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HAM-75-1.25 Trunk Line

Preliminary Geotechnical Baseline Report
(GBR-B) Report
ODOT PID: 122902
Cincinnati, Hamilton County, Ohio

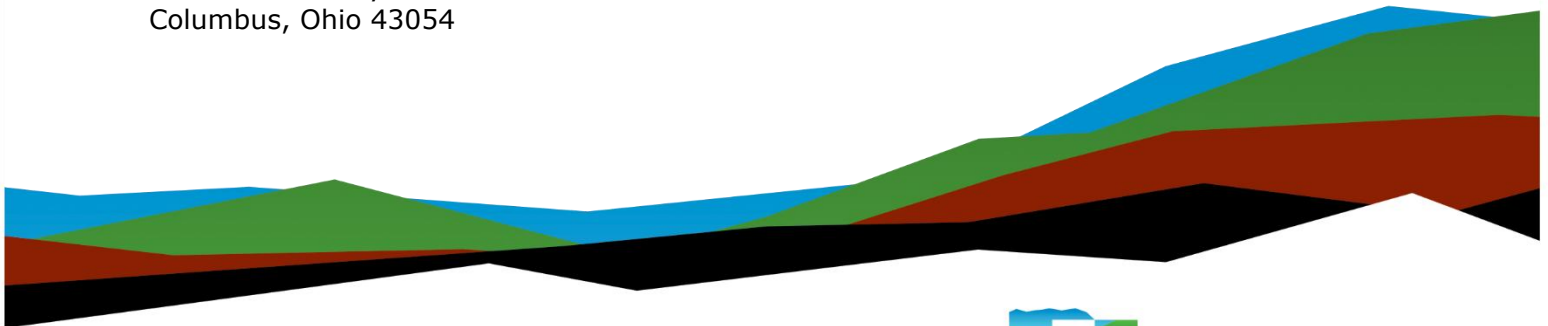
October 6, 2026 | Terracon Project No. N1245017

Prepared for:

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October 6, 2026

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HAM-75-1.25 Trunk Line
Western Avenue
Cincinnati, Hamilton County, Ohio
ODOT PID: 122902
Terracon Project No. N1245017

Dear Messrs. Brunot and Rahall:

Included herewith is the Preliminary Geotechnical Baseline Report (GBR-B) for the HAM-75-1.25 Trunk Line Project in Cincinnati, Hamilton County, Ohio for ODOT PID 122902. This report was completed in general accordance with Terracon Proposal No. PN1245017 dated April 15, 2024, which was authorized via the Subcontract Agreement Amendments between Burgess & Niple, Inc. and Terracon dated August 14, 2024, and March 21, 2025.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

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1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of this Preliminary Geotechnical Baseline Report (GBR-B) is to provide interpretation and discussion of anticipated subsurface conditions and the anticipated behavior of the soil, rock, and groundwater during construction of the HAM-75-1.25 Trunk Line Sewer project. The GBR-B is not meant to provide instructions in tunnel construction methodology and operations to contractors. Baseline values for the project will need to be negotiated between the owner and the design-build (D-B) team and incorporated into a GBR-C to be prepared by the D-B team.

The GBR-B also serves to document the key design conditions and provide additional information to the Contractor in relation to geotechnical, geologic, hydrogeologic, and environmental conditions within the project area and to provide clear indications for resolution of disputes concerning subsurface conditions. In addition, the GBR-B serves to provide information to assist prospective bidders in evaluating the requirements for excavating and supporting the ground, controlling groundwater, controlling ground movement and identifying the behavior thereof, and constructing the work described in the Contract Documents.

This GBR-B is part of the Contract Documents, as is the Geotechnical Data Report (GDR). The latter presents the factual data developed during the geotechnical investigations for the project, in the form of boring logs, rock core photographs, and field and laboratory test results. The GBR-B has a higher order of precedence than the GDR within the Contract Documents, meaning that in the event of conflict between the GBR-B and the GDR, the GBR-B governs.

The GDR contains all geotechnical exploration data collected for this project, including data obtained along alternate tunnel alignments evaluated during the conceptual pre-design process. Some of the borings made for the HAM-75-1.05 and HAM-75-1.95 roadway projects are at a significant distance from the current alignment and have not been utilized in this GBR-B but have been included in the GDR for reference only.

