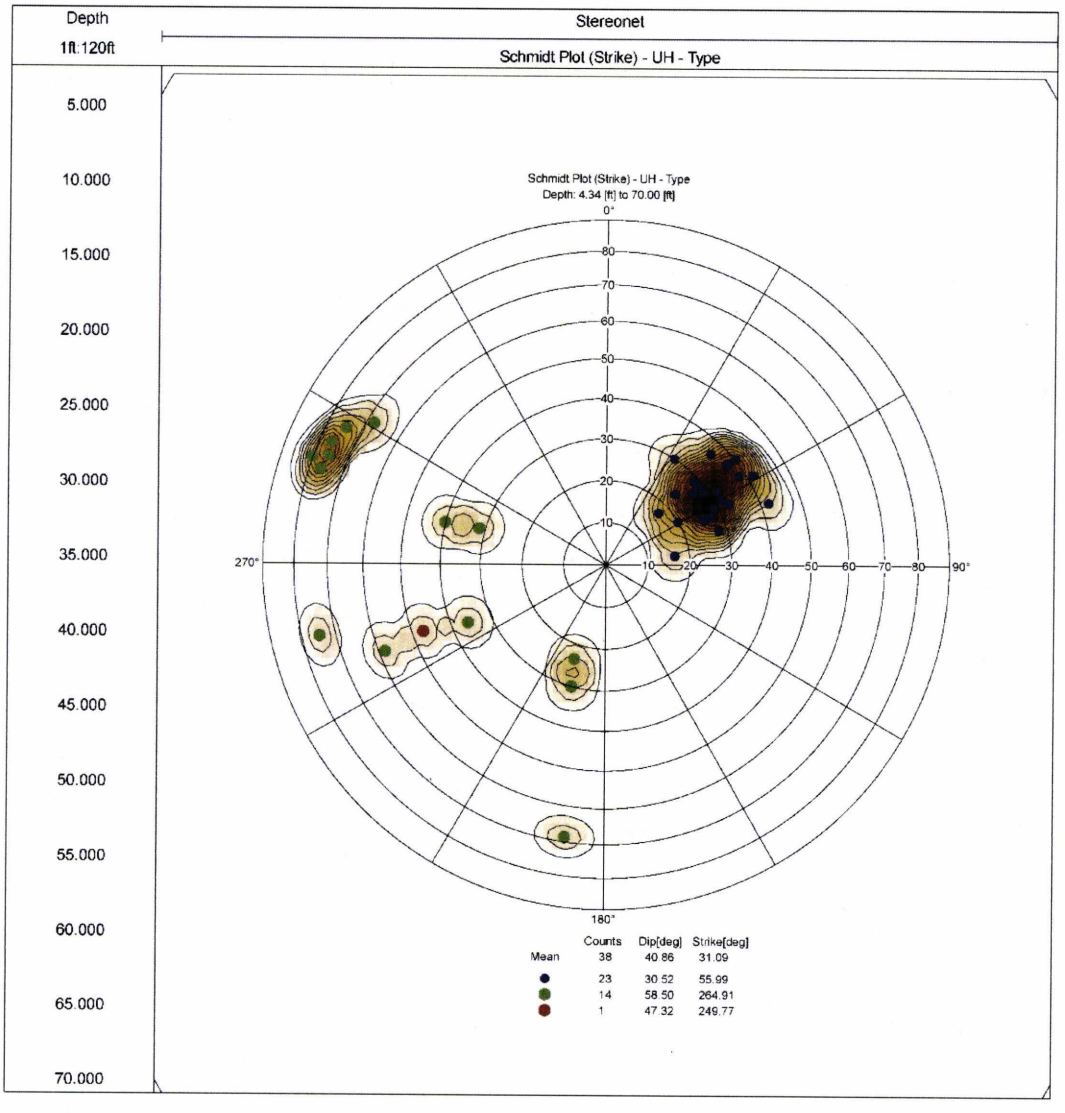


Figure 14. Boring AD6, Optical Stereonet Diagram

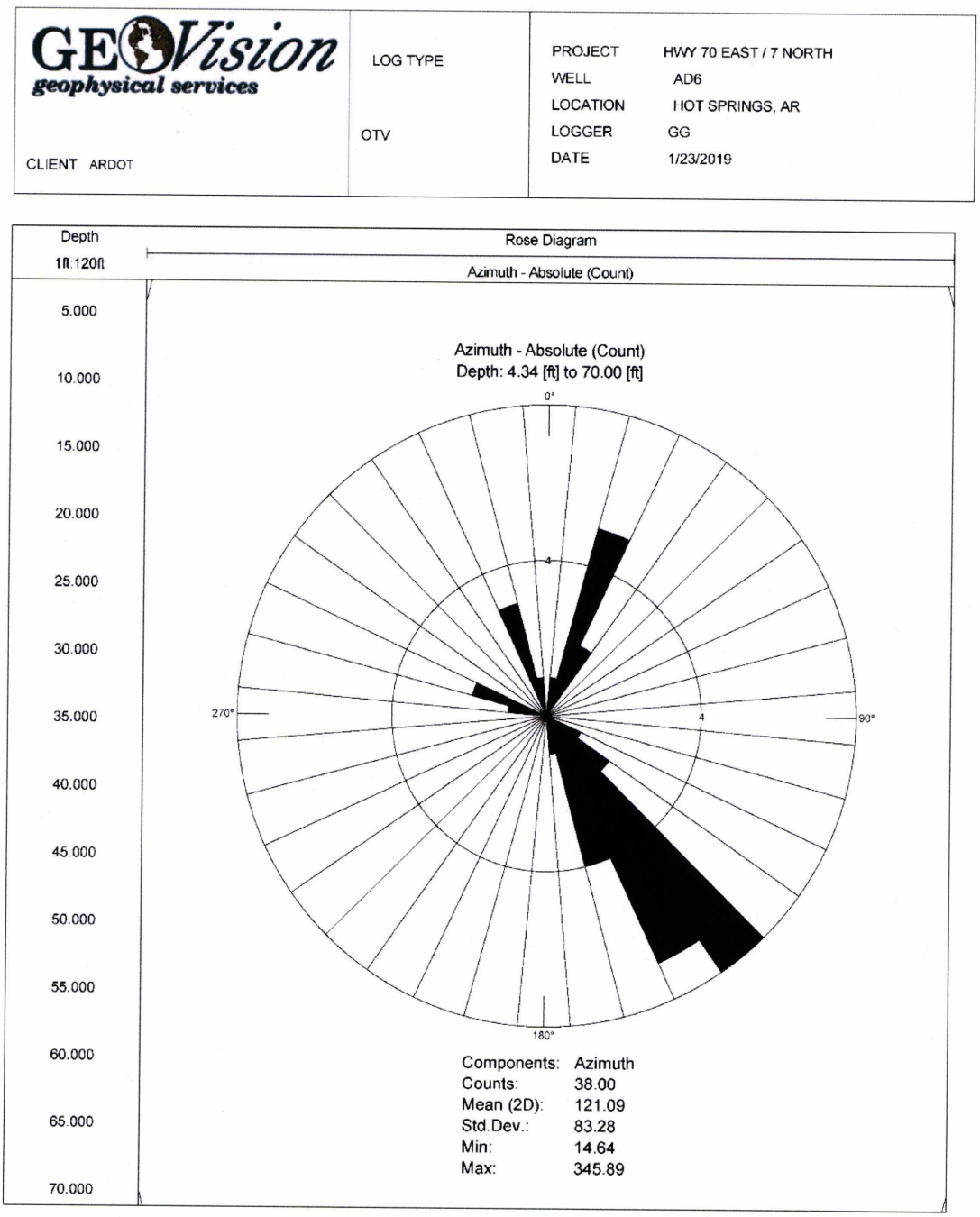
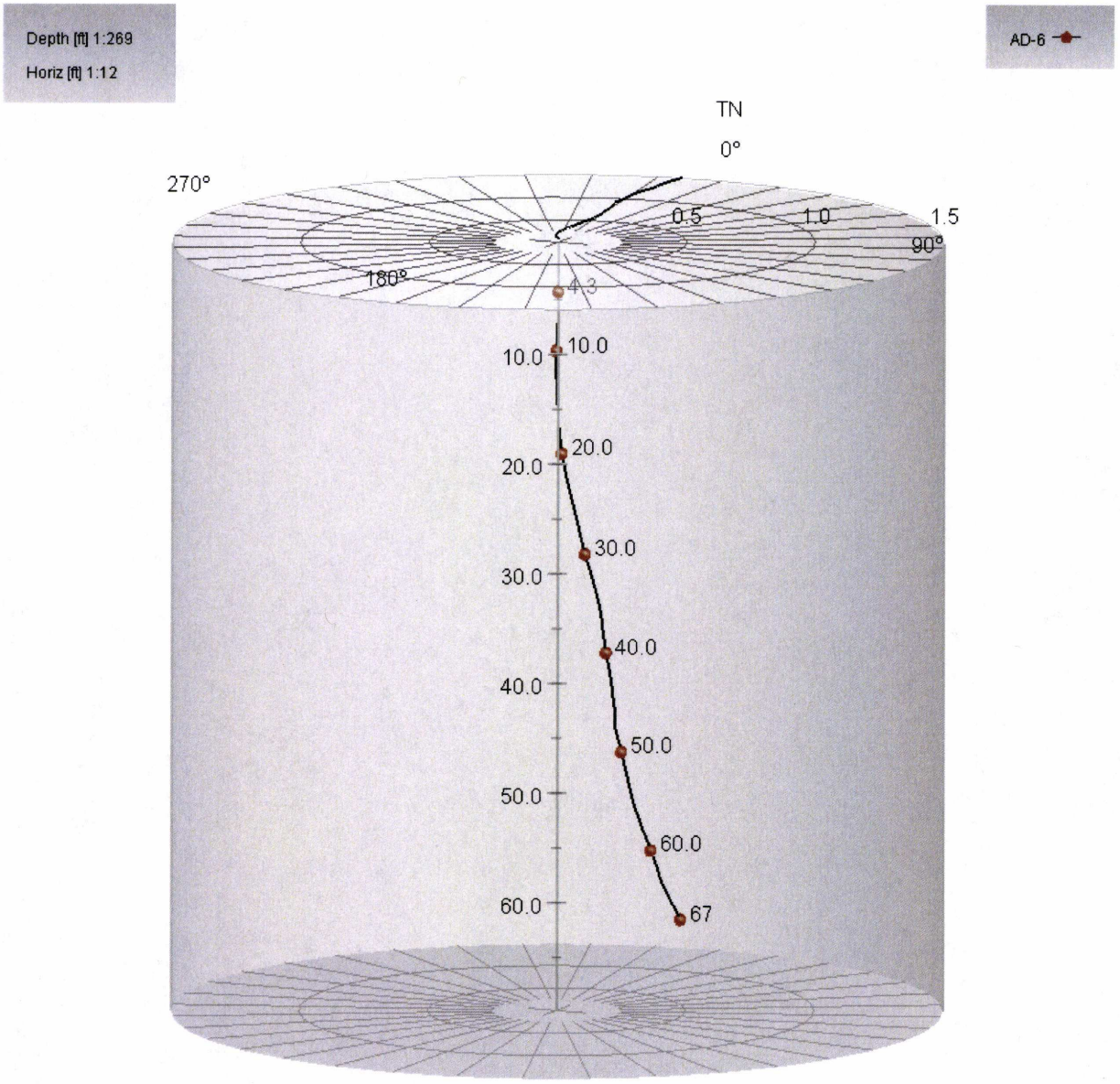


Figure 15. Boring AD6, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 1.5 feet

Figure 16. Boring AD6, Optical Deviation Projection

Table 9. Boring AD8, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD8

Depth	Azimuth	Dip	Aperture	Type
ft	deg	deg	mm	
9.4	224.5	77.4	0.0	Filled Joint / Fracture
9.4	15.3	79.3	0.0	Filled Joint / Fracture
9.8	239.9	71.2	0.0	Filled Joint / Fracture
10.0	131.6	45.9	0.0	Filled Joint / Fracture
10.4	254.9	76.5	0.0	Filled Joint / Fracture
10.7	353.6	81.2	0.0	Filled Joint / Fracture
11.2	268.5	75.3	0.0	Filled Joint / Fracture
11.5	204.1	83.1	0.0	Filled Joint / Fracture
13.3	224.6	84.1	0.0	Filled Joint / Fracture
15.2	229.6	78.8	0.0	Filled Joint / Fracture
15.7	17.4	77.5	0.0	Filled Joint / Fracture
16.2	304.6	27.4	0.0	Filled Joint / Fracture
17.1	225.3	82.9	0.0	Filled Joint / Fracture
17.9	21.5	54.7	0.0	Filled Joint / Fracture
18.7	118.2	42.9	0.0	Bedding / Banding / Foliation
20.0	131.1	48.1	0.0	Bedding / Banding / Foliation
21.3	245.4	80.2	0.0	Filled Joint / Fracture
21.9	135.1	43.1	0.0	Filled Joint / Fracture
23.4	146.6	49.9	0.0	Filled Joint / Fracture
23.5	137.1	46.1	0.0	Bedding / Banding / Foliation
23.8	14.3	74.4	0.0	Filled Joint / Fracture
28.9	21.0	75.9	0.0	Filled Joint / Fracture
29.9	144.0	48.8	0.0	Filled Joint / Fracture
31.0	139.1	50.9	0.0	Bedding / Banding / Foliation
31.8	130.2	38.7	0.0	Bedding / Banding / Foliation
33.0	138.2	50.9	0.0	Bedding / Banding / Foliation
34.7	135.2	46.0	0.0	Bedding / Banding / Foliation
36.8	117.7	36.6	0.0	Bedding / Banding / Foliation
40.1	137.3	49.2	0.0	Filled Joint / Fracture
40.4	29.3	45.2	0.0	Filled Joint / Fracture
46.3	138.1	57.9	0.0	Filled Joint / Fracture
50.2	359.4	73.3	0.0	Filled Joint / Fracture
51.2	136.8	57.1	0.0	Bedding / Banding / Foliation
52.2	148.3	41.0	0.0	Bedding / Banding / Foliation
53.1	304.9	68.3	0.0	Filled Joint / Fracture

Optical Televiewer Features - Boring AD8

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
53.3	139.8	64.4	0.0	Bedding / Banding / Foliation
54.8	141.0	61.0	0.0	Bedding / Banding / Foliation
55.9	81.0	34.7	0.0	Filled Joint / Fracture
56.4	160.7	60.0	0.0	Bedding / Banding / Foliation
56.8	145.0	60.8	0.0	Bedding / Banding / Foliation
58.9	7.2	53.9	0.0	Filled Joint / Fracture
60.0	131.2	61.5	0.0	Bedding / Banding / Foliation
60.2	13.4	83.8	0.0	Filled Joint / Fracture
61.9	301.5	62.5	0.0	Filled Joint / Fracture
63.0	127.6	80.3	0.0	Filled Joint / Fracture
64.0	137.9	54.5	0.0	Bedding / Banding / Foliation
64.3	267.0	71.7	0.0	Filled Joint / Fracture
65.2	301.0	61.5	0.0	Filled Joint / Fracture
69.9	336.8	45.4	0.0	Filled Joint / Fracture
72.6	128.5	60.3	0.0	Bedding / Banding / Foliation
73.7	131.4	61.0	0.0	Bedding / Banding / Foliation

GEOVision geophysical services

CLIENT ARDOT

LOG TYPE

OTV

PROJECT	HWY 70 EAST / 7 NORTH
WELL	AD8
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/23/2019

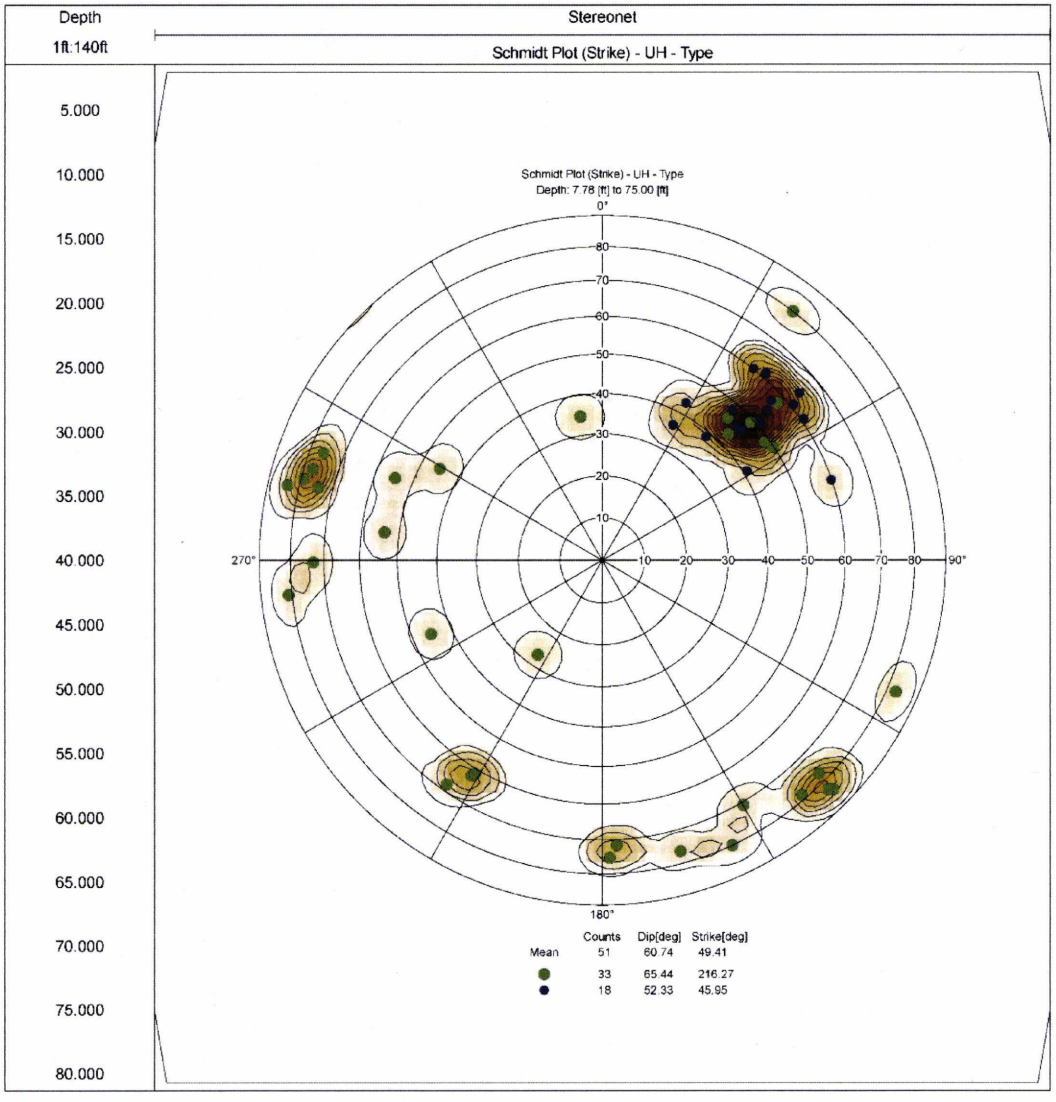


Figure 17. Boring AD8, Optical Stereonet Diagram

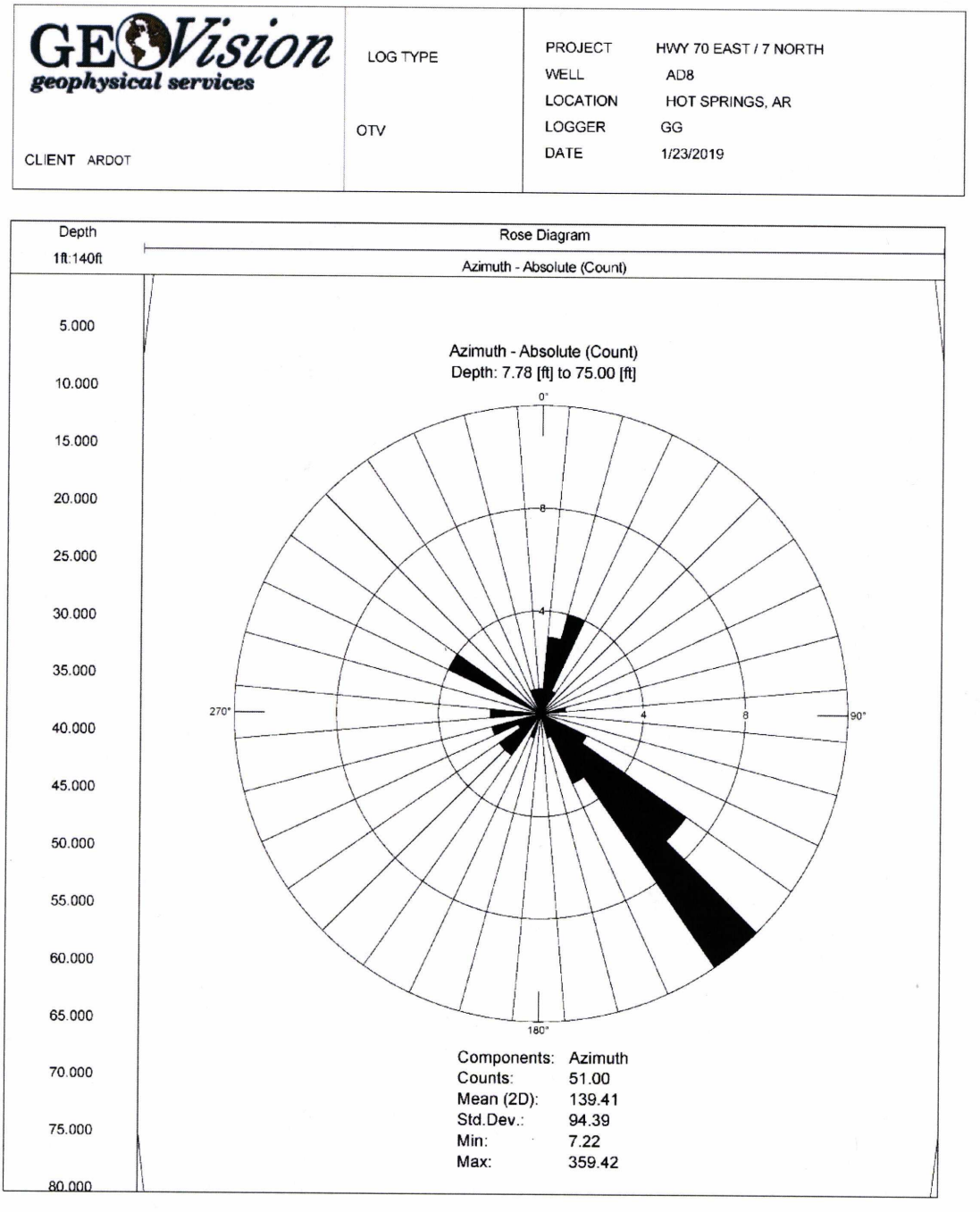
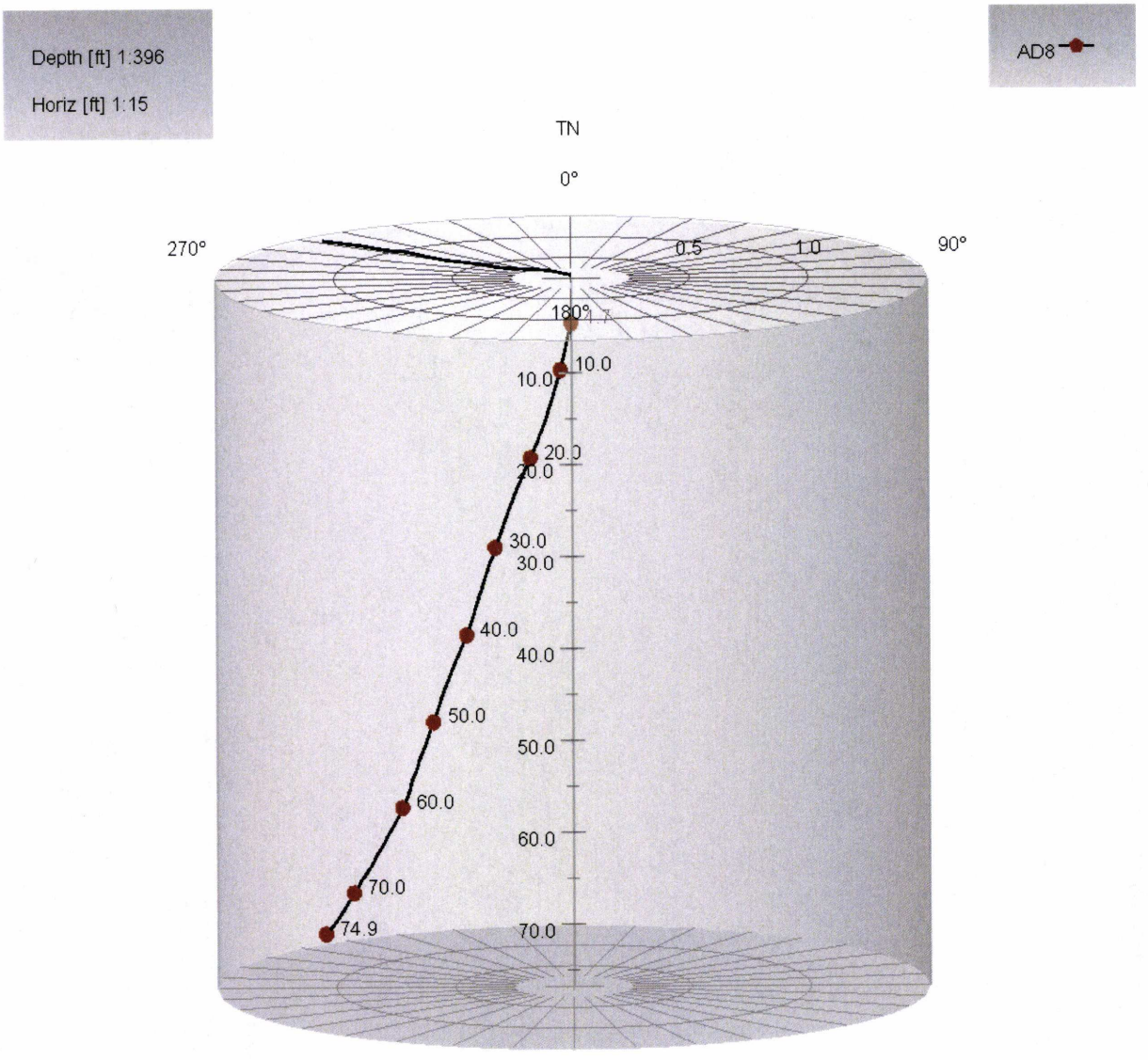


Figure 18. Boring AD8, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 1.5 feet

Figure 19. Boring AD8, Optical Deviation Projection

Table 10. Boring AD9, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD9

Depth	Azimuth	Dip	Aperture	Type
ft	deg	deg	mm	
5.5	158.5	33.2	0.0	Filled Joint / Fracture
6.7	91.1	34.2	0.0	Filled Joint / Fracture
7.5	13.1	72.1	0.0	Filled Joint / Fracture
7.8	2.3	76.4	0.0	Filled Joint / Fracture
10.5	22.6	65.5	0.0	Filled Joint / Fracture
13.1	11.5	71.6	0.0	Filled Joint / Fracture
13.6	3.0	85.4	0.0	Filled Joint / Fracture
13.7	115.4	28.8	0.0	Bedding / Banding / Foliation
15.5	18.1	68.0	0.0	Filled Joint / Fracture
16.3	27.1	83.9	0.0	Filled Joint / Fracture
17.1	286.7	49.8	0.0	Filled Joint / Fracture
17.7	2.1	83.0	0.0	Filled Joint / Fracture
18.3	81.9	74.1	0.0	Filled Joint / Fracture
18.6	95.5	47.1	0.0	Filled Joint / Fracture
20.9	319.3	65.0	0.0	Filled Joint / Fracture
21.1	189.0	81.3	0.0	Filled Joint / Fracture
21.5	58.7	45.7	0.0	Filled Joint / Fracture
22.7	139.4	42.5	0.0	Bedding / Banding / Foliation
25.1	190.4	82.3	0.0	Filled Joint / Fracture
26.6	345.9	70.3	0.0	Filled Joint / Fracture
27.4	217.9	79.9	0.0	Filled Joint / Fracture
28.9	265.6	82.7	0.0	Filled Joint / Fracture
29.1	111.8	48.1	0.0	Bedding / Banding / Foliation
30.5	129.2	39.5	0.0	Bedding / Banding / Foliation
31.5	126.9	48.8	0.0	Bedding / Banding / Foliation
31.9	123.2	46.5	0.0	Bedding / Banding / Foliation
32.2	120.0	40.7	0.0	Bedding / Banding / Foliation
32.7	119.7	49.9	0.0	Bedding / Banding / Foliation
34.9	115.7	46.8	0.0	Bedding / Banding / Foliation
35.4	123.5	51.6	0.0	Bedding / Banding / Foliation
37.4	246.2	80.6	0.0	Filled Joint / Fracture
40.4	138.3	54.1	0.0	Bedding / Banding / Foliation
40.8	228.7	79.1	0.0	Filled Joint / Fracture
44.5	59.2	77.3	0.0	Filled Joint / Fracture
48.4	148.5	40.0	0.0	Bedding / Banding / Foliation

Optical Televiewer Features - Boring AD9

Depth	Azimuth	Dip	Aperture	
ft	deg	deg	mm	Type
48.8	143.9	57.5	0.0	Bedding / Banding / Foliation
49.2	151.2	52.3	0.0	Bedding / Banding / Foliation
49.8	141.1	59.7	0.0	Bedding / Banding / Foliation
50.3	142.2	59.0	0.0	Bedding / Banding / Foliation
50.9	131.0	54.2	0.0	Bedding / Banding / Foliation
52.0	296.7	69.6	0.0	Filled Joint / Fracture
52.9	132.5	62.2	0.0	Bedding / Banding / Foliation
53.2	145.8	55.5	0.0	Bedding / Banding / Foliation
53.4	136.3	59.6	0.0	Bedding / Banding / Foliation
54.1	132.4	60.8	0.0	Bedding / Banding / Foliation
54.4	275.8	20.9	0.0	Filled Joint / Fracture
54.4	134.0	55.2	0.0	Bedding / Banding / Foliation
54.8	132.8	56.3	0.0	Bedding / Banding / Foliation
55.3	140.9	56.4	0.0	Bedding / Banding / Foliation
55.5	129.5	75.2	0.0	Filled Joint / Fracture
55.7	220.8	77.6	0.0	Filled Joint / Fracture
56.0	62.4	72.6	0.0	Filled Joint / Fracture

GEOVision geophysical services

CLIENT ARDOT

LOG TYPE

OTV

PROJECT HWY 70 EAST / 7 NORTH
WELL AD9
LOCATION HOT SPRINGS, AR
LOGGER GG
DATE 1/23/2019

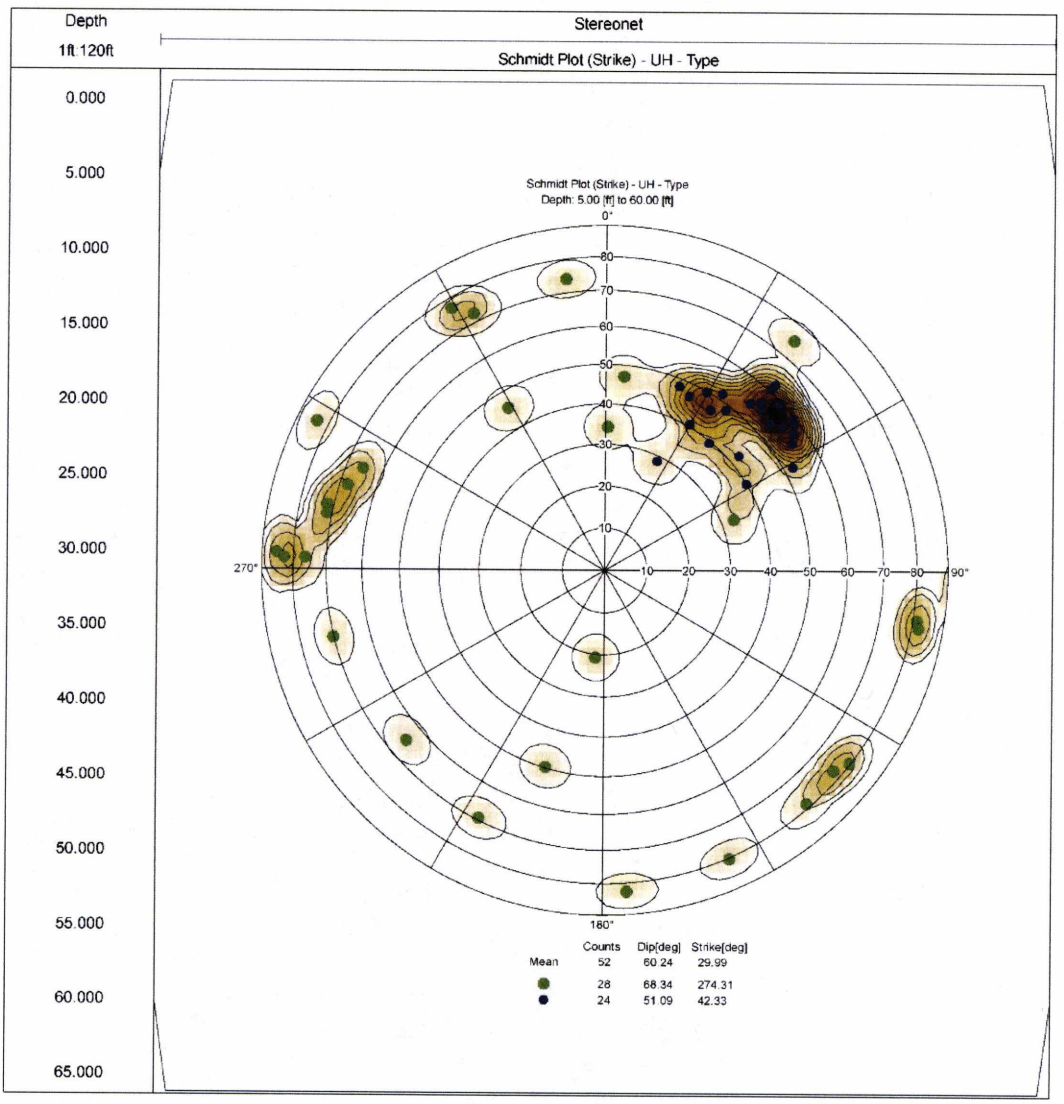


Figure 20. Boring AD9, Optical Stereonet Diagram

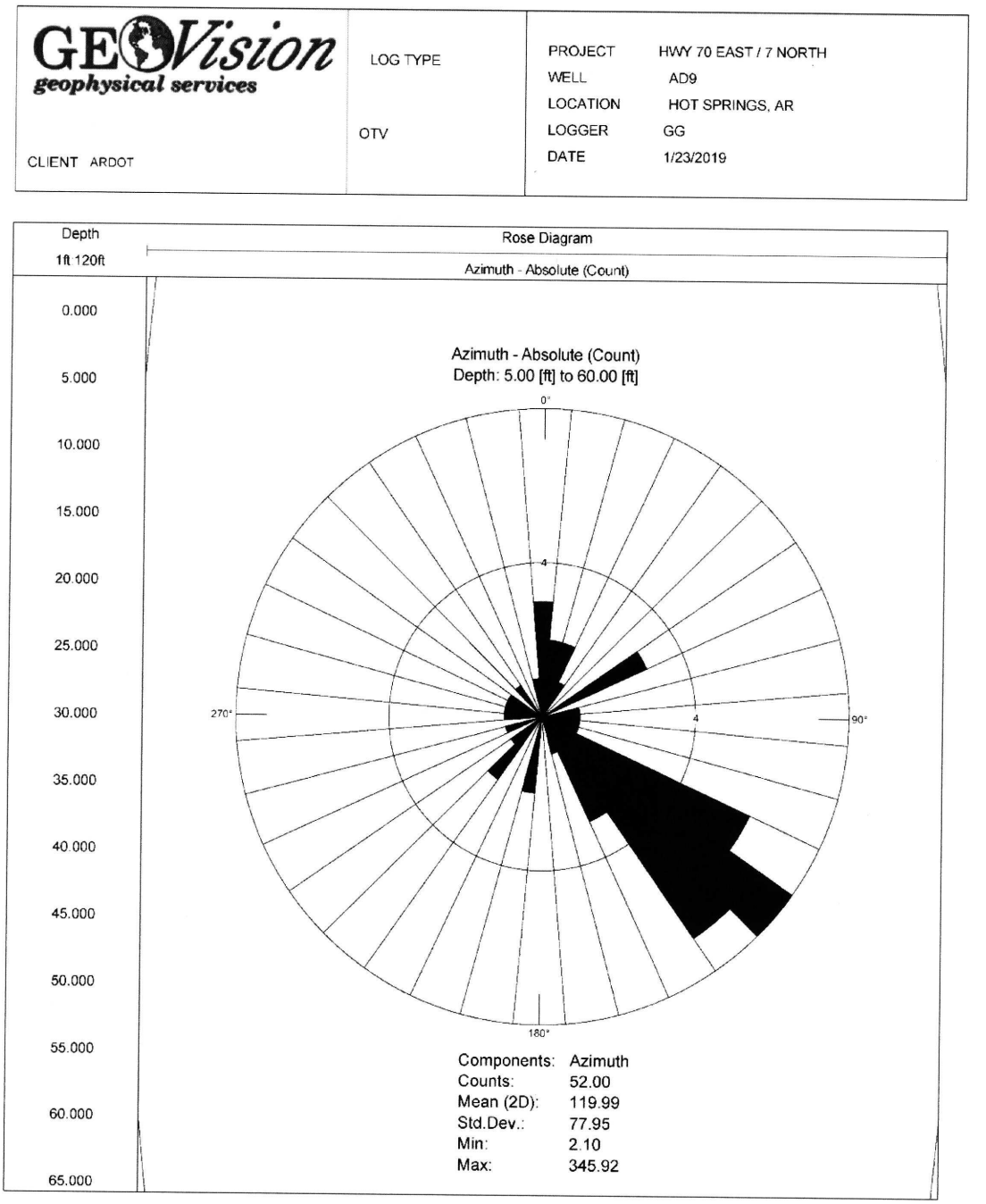
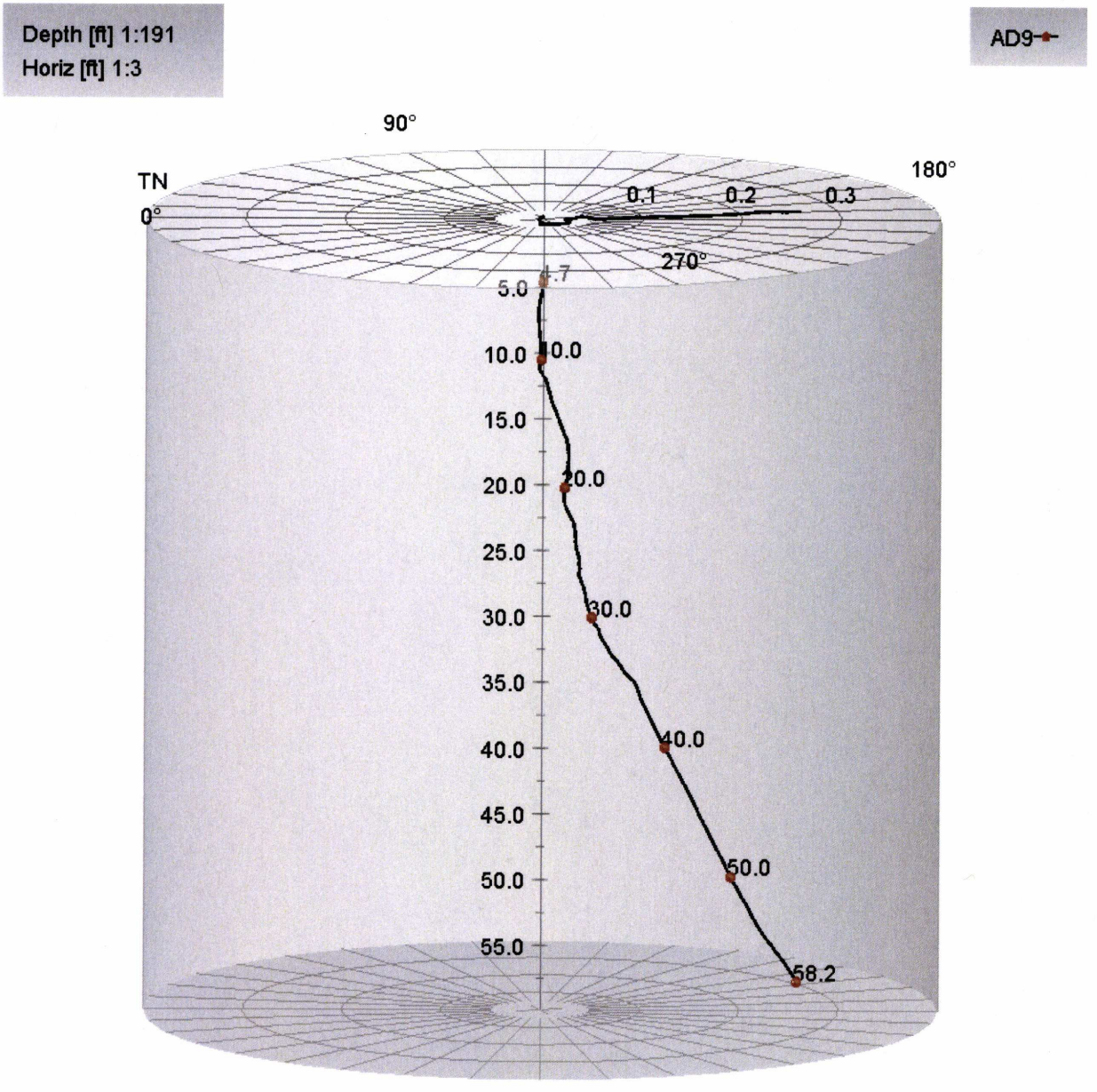


Figure 21. Boring AD9, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 0.4 feet

Figure 22. Boring AD9, Optical Deviation Projection

Table 11. Boring AD10, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD10

Depth	Azimuth	Dip	Aperture	Type
ft	deg	deg	mm	
8.7	317.8	66.2	0.0	Bedding / Banding / Foliation
12.2	316.9	66.5	0.0	Bedding / Banding / Foliation
14.1	312.6	67.0	0.0	Bedding / Banding / Foliation
23.4	313.7	64.8	0.0	Bedding / Banding / Foliation
25.2	306.9	64.5	0.0	Bedding / Banding / Foliation
28.0	299.4	62.4	0.0	Bedding / Banding / Foliation
29.7	297.6	73.3	0.0	Bedding / Banding / Foliation
32.0	329.8	64.9	0.0	Bedding / Banding / Foliation
36.8	299.3	54.8	0.0	Bedding / Banding / Foliation
40.5	293.8	57.5	0.0	Bedding / Banding / Foliation
42.3	306.0	58.5	0.0	Bedding / Banding / Foliation
43.7	303.7	62.0	0.0	Bedding / Banding / Foliation
45.4	306.2	58.5	0.0	Bedding / Banding / Foliation

GEOVision geophysical services

CLIENT ARDOT

LOG TYPE

OTV

PROJECT	HWY 70 EAST / 7 NORTH
WELL	AD10
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/23/2019

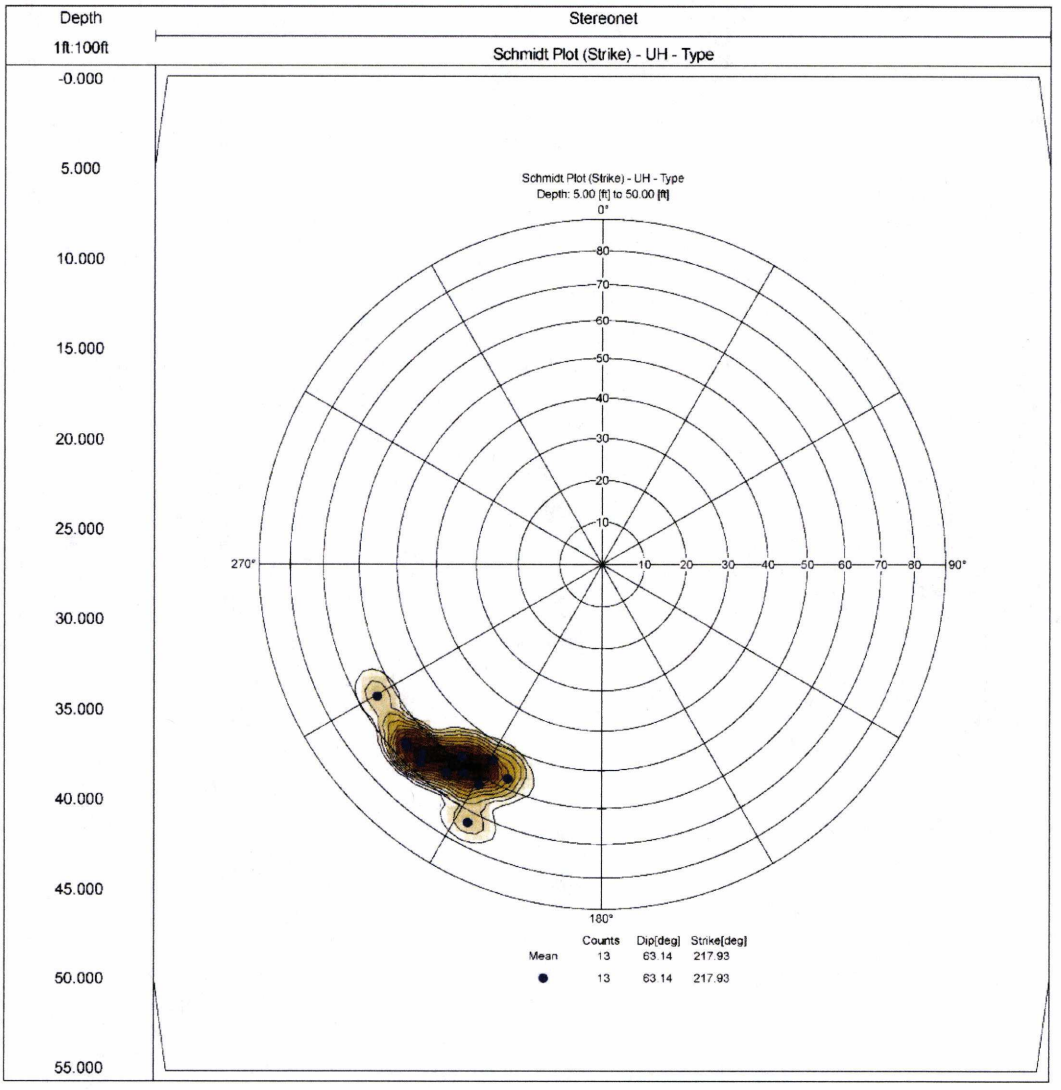


Figure 23. Boring AD10, Optical Stereonet Diagram

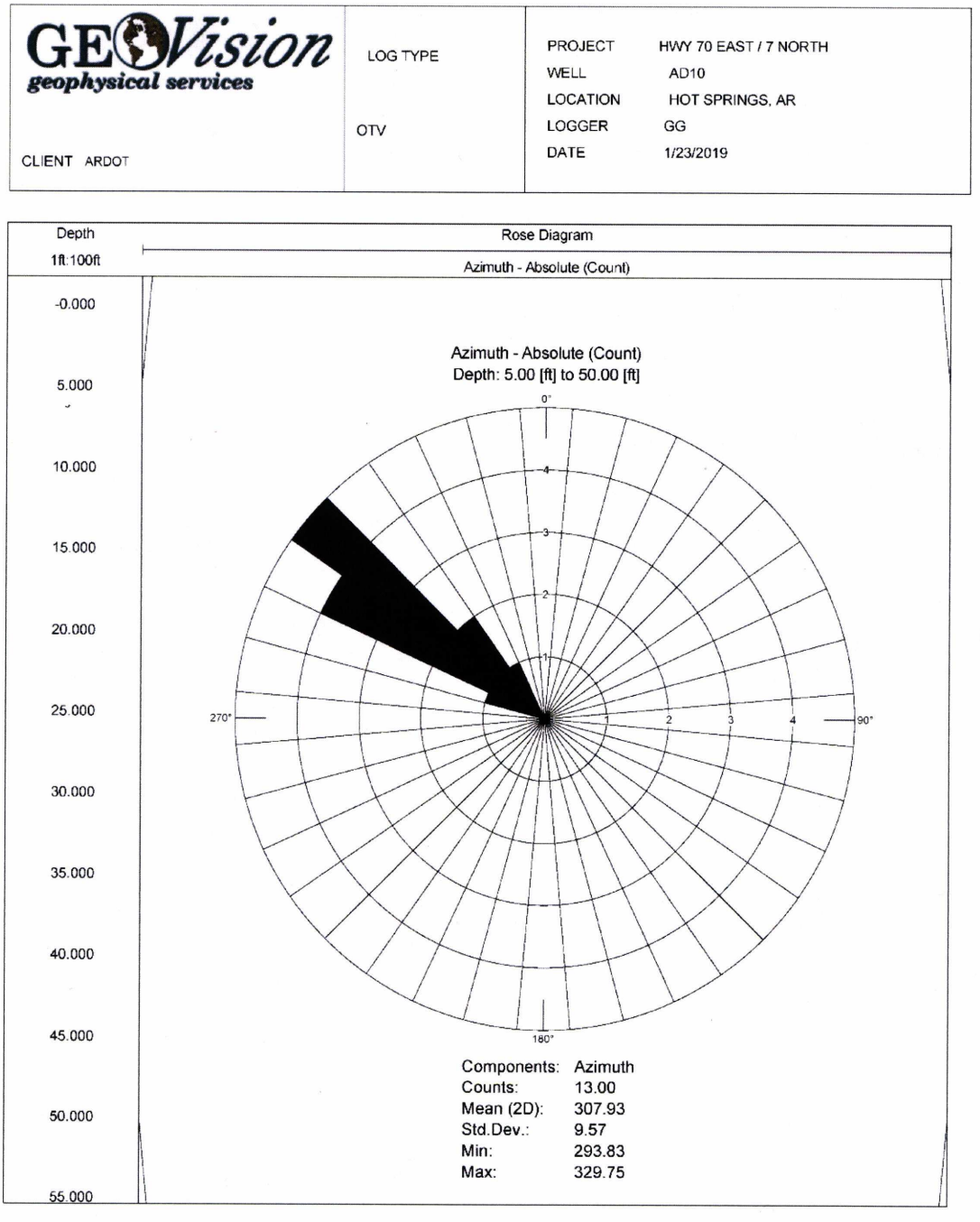
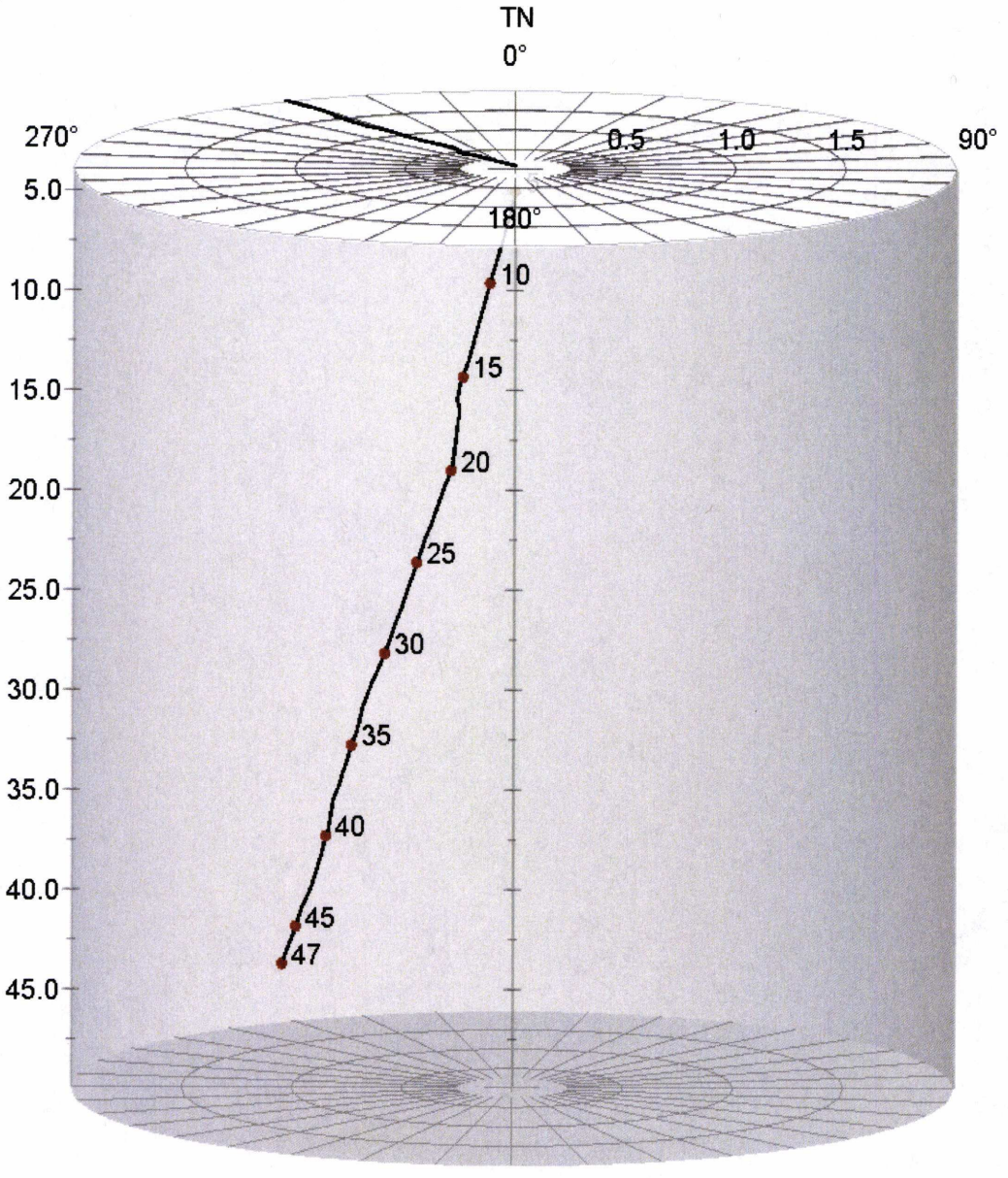


Figure 24. Boring AD10, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 2 feet

Figure 25. Boring AD10, Optical Deviation Projection

Table 12. Boring AD11, Optical Televiewer Feature depth, dip azimuth, dip, aperture, and description

Optical Televiewer Features - Boring AD11

Depth	Azimuth	Dip	Aperture	Type
ft	deg	deg	mm	
14.7	334.8	25.9	0.0	Bedding / Banding / Foliation
16.2	351.3	35.4	0.0	Bedding / Banding / Foliation
26.1	295.9	35.2	0.0	Bedding / Banding / Foliation
27.2	328.6	41.0	0.0	Bedding / Banding / Foliation
42.9	307.3	47.0	0.0	Bedding / Banding / Foliation
50.8	7.6	72.2	0.0	Bedding / Banding / Foliation

GEOVision geophysical services

CLIENT ARDOT

LOG TYPE

OTV

PROJECT	HWY 70 EAST / 7 NORTH
WELL	AD11
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/23/2019

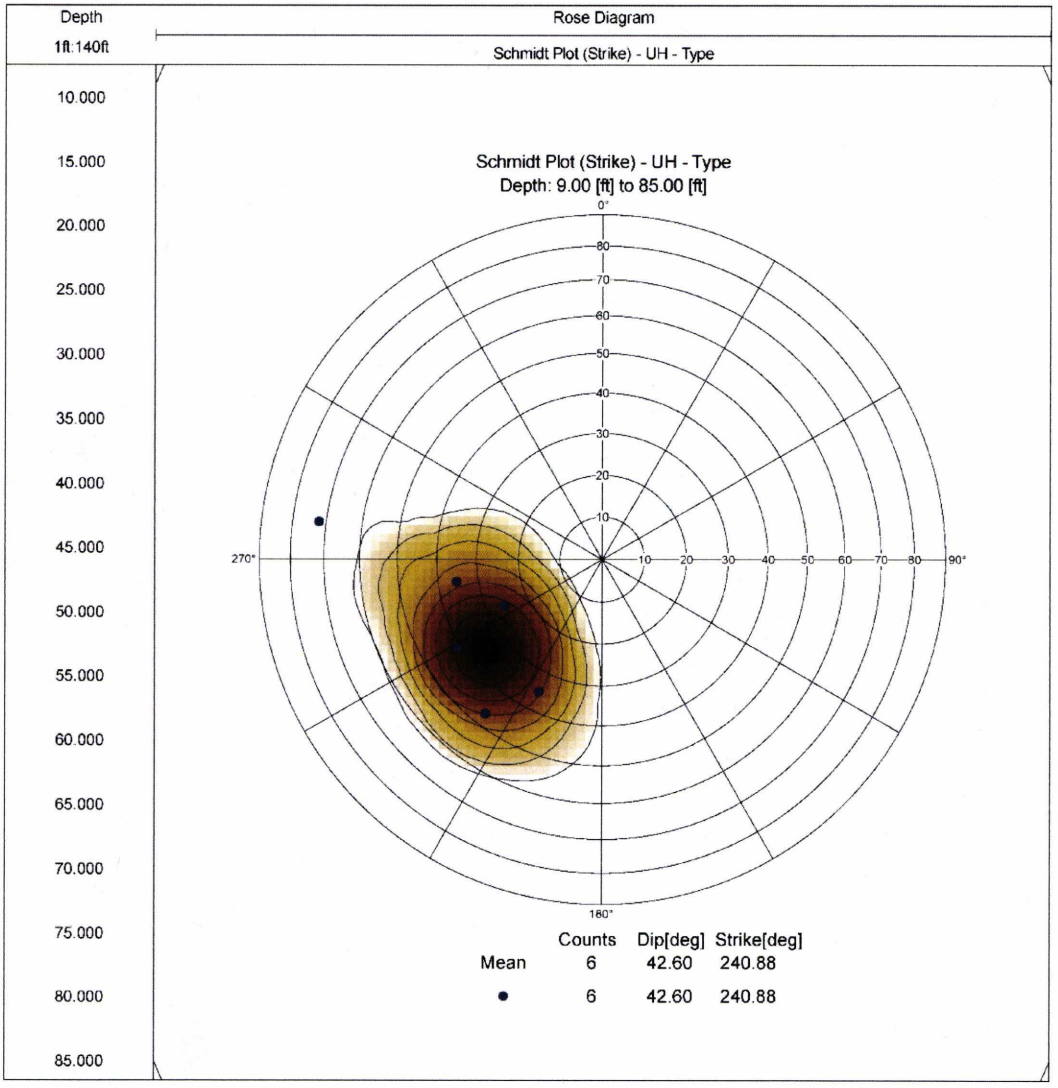


Figure 26. Boring AD11, Optical Stereonet Diagram

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CLIENT ARDOT

LOG TYPE

OTV

PROJECT	HWY 70 EAST / 7 NORTH
WELL	AD11
LOCATION	HOT SPRINGS, AR
LOGGER	GG
DATE	1/23/2019

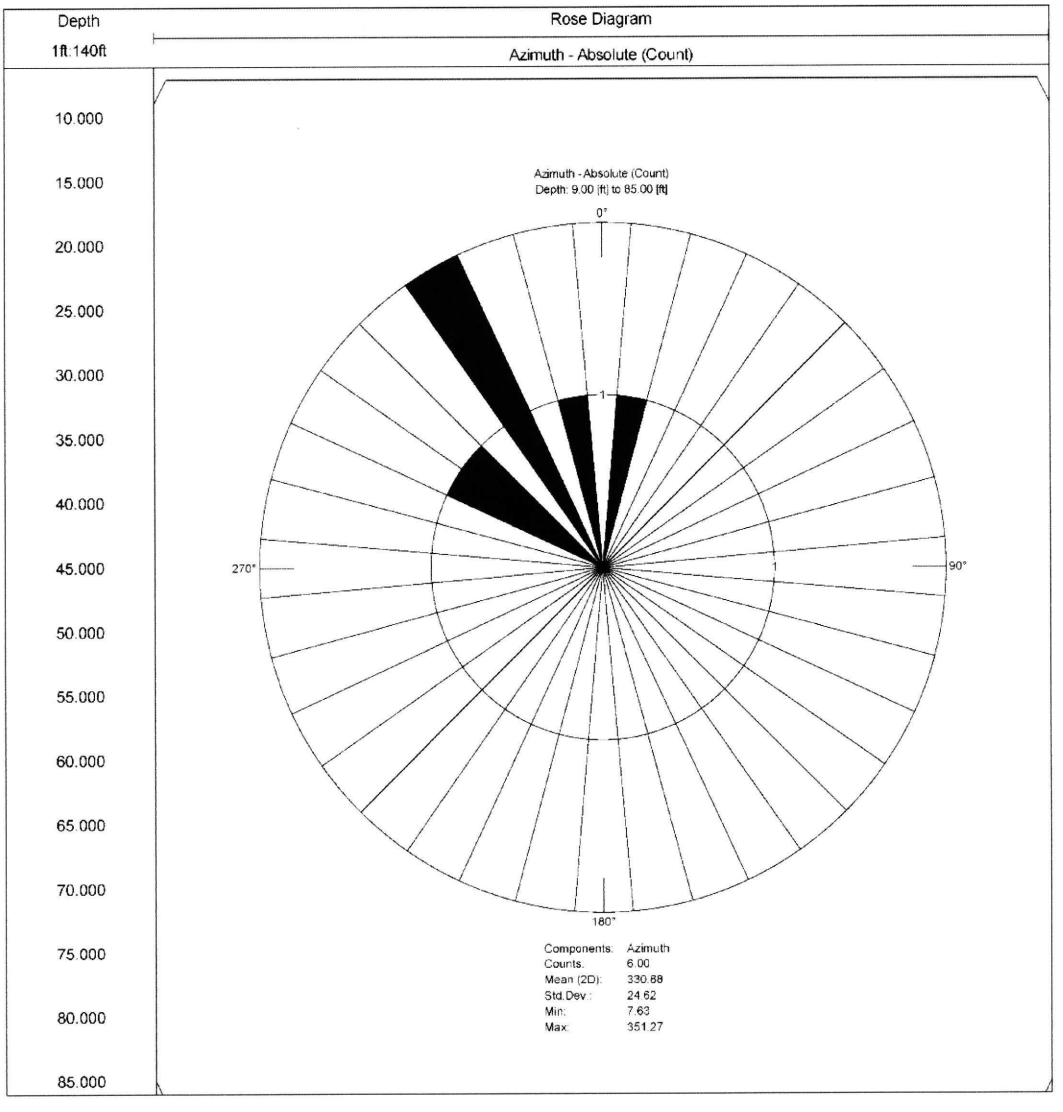
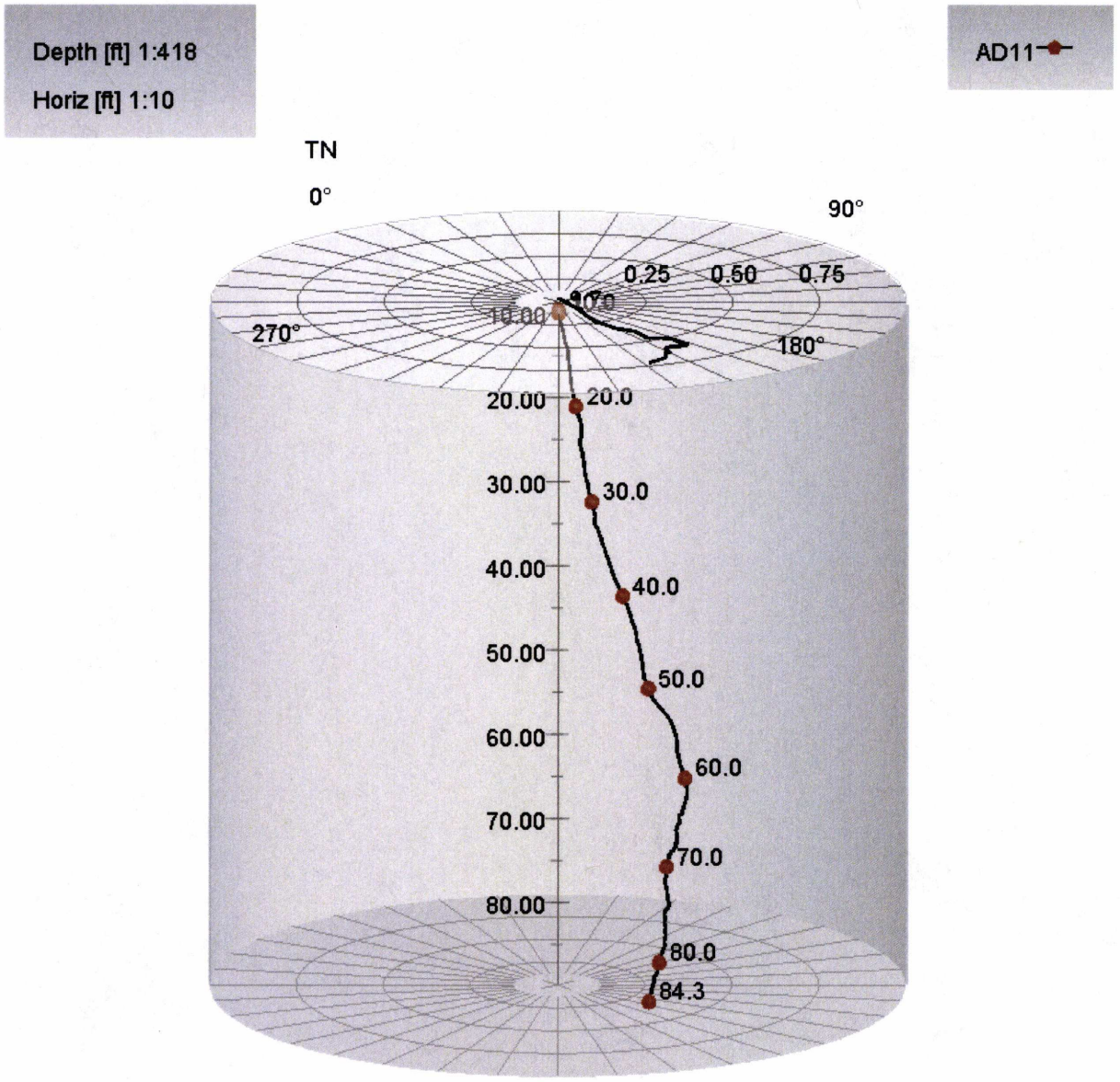


Figure 27. Boring AD11, Optical Rose Diagram



Note: Horizontal scale is exaggerated, cylinder radius is 1 foot

Figure 28. Boring AD11, Optical Deviation Projection

APPENDIX A

PROCESSED TELEVIEWER IMAGES WITH TADPOLES

GEOVision Televiewer Feature Notes and Picking Criteria:

All televiewer feature classifications are done as a best estimate, using information from the televiewer images, complemented by other geophysical logs, if available. Information from core logs may be used to inform the feature classifications as well, if they are available.

Generally, feature classifications from core data are more conclusive than classifications derived from televiewer images, though this may not be true in cases of friable or fractured rock that does not produce an intact core. Fractured rock may produce larger apertures in the boring wall than would be found in an undisturbed environment, so a group of adjacent hairline fractures may coalesce into what appears to be an open fracture in the televiewer image. Spalling or plucking of the borehole wall adjacent to a single hairline fracture may also produce a feature that appears to be a larger open fracture.

Most televiewer features fall into these classifications:

Bedding features:

- Exhibits a change in material or texture across the feature
- Conforms to the dip magnitude and azimuth of other bedding features in the borehole (or zone of the borehole)

Hairline fractures:

- Does not exhibit an open aperture for the full circumference of the borehole
- May not be visible for the full circumference of the borehole, but visible portion matches feature sinusoid well
- May have open segments, or be open for the full circumference of the borehole due to spalling, plucking or other drilling induced damage of the borehole wall. Review of the feature structure at a larger radius, when visible, is used to support this classification

Open fractures:

- Exhibits an open aperture for the full circumference of the borehole
- Has open aperture at the maximum radius of televiewer imaging
- Aperture may not be obvious for the full circumference of the borehole due to borehole damage or intersecting features, but shape of visible portion matches feature sinusoid well
- Often is present at the intersection of multiple hairline fractures

Voids:

- Features with vertical and radial extent of several inches or more, so no televiewer image is present to define the radial extent of the feature.
- Often the lower limit of the televiewer log, due to concerns over probe loss

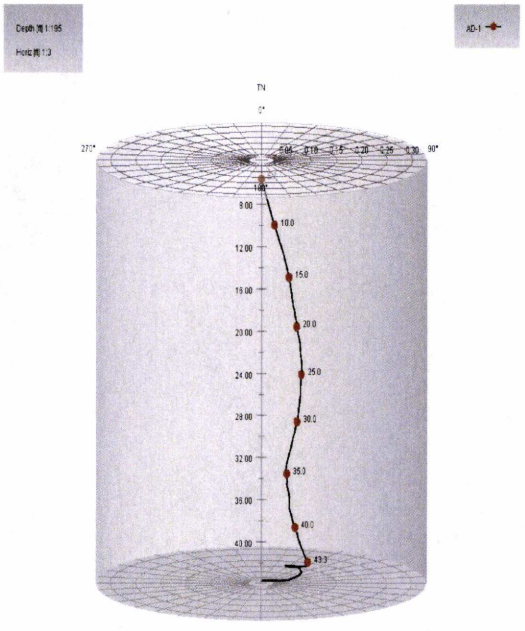
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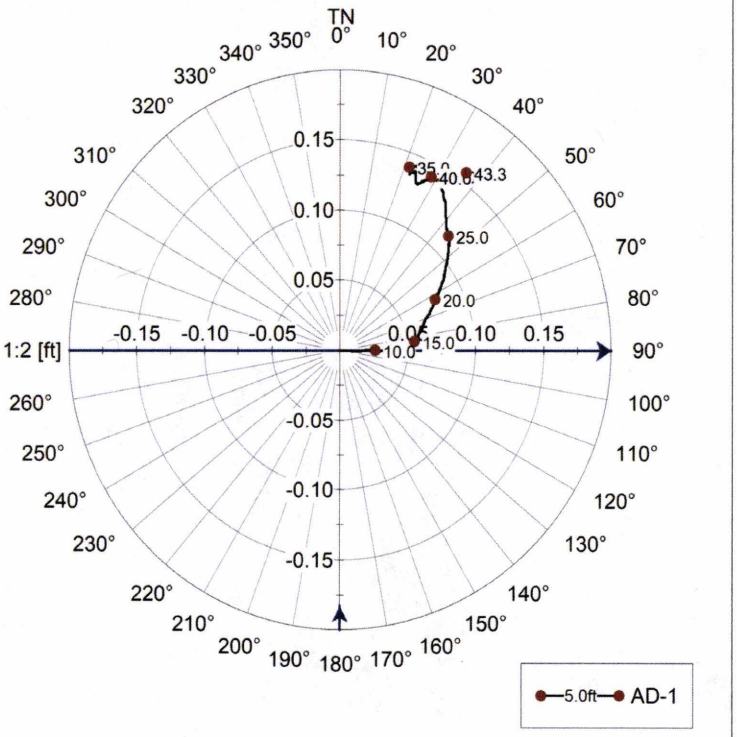
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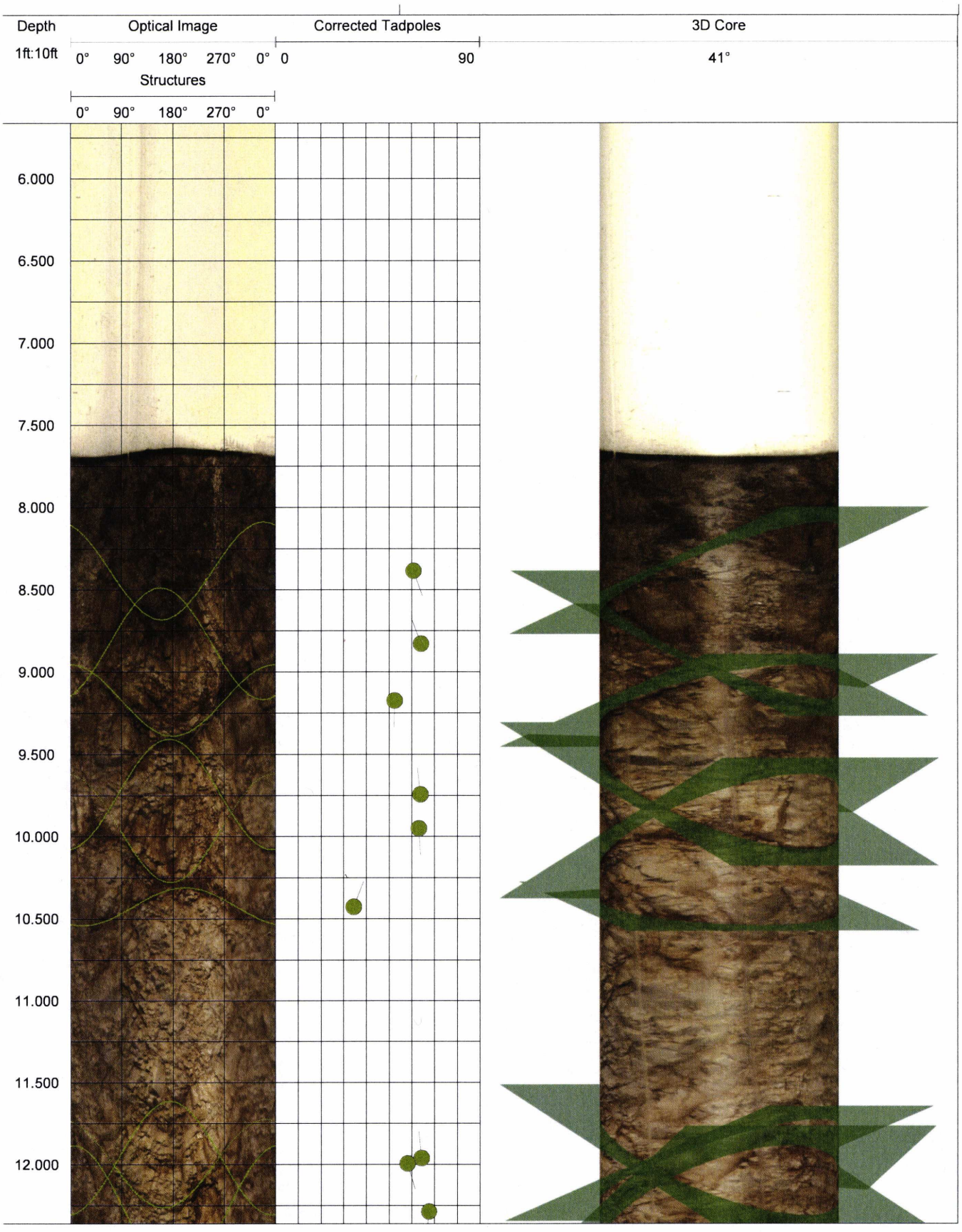
Project:	Hwy 70 East / Hwy 7 North (S)	**Date:**	1/22/2019
Location:	Hot Springs, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD-1	**Start Depth:**	5.7
		End Depth:	43.3

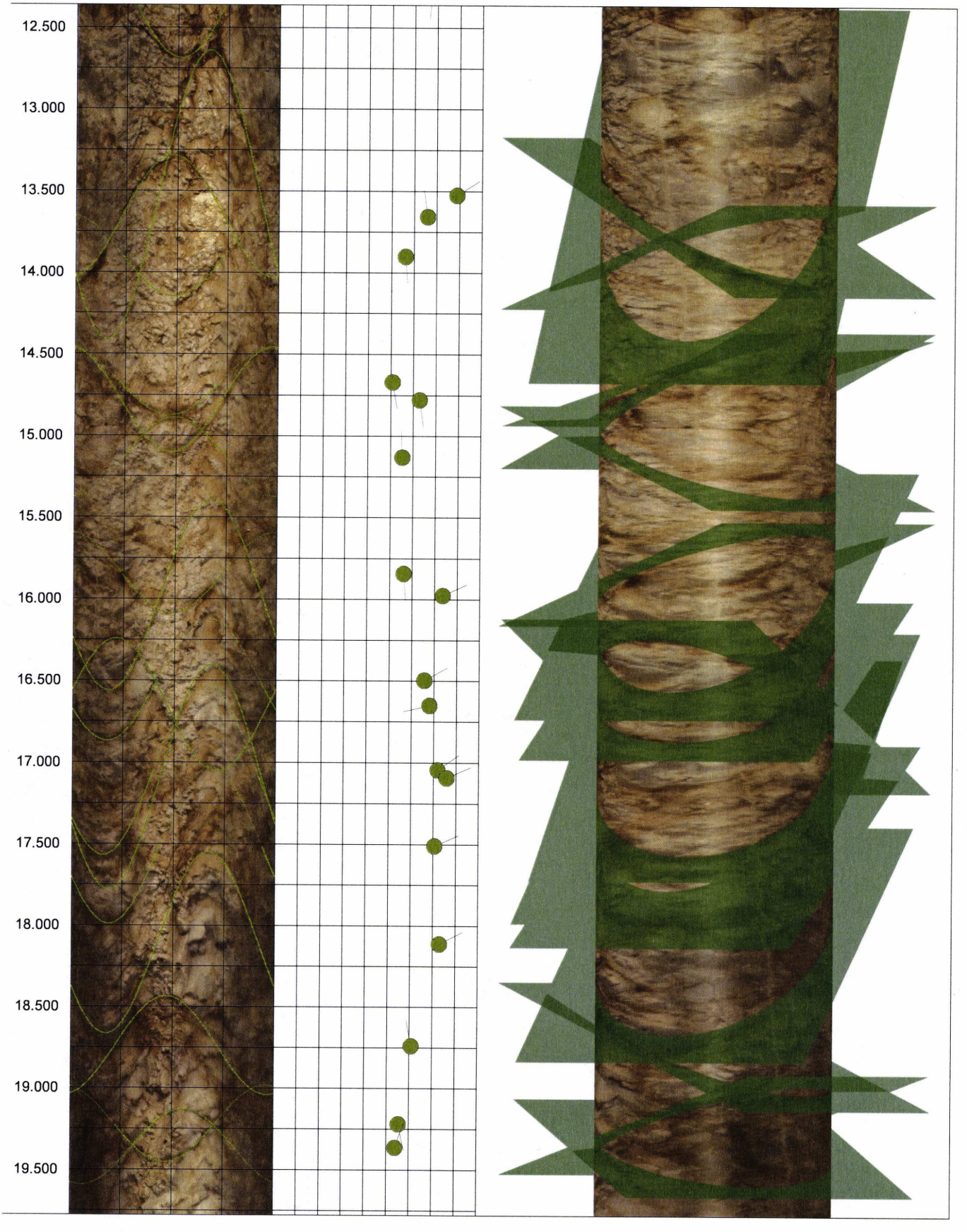
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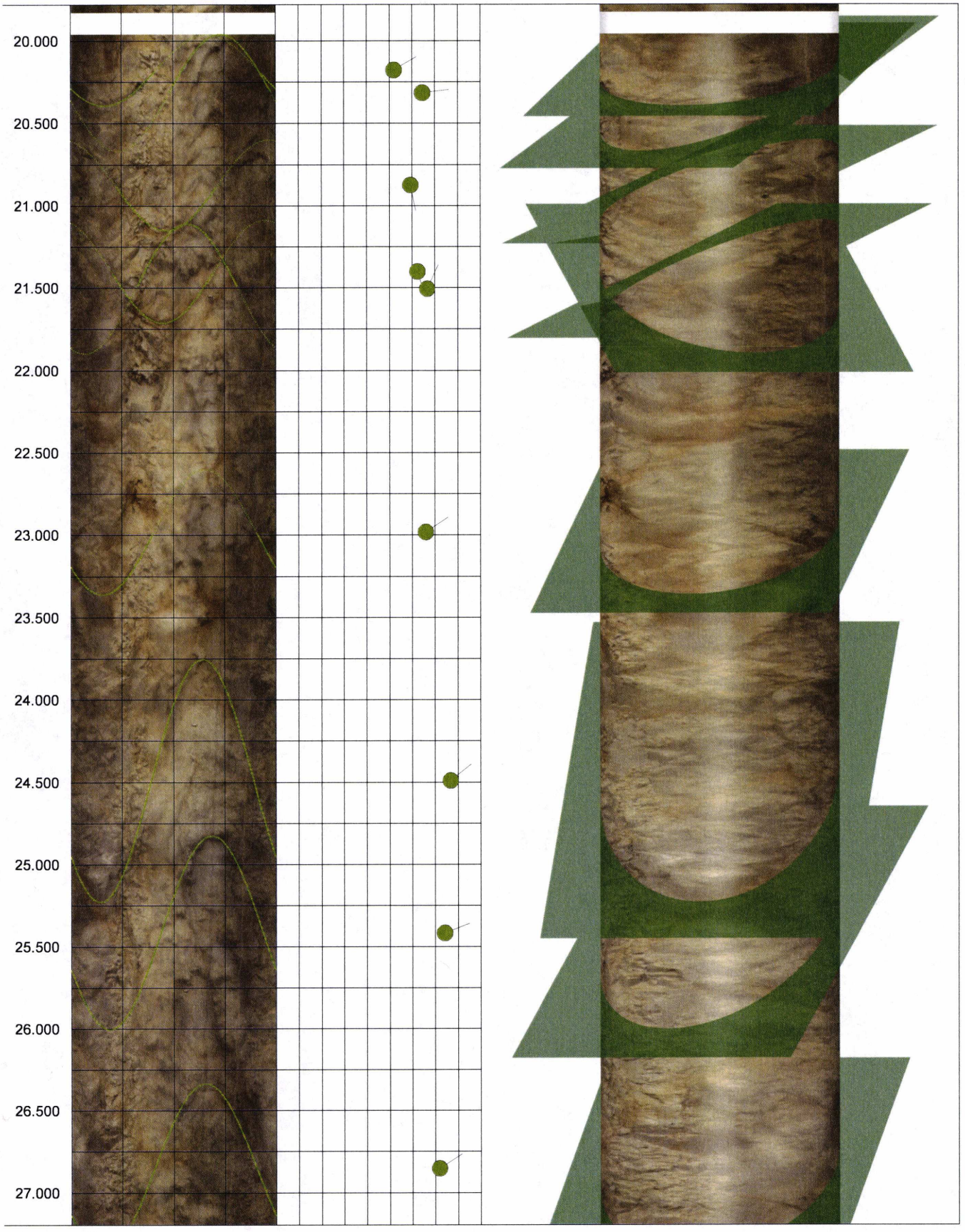
Filled Joint / Fracture

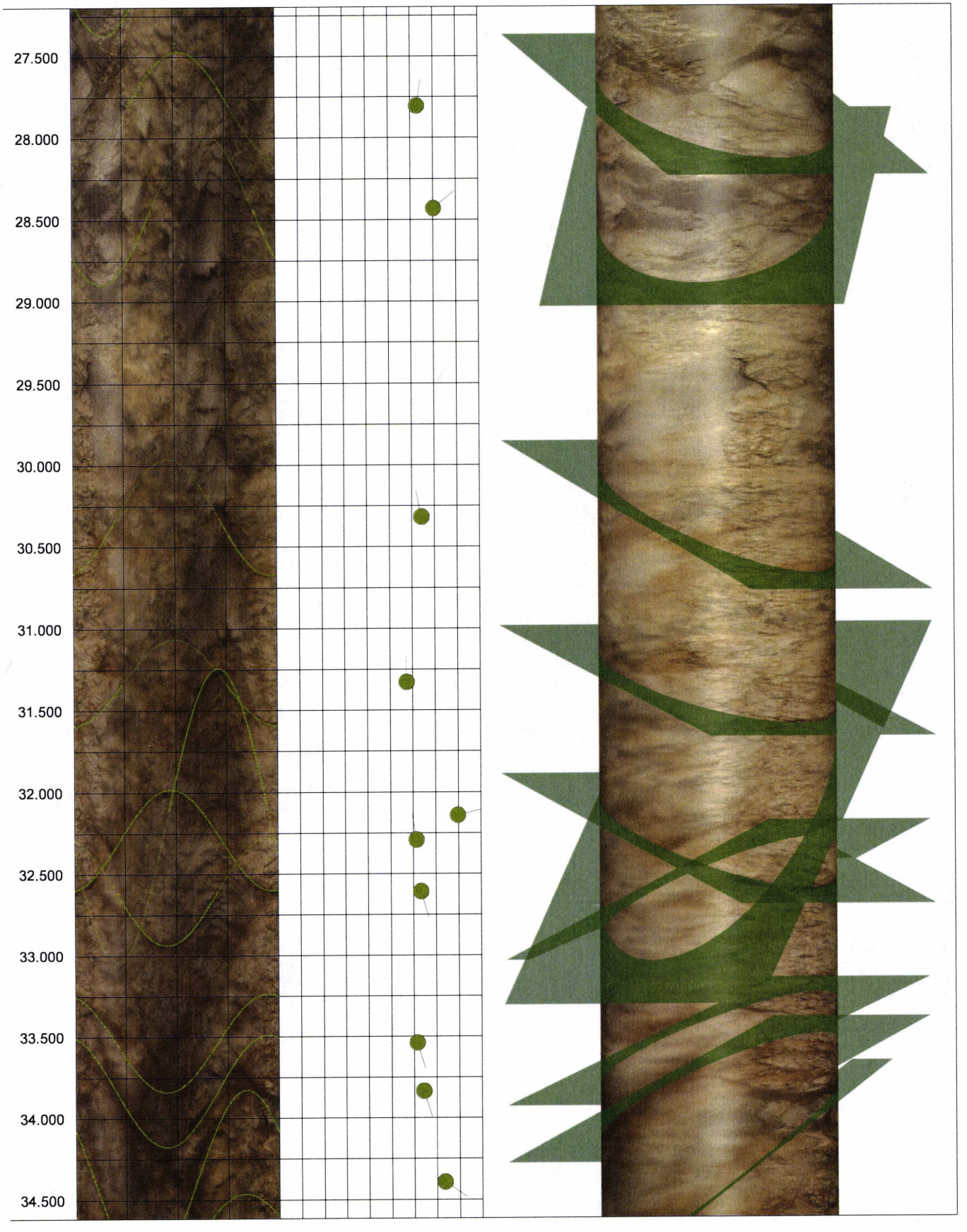


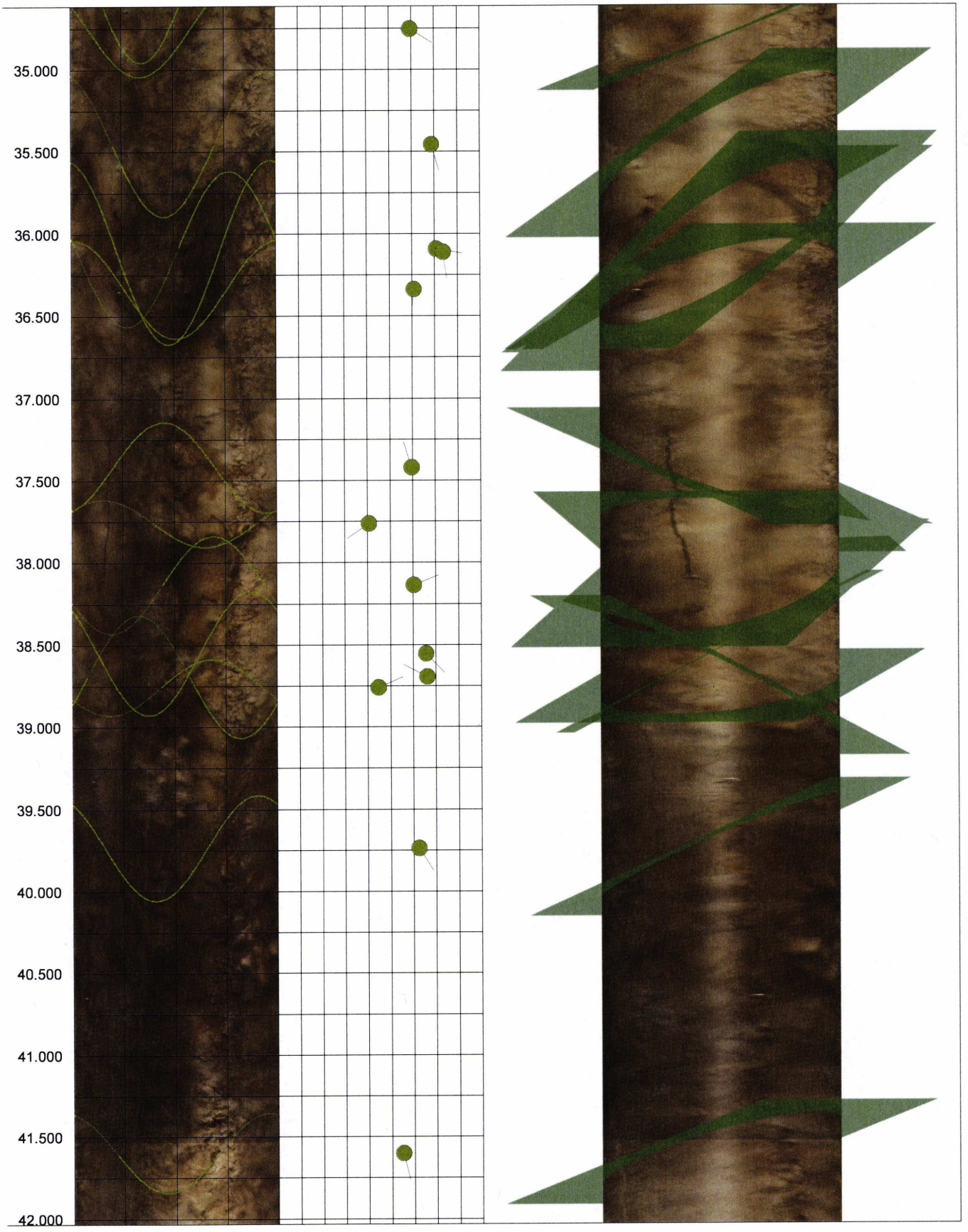


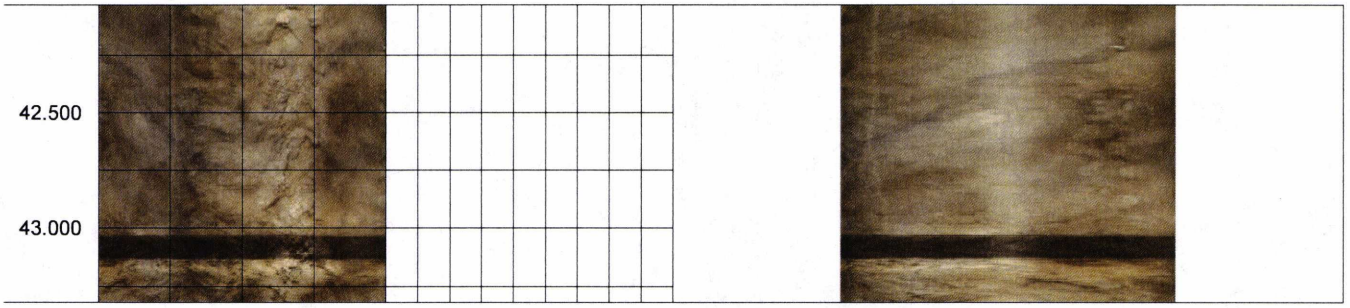

Depth
1ft:10ft
Optical Image
0° 90° 180° 270° 0°
Structures
0° 90° 180° 270° 0°
Corrected Tadpoles
0 90
3D Core
41°
6.000
6.500
7.000
7.500
8.000
8.500
9.000
9.500
10.000
10.500
11.000
11.500
12.000


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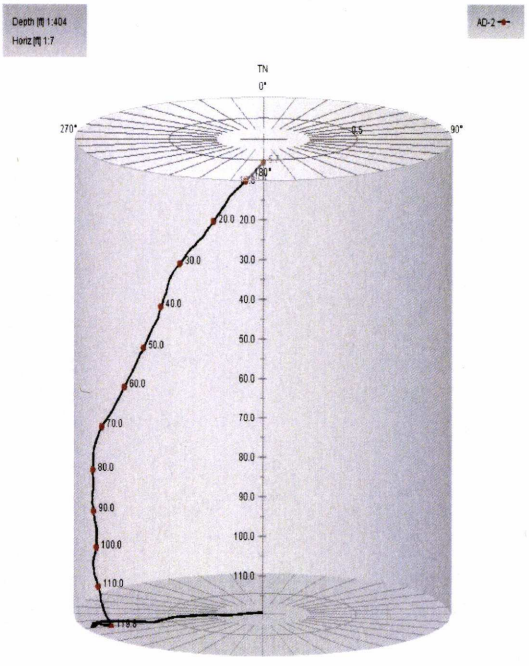
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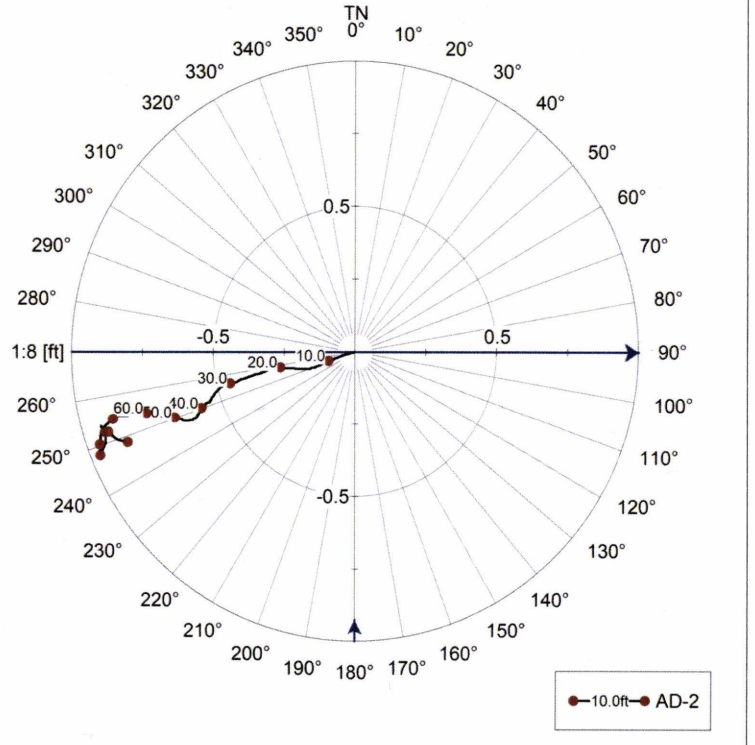
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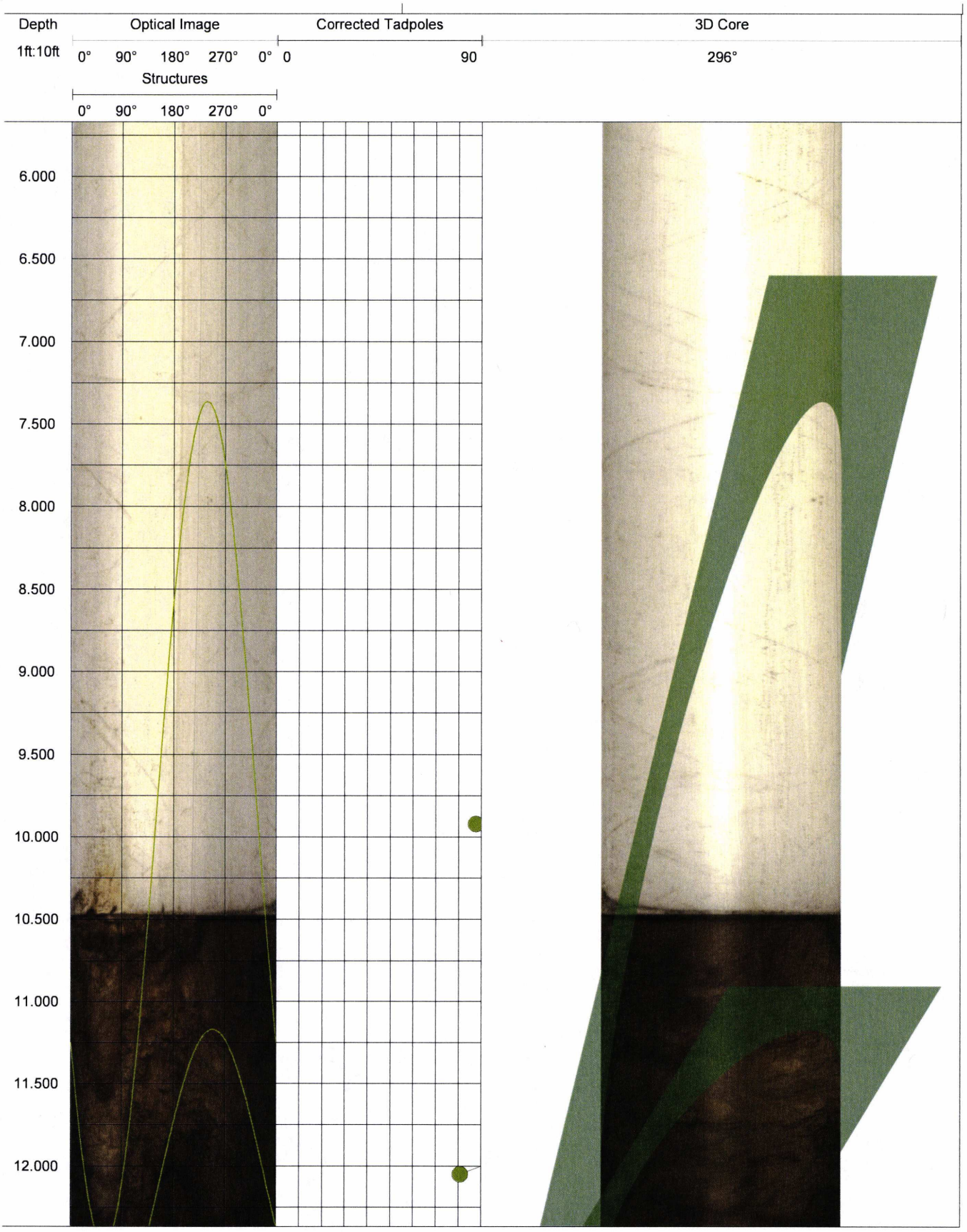
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Location:	Hot Springs, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD-2	**Start Depth:**	5.7
		End Depth:	119.7

