REPORT OF SUBSURFACE EXPLORATION

MSD WASTEWATER TREATMENT PLANT

ASHEVILLE, NC

METROPOLITAN SEWERAGE DISTRICT OF BUNCOMBE COUNTY

PROJECT NO.: US-EI-0039737.6091.001
DATE: FEBRUARY 03, 2025

WSP USA, INC.
1308-C PATTON AVENUE
ASHEVILLE, NORTH CAROLINA 28806
NORTH CAROLINA ENGINEERING FIRM LICENSE NO. F-0165

WSP.COM

February 03, 2025

Metropolitan Sewerage District of Buncombe County
2028 Riverside Drive
Asheville, North Carolina 28804

Attention: Mr. Timothy Hensley, PE

Subject: Report of Subsurface Exploration
MSD French Broad River Reclamation Facility off Riverside Drive
Woodfin, North Carolina
WSP Project No. US0039737.6091.001

Dear Mr. Hensley,

WSP USA Inc. (WSP) is pleased to provide this Report of Subsurface Exploration within and adjacent to the existing Metropolitan Sewerage District (MSD) French Broad River Reclamation Facility (also known as the Wastewater Treatment Plant (WWTP)) located off Riverside Drive in Woodfin, North Carolina. Our services were provided in accordance with our Proposal No. 2024US306091 for subsurface exploration dated September 9, 2024 and authorized by you.

The purpose of this exploration was to determine general subsurface conditions within the requested borehole locations within the facility. This report presents the subsurface conditions encountered.

Thank you for the opportunity to provide our professional geotechnical services for this project. We would be pleased to discuss our evaluation with you and welcome the opportunity to continue to provide geotechnical consulting and construction materials testing services as this project progresses.

Sincerely,
WSP USA Inc.

Naim Muhammad, PhD, P.E.
Vice President- Geotechnical Engineering
Registered, North Carolina 058942

Timothy P. Quigley, P.E
Senior Engineer
Registered, North Carolina 034969

NORTH CAROLINA PROFESSIONAL SEAL 034969 ENGINEER TIMOTHY P. QUIGLEY 2/3/25

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1 PROJECT AND SITE INFORMATION

1.1 INTRODUCTION

In accordance with our Proposal No. 2024US306091 dated September 9, 2024, and authorized by MSD, we have performed a subsurface exploration at the MSD Wastewater Treatment Plant located off Riverside Drive in Woodfin, Buncombe County, North Carolina.

The subsurface exploration was requested to provide subsurface information within the borehole areas for potential future development within the area. This report presents the results of our exploration.

1.2 SITE DESCRIPTION AND PROPOSED CONSTRUCTION

Project information was provided by you in emails and telephone conversations and site visits by WSP personnel. The site is located at the existing Metropolitan Sewerage District's (MSD) French Broad River Reclamation Facility (also known as the Wastewater Treatment Plant (WWTP)) located off Riverside Drive in Woodfin, Buncombe County, North Carolina. A total of five soil test borings were requested for drilling to provide subsurface information for potential future development at the site. Two of the borings were located within the existing facility and remaining three borings were located within a partially developed property adjacent to the north of the existing plant facility. The locations of these five requested borings were shown in a location plan provided to us.

1.3 SUBSURFACE EXPLORATION

Five soil test borings (designated as P-1 through P-5), were performed at the approximate locations shown on the attached Site and Boring Location Plan (Figure 1). The boring locations were located by WSP personnel in the field with Mr. Hensley of MSD, utilizing site features near the locations designated on the provided proposed boring location plan provided to us.

Ground surface elevations were estimated based on the contour lines shown on the WWTP plans provided to us during boring layout by MSD. Therefore, boring locations shown on Figure 1 and ground surface elevations shown on the boring logs should be considered approximate.

Prior to drilling, N.C. One-Call was contacted to mark public utilities. We also performed subsurface utility engineering (SUE) services to employ geophysical locating methods including ground penetrating radar (GPR) and electromagnetic (EM) in an attempt to locate the presence and approximate horizontal position of underground utilities at each of the boring locations. Due to the presence of numerous known and unknown underground utilities within the area of boring P-1, MSD vacuum excavated the soil at the borehole location on November 15, 2024 to a depth of approximately 10 feet and a diameter of approximately 2 feet to confirm underground utilities were not present. After the vacuum excavation was complete, MSD backfilled the open borehole with gravel for safety purposes prior to our field exploration with a drill rig. Therefore, SPT samples were not obtained within the upper 10 feet of drilling.

Soil test borings were drilled using an ATV drill rig with mechanically twisting 3 ¼ inch diameter hollow-stem augers into the soil. Soil sampling and penetration testing were performed in

general accordance with ASTM D1586 using an automatic hammer system. At assigned intervals, soil samples were obtained with a standard 1.4-inch I.D., 2-inch O.D. split-spoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows from a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final 12 inches was recorded and is designated the "N-Value" or "penetration resistance". The N-Value, when properly evaluated, is an index to soil strength and foundation support capability. A WSP staff geologist was on-site during parts of the drilling classifying the recovered soil samples.

Portions of split spoon samples were sealed in containers and returned to our laboratory where they were visually classified by a geologist. Selected samples were assigned for subsequent index laboratory testing. The depth to water was measured in the boreholes at the time of drilling and prior to backfilling. The borings were drilled down to the planned depth of about 50 feet or auger refusal.

Refusal materials are materials that cannot be penetrated with standard soil drilling methods. Refusal using dry-auger methods, thus indicated, may result from boulders, lenses, ledges or layers of relatively hard rock underlain by partially weathered rock or residual soil; refusal may also represent the surface of relatively continuous bedrock. Core drilling procedures are required to penetrate refusal materials to determine their character and continuity. However, no core drilling was performed in this exploration as per our proposal.

1.4 SOIL BORING LOGS

The attached Soil Boring Logs represent our interpretation of the field drilling logs based on engineering examination of the field samples. Therefore, these boring logs contain both factual and interpretive information. Lines delineating subsurface strata on the boring logs are intended to group soils having similar engineering properties and characteristics. They should be considered approximate as the actual transition between soil types (strata) may be gradual. A Key to the Soil Symbols and Descriptions used on the boring logs is also included.

2 AREA GEOLOGY AND SUBSURFACE CONDITIONS

2.1 GEOLOGIC SETTING

The project site is located within the Blue Ridge Physiographic Province of North Carolina. The bedrock in this province is a complex mixture of igneous, sedimentary, and metamorphic rock that has been repeatedly squeezed, fractured, faulted, and distorted by past tectonic movements. The virgin soils encountered in this area are the residual product of in-place weathering of rock, which was similar to the rock presently underlying the site. In areas not altered by erosion or disturbed by the activities of development, the typical residual soil profile consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands. The less weathered soils exhibit relict features of the parent rock, including foliation patterns and joints.

