

SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING

PROPOSED PICKLEBALL COURT AND PARKING AREA

WEST NECK VILLAGE

VIRGINIA BEACH, VIRGINIA

MTL PROJECT #23-1164

Prepared for: West Neck Community Association
2580 Signature Drive
Virginia Beach, Virginia 23456

Attention: George Davis

McCALLUM

TESTING LABORATORIES

Geotechnical Engineering, Materials Testing & Environmental Services

June 5, 2023

West Neck Community Association

2580 Signature Drive
Virginia Beach, Virginia 23456

Attention: **George Davis**

Subject: **SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING**

Proposed Pickleball Court and Parking Area
West Neck Village
Virginia Beach, Virginia
MTL Project #23-1164

Dear **Mr. Davis**:

McCALLUM TESTING LABORATORIES is pleased to present this report of subsurface exploration and geotechnical engineering services for the above referenced project. Included in this report are:

1. A brief description of the project;
2. An outline of the services performed;
3. A tabulation of the subsurface conditions encountered; and
4. Our detailed recommendations for site preparation and construction of pickleball court and pavements.

Should you have any questions concerning this report, please do not hesitate to contact this office at your earliest convenience.

Very truly yours,

McCALLUM TESTING LABORATORIES


R. WAYNE KENDRICK, E.I.T.
STAFF ENGINEER

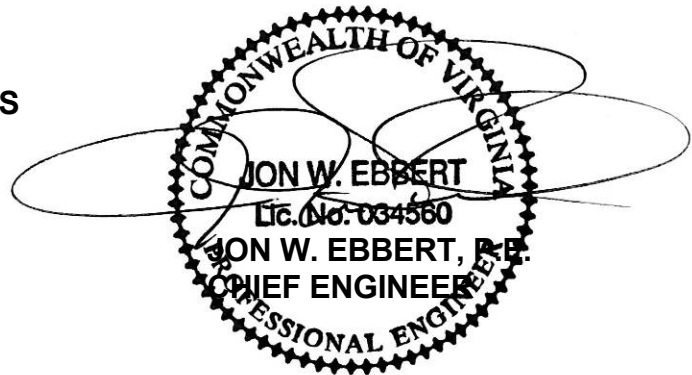




TABLE OF CONTENTS

1.0 SUMMARY.....	1
2.0 PROJECT INFORMATION.....	2
3.0 SCOPE OF SERVICES.....	3
4.0 SUBSURFACE CONDITIONS.....	4
4.1 Stratigraphy	4
4.2 Groundwater	4
5.0 RECOMMENDATIONS.....	5
5.1 Basis	5
5.2 Site Preparation	5
5.3 Pickleball Court and Pavements.....	6
APPENDIX A	
Site Location Plan.....	Drawing 1
Boring and CBR Location Plan.....	Drawing 2
Subsurface Profiles	Drawing 3
Test Boring Records	
APPENDIX B	
Laboratory Test Results	

1.0 SUMMARY

The encountered subsurface conditions and our major geotechnical engineering recommendations have been summarized here for convenience. A detailed description of the soil conditions encountered and our detailed recommendations are provided in the report.

- The borings encountered 6 inches of topsoil overlying Coastal Plain Sediments. The underlying sediments consist of a 4 ft. layer of medium stiff sandy clays and very loose clayey sands overlying loose to medium compact silty sands to the maximum depth of exploration, 10 ft. below existing grade. At the time of our exploration, water level measurements indicated groundwater to be approximately 4 feet below existing grade.
- The preparation of the site should consist of the stripping of all surface vegetation and topsoil, proofrolling, undercutting of localized areas of excessively soft soils and the filling to grade with properly compacted soil.
- The *International Building Code (2021)* and the *American Society of Civil Engineers (ASCE 7)* indicates that the project area has a soil classification of Site Class D for use in determining earthquake loads.
- The results of our laboratory CBR testing indicate a soaked CBR value of 9.5 percent can be used for the design of the pavement sections required by the project.

2.0 PROJECT INFORMATION

The site for the proposed pickleball court and parking area is located on the east side of Wilderness Lane, just east of its intersection with Arnold Palmer Drive in the West Neck Village of Virginia Beach, Virginia. The relatively level site is presently a grass covered lot with mature trees to the east.

The new pickleball court is anticipated to be constructed with asphalt pavement topped with a synthetic or acrylic finish. We anticipate that up to 1 ft. of fill will be required to obtain the finished subgrade elevation.

The development of the site will also include an asphalt paved driveway and parking areas located directly south of the pickleball court.

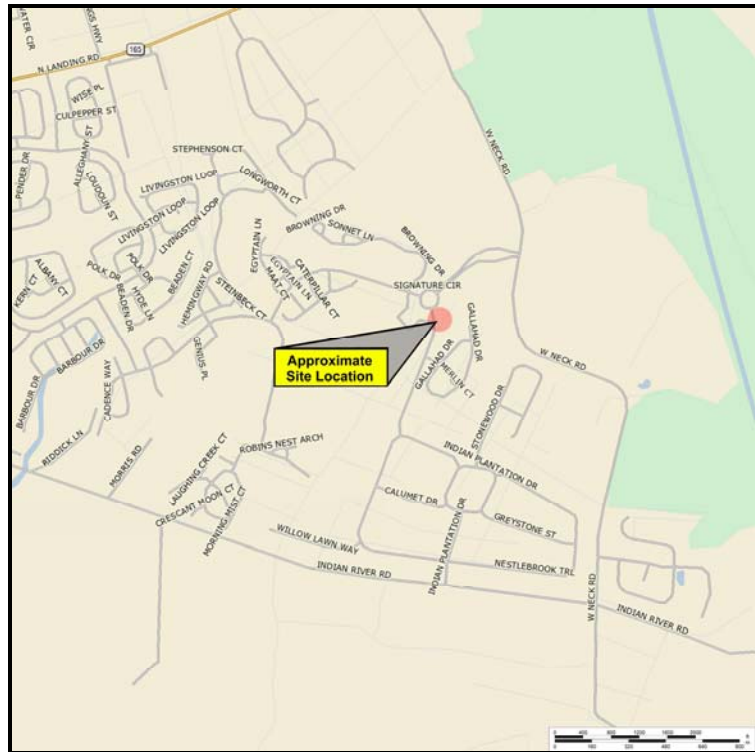


Figure 1. Site Location Plan

3.0 SCOPE OF SERVICES

The evaluation of the site for the planned pickleball court and parking area required both the collection of subsurface data and the performance of various geotechnical analyses. These analyses were based on our experience with local conditions and site preparation methods. All work was directed and supervised by a Professional Engineer specializing in geotechnical design and construction. This report which describes the exploration and provides our recommendations for site preparation and construction of the pickleball court and pavements was prepared after reviewing the project information provided to us and analyzing the subsurface data collected for the project.