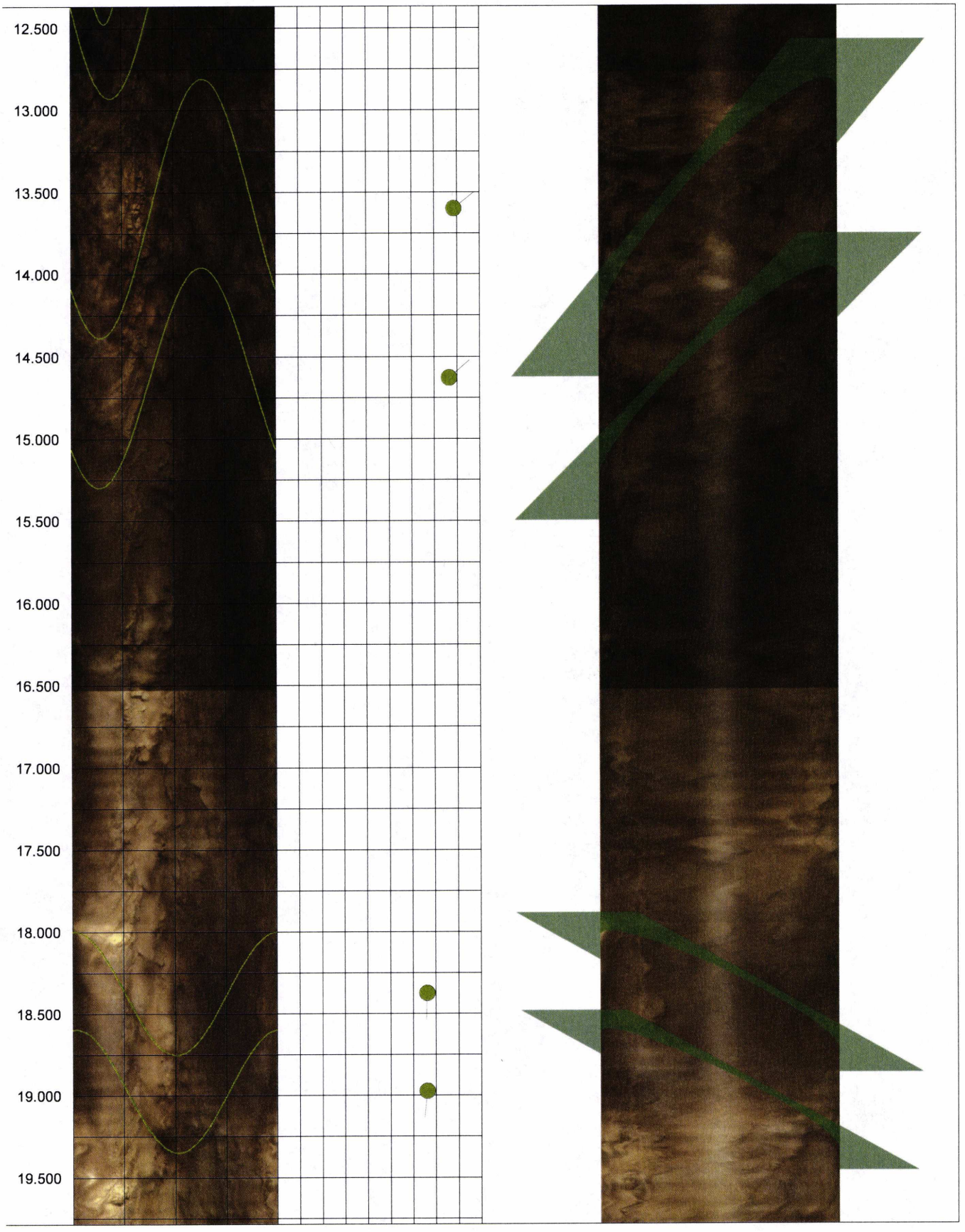
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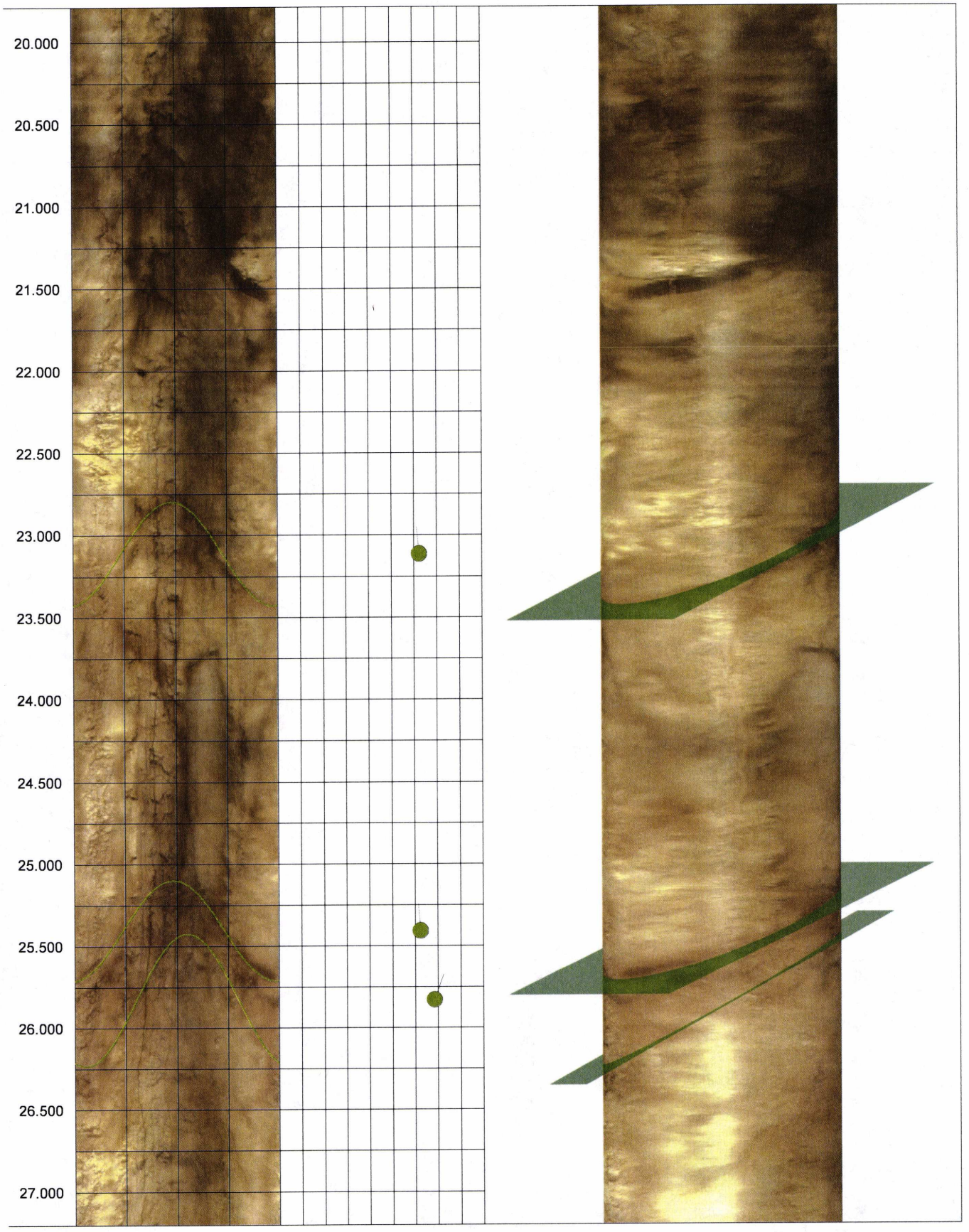
Filled Joint / Fracture

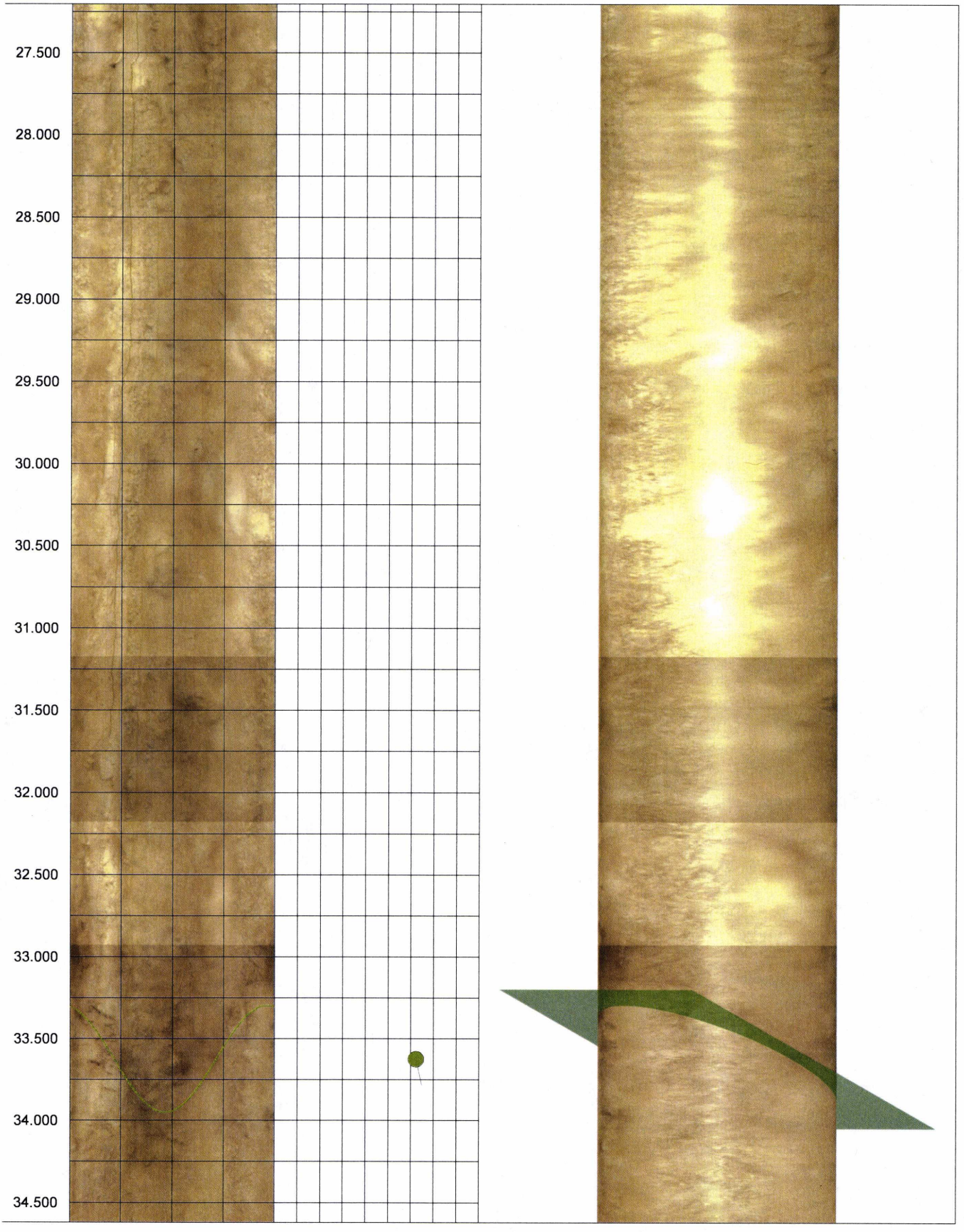


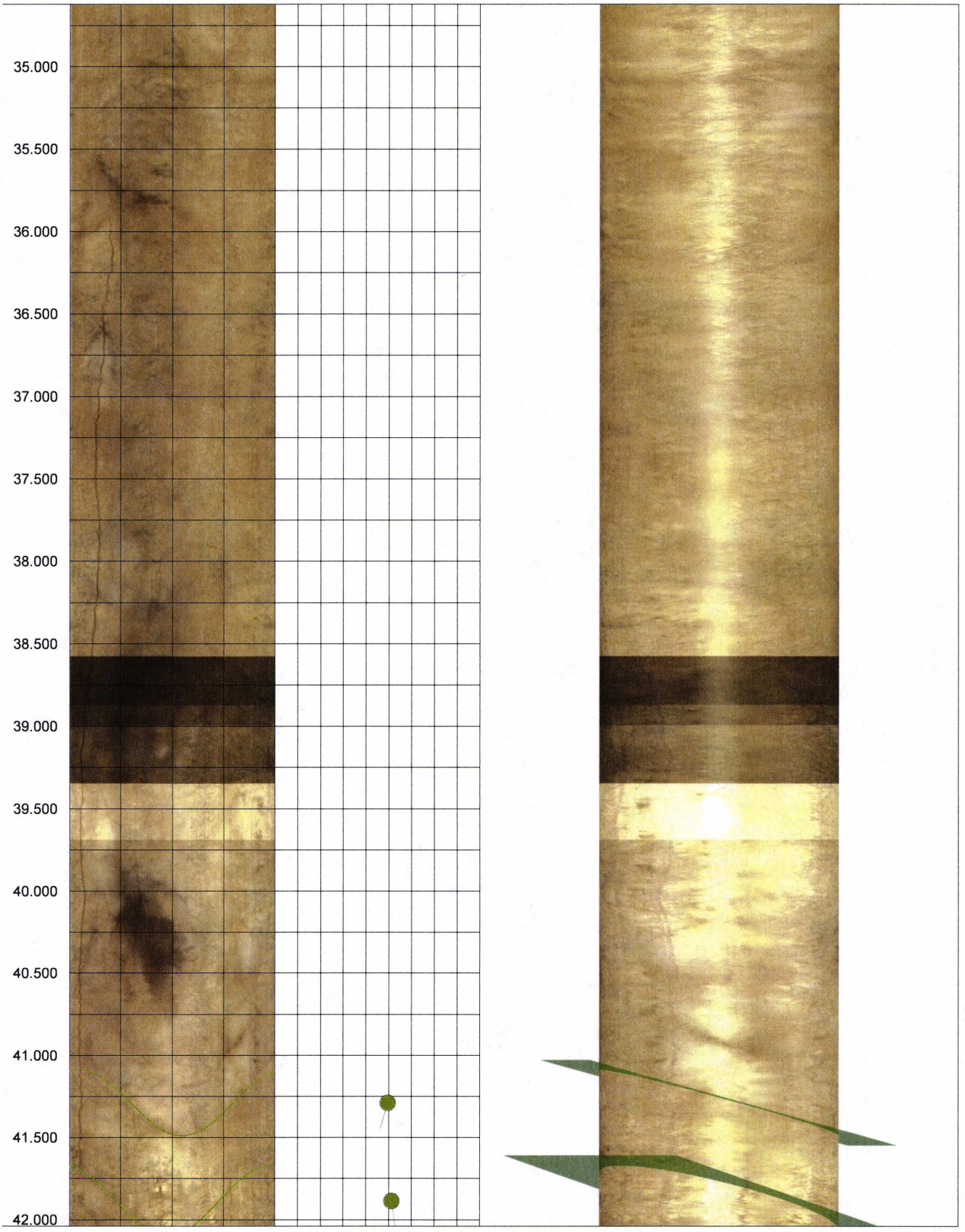


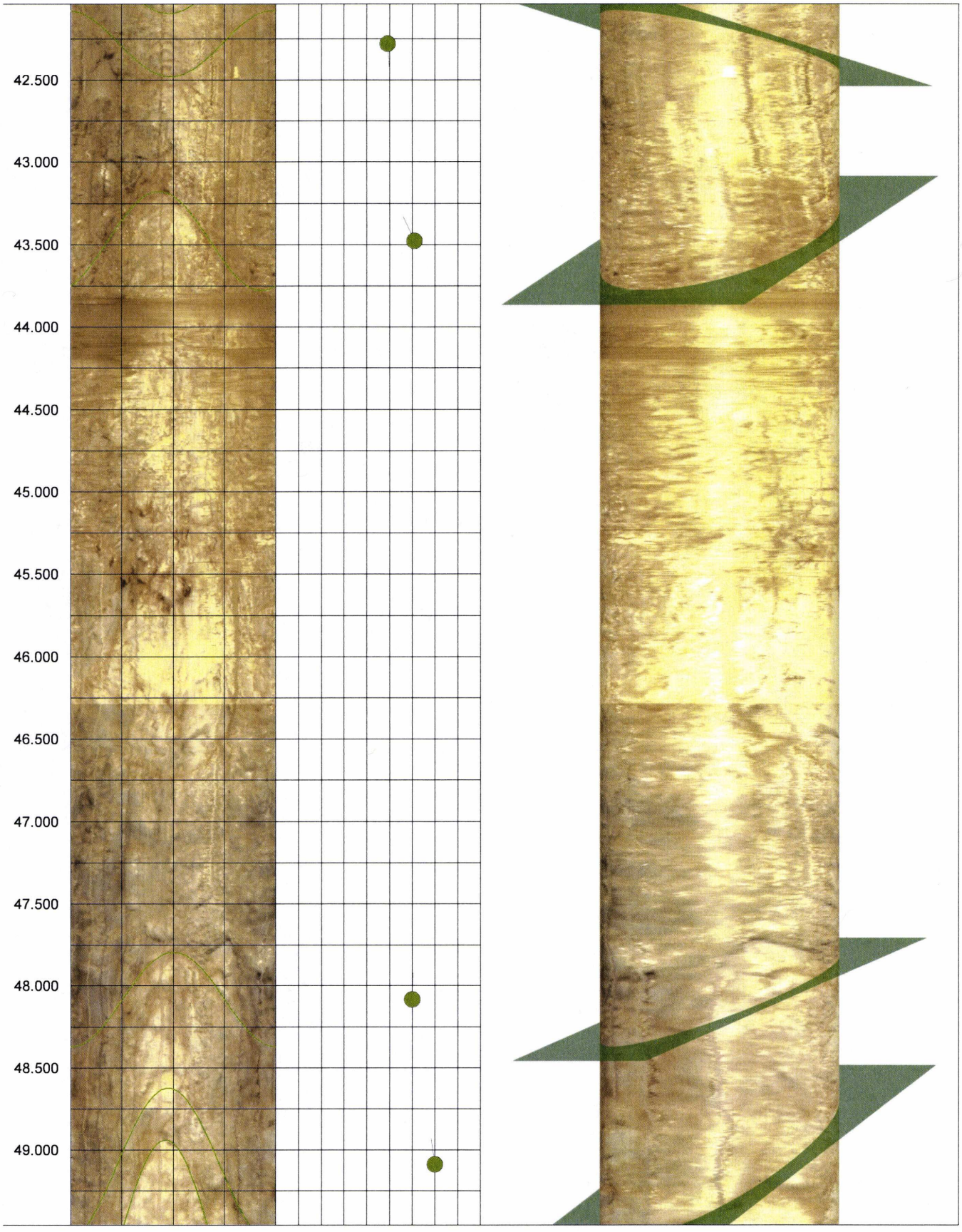

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Optical Image
0° 90° 180° 270° 0°
Structures
0° 90° 180° 270° 0°
Corrected Tadpoles
0
90
3D Core
296°
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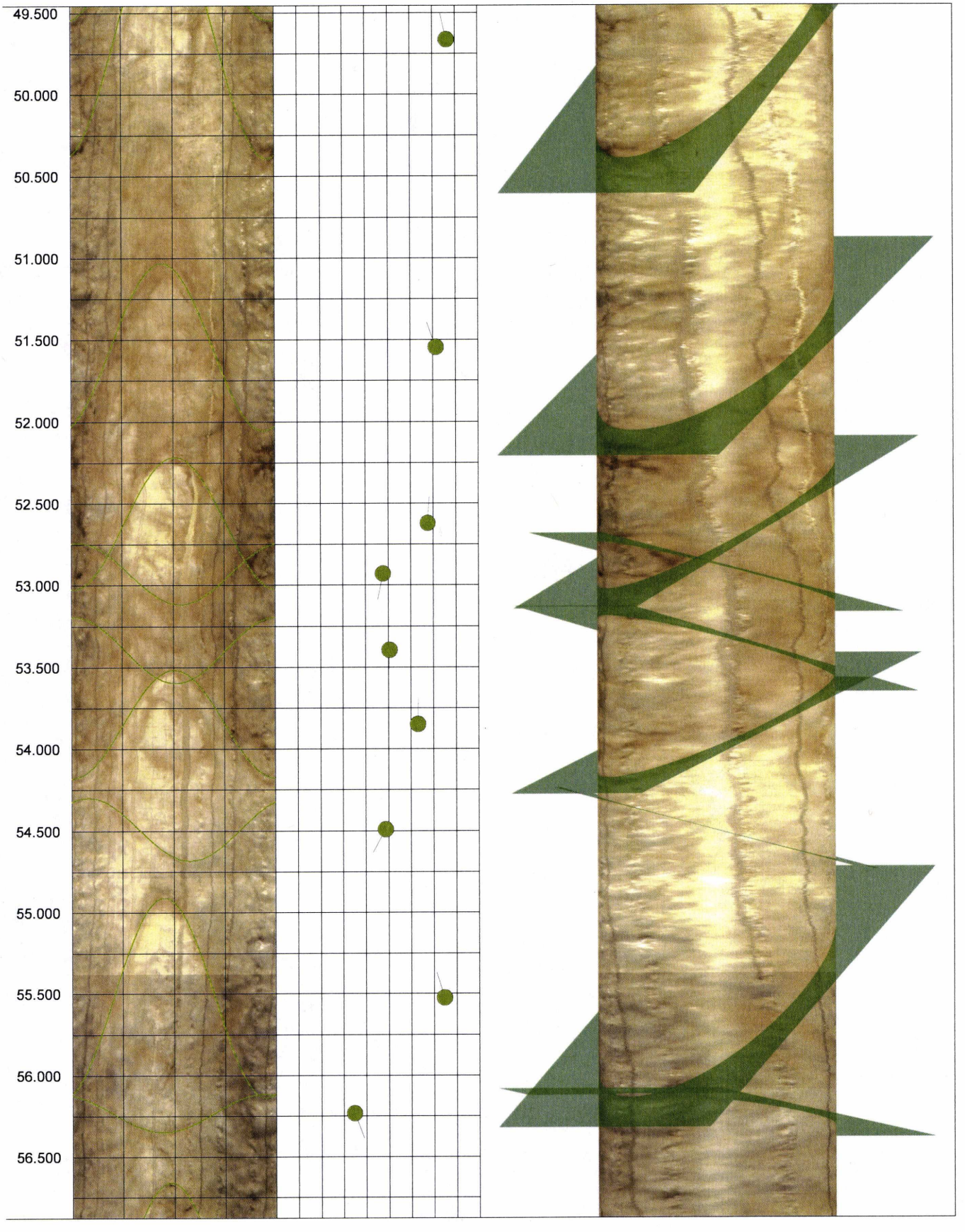

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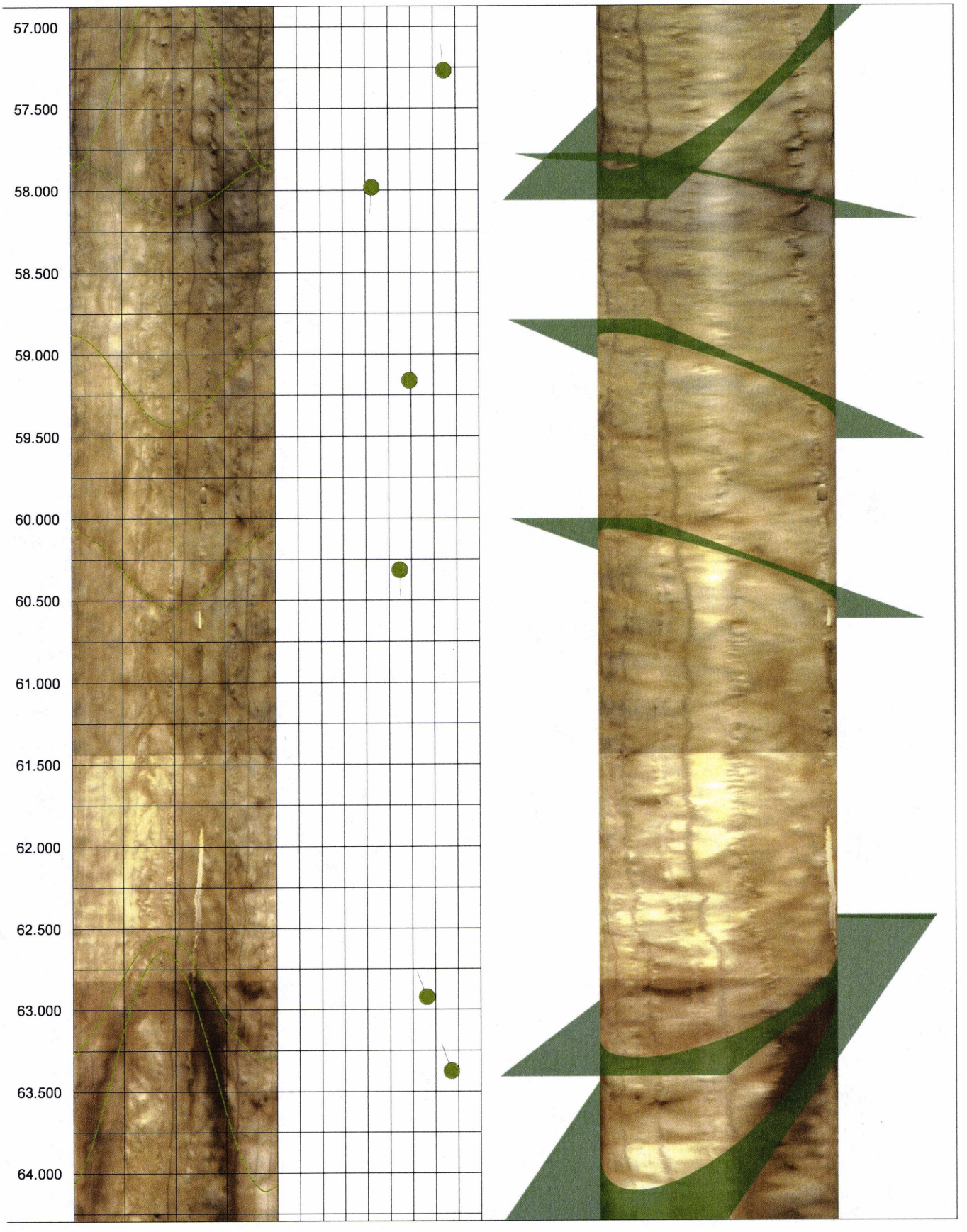

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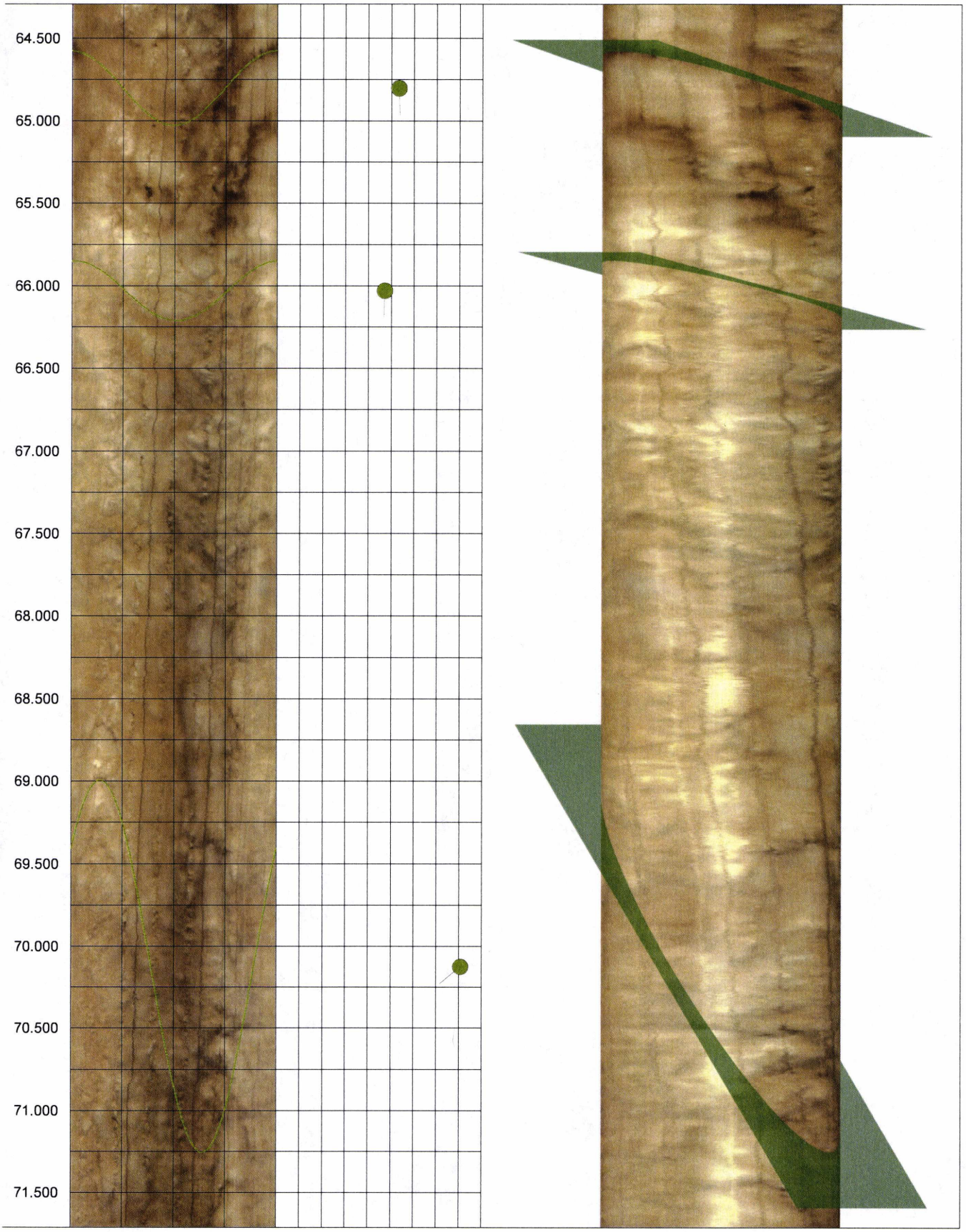

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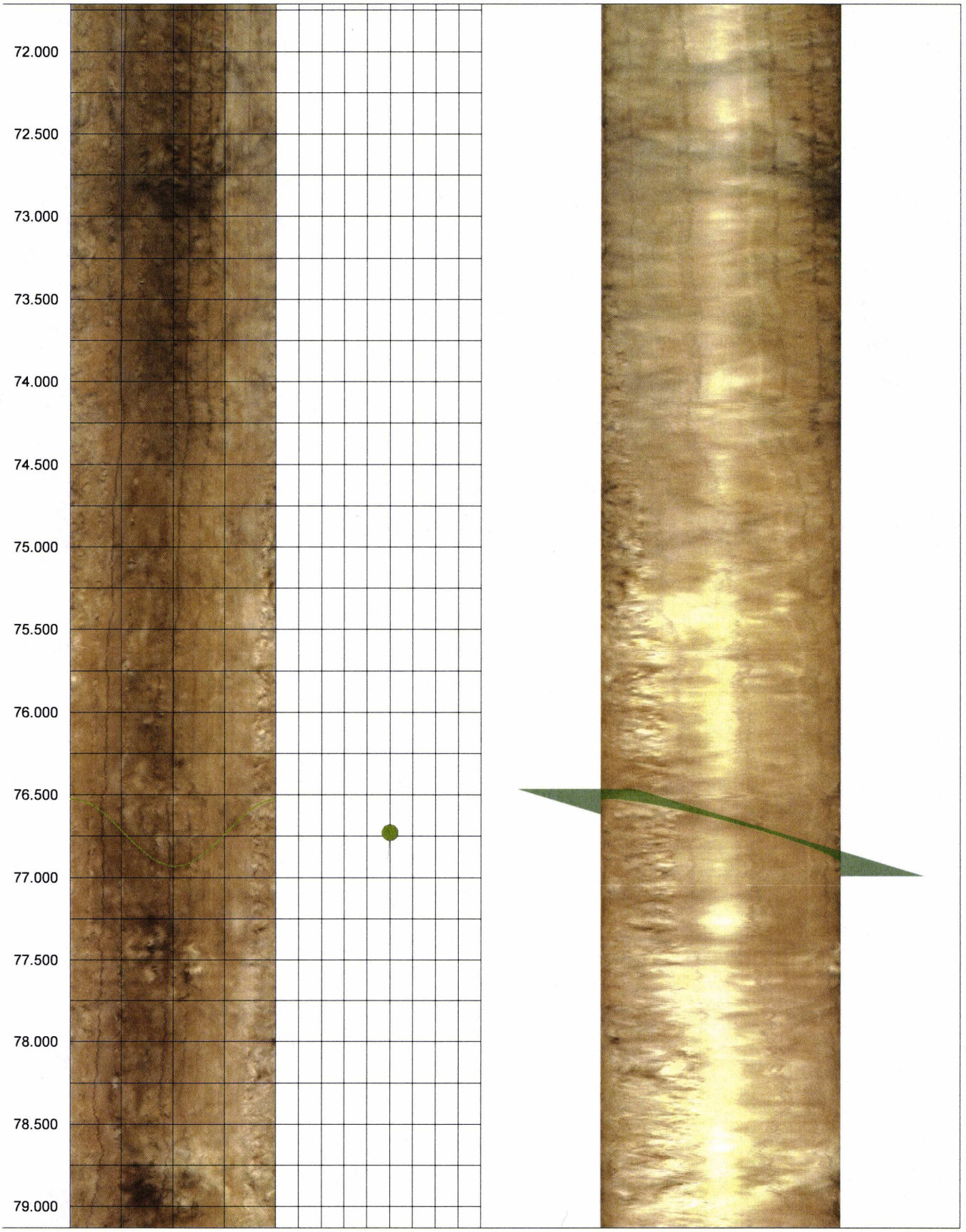

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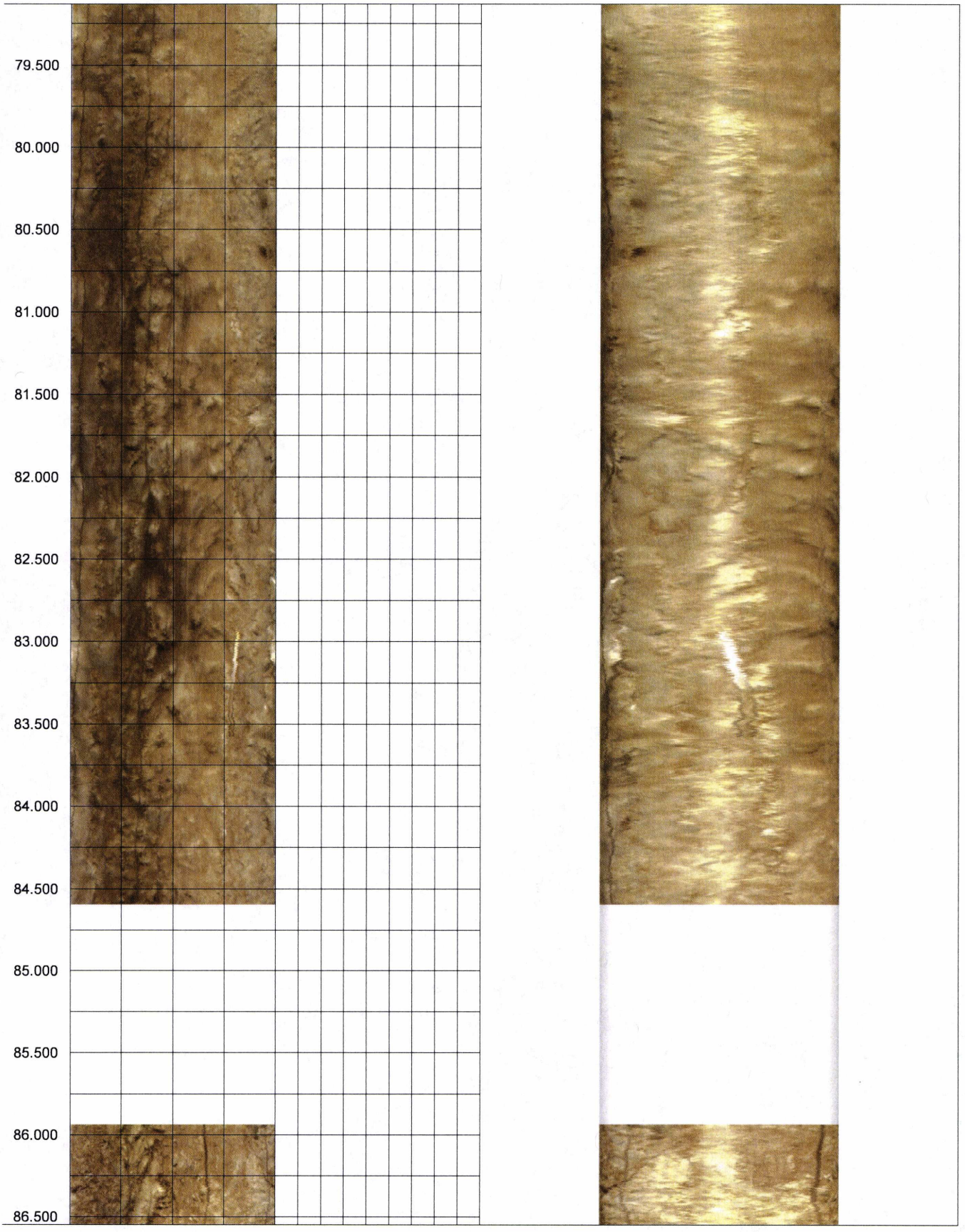

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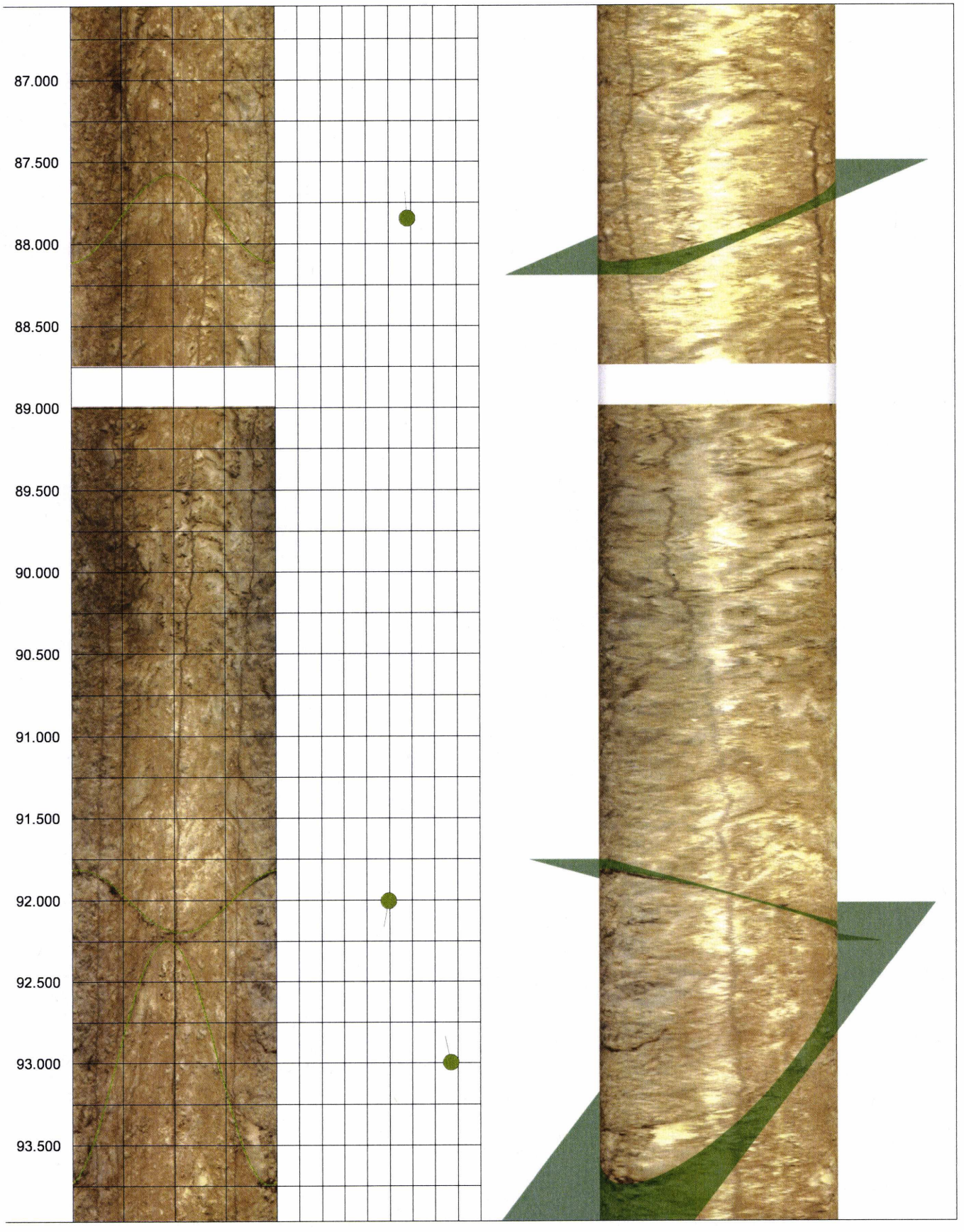

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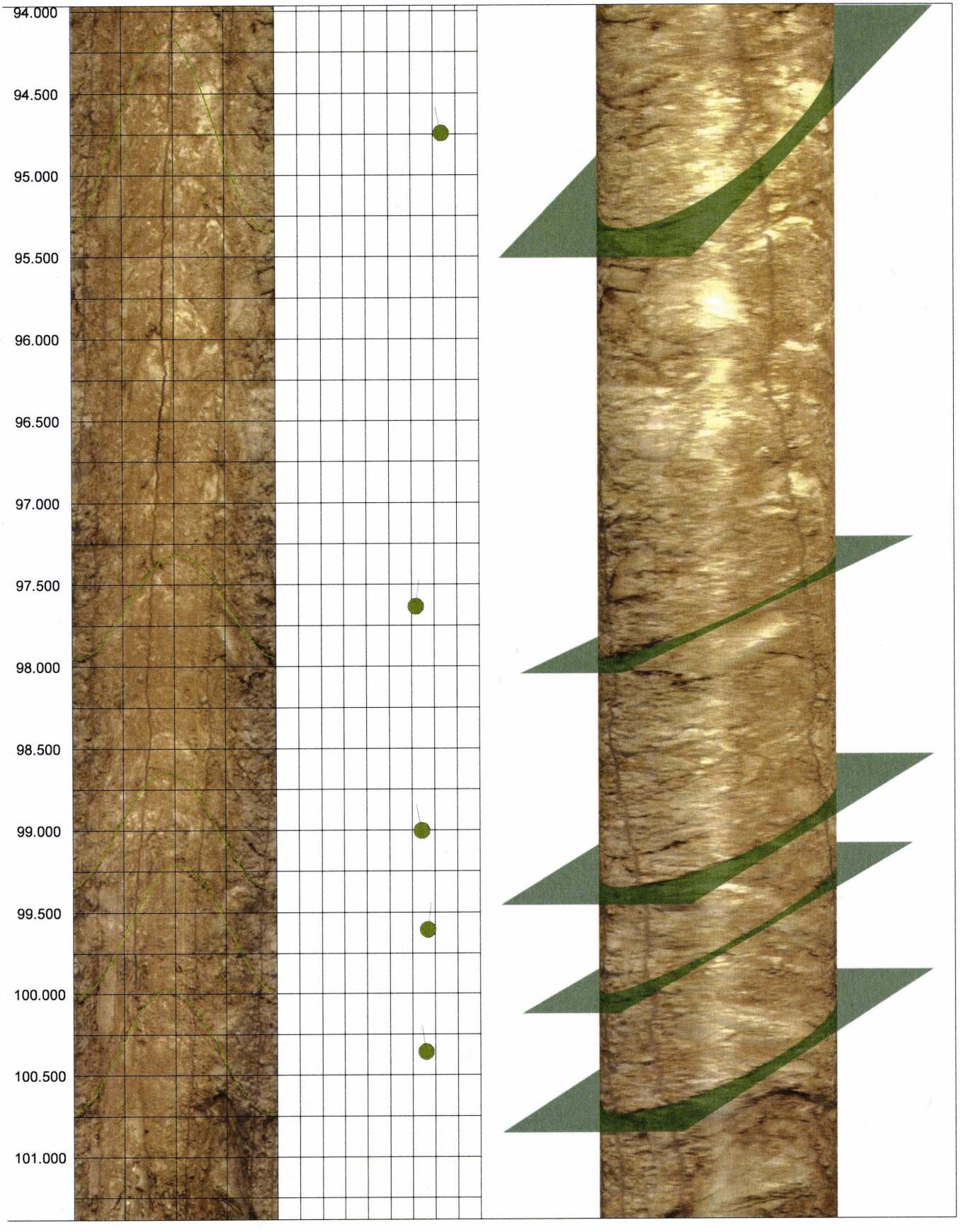

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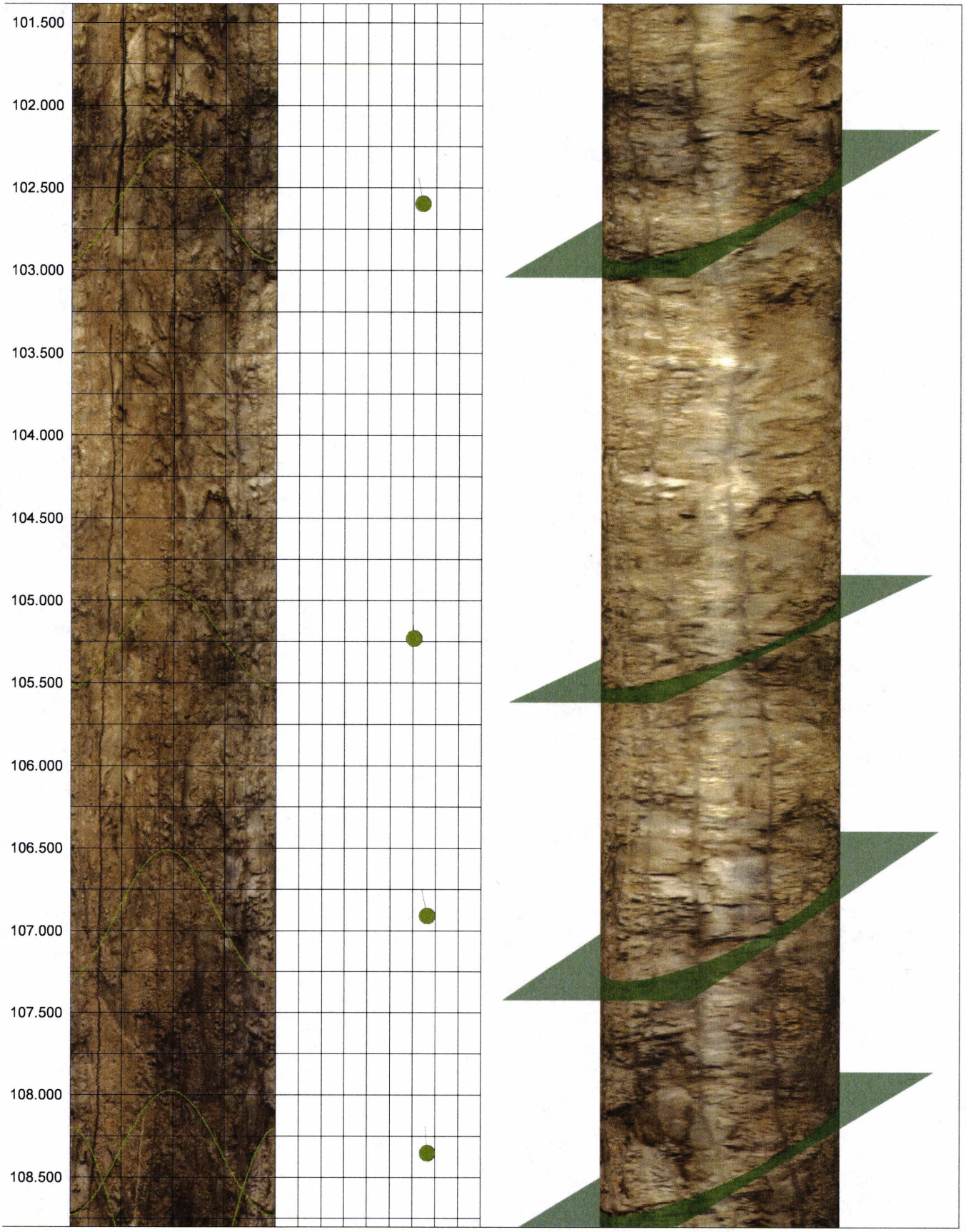

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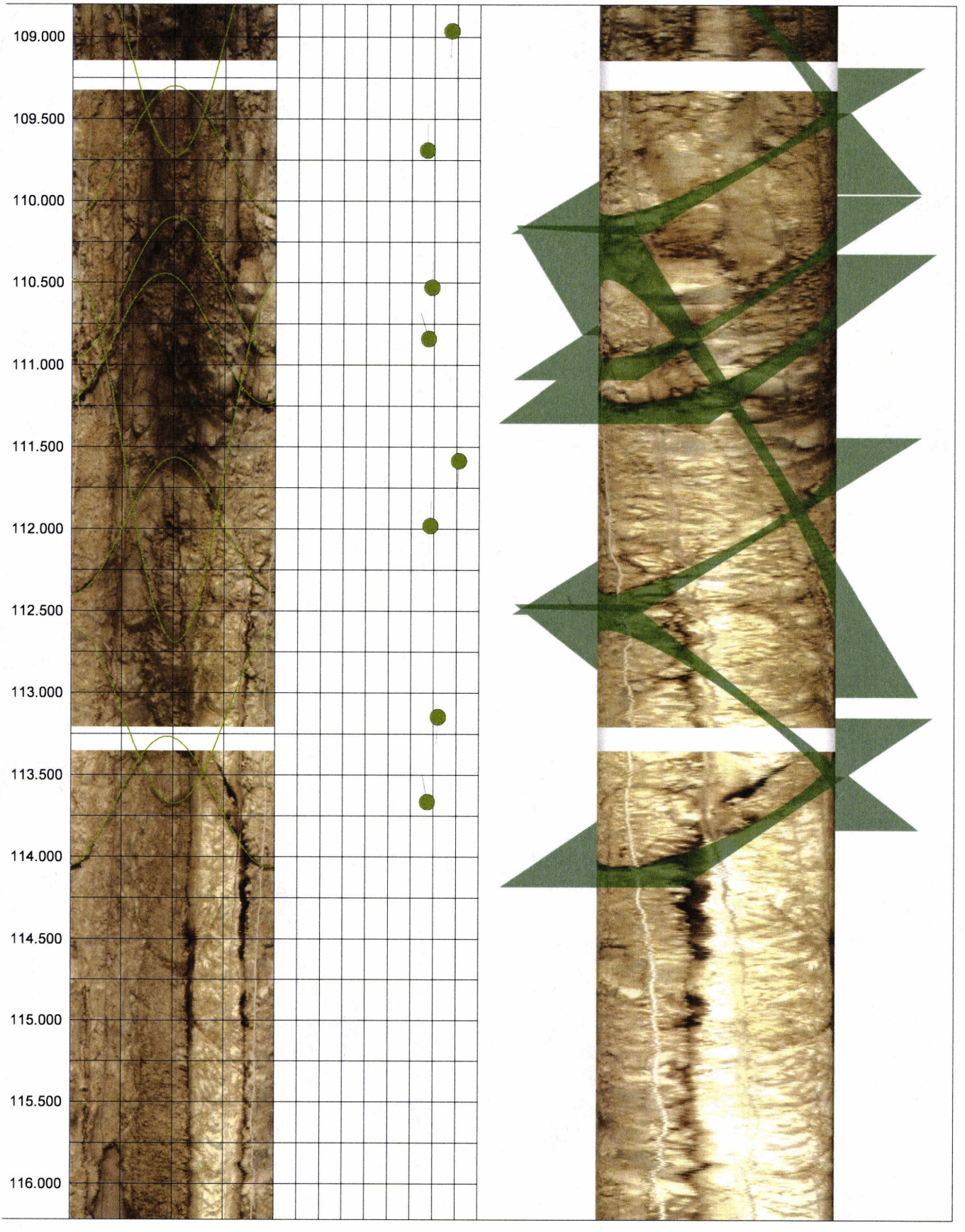

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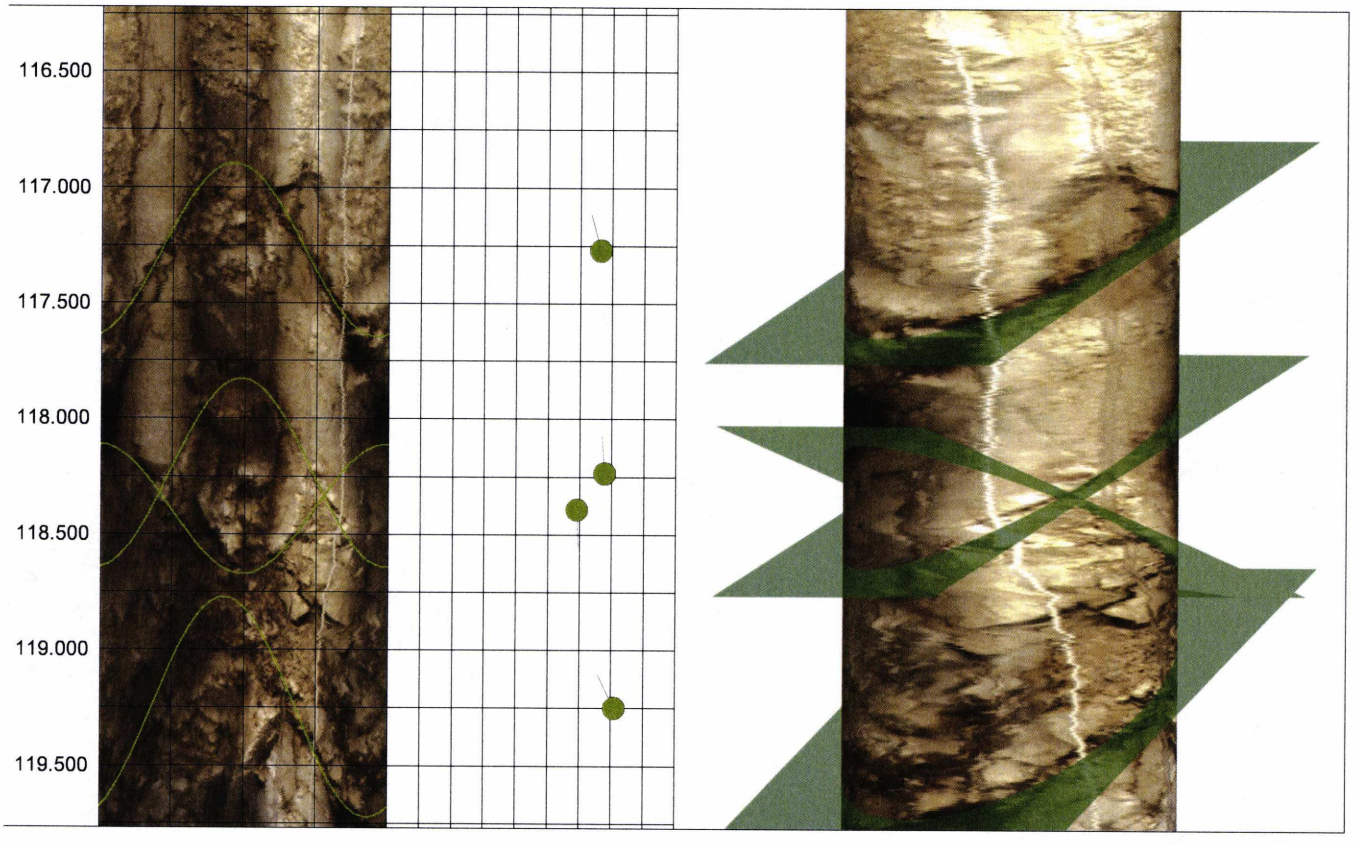

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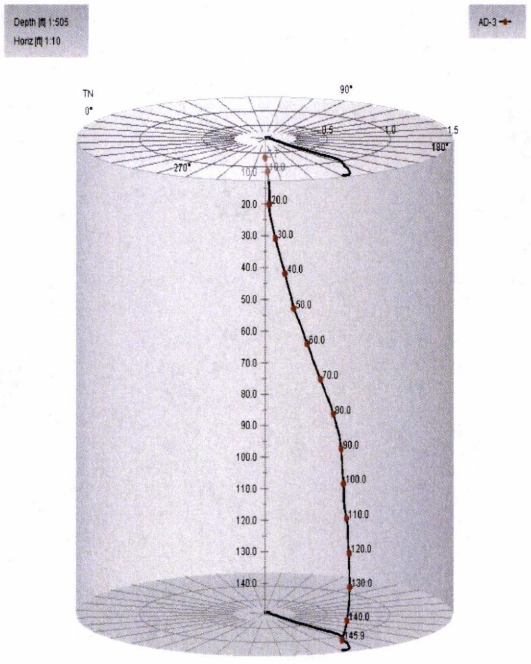
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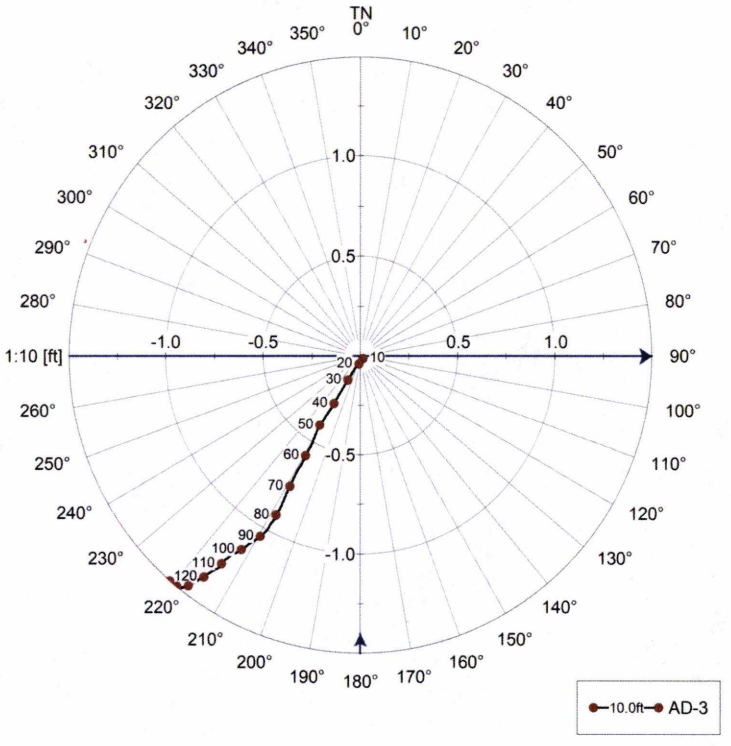
Interpreted Log Type: OTV

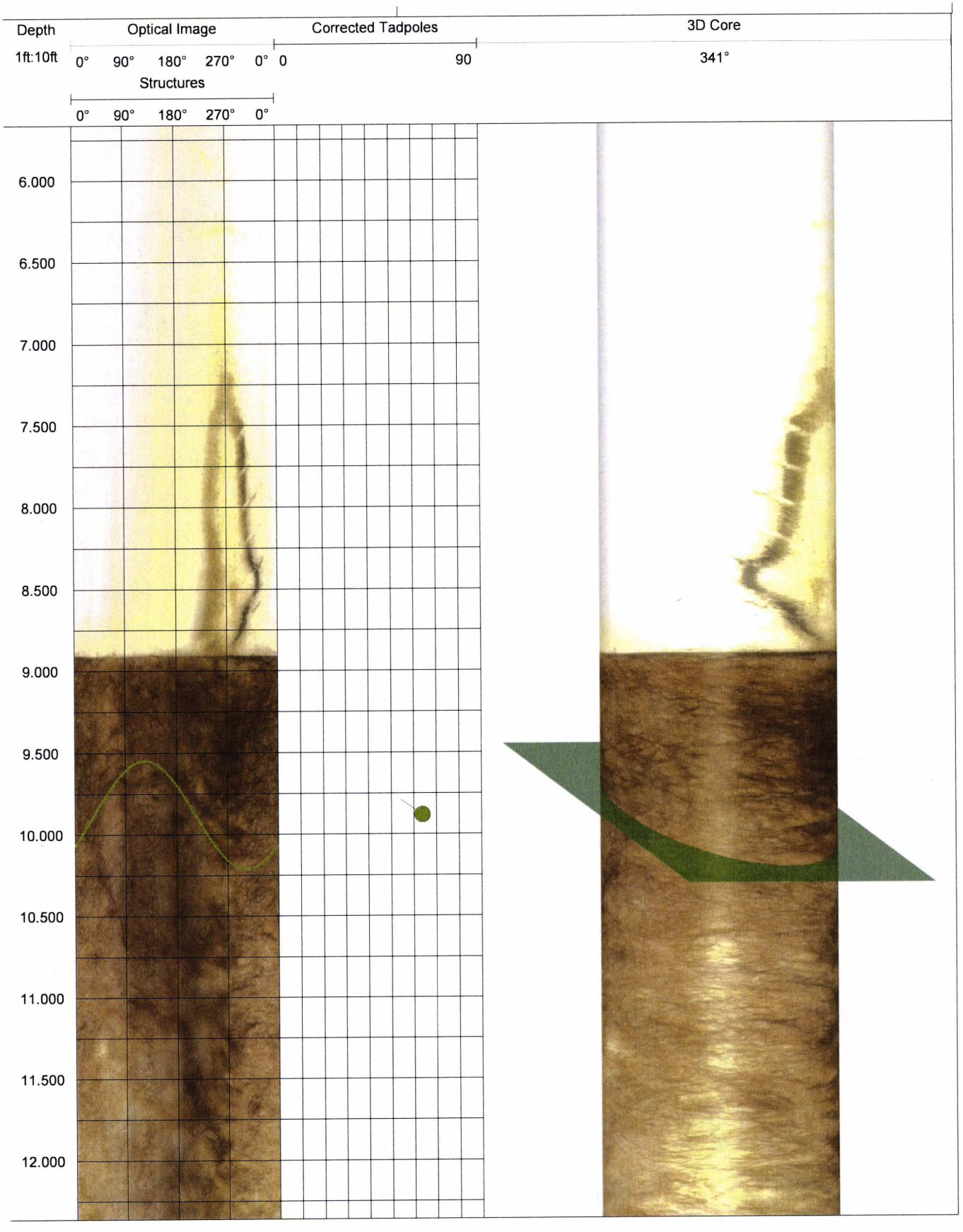
Project:	HWY 70 EAST / HWY 7 NORTH	**Date:**	1/22/2019
Location:	HOT SPRINGS, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD3	**Start Depth:**	5.7
		End Depth:	145.9

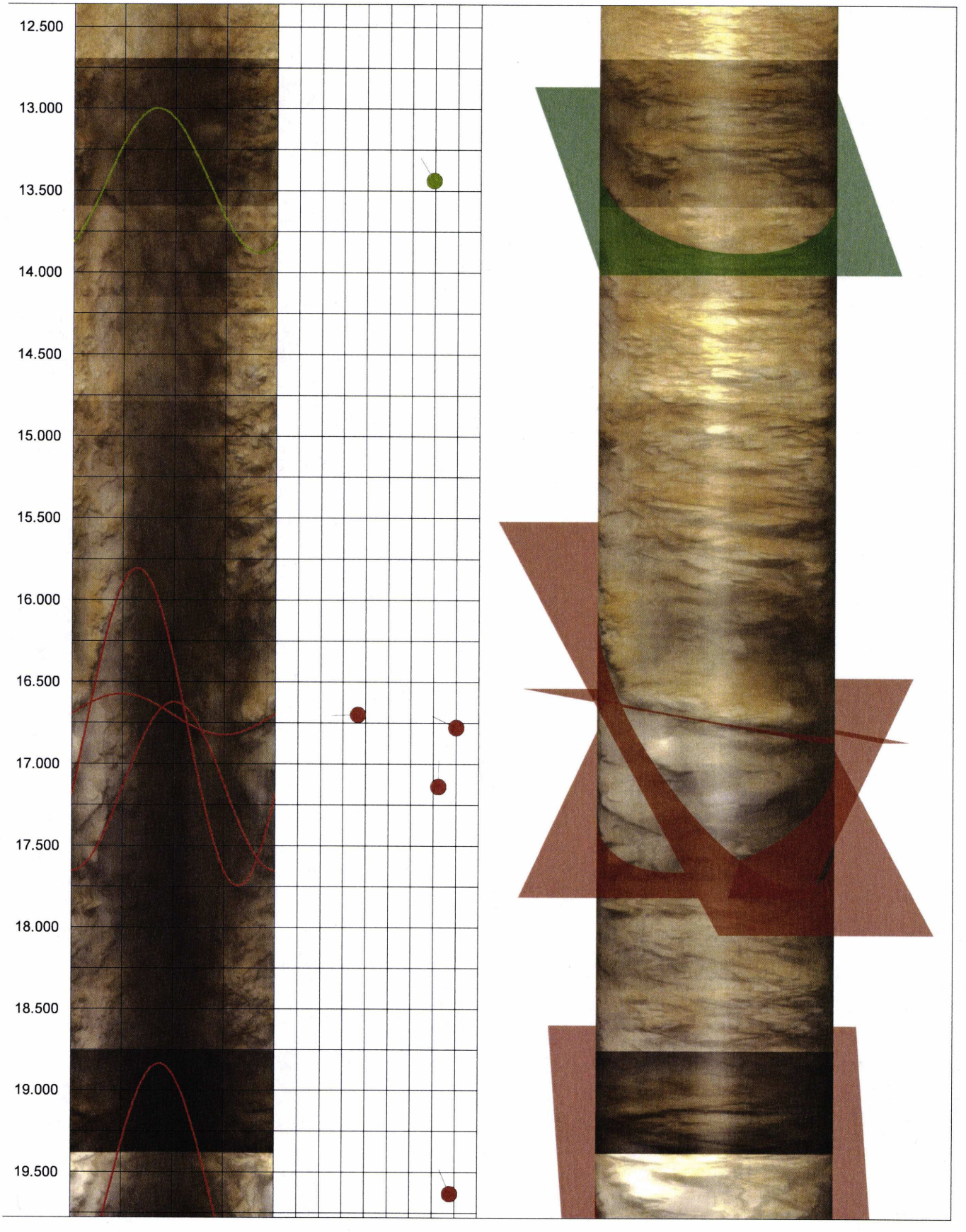
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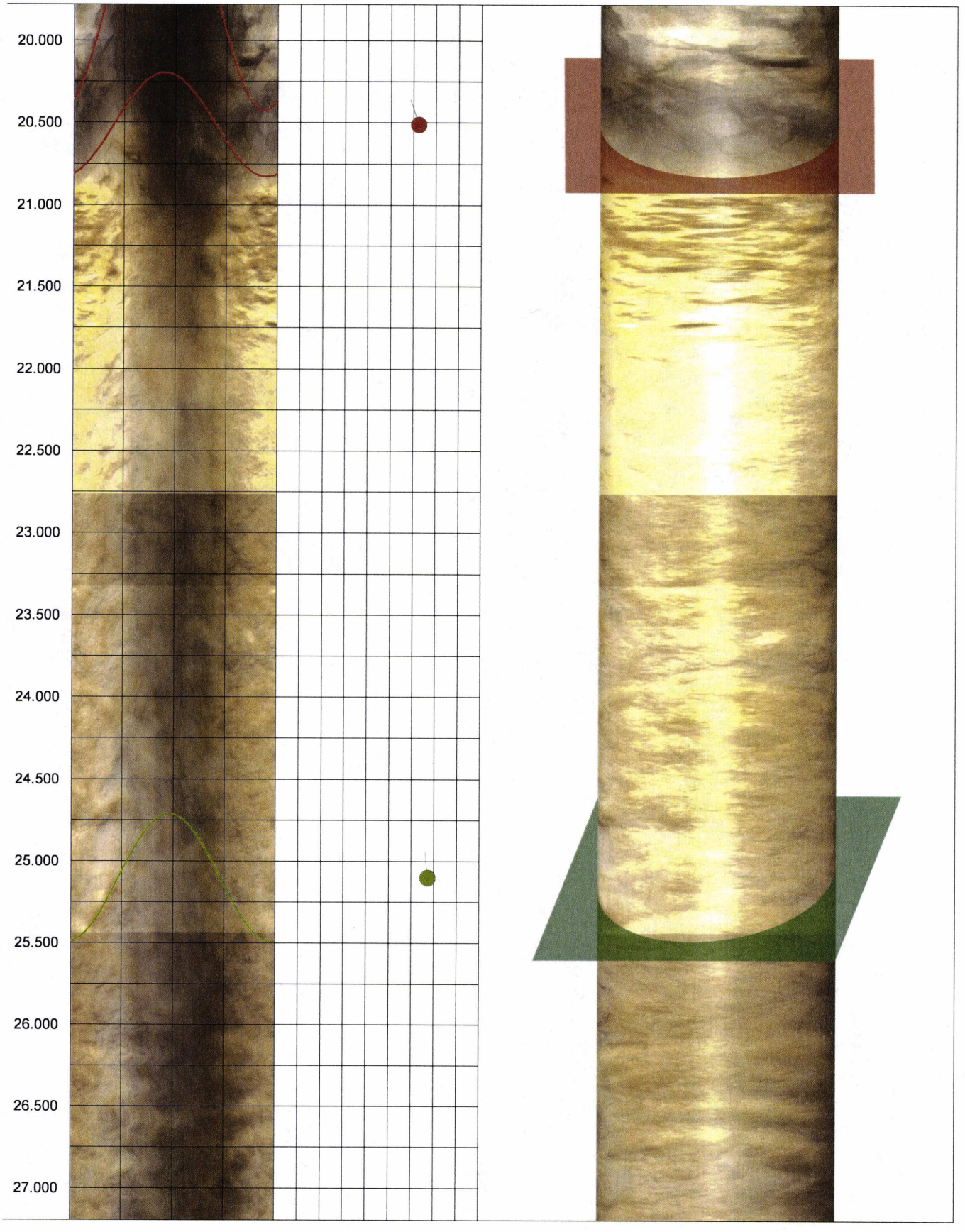
Open Joint / Fracture Filled Joint / Fracture

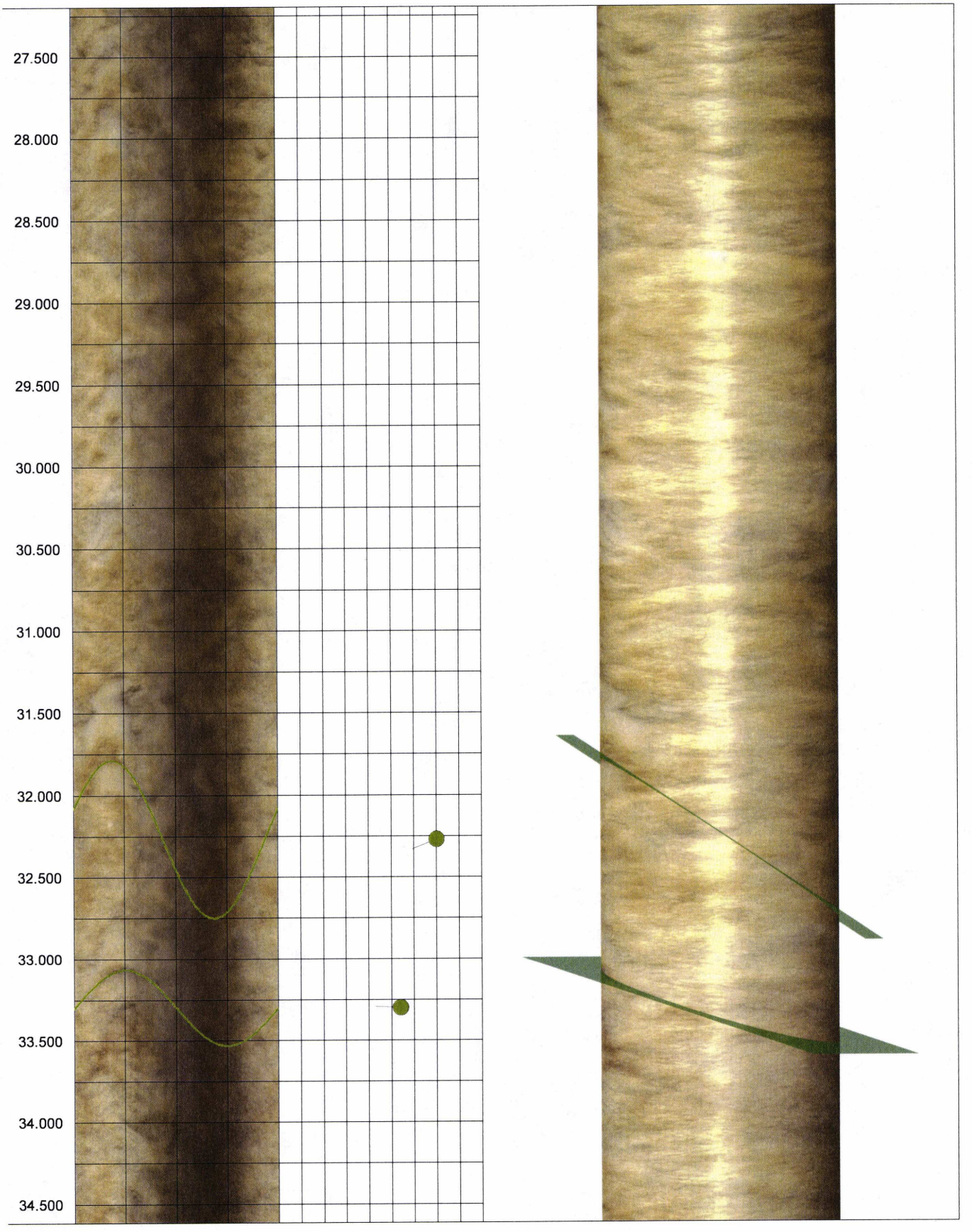


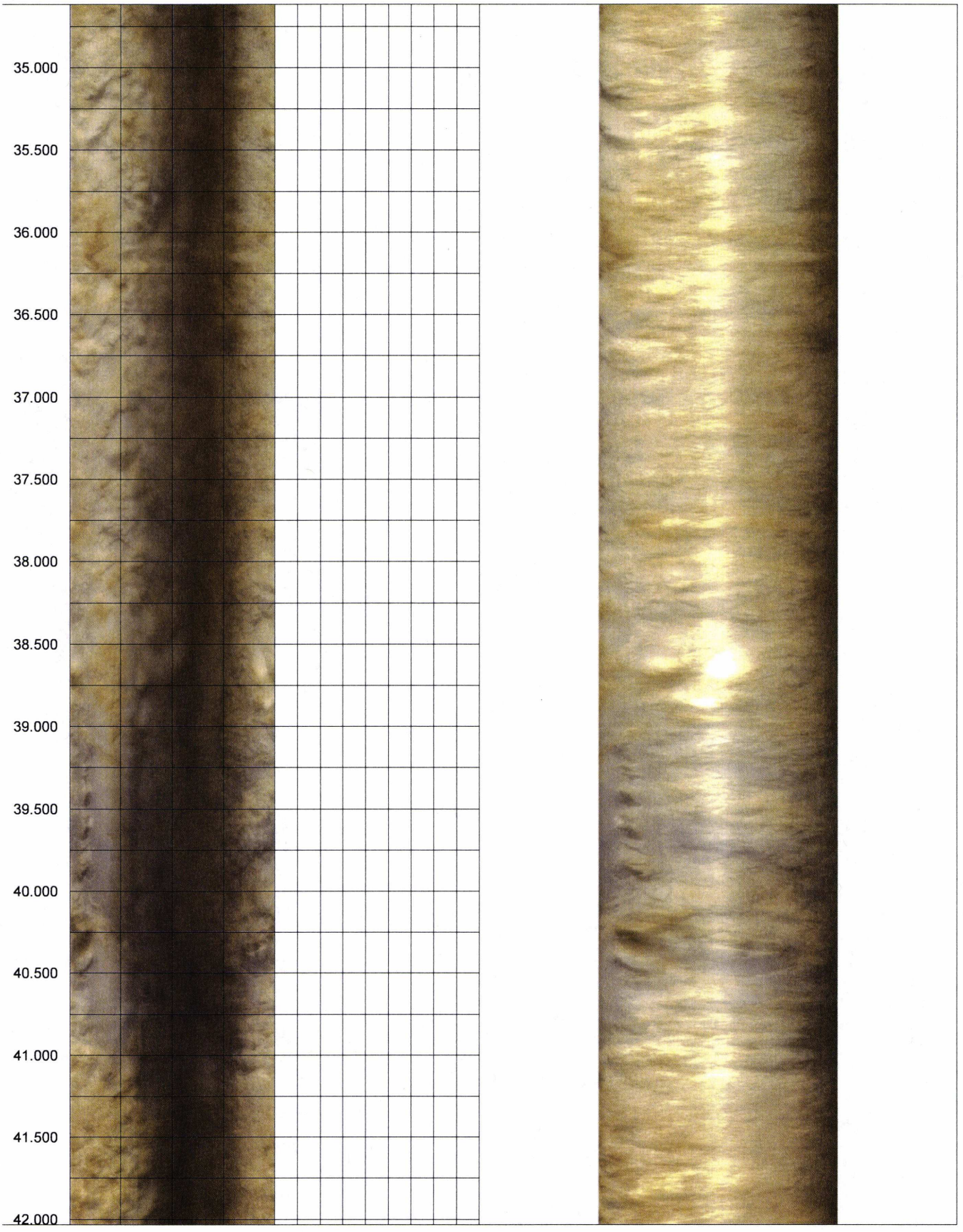


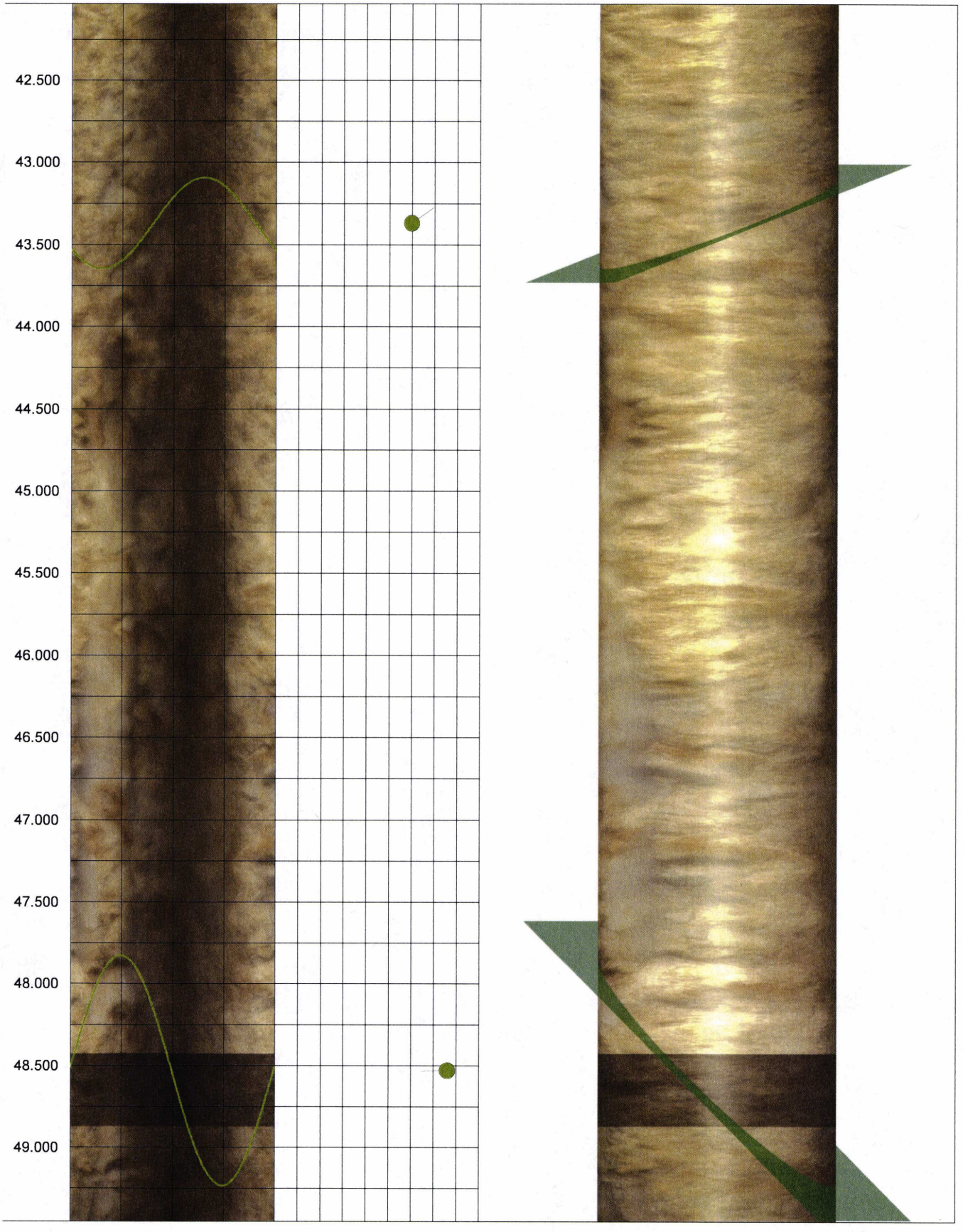

Depth
1ft:10ft
Optical Image
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Corrected Tadpoles
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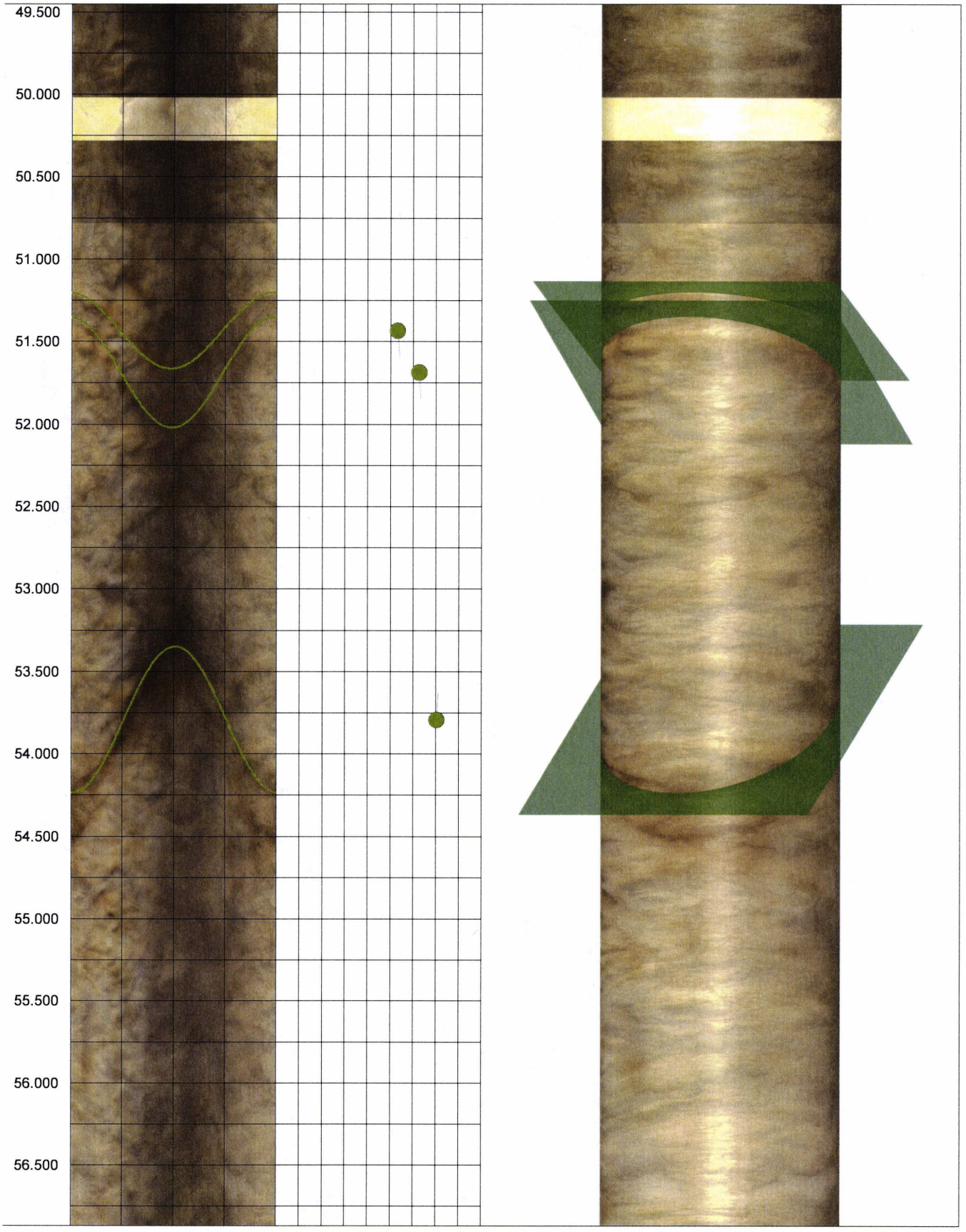

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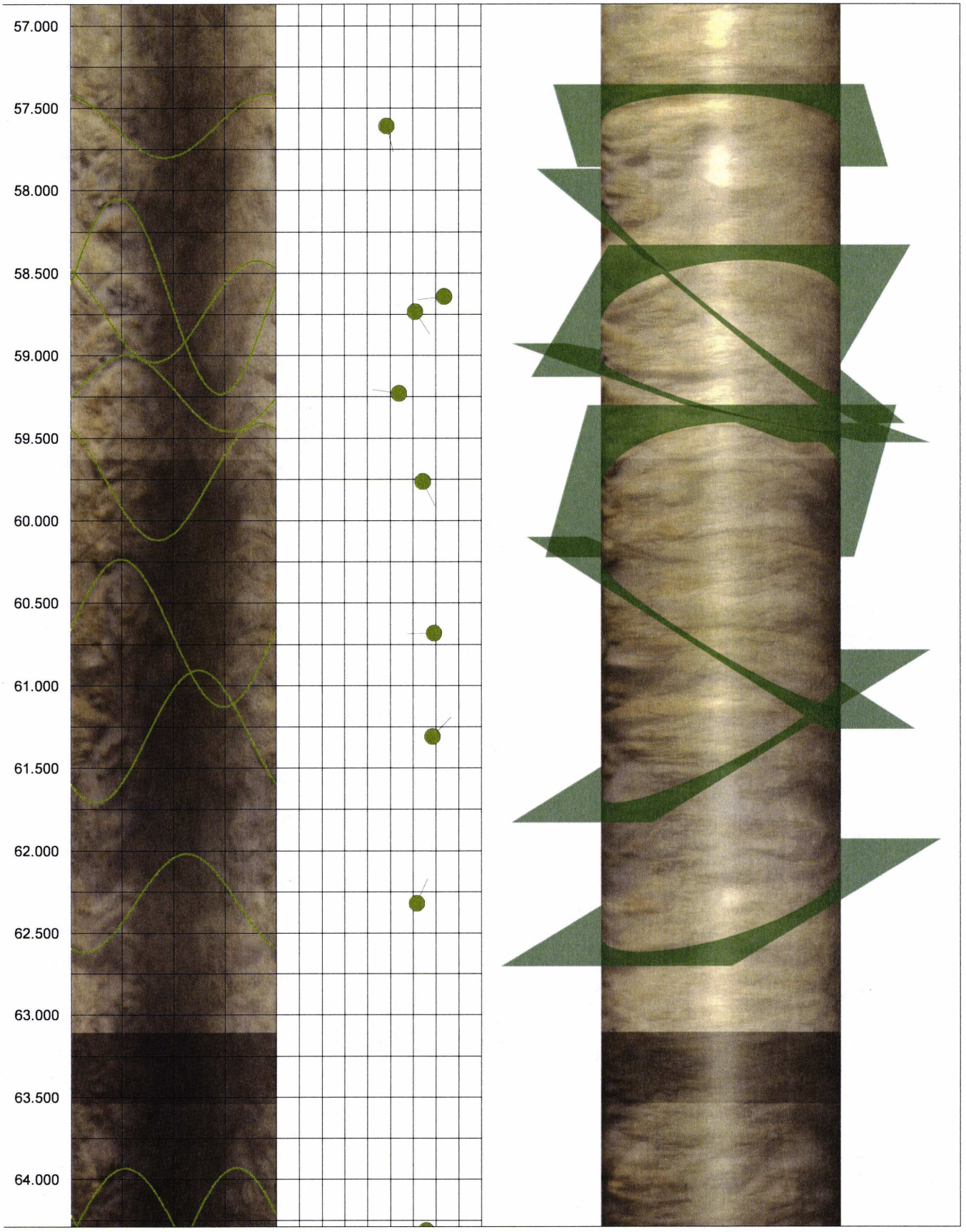

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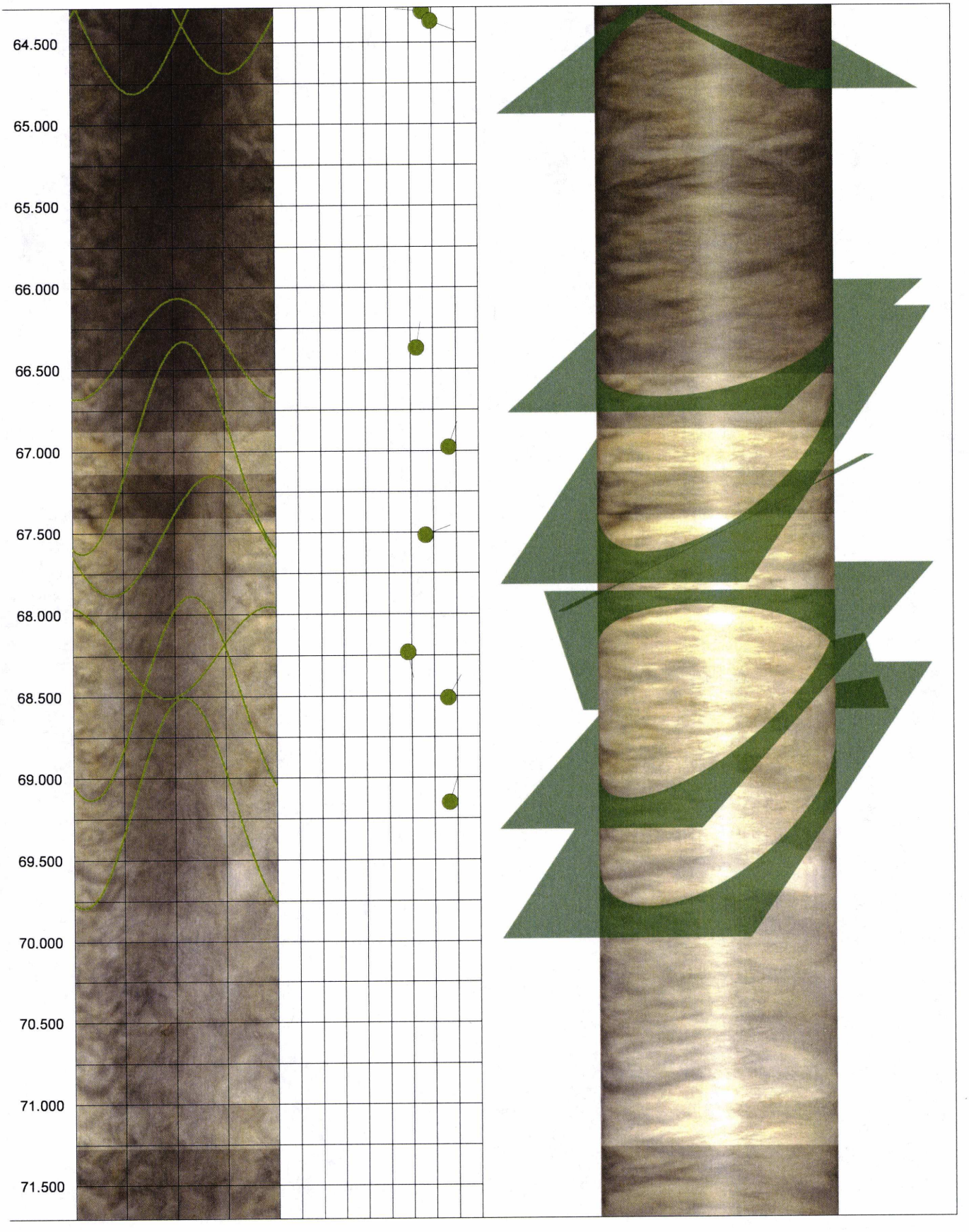