The boundary between soil and rock is not sharply defined. This transitional zone, termed "partially weathered rock" (PWR), is normally found overlying the parent bedrock. Partially weathered rock is defined, for engineering purposes, as residual material with standard penetration resistance values in excess of 100 blows per foot. Fractures, joints, and the presence of less resistant rock types facilitate weathering. Consequently, the profile of the partially weathered rock and hard rock is quite irregular and erratic, even over short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level.

The upper soils along drainage features and in floodplain areas are often water-deposited (alluvial) materials that have been eroded and washed down from adjacent higher ground.

2.2 GENERALIZED SUBSURFACE STRATIGRAPHY

General subsurface conditions observed during our subsurface exploration are described in this section. For more detailed soil descriptions and stratifications at a particular boring location, the respective “Soil Boring Log” attached to this report should be reviewed.

2.2.1 TOPSOIL

Approximately 3 to 5 inches of topsoil were noted at the surface of P-2, P-3, P-4, and P-5. Grass was present at the surface at borehole location P-1 prior to the vacuum excavation. Topsoil is typically a dark-colored soil material containing roots, fibrous matter, and/or other organic components, and is generally unsuitable for engineering purposes. It should be noted that WSP has not performed any laboratory testing to determine the organic content or other horticultural properties of the observed surficial materials. Furthermore, the transition from topsoil to underlying material may be gradual, and therefore, the observation and measurement of these thicknesses is somewhat subjective. Actual topsoil depths should be expected to vary across the project site and will generally increase as the amount of vegetation present over the site increases.

2.2.2 EXISTING FILL SOILS

Existing fill and likely fill soils were encountered in borings P-2 and P-3 to a depth of approximately 7.8 and 17 feet, respectively. These soils were generally sampled as very loose to very dense silty sand (SM) with varying amounts of mica and rock fragments with SPT N-values ranging from 2 to 51 blows per foot (bpf). The higher N-value blow counts were likely magnified by the gravel or rock fragments contained in these soils. Thus, these higher N-values are not indicative of the consistency or relative density of the overall soil portions of the fill.

2.2.3 ALLUVIAL SOILS

A layer of likely alluvial (or possible fill) soils was encountered in boring P-3 between approximately 12 to 17 feet below the existing ground surface. These soils were sampled as medium dense silty sand (SM) with an SPT N-value of 19 bpf.

2.2.4 RESIDUAL SOILS

Residual soils were encountered in the borings below the surface, existing fill or alluvial soils. When sampled, the residual soils consisted of very loose to very dense silty sands (SM) and stiff to hard sandy silts (ML). SPT N-values for the sampled residuum ranged from 4 to 54 bpf.

2.2.5 PARTIALLY WEATHERED ROCK AND AUGER REFUSAL MATERIALS

PWR was encountered in borings P-1 and P-3 and auger refusal in borings P-1 through P-4 within the depths of our subsurface exploration. A summary table showing depths of PWR and auger refusal encountered is presented in Table 1 below.

Auger refusal may result from boulders, lenses, ledges or layers of relatively hard rock underlain by PWR or residual soil. Core drilling procedures are required to penetrate refusal materials and determine their character and continuity. Core drilling was beyond the scope of this exploration.

It should be noted that refusal of drilling equipment may be a result of hard rock, or a hard rock lens or a boulder underlain by additional partially weathered rock or residual soil. Auger refusal may not indicate the top of the parent rock formation.

Table 1: Approximate Depths of Initial PWR Layer and Auger Refusal

Boring Number	Initial PWR Layer Depth (feet)	Initial PWR Layer Elevation (feet)	Auger Refusal Depth (feet)	Auger Refusal Elevation (feet)
P-1	10	1933	13	1930
P-2**	NE	NE	7.8**	1934.2**
P-3	47	1914	NE	NE
P-4	NE	NE	43.5	1986.5
P-5	NE	NE	NE	NE

NE – Not Encountered

**Adjacent to borehole P-2 a tall, near vertical continuous rock face is currently present, likely the result of rock blasting and excavation during construction of the larger WWTP facility. Additionally, a stormwater drop inlet and underground pipes are present near the borehole. Based on site observations, the rocky fill soils encountered within our soil test boring above the auger refusal depth were most likely due to the overexcavated rock resulted from the installation of the underground stormwater pipes. Therefore, the general subsurface conditions in this area should be expected to contain rock or boulders of varying sizes at or close to the existing ground surface elevations.

2.2.6 DEPTH-TO-WATER

Groundwater was encountered during drilling within three soil test borings. The approximate depths and elevations are shown on the attached Soil Test Boring Records and are summarized in Table 2 below. Groundwater levels were measured at the time of drilling (TOD). Most of the boreholes were backfilled after the completion of drilling due to safety concerns, so additional and stabilized groundwater measurements were unable to be obtained.

Table 2. Approximate Groundwater Depths

Boring Number	Depth to Groundwater (feet)	Elevation to Groundwater (feet)
P-1	7.9 (TOD)	1935.1
P-3	33 (TOD)	1928
P-4	21.7	2008.3

The groundwater level at the project site is anticipated to fluctuate seasonally depending on the amount of rainfall, prevailing weather conditions, subsurface drainage characteristics, and the influence of nearby construction. Groundwater elevations will vary seasonally, with higher levels

typically occurring during late winter and early spring. Fluctuations in the water level of the French Broad River, which can vary greatly after heavy rainfall events or dry periods, will also cause variations in groundwater levels in adjacent areas. Additionally, the construction process itself can alter groundwater elevations.

2.3 LABORATORY TESTING

WSP completed laboratory tests (natural moisture content and percent finer than a No. 200 sieve) on split spoon samples obtained during our field exploration to assist in classification of on-site soils. The laboratory tests were conducted in general accordance with ASTM standards and results are presented in Table 3 below.

Table 3: Summary of Laboratory Testing Results

Sample Location	Sample Depth, ft	Sample Type	Percent Passing No. 200 Sieve	Natural Moisture Content (%)
P-3	3.5-5	Split Spoon	28.2	12.6
P-4	8.5-10	Split Spoon	45.2	21.0
P-5	3.5-5.0	Split Spoon	39.7	13.3

2.4 EXCAVATION CONDITIONS

Partially weathered rock and material sufficiently hard enough to cause auger refusal was encountered within the two borings as shown on our attached Soil Test Boring Records.