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drilled a total of two soil test borings extending to a depth of 10 ft. each beneath the existing ground surface. Standard Penetration Tests (SPT's) were performed at 2 ft. intervals in the upper 10 ft. of boring. In addition, a bulk bag sample of the near surface soils was obtained at one pavement boring for laboratory California Bearing Ratio (CBR) testing. All drilling, sampling and testing was performed in accordance with applicable ASTM Standards or other widely accepted standards. At the completion of drilling, water level measurements were made within the completed bore holes. All samples obtained from the borings were visually examined by a Geotechnical Engineer and visually classified according to the Unified Soils Classification System. Laboratory testing (Moisture Content, Atterberg Limits and Percent Passing a No. 200 Sieve) was performed on selected soil samples at various depths to aid in soil classification.



Figure 2. Boring and CBR Location Plan

Laboratory testing (Moisture Content, Atterberg Limits and Percent Passing a No. 200 Sieve) was performed on selected soil samples at various depths to aid in soil classification.

A Site Location Plan, a Boring and CBR Location Plan, a Subsurface Profile, and the detailed results of field sampling and testing are presented in Appendix A. The results of all laboratory testing performed for this study are presented in Appendix B.

4.0 SUBSURFACE CONDITIONS

4.1 Stratigraphy

Directly beneath a surface veneer of topsoil 6 inches thick, the borings encountered Coastal Plain Sediments as shown in Figure 3. A summarization of the subsurface conditions encountered is presented in the following tabulation:

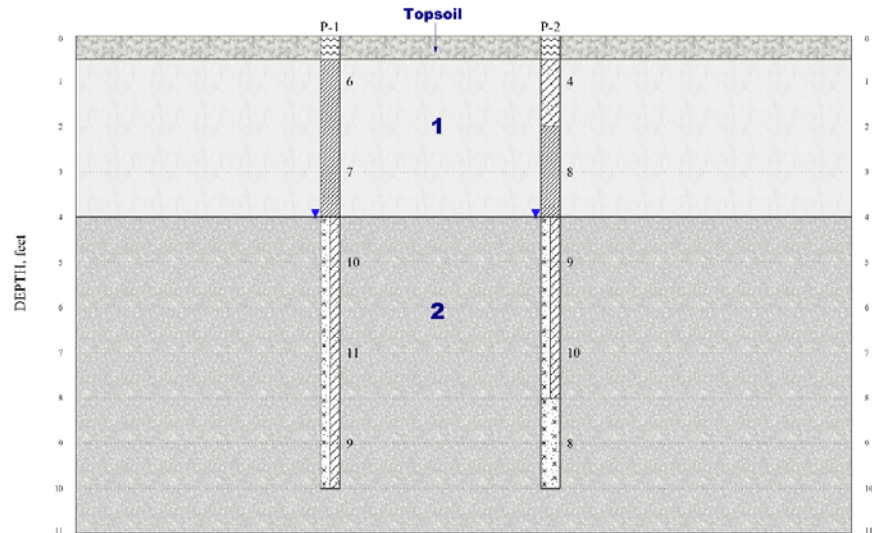


Figure 3. Subsurface Profile

STRATUM	AVERAGE DEPTH (FT)	DESCRIPTION	STANDARD PENETRATION RESISTANCE (BLOWS/FT)
1	0.5 - 4.0	Medium stiff, moist, gray, silty, fine sandy clay (CL) and very loose, moist, brown, silty, clayey, fine sand (SC)	4 to 8
2	4.0 - 10.0 ⁽¹⁾	Loose to medium compact, wet, gray, clayey, silty, fine sand (SM-SC, SM)	8 to 11
Note: (1) Maximum Depth of Exploration			

4.2 Groundwater

Our groundwater level measurements made at the completion of drilling operations indicated the level of groundwater to be approximately 4 ft. below the existing ground surface. Seasonal groundwater level fluctuations on the order of 2 to 3 feet are not uncommon in this area. Lowest groundwater levels normally occur in late summer and early fall while the highest levels generally occur in late winter and early spring. At the time of our study, we believe groundwater levels were between their seasonal high and low elevations.

5.0 RECOMMENDATIONS

5.1 Basis

The following recommendations are based on data obtained by this subsurface exploration program, the structural and site orientation data given previously and our past experience within the area. This report does not reflect variations that may occur between soil borings or across the site. If the project information presented is incorrect or changed in the final design or if site or subsurface conditions encountered during construction differ appreciably from those indicated by this report, this office should be notified to determine the applicability of our recommendations in light of the changed conditions. This report has been prepared for the exclusive use of our client for the specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering principles and practices.

5.2 Site Preparation

Initially, areas planned to support new fill, pickleball court or pavements should be stripped of all surface vegetation and topsoil. Stripping should extend at least 2 ft. beyond pickleball court and pavement lines. These areas should then be proofrolled with a heavily loaded dump truck and be monitored by the Geotechnical Engineer to locate any pockets of excessively weak surface soils. All areas that deflect excessively or rut and fail to tighten up under continued proofrolling should be undercut to firm material and be replaced with properly compacted fill.

Based on the results of our Standard Penetration Testing, it is possible that a large portion of the site will require undercuts on the order of 2 ft. The surface soils to be exposed by the stripping operations do have a tendency to become softened and unstable when saturated and worked by equipment. Therefore, to help prevent additional undercutting, the exposed subgrade should be well drained to help prevent accumulation of water on the site and construction traffic across the site should be limited as much as possible. It will be most preferable to have the subgrade exposed only during the drier seasons of the year and to limit construction traffic to well defined areas outside the pickleball court and pavement areas.

After the successful completion of proofrolling and any required undercutting operations, fill required to reach finished subgrade elevations can be placed. Pickleball court and pavement area fills should extend approximately 2 ft. beyond pavement lines. Fill and backfill (undercuts, utilities, etc.) should be classified as SP-SM, SP or SW by the Unified Soils Classification System, with no more than 12 percent passing the No. 200 sieve. All fill and backfill materials proposed for use should be tested and approved by the Geotechnical Engineer prior to their placement on site. All fill and backfill placed beneath the pickleball court and pavements should be compacted in loose lifts of 8 inches or less to a minimum of 95 percent of their maximum dry density as determined by the procedures outlined in ASTM D 698.