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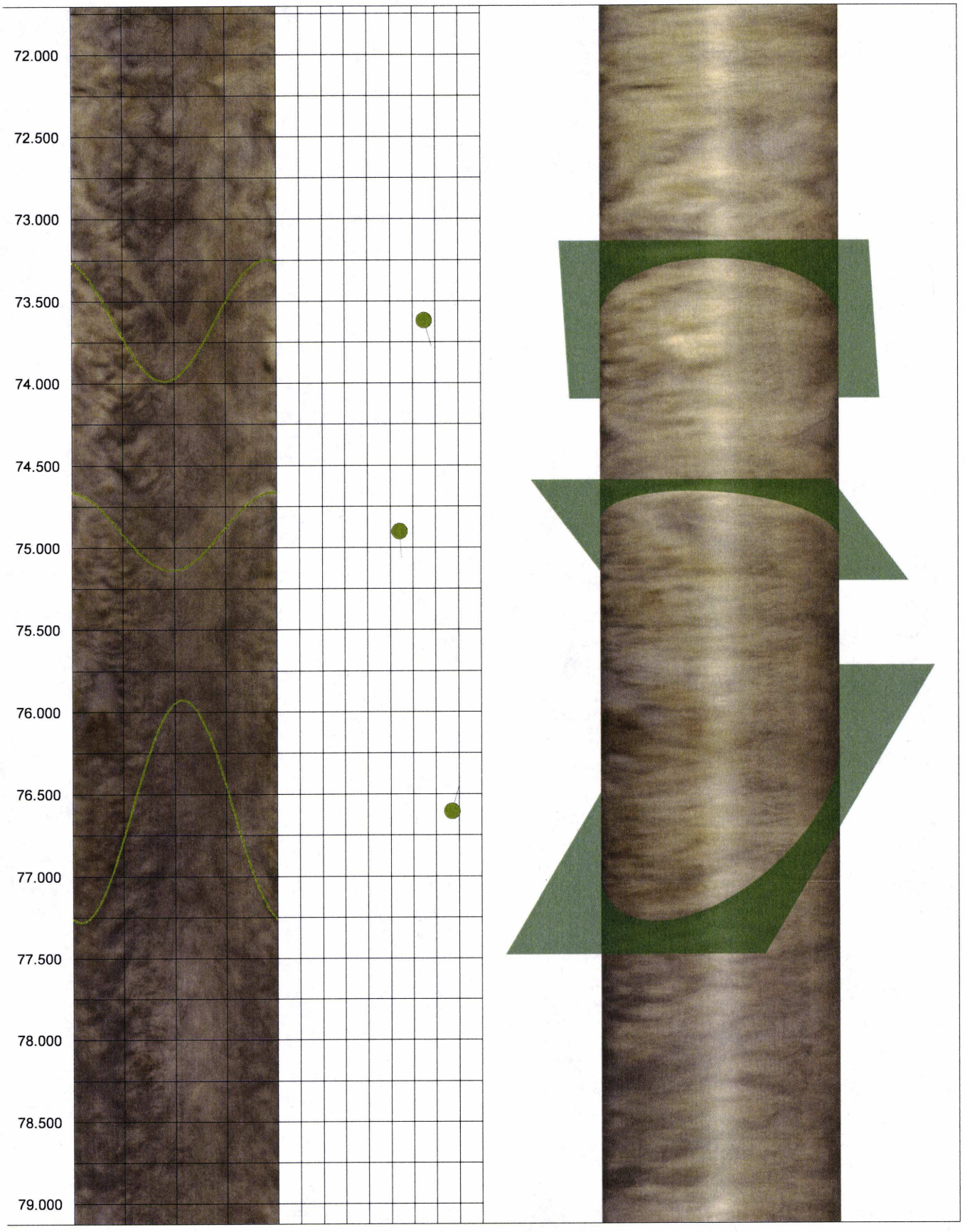

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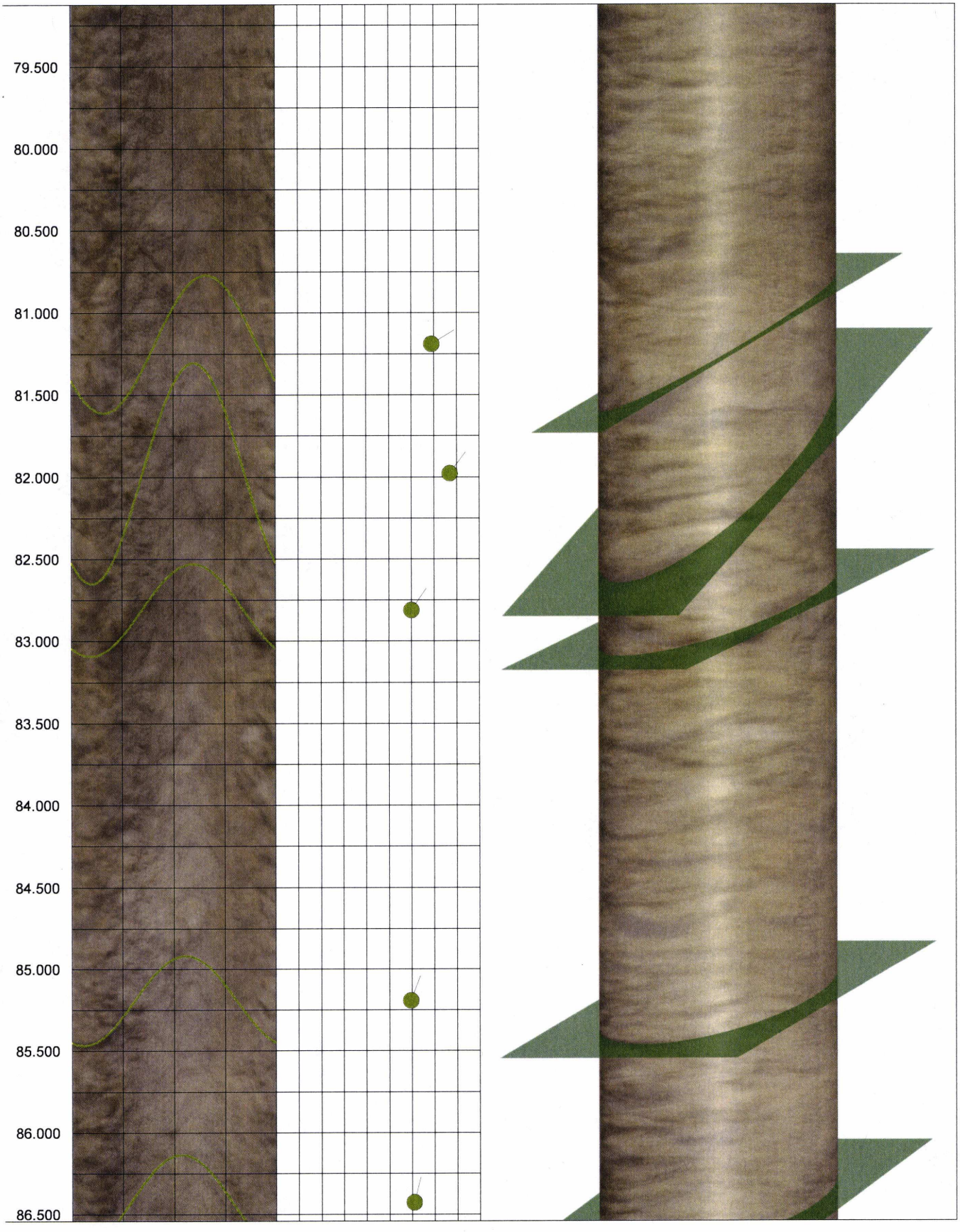

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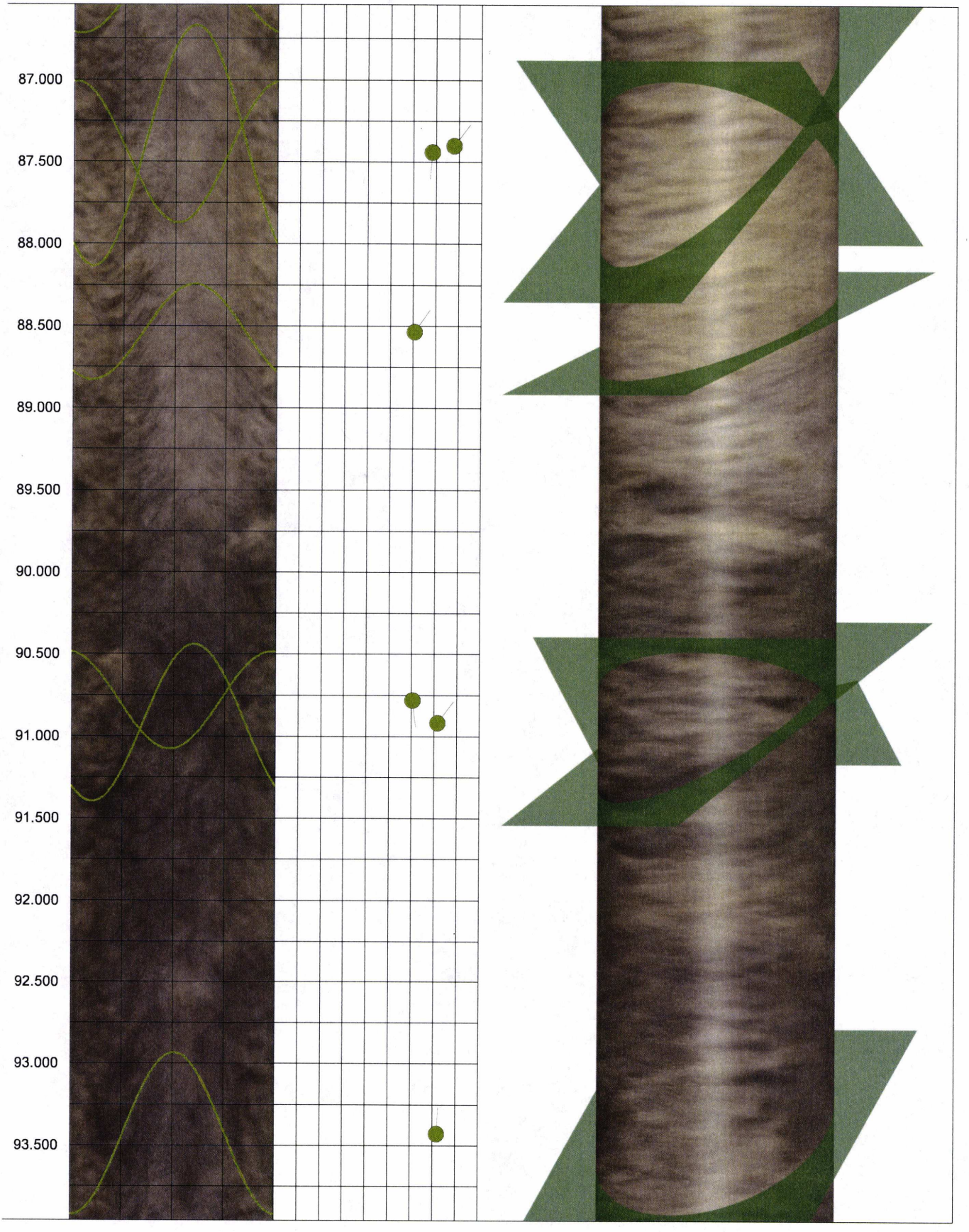

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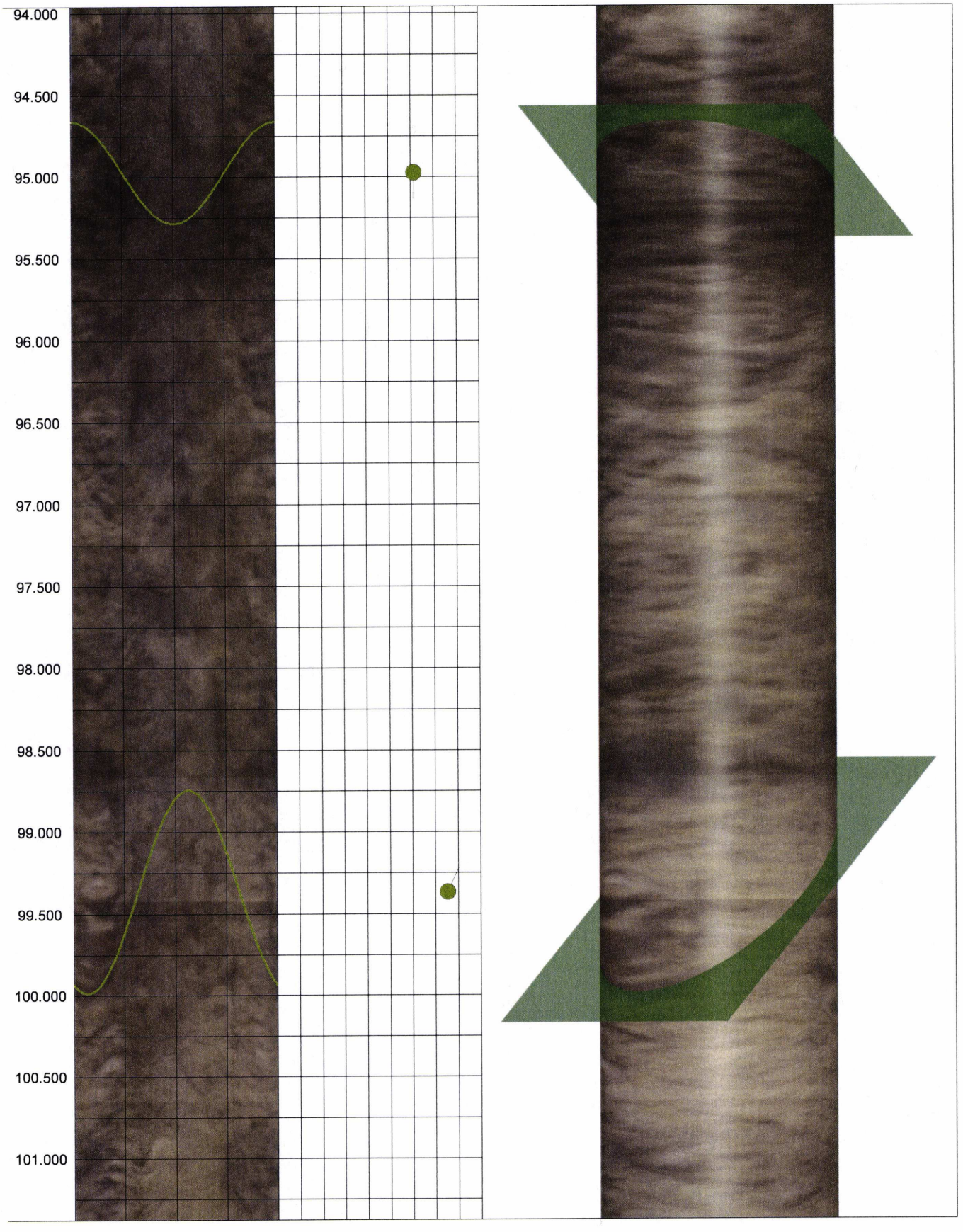

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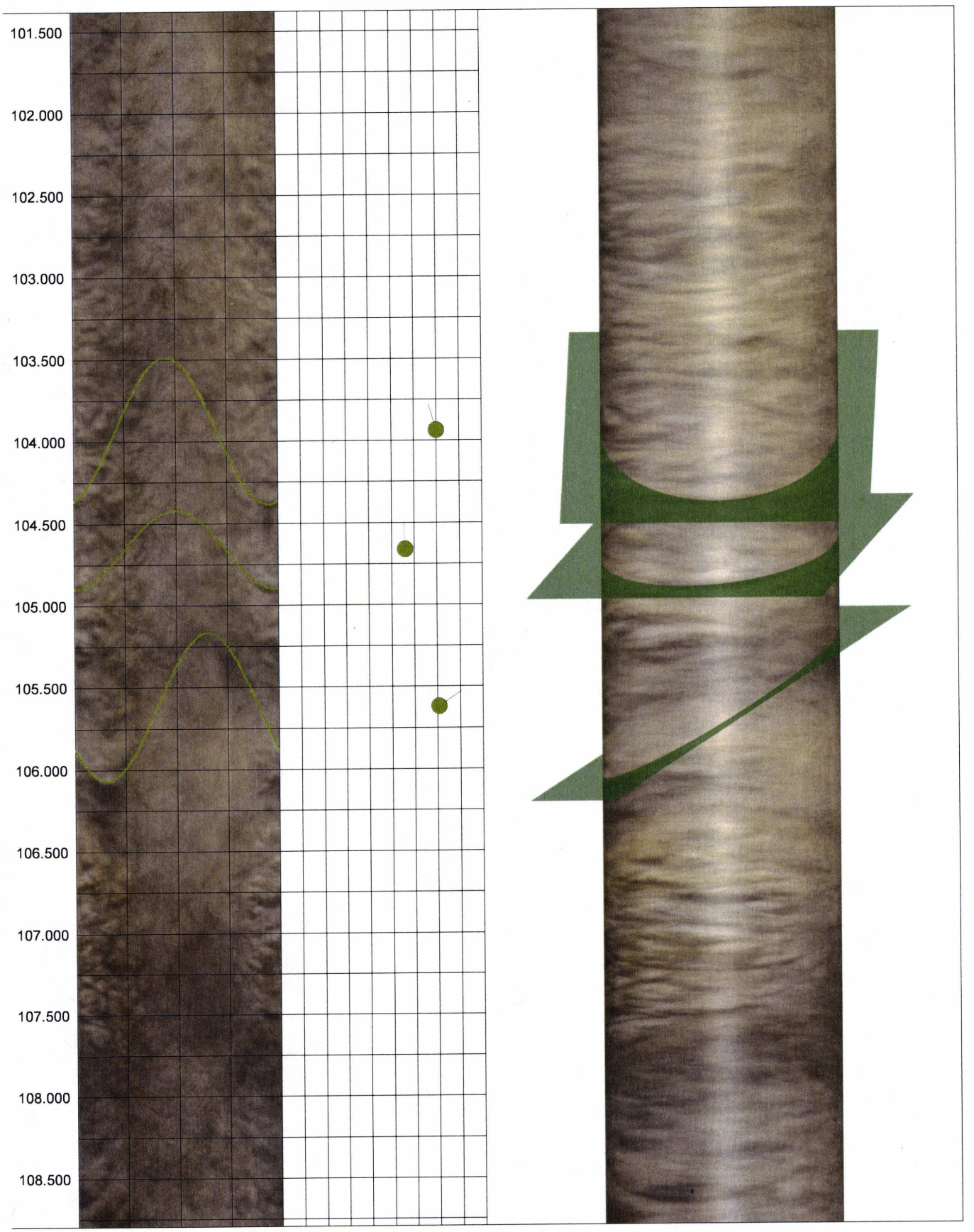

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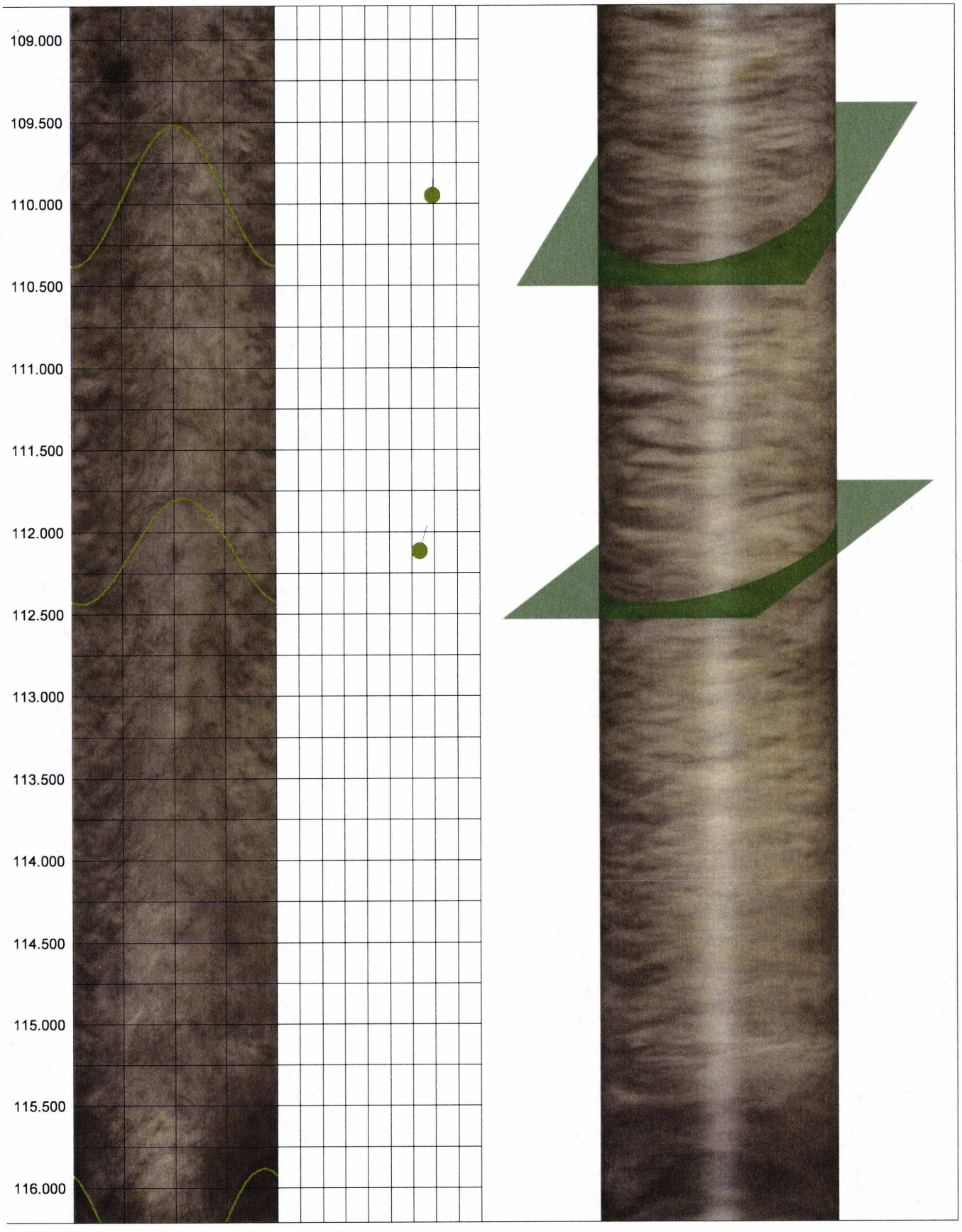

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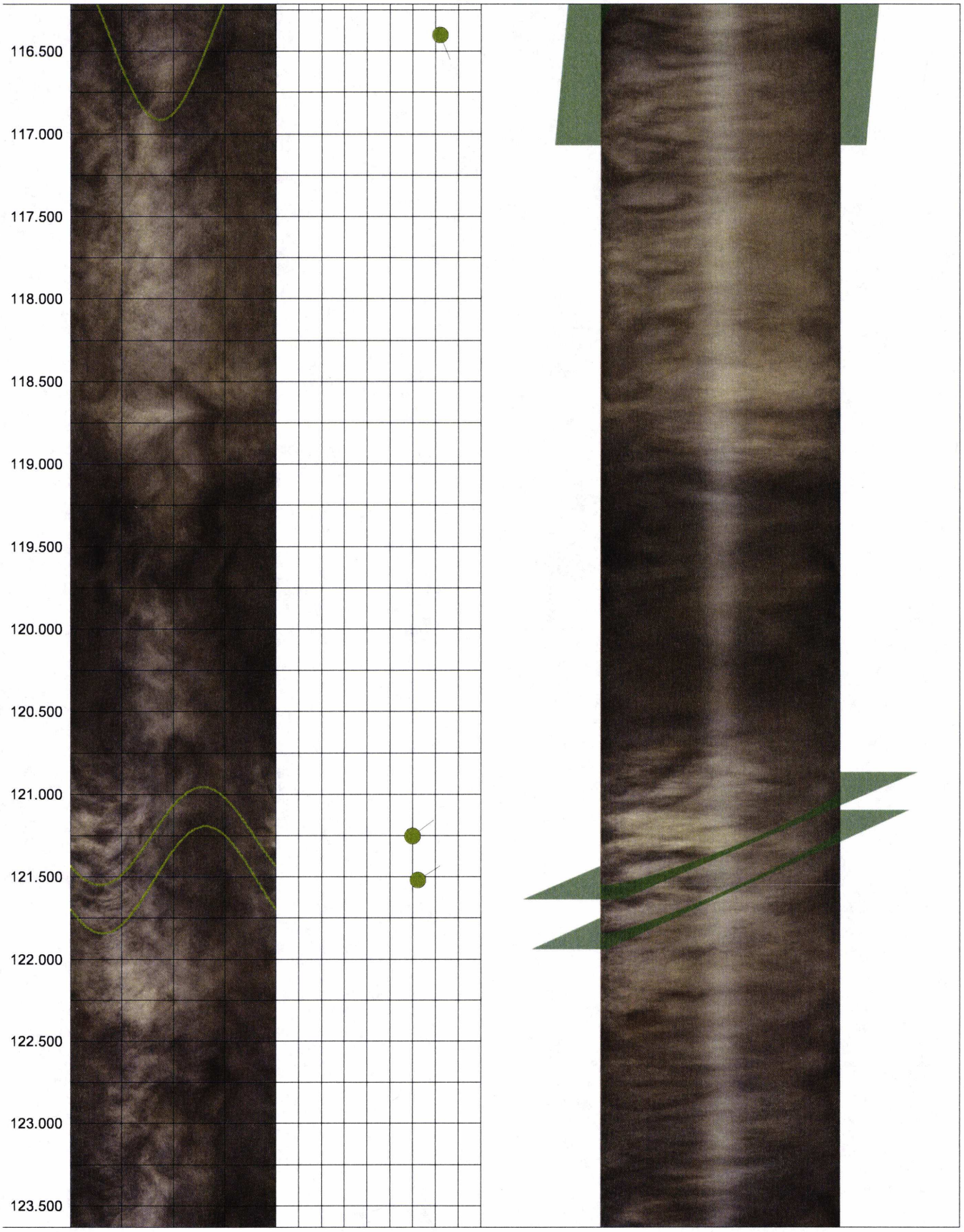

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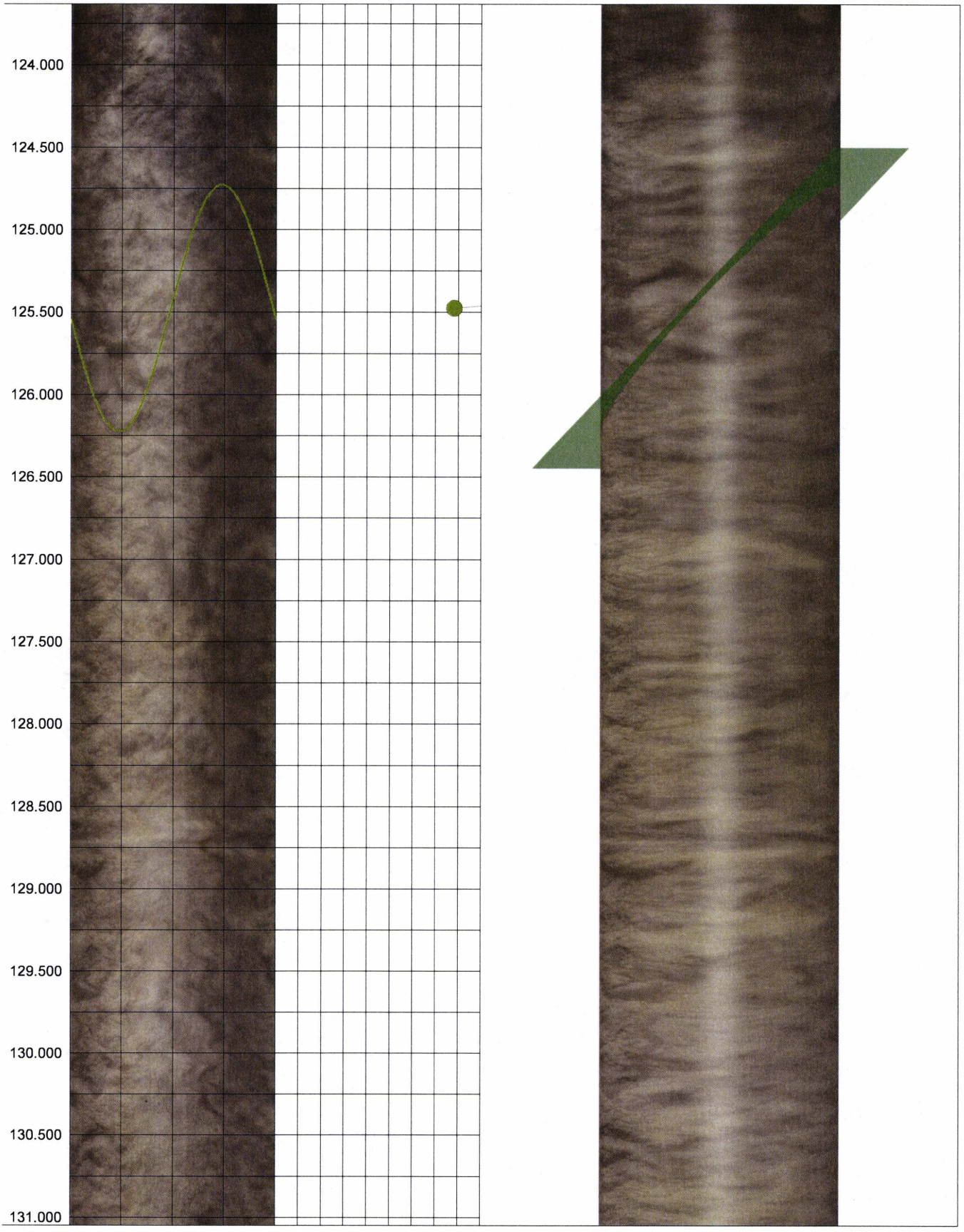

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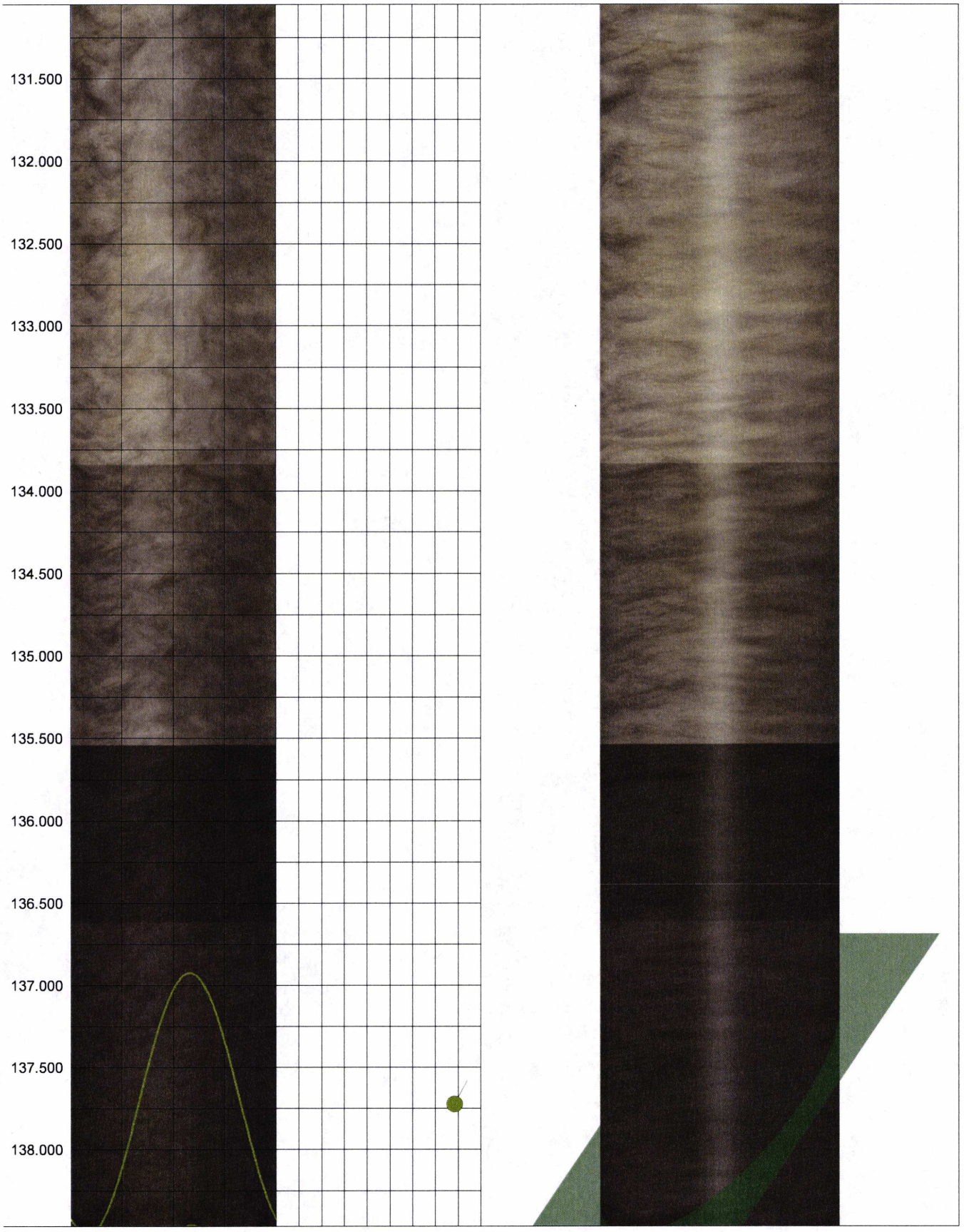

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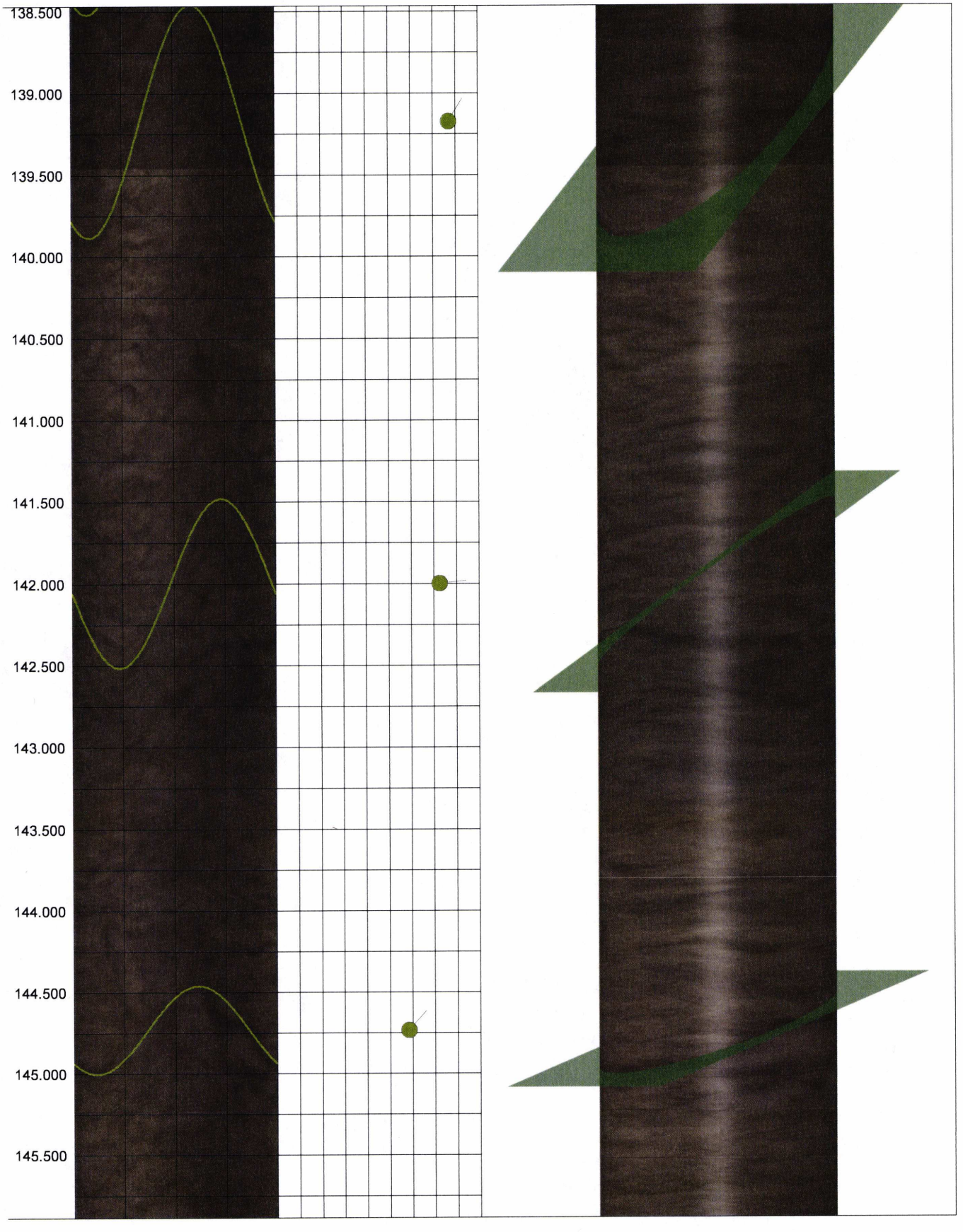

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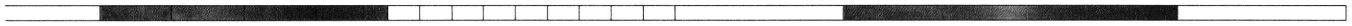

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GEOVision geophysical services

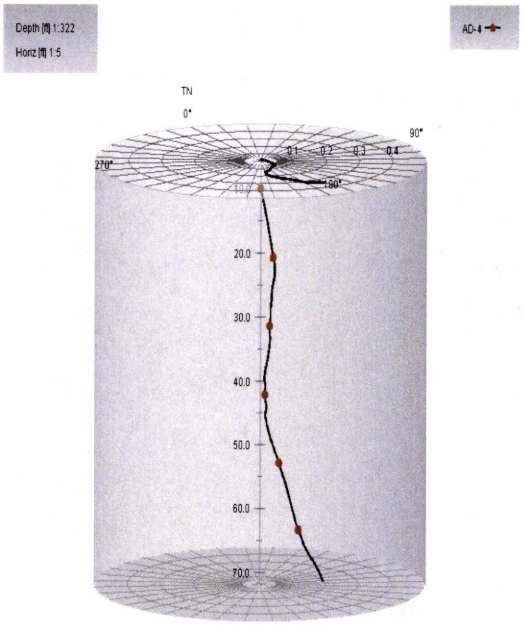
Interpreted Log Type: OTV

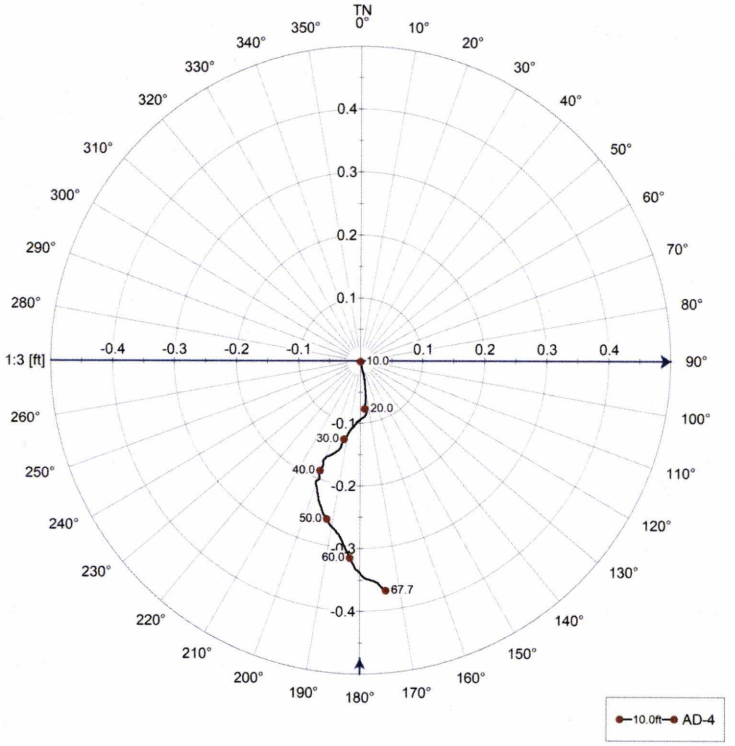
Project:	HWY 70 EAST HWY 7 NORTH	**Date:**	1/23/2019
Location:	Hot Springs, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD-4	**Start Depth:**	9.8
		End Depth:	67.7

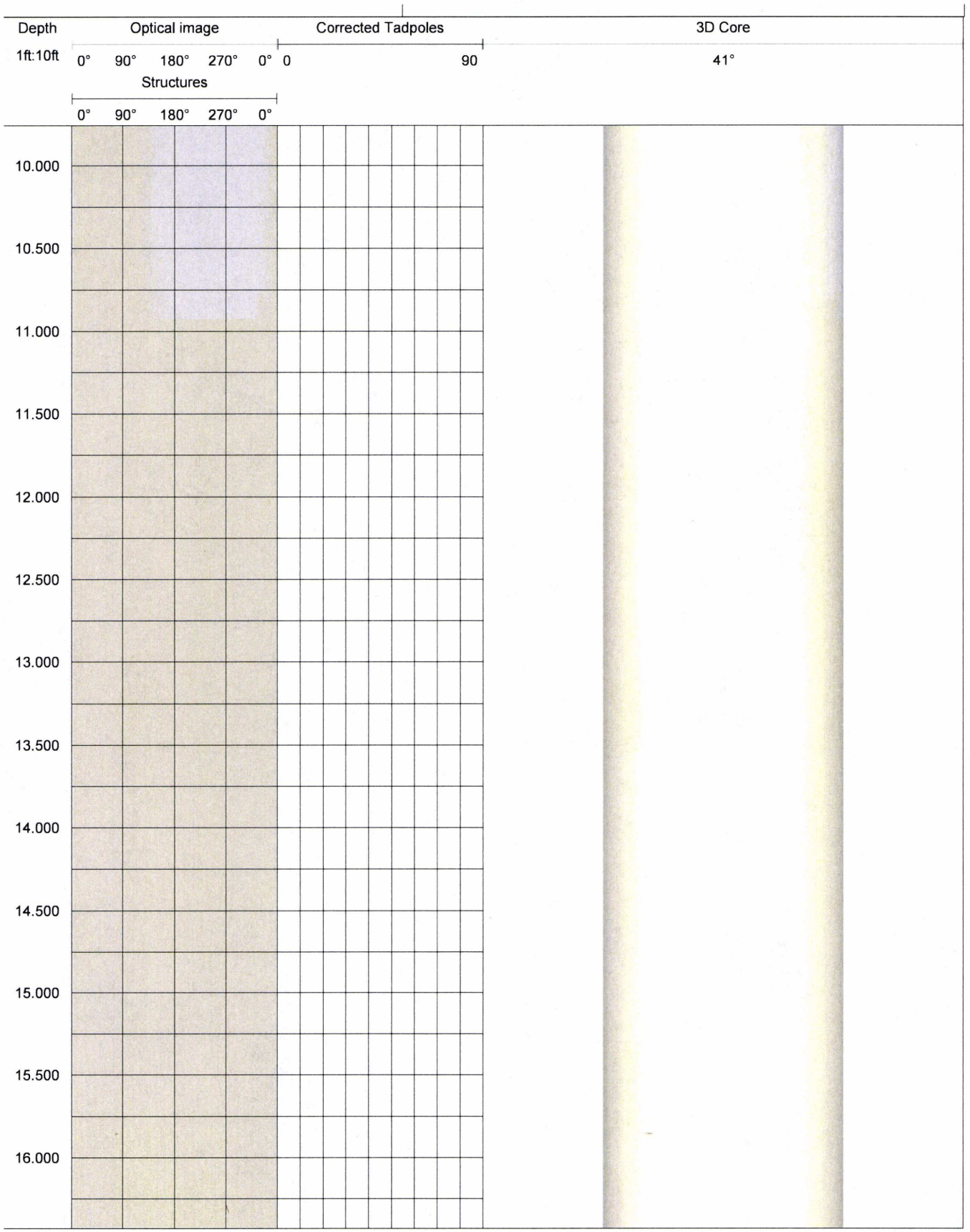
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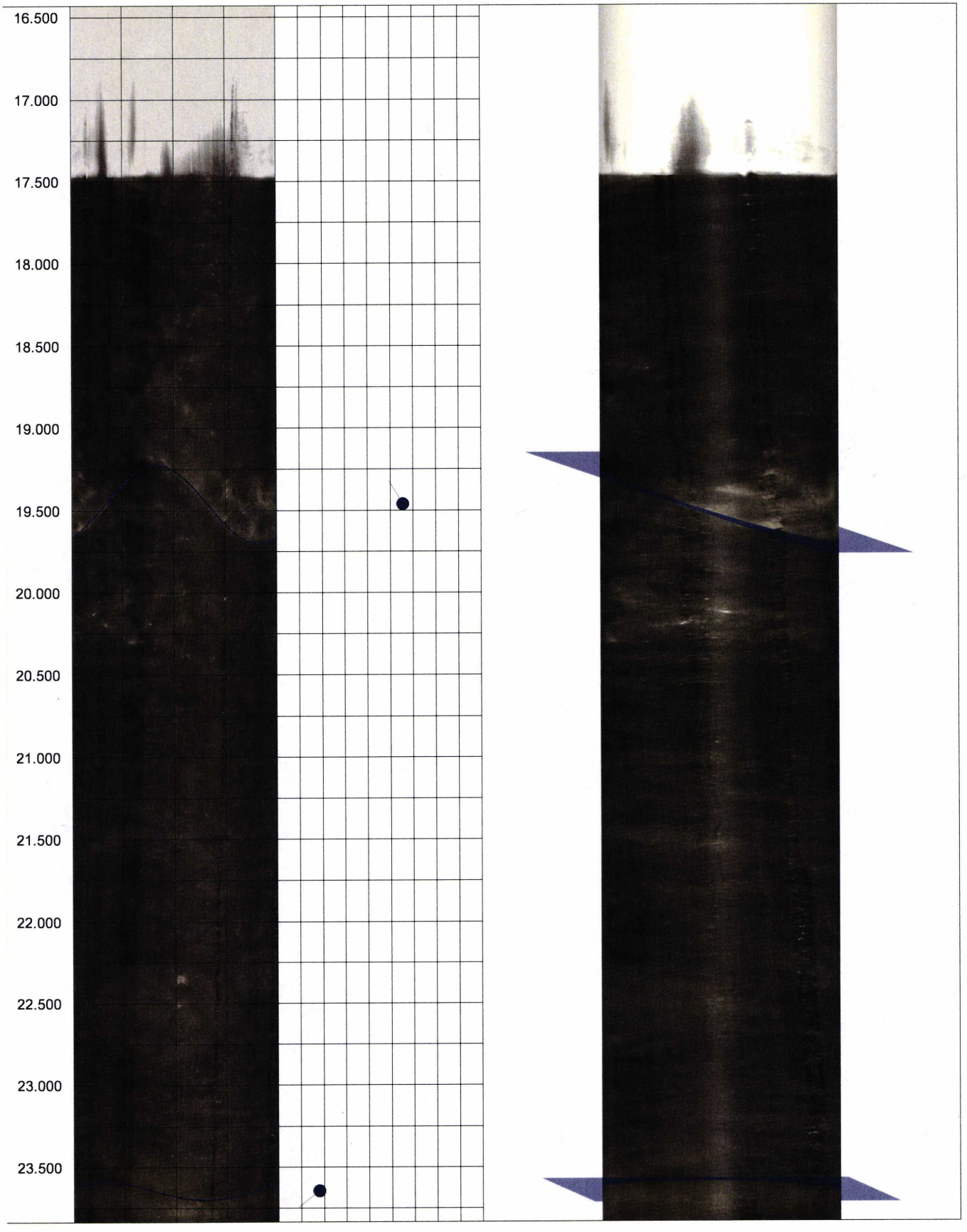
Filled Joint / Fracture

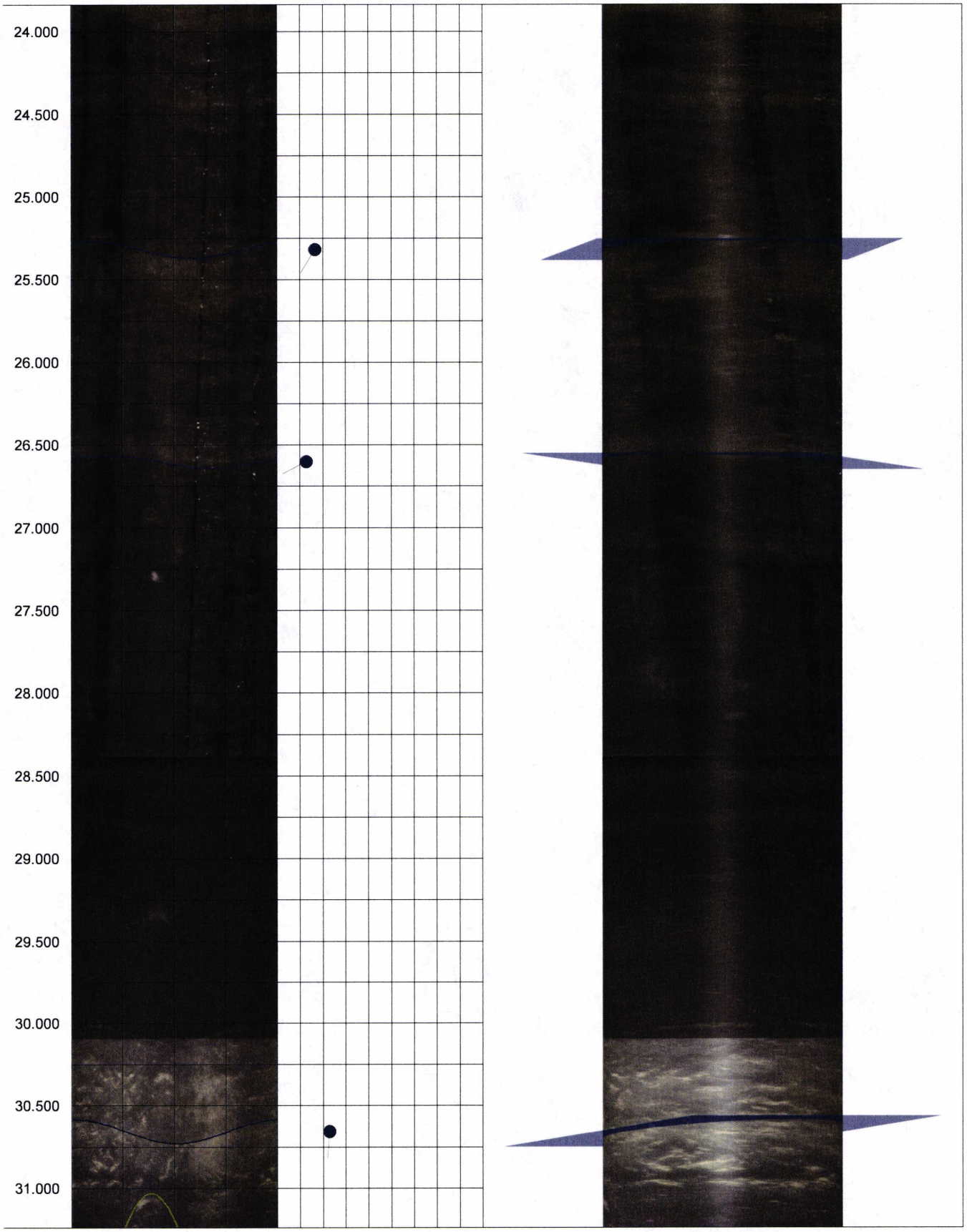
Bedding / Banding / Foliation

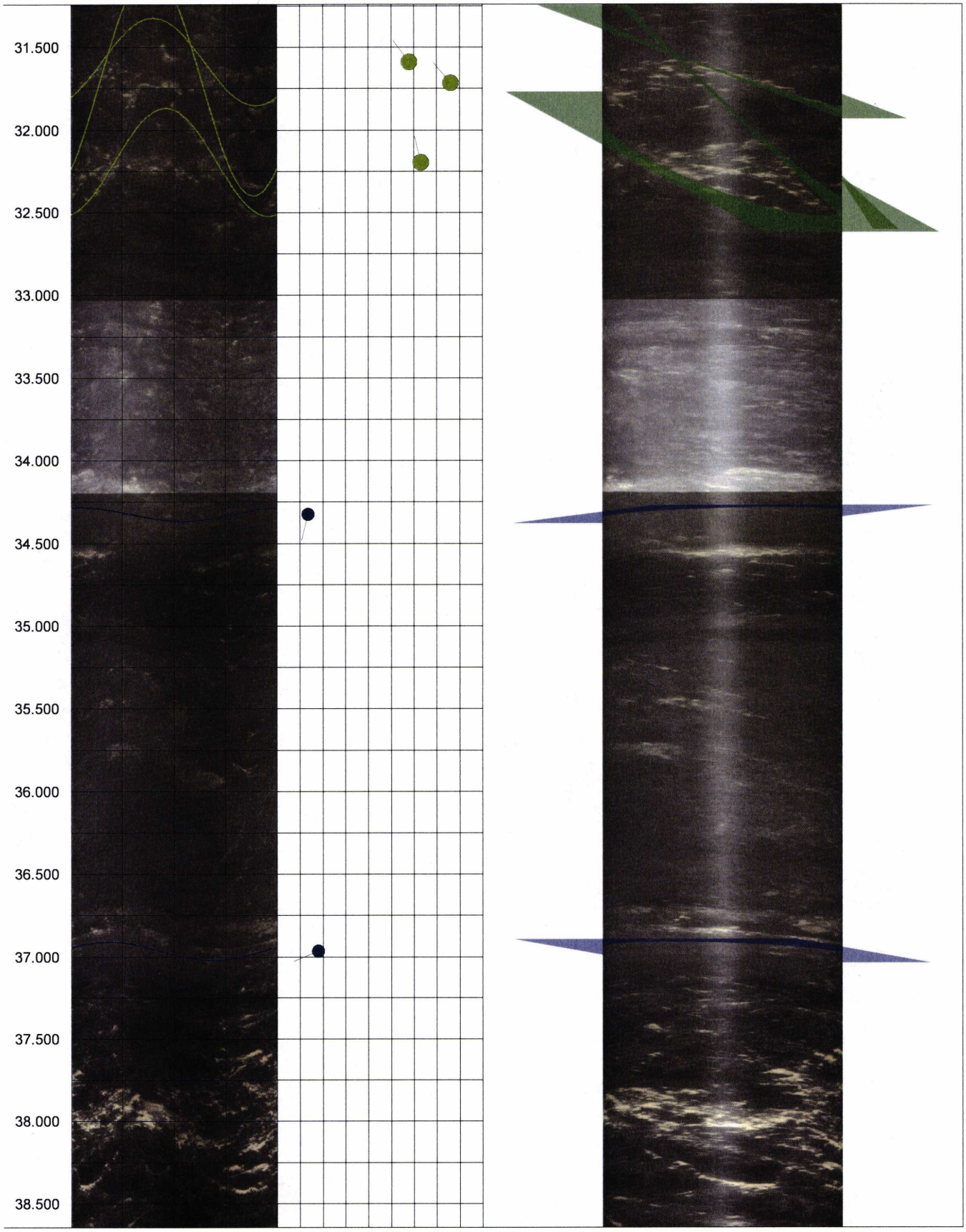


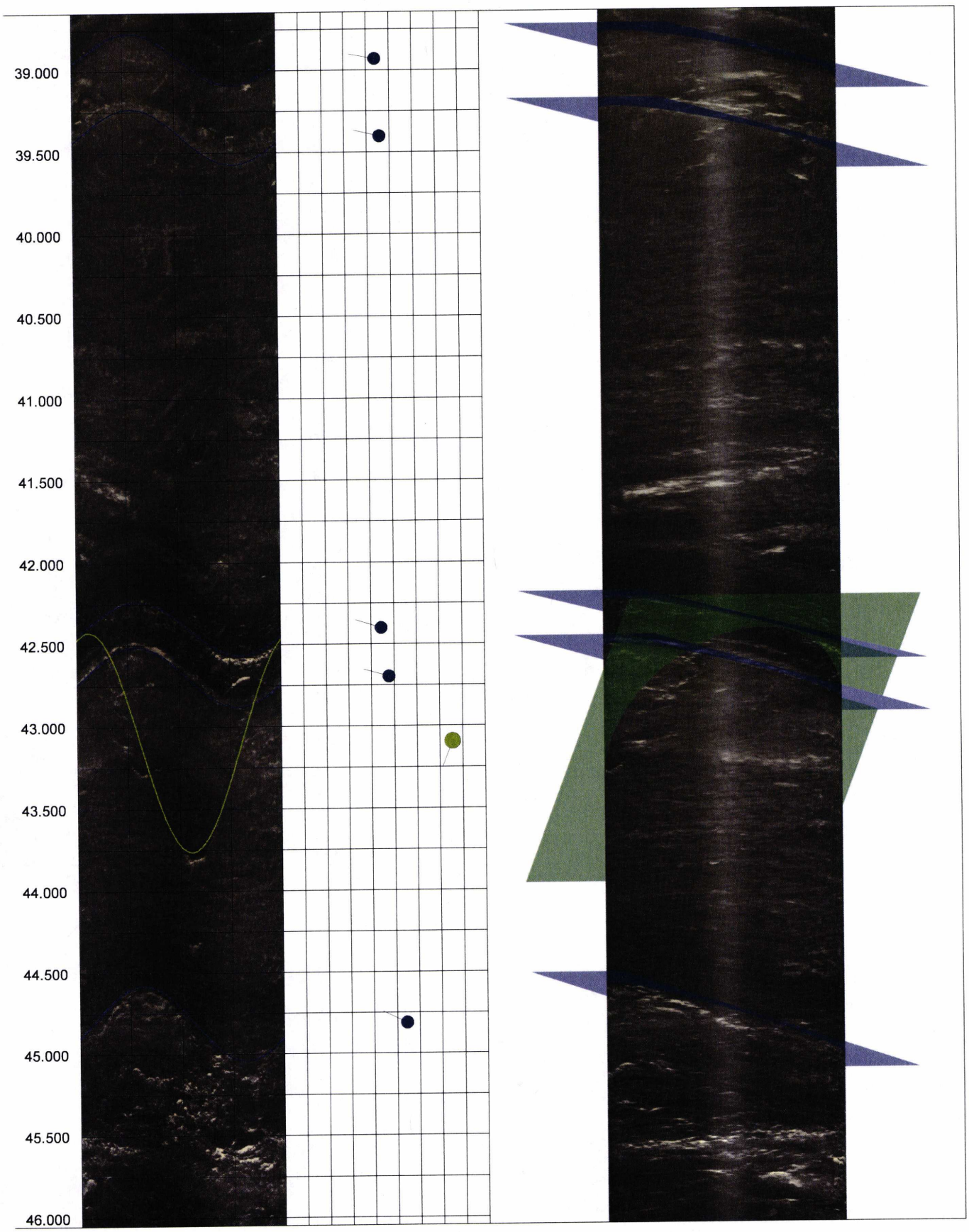


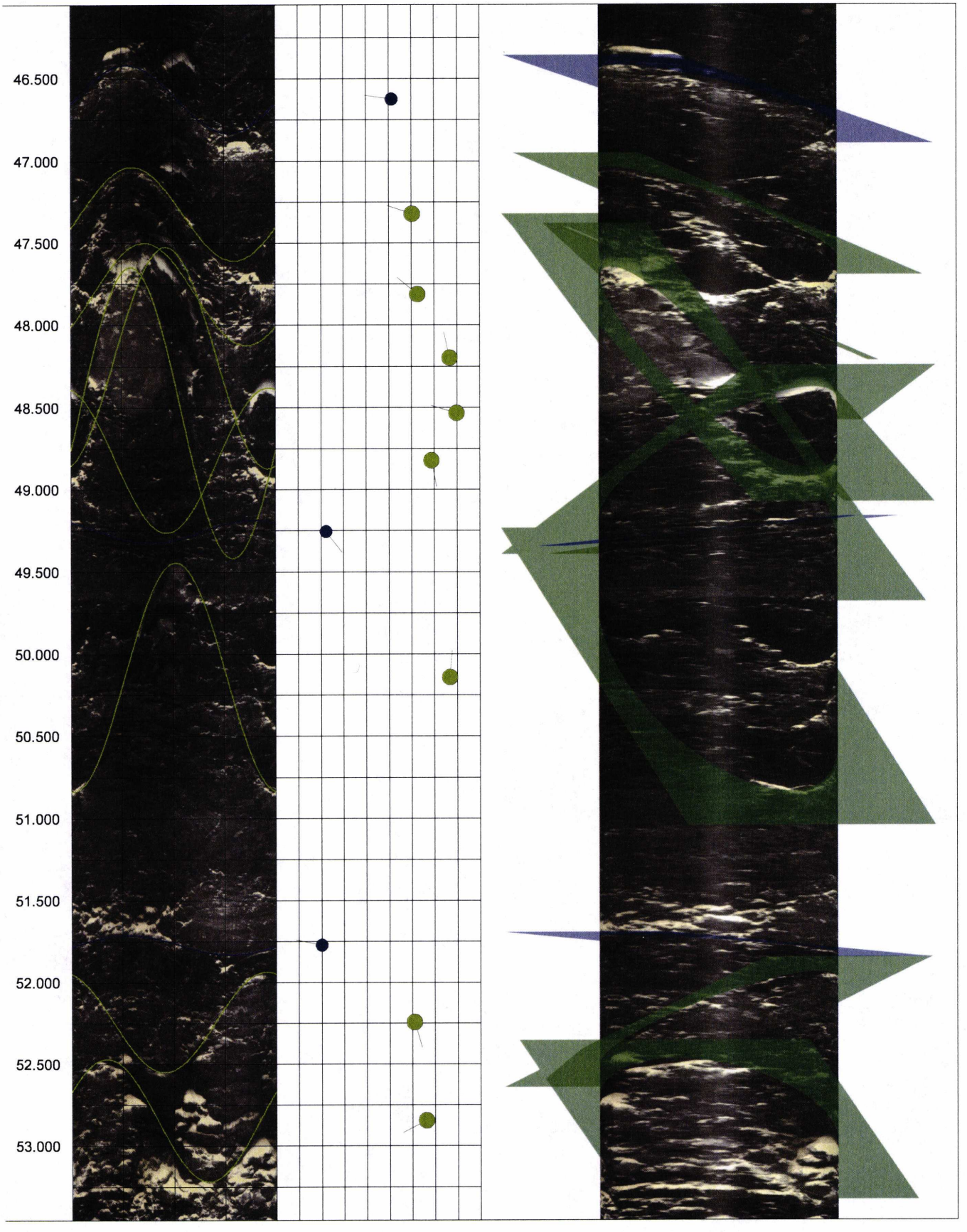

Depth
1ft:10ft
Optical image
0° 90° 180° 270° 0°
Structures
0° 90° 180° 270° 0°
Corrected Tadpoles
0
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3D Core
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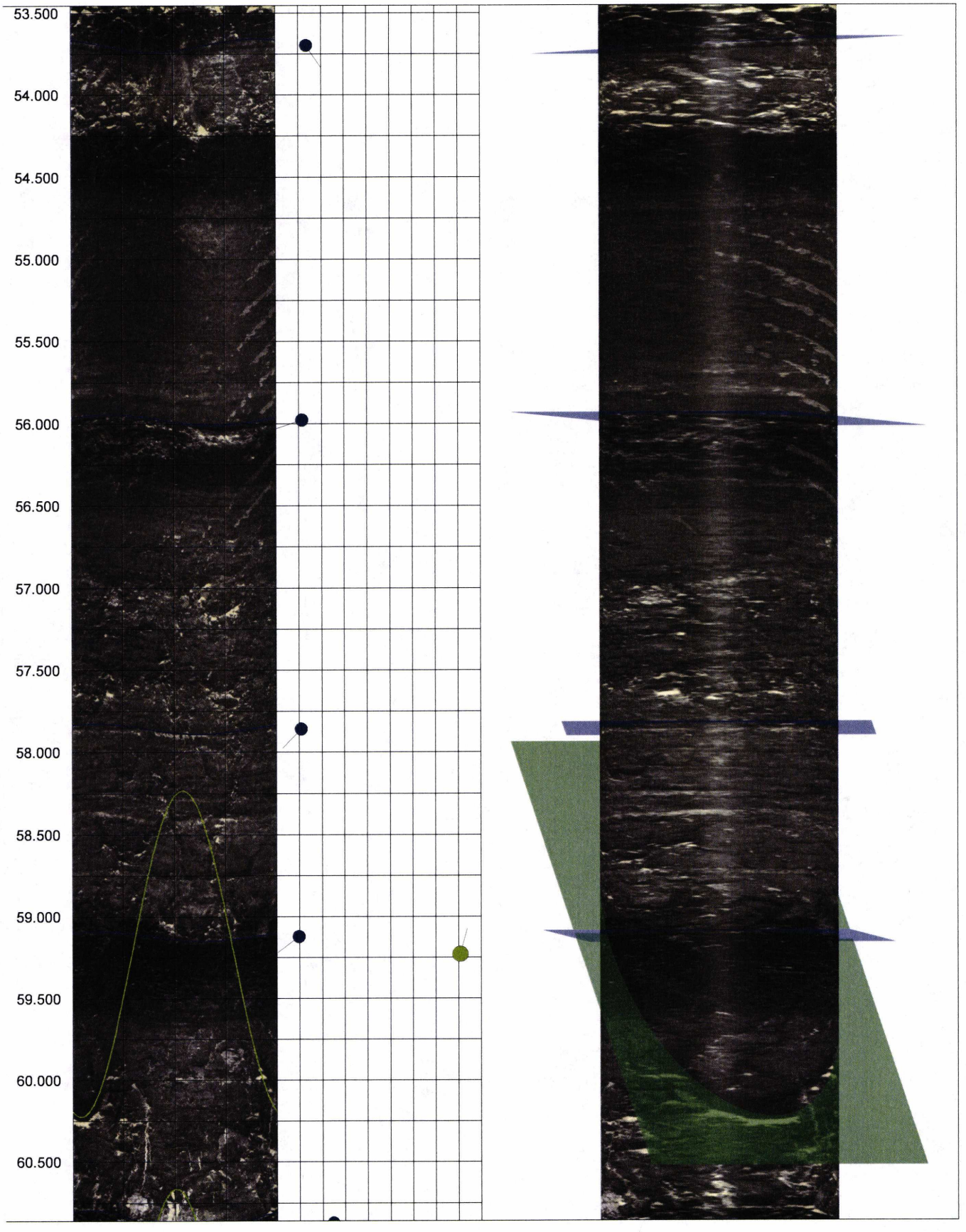

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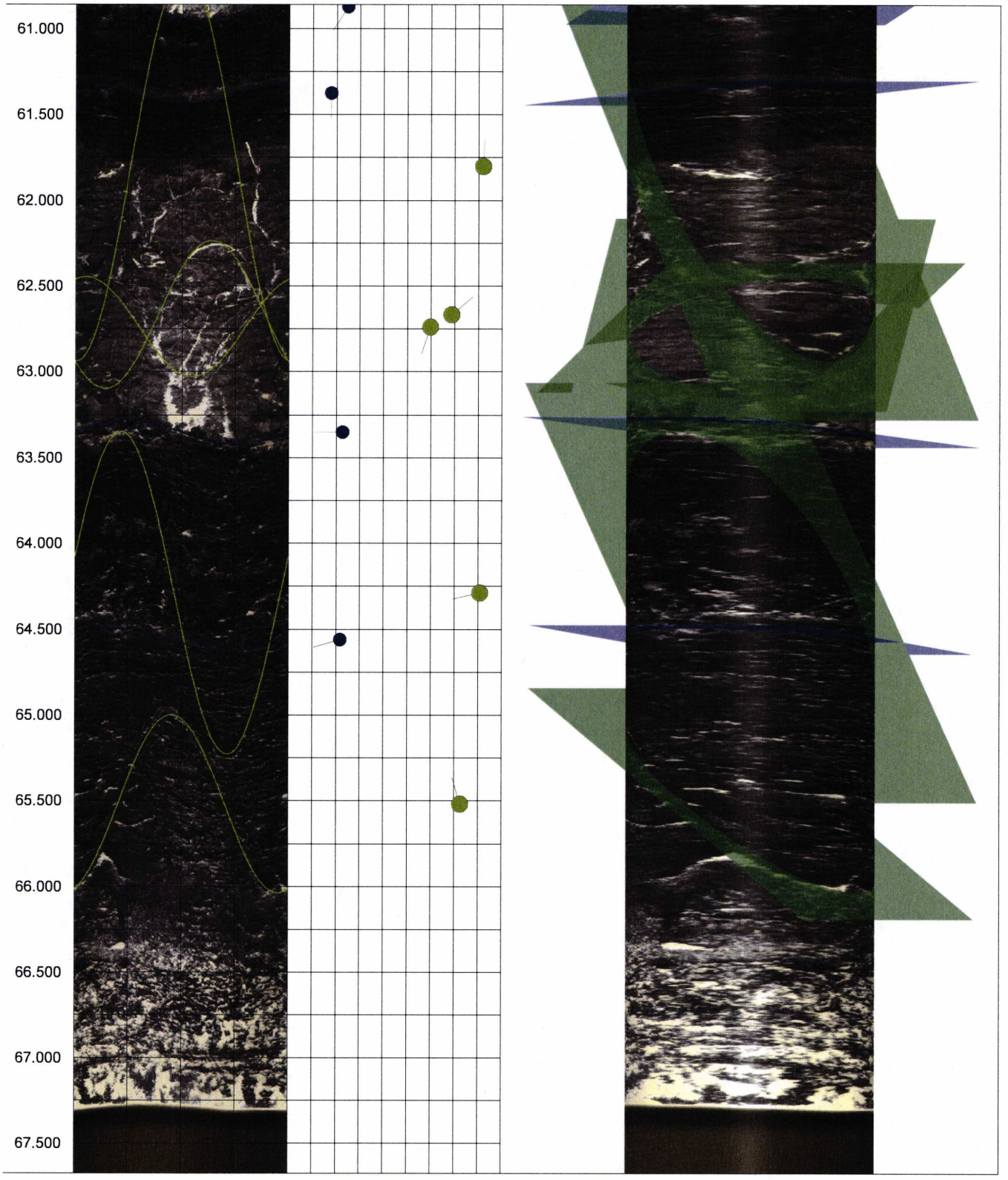

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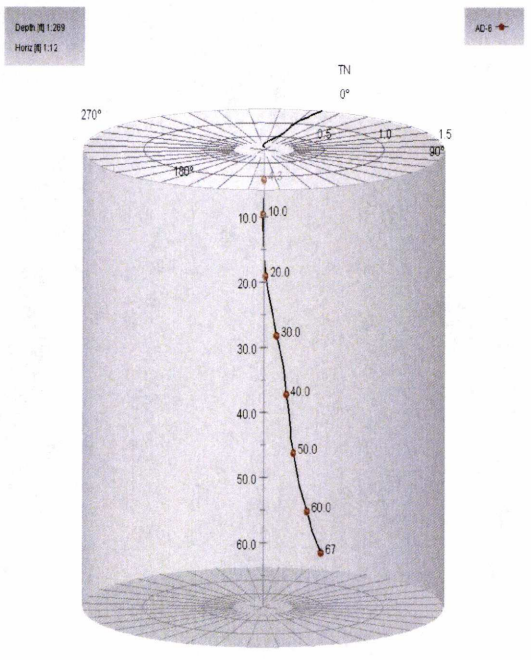
GEOVision geophysical services

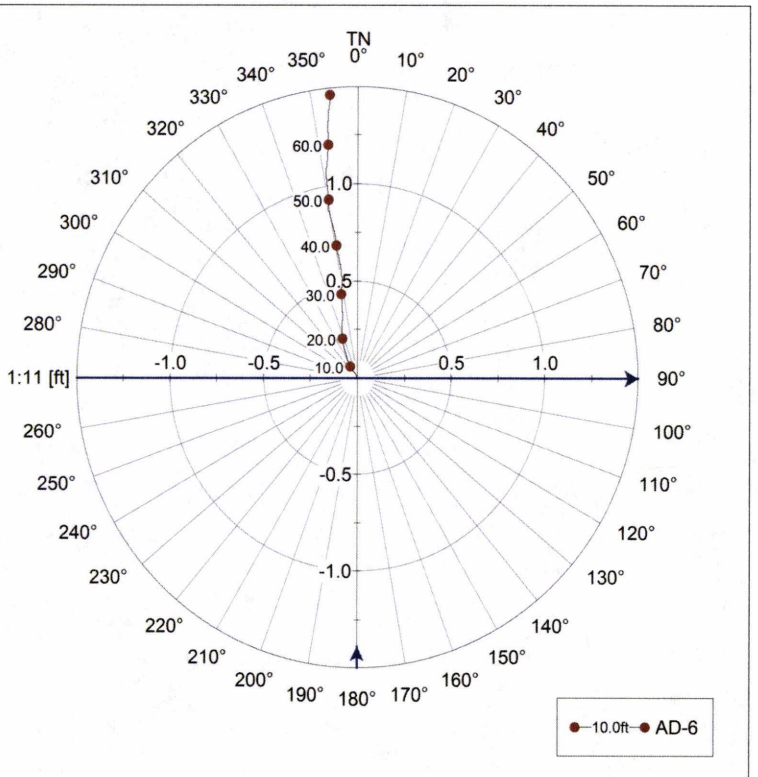
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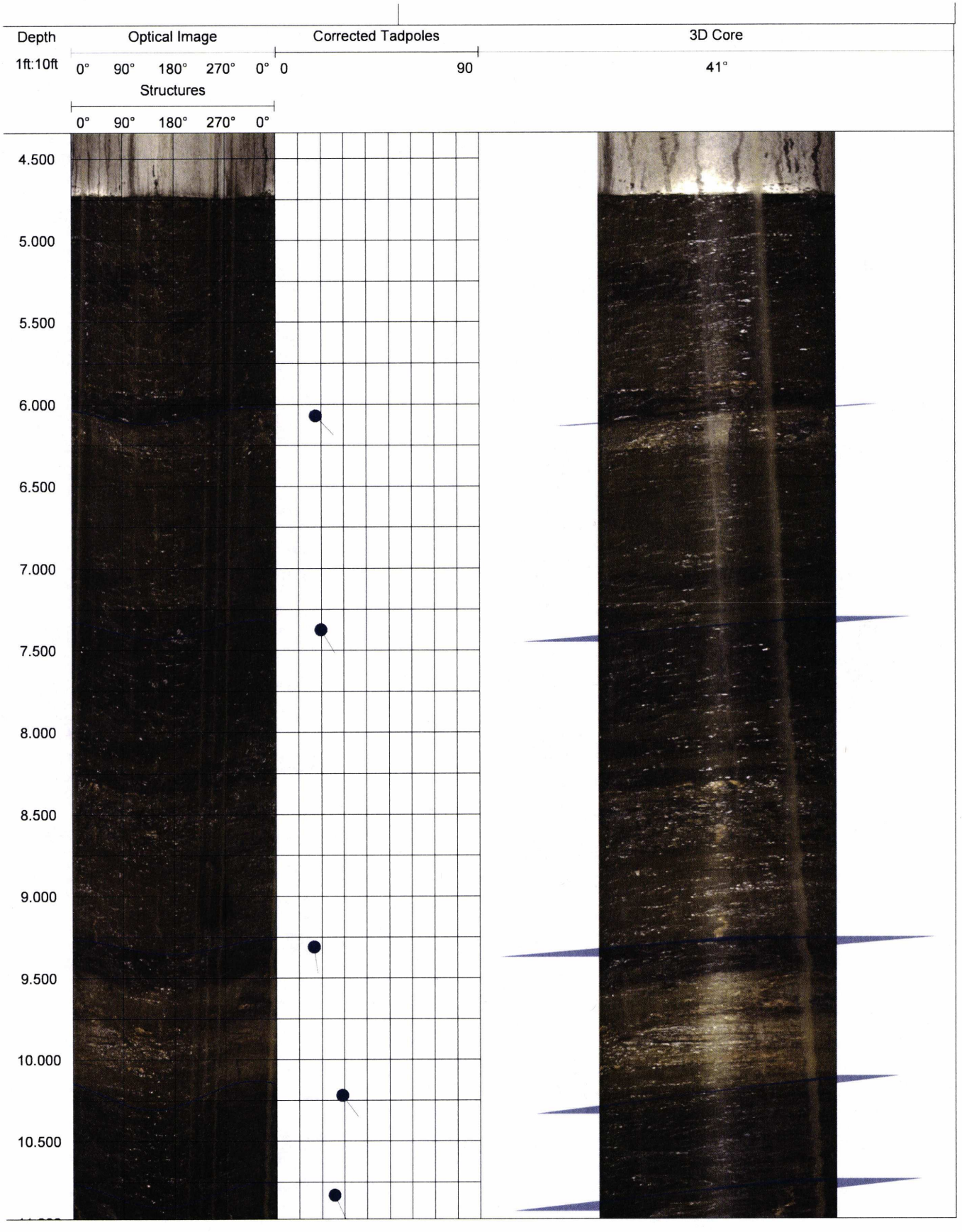
Project:	HWY 70 EAST / 7 NORTH	**Date:**	1/23/2019
Location:	HOT SPRINGS, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD-6	**Start Depth:**	4.3
		End Depth:	67.3

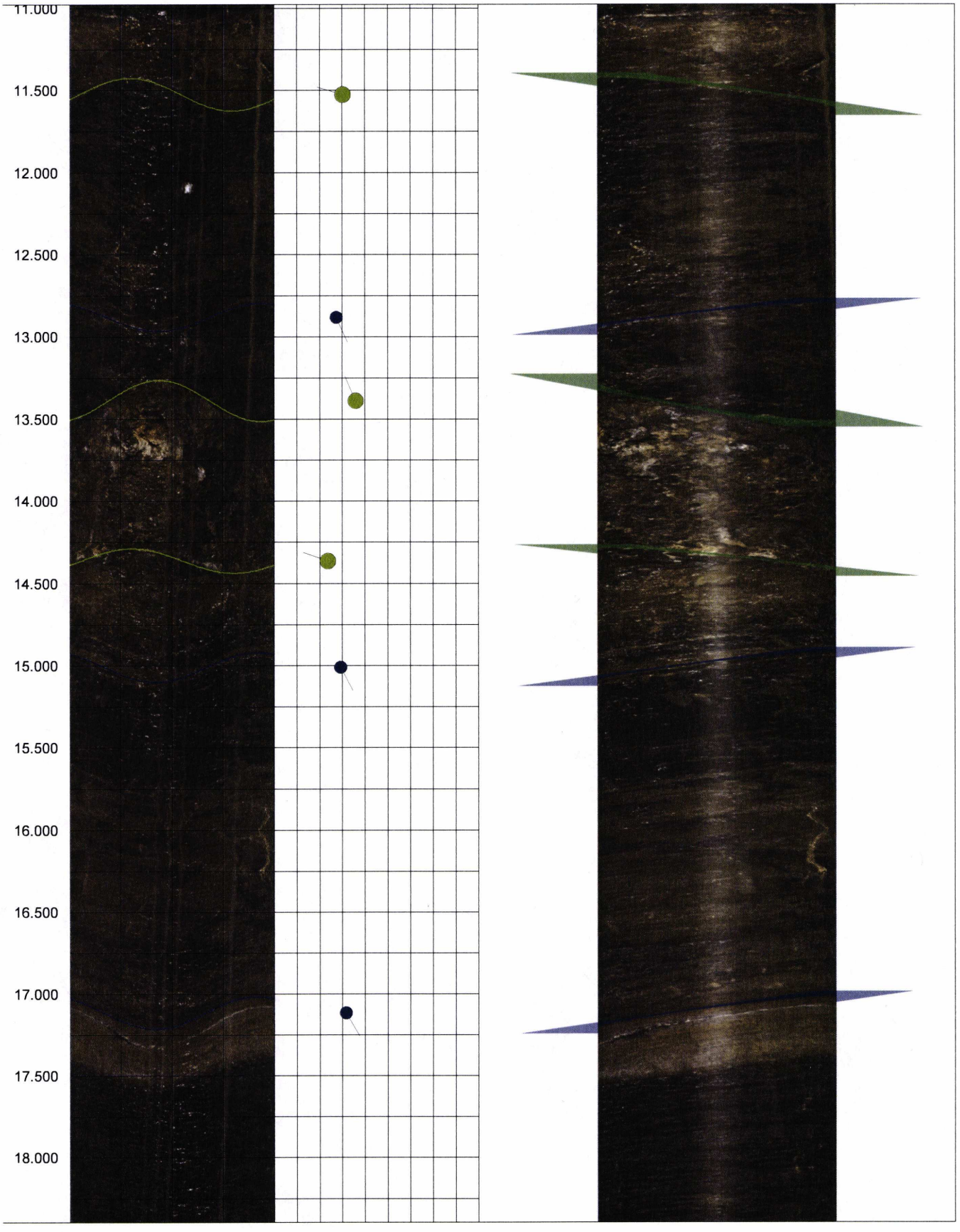
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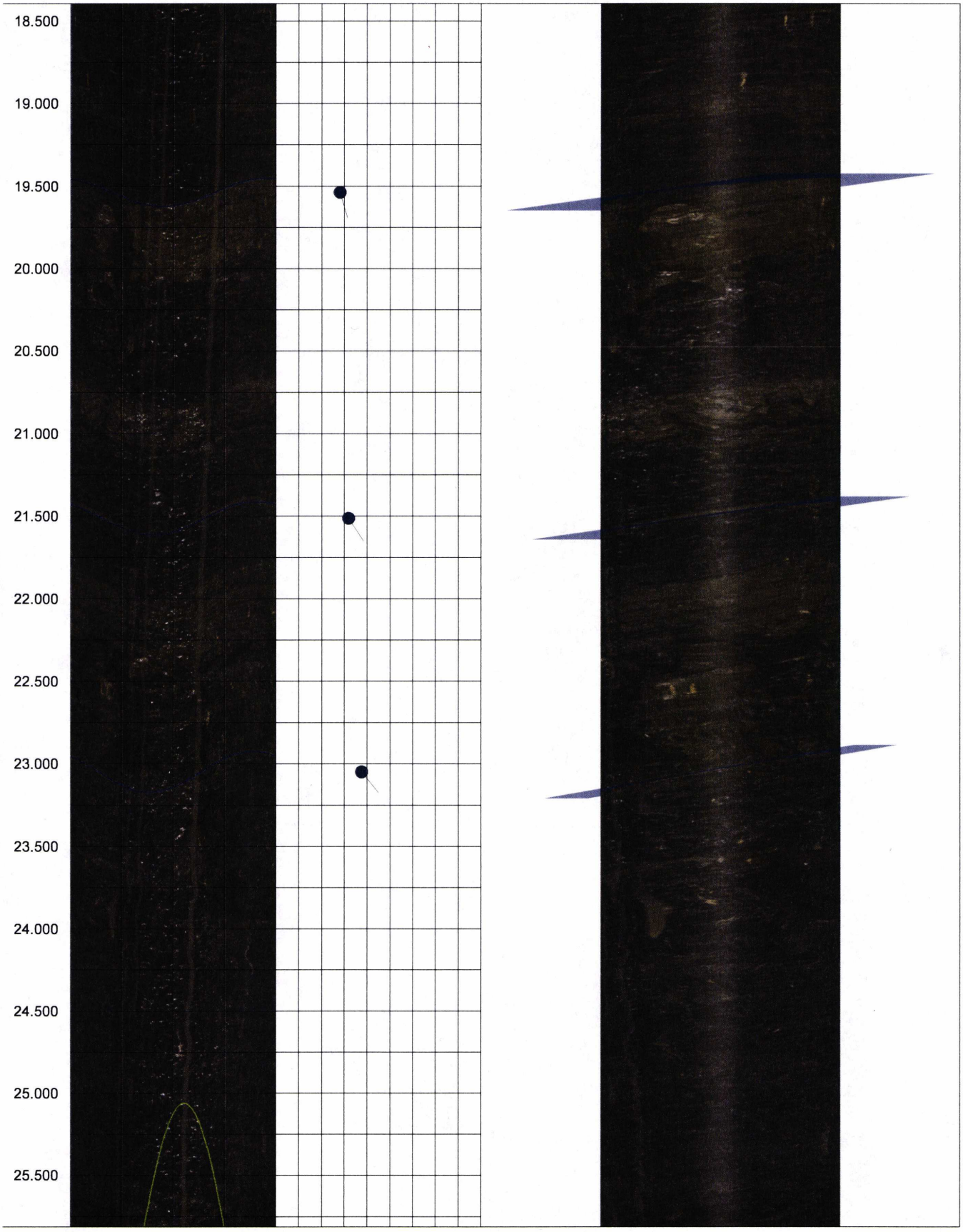
Open Joint / Fracture Filled Joint / Fracture Bedding / Banding / Foliation

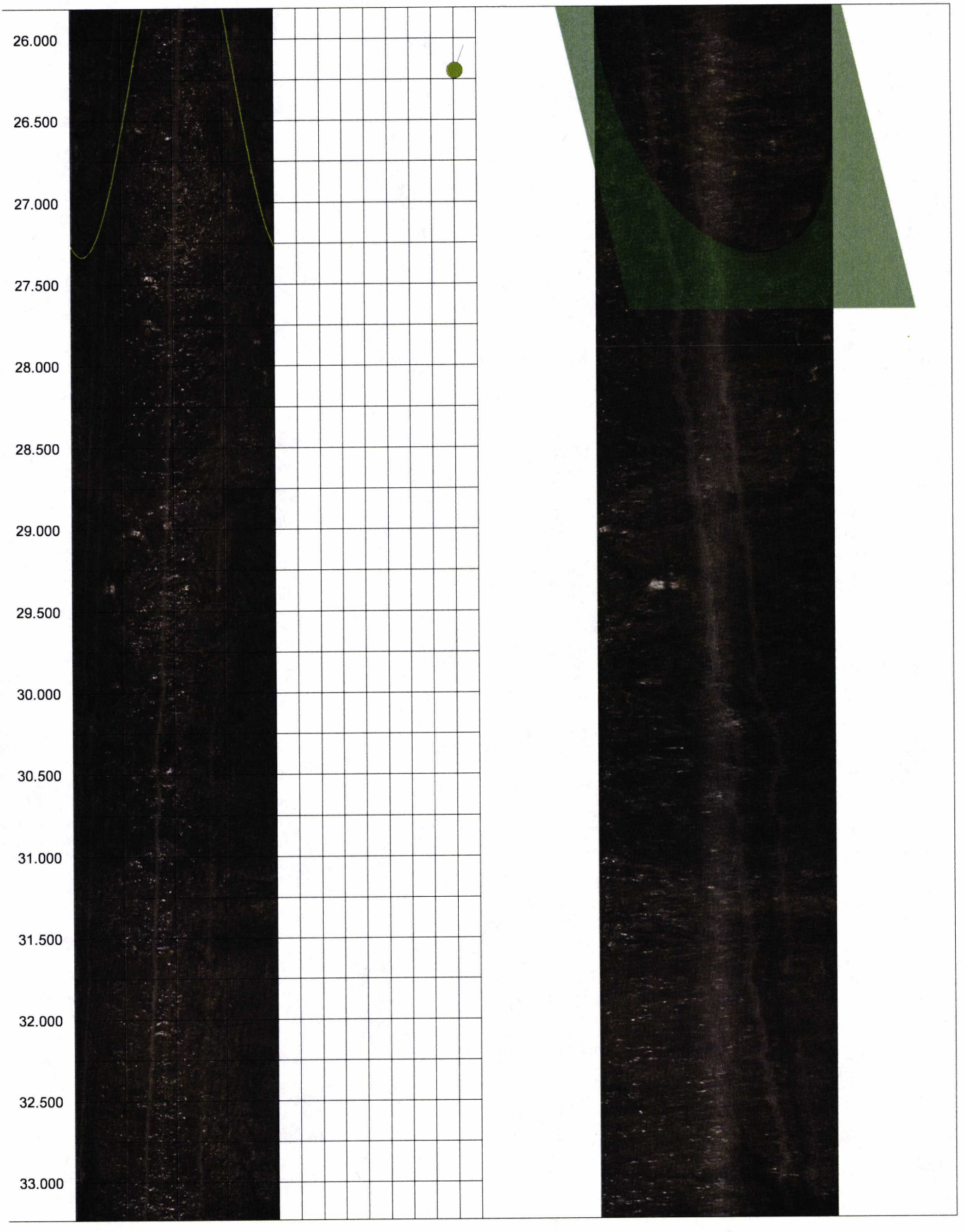


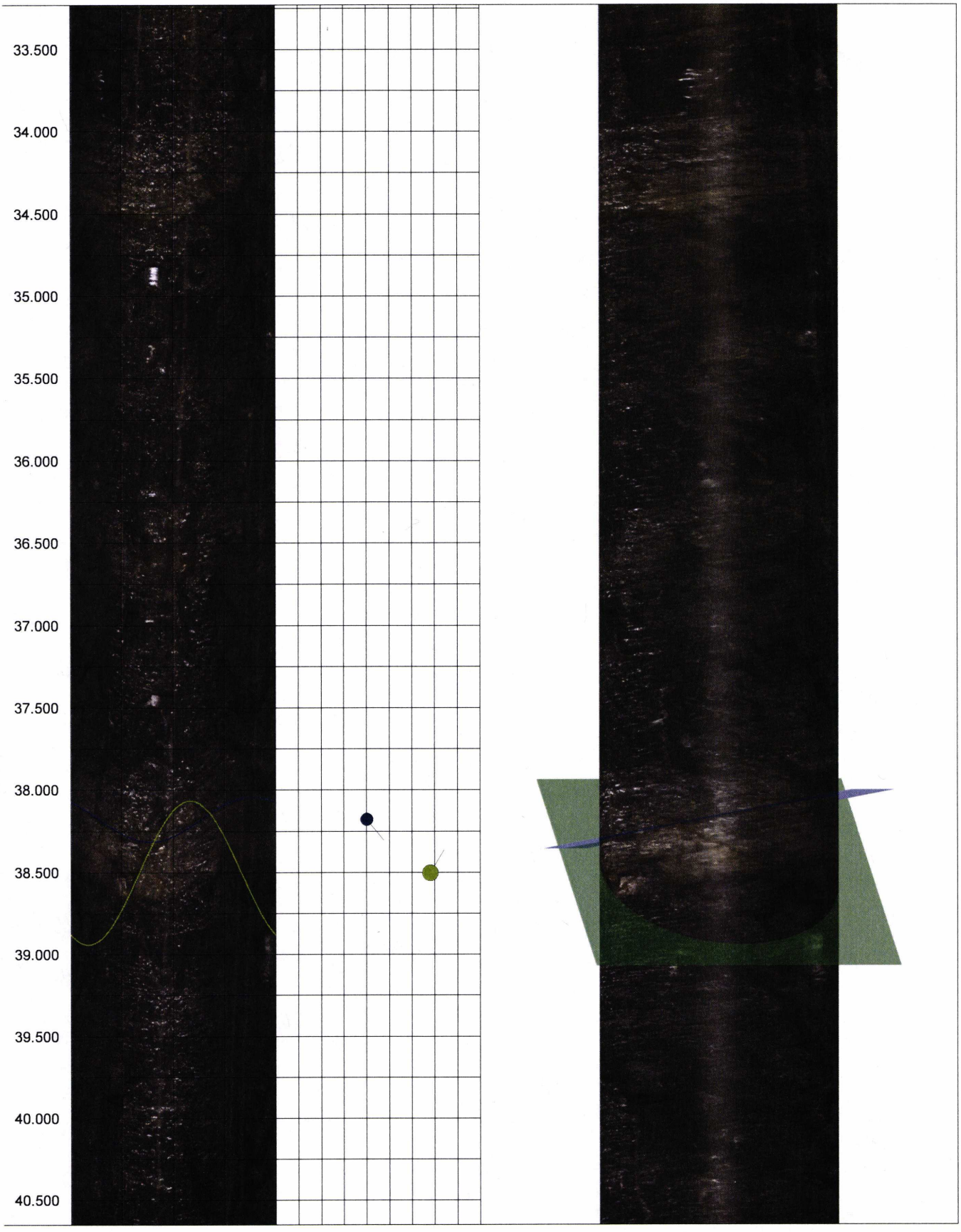


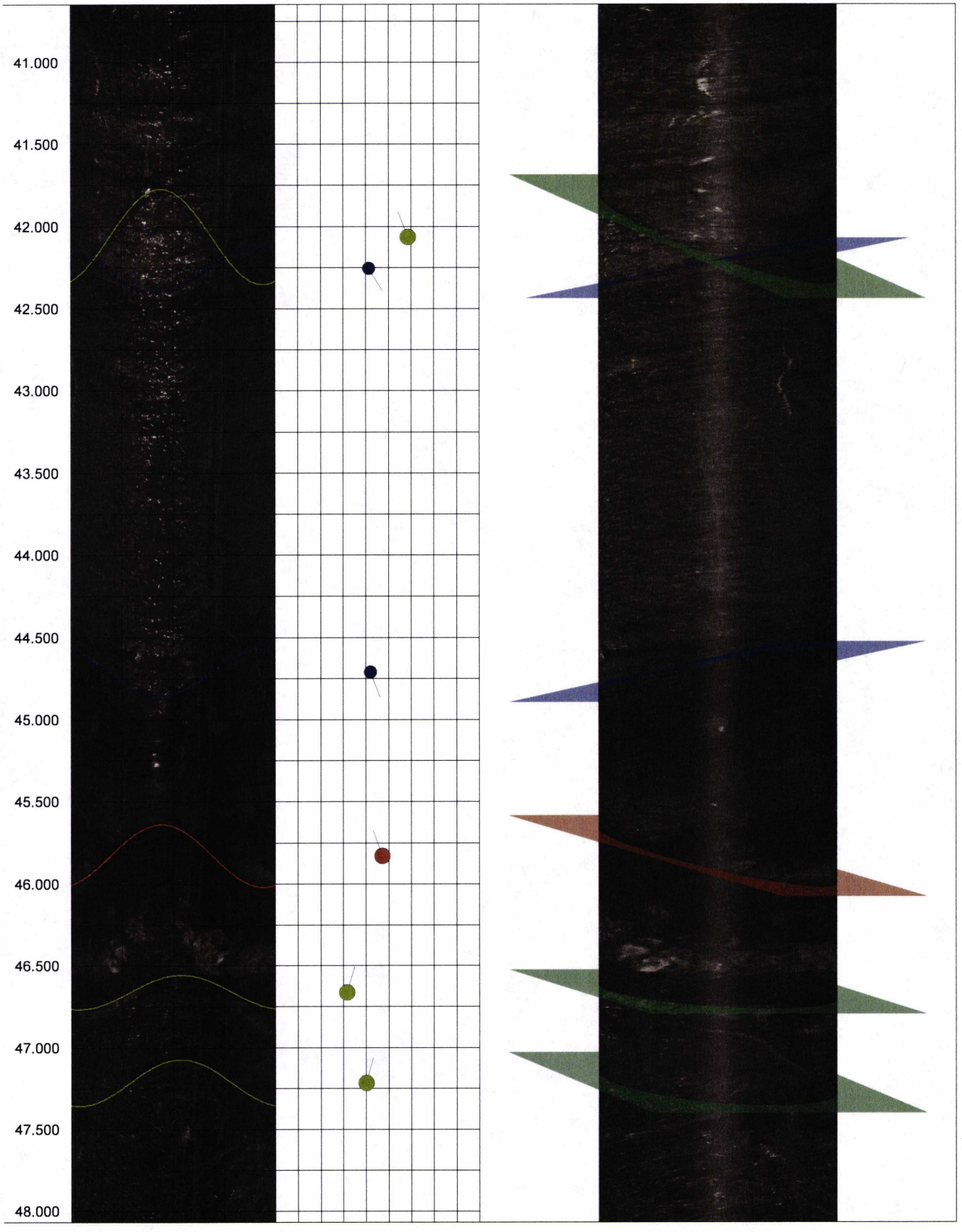

Depth
1ft:10ft
Optical Image
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Structures
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Corrected Tadpoles
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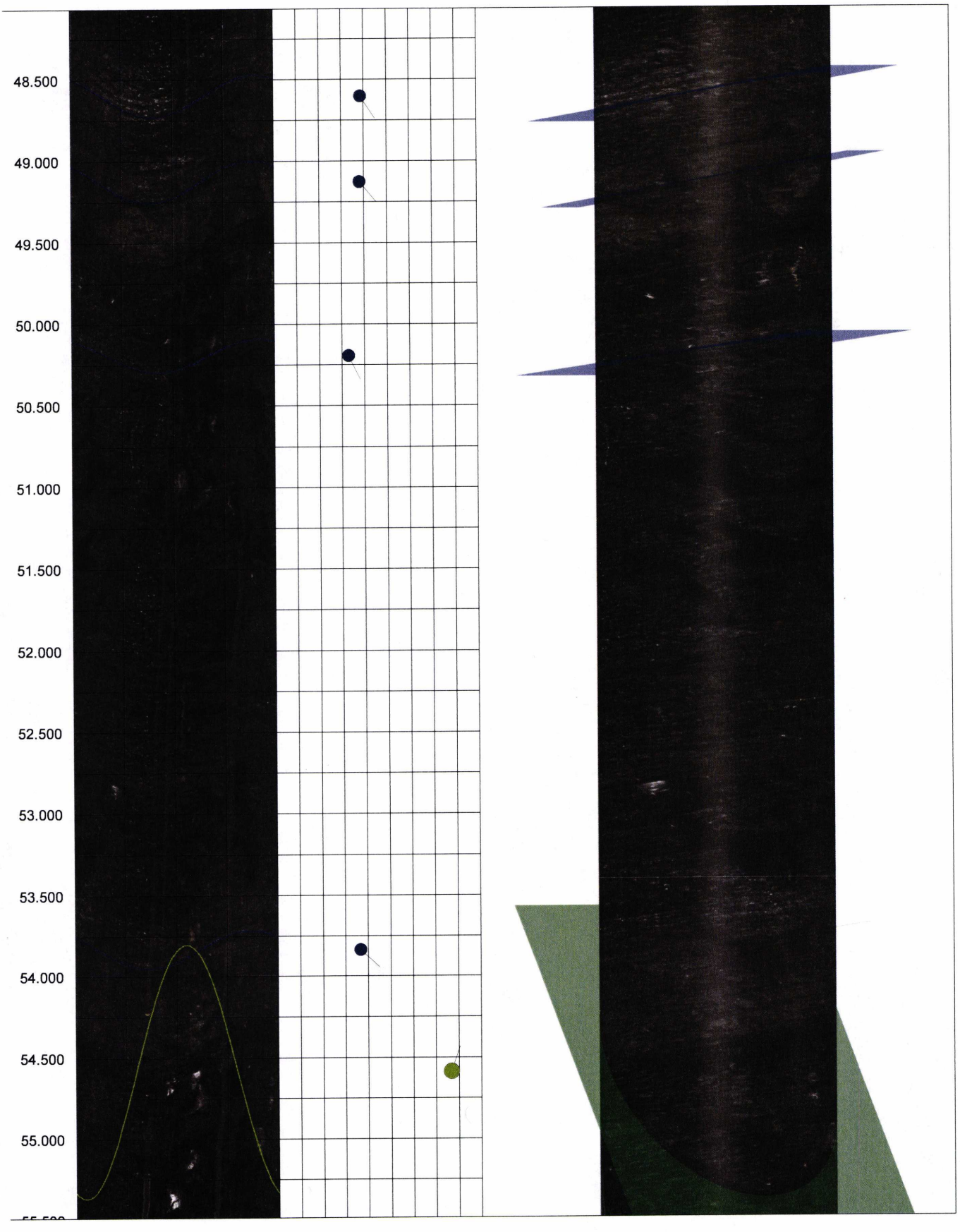

