SECTION 00 31 32

Geotechnical Data Report

for

Herbert Hoover Dike Rehabilitation

Structure Replacements

S-291 (IP-3)

Reconstruction

Prepared by

Geotechnical Branch

Engineering Division

Jacksonville District Corps of Engineers

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Geotechnical Data Report

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Geotechnical Data Report

1.1 SCOPE

The information provided in this section encompasses the geotechnical field investigations available for this project. The investigations consist of borings, cone penetrometers, test pits, and sediment probes. The associated boring logs, laboratory and field data are presented in paragraphs 1.5.6 and 1.5.7, respectively. A character of materials paragraph is included to provide a comprehensive description of the materials utilizing both recent and historical knowledge of the project area. Also included in this section are definitions of terms and boring log notes, which provide additional explanation of the boring logs and drilling techniques.

Items discussed in the character of materials paragraph may not appear explicitly on the boring logs. Based on historic knowledge of the project area, the character of materials paragraph includes items that supplement the data documented by the boring logs. When reviewing the boring logs, use all of the data on the logs, including the materials description, legend, and blow counts. When evaluating the subsurface conditions, use all of the data, including the character of materials paragraph and boring logs.

During the solicitation period, any questions that pertain to the information provided in this section should be addressed to the contract specialist identified in Block 9 of SF1442. After contract award, questions should be addressed to the appointed ACO/COR, which will coordinate with Geotechnical Branch.

1.2 PROJECT BACKGROUND

The Herbert Hoover Dike (HHD) is an earthen embankment that completely encompasses Lake Okeechobee, located in south central Florida. To reduce seepage pathways, restoration of the embankment is being achieved by constructing a seepage barrier into the foundation and replacing aged culvert structures.

Total replacement of Structure 291 (culvert IP-3) will be performed at this site. This geotechnical data report presents all the lateral geologic information for this site, and will not be limited to the construction limits.

1.3 CHARACTER OF MATERIALS

1.3.1 Regional Geology

Reach 8 (Indian Prairie Canal) of Herbert Hoover Dike is located in the east-central portion of Glades County, which borders the northwestern shore of Lake Okeechobee in the Okeechobee Plain physiographic region. The regional geology of Glades County for the Quaternary and upper Tertiary Systems range in age from Recent to Pleistocene to Miocene age

sediments. The Recent to late Pleistocene Age sediments are undifferentiated and cover the county with an average 5-foot thickness. From the west and northwest moving towards the lake to the Everglades area, the sediments are terraces of fine to medium quartz sands and shell. Closer to the lake nearing the Everglades area, the sand becomes mixed with organics with occasional layers of peat, with thicknesses ranging from 0 to 8 feet. Below the sands and peat, the mid to early Pleistocene Anastasia Formation is present. In this region the Anastasia is composed of semi-consolidated marine fine quartz sands, shell beds, and thin discontinuous layers of sandy limestone or sandstone. The Anastasia ranges in thickness from approximately 200 feet at the east coast and thins to approximately 15-feet at the edge of the Everglades, where it then pinches out or merges with the Ft. Thompson Formation. The Ft. Thompson is prevalent in the Everglades and its composition varies throughout, but is primarily composed of alternating fresh water and marine sands, shell beds, limestone, or sandstone. The formation ranges in thickness from 2 to 25 feet. These deposits lie unconformably with the upper Miocene/Pliocene sediments of the Caloosahatchee and Tamiami Formations. The Caloosahatchee is primarily composed of unconsolidated sand, sandy silt/clay layers, which have an abundance of shell materials, with an occasional layer of limestone or sandstone. In the Everglades, the Caloosahatchee can range in thickness from 15 to 30 feet. Tamiami sediments are comprised of silty, shelly quartz sands and silty shell beds with occasional thin interbedded layers of limestone and sandstone.
The Tamiami Formation below the Kissimmee River occurs approximately 50 feet below land surface with a nominal thickness at the eastern portion of the Highlands Ridge to a maximum thickness of approximately 100 feet at the western edge of the county near the Kissimmee River.

The Hawthorn Group of middle Miocene Age, lies unconformably below the upper Miocene/Pliocene sediments which underlie the county. The uppermost portion sediments are considered to be Post-Miocene in age. The sediments are typically dark green to bright green to white montmorillonitic clay, white to cream dense sandy phosphatic limestone, fine to pebble size quartz sand, phosphorite pebbles, and phosphatic clay. As the depths of the sediments increase, its mixture may alter from clastic to increased percentages of carbonate units. Its formational contact may occur at depths of approximately 85 to 100 feet below land surface and may be as thick as 350 feet.

1.3.1.1 Embankment Fill

The thickness of the embankment averages less than 20 feet at the crest and thins toward the flanks. The embankment material is a heterogeneous mixture of loose to medium consistency, fine to medium-grained, clean to silty, quartz sand (SP to SM) with whole and broken shell and limestone/sandstone gravel, cobbles, and occasional boulders. Other materials encountered in minor amounts are thin scattered layers organics, and clay/silt. The limestone/sandstone materials have varying percentages and distribution within the embankment.

1.3.1.2 Structure 291 (Culvert IP-3)

The materials encountered for Structure 291 are represented through the borings, and probes plotted on Plates 2 through 4. Different from

embankment fill, the materials in the adjacent channels are not native, but were naturally deposited by lake processes. Investigations show that soft sediment had settled in the channels post excavation. Typically the sediment is a very soft, sandy, organic rich silty material with high water content. Twenty four (24) probes were performed in the lakeside outlet channel and Indian Prairie Canal for both structures 290 and 291. The outlet channel has an average soft sediment thickness of 1.5 feet with an average base elevation of 8.0 feet (NAVD-88). The soft sediments in the canal ranges from approximately 0.0 to 2.5 feet in thickness with a base elevation that ranges from approximately 8.8 to -2.3 feet (typically deeper in the middle of the channel). Three (3) probes were performed in the landside channel just off the concrete sill and soft sediments are found to be up to five feet thick. Elevations were not obtained for these three probes.

The top of natural ground consists of semi-continuous, organic-stained, sandy soil and organic silt that is encountered at an average elevation of 16.5 feet. This material consists of loose, fine to medium-grained, clean to silty, quartz sand and organic silt with varying amounts of silt and organics that is best delineated by its dark brown to black color. This layer averages 1 foot thick.

Below the black sand layer is a thick unit of homogeneous, light greenish gray, clean to slightly silty, fine, medium to very dense, quartz sand with shell that averages 30 feet thick. The shell content varies horizontally and vertically, with sand to gravel-sized whole and broken shell. Near the top of this unit are occasional thin layers of silty to clayey fine quartz sand. The upper five feet of this sand layer at average elevation 11.5 feet is partially cemented, and forms a sporadic layer of soft to moderately hard, highly weathered sandstone that ranges from 0.0 to 5.0 feet thick.

Below the dense sand unit a continuous layer of clayey sand is encountered at average elevation of -19.0 feet. This layer averages 4.0 feet thick and is comprised of very fine quartz sand, of loose to very loose density, with shell and occasionally interbedded with sandy fat clay. The above clayey sand layer transitions into layers of silty/clayey to slightly silty fine sand with shell with an average thickness of 17 feet. This transition layer is comprised of medium density, fine to very fine quartz sand, with sand to gravel size shell. The upper 5 feet of this transition zone has weak cementation where thin layers of sandstone one to two inches in thickness and/or nodules are found throughout.

At average elevation -40 feet a second continuous layer of clayey sand is encountered. This layer ranges from 2.0 to 10 feet thick and is comprised of very fine quartz sand, loose to very loose density, with shell. Similar to the clayey sand layer descried above, this layer also transitions into layers of silty and clayey fine sand with shell to the deepest boring of elevation -59 feet. This transition layer is comprised of loose to medium dense, very fine quartz sand, with sand to gravel size shell.

1.4 DEFINITIONS

Definitions not explicitly indicated in the sections below are typical industry standard definitions from their respective ASTMs.

1.4.1 Definitions of Basic Terms

Carbonate – Soil component that reacts with HCl of an indeterminate origin (shell, rock, etc.).
Fill – Material that has been placed by man, described with all soil characteristics.
Layer – Rock or soil with a thickness of 6 inches or less.
Lens – A geologic deposit of variable thickness, which disappears laterally in all directions and cannot be correlated to adjacent borings.
Rock – A naturally occurring substance composed of one or more minerals bound together. This geologic term includes a range of engineering properties: strength, hardness, permeability, weathering, and discontinuity. These properties are noted or can be inferred from the boring logs as blow counts, penetration rate, RQD, hardness, etc.
Shell – Material composed of predominantly (>75%) coarse-grained sand to gravel-sized whole or broken shell.

1.4.2 Current Logging Terms

Definition of terms used on boring logs dated since 2000:

Banded - 0.02' (6 mm) to 0.1' (3.0 cm).
Boulder-Sized – Particles greater than 12 inches in diameter.
Cavity - Voids greater than the diameter of the core.
Coarse Grained - Grain diameter greater than 0.079" (2 mm) for sedimentary rocks or 0.197" (5 mm) for igneous or metamorphic rocks.
Coarse Grained Sand-Sized – Less than 10 percent of fine and medium grained sand sizes are present.
Coarse Gravel-Sized – Particles greater than 3/4 of an inch but less than 3 inches in diameter.
Cobble-Sized – Particles greater than 3 inches but less than 12 inches in diameter.
Decomposed – Applicable to saprolitic rock; rock is essentially reduced to a soil with a relic rock texture; can be molded or crumbled by hand.
Dipping (Dip) - 20 to 45 degrees.
Discontinue – Particles were present within the unit above but are no longer present.
Fine Grained - Grain diameter between 0.004" (0.1 mm) and 0.016" (0.4 mm) for sedimentary rocks or 0.039" (1 mm) for igneous or metamorphic rocks.
Fine Grained Sand-Sized - Less than 10 percent of medium and coarse grained sand sizes are present.
Fine Gravel-Sized – Particles greater than No. 4 sieve but less than 3/4 of an inch in diameter.
Flat (Dip) - 0 to 20 degrees.
Fossiliferous – Greater than 40 percent fossils.
Hard (Hardness) - Difficult to scratch with a knife (cannot be pitted with a geology hammer, but can be chipped with moderate blows of the hammer).
Highly Fractured - Spacing 0.3' (9.1 cm) to 1' (30.5 cm).

Highly Weathered - Entire section is discolored; alteration is greater than 50%; some areas of slightly weathered rock are present; some minerals are leached away; retains only a fraction of its original strength (wet strength usually lower than dry strength).
Intact – Spacing greater than 6' (1.8 m).
Intensely Fractured - Spacing less than 0.3' (9.1 cm).
Massive – Over 3' (0.9 m) thick.
Medium-Bedded - 0.3' (9.1 cm) to 1' (30.5 cm) thick.
Medium Grained - Grain diameters between 0.016" (0.4 mm) to 0.079" (2 mm) for sedimentary rocks or 0.039" (1 mm) to 0.197" (5 mm) for igneous or metamorphic rocks.
Medium Grained Sand-Sized - Less than 10 percent of fine and coarse grained sand sizes are present.
Moderately Fractured - Spacing 1' (30.5 cm) to 3' (0.9 m).
Moderately Hard (Hardness) - Can be scratched easily with a knife, but cannot be scratched by a fingernail (can be pitted with moderate blows of a geology hammer).
Moderately Open (Fracture Aperture) - 0.020" (0.5 mm) to 0.098" (2.5 mm).
Moderately Weathered - Discoloration is evident; surface is pitted and altered, with alterations penetrating well below rock surfaces; 10% to 50% of the rock is altered; strength is noticeably less than unweathered rock.
Non-fossiliferous – No observed fossils.
Open (Fracture Aperture) - 0.098" (2.5 mm) to 0.394" (10 mm).
Pitted - Voids 0.039" (1mm) to 0.236" (6mm) in diameter.
Porous - Voids less than 0.039" (1mm) in diameter.
Slightly Fractured - Spacing 3' (0.9 m) to 6' (1.8 m).
Slightly Weathered - Superficial discoloration, alteration and/or discoloration along discontinuities; less than 10% of the rock volume is altered; strength is essentially unaffected.
Soft (Hardness) - Can be scratched with a fingernail (cannot be crumbled between fingers, but can be easily pitted with light blows of a geology hammer).
Solid - Absence of voids.
Sparsely Fossiliferous – Less than 40 percent fossils.
Steeply Dipping (Dip) - 45 to 90 degrees.
Thick-Bedded – 1' (30.5 cm) to 3' (0.9 m) thick.
Thin-Bedded - 0.1' (3.0 cm) to 0.3' (9.1 cm) thick.
Thin Parting - Paper thin to 0.002' (0.6 mm).
Tight (Fracture Aperture) - 0.004" (0.1 mm) to 0.020" (0.5 mm).
Unweathered - No evidence of any mechanical or chemical alteration.
Very Fine Grained - Grain diameter less than 0.004" (0.1 mm); individual grains or crystals are too small to be seen with the naked eye.
Very Hard (Hardness) - Cannot be scratched with a knife (chips can be broken off only with heavy blows of a geology hammer).
Very Soft (Hardness) - Can be deformed by hand (has a rock-like character, but can be easily broken by hand).
Very Tight (Fracture Aperture) - less than 0.004" (0.1 mm).
Very Wide (Fracture Aperture) - 0.394" (10 mm) to 0.984" (25 mm).
Vuggy - Voids 0.236" (6mm) to the diameter of the core.

1.4.3 Previous Logging Terms

Definition of terms used on boring logs dated before 2000:

Dense – Equivalent to SPT N-value of 30 to 50.

Incompetent – Rock that disintegrates while coring; weak.
Indurated – Rock or soil hardened or consolidated by pressure or cementation. Very difficult to break by hand.
Poorly-Indurated – See semi-indurated.
Seam – Rock or soil with average thickness of 2 to 3 inches.
Semi-Indurated – Rock or soil with a lesser degree of hardening or consolidation by pressure or cementation. Crumbles with little effort by hand.

1.4.4 Testing and Procedure Methods

Test/Procedure	Method
Abrasion Resistance of Large-Size Coarse Aggregate, Los Angeles Machine	ASTM C535
Abrasion Resistance of Small-Size Coarse Aggregate, Los Angeles Machine	ASTM C131
Air Content by the Pressure Method	ASTM C231
Air Content by the Volumetric Method	ASTM C173
Air-Entraining Admixtures for Concrete	ASTM C233
Atterberg Limits, wet preparation method, test method a multipoint	ASTM D4318
Bulk Specific Gravity of Bituminous Mixtures	ASTM D2726
Capping Cylindrical Concrete Specimens	ASTM C617
Carbonate Content	ASTM D4373
Compaction: 4" Mold, Modified Proctor	ASTM D1557
Compaction: 4" Mold, Standard Proctor	ASTM D698
Compaction: 6" Mold, Modified Proctor	ASTM D1557
Compaction: 6" Mold, Standard Proctor	ASTM D698
Compressive Strength of Cast in Place Concrete Cylinders	ASTM C873
Compressive Strength of Cylindrical Concrete Specimens (Set of 4)	ASTM C39
Compressive Strength of Lightweight Concrete	ASTM C495
Consolidation, each load of rebound increment with complete time	ASTM D2435
Density and Water Content of Soil by Nuclear Methods (Minimum 4)	ASTM D2922/D3017
Density of Bituminous Concrete in Place by Nuclear Methods (Minimum 4)	ASTM D2950
Density of Soil in Place by the Sand-Cone Method	ASTM D1556
Direct Shear	ASTM D3080
Drilled Cores and Sawed Beams of Concrete	ASTM C42
Extraction of Bituminous Paving Mixtures	ASTM D2172
Freezing and Thawing (up to 55 cycles)	ASTM D5312
Grain size sieve Analysis	ASTM D422
Hydrometer Analysis	ASTM D422
Making and Curing Concrete Test Specimens in the Field (Set of 6)	ASTM C31
Making and Curing Concrete Test Specimens in the Lab (Set of 4)	ASTM C192
Marshall Resistance to Plastic Flow (Set of 3)	ASTM D1559

Test/Procedure	Method
Material Passing No. 200 Sieve	ASTM D1140
Modulus of Elasticity	ASTM D3148
Moisture Content	ASTM D2216
Munsell Color	Munsell Soil Color Charts
Organic Content, Test Method C	ASTM D2974
Organic Impurities in Fine Aggregate	ASTM C40
Permeability: Constant Head Permeability	ASTM D2434
Permeability: Falling Head Permeability	ASTM D5084
Petrographic Examination	ASTM C295
Sampling Aggregate (Minimum 4 hours)	ASTM D75
Sampling Freshly Mixed Concrete	ASTM C172
Sedimentation Rate	No ASTM
Sieve Analysis of Aggregate	ASTM C136
Slump of Hydraulic-Cement Concrete	ASTM C143
Soil Classification (Boring logs)	ASTM D 2488
Specific Gravity and Absorption of Fine Aggregate	ASTM C128
Specific Gravity for Rock	ASTM C127
Specific Gravity for Soil	ASTM D854
SPLITTING TENSILE STRENGTH	ASTM D3967
Splitting Tensile Strength of Concrete Cylinders	ASTM C496
Subsample Preparation ASTM D4220, Group B	ASTM D4220,
Sulfate Soundness	ASTM C88
Total Evaporable Moisture Content	ASTM C566
Triaxial Compression Test for Rock with Strain Gages or LVDTs (per confining pressure)	ASTM D2664
Triaxial compression: Consolidated Undrained (CU) Triaxial Compression Test R Test with Pore Pressure Measurements (per confining pressure)	ASTM D4767
Triaxial compression: Unconsolidated Undrained (UU) Triaxial Compression Test Q Test with Pore Pressure Measurements (per confining pressure)	ASTM D2850
Unbonded Caps for Compressive Strength	ASTM C1231
Unconfined Compressive Strength for Rock Greater than 9,000 psi with Strain	ASTM D2938
Unconfined Compressive Strength for Rock up to 9,000 psi with Strain	ASTM D2938
Unconfined Compressive Strength for Soil	ASTM D2166
Unit Weight and Absorption	ASTM C127
Unit Weight of Aggregate	ASTM C29 -
Visual Percent Shell	No ASTM
Wetting and Drying	ASTM D5313

1.5 GEOMECHANICAL DATA

1.5.1 Summary of Field Investigations

The tables below summarizes the historical/recent field investigations data set available for this project.

Table 1. Available Boring Data

Designation	State Plane, FL-East, NAD83		Project Location
	X	Y	
CB-IP-3-R	654534	1002683	Structure 291
HHD13-S291-CB-1	654557	1002483	Structure 291
HHD13-S291-CB-2	654450	1002614	
HHD13-S291-CB-3	654487	1002691	
HHD13-S291-CB-4	654594	1002722	
HHD13-S291-CB-5	654605	1002777	
HHD13-S291-CB-6	654522	1002865	
HHD15-S291-CB-1	654863	1002054	
HHD15-S291-CB-2	654779	1002252	
HHD15-S291-CB-3	654698	1002258	
HHD15-S291-CB-4	654782	1002351	
HHD15-S291-CB-5	654903	1002191	
HHD15-S291-CB-6	654915	1002348	
HHD15-S291-CB-7	654809	1002513	
HHD15-S291-CB-8	654678	1002646	
* Coordinates presented correspond to the project coordinate system and datum			

Table 2. Available Cone Penetrometer Data

Designation	State Plane, FL-East, NAD83		Project Location
	X	Y	
HHD15-S291-CP-1	654860	1002060	Structure 291
HHD15-S291-CP-2	654773	1002265	
HHD15-S291-CP-3	654691	1002268	
HHD15-S291-CP-4	655001	1002245	
HHD15-S291-CP-5	654975	1002281	
HHD15-S291-CP-6	654692	1002573	
HHD15-S291-CP-7	654669	1002729	
HHD15-S291-CP-8	654775	1002360	
HHD15-S291-CP-9	654627	1002632	
* Coordinates presented correspond to the project coordinate system and datum			

Table 3. Available Test Pit Data

Designation	State Plane, FL-East, NAD83		Project Location
	X	Y	
HHD15-S-291-TP-1	654760	1002391	Structure 291
HHD15-S-291-TP-2	654694	1002538	
* Coordinates presented correspond to the project coordinate system and datum			

Table 4. Available Probing Data

Designation	State Plane, FL-East, NAD83		Project Location
	X	Y	
1	654250	1002674	Structure 291
2	654277	1002695	
3	654313	1002715	
4	654322	1002553	
5	654368	1002563	
6	654395	1002604	
7	654359	1002503	
8	654404	1002513	
9	654422	1002543	
10	654250	1002462	Structure 290
11	654295	1002442	
12	654350	1002442	
13	654413	1002432	Structure 291
14	654440	1002442	
15	654458	1002483	
16	654485	1002513	
17	654513	1002563	
18	654512	1002614	
19	654494	1002351	
20	654516	1002382	
21	654548	1002392	
22	654557	1002250	
23	654585	1002281	
24	654612	1002291	
25	654528	1002739	
26	654546	1002736	
27	654566	1002736	
* Coordinates presented correspond to the project coordinate system and datum			

Table 5. Available Surficial Samples Data

Designation	State Plane, FL-East, NAD83		Project Location
	X	Y	
HHD15-S291-SS-1	654603	1002551	Structure 291
HHD15-S291-SS-2	654642	1002646	
HHD15-S291-SS-3	654559	1002689	
HHD15-S291-SS-4	654464	1002692	
HHD15-S291-SS-5	654477	1002752	
* Coordinates presented correspond to the project coordinate system and datum			

Slug tests and Pore Pressure Dissipation (PPD) tests for the determination of hydraulic conductivity were obtained for this data set of the foundation soils. Slug tests were performed in open standpipe wells in the higher permeable sands above elevation -15 ft. PPD tests were performed with a cone penetrometer system in the lower permeable soils below elevation -18 ft. Analysis of the data utilized Bouwer-Rice, and Mayne 2002 respectively. For more detailed testing results, see paragraph 1.5.7.

Table 6: Hydraulic Conductivity Tests

Designation	Elevation (NAVD-88,ft)	Hydraulic Conductivity (cm/s)		Project Location
		Slug	PPD	
HHD15-S291-CB-2	-5.2 to -10.2	2.6E-02		Structure 291
HHD15-S291-CB-4	-5.1 to -10.1	2.4E-02		
HHD15-S291-CP-1	-18	`	5.22E-06	
	-26		1.77E-04	
	-37		2.54E-04	
	-38.1		1.07E-04	
	-40		6.42E-05	
	-44.4		7.44E-05	
HHD15-S291-CP-2	-21		5.63E-05	
	-27.8		1.34E-04	
	-40.5		1.77E-04	Structure 291
	-44.9		1.77E-04	
	-50.8		1.34E-04	
HHD15-S291-CP-3	-19.1		1.1E-05	
	-27.6		1.34E-04	
	-41.6		1.04E-04	
	-45.5		1.07E-04	
Slug: Slug Test, PPD: Pore Pressure Dissipation Test				

1.5.2 Summary of Index Testing Data

The table below summarizes the index testing available for this project.

Table 7: Index Testing Available for this Project

Boring Designation	Sample Designation	USCS	LL	PL	PI	Org %	Visual Shell %	w_n	G_S
HHD13-S291-CB-1	6	SP							
	9	SP							2.65
	16	SP-SM							
	26	SP-SM							
	U-1	ML	38	27	11			38.3	2.68
	31	SC	35	19	16		34	32.8	
	35	SC	23	16	7			22.2	
	40	SC	27	15	12			23.3	
HHD13-S291-CB-3	4	SP-SM							
	10	SP							
	26	SP-SM							
	34	SM	22	21	11			26.2	
	44	SC	37	18	19			35.5	
HHD13-S291-CB-5	5	SP					33	17.6	
	9	SP							2.67
	15	SP-SM							
	21	SP							
	28	SC	44	16	28			40.7	
	34	SM						20.5	
	36	SP-SM					56		
	40	SC	25	14	11			26.2	
HHD15-S291-SS-1	1	SP							
HHD15-S291-SS-2	1	SP-SM						17	2.82

Boring Designation	Sample Designation	USCS	LL	PL	PI	Org %	Visual Shell %	w_n	G_S
HHD15-S291-SS-3	1	SP							
HHD15-S291-SS-4	1	SP							
HHD15-S291-SS-5	1	SP							
HHD15-S291-CB-1	9	SP-SM					36		
	15	SP							
	19	SP							
	27	CL	46	17	29			41.5	
	31	SM							
	35	SM							
	39	SM	27	24	3			27.3	
HHD15-S291-CB-2	3	SP							
HHD15-S291-CB-2	7	SP							
	15	SP							
	22	SP							2.65
	32	SP							
	39	SM							
HHD15-S291-CB-2	42	SM	20	18	2			26.5	
HHD15-S291-CB-5	2	SM				4		24.3	
HHD15-S291-CB-7	1	SM	0	0	NP	7			
HHD15-S291-CB-8	7	SP-SM					46		
HHD15-S291-TP-1	2	SP							
HHD15-S291-TP-2	2	SM							

USCS: Unified Soil Classification System; LL: liquid limit; PL: plastic limit; PI: Plastic Index; Org %: Organic Content; w_n: moisture content; G_S: specific gravity

1.5.3 Summary of Additional Laboratory Testing Data

Consolidation testing results were obtained for this data set. For testing results, see paragraph 1.5.7.

1.5.4 Boring Log Notes

Borings were driven using the Standard Penetration Test (SPT) procedure ASTM D1586 with a 140 pound hammer with a 30-inch drop using a 2.0 foot split spoon (1 3/8-inch I.D. and 2-inch O.D.). Borings were advanced in 18-inch intervals, or until refusal was encountered. Refusal is defined as a total of 50 blows of the hammer within any 6-inch increment, a total of 100 blows within any 1-foot increment, or no observed advance of the sampler after 10 successive blows of the hammer.

Cone Penetrometers were advanced using a track mounted penetrometer system. The truck has a static weight of 22 tons and pushes a 10 cm^2 base cone at a rate of 120 cm/s. Testing procedures follow ASTM D5778-87.

Test pits were excavated using a Bobcat E-80 rubber track backhoe with a three cubic foot toothed bucket.

The surficial samples were sampled with a post-hole digger and shovel.

1.5.5 Recovered Materials

The material recovered from boring CB-IP-3-R is not available.

The material recovered from the remainder of the borings are available for inspection by prospective offerors at the Corps of Engineers District warehouse listed below:

Address: 3077 Talleyrand Avenue
Jacksonville, Florida

Hours: 7:00 am to 2:30 pm

The recovered materials will be available for inspection during normal business hours as noted above, except Federal holidays, during the entire bid period. Prospective offerors shall notify the project geologist at 904-232-1607 or Chief, Geology and Explorations Section at 904-232-1617 at least four (4) working days before the visit. The following information will be required to schedule the visit: (1) the project title; (2) the specific borings or entire set which are to be viewed; (3) the date, time, and duration of the visit; the name of the person(s) and company to view the borings; and (5) a point of contact and phone number regarding the visit. Prospective offerors shall record their material examination visit in a record book maintained at the inspection site.

It is strongly suggested that prospective offerors view the samples before submitting their bid.

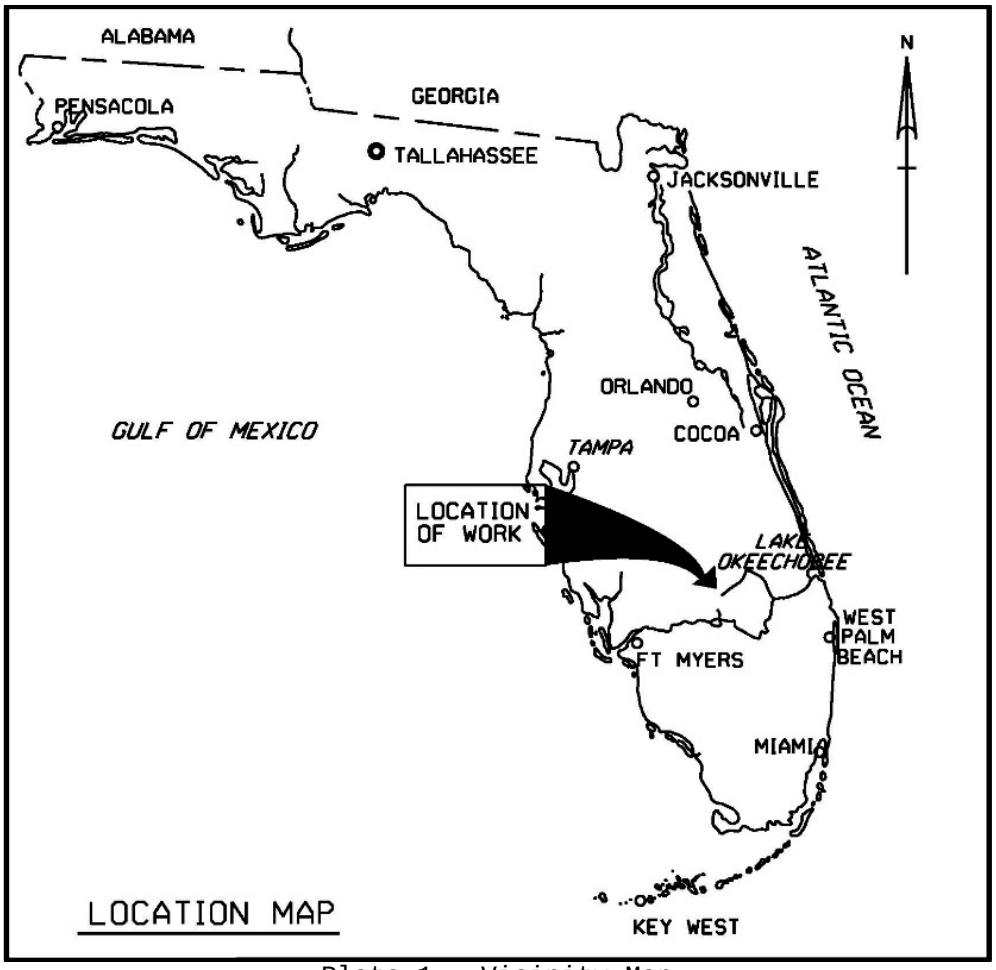

Plate 1. Vicinity Map

Plate 2. Location of Boring Investigations for S-291

Plate 3. Location of CPT and Test Pit Investigations for S-291

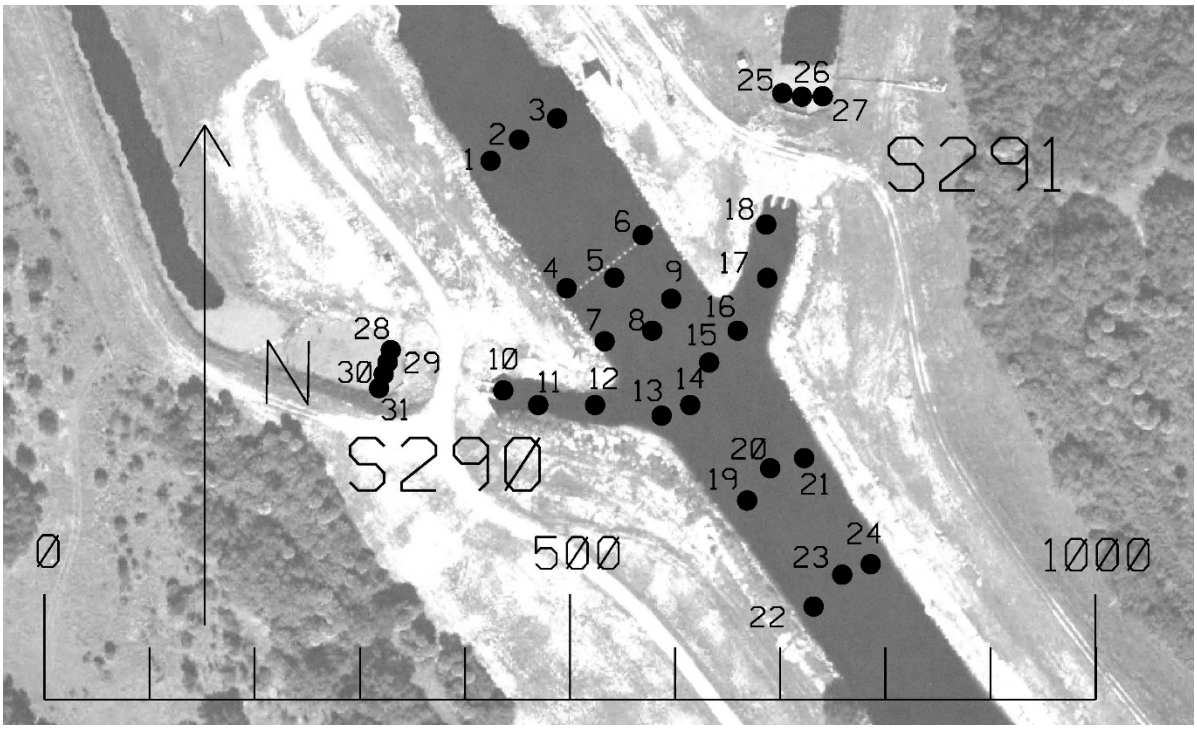

Plate 4. Location of Canal Sediment Probes for S-291 and S-290

1.5.6 Boring Logs

Applicable boring logs, test pit logs, CPT soundings, and sediment probes are presented on the following pages.

While the Government’s borings are representative of subsurface conditions at their respective locations and vertical reaches, local variations in the characteristics of the subsurface materials of this region are to be expected. Accordingly, prospective offerors shall form their own conclusions from the examination of the recovered materials prior to submission of their offer.

Boring Designation CB-IP-3-R

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 4 SHEETS
1. PROJECT	Herbert Hoover Dike Tributary Culvert - Indian Prairie Canal Culvert 3
2. BORING DESIGNATION	CB-IP-3-R
LOCATION COORDINATES	X = 654,535 Y = 1,002,684
3. DRILLING AGENCY	Corps of Engineers - CESAJ
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	L.C. Gregory
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	60.0 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.)
HORIZONTAL	NAD83
VERTICAL	NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500
☐ AUTO HAMMER ☒ MANUAL HAMMER	
12. TOTAL SAMPLES	DISTURBED 40 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	3
14. ELEVATION GROUND WATER	12.6 Ft.
15. DATE BORING	STARTED 05-25-94 / COMPLETED 05-27-94
16. ELEVATION TOP OF BORING	32.6 Ft.
17. TOTAL RECOVERY FOR BORING	82 %
18. SIGNATURE AND TITLE OF INSPECTOR	M. Marty Goff, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
32.6	0.0						32.6		
			FILL, SAND, fine to medium-grained quartz, slightly damp, trace shell, tan to light brown (SP)	100	1		SPT Sampler	3 7 9	16
							31.1		
				100	2		SPT Sampler	13 7 12	19
							29.6		
			At El. 29.6 Ft. trace organic stain, tan	100	3		SPT Sampler	11 12 13	25
							28.1		
				100	4		SPT Sampler	14 14 12	26
							26.6		
				100	5		SPT Sampler	13 14 16	30
							25.1		
				100	6		SPT Sampler	3 3 4	7
							23.6		
				93	7		SPT Sampler	4 4 5	9
							22.1		
			At El. 21.6 Ft. light tan	100	8		SPT Sampler	3 4 4	8
							20.6		
				100	9		SPT Sampler	8 11 12	23
							19.1		
				100	10		SPT Sampler	14 8 12	20
							17.6		

0 5 10 15

(Continued)

SAJ FORM 1836
JUN 02

Boring Designation CB-IP-3-R

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 2 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,535 Y = 1,002,684	32.6 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	11		SPT Sampler	11 10	21
16.1	16.5						16.1	11	
			At El. 16.1 Ft. potential base of FILL SAND, fine to medium-grained quartz, trace shell, wet, black organic stain, brown (SP)	87	12		SPT Sampler	2 2	4
			At El. 14.6 Ft. fine-grained, little organic matter, staining				14.6	2	
				100	13		SPT Sampler	4 6	13
13.1	19.5						13.1	7	
			SAND clayey, fine to medium-grained quartz, organic staining, wet, black to dark gray (SC) ▼	80	14		SPT Sampler	3 2	3
11.6	21.0						11.6	1	
			CLAY, soft, dark gray (CH)	87	15		SPT Sampler	WOH 1	2
10.1	22.5						10.1	1	
			SAND, clayey, fine-grained quartz, gray (SC)	100	16		SPT Sampler	1 4	12
8.6	24.0						8.6	8	
			SAND, fine to medium-grained quartz, trace shell, wet, tan (SP)	20	17		SPT Sampler	2 5	11
							7.1	6	
				47	18		SPT Sampler	2 4	13
							5.6	9	
				60	19		SPT Sampler	2 4	7
							4.1	3	
				53	20		SPT Sampler	5 9	23
			At El. 2.6 Ft. trace to little shells, tan				2.6	14	
				53	21		SPT Sampler	3 7	20
							1.1	13	
				67	22		SPT Sampler	8 23	50
							-0.4	27	
				87	23		SPT Sampler	1 5	15
			At El. -1.9 Ft. trace small clayey nodules				-1.9	10	
				60	24		SPT Sampler	11	

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JUN 02

Boring Designation CB-IP-3-R

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 3 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,535 Y = 1,002,684	32.6 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				60	24		SPT Sampler	17 33	50
				67	25		SPT Sampler	8 17 31	48
				100	26		SPT Sampler	7 16 30	46
				40	27		SPT Sampler	15 24 25	49
				40	28		SPT Sampler	10 25 33	58
				33	29		SPT Sampler	17 20 16	36
				80	30		SPT Sampler	4 9 10	19
-12.4	45.0		CLAY, fat, soft, trace sand, trace shell, gray to green (CH)	100	31		SPT Sampler	3 1 1	2
				80	32		SPT Sampler	5 4 3	7
				73	33		SPT Sampler	4 1 3	4
				73	34		SPT Sampler	2 1 3	4
				100	35		SPT Sampler	1 2 5	7
				87	36		SPT Sampler	1 3 5	8
				100	37		SPT Sampler	2 3	

-3.4 -4.9 -6.4 -7.9 -9.4 -10.9 -12.4 -13.9 -15.4 -16.9 -18.4 -19.9 -21.4

35 40 45 50 55

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Boring Designation CB-IP-3-R

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 4 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,535 Y = 1,002,684	32.6 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
-22.9	55.5			100	37		-22.9 SPT Sampler	4	7
-24.4	57.0		CLAY, soft, trace to little sand, trace shell, calcareous, occasional thin layer of limestone, white to gray (CL)	100	38		SPT Sampler -24.4	6 6 16	22
-25.9	58.5		SILT, little sand, calcareous, soft white (MH)	100	39		SPT Sampler -25.9	6 1 6	7
-27.4	60.0		SILT, little sand, trace shell, occasional thin layer of limestone, white (ML)	100	40		SPT Sampler -27.4	3 7 10	17

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Revised boring log: Boring log updated to reflect current project horizontal and vertical datum, corrected minor omissions/errors, and revised lithology.

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:
WOH = Weight of Hammer.)>>

55
60
65
70
75

SAJ FORM 1836-A
JUN 02

Boring Designation HHD13-S291-CB-1

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 5 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD13-S291-CB-1
LOCATION COORDINATES	X = 654,557 Y = 1,002,483
3. DRILLING AGENCY	Corps of Engineers - CESAM
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Charlie Brown
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	70.5 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500 ☐ AUTO HAMMER ☒ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 40 / UNDISTURBED (UD) 2
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	11.2 Ft.
15. DATE BORING	STARTED 05-30-14 / COMPLETED 05-30-14
16. ELEVATION TOP OF BORING	22.0 Ft.
17. TOTAL RECOVERY FOR BORING	79 %
18. SIGNATURE AND TITLE OF INSPECTOR	Bobby Norris, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
22.0	0.0						22.0		
			FILL, sandy, mostly fine-grained sand-sized quartz, few silt, trace fine-grained sand-sized shell, trace fine gravel-sized limestone, moist, 5Y 5/1 gray	80	1		SPT Sampler	2 4 7	11
			At El. 20.5 Ft., trace organic matter, discontinue fine gravel-sized limestone				20.5		
			At El. 19.7 Ft., trace sand to gravel-sized shell, 10YR 6/1 gray	93	2		SPT Sampler	10 15 14	29
							19.0		
				73	3		SPT Sampler	5 6 5	11
17.5	4.5						17.5		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, moist, (Native?), white (SP)	60	4		SPT Sampler	6 8 12	20
							16.0		
				67	5		SPT Sampler	6 11 13	24
			At El. 14.5 Ft., 10Y 7/1 light greenish gray				14.5		
				80	6		SPT Sampler	4 6 7	13
							13.0		
12.2	9.8			87	7		SPT Sampler	4 5 5	10
12.1	9.9		SAND, clayey, mostly fine-grained sand-sized quartz, little clay, little silt, moist, light brown (SC)				11.5		
			SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, trace silt, wet, light brown gray (SP)	73	8		SPT Sampler	2 3 5	8
							10.0		
				80	9		SPT Sampler	2 4 4	8
							8.5		
			At El. 8.0 Ft., mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace phosphate, 10Y 7/1 light greenish	73	10		SPT Sampler	2 4 5	9
							7.0		

(Continued)

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JUN 02

Boring Designation HHD13-S291-CB-1

DRILLING LOG (Cont. Sheet)

INSTALLATION: Jacksonville District

SHEET 2 OF 5 SHEETS

PROJECT: Herbert Hoover Dike

COORDINATE SYSTEM/DATUM: State Plane, FLE (U.S. Ft.) | HORIZONTAL: NAD83 | VERTICAL: NAVD88

LOCATION COORDINATES: X = 654,557 Y = 1,002,483

ELEVATION TOP OF BORING: 22.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			gray From El. 7.0 to 6.0 Ft., few silt	73	11		SPT Sampler 5.5	3 2 3	5
			At El. 4.9 Ft., weak cementation, N 7/ light gray	67	12		SPT Sampler 4.0	4 10 15	25
3.5	18.5								
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, few fine to coarse-grained sand-sized shell, trace phosphate, wet, weak cementation, N 7/ light gray (SP-SM)	73	13		SPT Sampler 2.5	10 14 19	33
				67	14		SPT Sampler 1.0	7 16 24	40
			At El. 1.0 Ft., trace fine to medium-grained sand-sized shell, occasional thin layers of slightly silty sand	53	15		SPT Sampler -0.5	8 17 25	42
				60	16		SPT Sampler -2.0	15 17 30	47
				67	17		SPT Sampler -3.5	19 30 35	65
-3.5	25.5								
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace fine to medium-grained sand-sized shell, trace phosphate, wet, silt content varies with depth, 5Y 6/1 gray (SP)	73	18		SPT Sampler -5.0	15 35 44	79
				73	19		SPT Sampler -6.5	15 24 24	48
				93	20		SPT Sampler -7.9	10 35 50/0.4'	85+
							-8.0 Advanced Boring		
				73	21		SPT Sampler -9.5	15 24 20	44
				78	22		SPT Sampler -10.4	39 50/0.4'	
							-11.0 Advanced Boring w/ fishtail bit		
				73	23		SPT Sampler -12.5	18 28 25	53
				73	24		SPT Sampler	7	

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Boring Designation HHD13-S291-CB-1

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 3 OF 5 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,557 Y = 1,002,483	22.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				73	24		SPT Sampler	18 / 25	43
-14.5	36.5						-14.0		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, few fine to medium-grained sand-sized shell, trace phosphate, wet, 5Y 6/1 gray (SP-SM)	80	25		SPT Sampler	12 / 23 / 31	54
							-15.5		
				87	26		SPT Sampler	14 / 26 / 35	61
			At El. -17.0 Ft., 5Y 5/1 gray				-17.0		
				73	27		SPT Sampler	6 / 11 / 17	28
							-18.5		
				67	28		SPT Sampler	12 / 22 / 18	40
-20.3	42.3						-20.0		
			SAND, clayey, mostly fine-grained sand-sized quartz, little clay, little silt, few fine to coarse-grained sand-sized shell, wet, interbedded with layers of sandy clay, 10Y 5/2 dark greenish gray (SC)	93	29		SPT Sampler	3 / 1 / 1	2
							-21.5		
				87	30		SPT Sampler	1 / 1 / 1	2
						U-1	-23.0		
				80	31		SPT Sampler	1 / 0 / 1	1
							-24.5		
				100	32	U-2	SPT Sampler	2 / 2 / 5	7
							-26.0		
				93	33		SPT Sampler	2 / 3 / 4	7
							-27.5		
							Advanced Boring w/ fishtail bit		
							-29.0		
			At El. -29.0 Ft., few sand to gravel-sized shell, few silt, few clay, trace phosphate, moderate cementation, occasional thin layers of sandstone, dicontinue interbedded layers of sandy clay, 10Y 6/2 light grayish olive	100	34		SPT Sampler	3 / 7 / 4	11
							-30.5		
							Advanced Boring w/ fishtail bit		
							-32.0		
			At El. -32.0 Ft., some fine to coarse-grained sand-sized shell, 10GY 7/1 light greenish gray	100	35		SPT Sampler	7 / 7	

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Boring Designation HHD13-S291-CB-1

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET 4 OF 5 SHEETS
Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,557 Y = 1,002,483	22.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
-33.5	55.5		At El. -33.0 Ft., little sand to gravel-sized shell SAND, clayey, mostly fine to coarse-grained sand-sized shell, few fine-grained sand-sized quartz, 5GY 6/1 greenish gray (SC)	100	35		-33.5 SPT Sampler	12	19
							Advanced Boring w/ fishtail bit -35.0		
				93	36		SPT Sampler -36.5	8 8 9	17
-37.0	59.0						Advanced Boring w/ fishtail bit -38.0		
			SAND, poorly-graded with silt, mostly fine to coarse-grained sand-sized shell, few silt, few fine to medium-grained sand-sized quartz, wet, 5GY 6/1 greenish gray (SP-SM)	73	37		SPT Sampler -39.5	6 7 8	15
-40.0	62.0						Advanced Boring w/ fishtail bit -41.0		
			SAND, silty, some sand to gravel-sized shell, some fine to medium-grained sand-sized quartz, little silt, trace phosphate, wet, 5GY 6/1 greenish gray (SM)	80	38		SPT Sampler -42.5	8 6 4	10
-43.0	65.0						Advanced Boring w/ fishtail bit -44.0		
			SAND, clayey, mostly fine-grained sand-sized quartz, little silt, little clay, trace fine to coarse-grained sand-sized shell, trace phosphate, wet, very fine grained quartz, 10Y 4/2 grayish olive (SC)	100	39		SPT Sampler -45.5	2 1 2	3
							Advanced Boring w/ fishtail bit -47.0		
-48.5	70.5			87	40		SPT Sampler -48.5	2 1 2	3
			NOTES: 1. USACE Jacksonville is the custodian for these original files. 2. Soils are field visually classified in accordance with the Unified Soils Classification System. 3. Companion boring drilled to collect two 3-inch undisturbed sample in Feb-2015. U-1, 1.95 foot recovery, 200 psi at 16 seconds for push, U-2, 1.95 foot recovery, 250 psi at 13 seconds for push.				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

55 60 65 70 75

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Boring Designation HHD13-S291-CB-1

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 5 OF 5 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,557 Y = 1,002,483	22.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE

4. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION
6	7.5/9.0	SP*
9	12.0/13.5	SP*
16	22.5/24.0	SP-SM*
26	37.5/39.0	SP-SM*
U-1	/70.5	ML
31	45.0/46.5	SC
35	54.0/55.5	SC
40	69.0/70.5	SC

*Lab visual classification based on gradation curve

5. Additional Laboratory Testing

9 Specific Gravity
U-1 Moisture Content
U-1 Specific Gravity
U-1 Atterberg
31 Moisture Content
31 Atterberg
35 Moisture Content
35 Atterberg
35 Percent Visual Shell
40 Moisture Content
40 Atterberg

75
80
85
90
95

SAJ FORM 1836-A
JUN 02

Boring Designation HHD13-S291-CB-2

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 4 SHEETS
1. PROJECT	Culvert IP-3 Rehabilitation Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD13-S291-CB-2
LOCATION COORDINATES	X = 654,450 Y = 1,002,615
3. DRILLING AGENCY	Corps of Engineers - CESAM
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Ricky Brown
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	70.5 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500 ☐ AUTO HAMMER ☒ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 40 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	12.5 Ft.
15. DATE BORING	STARTED 12-19-13 / COMPLETED 12-20-13
16. ELEVATION TOP OF BORING	21.1 Ft.
17. TOTAL RECOVERY FOR BORING	79 %
18. SIGNATURE AND TITLE OF INSPECTOR	Bobby Norris, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
21.1	0.0						21.1		
			FILL, sandy, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, few silt, trace organic matter, dry, 5Y 7/1 light gray At El. 20.1 Ft., few fine to coarse gravel-sized limestone, discontinue organic matter At El. 19.6 Ft., trace silt, discontinue shell, discontinue fine to coarse gravel-sized limestone At El. 18.1 Ft., few silt, trace shell, moist	40	1		SPT Sampler	2 6 10	16
				80	2		SPT Sampler 19.6 18.1	7 7 5	12
				73	3		SPT Sampler 16.6	7 9 10	19
16.3	4.8								
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, dry, 10Y 8/1 light greenish gray (SP)	87	4		SPT Sampler 15.1	8 11 17	28
15.1	6.0								
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, wet, iron staining, tan (SP-SM) At El. 13.6 Ft., trace clay, brown	53	5		SPT Sampler 13.6	7 8 9	17
				67	6		SPT Sampler 12.1	6 7 8	15
12.1	9.0								
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, few fine to coarse-grained sand-sized shell, trace clay, wet, weak cementation, 5Y 5/2 olive gray (SM) At El. 10.3 Ft., some fine to coarse-grained sand-sized shell, discontinue clay, occasional thin layer of limestone	53	7		SPT Sampler 10.6	4 3 3	6
				73	8		SPT Sampler 9.1	2 7 9	16
9.1	12.0								
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, few silt, wet, 5GY 6/1 greenish gray (SP-SM) At El. 7.6 Ft., trace shell	80	9		SPT Sampler 7.6	5 6 8	14
				100	10		SPT Sampler 6.1	1 4 12	16
6.1	15.0								

(Continued)

Boring Designation HHD13-S291-CB-2

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,450 Y = 1,002,615	21.1 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace phosphate, trace shell, wet, 5Y 6/1 gray (SP)	73	11		SPT Sampler	6 16 16	32
							4.6		
				80	12		SPT Sampler	7 14 18	32
							3.1		
				87	13		SPT Sampler	8 16 18	34
1.6	19.5						1.6		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace phosphate, trace shell, wet, silt content varies with depth, 5Y 6/1 gray (SP-SM)	73	14		SPT Sampler	10 15 20	35
							0.1		
				80	15		SPT Sampler	10 15 21	36
							-1.4		
				80	16		SPT Sampler	12 16 23	39
							-2.9		
				87	17		SPT Sampler	10 17 25	42
							-4.4		
-4.9	26.0								
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace phosphate, trace shell, wet, occasional thin layers of slightly silty sand, silt content varies with depth, 5Y 6/1 gray (SP)	73	18		SPT Sampler	11 18 23	41
							-5.9		
				87	19		SPT Sampler	11 24 35	59
							-7.4		
				80	20		SPT Sampler	12 21 30	51
							-8.9		
				87	21		SPT Sampler	17 23 33	56
							-10.4		
				87	22		SPT Sampler	18 25 31	56
							-11.9		
				73	23		SPT Sampler	12 28 41	69
							-13.4		
			At El. -13.4 Ft., frequency of slightly silty sand	80	24		SPT Sampler	14	

15 20 25 30 35

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Boring Designation HHD13-S291-CB-2

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 3 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,450 Y = 1,002,615	21.1 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			layers increase with depth	80	24		SPT Sampler	27 36	63
							-14.9		
				73	25		SPT Sampler	12 14 21	35
							-16.4		
				73	26		SPT Sampler	13 16 20	36
							-17.9		
				67	27		SPT Sampler	15 25 20	45
							-19.4		
				73	28		SPT Sampler	16 21 8	29
-20.9	42.0						-20.9		
			SAND, clayey, some fine-grained sand-sized quartz, some clay, little silt, few fine to coarse-grained sand-sized shell, wet, very fine grained quartz, 10Y 4/1 dark greenish gray (SC)	100	29		SPT Sampler	1 1 9	10
							-22.4		
-22.9	44.0								
			SAND, silty, mostly fine-grained sand-sized quartz, some silt, few fine to coarse-grained sand-sized shell, trace clay, wet, occasional thin layers of sandstone, very fine grained quartz, 5Y 7/1 light gray (SM)	73	30		SPT Sampler	10 7 6	13
							-23.9		
			At El. -24.4 Ft., little silt, discontinue clay	87	31		SPT Sampler	2 5 10	15
							-25.4		
				87	32		SPT Sampler	3 3 6	9
							-26.9		
			At El. -26.9 Ft., some sand to gravel-sized shell, few clay, discontinue very fine grained quartz, 5GY 7/1 light greenish gray	93	33		SPT Sampler	4 4 4	8
							-28.4		
-29.4	50.5						Advanced Boring w/ fishtail bit		
			SAND, silty, mostly fine to coarse-grained sand-sized shell, some fine-grained sand-sized quartz, discontinue clay (SM)				-29.9		
				73	34		SPT Sampler	16 8 15	23
							-31.4		
			At El. -32.4 Ft., some sand to gravel-sized shell				Advanced Boring w/ fishtail bit		
							-32.9		
				87	35		SPT Sampler	4 11	

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Boring Designation HHD13-S291-CB-2

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 4 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,450 Y = 1,002,615	21.1 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				87	35		-34.4 SPT Sampler	8	19
			At El. -34.9 Ft., mostly fine to coarse-grained sand-sized shell, little fine-grained sand-sized quartz				Advanced Boring w/ fishtail bit -35.9		
				73	36		SPT Sampler -37.4	5 7 9	16
							Advanced Boring w/ fishtail bit -38.9		
				80	37		SPT Sampler -40.4	3 5 6	11
-41.9	63.0						Advanced Boring w/ fishtail bit -41.9		
			SAND, clayey, mostly fine-grained sand-sized quartz, few silt, few clay, trace fine to coarse-grained sand-sized shell, trace phosphate, wet, very fine grained quartz, 10Y 6/1 greenish gray (SC)	93	38		SPT Sampler -43.4	1 0 2	2
							Advanced Boring w/ fishtail bit -44.9		
				100	39		SPT Sampler -46.4	1 1 2	3
							Advanced Boring w/ fishtail bit -47.9		
				100	40		SPT Sampler -49.4	0 1 3	4
-49.4	70.5								
			NOTES: 1. USACE Jacksonville is the custodian for these original files. 2. Soils are field visually classified in accordance with the Unified Soils Classification System.				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

55 60 65 70 75

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Boring Designation HHD13-S291-CB-3

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 6 SHEETS
1. PROJECT	Culvert IP-3 Rehabilitation Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD13-S291-CB-3
LOCATION COORDINATES	X = 654,487 Y = 1,002,692
3. DRILLING AGENCY	Corps of Engineers - CESAM
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Charlie Brown
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	91.5 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500 ☐ AUTO HAMMER ☒ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 45 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	12.9 Ft.
15. DATE BORING	STARTED 06-10-14 / COMPLETED 06-11-14
16. ELEVATION TOP OF BORING	32.4 Ft.
17. TOTAL RECOVERY FOR BORING	80 %
18. SIGNATURE AND TITLE OF INSPECTOR	Bobby Norris, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
32.4	0.0						32.4		
			FILL, sandy, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, few silt, trace organic matter, moist, 5Y 7/1 light gray	73	1		SPT Sampler	6 8 8	16
							30.9		
				80	2		SPT Sampler	6 4 3	7
							29.4		
				87	3		SPT Sampler	3 3 7	10
							27.9		
			At El. 27.5 Ft., trace shell, discontinue organic matter, tan	80	4		SPT Sampler	3 4 4	8
							26.4		
				80	5		SPT Sampler	3 3 3	6
							24.9		
				73	6		SPT Sampler	3 4 3	7
							23.4		
				80	7		SPT Sampler	2 3 3	6
							21.9		
				87	8		SPT Sampler	3 3 4	7
							20.4		
			At El. 19.8 Ft., trace silt, trace organic matter, moist, light brown	80	9		SPT Sampler	3 3 3	6
							18.9		
				87	10		SPT Sampler	2 2 3	5
							17.4		

(Continued)

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Boring Designation HHD13-S291-CB-3

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 2 OF 6 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,487 Y = 1,002,692	32.4 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
16.9	15.5								
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, moist, 10Y 8/1 light greenish gray (SP)	80	11		SPT Sampler	4 8 10	18
15.3	17.1						15.9		
			SAND, clayey, mostly fine-grained sand-sized quartz, few clay, few silt, moist, 10Y 4/2 grayish olive (SC)	93	12		SPT Sampler	7 7 7	14
14.4	18.0						14.4		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, trace clay, moist, brown (SM)	87	13		SPT Sampler	5 8 10	18
			▼				12.9		
11.9	20.5			80	14		SPT Sampler	4 5 11	16
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, some fine to coarse-grained sand-sized shell, few silt, wet, silt content varies with depth, light gray brown (SP-SM)				11.4		
				87	15		SPT Sampler	4 7 12	19
							9.9		
				73	16		SPT Sampler	15 23 24	47
							8.4		
				80	17		SPT Sampler	8 7 9	16
6.9	25.5						6.9		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, light gray (SP)	87	18		SPT Sampler	6 8 23	31
							5.4		
				80	19		SPT Sampler	8 15 24	39
							3.9		
			At El. 3.9 Ft., trace shell, weak cementation	80	20		SPT Sampler	11 17 23	40
							2.4		
				73	21		SPT Sampler	15 22 24	46
							0.9		
				67	22		SPT Sampler	13 20 27	47
-0.6	33.0						-0.6		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace fine to coarse-grained sand-sized shell, wet, 5Y 5/1 gray (SP-SM)	80	23		SPT Sampler	19 35 40	75
							-2.1		
				73	24		SPT Sampler	13	

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Boring Designation HHD13-S291-CB-3

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 3 OF 6 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,487 Y = 1,002,692	32.4 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				73	24		SPT Sampler	28 / 46	74
							-3.6		
				67	25		SPT Sampler	16 / 25 / 36	61
							-5.1		
				73	26		SPT Sampler	15 / 24 / 48	72
-6.6	39.0						-6.6		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace phosphate, trace shell, wet, moderate cementation, occasional thin layers of slightly silty sand, 5Y 5/1 gray (SP)	86	27		SPT Sampler	25 / 42 / 50/0.4'	92+
							-8.0		
							-8.1 Advanced Boring		
				92	28		SPT Sampler	17 / 34 / 50/0.3'	84+
							-9.4		
							-9.6 Advanced Boring		
				89	29		SPT Sampler	34 / 50/0.4'	
							-10.5		
							-11.1 Advanced Boring		
				100	30		SPT Sampler	37 / 50/0.3'	
							-11.9		
							-12.6 Advanced Boring		
				53	31		SPT Sampler	24 / 23 / 36	59
							-14.1		
				47	32		SPT Sampler	18 / 36 / 48	84
-15.6	48.0						-15.6		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, little fine to medium-grained sand-sized shell, few silt, trace clay, wet, dark gray green (SP-SM)	67	33		SPT Sampler	11 / 20 / 30	50
							-17.1		
-17.6	50.0						Advanced Boring		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, few fine to coarse-grained sand-sized shell, trace clay, wet, 10Y 5/2 dark greenish gray (SM)				-18.6		
				87	34		SPT Sampler	15 / 14 / 10	24
							-20.1		
							Advanced Boring		
			At El. -21.1 Ft., some silt, moderate cementation, occasional thin layers of limestone, very fine grained quartz, 5Y 7.5/1 yellowish gray				-21.6		
				100	35		SPT Sampler	5 / 8	

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Boring Designation HHD13-S291-CB-3

DRILLING LOG (Cont. Sheet)	INSTALLATION: Jacksonville District	SHEET 4 OF 6 SHEETS
PROJECT: Culvert IP-3 Rehabilitation	COORDINATE SYSTEM/DATUM: State Plane, FLE (U.S. Ft.)	HORIZONTAL: NAD83 / VERTICAL: NAVD88
LOCATION COORDINATES: X = 654,487 Y = 1,002,692	ELEVATION TOP OF BORING: 32.4 Ft.	