In general, very dense residual soil and partially weathered rock with N-values ranging from 50 blows per 6 inches to 50 blows per 3 inches can often be excavated with bulldozers (Caterpillar D-8 with a single tooth-ripper, or equivalent) or powerful tractor-drawn rippers without blasting, although often with difficulty. Much can depend on the quality of the equipment and the experience of the operators, as well as the nature of the material being excavated (i.e., presence and direction of more weathered seams, bedding planes, etc.). Our experience indicates that partially weathered rock that has a standard penetration resistance of 50/3 inches or fewer, as indicated on the boring records, will require an extreme amount of effort to be removed by ripping and can most effectively be removed by blasting.

Confined excavations, such as utility trenches, in partially weathered rock may require pneumatic hammers or blasting. Blasting may be necessary to efficiently remove more resistant rock and large boulders that could be present within the partially weathered rock. The ease of excavation of partially weathered rock cannot be specifically quantified and depends on the quality of grading equipment, skill of the equipment operators and geologic structure of the material itself, such as the direction of bedding, planes of weakness and spacing between discontinuities.

Auger refusal material, confirmed to be continuous based on the rock coring performed, will require blasting to excavate. Alternatively, non-explosive methods such as pneumatic hammers and expansive grout poured into drilled holes in the rock could be utilized for rock excavation. We recommend that the requirement for blasting be defined in terms of equipment performance. For general excavation, typical recommendations would be that rock be defined as material that cannot be excavated with a single tooth-ripper drawn by a Caterpillar D-8 or equivalent bulldozer. For trench excavation, typical recommendations would be that rock be defined as material that cannot be excavated by a Caterpillar 225 or equivalent backhoe equipped with rock teeth.

Prior to blasting, pre-blast surveys of nearby structures should be performed to document existing damage to these structures. Vibration monitoring should also be performed near the closest structures to the site during blasting.

In a larger, open excavation site, a particularly resistant area could be approached from any direction with the ripper and thus align with a plane of weakness. Partially weathered rock that is excavated by ripping may be removed in large slabs or boulders which are difficult to move and/or break into smaller pieces for use in the fill. Given the anticipated relatively small widths of the excavations on this project, this may prove difficult.

3 LIMITATIONS

The information provided are based in part on project information provided to us, and they only apply to the specific project and site discussed in this report. If the project information referenced in this report contains incorrect information or if additional information is available, you should convey the correct or additional information to us and retain us to review our information.

Regardless of the thoroughness of a subsurface exploration, there is always a possibility that conditions between borings will be different from those at specific boring locations, and that conditions will not be as anticipated by the designers or contractors. In addition, the construction process may itself alter soil conditions. Therefore, experienced geotechnical personnel should observe and document the construction procedures used and the conditions encountered. Unanticipated conditions and inadequate procedures should be reported to the design team along with timely recommendations to solve the problems created. We are available to assist the design and construction team in providing this service based upon our familiarity with the project, the subsurface conditions, and the intent of the recommendations.

WSP prepared this report solely for the use of the intended recipient, MSD of Buncombe County, in accordance with our Proposal dated September 9, 2024. The intended recipient is solely responsible for the disclosure of any information contained in this report. The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance, or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report. This limitations statement is considered an integral part of this report.

APPENDIX

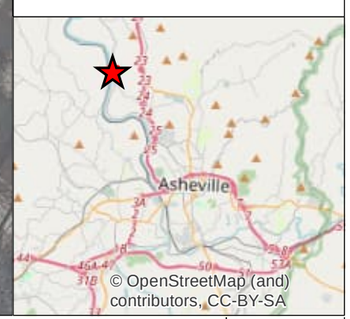
A FIGURES

Legend

- Soil Test Boring
- Parcel Boundary

N
W E
S

0 40 80 160
Feet



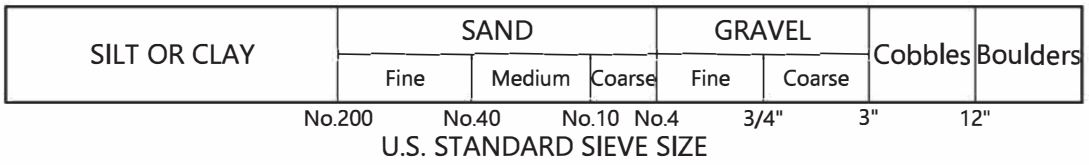
wsp	**WSP USA Inc.** 1308 Patton Ave Suite C Asheville, NC 28806	Note: This map is for reference only.	**TITLE:** SITE AND BORING LOCATION PLAN MSD WASTEWATER TREATMENT PLANT ASHEVILLE, NORTH CAROLINA	PREPARED BY: L. BARON 1/27/2025 CHECKED BY: T. QUIGLEY 1/27/2025	PROJECT NUMBER: US0039737.6091.002 REFERENCE: NC ONEMAP	Figure No. 1

APPENDIX

B SOIL BORING LOGS

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			GP	Poorly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel - sand - silt mixtures.
			GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, well graded sands with gravel.
			SP	Poorly graded sands, poorly graded sands with gravel.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands.
			SC	Clayey sands.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts, sandy or clayey silts with low plasticity.
			CL	Inorganic clays of low plasticity.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of high plasticity, organic silts.
CORED ROCK			RK	Rock

<u>BOUNDARY CLASSIFICATIONS:</u> Soils possessing characteristics of two groups are designated by combinations of group symbols.



<u>Reference:</u> "Classification of Soils for Engineering Purposes" (Unified Soil Classification System) ASTM D 2487, and/or "Description and Identification of Soils" (Visual-Manual Procedure), ASTM D 2488.

	Undisturbed Sample		Auger Cuttings
	Split Spoon Sample		Bulk Sample
	Rock Core		Crandall Sampler
	Dilatometer		Pressure Meter
	Packer		No Recovery
	Water Table at time of drilling		Water Table after 24 hours
	Caved Depth		WOH = Weight of Hammer