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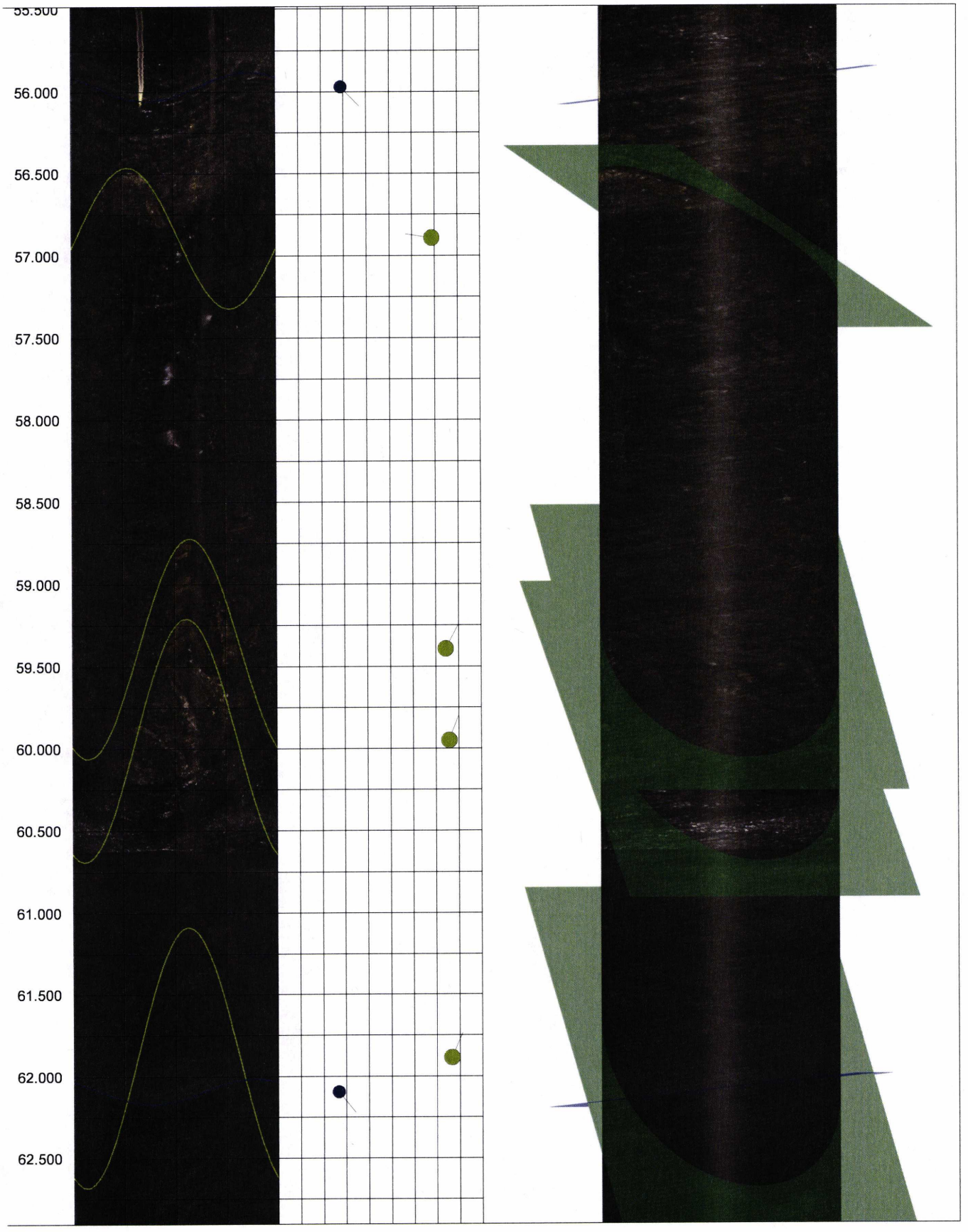

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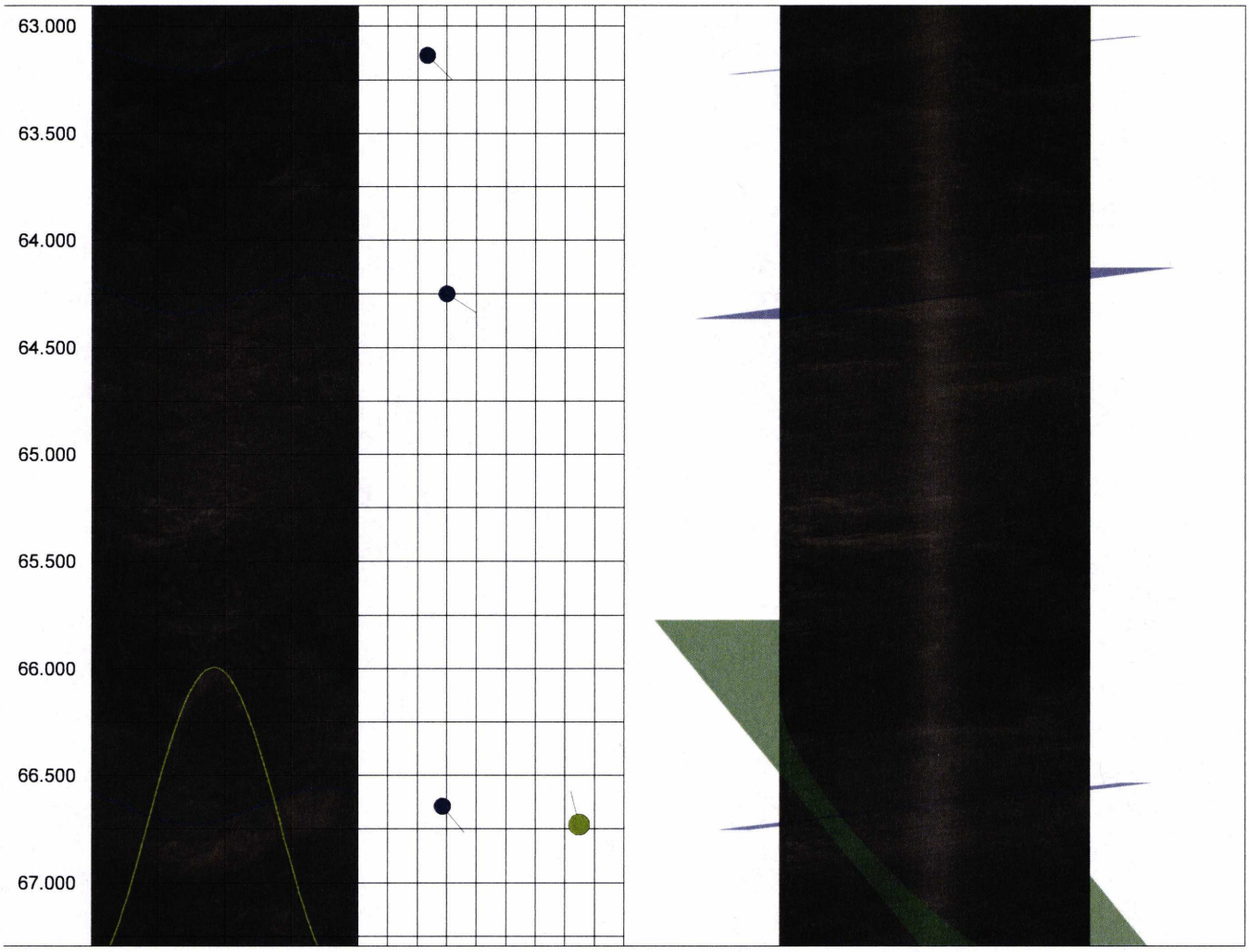

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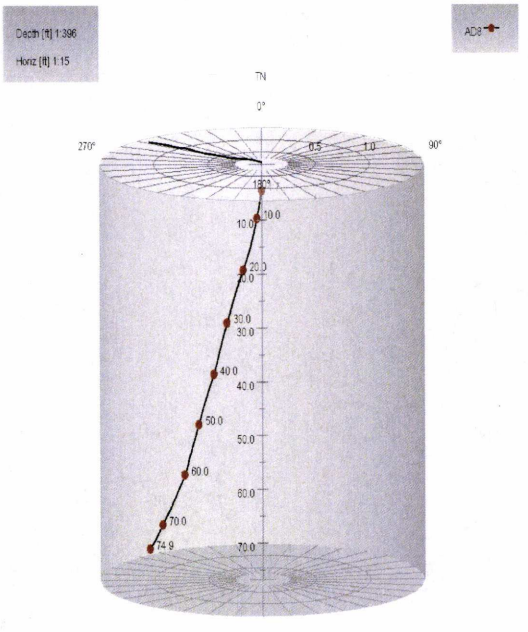
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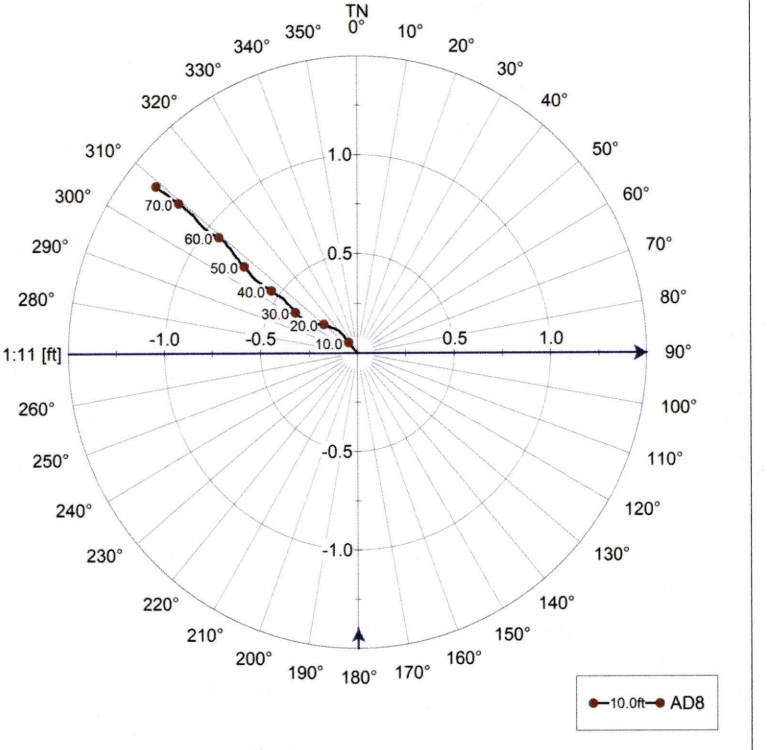
Project:	HWY 70 EAST HWY 7 NORTH	**Date:**	1/23/2019
Location:	HOT SPRINGS, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD8	**Start Depth:**	4.7
		End Depth:	74.8

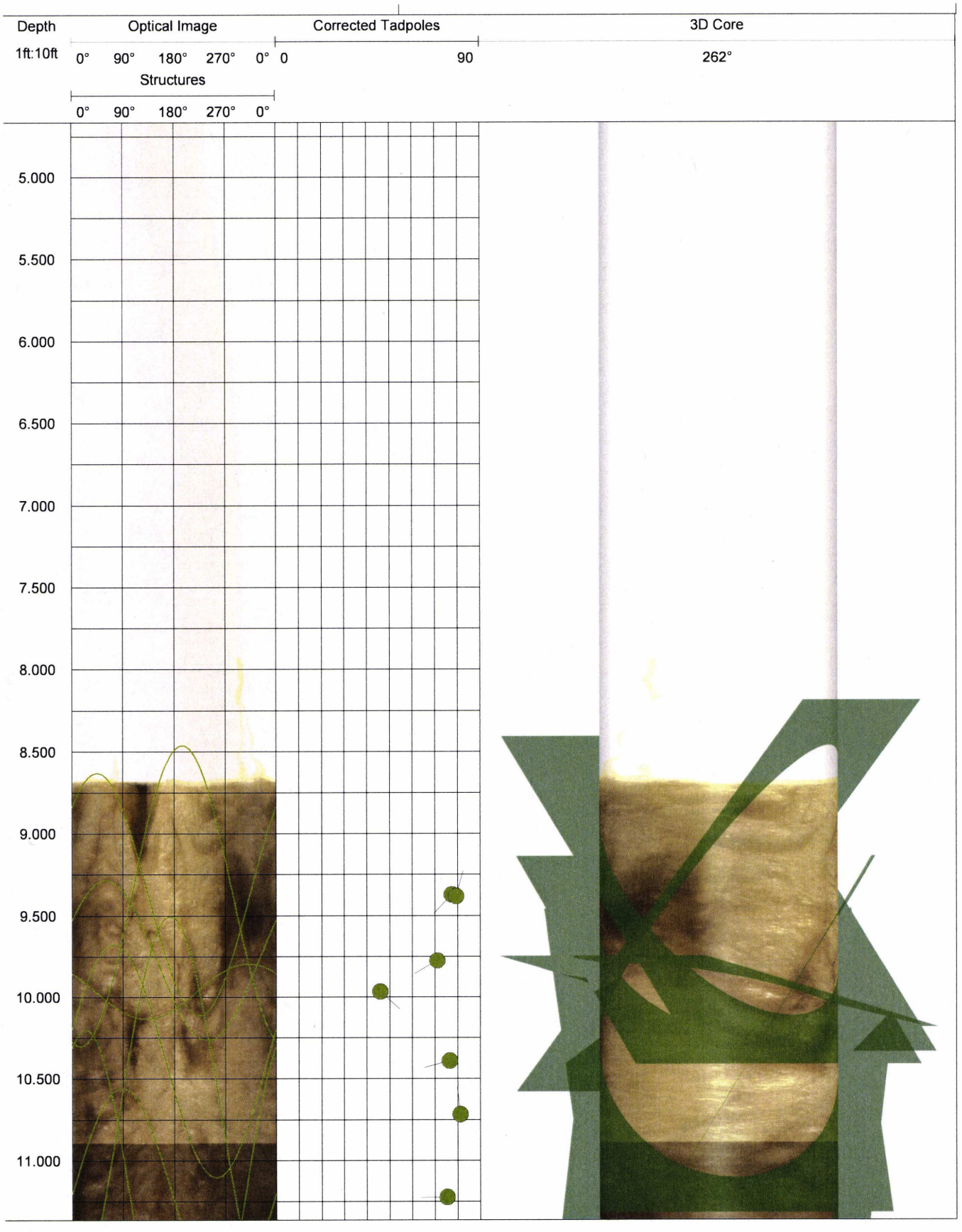
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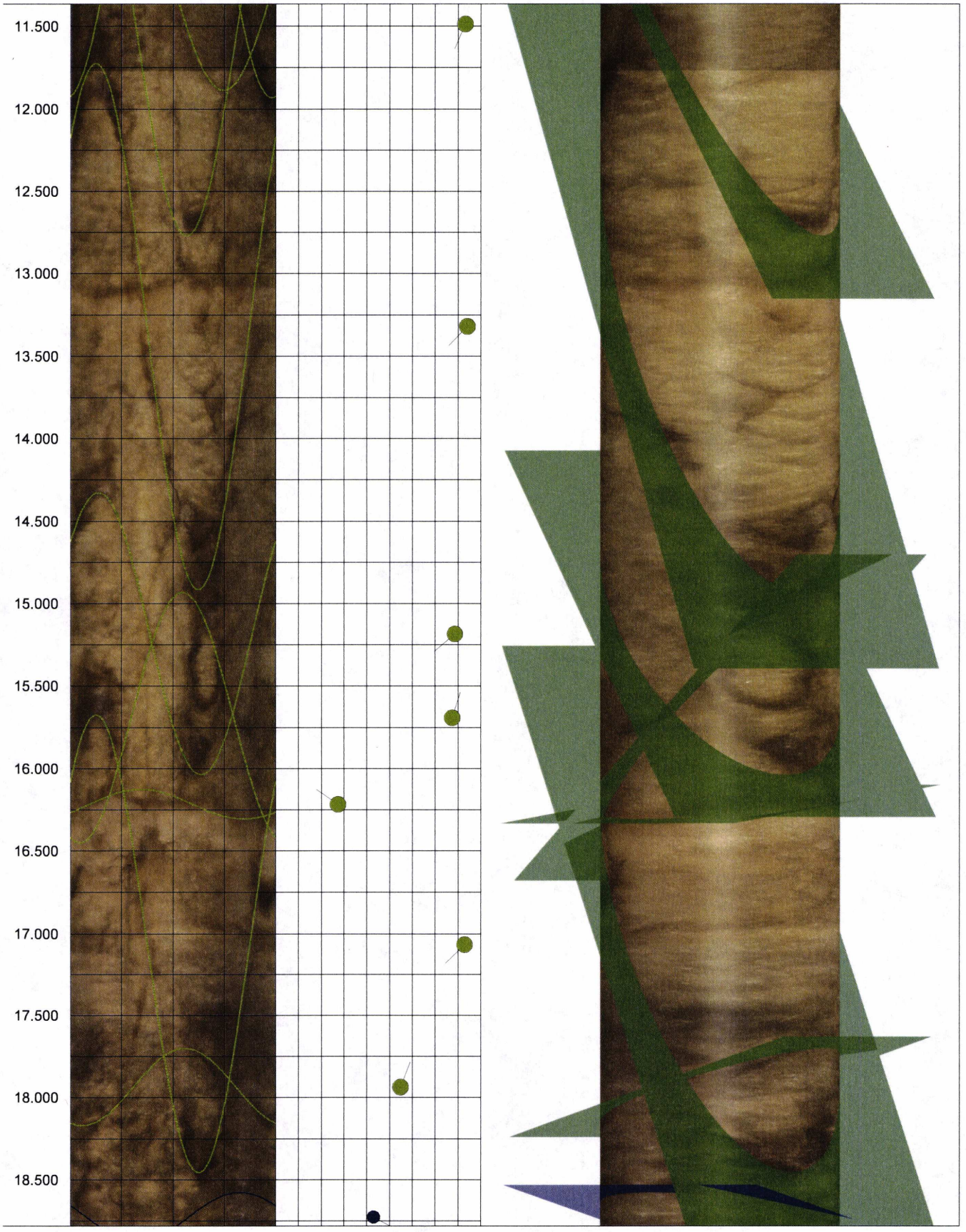
Filled Joint / Fracture

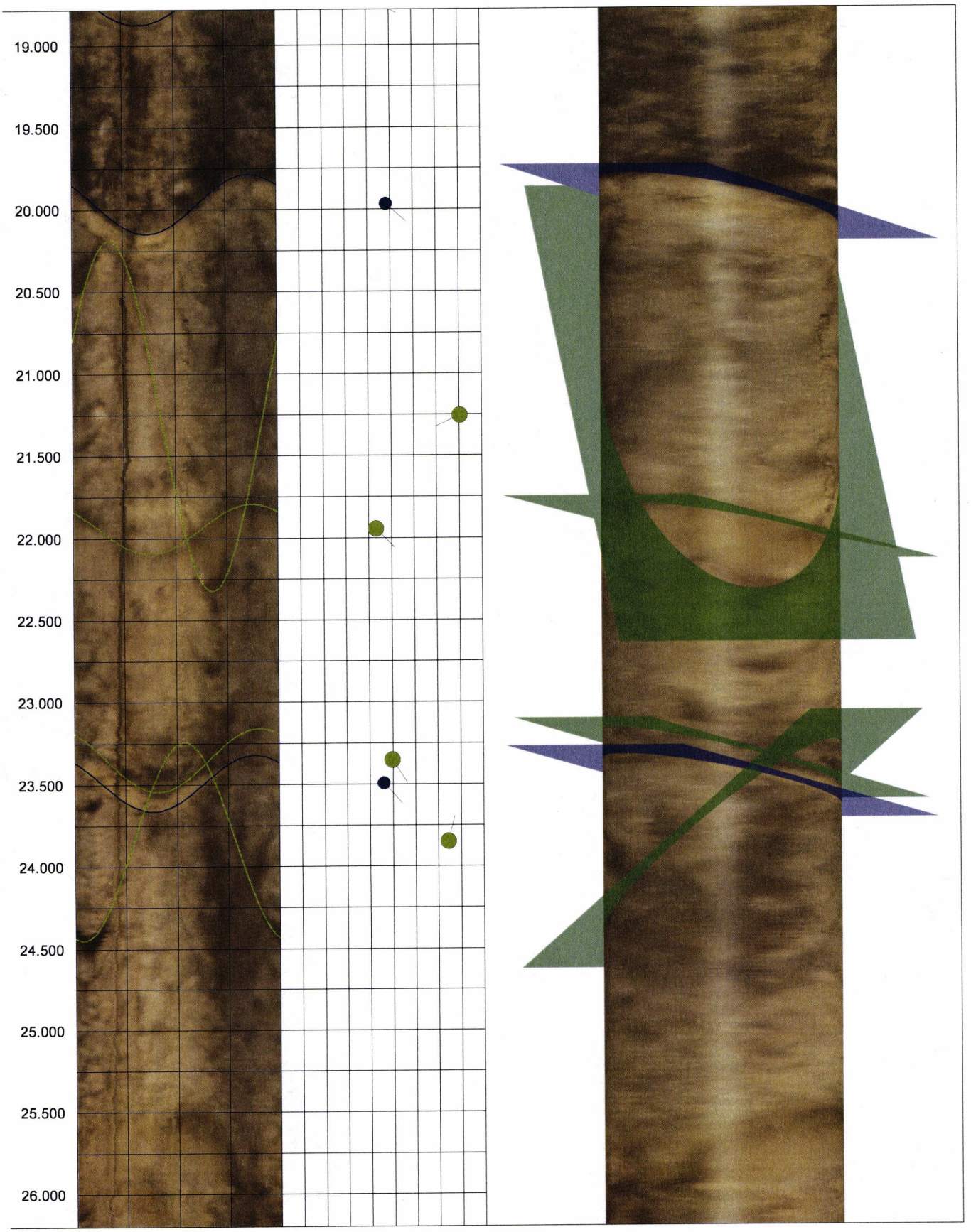
Bedding / Banding / Foliation

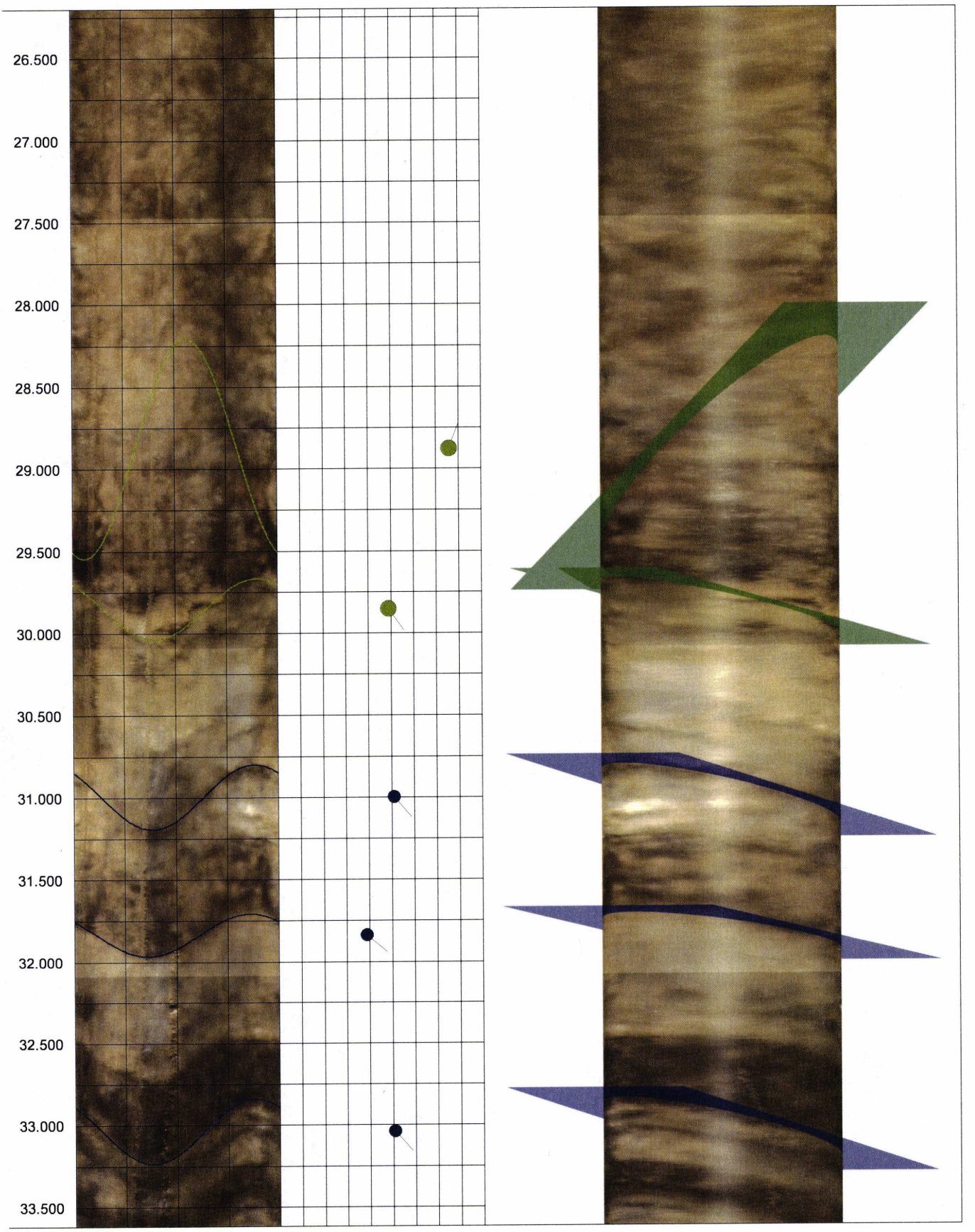


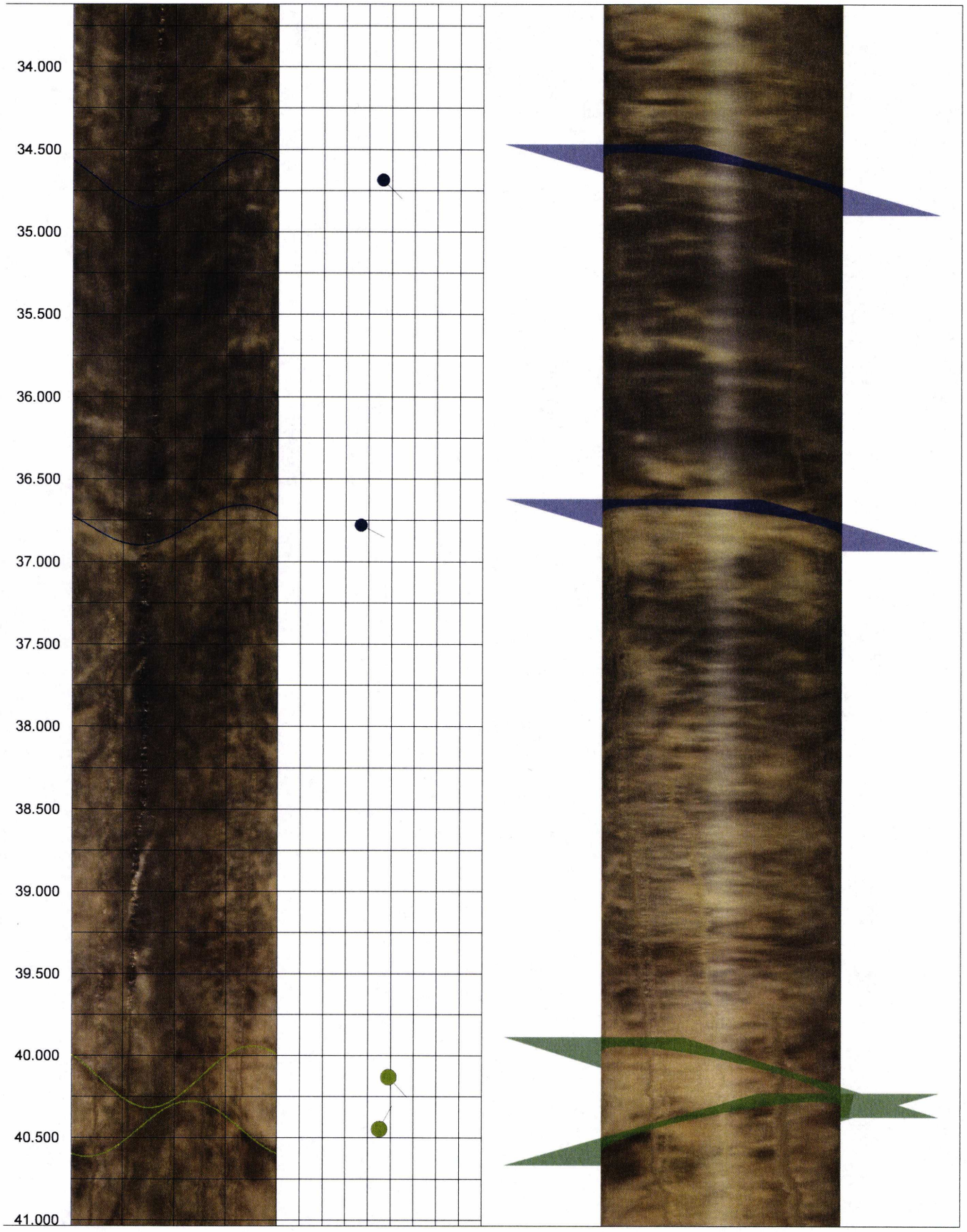


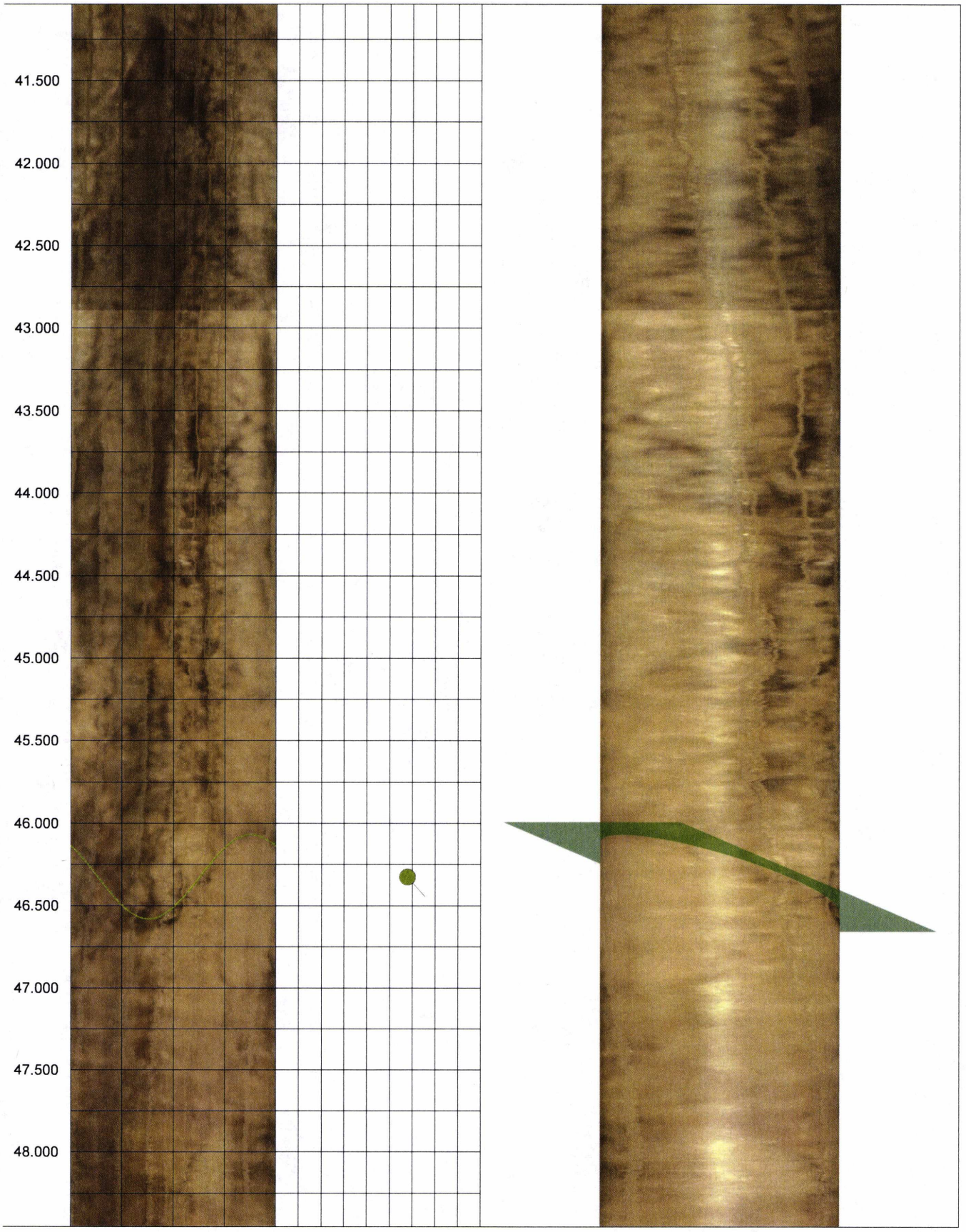

Depth
1ft:10ft
Optical Image
0° 90° 180° 270° 0°
Structures
0° 90° 180° 270° 0°
Corrected Tadpoles
0
90
3D Core
262°
5.000
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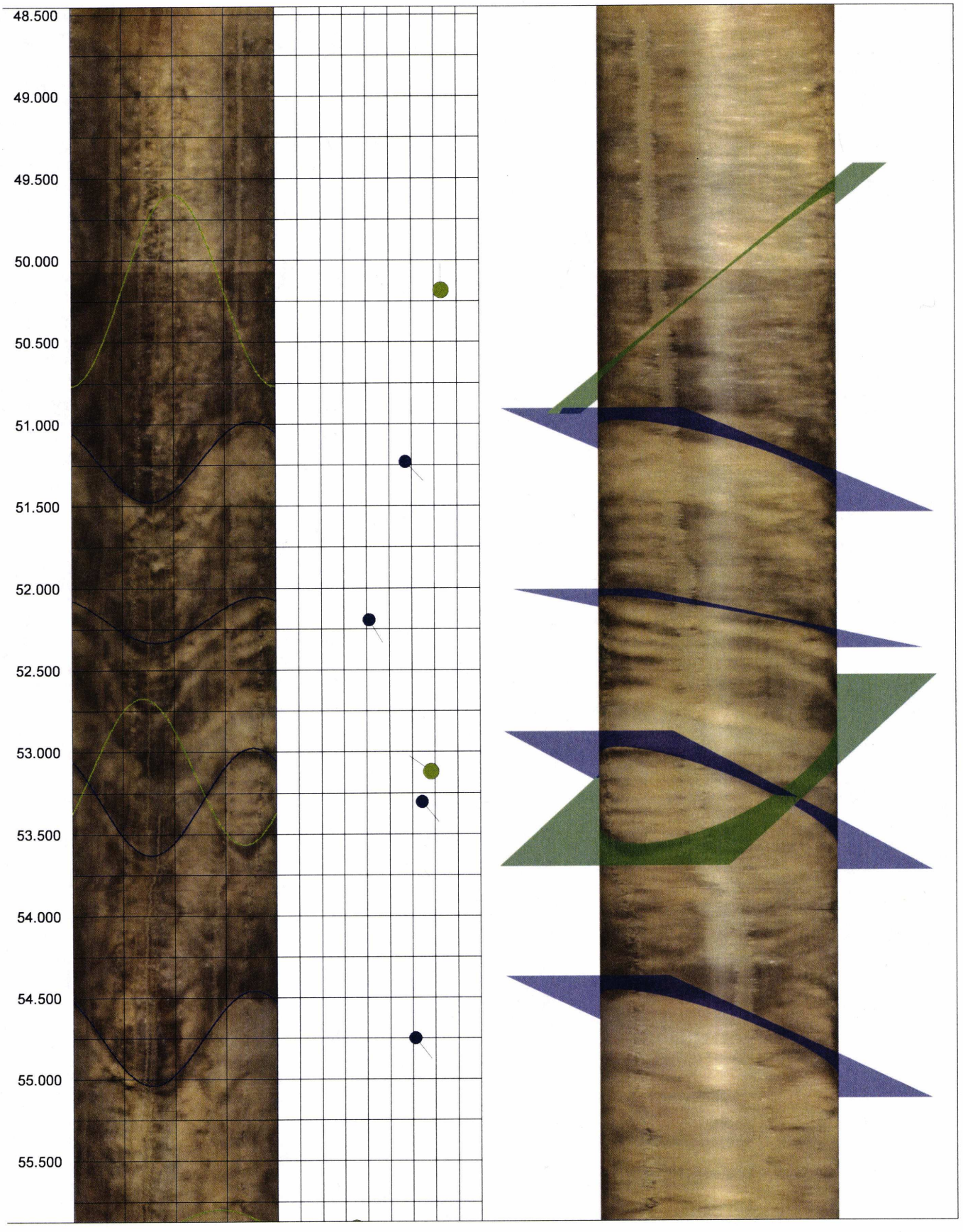

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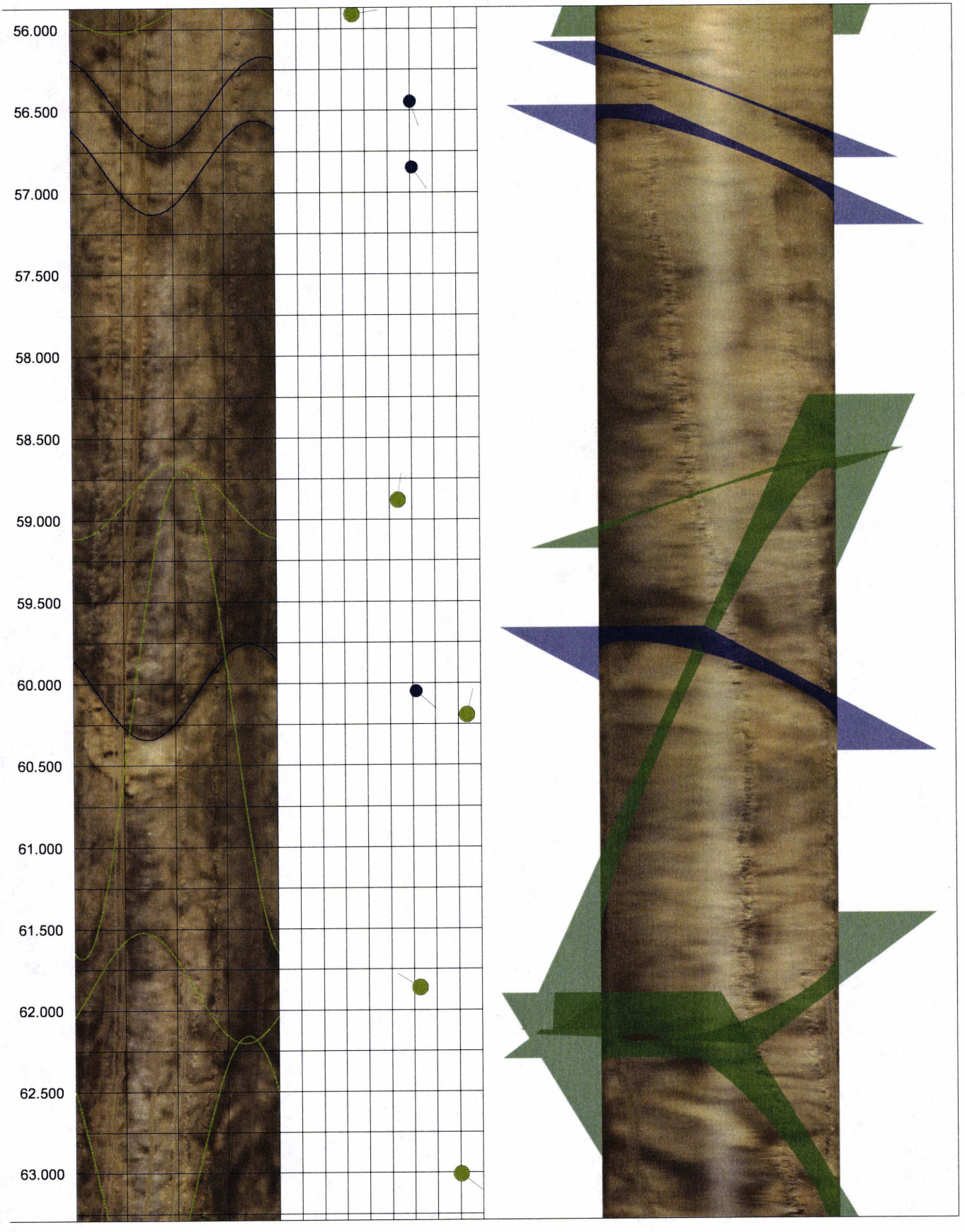

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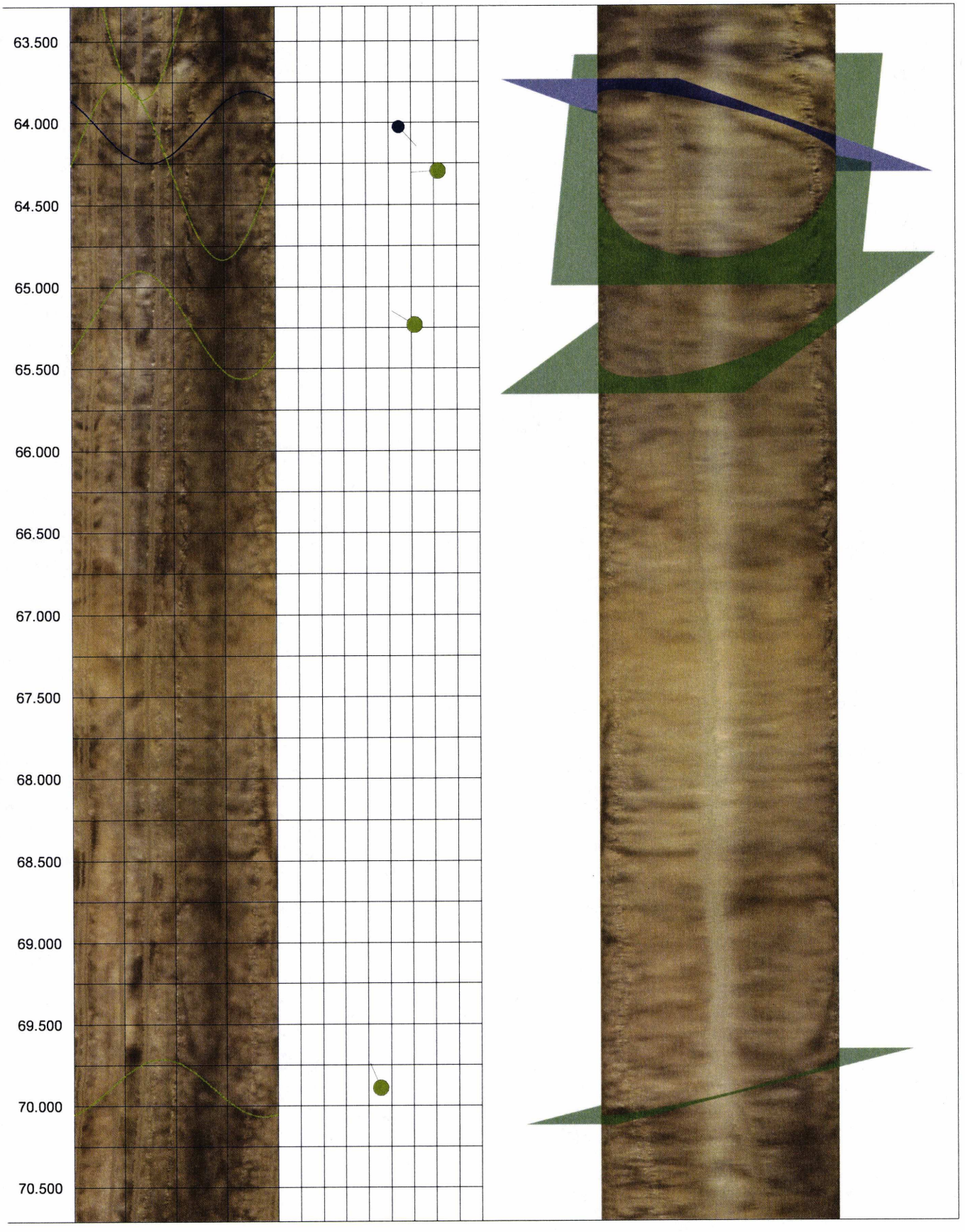

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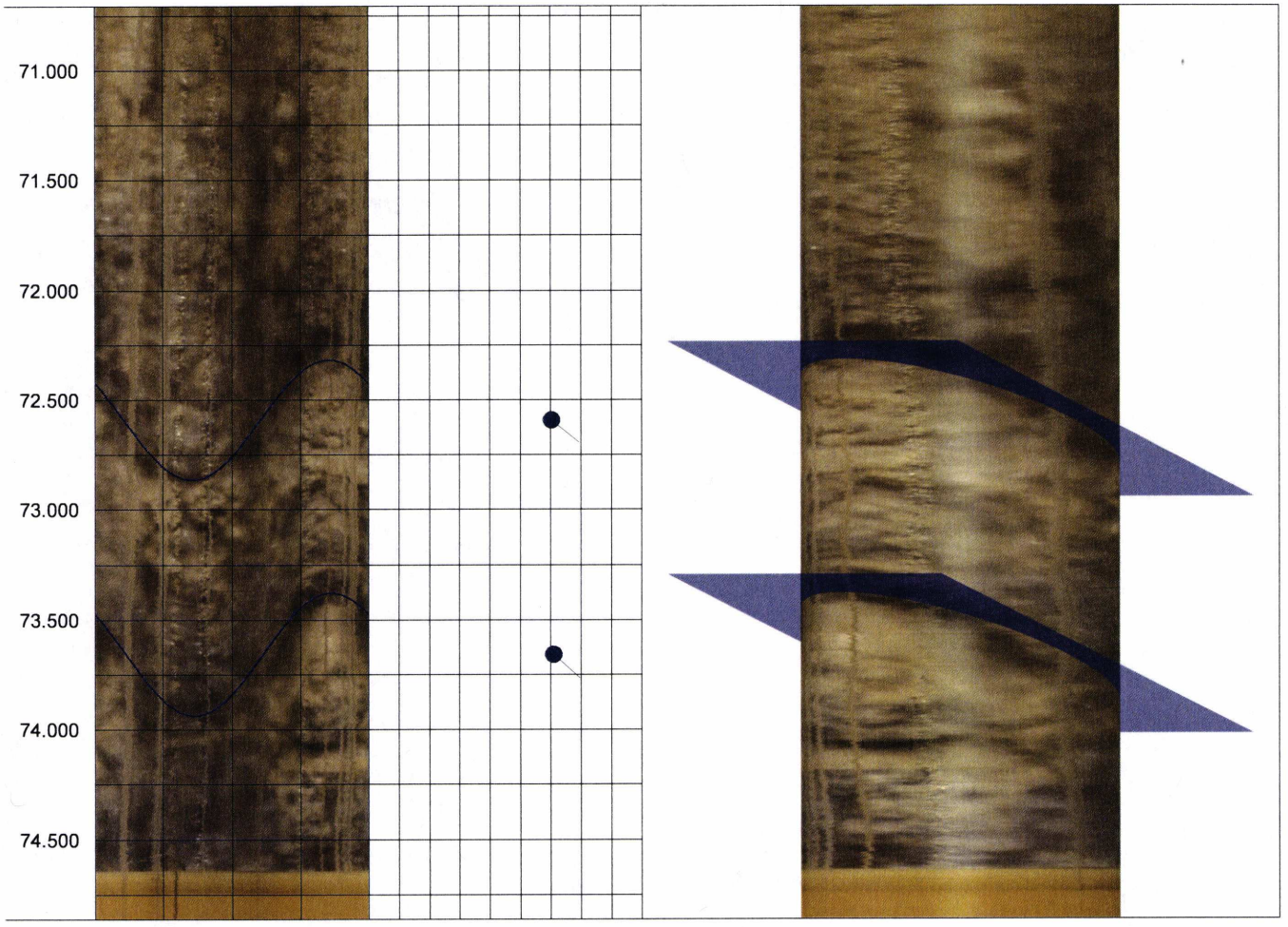

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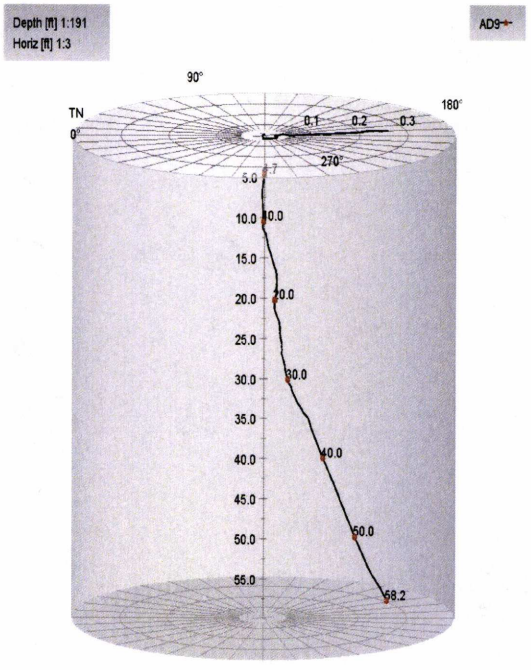
Interpreted Log Type: OTV

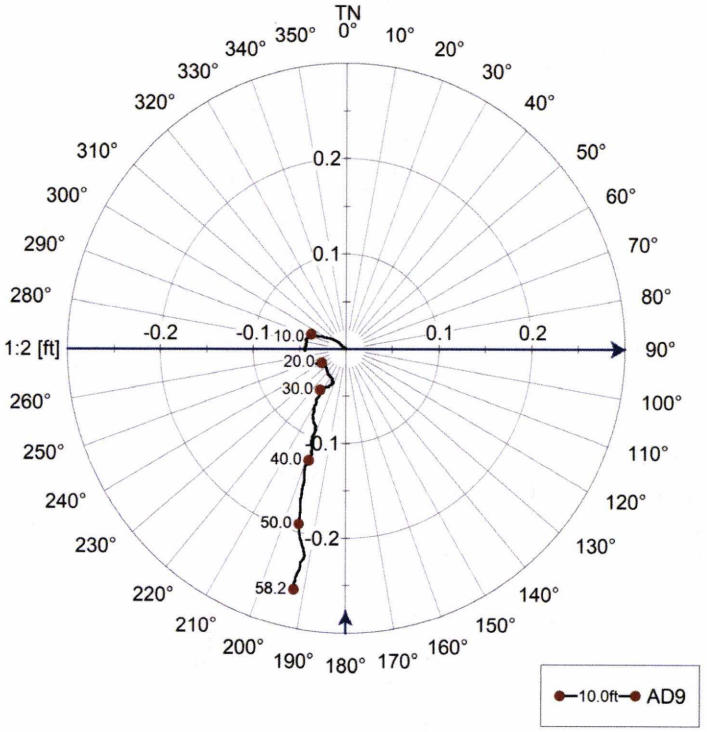
Project:	HWY 70 EAST HWY 7 NORTH	**Date:**	1/23/2019
Location:	HOT SPRINGS, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD9	**Start Depth:**	4.7
		End Depth:	58.2

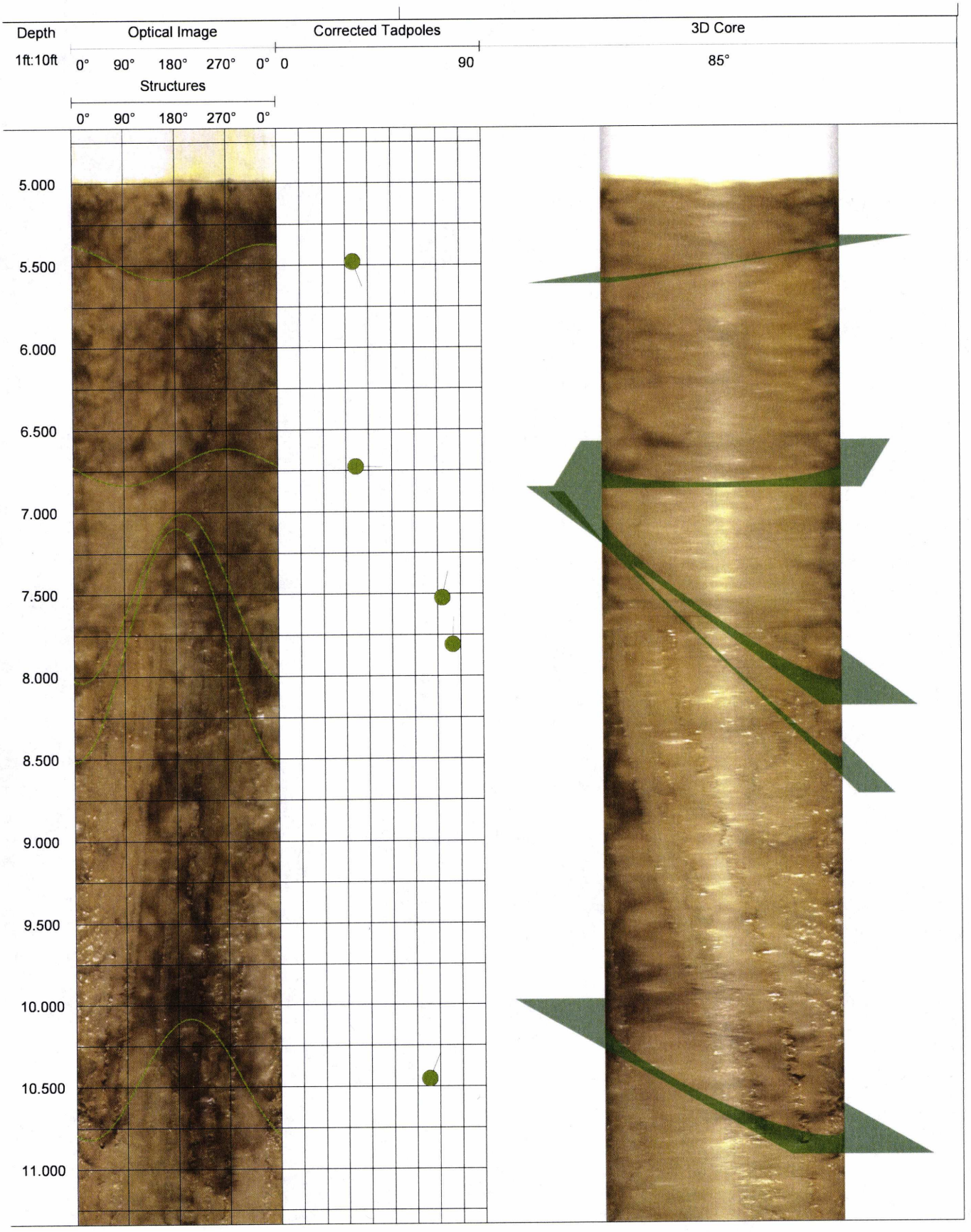
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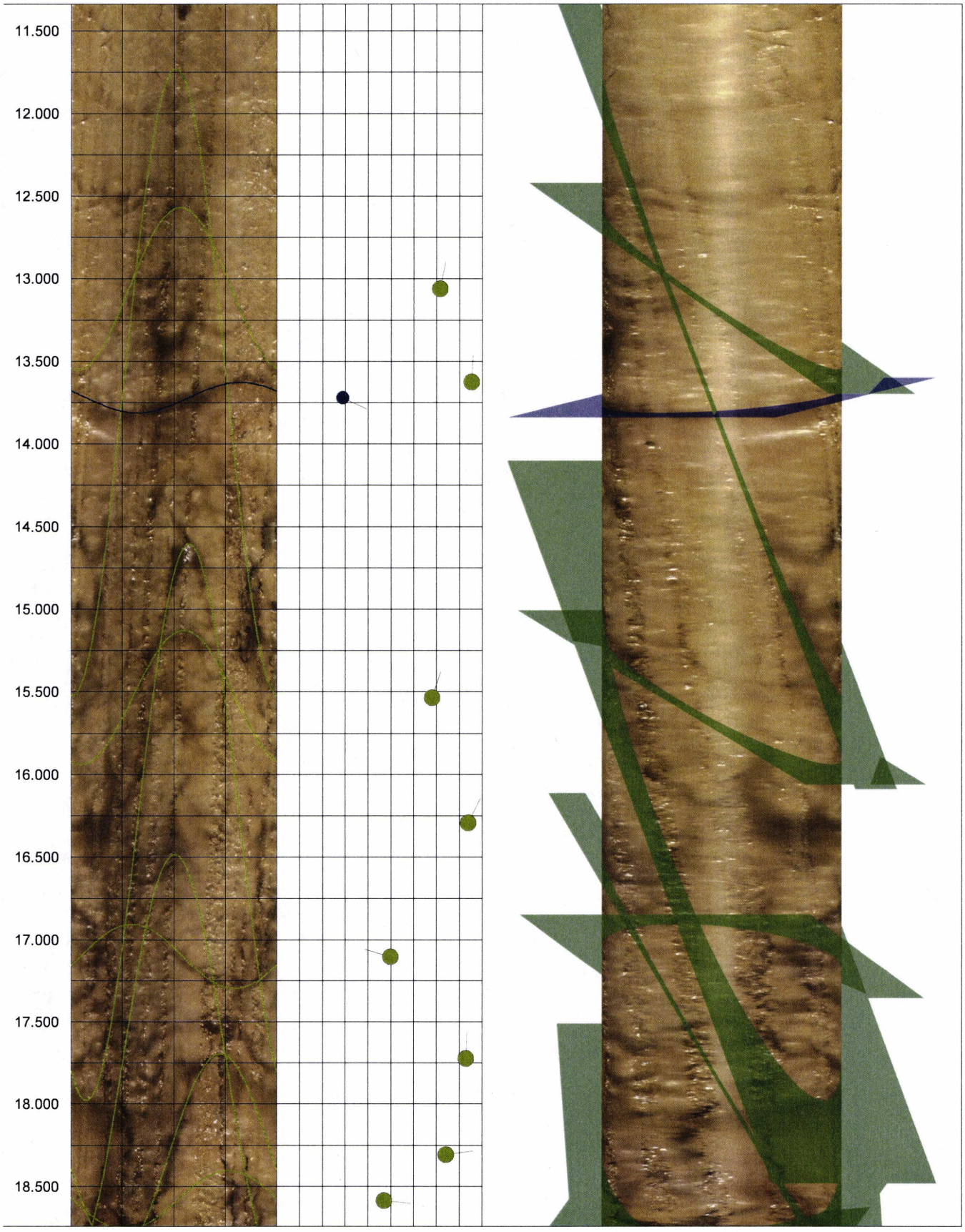
Filled Joint / Fracture

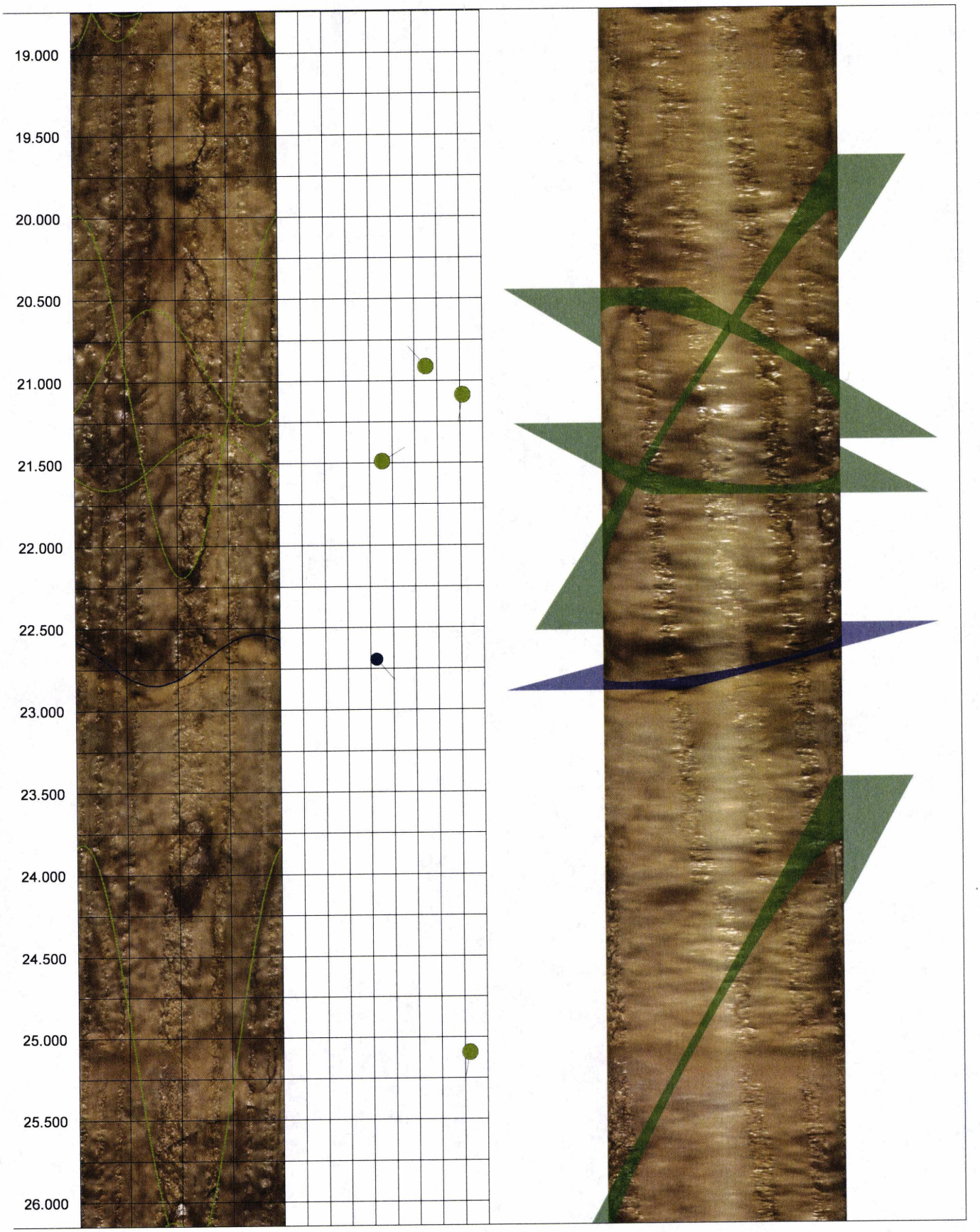
Bedding / Banding / Foliation

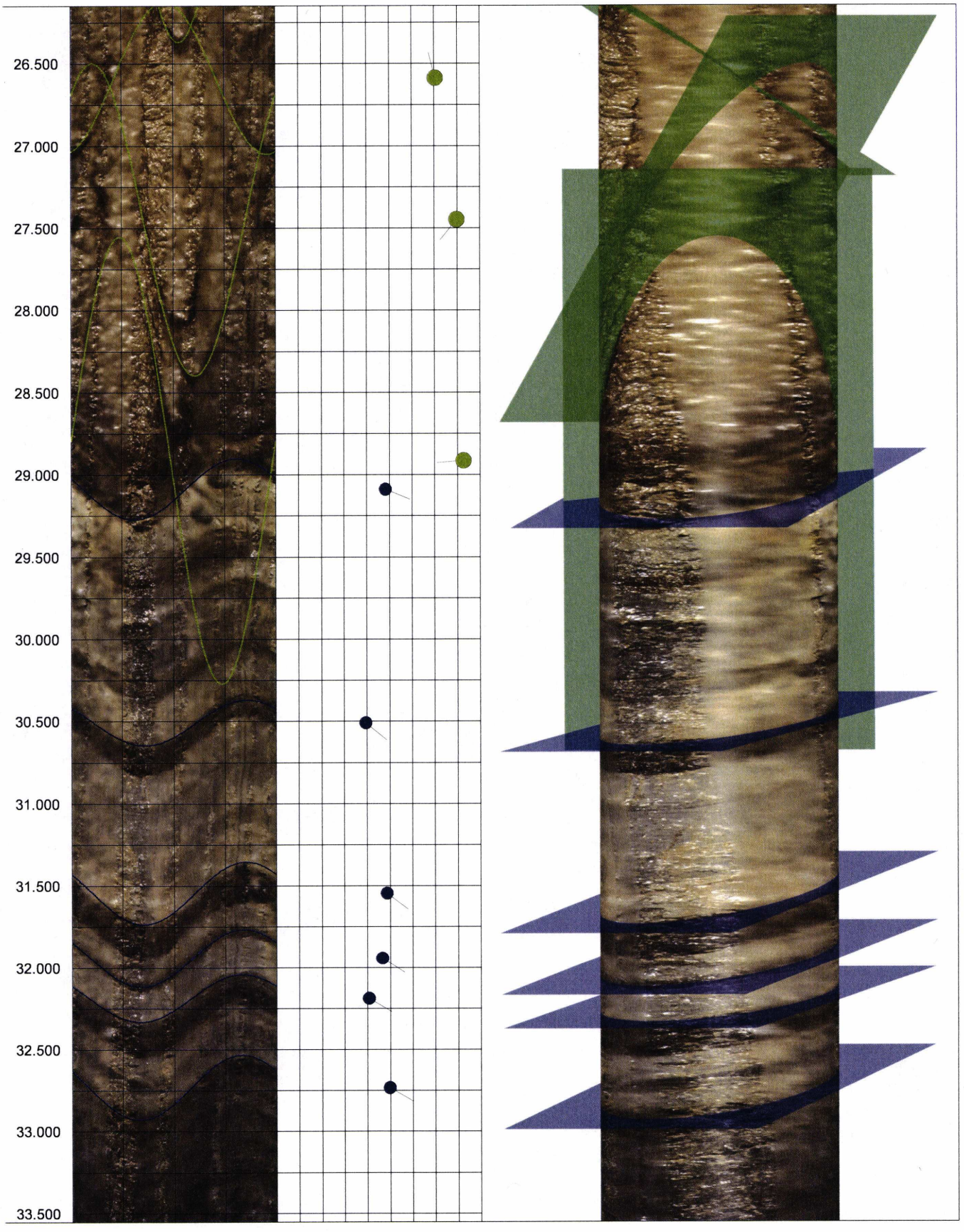


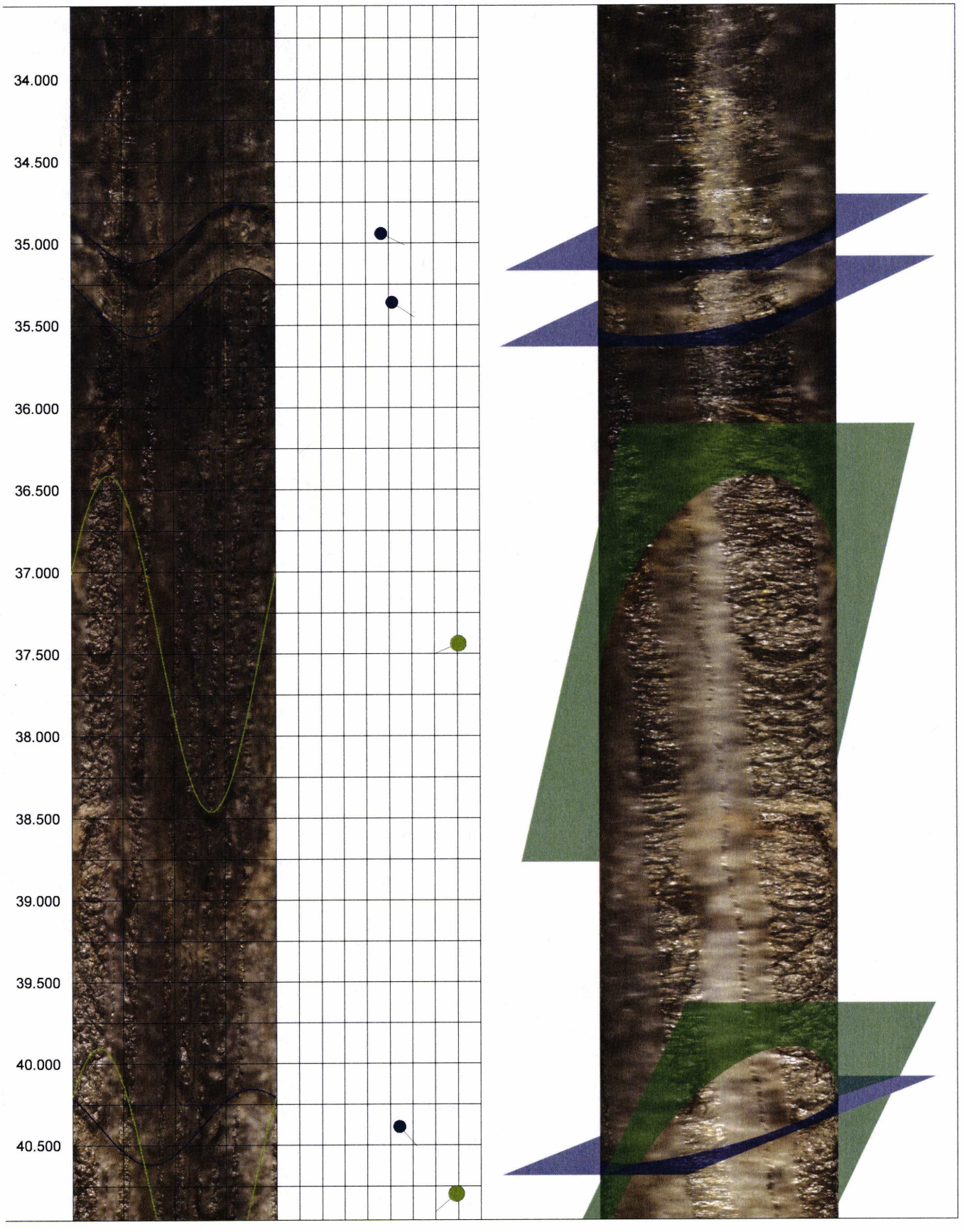


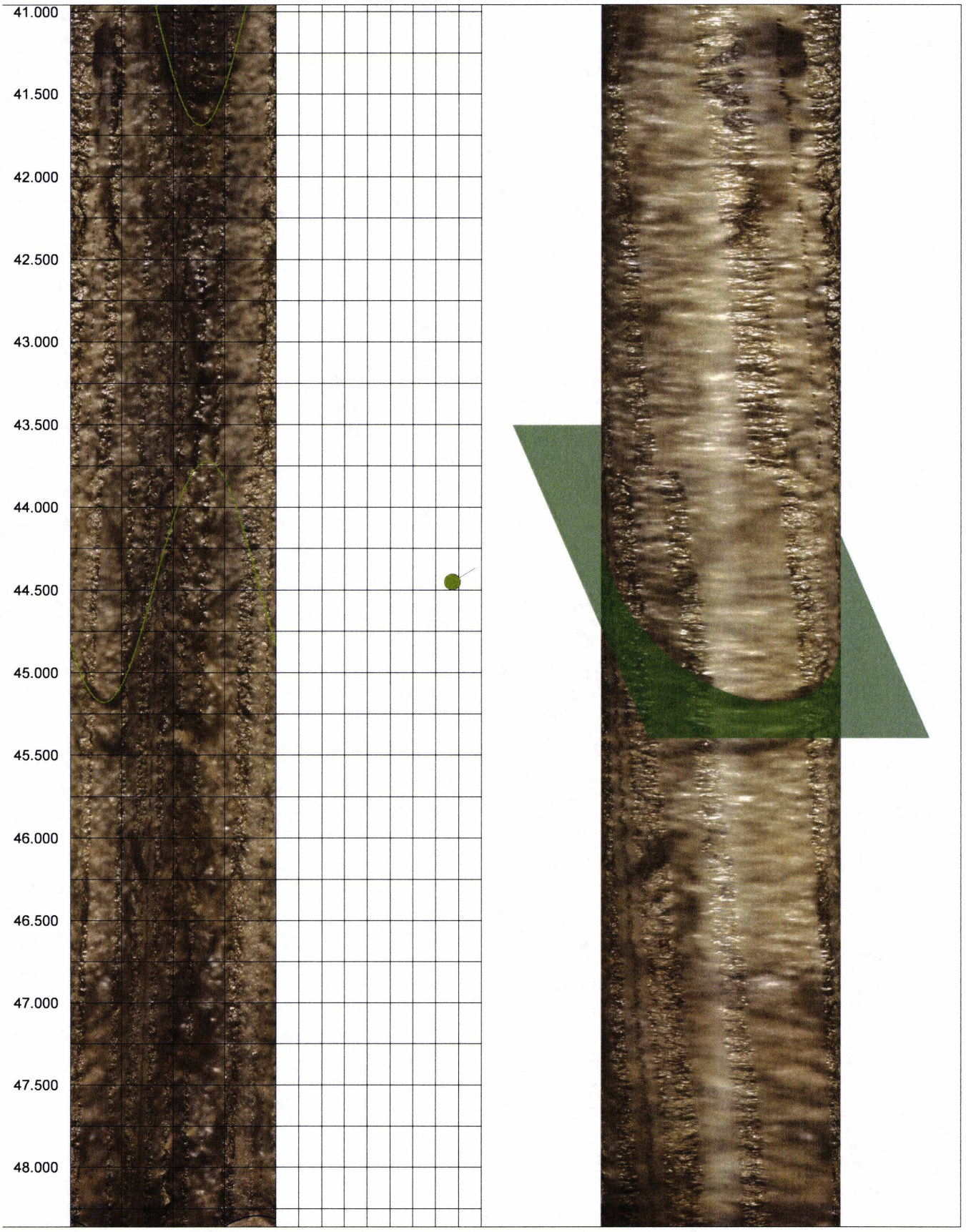

Depth
1ft:10ft
Optical Image
0° 90° 180° 270° 0°
Structures
0° 90° 180° 270° 0°
Corrected Tadpoles
0
90
3D Core
85°
5.000
5.500
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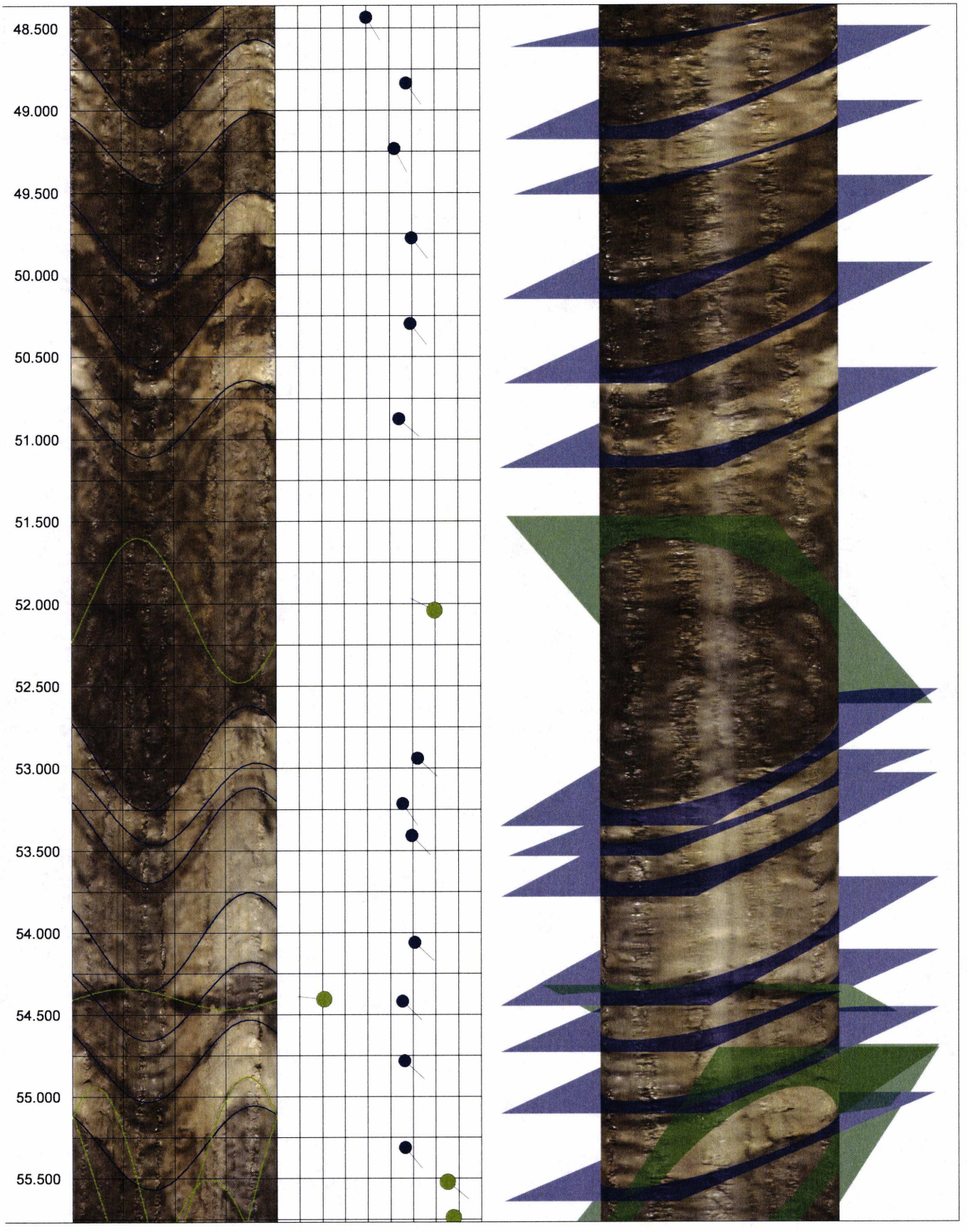

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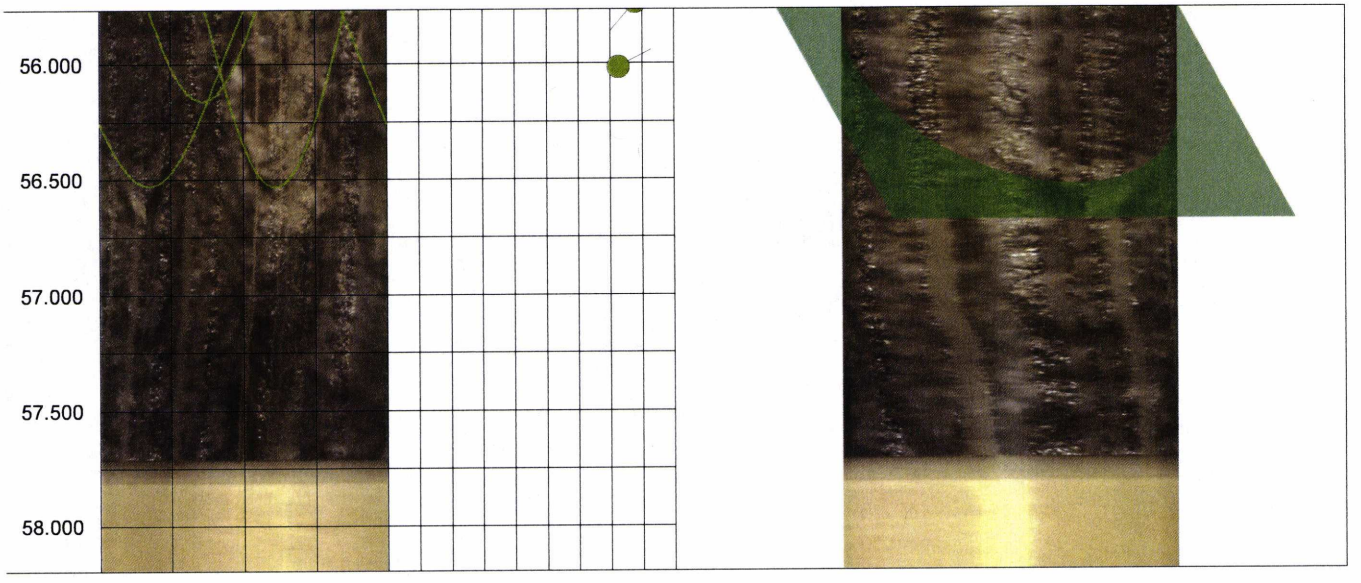

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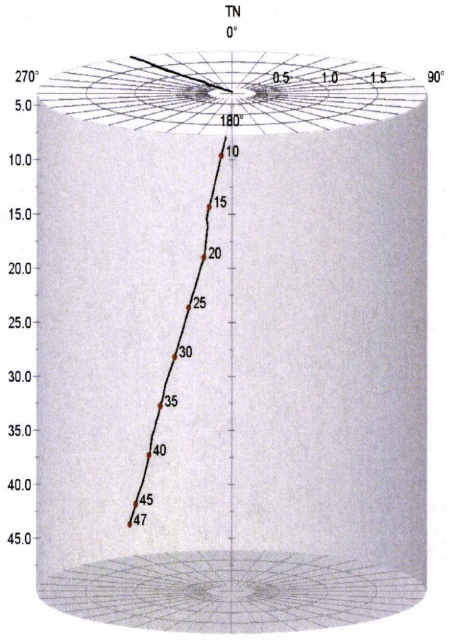
GEOVision geophysical services

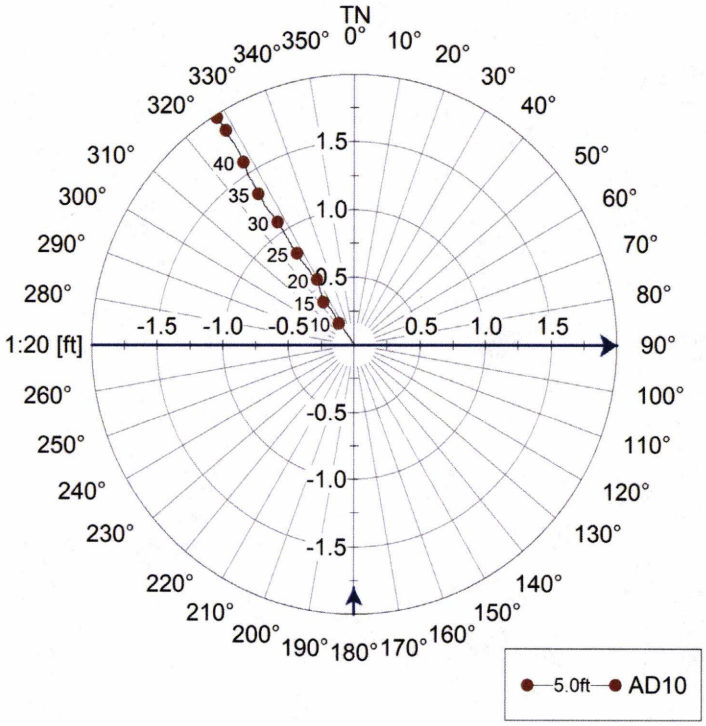
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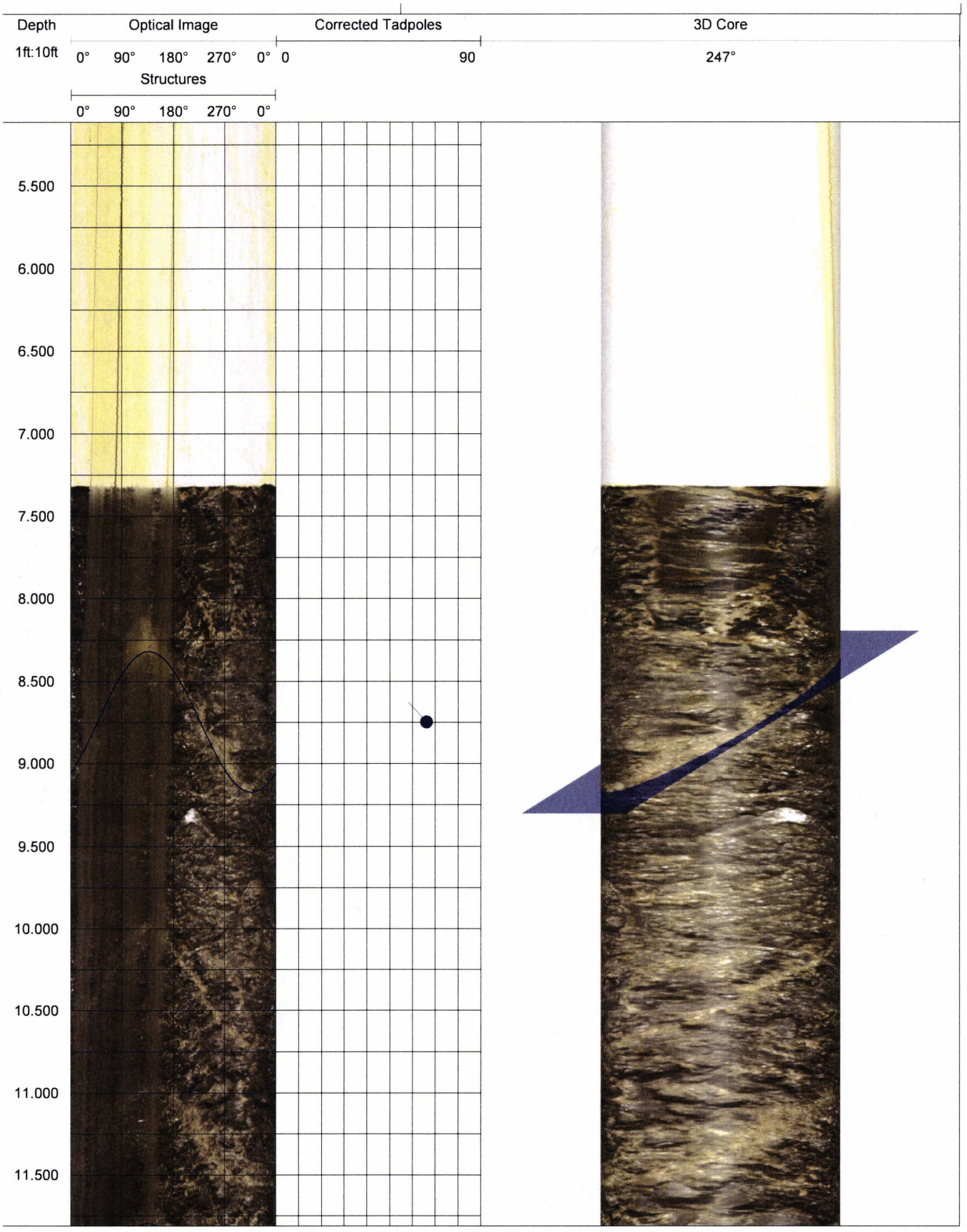
Project:	HWY 70 EAST/ HWY 7 NORTH	**Date:**	1/23/2019
Location:	HOT SPRINGS, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD10	**Start Depth:**	5.1
		End Depth:	47.0

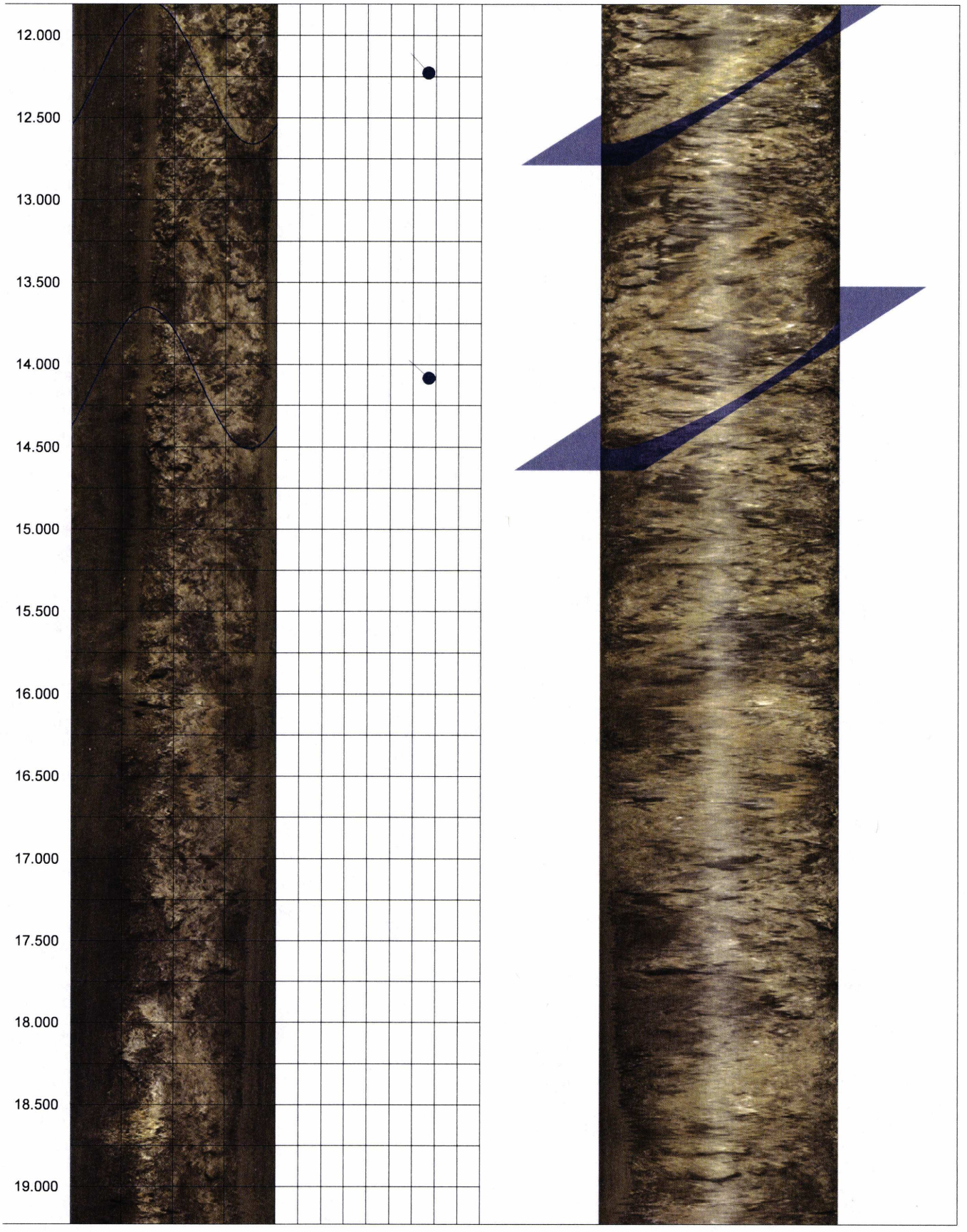
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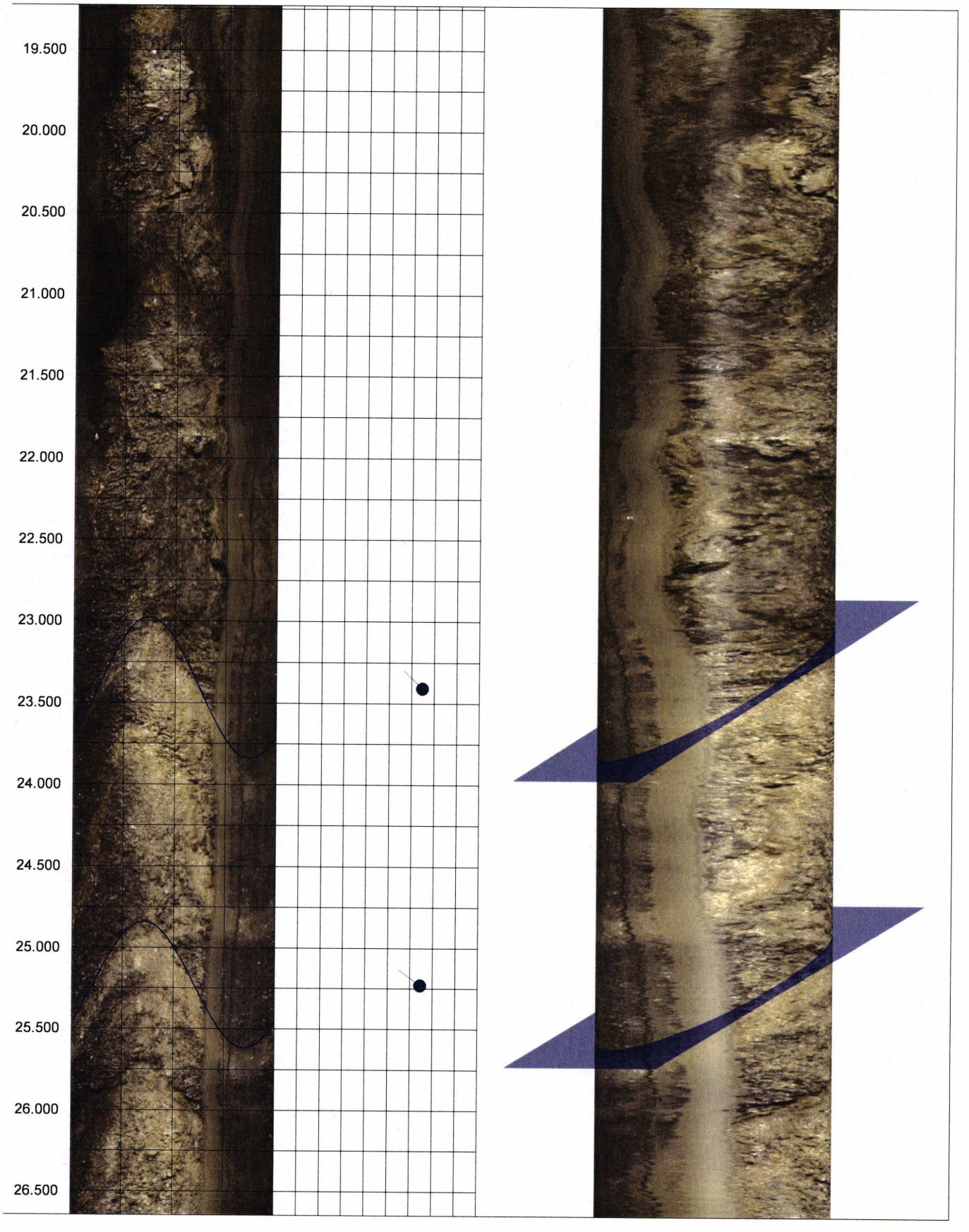
Bedding / Banding / Foliation