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	35		-23.1 SPT Sampler	5	13
							Advanced Boring -24.6		
			At El. -24.6 Ft., 5GY 7/1 light greenish gray	100	36		SPT Sampler -26.1	6 12 12	24
							Advanced Boring -27.6		
				0	37		SPT Sampler -29.1	2 2 2	4
							Advanced Boring -30.6		
			At El. -30.6 Ft., little silt, little fine to coarse-grained sand-sized shell, discontinue clay, 5GY 7/1 light greenish gray	93	38		SPT Sampler -32.1	15 16 14	30
							Advanced Boring -33.6		
-33.6	66.0		SAND, silty, mostly fine to coarse-grained sand-sized shell, some silt, little fine-grained sand-sized quartz, 5GY 6/1 greenish gray (SM)	87	39		SPT Sampler -35.1	9 10 11	21
-35.6	68.0		SAND, poorly-graded with silt, mostly fine to coarse-grained sand-sized shell, little fine-grained sand-sized quartz, few silt, wet, 5GY 6/1 greenish gray (SP-SM)				Advanced Boring -36.6		
				73	40		SPT Sampler -38.1	8 12 13	25
-38.6	71.0		SAND, silty, mostly fine-grained sand-sized quartz, some fine to coarse-grained sand-sized shell, little silt, few clay, trace phosphate, wet, 10Y 6/2 light grayish olive (SM)				Advanced Boring -39.6		
				80	41		SPT Sampler -41.1	7 7 7	14
			At El. -42.1 Ft., trace fine to coarse-grained				Advanced Boring -42.6		

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Boring Designation HHD13-S291-CB-3

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 5 OF 6 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,487 Y = 1,002,692	32.4 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			sand-sized shell, trace clay, 10Y 4/2 grayish olive	100	42		SPT Sampler	NR NR NR	
							-44.1		
-45.6	78.0						Advanced Boring		
			SAND, clayey, mostly fine-grained sand-sized quartz, little silt, little clay, few fine to medium-grained sand-sized shell, wet, very fine grained quartz, 10Y 4/2 grayish olive (SC)				-47.6		
				100	43		SPT Sampler	NR NR NR	
							-49.1		
							Advanced Boring		
							-52.6		
			At El. -52.6 Ft., trace fine to coarse-grained sand-sized shell	100	44		SPT Sampler	NR NR NR	
							-54.1		
							Advanced Boring		
							-57.6		
				100	45		SPT Sampler	NR NR NR	
-59.1	91.5						-59.1		

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Laboratory Testing Results

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:

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Boring Designation HHD13-S291-CB-3

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 6 OF 6 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,487 Y = 1,002,692	32.4 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION
4	4.5/6.0	SP-SM*
10	13.5/15.0	SP*
26	37.5/39.0	SP-SM*
34	51.0/52.5	SM
44	85.0/86.5	SC

*Lab visual classification based on gradation curve

4. Additional Laboratory Testing

34 Moisture Content
34 Atterberg
44 Moisture Content
44 Atterberg

95
100
105
110
115

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Boring Designation HHD13-S291-CB-4

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 4 SHEETS
1. PROJECT	Culvert IP-3 Rehabilitation Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD13-S291-CB-4
LOCATION COORDINATES	X = 654,595 Y = 1,002,723
3. DRILLING AGENCY	Corps of Engineers - CESAM
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Charlie Brown
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	70.5 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500 ☐ AUTO HAMMER ☒ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 40 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	12.4 Ft.
15. DATE BORING	STARTED 06-07-14 / COMPLETED 06-09-14
16. ELEVATION TOP OF BORING	23.3 Ft.
17. TOTAL RECOVERY FOR BORING	72 %
18. SIGNATURE AND TITLE OF INSPECTOR	Bobby Norris, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
23.3	0.0						23.3		
			FILL, sandy, mostly fine-grained sand-sized quartz, few silt, few fine to coarse-grained sand-sized shell, trace organic matter, trace fine to coarse gravel-sized limestone, moist, 5Y 5/1 gray	67	1		SPT Sampler	3 6 18	24
							21.8		
				47	2		SPT Sampler	8 8 12	20
							20.3		
			At El. 20.3 Ft., discontinue organic matter	67	3		SPT Sampler	4 4 2	6
							18.8		
			At El. 18.8 Ft., discontinue fine to coarse gravel-sized limestone	80	4		SPT Sampler	3 4 2	6
							17.3		
				20	5		SPT Sampler	9 10 11	21
			From El. 16.1 to 15.1 Ft., cobble zone				15.8		
				0	6		15.5 SPT Sampler	50/0.3'	
14.3	9.0						Advanced Boring w/ auger 14.3		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, moist, iron staining, 5Y 7/1 light gray (SP-SM)	47	7		SPT Sampler	4 5 9	14
12.8	10.5						12.8		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, wet, 5Y 7/1 light gray (SP) ▼	53	8		SPT Sampler	5 8 11	19
							11.3		
			At El. 11.3 Ft., some fine to coarse-grained sand-sized shell, 10Y 7/1 light greenish gray	53	9		SPT Sampler	5 10 16	26
							9.8		
			At El. 9.8 Ft., few fine to coarse-grained sand-sized shell	67	10		SPT Sampler	2 4 6	10
8.3	15.0						8.3		

(Continued)

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Boring Designation HHD13-S291-CB-4

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,595 Y = 1,002,723	23.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, some fine to coarse-grained sand-sized shell, few silt, wet, gray brown (SP-SM)	67	11		SPT Sampler	3 4 4	8
				73	12		SPT Sampler	6 10 11	21
			At El. 5.3 Ft., light gray brown	73	13		SPT Sampler	8 9 10	19
3.8	19.5						3.8		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace fine-grained sand-sized shell, trace phosphate, wet, light gray (SP)	80	14		SPT Sampler	8 12 17	29
			At El. 2.3 Ft., little fine to coarse-grained sand-sized shell	67	15		SPT Sampler	10 10 13	23
				73	16		SPT Sampler	12 22 24	46
-2.3	25.5			73	17		SPT Sampler	11 20 21	41
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, few silt, trace phosphate, wet, silt content varies with depth, 10Y 6/1 greenish gray (SP-SM)	80	18		SPT Sampler	15 23 25	48
				73	19		SPT Sampler	12 16 23	39
-6.8	30.0			80	20		SPT Sampler	14 22 26	48
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, occasional thin layers of slightly silty sand, silt content varies with depth, 10Y 6/1 greenish gray (SP)	67	21		SPT Sampler	12 23 29	52
				73	22		SPT Sampler	21 24 30	54
				67	23		SPT Sampler	20 18 22	40
				53	24		SPT Sampler	11	

-8.3 -9.8 -11.3

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Boring Designation HHD13-S291-CB-4

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 3 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,595 Y = 1,002,723	23.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				53	24		SPT Sampler	22 22	44
							-12.8		
				73	25		SPT Sampler	10 18 23	41
							-14.3		
				77	26		SPT Sampler	38 48 50/0.3'	98+
							-15.6		
							-15.8 Advanced Boring		
				73	27		SPT Sampler	27 34 47	81
							-17.3		
				67	28		SPT Sampler	21 28 30	58
							-18.8		
				53	29		SPT Sampler	19 23 24	47
-20.2	43.4						-20.3		
			SAND, clayey, some fine-grained sand-sized quartz, little silt, little clay, few fine to coarse-grained sand-sized shell, wet, very fine grained quartz, interbedded with thin layers of sandy clay, 10Y 5/2 dark greenish gray (SC)	80	30		SPT Sampler	9 2 2	4
							-21.8		
				93	31		SPT Sampler	1 2 3	5
							-23.3		
				93	32		SPT Sampler	2 2 3	5
							-24.8		
-25.3	48.5								
			SAND, silty, mostly fine-grained sand-sized quartz, some silt, few fine to coarse-grained sand-sized shell, trace clay, trace phosphate, wet, moderate cementation, very fine grained quartz, occasional thin layer of sandstone, 10Y 4/2 grayish olive (SM)	100	33		SPT Sampler	1 3 7	10
							-26.3		
							Advanced Boring w/ fishtail bit		
							-27.8		
			At El. -27.8 Ft., 10GY 7/1 light greenish gray	100	34		SPT Sampler	4 5 9	14
							-29.3		
			At El. -29.8 Ft., little silt, few clay, discontinue sandstone layers, 10Y 5/2 dark greenish gray				Advanced Boring w/ fishtail bit		
							-30.8		
				93	35		SPT Sampler	1 3	

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Boring Designation HHD13-S291-CB-4

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 4 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,595 Y = 1,002,723	23.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				93	35		-32.3 SPT Sampler	3	6
							Advanced Boring w/ fishtail bit -33.8		
			At El. -33.8 Ft., little fine to coarse-grained sand-sized shell, trace clay, 10GY 7/1 light greenish gray	93	36		SPT Sampler -35.3	7 9 14	23
							Advanced Boring w/ fishtail bit -36.8		
-37.3	60.5		SAND, silty, mostly sand to gravel-sized shell, some fine-grained sand-sized quartz, discontinue clay, wet (SM)	87	37		SPT Sampler -38.3	10 12 13	25
							Advanced Boring w/ fishtail bit -39.8		
				47	38		SPT Sampler -41.3	5 8 10	18
-41.8	65.0						Advanced Boring w/ fishtail bit -42.8		
			SAND, clayey, mostly fine-grained sand-sized quartz, some fine to coarse-grained sand-sized shell, few silt, few clay, trace phosphate, wet, very fine grained quartz, 10Y 6/2 light grayish olive (SC)	87	39		SPT Sampler -44.3	4 6 2	8
			At El. -44.8 Ft., trace fine to coarse-grained sand-sized shell, 10Y 4/2 grayish olive				Advanced Boring w/ fishtail bit -45.8		
				100	40		SPT Sampler -47.3	1 3 2	5
-47.3	70.5								
			NOTES: 1. USACE Jacksonville is the custodian for these original files. 2. Soils are field visually classified in accordance with the Unified Soils Classification System.				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

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Boring Designation HHD13-S291-CB-5

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 5 SHEETS
1. PROJECT	Culvert IP-3 Rehabilitation Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD13-S291-CB-5
LOCATION COORDINATES	X = 654,605 Y = 1,002,778
3. DRILLING AGENCY	Corps of Engineers - CESAM
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Charlie Brown
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	70.5 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500 ☐ AUTO HAMMER ☒ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 40 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	17.9 Ft.
15. DATE BORING	STARTED 06-05-14 / COMPLETED 06-05-14
16. ELEVATION TOP OF BORING	23.3 Ft.
17. TOTAL RECOVERY FOR BORING	79 %
18. SIGNATURE AND TITLE OF INSPECTOR	Bobby Norris, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
23.3	0.0						23.3		
			FILL, sandy, mostly fine-grained sand-sized quartz, few silt, trace organic matter, moist, 5Y 6.5/1 olive gray	67	1		SPT Sampler	4 2 5	7
							21.8		
				0	2		21.4 SPT Sampler	50/0.4'	
			At El. 21.4 Ft., cobble				Advanced Boring w/ auger		
							20.3		
			At El. 20.3 Ft., little silt, few fine to coarse gravel-sized limestone, few fine to coarse-grained sand-sized shell, 10Y 7/1 light greenish gray	60	3		SPT Sampler	6 6 1	7
							18.8		
17.9	5.4			73	4		SPT Sampler	1 1 8	9
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace fine to medium-grained sand-sized shell, discontinue silt, wet, (Native?), light brown (SP)				17.3		
			At El. 17.3 Ft., some fine to coarse-grained sand-sized shell, 5Y 6/1 gray	87	5		SPT Sampler	12 11 13	24
							15.8		
				87	6		SPT Sampler	8 11 11	22
							14.3		
			At El. 14.3 Ft., few fine to coarse-grained sand-sized shell, silt content varies with depth, 5Y 5/1 gray	73	7		SPT Sampler	3 4 3	7
							12.8		
			At El. 12.8 Ft., some fine to coarse-grained sand-sized shell	60	8		SPT Sampler	4 6 8	14
							11.3		
			At El. 11.3 Ft., little fine to coarse-grained sand-sized shell, 5Y 6.5/1 olive gray	80	9		SPT Sampler	4 7 12	19
							9.8		
			At El. 9.8 Ft., few fine to coarse-grained sand-sized shell	80	10		SPT Sampler	5 8 9	17
							8.3		

(Continued)

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Boring Designation HHD13-S291-CB-5

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 2 OF 5 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,605 Y = 1,002,778	23.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			At El. 8.3 Ft., 5Y 7/1 light gray	80	11		SPT Sampler	7 13 13	26
			At El. 6.3 Ft., trace fine to coarse-grained sand-sized shell, trace phosphate, weak cementation	87	12		SPT Sampler	8 19 23	42
3.8	19.5			87	13		SPT Sampler	15 21 22	43
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace fine to coarse-grained sand-sized shell, trace phosphate, wet, weak cementation, 5Y 7/1 light gray (SP-SM)	93	14		SPT Sampler	12 19 21	40
				87	15		SPT Sampler	7 20 27	47
				73	16		SPT Sampler	13 20 22	42
-2.2	25.5			80	17		SPT Sampler	16 21 18	39
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace fine to coarse-grained sand-sized shell, trace phosphate, wet, weak cementation, 5Y 7/1 light gray (SP)	73	18		SPT Sampler	14 20 21	41
				80	19		SPT Sampler	18 26 37	63
				73	20		SPT Sampler	17 24 31	55
				80	21		SPT Sampler	12 20 24	44
				93	22		SPT Sampler	19 14 25	39
			At El. -9.7 Ft., silt content increases with depth with thin layers of slightly silty sand	87	23		SPT Sampler	17 18 22	40
				80	24		SPT Sampler	10	

Boring Designation HHD13-S291-CB-5

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 3 OF 5 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,605 Y = 1,002,778	23.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				80	24		SPT Sampler	24 45	69
							-12.7		
				73	25		SPT Sampler	13 21 33	54
							-14.2		
				53	26		SPT Sampler	8 11 12	23
-15.7	39.0		At El. -15.0 Ft., few fine to coarse-grained sand-sized shell				-15.7		
			SAND, clayey, mostly fine-grained sand-sized quartz, little clay, little silt, trace fine to coarse-grained sand-sized shell, wet, interbedded with thin layers of sandy clay, 10Y 4/2 grayish olive (SC)	60	27		SPT Sampler	4 3 1	4
							-17.2		
				100	28		SPT Sampler	1 1 3	4
							-18.7		
				93	29		SPT Sampler	1 2 2	4
							-20.2		
				93	30		SPT Sampler	2 1 2	3
-21.7	45.0						-21.7		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, few fine to coarse-grained sand-sized shell, trace phosphate, wet, moderate cementation, occasional thin layers of sandstone, 10GY 6/1 greenish gray (SM)	80	31		SPT Sampler	4 4 5	9
							-23.2		
				87	32		SPT Sampler	5 4 5	9
-24.9	48.2						-24.7		
			SAND, clayey, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, little silt, little clay, wet, 10Y 5/2 dark greenish gray (SC)	53	33		SPT Sampler	1 2 8	10
							-26.2		
-27.2	50.5						Advanced Boring w/ auger		
			SAND, silty, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, little silt, trace clay, trace phosphate, wet, weak cementation, 10GY 7/1 light greenish gray (SM)				-27.7		
				87	34		SPT Sampler	14 20 22	42
							-29.2		
-30.2	53.5						Advanced Boring w/ auger		
			SAND, poorly-graded with silt, mostly fine to coarse-grained sand-sized shell, few fine-grained sand-sized quartz, few silt, wet, silt content increases with depth, 10GY 7/1 light greenish gray (SP-SM)				-30.7		
				67	35		SPT Sampler	6 9	

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Boring Designation HHD13-S291-CB-5

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 4 OF 5 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,605 Y = 1,002,778	23.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				67	35		-32.2 SPT Sampler	9	18
			At El. -32.7 Ft., moderate cementation, occasional thin layers of limestone				Advanced Boring w/ auger -33.7		
				73	36		SPT Sampler -35.2	7 8 8	16
-36.7	60.0						Advanced Boring w/ auger -36.7		
			SAND, silty, mostly fine to coarse-grained sand-sized shell, some silt, few fine-grained sand-sized quartz, wet, 10Y 6/2 light grayish olive (SM)	80	37		SPT Sampler -38.2	5 6 4	10
-39.7	63.0						Advanced Boring w/ auger -39.7		
			SAND, clayey, mostly fine-grained sand-sized quartz, little silt, few clay, trace fine to coarse-grained sand-sized shell, trace phosphate, wet, very fine grained quartz, 10Y 5/2 dark greenish gray (SC)	100	38		SPT Sampler -41.2	2 2 3	5
							Advanced Boring w/ auger -42.7		
				93	39		SPT Sampler -44.2	2 3 3	6
							Advanced Boring w/ auger -45.7		
				100	40		SPT Sampler -47.2	4 5 3	8
-47.2	70.5								

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

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Boring Designation HHD13-S291-CB-5

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 5 OF 5 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,605 Y = 1,002,778	23.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE

5	6.0/7.5	SP*
9	12.0/13.5	SP*
15	21.0/22.5	SP-SM*
21	30.0/31.5	SP*
28	40.5/42.0	SC
34	51.0/52.5	SM*
36	57.0/58.5	SP-SM*
40	69.0/70.5	SC

*Lab visual classification based on gradation curve

4. Additional Laboratory Testing

5	Moisture Content
5	Percent Visual Shell
9	Specific Gravity
28	Moisture Content
28	Atterberg
34	Moisture Content
36	Percent Visual Shell
40	Moisture Content
40	Atterberg

75
80
85
90
95

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Boring Designation HHD13-S291-CB-6

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 4 SHEETS
1. PROJECT	Culvert IP-3 Rehabilitation Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD13-S291-CB-6
LOCATION COORDINATES	X = 654,522 Y = 1,002,865
3. DRILLING AGENCY	Corps of Engineers - CESAM
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Charlie Brown
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	70.5 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Failing 1500 ☐ AUTO HAMMER ☒ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 40 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	15.4 Ft.
15. DATE BORING	STARTED 05-31-14 / COMPLETED 06-02-14
16. ELEVATION TOP OF BORING	19.6 Ft.
17. TOTAL RECOVERY FOR BORING	79 %
18. SIGNATURE AND TITLE OF INSPECTOR	Bobby Norris, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
19.6	0.0						19.6		
			FILL, sandy, mostly fine-grained sand-sized quartz, few silt, trace organic matter, moist, 5Y 5/2 olive gray	67	1		SPT Sampler	1 3 6	9
							18.1		
			At El. 18.1 Ft., trace fine to coarse-grained sand-sized shell	93	2		SPT Sampler	8 7 5	12
							16.6		
				80	3		SPT Sampler	3 2 2	4
			At El. 15.4 Ft., wet ▼				15.1		
				53	4		SPT Sampler	2 4 4	8
13.6	6.0						13.6		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, few silt, wet, 5Y 4/1 dark gray (SP-SM)	87	5		SPT Sampler	2 2 8	10
11.5	8.1						12.1		
			SAND, silty, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, little silt, wet, moderate cementation, occasional thin layers of limestone, 5Y 6/1 gray (SM)	80	6		SPT Sampler	5 13 12	25
							10.6		
			At El. 10.1 Ft., some fine to coarse-grained sand-sized shell, some fine-grained sand-sized quartz, discontinue layers of limestone, silt content decreases with depth	87	7		SPT Sampler	3 5 5	10
							9.1		
				100	8		SPT Sampler	3 6 6	12
7.6	12.0						7.6		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, some fine to coarse-grained sand-sized shell, few silt, wet, 5Y 6/1 gray (SP-SM)	80	9		SPT Sampler	2 3 5	8
							6.1		
			At El. 6.1 Ft., little fine to coarse-grained sand-sized shell	67	10		SPT Sampler	2 5 7	12
4.6	15.0						4.6		

(Continued)

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Boring Designation HHD13-S291-CB-6

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,522 Y = 1,002,865	19.6 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, 5Y 7.5/1 yellowish gray (SP)	53	11		SPT Sampler	6 13 16	29
							3.1		
				53	12		SPT Sampler	10 17 20	37
							1.6		
				67	13		SPT Sampler	6 16 21	37
							0.1		
				67	14		SPT Sampler	7 12 14	26
							-1.4		
				73	15		SPT Sampler	8 16 24	40
-2.9	22.5						-2.9		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace fine to coarse-grained sand-sized shell, trace phosphate, wet, 5Y 7.5/1 yellowish gray (SP-SM)	80	16		SPT Sampler	10 28 20	48
							-4.4		
				80	17		SPT Sampler	12 14 19	33
							-5.9		
				80	18		SPT Sampler	5 19 30	49
-7.4	27.0						-7.4		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, 5Y 7.5/1 yellowish gray (SP)	73	19		SPT Sampler	11 21 25	46
							-8.9		
				67	20		SPT Sampler	10 20 25	45
							-10.4		
			At El. -10.4 Ft., silt content varies with depth	60	21		SPT Sampler	10 14 25	39
							-11.9		
				67	22		SPT Sampler	9 25 26	51
							-13.4		
				80	23		SPT Sampler	9 24 23	47
							-14.9		
				67	24		SPT Sampler	12	

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Boring Designation HHD13-S291-CB-6

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 3 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,522 Y = 1,002,865	19.6 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				67	24		SPT Sampler	24 / 29	53
			At El. -16.4 Ft., few fine to coarse-grained sand-sized shell				-16.4		
				73	25		SPT Sampler	11 / 25 / 30	55
							-17.9		
				47	26		SPT Sampler	10 / 12 / 7	19
-19.4	39.0						-19.4		
			SAND, clayey, mostly fine-grained sand-sized quartz, little silt, little clay, few fine to coarse-grained sand-sized shell, wet, very fine grained quartz, interbedded with thin layers of sandy clay, 10Y 5/2 dark greenish gray (SC)	87	27		SPT Sampler	1 / 1 / 2	3
							-20.9		
				93	28		SPT Sampler	2 / 1 / 2	3
							-22.4		
-22.8	42.4								
			SAND, silty, mostly fine-grained sand-sized quartz, some silt, trace clay, trace shell, wet, moderate cementation, very fine grained quartz, occasional thin layers of limestone, 10GY 8/1 light greenish gray (SM)	87	29		SPT Sampler	2 / 2 / 10	12
							-23.9		
				73	30		SPT Sampler	5 / 7 / 9	16
							-25.4		
			At El. -25.4 Ft., few fine to coarse-grained sand-sized shell, discontinue thin layers of limestone	87	31		SPT Sampler	2 / 2 / 3	5
							-26.9		
			At El. -26.9 Ft., little sand to gravel-sized shell, trace clay	93	32		SPT Sampler	3 / 2 / 3	5
							-28.4		
			At El. -28.4 Ft., some fine to coarse-grained sand-sized shell, little silt, trace phosphate, 10Y 6/2 light grayish olive	100	33		SPT Sampler	2 / 2 / 4	6
							-29.9		
							Advanced Boring w/ fishtail bit		
							-31.4		
			At El. -31.4 Ft., little fine to coarse-grained sand-sized shell, discontinue clay	93	34		SPT Sampler	6 / 8 / 5	13
							-32.9		
			At El. -33.4 Ft., occasional limestone nodules				Advanced Boring w/ fishtail bit		
							-34.4		
				87	35		SPT Sampler	7 / 7	

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Boring Designation HHD13-S291-CB-6

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 4 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Culvert IP-3 Rehabilitation	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,522 Y = 1,002,865	19.6 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				87	35		-35.9 SPT Sampler	9	16
							Advanced Boring w/ fishtail bit		
-37.4	57.0						-37.4		
			SAND, silty, mostly sand to gravel-sized shell, some fine-grained sand-sized quartz, 5GY 6/1 greenish gray (SM)	80	36		SPT Sampler	5 6 7	13
							-38.9		
							Advanced Boring w/ fishtail bit		
-40.4	60.0						-40.4		
			SAND, clayey, mostly fine-grained sand-sized quartz, little silt, little fine to coarse-grained sand-sized shell, trace phosphate, wet, 10Y 4/2 grayish olive (SC)	93	37		SPT Sampler	6 4 2	6
							-41.9		
							Advanced Boring w/ fishtail bit		
							-43.4		
			At El. -43.4 Ft., few silt, trace fine to medium-grained sand-sized shell	87	38		SPT Sampler	2 2 3	5
							-44.9		
							Advanced Boring w/ fishtail bit		
							-46.4		
				100	39		SPT Sampler	3 2 3	5
							-47.9		
							Advanced Boring w/ fishtail bit		
							-49.4		
				100	40		SPT Sampler	7 7 7	14
-50.9	70.5						-50.9		
			NOTES: 1. USACE Jacksonville is the custodian for these original files. 2. Soils are field visually classified in accordance with the Unified Soils Classification System.				140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).		

55 60 65 70 75

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Boring Designation HHD15-S291-CB-1

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 5 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-CB-1
LOCATION COORDINATES	X = 654,864 Y = 1,002,055
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	72.0 Ft.
9. SIZE AND TYPE OF BIT	4.25" Hollow-Stem Auger
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.)
HORIZONTAL	NAD83
VERTICAL	NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-75 (land-based)
	☒ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 41 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	13.7 Ft.
15. DATE BORING	STARTED 08-18-15 / COMPLETED 08-18-15
16. ELEVATION TOP OF BORING	21.2 Ft.
17. TOTAL RECOVERY FOR BORING	91 %
18. SIGNATURE AND TITLE OF INSPECTOR	William McIntosh, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
21.2	0.0						21.2		
			FILL, sandy, mostly fine-grained sand-sized quartz, few silt, trace organic matter, trace shell, dry, light gray At El. 20.9 Ft., trace silt, discontinue organic matter, silt content varies with depth, 7.5YR 7/2 pinkish gray	100	1		SPT Sampler	2 3 5	8
							19.7		
				87	2		SPT Sampler	3 3 4	7
							18.2		
17.2	4.0			113	3		SPT Sampler	1 1 1	2
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace shell, trace organic matter, moist, occasional thin layers of organic stained sand, 10YR 2/2 very dark brown (SP-SM) At El. 16.7 Ft., 10YR 7/3 very pale brown				16.7		
				87	4		SPT Sampler	1 2 5	7
15.2	6.0						15.2		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace shell, moist, slight iron staining, 7.5YR 7/2 pinkish gray (SP)	100	5		SPT Sampler	5 6 7	13
13.7	7.5						13.7		
13.2	8.0		SAND, clayey, mostly fine to medium-grained sand-sized quartz, few clay, few silt, trace shell, wet, 10YR 3/2 very dark grayish brown (SC)	73	6		SPT Sampler	2 3 8	11
			SAND, poorly-graded with silt, mostly fine to medium-grained sand-sized quartz, few silt, few fine to coarse-grained sand-sized shell up to 1/2", weak reaction with HCl, wet, weak cementation, 10YR 6/6 brownish yellow (SP-SM)				12.2		
				80	7		SPT Sampler	3 5 7	12
			At El. 11.5 Ft., mostly fine-grained sand-sized quartz, trace fine to coarse-grained sand-sized shell, 10YR 8/2 very pale brown				10.7		
				87	8		SPT Sampler	3 4 6	10
			At El. 10.7 Ft., mostly fine to medium-grained sand-sized quartz, silt content varies with depth, 10YR 6/2 light brownish gray				9.2		
				100	9		SPT Sampler	3 5 7	12
			At El. 9.2 Ft., some sand to gravel-sized shell up to 3/4", strong reaction with HCl, 10YR 6/1 gray				7.7		
			At El. 7.7 Ft., few fine to coarse-grained sand-sized shell, weak reaction with HCl	73	10		SPT Sampler	3 7 11	18
6.2	15.0						6.2		

(Continued)

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Boring Designation HHD15-S291-CB-1

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 5 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,864 Y = 1,002,055	21.2 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace phosphate, trace fine to medium-grained sand-sized shell, wet, 10YR 6/1 gray (SP)	93	11		SPT Sampler	3 5 6	11
				80	12		SPT Sampler	3 8 14	22
			At El. 3.2 Ft., trace fine to medium-grained sand-sized shell, 10YR 5/1 gray	100	13		SPT Sampler	4 16 36	52
				80	14		SPT Sampler	4 7 12	19
			At El. 0.2 Ft., 10YR 7/1 light gray	93	15		SPT Sampler	5 9 12	21
				87	16		SPT Sampler	3 5 12	17
-4.3	25.5		At El. -3.5 Ft., finer grained than above, 10YR 7/2 light gray	100	17		SPT Sampler	1 2 4	6
-5.8	27.0		SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace phosphate, trace fine to coarse-grained sand-sized shell, wet, silt content decreases with depth, 10YR 5/2 grayish brown (SP-SM)	73	18		SPT Sampler	1 1 7	8
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace fine to medium-grained sand-sized shell, trace phosphate, trace silt, wet, 10YR 6/1 gray (SP)	87	19		SPT Sampler	3 5 12	17
				87	20		SPT Sampler	3 5 14	19
			At El. -8.8 Ft., silt content varies with depth, occasional zones of slightly silty sand, 10YR 6/2 light brownish gray	100	21		SPT Sampler	3 3 8	11
				93	22		SPT Sampler	4 5 15	20
			At El. -11.8 Ft., trace clay	80	23		SPT Sampler	3 3 9	12
			At El. -13.3 Ft., discontinue clay	93	24		SPT Sampler	2	

Boring Designation HHD15-S291-CB-1

DRILLING LOG (Cont. Sheet)

INSTALLATION: Jacksonville District

SHEET 3 OF 5 SHEETS

PROJECT: Herbert Hoover Dike

COORDINATE SYSTEM/DATUM: State Plane, FLE (U.S. Ft.) | HORIZONTAL: NAD83 | VERTICAL: NAVD88

LOCATION COORDINATES: X = 654,864 Y = 1,002,055

ELEVATION TOP OF BORING: 21.2 Ft.

ELEV.	DEPTH	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
		At El. -14.8 Ft., 10YR 5/1 gray	93	24		SPT Sampler	4 11	15
			100	25		SPT Sampler	5 16 24	40
			100	26		SPT Sampler	4 7 6	13
-17.8	39.0					-17.8		
-18.3	39.5	SAND, clayey, mostly fine-grained sand-sized quartz, little silt, little clay, few fine to coarse-grained sand-sized shell, wet, 10YR 5/1 gray (SC)	87	27		SPT Sampler	3 1 1	2
-19.3	40.5	CLAY, lean, medium plasticity, soft, little fine-grained sand-sized quartz, few silt, few fine to coarse-grained sand-sized shell, moist, 10YR 4/1 dark gray (CL)				-19.3		
-19.8	41.0		87	28		SPT Sampler	2 1 2	3
-20.3	41.5	SAND, clayey, mostly fine-grained sand-sized quartz, little clay, few silt, few fine to coarse-grained sand-sized shell, wet, 10YR 5/1 gray (SC)						
-20.8	42.0	CLAY, fat, medium plasticity, firm, little fine-grained sand-sized quartz, few silt, few fine to coarse-grained sand-sized shell, moist, 10YR 3/1 very dark gray (CH)				-20.8		
		SAND, clayey, mostly fine-grained sand-sized quartz, some clay, few fine to coarse-grained sand-sized shell, trace silt, wet, 10YR 5/1 gray (SC)	93	29		SPT Sampler	5 5 5	10
		SAND, silty, mostly fine-grained sand-sized quartz, little silt, trace fine to coarse-grained sand-sized shell, strong reaction with HCl, wet, moderate cementation, very fine grained quartz, occasional thin layers of sandstone and nodules, 10YR 7/1 light gray (SM)	93	30		SPT Sampler	3 3 4	7
			100	31		SPT Sampler	2 1 3	4
-25.3	46.5					-25.3		
		At El. -22.3 Ft., trace fine to medium-grained sand-sized shell At El. -23.8 Ft., 10YR 8/1 white	100	32		SPT Sampler	3 2 2	4
		SAND, clayey, mostly fine-grained sand-sized quartz, some sand to gravel-sized shell up to 1-1/4", few silt, few clay, strong reaction with HCl, wet, 5Y 6/1 gray (SC)	100	33		SPT Sampler	1 1 3	4
-28.3	49.5					-28.3		
		At El. -26.8 Ft., little silt, little fine to coarse-grained sand-sized shell, few clay, clay content decrease with depth	67	34		SPT Sampler	4 7 7	14
		SAND, silty, mostly fine-grained sand-sized quartz, little silt, little fine to coarse-grained sand-sized shell, trace clay, strong reaction with HCl, wet, weak cementation, 10YR 7/1 light gray (SM)				Advanced Boring w/ auger		
		At El. -30.8 Ft., some sand to gravel-sized shell, little silt, 5Y 6/1 gray				-31.3		
			100	35		SPT Sampler	3 3 2	5
						-32.8		
						Advanced Boring w/ auger		

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Boring Designation HHD15-S291-CB-1

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 4 OF 5 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,864 Y = 1,002,055	21.2 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			At El. -33.8 Ft., no cementation, gray				-34.3		
				80	36		SPT Sampler	2 2 4	6
							-35.8		
-36.8	58.0						Advanced Boring w/ auger		
			SAND, clayey, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, few silt, few clay, strong reaction with HCl, wet, green gray (SC)				-37.3		
				87	37		SPT Sampler	3 3 2	5
							-38.8		
-39.8	61.0						Advanced Boring w/ auger		
			SAND, silty, mostly fine-grained sand-sized quartz, few clay, few silt, trace fine to medium-grained sand-sized shell, wet, very fine grained quartz, silt and clay content vary with depth, 5Y 5/2 olive gray (SM)				-40.3		
				93	38		SPT Sampler	WOR WOR 4	4
							-41.8		
							Advanced Boring w/ auger		
							-43.3		
				100	39		SPT Sampler	1 1 1	2
							-44.8		
							Advanced Boring w/ auger		
							-46.3		
			At El. -46.3 Ft., 5Y 5/2 olive gray						
				100	40		SPT Sampler	1 2 2	4
							-47.8		
							Advanced Boring w/ auger		
							-49.3		
				100	41		SPT Sampler	WOH WOH 2	2
-50.8	72.0						-50.8		

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:
WOR = Weight of Rods.
WOH = Weight of Hammer

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Boring Designation HHD15-S291-CB-1

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 5 OF 5 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,864 Y = 1,002,055	21.2 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE

3. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION
9	12.0/13.5	SP-SM*
15	21.0/22.5	SP*
19	27.0/28.5	SP*
27	39.0/40.5	CL
31	45.0/46.5	SM*
35	52.5/54.0	SM*
39	64.5/66.0	SM

*Lab visual classification based on gradation curve

4. Additional Laboratory Testing

9 Percent Visual Shell
27 Moisture Content
27 Atterberg
39 Moisture Content
39 Atterberg

75
80
85
90
95

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Boring Designation HHD15-S291-CB-2

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 6 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-CB-2
LOCATION COORDINATES	X = 654,779 Y = 1,002,253
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	85.0 Ft.
9. SIZE AND TYPE OF BIT	4.25" Hollow-Stem Auger
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.)
HORIZONTAL	NAD83
VERTICAL	NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-75 (land-based)
	☒ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 45 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	12.5 Ft.
15. DATE BORING	STARTED 08-10-15 / COMPLETED 08-11-15
16. ELEVATION TOP OF BORING	32.0 Ft.
17. TOTAL RECOVERY FOR BORING	100 %
18. SIGNATURE AND TITLE OF INSPECTOR	John Markov, Geologist

ELEV.	DEPTH	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
32.0	0.0					32.0		
		FILL, sandy, mostly fine-grained sand-sized quartz, little silt, trace organic matter, trace shell, dry, light brown	100	1		SPT Sampler	3 3 4	7
		At El. 30.5 Ft., few fine to coarse-grained sand-sized shell, trace silt, moist, silt content varies with depth, tan	100	2		30.5 SPT Sampler	3 4 7	11
			100	3		29.0 SPT Sampler	1 2 3	5
		At El. 27.5 Ft., little fine to coarse-grained sand-sized shell, trace fine to coarse gravel-sized sandstone	100	4		27.5 SPT Sampler	2 2 2	4
		At El. 26.0 Ft., few fine to coarse-grained sand-sized shell	100	5		26.0 SPT Sampler	2 3 2	5
		At El. 24.5 Ft., little sand to gravel-sized shell, trace phosphate, iron staining	100	6		24.5 SPT Sampler	1 2 3	5
			100	7		23.0 SPT Sampler	3 2 3	5
		At El. 21.7 Ft., trace fine to coarse-grained sand-sized shell, trace silt, tan	100	8		21.5 SPT Sampler	1 1 2	3
		At El. 20.0 Ft., trace shell up to 1/8"	100	9		20.0 SPT Sampler	1 2 2	4
18.5	13.5					18.5		
		SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace shell, trace organic matter, moist, with thin layers of organic silt, light brown (SP-SM)	100	10		SPT Sampler	1 2 2	4
17.0	15.0					17.0		

(Continued)

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Boring Designation HHD15-S291-CB-2

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 2 OF 6 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,779 Y = 1,002,253	32.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace phosphate, moist, tan (SP)	80	11		SPT Sampler	2 4 9	13
15.0	17.0						15.5		
			SAND, clayey, mostly fine-grained sand-sized quartz, little silt, little clay, few fine to medium-grained sand-sized shell, moist, brown (SC)	100	12		SPT Sampler	2 4 9	13
13.5	18.5						14.0		
			SAND, silty, mostly fine-grained sand-sized quartz, some sand to gravel-sized shell, little silt, trace phosphate, weak reaction with HCl, moist, weak cementation, iron stained, light orange tan (SM)	100	13		SPT Sampler	2 4 10	14
12.0	20.0						12.5		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, some sand to gravel-sized shell, trace silt, trace phosphate, wet, weak cementation, iron stained, silt content decrease with depth, light orange tan (SP)	100	14		SPT Sampler	1 7 9	16
							11.0		
			At El. 11.0 Ft., few fine to medium-grained sand-sized shell, orange tan	100	15		SPT Sampler	2 4 7	11
							9.5		
			At El. 9.5 Ft., little fine to coarse-grained sand-sized shell, no cementation, gray	100	16		SPT Sampler	3 4 9	13
							8.0		
			At El. 8.0 Ft., silt content varies with depth	100	17		SPT Sampler	3 4 9	13
							6.5		
			From El. 6.5 to 6.0 Ft., higher silt content	100	18		SPT Sampler	4 7 11	18
							5.0		
			At El. 5.0 Ft., silt content varies with depth, light gray	100	19		SPT Sampler	2 5 6	11
							3.5		
				100	20		SPT Sampler	3 4 11	15
							2.0		
				100	21		SPT Sampler	5 7 9	16
							0.5		
				100	22		SPT Sampler	7 14 20	34
							-1.0		
			At El. -1.0 Ft., few fine to coarse-grained sand-sized shell	100	23		SPT Sampler	4 4 12	16
							-2.5		
				100	24		SPT Sampler	3	

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Boring Designation HHD15-S291-CB-2

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 3 OF 6 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,779 Y = 1,002,253	32.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			At El. -3.0 Ft., silt content increases with depth	100	24		SPT Sampler	4 10	14
							-4.0		
				100	25		SPT Sampler	4 5 6	11
-5.5	37.5						-5.5		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few fine to medium-grained sand-sized shell, few silt, trace phosphate, wet, dark gray (SP-SM)	100	26		SPT Sampler	3 5 9	14
							-7.0		
				100	27		SPT Sampler	3 4 8	12
-8.5	40.5						-8.5		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace phosphate, trace silt, wet, silt content varies with depth, gray (SP)	100	28		SPT Sampler	2 3 7	10
							-10.0		
			At El. -10.0 Ft., trace shell	100	29		SPT Sampler	3 3 7	10
							-11.5		
			At El. -11.5 Ft., light gray	100	30		SPT Sampler	2 4 10	14
							-13.0		
				100	31		SPT Sampler	6 7 15	22
			At El. -14.5 Ft., gray				-14.5		
				100	32		SPT Sampler	5 6 8	14
							-16.0		
			At El. -16.0 Ft., few fine to coarse-grained sand-sized shell	100	33		SPT Sampler	4 5 8	13
							-17.5		
-18.3	50.3		At El. -18.0 Ft., clay content increases with depth	100	34		SPT Sampler	2 1 1	2
			SAND, clayey, mostly fine-grained sand-sized quartz, some clay, few silt, trace shell, wet, very fine grained quartz, occasional thin layers of sandy clay, dark gray (SC)				Advanced Boring w/ auger		
							-20.5		
			At El. -20.5 Ft., little clay, little silt, few shell	100	35		SPT Sampler	2 5 4	9
-21.5	53.5						-22.0		
			SAND, silty, mostly fine-grained sand-sized quartz, some silt, few fine to medium-grained sand-sized shell, trace clay, wet, moderate cementation, very fine grained quartz, occasional thin layers of sandstone, light		35B		Advanced Boring w/ auger		

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Boring Designation HHD15-S291-CB-2

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 4 OF 6 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,779 Y = 1,002,253	32.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			gray (SM)				-23.5		
			At El. -23.0 Ft., discontinue clay	100	36		SPT Sampler	2 2 4	6
							-25.0		
-26.0	58.0						Advanced Boring w/ auger		
			SAND, clayey, mostly fine-grained sand-sized quartz, little clay, little sand to gravel-sized shell, few silt, weak reaction with HCl, wet, light greenish gray (SC)				-26.5		
				100	37		SPT Sampler	2 2 2	4
							-28.0		
-29.5	61.5						Advanced Boring w/ auger		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, little fine to coarse-grained sand-sized shell, trace phosphate, trace clay, wet, light gray (SM)	100	38		-29.5 SPT Sampler	5 5 7	12
							-31.0		
							Advanced Boring w/ auger		
							-32.5		
			At El. -32.5 Ft., little fine to medium-grained sand-sized shell, discontinue clay	100	39		SPT Sampler	2 3 3	6
							-34.0		
							Advanced Boring w/ auger		
			At El. -35.0 Ft., some sand to gravel-sized shell				-35.5		
				100	40		SPT Sampler	3 3 3	6
							-37.0		
-38.0	70.0						Advanced Boring w/ auger		
			SAND, silty, mostly sand to gravel-sized shell, some fine-grained sand-sized quartz, trace clay (SM)				-38.5		
				100	41		SPT Sampler	3 4 3	7
							-40.0		
-41.0	73.0						Advanced Boring w/ auger		
			SAND, silty, mostly fine-grained sand-sized quartz, few clay, few silt, trace fine-grained sand-sized shell, very fine grained quartz, dark gray (SM)				-41.5		
				100	42		SPT Sampler	1 1 1	2
							-43.0		

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Boring Designation HHD15-S291-CB-2

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 5 OF 6 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,779 Y = 1,002,253	32.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			At El. -44.0 Ft., little clay, few fine to coarse-grained sand-sized shell, greenish gray				Advanced Boring w/ auger		
							-46.5		
				100	43		SPT Sampler	WOH WOH 2	2
							-48.0		
			At El. -50.0 Ft., few clay, trace fine to medium-grained sand-sized shell, dark green gray				Advanced Boring w/ auger		
							-51.5		
				100	44		SPT Sampler	WOH 1 3	4
-53.0	85.0						-53.0		

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Monitoring well placed in companion boirng and slug tests performed. Three "in" and three "out". Average permeability from the six tests are 2.2E-02 cm/sec. See separate sheets for details of well as-built and slug test results. Wells abandoned after testing.

4. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION
3	3.0/4.5	SP*
7	9.0/10.5	SP*
15	21.0/22.5	SP*
22	31.5/33.0	SP*
32	46.5/48.0	SP*
39	64.5/66.0	SM*
42	73.5/75.0	SM

*Lab visual classification based on gradation curve

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:
WOH = Weight of Hammer

75
80
85
90
95

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Boring Designation HHD15-S291-CB-2

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 6 OF 6 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,779 Y = 1,002,253	32.0 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			5. Additional Laboratory Testing 22 Specific Gravity 42 Moisture Content 42 Atterberg						

95
100
105
110
115

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Boring Designation HHD15-S291-CB-3

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 4 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-CB-3
LOCATION COORDINATES	X = 654,699 Y = 1,002,259
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	72.0 Ft.
9. SIZE AND TYPE OF BIT	4.25" Hollow-Stem Auger
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.)
HORIZONTAL	NAD83
VERTICAL	NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-75 (land-based)
	☒ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 41 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	11.9 Ft.
15. DATE BORING	STARTED 08-19-15 / COMPLETED 08-19-15
16. ELEVATION TOP OF BORING	21.3 Ft.
17. TOTAL RECOVERY FOR BORING	89 %
18. SIGNATURE AND TITLE OF INSPECTOR	William McIntosh, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
21.3	0.0						21.3		
			FILL, sandy, mostly fine-grained sand-sized quartz, few silt, trace organic matter, dry, 10YR 7/3 very pale brown	87	1		SPT Sampler	1 3 4	7
			At El. 19.8 Ft., trace shell up to 1/4", discontinue organic matter, moist				19.8		
				100	2		SPT Sampler	2 3 4	7
17.8	3.5						18.3		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace clay, trace shell, trace organic matter, moist, occasional thin layers of organic stained sand, 10YR 7/1 light gray (SP-SM)	80	3		SPT Sampler	2 1 3	4
16.8	4.5						16.8		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, moist, slight iron stain, 10YR 8/2 very pale brown (SP)	100	4		SPT Sampler	3 4 8	12
							15.3		
14.2	7.1			100	5		SPT Sampler	8 6 5	11
13.8	7.5		SAND, clayey, mostly fine-grained sand-sized quartz, little clay, little silt, few fine to coarse-grained sand-sized shell, moist, 10YR 6/4 light yellowish brown (SC)				13.8		
				100	6		SPT Sampler	4 8 10	18
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, little fine to coarse-grained sand-sized shell, trace clay, strong reaction with HCl, moist, weak cementation, heavy iron staining, 10YR 7/6 yellow (SM)				12.3		
11.9	9.4			73	7		SPT Sampler	4 8 6	14
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace silt, wet, iron staining, 10YR 8/6 yellow (SP-SM)				10.8		
			At El. 10.8 Ft., trace fine to coarse-grained sand-sized shell, discontinue iron staining, 10YR 6/2 light brownish gray	80	8		SPT Sampler	1 1 2	3
			At El. 9.3 Ft., little fine to coarse-grained sand-sized shell				9.3		
				73	9		SPT Sampler	6 6 9	15
			At El. 7.8 Ft., few fine to coarse-grained sand-sized shell, 10YR 7/1 light gray				7.8		
				67	10		SPT Sampler	2 5 9	14
6.3	15.0						6.3		

(Continued)

Boring Designation HHD15-S291-CB-3

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 2 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,699 Y = 1,002,259	21.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, 10YR 6/1 gray (SP)	100	11		SPT Sampler	3 3 7	10
			At El. 4.8 Ft., trace shell, 10YR 7/2 light gray				4.8		
				87	12		SPT Sampler	4 6 11	17
			At El. 3.3 Ft., few fine to medium-grained sand-sized shell, 10YR 6/2 light brownish gray				3.3		
				87	13		SPT Sampler	2 3 5	8
							1.8		
				80	14		SPT Sampler	2 5 9	14
			At El. 0.3 Ft., 10YR 7/2 light gray				0.3		
				87	15		SPT Sampler	4 4 8	12
			At El. -1.2 Ft., trace shell, 10YR 6/2 light brownish gray				-1.2		
				100	16		SPT Sampler	3 6 12	18
			At El. -2.7 Ft., 10YR 6/1 gray				-2.7		
				93	17		SPT Sampler	3 4 10	14
							-4.2		
-5.0	26.3			100	18		SPT Sampler	3 4 9	13
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace clay, trace phosphate, trace fine to medium-grained sand-sized shell, wet, silt and clay content vary with depth, occasional layers of slightly silty sand, 10YR 5/2 grayish brown (SP-SM)				-5.7		
			At El. -5.7 Ft., 10YR 7/1 light gray	93	19		SPT Sampler	2 5 7	12
							-7.2		
				87	20		SPT Sampler	3 3 6	9
			At El. -8.7 Ft., 10YR 5/1 gray				-8.7		
				87	21		SPT Sampler	1 1 3	4
							-10.2		
				93	22		SPT Sampler	3 7 11	18
							-11.7		
-12.4	33.7			80	23		SPT Sampler	WOR 2 8	10
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace clay, trace fine to medium-grained sand-sized shell, trace phosphate, wet, 10YR 7/2 light gray				-13.2		
				100	24		SPT Sampler	1	

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Boring Designation HHD15-S291-CB-3

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 3 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,699 Y = 1,002,259	21.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			(SP) At El. -13.2 Ft., 10YR 6/2 light brownish gray	100	24		SPT Sampler	8 15	23
			At El. -14.7 Ft., few fine to coarse-grained sand-sized shell, 10YR 6/1 gray				-14.7		
				87	25		SPT Sampler	4 11 15	26
							-16.2		
				93	26		SPT Sampler	1 4 9	13
-18.2	39.5						-17.7		
			SAND, clayey, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, few clay, few silt, wet, 10Y 5/2 dark greenish gray (SC)	100	27		SPT Sampler	2 2 1	3
-19.4	40.7						-19.2		
			CLAY, fat, medium plasticity, firm, some fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, few silt, strong reaction with HCl, moist, interbedded with layers of clayey sand (50/50), 5Y 5/1 gray (CH)	80	28		SPT Sampler	WOR 1 2	3
-20.9	42.2						-20.7		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, few shell up to 1", trace clay, strong reaction with HCl, wet, moderate cementation, very fine grained quartz, occasional thin layers of sandstone, 5Y 7/1 light gray (SM)	93	29		SPT Sampler	4 5 4	9
							-22.2		
				100	30		SPT Sampler	1 2 1	3
							-23.7		
			At El. -23.7 Ft., weak cementation, discontinue thin sandstone layers	100	31		SPT Sampler	2 1 2	3
-25.2	46.5						-25.2		
			SAND, clayey, mostly fine-grained sand-sized quartz, little clay, little fine to coarse-grained sand-sized shell, few silt, strong reaction with HCl, wet, very fine grained quartz, 10Y 6/2 light grayish olive (SC)	100	32		SPT Sampler	2 2 2	4
							-26.7		
			At El. -26.7 Ft., few fine to coarse-grained sand-sized shell, 5GY 6/2 light olive gray	87	33		SPT Sampler	2 1 1	2
-28.2	49.5						-28.2		
			SAND, silty, mostly fine-grained sand-sized quartz, some sand to gravel-sized shell, few silt, few clay, strong reaction with HCl, wet, 5Y 7/1 light gray (SM)	87	34		SPT Sampler	2 6 18	24
							-29.7		
			At El. -30.7 Ft., trace clay				Advanced Boring w/ auger		
							-31.2		
				80	35		SPT Sampler	6 5 9	14
							-32.7		
							Advanced Boring w/ auger		

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Boring Designation HHD15-S291-CB-3

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 4 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,699 Y = 1,002,259	21.3 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
							-34.2		
			At El. -34.2 Ft., 10Y 6/2 light grayish olive	73	36		SPT Sampler	2 2 2	4
							-35.7		
							Advanced Boring w/ auger		
							-37.2		
				73	37		SPT Sampler	4 4 4	8
							-38.7		
							Advanced Boring w/ auger		
							-40.2		
			At El. -40.9 Ft., few clay, trace shell, very fine grained quartz, clay content varies with depth	80	38		SPT Sampler	2 1 2	3
							-41.7		
							Advanced Boring w/ auger		
							-43.2		
				93	39		SPT Sampler	WOR WOR 1	1
							-44.7		
							Advanced Boring w/ auger		
							-46.2		
			At El. -46.2 Ft., few fine to coarse-grained sand-sized shell, 10Y 5/2 dark greenish gray	100	40		SPT Sampler	1 2 3	5
							-47.7		
							Advanced Boring w/ auger		
							-49.2		
			At El. -49.2 Ft., discontinue shell, 10Y 4/2 grayish olive	100	41		SPT Sampler	1 2 2	4
-50.7	72.0						-50.7		

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:
WOR = Weight of Rods.

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Boring Designation HHD15-S291-CB-4

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 4 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-CB-4
LOCATION COORDINATES	X = 654,782 Y = 1,002,352
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	57.0 Ft.
9. SIZE AND TYPE OF BIT	4.25" Hollow-Stem Auger
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.)
HORIZONTAL	NAD83
VERTICAL	NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-75 (land-based)
	☒ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 38 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	2
14. ELEVATION GROUND WATER	10.4 Ft.
15. DATE BORING	STARTED 08-12-15 / COMPLETED 08-12-15
16. ELEVATION TOP OF BORING	17.9 Ft.
17. TOTAL RECOVERY FOR BORING	96 %
18. SIGNATURE AND TITLE OF INSPECTOR	John Markov, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
17.9	0.0						17.9		
			FILL, sandy, mostly fine-grained sand-sized quartz, few silt, trace organic matter, dry, dark brown	100	1		SPT Sampler	1 2 4	6
			At El. 16.4 Ft., trace silt, moist, white				16.4		
				100	2		SPT Sampler	2 6 6	12
							14.9		
14.2	3.7			100	3		SPT Sampler	3 3 3	6
			SAND, clayey, mostly fine-grained sand-sized quartz, little silt, trace shell, moist, brown (SC)				13.4		
			At El. 13.4 Ft., trace shell up to 1/4"	100	4		SPT Sampler	2 1 2	3
11.9	6.0						11.9		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, little fine to coarse-grained sand-sized shell, strong reaction with HCl, moist, moderate cementation, occasional thin layers of sandstone, grayish brown (SM)	100	5		SPT Sampler	1 2 3	5
			At El. 10.4 Ft., some fine to coarse-grained sand-sized shell, wet, light gray				10.4		
9.4	8.5			100	6		SPT Sampler	2 4 7	11
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, some fine to coarse-grained sand-sized shell, few silt, trace phosphate, wet, silt content decreases with depth, light gray (SP-SM)				8.9		
				100	7		SPT Sampler	2 4 8	12
							7.4		
				100	8		SPT Sampler	4 8 9	17
5.9	12.0						5.9		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, few fine to medium-grained sand-sized shell, trace silt, trace phosphate, wet, light gray (SP)	100	9		SPT Sampler	3 3 7	10
							4.4		
				100	10		SPT Sampler	2 3 10	13
							2.9		

(Continued)

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Boring Designation HHD15-S291-CB-4

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,782 Y = 1,002,352	17.9 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	11		SPT Sampler	3 4 7	11
			At El. 1.4 Ft., little fine to coarse-grained sand-sized shell				1.4		
				100	12		SPT Sampler	3 6 8	14
							-0.1		
				100	13		SPT Sampler	3 4 9	13
-1.6	19.5						-1.6		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace shell up to 1/8", trace phosphate, wet, gray (SP-SM)	87	14		SPT Sampler	2 5 5	10
							-3.1		
			At El. -3.1 Ft., trace shell up to 1/2", sand finer than above, silt content increases with depth	87	15		SPT Sampler	4 5 16	21
							-4.6		
			At El. -4.6 Ft., trace shell up to 1/8"	100	16		SPT Sampler	3 4 9	13
-6.1	24.0						-6.1		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace fine to medium-grained sand-sized shell, trace phosphate, wet, silt content varies with depth, light gray (SP)	73	17		SPT Sampler	3 4 8	12
							-7.6		
				100	18		SPT Sampler	5 7 15	22
							-9.1		
				73	19		SPT Sampler	WOH 1 4	5
							-10.6		
				87	20		SPT Sampler	3 6 8	14
							-12.1		
				100	21		SPT Sampler	3 9 14	23
							-13.6		
				100	22		SPT Sampler	2 5 7	12
							-15.1		
				93	23		SPT Sampler	5 12 15	27
							-16.6		
			At El. -16.6 Ft., few fine to coarse-grained	100	24		SPT Sampler	3	

Boring Designation HHD15-S291-CB-4

DRILLING LOG (Cont. Sheet)

INSTALLATION	SHEET / OF
Jacksonville District	SHEET 3 OF 4 SHEETS

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,782 Y = 1,002,352	17.9 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			sand-sized shell, sand coarser than above	100	24		SPT Sampler	6 7	13
-18.1	36.0						-18.1		
-18.5	36.4		SAND, silty, mostly fine-grained sand-sized quartz, little silt, few fine to coarse-grained sand-sized shell, trace clay, wet, gray (SM)	93	25 25B		SPT Sampler	3 1 1	2
			CLAY, fat, medium plasticity, soft, some silt, little fine-grained sand-sized quartz, trace shell, moist, sand content increases with depth, dark gray (CH)				-19.6		
-20.1	38.0			100	26		SPT Sampler	1 1 1	2
			SAND, clayey, some fine-grained sand-sized quartz, some clay, some silt, trace fine to medium-grained sand-sized shell, moist, very fine grained quartz, sand content increase with depth, dark gray (SC)				-21.1		
-21.7	39.6			87	27 27B		SPT Sampler	WOH 1 4	5
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, few fine to coarse-grained sand-sized shell, trace phosphate, weak reaction with HCl, wet, moderate cementation, very fine grained quartz, occasional sandstone nodule, light gray (SM)				-22.6		
				100	28		SPT Sampler	2 3 3	6
							-24.1		
				100	29		SPT Sampler	2 3 4	7
							-25.6		
			At El. -25.6 Ft., little fine to coarse-grained sand-sized shell, trace clay, clay content increase with depth	100	30		SPT Sampler	1 1 2	3
							-27.1		
			At El. -27.1 Ft., few clay, discontinue very fine grained sand, gray	100	31		SPT Sampler	1 1 1	2
							-28.6		
			At El. -28.6 Ft., little sand to gravel-sized shell up to 1/4", discontinue clay, light gray	100	32		SPT Sampler	15 6 6	12
							-30.1		
			At El. -30.1 Ft., little fine to coarse-grained sand-sized shell, trace clay	100	33		SPT Sampler	3 3 4	7
							-31.6		
			At El. -31.6 Ft., some sand to gravel-sized shell, discontinue clay	100	34		SPT Sampler	3 4 4	8
							-33.1		
							Advanced Boring w/ auger		
			At El. -34.1 Ft., little fine to coarse-grained sand-sized shell				-34.6		
				67	35		SPT Sampler	3 2 4	6
							-36.1		
-37.1	55.0						Advanced Boring w/ auger		

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Boring Designation HHD15-S291-CB-4

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 4 OF 4 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,782 Y = 1,002,352	17.9 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			SAND, silty, mostly sand to gravel-sized shell, some fine-grained sand-sized quartz (SM)				-37.6		
				100	36		SPT Sampler	2 3 2	5
-39.1	57.0						-39.1		

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Monitoring well placed in companion boirng and slug tests performed. Three "in" and three "out". Average permeability from the six tests are 2.0E-02 cm/sec. See separate sheets for details of well as-built and slug test results. Wells abandoned after testing.

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:
WOH = Weight of Hammer

55
60
65
70
75

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Boring Designation HHD15-S291-CB-5

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 2 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-CB-5
LOCATION COORDINATES	X = 654,904 Y = 1,002,191
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	21.0 Ft.
9. SIZE AND TYPE OF BIT	4.25" Hollow-Stem Auger
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.)
HORIZONTAL	NAD83
VERTICAL	NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-75 (land-based)
	☒ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 15 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	1
14. ELEVATION GROUND WATER	12.4 Ft.
15. DATE BORING	STARTED 08-13-15 / COMPLETED 08-13-15
16. ELEVATION TOP OF BORING	16.9 Ft.
17. TOTAL RECOVERY FOR BORING	75 %
18. SIGNATURE AND TITLE OF INSPECTOR	John Markov, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
16.9	0.0						16.9		
			FILL, sandy, mostly fine-grained sand-sized quartz, little silt, trace organic matter, dry, dark gray	60	1		SPT Sampler	1 1 2	3
14.9	2.0						15.4		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, trace organic matter, moist, organic stained, black (SM)	100	2		SPT Sampler	1 1 0	1
			At El. 13.9 Ft., trace clay, silt and organic content decrease with depth				13.9		
12.9	4.0			80	3		SPT Sampler	WOR WOR	0
			SAND, clayey, mostly fine-grained sand-sized quartz, few silt, few clay, moist, 10YR 4/3 brown (SC) ▼		3B			WOR	
11.9	5.0						12.4		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace clay, wet, 10YR 4/3 brown (SP-SM)	80	4		SPT Sampler	1 1 2	3
10.9	6.0						10.9		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, wet, light gray (SP)	73	5		SPT Sampler	1 1 1	2
							9.4		
				87	6		SPT Sampler	1 2 1	3
7.9	9.0						7.9		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, few fine to medium-grained sand-sized shell, wet, 10YR 4/3 brown (SM)	60	7		SPT Sampler	1 1 3	4
6.4	10.5						6.4		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, few silt, trace phosphate, wet, N 7/ light gray (SP-SM)	73	8		SPT Sampler	1 1 2	3
							4.9		
				73	9		SPT Sampler	4 7 12	19
3.4	13.5						3.4		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, N 7/ light gray (SP)	67	10		SPT Sampler	2 3 7	10
							1.9		

(Continued)

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Boring Designation HHD15-S291-CB-5

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,904 Y = 1,002,191	16.9 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				87	11		SPT Sampler	2 4 8	12
							0.4		
				67	12		SPT Sampler	4 8 12	20
							-1.1		
				80	13		SPT Sampler	4 7 12	19
-2.6	19.5						-2.6		
-4.1	21.0		SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, few silt, trace phosphate, wet, gray (SP-SM)	67	14		SPT Sampler	2 3 6	9
							-4.1		

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION
2	1.5/3.0	SM*

*Lab visual classification based on gradation curve

4. Additional Laboratory Testing

2 Moisture Content
2 Percent Organic

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:
WOR = Weight of Rods.

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Boring Designation HHD15-S291-CB-6

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 2 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-CB-6
LOCATION COORDINATES	X = 654,916 Y = 1,002,349
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	21.0 Ft.
9. SIZE AND TYPE OF BIT	4.25" Hollow-Stem Auger
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.)
HORIZONTAL	NAD83
VERTICAL	NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-75 (land-based)
☒ AUTO HAMMER ☐ MANUAL HAMMER	
12. TOTAL SAMPLES	DISTURBED 14 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	1
14. ELEVATION GROUND WATER	11.5 Ft.
15. DATE BORING	STARTED 08-21-15 / COMPLETED 08-21-15
16. ELEVATION TOP OF BORING	15.2 Ft.
17. TOTAL RECOVERY FOR BORING	90 %
18. SIGNATURE AND TITLE OF INSPECTOR	William McIntosh, Geologist

ELEV.	DEPTH	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/0.5 FT.	N-VALUE
15.2	0.0					15.2		
		SILT, organic-L, low plasticity, firm, little fine-grained sand-sized quartz, moist, 10YR 8/2 very pale brown (OL)	40	1		SPT Sampler	2 1 2	3
13.7	1.5					13.7		
		SAND, clayey, mostly fine-grained sand-sized quartz, few clay, few silt, trace organic matter, moist, 10YR 3/2 very dark grayish brown (SC) At El. 12.7 Ft., mottled orange At El. 12.2 Ft., little clay, 10YR 5/2 grayish brown	100	2		SPT Sampler	WOR WOR 1	1
11.5	3.7					12.2		
		SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace organic matter, wet, occasional thin layer of orgainc stained sand, 10YR 6/2 light brownish gray (SP-SM) At El. 10.7 Ft., discontinue organic matter, silt content varies with depth, 10YR 7/2 light gray At El. 9.2 Ft., 10YR 7/3 very pale brown	67	3		SPT Sampler	1 1 2	3
						10.7		
			87	4		SPT Sampler	1 2 3	5
						9.2		
			80	5		SPT Sampler	1 1 1	2
						7.7		
		At El. 7.7 Ft., some fine to coarse-grained sand-sized shell, strong reaction with HCl, 5Y 7/2 light gray	100	6		SPT Sampler	1 1 3	4
						6.2		
		At El. 6.2 Ft., few fine to coarse-grained sand-sized shell, 5Y 5/1 gray At El. 5.5 Ft., 5Y 7/2 light gray	93	7		SPT Sampler	1 2 4	6
						4.7		
4.2	11.0							
		SAND, poorly-graded, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, 5Y 7/1 light gray (SP) At El. 3.2 Ft., trace fine to coarse-grained sand-sized shell, 2.5Y 7/1 light gray	100	8		SPT Sampler	WOR 1 6	7
						3.2		
			100	9		SPT Sampler	3 5 9	14
						1.7		
			93	10		SPT Sampler	3 3 9	12
						0.2		

0 5 10 15

(Continued)

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Boring Designation HHD15-S291-CB-6

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,916 Y = 1,002,349	15.2 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			At El. 0.2 Ft., 2.5Y 8/1 white	100	11		SPT Sampler	3 6 10	16
-1.3							-1.3		
			At El. -2.3 Ft., 2.5Y 6/2 light brownish gray	100	12		SPT Sampler	4 7 7	14
-2.8	18.0						-2.8		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace fine to coarse-grained sand-sized shell, wet, 5Y 6/2 light olive gray (SP-SM)	100	13		SPT Sampler	3 2 11	13
-4.3	19.5						-4.3		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, silt content varies with depth, 5Y 7/1 light gray (SP)	93	14		SPT Sampler	2 3 9	12
-5.8	21.0						-5.8		

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:
WOR = Weight of Rods.

15 20 25 30 35

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Boring Designation HHD15-S291-CB-7

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 2 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-CB-7
LOCATION COORDINATES	X = 654,810 Y = 1,002,514
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	21.0 Ft.
9. SIZE AND TYPE OF BIT	4.25" Hollow-Stem Auger
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.)
HORIZONTAL	NAD83
VERTICAL	NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-75 (land-based)
☒ AUTO HAMMER ☐ MANUAL HAMMER	
12. TOTAL SAMPLES	DISTURBED 14 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	1
14. ELEVATION GROUND WATER	11.7 Ft.
15. DATE BORING	STARTED 08-21-15 / COMPLETED 08-21-15
16. ELEVATION TOP OF BORING	16.8 Ft.
17. TOTAL RECOVERY FOR BORING	77 %
18. SIGNATURE AND TITLE OF INSPECTOR	William McIntosh, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
16.8	0.0						16.8		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, few organic matter, moist, (Organic), 10YR 8/2 very pale brown (SM)	67	1		SPT Sampler	2 3 4	7
15.3	1.5						15.3		
			SAND, clayey, mostly fine-grained sand-sized quartz, little clay, little silt, moist, 10YR 3/2 very dark grayish brown (SC)	80	2		SPT Sampler	3 1 3	4
13.3	3.5						13.8		
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, trace clay, trace organic matter, moist, 10YR 4/2 dark grayish brown (SM)	60	3		SPT Sampler	WOH 2 3	5
11.7	5.1						12.3		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace fine to medium-grained sand-sized shell, strong reaction with HCl, wet, moderate cementation, occasional thin layers of sandstone, 2.5Y 8/2 pale yellow (SP-SM)	73	4		SPT Sampler	2 3 6	9
			At El. 10.8 Ft., silt content increases with depth				10.8		
				60	5		SPT Sampler	WOH 1 1	2
			At El. 9.3 Ft., some fine to coarse-grained sand-sized shell up to 1/2", 2.5Y 7/1 light gray				9.3		
				47	6		SPT Sampler	1 1 2	3
							7.8		
				73	7		SPT Sampler	1 1 3	4
							6.3		
			At El. 6.3 Ft., little fine to coarse-grained sand-sized shell up to 1/2', silt content decrease with depth	87	8		SPT Sampler	2 4 5	9
4.8	12.0						4.8		
			SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, few fine to coarse-grained sand-sized shell, trace silt, trace phosphate, wet, 2.5Y 7/1 light gray (SP)	100	9		SPT Sampler	3 5 10	15
			At El. 3.3 Ft., 2.5Y 8/1 white				3.3		
				93	10		SPT Sampler	4 8 14	22
							1.8		

(Continued)

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Boring Designation HHD15-S291-CB-7

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,810 Y = 1,002,514	16.8 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
			At El. 1.8 Ft., trace fine to coarse-grained sand-sized shell	87	11		SPT Sampler	3 4 9	13
			At El. 0.3 Ft., few silt, silt content varies with depth, 2.5Y 6/2 light brownish gray	93	12		SPT Sampler	4 6 9	15
			At El. -1.2 Ft., few fine to coarse-grained sand-sized shell	87	13		SPT Sampler	4 7 7	14
			At El. -2.7 Ft., trace fine to coarse-grained sand-sized shell	73	14		SPT Sampler	2 4 8	12
-4.2	21.0								

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION
1	0.0/1.5	SM

not on atterberg limits.