5.3 Pickleball Court and Pavements

The parameters of the near surface soils will govern the design and performance of the paved areas for the planned pickleball court and pavement areas. When properly compacted near optimum moisture content, these materials can provide fair subgrades for pickleball court and pavements. However, they do have a tendency to become unstable and "pump" or deflect excessively under rolling loads when they are wet of optimum. Therefore, care must be taken to have subgrades exposed to the environment for only short periods of time. In addition, adequate drainage of the subgrade areas must be maintained to help prevent ponding and the resulting damage to the subgrade soils.

To help provide parameters for pickleball court and pavement design, a California Bearing Ratio (CBR) test were performed on the near surface soils. The results of our laboratory CBR testing indicate a soaked CBR value of 9.5 percent. However, CBR tests are generally performed on remolded samples just above optimum moisture content at dry densities near maximum. Therefore, to develop field conditions with CBR values of the magnitude obtained in the laboratory, similar subgrade moisture and density conditions will have to be obtained in the field. We recommend original soil subgrades beneath pavements be compacted to at least 95 percent of ASTM D 698 prior to placement of any required subbase fill or stone base course.

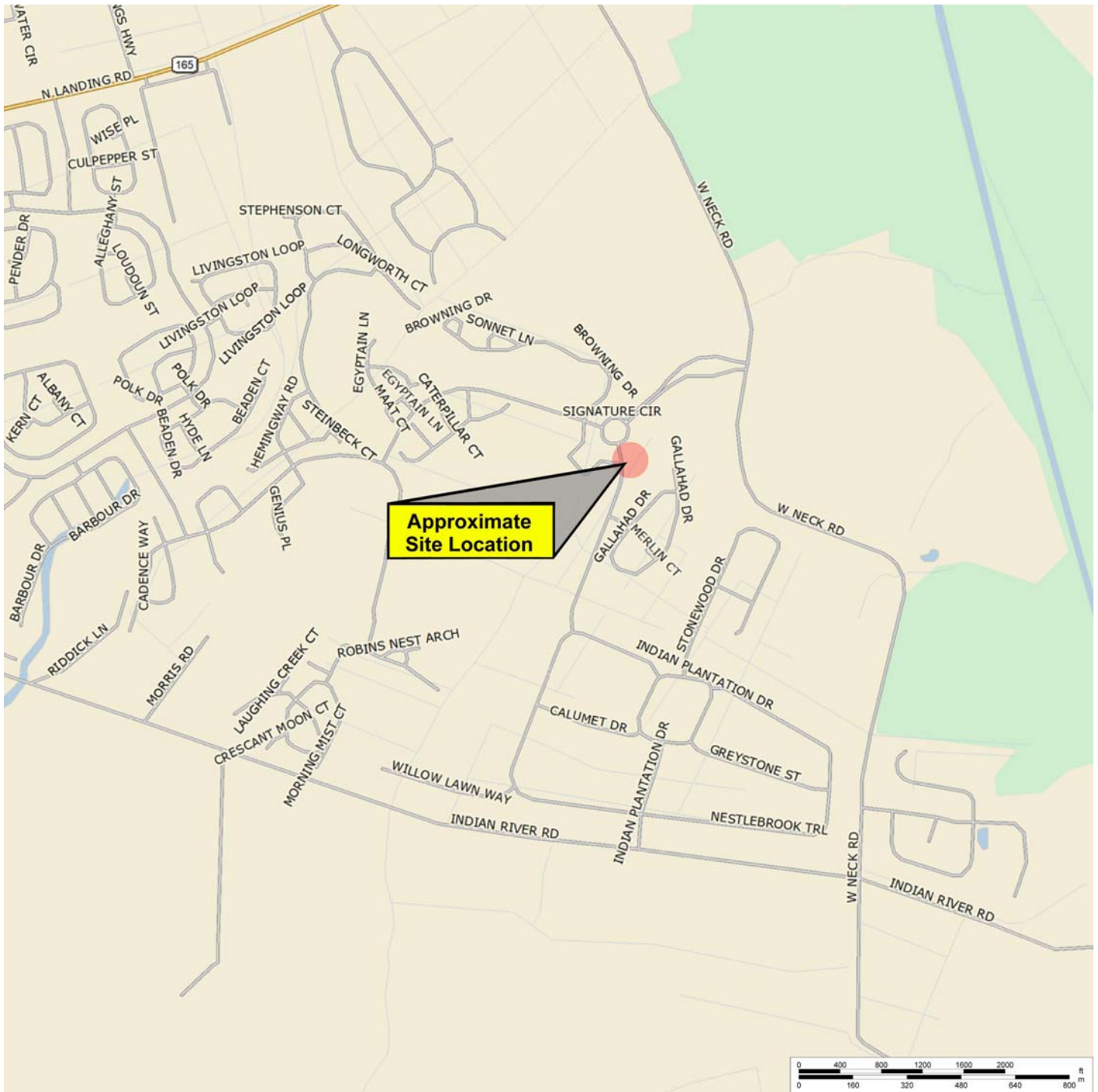
APPENDIX A

Site Location Plan

Boring and CBR Location Plan

Subsurface Profile

Test Boring Records

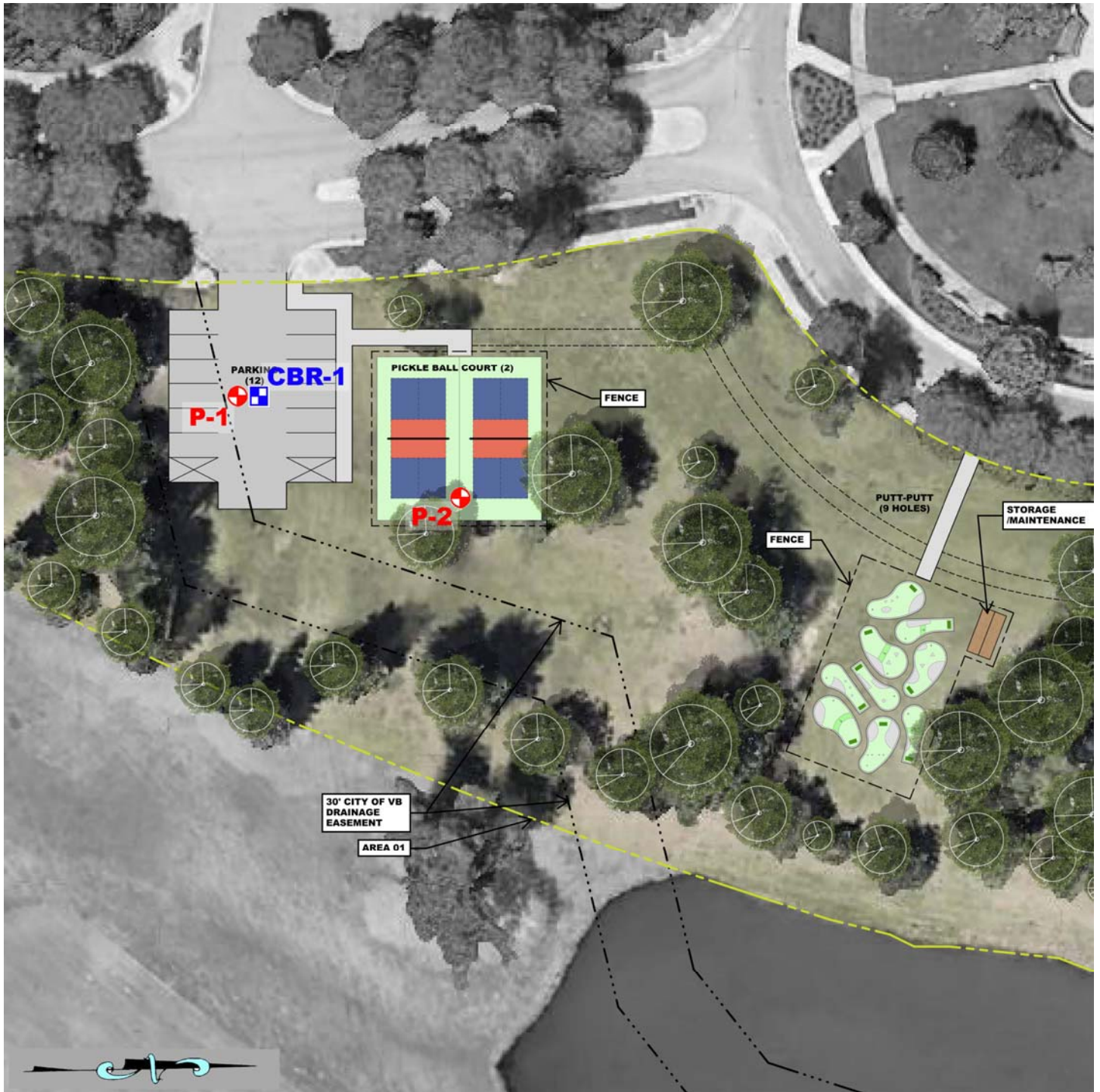


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Geotechnical Engineering, Materials Testing & Environmental Services

Scale:	As Shown	Approved By:	Wayne Kendrick, E.I.T.	Date:	6/5/23
Project:	Proposed Pickleball Court and Parking Area West Neck Village Virginia Beach, Virginia				
Drawing Title:	Site Location Plan			Drawing Number:	1



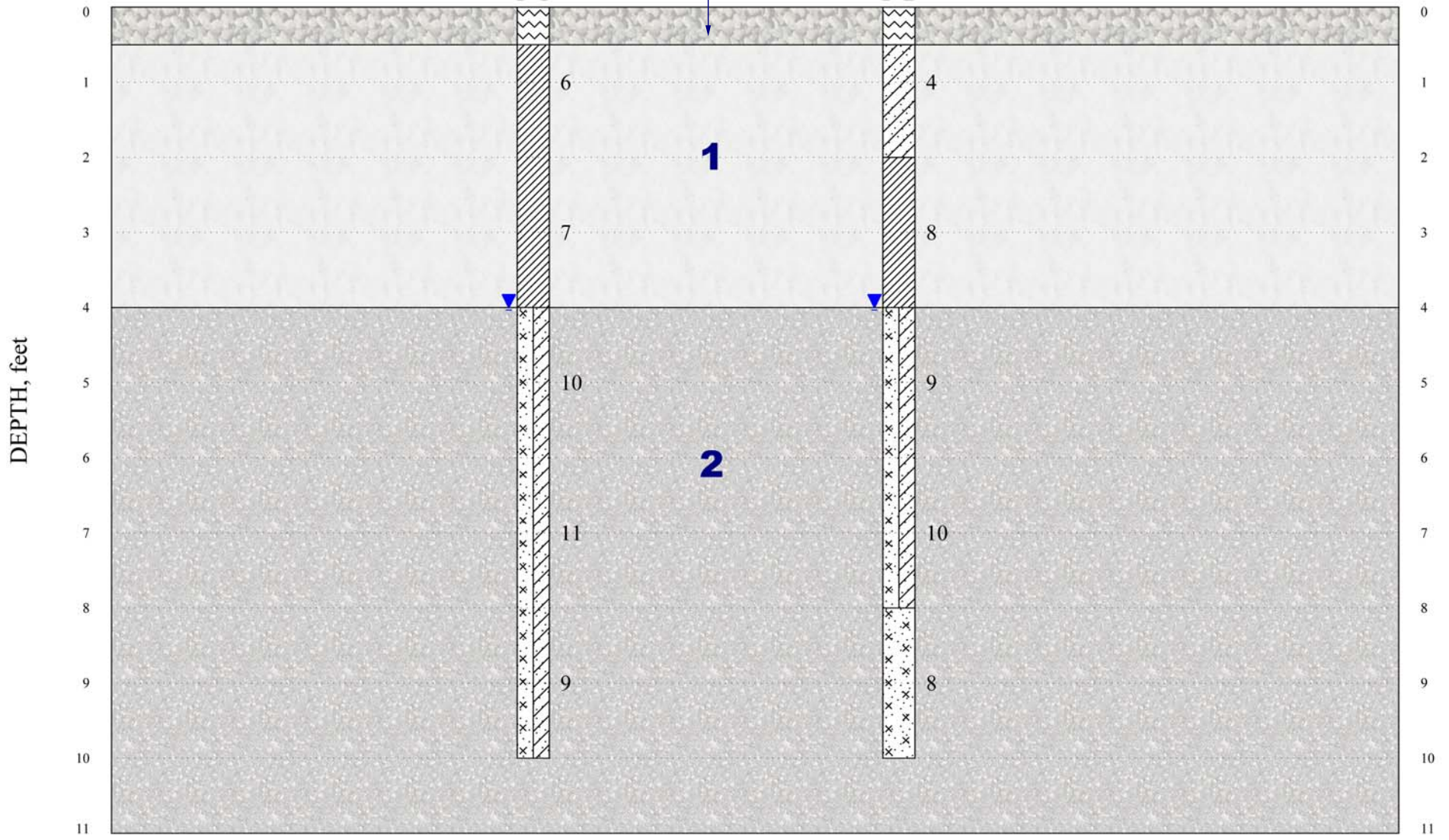
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Geotechnical Engineering, Materials Testing & Environmental Services

Scale:	NTS	Approved By:	Wayne Kendrick, E.I.T.	Date:	6/5/23
Project:	Proposed Pickleball Court and Parking Area West Neck Village Virginia Beach, Virginia				
Drawing Title:	Boring and CBR Location Plan			Drawing Number:	2

Topsoil



LEGEND

B-1 Boring No.