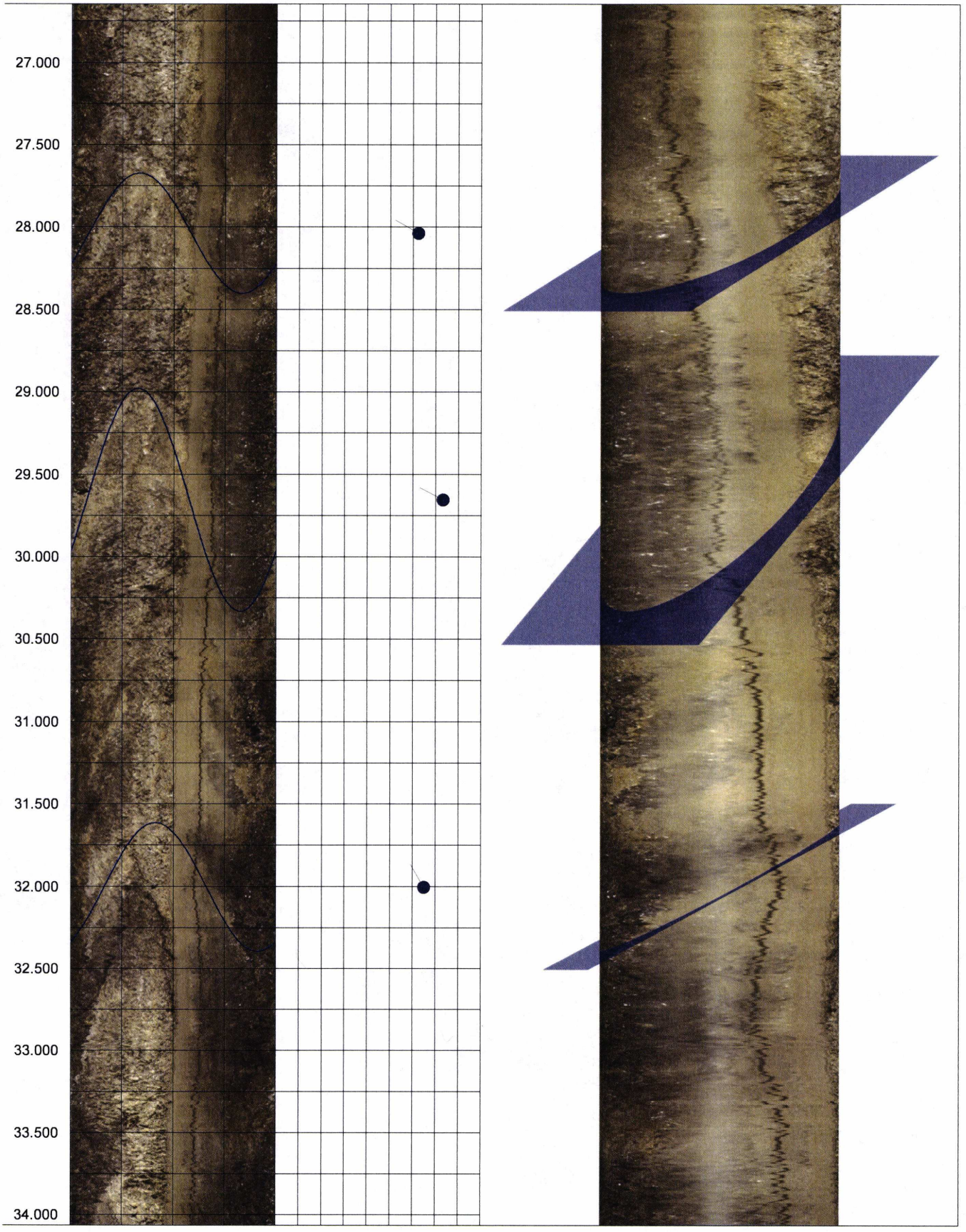


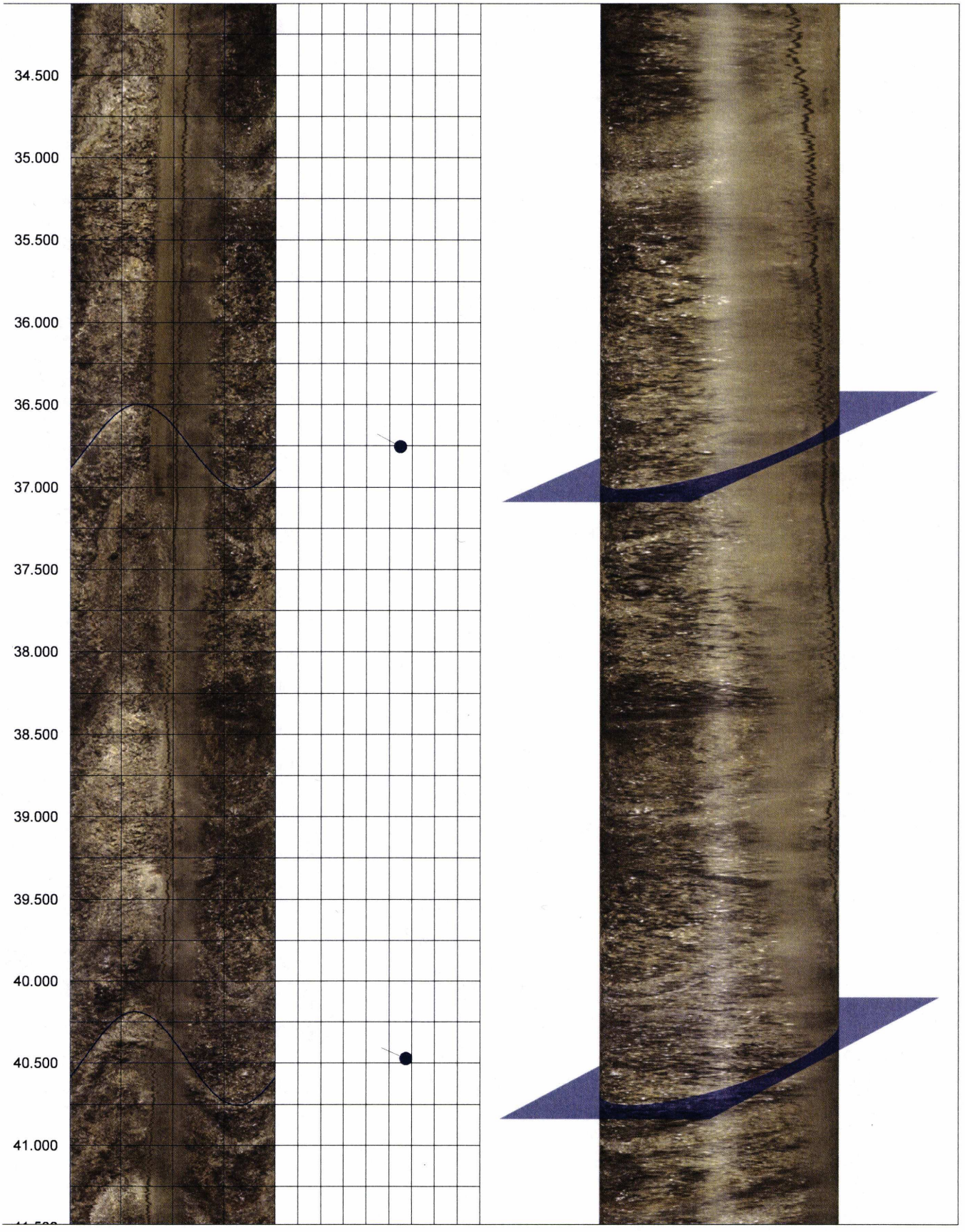


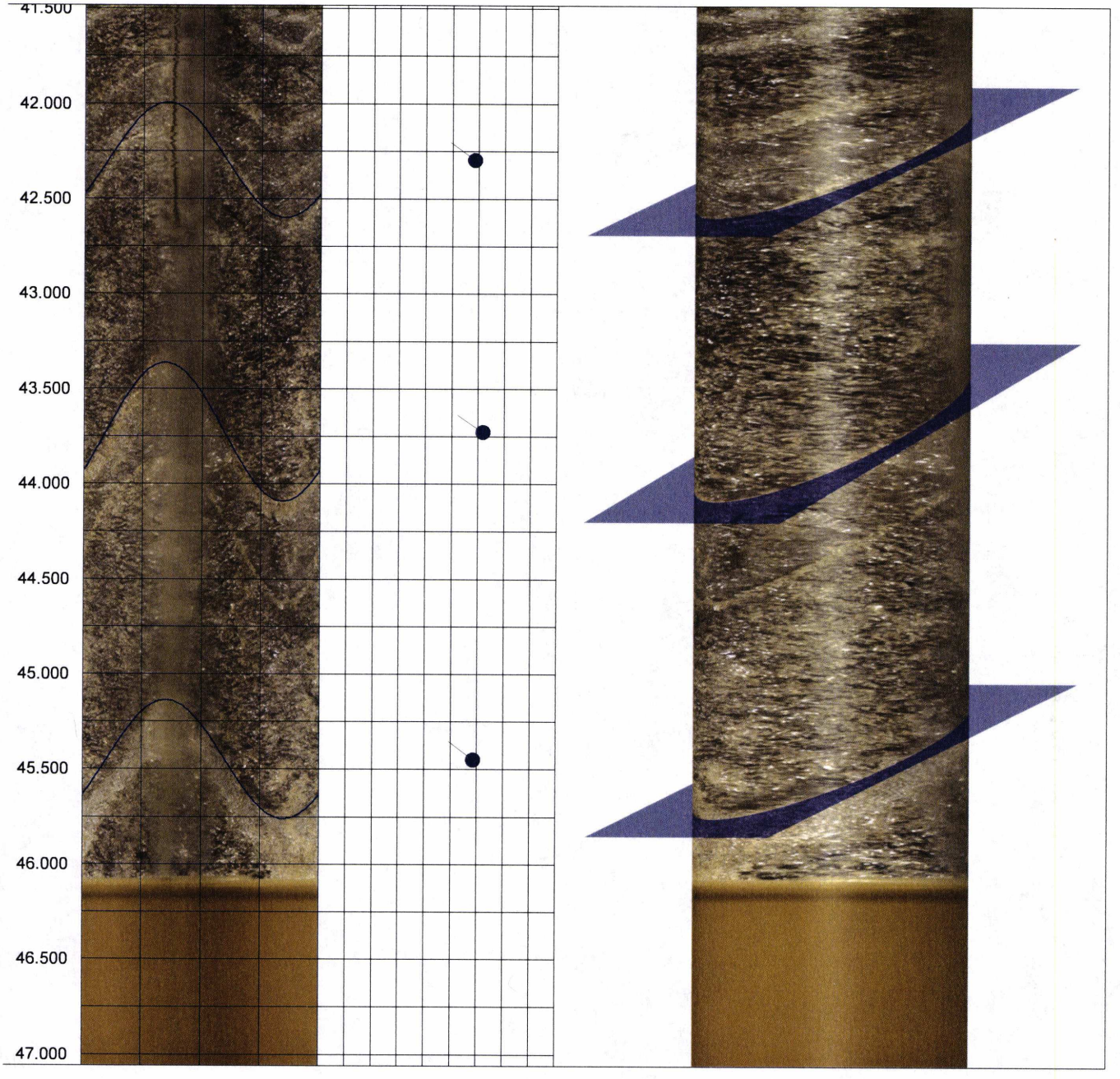

Depth
1ft:10ft
Optical Image
0° 90° 180° 270° 0°
Structures
0° 90° 180° 270° 0°
Corrected Tadpoles
0
90
3D Core
247°
5.500
6.000
6.500
7.000
7.500
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9.000
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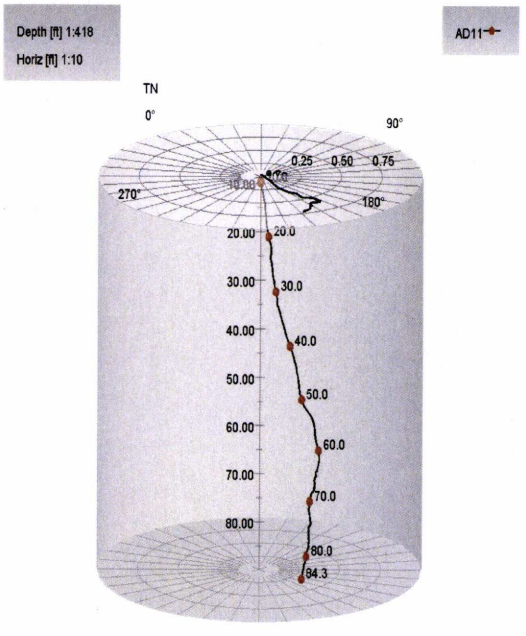
GEOVision geophysical services

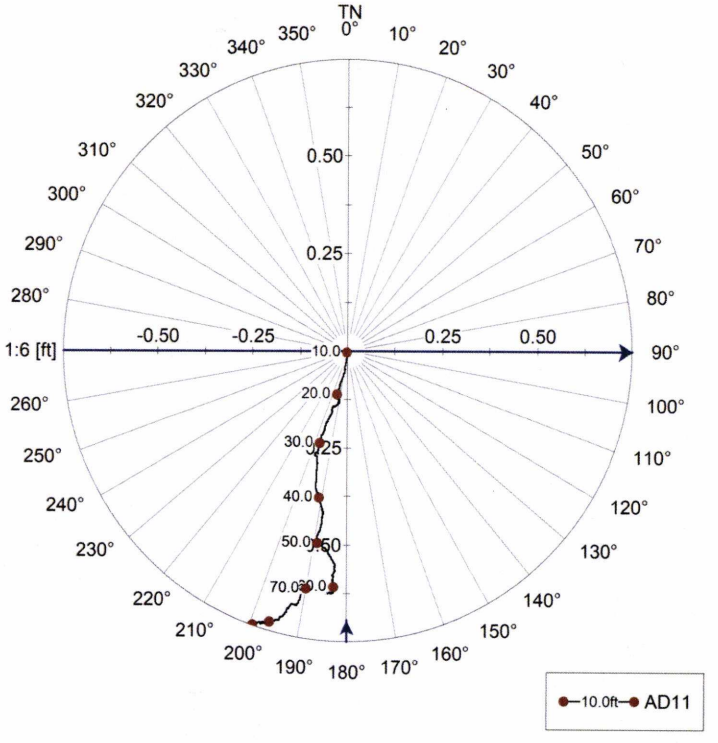
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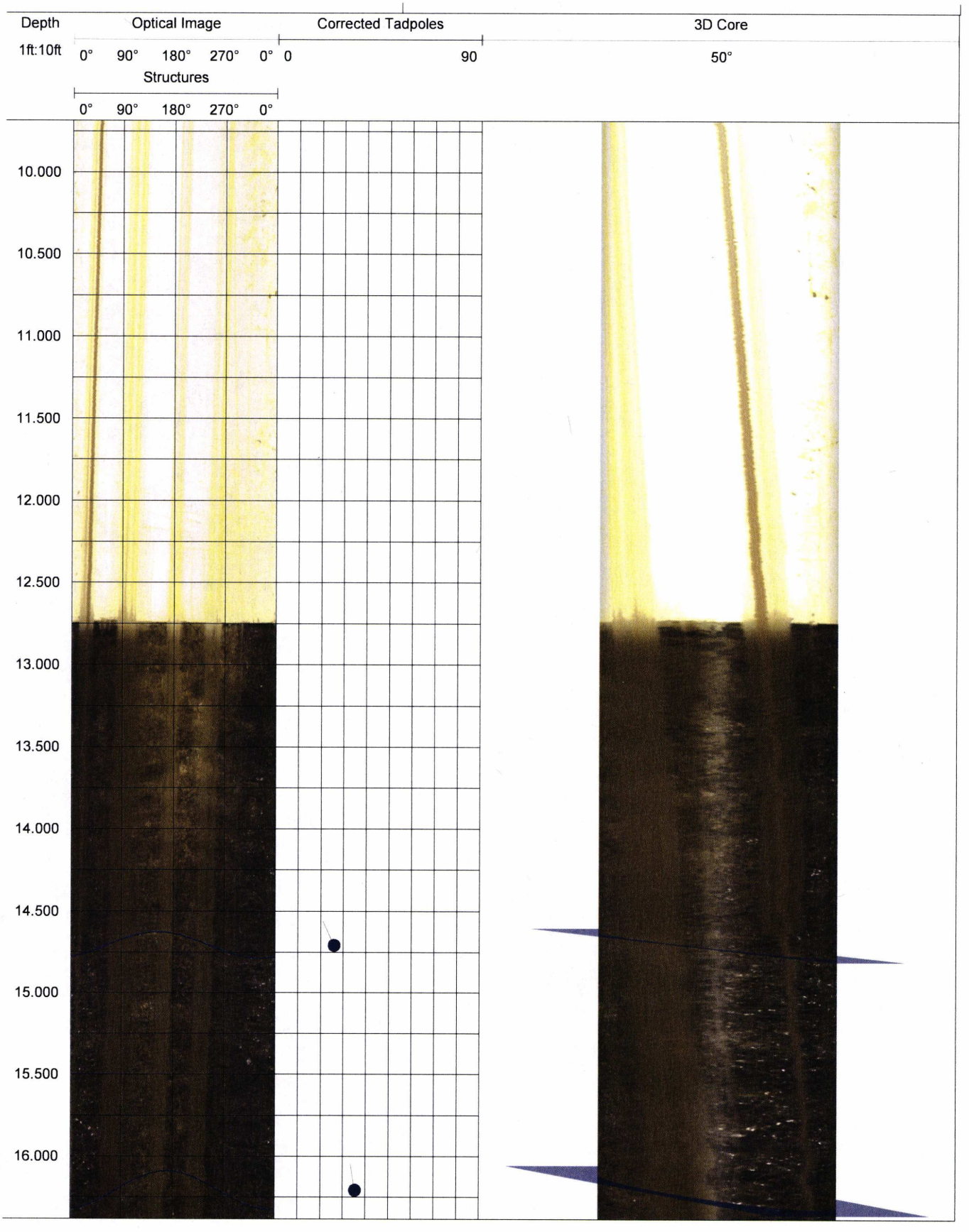
Project:	HWY 70 EAST/ HWY 7 NORTH	**Date:**	1/23/2019
Location:	HOT SPRINGS, AR	**Diameter:**	4"
Client:	ARDOT	**Logged By:**	GG
Borehole ID:	AD11	**Start Depth:**	9.7
		End Depth:	84.3

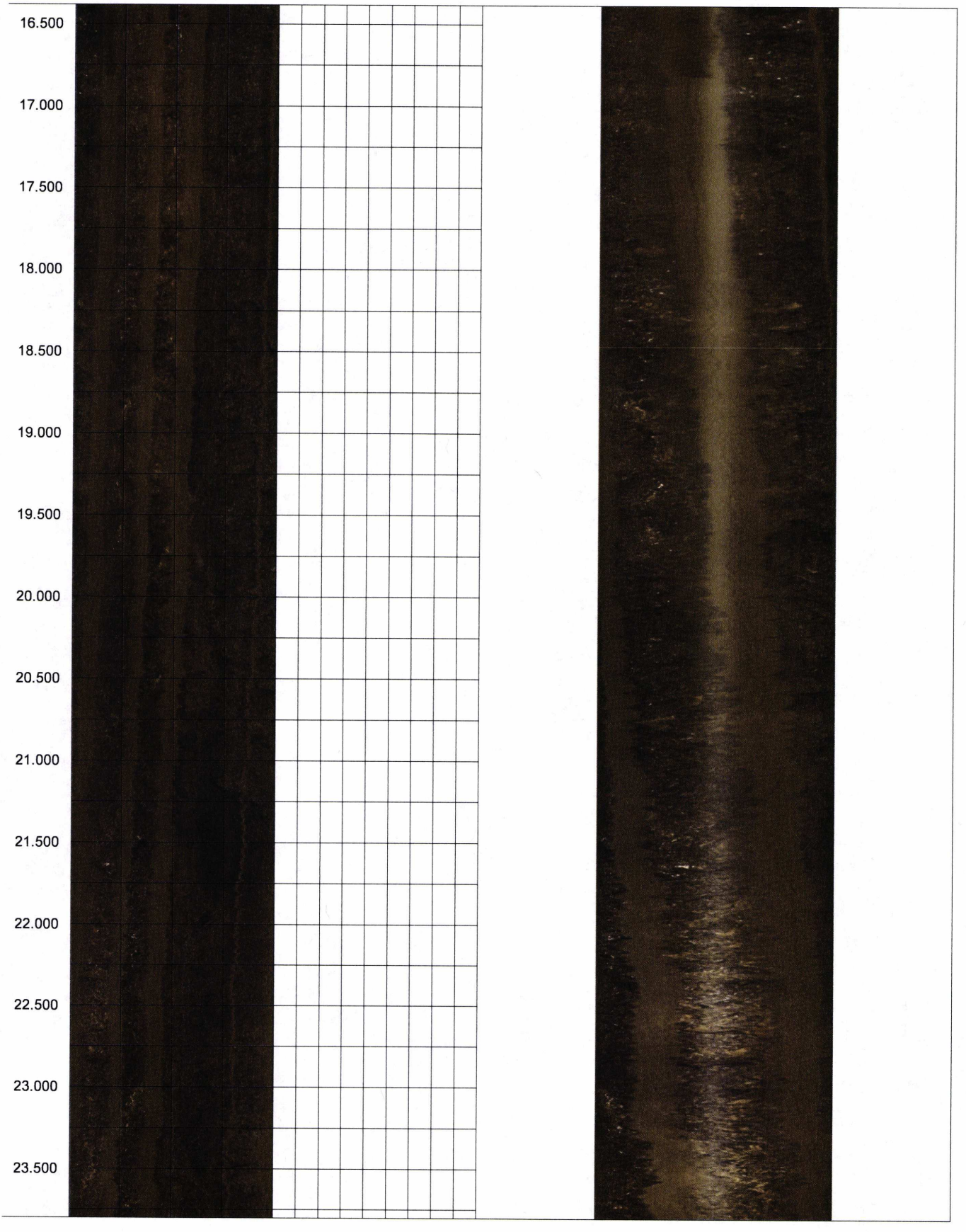
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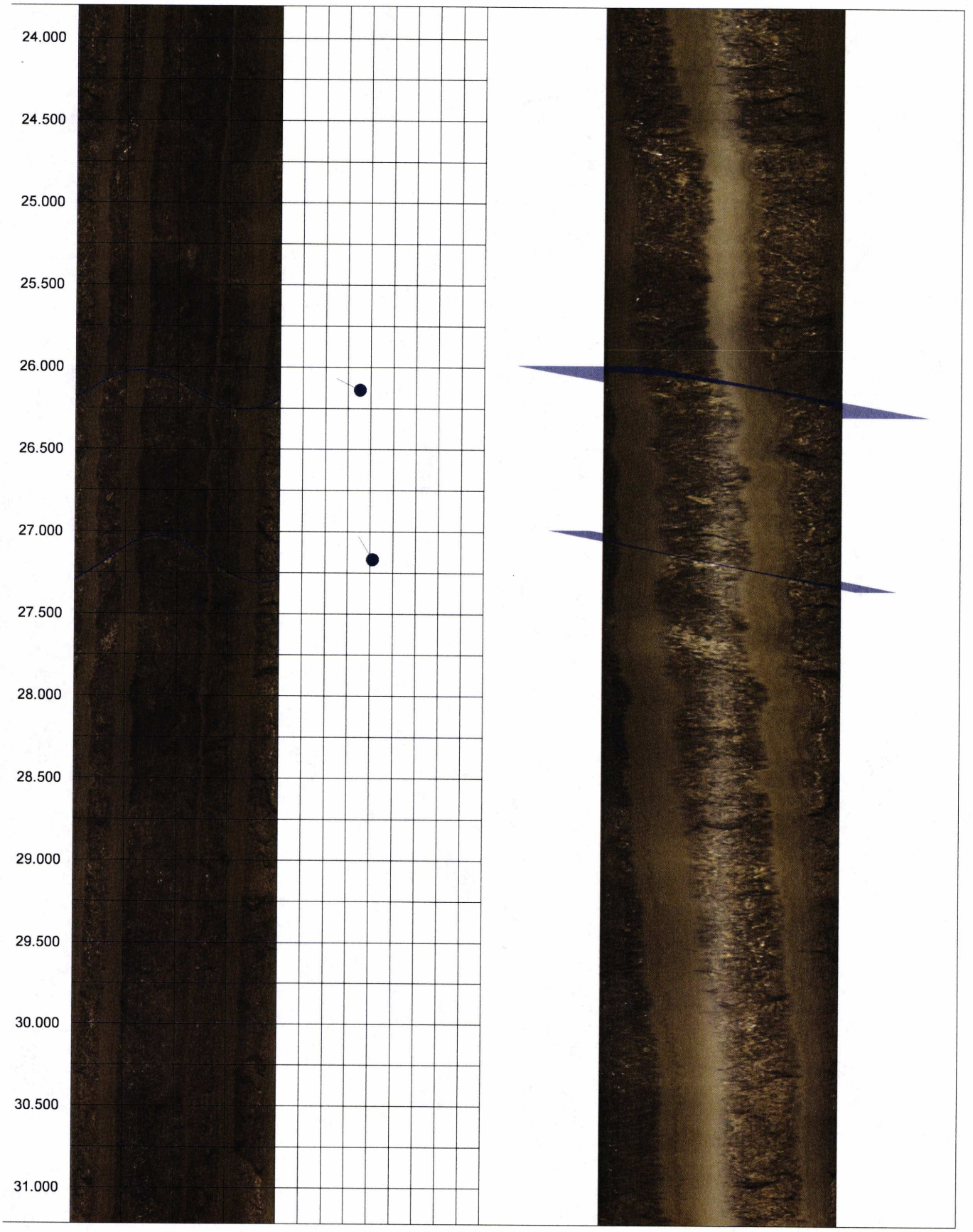
Bedding / Banding / Foliation

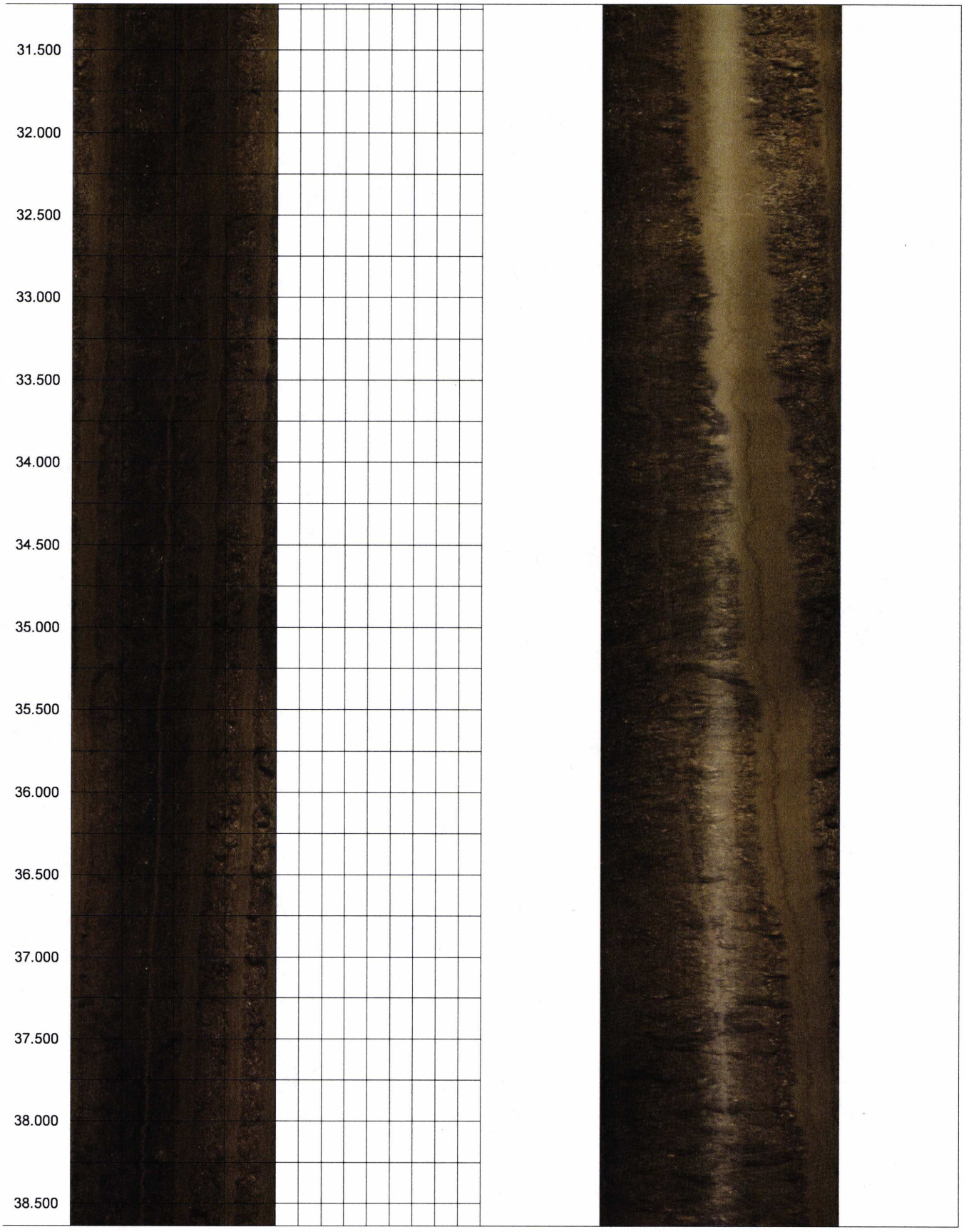


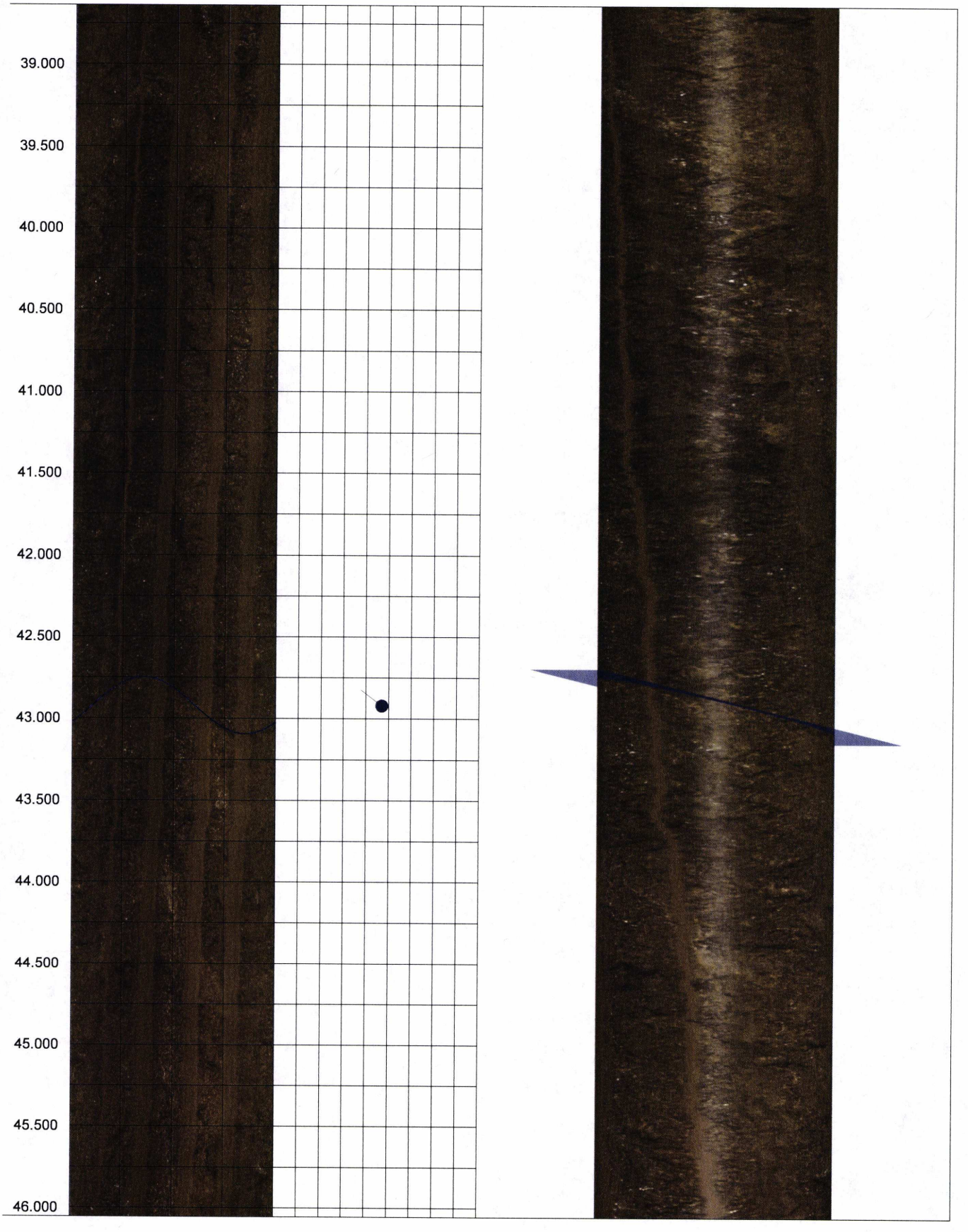


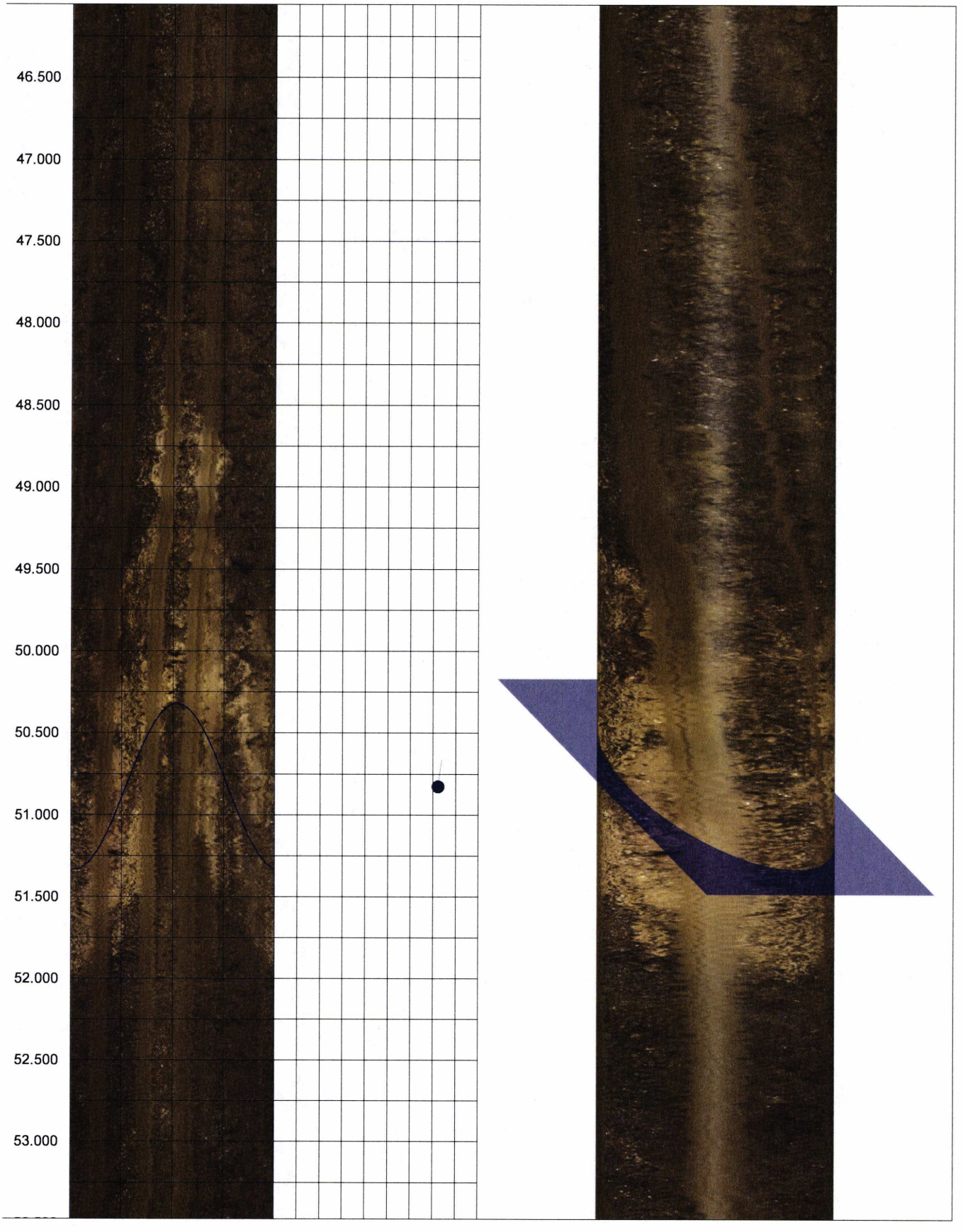

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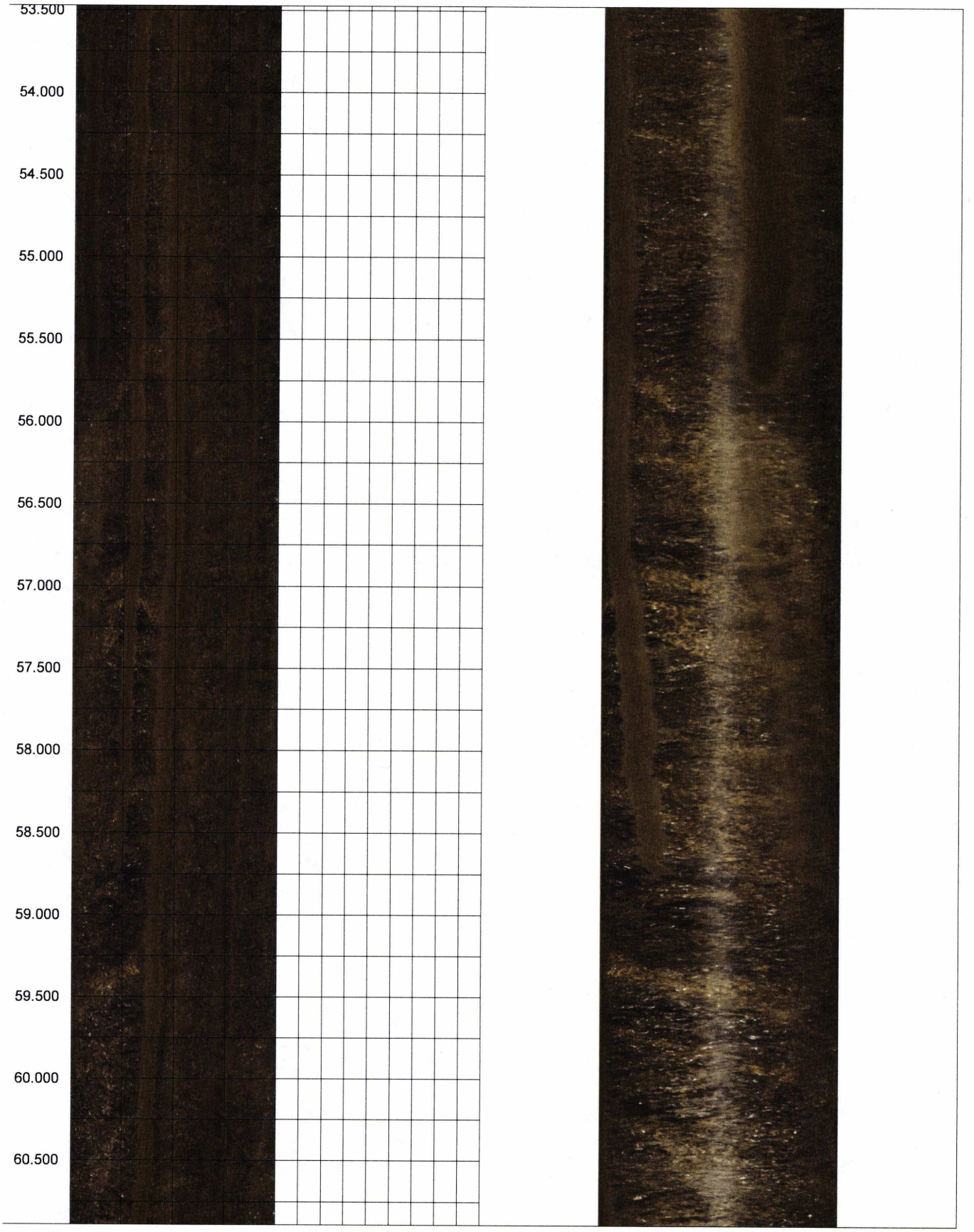

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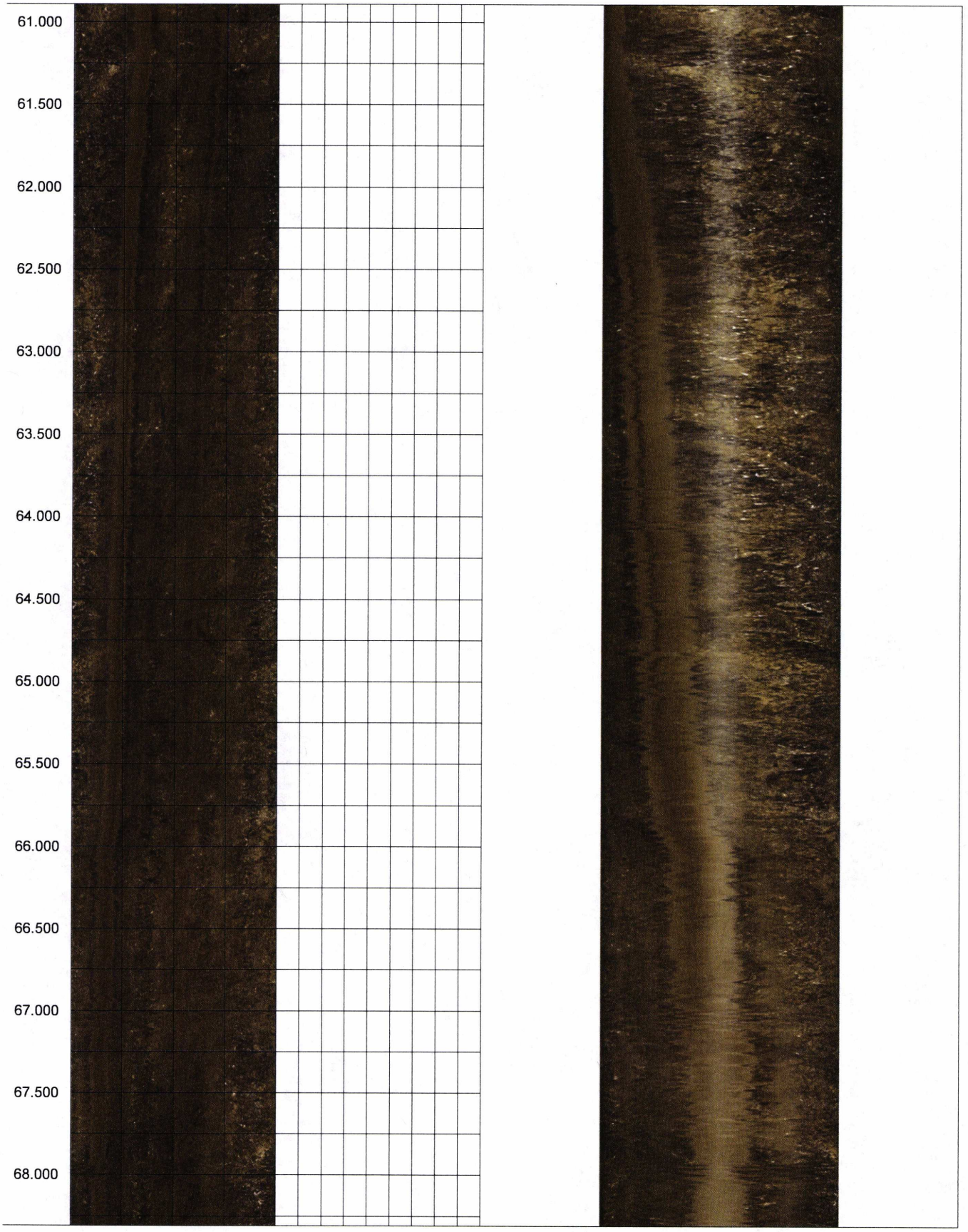

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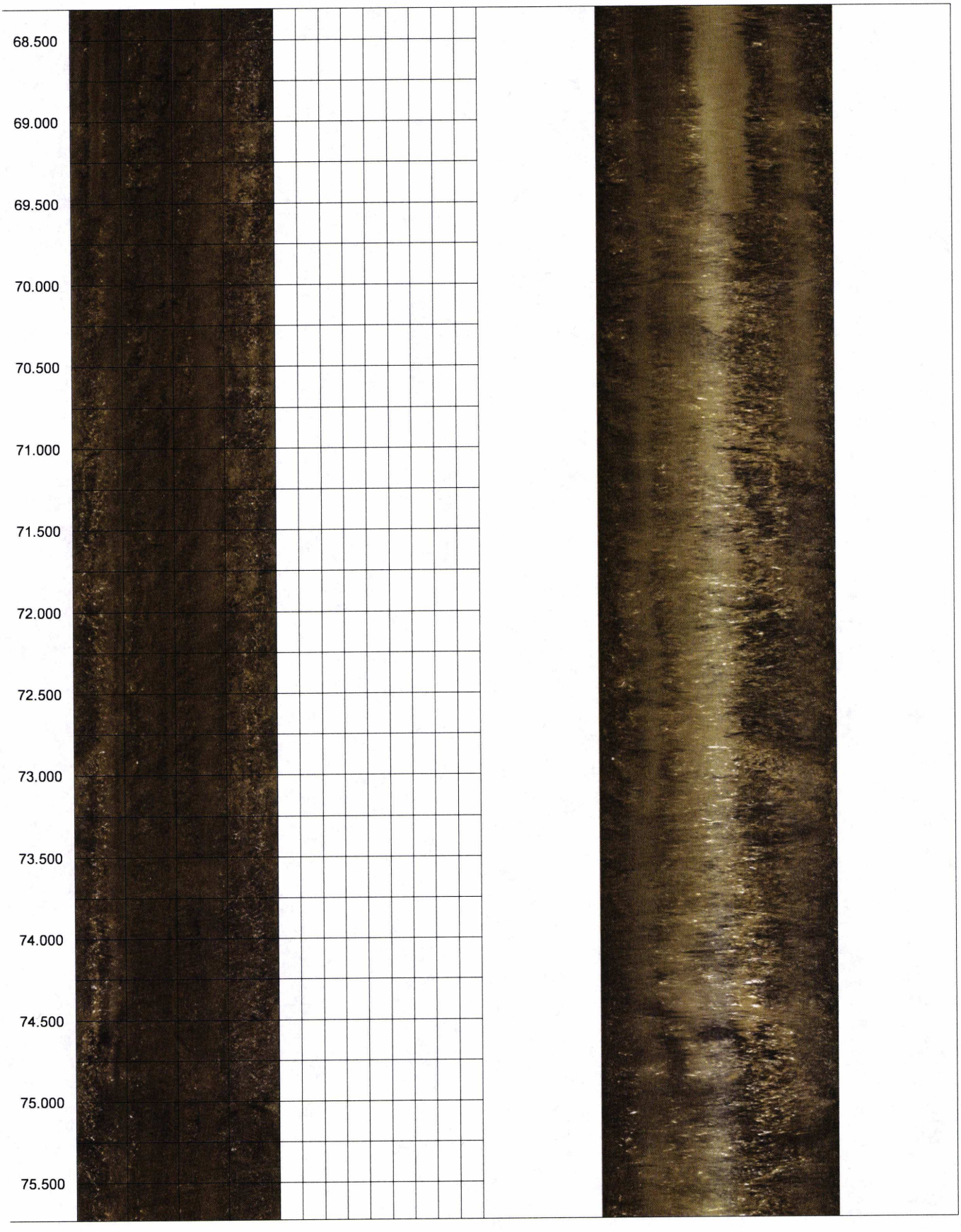

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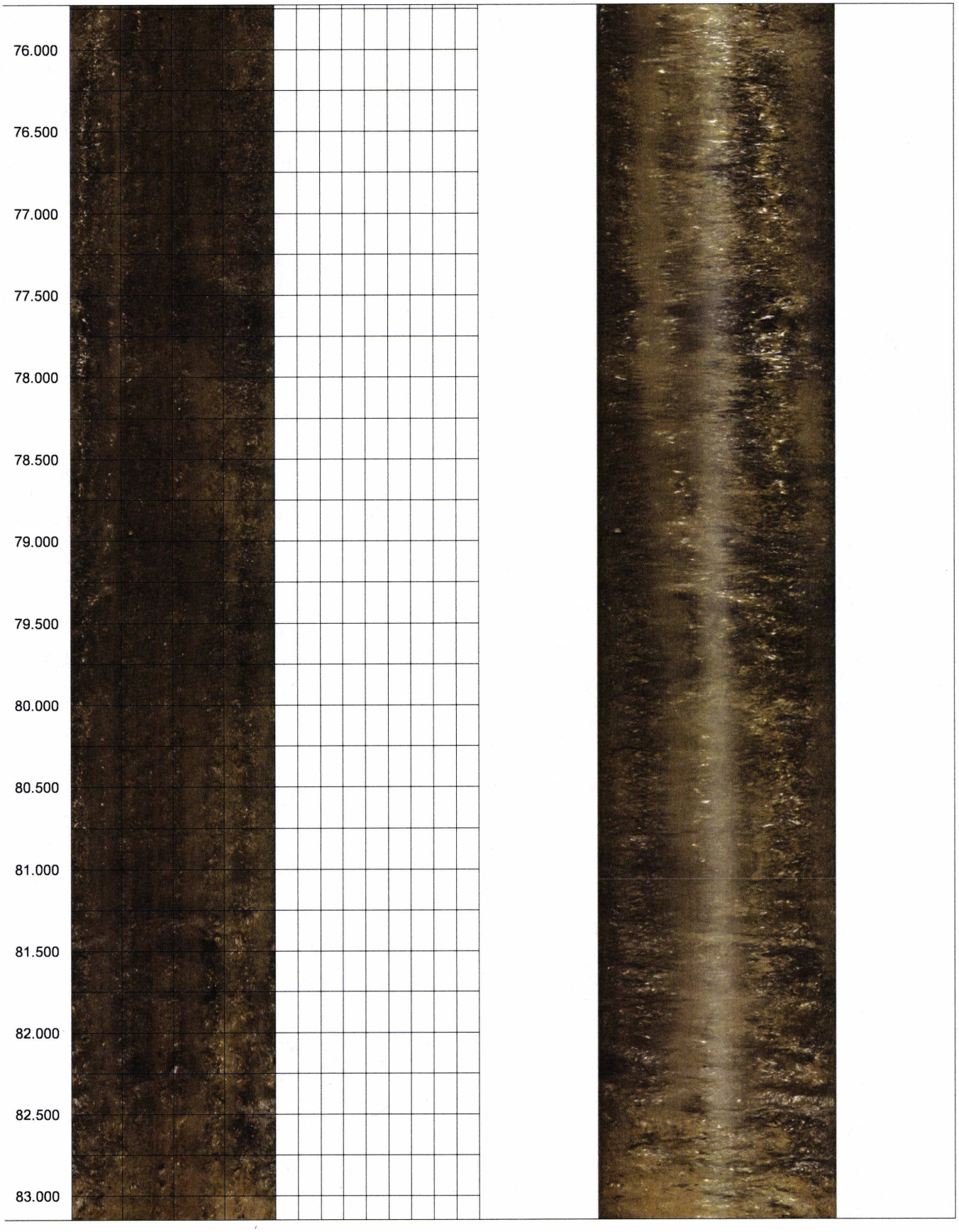

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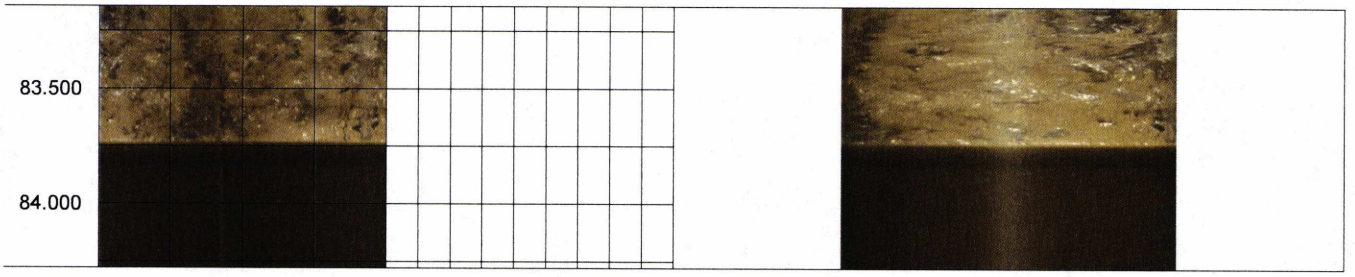

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APPENDIX B

TRC 1803 SUBSURFACE MAPPING REPORT

Subsurface Mapping Report for ARDOT Job #R60140, Hwy. 70 East-Hwy. 7 North, Hot Springs, AR (Phase 1&2-Draft)

for:

ARDOT
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March 12, 2019

1 Introduction

This report details geophysical testing conducted for ARDOT Job #R60140, Hwy. 70 E-Hwy. 7 N. Geophysical testing for the project consisted of Multichannel Analysis of Surface Waves (MASW) and single station Horizontal to Vertical Spectra Ratio (HVSR). These tests were conducted along trails and roads in areas where significant material excavation is expected based on the proposed cross sections. The testing was conducted both perpendicular and parallel to the proposed highway alignment depending on access in the area of interest. The goals of the geophysical testing were to identify the overburden thickness, depth to different bedrock units, and bedrock rippability in areas where excavation is expected.

2 Site location

ARDOT Job #R60140 is located just North-East of Hot Springs, Arkansas, as shown in Figure 1. MASW and HVSR testing were conducted along nine survey lines labeled as Lines A, B, C, D, E, F, G, H, I, J and K as shown in Figure 1. The GPS coordinates and station and offset for the starting and ending points of the MASW survey lines are provided in Table 1. These locations were identified using the preliminary cross sections provided by ARDOT. The exact locations of the tested areas will be presented later in the report.

Table 1- Coordinates of the starting and ending points of MASW survey lines.

	Start point					**end point**				
Line ID	Start point	Latitude	Longitude	Station	Offset	End point	Latitude	Longitude	Station	Offset
A	1	34.54057872	-92.98309873	778+70	162 ft left	15	34.54237550	-92.98238246	786+30	102 ft left
B	1	34.54715675	-92.98283181	802+50	575 ft left	13	34.54686408	-92.98091311	802+50	17 ft right
C	1	34.54553848	-92.98044444	798+05	230 ft right	24	34.54857157	-92.98121747	806+65	180 ft left
D	1	34.55807625	-92.98068999	845+45	337 ft left	18	34.56000879	-92.97910326	849+90	408 ft right
E	1	34.55853225	-92.97801360	843+85	441 ft right	15	34.55696221	-92.97924073	840+00	29 ft left
F	1	34.55805365	-92.98058217	845+40	308 ft left	5	34.55758516	-92.98030400	843+20	285 ft left
G	1	34.55598341	-92.98018529	837+00	365 ft left	16	34.55491529	-92.97837672	832+60	175 ft right
H	1	34.55642883	-92.97926297	838+10	74 ft left	13	34.55494162	-92.97890260	834+50	18 ft right
K	1	34.51970018	-92.98409258	691+40	475 ft left	21	34.51953884	-92.98099493	693+80	367 ft right
I	1	34.56462903	-92.98176507	870+30	300 ft right	5	34.56446275	-92.98128457	869+50	450 ft right
J	1	34.56570110	-92.98087056	876+20	470 ft right	5	34.56611964	-92.98076933	878+30	420 ft right

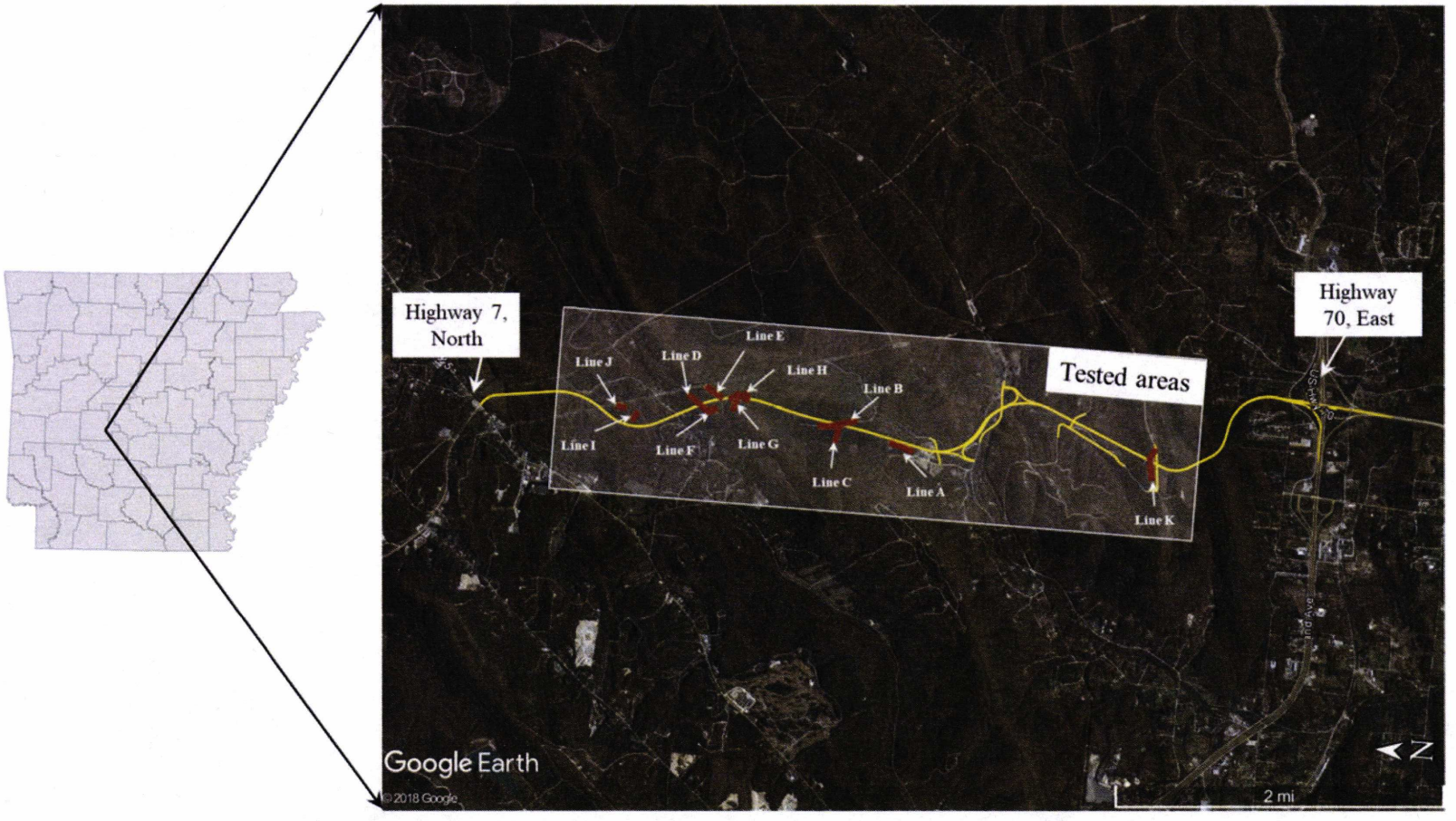


Figure 1- Location of MASW and HVSR survey lines conducted for ARDOT Job #R60140.

3 Geophysical tests

Geophysical testing was conducted using the MASW and HVSR methods for ARDOT Job #R60140. The MASW testing was conducted using Love type surface waves rather than traditional Rayleigh type surface waves as more reliable experimental dispersion curves were observed for Love type surface waves for the project and previous project experience has shown that MASW with Love type surface waves performs better for shallow bedrock sites than Rayleigh type surface waves. HVSR measurements were taken both along the MASW survey lines to aid in the development of the shear wave velocity profiles from MASW and in an extensive grid pattern throughout many of the areas where significant excavation is expected for the project. The background and project specific testing parameters for each of these methods are briefly explained in the next section.

3.1 Multichannel Analysis of Surface Wave (MASW)

Multichannel Analysis of Surface Waves (MASW) was introduced in 1999 by Park et al. This method has gained popularity in geotechnical engineering for near surface site characterization (generally for depths shallower than 100 ft) because of its adaptability to different project requirements, nondestructive and rapid testing, and reliable results. MASW works by utilizing the dispersive nature of surface waves, either Rayleigh or Love, which can be easily generated using an impulsive source such as a sledgehammer. These waves then propagate away from the source and through the subsurface geomaterials and are measured using a linear array of geophones/seismometers at the ground surface. Using these measurements, a dispersion curve (variation of surface wave velocity with frequency or wavelength) can be generated and inverted to estimate the variation of shear wave velocity (Vs) with depth. The Vs of geomaterials is directly related to the shear modulus or stiffness of the geomaterial and has a strong correlation with other stiffness/strength related properties such as unconfined compressive strength, Standard Penetration Test (SPT) blow count, and rock rippability (Foti et al. 2014). A typical MASW configuration, which includes field laptop, seismograph, geophones, strike plate, and sledgehammer is presented in Figure 2 (modified from Moon et al. 2017). Additional information regarding the MASW method can be found in Foti et al. (2014).

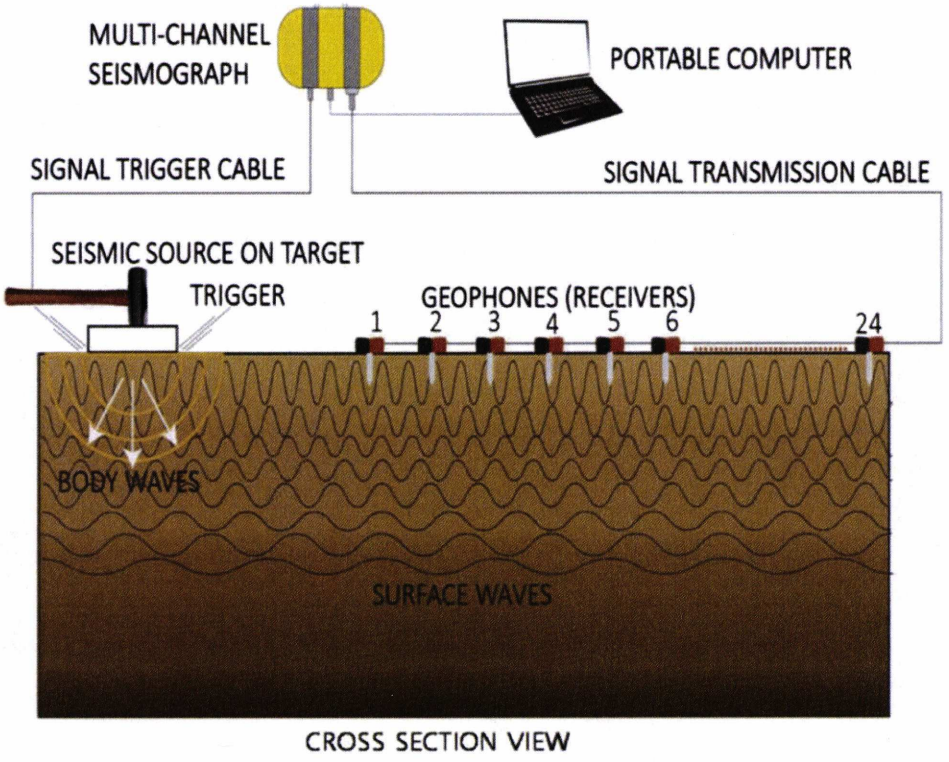


Figure 2- Standard configuration for MASW testing (Moon et al. 2017).

3.2 MASW Data Collection

For MASW testing on this project, a linear array of 24 or 48, 4.5 Hz horizontal geophones with uniform spacing of either 3.3 ft, or 6.6 ft between geophones was used. A geometrics Geode seismograph was used to record the seismic signals from each geophone. A 12 lb sledgehammer was used to generate Love type surface waves by striking a wooden shear beam with aluminum ends horizontally cross line to the array (see Figure 3). Between 3 and 5 sledgehammer blows were recorded at each source position to average together or provide data redundancy. For locations along trails or roads (Survey lines A, B, C, D, F, G, H, and K), the 24 geophones were attached via a landstreamer system (see Figure 3b) to increase the rate of testing. The landstreamer allows all geophones in the array to be dragged as a single system across the survey line instead of coupling each geophone to the ground via a spike. For the MASW conducted with the landstreamer, a geophone spacing of 3.3 ft was utilized along with multiple (at least three) source positions between 3.3 ft and 49 ft from the first geophone for each array setup. Testing was typically conducted every 50 ft along the survey lines providing a 30% overlap between measurements for the 75 ft geophone array (i.e., 24 geophones at a 3.3 ft spacing). For survey Line E, I and J, the areas were too rocky and rough to utilize the landstreamer. Therefore, 48 geophones were installed at a 6.6 ft uniform spacing and coupled

to the ground via spikes. Source positions from 3.3 ft off each end and every 20 ft within the array (total of 17 source positions) were used with the 48 geophone array. The same 12 lb sledgehammer and shear beam were used to generate Love waves and 3 sledgehammer blows were recorded at each source position. Following the completion of one array setup, 24 geophones were rolled along the survey line (moved from the beginning of the survey line to the next section) while the rear 24 geophones remained in place. The testing was repeated for the new 48 channel array. This allows the development of a 2D profile along the survey line. A total of 4 array setups were completed along Line E and 1 array setup was used for Lines I and J.

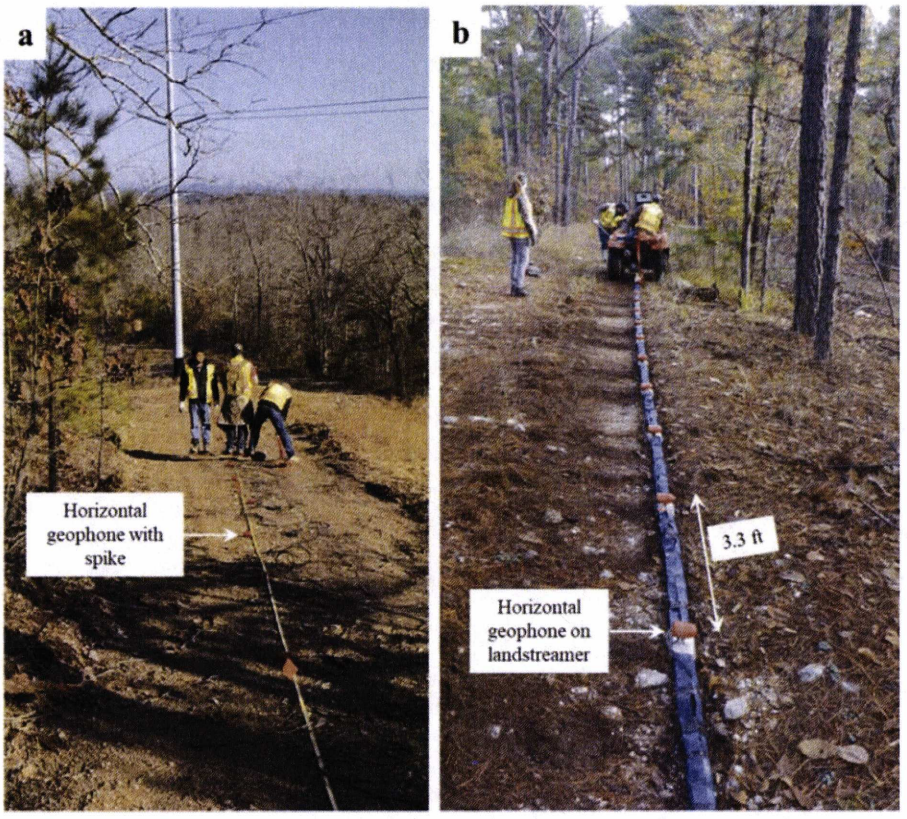


Figure 3- MASW testing at Hot Springs, Arkansas. a) Love type surface wave testing using geophones with spikes, b) Love type surface wave testing using a landstreamer system.

3.3 MASW Data Processing

The raw MASW data of each array setup was processed using the following steps:

- The time domain signals (time vs ground vibration amplitude) from 24 geophones are analyzed using the frequency domain beamformer (FDBF) method (Zywicki 1999) in Matlab in order to generate a dispersion curve for each array setup. An example dispersion curve is shown in Figure 4a.

- The maximum spectral peak in the frequency-wavenumber domain is picked automatically for each frequency to identify the surface wave velocity associated with each frequency (see white circles in Figure 4a).
- The dispersion data points picked from each source offset are combined using the multiple source offset technique to create a composite experimental dispersion curve for each array which provides redundancy and allows uncertainty to be quantified (see Figure 4b).
- The final experimental dispersion curve is identified for each station (see Figure 4b) by removing the data points related to higher modes, affected by near-field effects, or clearly not associated with the fundamental mode of surface wave propagation. However, the "normal" scatter of the dispersion data is left to allow quantification of uncertainty.
- An iterative inversion process within the Geopsy software package was used to invert the experimental dispersion curve in order to develop the shear wave velocity profile at each array location. For this purpose, the final experimental dispersion curve from MASW and the frequency associated with the peak HVSR were used as the inputs into the Geopsy software. Weighting factors of 0.8 and 0.2 were used for MASW and HVSR, respectively, in the joint inversion process. A layering ratio of 3 was selected for parameterization since depths to sharp velocity contrasts (i.e. bedrock) are of primary interest in this project. During the inversion process, over 200,000 trial Vs profiles were generated using a neighborhood algorithm during the inversion process to ensure the best fit was achieved between the theoretical and experimental dispersion curve. The goodness of fit between the experimental and theoretical dispersion curves was judged based on the value of the misfit parameter (collective squared error between experimental and theoretical dispersion curves) and by visual comparison of the experimental and theoretical dispersion curves.
- The median of the 1000 lowest misfit Vs profiles was taken as the final 1D Vs profile for each array setup (see Figure 4c).

This procedure was followed for all MASW array locations to develop the 1D Vs profile (Vs versus depth at the center of the geophone array) for each array setup.

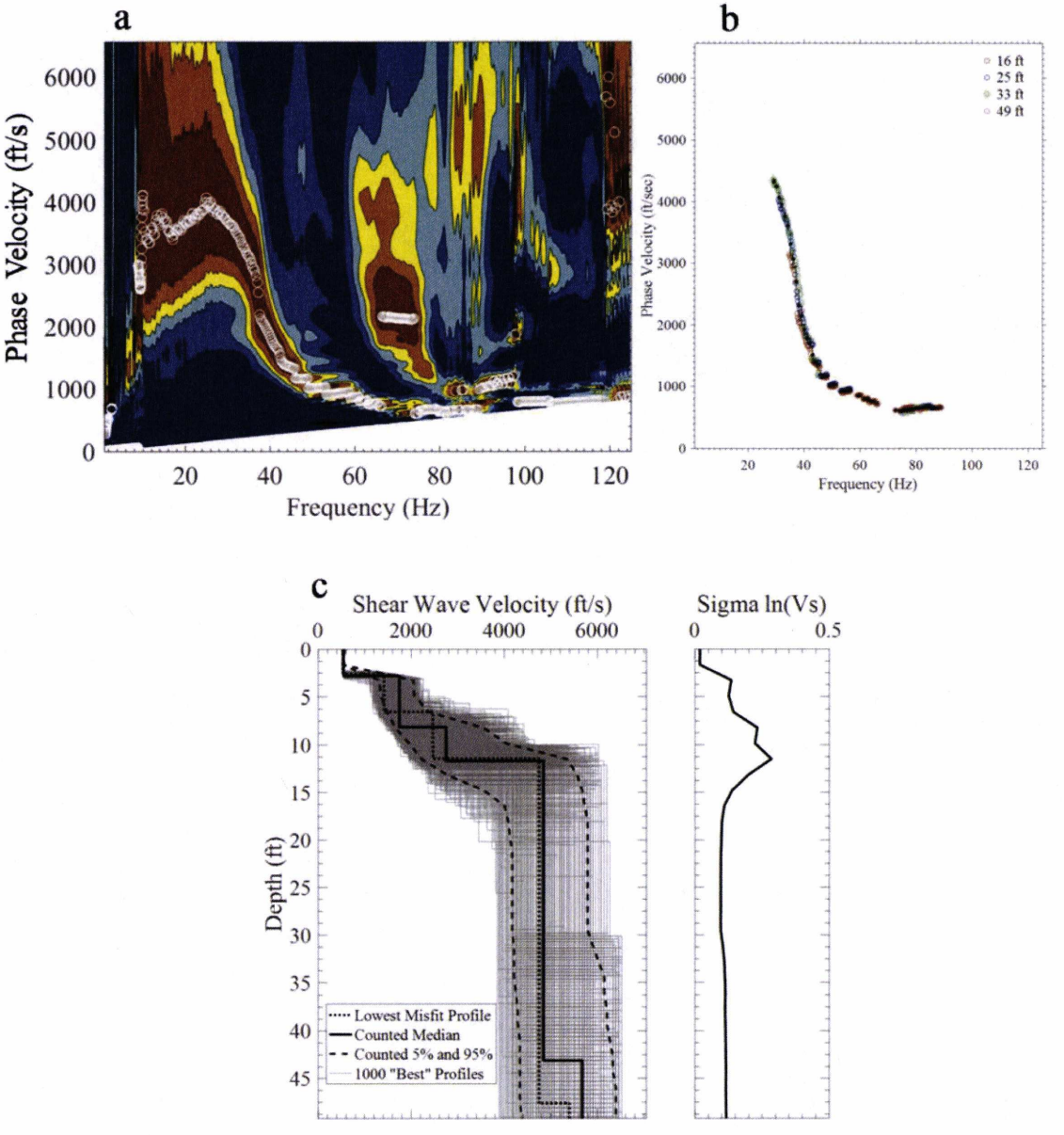


Figure 4- MASW data processing for station B14. a) Example raw experimental dispersion curve for one of the source offset, b) Final experimental dispersion curve used for inversion process, c) Median, lowest misfit, and 1000 best Vs profiles.

As aforementioned, the final output of the MASW testing is a shear wave velocity (Vs) profile presenting the variations in Vs of the geomaterials with depth. These profiles were used to develop a pseudo 2D Vs cross section for each MASW survey line. For this purpose, each shear wave velocity profile was first divided into 50 data points of depth versus Vs (1 ft depth interval between the data points). Then, all the shear wave velocity data points from different array setups along the MASW survey line were combined to generate a pseudo 2D Vs cross section of the subsurface materials using the software package Surfer. Surfer is a contouring

and mapping software which is used to create 2D and 3D maps. The Kriging method was used to interpolate between known 1D Vs profiles as the resulting cross section match best with the input data points. For data averaging, a Y (depth) spacing of 1 ft was selected for all MASW survey lines, so that it exactly matches the input shear wave velocity data points. In addition, the X spacing was selected to be equal to the distance between the MASW array setups (typically equal to 50 ft).

In order to determine the rippability of rock units using the Vs results from MASW, correlations between rippability and Vs are required to understand the quality of the subsurface material and the difficulty in removing the material. In this respect, the Caterpillar Handbook on Ripping (2000) provides the industry standard for rock rippability for different types of dozer/ripper combinations (D8, D9, D10, and D11 with multi or single shanks) based on the P-wave velocity of the rock materials. In the handbook, geologic rock type is divided into three groups (rippable, marginal rippable, and non-rippable rock units) based on their P-wave velocities. In this report, the chart provided for a D8R Caterpillar Dozer (see Figure 5) was used as a guide to determine the ranges of P-wave velocity (Vp) associated with the rippable, marginal rippable, and non-rippable rock materials. In general, the average of the values listed for sedimentary rocks in Figure 6 was used to determine the appropriate ranges. The Vs determined from MASW was converted to Vp using the Poisson's Ratio of 0.35 for very stiff soil to highly weathered rock (rippable), 0.3 for rippable rock, and 0.25 for marginal rippable and non-rippable rock. These values were determined based on the typical values of Poisson's Ratio for sedimentary rocks which were provided by Gercek et al., (2007). This allows the development of the rippable recommendations based on Vs which was measured in the field. It is the authors' belief that Vs provides a more accurate representation of the stiffness and rippability of rock formations as compared to Vp. While both are directly related to the modulus values of the rock, Vp is related to the compression modulus of the rock (i.e., the stiffness of the rock when a compression load is applied), whereas Vs is related to the shear modulus of the rock (i.e., the stiffness of the rock when a shearing load is applied). When considering the loads being applied during the ripping process, shearing and tensile loads tend to dominate the mechanics while very little compressive loads are being applied. Therefore, the ability of the rock to resist shearing loads is of more interest. Therefore, it is presumed that Vs would provide a better correlation than Vp. The original Caterpillar rippability charts were first developed several decades ago when geophysical methods that measure Vp (such as P-wave refraction) were the primary method of choice and Vs was much more difficult to measure in the field. As

a result, the use of Vp as a rippability measure has continued despite other measurements such as Vs from MASW being available and likely being more appropriate.

It should be noted that while seismic velocity such as Vp and Vs provide a good understanding of the rippability of rock units, caution should always be used as other factors including but not limited to anisotropy, fractures, abrasiveness, and thickness play a critical role in rock rippability. The rippability indexes provided in this report are provided as the authors' interpretations of the rock conditions given the available information.

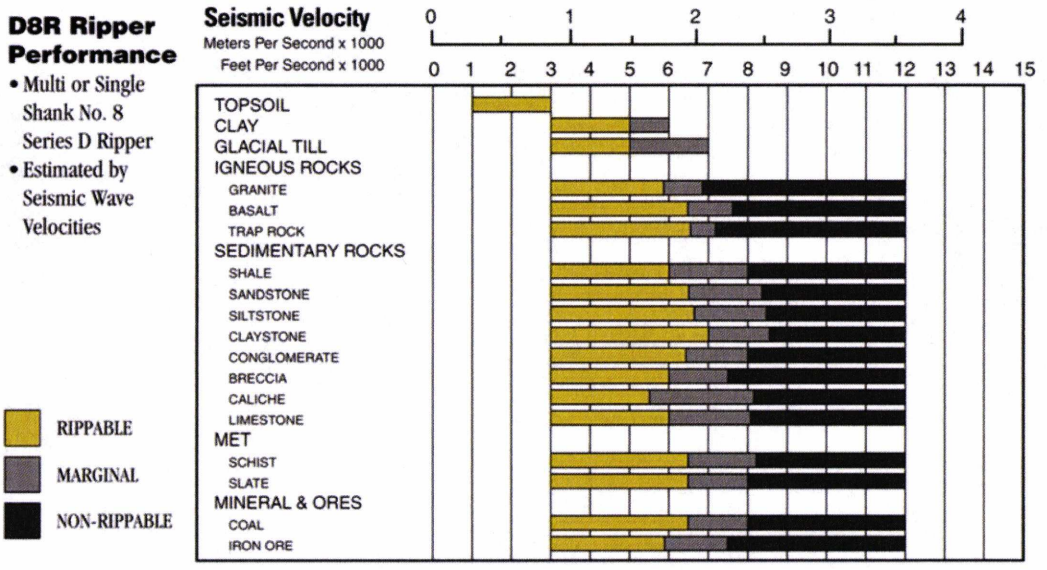


Figure 5- Rippability of rock materials based on the P-wave velocity for D8R ripper.

3.4 Horizontal to vertical spectra ratio (H/V)

The horizontal to vertical spectra ratio (HVSR) was popularized in 1989 by Nakamura. This method has been widely used for estimating sediment thickness and the fundamental frequency of sites in geotechnical engineering. This method is based on analysis of horizontal and vertical components of background noise. The method utilizes a single three-component sensor to record microtremors from the surface. The horizontal to vertical spectral ratio (H/V) is defined as the ratio between the Fourier amplitude spectra of the horizontal and vertical components. Typically, the geometric mean of the two horizontal components is used for calculation of horizontal to vertical spectral ratios. The final output of the H/V technique is a plot of H/V amplitude versus frequency. If there is a strong velocity contrast in the subsurface (e.g., an impedance ratio greater than approximately 2), a peak will form in the frequency-spectral ratio domain, whose frequency is presumed to be the fundamental site frequency or

period. Peak frequencies from multiple test locations can be combined together in map form to understand the spatial variations in bedrock depth along an alignment. It should be noted that in order to estimate depth to bedrock or other impedance contrast associated with an H/V peak, additional information about the average shear wave velocity of the soil deposits located above the impedance contrast is required.

3.5 HVSR Data Collection

HVSR measurements for ARDOT Job #60140 were performed using Nanometrics Trillium Compact seismometers as shown in Figure 6b. The broadband three-component seismometers have a flat response from 100 Hz to 20 sec. Each sensor was recorded using a Nanometrics Centaur Digitizer. The Centaur digitizer is a high resolution three-channel, 24-bit data acquisition system capable of recording at sample rates up to 5000 sps. The Centaur uses a GPS timing system to time stamp waveforms ensuring waveform records are synced between stations (Nanometrics 2017). In order to create contour maps of depth to bedrock across the site and obtain enough information regarding bedrock location at each cross section along the proposed highway alignment, more than 400 HVSR tests were conducted across the area. HVSR testing was performed with a minimum recording time of 16 minutes for each station. A plastic bucket was placed over the seismometer for HVSR testing to limit the unwanted noises from wind or rain during data recording, as shown in Figure 6a.

HVSR measurements were acquired in a grid pattern along some sections of the proposed highway alignment, where rock cuts are expected to be needed to reach the desired elevation of the roadway. Additionally, HVSR measurements were collected at the center of each MASW testing setup to reduce the uncertainties associated with the inversion process through the joint inversion of MASW and HVSR.

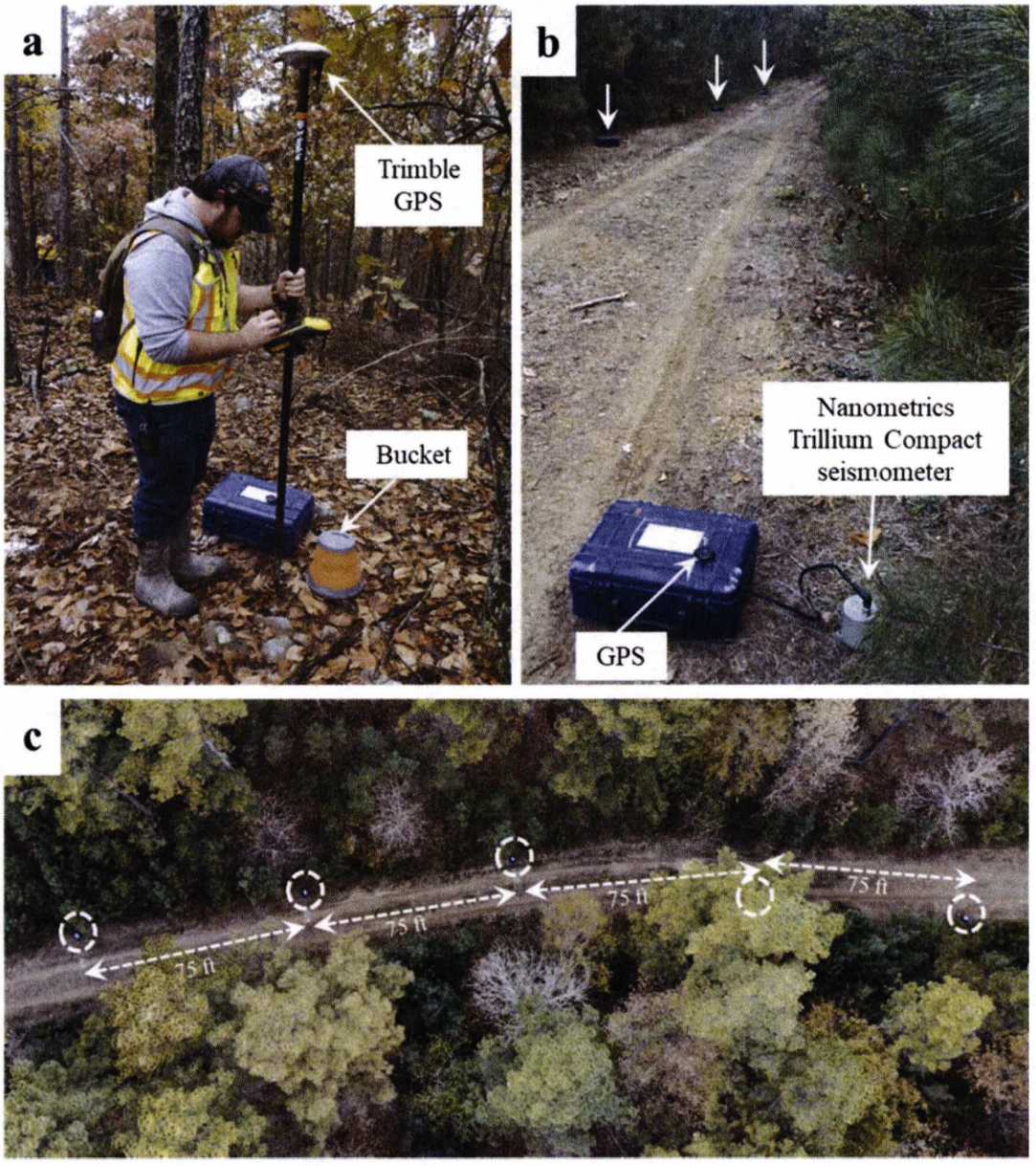


Figure 6- HVSR testing at Hot Springs, Arkansas. a) Seismometer placed at the desired location with a plastic bucket over it, b) Nanometrics Trillium Compact seismometer, c) HVSR stations placed along a section of a gravel road.

3.6 HVSR Data Processing

The raw HVSR data were processed in general accordance with SESAME (2004). The raw 16 minutes of microtremor data were divided into 2- or 4-minute time windows to allow for uncertainty in the HVSR results to be estimated. The Fourier amplitude spectra (FAS) of each component (Vertical, North and East) was estimated for each time window and smoothed using a Konno and Ohmachi smoothing filter (Konno and Ohmachi 1998). The geometric mean of the two horizontal (north and east) components FAS was computed and divided by the

vertical FAS. The mean HVSR was computed from the individual HVSRs from each time window and used to determine the frequency(s) associated with the maximum HVSR (i.e. the peak/peaks) for each testing location. If the peak(s) of the HVSR measurement meets the requirements of a true and reliable peak (SESAME 2004), then it was used for further processing to estimate depth to the sharp impedance contrast (i.e. depth to bedrock) of the site using the equation below.

$$H=(V_{s,avg}/4f) \quad (1)$$

In this equation, $V_{s,avg}$ is the average shear wave velocity of the materials above the sharp impedance contrast, H is the thickness of sediments above the sharp impedance contrast, and f is the frequency associated with the HVSR peak. The average shear wave velocity of materials above the sharp impedance contrast can be determined either from the MASW testing or it can be back-calculated from the boring information. In this report, the average shear wave velocity was determined using the information from the MASW testing. It should be mentioned that significant changes in subsurface materials (i.e., large changes in Vs of materials) within a tested grid can increase the uncertainty associated with the depths determined from HVSR. During the data analysis, every effort was made to separate geologic material types during analysis to ensure the most accurate depth estimates were made.

According to the HVSR results from the Hot Springs project, while all HVSR measurements have a clear high frequency peak ranging from 45-120 Hz, there are some locations where a second low frequency peak (10-30 Hz) is observed in HVSR plot that satisfies the requirements of a clear and reliable peak. An example HVSR plot with one clear high frequency peak and HVSR plot with a clear high frequency and a clear low frequency peak are shown in Figure 7a and b, respectively. For locations similar to that shown in Figure 7b (i.e., two HVSR peaks), the site has two major velocity contrasts. The first (high frequency) peak is typically associated with the stiff soil/rippable rock (weathered rock) or very stiff soil interface and the second (low frequency) peak is typically associated with the rippable/marginal rippable rock interface.

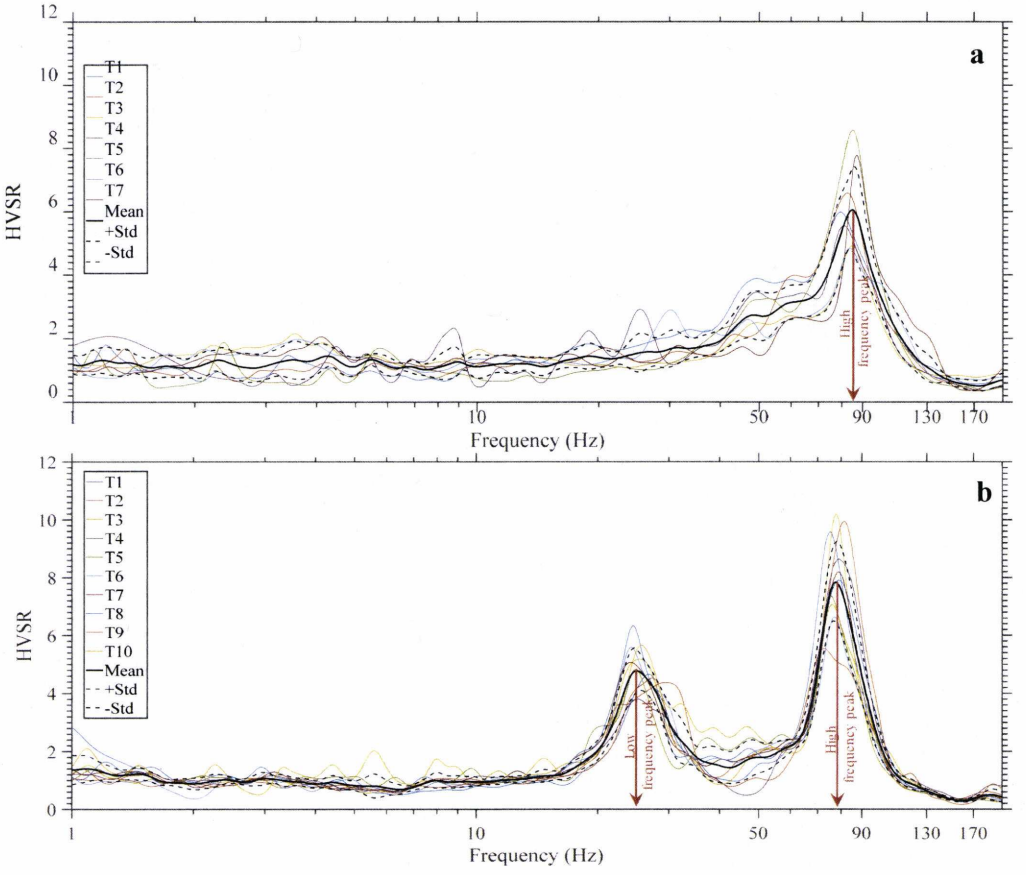


Figure 7- Example HVSR results for the Hot Springs project. a) HVSR plot with one clear high frequency peak, b) HVSR plot with a clear high frequency and a clear low frequency peak.

4 Results

4.1 MASW Results

4.1.1 Survey line A

Survey line A was conducted parallel to the proposed highway alignment (shown with yellow in Figure 8a) and was located on the left side of the proposed alignment between the Stations 778+00 and 785+00 on a private gravel road. A total of 15 MASW array setups with uniform spacing of 50 ft, as illustrated in Figure 8a, were performed along this survey line using the landstreamer system.