As this is considered a Preliminary Geotechnical Baseline Report for the design-build project, it is intended for use in informing the D-B team of the ground characteristics and potential construction challenges for the project during the bid. Information depicted herein has been prepared based on the conceptual pre-design project alignment and profile shown in the pre-design project plans. The D-B team will need to prepare and negotiate with the owner a GBR-C document to align the geotechnical baselines with their final selected plan, profile, and construction means and methods; and to serve as the primary reference point for settling Differing Site Conditions (DSC) claims.

1.2 Report Organization

The GBR-B is divided into five chapters. A brief summary of each chapter is presented below.

- Chapter 1.0 – Introduction: This chapter discusses the purpose, scope, and organization of the report.
- Chapter 2.0 – Project Description: This chapter provides a description of the trunk sewer project and how it fits into the overall HAM-75-1.05 and HAM-75-1.95 Projects.
- Chapter 3.0 – Project Geologic Setting: This chapter provides a description of the regional geology in the project area, summarizes soil stratigraphy, and provides a description of the bedrock geology, groundwater conditions, and hydraulic conductivity.
- Chapter 4.0 – Design Considerations: This chapter discusses design considerations for the tunnel and shafts. The design considerations are based on the alignment and profile shown in the pre-design project plans.
- Chapter 5.0 – Construction Considerations: This chapter provides a discussion of construction challenges related to shaft and tunnel construction. The construction considerations are written based on the alignment and profile shown in the pre-design project plans.

2.0 PROJECT DESCRIPTION

The HAM-75-1.25 Trunk Line Project, as part of the HAM-75-1.05 and HAM-75-1.95 Projects (ODOT PIDs 113361 and 114161, respectively), is a stormwater trunk sewer proposed adjacent to the reconfiguration of I-75. The upstream end of the trunk sewer is located at the north end of the HAM-75-1.95 Project, and the south end of the HAM-75-1.95 trunk sewer will connect to the north end of the HAM-75-1.05 trunk sewer.

The proposed trunk sewer within the HAM-75-1.05 Project is planned to be constructed via trenchless construction methods.

- The trunk sewer will be located along the east side of Western Avenue extending from the Gest Street Launch Shaft (shaft is being designed and constructed by others as part of a separate ongoing project by the Metropolitan Sewer District of Greater Cincinnati [MSDGC]) to north of Findlay Street (i.e., the connection with the HAM-75-1.95 portion of the sewer)

The proposed sewer within the HAM-75-1.95 Project is planned to be constructed with a combination of trenchless and open-cut installation methods at its northern/upstream end.

- The sewer will be located along the east side of Western Avenue, Dalton Avenue, and Spring Grove Avenue (i.e., west of I-75) extending upstream from Findlay Street to just north of Harrison Avenue, where the sewer will turn to the east crossing underneath the fill embankment for I-75 and into the infield of the existing on-ramp

from the Western Hills Viaduct (also referred to as WHV) to northbound (NB) I-75. Within this infield, the sewer will turn to the north paralleling I-75 on its east side and extend underneath the east approach to WHV and terminate within the infield of the existing I-75 NB off-ramp to WHV.

A portion of the Brent Spence Bridge (BSB) Trunk Sewer, which will be connected into the Gest Street Launch Shaft, is to be constructed as part of this project.

- The BSB Trunk Sewer is being designed by (E.L. Robinson Engineering (ELRE).
- The BSB Trunk Sewer will be partially constructed up to Manhole (MH) D1316 prior to awarding the HAM-75-1.25 Trunk Line Project.
- Both MH D1316 and the segment of the BSB Trunk Sewer between MH D1316 and the Gest Street Launch Shaft are to be constructed as a part of this project.

A portion of the 54-inch NE Storm Sewer, which will be connected into the Gest Street Launch Shaft, is to be constructed as part of this project.

- The 54-inch NE Storm Sewer is being designed by Burgess & Niple (B&N).
- The segment of the 54-inch NE Storm Sewer between MH D-1 and the Gest Street Launch Shaft is to be constructed as a part of this project.