4. Additional Laboratory Testing

1 Atterberg
1 Percent Organic

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

Abbreviations:
WOH = Weight of Hammer

15 20 25 30 35

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Boring Designation HHD15-S291-CB-8

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 2 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-CB-8
LOCATION COORDINATES	X = 654,678 Y = 1,002,646
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	21.0 Ft.
9. SIZE AND TYPE OF BIT	4.25" Hollow-Stem Auger
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	CME-75 (land-based) ☒ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 15 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	1
14. ELEVATION GROUND WATER	13.6 Ft.
15. DATE BORING	STARTED 08-13-15 / COMPLETED 08-13-15
16. ELEVATION TOP OF BORING	19.6 Ft.
17. TOTAL RECOVERY FOR BORING	83 %
18. SIGNATURE AND TITLE OF INSPECTOR	John Markov, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
19.6	0.0						19.6		
			FILL, sandy, mostly fine-grained sand-sized quartz, little silt, few organic matter, trace fine gravel-sized sandstone, dry, occasional sandstone cobbles, 10YR 4/3 brown	53	1		SPT Sampler	1 2 18	20
			At El. 18.1 Ft., few silt, discontinue organic matter, moist, 7.5YR 6/3 light brown	100	2		SPT Sampler	2 2 3	5
16.6	3.0						16.6		
15.9	3.7		SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, few silt, trace organic matter, moist, occasional thin layeRs of ogranic silt and clay, 7.5YR 6/3 light brown (SP-SM)	100	3 3B		SPT Sampler	2 1 3	4
14.9	4.7		SAND, clayey, mostly fine-grained sand-sized quartz, little silt, little clay, trace shell, moist, mottled orange, light tan, N 7/ light gray (SC)	93	4		SPT Sampler	2 3 2	5
13.5	6.1		SAND, silty, mostly fine-grained sand-sized quartz, little silt, trace clay, weak reaction with HCl, moist, weak cementation, mottled orange, occasional thin layers of sandatone, N 7/ light gray (SM)	93	5		SPT Sampler	3 3 5	8
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, some sand to gravel-sized shell up to 1/2", few silt, trace clay, strong reaction with HCl, wet, iron stained, 5Y 8/2 pale yellow (SP-SM)	73	6		SPT Sampler	2 4 4	8
			At El. 12.1 Ft., few fine to coarse-grained sand-sized shell, discontinue clay, silt content varies with depth, 5Y 8/2 pale yellow	87	7		SPT Sampler	2 3 4	7
			At El. 10.6 Ft., little fine to coarse-grained sand-sized shell, N 7/ light gray	60	8		SPT Sampler	2 4 6	10
			At El. 7.6 Ft., few fine to coarse-grained sand-sized shell, weak reaction with HCl, silt content decreases with depth	93	9		SPT Sampler	3 5 8	13
				87	10		SPT Sampler	7 8 15	23

(Continued)

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JUN 02

Boring Designation HHD15-S291-CB-8

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,678 Y = 1,002,646	19.6 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 0.5 FT.	N-VALUE
				100	11		SPT Sampler	3 5 10	15
			At El. 3.1 Ft., trace fine to medium-grained sand-sized shell				3.1		
				53	12		SPT Sampler	4 6 8	14
1.6	18.0						1.6		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace shell, trace phosphate, wet, N 7/ light gray (SP)	80	13		SPT Sampler	4 8 17	25
							0.1		
				87	14		SPT Sampler	2 7 18	25
-1.4	21.0						-1.4		

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION
7	9.0/10.5	SP-SM*

*Lab visual classification based on gradation curve

4. Additional Laboratory Testing

7 Percent Visual Shell

140# hammer w/30" drop used with 2.0' split spoon (1-3/8" I.D. x 2" O.D.).

15 20 25 30 35

SAJ FORM 1836-A
JUN 02

Boring Designation HHD15-S291-TP-1

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 1 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-TP-1
LOCATION COORDINATES	X = 654,761 Y = 1,002,391
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	8.5 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Bobcat E80 ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 3 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	1
14. ELEVATION GROUND WATER	9.8 Ft.
15. DATE BORING	STARTED 08-20-15 / COMPLETED 08-20-15
16. ELEVATION TOP OF BORING	18.3 Ft.
17. TOTAL RECOVERY FOR BORING	100 %
18. SIGNATURE AND TITLE OF INSPECTOR	William McIntosh, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/1 FT.	N-VALUE
18.3	0.0						18.3		
			FILL, sandy, mostly fine-grained sand-sized quartz, few silt, trace organic matter, moist, 10YR 5/2 grayish brown				Test Pit		
			At El. 17.5 Ft., 10YR 8/2 very pale brown				17.3		
					1		Test Pit		
14.3	4.0						14.3		
			SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace clay, moist, 10YR 6/3 pale brown (SP)		2		Test Pit		
							10.3		
9.8	8.5		At El. 10.3 Ft., little fine to coarse-grained sand-sized shell up to 3/4", wet, 5Y 6/3 pale olive ▼		3		9.8 Test Pit		

NOTES:

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2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION
2	4.0/5.0	SP*

*Lab visual classification based on gradation curve

SAJ FORM 1836
JUN 02

Boring Designation HHD15-S291-TP-2

DRILLING LOG

DIVISION	South Atlantic
INSTALLATION	Jacksonville District
SHEET	1 OF 2 SHEETS
1. PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
2. BORING DESIGNATION	HHD15-S291-TP-2
LOCATION COORDINATES	X = 654,695 Y = 1,002,538
3. DRILLING AGENCY	Corps of Engineers - CESAS
CONTRACTOR FILE NO.	
4. NAME OF DRILLER	Joe Bowerman
5. DIRECTION OF BORING	☒ VERTICAL ☐ INCLINED
DEG. FROM VERTICAL	
BEARING	
6. THICKNESS OF OVERBURDEN	N/A
7. DEPTH DRILLED INTO ROCK	N/A
8. TOTAL DEPTH OF BORING	9.0 Ft.
9. SIZE AND TYPE OF BIT	See Remarks
10. COORDINATE SYSTEM/DATUM	State Plane, FLE (U.S. Ft.) / HORIZONTAL NAD83 / VERTICAL NAVD88
11. MANUFACTURER'S DESIGNATION OF DRILL	Bobcat E80 ☐ AUTO HAMMER ☐ MANUAL HAMMER
12. TOTAL SAMPLES	DISTURBED 3 / UNDISTURBED (UD) 0
13. TOTAL NUMBER CORE BOXES	1
14. ELEVATION GROUND WATER	10.6 Ft.
15. DATE BORING	STARTED 08-20-15 / COMPLETED 08-20-15
16. ELEVATION TOP OF BORING	19.6 Ft.
17. TOTAL RECOVERY FOR BORING	100 %
18. SIGNATURE AND TITLE OF INSPECTOR	William McIntosh, Geologist

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/1 FT.	N-VALUE
19.6	0.0						19.6		
			FILL, sandy, mostly fine-grained sand-sized quartz, little silt, trace organic matter, moist, 10YR 5/2 grayish brown At El. 18.8 Ft., few silt, 10YR 8/2 very pale brown				Test Pit 18.6		
					1		Test Pit 16.6		
16.1	3.5				2				
			SAND, silty, mostly fine-grained sand-sized quartz, little silt, trace clay, moist, heavy iron staining, 10YR 5/2 grayish brown (SM) At El. 15.4 Ft., light iron staining, 10YR 7/2 light gray At El. 14.6 Ft., mottled with light orange, 10YR 6/3 pale brown				Test Pit		
12.1	7.5								
11.6	8.0	HW	SANDSTONE, sparsely fossiliferous, moderately hard, highly weathered, medium grained, mostly quartz grains, interbedded with poorly cemented sand and shell, 10YR 6/3 pale brown				11.6		
10.6	9.0				3		Test Pit 10.6		
			SAND, poorly-graded with silt, mostly fine-grained sand-sized quartz, little fine to coarse-grained sand-sized shell, few silt, trace phosphate, wet, 10YR 7/1 light gray (SP-SM)						

NOTES:

1. USACE Jacksonville is the custodian for these original files.

2. Soils are field visually classified in accordance with the Unified Soils Classification System.

3. Laboratory Testing Results

SAMPLE ID	SAMPLE DEPTH	LABORATORY CLASSIFICATION

(Continued)

SAJ FORM 1836
JUN 02

Boring Designation HHD15-S291-TP-2

DRILLING LOG (Cont. Sheet)	INSTALLATION	SHEET 2 OF 2 SHEETS
	Jacksonville District	

PROJECT	COORDINATE SYSTEM/DATUM	HORIZONTAL	VERTICAL
Herbert Hoover Dike	State Plane, FLE (U.S. Ft.)	NAD83	NAVD88

LOCATION COORDINATES	ELEVATION TOP OF BORING
X = 654,695 Y = 1,002,538	19.6 Ft.

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% REC.	BOX OR SAMPLE	RQD OR UD	REMARKS	BLOWS/ 1 FT.	N-VALUE
			2 3.0/4.0 SM*						
			*Lab visual classification based on gradation curve						

15
20
25
30
35

SAJ FORM 1836-A
JUN 02

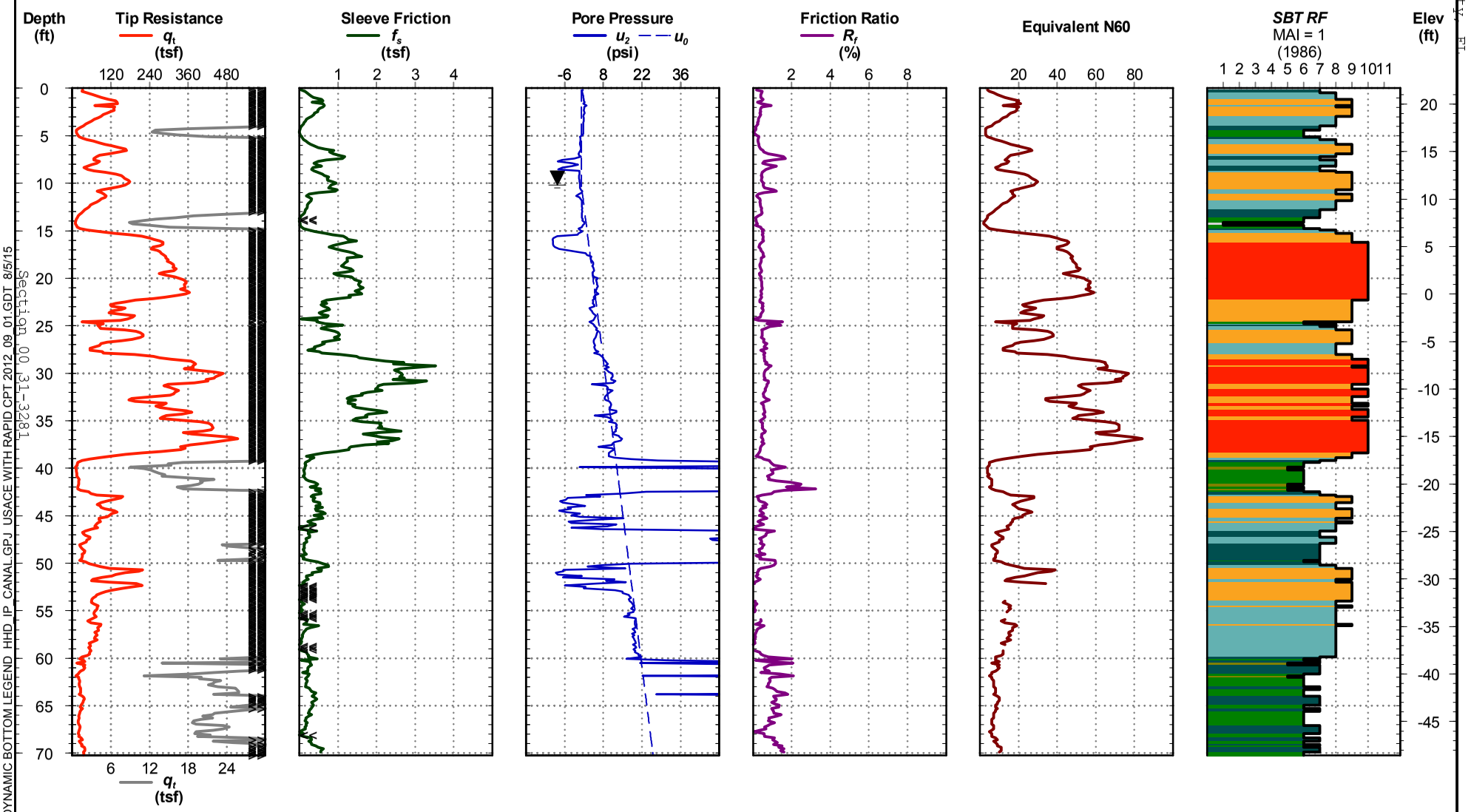
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-1

Date: Jun. 26, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002060.469
Easting: 654860.376
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 21.7
Water Depth: 10.21
Total Depth: 70.2 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT1.cpt

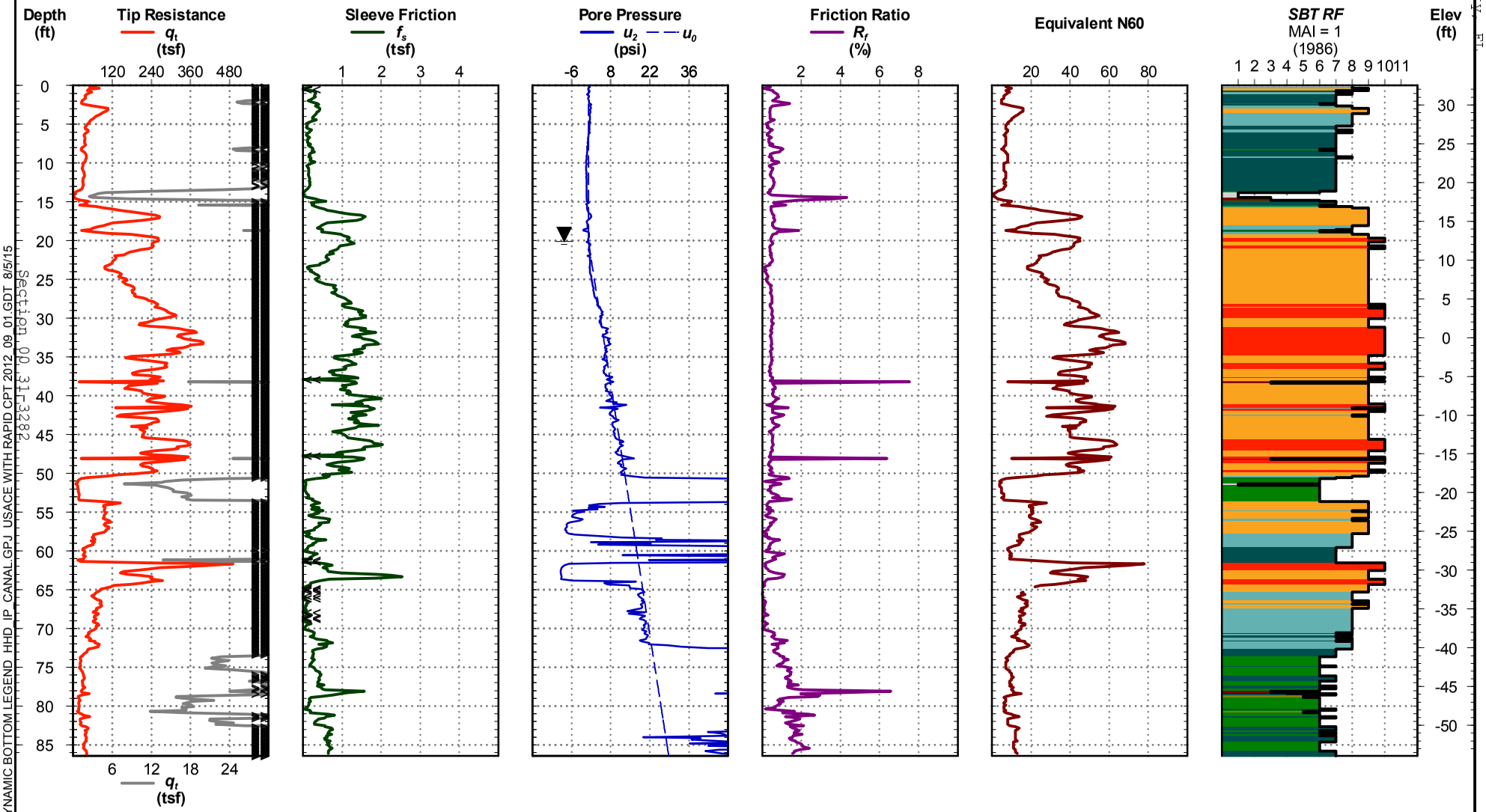
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-2

Date: Jun. 26, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002265.83
Easting: 654773.362
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 32.5
Water Depth: 20.11
Total Depth: 86.5 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT2.cpt

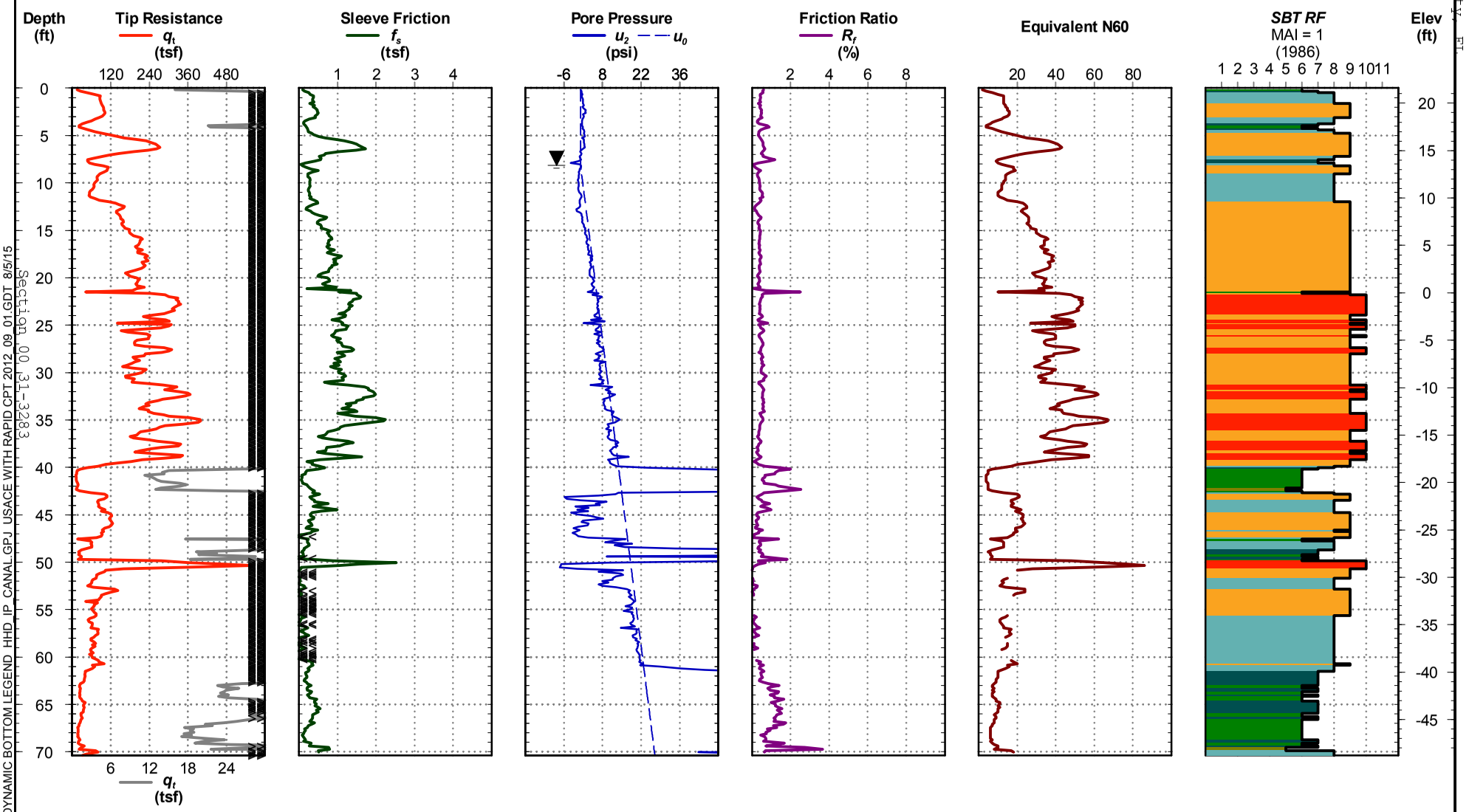
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-3

Date: Jun. 26, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002268.188
Easting: 654691.165
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 21.6
Water Depth: 8.16
Total Depth: 70.4 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT3.cpt

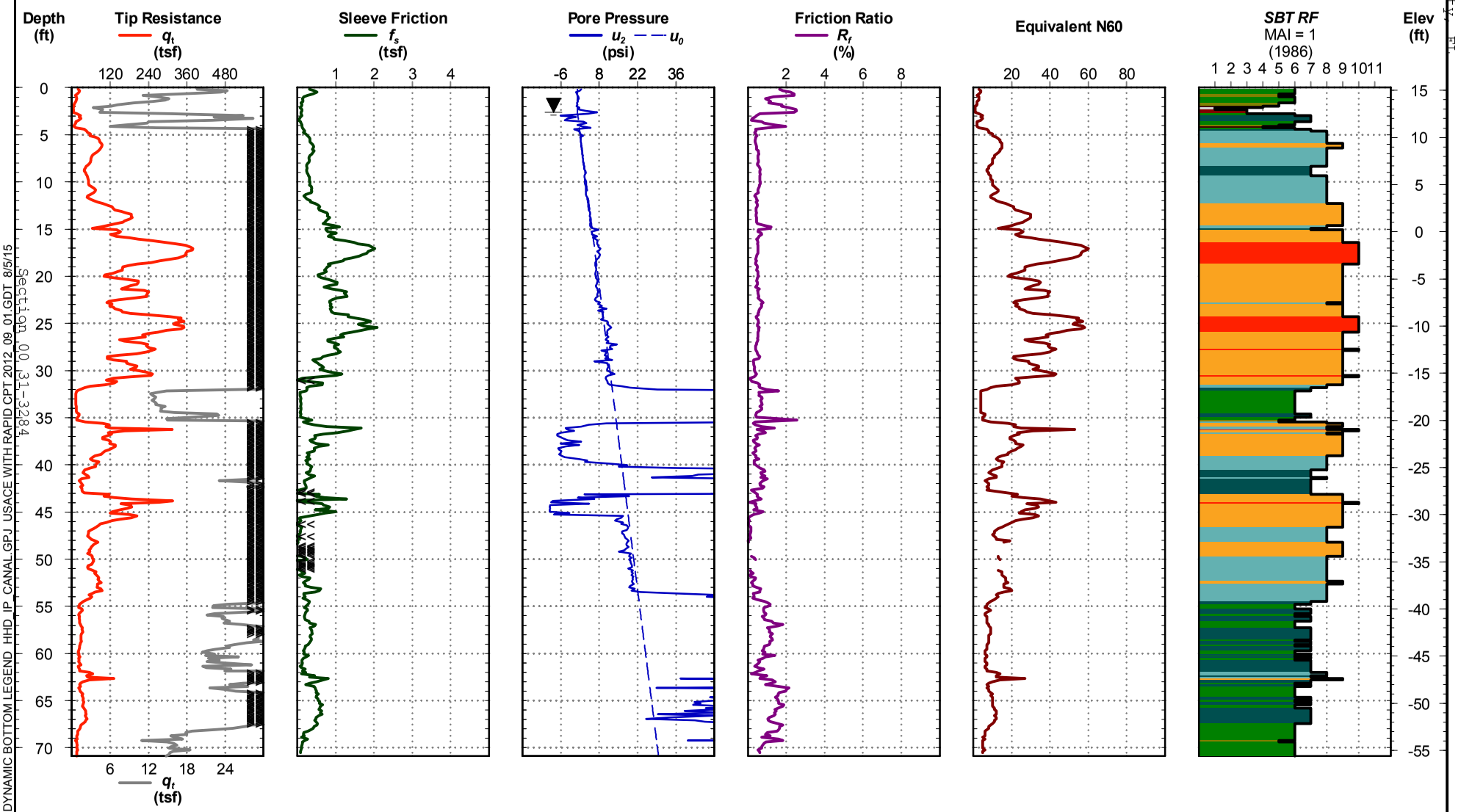
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-4

Date: Jun. 26, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002245.294
Easting: 655001.392
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 15.3
Water Depth: 2.6
Total Depth: 70.9 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT4.cpt

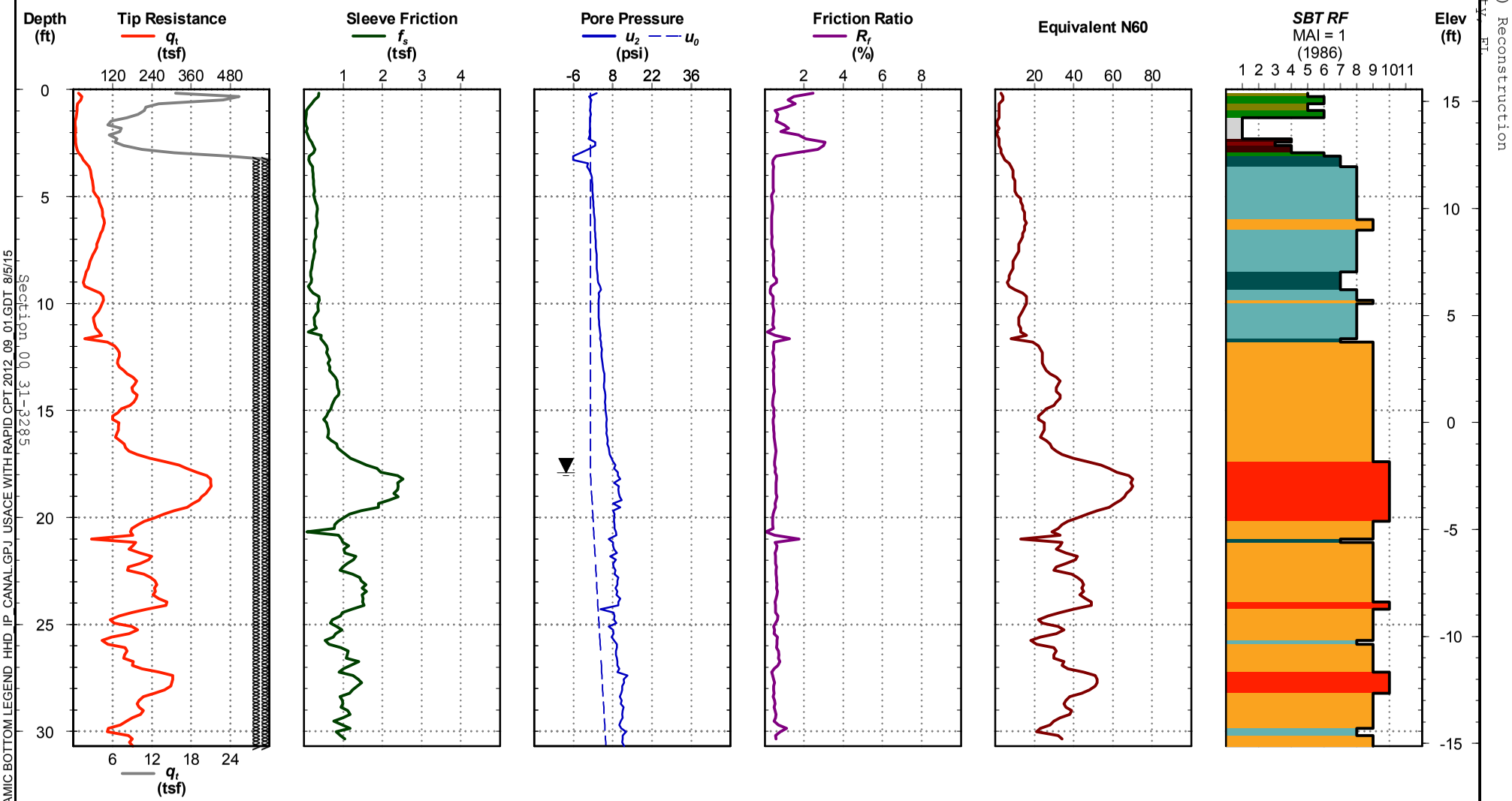
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-5

Date: Jun. 25, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002281.437
Easting: 654975.576
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 15.6
Water Depth: 17.92
Total Depth: 30.7 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT5.cpt

CPT REPORT - DYNAMIC BOTTOM LEGEND HHD_IP_CANAL.GPJ USACE WITH RAPID CPT 2012_09_01.GDT 8/5/15

Section 00 31-2285

HHD Structure Replacements
S-291 (IP-3) Reconstruction
Glades County, FL

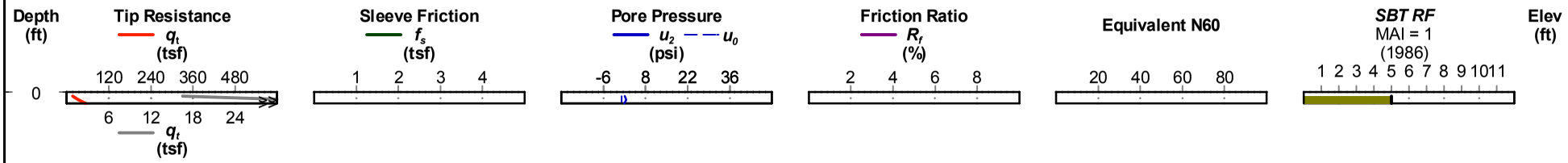
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-6

Date: Jun. 25, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002573.423
Easting: 654692.827
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 19.8
Water Depth:
Total Depth: 0.5 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT6.cpt

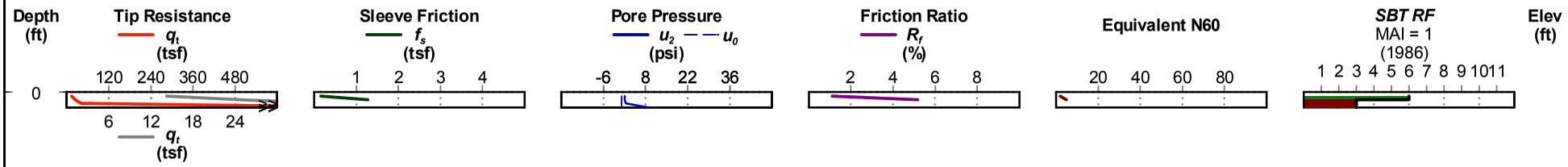
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-6b

Date: Jun. 25, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002573.423
Easting: 654692.827
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 19.8
Water Depth:
Total Depth: 0.7 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT6b.cpt

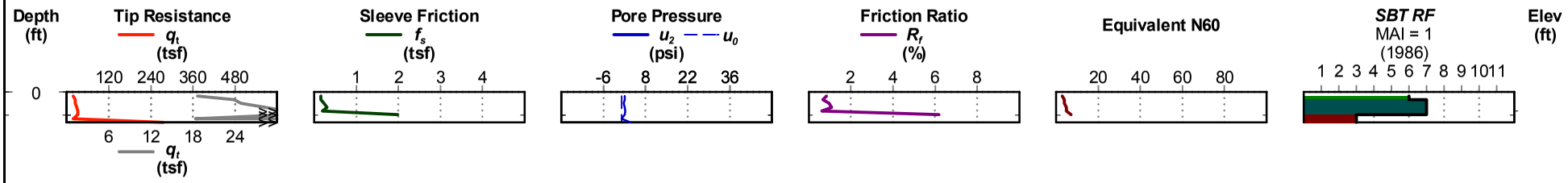
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-6c

Date: Jun. 25, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002573.423
Easting: 654692.827
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 19.8
Water Depth:
Total Depth: 1.3 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename: HHD15-S291-CPT6c.cpt

HHD Structure Replacements
S-291 (IP-3) Reconstruction
Glades County, FL

Section 00 31-3288

CPT REPORT - DYNAMIC BOTTOM LEGEND HHD_IP_CANAL.GPJ USACE WITH RAPID CPT 2012_09_01.GDT 8/5/15

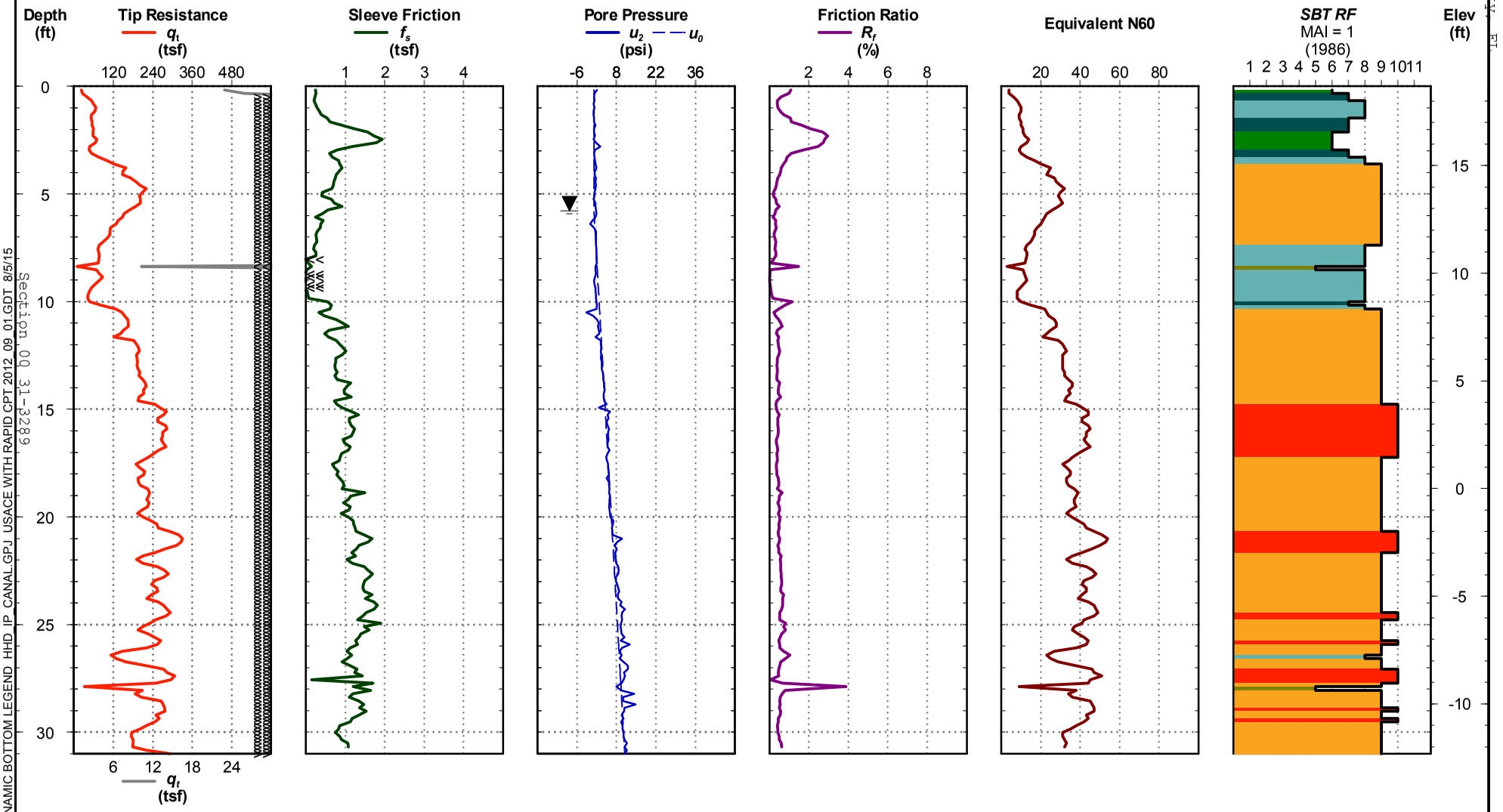
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-7

Date: Jun. 26, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002729.829
Easting: 654669.21
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 18.7
Water Depth: 5.79
Total Depth: 31.0 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT7.cpt

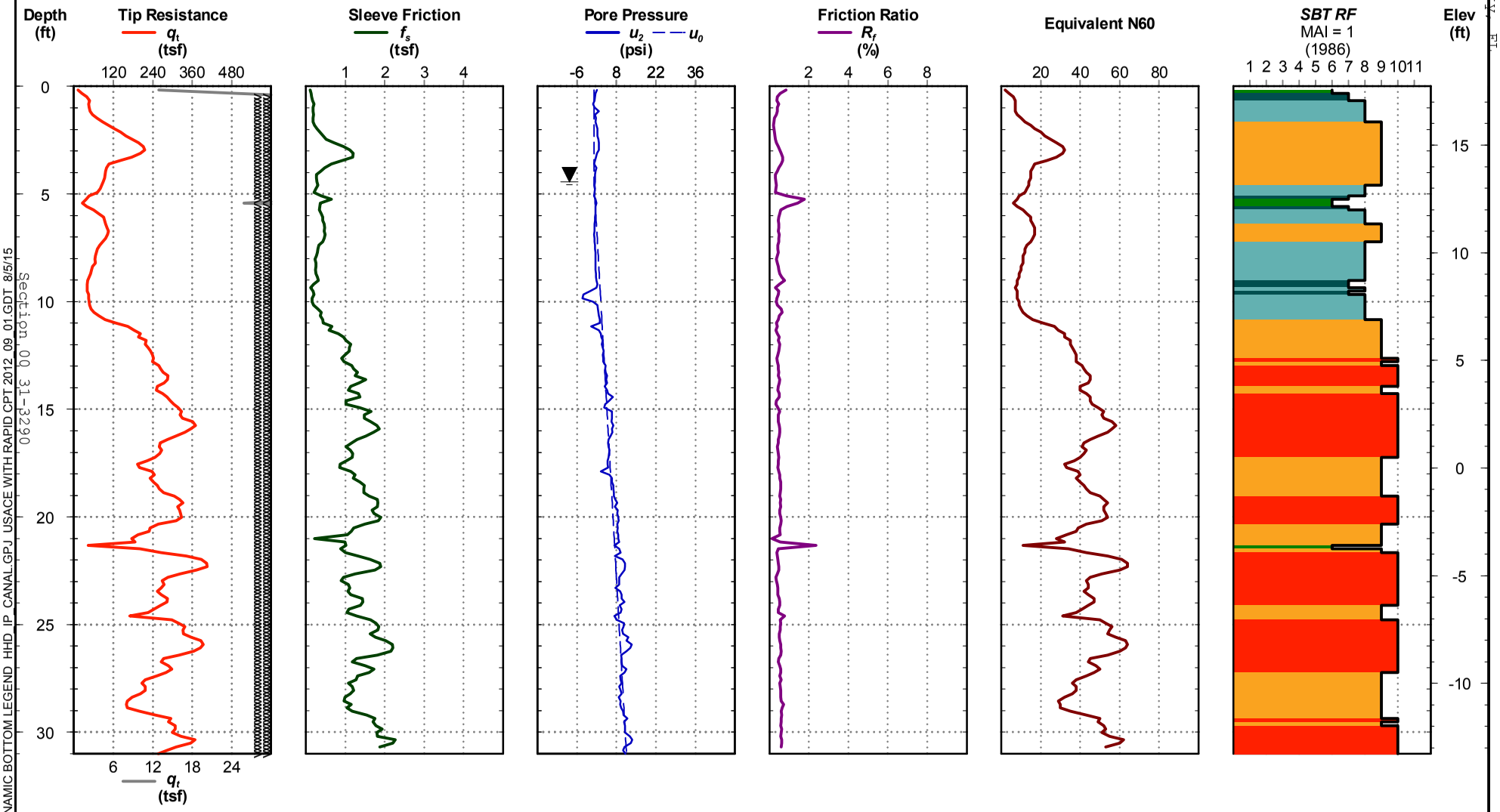
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-8

Date: Jun. 25, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002360.602
Easting: 654775.427
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 17.7
Water Depth: 4.44
Total Depth: 31.0 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT8.cpt

HHD Structure Replacements
S-291 (IP-3) Reconstruction
Glades County, FL

CPT REPORT - DYNAMIC BOTTOM LEGEND HHD_IP_CANAL.GPJ USACE WITH RAPID CPT 2012_09_01.GDT 8/5/15

Section 00 31-2290

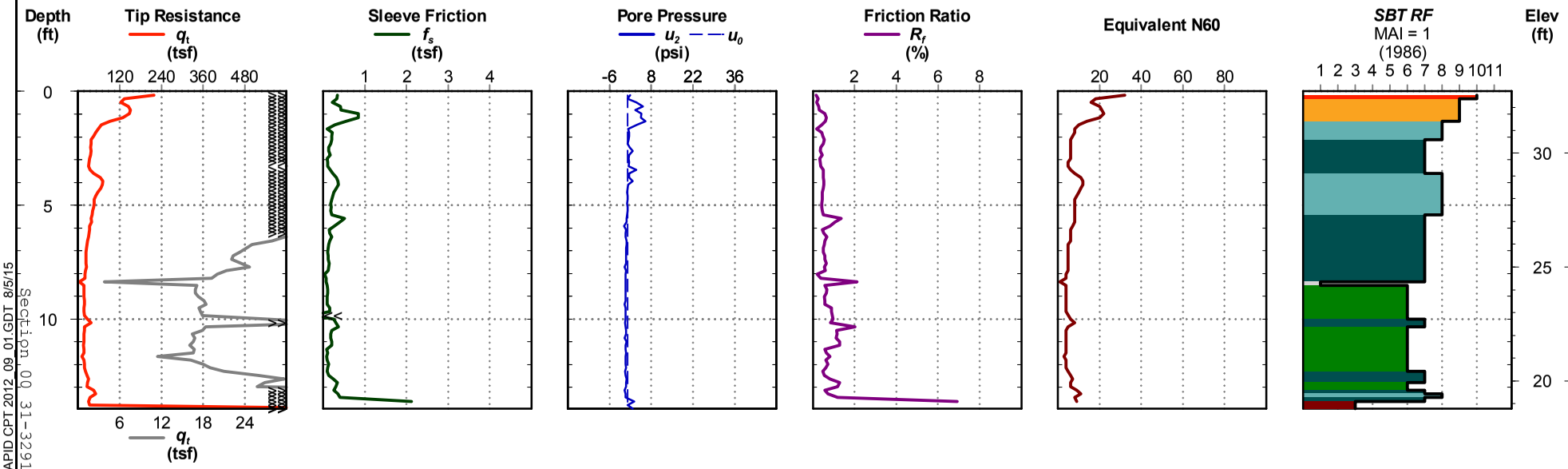
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-9

Date: Jun. 25, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002632.037
Easting: 654627.947
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 32.7
Water Depth:
Total Depth: 13.9 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT9.cpt

HHD Structure Replacements
S-291 (IP-3) Reconstruction
Glades County, FL

CPT REPORT - DYNAMIC BOTTOM LEGEND HHD_IP_CANAL.GPJ USACE WITH RAPID CPT 2012_09_01.GDT 8/5/15

Section 00 31-3291

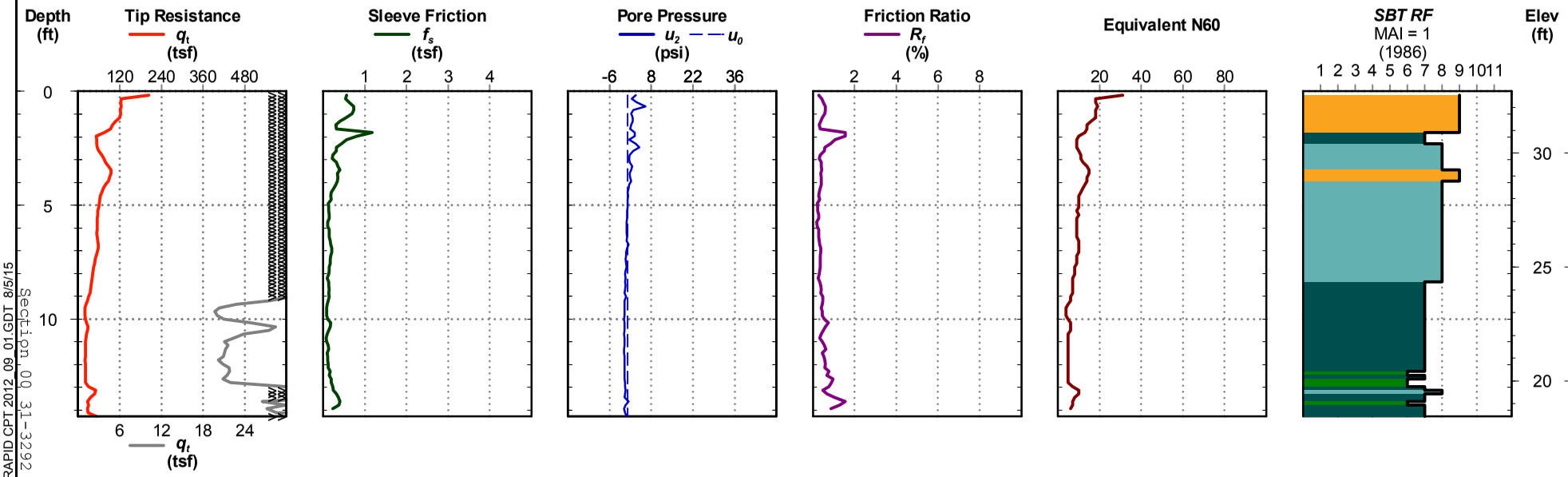
HHD - Indian Prairie Canal
S290/S291
Project No: FY 2015

Cone Penetration Test HHD15-S291-CP-9b

Date: Jun. 25, 2015
Operator: Markov
Drilling Agency: USACE, Savannah District

Northing: 1002632.037
Easting: 654627.947
Probe ID/Net Area Ratio: DSG1071 / 0.8

Elevation: 32.7
Water Depth:
Total Depth: 14.3 ft



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Electronic Filename:
HHD15-S291-CPT9b.cpt

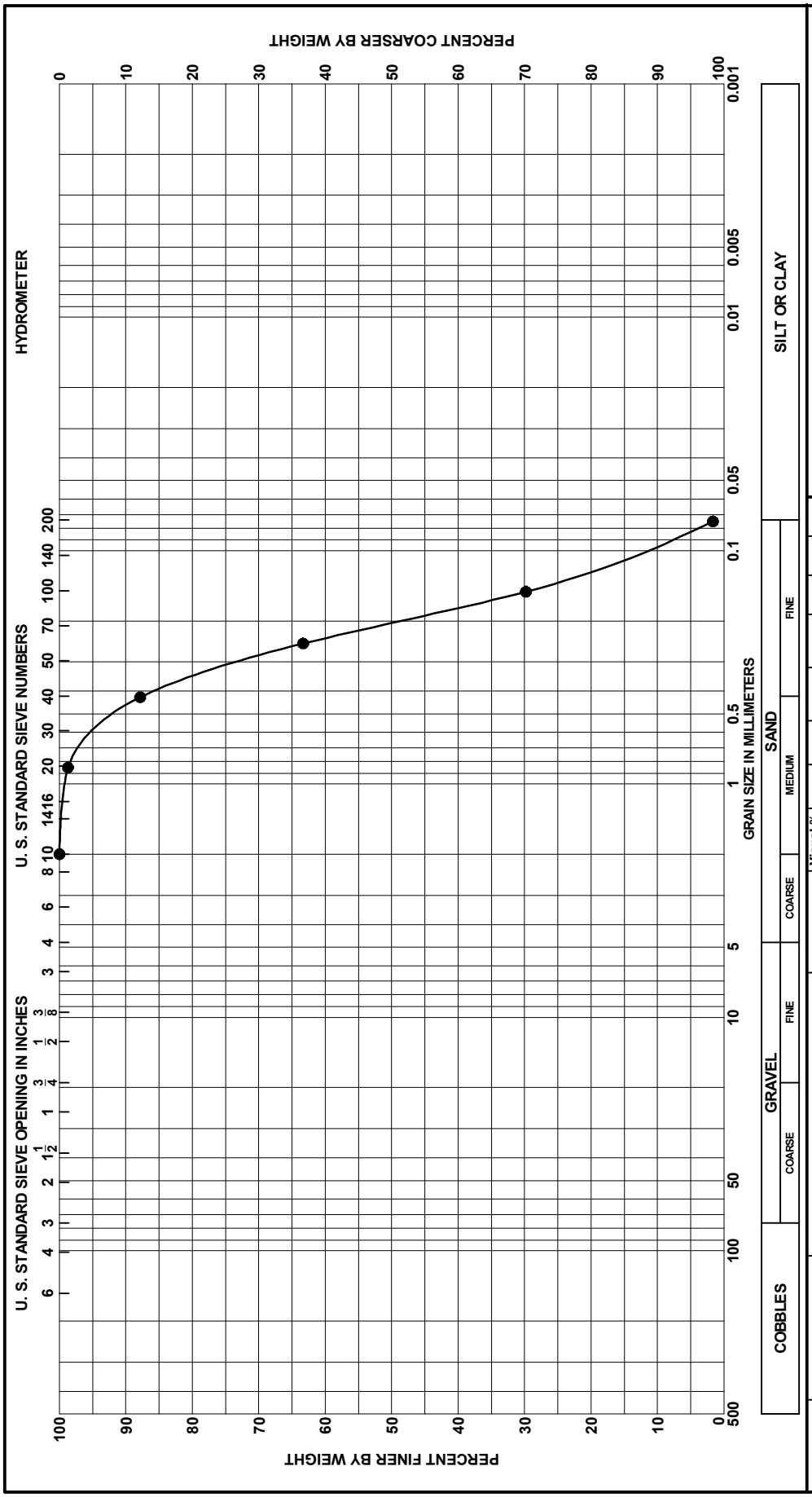
STRUCTURE 290 (IP-2) & STRUCTURE 291 (IP-3) SEDIMENT PROBE

PROBE	LAKE ELEVATION (ft)	WATER COLUMN (ft)	TOP OF SEDIMENT ELEVATION (ft)	BOTTOM OF SOFT SEDIMENT (ft)	BOTTOM OF SEDIMENT ELEVATION (ft)	THICKNESS OF SOFT SEDIMENT (ft)	EASTINGS (X)	NORTHINGS(Y)
1	14.23	15.50	-1.27	15.50	-1.27	0.00	654251	1002675
2	14.23	16.40	-2.17	16.50	-2.27	0.10	654278	1002695
3	14.23	16.30	-2.07	16.60	-2.37	0.30	654314	1002715
4	14.23	7.20	7.03	7.20	7.03	0.00	654323	1002554
5	14.23	9.60	4.63	10.50	3.73	0.90	654368	1002564
6	14.23	8.80	5.43	9.40	4.83	0.60	654395	1002604
7	14.23	7.00	7.23	7.50	6.73	0.50	654359	1002503
8	14.23	9.50	4.73	10.10	4.13	0.60	654404	1002513
9	14.23	8.90	5.33	11.40	2.83	2.50	654422	1002544
10	14.23	6.60	7.63	6.60	7.63	0.00	654251	1002463
11	14.23	2.30	11.93	6.60	7.63	4.30	654296	1002443
12	14.23	2.10	12.13	6.30	7.93	4.20	654350	1002443
13	14.23	6.40	7.83	7.00	7.23	0.60	654413	1002433
14	14.23	7.80	6.43	8.60	5.63	0.80	654440	1002443
15	14.23	9.00	5.23	10.50	3.73	1.50	654459	1002483
16	14.23	4.90	9.33	5.40	8.83	0.50	654486	1002513
17	14.23	11.60	2.63	14.20	0.03	2.60	654514	1002564
18	14.23	7.10	7.13	7.10	7.13	0.00	654513	1002614
19	14.23	8.50	5.73	10.00	4.23	1.50	654495	1002352
20	14.23	8.70	5.53	9.20	5.03	0.50	654517	1002382
21	14.23	7.20	7.03	9.60	4.63	2.40	654549	1002392
22	14.23	9.40	4.83	11.00	3.23	1.60	654558	1002251
23	14.23	9.30	4.93	9.90	4.33	0.60	654585	1002281
24	14.23	8.60	5.63	9.80	4.43	1.20	654612	1002291
25	N/A	3.50	N/A	5.80	N/A	2.30	654528	1002739
26	N/A	4.80	N/A	8.00	N/A	3.20	654546	1002736
27	N/A	4.00	N/A	9.00	N/A	5.00	654566	1002736
28	N/A	2.50	N/A	6.00	N/A	3.50	654155	1002495
29	N/A	4.50	N/A	9.50	N/A	5.00	654153	1002483
30	N/A	3.40	N/A	6.50	N/A	3.00	654149	1002472
31	N/A	3.50	N/A	7.00	N/A	3.30	654144	1002459

Datums presented in NAVD-88, & NAD-83 Fl-E Probes 1-24 performed August 2013, Probes 25-31 performed April 2016
Sediment probe is a 1" hollow aluminum pipe 22' long with an attached 1' X 1' 1/4" plate on one end.
The probe is sent to the bottom of the channel where the top of sediment is measured from the lake surface. One grown man then presses the 1-inch end of the probe into the sediment to refusal. The thickness of the sediment is obtained by the final pushing. Water level elevation behind culverts not obtained.

1.5.7 Laboratory and Field Testing Data

Applicable laboratory and field testing data are presented on the following pages.



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 6	7.5 to 9.0 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, trace silt, light yellowish brown (SP)	2.5Y 6/4								

GRADATION CURVES

PROJECT	Culvert IP-3 Rehabilitation Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD13-S291-CB-1
BORING ELEV.	22.0 Ft., NAVD88
DATE	1/16/2015

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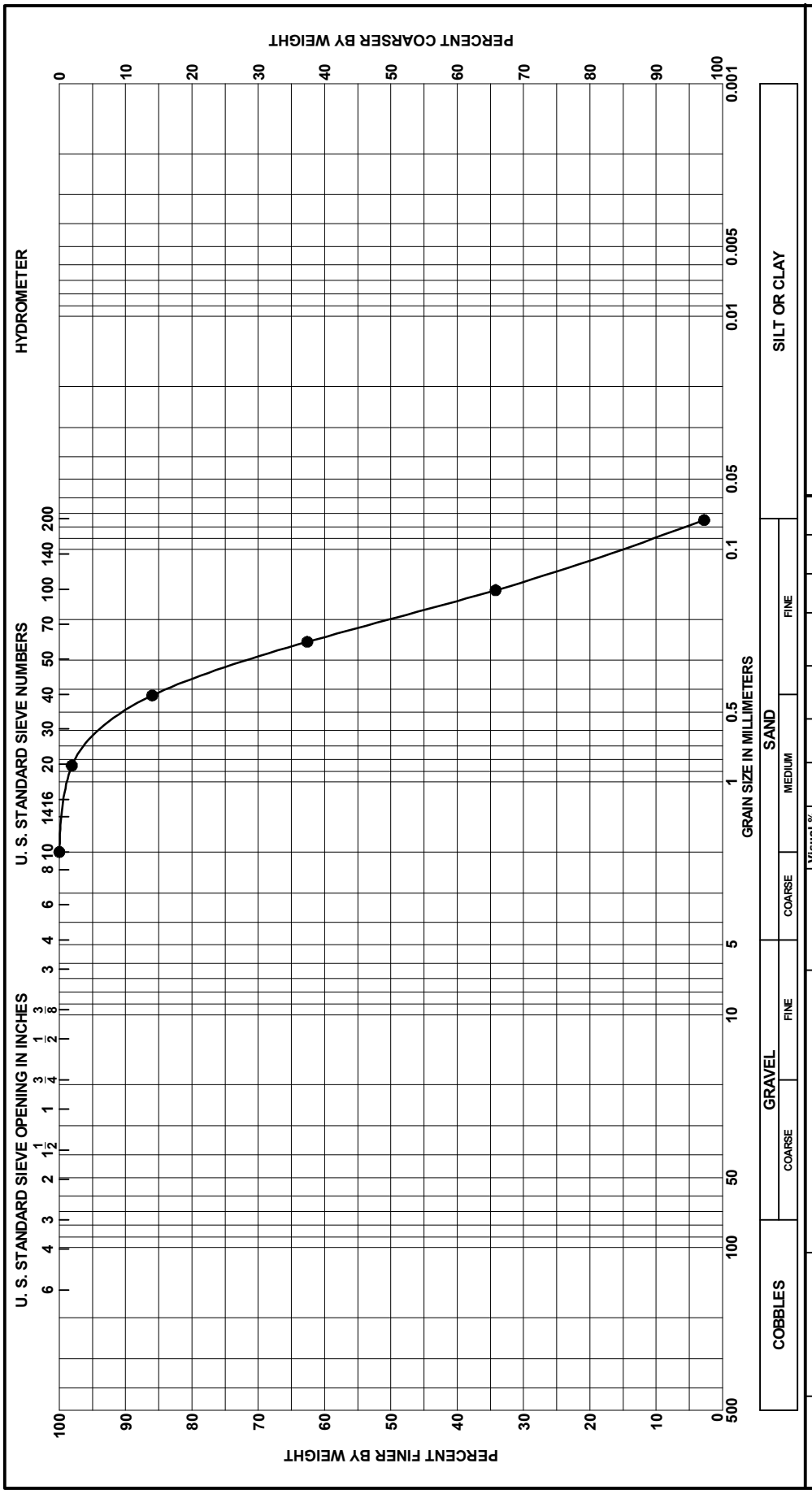

Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 9	12.0 to 13.5 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, trace silt, light yellowish brown (SP)	2.5Y 6/4			2.65					

GRADATION CURVES

PROJECT	Culvert IP-3 Rehabilitation Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD13-S291-CB-1
BORING ELEV.	22.0 Ft., NAVD88
DATE	1/16/2015

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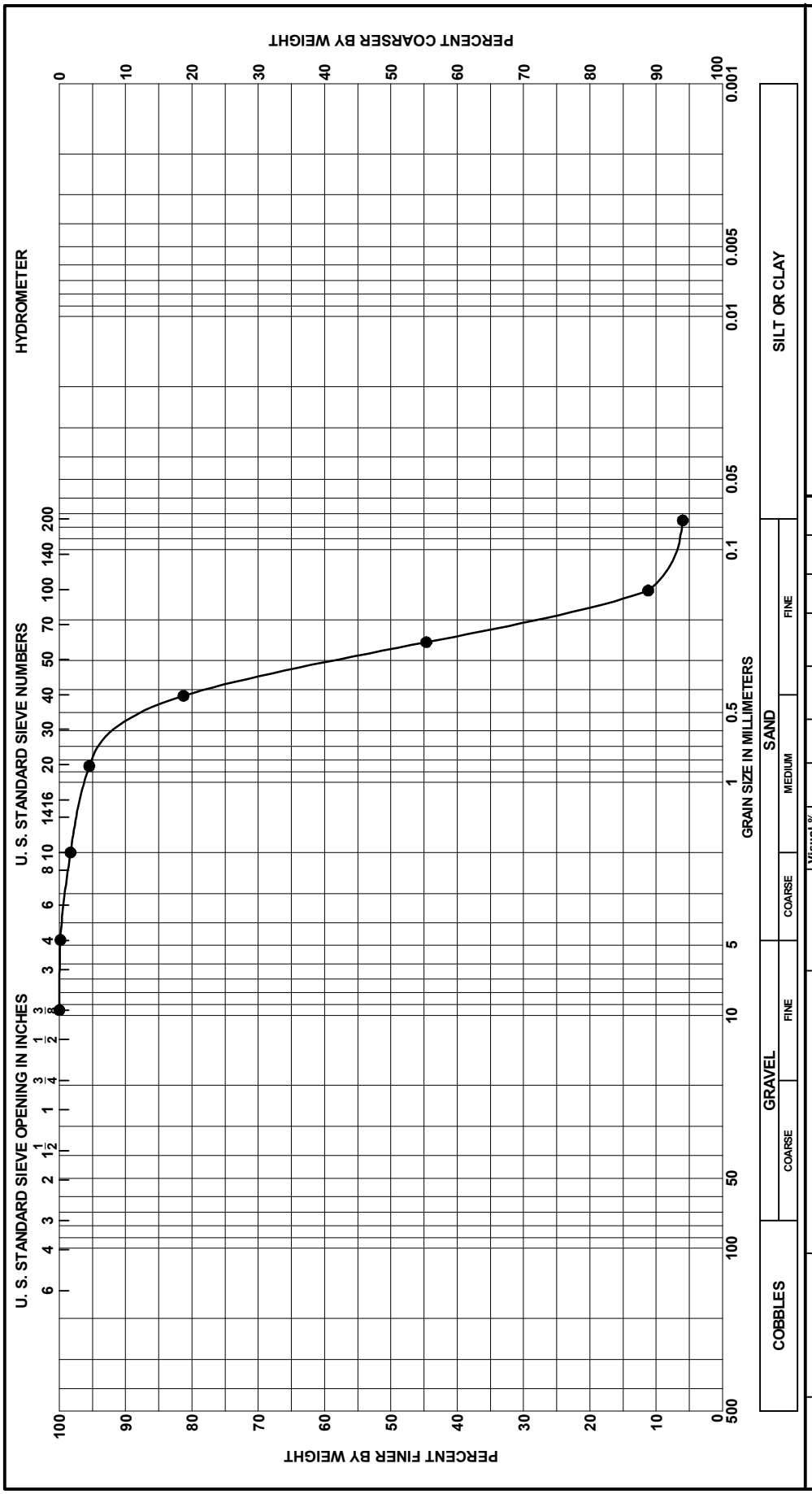

Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 16	22.5 to 24.0 Ft.	SAND, poorly-graded with silt, mostly fine to medium-grained sand-sized quartz, few medium-grained sand-sized shell, few silt, grayish brown (SP-SM)	2.5Y 5/2								

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-1
BORING ELEV. 22.0 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

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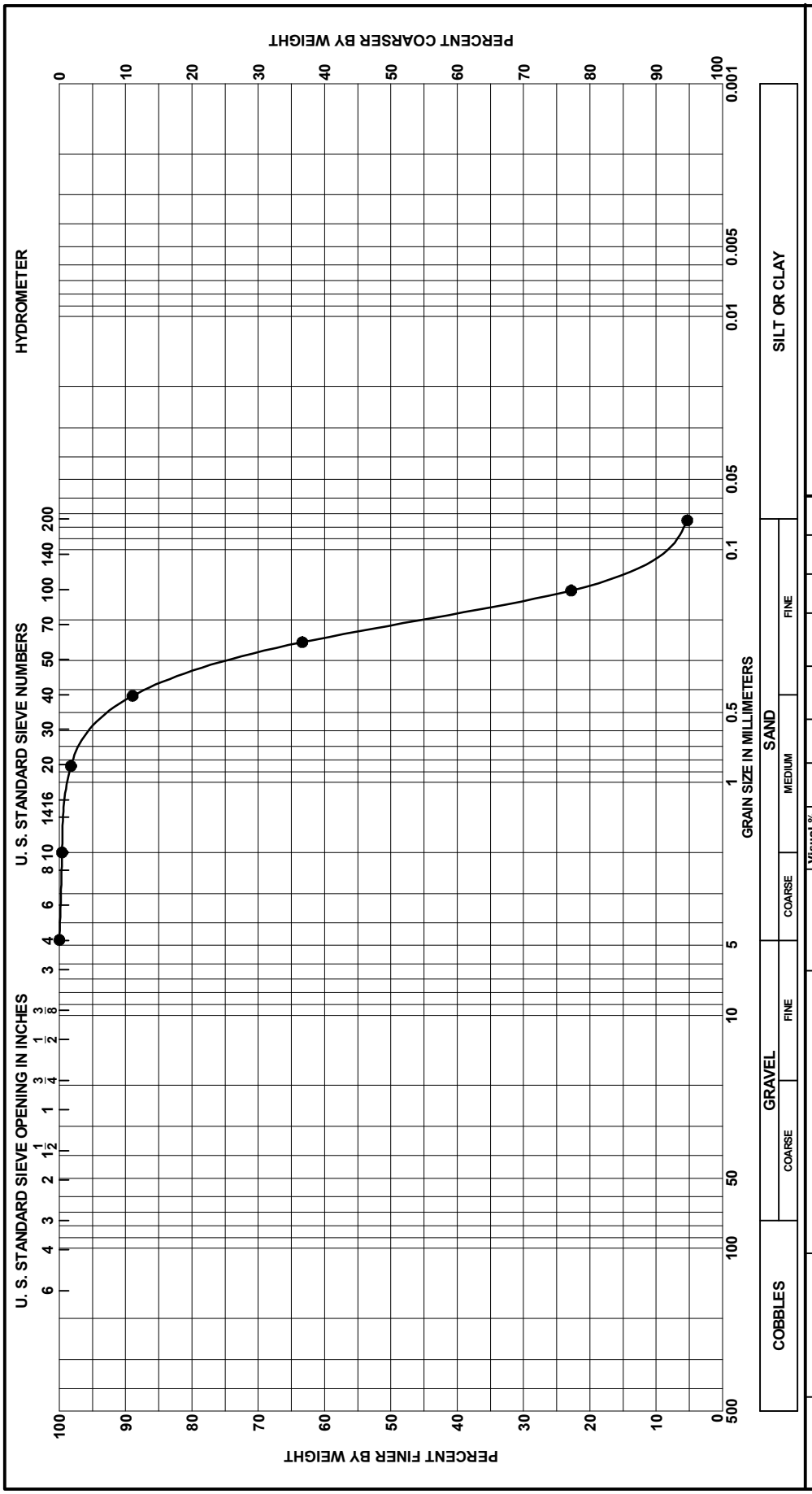
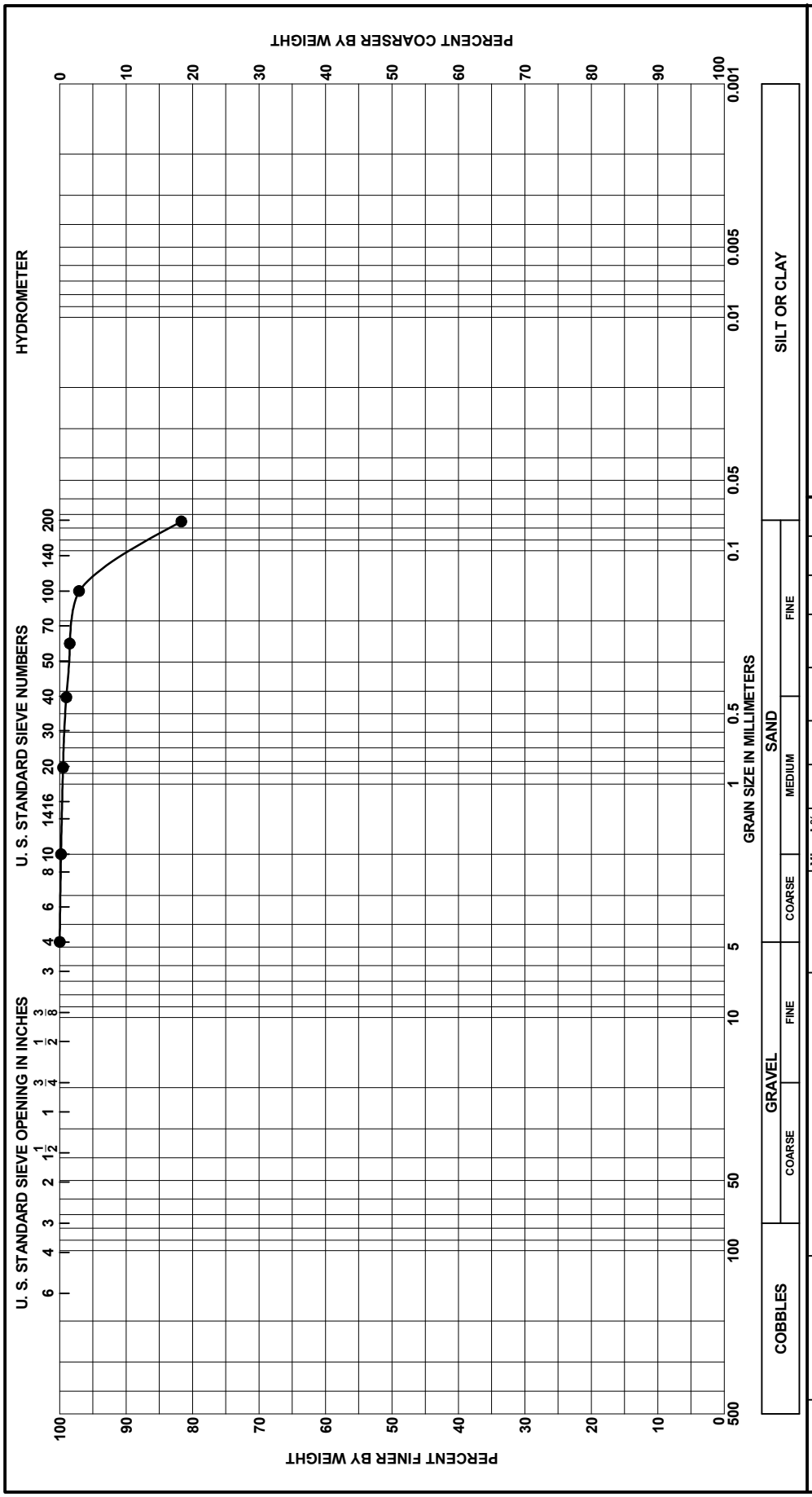


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 26	37.5 to 39.0 Ft.	SAND, poorly-graded with silt, mostly fine to medium-grained sand-sized quartz, few silt, trace shell, grayish brown (SP-SM)	2.5Y 5/2								

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-1
BORING ELEV. 22.0 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● U-1	to 70.5 Ft.	SILT, inorganic-L, little fine-grained sand-sized quartz, trace shell, greenish gray (ML)	10Y 5/1			2.68		38.3	38	27	11

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-1
BORING ELEV. 22.0 Ft., NAVD88
DATE 4/9/2015

GRADATION CURVES

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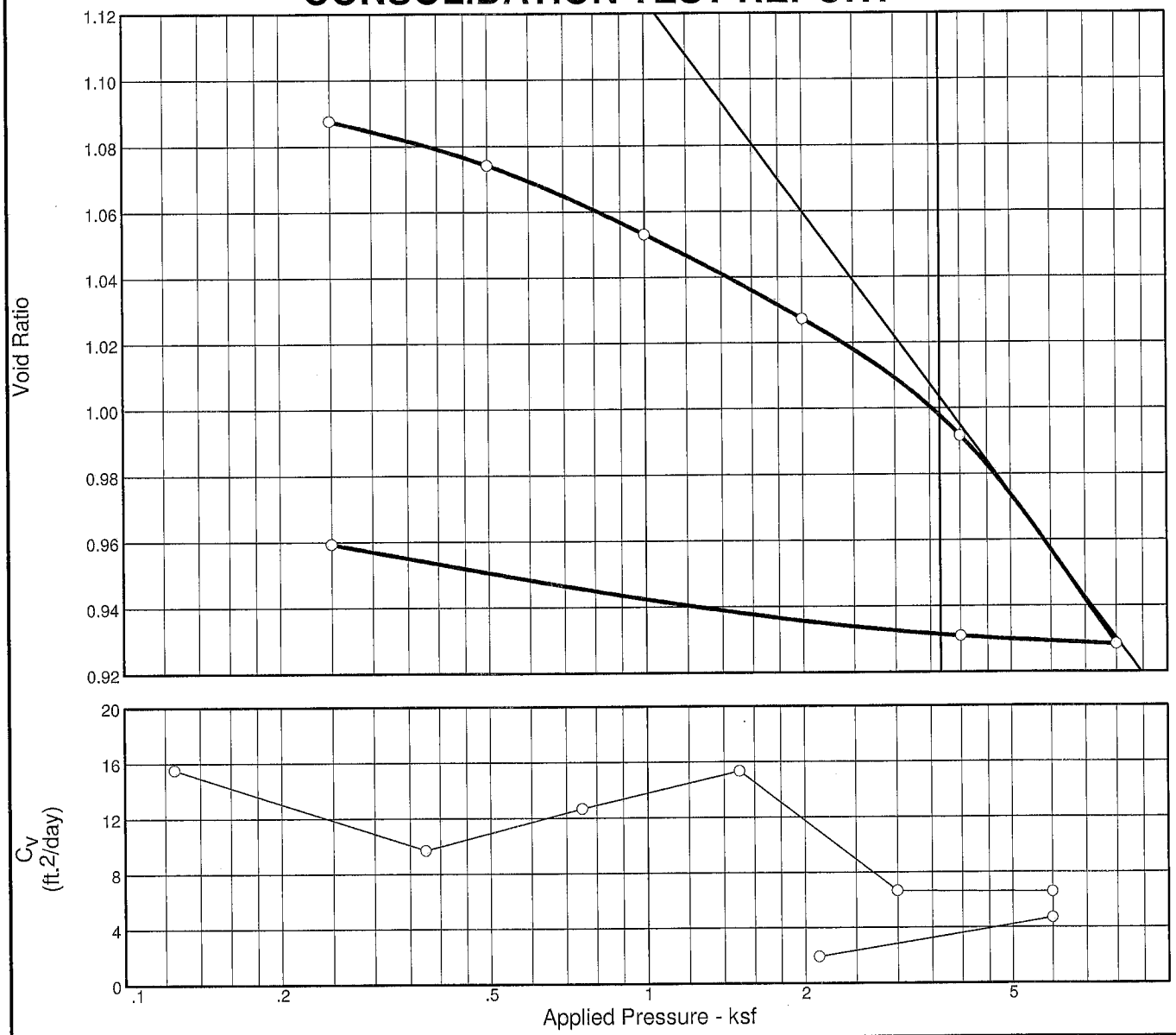
JUN 02

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
SILT, inorganic-L, little fine-grained sand-sized quartz, trace shell, 10Y 5/1, greenish gray (ML)	ML	

LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (ksf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
38	11	2.678		79.6		38.3 %	42.6 %	93.3 %	100.0 %	1.100	0.959	4.01	0.22

Preparation Process: Trimmed using a cylindrical cutting tool

Condition of Test: natural moisture, inundated at 0.05 ksf

D2435 Method	C_r	Swell Press. (ksf)	Swell %
B	0.02		

Project No. 6738155416 **Client:** USACE

Project: HHD Culvert Undisturbed & Embankment

Source: HHD13-S291-CB-1 **Sample No.:** U-1 **Elev./Depth:** 44.5'-46.5'

Remarks:

Checked By: Corey Chascin, E.I.