Monitoring Well Explanation

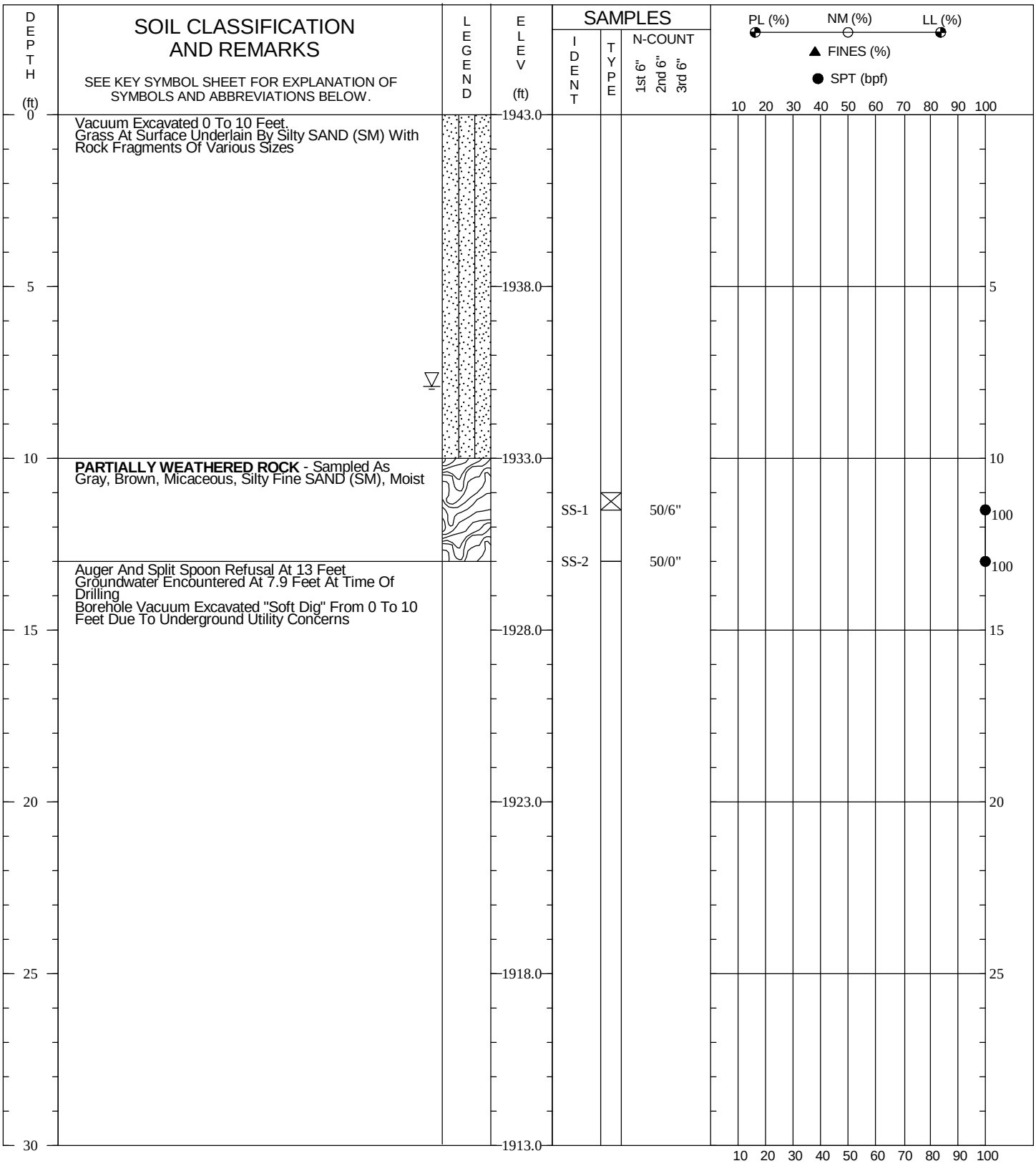
Cement | Bentonite | Sand Filter | Screen

Correlation of Penetration Resistance with Relative Density and Consistency

NON-COHESIVE		COHESIVE	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 1	Very Soft
5 - 10	Loose	2 - 4	Soft
11 - 30	Medium Dense	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
Over 50	Very Dense	16 - 30	Very Stiff
		Over 30	Hard

KEY TO SYMBOLS AND DESCRIPTIONS

WSP USA Inc.



SOIL LOG MSD WWTP.GPJ 2/3/25

DRILLER:	IET Drilling
EQUIPMENT:	CME 550
METHOD:	3.25" HSA
HOLE DIA.:	
REMARKS:	
PREPARED BY:	MNQ
CHECKED BY:	TPQ

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

PROJECT: MSD Wastewater Treatment Plant **BORING NO.:** P-1

DRILLED: November 26, 2024

PROJ. NO.: US0039737.6091.001 **PAGE** 1 **OF** 1

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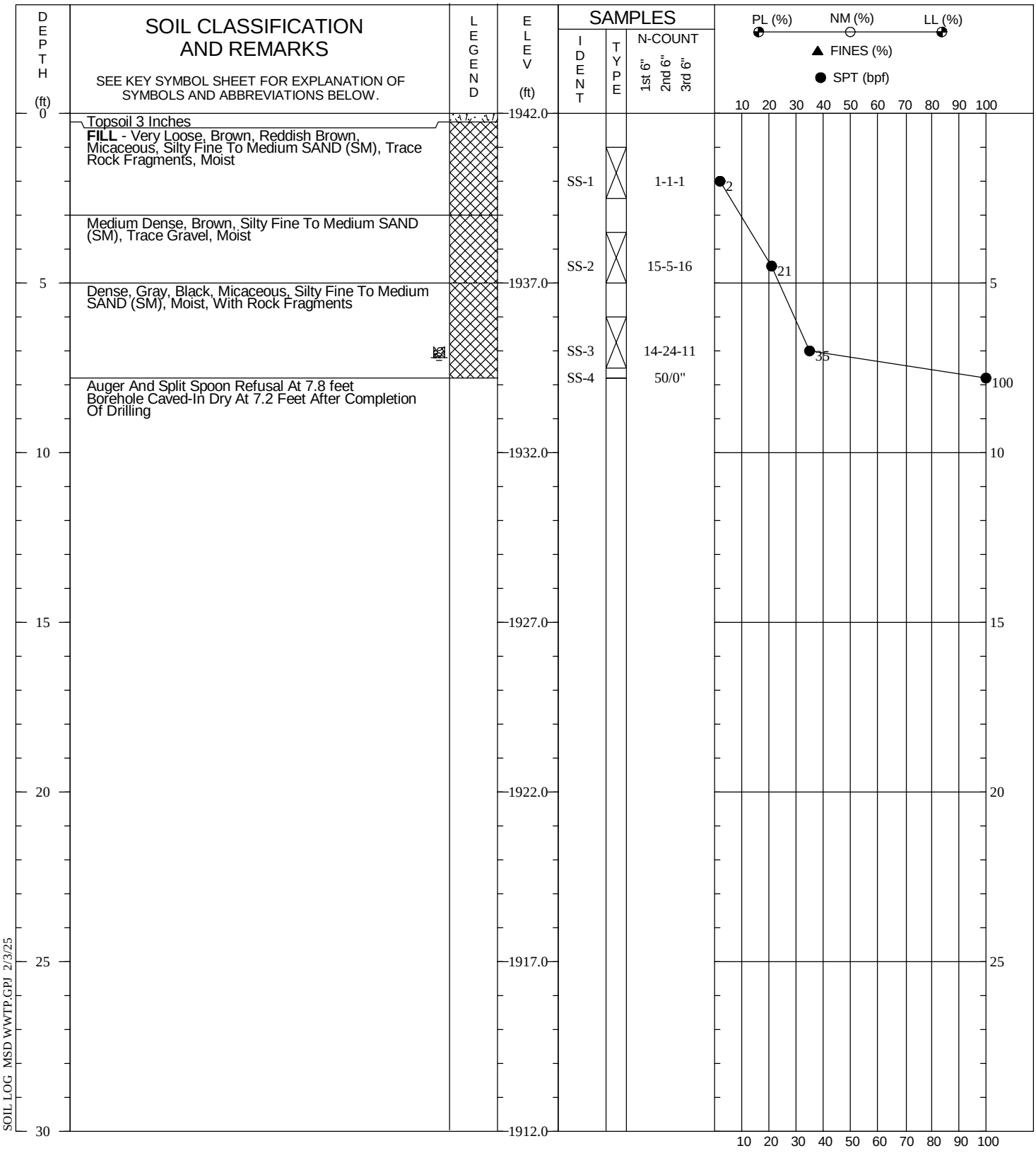