3.0 PROJECT GEOLOGIC SETTING

3.1 Subsurface Field Investigation and Laboratory Testing

The subsurface investigation program for the HAM-75-1.25 Trunk Line tunnel was conducted in several stages, commencing in 2021 and concluding in 2025. The program consisted of borings drilled for the HAM-75-1.05 and HAM-75-1.95 roadway projects along with borings drilled specifically for the Trunk Line Sewer project. In total, 99 borings are summarized and included in the GDR for this project.

To supplement the borings in the area of the on- and off-ramps for the Western Hills Viaduct, a seismic survey using the 2-dimensional Multi-Channel Analysis of Surface Waves (MASW) method was completed along five lines.

Samples recovered from the soil and bedrock during the 2024 and 2025 borings were selected for laboratory testing. The laboratory testing program included the following types of tests on soils:

- Water content
- Dry unit weight
- Atterberg limits
- Particle-size (gradation) analysis
- One-dimensional consolidation
- Unconfined compressive strength
- Unconsolidated-undrained triaxial compression

- Consolidated-undrained triaxial compression with pore-pressure measurements
- Flexible wall permeability
- Chemical analyses – pH, sulfates, chloride ion, oxidation-reduction potential, and electrical resistivity
- Slurry abrasivity tests

Additionally, the laboratory testing program included the following types of tests on bedrock:

- Water content
- Splitting tensile strength
- CERCHAR abrasiveness
- Punch penetration
- Slake durability

Groundwater levels were observed during drilling and immediately at the completion of the drilling activities at each test boring location. Additionally, observation wells were installed in four borings to obtain long-term groundwater level readings and allow for field permeability testing.

The data obtained from the geotechnical investigations was utilized in conceptualizing the pre-design project plan, in the preparation of this GBR-B, and in the development of geologic profiles along the pre-design tunnel alignment.

Discussions of soil, bedrock, and groundwater conditions described in the GBR-B are based on subsurface data collected from widely spaced borings. As a consequence, variations in ground conditions between the borings, along the tunnel alignment, must be expected. Detailed information on the subsurface investigation results and the field and laboratory tests performed is presented in the GDR and its Attachments. Boring locations are indicated on the plan of borings included in the GDR. The geologic profiles are included in the GBR-B.

3.2 Site Geology

The alignment of the trunk line is located within a buried valley referred to as the Mill Creek Valley. While Mill Creek is currently a southwardly flowing tributary to the Ohio River within the Mill Creek Valley, the ancestral river system that predates the current Ohio River alignment flowed northwardly. Multiple glacial advances, including the Illinoian glaciation, dammed and rerouted the ancestral river system to its current configuration. A combination of the northwardly flowing ancestral river system and the meltwater from the glaciations carved the buried valley within the Mill Creek Valley. Additionally, the Illinoian and subsequent Wisconsinan glaciations created deposits that filled this channel.

Where the corridor for the trunk sewer alignment roughly parallels the west side of I-75 (i.e., roughly between Gest Street and just north of Harrison Avenue), recent and previous borings, which are provided in the 2026 GDR, indicate that the subsurface conditions generally consist of urban fill of variable thickness for the existing and previously

demolished structures and infrastructure, as well as I-75, followed by interlayered fine- and coarse-grained alluvial soils that generally became coarser with depth. The overburden soils were underlain by bedrock comprised of interbedded shale and limestone layers. According to the online Ohio Geology Interactive Map operated by Ohio Department of Natural Resources (ODNR), the depth to bedrock varies from 110 to 150 feet below existing grades.

At the north end of the alignment on the east side of I-75 in the proximity of the on- and off-ramps for the Western Hills Viaduct, the alignment approaches the east valley wall of the Mill Creek Valley, and the subsurface conditions also contain clayey colluvial soils that are intertongued with, or underlie, the alluvium. This intertongued alluvium and colluvium is underlain by clayey residual soils that are followed by the interbedded shale and limestone bedrock. The borings in this area encountered bedrock at depths of 15.5 to 93.5 feet below the ground surface at the time of drilling. The geologic profiles, included in the GBR-B, are derived from the borings drilled for this project. Detailed descriptions of the various soil deposits and rock formations encountered in the borings and shown in the geologic profiles are presented below.