Title: Staff Engineer

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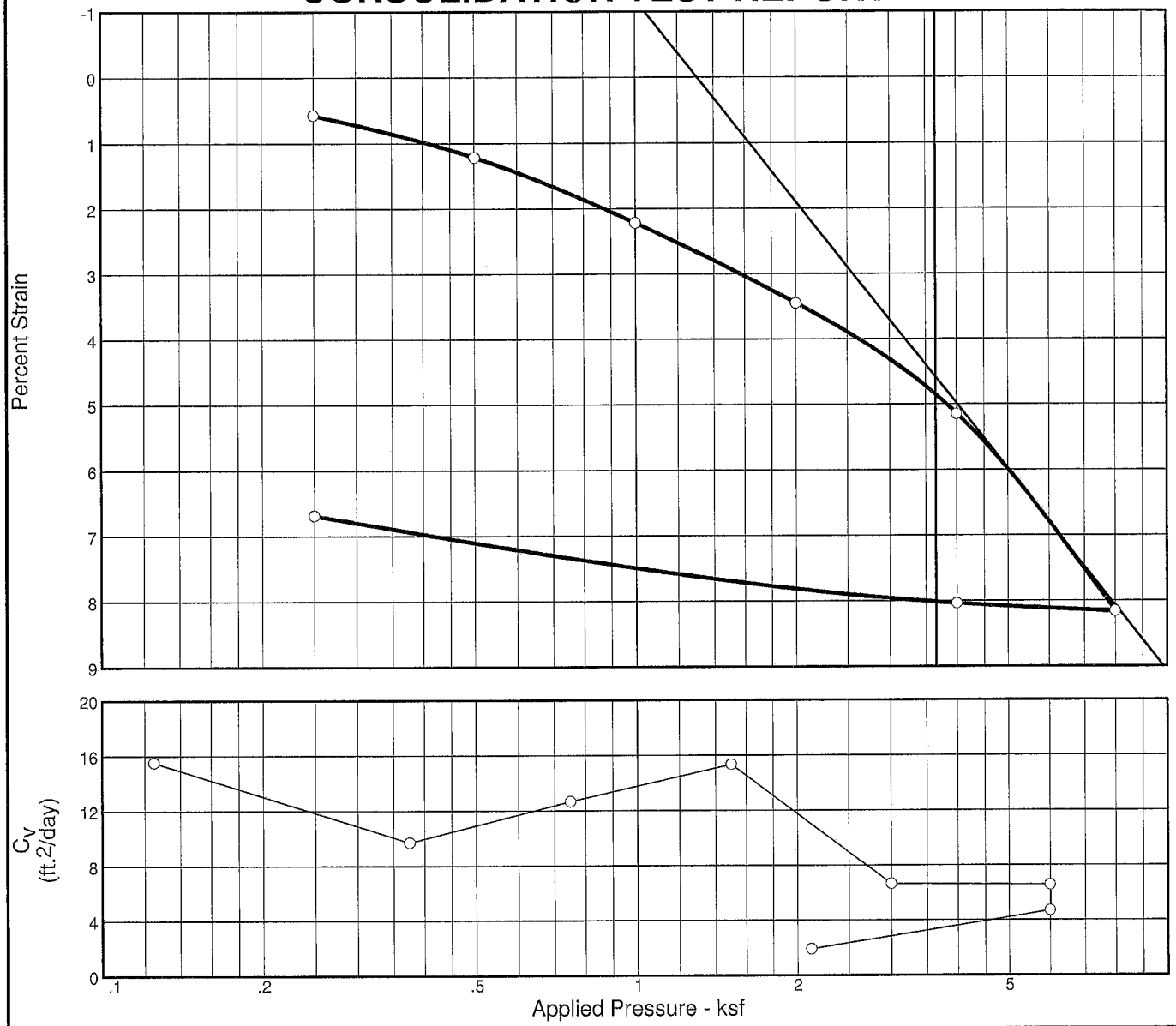
Figure

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
SILT, inorganic-L, little fine-grained sand-sized quartz, trace shell, 10Y 5/1, greenish gray (ML)	ML	

LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (ksf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
38	11	2.678		79.6		38.3 %	42.6 %	93.3 %	100.0 %	1.100	0.959	4.01	0.22

Preparation Process: Trimmed using a cylindrical cutting tool

Condition of Test: natural moisture, inundated at 0.05 ksf

D2435 Method	C_r	Swell Press. (ksf)	Swell %
B	0.02		

Project No. 6738155416 **Client:** USACE

Project: HHD Culvert Undisturbed & Embankment

Source: HHD13-S291-CB-1 **Sample No.:** U-1 **Elev./Depth:** 44.5'-46.5'

Remarks:

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Checked By: Corey Chascin, E.I.

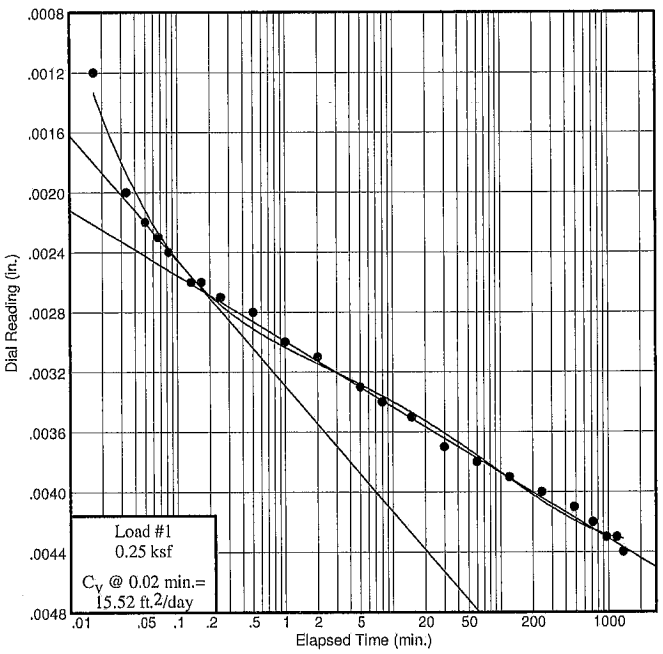
Title: Staff Engineer

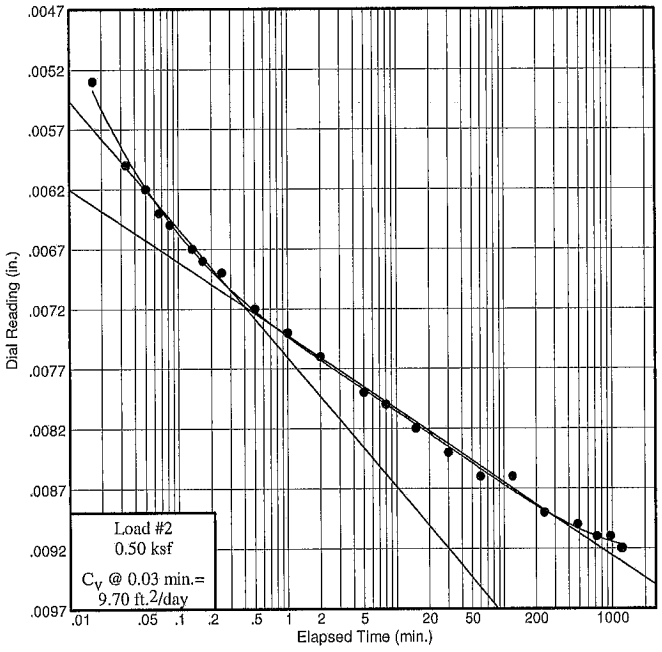
Figure

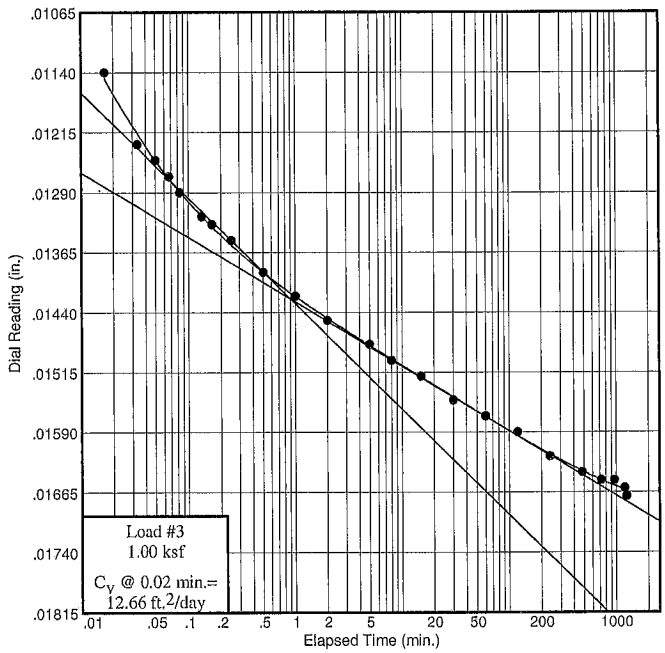
Dial Reading vs. Time

Project No.: 6738155416
Project: HHD Culvert Undisturbed & Embankment

Source: HHD13-S291-CB-1 Sample No.: U-1 Elev./Depth: 44.5'-46.5'







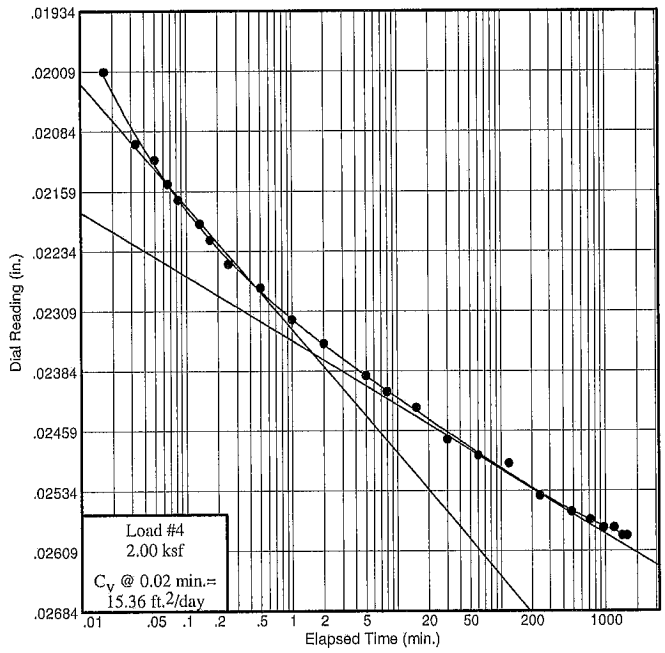


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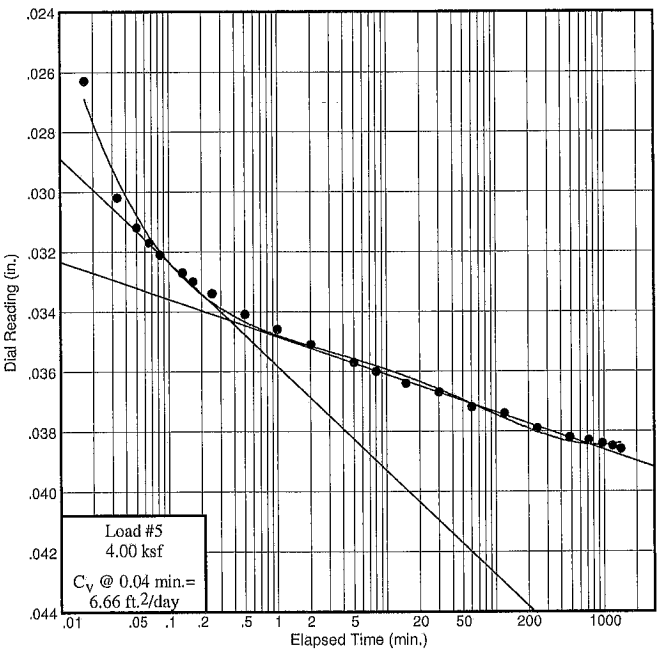
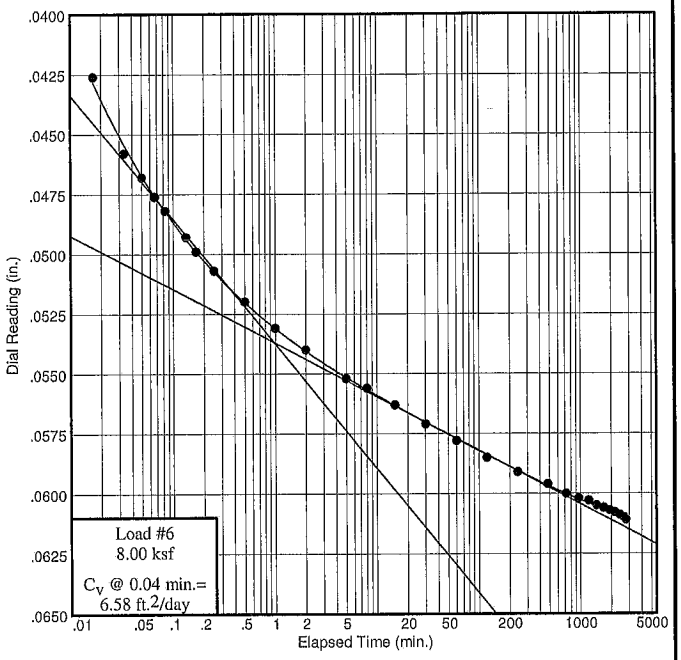
Figure

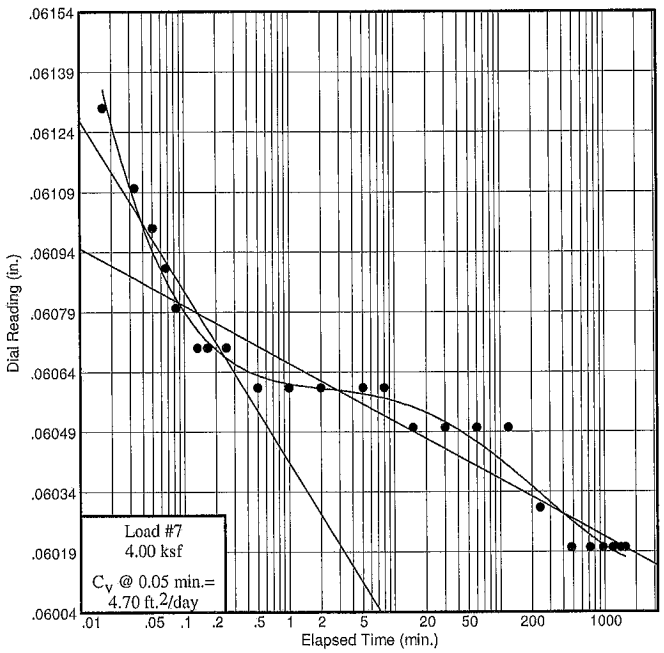
Dial Reading vs. Time

Project No.: 6738155416
Project: HHD Culvert Undisturbed & Embankment

Source: HHD13-S291-CB-1 Sample No.: U-1 Elev./Depth: 44.5'-46.5'







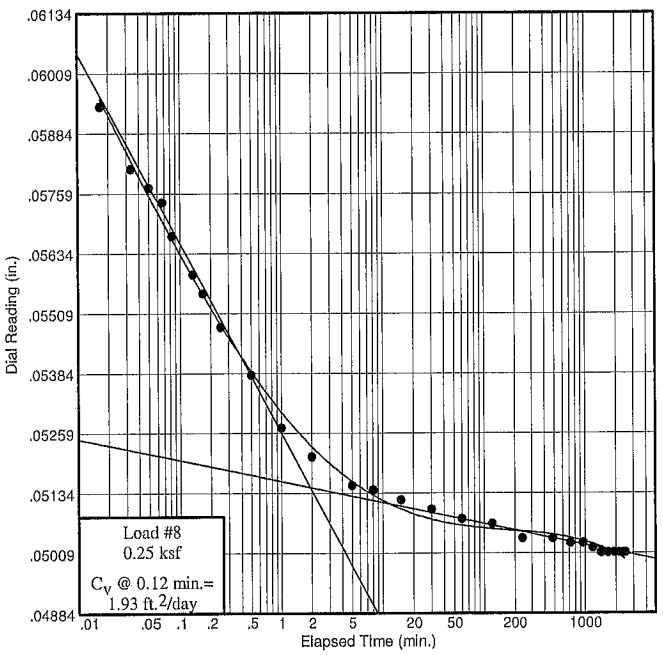


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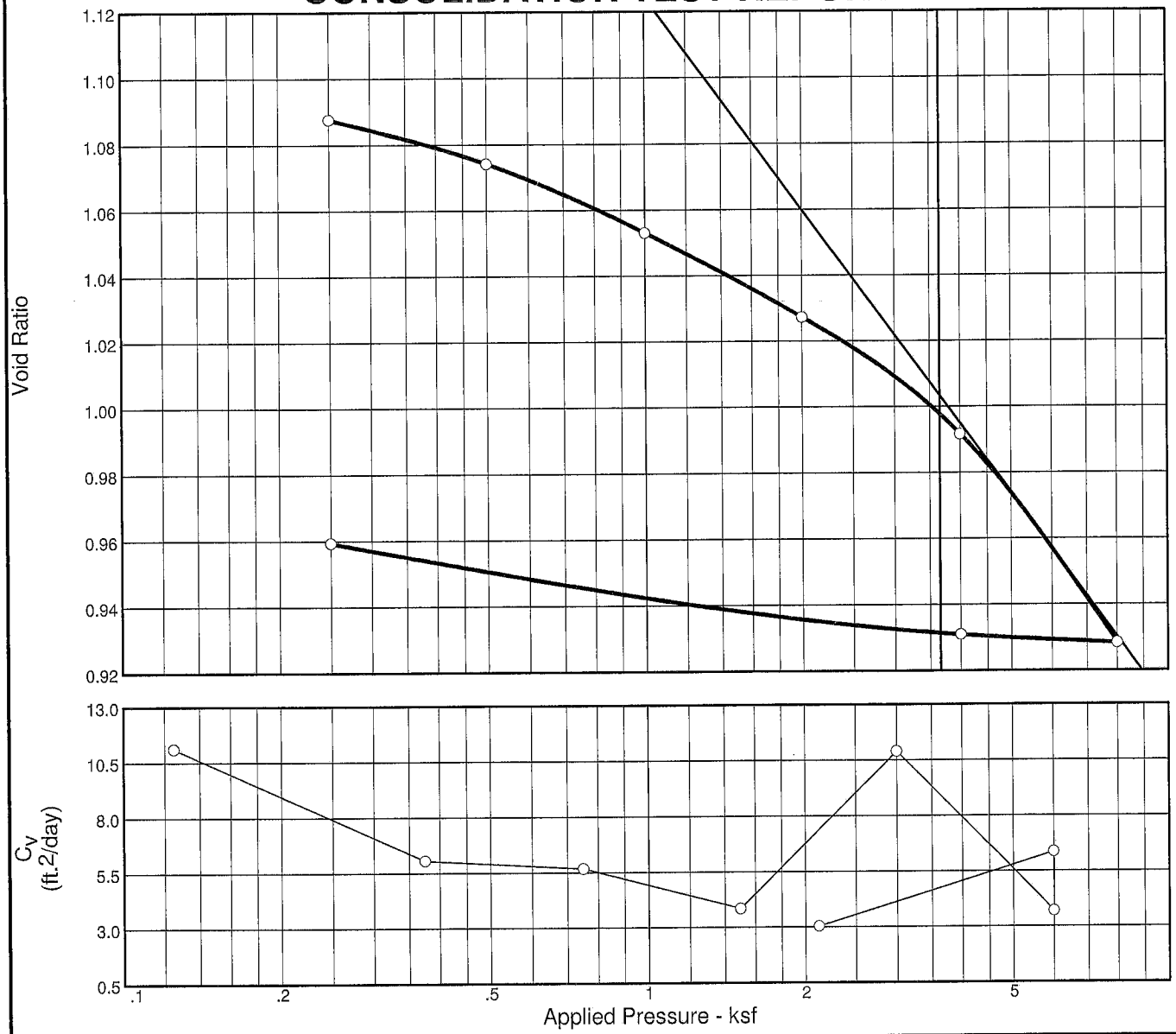
Figure

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
SILT, inorganic-L, little fine-grained sand-sized quartz, trace shell, 10Y 5/1, greenish gray (ML)	ML	

LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (ksf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
38	11	2.678		79.6		38.3 %	42.6 %	93.3 %	100.0 %	1.100	0.959	4.01	0.22

Preparation Process: Trimmed using a cylindrical cutting ring

Condition of Test: Natural Moisture, Inundated at 0.05 KSF

D2435 Method	C_r	Swell Press. (ksf)	Swell %
B	0.02		

Project No. 6738155416 **Client:** USACE

Project: HHD Culvert Undisturbed & Embankment

Source: HHD13-S291-CB-1 **Sample No.:** U-1 **Elev./Depth:** 44.5'-46.5'

Remarks:

Checked By: Corey Chascin, E.I.

Title: Staff Engineer

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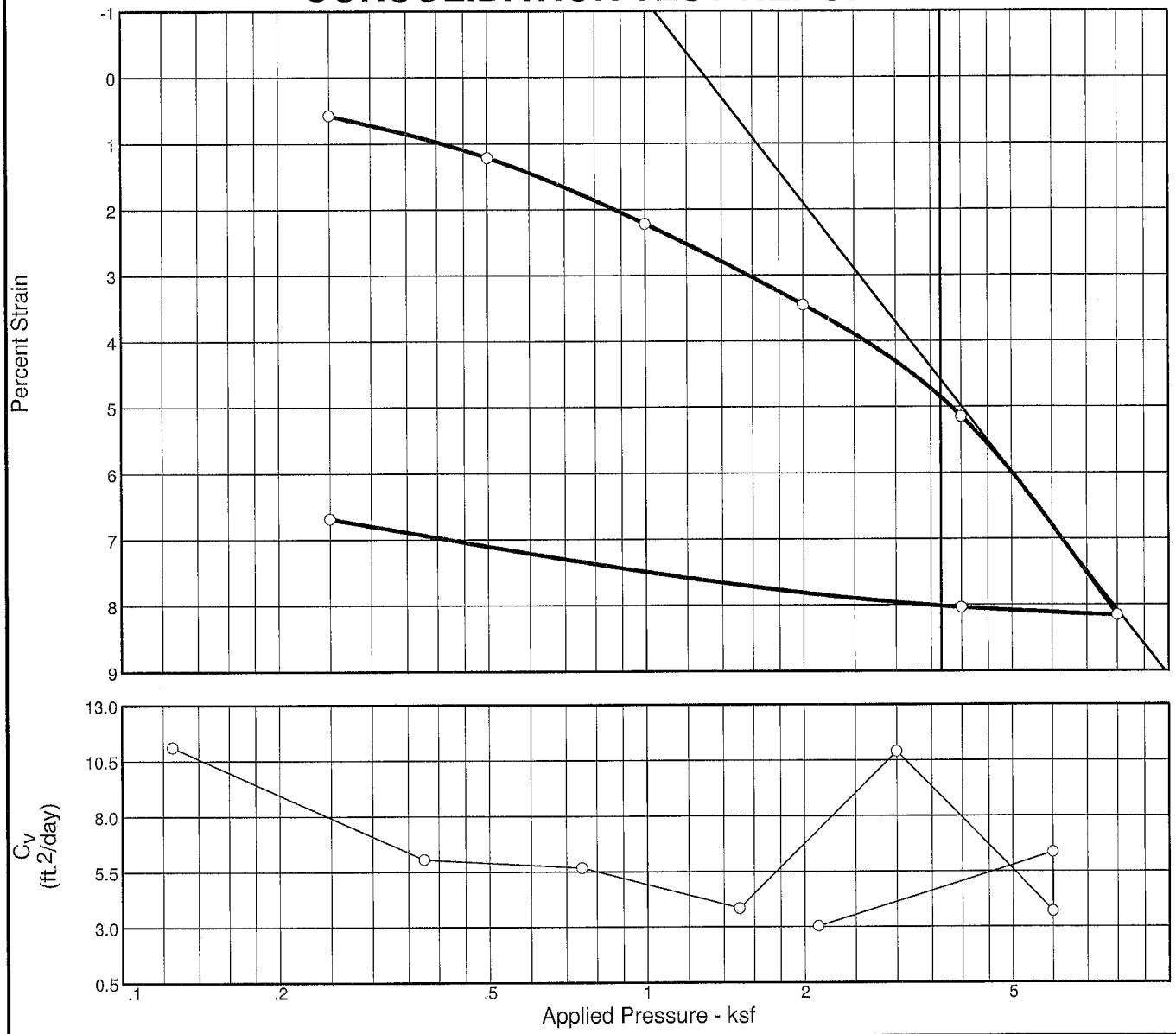
Figure

CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
SILT, inorganic-L, little fine-grained sand-sized quartz, trace shell, 10Y 5/1, greenish gray (ML)	ML	

LL	PI	Sp. Gr.	Overburden (ksf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (ksf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
38	11	2.678		79.6		38.3 %	42.6 %	93.3 %	100.0 %	1.100	0.959	4.01	0.22

Preparation Process: Trimmed using a cylindrical cutting ring

Condition of Test: Natural Moisture, Inundated at 0.05 KSF

D2435 Method	C_r	Swell Press. (ksf)	Swell %
B	0.02		

Project No. 6738155416 **Client:** USACE

Project: HHD Culvert Undisturbed & Embankment

Source: HHD13-S291-CB-1 **Sample No.:** U-1 **Elev./Depth:** 44.5'-46.5'

Remarks:

Checked By: Corey Chascin, E.I.

Title: Staff Engineer

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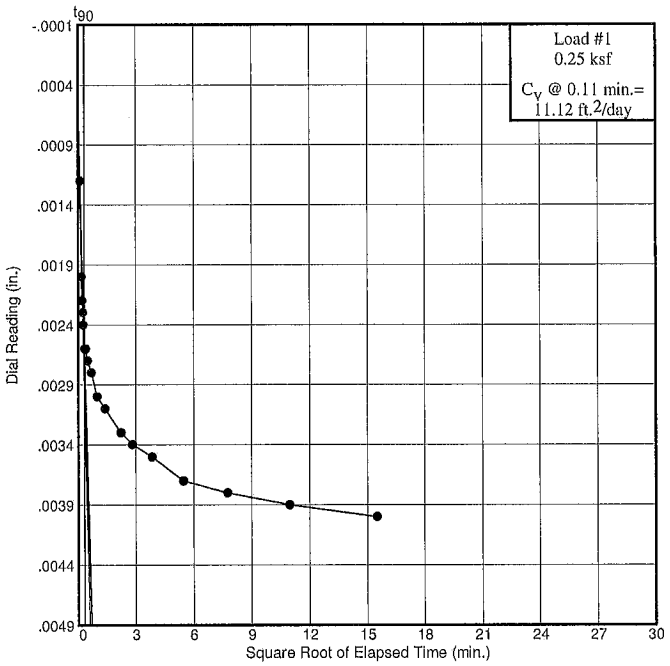
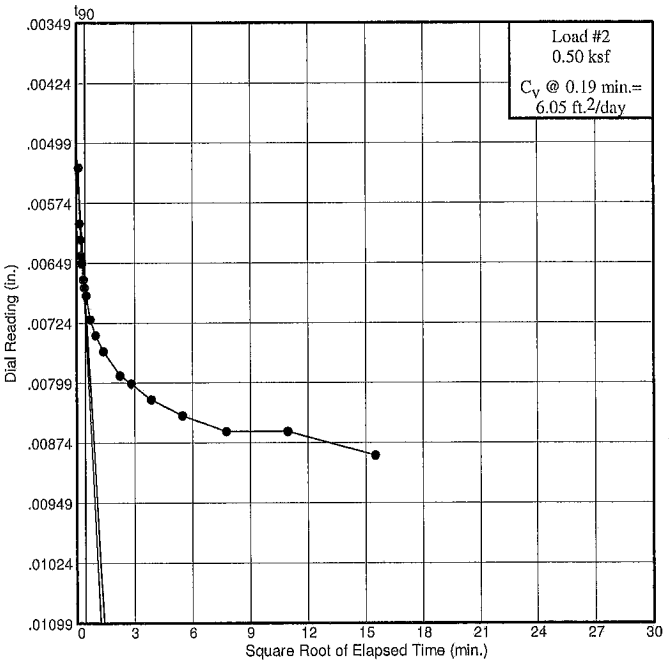
Figure

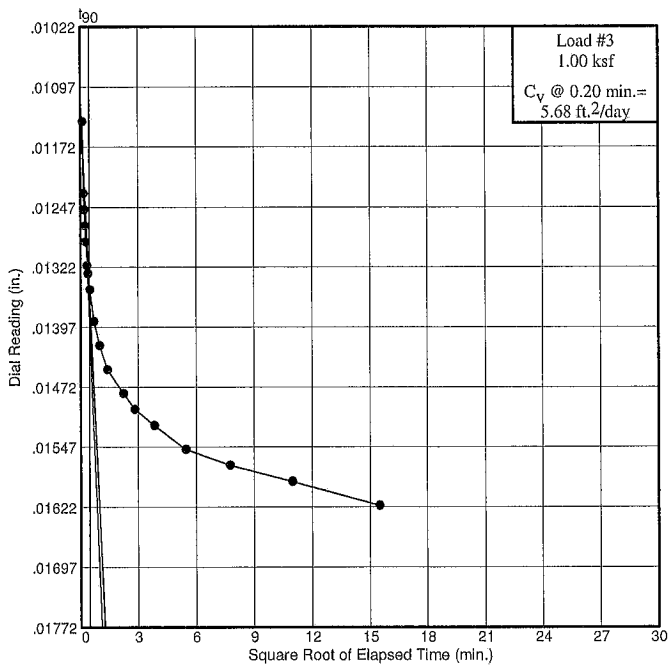
Dial Reading vs. Time

Project No.: 6738155416
Project: HHD Culvert Undisturbed & Embankment

Source: HHD13-S291-CB-1 Sample No.: U-1 Elev./Depth: 44.5'-46.5'







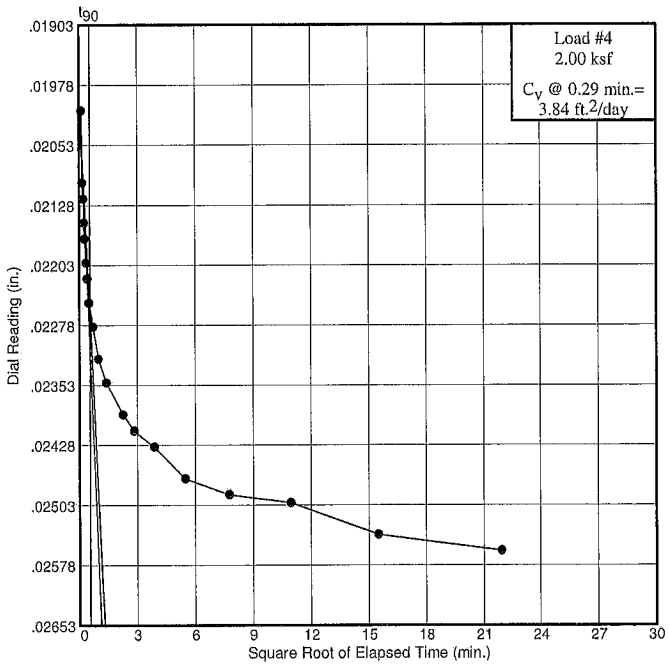


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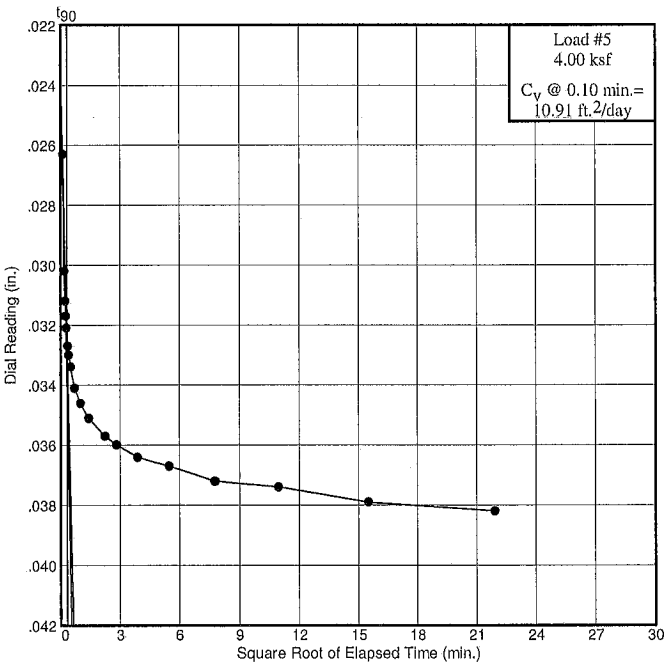
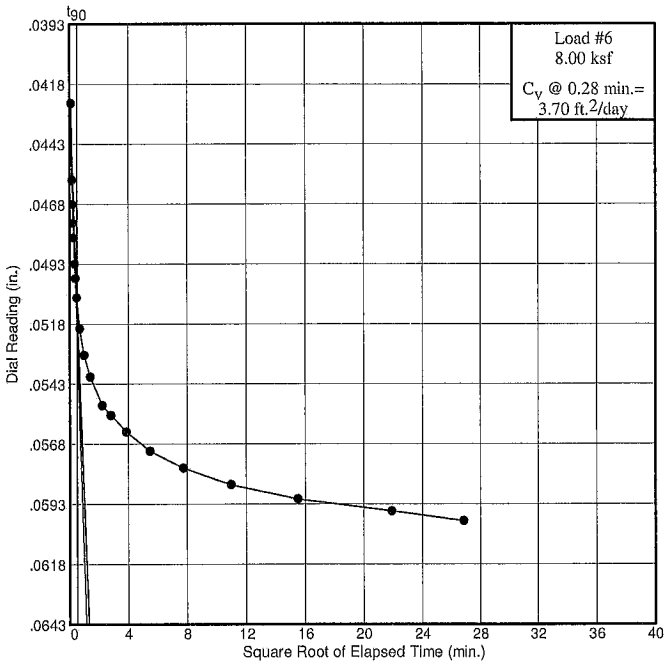
Figure

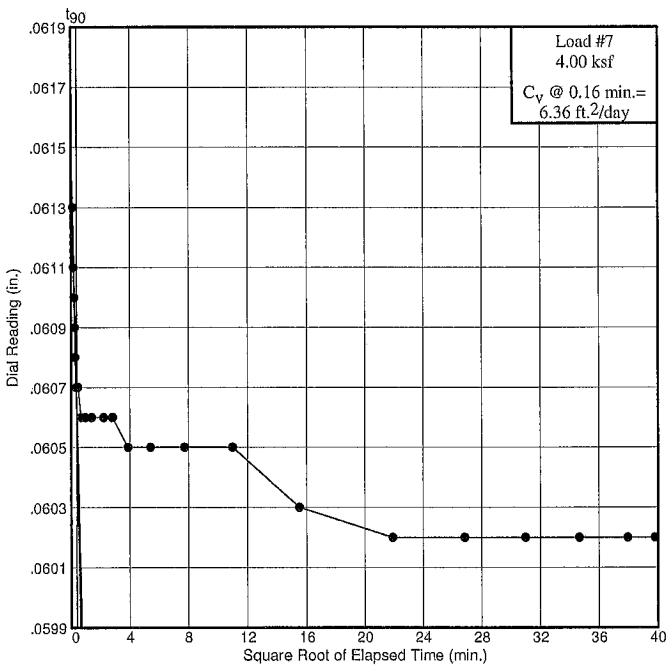
Dial Reading vs. Time

Project No.: 6738155416
Project: HHD Culvert Undisturbed & Embankment

Source: HHD13-S291-CB-1 Sample No.: U-1 Elev./Depth: 44.5'-46.5'







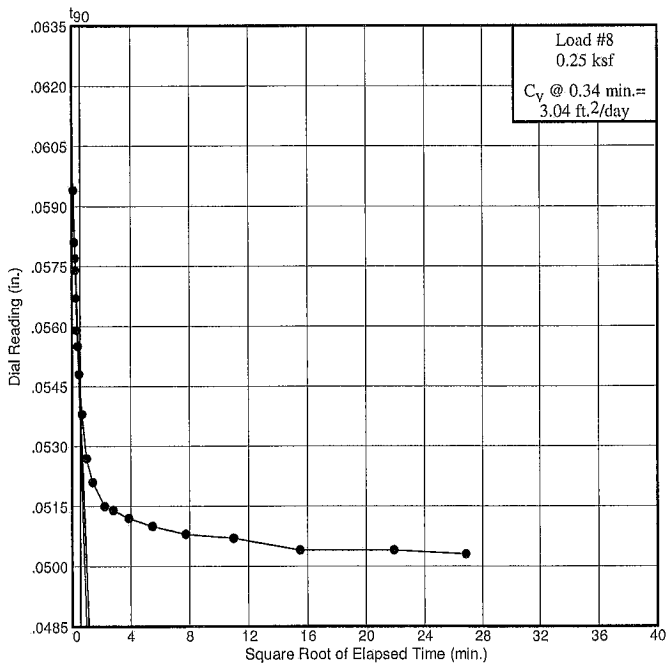


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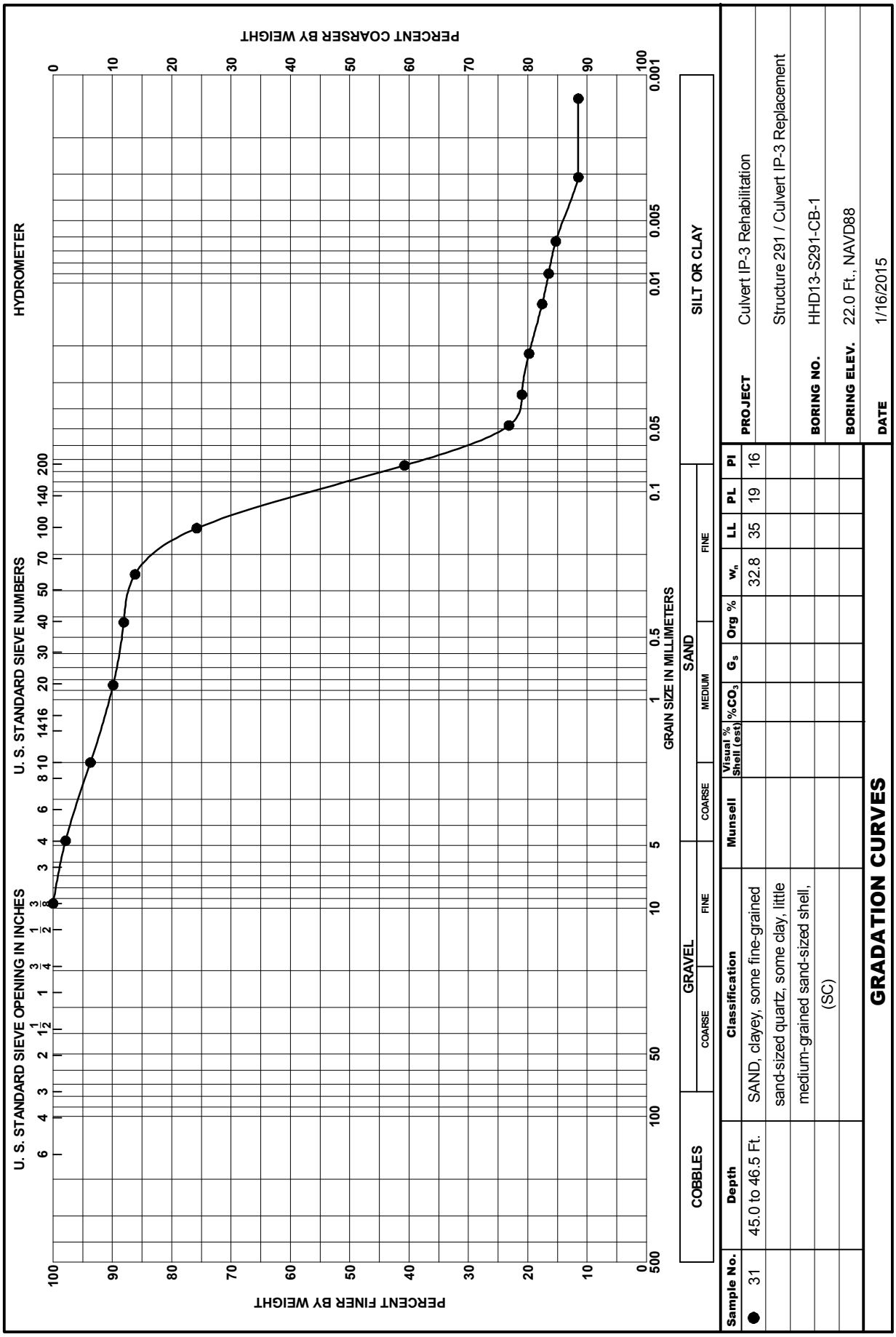
Figure



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 31	45.0 to 46.5 Ft.	SAND, clayey, some fine-grained sand-sized quartz, some clay, little medium-grained sand-sized shell, (SC)						32.8	35	19	16

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-1
BORING ELEV. 22.0 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

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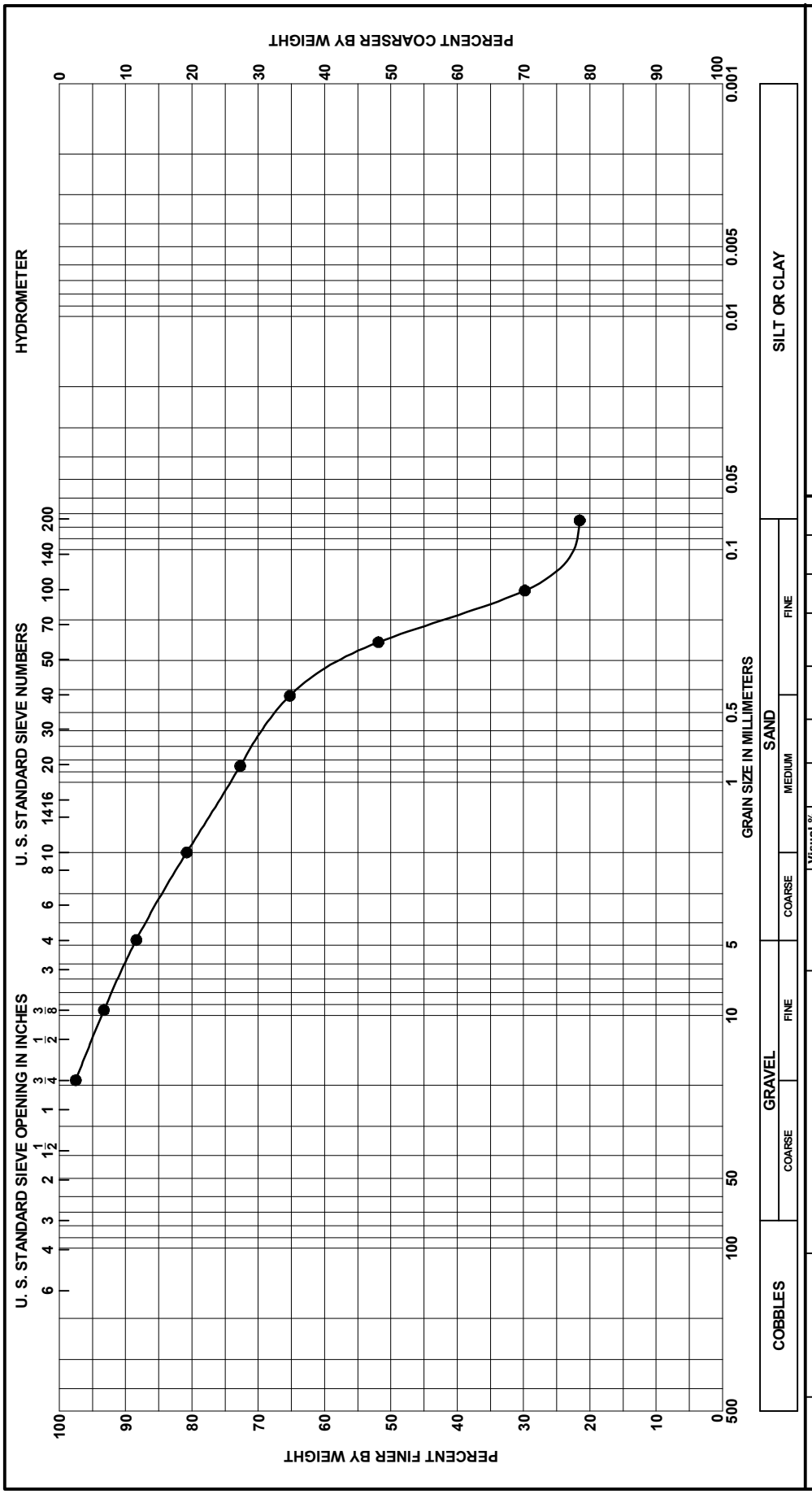
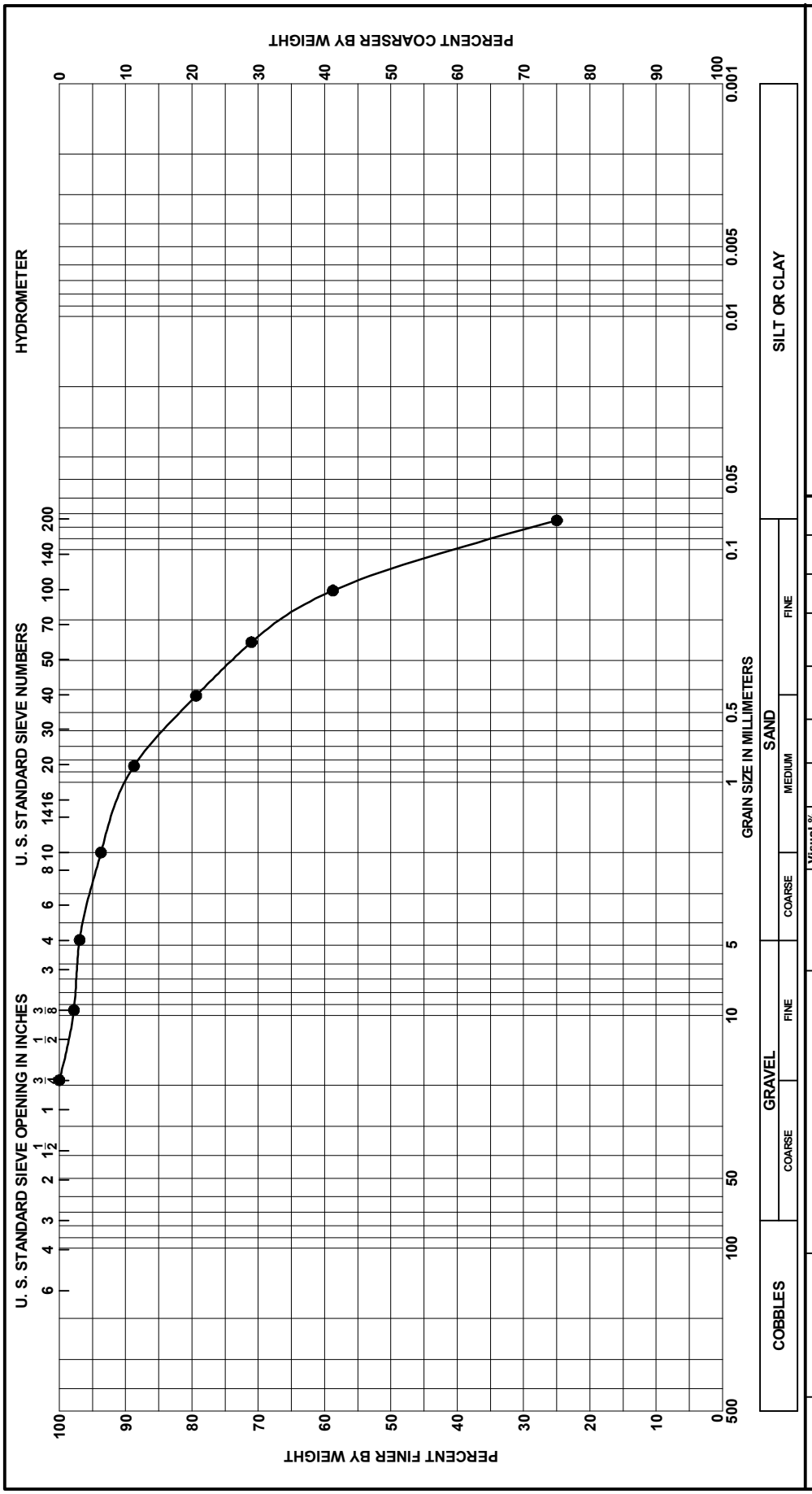


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 35	54.0 to 55.5 Ft.	SAND, clayey, some fine-grained sand-sized quartz, some sand to gravel-sized shell, little clay, light gray (SC)	5Y 7/2	34				22.2	23	16	7

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-1
BORING ELEV. 22.0 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

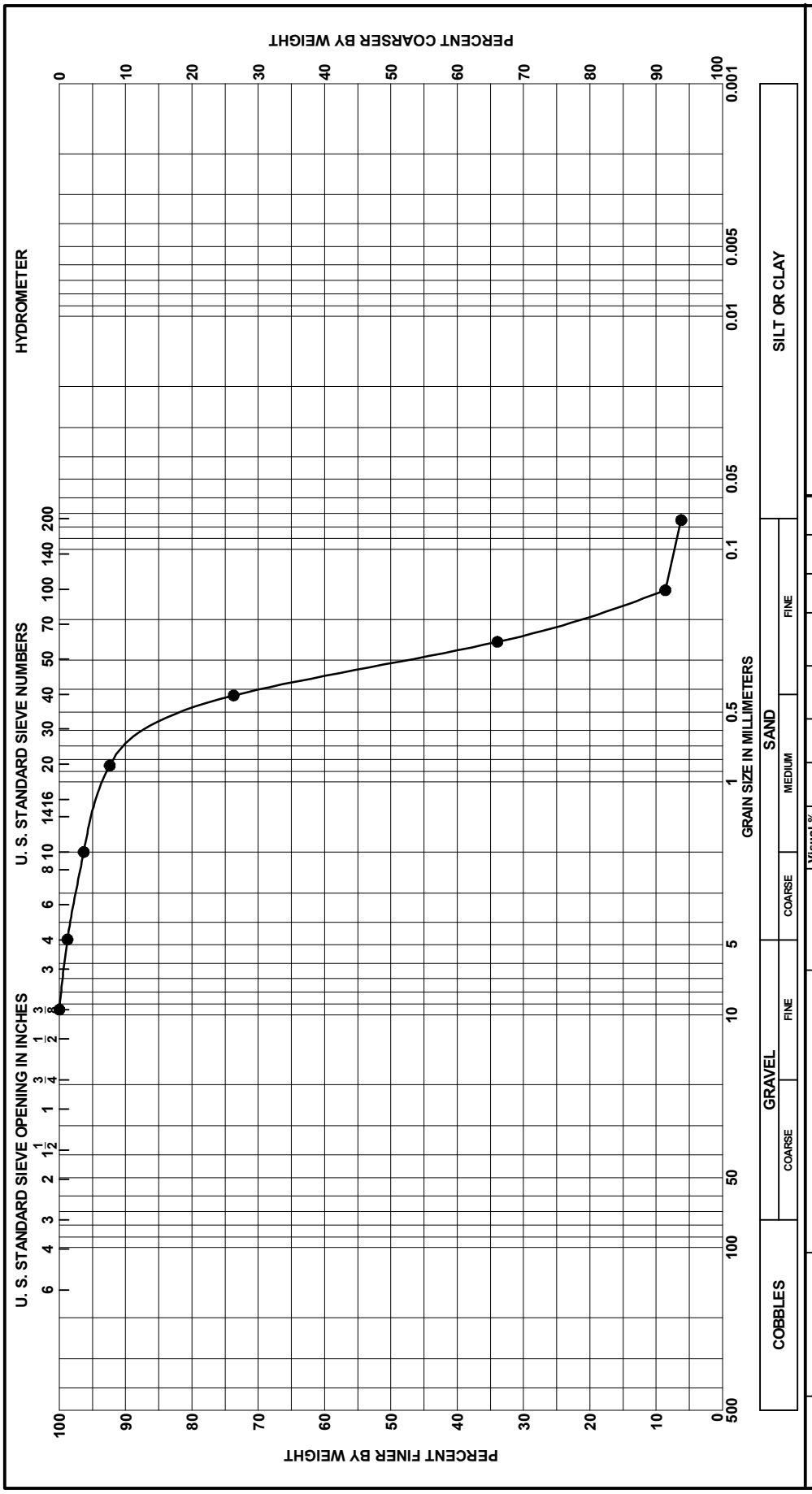


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 40	69.0 to 70.5 Ft.	SAND, clayey, mostly fine to medium-grained sand-sized quartz, little clay, few medium-grained sand-sized limestone, trace shell, olive gray (SC)	5Y 5/2					23.3	27	15	12

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-1
BORING ELEV. 22.0 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

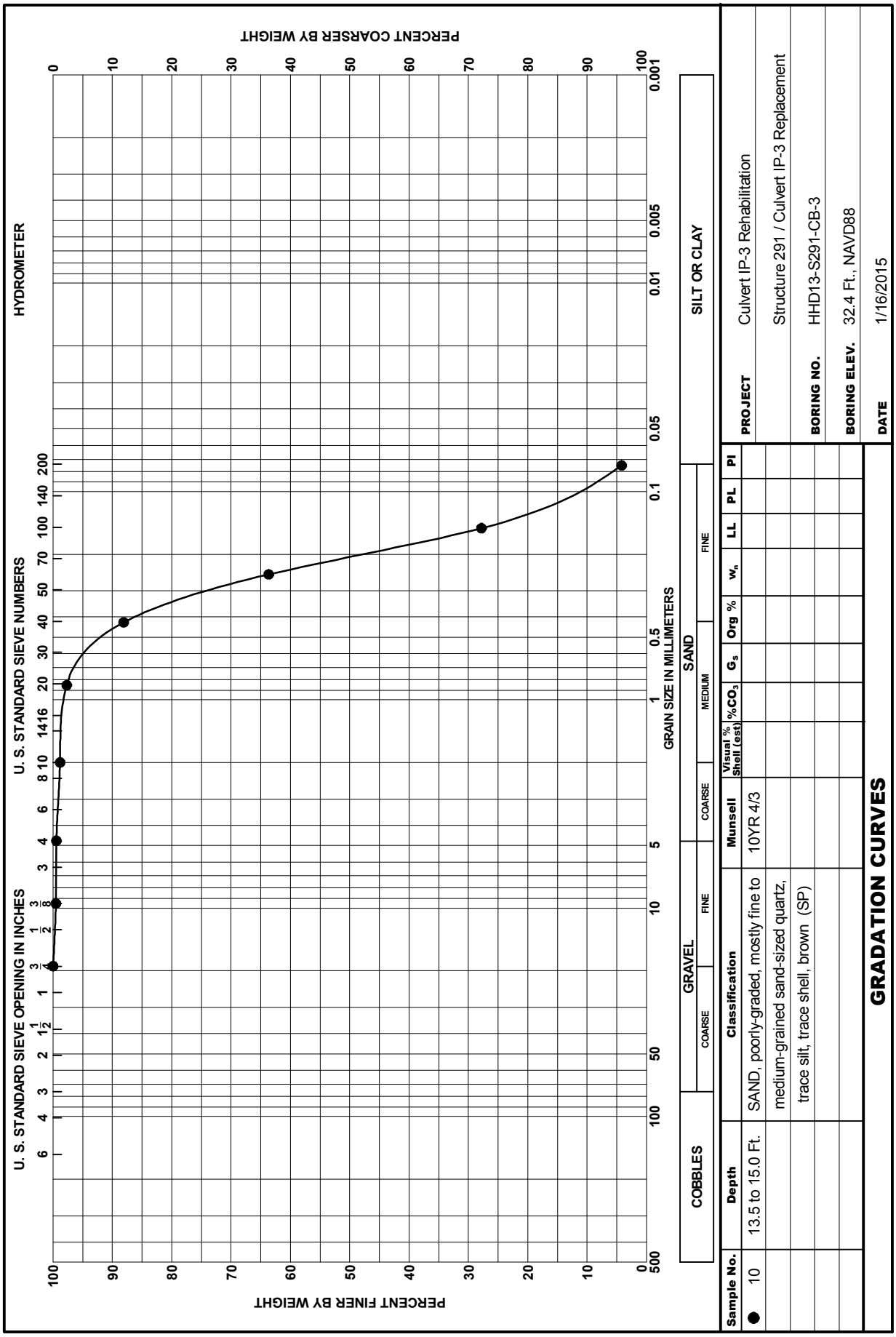


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 4	4.5 to 6.0 Ft.	SAND, poorly-graded with silt, mostly fine to medium-grained sand-sized quartz, few medium-grained sand-sized shell, few silt, gray (SP-SM)	2.5Y 6/1								