SOIL LOG MSD WWTP.GPJ 2/3/25

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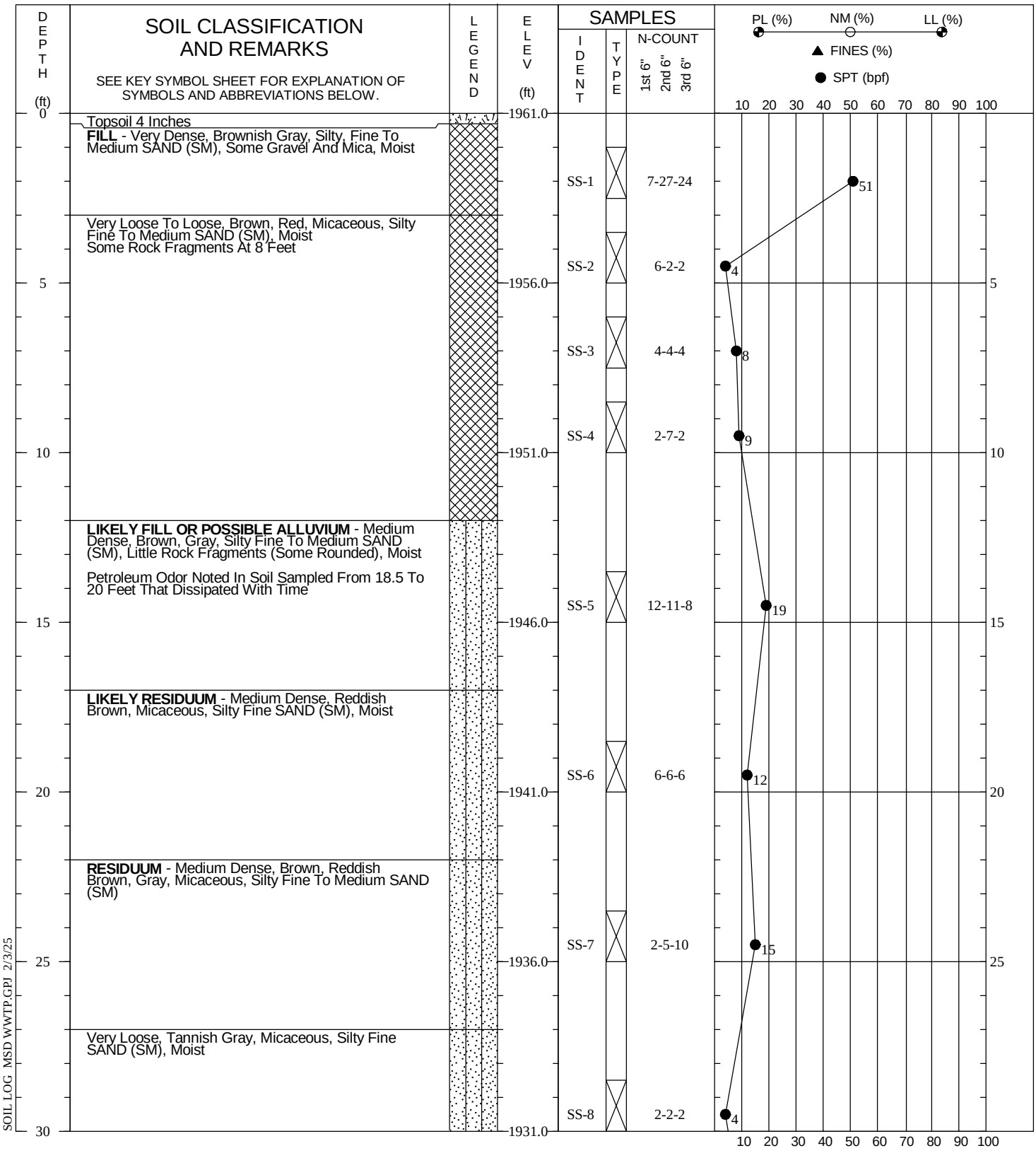
SOIL TEST BORING RECORD

PROJECT: MSD Wastewater Treatment Plant **BORING NO.:** P-2

DRILLED: November 26, 2024

PROJ. NO.: US0039737.6091.001 **PAGE** 1 **OF** 1



SOIL LOG MSD WWTP.GPJ 2/3/25

DRILLER:	IET Drilling
EQUIPMENT:	CME 550
METHOD:	3.25" HSA
HOLE DIA.:	
REMARKS:	
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SOIL TEST BORING RECORD