The pseudo 2D Vs cross section for the MASW survey line A is presented in Figure 8b along with station number and offsets along the top. Additionally, the range of shear wave velocity associated with soil, rippable rock, marginal rippable rock, and non-rippable rock are provided in this figure.

According to the variations of the Vs along this survey line, the subsurface materials consist of three main layers including a very thin rippable rock at shallow depths with an average Vs of 2450 ft/s, underlain by a marginal rippable rock with average Vs of 3850 ft/s, followed by a non-rippable rock with Vs higher than 4600 ft/s. The overburden thickness is found to be very thin (2-5 ft) for this survey line; however, it is not visible in this figure due to the averaging method that was used to create the pseudo 2D Vs cross section. The spatial variations of the overburden thickness across the area is presented later in the report based on the results of HVSR measurements. The estimated depth to the marginally rippable rock layer along this survey line is between 5-15 ft with the thicker ripperable rock being near the end of the survey line near Station 784+00. The depth to the non-rippable rock is estimated to be between 15-30 ft with shallower depths being located toward either end of the line. No borings are available along this survey line for comparison.

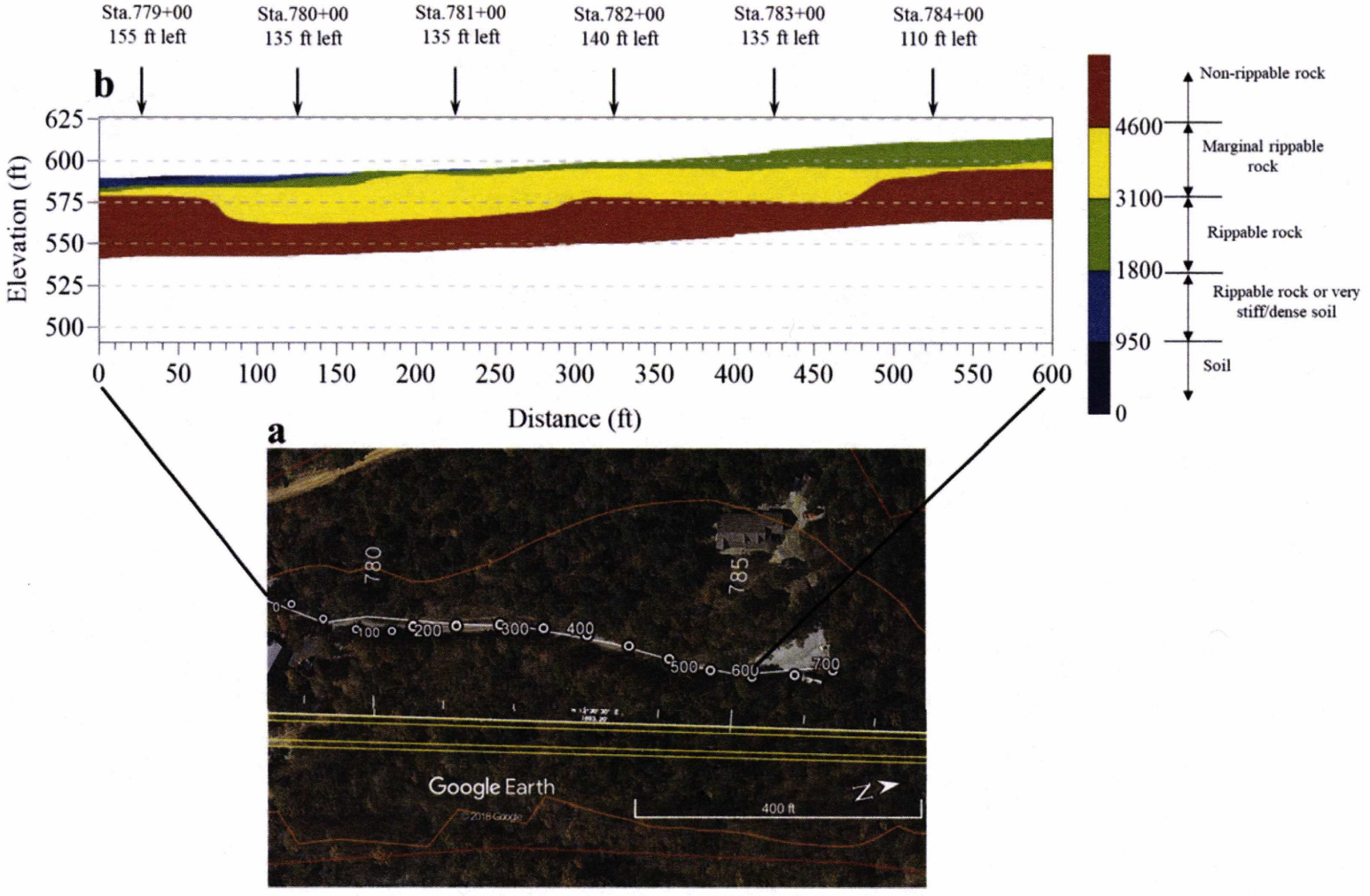


Figure 8- MASW survey line A. a) Location of the MASW survey line A along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line A along with the station numbers.

4.1.2 Survey line B

Shown in Figure 9a is the location of MASW survey line B along with the proposed highway alignment. MASW survey Line B includes 13 MASW setups and HVSR measurements spaced 50 ft apart, and was collected to the left of the proposed highway alignment between the Stations 802+00 and 803+00.

Presented in Figure 9b is the pseudo 2D Vs cross section for the MASW survey line B along with the drilling log from ARDOT BH6. From the figure, the subsurface layering of this survey line is comprised of five layers. This includes a very thin stiff/dense soil layer at the ground surface with average V_S of 735 ft/s (shown with dark blue), and a very stiff/very dense soil or a highly weathered (rippable) rock layer with average V_S of 1450 ft/s (shown with light blue), which correspond well with the weather shale in the boring BH6. These layers are underlain by a rippable rock layer with average V_S of 2360 ft/s (shown with green) and a marginal rippable rock layer with average V_S of 3800 ft/s (shown with yellow), which corresponds with a brown shale layer in boring BH6. The difference between the rippable and marginally rippable rock layering is presumed to be the degree of weather which is more significant for layers near the surface. The final layer in the cross section is a non-rippable rock layer (shown with red), which corresponds with the gray shale layer observed in boring BH6. The thickness of the layers varies slightly across the site with a thickness of the soil/highly weather rock layer being approximately 5-10 ft thick with the thickest locations near the middle and bottom of the slope. The depth to the marginally rippable rock layer is generally between 10 and 20 ft along the survey line. The non-rippable rock layer has the most variation in depth along the survey line and is estimated at 25-30 ft deep from a distance of 100-450 ft along the cross section. However, this layer dips below our maximum investigation depth (50 ft) from a distance of 450 ft to near the end of the survey line (appearing again near the end of the survey line).

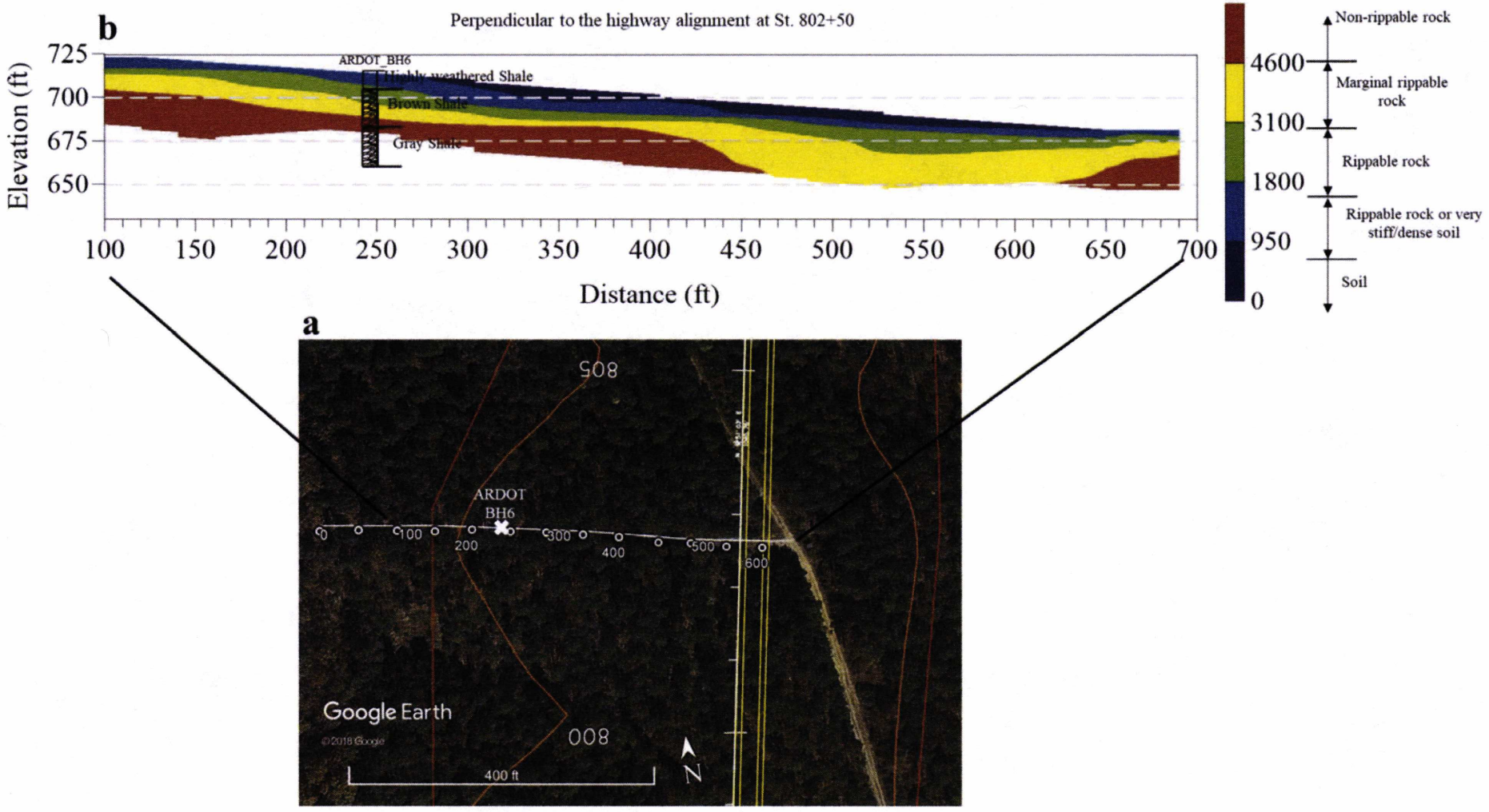


Figure 9- MASW survey line B. a) Location of the MASW survey line B along with the proposed highway alignment shown with yellow, b) The pseudo 2D V_S cross section for the survey line B.

4.1.3 Survey line C

Shown in Figure 10a is the location of MASW survey line C along with the proposed highway alignment and station number and offsets for the survey line. MASW survey line C was offset approximately 30 degrees from the proposed highway alignment with a total of 24 MASW setups spaced 50 ft apart. The starting point of MASW survey line C was located approximately 115 ft on the right side of Station 801+00 and the end point was located approximately 135 ft on the left side of Station 807+00. It should be noted that MASW survey line B intersects survey line C at Station 802+50 (approximate distance of 500 ft on survey line C).

The pseudo 2D Vs cross section for MASW survey line C is shown in Figure 10b along with station number and offsets. As shown in this figure, the subsurface layering of this survey line consists of five layers similar to those observed in survey line B. Items of interest in the survey line of the thicker soil deposits (approximately 15 ft thick) from Station 804+00 to 806+00 (distances 650 to 850 ft) along with the deeper depth (25 ft compared to 5-15 ft) to the marginally rippable rock layer from Station 803+50 to 805+00 (distances 600-750 ft). The depth to the non-rippable rock units also changes across the survey line with the depth from Station 800+50 to 804+00 (distances 250-650 ft) being between 10 and 15 ft deep. From Station 804+50 to the end of the survey line, the non-rippable rock unit is below the maximum depth of our measurements (50 ft). The subsurface materials identified at the intersection point of MASW survey line C and MASW survey line B (the end of MASW survey line B and approximate distance of 500 ft on survey line C) are in good agreement, as seen in Figure 9 and Figure 10.

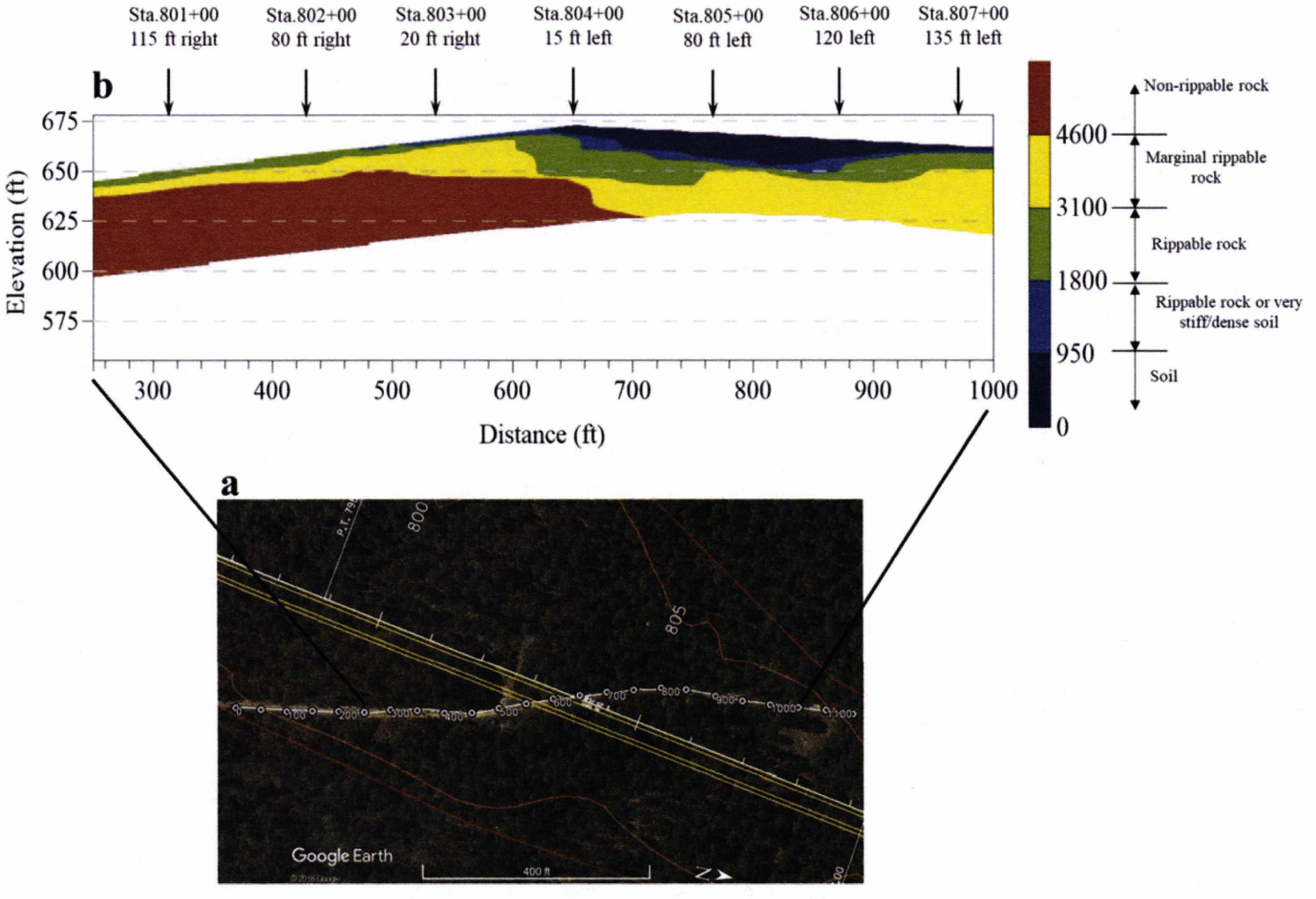


Figure 10- MASW survey line C. a) Location of the MASW survey line C along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line C along with the station numbers.

4.1.4 Survey line D

The locations of the MASW survey line D and the proposed highway alignment are presented in Figure 11a. The MASW survey line D was offset approximately 70 degrees from the proposed highway alignment (between the Stations 844+00 and 845+00) with a total of 18 MASW setups spaced 50 ft apart.

Presented in Figure 11b is the pseudo 2D Vs cross section for the MASW survey line D along with the station number and offsets along with the drilling log from ARDOT BH10. From the drilling log and geologic mapping, the subsurface consists of novaculite rock. The layering provided along the survey line is primarily associated with changes in weathering/fracturing within the Novaculite formation which influences the measured stiffness of the formation. The layering generally consists of a thin layer of very stiff/very dense soil or a highly weathered rock (rippable) at the ground surface and a rippable rock layer with depth ranging from 15-20 ft. A thicker deposit (10-15 ft compared to less than 5 ft) of very stiff soil is observed at approximately 500 ft along the survey line. The marginal rippable rock material is typically resolved approximately 20-25 ft below the surface. The non- rippable rock layer is estimated to be at a depth ranging from 30-45 ft across this survey line. However, this layer dips below our maximum investigation depth at the last 100 ft of the survey line (from 740-840 ft).

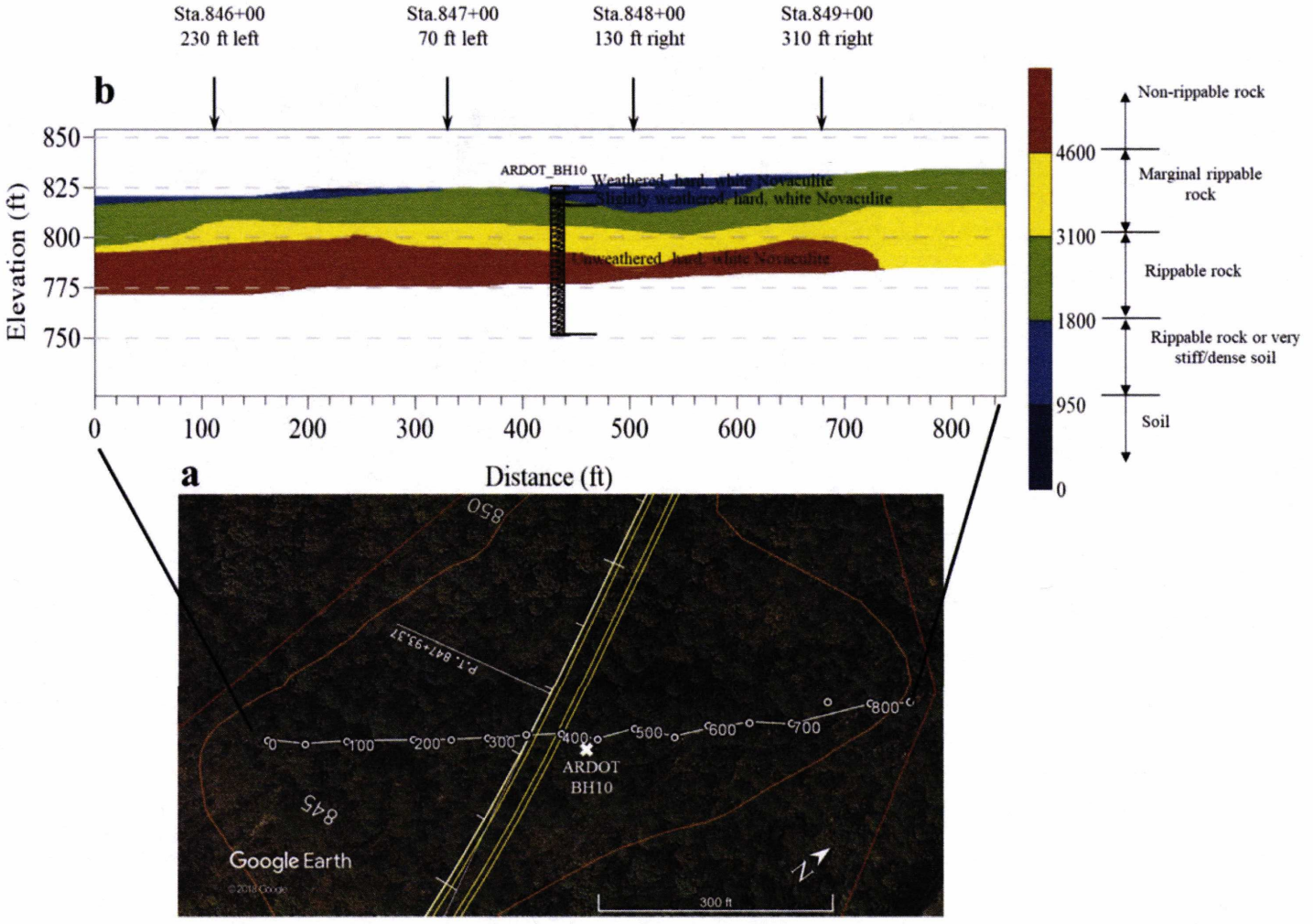


Figure 11- MASW survey line D. a) Location of the MASW survey line D along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line D along with the station numbers.

4.1.5 Survey line E

The MASW survey line E was offset approximately 60 degrees from the proposed highway alignment, as seen in Figure 12a, and was located between the Stations 845+00 and 850+00. This survey line includes 15 MASW setups and HVSR measurements along a steep slope.

The pseudo 2D Vs cross section for the MASW survey line E along with the station number and offsets along with drilling log from ARDOT BH8 and BH9 are presented in Figure 12b. As shown in this figure, the subsurface layering consists of a very stiff/very dense soil or a highly weathered rock layer from the ground surface to a depth ranging from 4-8 ft, that matches the sandstone boulder layer from the boring logs. This layer is underlined by a rippable rock layer from the bottom of the previous layer to a depth ranging from 8-46 ft, which corresponds well with a tan sandstone layer from BH8 and BH9. This is underlain by a marginal rippable rock layer which corresponds to a gray shale/brown sandstone layer. Most of the rock units under this survey line are comprised of rippable and marginal rippable rock layers up to a depth of 50 ft, which was the maximum depth resolved with MASW testing.

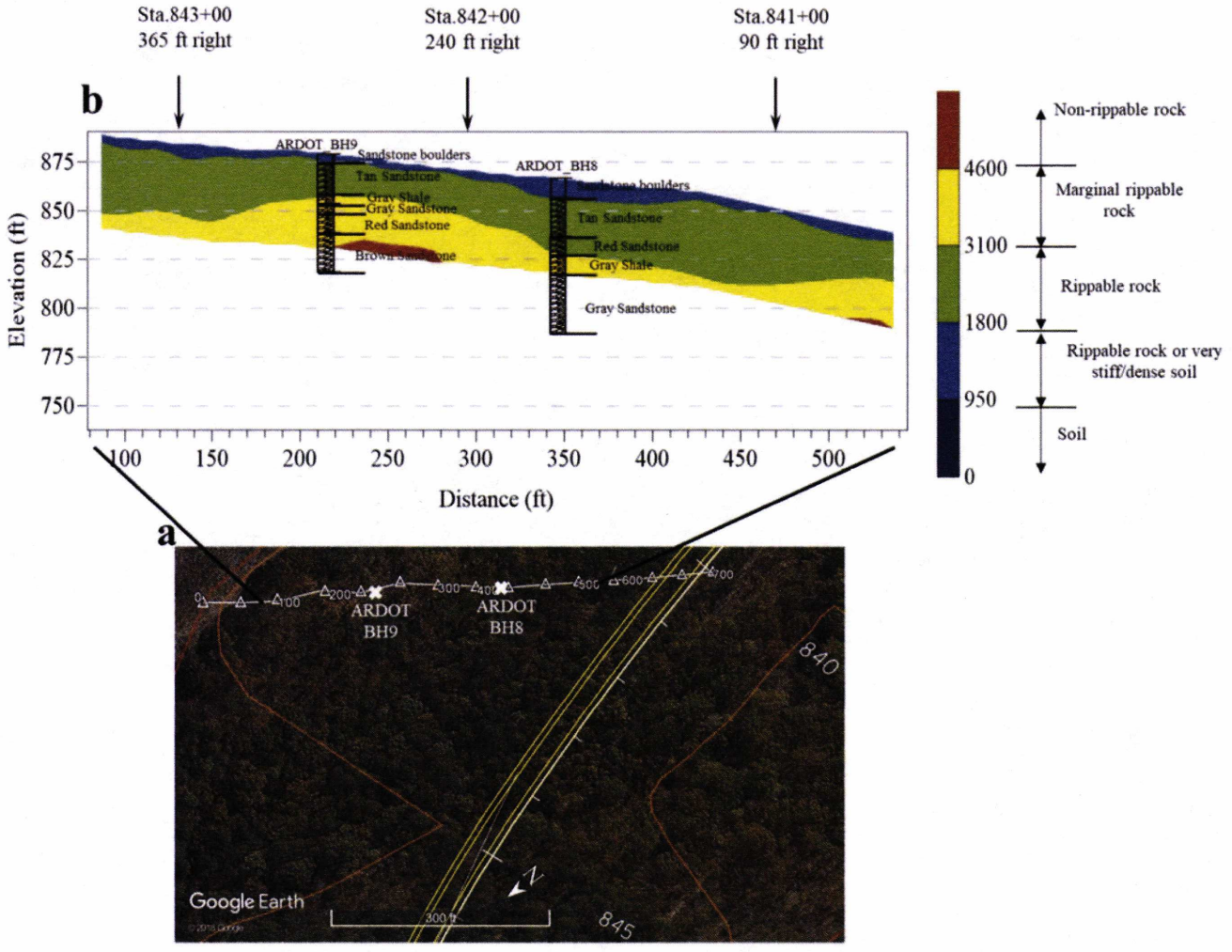


Figure 12- MASW survey line E. a) Location of the MASW survey line E along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line E along with the station numbers.

4.1.6 Survey line F

The locations of the MASW survey line F along with the proposed highway alignment are presented in Figure 13a. The MASW survey Line F was conducted approximately 285 ft to the left of the proposed highway alignment along a steep slope, between the Station 843+00 and 846+00, as shown in Figure 13a.

The pseudo 2D Vs cross section for the MASW survey line F along with the station number and offsets is shown in Figure 13b. Examining the variations of the Vs across this survey line, the subsurface materials include four layers of a very stiff/very dense soil or a highly weathered rock, a rippable rock layer with a thickness between 10-25 ft, a marginal rippable rock layer, and a non-rippable rock layer. The non-rippable rock layer is only observed from 0-80 ft across the survey line, as seen in Figure 13b. This layer dips below the maximum investigation depth (50 ft) towards the bottom of the slope (i.e., the last 120 ft of this survey line).

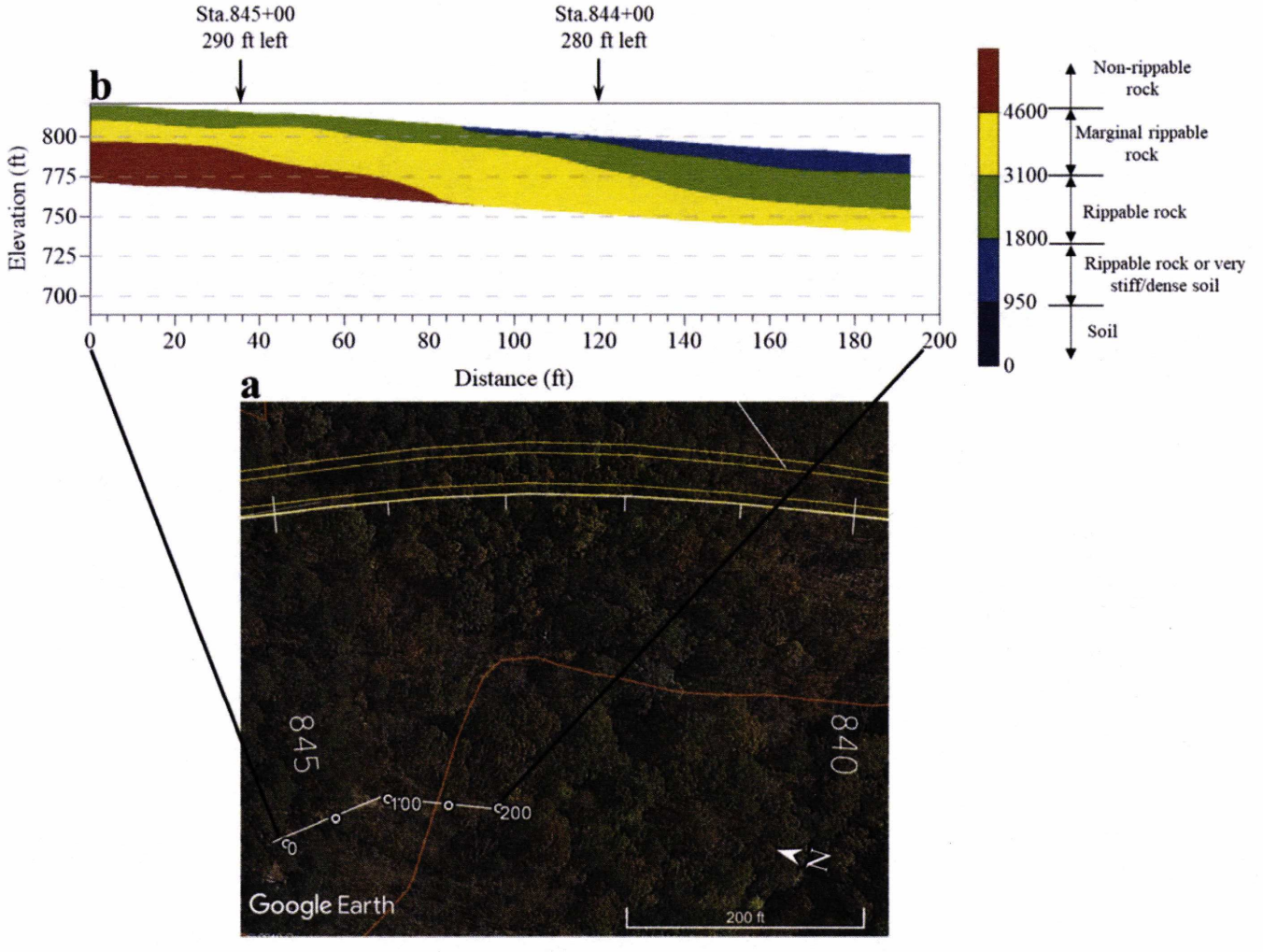


Figure 13- MASW survey line F. a) Location of the MASW survey line F along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line F along with the station numbers.

4.1.7 Survey line G

Presented in Figure 14a, is the location of the MASW survey line G along with the proposed highway alignment. Survey line G, which was located between Stations 832+00 and 837+00, consists of 16 MASW setups (G1-G16) with uniform spacing of 50 ft between them.

The pseudo 2D Vs cross section of the survey line G is shown in Figure 14b with the station number and offsets. Three layers make up the subsurface up to 50 ft deep including: a very stiff/very dense soil or a highly weathered rock layer at the ground surface, followed by a rippable rock layer up to a depth varying from 15-50 ft, underlain by a marginal rippable rock layer. Additionally, the majority of the rock units of the second half of the survey line (from 450 to 750 ft) are considered to be potentially rippable up to 50 ft deep.

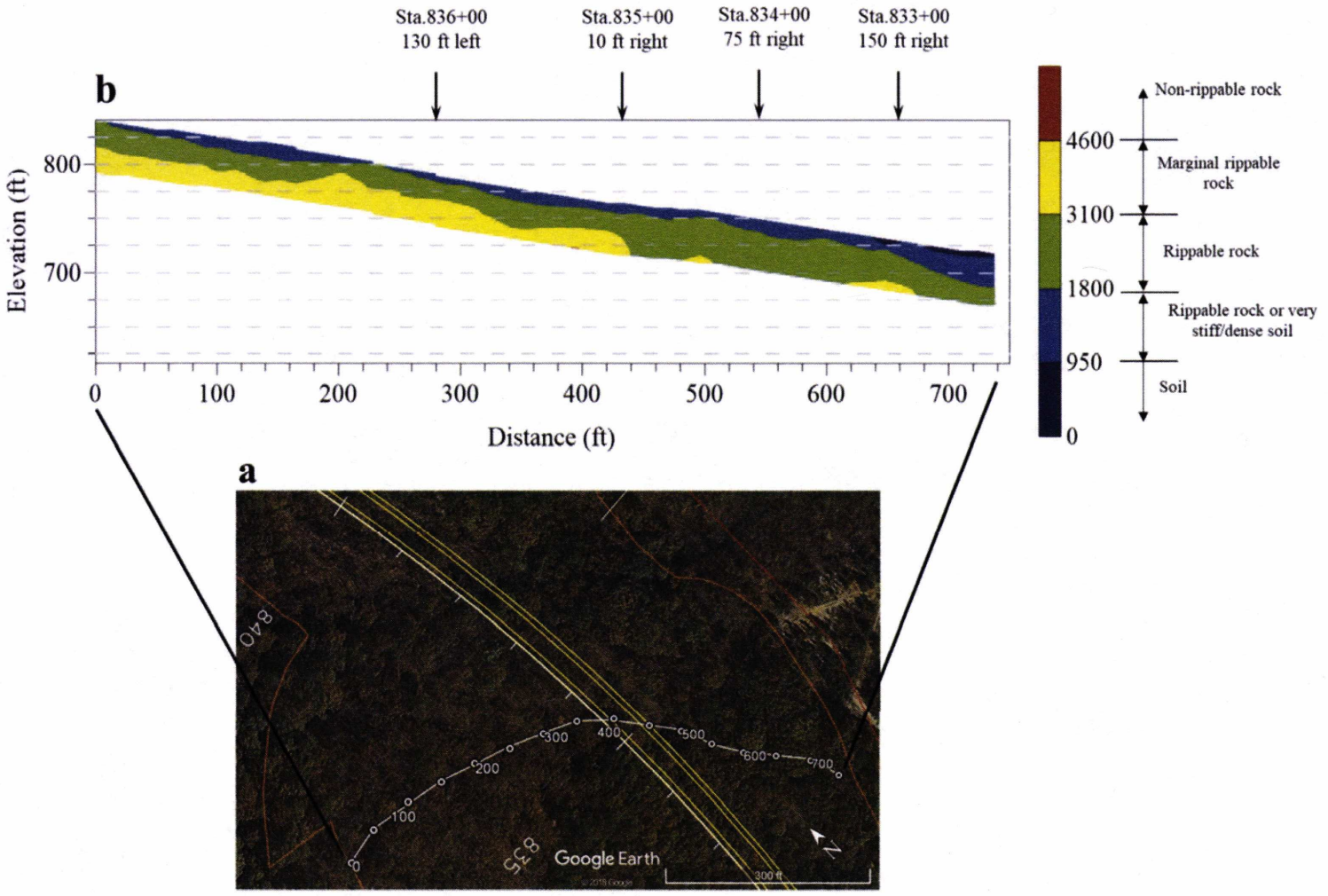


Figure 14- MASW survey line G. a) Location of the MASW survey line G along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line G along with the station numbers.

4.1.8 Survey line H

In Figure 15a, the location of the MASW survey line H along with the proposed highway alignment is shown. Survey line H was conducted almost parallel to the proposed highway alignment and was located between Stations 832+00 and 838+00 with a total of 13 MASW setups spaced 50 ft apart.

Presented in Figure 15b is the pseudo 2D Vs cross section for the MASW survey line H along with station number and offsets. Similar to the MASW survey line G, the subsurface materials of the MASW survey line H is comprised of three layers which include a very stiff/very dense soil or a highly weathered rock layer at the ground surface, a rippable rock layer, and a marginal rippable rock layer. In terms of rippability, the majority of the rock units of this survey line are estimated to be rippable or marginally rippable. This indicates that relatively weaker rock units exist at this survey line up to 50 ft deep compared to that of the other MASW survey lines.

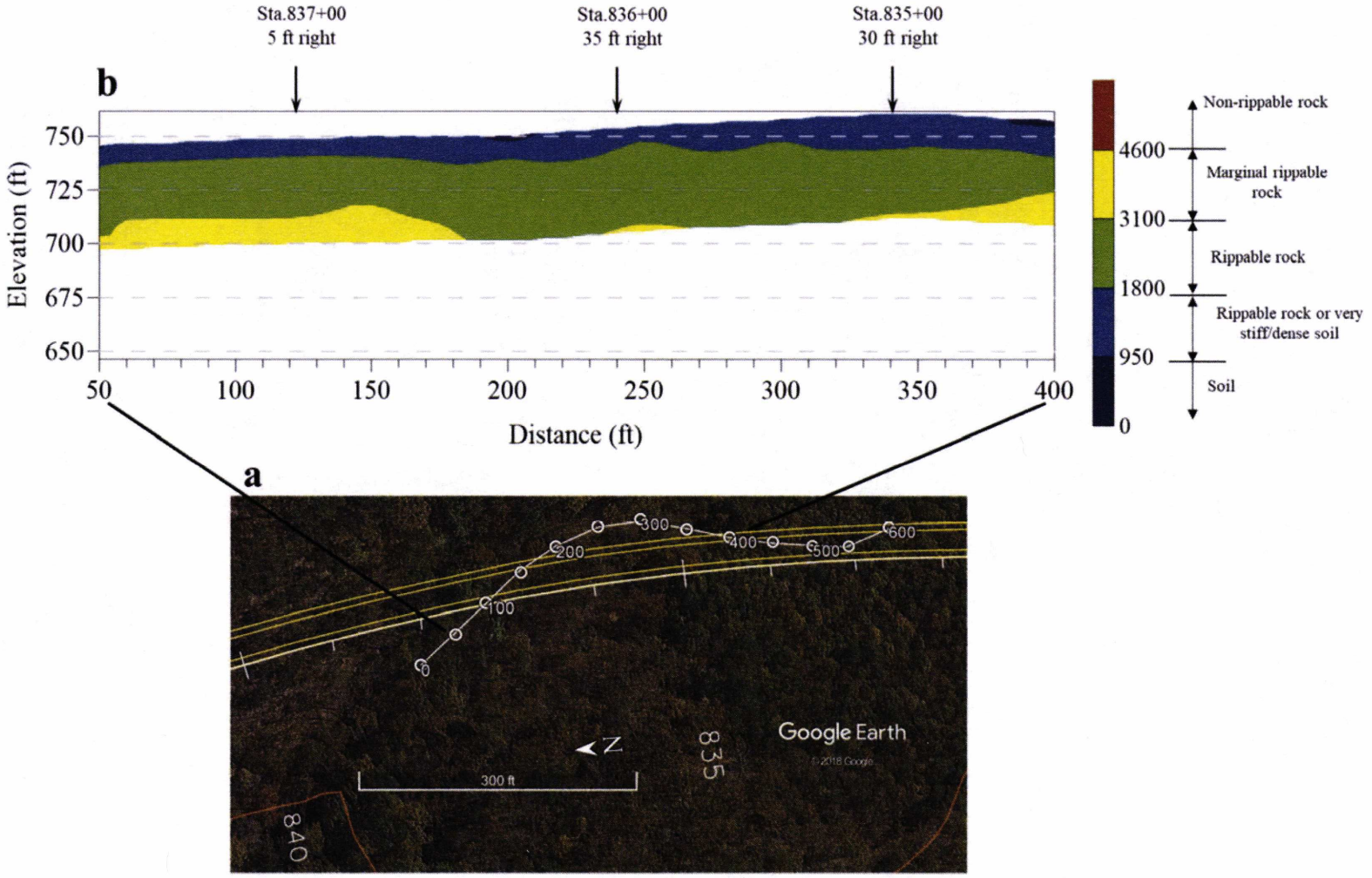


Figure 15- MASW survey line H. a) Location of the MASW survey line H along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line H along with the station numbers.

4.1.9 Survey line I

In Figure 16a, the location of the MASW survey line I along with the proposed highway alignment is shown. Survey line I was conducted at the edge of the proposed right of way and was located near Stations 871+00. This survey line, which was located on top of the ARDOT BH10, consisted of one MASW setup with 48 horizontal geophones with uniform spacing of 6.6 ft.

Shown in Figure 16b is the pseudo 2D Vs cross section for the MASW survey line I along with the ARDOT BH10. Two layers make up the subsurface up to 50 ft including a very stiff/very dense soil or a highly weathered rock unit that matches with the Gray silt with Chert fragments layer from the boring log. This layer is between 15-20 ft thick across the survey line. A rippable rock layer that corresponds well with the Gray and Brown Chert with interbedded Siltstone layer from the boring log underlies the Gray silt layer. According to the pseudo 2D cross section, all the materials of this survey line up to 50 ft deep are expected to be rippable.

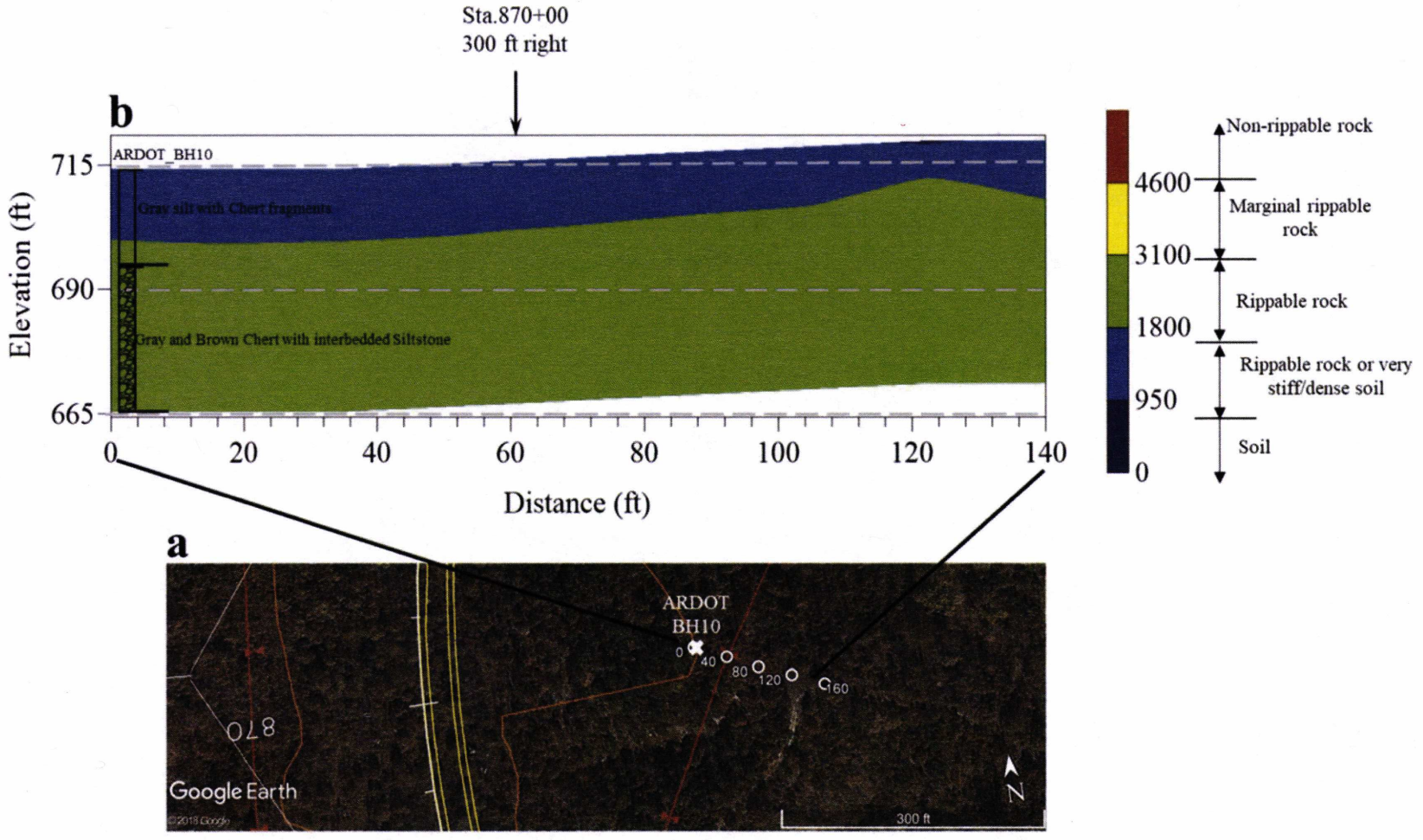


Figure 16- MASW survey line I. a) Location of the MASW survey line I along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line I along with the station numbers.

4.1.10 Survey line J

In Figure 17a, the location of the MASW survey line J along with the proposed highway alignment are shown. Survey line J was conducted at the edge of the proposed right of way and was located between the Stations 876+00 and 878+00. The MASW survey line J was conducted on top of the ARDOT BH11. MASW testing configuration consisted of one MASW setup with 48 horizontal geophones with uniform spacing of 6.6 ft.

The pseudo 2D Vs cross section for MASW survey line J along with the ARDOT BH11 are shown in Figure 17b. Similar to MASW survey line I, this survey line also consists of two layers: a very stiff/very dense soil or a highly weathered rock unit that matches very well with the Gary silt with Chert fragments layer from ARDOT BH11 and a rippable rock unit that corresponds very well with the Gray and Brown Chert with interbedded Siltstone layer from ARDOT BH11. The Gary silt layer is between 10-15 ft thick across the survey line. All the rock units of this survey line are considered to be rippable up to 50 ft deep.

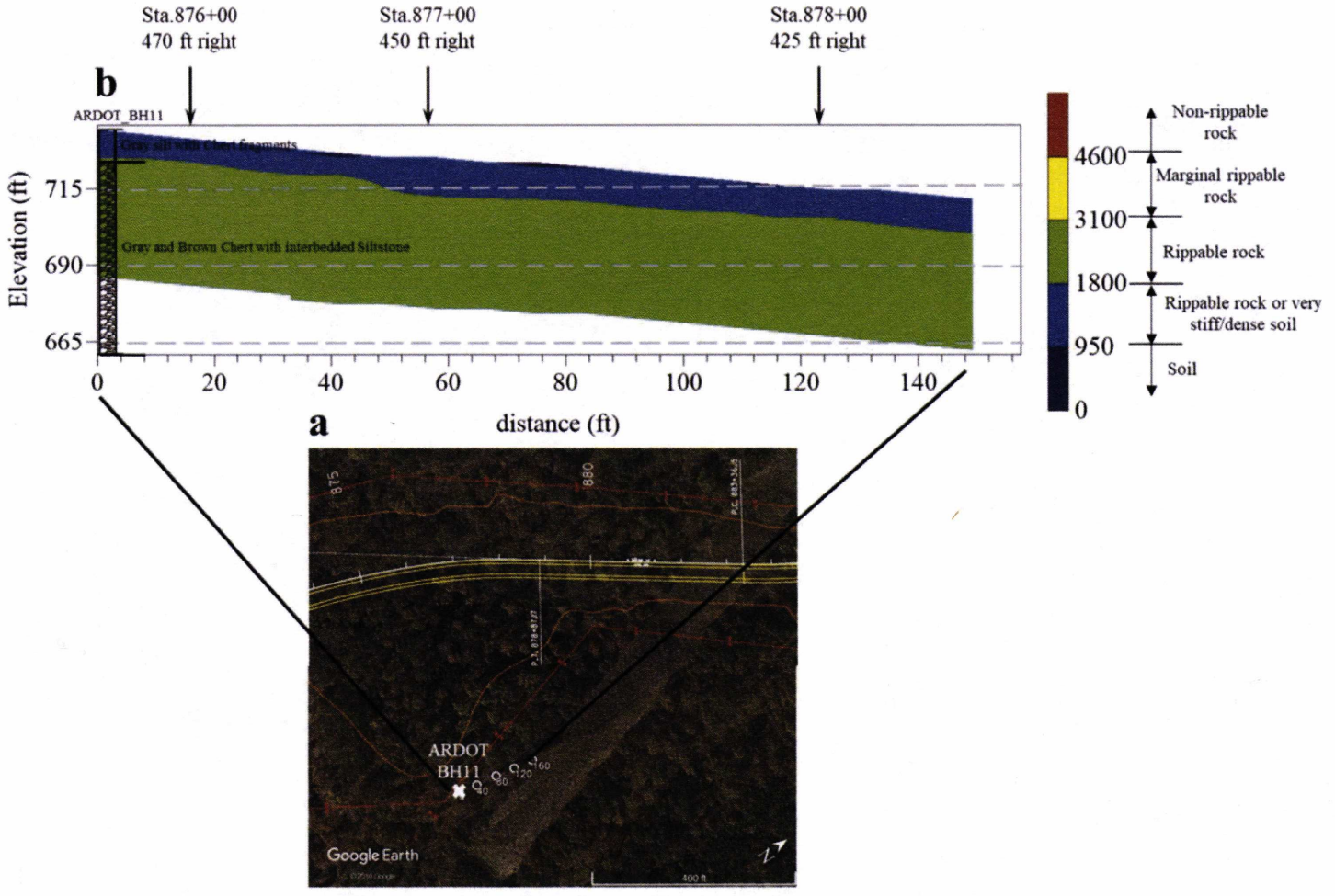


Figure 17- MASW survey line J. a) Location of the MASW survey line J along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line J along with the station numbers.

4.1.11 Survey line K

The survey line K was conducted along a gravel road on Promise Land Drive with a total of 21 MASW setups located between the Stations 691+00 and 695+00, as shown in Figure 18a. MASW testing was performed using a landstreamer system with uniform spacing of 50 ft between the MASW array setups.

The pseudo 2D Vs cross section for the survey line K is shown in Figure 18b along with the station number and offsets along with drilling logs from ARDOT BH1, BH2, and BH3. Similar to survey line D, the subsurface consists mainly of Novaculite (as observed from the boring logs) with varying levels of weathering/fracturing. The layering along the cross section generally consists of less than 5-10 ft of soil, followed by a rippable rock layer that extends to between 20-30 ft below the surface. This is underlain by an approximately 5 ft thick marginally rippable layer followed by a non-rippable rock unit which is present throughout the entire survey line.

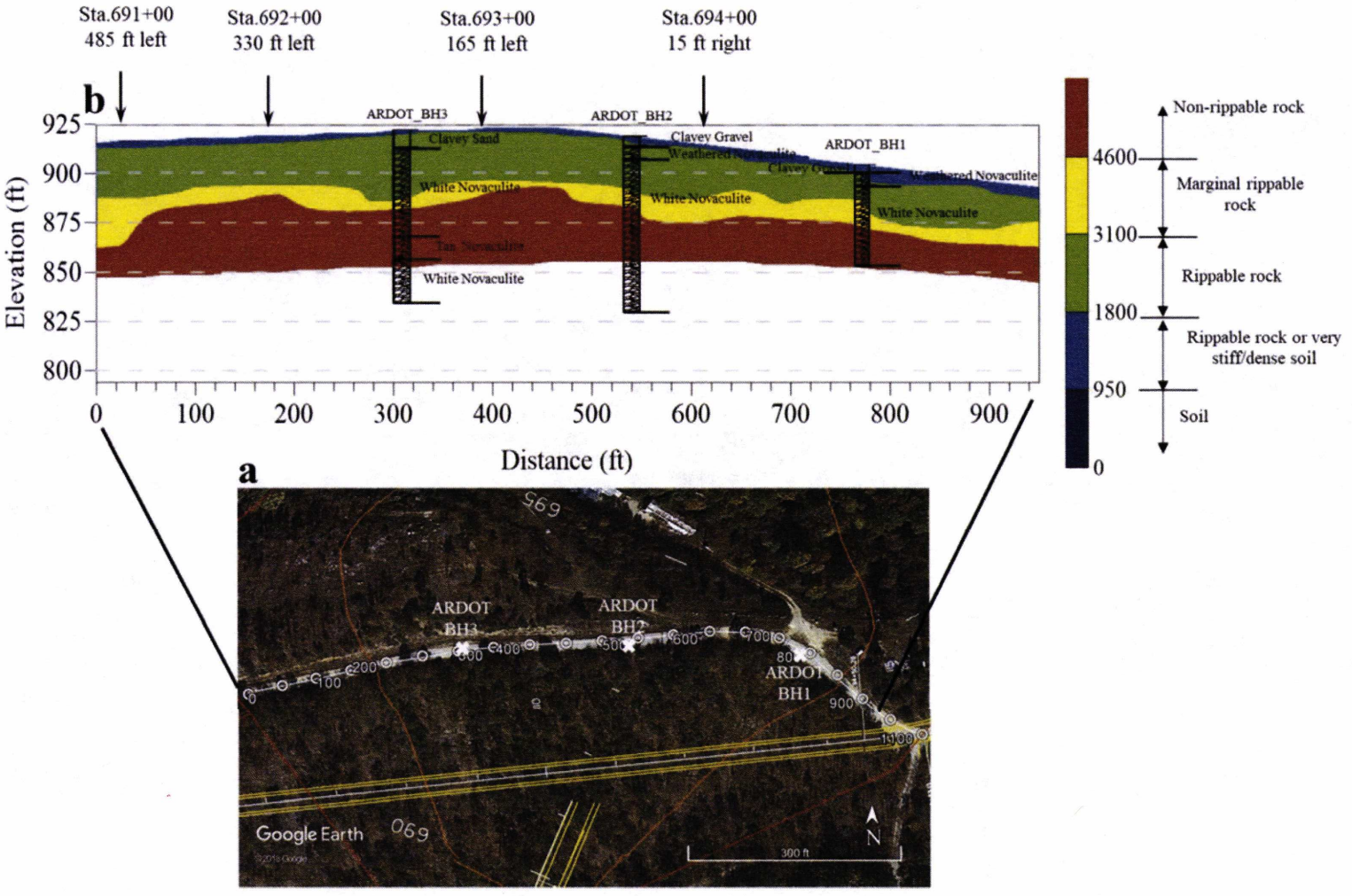


Figure 18- MASW survey line K. a) Location of the MASW survey line K along with the proposed highway alignment shown with yellow, b) The pseudo 2D Vs cross section for the survey line K along with the station numbers.

4.2 HVSR results

The results from the HVSR measurements (peak frequencies) and Eq. 1 are used to create contour maps showing the variations in depth to the first and second impedance contrasts across the areas tested. For the project area, almost all of the HVSR measurements exhibited a clear and reliable high frequency peak (first impedance contrast), which indicates the presence of a major impedance contrast near to the ground surface (i.e. weathered rock). However, the low frequency peak (second impedance contrast), which indicates the presence of a deeper impedance contrast, was only observed for some of the HVSR measurements. The lack of a low frequency peak at a particular location does not necessarily indicate the lack of a second strong impedance contrast below the surface as the weathering at some locations may slowly change with depth, which does not result in a clear impedance contrast that can be measured using HVSR. In addition, the resolution of a second lower frequency HVSR peak is less consistent than the resolution of a higher frequency HVSR peak making it less likely to observe a lower frequency HVSR peak at all locations.

All the HVSR measurements conducted for ARDOT Job #R60140, which includes more than 400 measurements, were divided into four zones as shown in Figure 19 below:

- Zone I: Stations 689+00 to 695+00.
- Zone II: Stations 779+00 to 806+000.
- Zone III: Stations 832+00 to 850+00.
- Zone V: Stations 869+00 to 879+00.

As mentioned previously, HVSR measurements were only performed at locations where significant excavation is expected for the highway project.

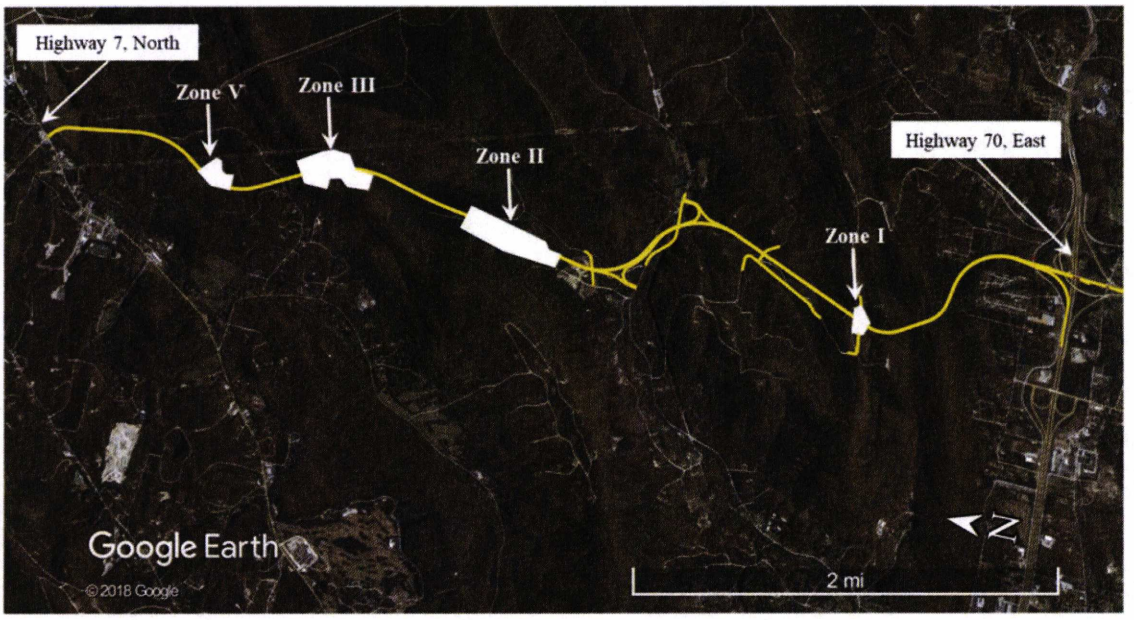


Figure 19- Zones of HVSR testing at Hot Springs site.

4.2.1 Zone I

4.2.1.1 High frequency peaks

Shown in Figure 20 are the results of high frequency HVSR peaks for Zone I, which was located between Stations 689+00 and 695+00. In Figure 20a, the locations of the HVSR measurements that exhibited a clear and reliable high frequency peak (first impedance contrast) are shown with a white circle along with their peak frequency in Hz. Additionally, the contour map of depth to the first (shallowest) impedance contrast for this zone is shown in Figure 20b.

As seen in Figure 20a, all the HVSR measurements exhibited a high frequency peak ranging between 36-90 Hz. Depth to the first impedance contrast, which is related to the overburden thickness, varies between 2-6 ft across the area, as shown in Figure 20b.

4.2.1.2 Low frequency peaks

The results of low frequency HVSR peaks for Zone I are presented in Figure 21. In Figure 21a, the locations of the HVSR measurements are shown with a circle along with their peak frequency in Hz. In this figure, the white circles show the HVSR stations with a clear low frequency peak (second impedance contrast), whereas the red circles show the HVSR stations without a clear and reliable low frequency peak. As seen in this figure, the majority of the HVSR measurements exhibited a low frequency peak ranging from 11-39 Hz. Additionally, the contour map of depth to the second (deeper) impedance contrast for this zone is shown in Figure 21b. From the figure, depth to the second impedance contrast, which corresponds to a weathered (rippable) rock layer, varies between 20-60 ft across the area.

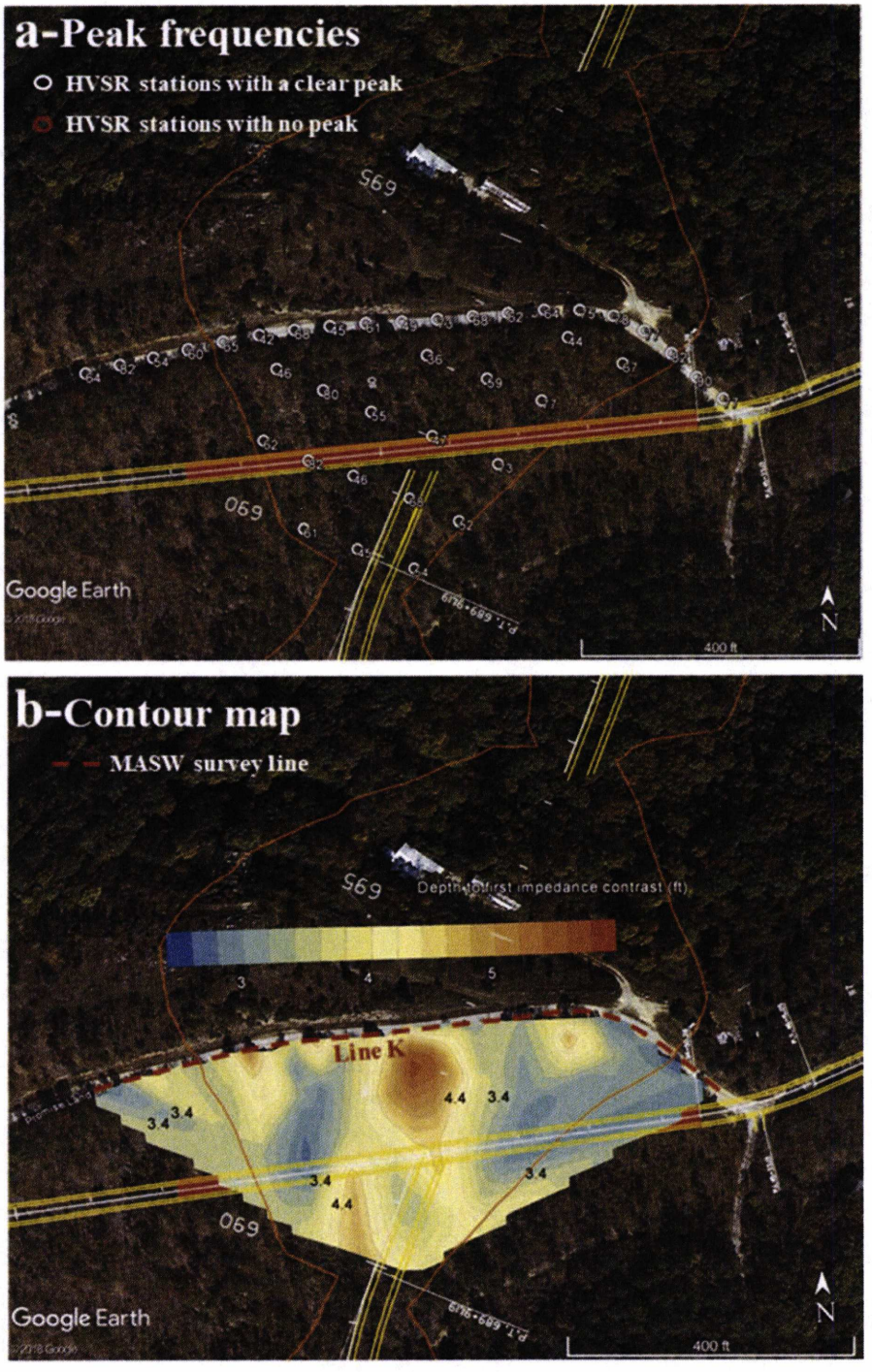


Figure 20- Results of high frequency HVSR peaks for Zone I. a) HVSR testing locations shown with circles (white for locations with a clear peak and red for locations with no peak) along with the values of peak frequencies in Hz, b) Contour map of depth to the first impedance contrast in ft.

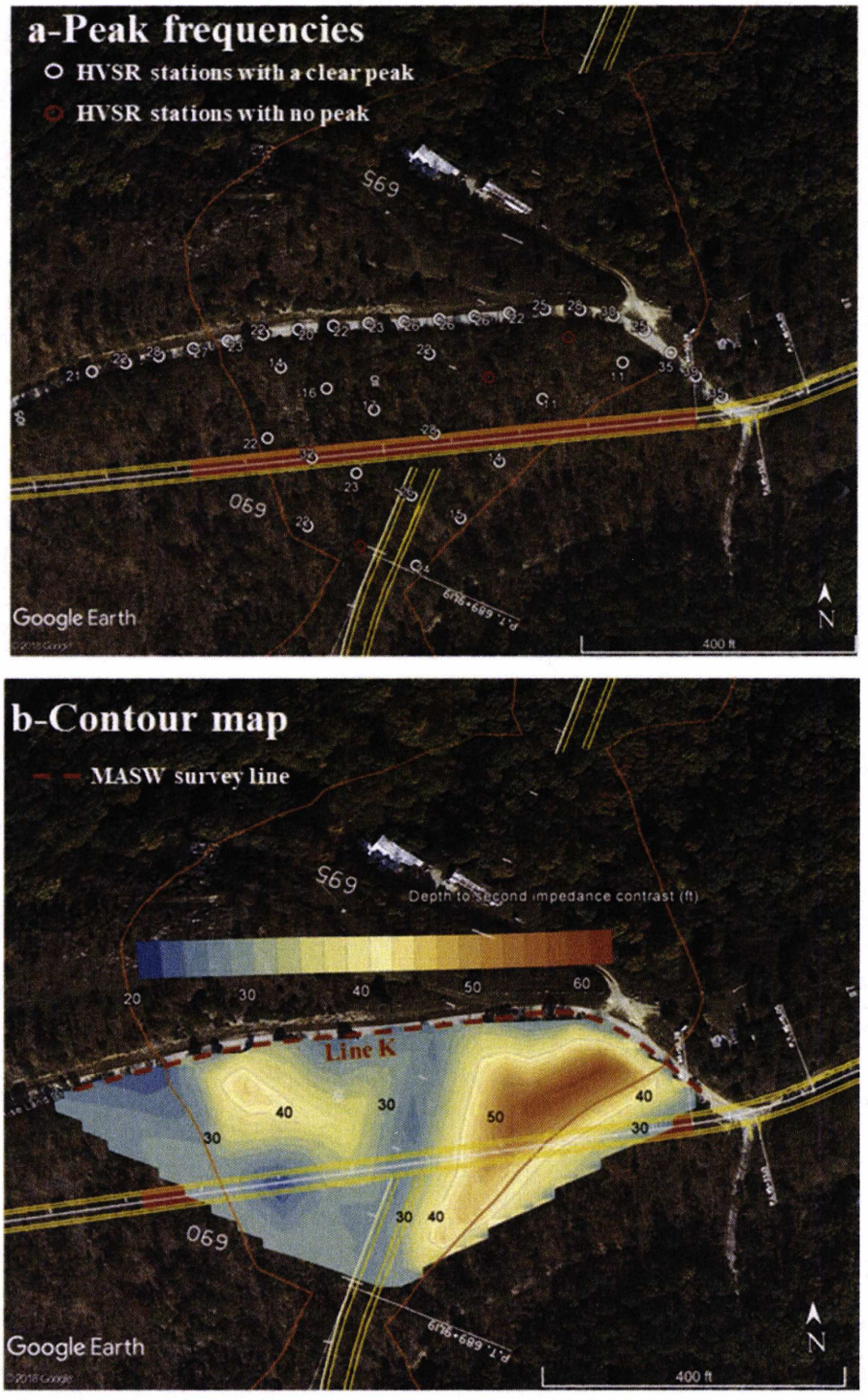


Figure 21- Results of low frequency HVSR peaks for Zone I. a) HVSR testing locations shown with circles (white for locations with a clear peak and red for locations with no peak) along with the values of peak frequencies in Hz, b) Contour map of depth to the second impedance contrast in ft.

4.2.2 Zone II

4.2.2.1 High frequency peaks

Extensive HVSR measurements were conducted for Zone II, which was located in a large area between the Stations 779+00 and 806+000. Shown in Figure 22a and 22b are the locations of the HVSR measurements for Zone II with their peak frequency and a contour map of the depth to the first impedance contrast for the area, respectively. The majority of the HVSR measurements in this zone have a clear and reliable high frequency peak ranging between 35-97 Hz, as seen in Figure 22a. Depth to the first impedance contrast is consistent in this zone ranging from 1-5 ft. This depth corresponds to the overburden thickness across the area.

4.2.2.2 Low frequency peaks

Presented in Figure 23 are the results of low frequency HVSR peaks for Zone II. The locations of HVSR measurements are shown with a circle in Figure 23a along with their peak frequency in Hz. The white circles show the HVSR stations with a clear low frequency peak (second impedance contrast), whereas the red circles show the HVSR stations without a clear and reliable low frequency peak. According to Figure 23a, while more than half of the HVSR stations have a low frequency peak ranging from 21-49 Hz, no low frequency peak was observed for the rest of the stations which are shown with red circles in Figure 23a. As seen in Figure 23a, the majority of the stations with no low frequency peak are located in two sections: 1) from Stations 791+00-795+00 and 2) from Stations 801+00-805+00. The depth to the impedance contrast for the contour map is interpolated in those areas based on the available measurements as a result, the accuracy in those areas is diminished compared to areas where measurements are more closely spaced.

Information from the HVSR stations with a clear and reliable low frequency peak was used to generate a contour map of depth to the second impedance contrast for Zone II and the results are shown in Figure 23b. For this zone, the second impedance contrast, which is related to a weathered rock layer, is located at a depth ranging from 12-28 ft as seen in Figure 23b.

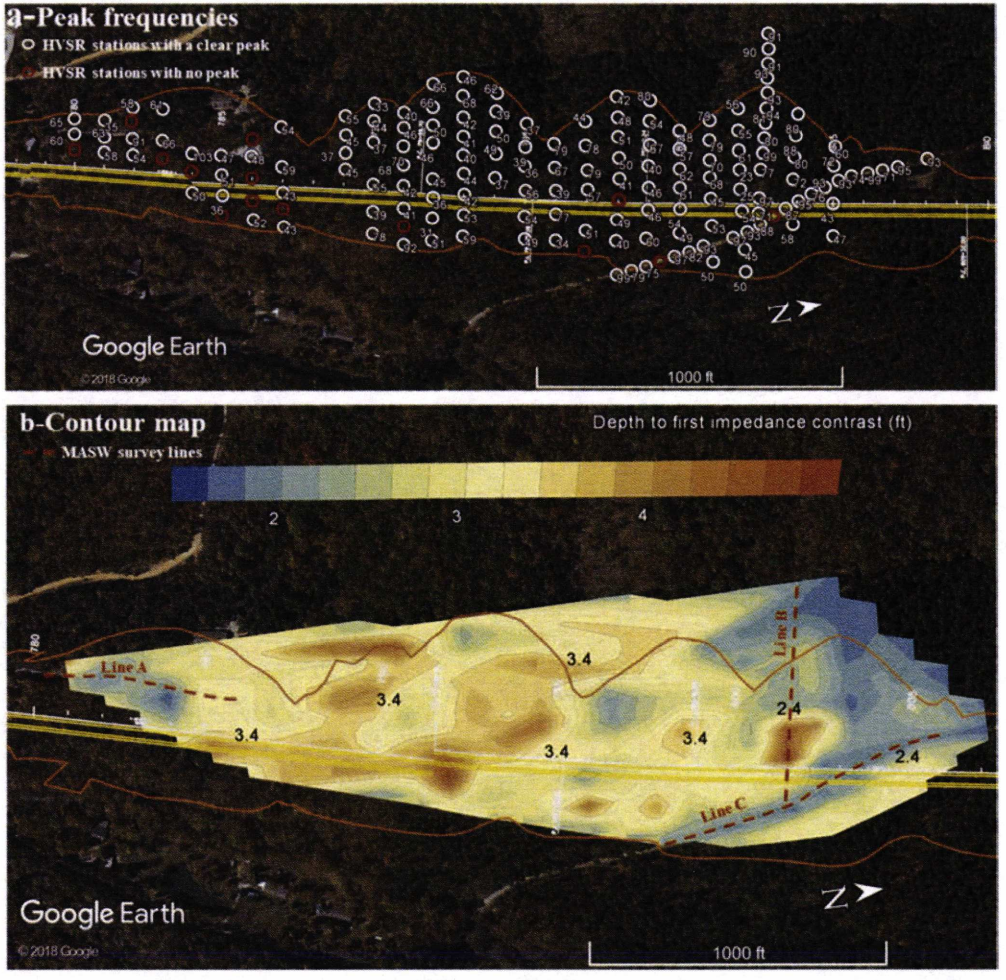


Figure 22- Results of high frequency HVSR peaks for Zone II. a) HVSR testing locations shown with circles (white for locations with a clear peak and red for locations with no peak) along with the values of peak frequencies in Hz, b) Contour map of depth to the first impedance contrast in ft.

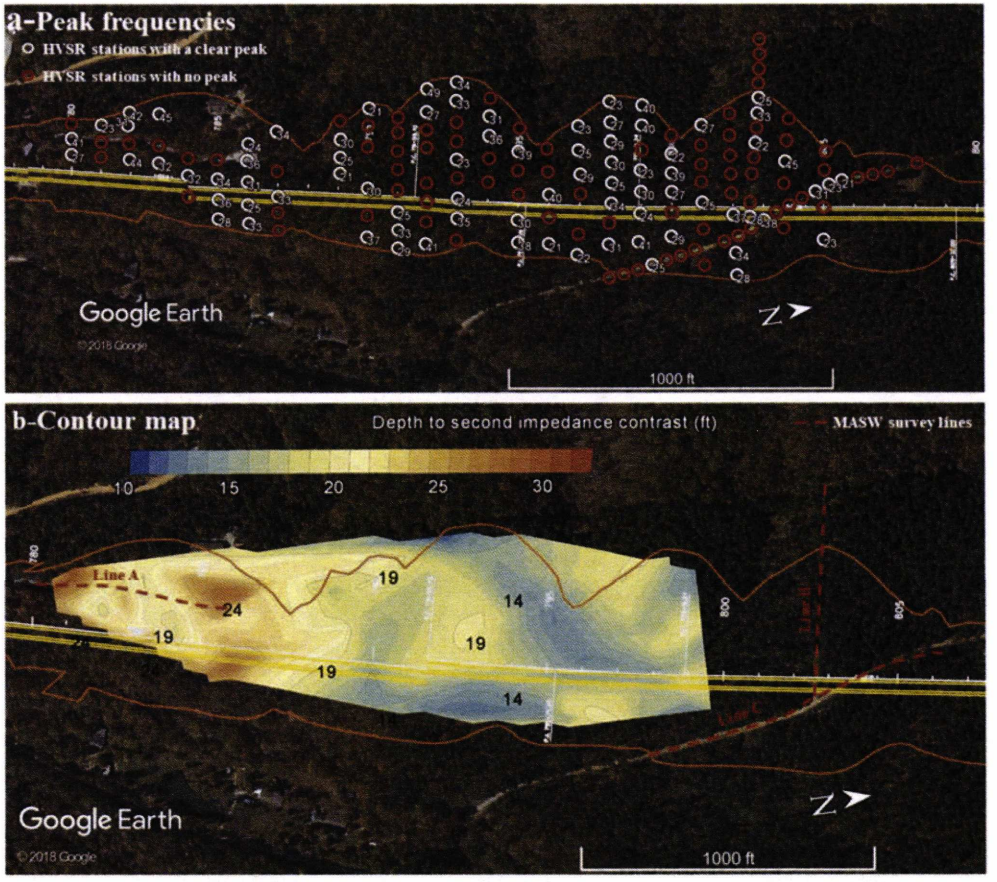


Figure 23- Results of low frequency HVSR peaks for Zone II. a) HVSR testing locations shown with circles (white for locations with a clear peak and red for locations with no peak) along with the values of peak frequencies in Hz, b) Contour map of depth to the second impedance contrast in ft.

4.2.3 Zone III

4.2.3.1 High frequency peaks

Zone III was located between the Stations 832+00 and 850+00 of the proposed highway alignment as shown in Figure 24a. HVSR measurements for this zone were collected at three separate sections as seen in Figure 24a.

Presented in Figure 24a are the locations of HVSR measurements for Zone III along with their peak frequency in Hz. Additionally, the contour map of depth to the first (shallowest) impedance contrast for this zone is shown in Figure 24b. As seen in Figure 24a, almost all of the HVSR measurements have a high frequency peak ranging between 36-107 Hz, however, there are several stations with no clear high frequency peak which are shown with red circles in this figure. According to the contour maps of depth to the first impedance contrast in Figure 24b, the first impedance contrast (overburden thickness) is very shallow across this zone ranging between 1-4 ft.

4.2.3.2 Low frequency peaks

Shown in Figure 25a and 25b are the locations of the HVSR measurements for Zone III with their low frequency peak and contour maps of depth to the second impedance contrast for the area, respectively. As seen in Figure 25a, most of the HVSR stations with no clear low frequency peak are located in the section between the Stations 833+00-837+00. The low frequency peak for this zone varies from 13-48 Hz. Examining the variations of depth to the second impedance for this zone in Figure 25b, it can be seen that it varies from 10-46 ft. The section with the shallowest second impedance contrast is the one located between Stations 845+00-850+00 and the section with the deepest second impedance contrast is the one located between Stations 833+00-838+00.

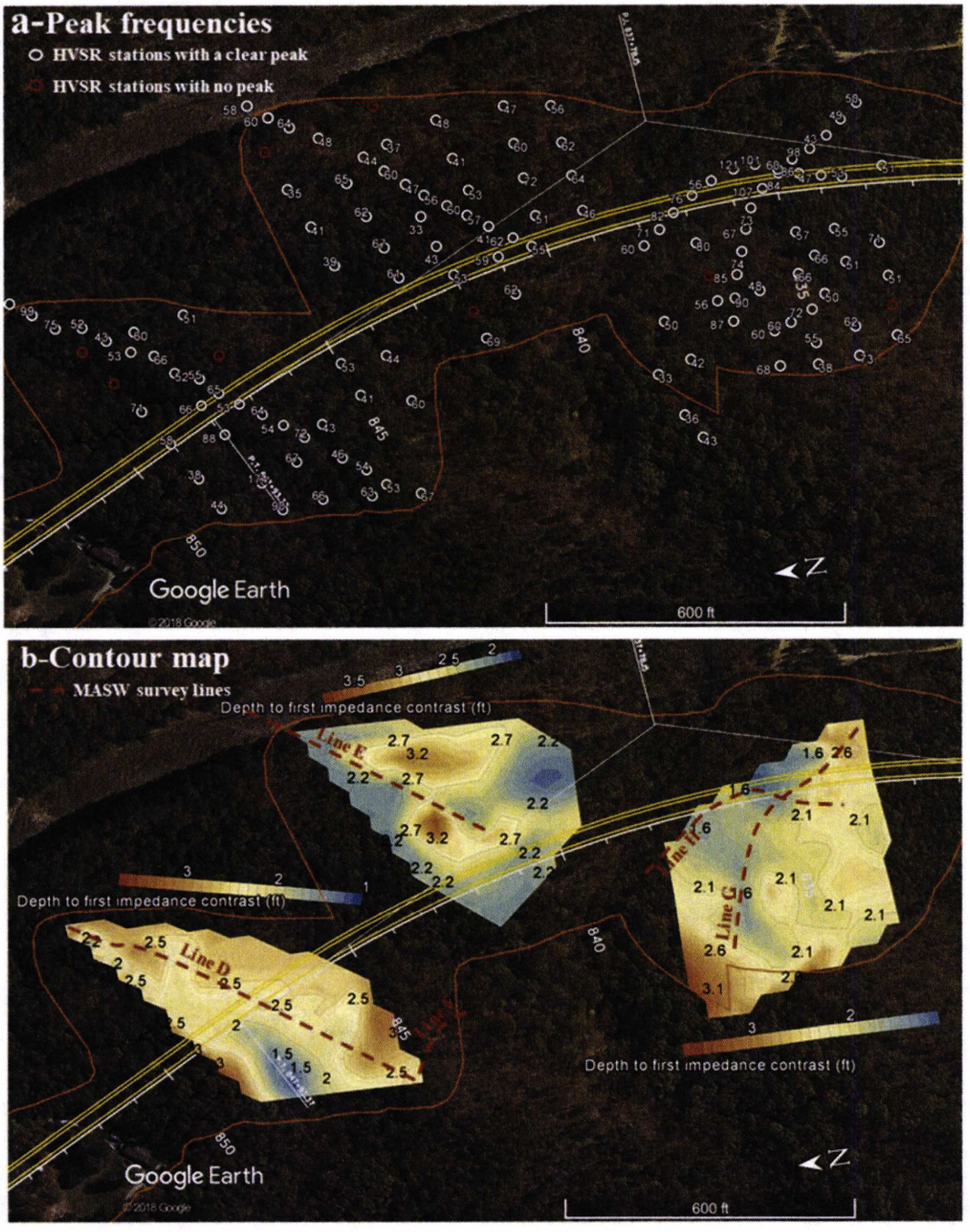


Figure 24- Results of high frequency HVSR peaks for Zone III. a) HVSR testing locations shown with a circles (white for locations with a clear peak and red for locations with no peak) along with the values of peak frequencies in Hz, b) Contour map of depth to the first impedance contrast in ft.

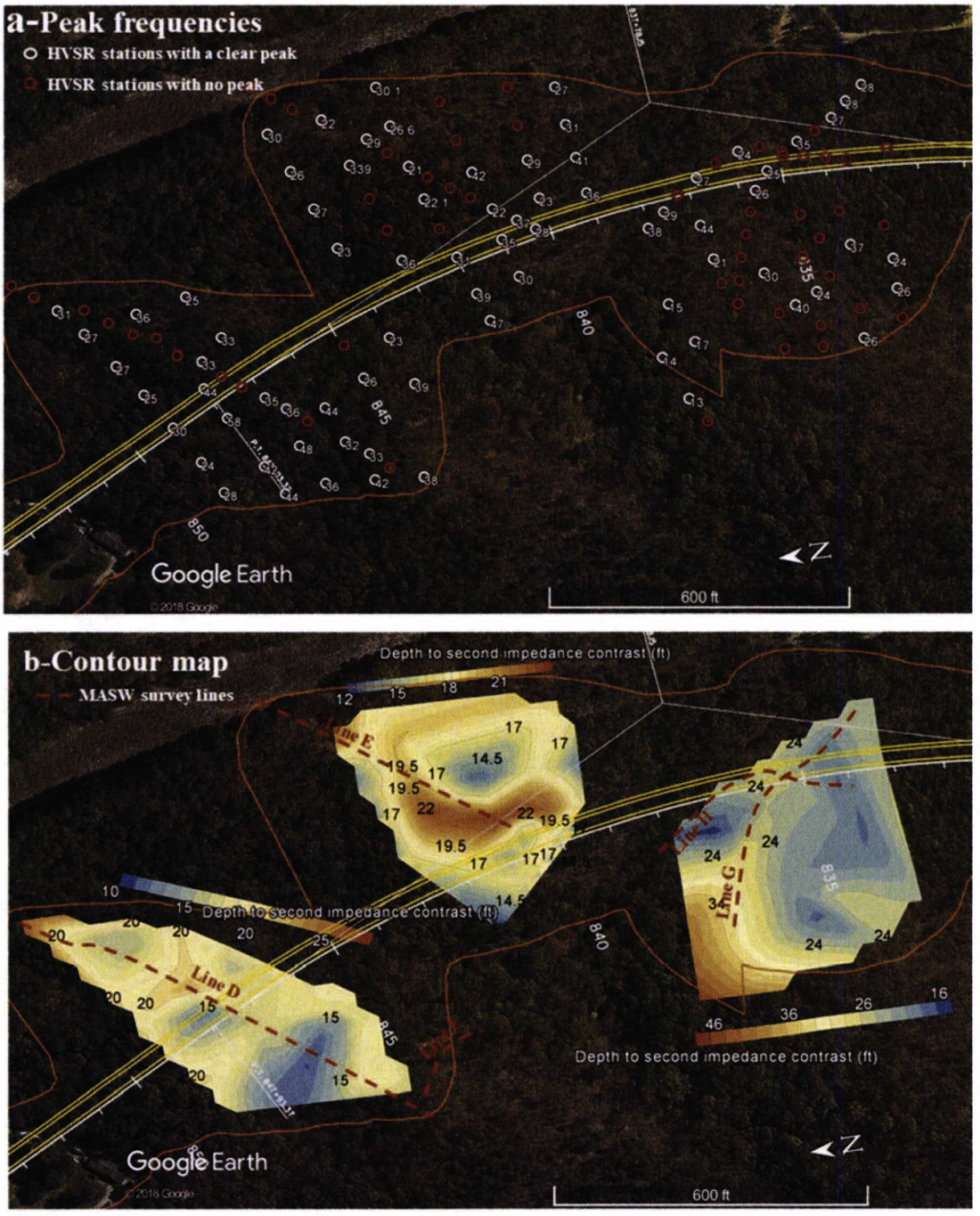


Figure 25- Results of low frequency HVSR peaks for Zone III. a) HVSR testing locations shown with circles (white for locations with a clear peak and red for locations with no peak) along with the values of peak frequencies in Hz, b) Contour map of depth to the second impedance contrast in ft.

4.2.4 Zone V

4.2.4.1 High frequency peaks

Zone V was located between Stations 869+00 and 879+00 of the proposed highway alignment close to the ARDOT BH10 and BH11.

The locations of the HVSR measurements and their high frequency peak are presented in Figure 26a. As seen in this figure, the high frequency peak was observed for all the HVSR stations in this zone except for one station which is shown with a red circle in Figure 26a. The high frequency peak varies between 28-82 Hz. Depth to the first impedance contrast is very shallow and consistent for this zone ranging between 1-5 ft, as seen in Figure 26b.

4.2.4.2 Low frequency peaks

Shown in Figure 27a and 27b are the locations of the HVSR measurements for the Zone V with their low frequency peak and contour maps of depth to the second impedance contrast for the area, respectively. As seen in Figure 27a, no low frequency peak was exhibited for the majority of the HVSR stations in this zone. Contour maps of depth to the second impedance contrast were created using the available information and the results are presented in Figure 27b. As shown in this figure, depth to the second impedance contrast is shallow for this zone ranging between 10 and 20 ft. This depth is likely related to the location of the Gary and Brown Chert with interbedded Siltstone layer in the boring logs.

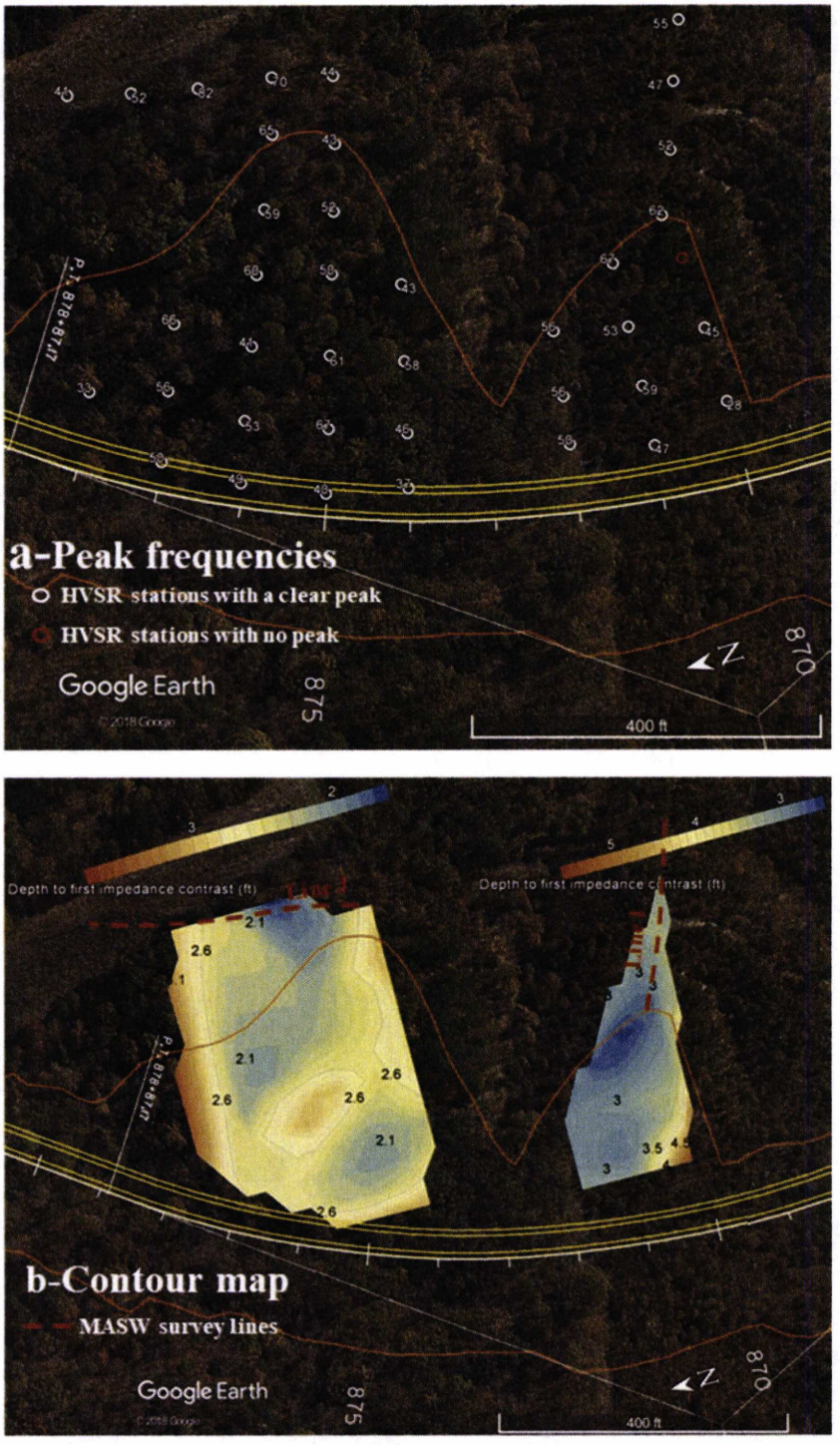


Figure 26- Results of high frequency HVSR peaks for Zone V. a) HVSR testing locations shown with circle (white for locations with a clear peak and red for locations with no peak) along with the values of peak frequencies in Hz, b) Contour map of depth to the first impedance contrast in ft.

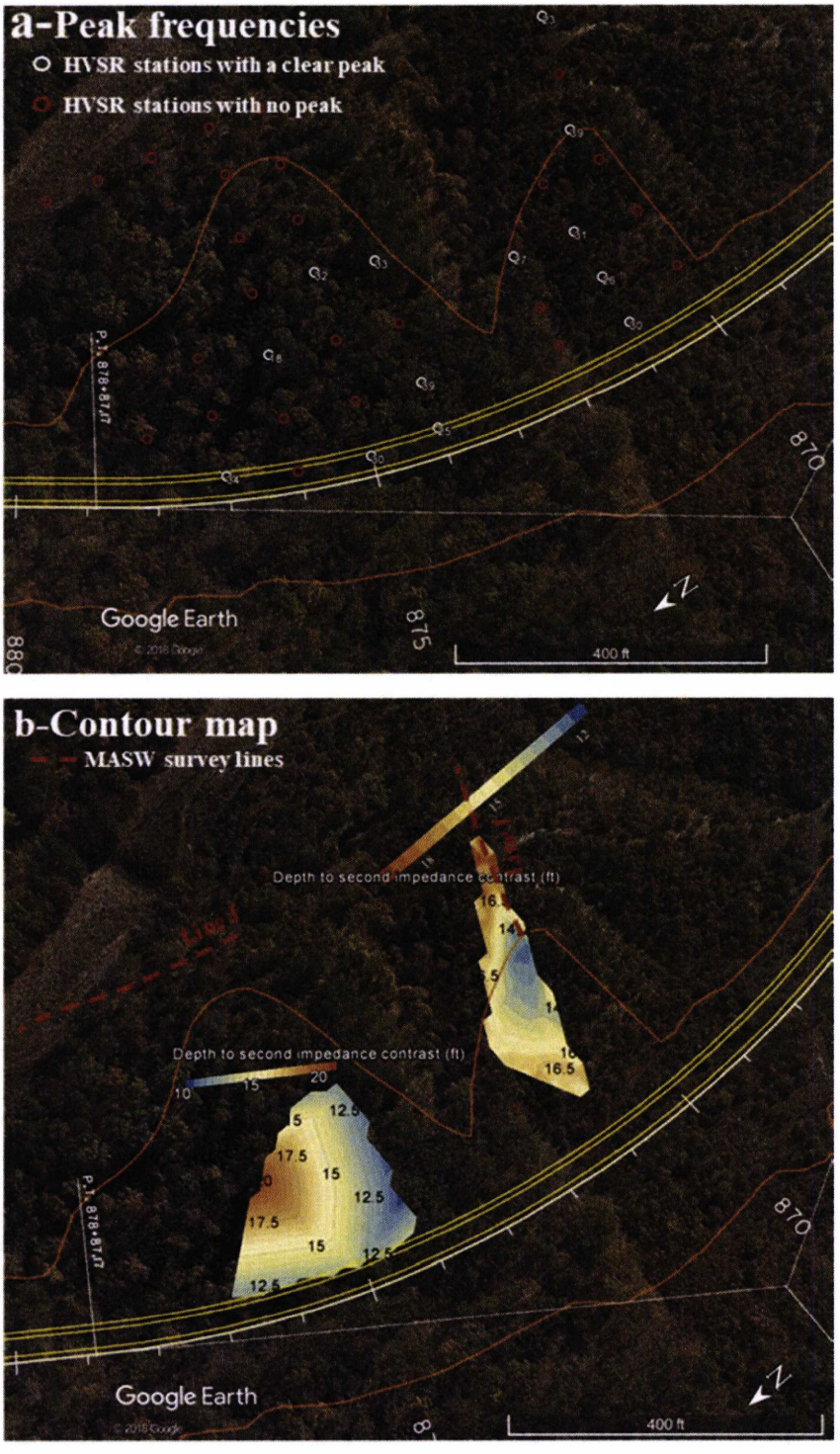


Figure 27- Results of low frequency HVSR peaks for Zone V. a) HVSR testing locations shown with circle (white for locations with a clear peak and red for locations with no peak) along with the values of peak frequencies in Hz, b) Contour map of depth to the second impedance contrast in ft.

4.3 Roadway cross section results

Shown in Figure 28 is an example cross section for Station 691+00 with the results of the MASW and HVSR testing. For the MASW testing, depth to soil and different rock layers were derived from the pseudo 2D Vs cross sections presented in Section 4.1 of the report. Additionally, for the HVSR testing, the results were derived from the contour maps of depth to the first (soil or overburden thickness) and second impedance contrasts (weathered rock), as provided in Section 4.2 of the report. In order to differentiate between the HVSR and MASW results reported on the cross section file, different colors were used for each of them in the cross section file (purple and cyan for the HVSR and light blue, dark blue, green, yellow, and red for the MASW).

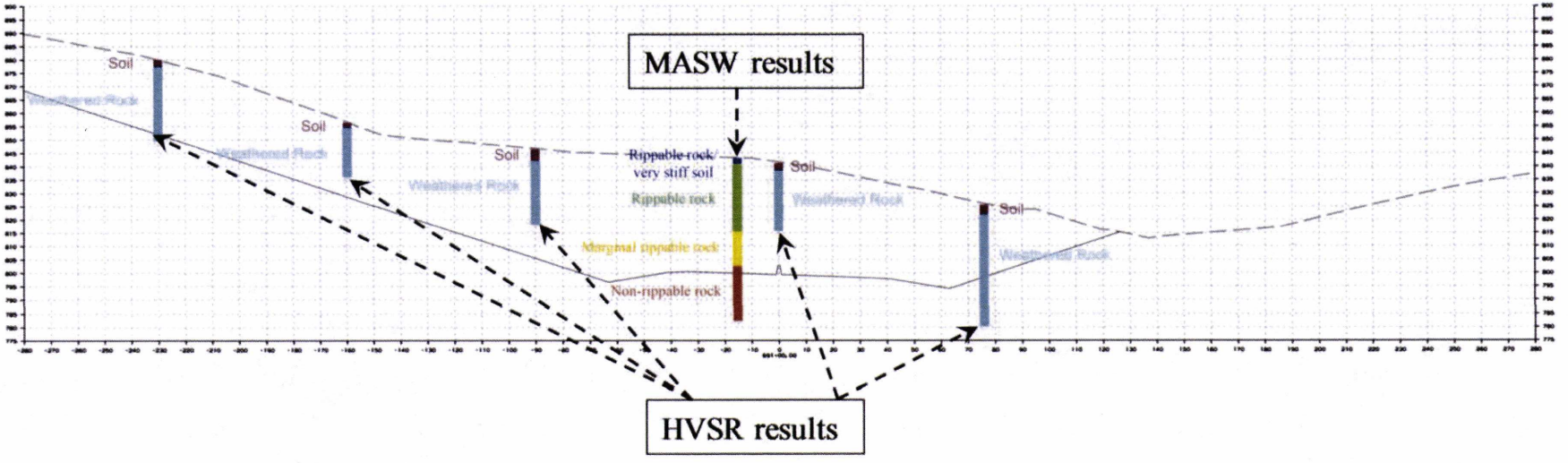


Figure 28- Example MASW and HVSR results shown for Station 691+00.