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-3
BORING ELEV. 32.4 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 10	13.5 to 15.0 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, trace silt, trace shell, brown (SP)	10YR 4/3								

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-3
BORING ELEV. 32.4 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

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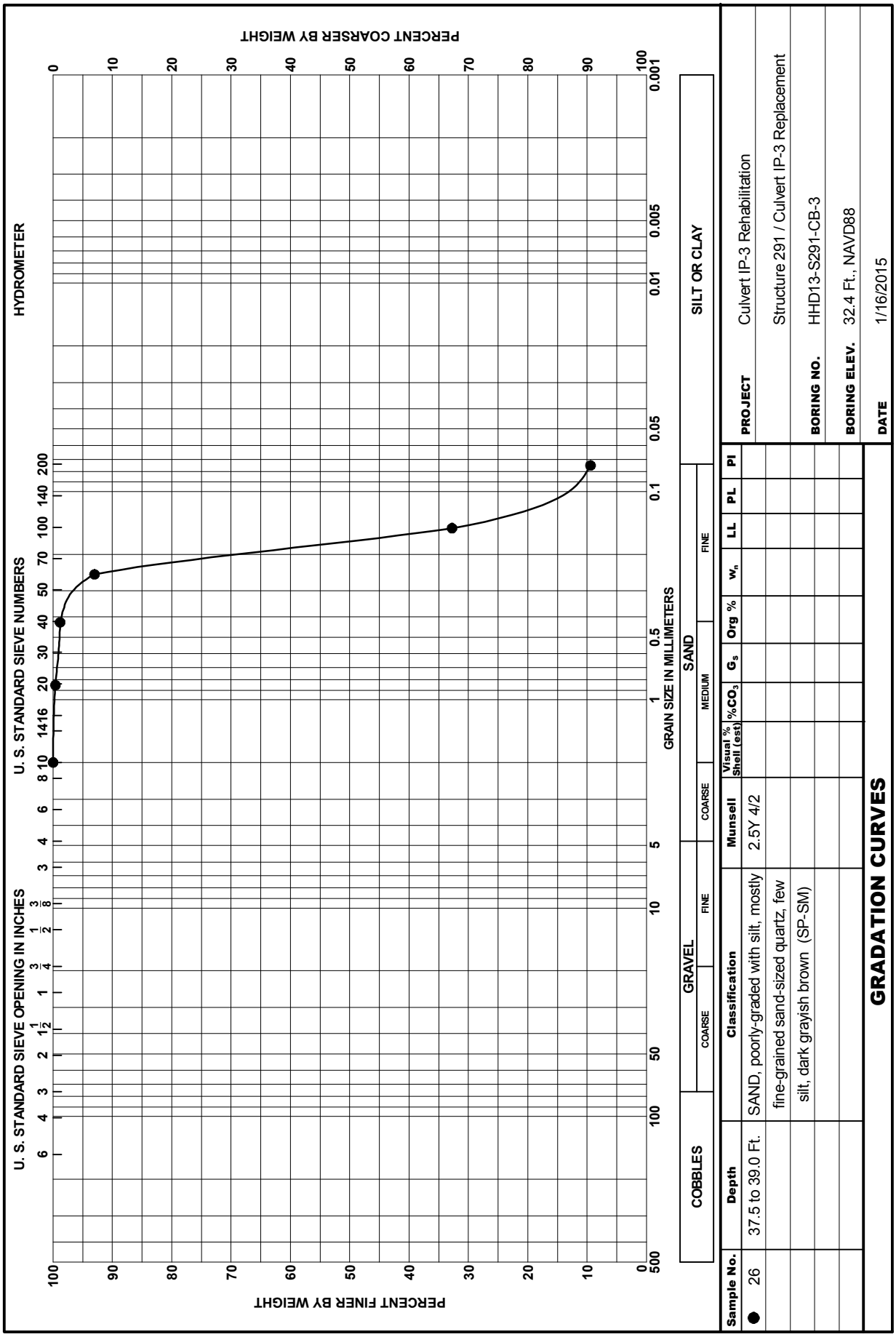

Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 26	37.5 to 39.0 Ft.	SAND, poorly-graded with silt, mostly	2.5Y 4/2								
		fine-grained sand-sized quartz, few									
		silt, dark grayish brown (SP-SM)									

GRADATION CURVES

PROJECT	Culvert IP-3 Rehabilitation
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD13-S291-CB-3
BORING ELEV.	32.4 Ft., NAVD88
DATE	1/16/2015

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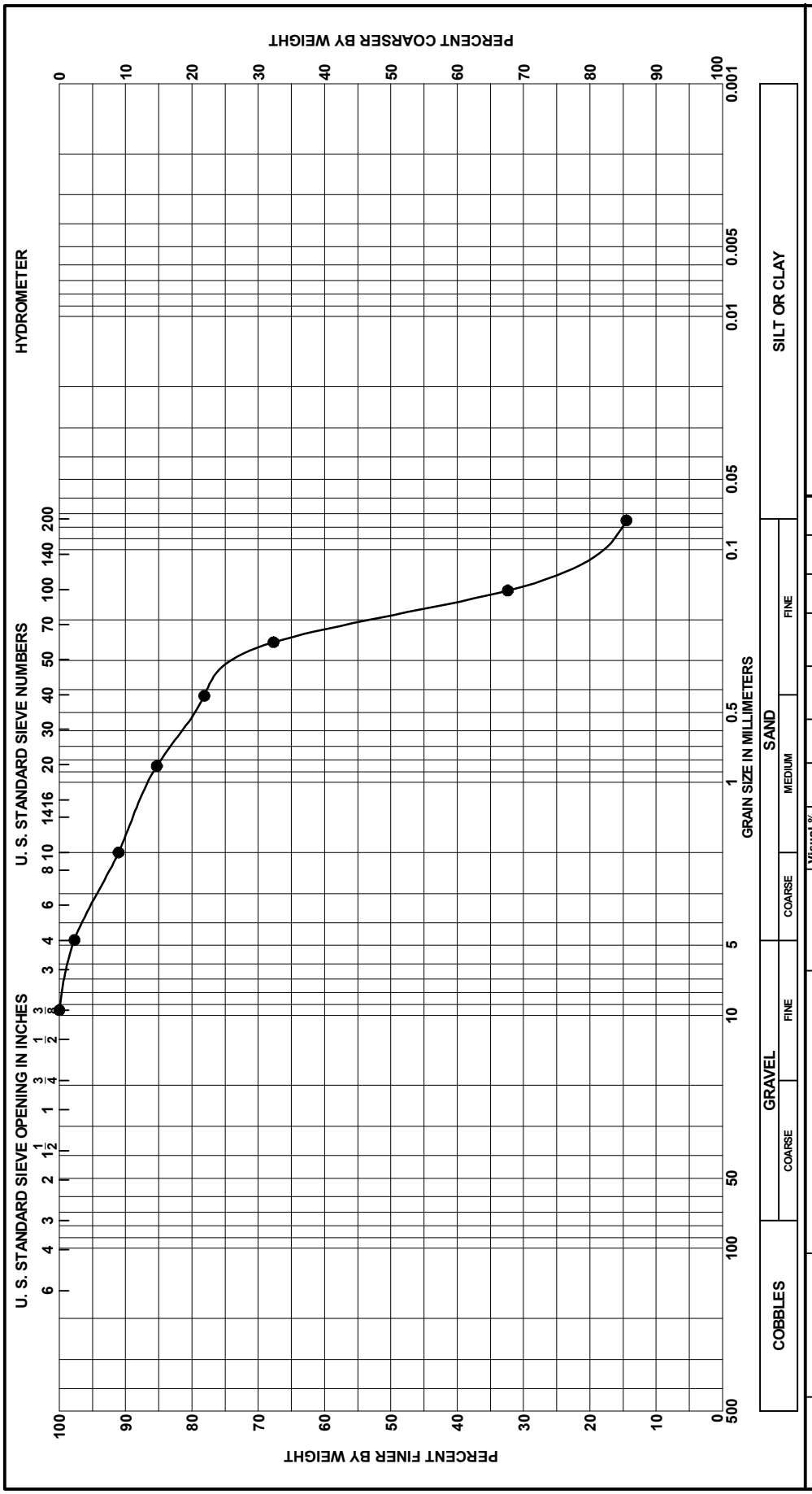
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 34	51.0 to 52.5 Ft.	SAND, silty, mostly fine-grained sand-sized quartz, little medium to coarse-grained sand-sized shell, little silt, olive gray (SM)	5Y 4/2					26.5	22	21	1

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-3
BORING ELEV. 32.4 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

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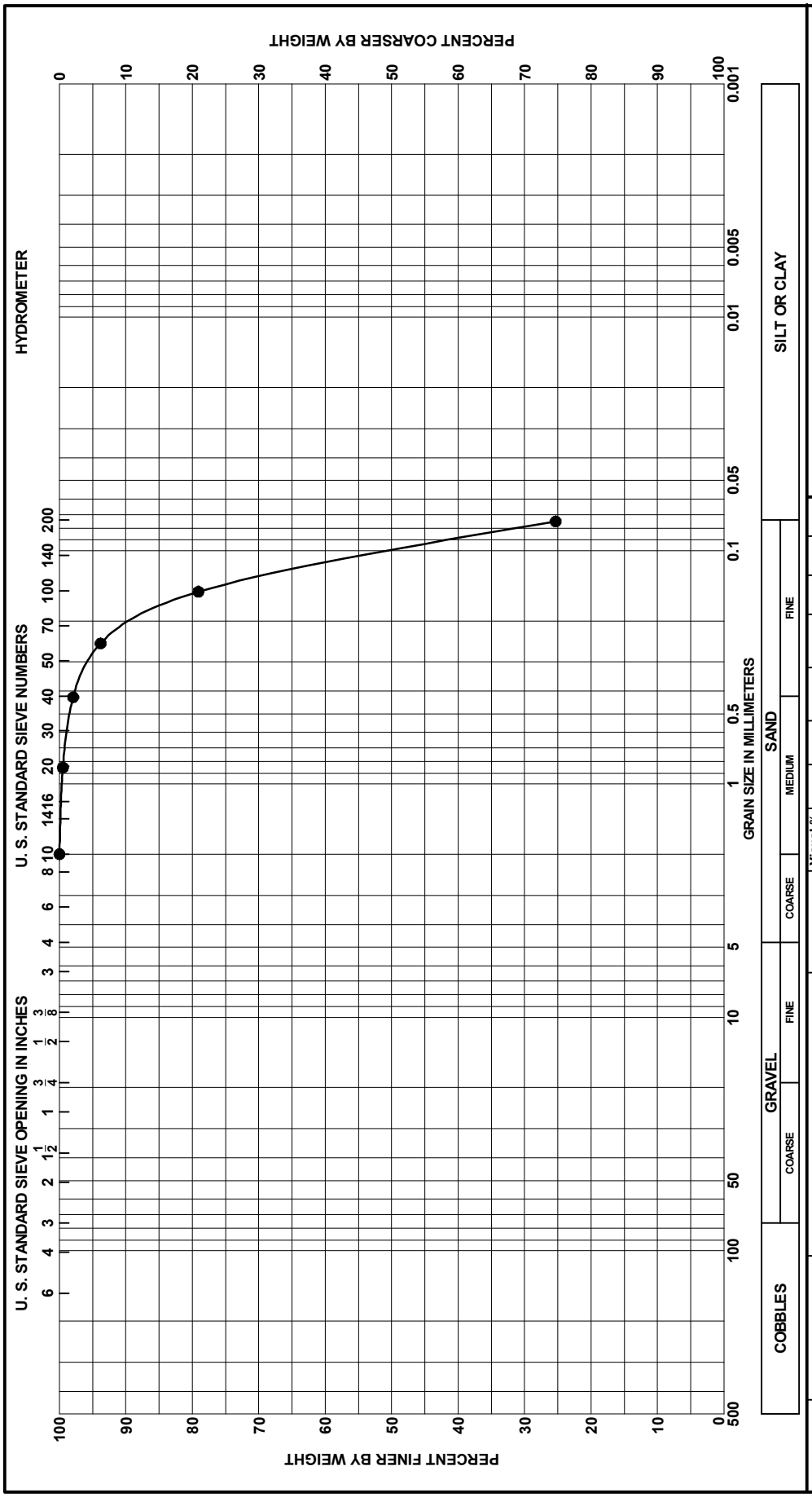
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 44	85.0 to 86.5 Ft.	SAND, clayey, mostly fine-grained sand-sized quartz, little clay, olive gray (SC)	5Y 5/2					35.5	37	18	19

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement

BORING NO. HHD13-S291-CB-3

BORING ELEV. 32.4 Ft., NAVD88

DATE 1/16/2015

GRADATION CURVES

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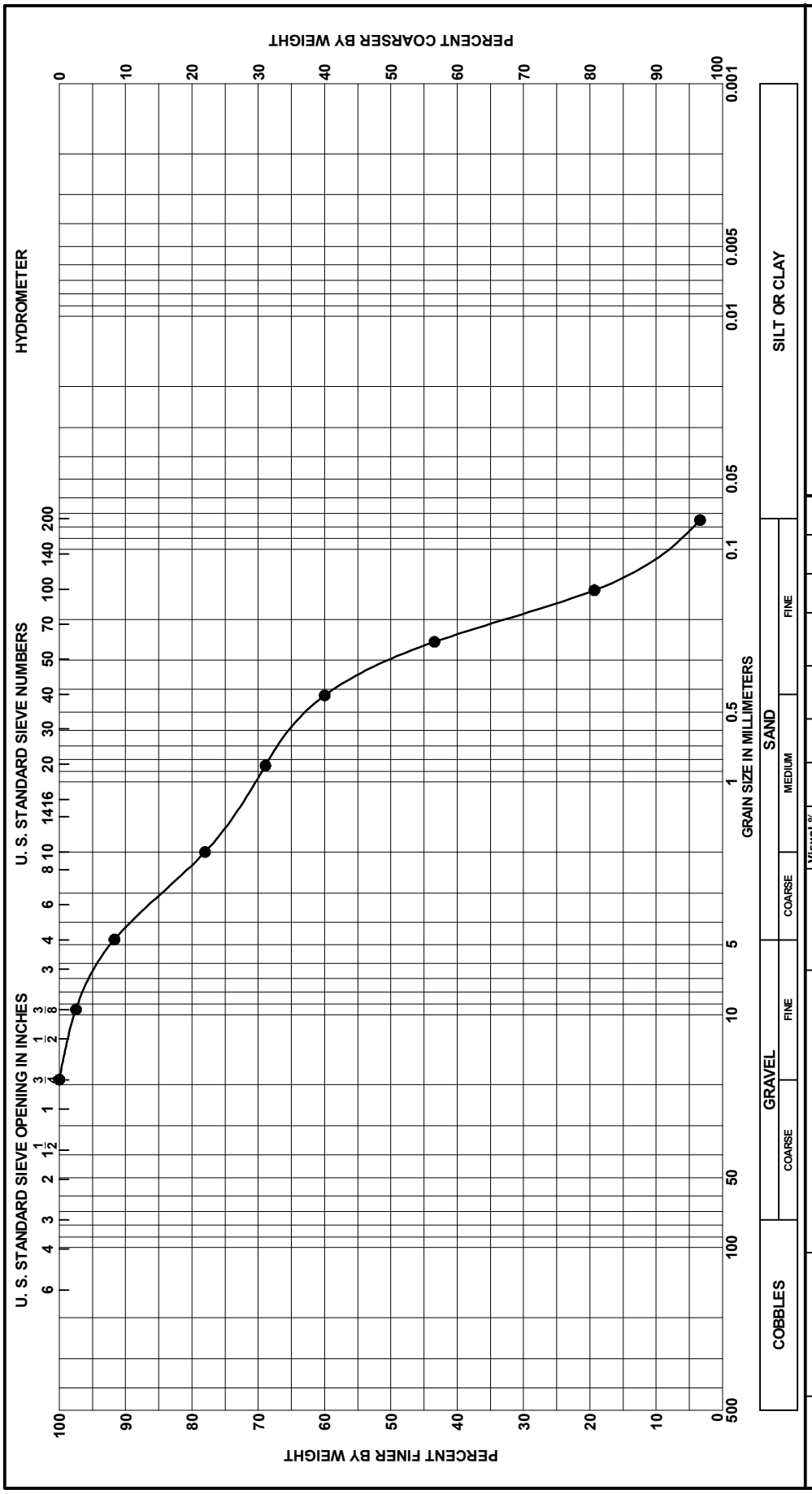
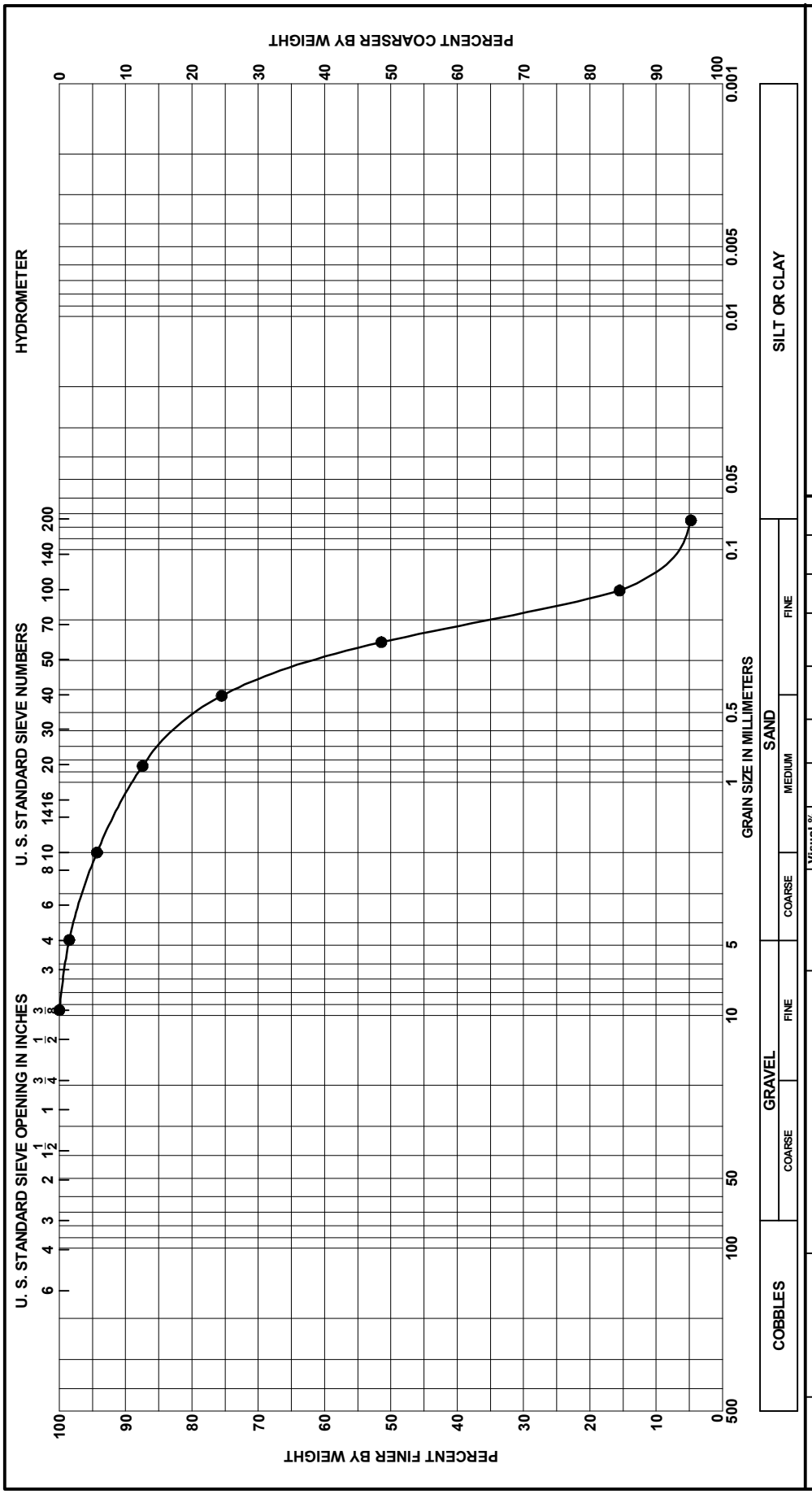


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 5	6.0 to 7.5 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, some sand to gravel-sized shell, trace silt, light yellowish brown (SP)	2.5Y 6/4	33				17.6			

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-5
BORING ELEV. 23.3 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 9	12.0 to 13.5 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, little medium to coarse-grained sand-sized shell, trace silt, light yellowish brown (SP)	2.5Y 6/4			2.67					

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-5
BORING ELEV. 23.3 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

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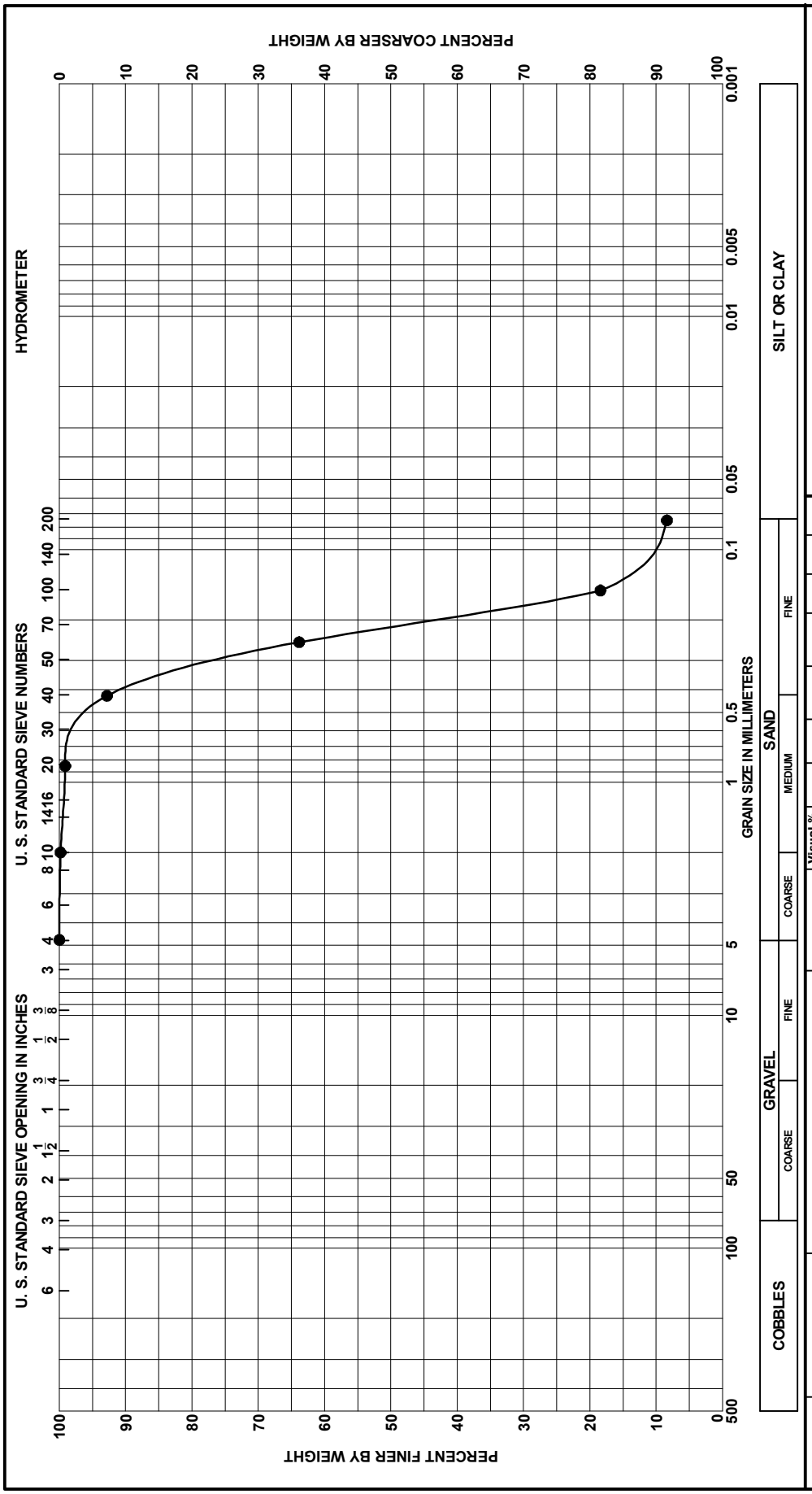
JUN 02

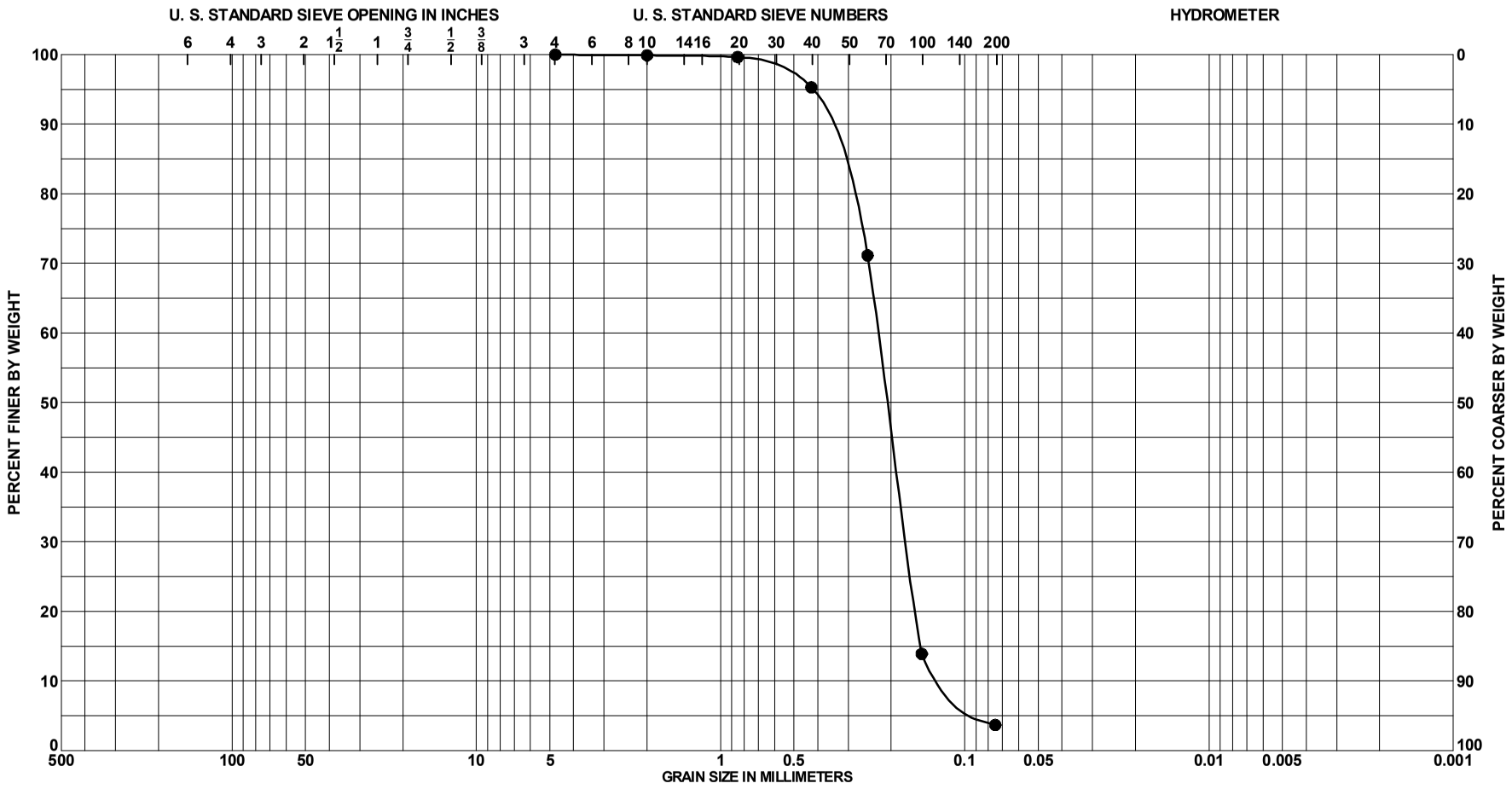


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 15	21.0 to 22.5 Ft.	SAND, poorly-graded with silt, mostly fine to medium-grained sand-sized quartz, few silt, trace shell, light brownish gray (SP-SM)	2.5Y 6/2								

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-5
BORING ELEV. 23.3 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

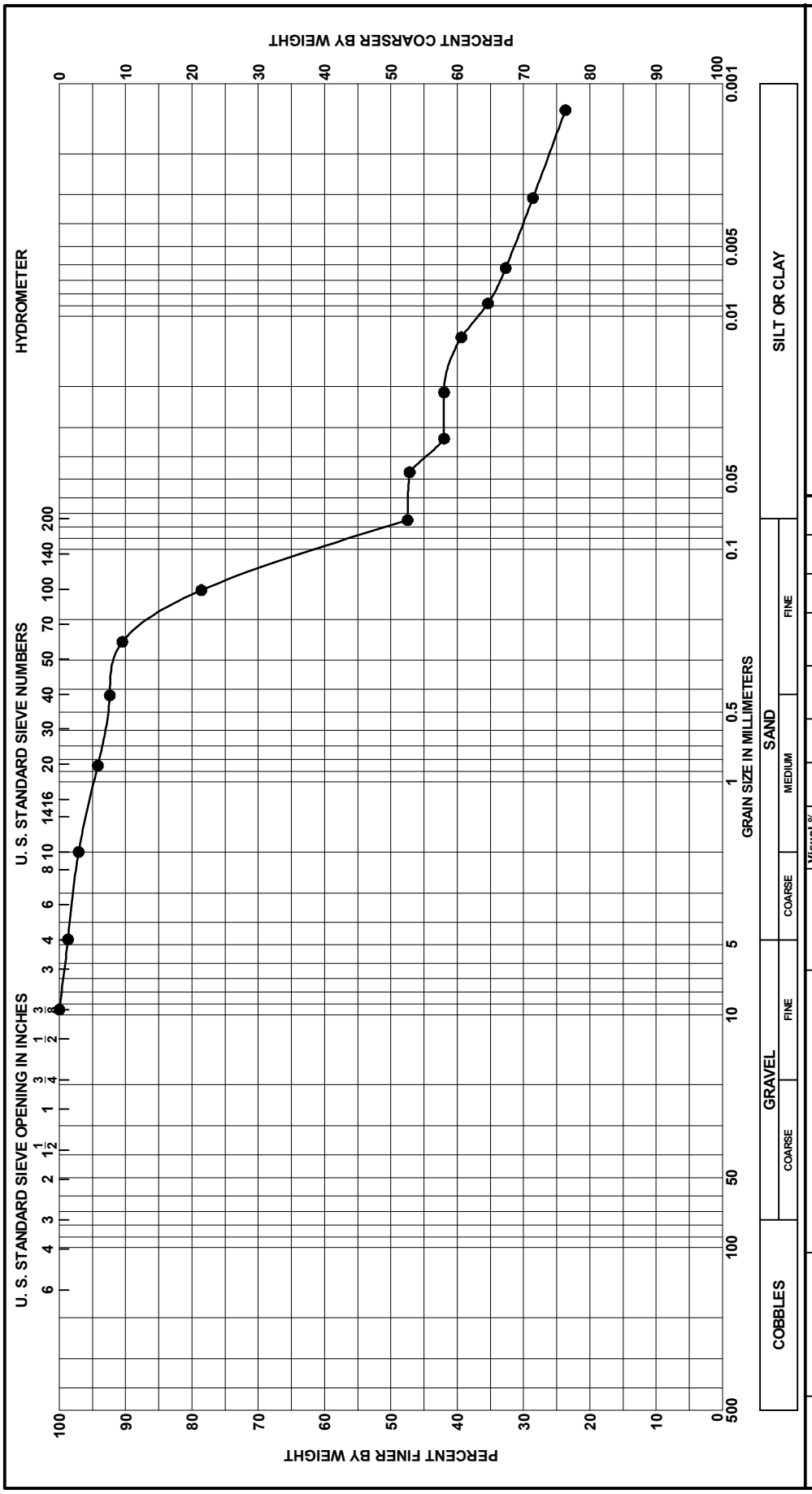


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 21	30.0 to 31.5 Ft.	SAND, poorly-graded, mostly	2.5Y 5/2								
		fine-grained sand-sized quartz, trace									
		silt, grayish brown (SP)									

GRADATION CURVES

PROJECT	Culvert IP-3 Rehabilitation
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD13-S291-CB-5
BORING ELEV.	23.3 Ft., NAVD88
DATE	1/16/2015

SAJ FORM 2087
JUN 02

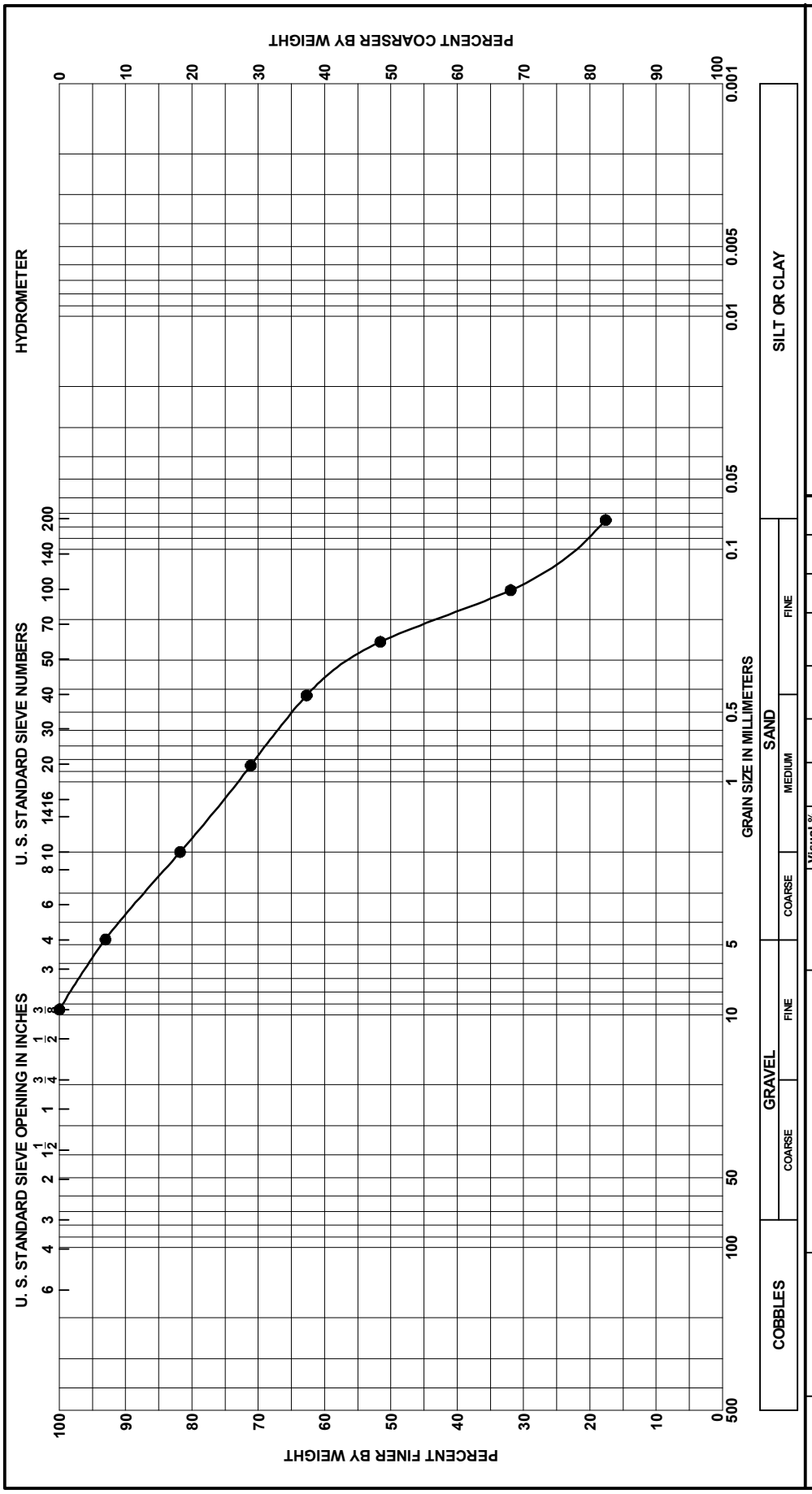


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	$\%CO_3$	G_s	Org %	w_n	LL	PL	PI
● 28	40.5 to 42.0 Ft.	SAND, clayey, some fine-grained sand-sized quartz, some clay, few medium-grained sand-sized shell, olive gray (SC)	5Y 4/2					40.7	44	16	28

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-5
BORING ELEV. 23.3 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

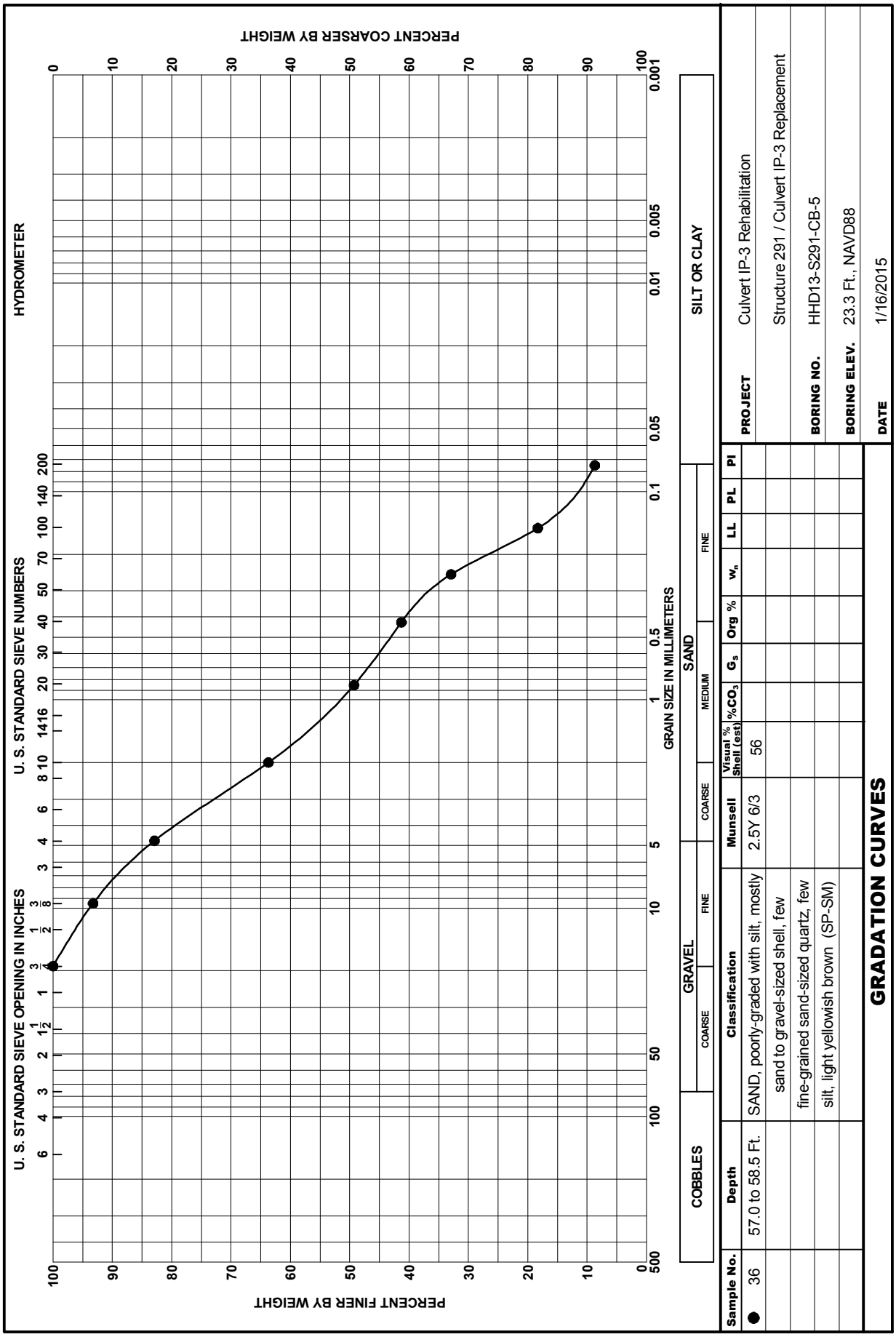


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 34	51.0 to 52.5 Ft.	SAND, silty, mostly fine to medium-grained sand-sized quartz, some medium to coarse-grained sand-sized shell, little silt, light olive gray (SM)	5Y 6/2					20.5			

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-5
BORING ELEV. 23.3 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 36	57.0 to 58.5 Ft.	SAND, poorly-graded with silt, mostly sand to gravel-sized shell, few fine-grained sand-sized quartz, few silt, light yellowish brown (SP-SM)	2.5Y 6/3	56							

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-5
BORING ELEV. 23.3 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

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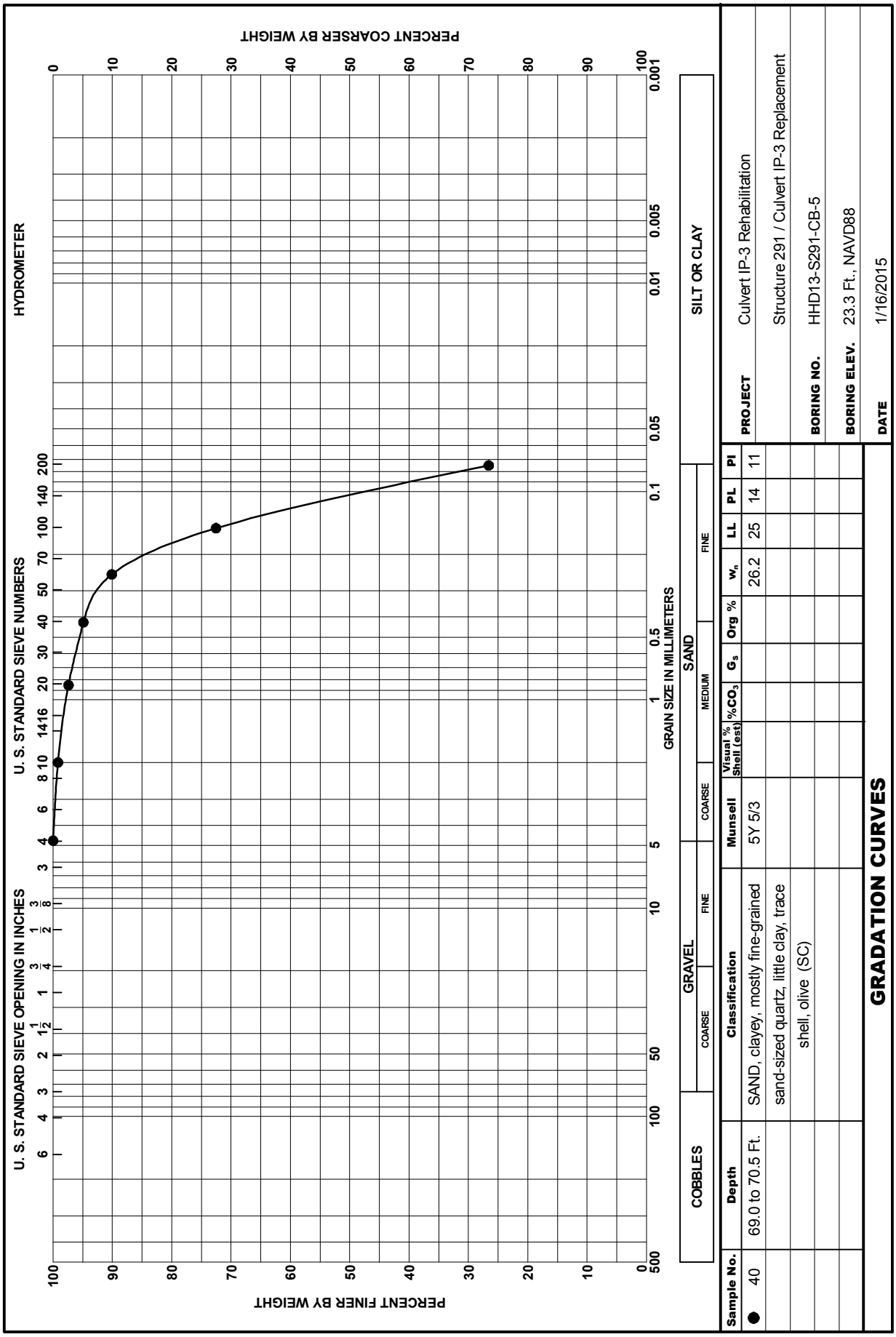
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 40	69.0 to 70.5 Ft.	SAND, clayey, mostly fine-grained	5Y 5/3					26.2	25	14	11
		sand-sized quartz, little clay, trace									
		shell, olive (SC)									

PROJECT Culvert IP-3 Rehabilitation
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD13-S291-CB-5
BORING ELEV. 23.3 Ft., NAVD88
DATE 1/16/2015

GRADATION CURVES

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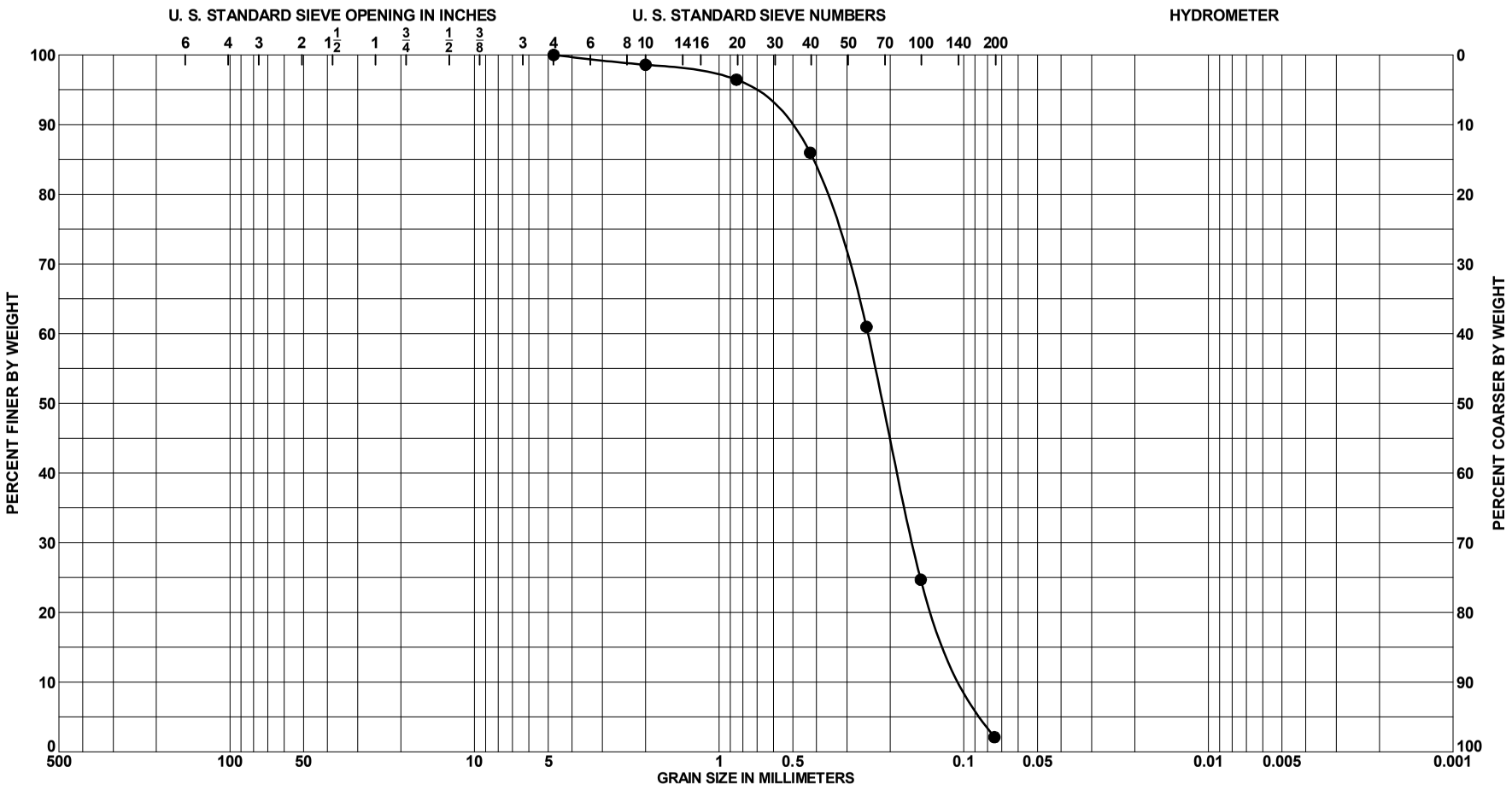
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 1	1.0 to 3.0 Ft.	SAND, poorly-graded, mostly fine-grained sand-sized quartz, few medium-grained sand-sized shell, trace silt, grayish brown (SP)	2.5Y 5/2								

GRADATION CURVES

PROJECT	Herbert Hoover Dike
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-SS-1
BORING ELEV.	Not Determined
DATE	5/12/2015

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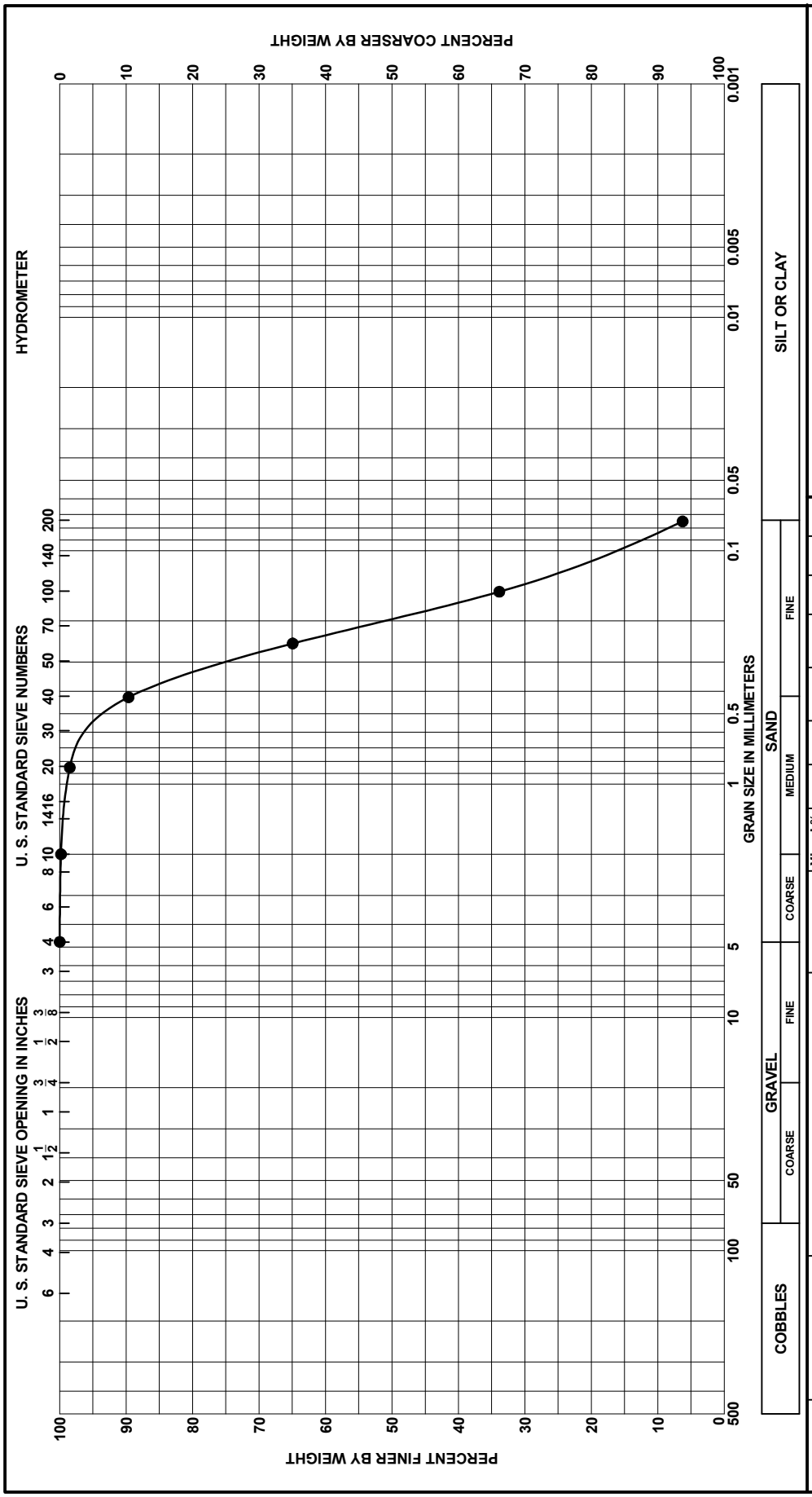
JUN 02

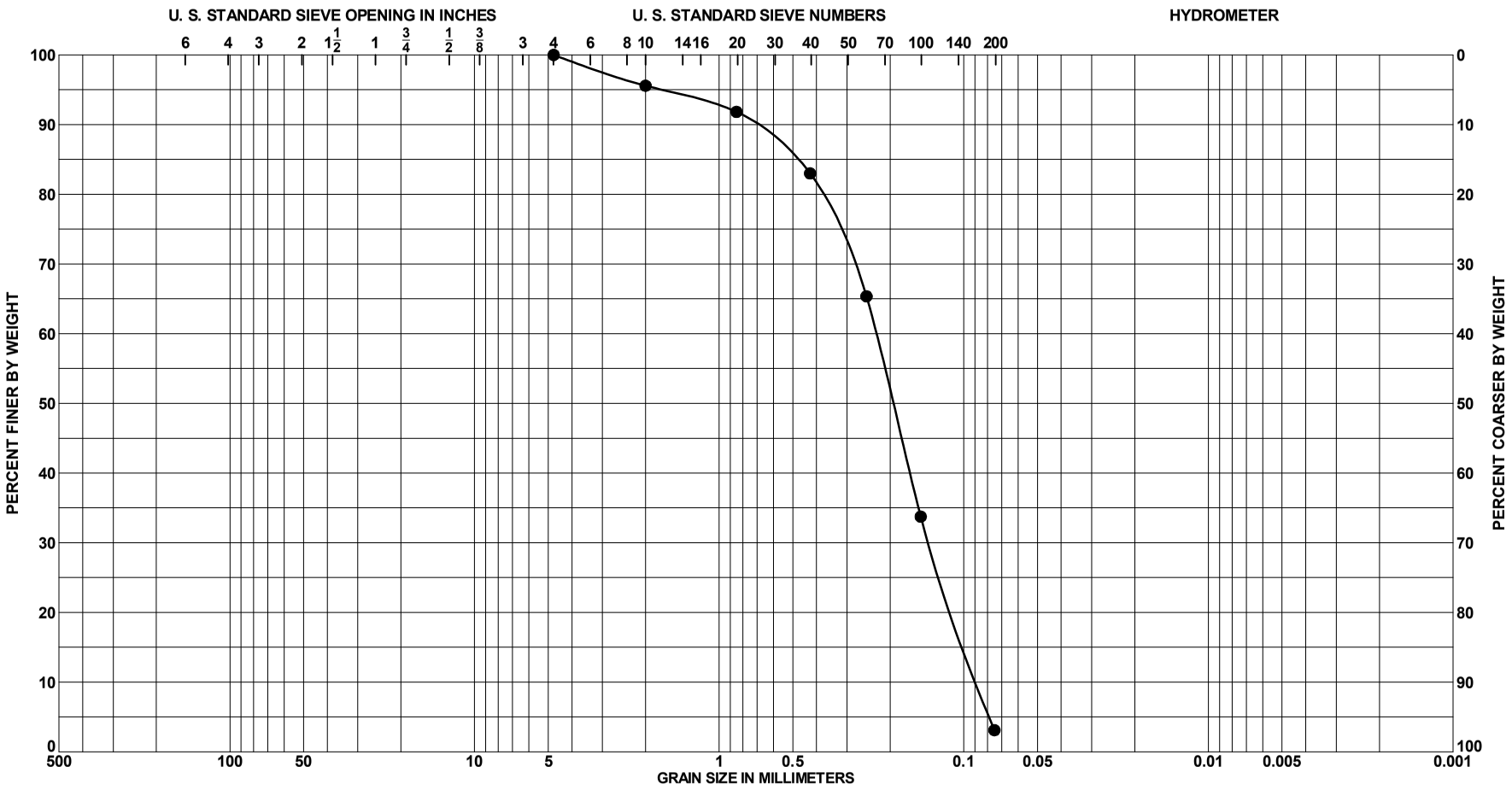


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 1	1.0 to 3.0 Ft.	SAND, poorly-graded with silt, mostly fine to medium-grained sand-sized quartz, few silt, very dark grayish brown (SP-SM)	2.5Y 3/2			2.82		1.7			

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-SS-2
BORING ELEV. Not Determined
DATE 5/12/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

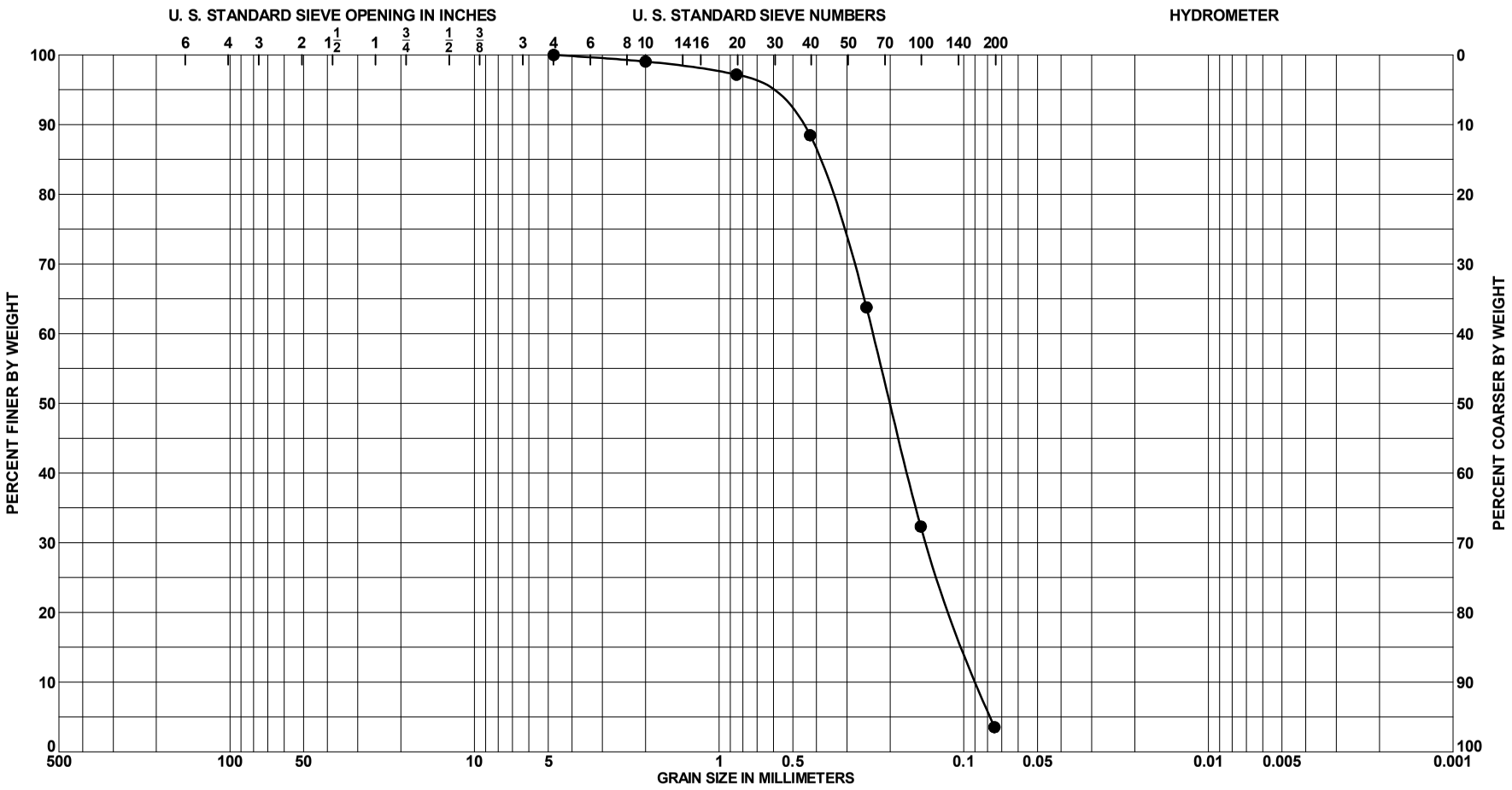


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 1	1.0 to 3.0 Ft.	SAND, poorly-graded, mostly fine to	2.5Y 5/2								
		medium-grained sand-sized quartz,									
		few medium-grained sand-sized									
		shell, trace silt, grayish brown (SP)									

GRADATION CURVES

PROJECT	Herbert Hoover Dike
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-SS-3
BORING ELEV.	Not Determined
DATE	5/12/2015

SAJ FORM 2087
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 1	1.0 to 3.0 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, trace silt, trace shell, light olive brown (SP)	2.5Y 5/4								

GRADATION CURVES

PROJECT	Herbert Hoover Dike
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-SS-4
BORING ELEV.	Not Determined
DATE	5/12/2015

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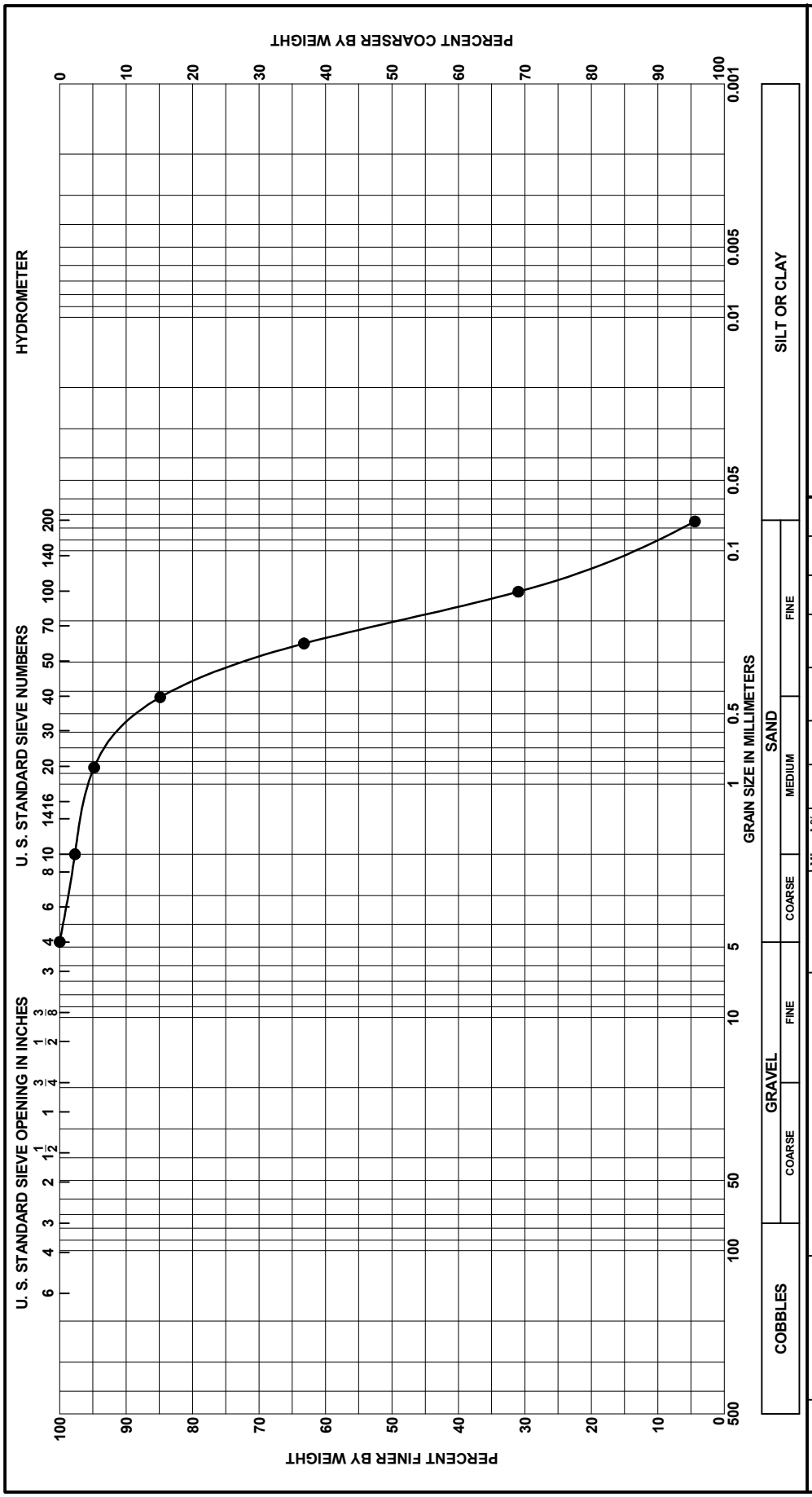

Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 1	1.0 to 3.0 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, few medium-grained sand-sized shell, trace silt, grayish brown (SP)	2.5Y 5/2								

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-SS-5
BORING ELEV. Not Determined
DATE 5/12/2015

GRADATION CURVES

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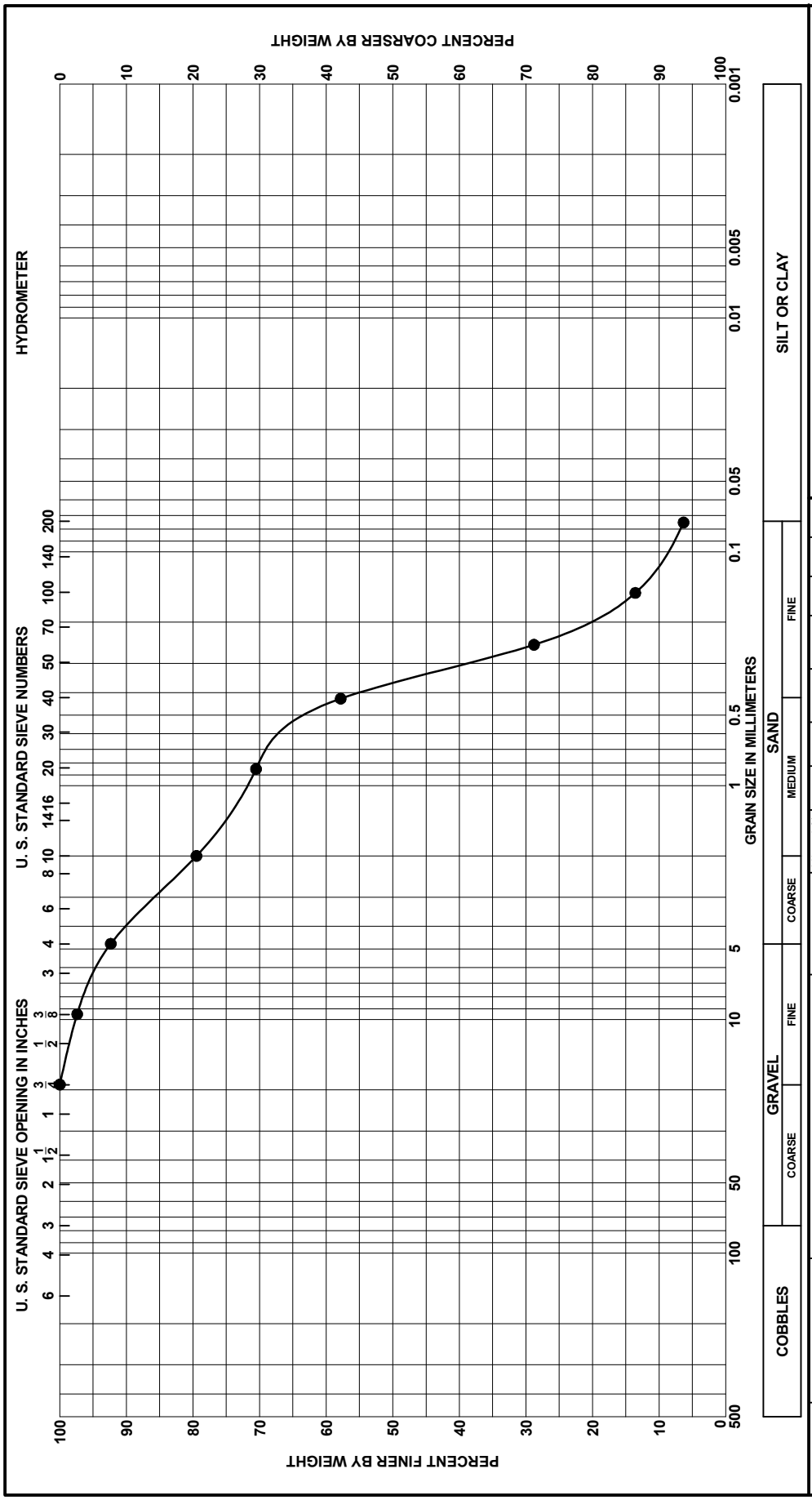

Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 9	12.0 to 13.5 Ft.	SAND, poorly-graded with silt, mostly fine to medium-grained sand-sized quartz, some sand to gravel-sized shell, few silt, gray (SP-SM)	2.5Y 6/1	36							

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-CB-1
BORING ELEV. 21.2 Ft., NAVD88
DATE 9/24/2015

GRADATION CURVES

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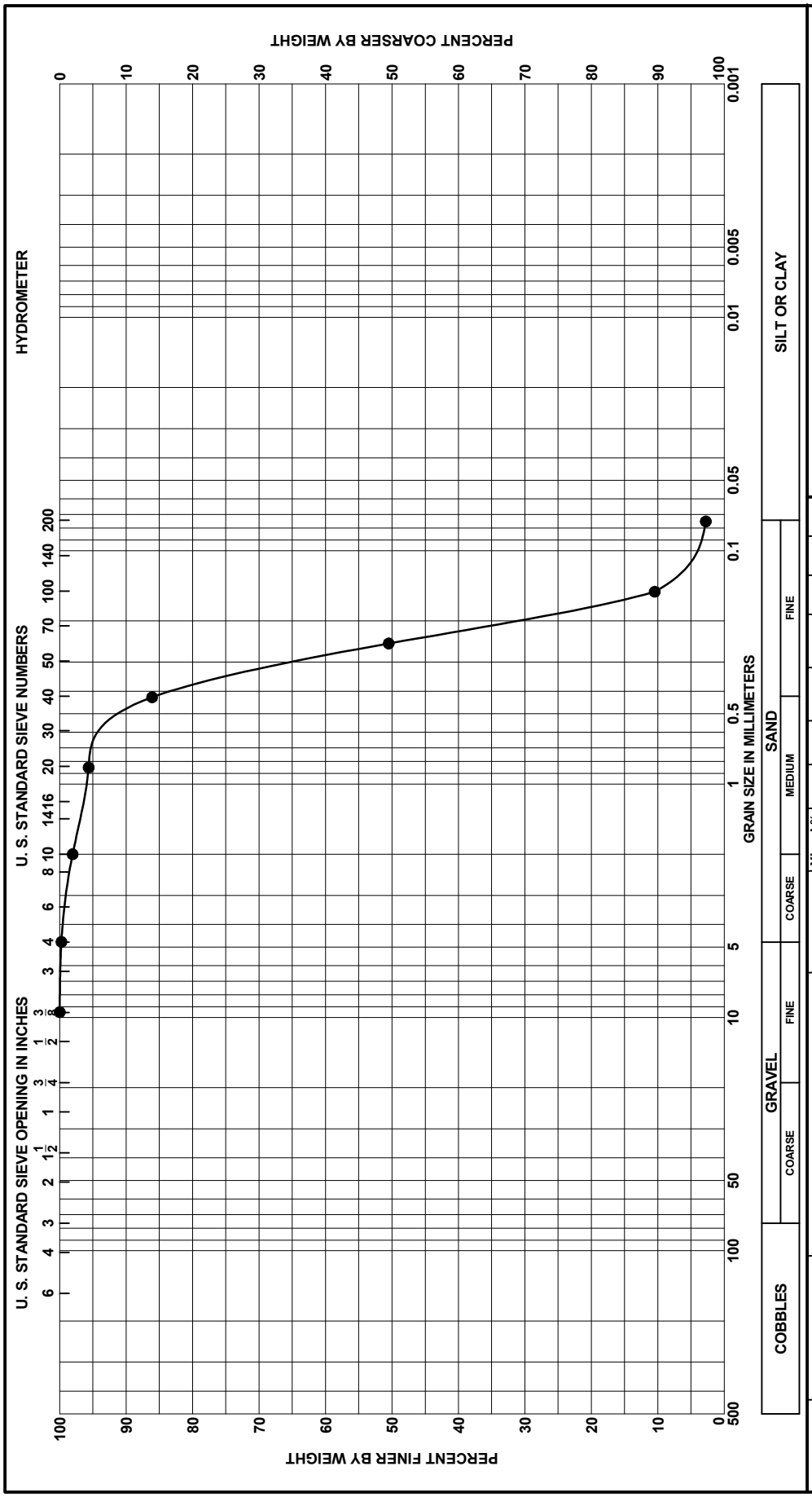

Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 15	21.0 to 22.5 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, little fine to medium-grained sand-sized shell, trace silt, gray (SP)	2.5Y 6/1								

GRADATION CURVES

PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-1
BORING ELEV.	21.2 Ft., NAVD88
DATE	9/24/2015

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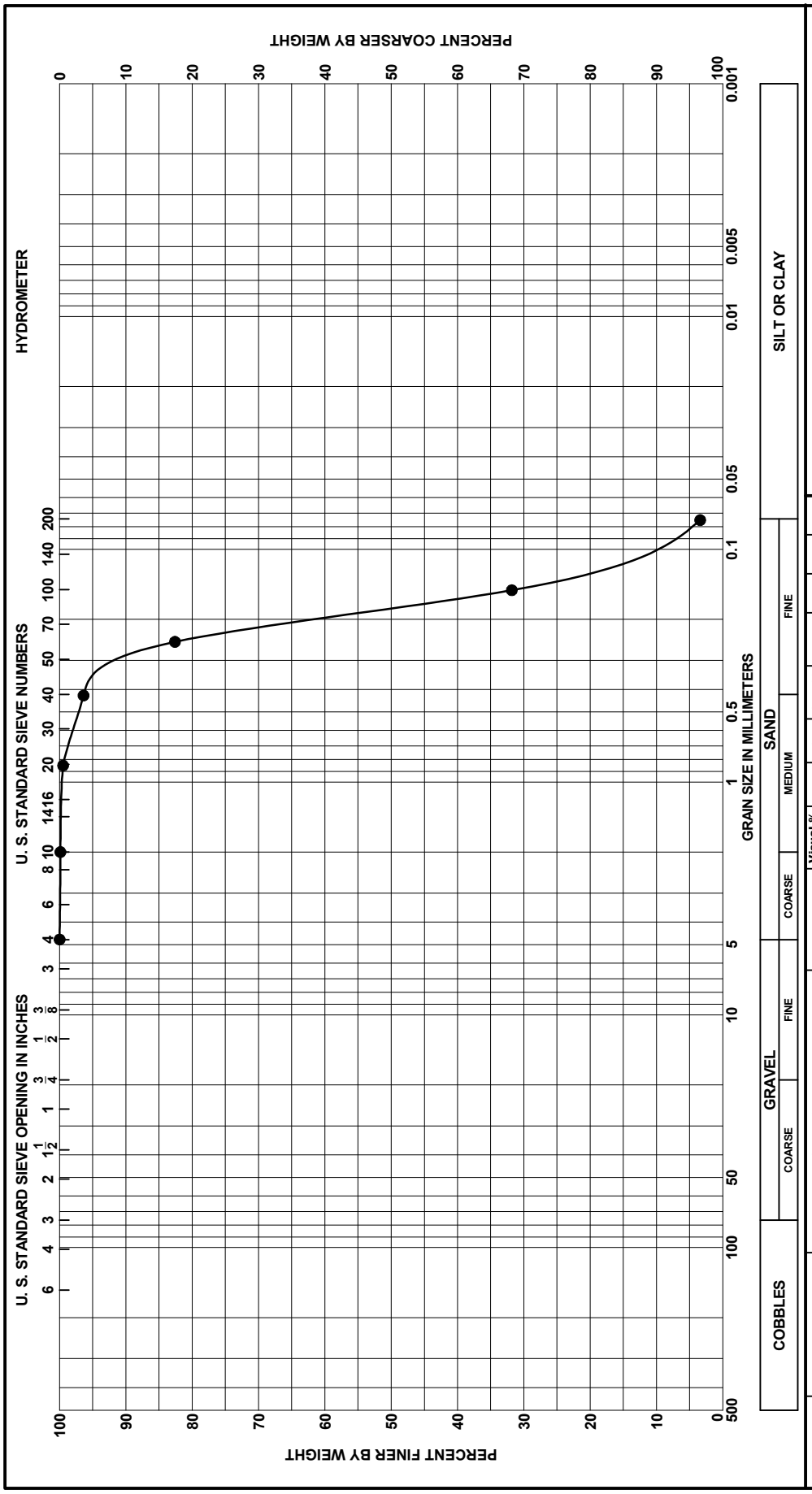
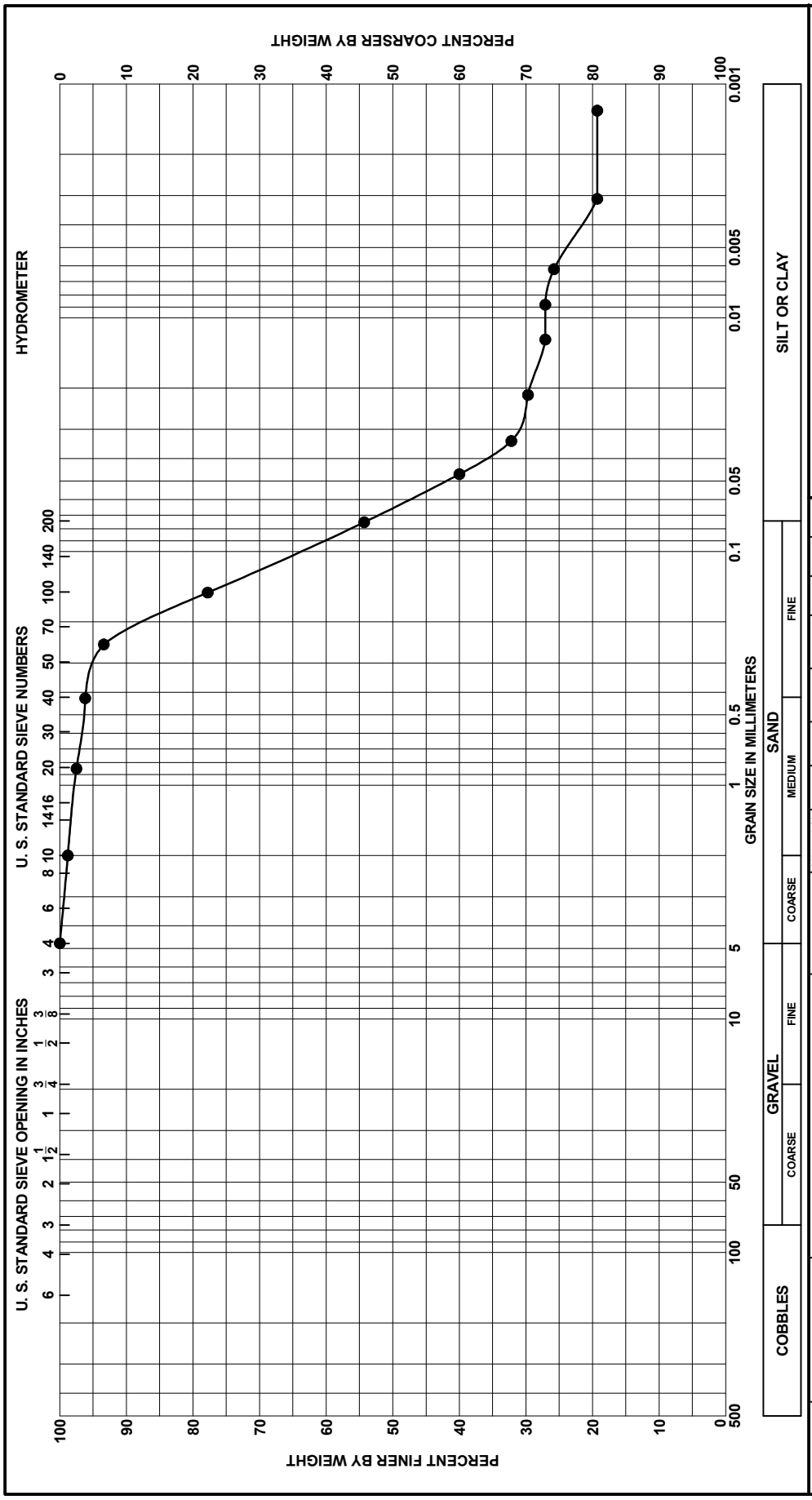


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 19	27.0 to 28.5 Ft.	SAND, poorly-graded, mostly fine-grained sand-sized quartz, trace silt, trace shell, gray (SP)	2.5Y 6/1								

GRADATION CURVES

PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-1
BORING ELEV.	21.2 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 27	39.0 to 40.5 Ft.	CLAY, lean, some fine-grained sand-sized quartz, few medium-grained sand-sized shell, dark gray (CL)	2.5Y 4/1					41.5	46	17	29

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-CB-1
BORING ELEV. 21.2 Ft., NAVD88
DATE 9/24/2015

GRADATION CURVES

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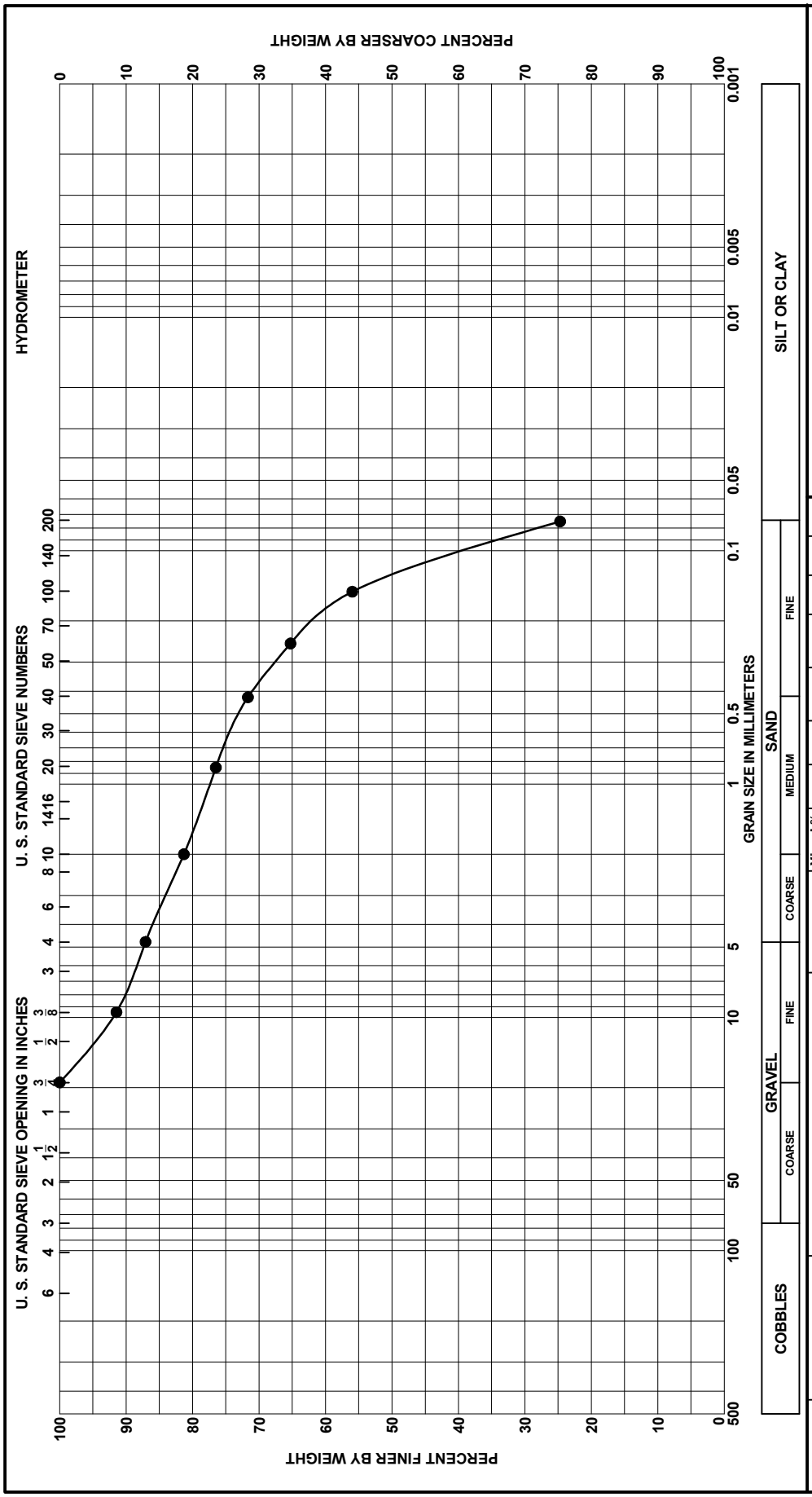
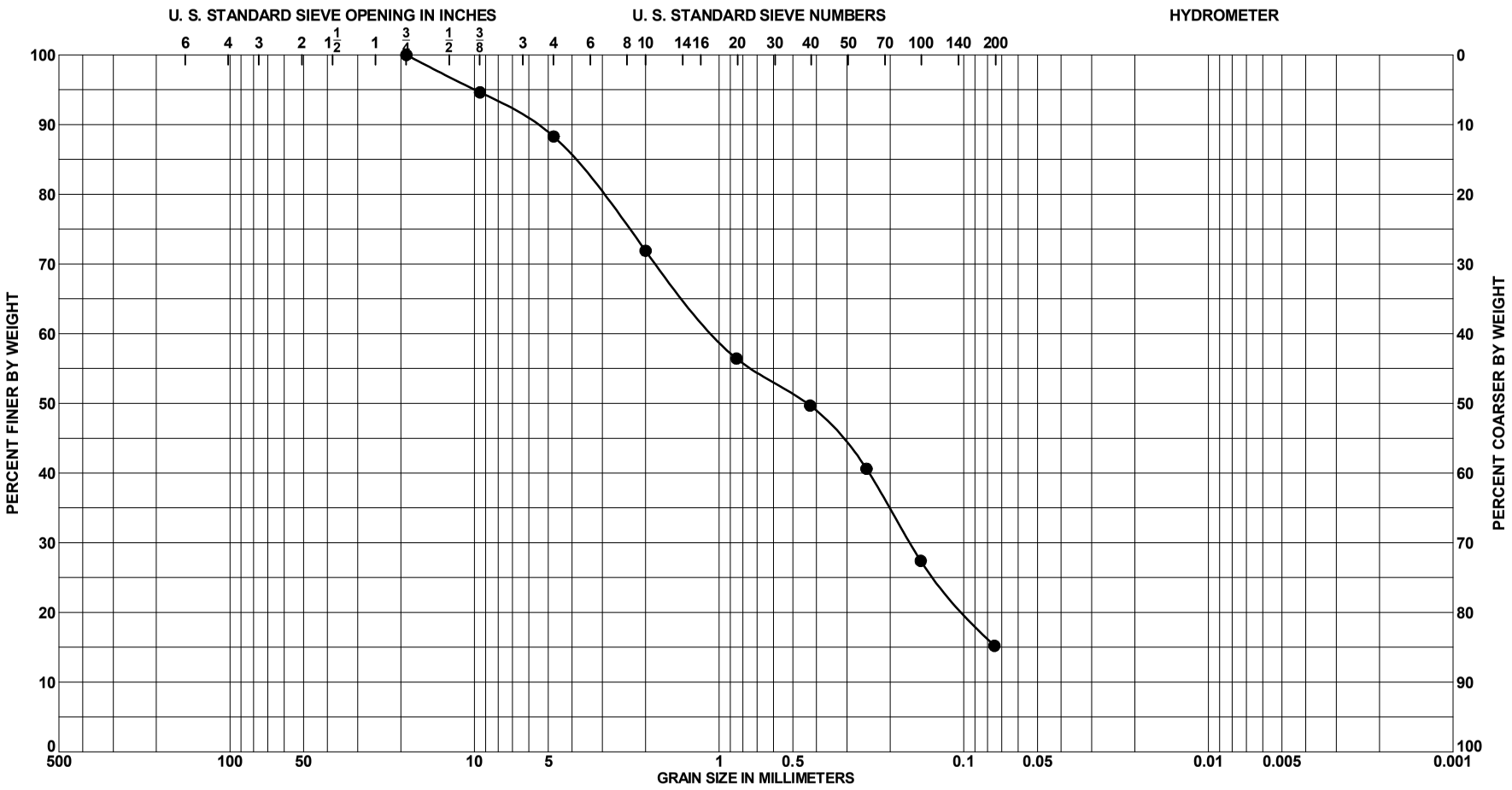


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 31	45.0 to 46.5 Ft.	SAND, silty, mostly fine-grained sand-sized quartz, little silt, little fine gravel-sized shell, few fine gravel-sized cemented shell, light gray (SM)	2.5Y 7/1								

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-CB-1
BORING ELEV. 21.2 Ft., NAVD88
DATE 9/24/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

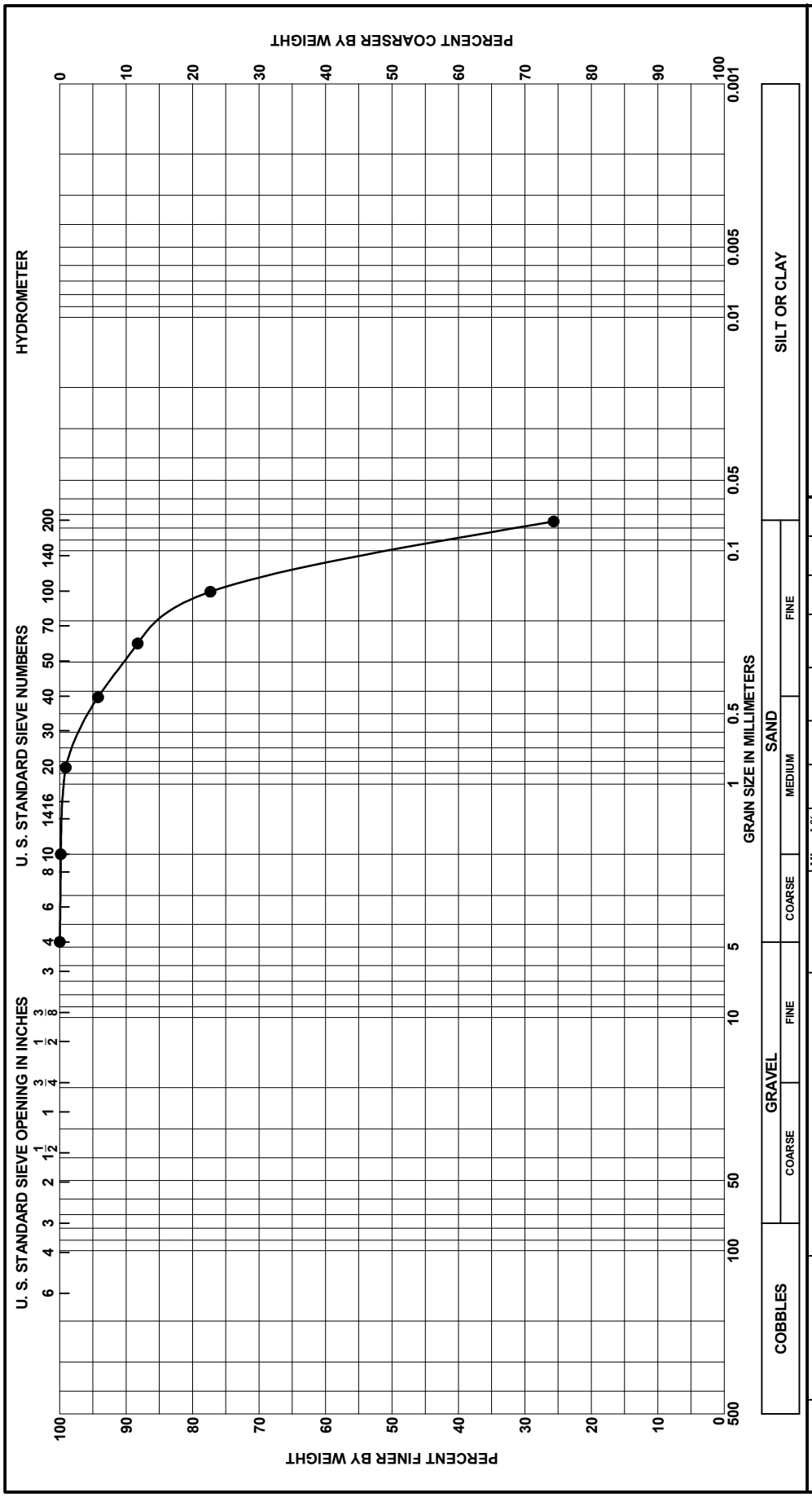


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 35	52.5 to 54.0 Ft.	SAND, silty, mostly sand to	2.5Y 7/1								
		gravel-sized shell, some									
		fine-grained sand-sized quartz, little									
		silt, light gray (SM)									

GRADATION CURVES

PROJECT	Herbert Hoover Dike
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-1
BORING ELEV.	21.2 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02

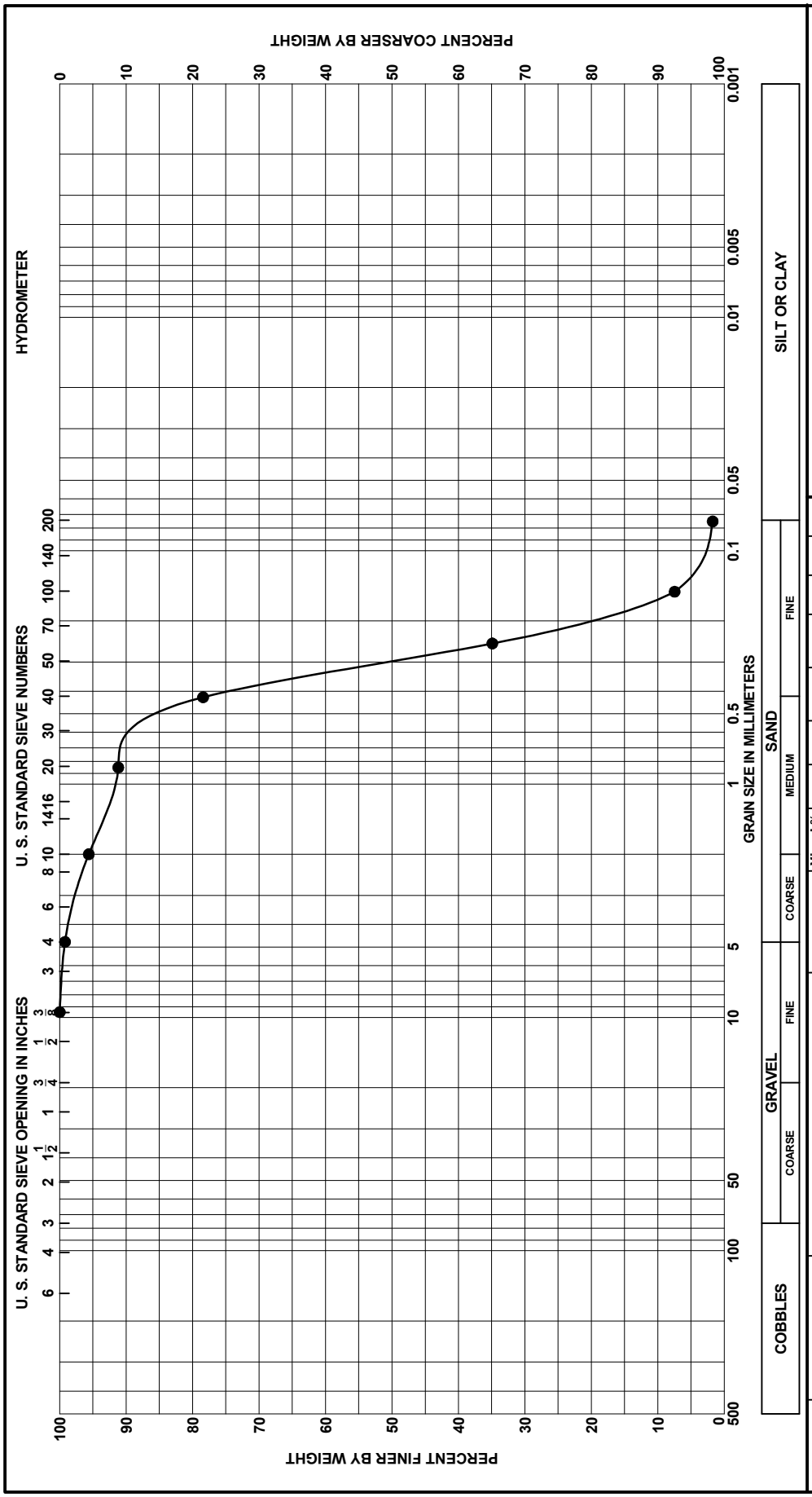


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 39	64.5 to 66.0 Ft.	SAND, silty, mostly fine-grained sand-sized quartz, little silt, few medium-grained sand-sized shell, dark gray (SM)	2.5Y 4/1					27.3	27	23	4

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-CB-1
BORING ELEV. 21.2 Ft., NAVD88
DATE 9/24/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

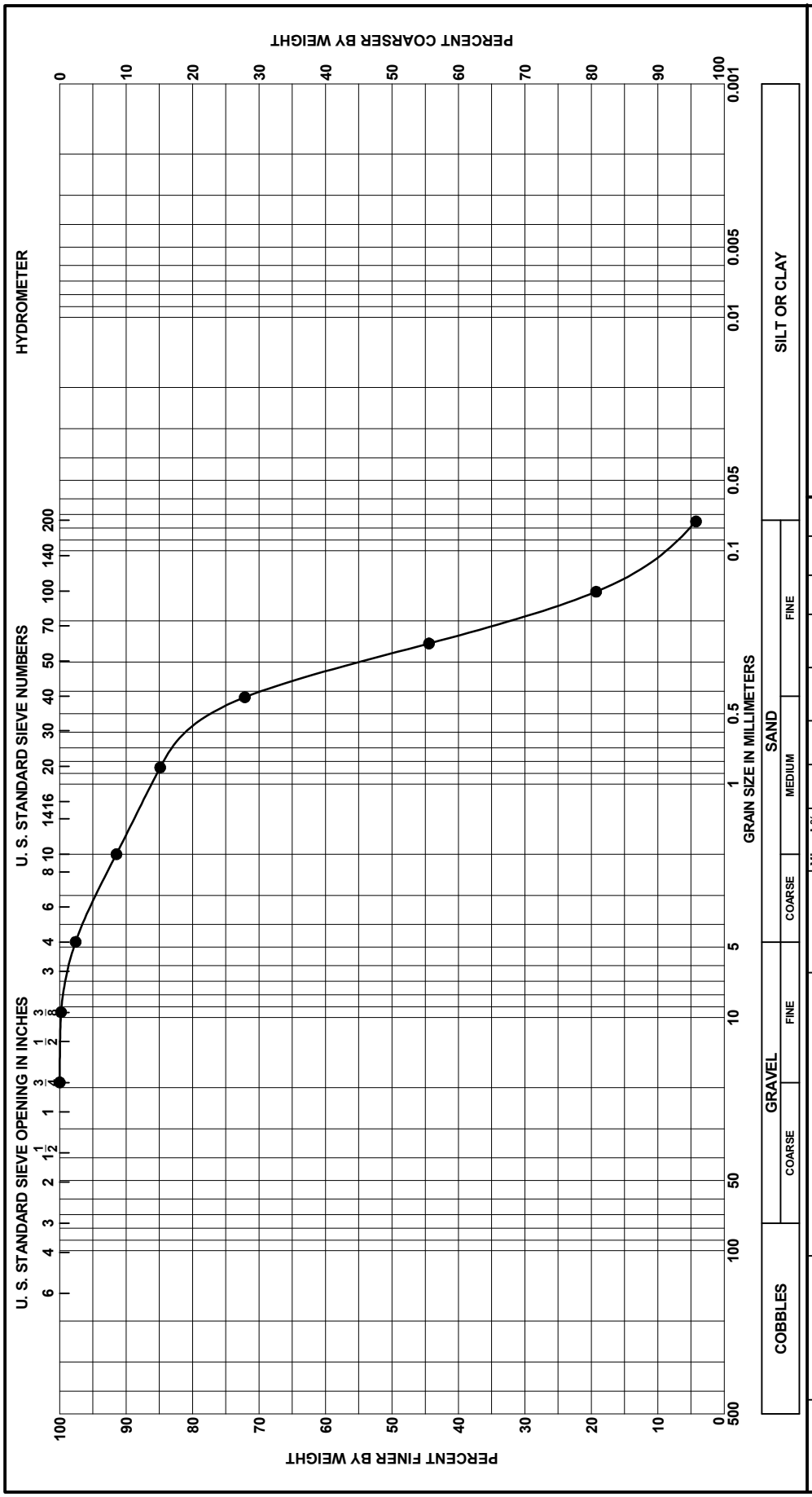


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 3	3.0 to 4.5 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, some fine to medium-grained sand-sized shell, trace silt, light brown (SP)	7.5YR 6/3								

GRADATION CURVES

PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-2
BORING ELEV.	32.0 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02

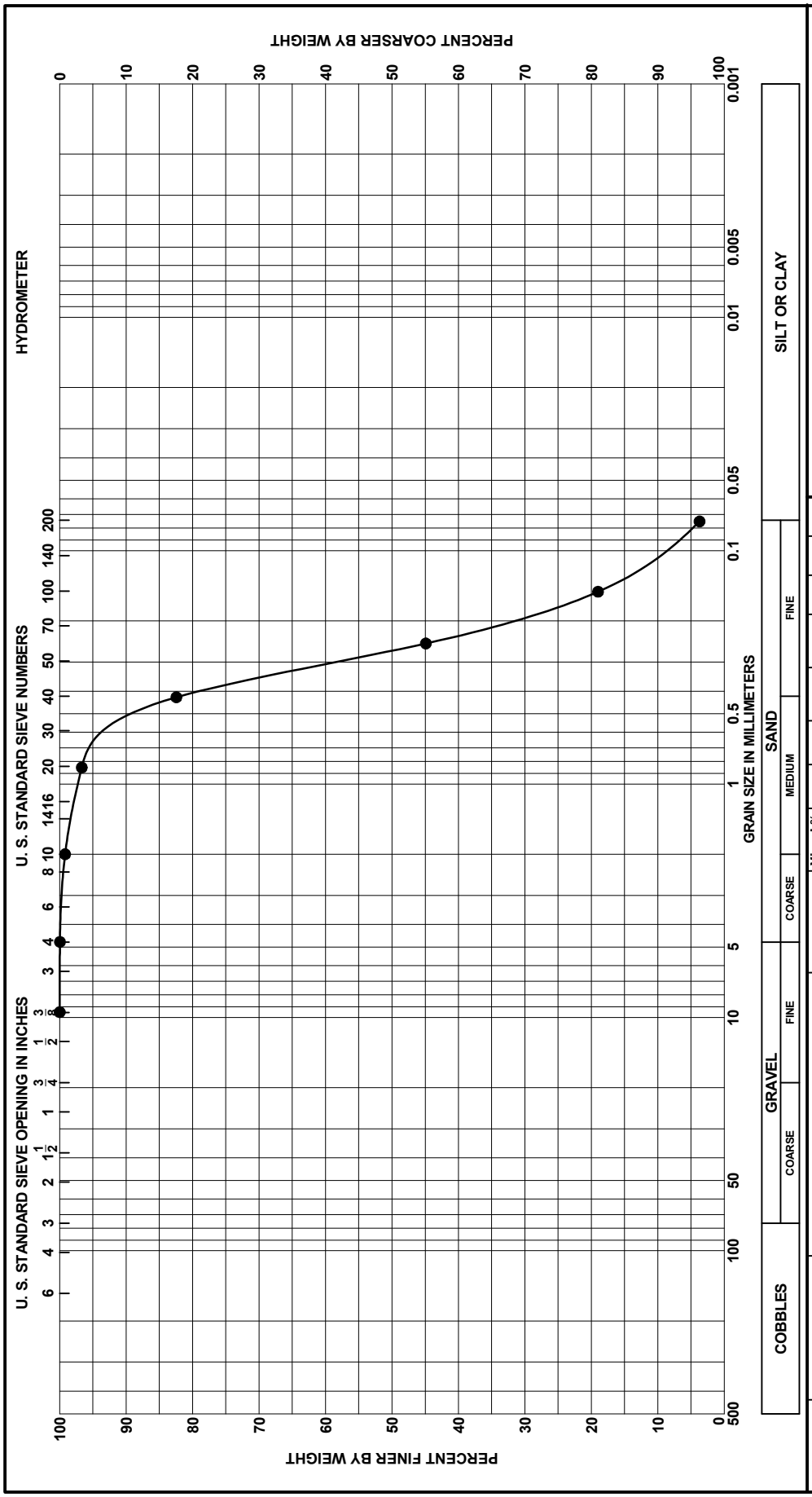


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 7	9.0 to 10.5 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, some fine to coarse-grained sand-sized shell, trace silt, light brown (SP)	7.5YR 6/3								

GRADATION CURVES

PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-2
BORING ELEV.	32.0 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02

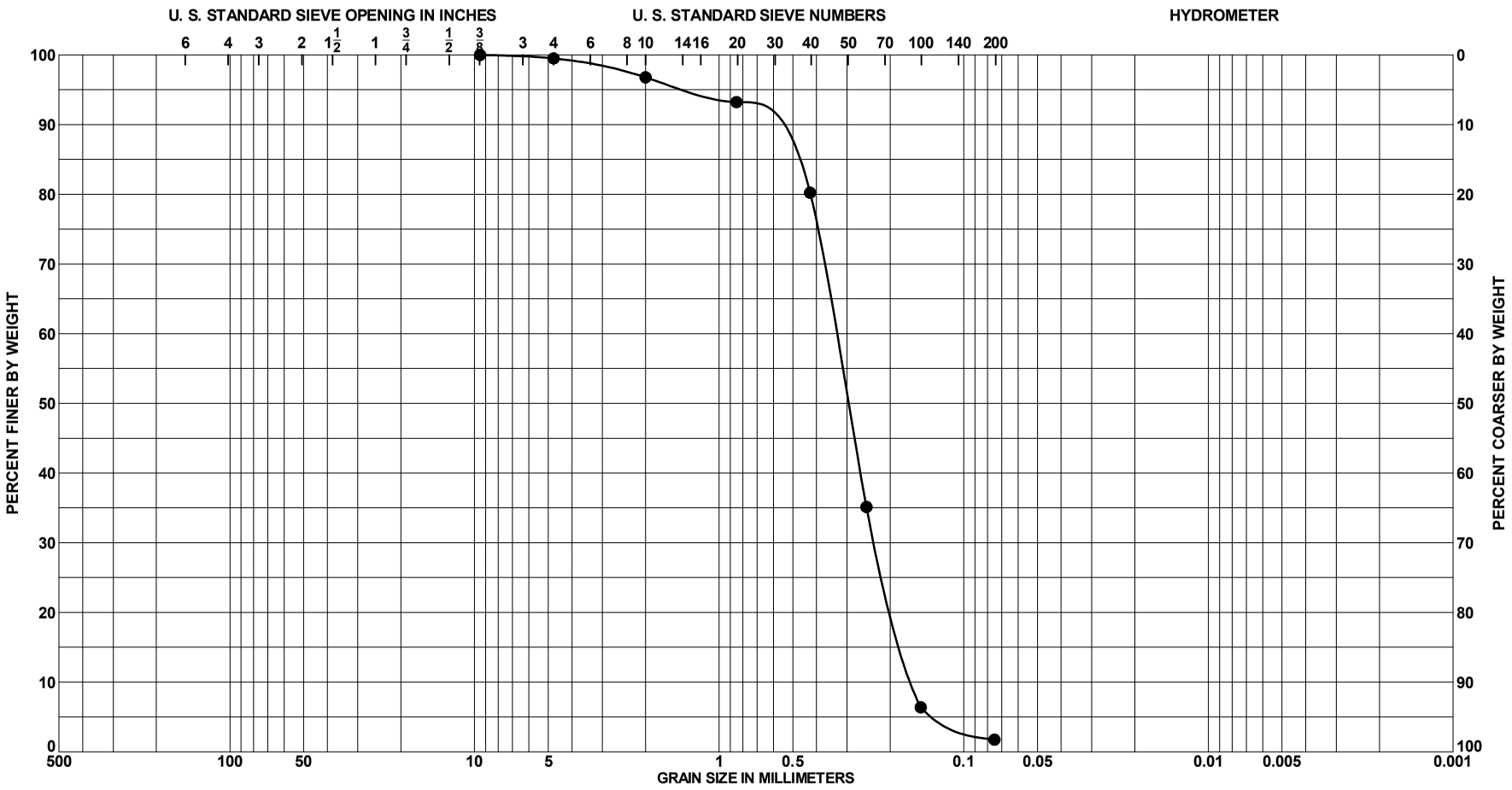


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 15	21.0 to 22.5 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, few medium-grained sand-sized shell, trace silt, light brown (SP)	7.5YR 6/3								

GRADATION CURVES

PROJECT	Herbert Hoover Dike Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-2
BORING ELEV.	32.0 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02

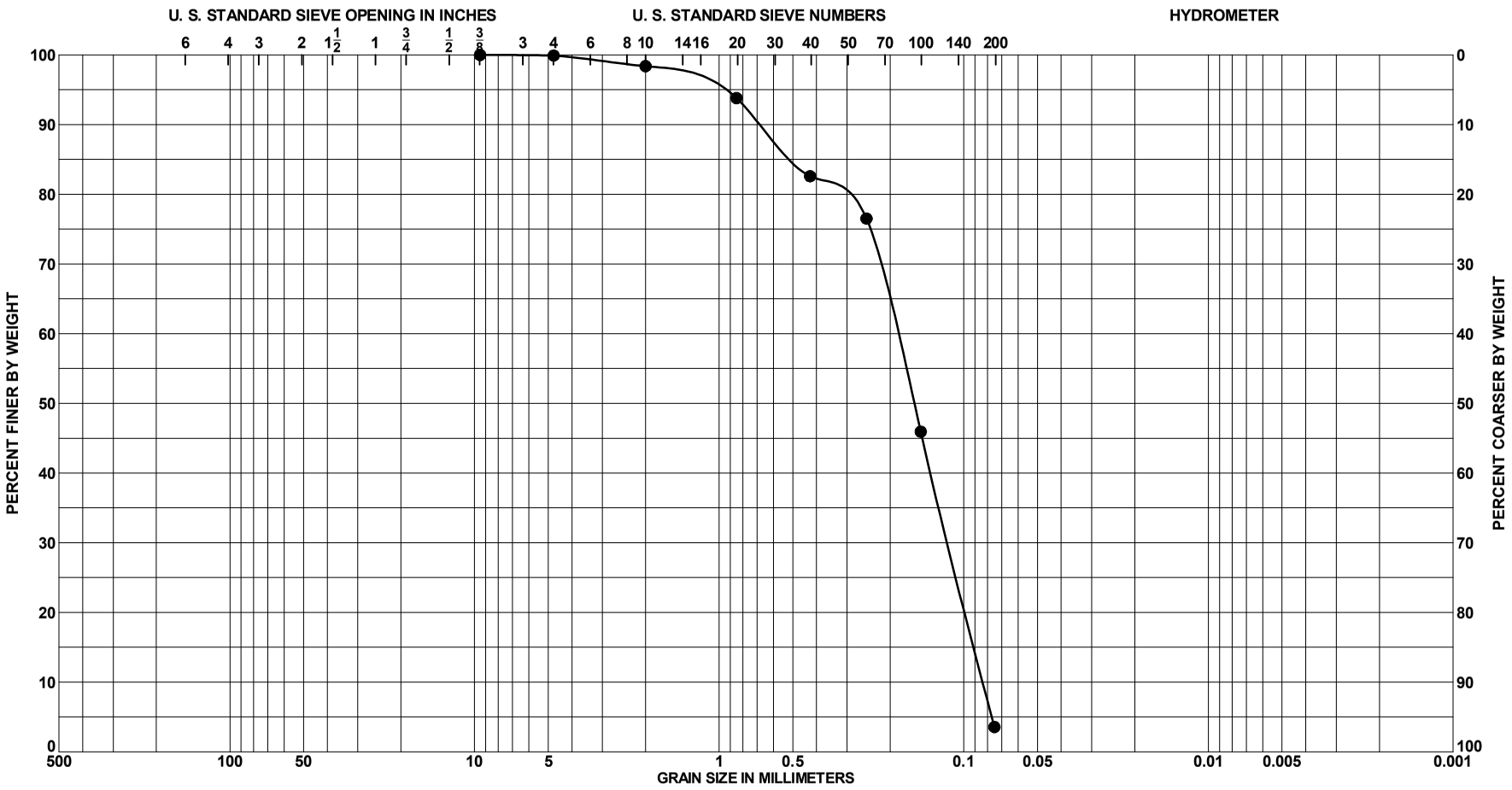


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 22	31.5 to 33.0 Ft.	SAND, poorly-graded, mostly fine to	2.5Y 7/1			2.65					
		medium-grained sand-sized quartz,									
		few medium-grained sand-sized									
		shell, trace silt, light gray (SP)									

GRADATION CURVES

PROJECT	Herbert Hoover Dike
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-2
BORING ELEV.	32.0 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02

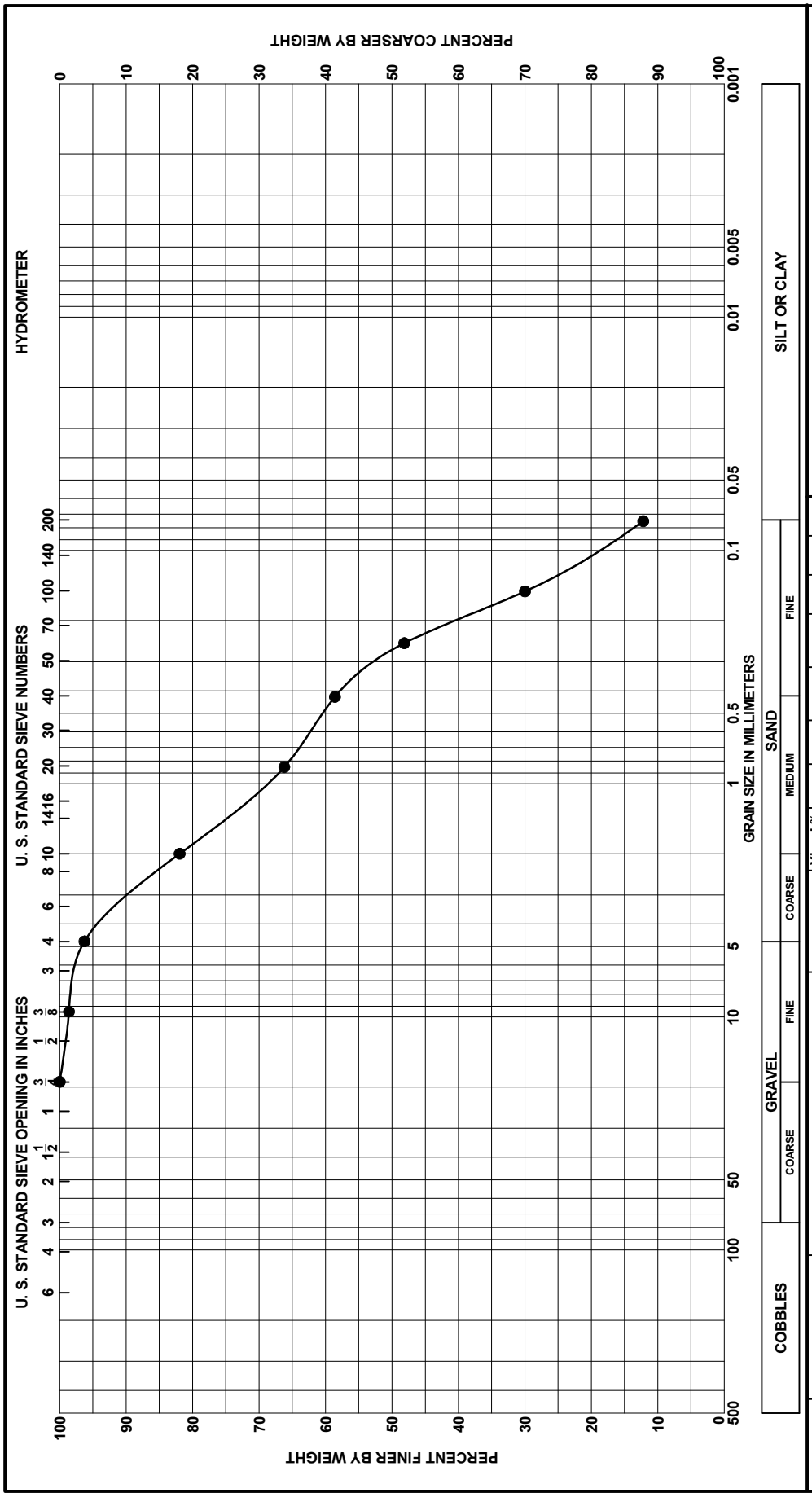


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 32	46.5 to 48.0 Ft.	SAND, poorly-graded, mostly fine to	2.5Y 6/1								
		medium-grained sand-sized quartz,									
		little medium-grained sand-sized									
		shell, trace silt, gray (SP)									

GRADATION CURVES

PROJECT	Herbert Hoover Dike
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-2
BORING ELEV.	32.0 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02

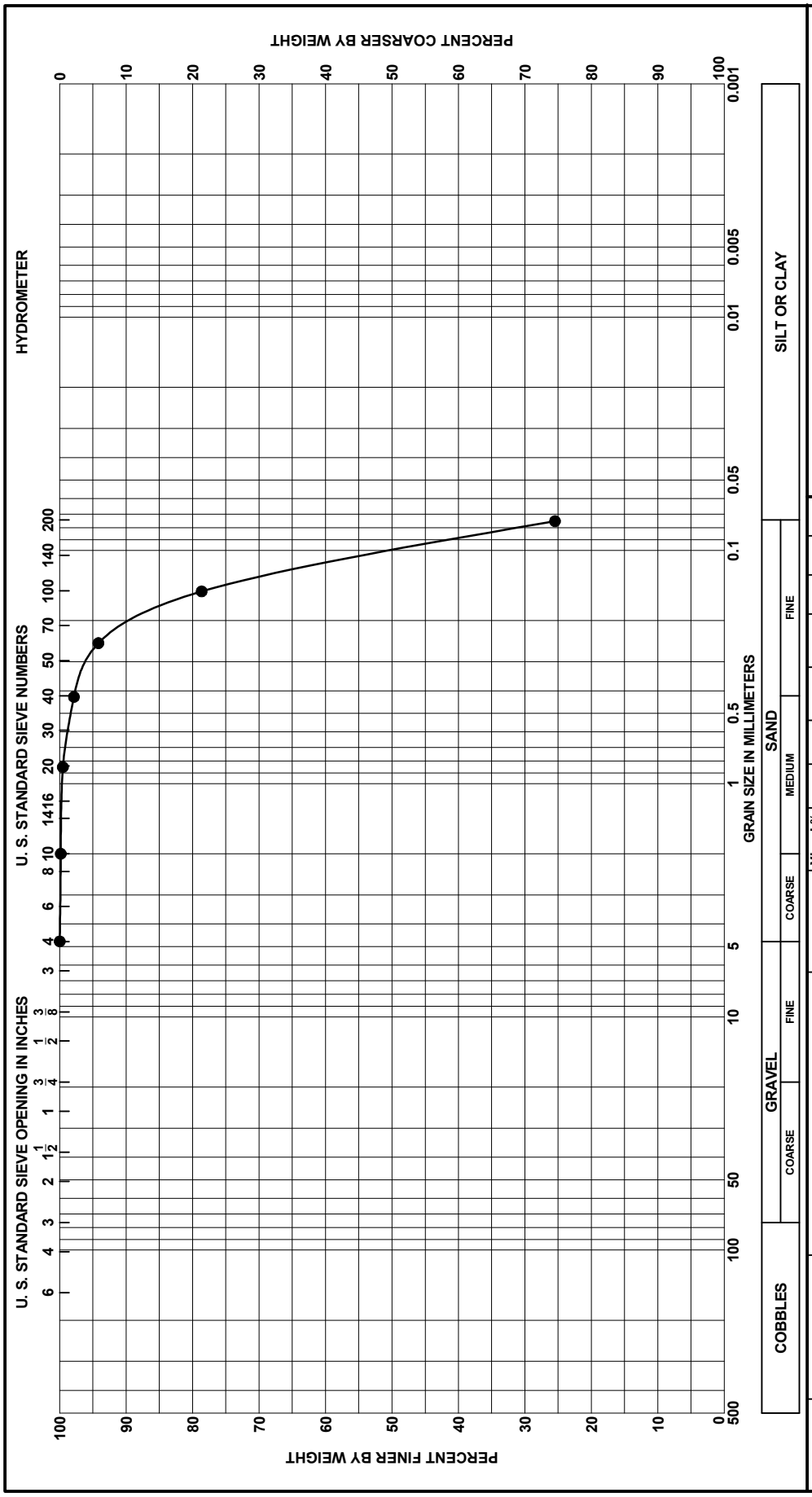


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 39	64.5 to 66.0 Ft.	SAND, silty, some fine-grained sand-sized quartz, some medium to coarse-grained sand-sized shell, little silt, light gray (SM)	2.5Y 7/1								

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-CB-2
BORING ELEV. 32.0 Ft., NAVD88
DATE 9/24/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 42	73.5 to 75.0 Ft.	SAND, silty, mostly fine-grained sand-sized quartz, little silt, trace shell, gray (SM)	2.5Y 6/1					26.5	20	18	2

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-CB-2
BORING ELEV. 32.0 Ft., NAVD88
DATE 9/24/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

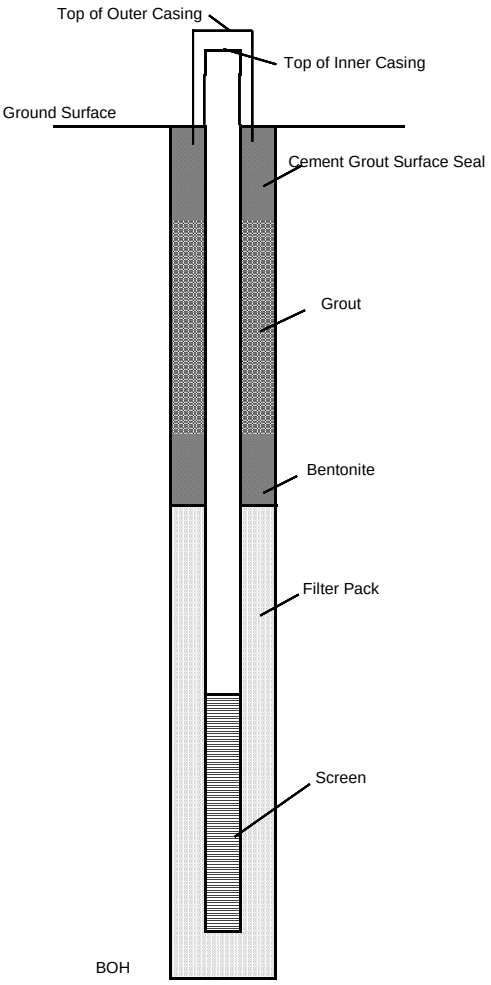
Herbert Hoover Dike Indian Prairie Canal Relocation Project
August 2015

Well ID	Slug In Test 1	Slug Out Test 1	Slug In Test 2	Slug Out Test 2	Slug In Test 3	Slug Out Test 3	Geometric Mean	Geo Mean Std Dev %	Geometric Mean Slug In Tests	Geo Mean Slug In Std Dev %	Geometric Mean Slug Out Tests	Geo Mean Slug Out Std Dev %
S290												
S290-2	2.0E-02	2.2E-02	2.0E-02	2.0E-02	1.9E-02	2.0E-02	**2.0E-02**	3.8	2.0E-02	2.9	2.1E-02	3.7
S290-4	2.2E-02	2.4E-02	2.4E-02	2.4E-02	2.3E-02	2.4E-02	**2.3E-02**	4.9	2.3E-02	5.8	2.4E-02	1.2
S291												
S291-2	2.2E-02	2.9E-02	2.3E-02	3.1E-02	2.1E-02	3.2E-02	**2.6E-02**	18.9	2.2E-02	4.7	3.0E-02	5.4
S291-4	2.1E-02	3.1E-02	2.0E-02	2.9E-02	1.9E-02	2.7E-02	**2.4E-02**	20.9	2.0E-02	6.0	2.9E-02	6.9

Notes:
All values are K presented in cm/sec.

AS BUILT MONITORING WELL RECORD

WELL NAME: HHD15-S291-MW-2	**LOCATION: STA.:**		**DRILLER: JOE BOWERMAN**
PROJECT: HHD INDIAN PRAIRIE CANAL	**SURFACE ELEVATION:**	**31.98 FEET**	**DEPTH TO GW (FT)*: 20.63**
DATE OF WELL COMPLETION: 8/11/15	**TOP OF PVC RISER (EL):**	**35.08 FEET**	**DRILLING METHOD: H.S.A.**
DATE DEVELOPMENT COMPLETED: 8/11/15	**TOP OF OUTER CASING:**	**N/A**	**DEVELOPMENT METHOD:**
INSPECTOR: JOHN MARKOV P.G.	**DATUMS:**	**NAD FL-E 83, NAVD-88**	**OVERPUMPING**



COORDINATES:	X=654784, Y=1002243"
TOP OF RISER ABOVE GROUND:	3.1 FEET
TOP OF GROUT:	N/A
I.D.OF RISER PIPE:	2.0 INCH
TYPE OF RISER PIPE:	SCHD 40
TYPE OF GROUT:	None
DEPTH TO TOP OF SEAL:	31.4 FEET
TYPE OF SEAL:	PELPLUG 3/8 INCH TR 30
DEPTH TO TOP OF FILTER PACK:	34.9 FEET
TYPE OF FILTER PACK:	20/30 SILICA SAND
DEPTH TO TOP OF SCREEN:	36.8 FEET
TYPE OF SCREEN:	SCHD 40 PVC
SLOT SIZE AND LENGTH:	0.010 INCH, 5 FEET
I.D. OF SCREEN:	2.0 INCH
DEPTH TO BOTTOM OF SCREEN:	41.8 FEET **
BOREHOLE DIAMETER:	8.25 INCH
BOTTOM OF HOLE:	42.2 FEET

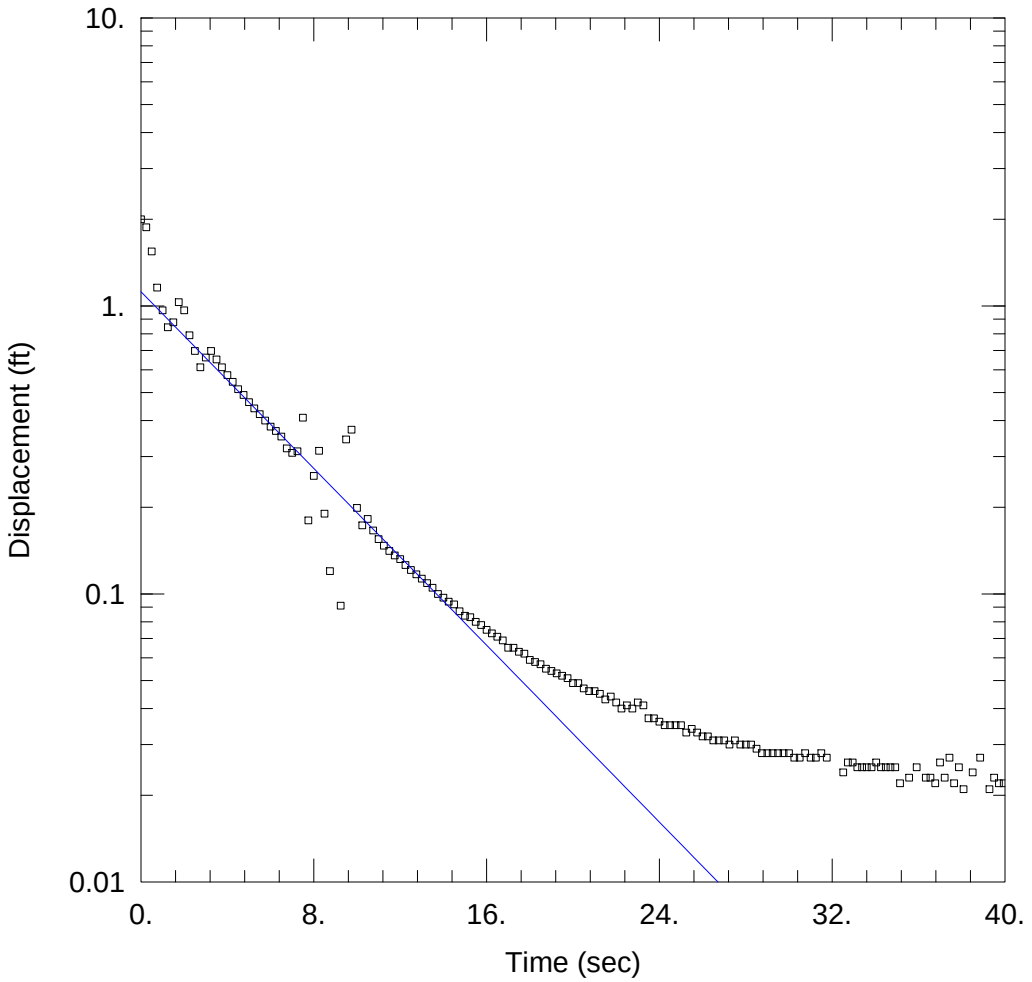
** Screening intervals based on estimated elevation data provided by SAJ.