PROJECT: MSD Wastewater Treatment Plant **BORING NO.:** P-3

DRILLED: November 26, 2024

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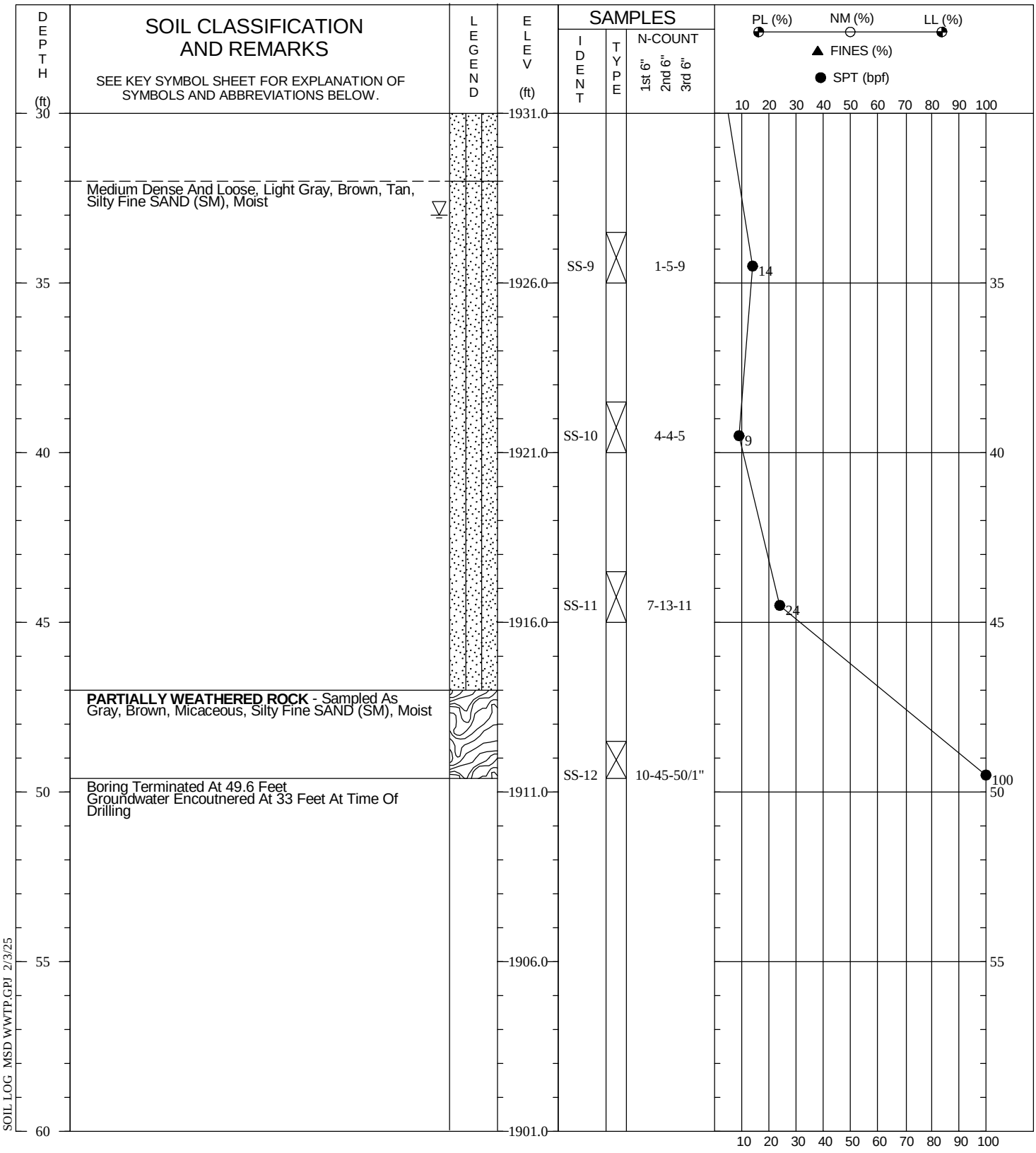

SOIL LOG MSD WWTP.GPJ 2/3/25

DRILLER:	IET Drilling
EQUIPMENT:	CME 550
METHOD:	3.25" HSA
HOLE DIA.:	
REMARKS:	
PREPARED BY:	MNQ
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SOIL TEST BORING RECORD

PROJECT: MSD Wastewater Treatment Plant **BORING NO.:** P-3

DRILLED: November 26, 2024

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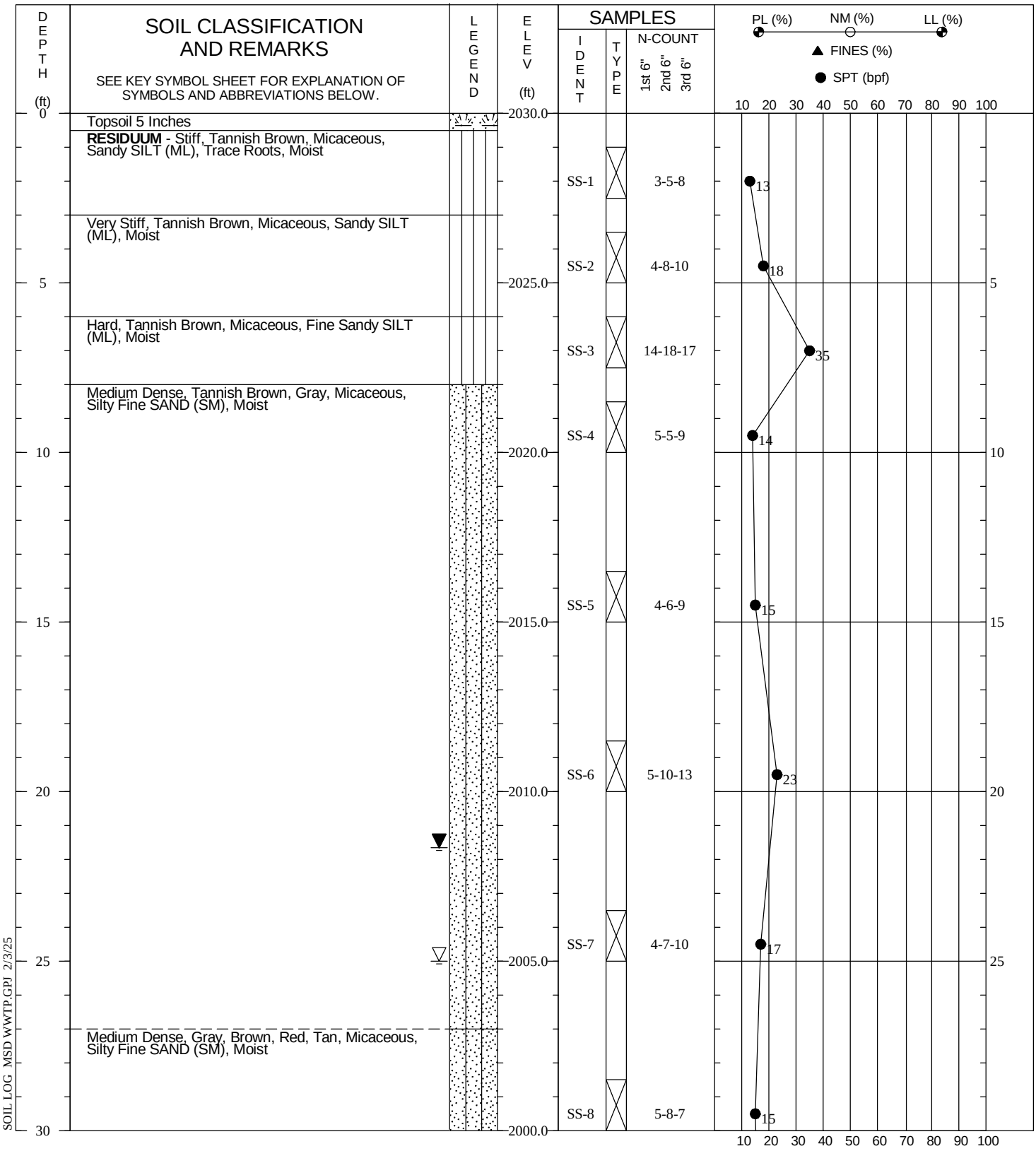