Stabilized Groundwater Level

Groundwater Level

Soil Type

SPT Resistance

WOH Weight of Hammer

Subsurface Profile

Drawing 3

PROJECT Proposed Pickleball Court & Parking Area

PROJECT NO. 23-1164

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Unified Soil Classification System ASTM Designation D 2487

Standard Penetration Test (SPT) Resistance Correlations

Coarse Grained Soils (More than 50% of material retained on the No. 200 Sieve)		Soil Symbols	Soil Descriptions
Gravels (more than 50% retained the No. 4 Sieve)	Sands (more than 50% passing the No. 4 Sieve)		
		GW	Well graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
		SW	Well graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine Grained Soils (More than 50% of material passes on the No. 200 Sieve)		Soil Symbols	Soil Descriptions
Silts & Clays (LL less than 50)			
		ML	Inorganic silts, very fine sands, silty or clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays
		OL	Organic silts and organic silty clays of low plasticity
		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, plastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity
		PEAT	Peat and other highly organic soils

Coarse Grained Soils

SPT
vs.
Relative Density

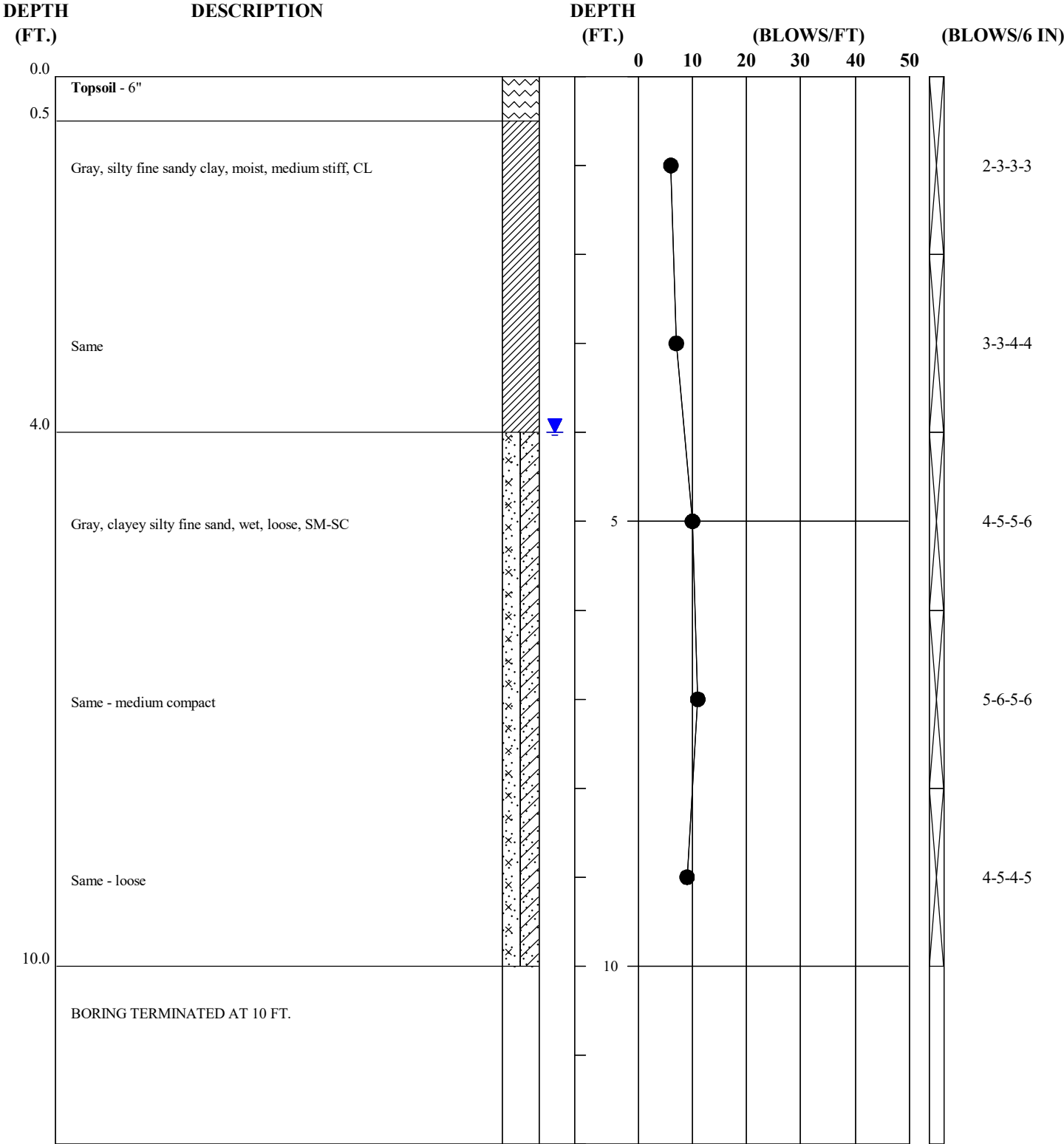
Blows/Ft	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Compact
31 - 50	Compact
Over 50	Very Compact

Fine Grained Soils

SPT
vs.
Consistency

Blows/Ft	Consistency
0 - 2	Very Soft
3 - 4	Soft
5 - 8	Medium Stiff
9 - 15	Stiff
16 - 30	Very Stiff
31 - 50	Hard
Over 50	Very Hard