* Depth to groundwater measured relative to ground surface

Wells were temporary and abandoned with grout after slug testing.
Results of slug tests are found on separate forms.

USACE - Jacksonville District

PROJECT:	**BORING NO.: Companion to**
HHD INDIAN PRAIRIE CANAL RELOCATION, Culvert IP-3	**HHD15-S291-CB-2**



S291-2_SLUGIN1

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-2\S291-2_slugin1.aqt
Date: 08/31/15 Time: 07:31:01

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-2
Test Date: 8/21/2015

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

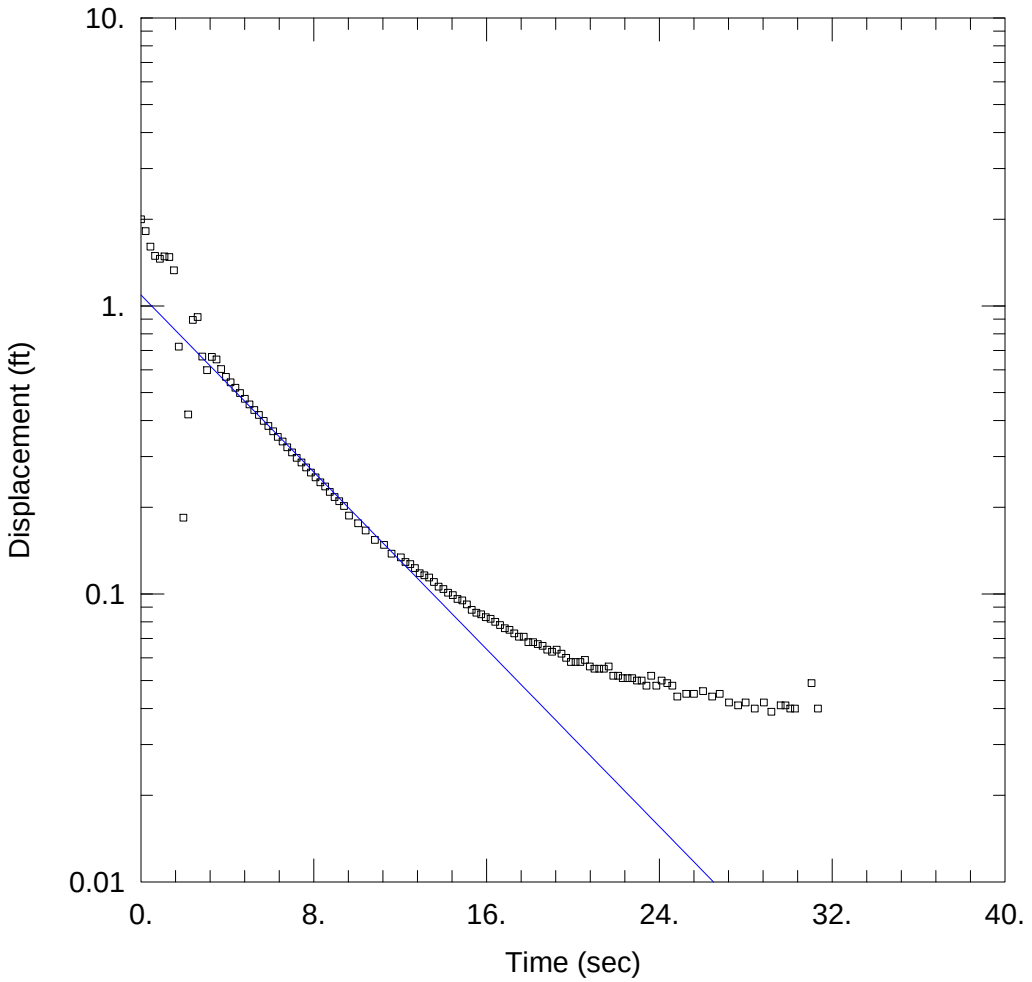
WELL DATA (S291-2_slugin1)

Initial Displacement: 2. ft
Total Well Penetration Depth: 42.2 ft
Casing Radius: 0.0853 ft
Static Water Column Height: 21.05 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.02245 cm/sec y0 = 1.12 ft



S291-2_SLUGIN2

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-2\S291-2_slugin2.aqt
Date: 08/28/15 Time: 13:44:36

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-2
Test Date: 8/21/2015

AQUIFER DATA

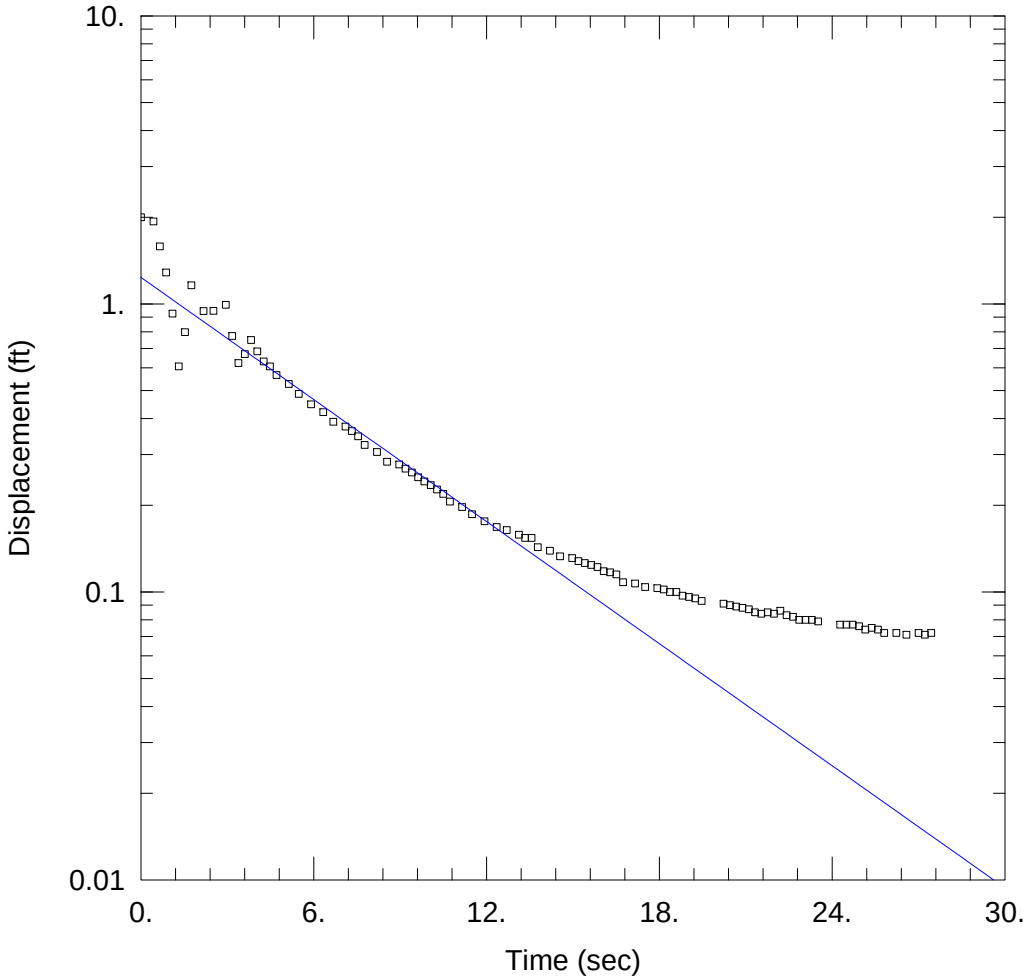
Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-2_slugin2)

Initial Displacement: 2. ft
Total Well Penetration Depth: 42.2 ft
Casing Radius: 0.0853 ft
Static Water Column Height: 21.05 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.0225 cm/sec
y0 = 1.091 ft



S291-2_SLUGIN3

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-2\S291-2_slugin3.aqt
Date: 08/28/15 Time: 13:43:53

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-2
Test Date: 8/21/2015

AQUIFER DATA

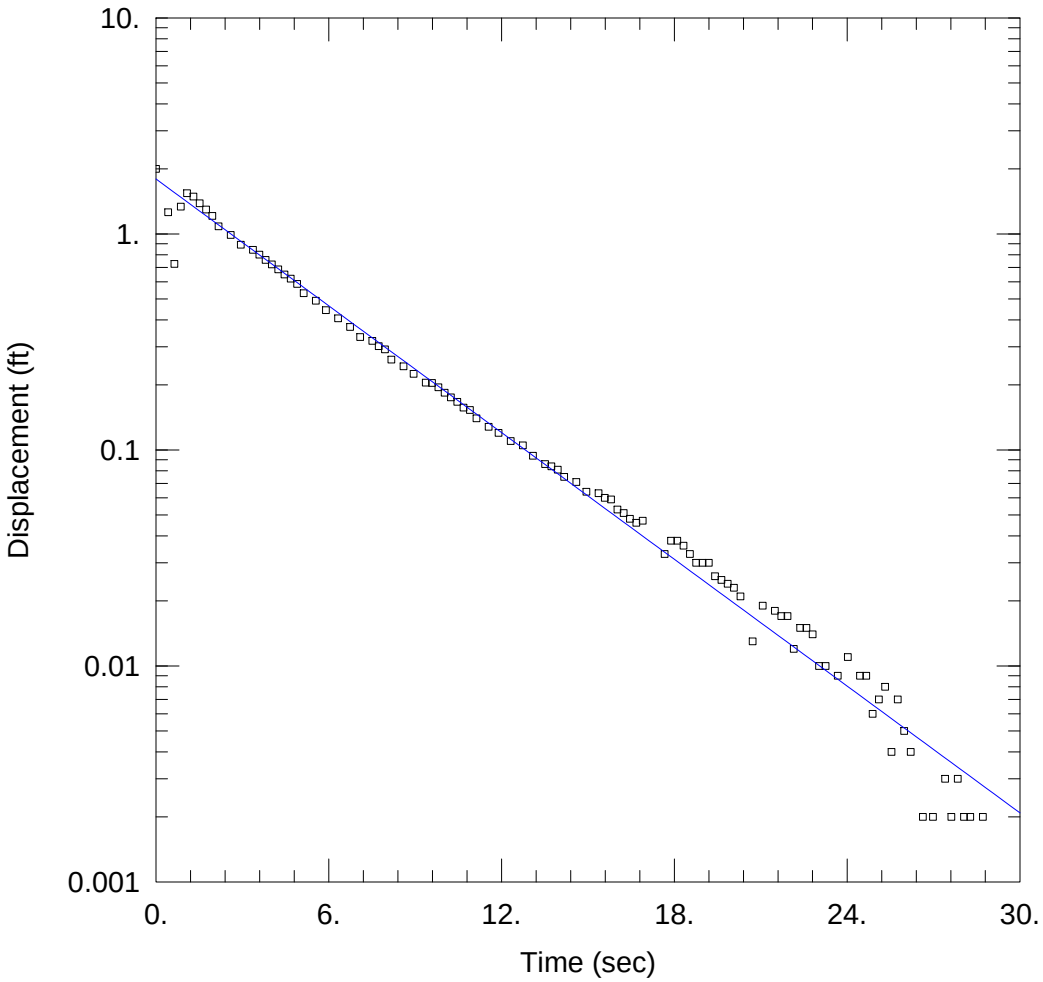
Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-2_slugin3)

Initial Displacement: 2. ft
Total Well Penetration Depth: 42.2 ft
Casing Radius: 0.0853 ft
Static Water Column Height: 21.05 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02068 cm/sec
y0 = 1.236 ft



S291-2_SLUGOUT1

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-2\S291-2_slugout1.aqt
Date: 08/28/15 Time: 13:43:22

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-2
Test Date: 8/21/2015

AQUIFER DATA

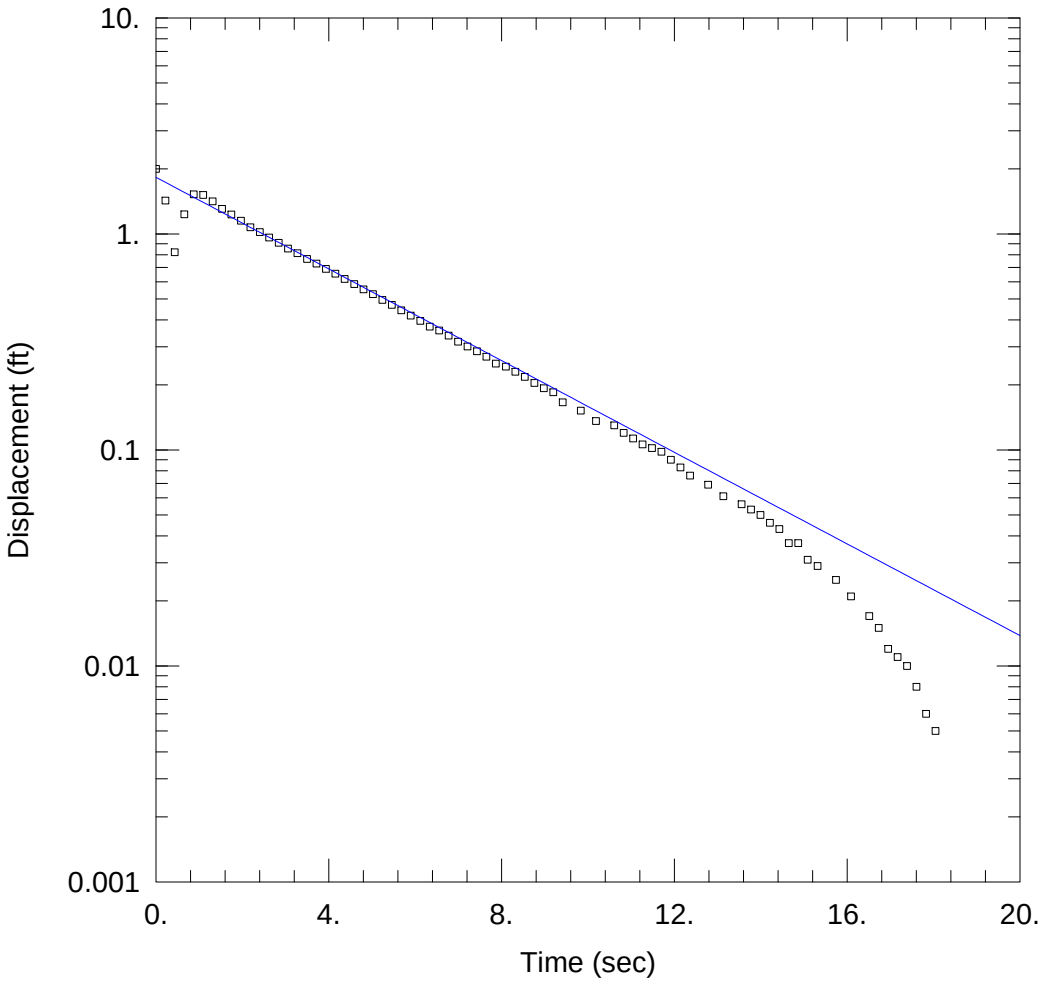
Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-2_slugout1)

Initial Displacement: 2. ft
Total Well Penetration Depth: 42.2 ft
Casing Radius: 0.0853 ft
Static Water Column Height: 21.05 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02863 cm/sec
y0 = 1.795 ft



S291-2_SLUGOUT2

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-2\S291-2_slugout2.aqt
Date: 08/28/15 Time: 13:45:38

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-2
Test Date: 8/21/2015

AQUIFER DATA

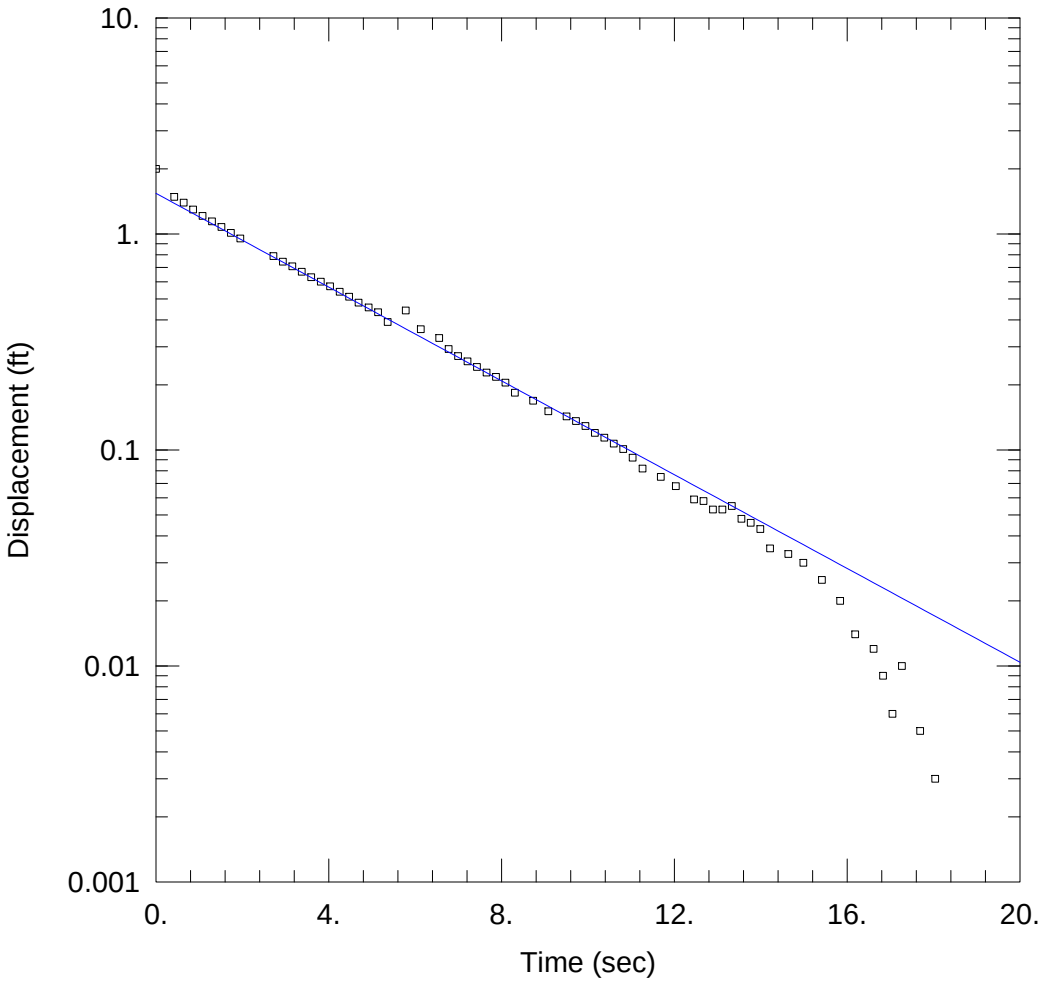
Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-2_slugout2)

Initial Displacement: 2. ft
Total Well Penetration Depth: 42.2 ft
Casing Radius: 0.0853 ft
Static Water Column Height: 21.05 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
K = 0.03104 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.829 ft



S291-2_SLUGOUT3

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-2\S291-2_slugout3.aqt
Date: 08/28/15 Time: 14:07:27

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-2
Test Date: 8/21/2015

AQUIFER DATA

Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-2_slugout3)

Initial Displacement: 2. ft
Total Well Penetration Depth: 42.2 ft
Casing Radius: 0.0853 ft
Static Water Column Height: 21.05 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.03176 cm/sec
y0 = 1.541 ft

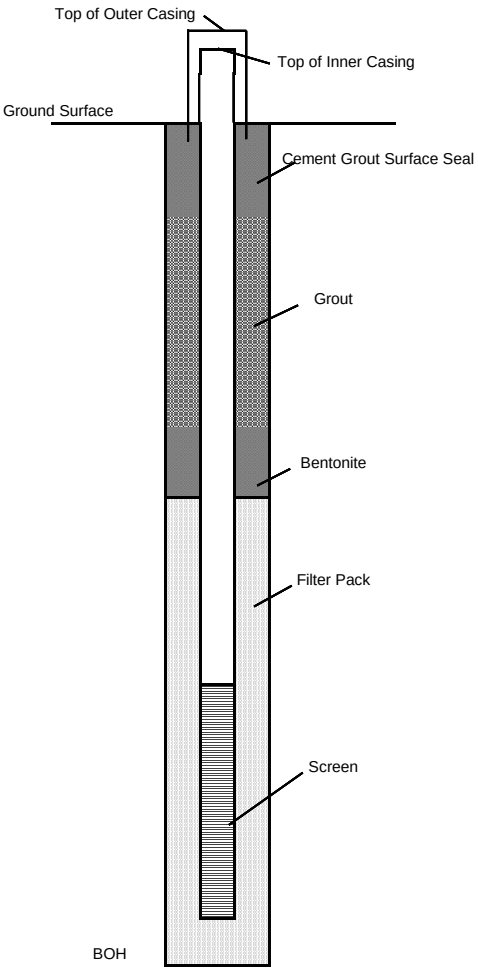
Herbert Hoover Dike Indian Prairie Canal Relocation Project
August 2015

Well ID	Slug In Test 1	Slug Out Test 1	Slug In Test 2	Slug Out Test 2	Slug In Test 3	Slug Out Test 3	Geometric Mean	Geo Mean Std Dev %	Geometric Mean Slug In Tests	Geo Mean Slug In Std Dev %	Geometric Mean Slug Out Tests	Geo Mean Slug Out Std Dev %
S290												
S290-2	2.0E-02	2.2E-02	2.0E-02	2.0E-02	1.9E-02	2.0E-02	**2.0E-02**	3.8	2.0E-02	2.9	2.1E-02	3.7
S290-4	2.2E-02	2.4E-02	2.4E-02	2.4E-02	2.3E-02	2.4E-02	**2.3E-02**	4.9	2.3E-02	5.8	2.4E-02	1.2
S291												
S291-2	2.2E-02	2.9E-02	2.3E-02	3.1E-02	2.1E-02	3.2E-02	**2.6E-02**	18.9	2.2E-02	4.7	3.0E-02	5.4
S291-4	2.1E-02	3.1E-02	2.0E-02	2.9E-02	1.9E-02	2.7E-02	**2.4E-02**	20.9	2.0E-02	6.0	2.9E-02	6.9

Notes:
All values are K presented in cm/sec.

AS BUILT MONITORING WELL RECORD

WELL NAME: HHD15-S291-MW-4	**LOCATION: STA.:**		**DRILLER: JOE BOWERMAN**
PROJECT: HHD INDIAN PRAIRIE CANAL	**SURFACE ELEVATION:**	**17.55 FEET**	**DEPTH TO GW (FT)*: 5.62**
DATE OF WELL COMPLETION: 8/13/15	**TOP OF PVC RISER (EL):**	**20.55 FEET**	**DRILLING METHOD: H.S.A.**
DATE DEVELOPMENT COMPLETED: 8/13/15	**TOP OF OUTER CASING:**	**N/A**	**DEVELOPMENT METHOD:**
INSPECTOR: JOHN MARKOV P.G.	**DATUMS:**	**NAD FL-E 83, NAVD-88**	**OVERPUMPING**



COORDINATES:	X=654789, Y=1002353
TOP OF RISER ABOVE GROUND:	3.0 FEET
TOP OF GROUT:	N/A
I.D.OF RISER PIPE:	2.0 INCH
TYPE OF RISER PIPE:	SCHD 40 PVC
TYPE OF GROUT:	None
DEPTH TO TOP OF SEAL:	17.0 FEET
TYPE OF SEAL:	PELPLUG 3/8 INCH TR 30
DEPTH TO TOP OF FILTER PACK:	20.0 FEET
TYPE OF FILTER PACK:	20/30 SILICA SAND
DEPTH TO TOP OF SCREEN:	22.6 FEET
TYPE OF SCREEN:	SCHD 40 PVC
SLOT SIZE AND LENGTH:	0.010 INCH, 5 FEET
I.D. OF SCREEN:	2.0 INCH
DEPTH TO BOTTOM OF SCREEN:	27.6 FEET **
BOREHOLE DIAMETER:	8.25 INCH
BOTTOM OF HOLE:	28.0 FEET

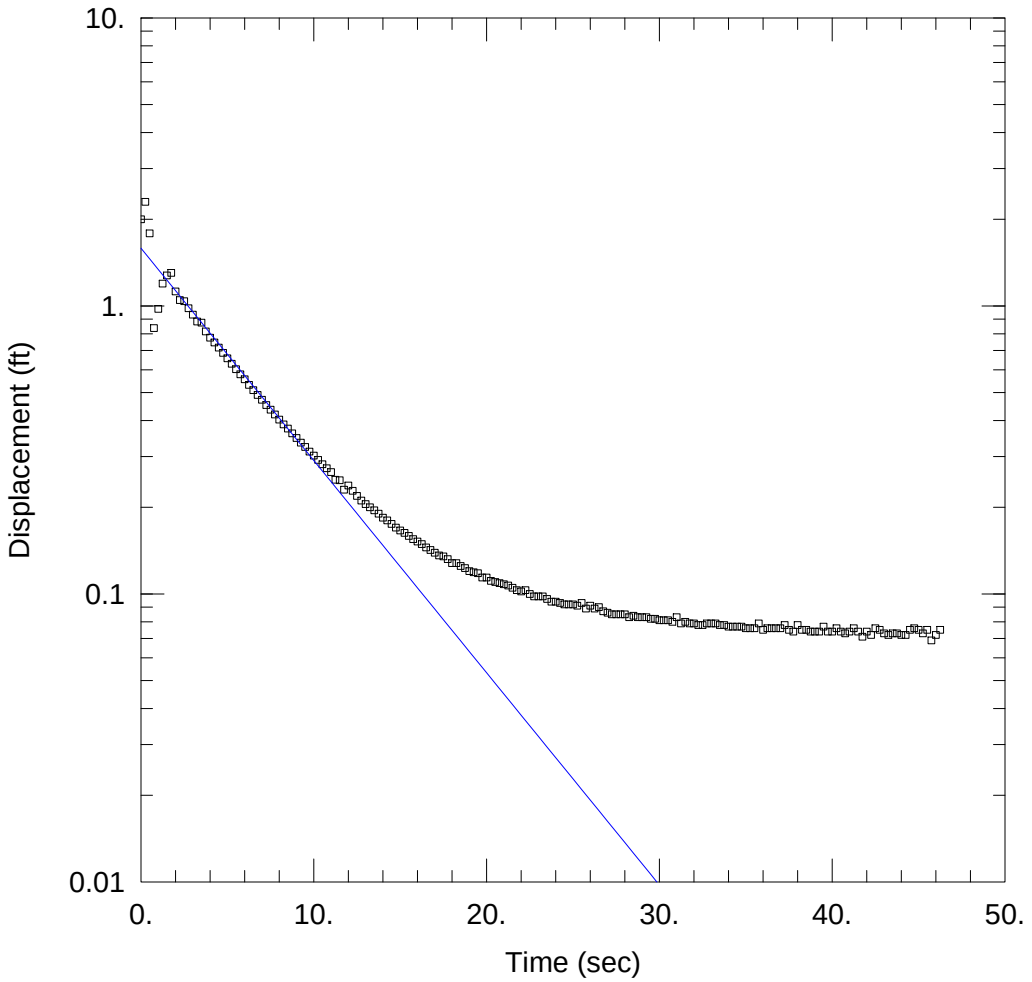
** Screening intervals based on estimated elevation data provided by SAJ.

* Depth to groundwater measured relative to ground surface

Wells were temporary and abandoned with grout after slug testing.
Results of slug tests are found on separate forms.

USACE - Jacksonville District

PROJECT:	**BORING NO.: Companion to**
HHD INDIAN PRAIRIE CANAL RELOCATION, Culvert IP-3	**HHD15-S291-CB-4**



S291-4_SLUGIN1

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-4\S291-4_slugin1.aqt
Date: 08/28/15 Time: 14:14:25

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-4
Test Date: 8/21/2015

AQUIFER DATA

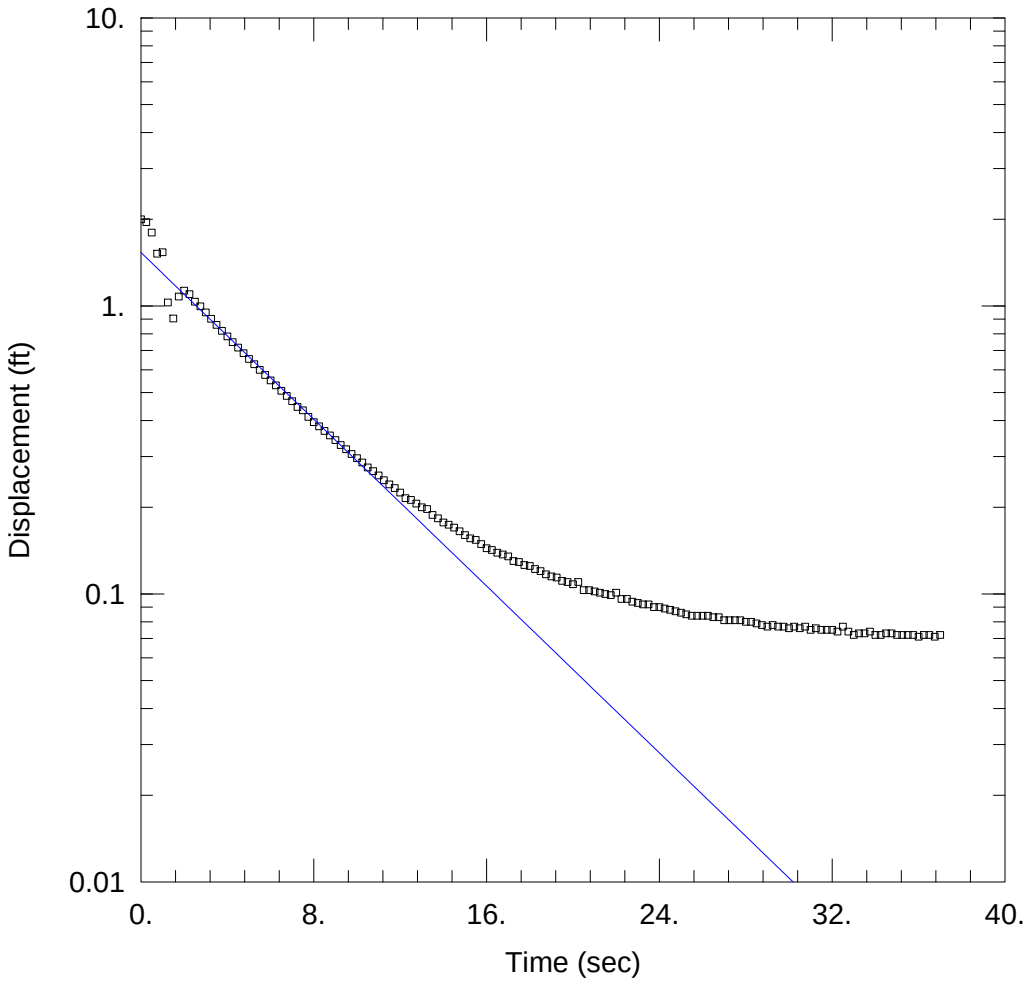
Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-4_slugin1)

Initial Displacement: 2. ft
Total Well Penetration Depth: 28. ft
Casing Radius: 0.0853 ft
Static Water Column Height: 22.46 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02075 cm/sec
y0 = 1.586 ft



S291-4_SLUGIN2

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-4\S291-4_slugin2.aqt
Date: 08/31/15 Time: 07:33:28

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-4
Test Date: 8/21/2015

AQUIFER DATA

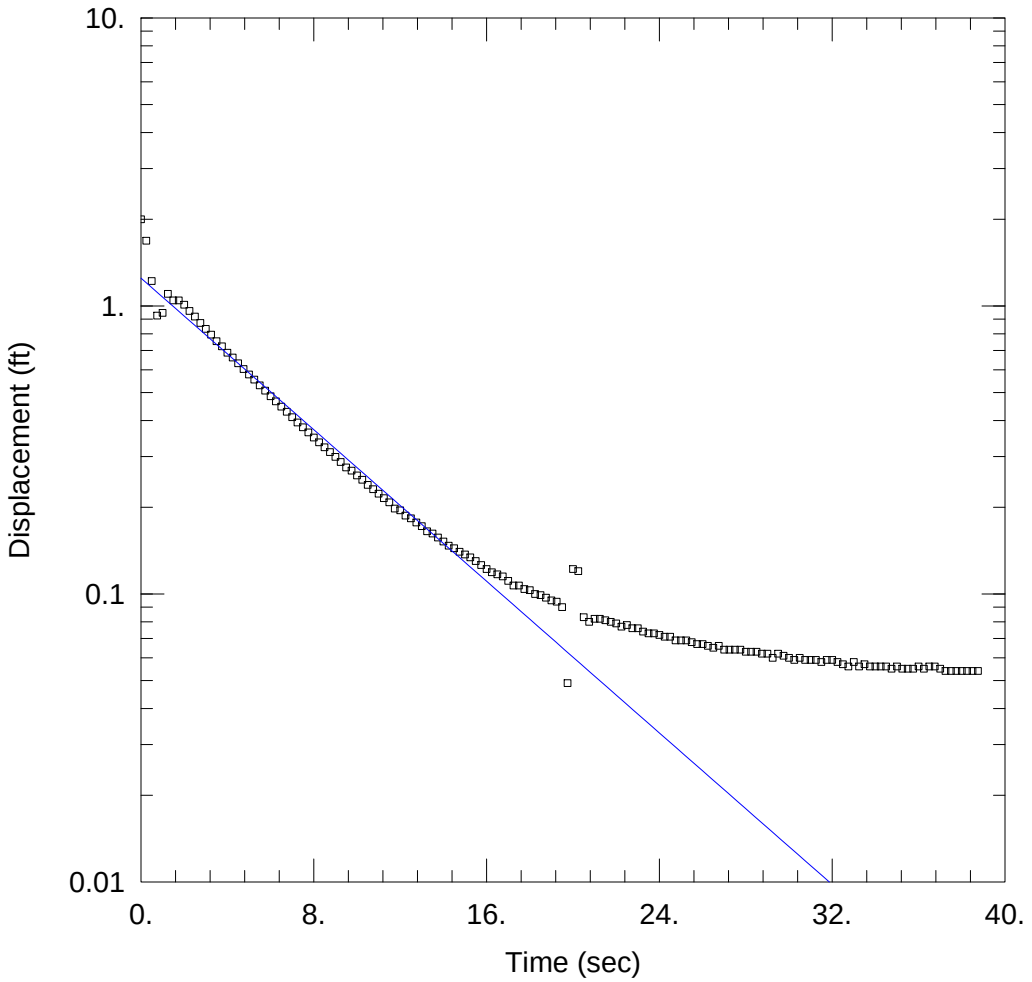
Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-4_slugin2)

Initial Displacement: 2. ft
Total Well Penetration Depth: 28. ft
Casing Radius: 0.0853 ft
Static Water Column Height: 22.46 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02038 cm/sec
y0 = 1.532 ft



S291-4_SLUGIN3

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-4\S291-4_slugin3.aqt
Date: 08/28/15 Time: 14:11:26

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-4
Test Date: 8/21/2015

AQUIFER DATA

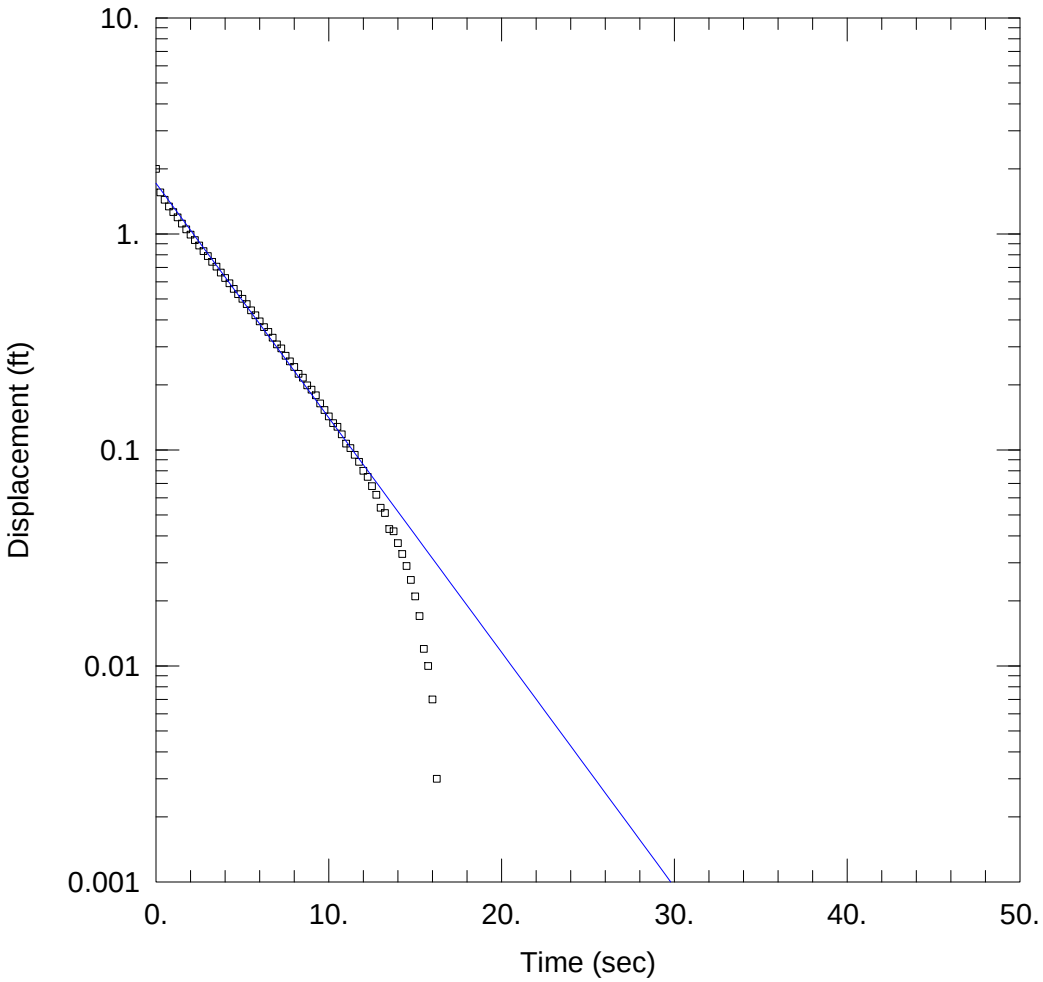
Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-4_slugin3)

Initial Displacement: 2. ft
Total Well Penetration Depth: 28. ft
Casing Radius: 0.0853 ft
Static Water Column Height: 22.46 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.01852 cm/sec
y0 = 1.249 ft



S291-4_SLUGOUT1

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-4\S291-4_slugout1.aqt
Date: 08/28/15 Time: 14:10:55

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-4
Test Date: 8/21/2015

AQUIFER DATA

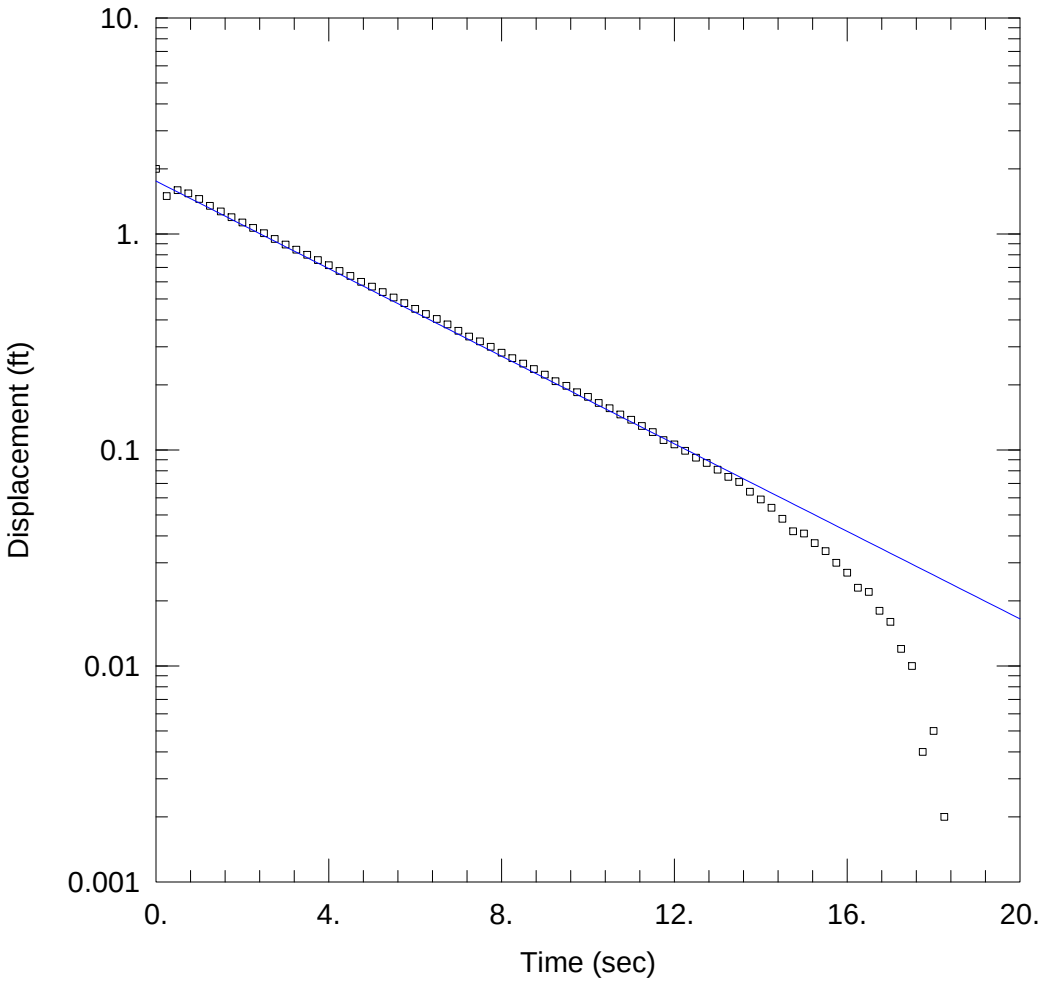
Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-4_slugout1)

Initial Displacement: 2. ft
Total Well Penetration Depth: 28. ft
Casing Radius: 0.0853 ft
Static Water Column Height: 22.46 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.03057 cm/sec
y0 = 1.715 ft



S291-4_SLUGOUT2

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-4\S291-4_slugout2.aqt
Date: 08/28/15 Time: 14:16:04

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-4
Test Date: 8/21/2015

AQUIFER DATA

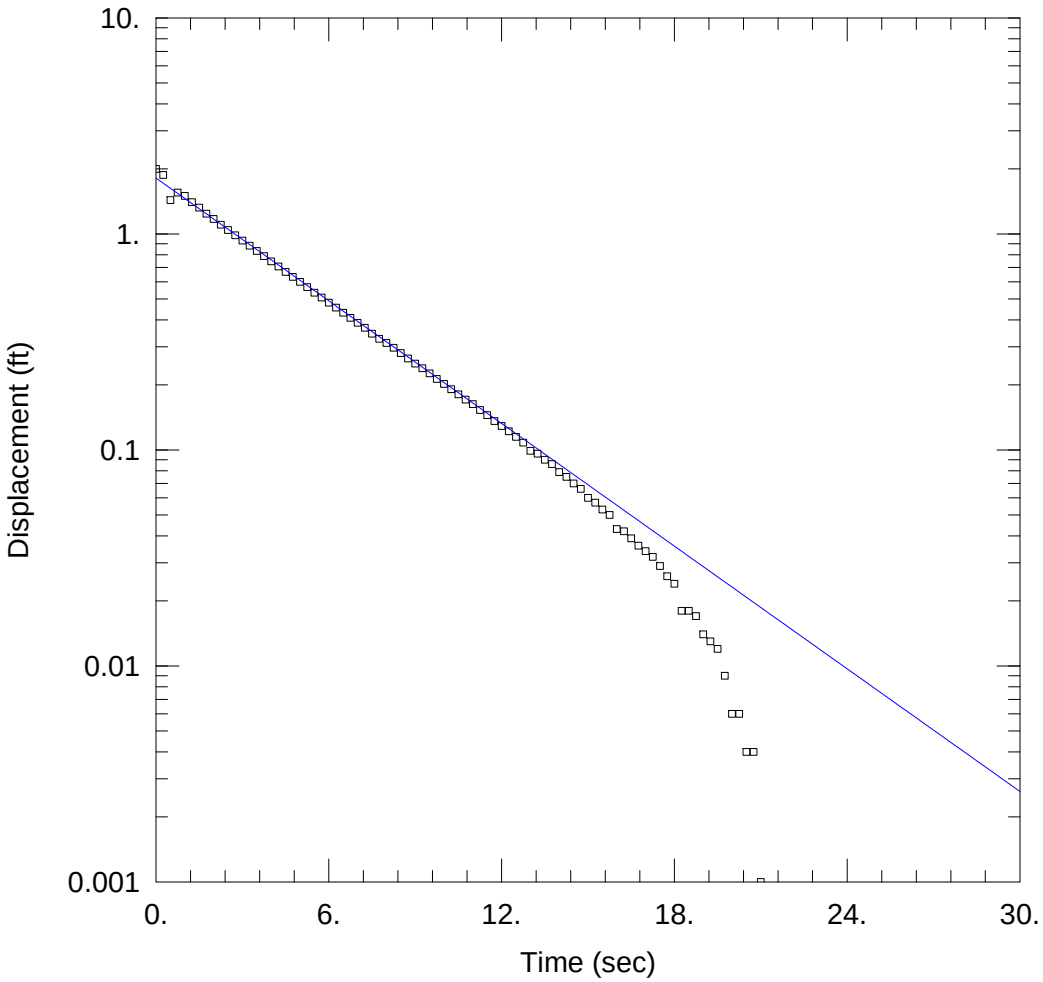
Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-4_slugout2)

Initial Displacement: 2. ft
Total Well Penetration Depth: 28. ft
Casing Radius: 0.0853 ft
Static Water Column Height: 22.46 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02853 cm/sec
y0 = 1.756 ft



S291-4_SLUGOUT3

Data Set: G:\EN-GG\Markov\HHD Indian Praire Canal Slug Tests\S291\S291-4\S291-4_slugout3.aqt
Date: 08/28/15 Time: 14:16:32

PROJECT INFORMATION

Company: CESAS
Client: Jacksonville District
Location: HHD Indian Prairie Canal
Test Well: S291-4
Test Date: 8/21/2015

AQUIFER DATA

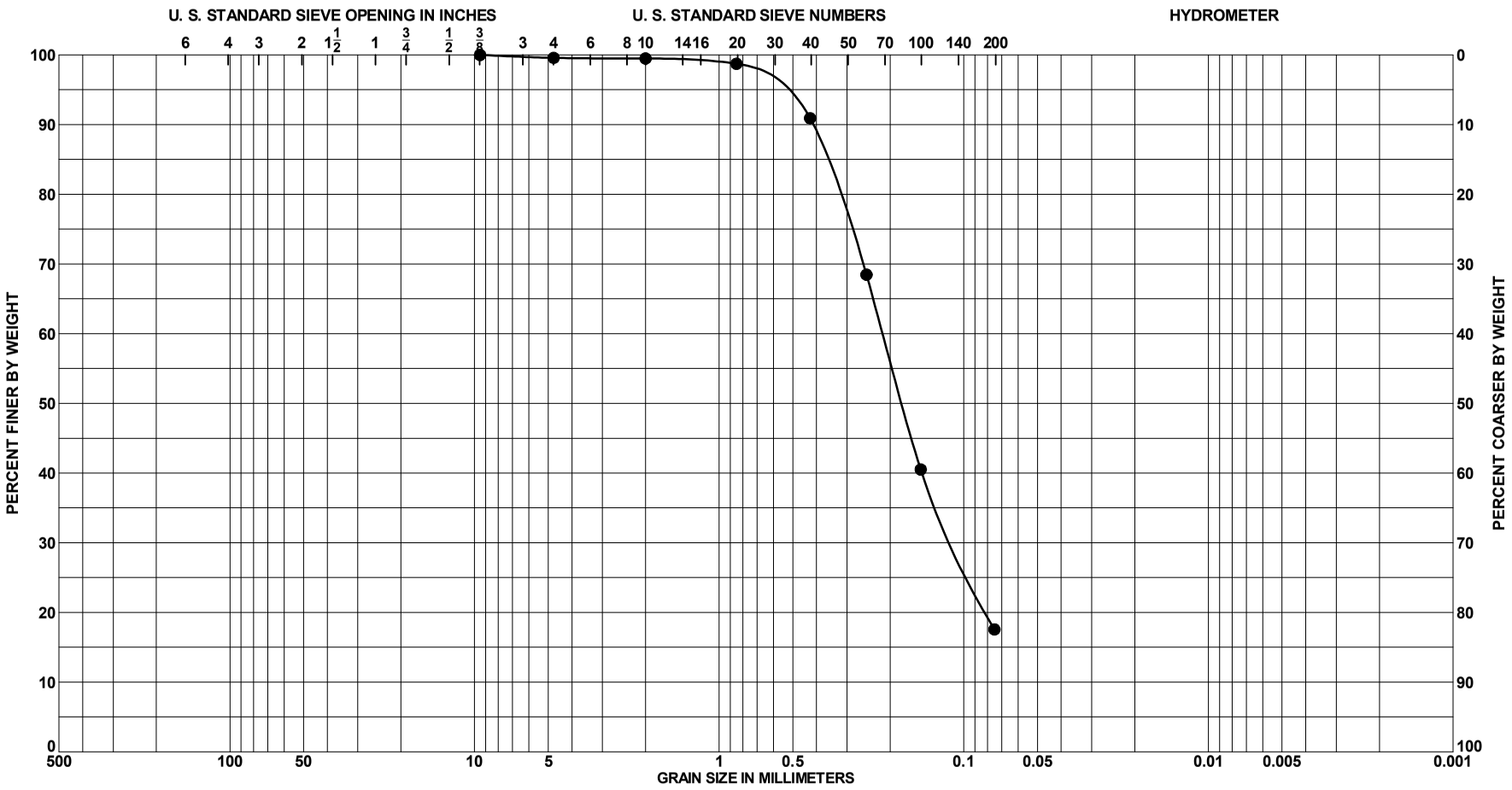
Saturated Thickness: 100. ft Anisotropy Ratio (Kz/Kr): 0.01

WELL DATA (S291-4_slugout3)

Initial Displacement: 2. ft
Total Well Penetration Depth: 28. ft
Casing Radius: 0.0853 ft
Static Water Column Height: 22.46 ft
Screen Length: 5. ft
Well Radius: 0.099 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.02666 cm/sec
y0 = 1.814 ft

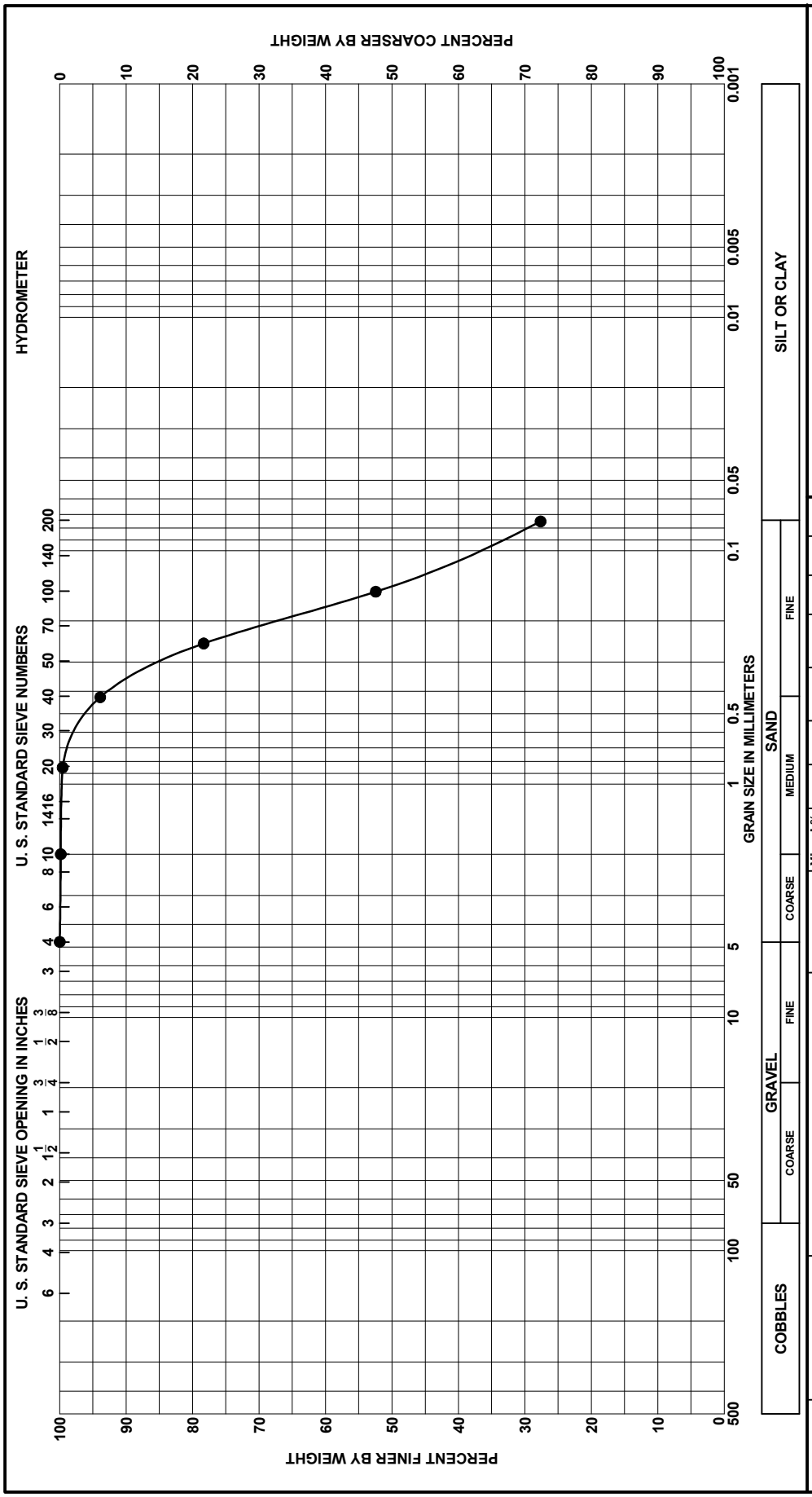


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 2	1.5 to 3.0 Ft.	SAND, silty, mostly fine to	7.5Y 3/2				4	24.3			
		medium-grained sand-sized quartz,									
		little silt, trace organics, dark									
		grayish yellowish brown (SM)									

GRADATION CURVES

PROJECT	Herbert Hoover Dike
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-5
BORING ELEV.	16.9 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02

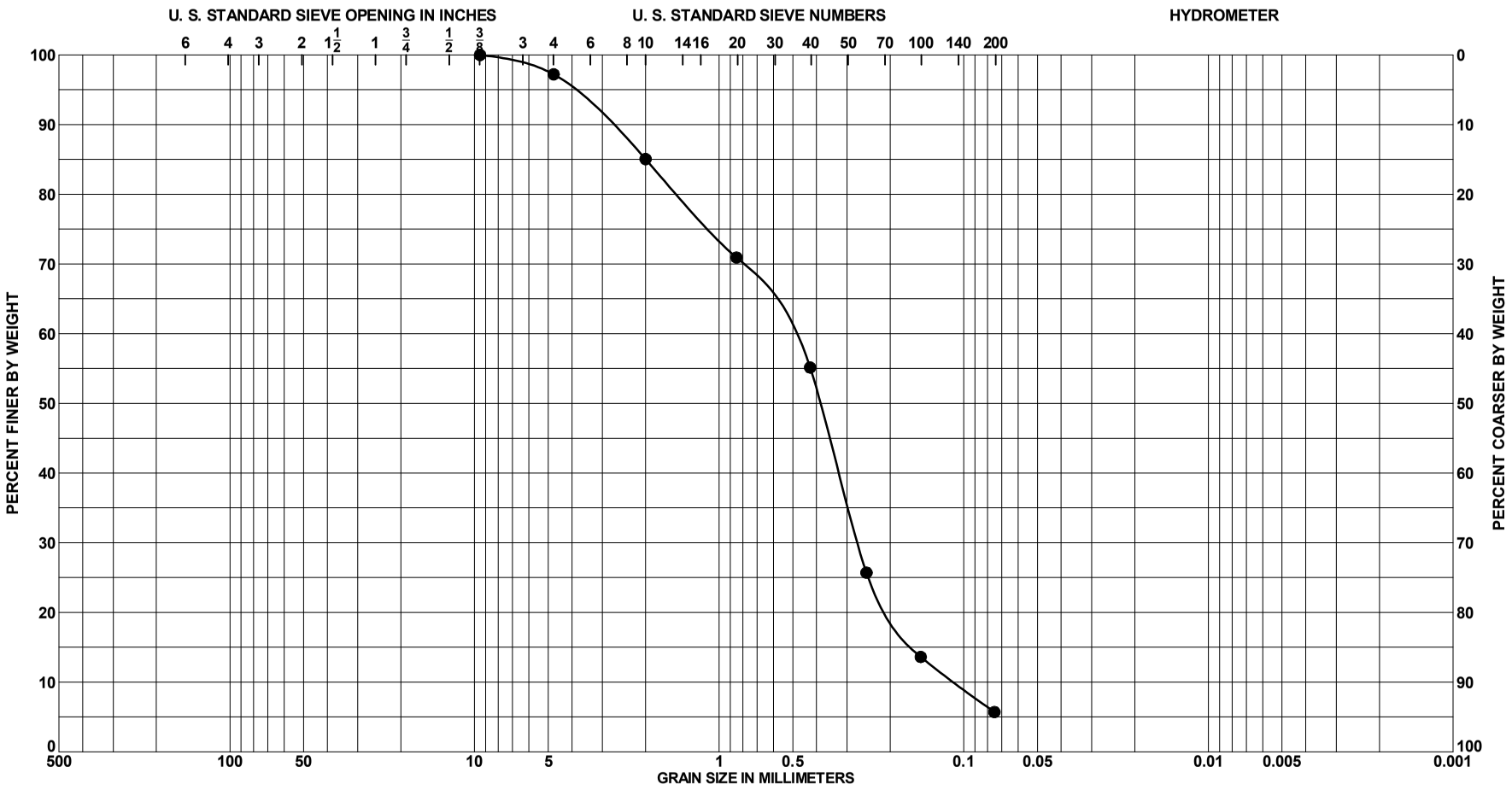


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 1	0.0 to 1.5 Ft.	SAND, silty, mostly fine-grained	7.5YR 3/2				7		0	0	NP
		sand-sized quartz, some silt, few									
		organics, dark brown (SM)									

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-CB-7
BORING ELEV. 16.8 Ft., NAVD88
DATE 9/24/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

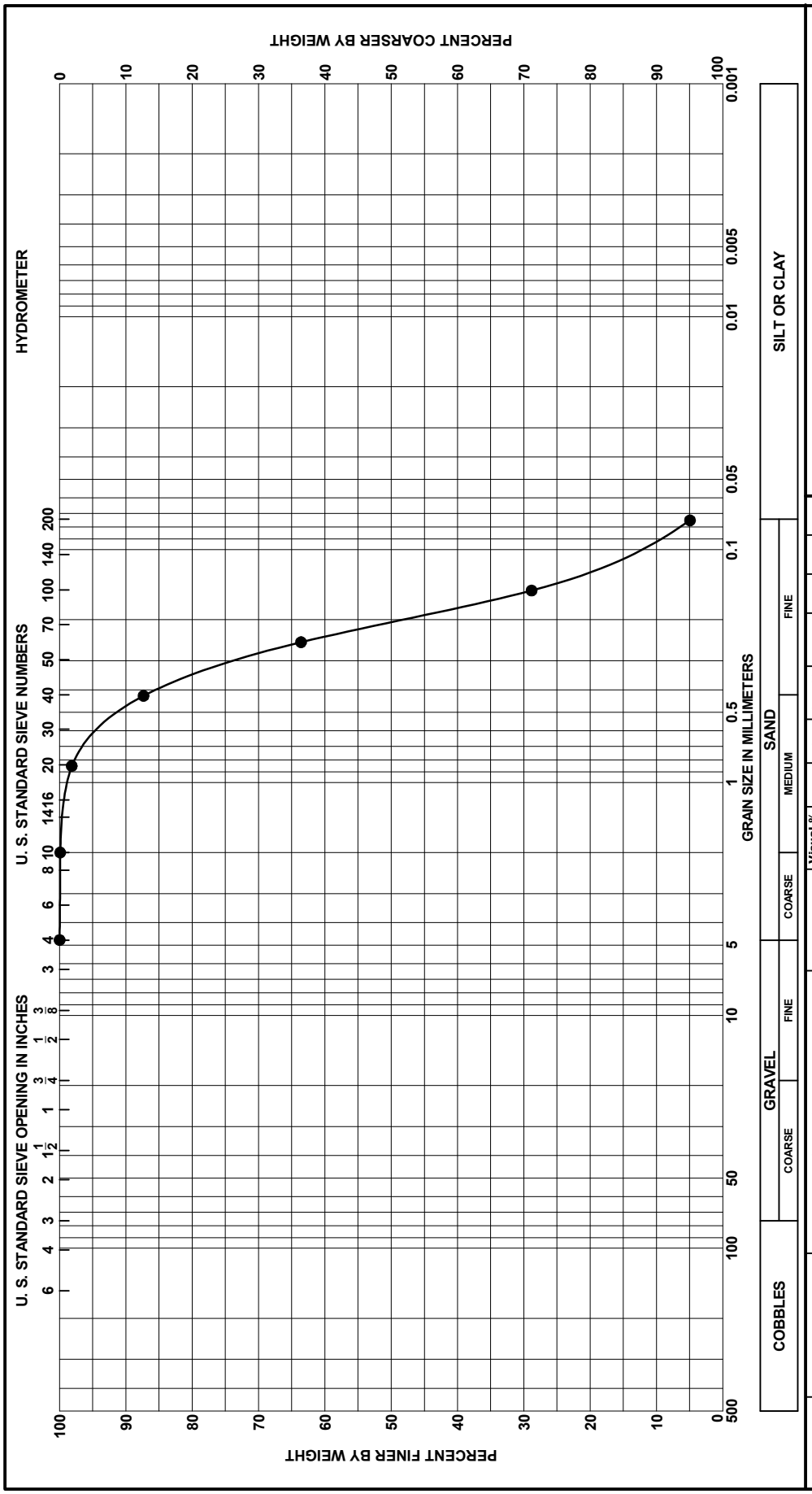


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 7	9.0 to 10.5 Ft.	SAND, poorly-graded with silt, some	2.5Y 7/1	46							
		fine to medium-grained sand-sized									
		quartz, some fine to coarse-grained									
		sand-sized shell, few silt, light gray									
		(SP-SM)									

GRADATION CURVES

PROJECT	Herbert Hoover Dike
	Structure 291 / Culvert IP-3 Replacement
BORING NO.	HHD15-S291-CB-8
BORING ELEV.	19.6 Ft., NAVD88
DATE	9/24/2015