5 Summary

Geophysical testing including MASW and HVSR were conducted for ARDOT project #R60140 with the goal of mapping subsurface conditions, particularly depth to bedrock and rock rippability across the project area. Based on the results of the MASW and HVSR testing, the overburden thickness (depth to the first impedance contrast identified in the HVSR measurements) is expected to be very thin ranging between 1-10 ft over the areas tested. For the majority of locations, a more weathered or softer rock formation, which is estimated to be rippable based on seismic velocity is believed to exist below the overburden soil with thicknesses varying between 5-25 ft. This layer is underlined by a non-weathered or harder rock formation that is considered either marginally or non-rippable. The depth to the marginally or non-rippable rock unit varied significantly across the areas tested with a non-rippable rock layer not observed within the maximum depth of investigation at some locations. From the results of each survey line, Lines D and K, which were conducted over Novaculite rock formations, were some of the stiffest and shallowest rock formations encountered on the project. The shale formations under Lines A, B, and C were also estimated to be particularly stiff at depth. The sandstone or sandstone/shale formations under Lines E, H, and G were determined to be relatively weak formations (although still stiff formations at depth) comparing to the rock units observed in Line A, B, C, D, and K. Finally, the Siltstone formations under Lines I and J were determined to be the weakest formations across the tested areas. In order to present the results of the MASW and HVSR testing in a more useful way, all the results are shown on top of the roadway cross sections of the proposed highway alignment in Appendix A.

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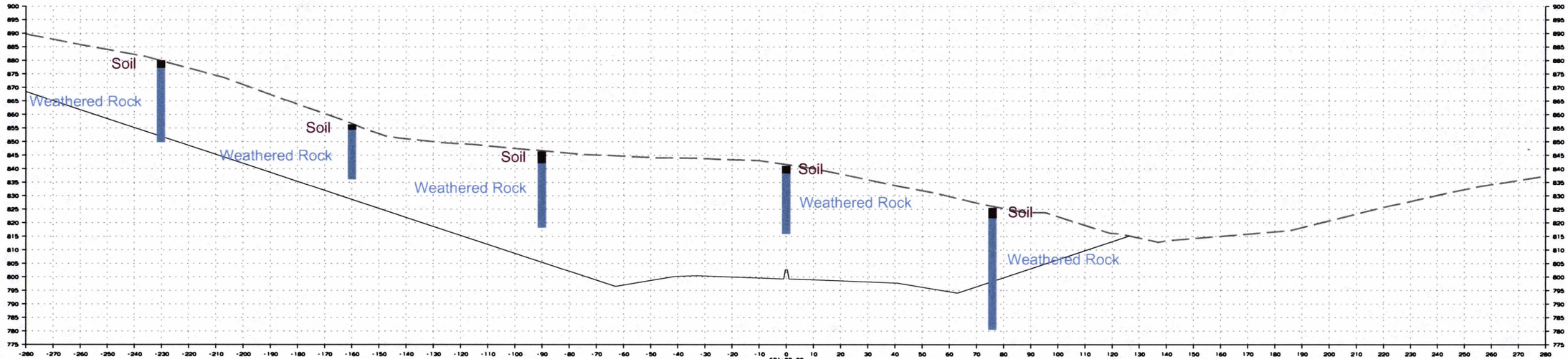
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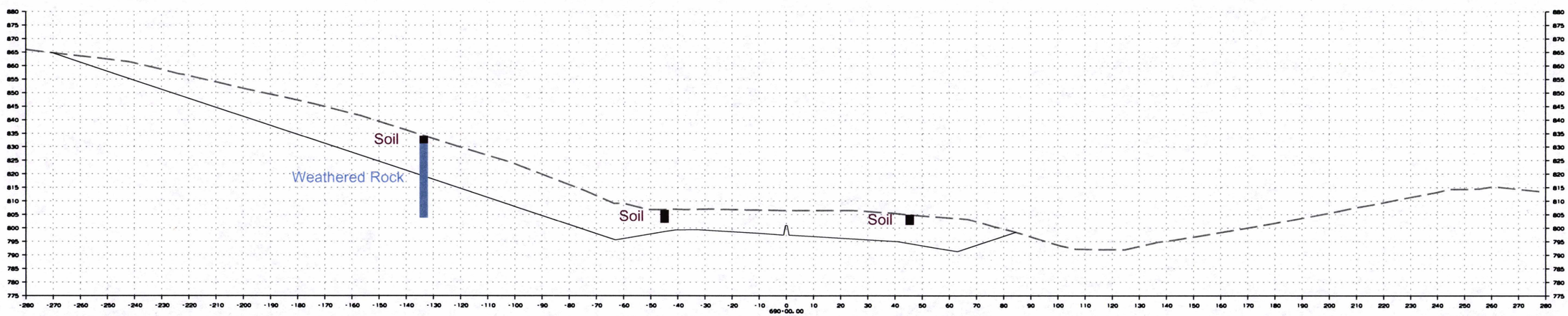
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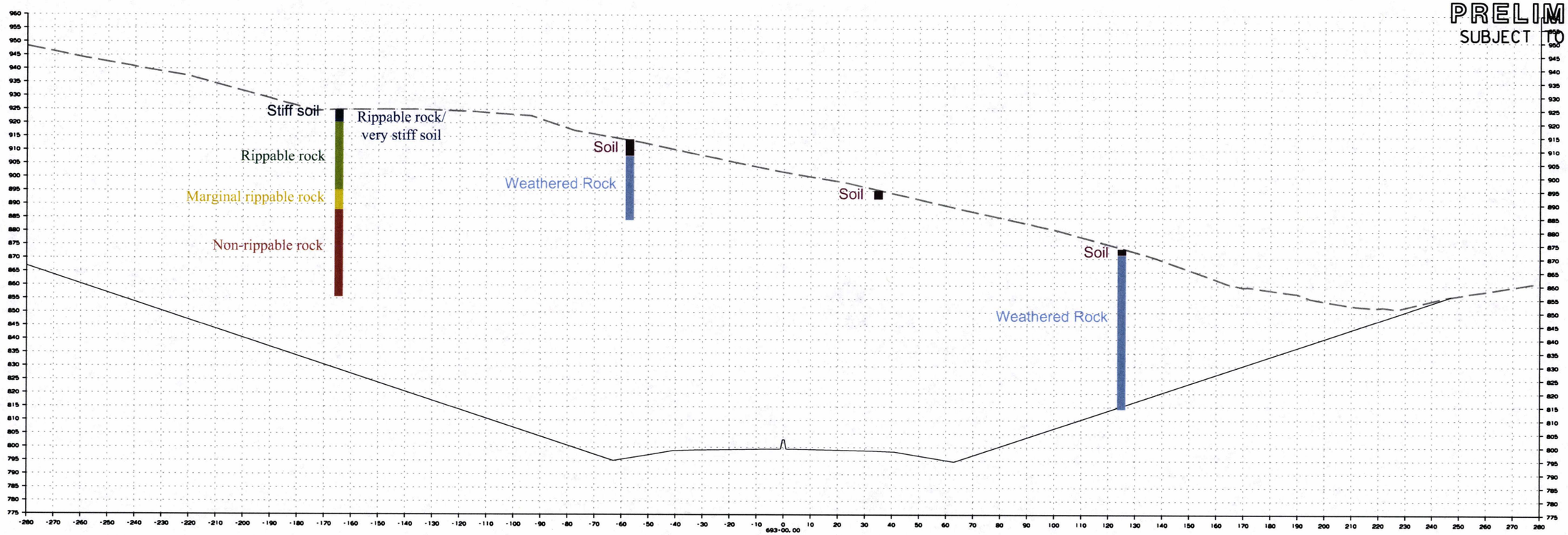
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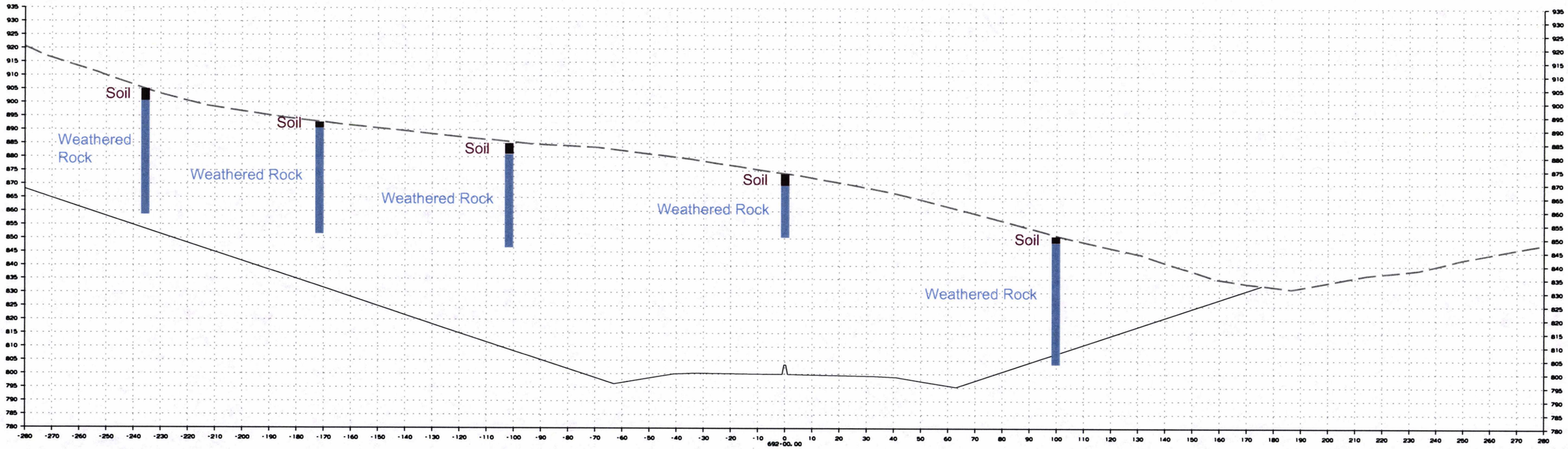
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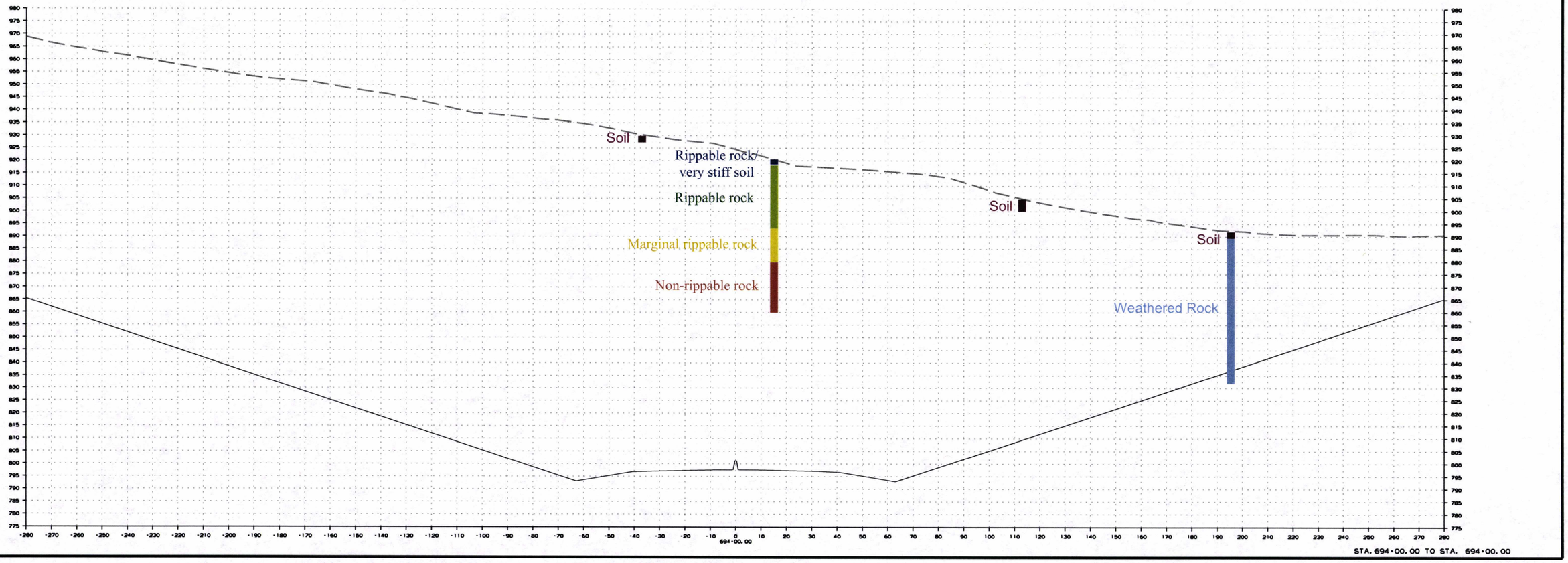
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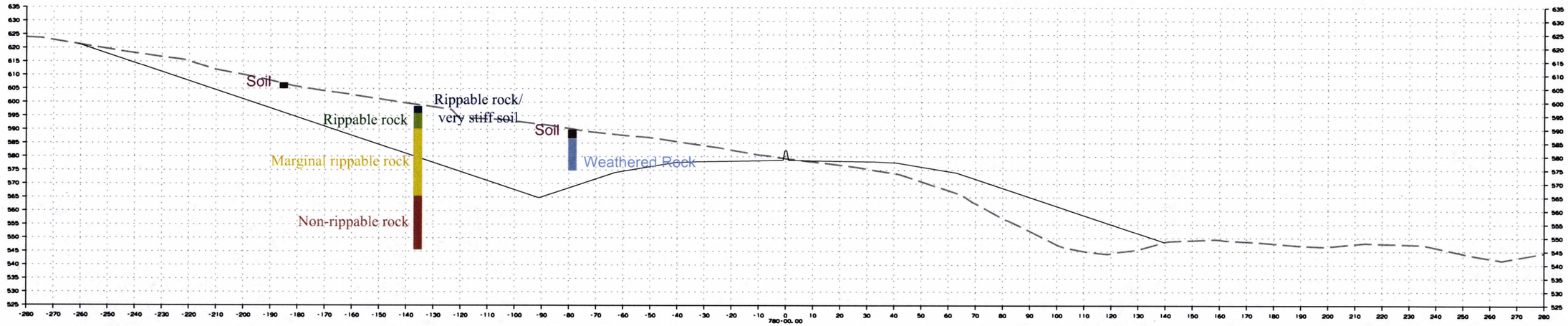
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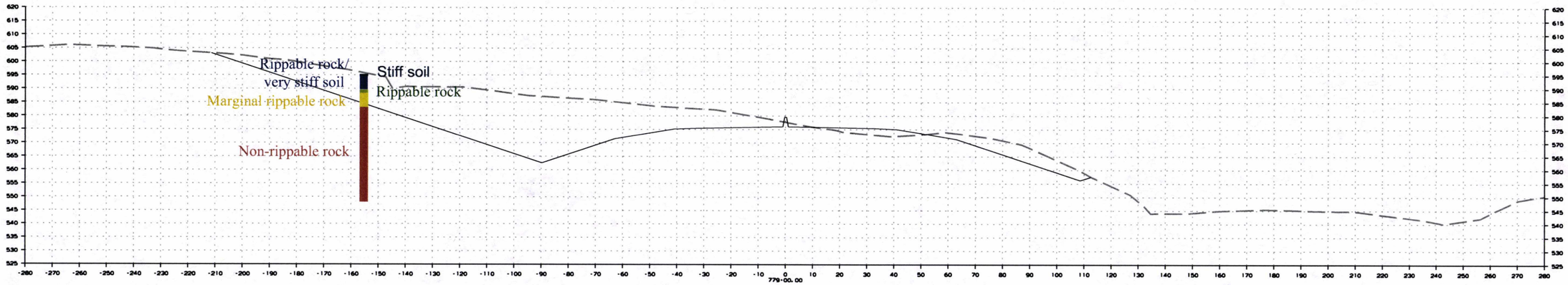
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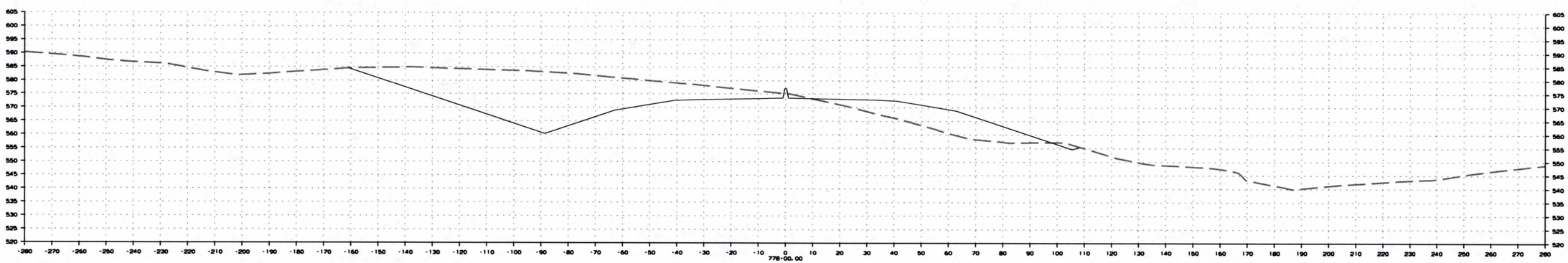
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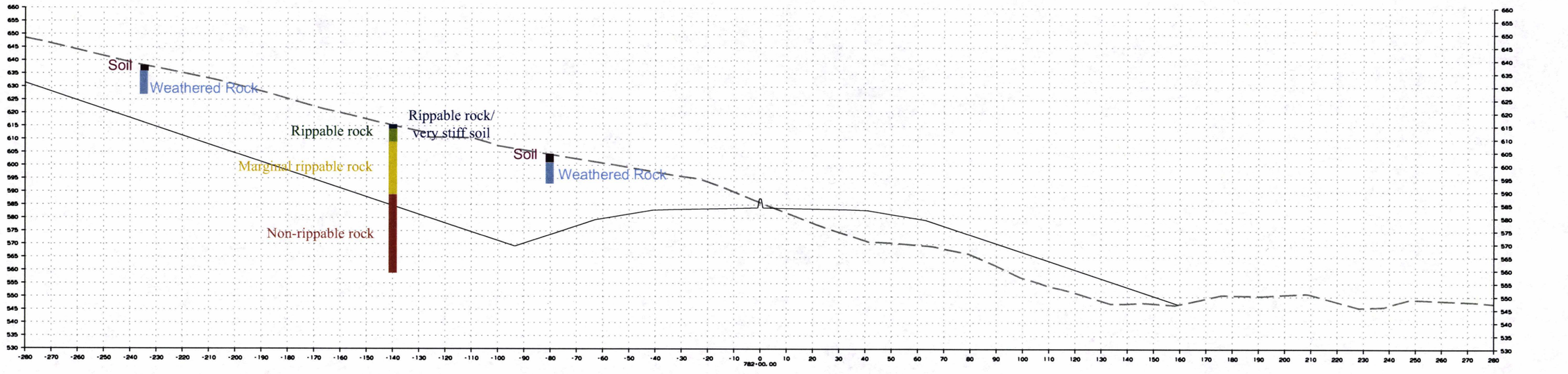
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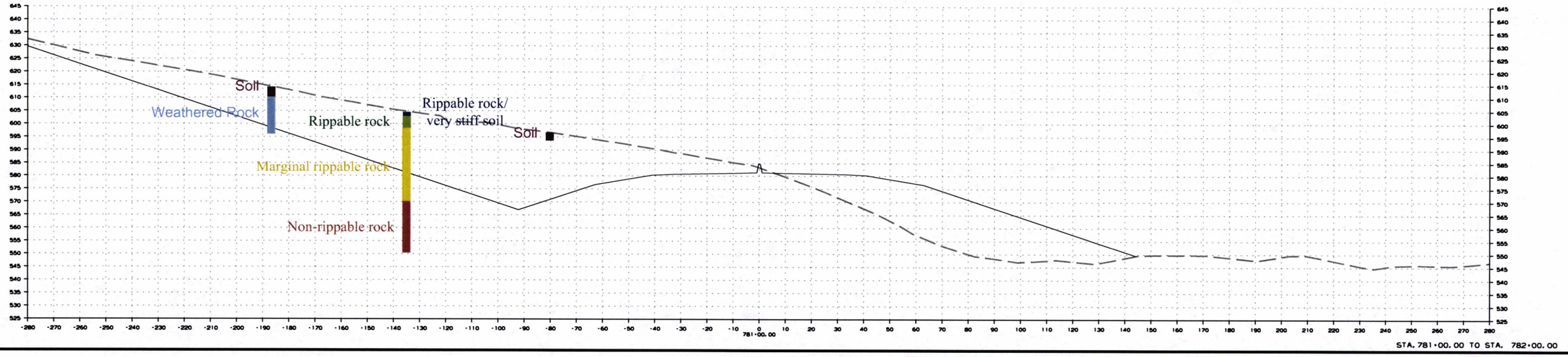
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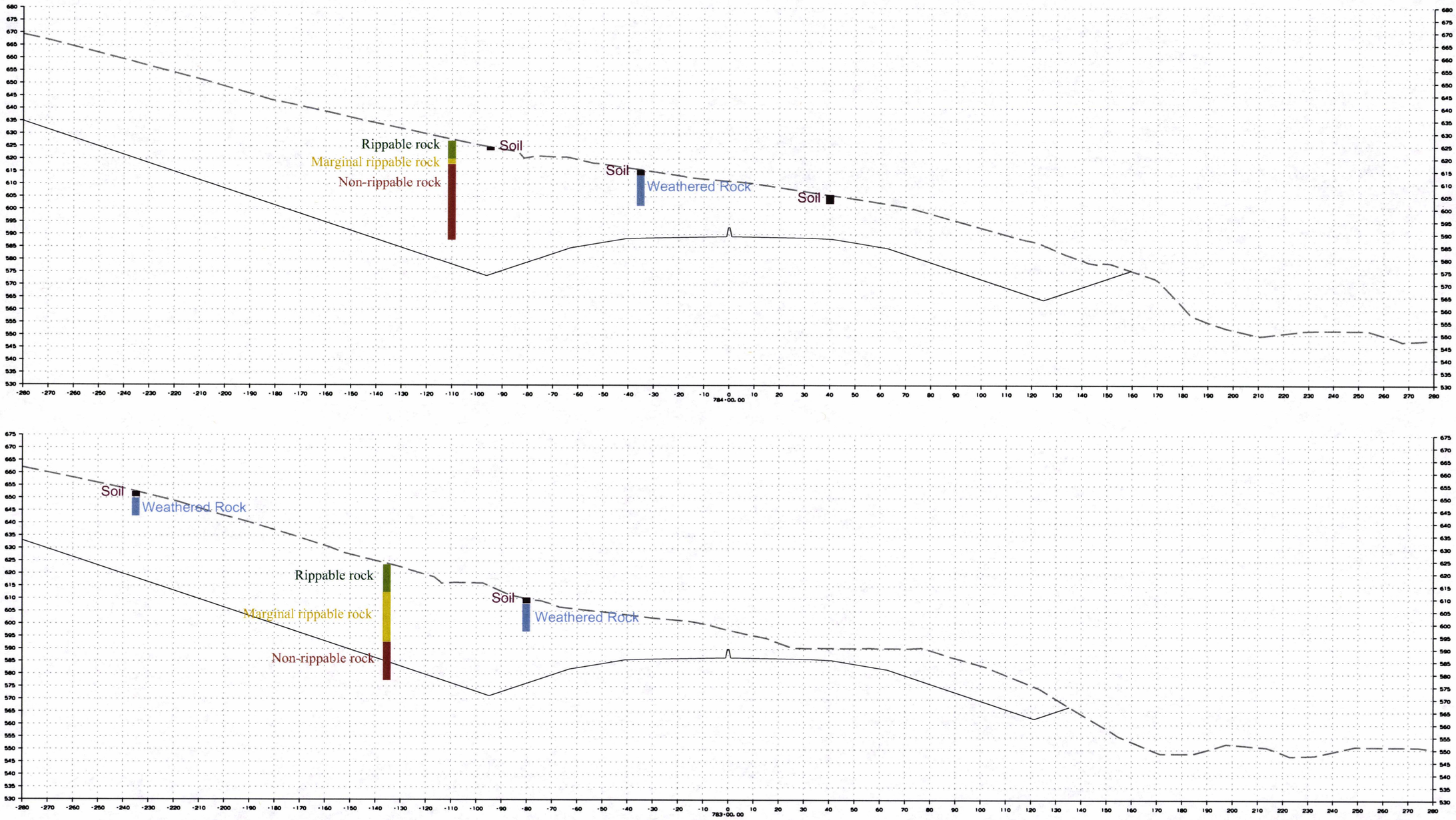
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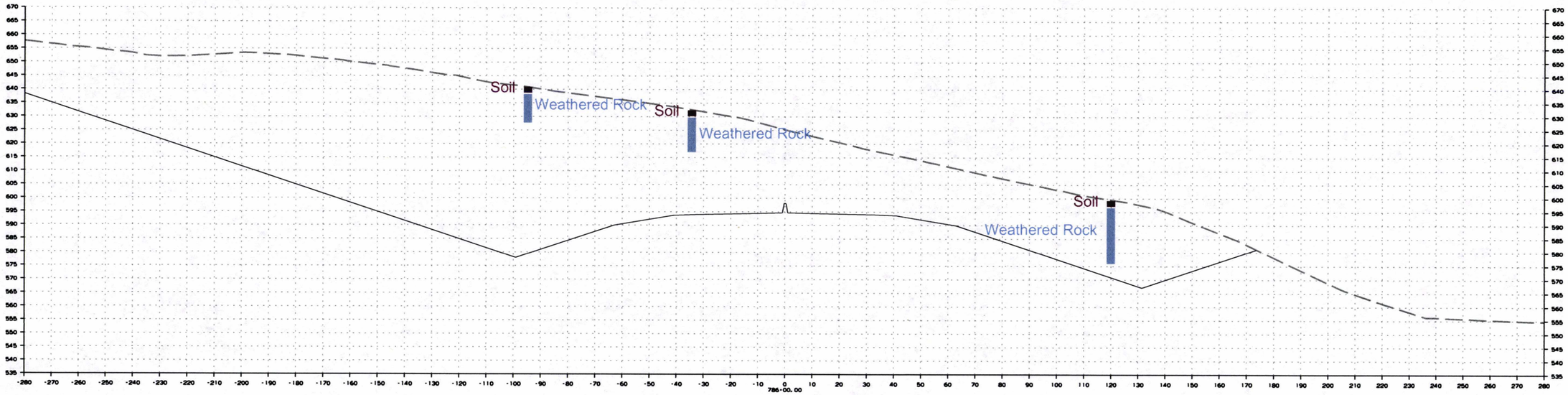
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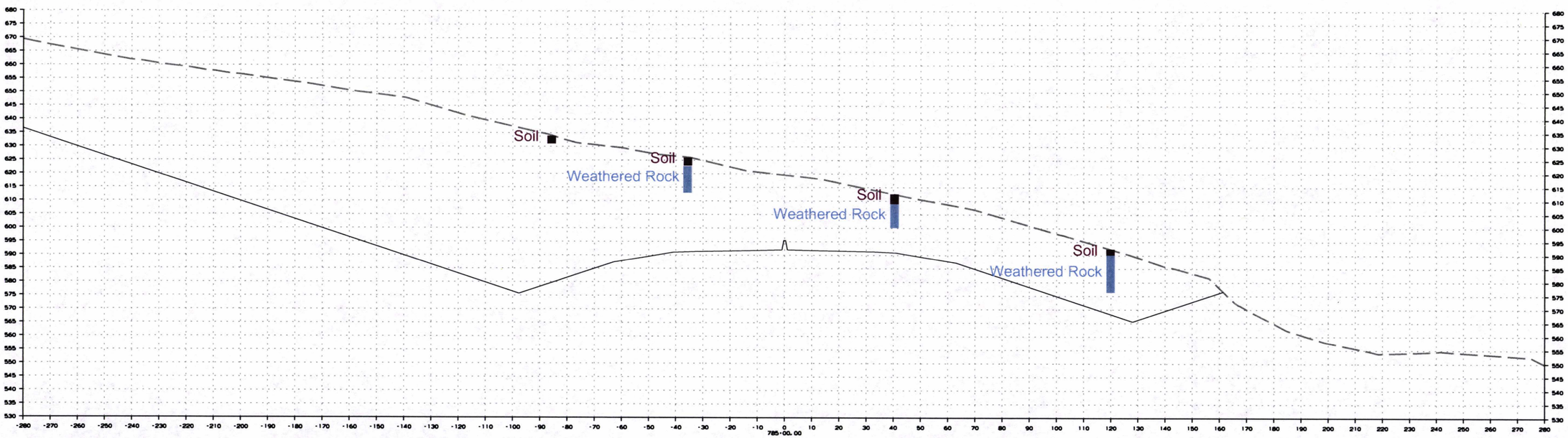
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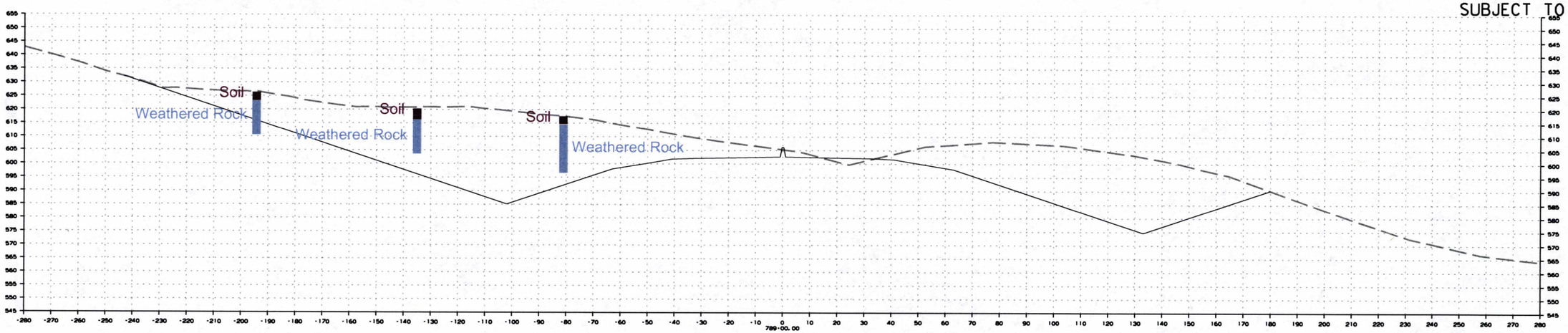
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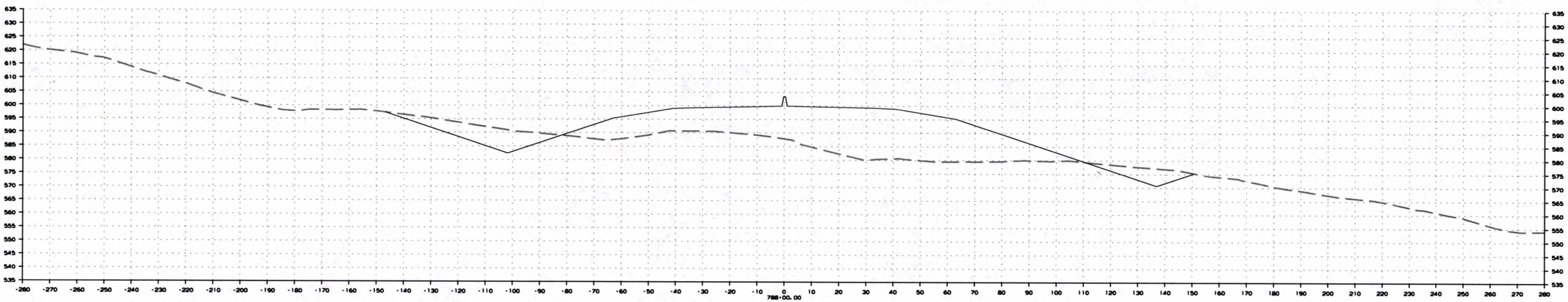
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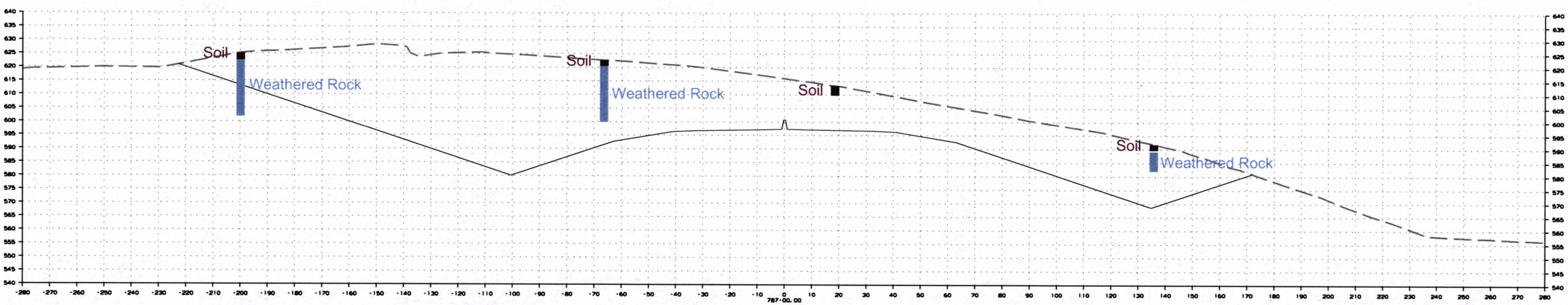
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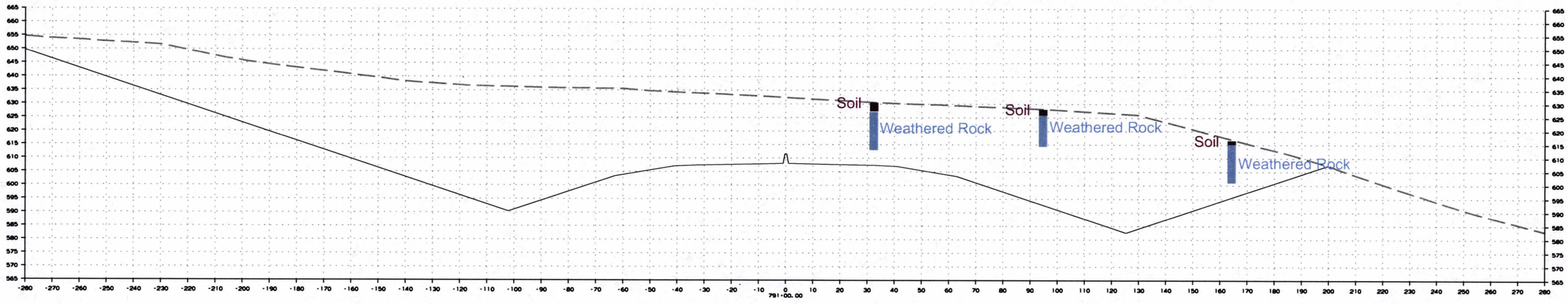
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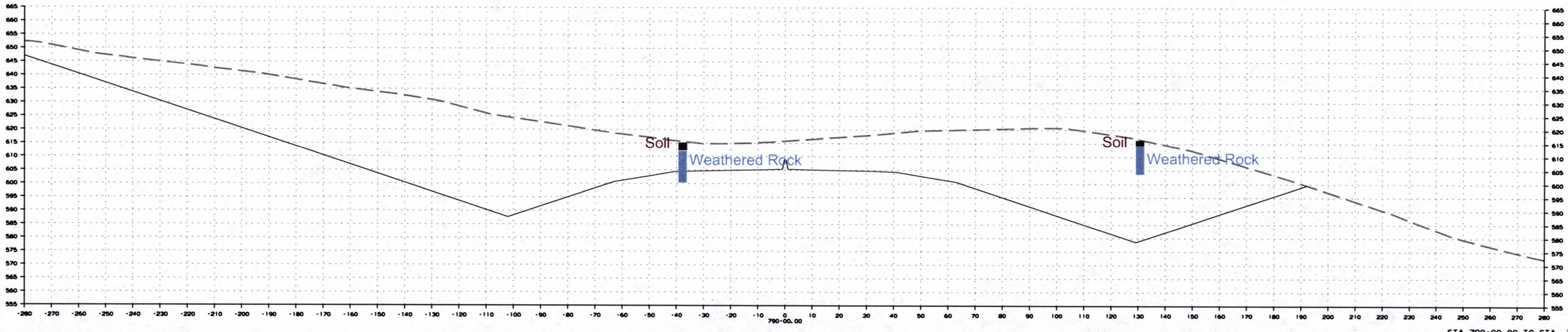
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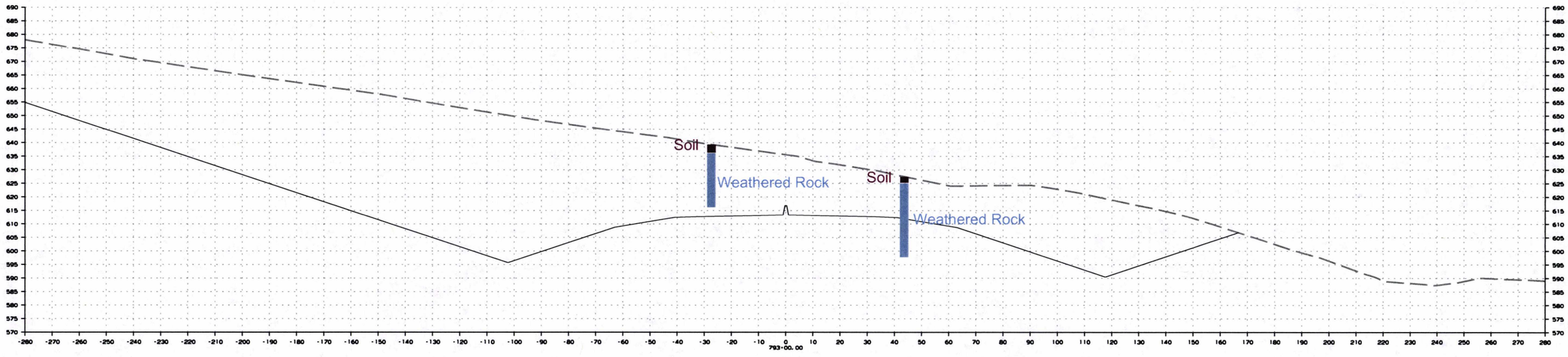
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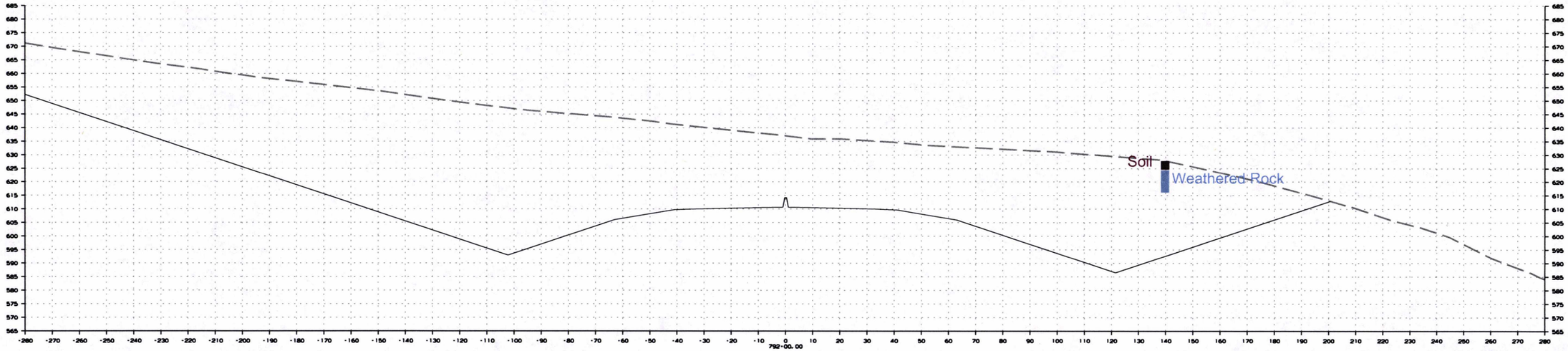
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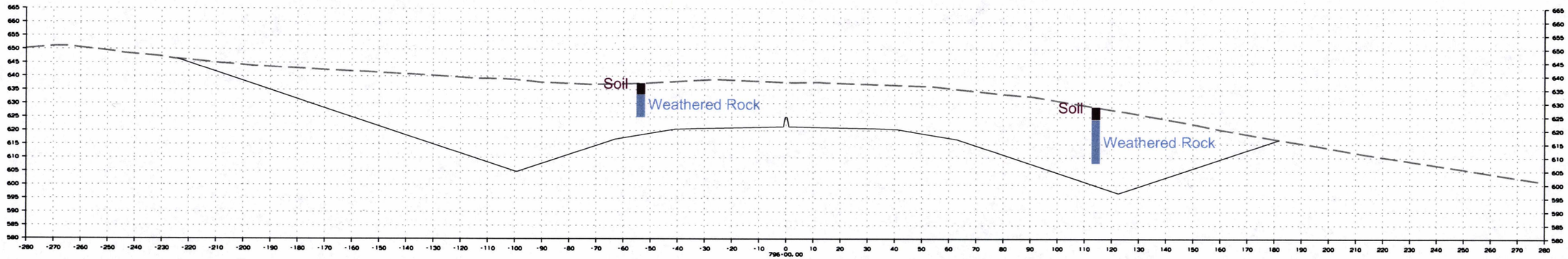
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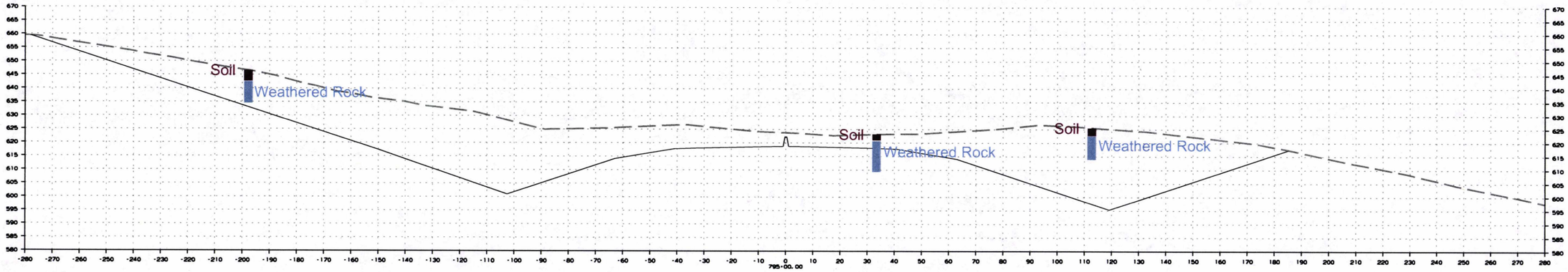
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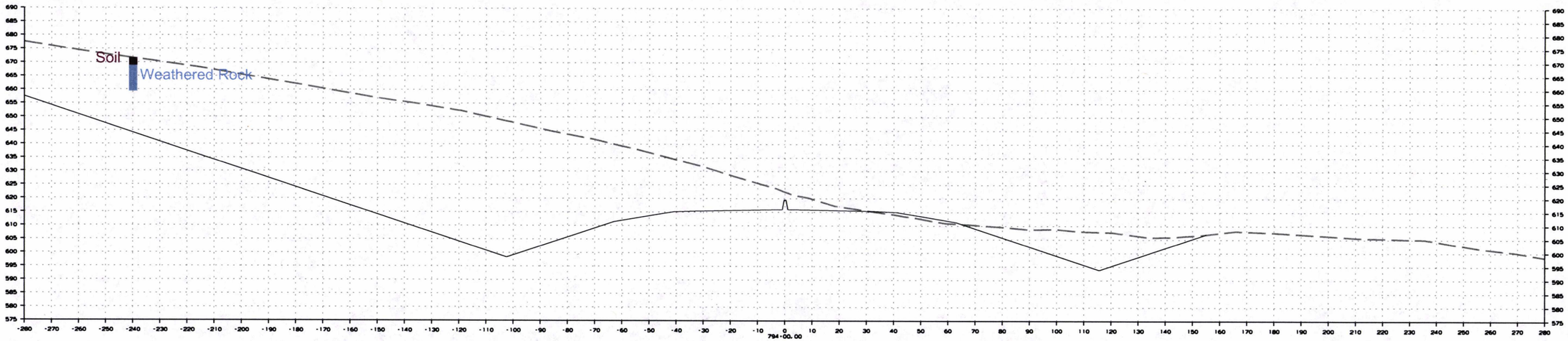
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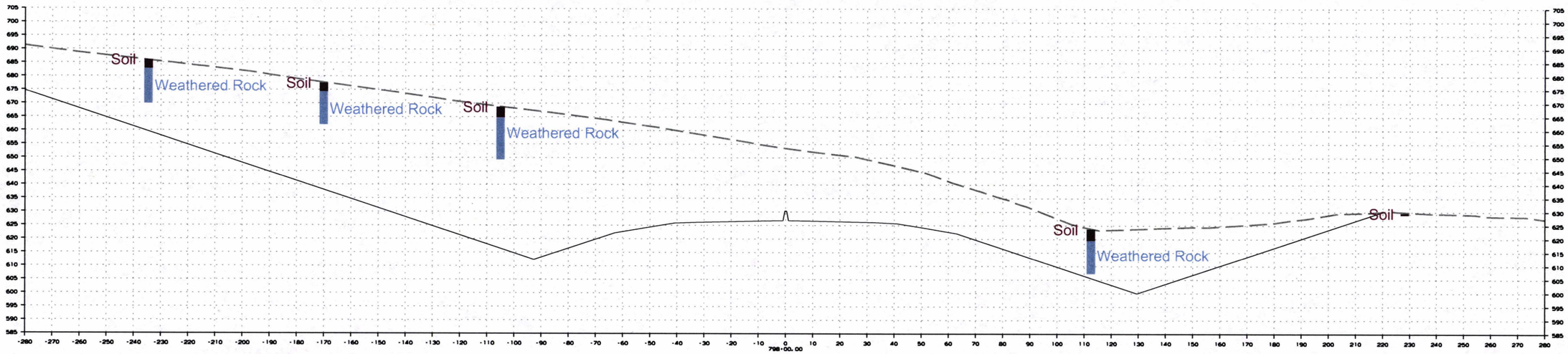
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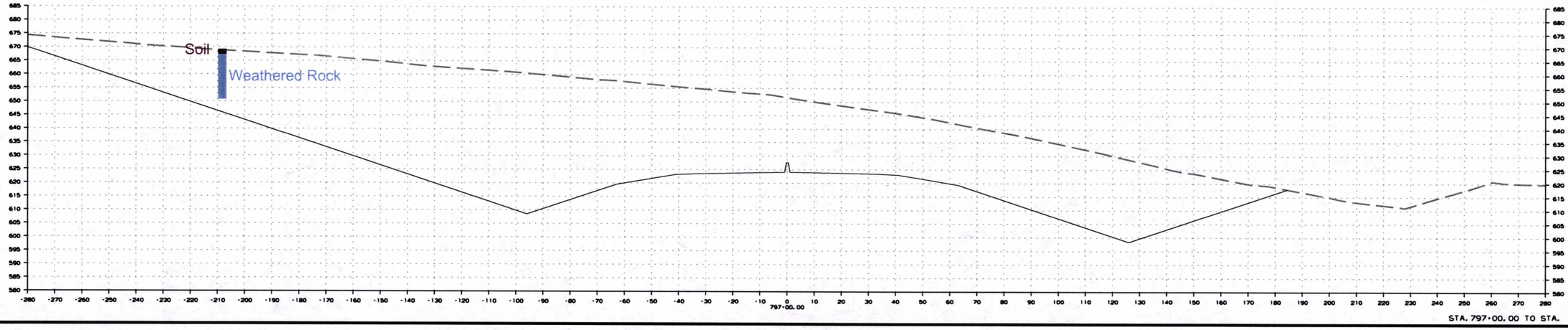
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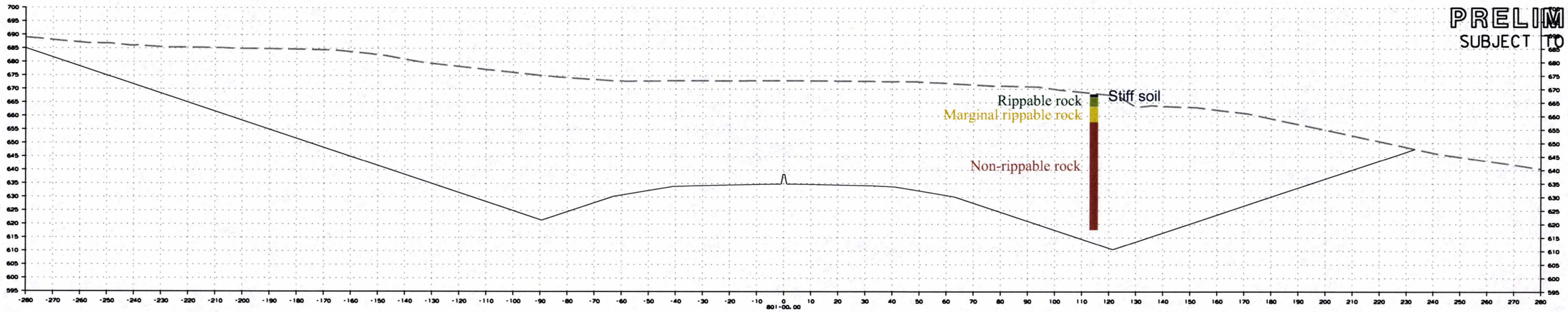
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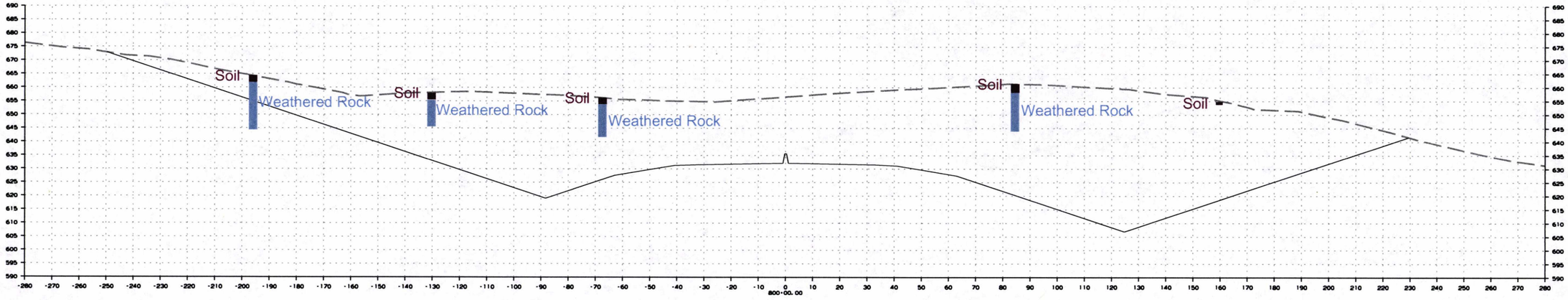
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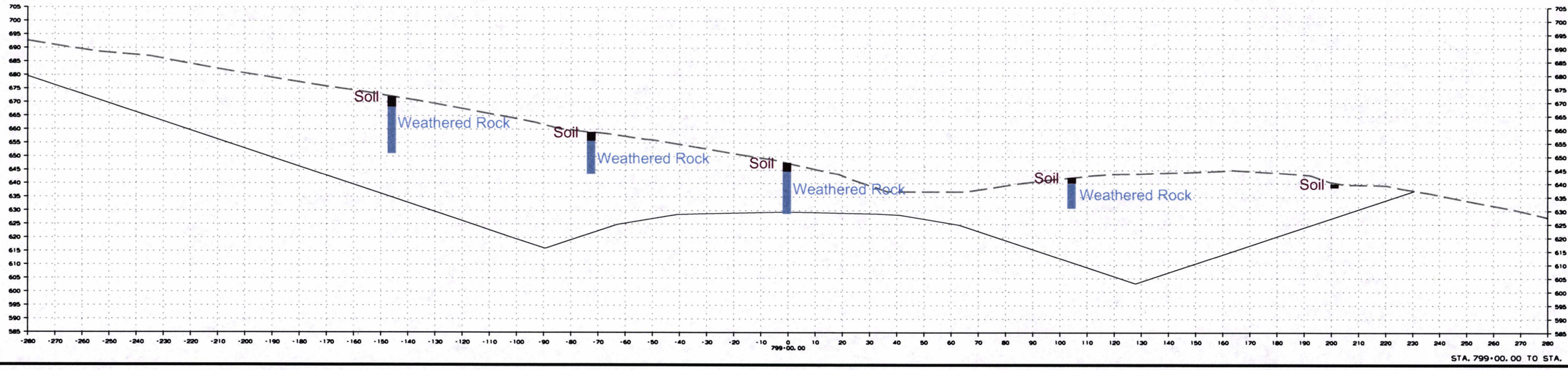
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PRELIMINARY
SUBJECT TO REVISION







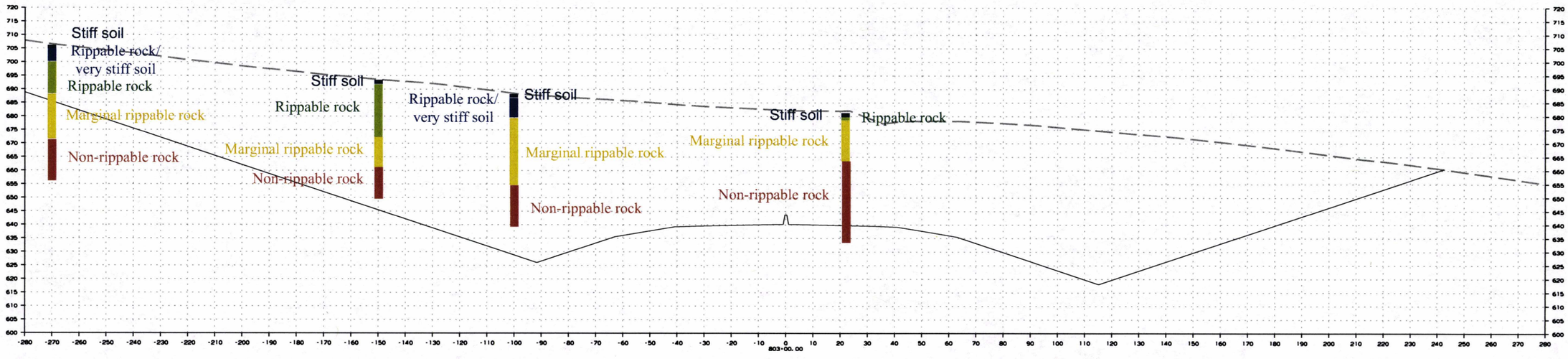
3/1/2018

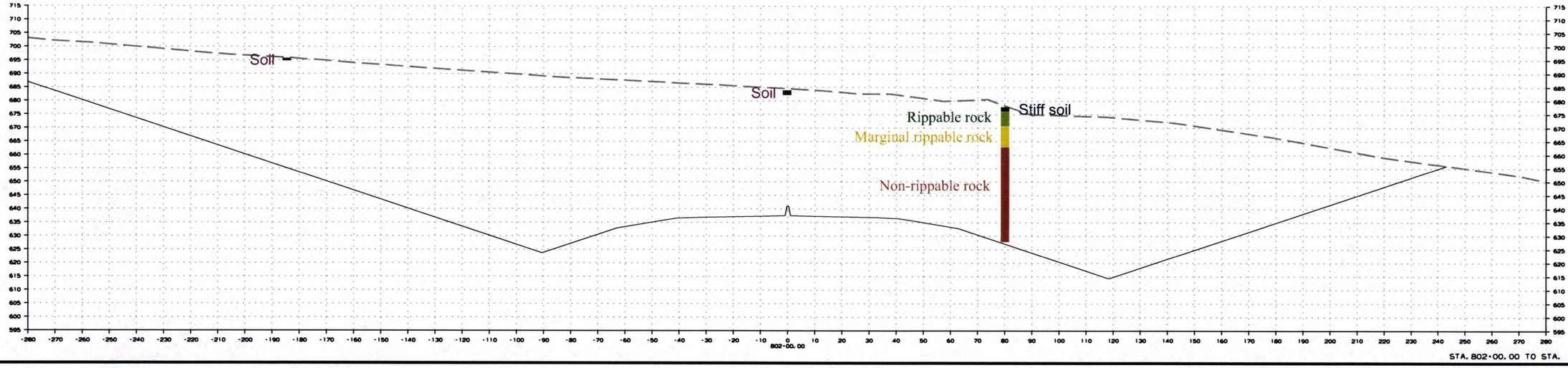
RR60140.DGN

STA. 799+00.00 TO STA. 801+00.00

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		R60140		
				(2)	....			

PRELIMINARY
SUBJECT TO REVISION





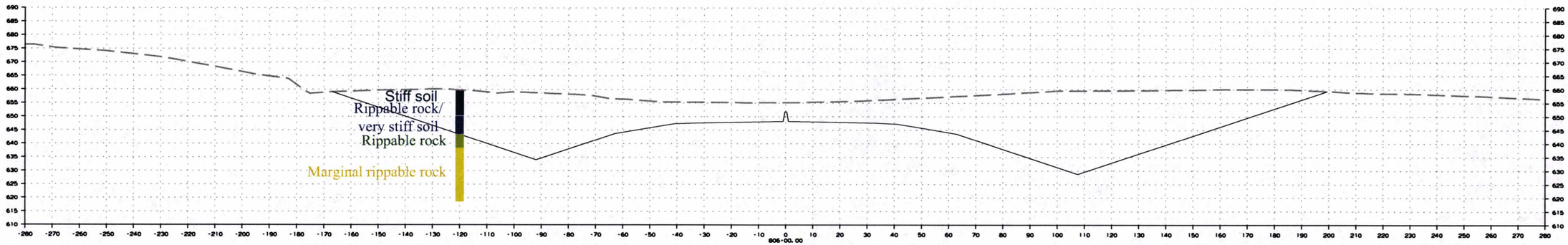
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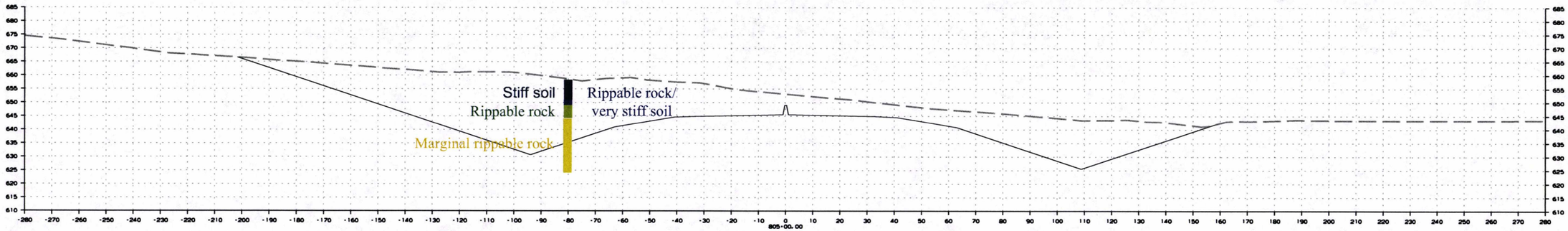
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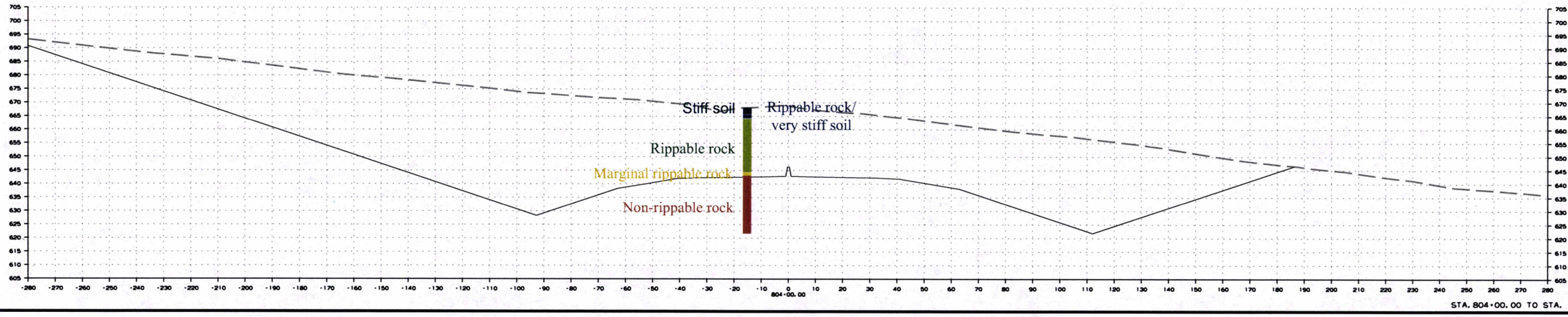
RR60140.DGN

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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				JOB NO.		R60140		
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PRELIMINARY
SUBJECT TO REVISION







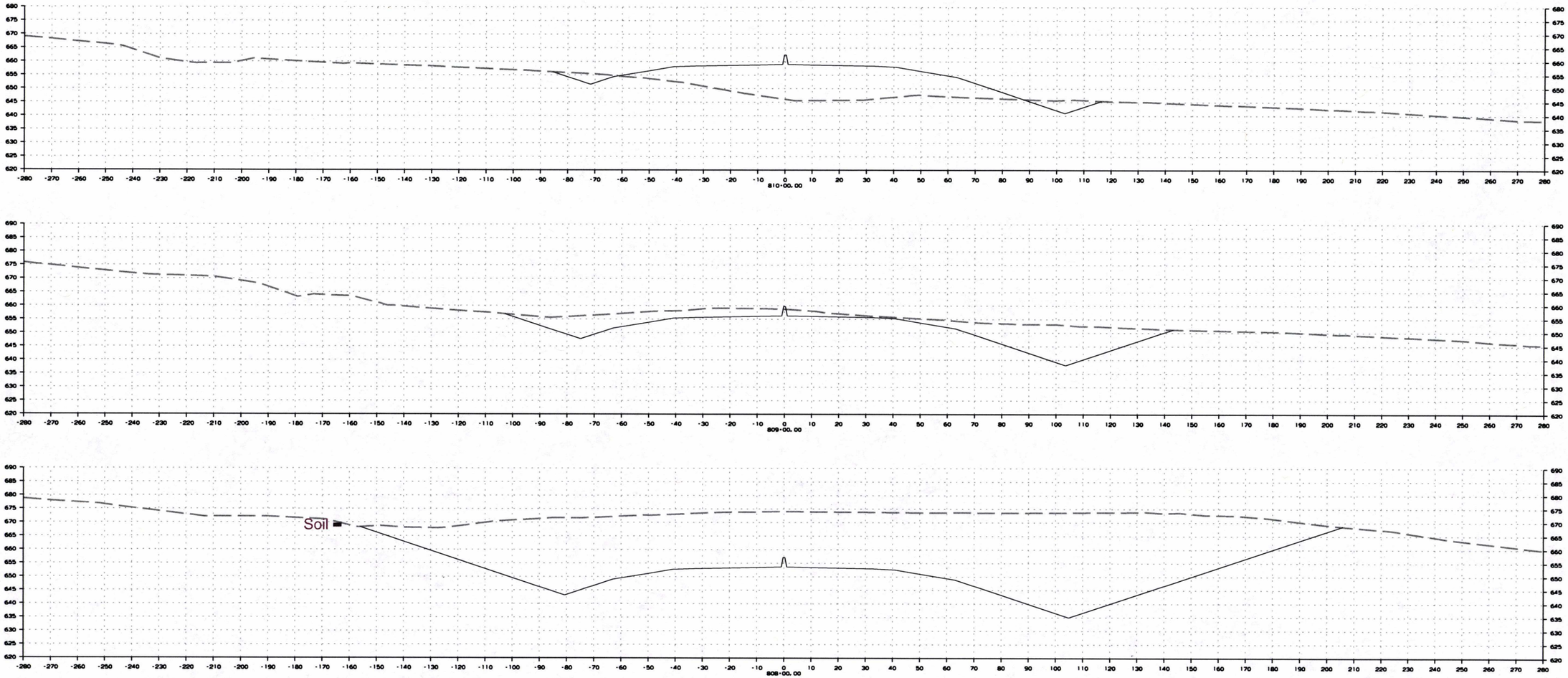
3/1/2018

RR60140.DGN

STA. 804+00.00 TO STA. 806+00.00

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PRELIMINARY
SUBJECT TO REVISION



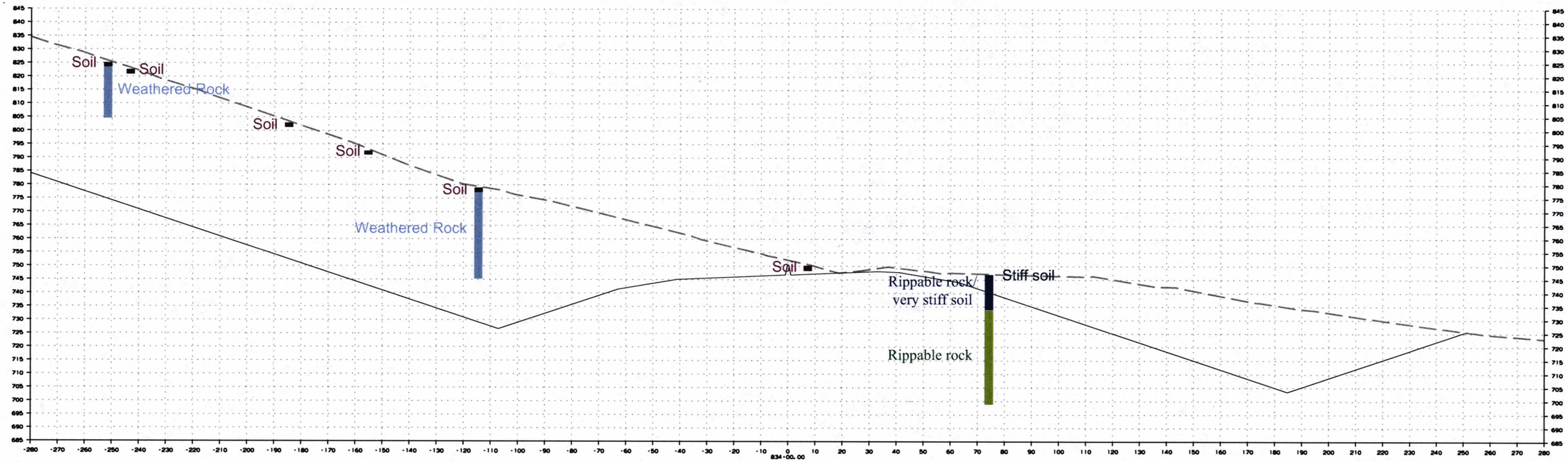
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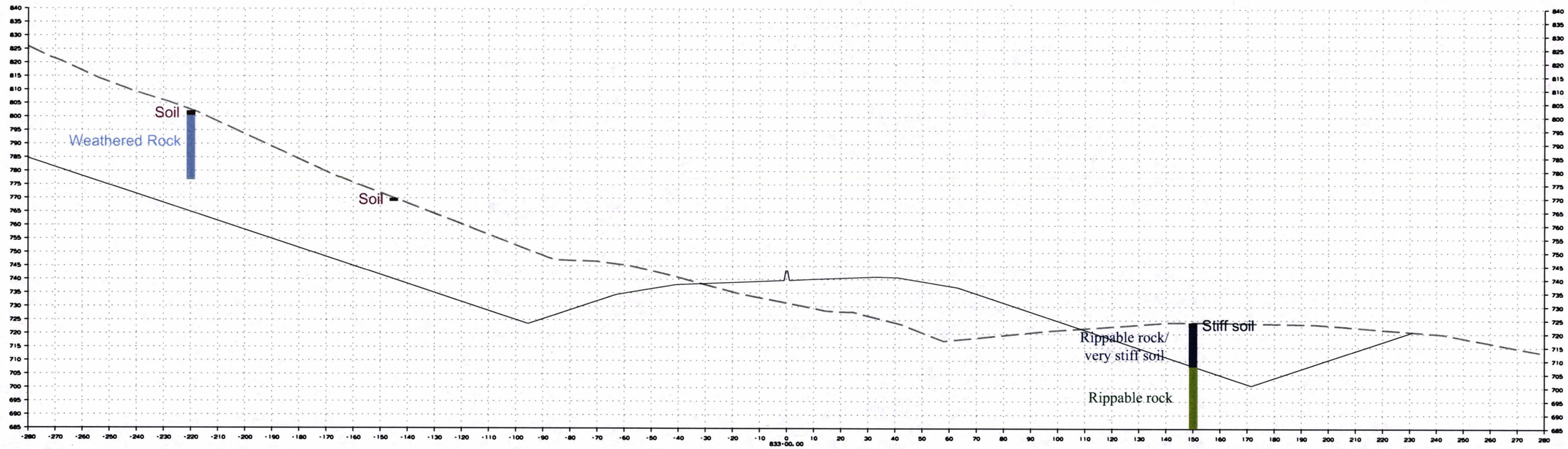
3/1/2018

RR60140.DGN

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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PRELIMINARY
SUBJECT TO REVISION





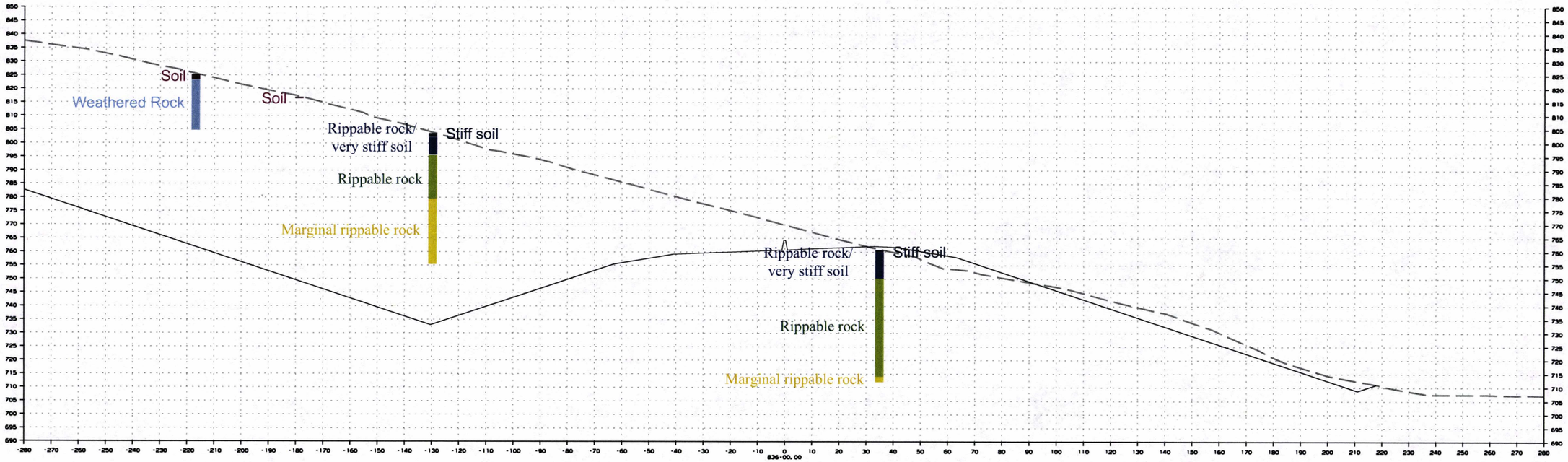
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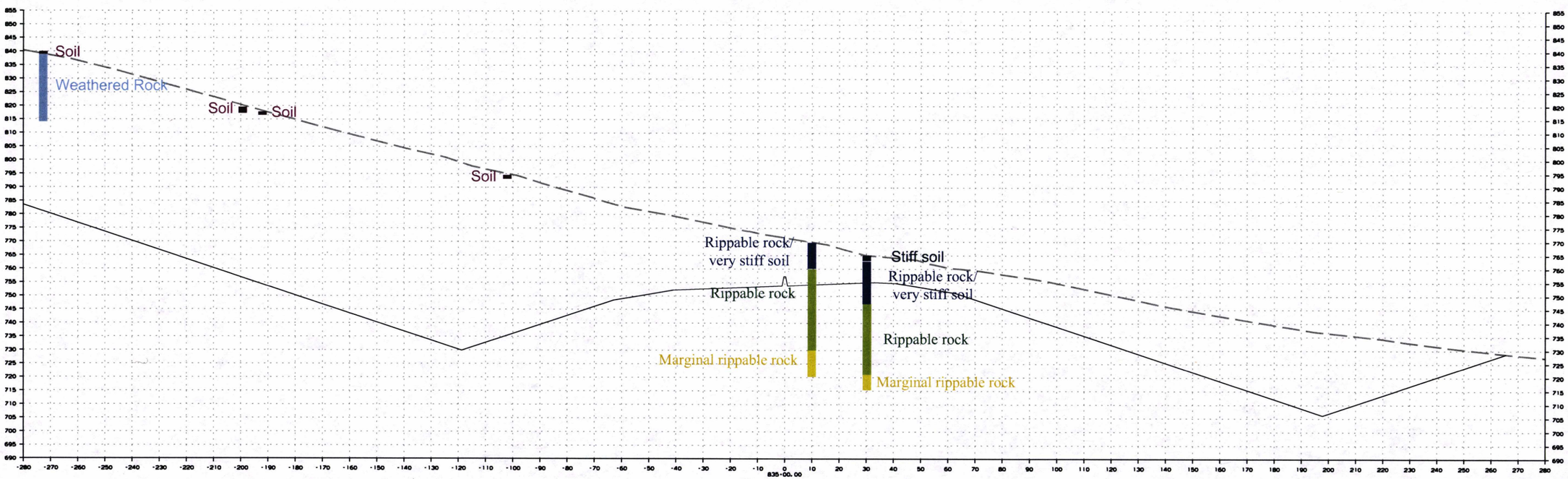
3/1/2018

RR60140.DGN

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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				JOB NO.		R60140		
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PRELIMINARY
SUBJECT TO REVISION





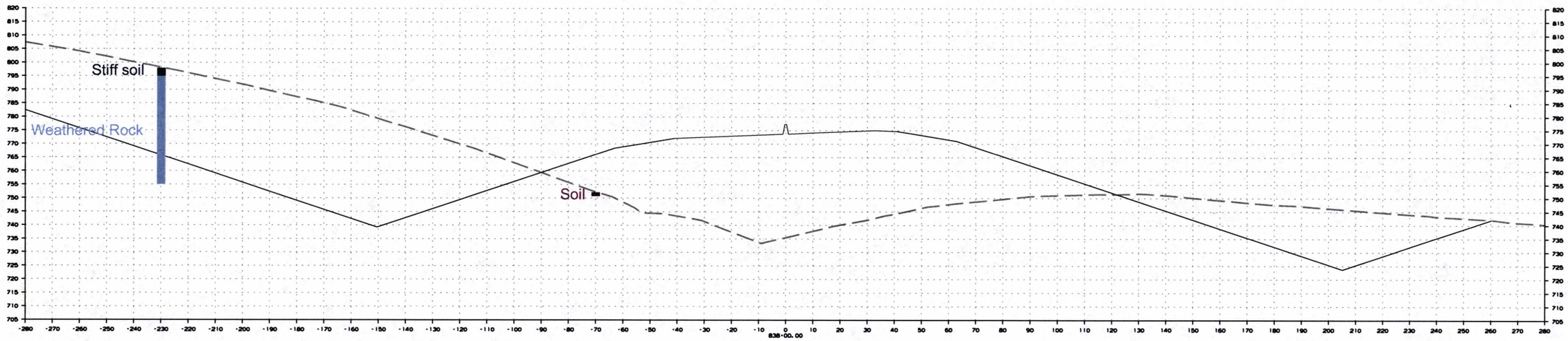
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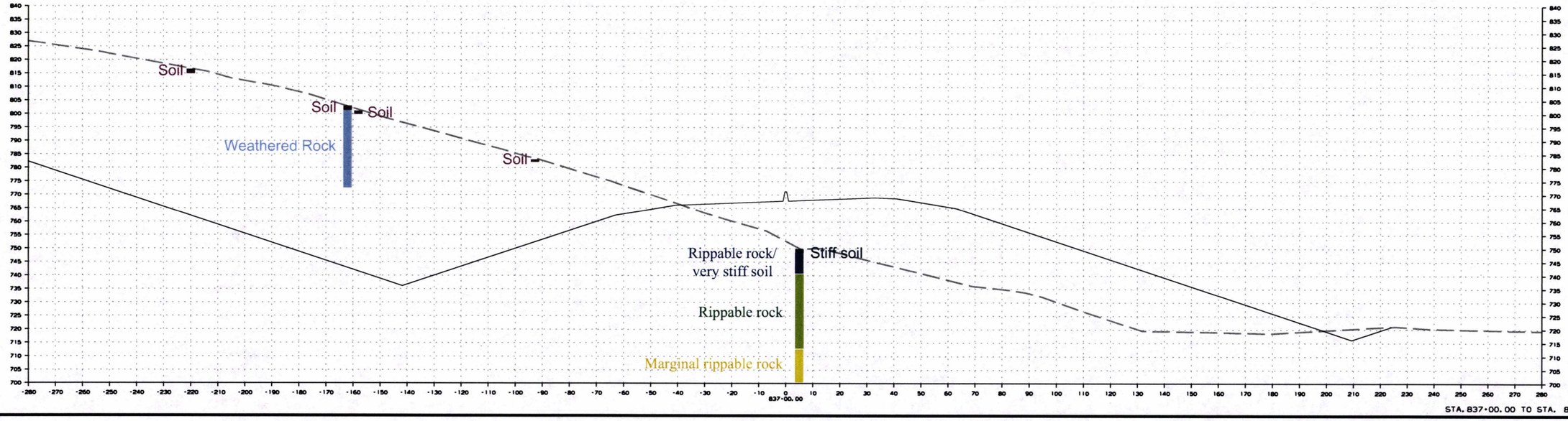
RR60140.DGN

STA. 835+00.00 TO STA. 836+00.00

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		R60140		
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PRELIMINARY
SUBJECT TO REVISION





STA. 837+00.00 TO STA. 838+00.00

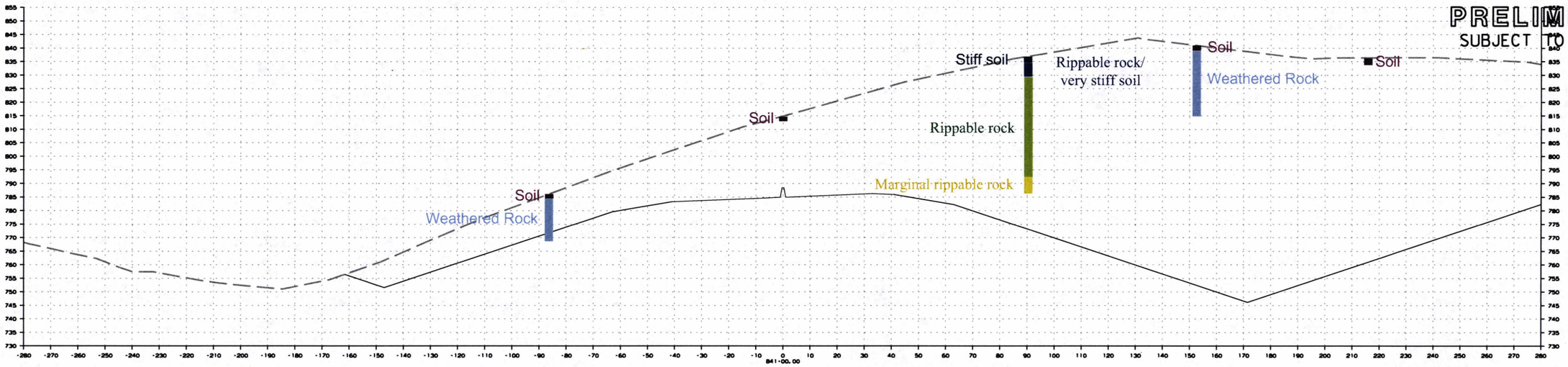
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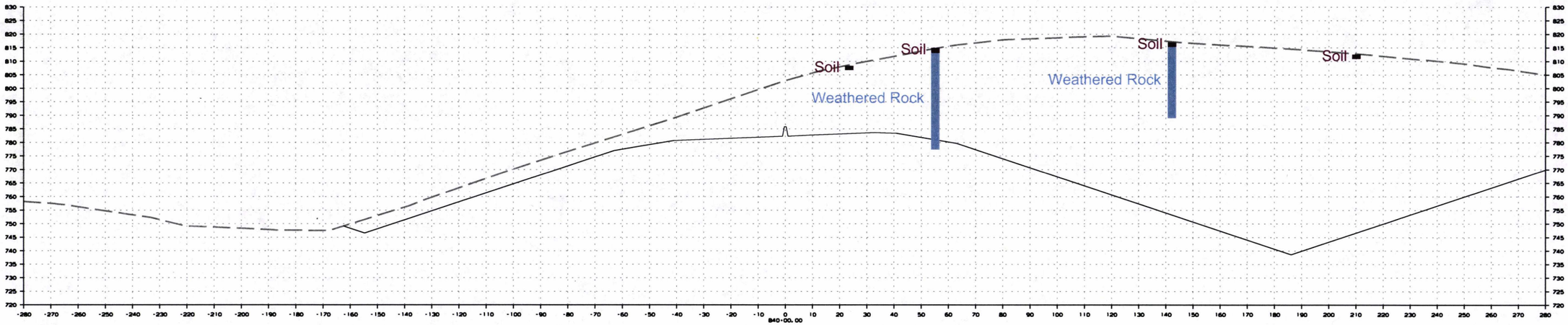
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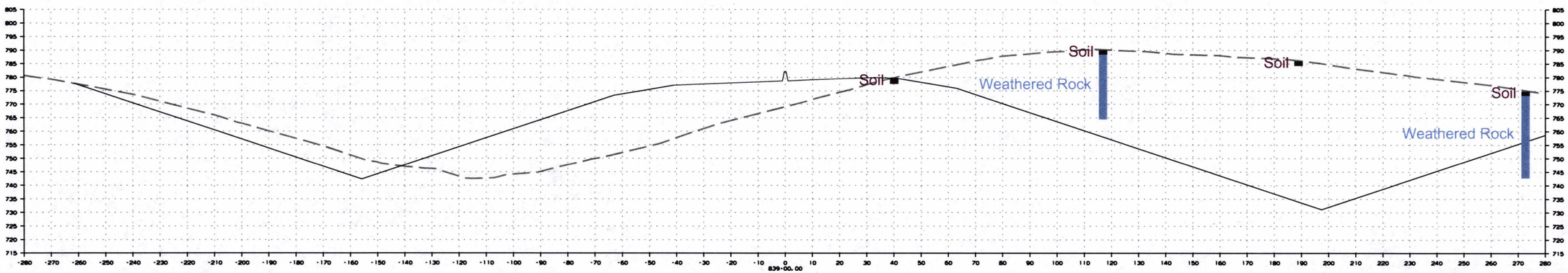
DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		R60140		

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PRELIMINARY
SUBJECT TO REVISION







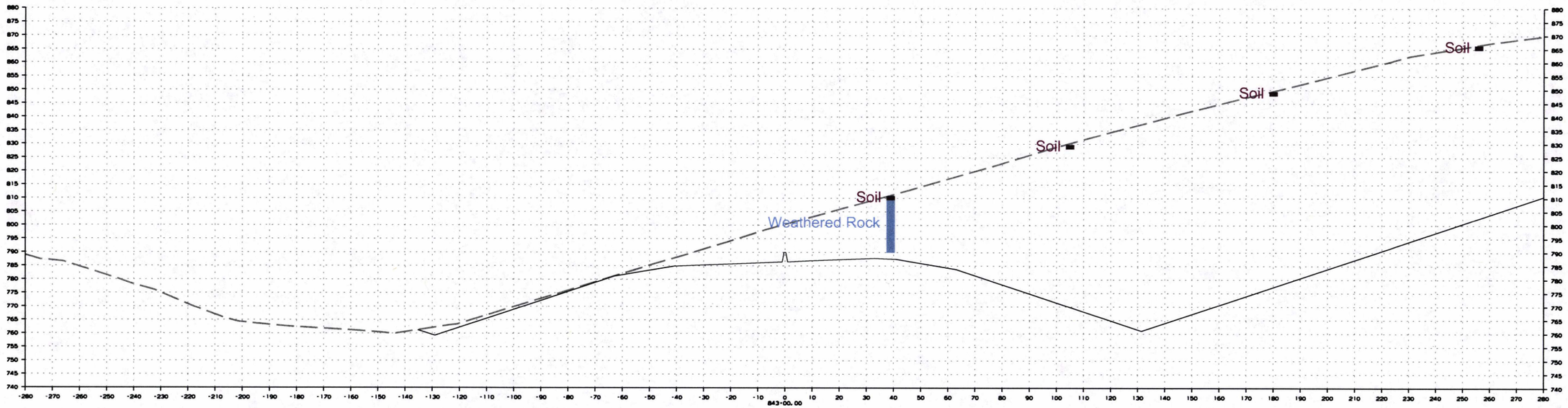
STA. 839+00.00 TO STA. 841+00.00

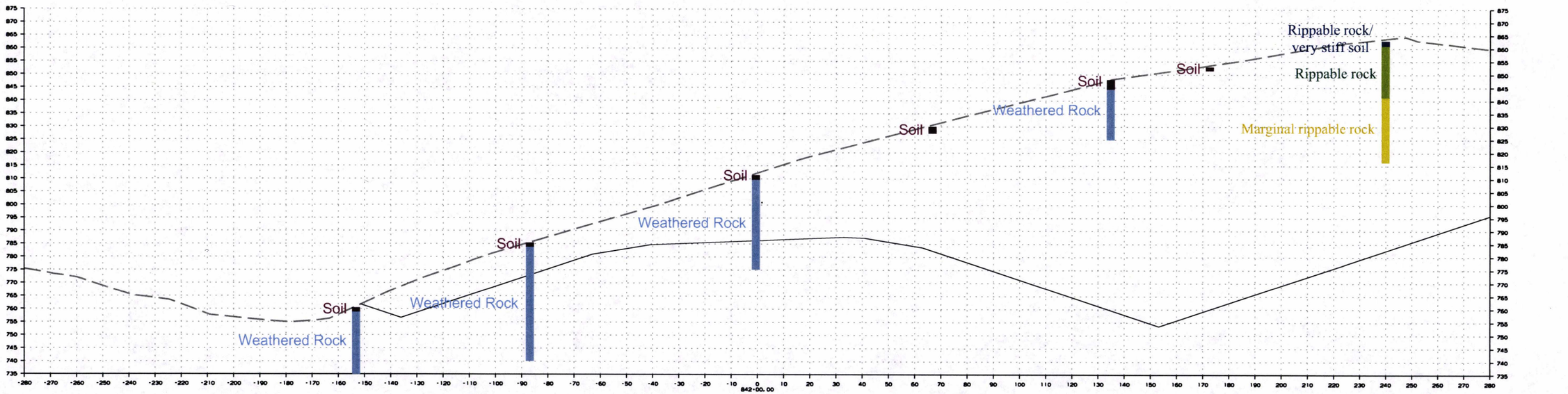
3/1/2018

RR60140.DGN

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		R60140		
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PRELIMINARY
SUBJECT TO REVISION





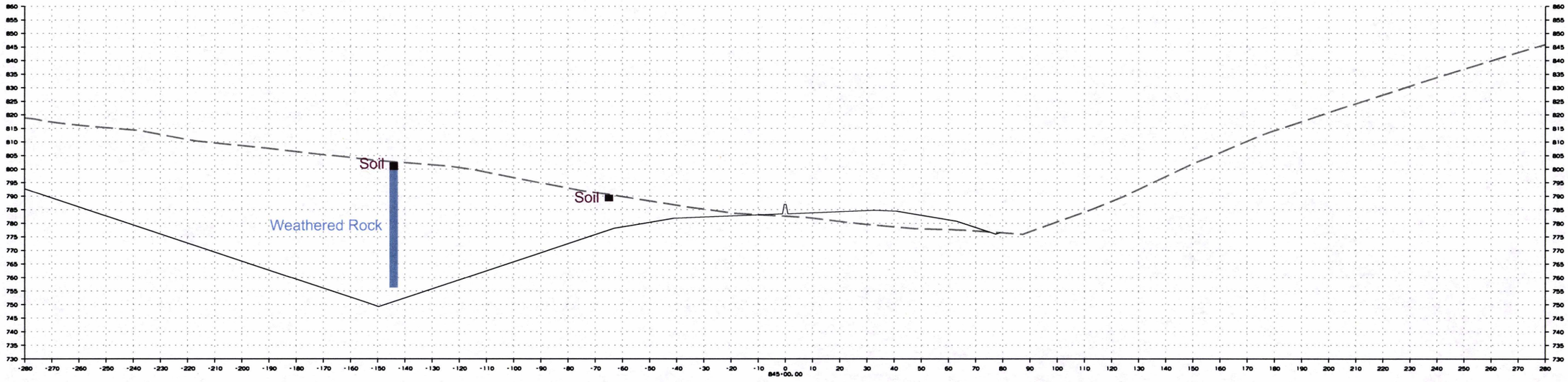
STA. 842+00.00 TO STA. 843+00.00

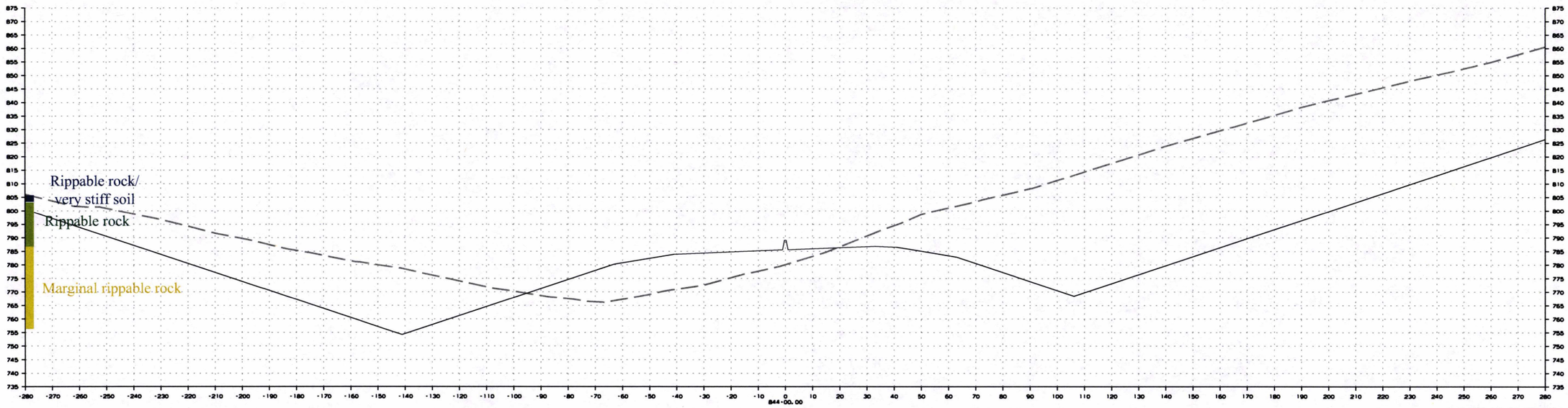
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RR60140.DGN

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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PRELIMINARY
SUBJECT TO REVISION





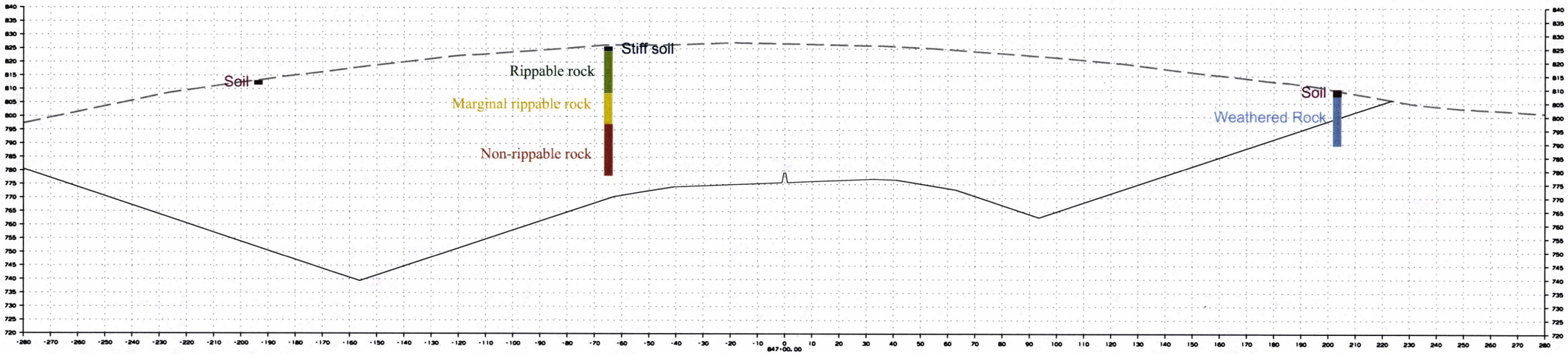
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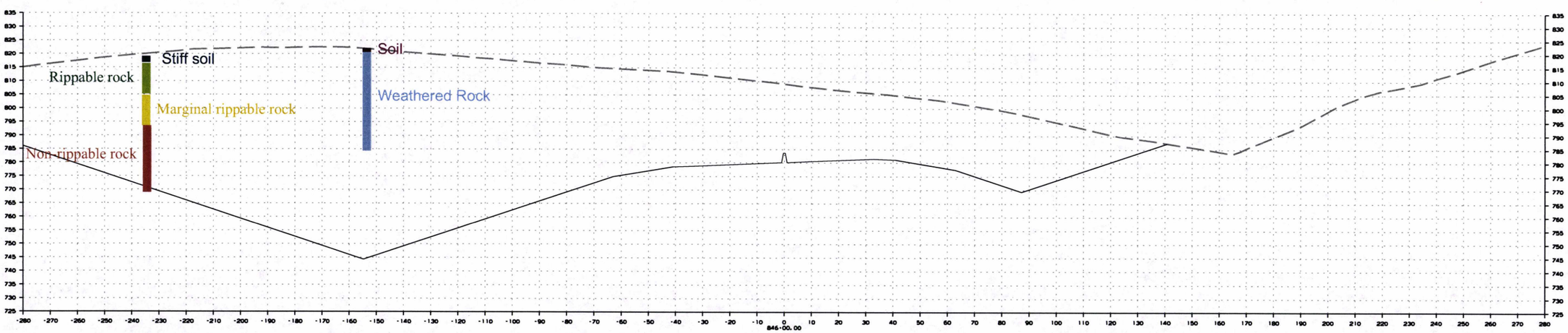
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RR60140.DGN