STANDARD PENETRATION RESISTANCE

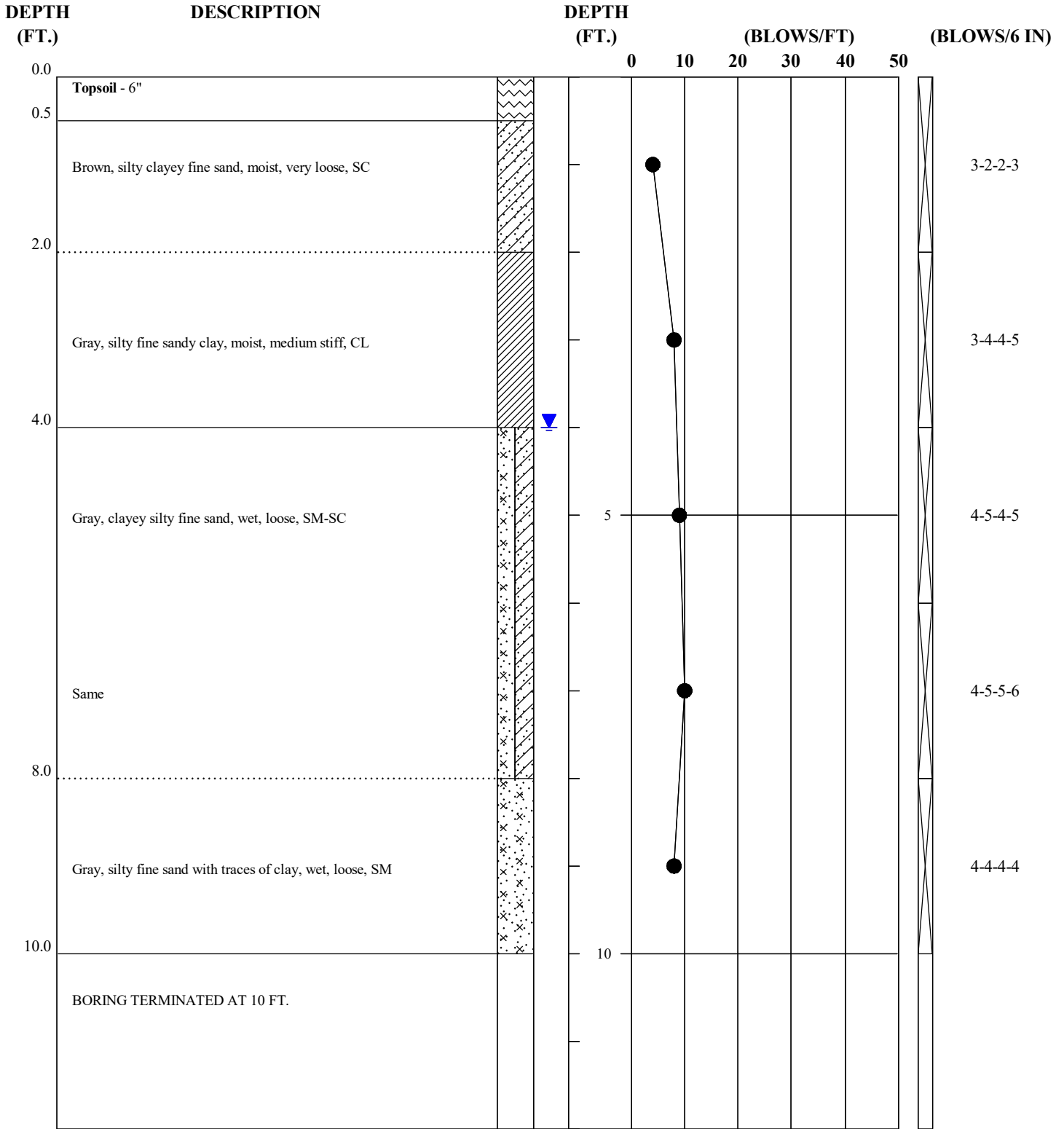


NOTES:

- - Gradual Stratum Change
- - - - - - Approximate Stratum Change
- - Penetration Resistance (N - value)
- ▣ - Standard Penetration Test
- ▬ - Undisturbed Sample
- ▼ - Groundwater Level at Time of Boring
- ◊ - Stabilized Groundwater Level Reading

TEST BORING RECORD	
BORING NUMBER	P-1
DATE DRILLED	May 5, 2023
PROJECT NUMBER	23-1164
PROJECT	Proposed Pickleball Court & Parking Area
LOCATION	West Neck Village, Virginia Beach, VA
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STANDARD PENETRATION RESISTANCE



NOTES:

- - Gradual Stratum Change
- - Approximate Stratum Change
- - Penetration Resistance (N - value)
- ▩ - Standard Penetration Test
- - Undisturbed Sample
- ▼ - Groundwater Level at Time of Boring
- ◊ - Stabilized Groundwater Level Reading

TEST BORING RECORD	
BORING NUMBER	P-2
DATE DRILLED	May 5, 2023
PROJECT NUMBER	23-1164
PROJECT	Proposed Pickleball Court & Parking Area
LOCATION	West Neck Village, Virginia Beach, VA
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APPENDIX B

Laboratory Test Results

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LABORATORY TEST RESULTS

Proposed Pickleball Court and Parking Area
West Neck Village
Virginia Beach, Virginia
MTL Project #23-1164

BORING NO.	SAMPLE DEPTH (FT.)	NATURAL PERCENT MOISTURE (ASTM D 2216)	ATTERBERG LIMITS (ASTM D 4318)			PERCENT FINER THAN A #200 SIEVE (ASTM D 1140)	SOIL CLASSIFICATION (ASTM D 2487)
			LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX		
P-1	4.0 - 6.0	19.0	24	17	7	33.8	SM-SC

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Geotechnical Engineering, Materials Testing & Environmental Services
1808 Hayward Avenue ♦ Chesapeake, VA 23320
Phone: 757-420-2520 ♦ Fax: 757-424-2874

DATE: 5/5/2023

CLIENT: West Neck Community Associates
2580 Signature Drive
Virginia Beach, VA 23456

PROJECT: Proposed Pickleball Court & Parking Area
West Neck Village
Virginia Beach, Virginia
MTL Project 231164