3.2.1 Ground Characterization

3.2.1.1 Existing Fill

The fill varied from granular soils to cohesive soils however, the majority of the fill encountered in the borings was classified as silt and clay, silty clay, and clay. Since the fill was an urban fill, areas of the fill contained various proportions of construction and demolition debris (e.g., brick, concrete, asphalt, stone fragments, coal fragments, cinders, wood and other organics, metal pieces, glass pieces, etc.). Occasionally, these materials were concentrated.

The existing fill layer varied in thickness from 3 to 47 feet with an average thickness of 20 feet. The granular fill in this layer was typically medium dense, and the cohesive fill was typically stiff. Higher blow counts during sampling within this layer are likely due to encountering cobbles and boulders rather than encountering a dense and stable soil matrix.

3.2.1.2 Alluvium

Alluvial soils (or alluvium) are sedimentary soils that are deposited by fluvial or flowing water systems (e.g., streams, rivers, etc.). Alluvium that is deposited by glacial meltwater is commonly referred to as outwash, and is frequently coarser grained due to the higher flow velocities that are typically associated with meltwater from receding glaciers. However, for the purposes of this report, the alluvium is only subdivided into fine-grained alluvium and coarse-grained alluvium.

Alluvium was encountered beneath the ground surface, pavement, or fill in 90 of the 99 borings. As previously stated, the alluvium consisted of interlayered fine- and coarse-grained soils and typically became coarser with depth. Additionally, the alluvium was intertongued with colluvium at the north end of the site in the proximity of the Western Hills Viaduct. The granular alluvium was typically medium dense, and the cohesive alluvium was

typically stiff. Cobbles and boulders, while not encountered during drilling, can be found in these deposits. Thickness of the alluvial layer, when encountered, varies widely with the fluctuations in the depth to bedrock. However, the thickness of the alluvium pinches out to the east as the bedrock surface rises along the east valley wall of the Mill Creek Valley.

3.2.1.3 Colluvium and Residuum

Colluvial soils (or colluvium) are soils that are formed by the downslope transport of soil and rock material under the influence of gravity. Frequently, the colluvium in the Greater Cincinnati Area is comprised of clay intermixed with shale and limestone fragments from the bedrock, particularly where bedrock is relatively shallow on steeply sloping terrain. Colluvium was encountered beneath the fill or alluvium or intertongued with the alluvium in 15 of the borings. The borings where colluvium was encountered were generally located in the area of the east valley wall of the Mill Creek Valley near the Western Hills Viaduct on- and off-ramps to northbound I-75. In some of these borings, the descriptions of the overburden soils on the logs were not definitive, and these soils may have been either colluvium or residuum.

Residual soils (or residuum) are soils that have formed by the in-situ weathering of the underlying bedrock into a soil. Occasionally, layers of the bedrock (i.e., shale or limestone layers) may be encountered within the residual soils. Residuum was encountered beneath the fill, alluvium, or colluvium in 11 of the borings. As previously stated, some of the descriptions of the overburden soils on the previous logs were not definitive and may be either colluvium or residuum.

Colluvial and residual soils encountered in the borings were classified as silt and clay, silty clay, or clay. Consistencies of these soils were very stiff on average. The thickness of the colluvium or residuum, when encountered, varied from 5 to 30 feet thick.

The following tables summarize the results of the laboratory testing performed on soil materials:

Table 1. Range of Soil Test Results – Classification Tests

Soil Strata	Atterberg Limits			Moisture Content %	Gradation Analysis (%)				
	LL	PL	PI		Gravel	Coarse Sand	Fine Sand	Silt	Clay
Existing Fill	10-56 (31)	9-30 (18)	3-32 (14)	3-86 (18)	0-97 (13)	0-48 (12)	0-76 (16)	1-88 (31)	1-68 (27)
Alluvium	19-50 (30)	13-27 (19)	1-32 (11)	2-37 (22)	0-49 (2.5)	0-74 (7.6)	0-95 (26.9)	1-99 (45.9)	0-60 (17.1)
Colluvium	29-57 (39)	15-26 (19)	12-31 (20)	4-28 (20)	0-33 (7)	0-17 (5)	1-16 (5)	17-55 (34)	19-67 (47)

Notes:

- Values indicate minimum to maximum range, and average value is in parentheses: Min-Max (Average).