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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PRELIMINARY
SUBJECT TO REVISION





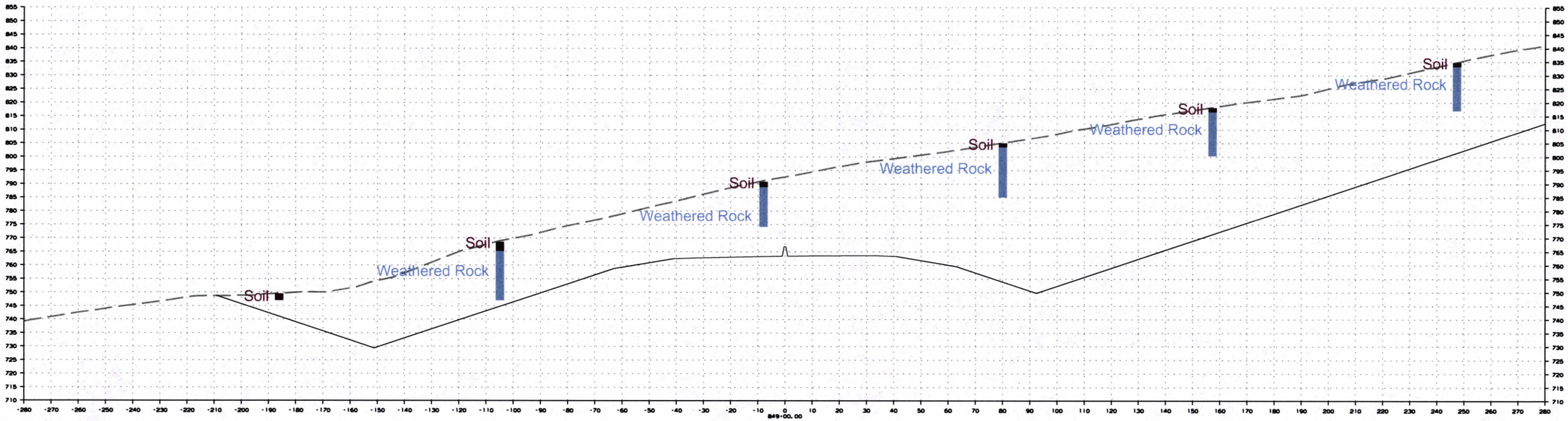
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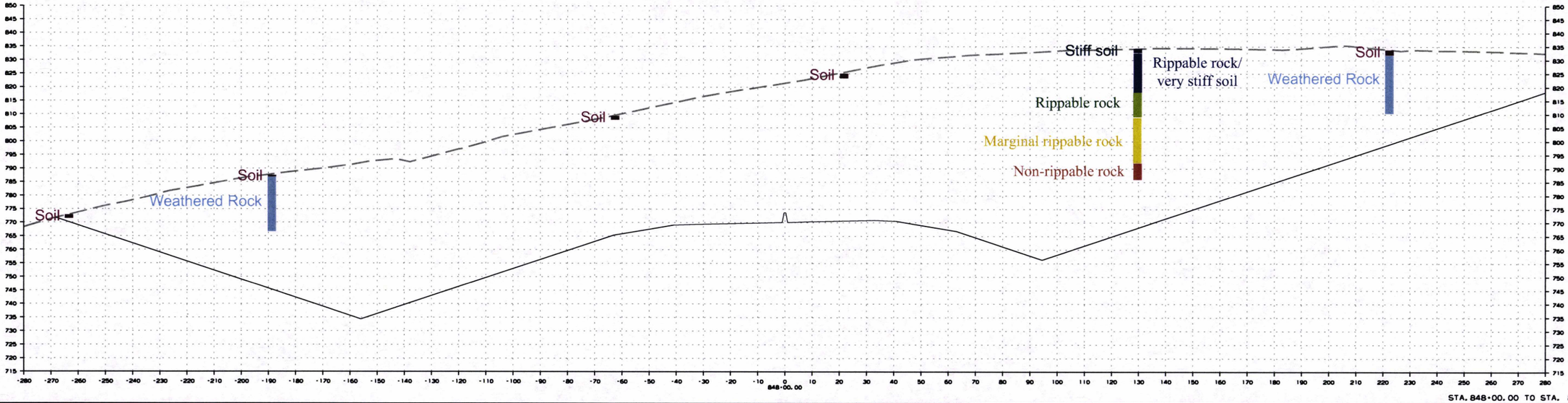
RR60140.DGN

STA. 846+00.00 TO STA. 847+00.00

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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				JOB NO.		R60140		
				②	****			

PRELIMINARY
SUBJECT TO REVISION





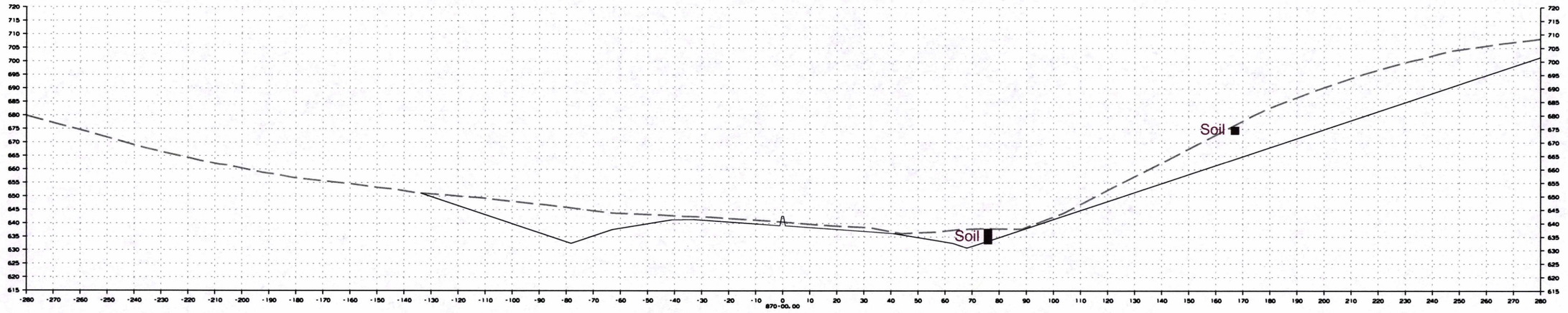
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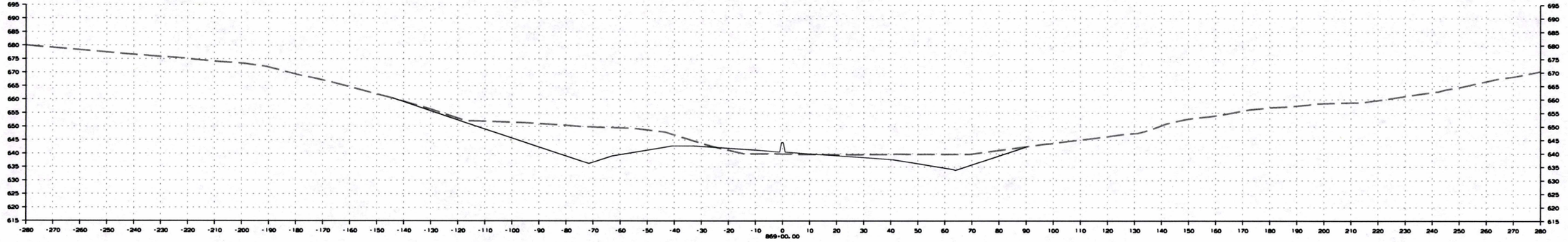
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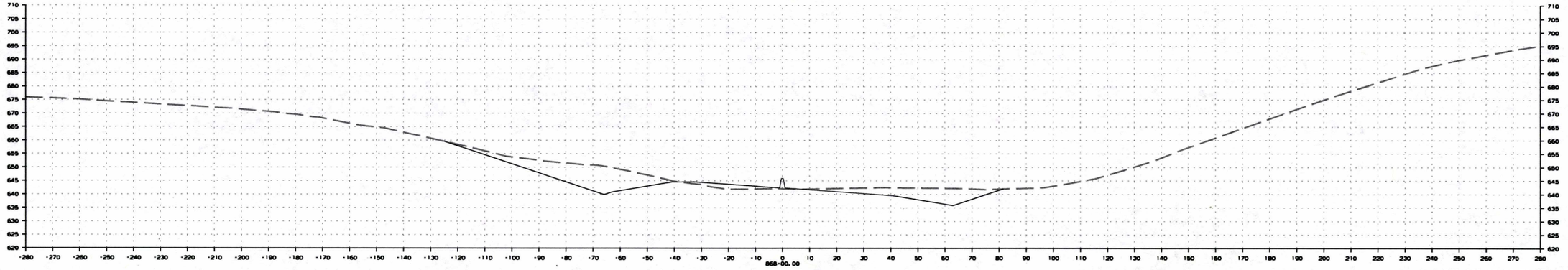
RR60140.DGN

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		R60140		
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PRELIMINARY
SUBJECT TO REVISION





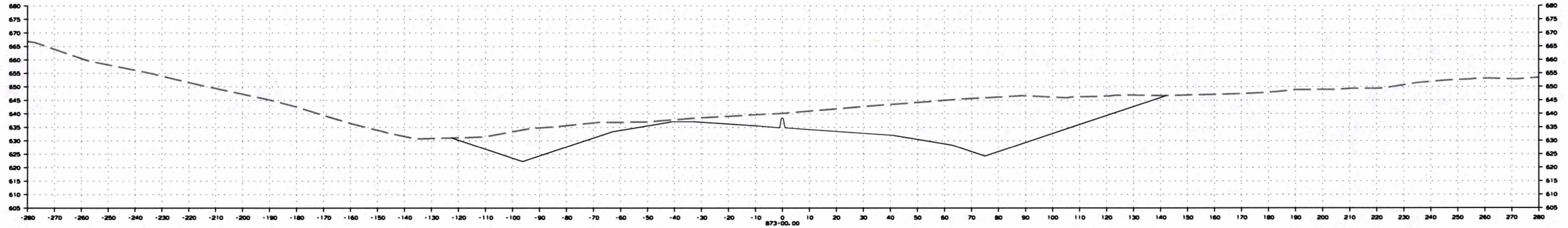


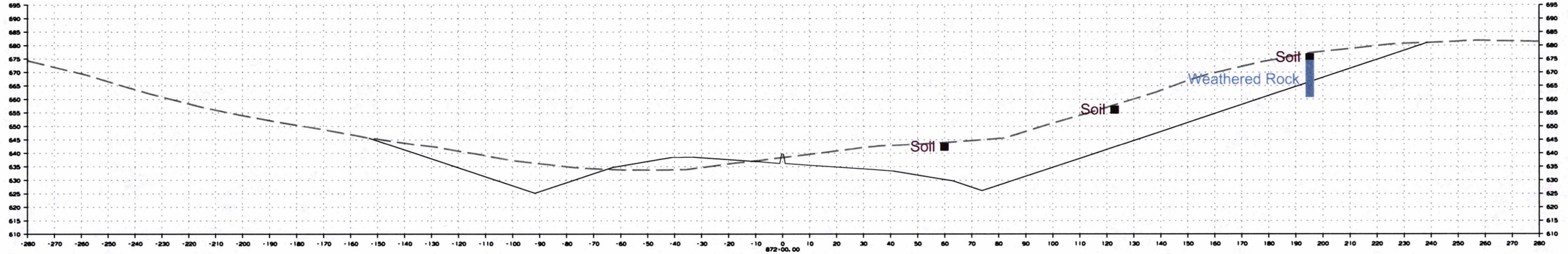
STA. 868+00.00 TO STA. 870+00.00

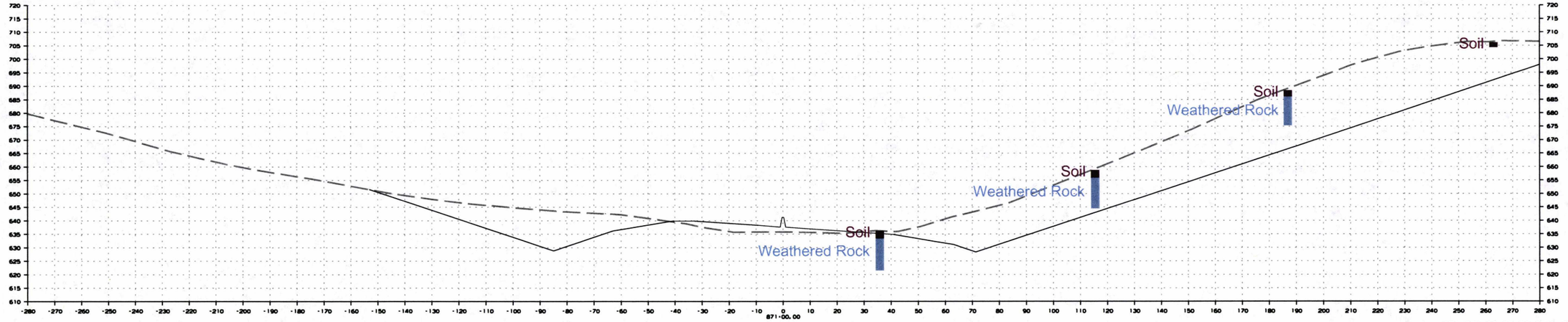
RR60140.DGN 3/1/2018

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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PRELIMINARY
SUBJECT TO REVISION





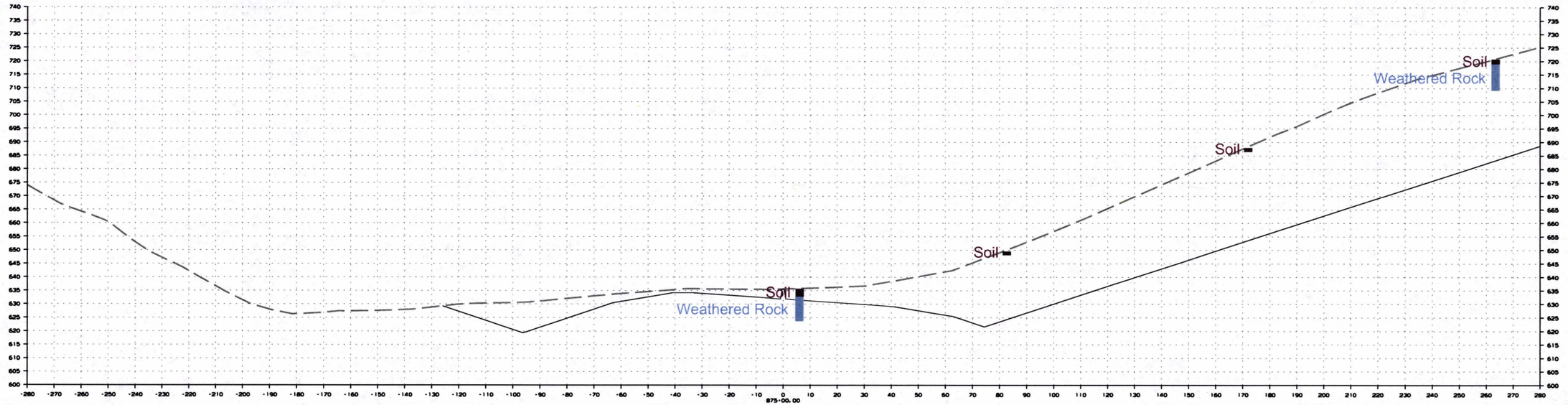


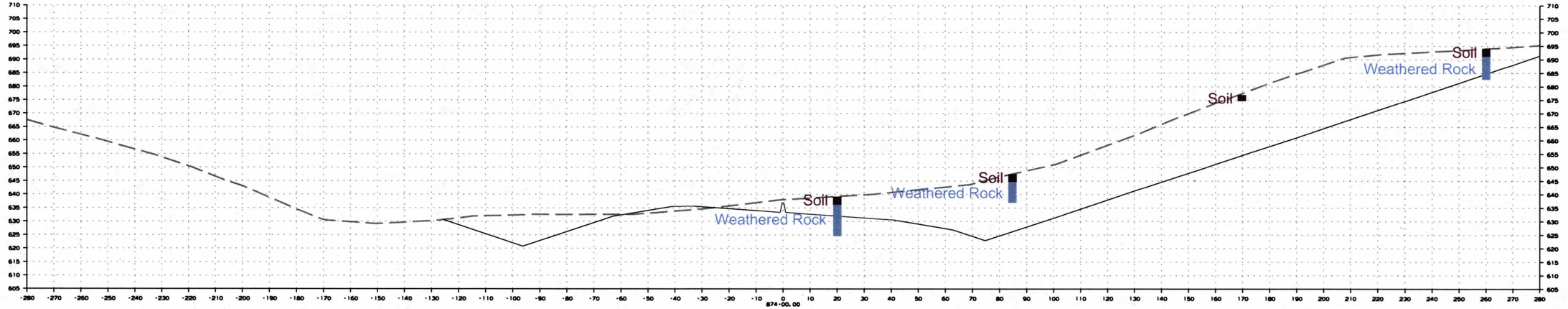
STA. 871+00.00 TO STA. 873+00.00

RR60140.DGN 3/1/2018

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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PRELIMINARY
SUBJECT TO REVISION





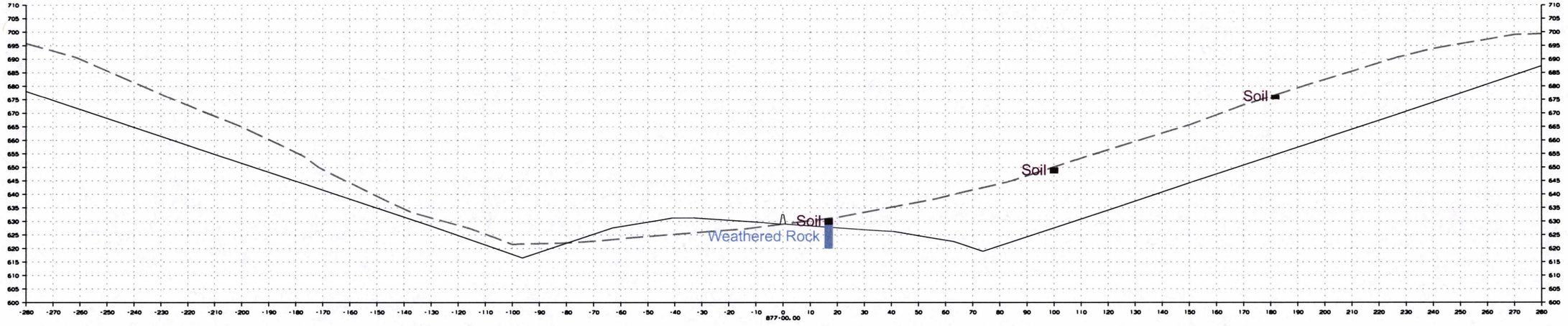
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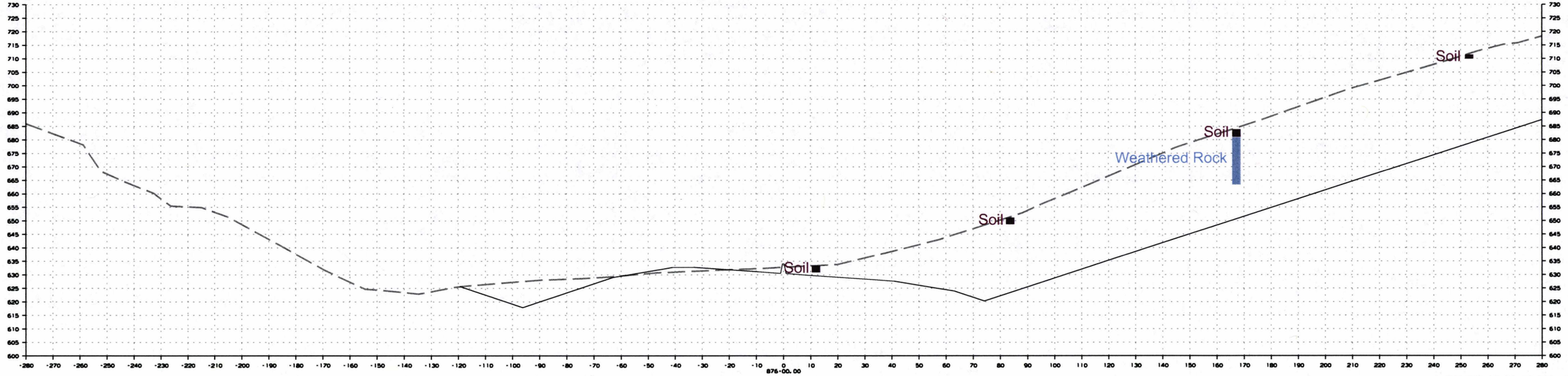
3/1/2018

RR60140.DGN

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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PRELIMINARY
SUBJECT TO REVISION



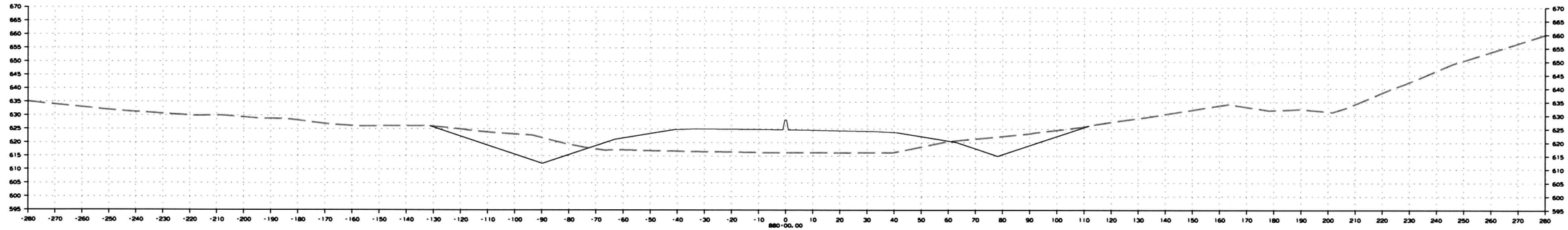


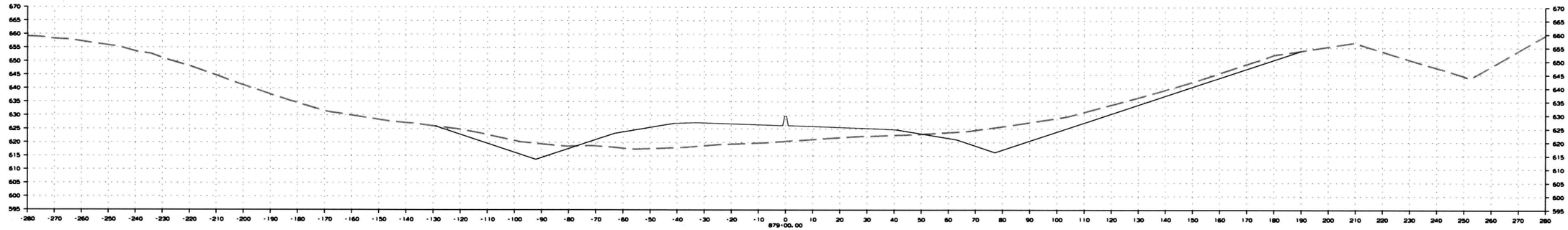
STA. 876+00.00 TO STA. 877+00.00

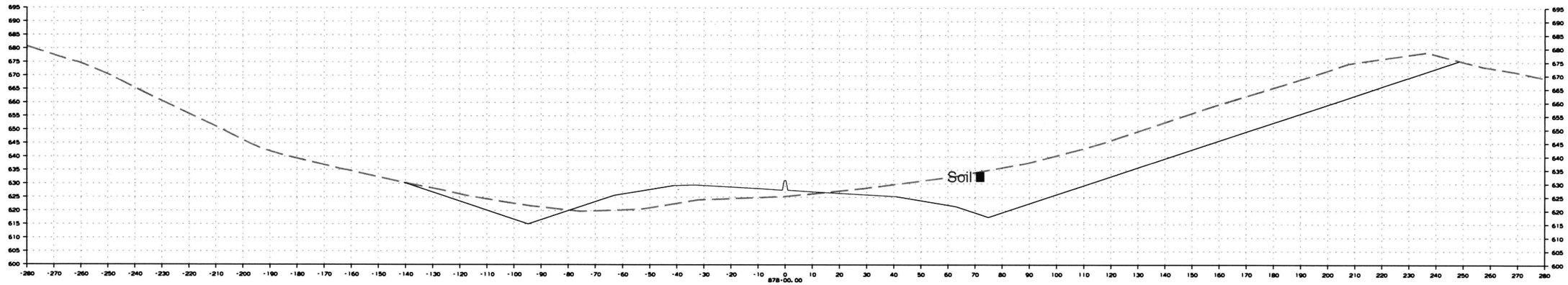
RR60140.DGN 3/1/2018

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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				JOB NO.		R60140		
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PRELIMINARY
SUBJECT TO REVISION







STA. 878+00.00 TO STA. 880+00.00

3/1/2018

RR60140.DGN

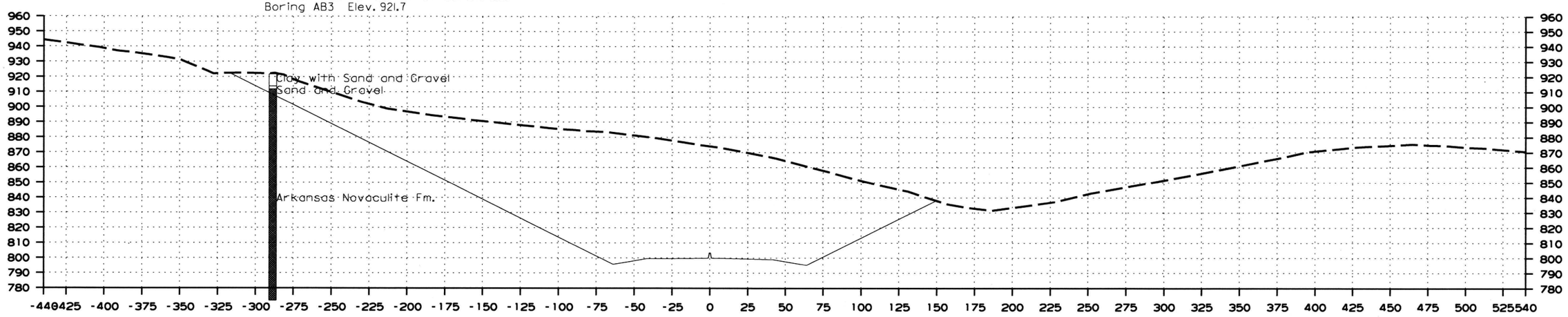
APPENDIX C

PRELIMINARY CROSS SECTIONS WITH BORING LOG INFORMATION

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.AID DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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PRELIMINARY
SUBJECT TO REVISION

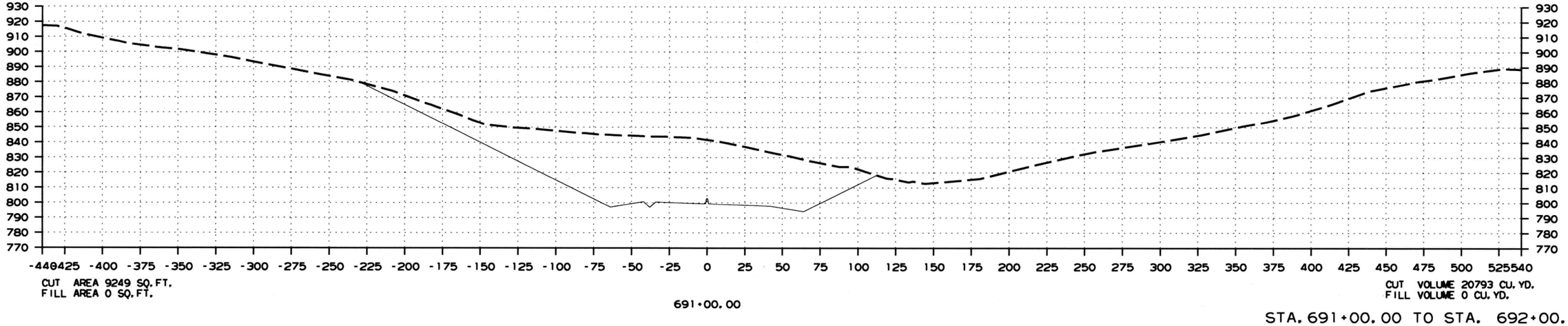
Station 692+03 291' Lt of Const. C.L.
Boring AB3 Elev. 921.7



CUT AREA 22603 SQ.FT.
FILL AREA 0 SQ.FT.

CUT VOLUME 58985 CU.YD.
FILL VOLUME 0 CU.YD.

692+00.00



CUT AREA 9249 SQ.FT.
FILL AREA 0 SQ.FT.

CUT VOLUME 20793 CU.YD.
FILL VOLUME 0 CU.YD.

691+00.00

STA. 691+00.00 TO STA. 692+00.00

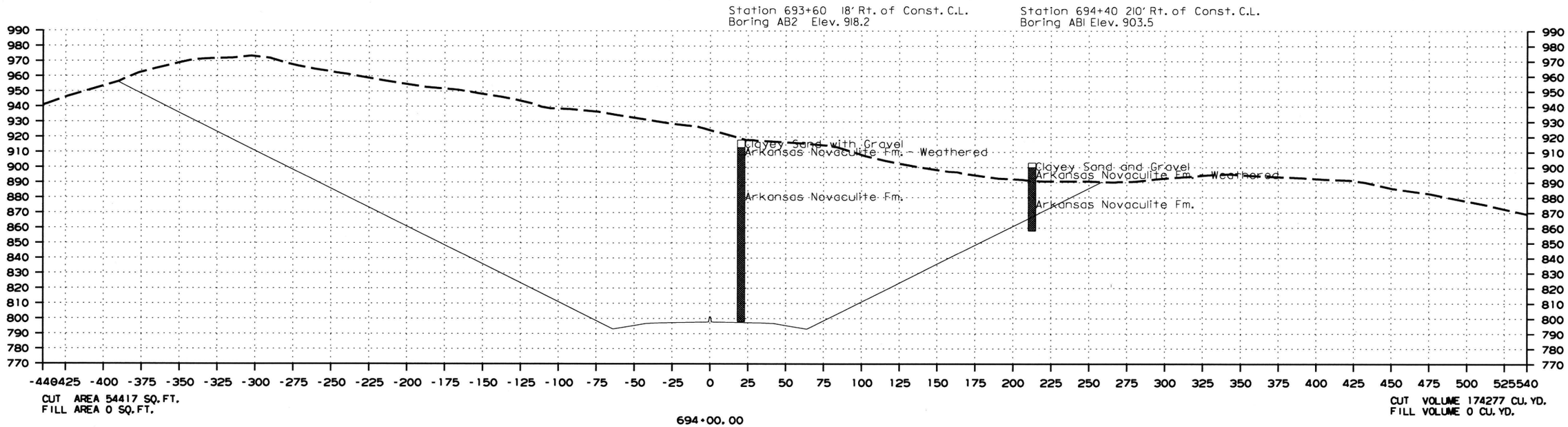
11/8/2011

Z80DROER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED

FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
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JOB NO.	****			
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PRELIMINARY
SUBJECT TO REVISION





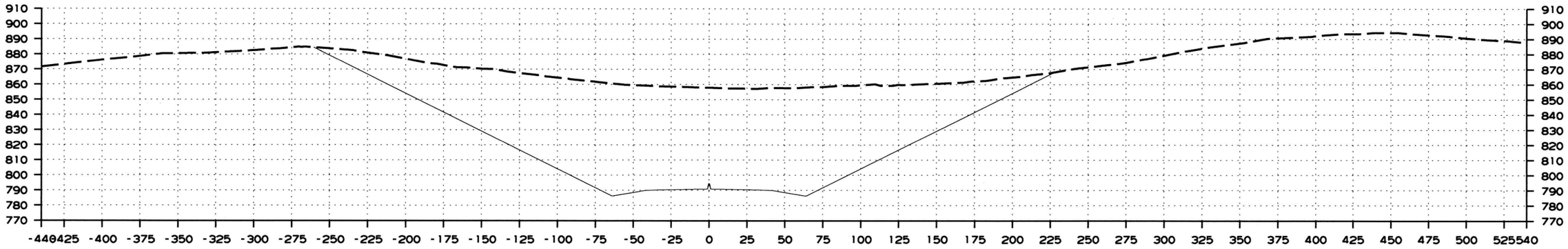
STA. 693+00.00 TO STA. 694+00.00

11/8/2011

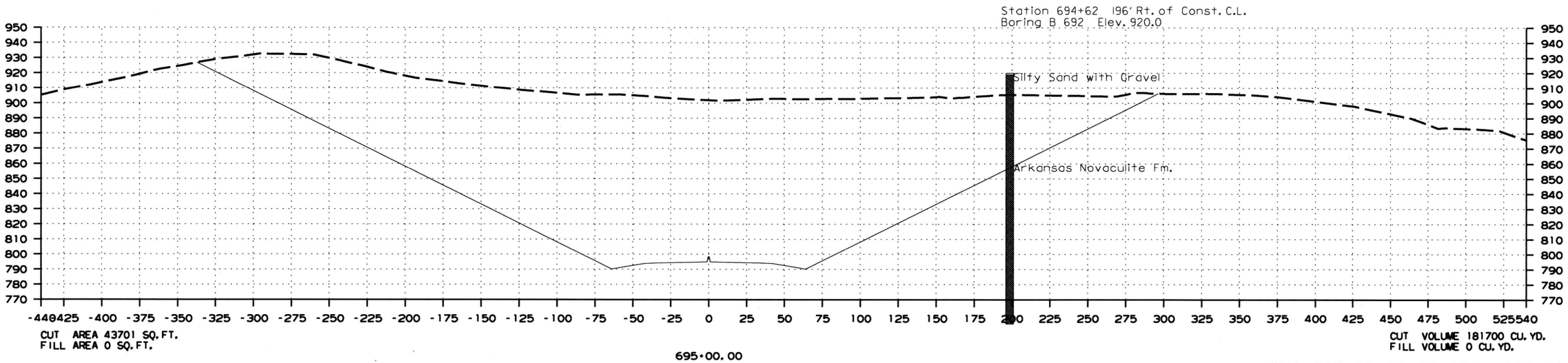
ZBORDER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		▪▪▪▪		
				▪▪▪▪				

PRELIMINARY
SUBJECT TO REVISION



696+00.00



695+00.00

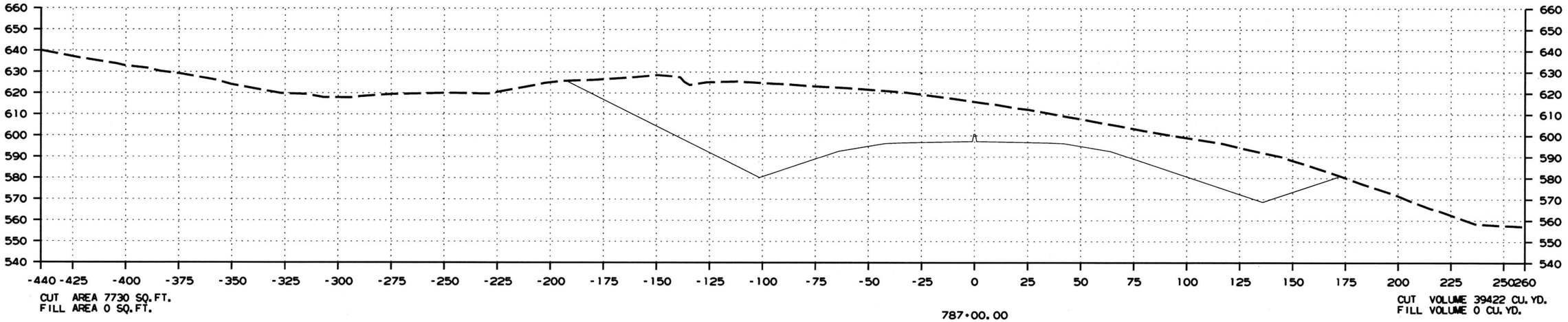
STA. 695+00.00 TO STA. 696+00.00

11/8/2011

ZBDROER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.	▪▪▪▪			
				▪▪▪▪				

PRELIMINARY
SUBJECT TO REVISION



Station 785+74 110' Lt of Const. C.L.
Boring B 791 Elev. 635.0



STA. 786+00.00 TO STA. 787+00.00

11/8/2011

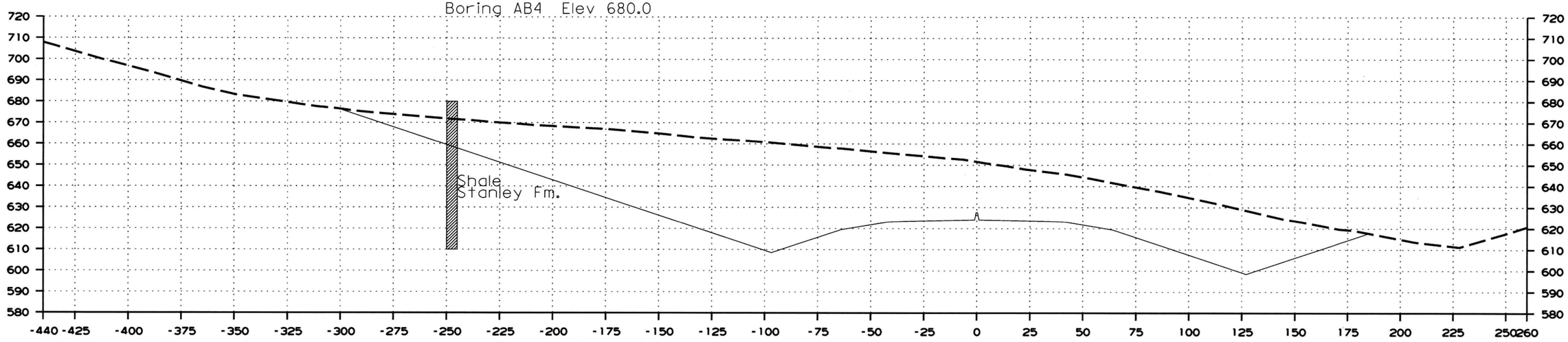
Z80ROGR.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED

FED.AID DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
6	ARK.			
JOB NO.		====		
② ====				

PRELIMINARY
SUBJECT TO REVISION

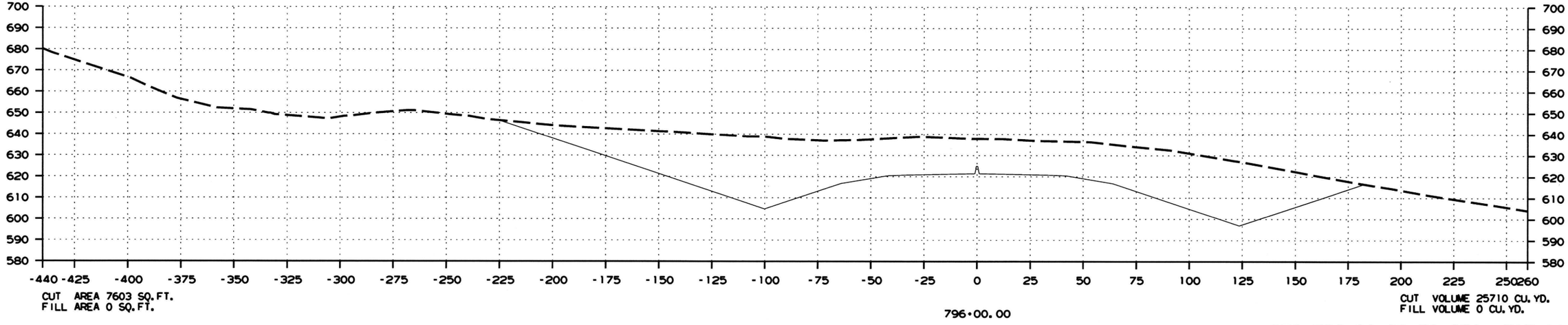
Station 797+46 250' Lt of Const. C.L.
Boring AB4 Elev 680.0



CUT AREA 12828 SQ.FT.
FILL AREA 0 SQ.FT.

797+00.00

CUT VOLUME 37836 CU.YD.
FILL VOLUME 0 CU.YD.



CUT AREA 7603 SQ.FT.
FILL AREA 0 SQ.FT.

796+00.00

CUT VOLUME 25710 CU.YD.
FILL VOLUME 0 CU.YD.

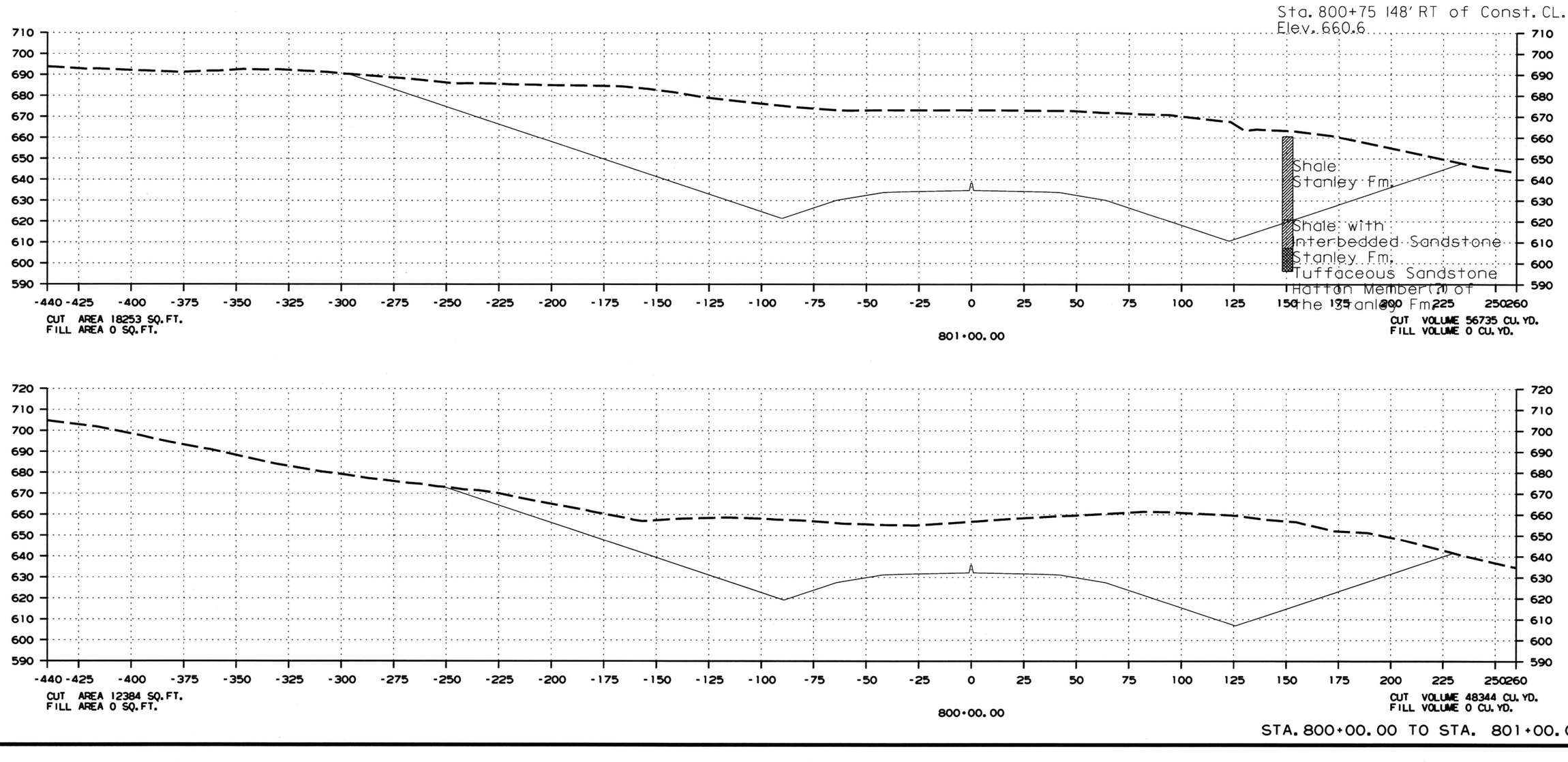
STA. 796+00.00 TO STA. 797+00.00

11/8/2011

Z80ROER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.	▪▪▪▪			
				② ▪▪▪▪				

PRELIMINARY
SUBJECT TO REVISION



STA. 800+00.00 TO STA. 801+00.00

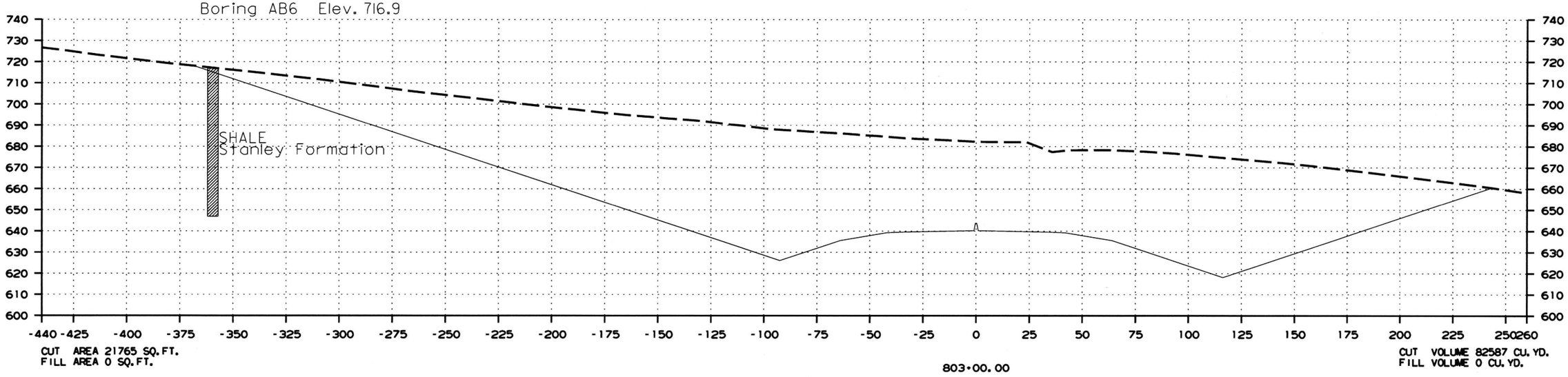
11/8/2011

ZBORDER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.HWY. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.	▪▪▪▪			
				② ▪▪▪▪				

PRELIMINARY
SUBJECT TO REVISION

Station 803+02 362' Lt. of Const. C.L.
Boring AB6 Elev. 716.9

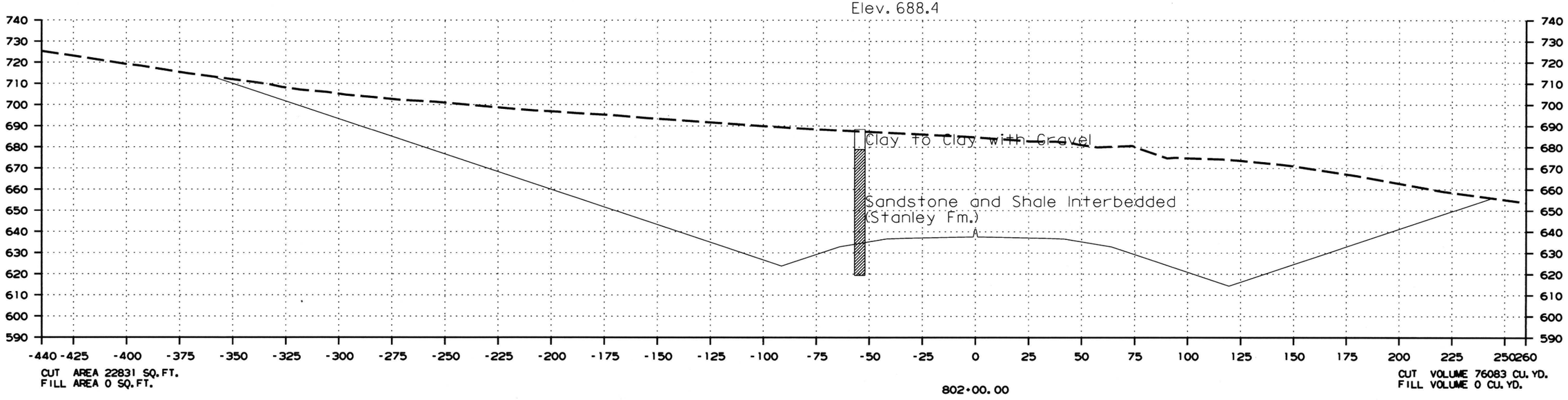


CUT AREA 21765 SQ. FT.
FILL AREA 0 SQ. FT.

803+00.00

CUT VOLUME 82587 CU. YD.
FILL VOLUME 0 CU. YD.

Sta. 802+35 57' LT of Const. CL.
Elev. 688.4



CUT AREA 22831 SQ. FT.
FILL AREA 0 SQ. FT.

802+00.00

CUT VOLUME 76083 CU. YD.
FILL VOLUME 0 CU. YD.

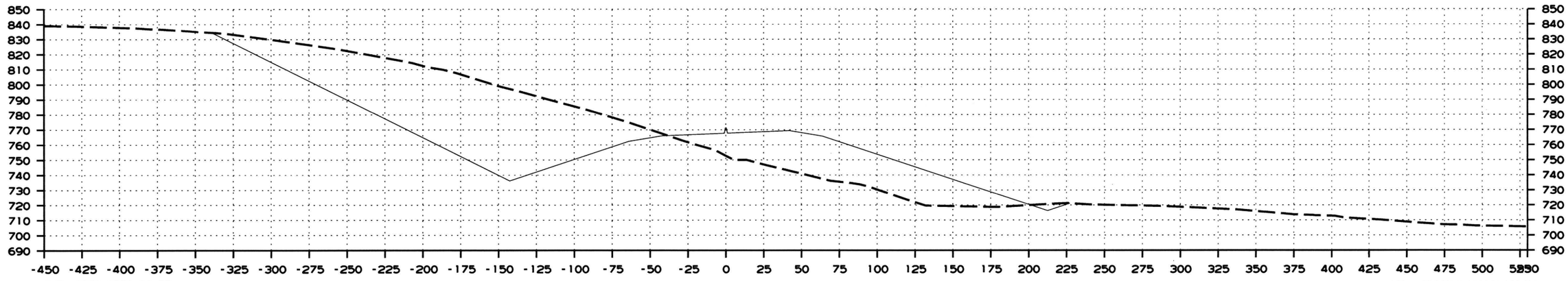
STA. 802+00.00 TO STA. 803+00.00

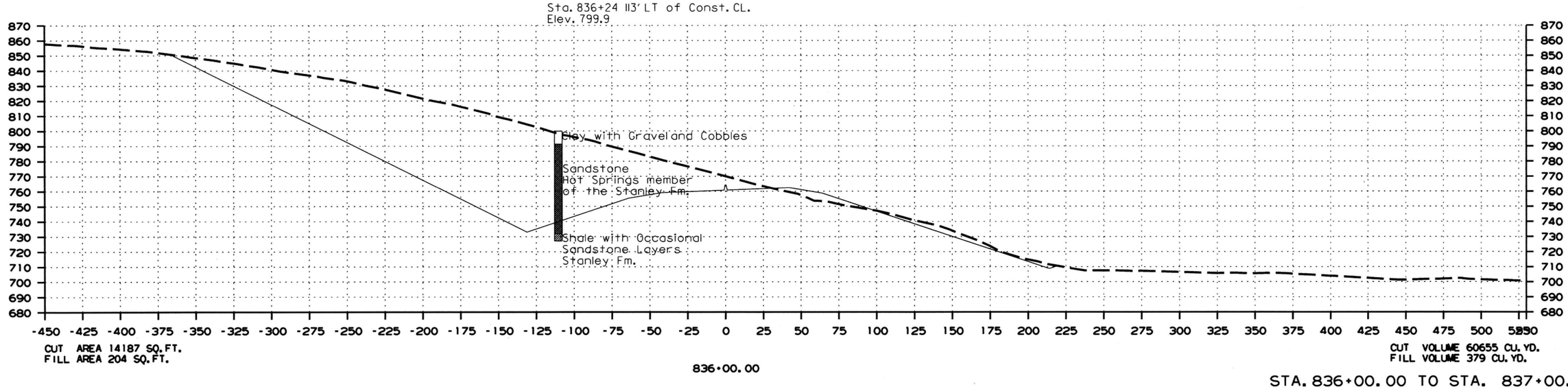
11/8/2011

Z8DROER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.AID DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		====		
				② ====				

PRELIMINARY
SUBJECT TO REVISION





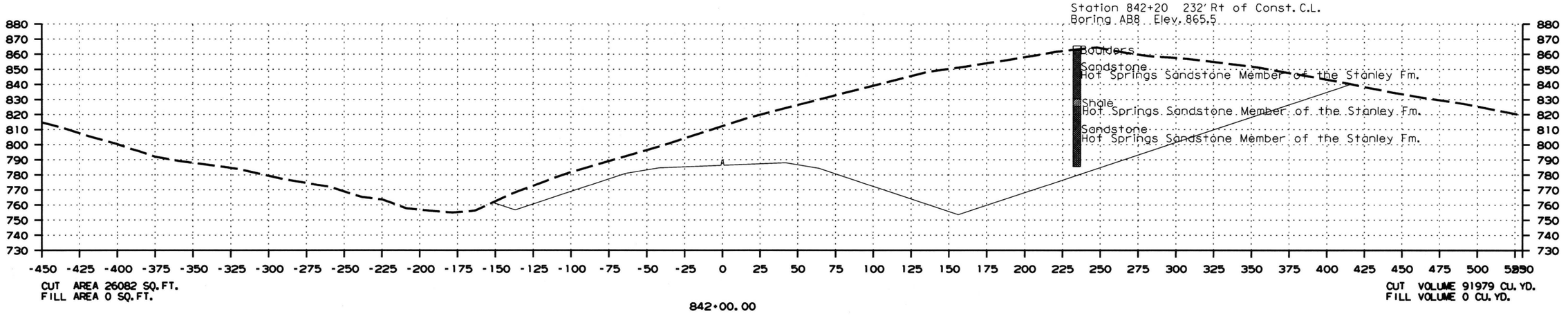
STA. 836+00.00 TO STA. 837+00.00

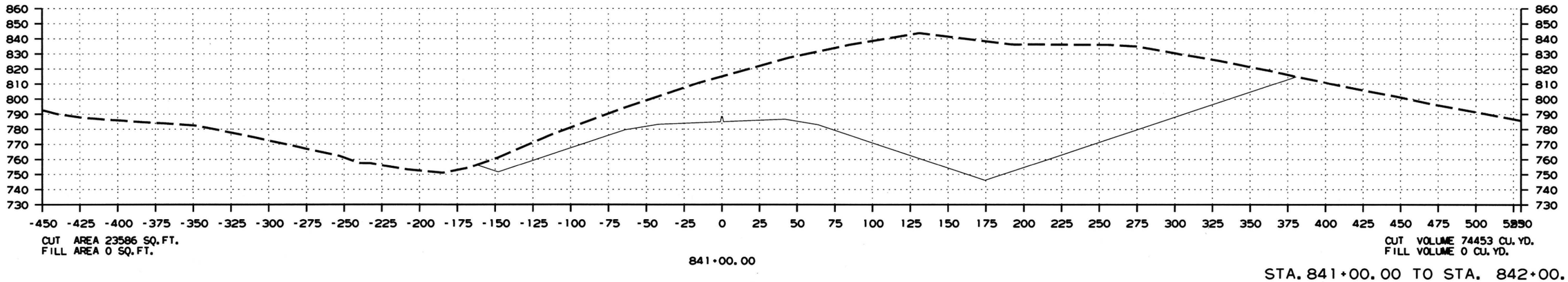
11/8/2011

ZBORDER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FEDERAL DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.	▪▪▪▪			
				② ▪▪▪▪				

PRELIMINARY
SUBJECT TO REVISION





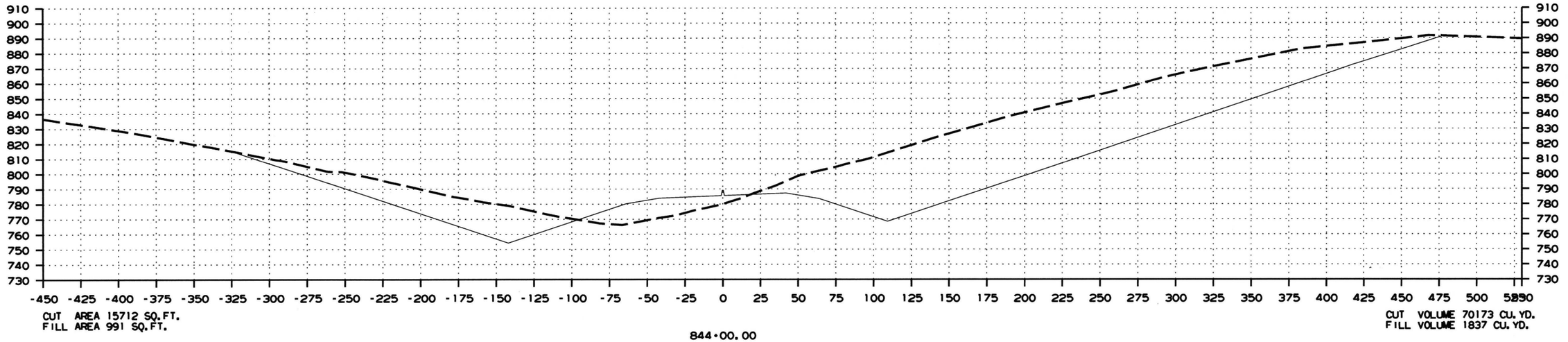
STA. 841+00.00 TO STA. 842+00.00

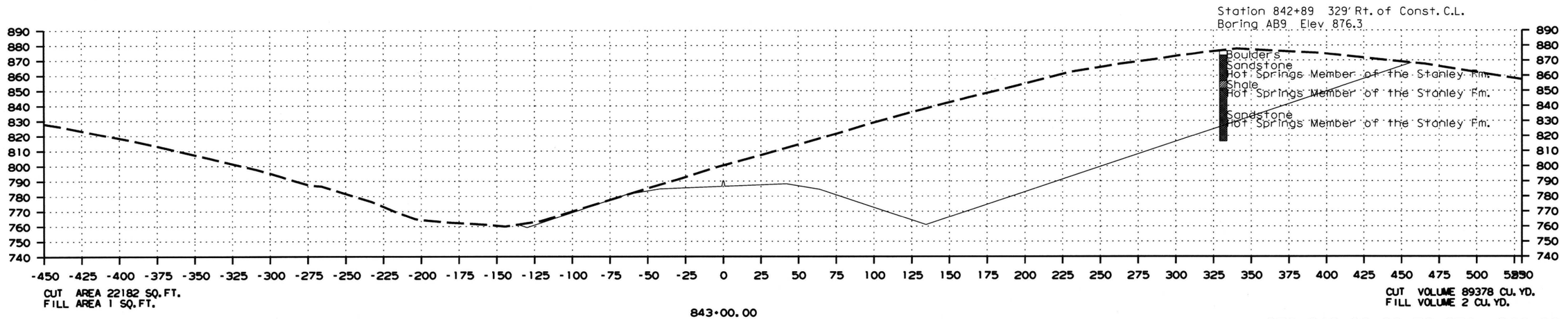
11/8/2011

Z80ROOER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.NO. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.	====			
				② ====				

PRELIMINARY
SUBJECT TO REVISION





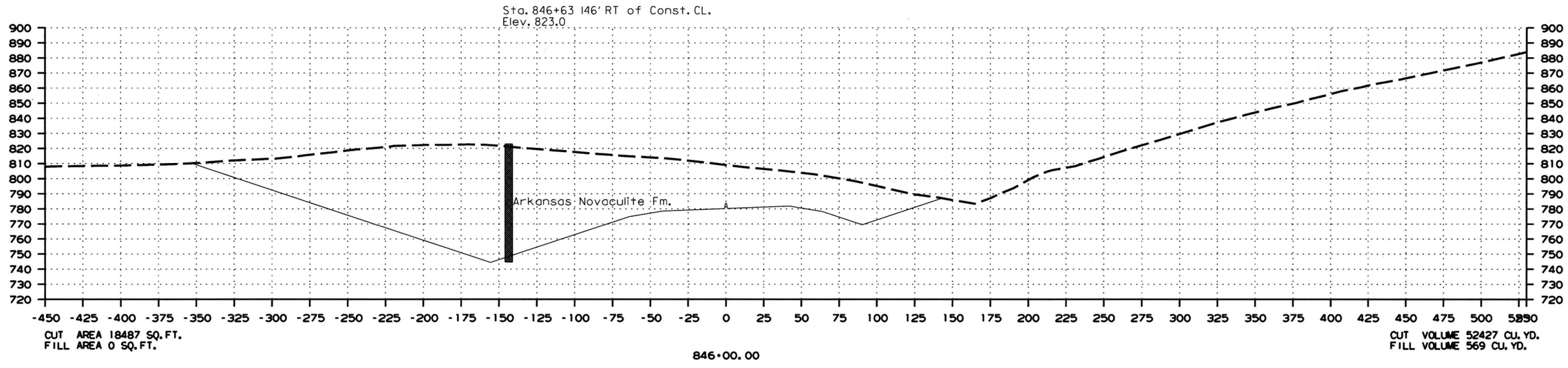
STA. 843+00.00 TO STA. 844+00.00

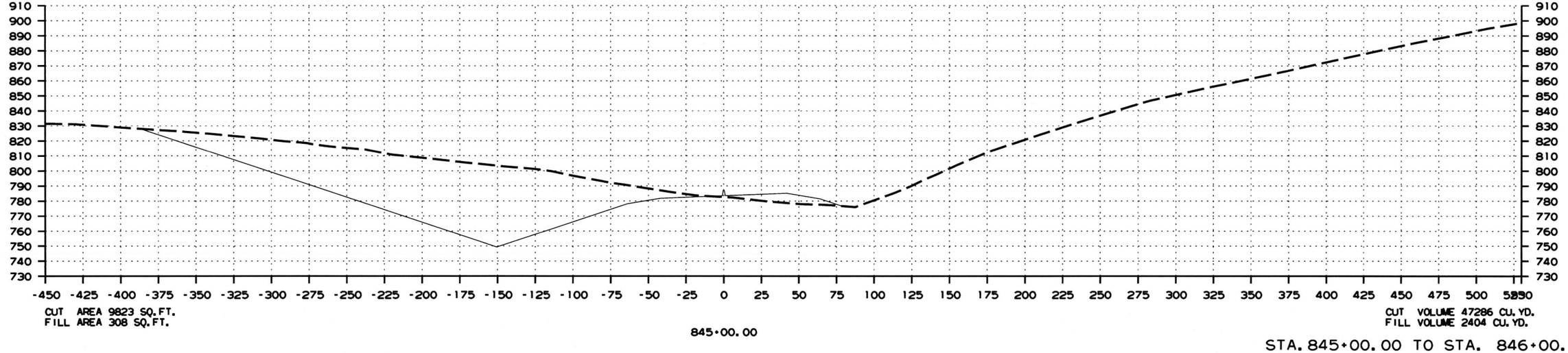
11/8/2011

ZBORDER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		****		
				② ****				

PRELIMINARY
SUBJECT TO REVISION





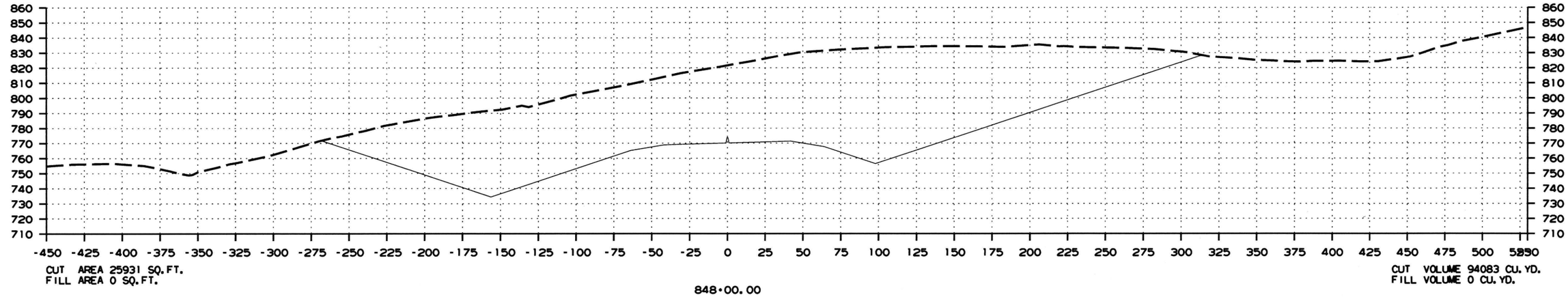
STA. 845+00.00 TO STA. 846+00.00

11/8/2011

Z80R02R.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		****		
				(2) ****				

PRELIMINARY
SUBJECT TO REVISION



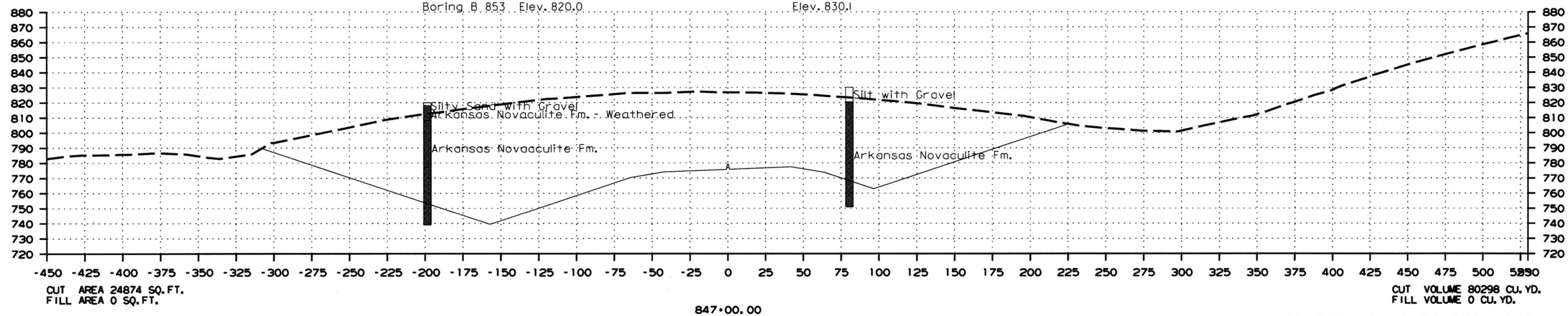
CUT AREA 25931 SQ.FT.
FILL AREA 0 SQ.FT.

CUT VOLUME 94083 CU.YD.
FILL VOLUME 0 CU.YD.

848+00.00

Station 846+63 201' Lt of Const. C.L.
Boring B 853 Elev. 820.0

Sta. 847+47 78' RT. of Const. CL.
Elev. 830.1



CUT AREA 24874 SQ.FT.
FILL AREA 0 SQ.FT.

CUT VOLUME 80298 CU.YD.
FILL VOLUME 0 CU.YD.

847+00.00

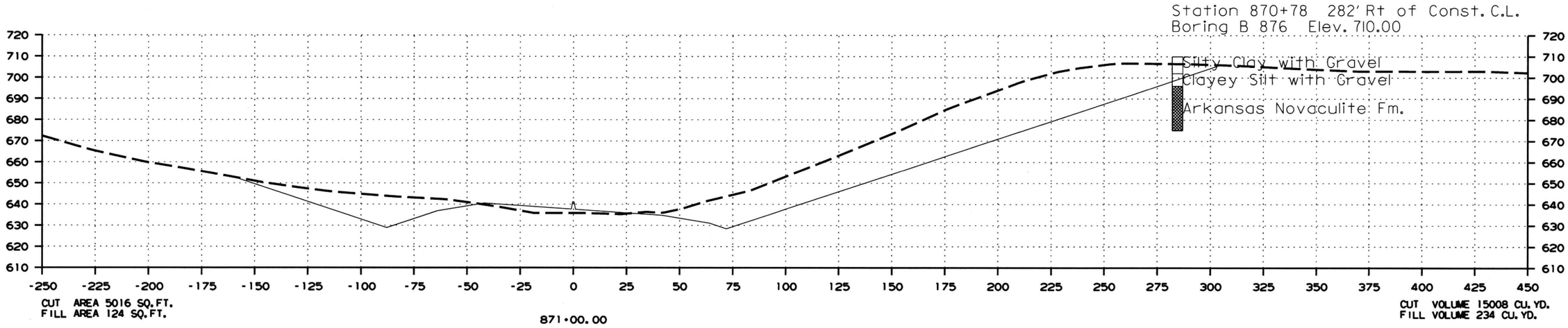
STA. 847+00.00 TO STA. 848+00.00

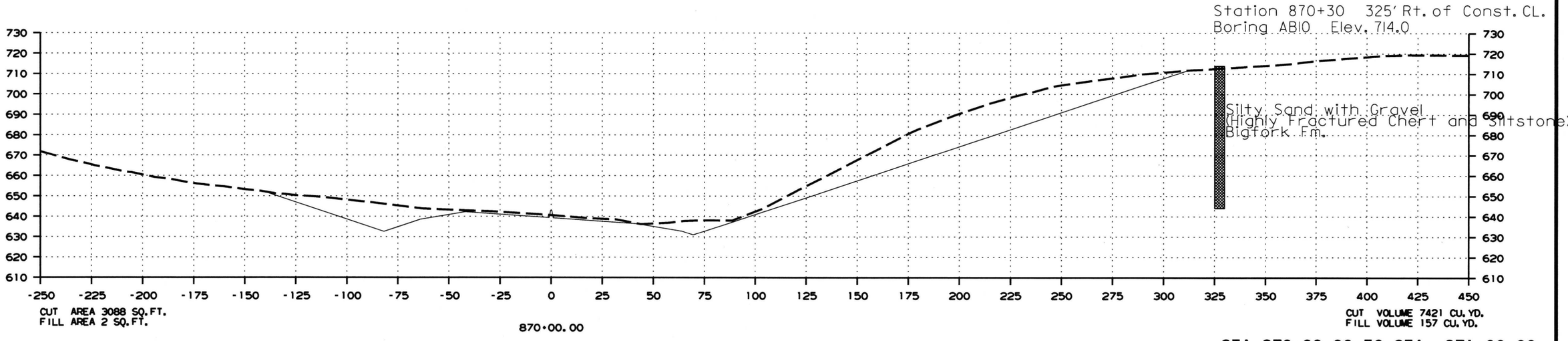
11/8/2011

Z80R02R.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		****		
				(2) ****				

PRELIMINARY
SUBJECT TO REVISION





STA. 870+00.00 TO STA. 871+00.00

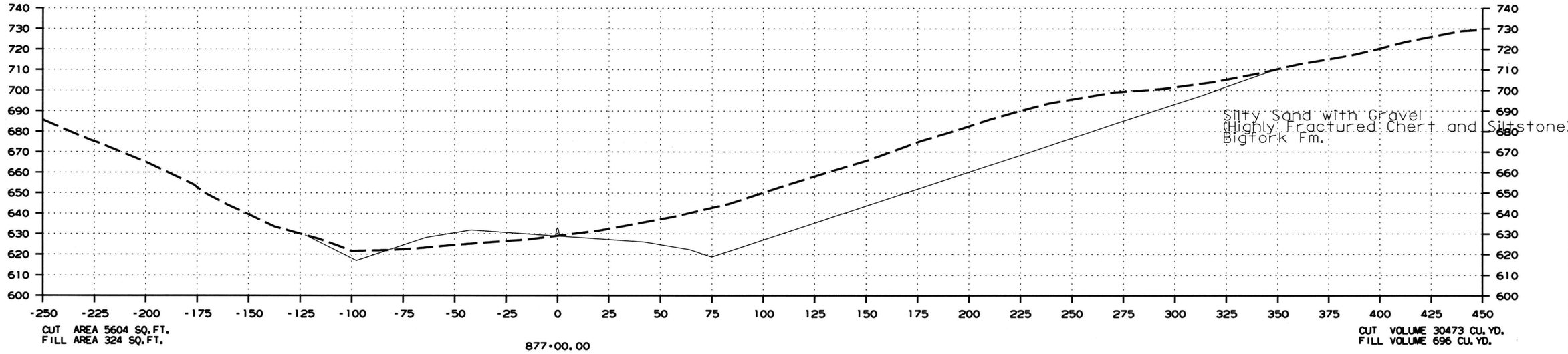
11/8/2011

Z80R00ER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.HWY. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.	▪▪▪▪			
				② ▪▪▪▪				

PRELIMINARY
SUBJECT TO REVISION

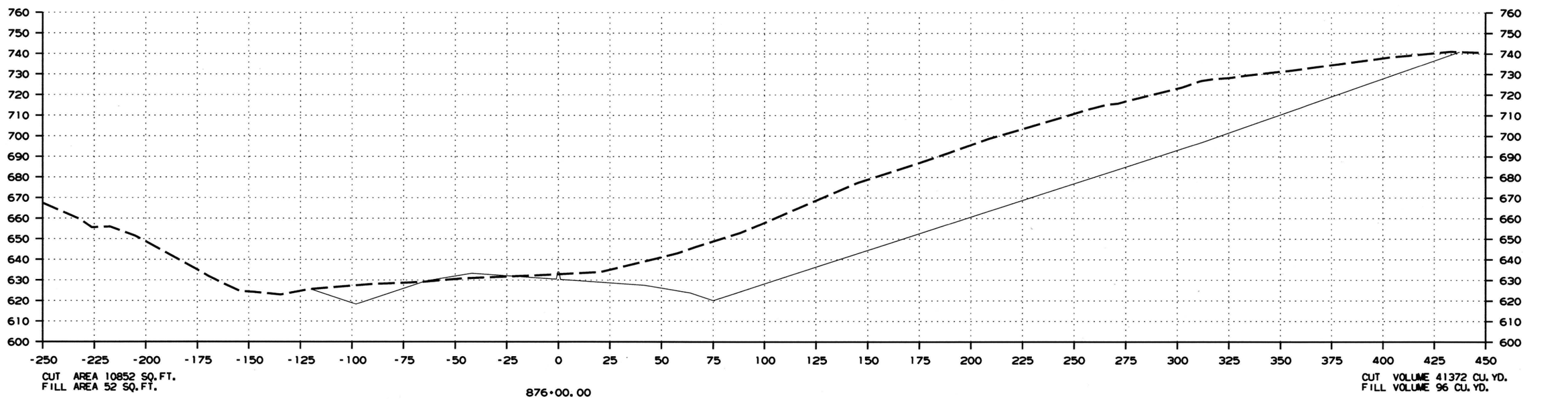
Station 876+59 495' Rt. of Const. C.L
Boring AB11 Elev. 727.8



CUT AREA 5604 SQ.FT.
FILL AREA 324 SQ.FT.

877+00.00

CUT VOLUME 30473 CU.YD.
FILL VOLUME 696 CU.YD.



CUT AREA 10852 SQ.FT.
FILL AREA 52 SQ.FT.

876+00.00

CUT VOLUME 41372 CU.YD.
FILL VOLUME 96 CU.YD.

STA. 876+00.00 TO STA. 877+00.00

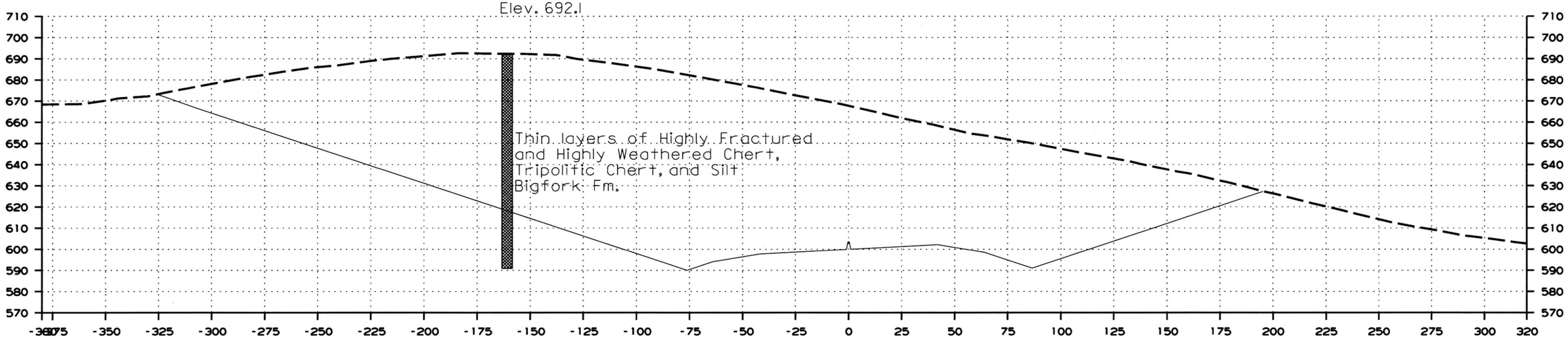
11/8/2011

Z80ROCR.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		▪▪▪▪		
				▪▪▪▪				

PRELIMINARY
SUBJECT TO REVISION

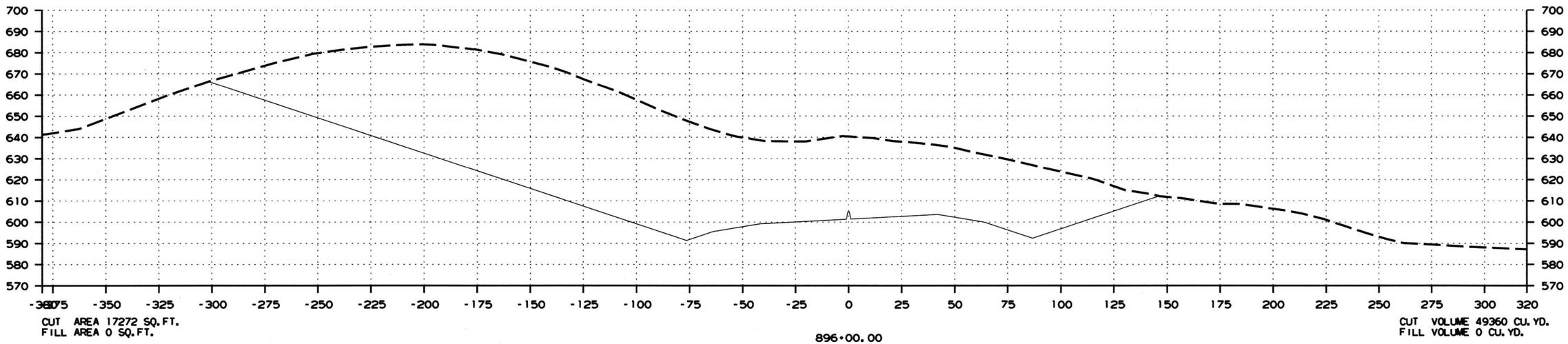
Sta. 896+91.63' Lt. of Const. CL.
Elev. 692.1



CUT AREA 28112 SQ.FT.
FILL AREA 0 SQ.FT.

CUT VOLUME 84043 CU.YD.
FILL VOLUME 0 CU.YD.

897+00.00



CUT AREA 17272 SQ.FT.
FILL AREA 0 SQ.FT.

CUT VOLUME 49360 CU.YD.
FILL VOLUME 0 CU.YD.

896+00.00

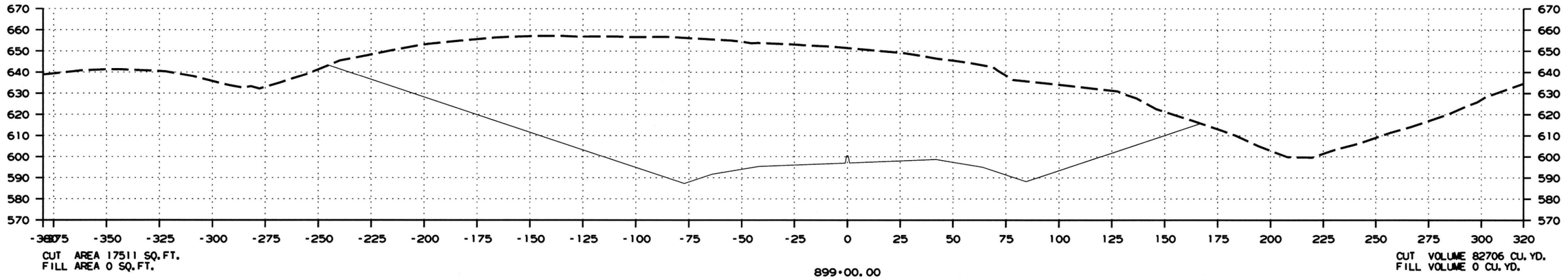
STA. 896+00.00 TO STA. 897+00.00

11/8/2011

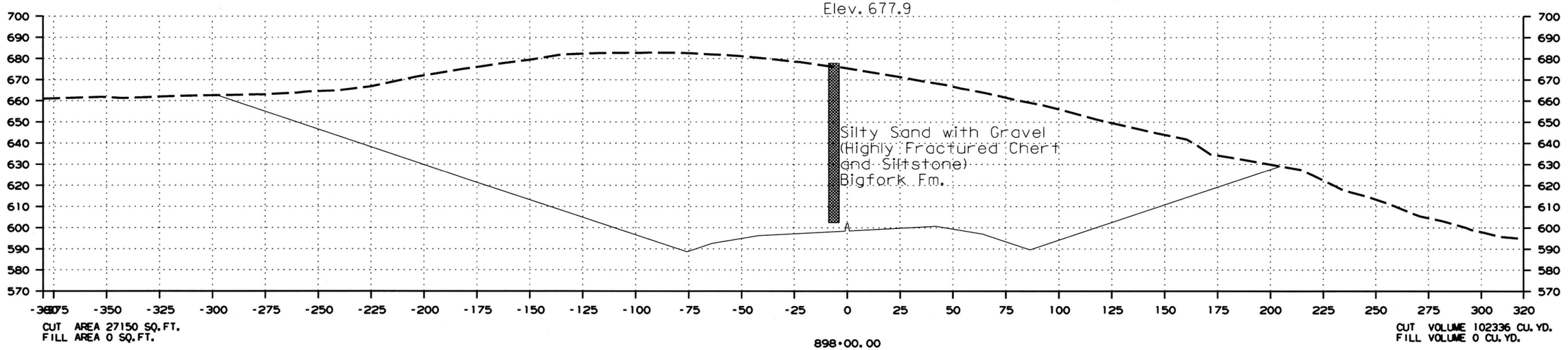
ZBORDER.CEL

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.	****			
				(2) ****				

PRELIMINARY
SUBJECT TO REVISION



Sta. 897+76 9' Lt. of Const. CL.
Elev. 677.9



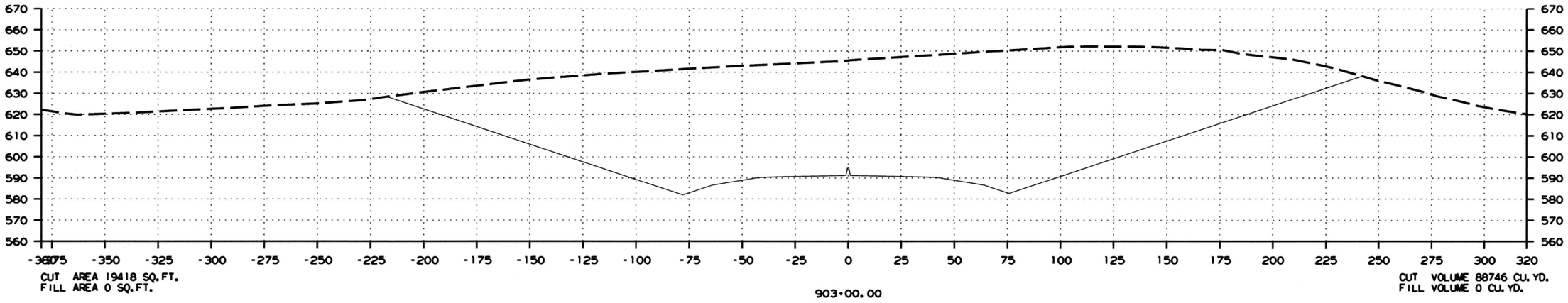
STA. 898+00.00 TO STA. 899+00.00

11/8/2011

ZBORDER.CEL

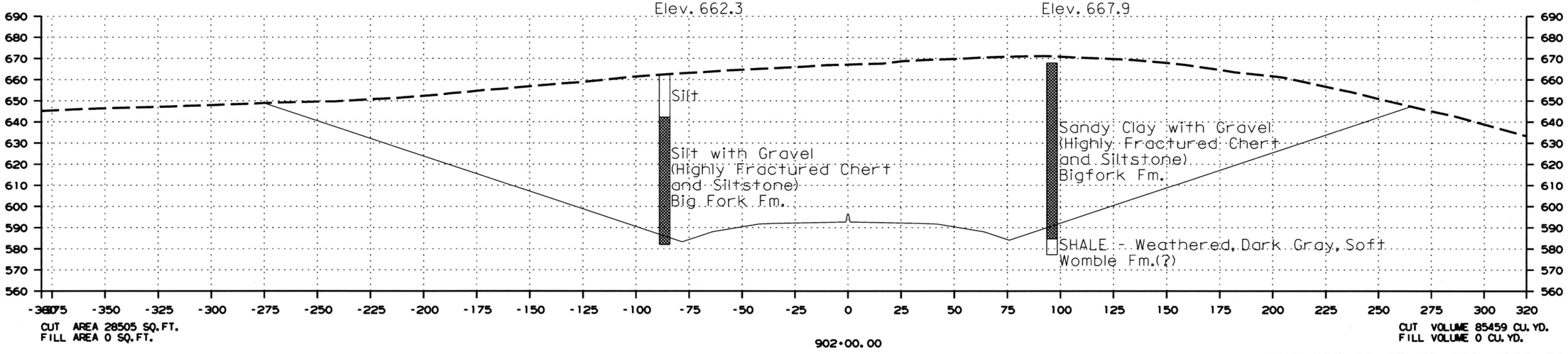
DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.AID PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		====		
				② ====				

PRELIMINARY
SUBJECT TO REVISION



Sta. 901+94 89' Left of Const. CL.
Elev. 662.3

Sta. 901+77 93' Rt. of Const. CL.
Elev. 667.9



STA. 902+00.00 TO STA. 903+00.00

11/8/2011

Z80ROOER.CEL

APPENDIX D – ADDITIONAL DATA

U.S.G.S. WATER WELL LOGS

GRUBBS, HOSKYN, BARTON & WYATT, INC (2006 BORING LOGS)

05-024

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 692

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 2 ft /Wash

LOCATION: Approximate Sta 692 + 75, 190 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %	% Recovery	% RQD
			SURF. EL: 920±						
			Dense tan silty fine sand w/novaculite fragments	25/0"					
			Hard very light gray slightly weathered novaculite w/very closely spaced fractures and ferrous stains	25/0"					
5				25/0"					
				25/0"					
10			- with highly weathered novaculite (tripoli) seams and layers below 10 ft					20	0
15								25	0
20			- tripoli layer at 18 ft					25	0
25								20	0
30			- less weathered below 28 ft, hard to very hard					5	0
35								10	0
40								10	0
45								10	0
50								0	0
55								20	0

FOR INFORMATION ONLY

COMPLETION DEPTH: 166.0 ft
DATE: 4-27-06

DEPTH TO WATER IN BORING: Dry

DATE: 04/27/06

ECRODN200 05-024.GPJ 5-1-06

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 692

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 2 ft /Wash

LOCATION: Approximate Sta 692 + 75, 190 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %	% Recovery	% RQD
			(continued)						
								15	0
65								25	0
70			Hard to very hard very light gray novaculite, fractured					0	0
75								5	0
			(Note: 2 hours to core 78 to 83 ft run)						
80								28	0
			(Note: 2 hours to core 83 to 88 ft run)						
85								25	0
			(Note: 1.5 hours to core 88 to 93 ft run)						
90								20	0
			(Note: 2.5 hours to core 93 to 98 ft run)						
95								50	0
			(Note: could not advance core boring below 98 ft, drill remainder with downhole hammer)						
100			- perched water at 103 ft - weathered layer from 103 to 104 ft - hard to very hard with some fractures and ferrous stains below 104 ft - less fractured below 108 ft						
105									
110									
115									

FOR INFORMATION ONLY

COMPLETION DEPTH: 166.0 ft
DATE: 4-27-06

DEPTH TO WATER IN BORING: Dry

DATE: 04/27/06

RECRQDN200 05-024.GPJ 5-1-06

05-024

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 692

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 2 ft /Wash

LOCATION: Approximate Sta 692 + 75, 190 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %	% Recovery	% RQD
			(continued)						
125			- translucent and light gray below 120 ft						
130									
135									
140									
145									
150									
155									
160									
165									
170									
175									

FOR INFORMATION ONLY

COMPLETION DEPTH: 166.0 ft
DATE: 4-27-06

DEPTH TO WATER IN BORING: Dry

DATE: 04/27/06

05-024

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 722

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 2 ft /Core 5 to 10 ft /Wash

LOCATION: Approximate Sta 721 + 50, 220 ft LT

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURF. EL: 760±	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT 0.2 0.4 0.6 0.8 1.0 1.2 1.4 PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT 10 20 30 40 50 60 70	- No. 200 %	% Recovery	% RQD
5			Hard gray and tan moderately weathered chert w/very closely spaced fractures, some clay seams and layers, and ferrous stains, ± 70° dip - auger refusal at 2 ft - less clay below 2 ft - dark gray and tan with occasional gray shale partings and seams below 2.5 ft (Note: Core barrel plugged with fractured rock and clay at 5 to 10 ft run)					40	0
10									
15			- gray and very dark gray below 15 ft						
20									
25			Hard very dark gray chert						
30			Hard tan and gray slightly weathered chert w/medium bedded highly weathered layers						
35			Hard to very hard very dark gray chert, fractured						
40								13	0
45			(Note: Highly fractured chert plugging barrel, wash with rock bit below 45 ft)						
50									
55			Hard very dark gray chert w/medium bedded weathered shale seams and ferrous stains						

FOR INFORMATION ONLY

COMPLETION DEPTH: 110.0 ft
DATE: 4-3-06

DEPTH TO WATER IN BORING: N/A

DATE: 04/03/06

RECRODN200 05-024.GPJ 5-1-06

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 722

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 2 ft /Core 5 to 10 ft /Wash

LOCATION: Approximate Sta 721 + 50, 220 ft LT

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (continued)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %	% Recovery	% RQD
65			(Note: Low core recovery at 61 to 66 ft, barrel plugging with fractured rock, wash below 66 ft)					5	0
70									
75									
80			- with medium bedded medium hard shale seams below 78 ft						
85			- with medium to thickly bedded weathered shale seams below 85 ft						
90									
95			- with thickly bedded quartz veins below 95 ft						
100									
105									
110									
115									

FOR INFORMATION ONLY

COMPLETION DEPTH: 110.0 ft
DATE: 4-3-06

DEPTH TO WATER IN BORING: N/A

DATE: 04/03/06

RECORDN200 05-024.GPJ 5-1-06

05-024

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 791

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 4 ft /Wash

LOCATION: Approximate Sta 791 + 00, 40 ft Lt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %	% Recovery	% RQD
			SURF. EL: 635±						
			Stiff tan and gray silty clay w/ferrous stains	20					
			Soft gray and tan highly weathered shale w/ferrous stains	50/8"					
5				50/6"					
			Soft tan, gray and dark gray weathered shale	50/6"					
				50/6"					
10									
				50/5"					
15									
				50/8"					
20									
				50/5"					
25									
			- with medium bedded dark gray clay seams below 28 ft	50/6"					
30									
35									
40									

FOR INFORMATION ONLY

COMPLETION DEPTH: 30.0 ft
DATE: 3-26-06

DEPTH TO WATER IN BORING: Dry to 4 ft

DATE: 03/26/06

RECRQDN200 05-024.GPJ 5-1-06

05-024

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 853

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 2 ft /Wash

LOCATION: Approximate Sta 852 + 00, 230 ft LT

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL SURF. EL: 820±	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %	% Recovery	% RQD
			Dense tan silty fine sand w/novaculite fragments	50/6"		●	19		
			Soft to hard very light gray novaculite w/ferrous stains and very closely spaced fractures, some healed fractures and vugs	25/0"					
5				25/0"					
			- with medium bedded weathered novaculite (tripoli) seams below 6 ft	25/0"					
				25/0"					
10									
			- hard to very hard below 12 ft						
15			- hard, light gray and translucent below 15 ft					90	20
20								80	40
						q_u = 12,720 psi			
25			- with some fractures and ferrous stains from 23 to 27 ft					85	28
								20	0
30			- very light gray from 30 to 30.8 ft						
			- gray and white with numerous healed fractures and vugs from 30.8 to 31 ft					95	32
						q_u = 14,610 psi		58	36
35			- tan and very light gray with closely spaced fractures below 32 ft						
			- with thickly bedded quartz veins with ferrous stains below 34 ft						
40			(Note: Could not advance corehole below 35 ft, drill to 81 ft with downhole hammer.)						

FOR INFORMATION ONLY

COMPLETION DEPTH: 81.0 ft
DATE: 4-27-06

DEPTH TO WATER IN BORING: N/A

DATE: 04/27/06

RECRQDN200 05-024.GPJ 5-1-06

05-024

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 853

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 2 ft /Wash

LOCATION: Approximate Sta 852 + 00, 230 ft LT

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL (continued)	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT 0.2 0.4 0.6 0.8 1.0 1.2 1.4 / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT 10 20 30 40 50 60 70	- No. 200 %	% Recovery	% RQD
50									
55									
60									
65									
70									
75									
80									
85									

FOR INFORMATION ONLY

COMPLETION DEPTH: 81.0 ft
DATE: 4-27-06

DEPTH TO WATER IN BORING: N/A

DATE: 04/27/06

05-024

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 876

Highway 7/70
Garland County, Arkansas

TYPE: Auger to 13.5 ft /Wash

LOCATION: Approximate Sta 875 + 60, 110 ft Rt

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %	% Recovery	% RQD
			SURF. EL: 710±						
			Very stiff tan and gray silty clay w/chert fragments	34 50/4"					
5			Very stiff reddish tan, gray and tan silty clay w/chert fragments and ferrous stains	50/4" 50/3"					
10			Very stiff tan clayey silt w/chert fragments	25/0" 25/0"					
15			Hard gray and tan chert w/very closely spaced fractures and ferrous stains	25/0"					
20			- reddish brown, tan and gray below 19 ft					20	0
25								25	0
30			(Note: Core barrel blocked with fractured rock, rock bit to completion depth.)						
35			- with some very dark gray below 34 ft						
40									

FOR INFORMATION ONLY

COMPLETION DEPTH: 35.0 ft
DATE: 3-29-06

DEPTH TO WATER IN BORING: Dry to 20 ft

DATE: 03/29/06

RECRODN200 05-024.GPJ 5-1-06