SOIL LOG MSD WWTP.GPJ 2/3/25

DRILLER:	IET Drilling
EQUIPMENT:	CME 550
METHOD:	3.25" HSA
HOLE DIA.:	
REMARKS:	
PREPARED BY:	MNQ
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SOIL TEST BORING RECORD

PROJECT: MSD Wastewater Treatment Plant **BORING NO.:** P-4

DRILLED: November 27, 2024

PROJ. NO.: US0039737.6091.001 **PAGE** 1 **OF** 2

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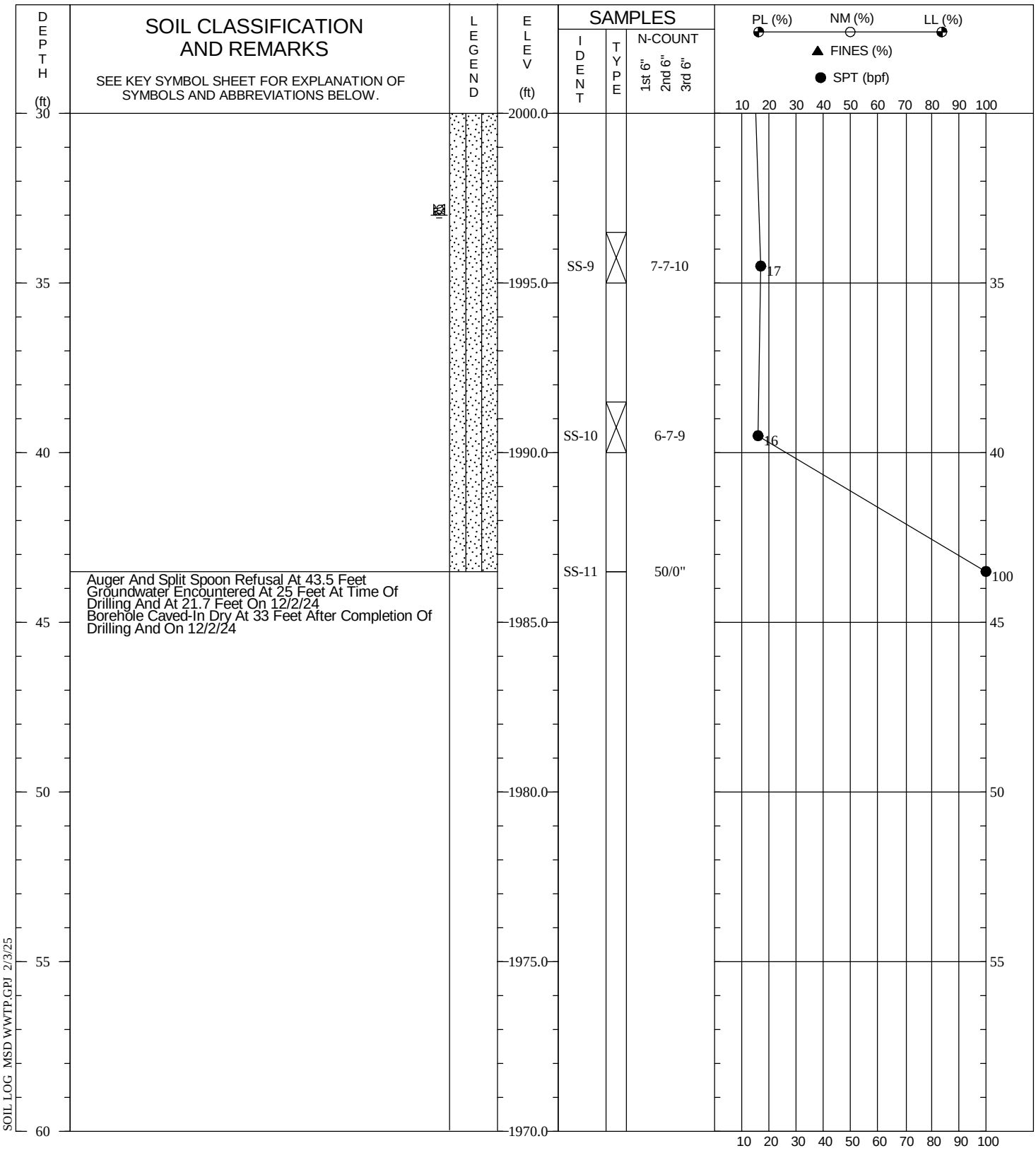

SOIL LOG MSD WWTP.GPJ 2/3/25

DRILLER:	IET Drilling
EQUIPMENT:	CME 550
METHOD:	3.25" HSA
HOLE DIA.:	
REMARKS:	
PREPARED BY:	MNQ
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SOIL TEST BORING RECORD