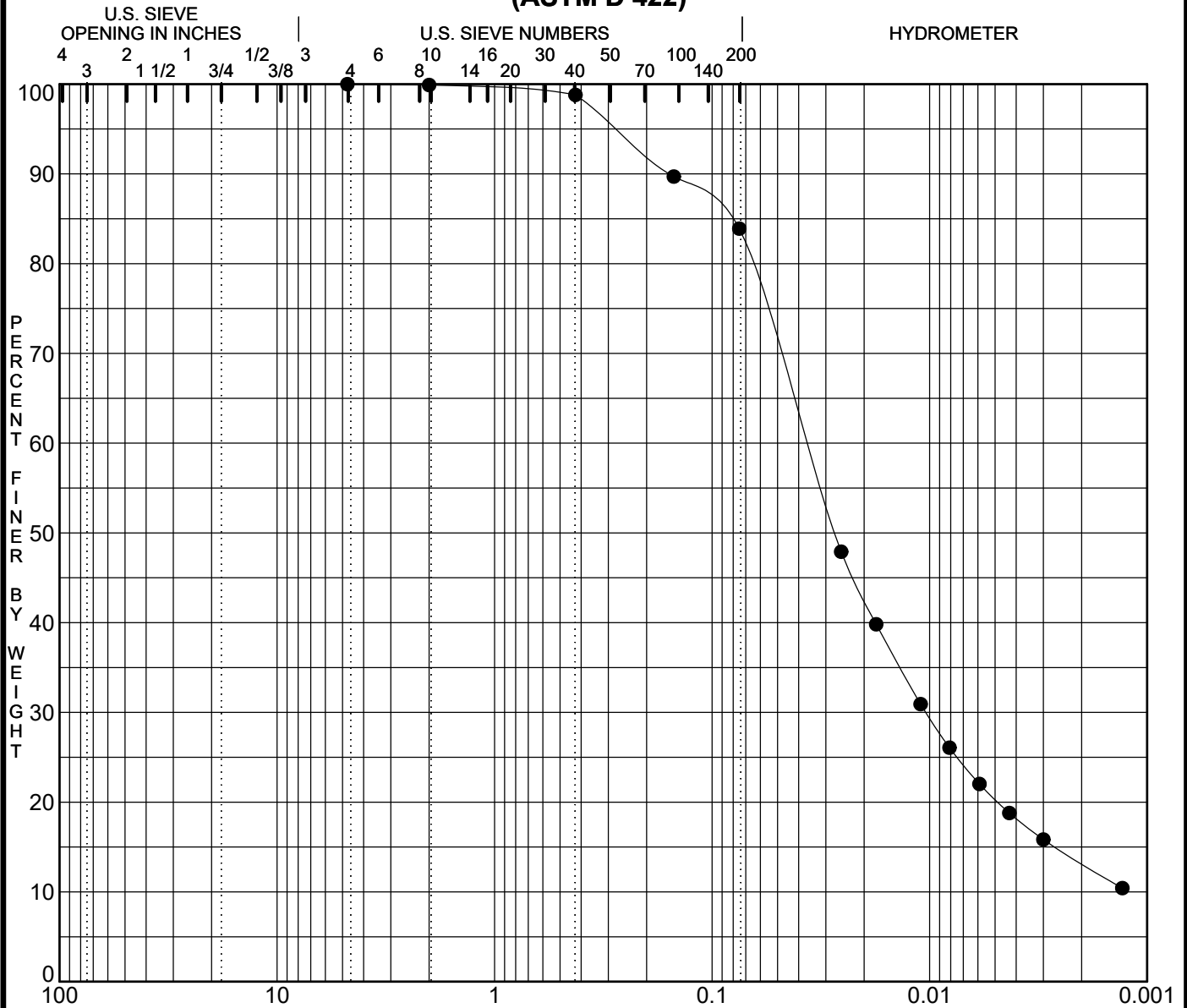
LABORATORY TEST RESULTS

SAMPLE NUMBER	CBR-1				
BORING NUMBER	(P-1)				
SAMPLE DEPTH	1.0 to 2.0 ft.				
NATURAL MOISTURE CONTENT, % (ASTM D 2216)					
MOISTURE CONTENT, %	14.8				
SPECIFIC GRAVITY OF SOILS TEST (ASTM D 854)					
SPECIFIC GRAVITY	2.62				
PARTICLE SIZE ANALYSIS OF SOILS TEST (ASTM D 422)					
SIEVE SIZES	PERCENT PASSING				
#4 (4.75 mm)	100				
#10 (2.00 mm)	99.9				
#40 (0.425 mm)	98.8				
#100 (0.150 mm)	89.7				
#200 (0.075 mm)	83.9				
HYDROMETER TEST (ASTM D 422)					
SILT CONTENT, % (0.075 - 0.005 mm)	63.6				
CLAY CONTENT, % (<0.005 mm)	20.3				
ATTERBERG LIMITS (ASTM D 4318)					
LIQUID LIMIT	35				
PLASTIC LIMIT	18				
PLASTICITY INDEX	17				
SOIL CLASSIFICATION (ASTM D 2487)					
UNIFIED SOIL CLASSIFICATION	CL				
AASHTO CLASSIFICATION	A-6				
MOISTURE DENSITY TEST (ASTM D 698)					
MAXIMUM DRY DENSITY (PCF)	109.9				
OPTIMUM MOISTURE CONTENT (%)	11.0				
CALIFORNIA BEARING RATIO TEST (ASTM D 1883)					
SOAKED C.B.R. VALUE	9.5				
SWELL (%)	+0.5				

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PARTICLE SIZE ANALYSIS (ASTM D 422)



GRAVEL		SAND			SILT OR CLAY
coarse	fine	coarse	medium	fine	

Specimen Identification	Classification					MC%	LL	PL	PI	Cc	Cu
● CBR-1 (P-1)	Gray mottled brown, silty fine sandy clay with traces of medium sand, CL					14.8	35	18	17		
Specimen Identification	D ₁₀₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Silt	%Clay		
● CBR-1 (P-1)	4.75	0.04	0.03	0.010		0.0	16.1	63.6	20.3		

PROJECT **Proposed Pickleball Court & Parking Area - West Neck Village, Virginia Beach, VA** JOB NO. **23-1164**
DATE **5/25/23**

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Geotechnical Engineering, Materials Testing & Environmental Services
1808 Hayward Avenue ♦ Chesapeake, VA 23320
Phone: 757-420-2520 ♦ Fax: 757-424-2874

DATE: 5/5/2023

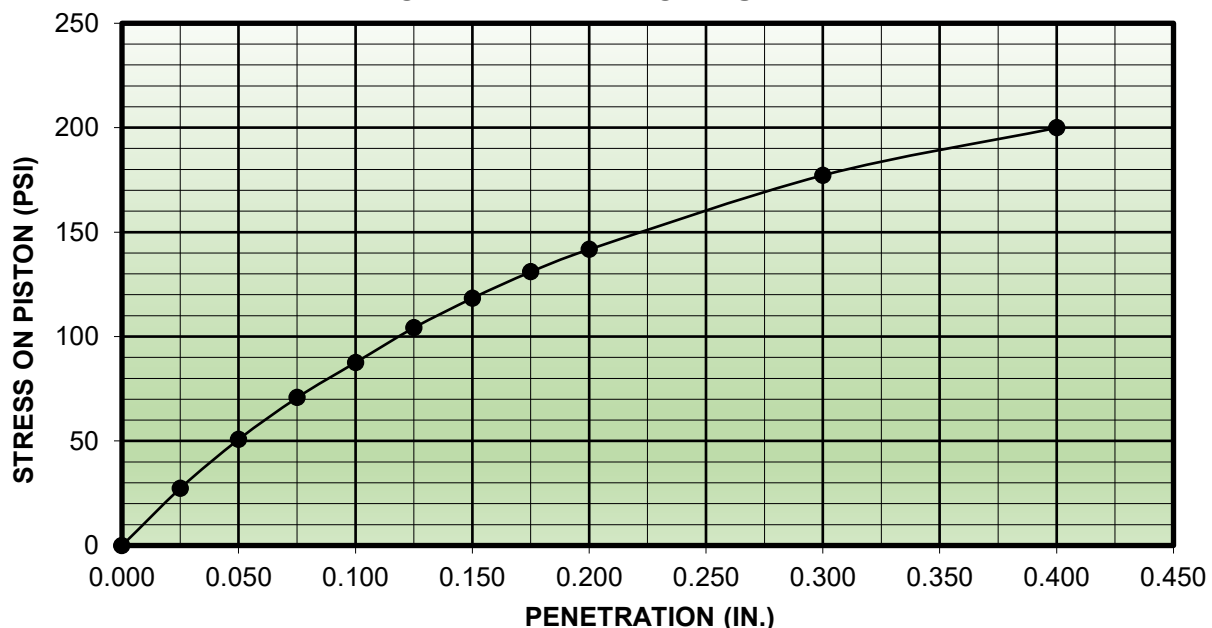
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2580 Signature Drive
Virginia Beach, VA 23456