SAJ FORM 2087
JUN 02

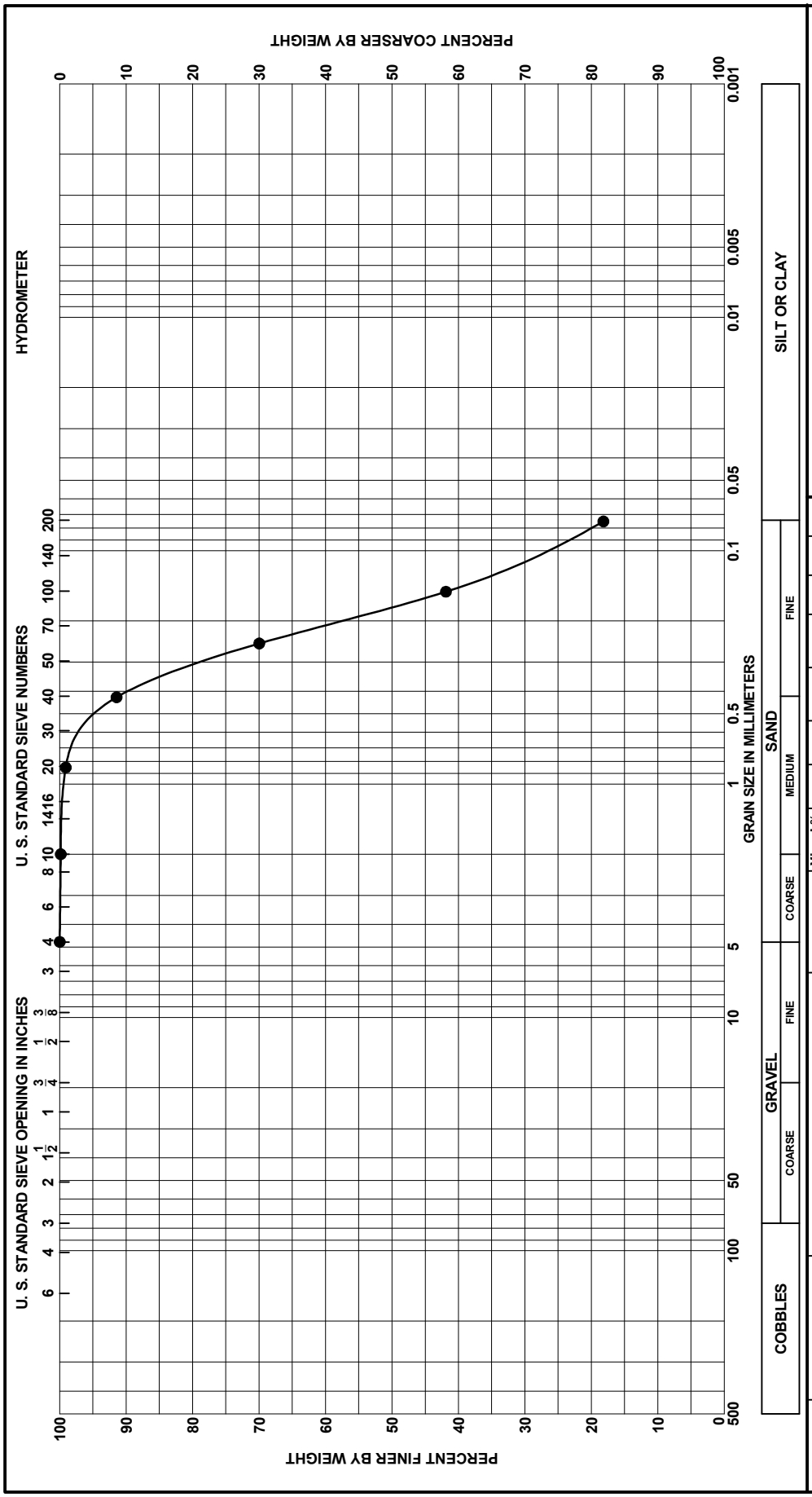


Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 2	4.0 to 5.0 Ft.	SAND, poorly-graded, mostly fine to medium-grained sand-sized quartz, trace silt, dark gray (SP)	2.5Y 4/1								

GRADATION CURVES

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-TP-1
BORING ELEV. 18.3 Ft., NAVD88
DATE 9/24/2015

SAJ FORM 2087
JUN 02



Sample No.	Depth	Classification	Munsell	Visual % Shell (est)	%CO_3	G_s	Org %	w_n	LL	PL	PI
● 2	3.0 to 4.0 Ft.	SAND, silty, mostly fine to medium-grained sand-sized quartz, little silt, light brown (SM)	7.5YR 6/3								

PROJECT Herbert Hoover Dike
Structure 291 / Culvert IP-3 Replacement
BORING NO. HHD15-S291-TP-2
BORING ELEV. 19.6 Ft., NAVD88
DATE 9/24/2015

GRADATION CURVES

SAJ FORM 2087
JUN 02

Pore Pressure Dissipation Tests

HHD15-S291-CP-1

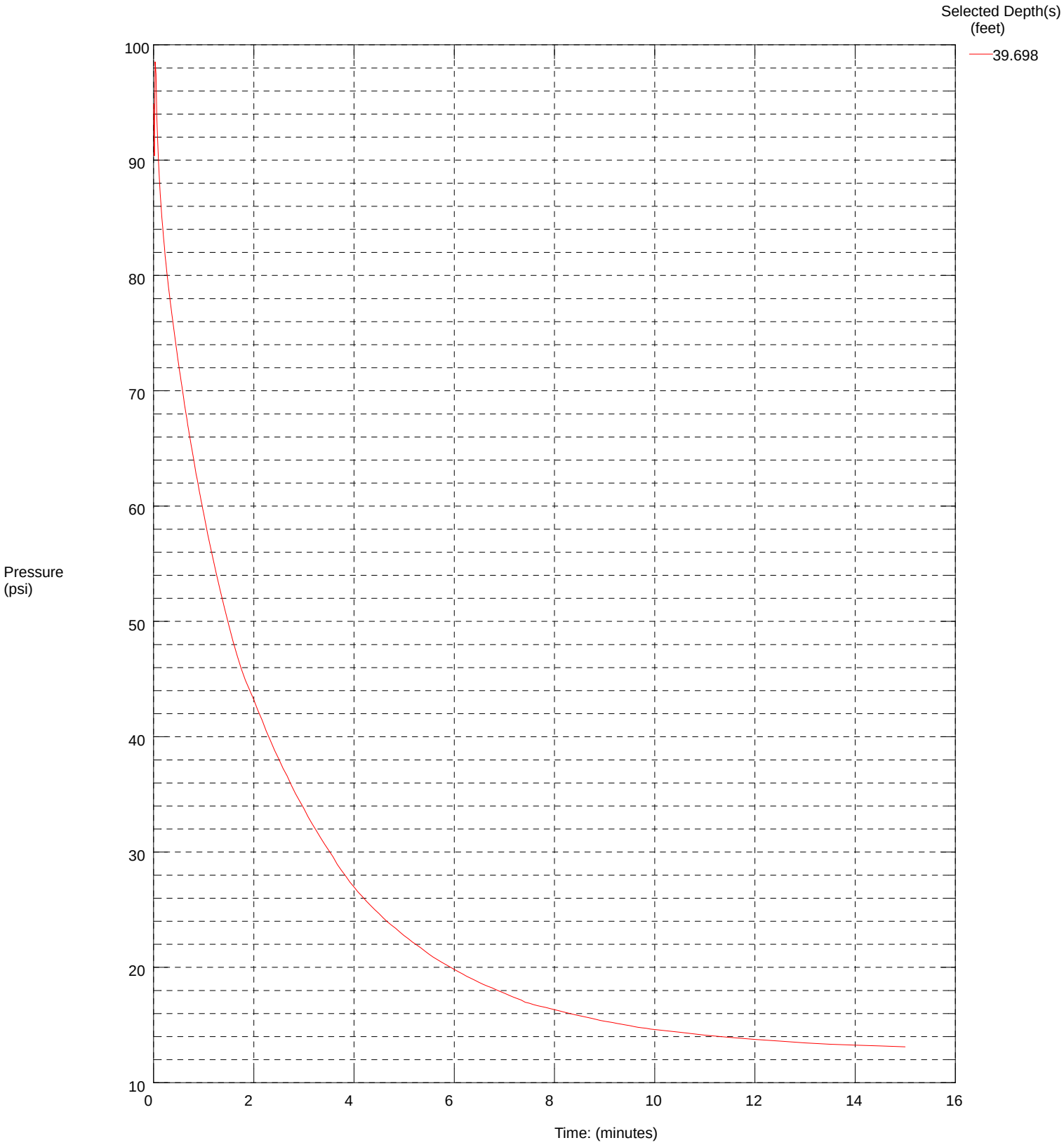
Test Depth (ft)	Permeability* (cm/s)
39.7	5.22E-06
47.4	1.77E-04
58.4	2.54E-04
59.8	1.07E-04
61.7	6.42E-05
66.1	7.44E-05

*Calculation based from Mayne 2002

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT1
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 10:13:29 AM
Location:
Job Number: HHD IPC

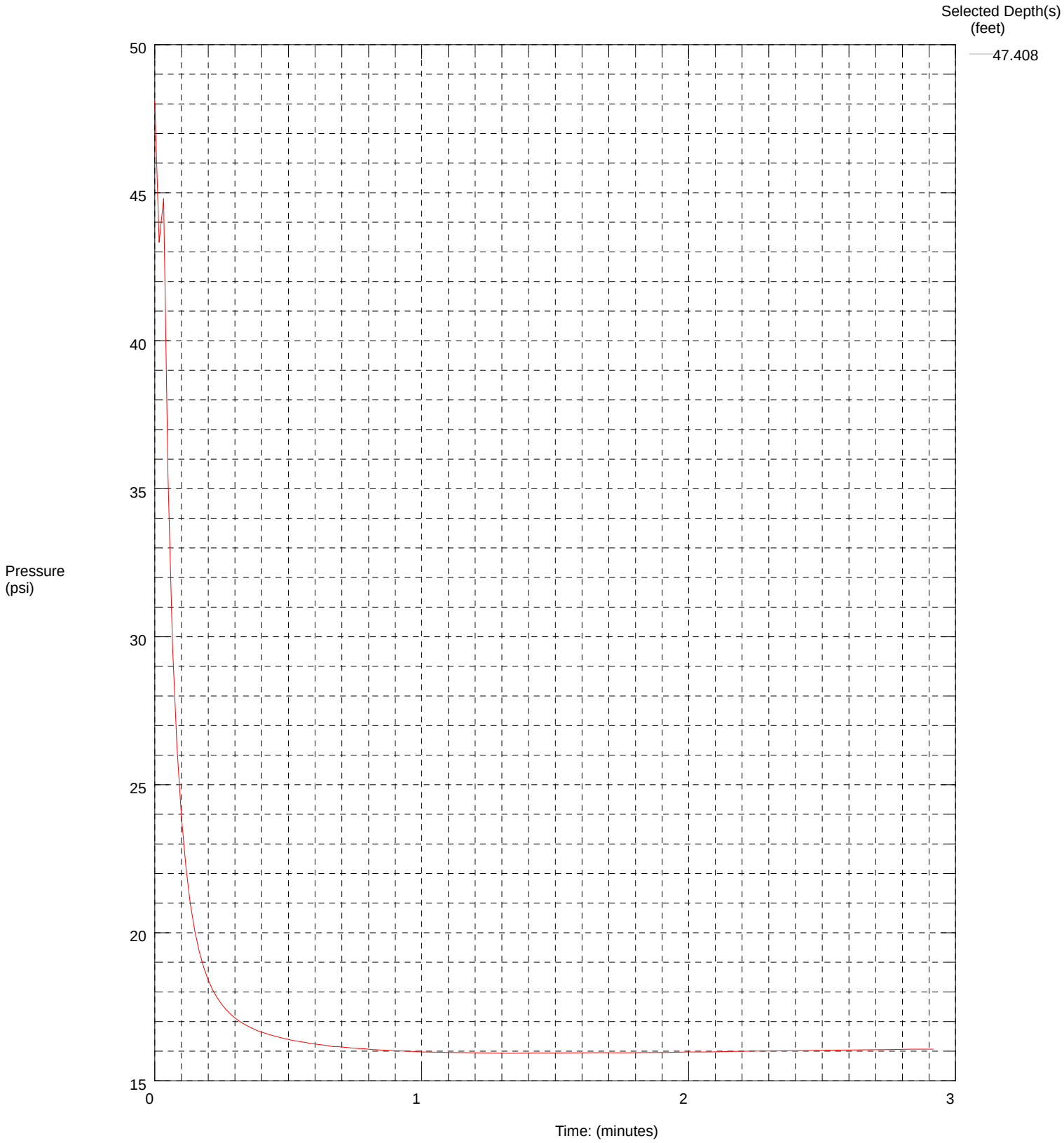


Maximum Pressure = 98.516 psi
Hydrostatic Pressure = 14.381 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT1
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 10:13:29 AM
Location:
Job Number: HHD IPC

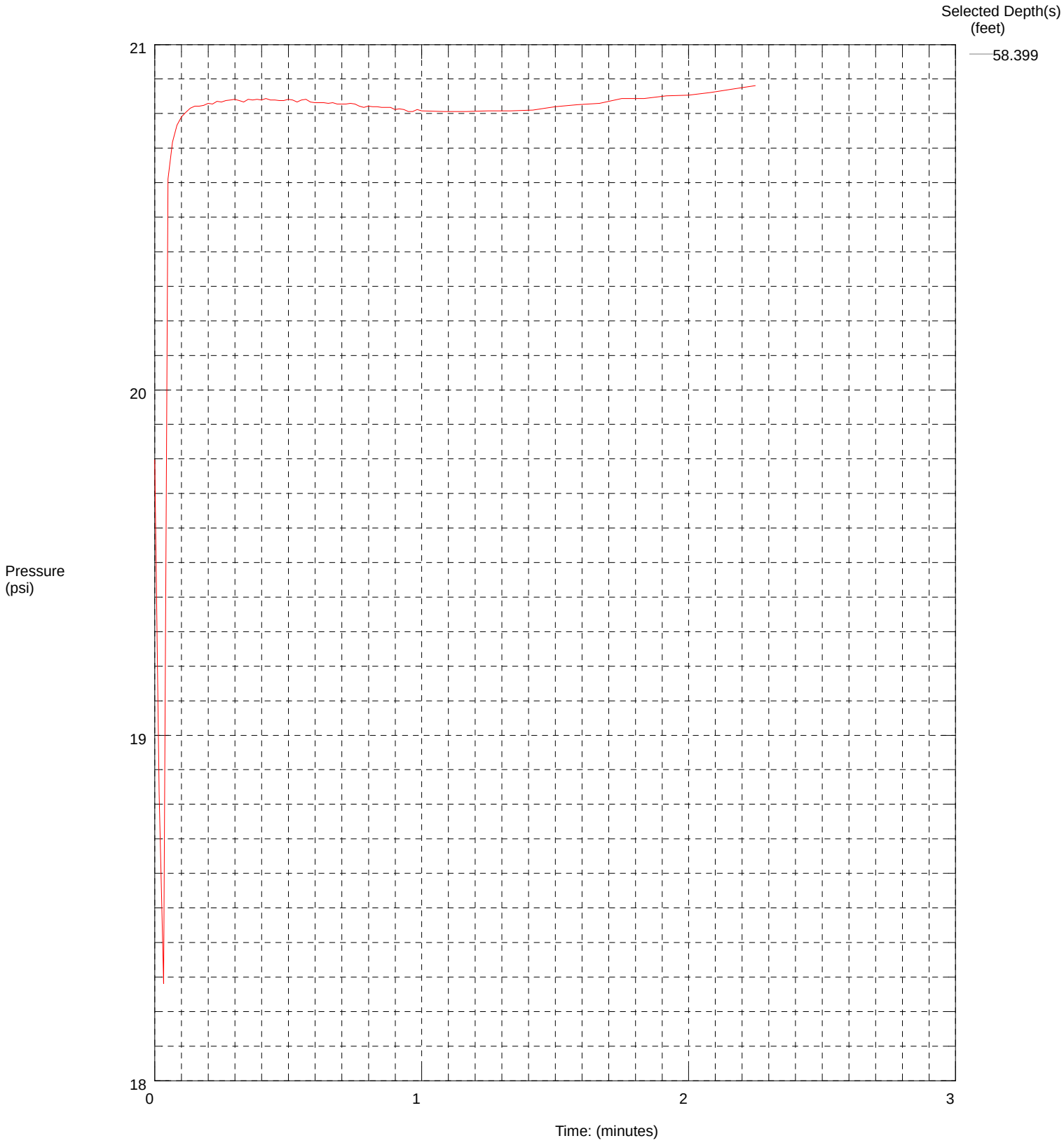


Maximum Pressure = 48.095 psi
Hydrostatic Pressure = 17.727 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT1
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 10:13:29 AM
Location:
Job Number: HHD IPC

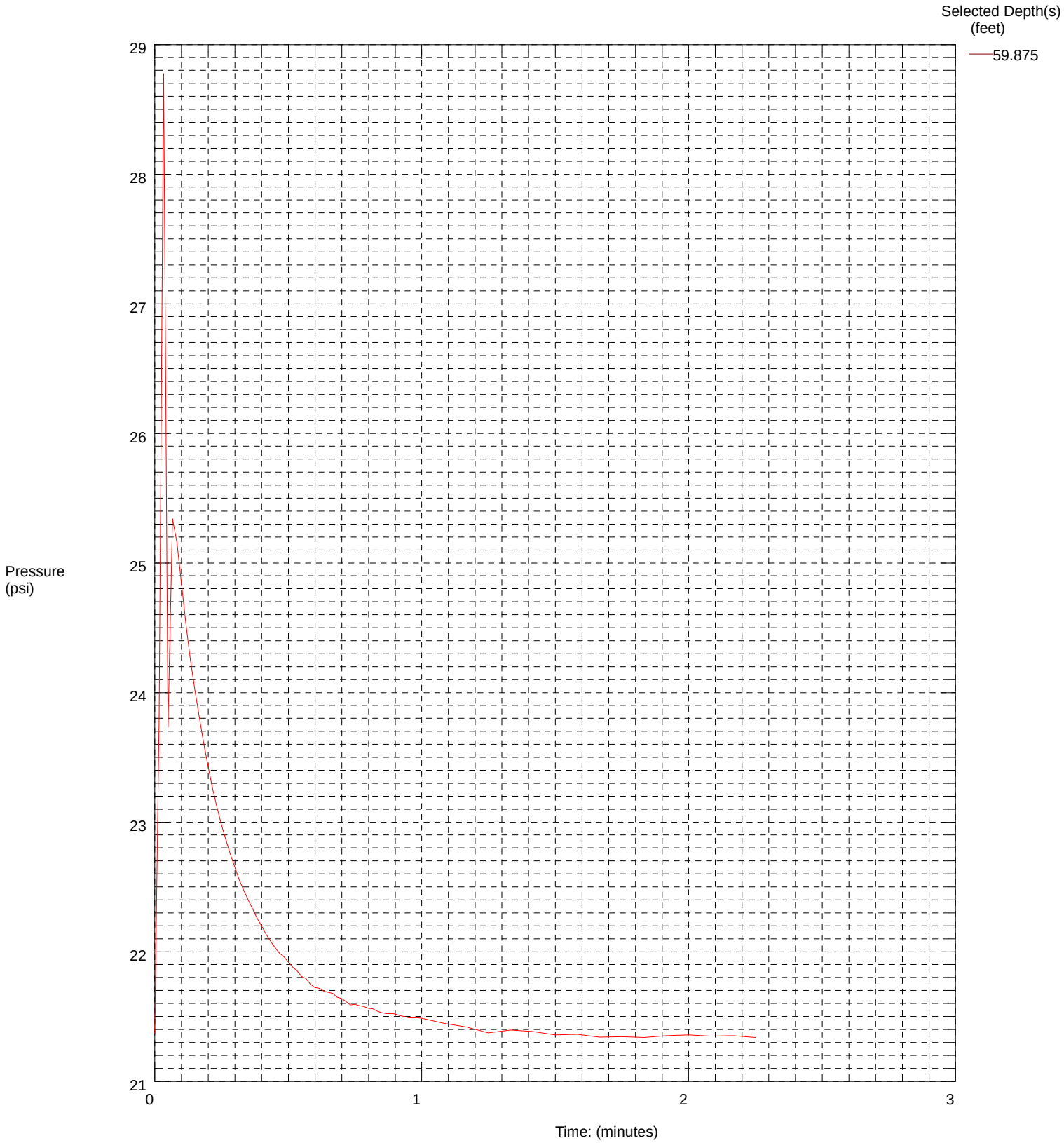


Maximum Pressure = 20.881 psi
Hydrostatic Pressure = 22.497 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT1
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 10:13:29 AM
Location:
Job Number: HHD IPC

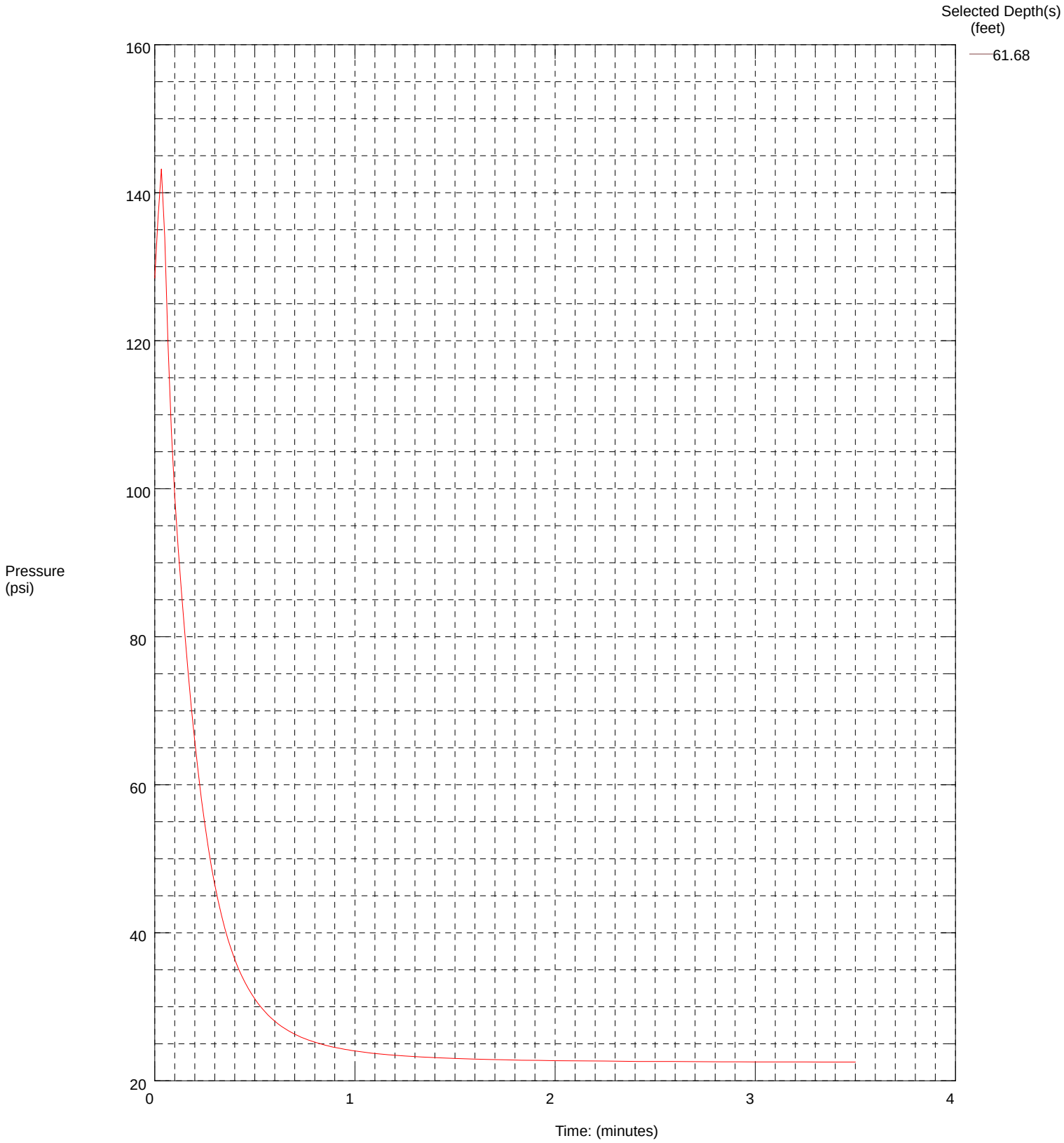


Maximum Pressure = 28.777 psi
Hydrostatic Pressure = 23.138 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT1
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 10:13:29 AM
Location:
Job Number: HHD IPC

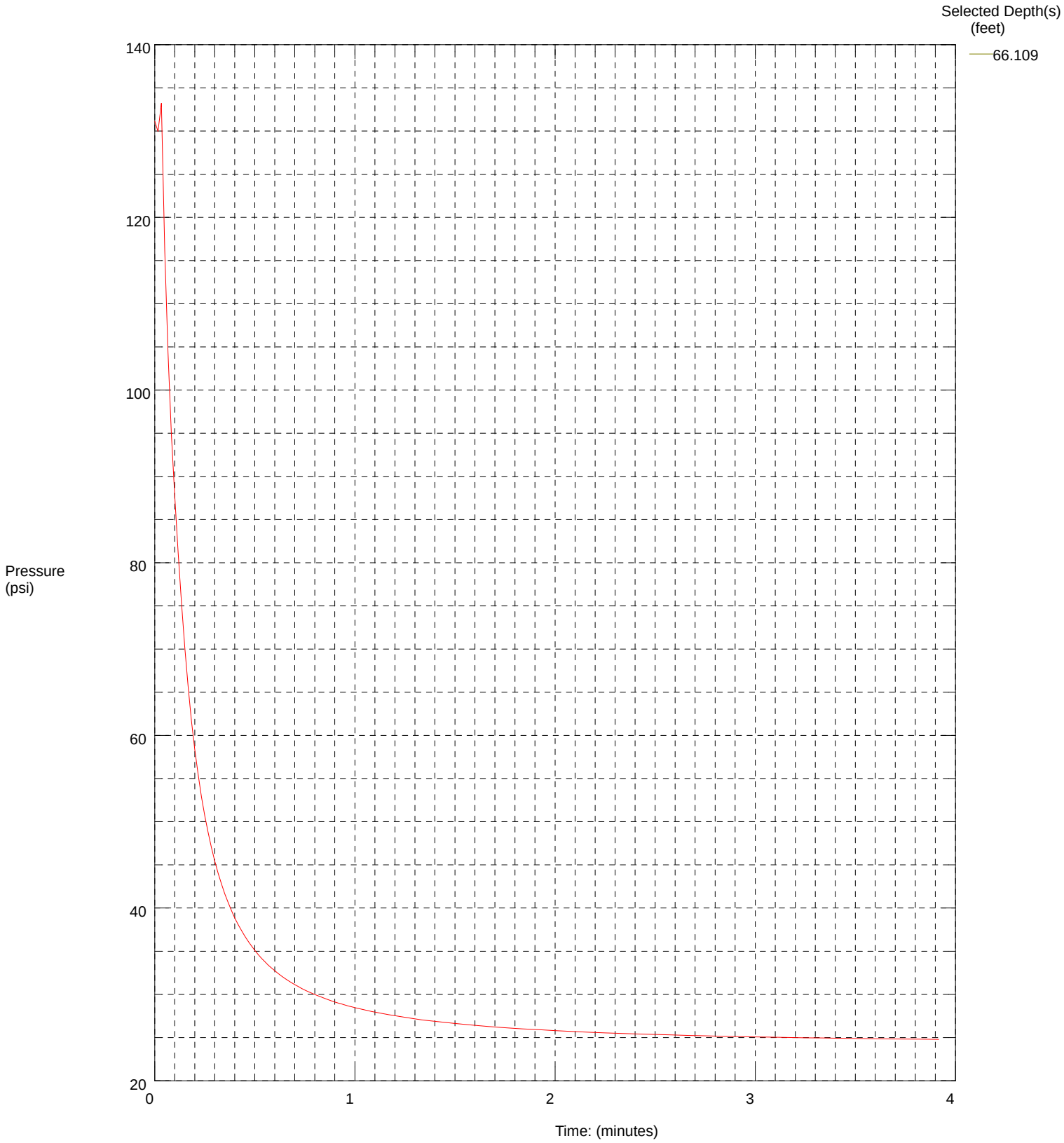


Maximum Pressure = 143.206 psi
Hydrostatic Pressure = 23.921 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT1
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 10:13:29 AM
Location:
Job Number: HHD IPC



Maximum Pressure = 133.204 psi
Hydrostatic Pressure = 25.844 psi

Pore Pressure Dissipation Tests

HHD15-S291-CP-2

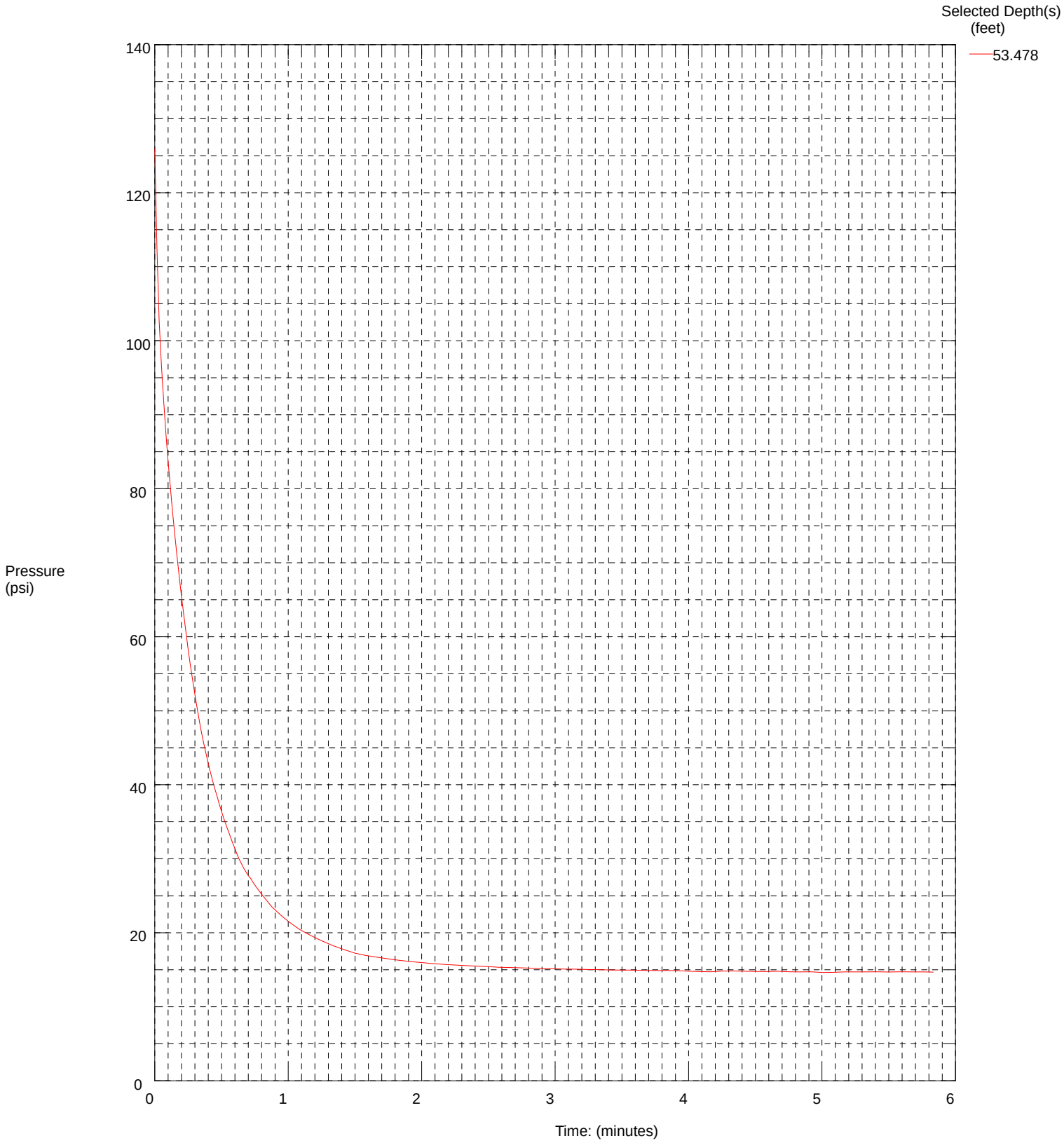
Test Depth (ft)	Permeability* (cm/s)
53.3	5.63E-05
60.3	1.34E-04
73	1.77E-04
77.4	1.77E-04
83.8	1.34E-04

*Calculation based from Mayne 2002

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT2
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 1:02:24 PM
Location:
Job Number: HHD IPC

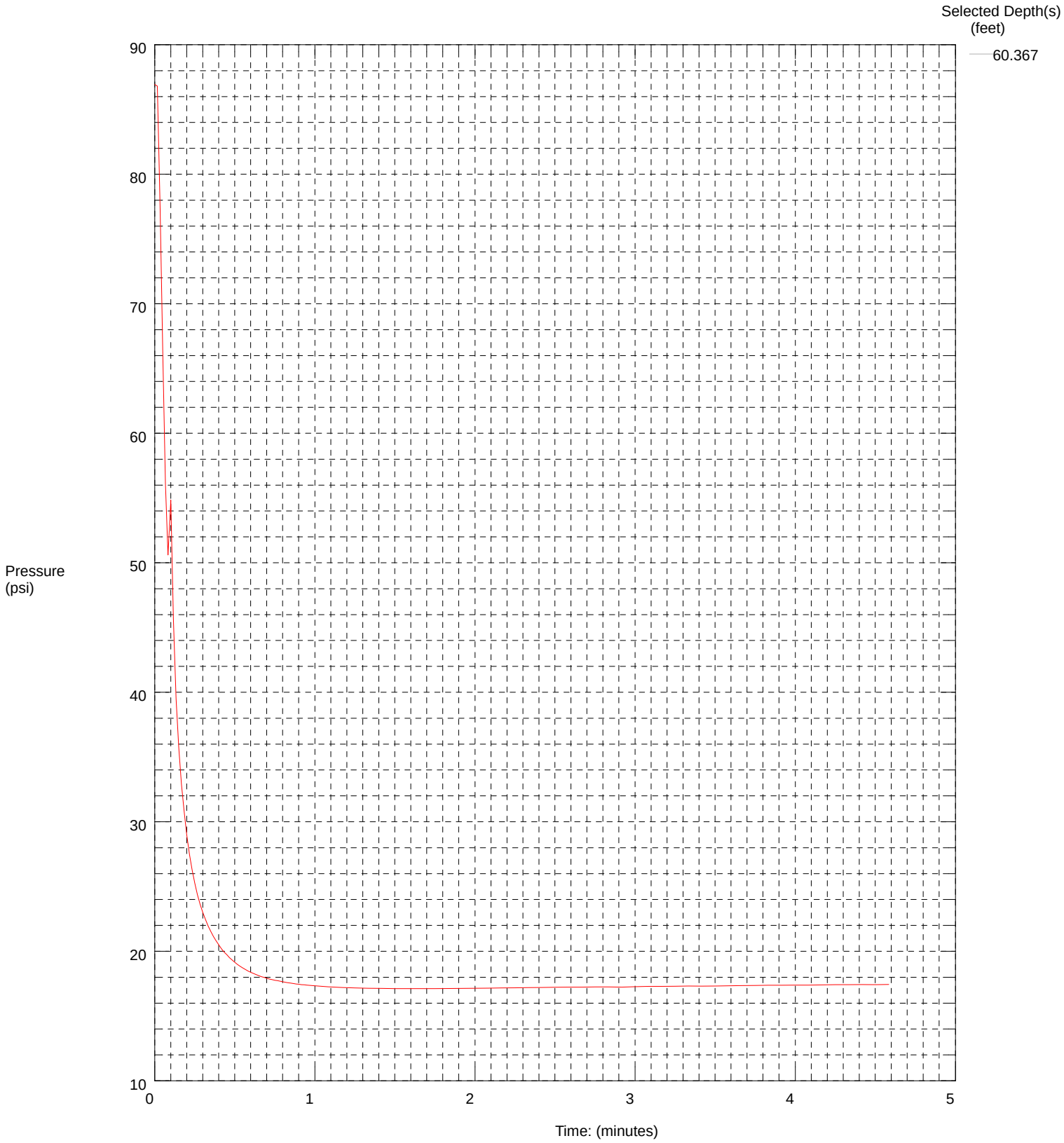


Maximum Pressure = 125.924 psi
Hydrostatic Pressure = 17.514 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT2
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 1:02:24 PM
Location:
Job Number: HHD IPC

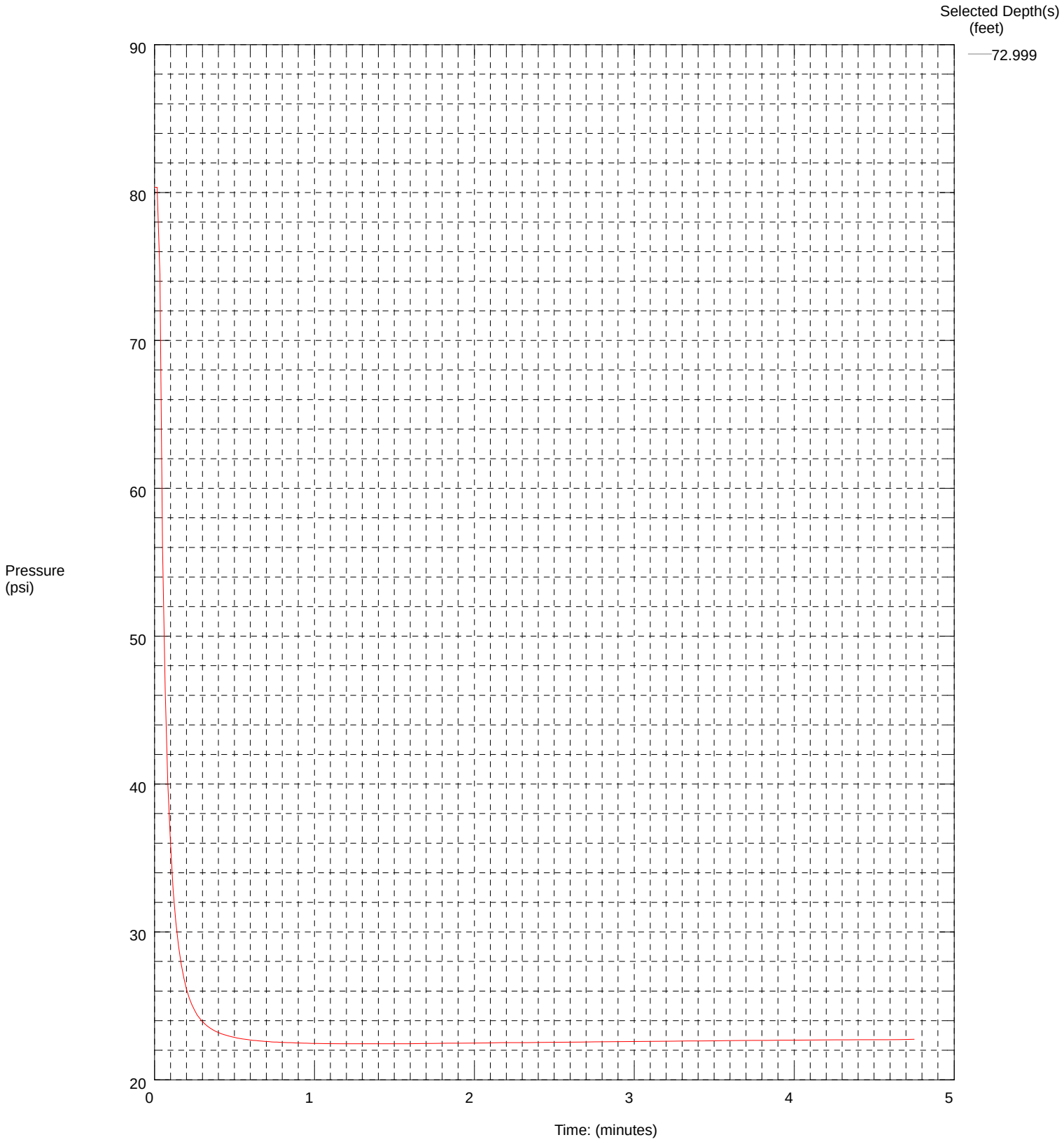


Maximum Pressure = 86.926 psi
Hydrostatic Pressure = 20.504 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT2
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 1:02:24 PM
Location:
Job Number: HHD IPC

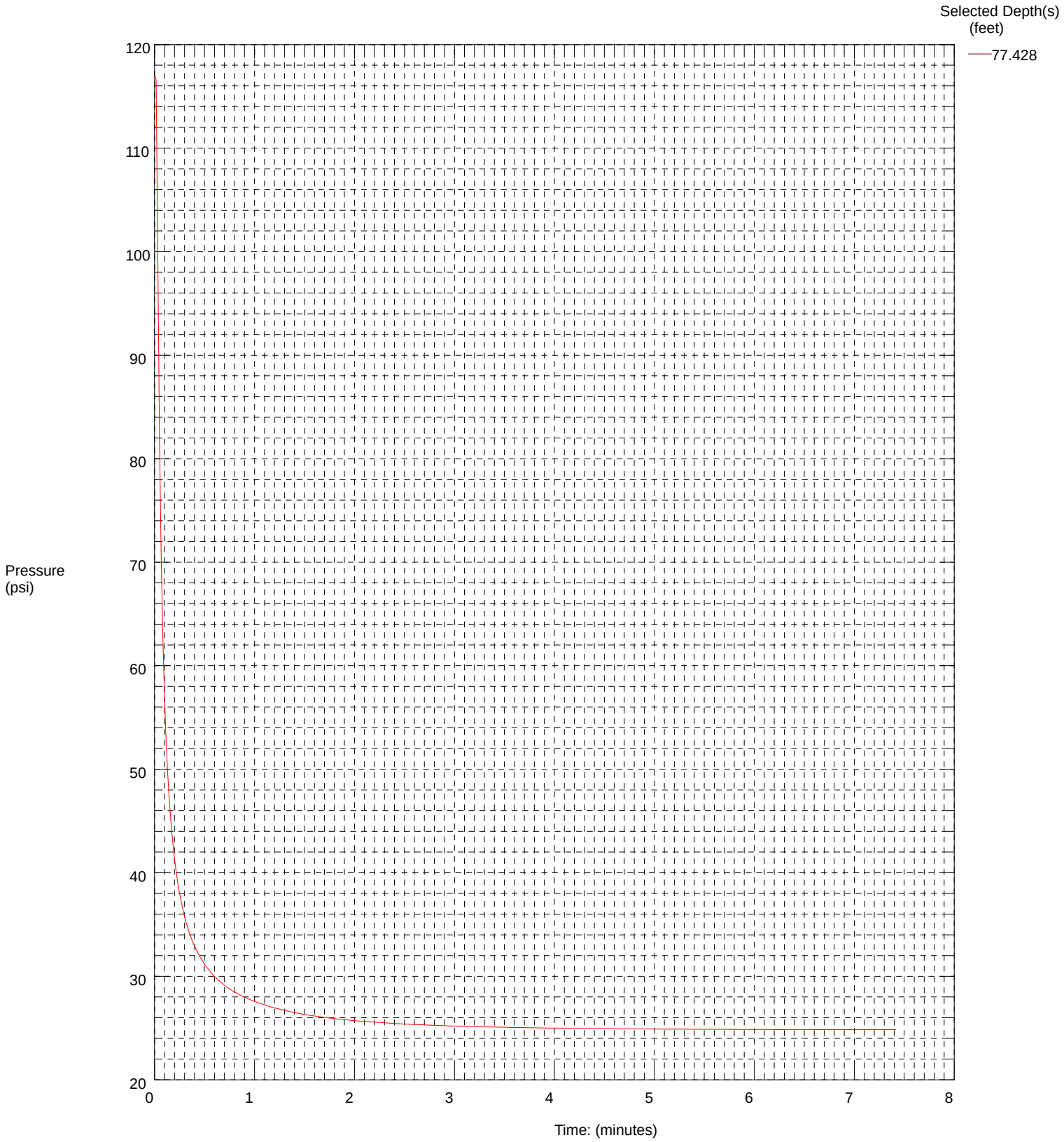


Maximum Pressure = 80.351 psi
Hydrostatic Pressure = 25.986 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT2
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 1:02:24 PM
Location:
Job Number: HHD IPC

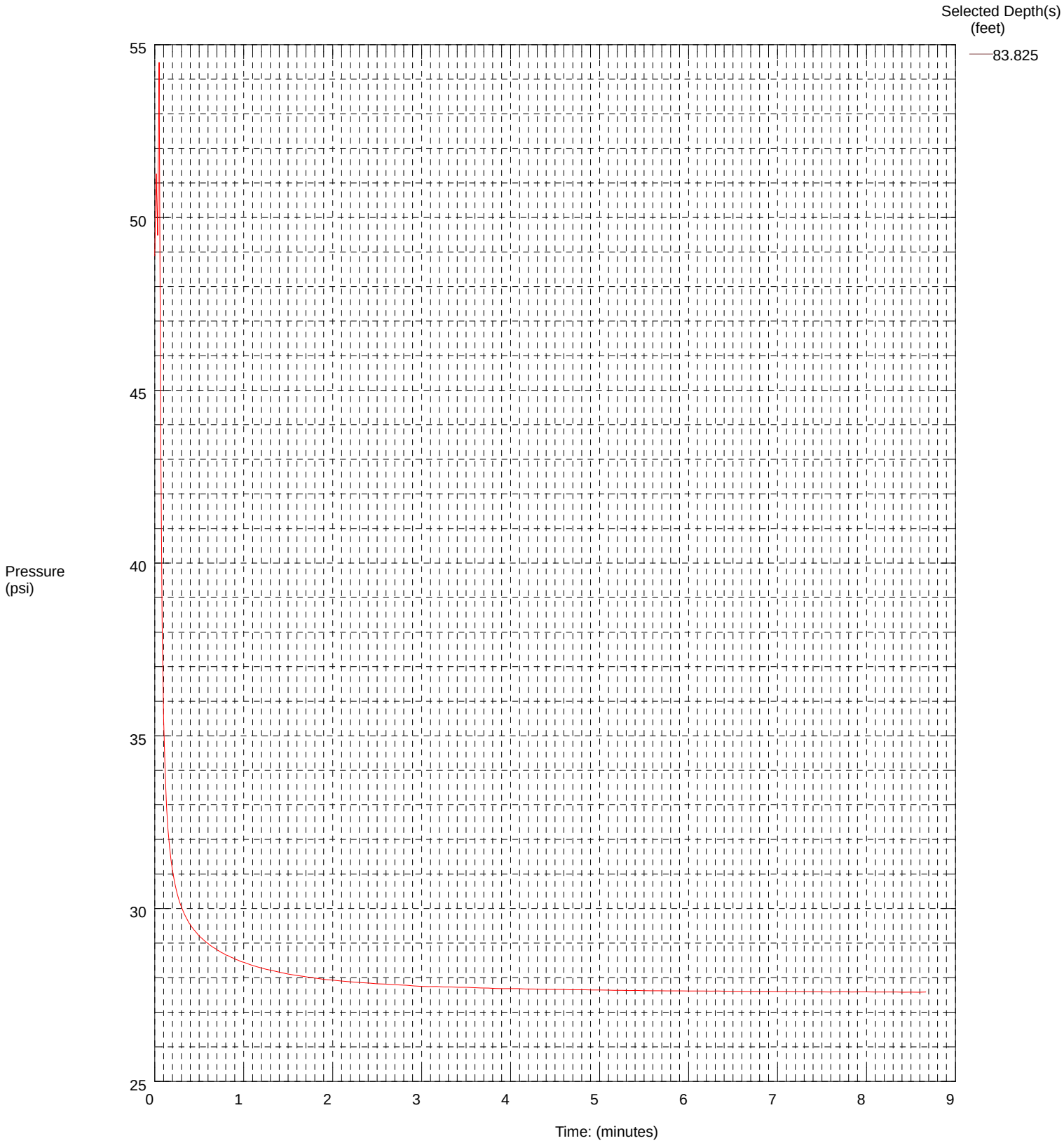


Maximum Pressure = 117.071 psi
Hydrostatic Pressure = 27.908 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT2
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 1:02:24 PM
Location:
Job Number: HHD IPC



Maximum Pressure = 54.484 psi
Hydrostatic Pressure = 30.685 psi

Pore Pressure Dissipation Tests

HHD15-S291-CP-3

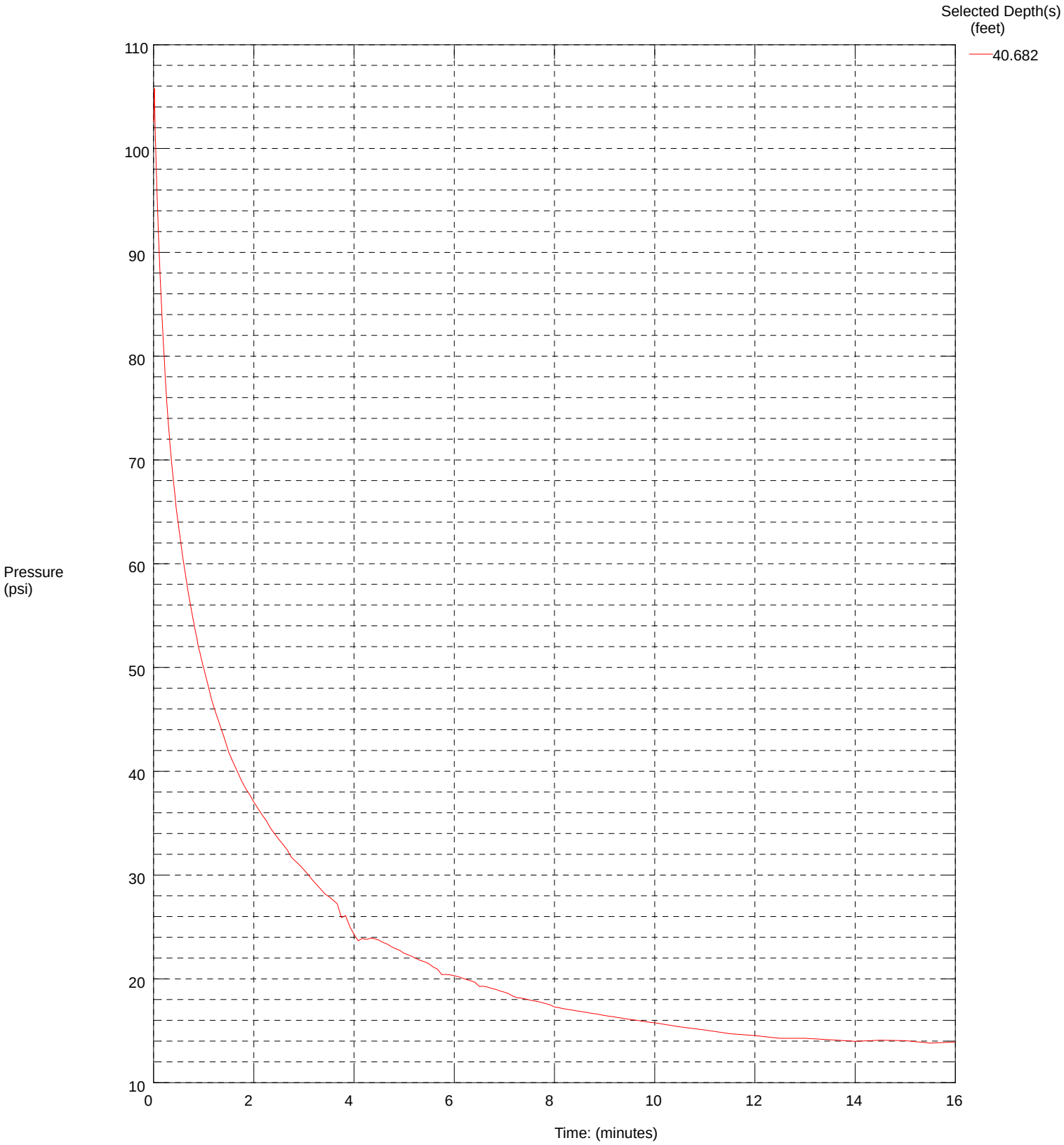
Test Depth (ft)	Permeability* (cm/s)
40.7	1.1E-05
49.2	1.34E-04
63.2	1.07E-04
67.1	1.07E-04

*Calculation based from Mayne 2002

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT3
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 11:36:26 AM
Location:
Job Number: HHD IPC

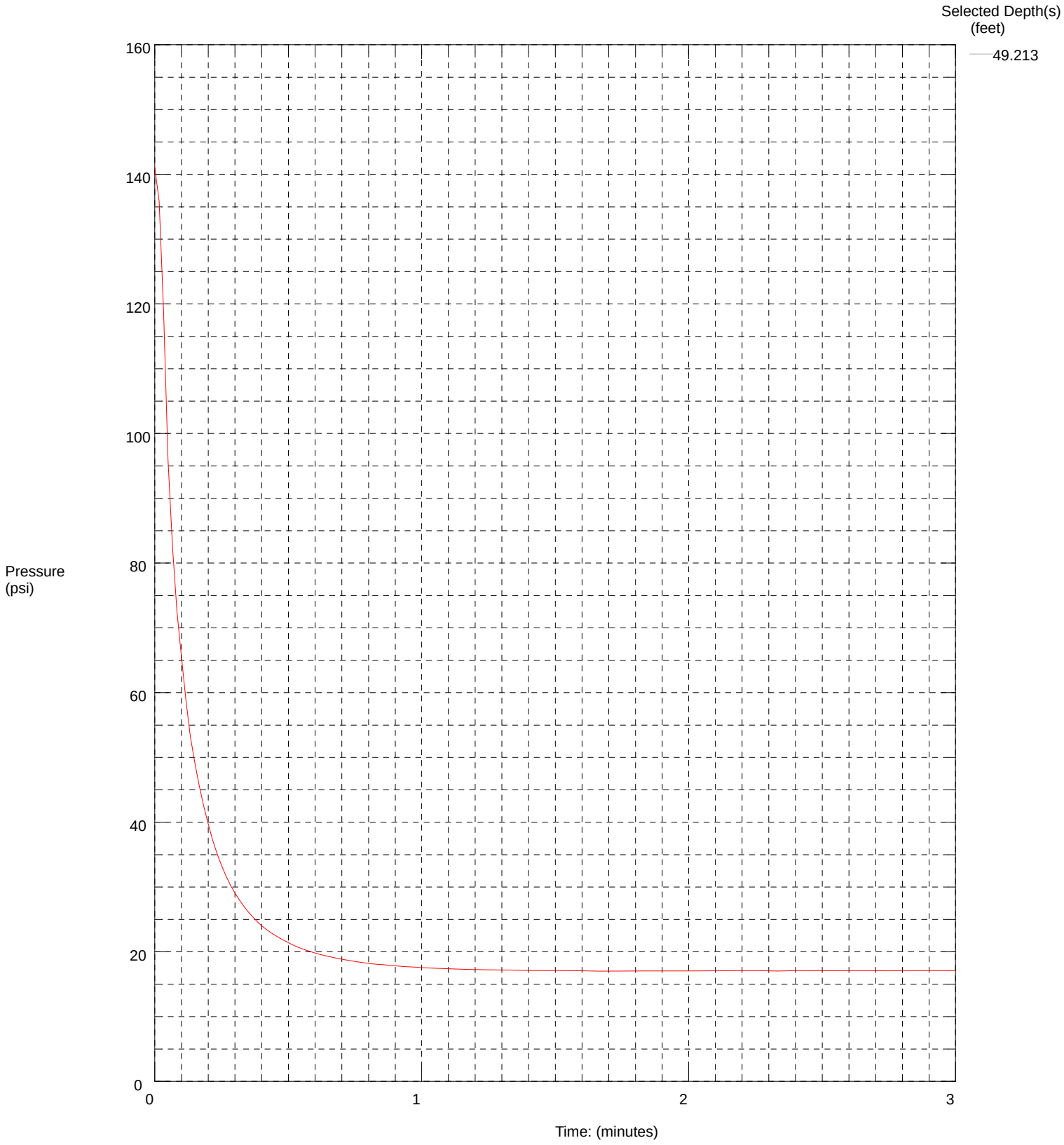


Maximum Pressure = 105.797 psi
Hydrostatic Pressure = 14.808 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT3
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 11:36:26 AM
Location:
Job Number: HHD IPC

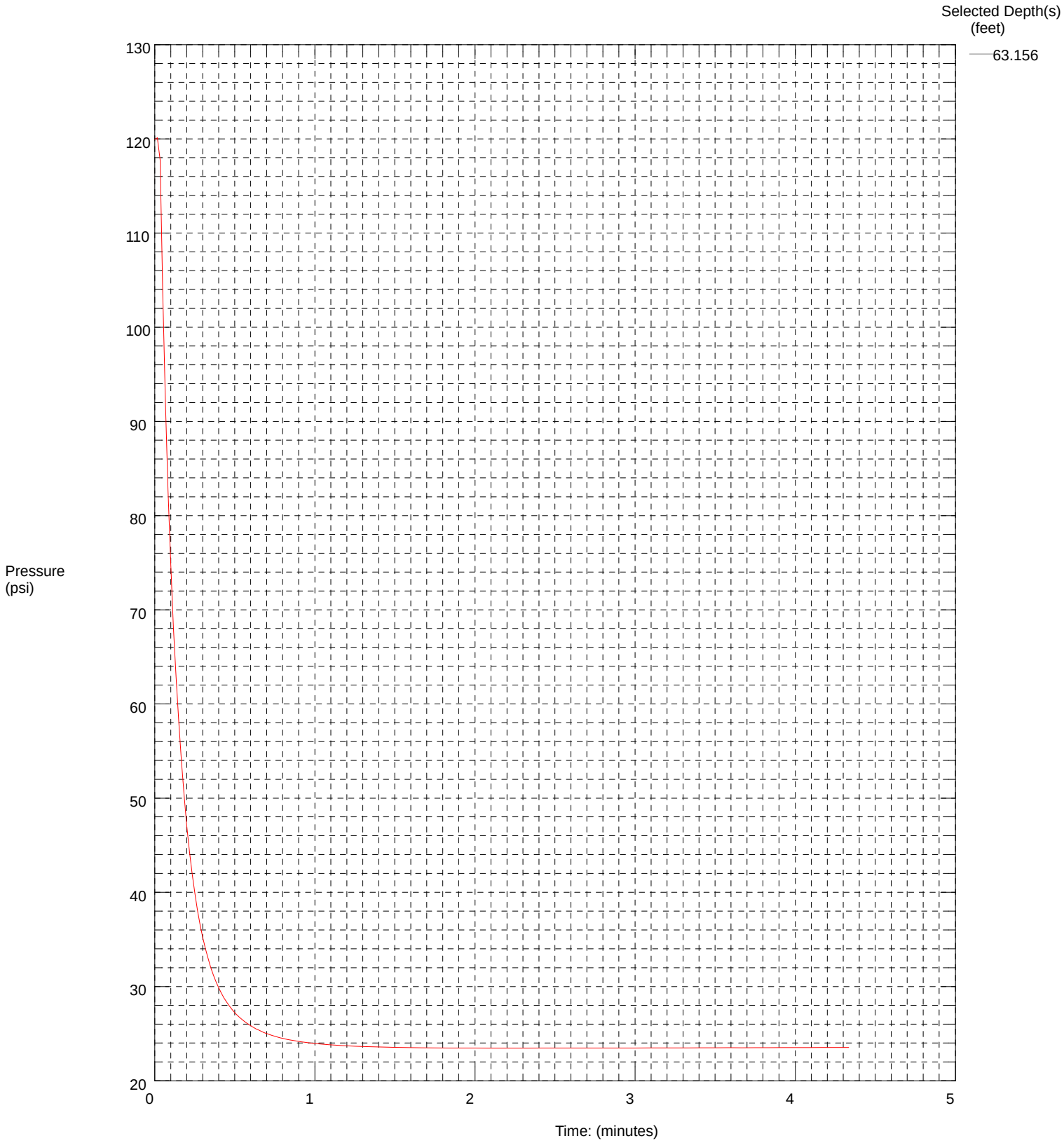


Maximum Pressure = 141.046 psi
Hydrostatic Pressure = 18.511 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT3
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 11:36:26 AM
Location:
Job Number: HHD IPC

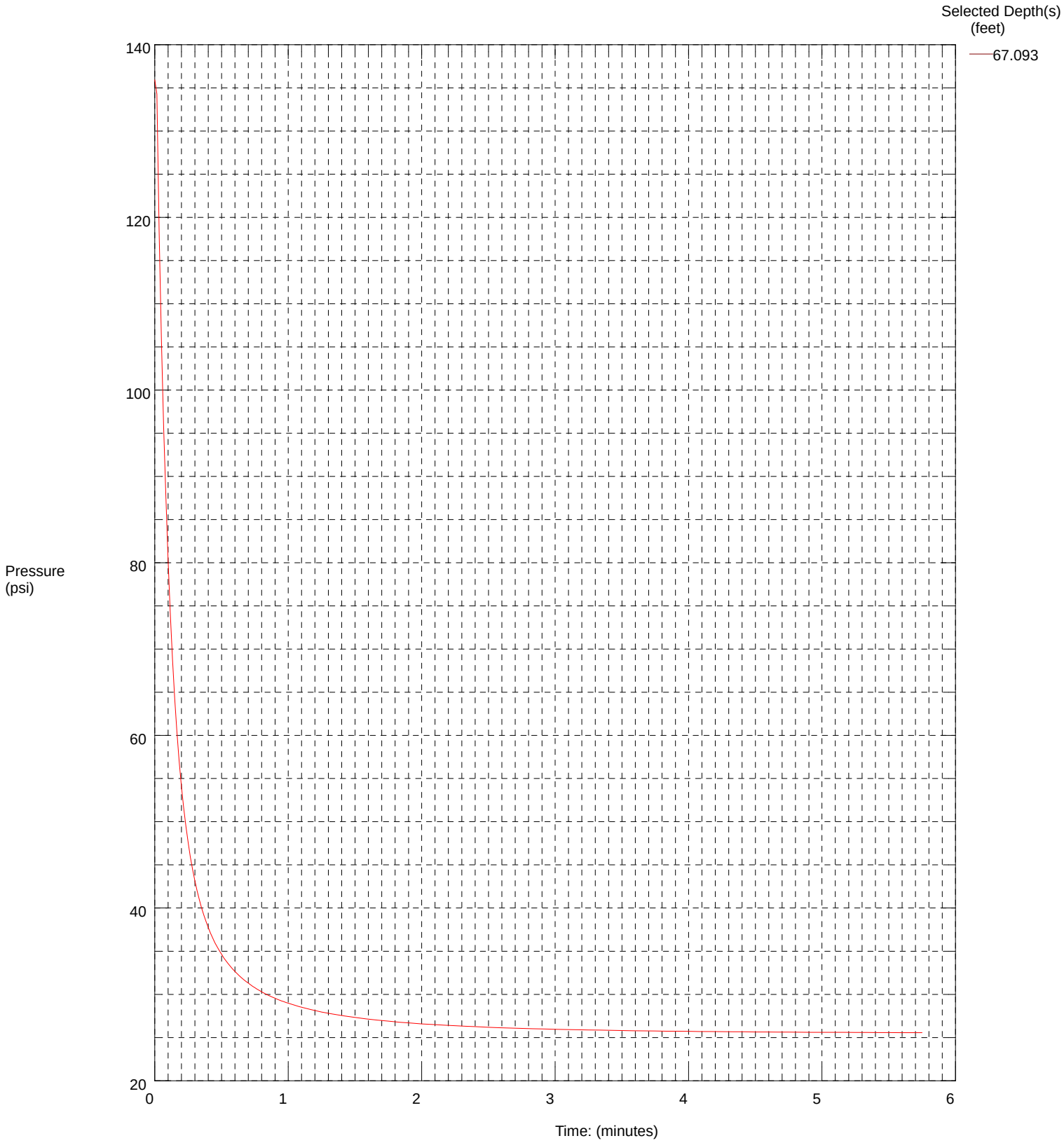


Maximum Pressure = 120.112 psi
Hydrostatic Pressure = 24.562 psi

U.S Army Corps of Engineers

Operator Markov
Sounding: HHD15-S291-CPT3
Cone Used: DSG1071

CPT Date/Time: 6/26/2015 11:36:26 AM
Location:
Job Number: HHD IPC



Maximum Pressure = 135.933 psi
Hydrostatic Pressure = 26.271 psi