PROJECT: MSD Wastewater Treatment Plant **BORING NO.:** P-4

DRILLED: November 27, 2024

PROJ. NO.: US0039737.6091.001 **PAGE** 2 **OF** 2

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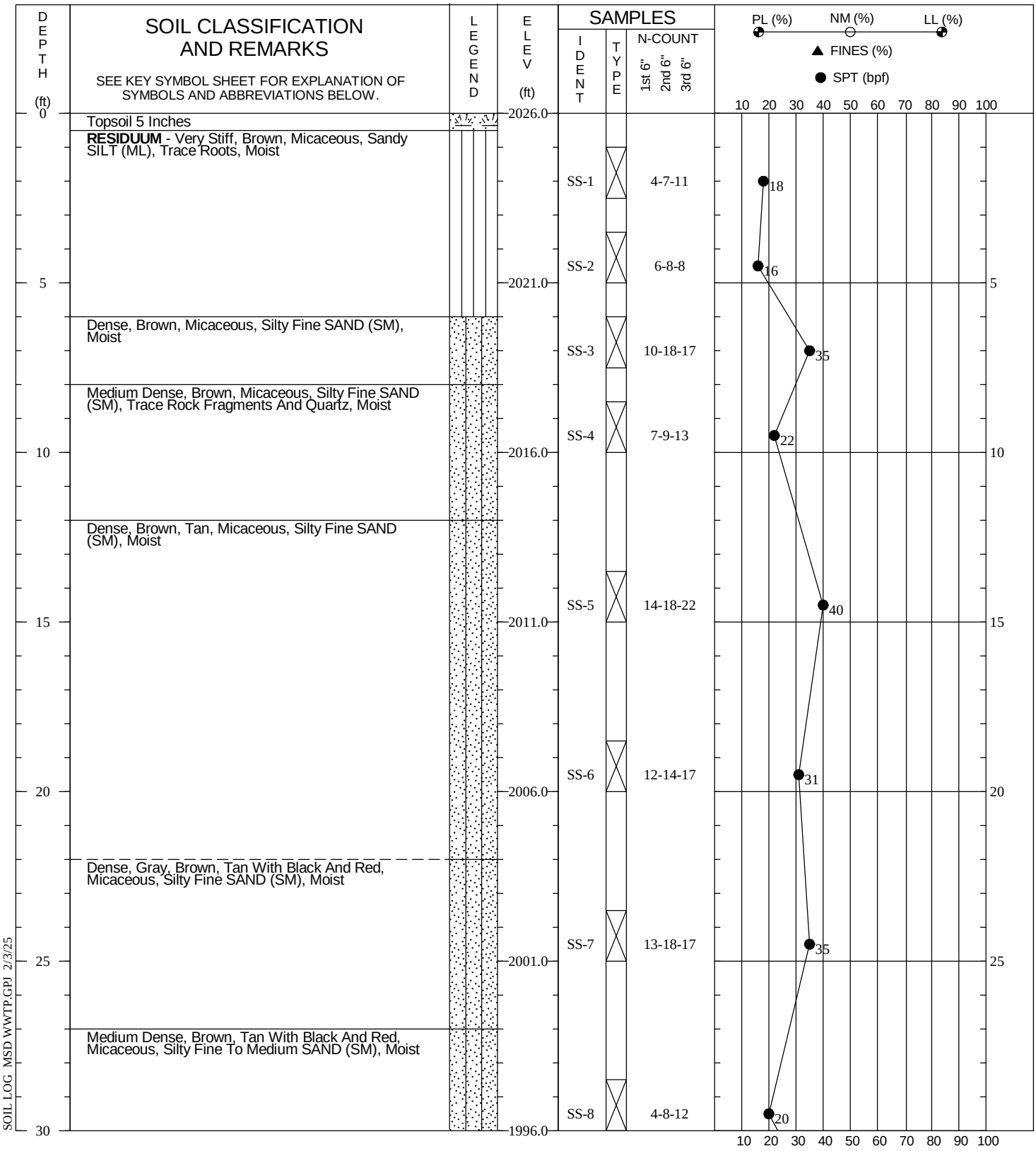

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DRILLER:	IET Drilling
EQUIPMENT:	CME 550
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HOLE DIA.:	
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PREPARED BY:	MNQ
CHECKED BY:	TPQ

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

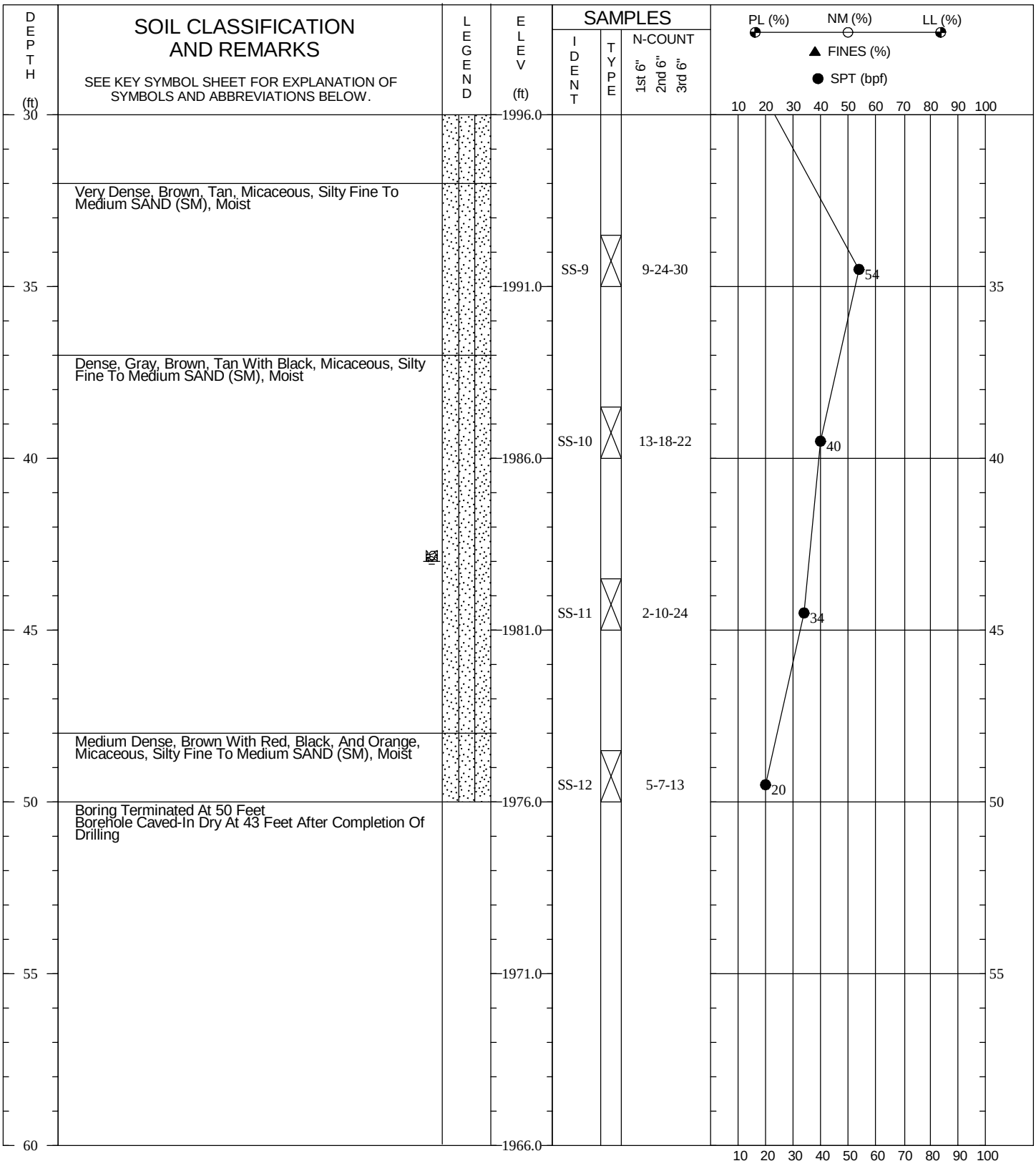
SOIL TEST BORING RECORD

PROJECT: MSD Wastewater Treatment Plant **BORING NO.:** P-5

DRILLED: November 27, 2024

PROJ. NO.: US0039737.6091.001 **PAGE** 1 **OF** 2

wsp



SOIL LOG MSD WWTP.GPJ 2/3/25

DRILLER:	IET Drilling
EQUIPMENT:	CME 550
METHOD:	3.25" HSA
HOLE DIA.:	
REMARKS:	
PREPARED BY:	MNQ
CHECKED BY:	TPQ

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