PROJECT: Proposed Pickleball Court & Parking
Area
West Neck Village
Virginia Beach, Virginia
MTL Project 231164

LABORATORY CALIFORNIA BEARING RATIO TEST (ASTM D 1883)

SAMPLE IDENTIFICATION		CBR-1 (P-1)	
SAMPLE OF		Subgrade Material	
SOURCE		1.0 to 2.0 ft.	
PROPOSED USE		Pavement Subgrade/General Fill	
MAXIMUM DRY DENSITY (ASTM D 698)		109.9 pcf	1760.5 kg/m ³
DRY DENSITY BEFORE SOAKING		107.7 pcf	1724.6 kg/m ³
DRY DENSITY AFTER SOAKING		107.2 pcf	1717.2 kg/m ³
COMPACTION BEFORE SOAKING		98.0 %	
COMPACTION AFTER SOAKING		97.5 %	
OPTIMUM MOISTURE (ASTM D 698)		11.0 %	
MOISTURE CONTENT BEFORE SOAKING		10.5 %	
MOISTURE CONTENT AFTER SOAKING		15.4 %	
SWELL		+0.5 %	
CBR VALUE - SOAKED		9.5 %	

LOAD PENETRATION CURVE



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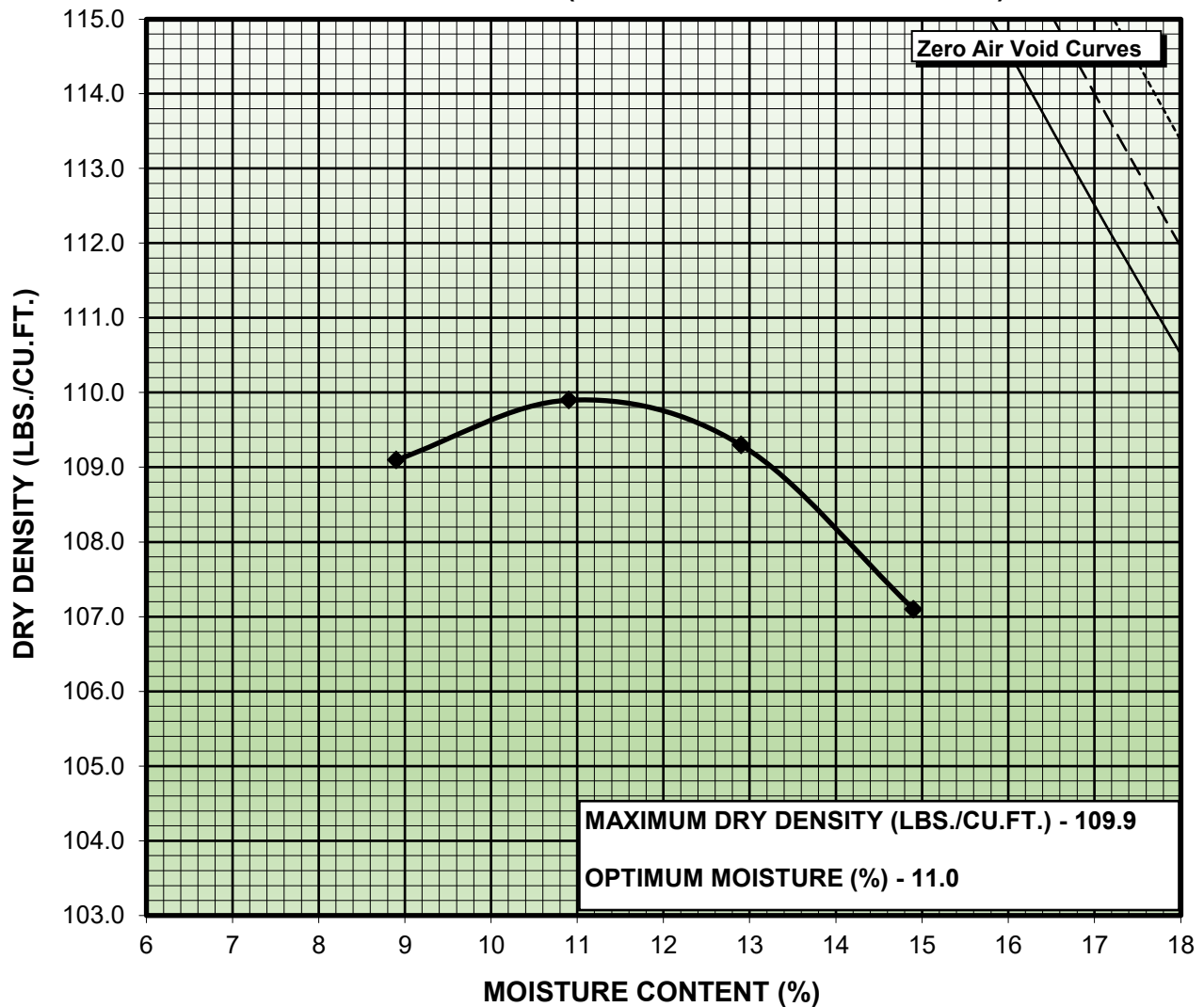
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PROJECT: Proposed Pickleball Court & Parking
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LABORATORY TEST RESULTS

SAMPLE NO.	SOURCE	DATE RECEIVED	VISUAL DESCRIPTION
CBR-1 (P-1)	Subgrade Material 1.0 to 2.0 ft.	5/5/2023	Gray mottled brown, silty fine sandy clay with traces of medium sand, CL

MOISTURE DENSITY TEST (ASTM D 698 - PROCEDURE A)



Moisture-Density Curve Gs=2.60 Gs=2.65 Gs=2.70