Table 2. Range of Soil Test Results – Chemical Tests

Soil Strata	pH	Sulfides	Chlorides	Sulfates	Miller Number
Existing Fill	-	-	-	36-604 (282)	-
Alluvium	8.6-9.0 (8.8)	0-0.011 (0.003)	91-147 (112)	< 100	129.1-145.0 (139.0)
Colluvium	-	-	-	-	-

Notes:

- Values indicate minimum to maximum range, and average value is in parentheses:
Min-Max (Average).

Table 3. Range of Soil Test Results – Strength Tests

Soil Strata	N ₆₀ (bpf)	HP (tsf)	Dry Unit Wt. (pcf)	c (psf)	φ (°)	c' (psf)	φ' (°)
Existing Fill	0-93 (20)	0.25-4.5 (2.7)	95.6-109.4 (104.3)	527-1150 (735)	14.5-20.3 (18.4)	163-252 (222)	29.5-30.0 (29.7)
Alluvium	0-117 (17)	0.25-4.5 (1.66)	94.8-112.9 (105.0)	0-1010 (379)	8.7-39.5 (29.1)	0-469 (72)	32.9-34.9 (33.7)
Colluvium	6-98 (36)	1.0-4.5 (3.3)	120.9	282	27.2	0	37.9

Notes:

- Values indicate minimum to maximum range, and average value is in parentheses:
Min-Max (Average).

Table 4. Range of Soil Test Results – Consolidation Tests.

Soil Strata	e ₀	p _c (tsf)	C _c	C _r
Existing Fill	0.53-0.72 (0.62)	1.0-3.9 (2.1)	0.09-0.21 (0.15)	0.005-0.04 (0.018)
Alluvium	0.53-0.83 (0.64)	1.0-4.2 (2.1)	0.12-0.19 (0.15)	0.008-0.03 (0.020)
Colluvium	-	-	-	-

Notes:

- Values indicate minimum to maximum range, and average value is in parentheses:
Min-Max (Average).

3.2.2 Bedrock

The bedrock encountered in the borings is Ordovician-aged from the Kope and Point Pleasant Formations, which consist of interbedded shale and limestone bedrock. Bedrock was encountered at depths of 15.5 to 93.5 feet below the ground surface in 18 of the

borings with the surface of the bedrock varying from El. 421.5 to 514.0 feet. In general, the borings that encountered bedrock were located near the east valley wall of the Mill Creek Valley around the on- and off-ramps for the Western Hills Viaduct at the north end of the site. Additionally, the bedrock surface slopes up rather steeply to the east from I-75 toward Central Parkway at the crest of the slope.

The bedrock was cored in the majority of these borings. The Kope Formation was primarily made up of shale, 93% on average, while the limestone component was 7% on average. However, in the Point Pleasant Formation the distribution was relatively even with the shale component at 55% on average and the limestone component at 45%. Overall, the rock is generally slightly to highly weathered and the rock quality designation (RQD) varied from 0 to 100 with an average RQD of 55.

Uniaxial compressive strength test results ranged from 255 psi to 973 psi with an average of 638 psi in the shale and 1,182 psi to 12,452 psi with an average of 5,727 psi in the limestone. Splitting tensile strength (Brazilian) test results on the shale varied from 6.6 psi to 262.2 psi with an average of 81.4 psi. According to ODOT's strength classification of bedrock, the tested specimens from the shale component of the bedrock varied from very weak to weak, while the tested specimens from the limestone component varied from weak to strong. In the rock cores, the limestone component of the bedrock was generally very thin to thin bedded while the shale component varied from thin to thick bedded.

The Slake Durability Index test results (35.2 average) for the shale indicate the rock has low durability and is prone to degrade rapidly under weathering elements that can occur during construction, such as: flowing water and wet/dry cycles. CERCHAR Abrasivity Index test results (0.26 for the shale and 0.93 for the limestone) indicate that the rock is hardly to slightly abrasive, producing low wear on tools.

Table 5. Summary of Rock Core RQD and Percentage of Shale versus Limestone

		Minimum	Maximum	Average
Kope Formation	RQD (%)	23	94	55
	Shale Component (%)	80	100	93
	Limestone Component (%)	0	20	7
Point Pleasant Formation	RQD (%)	0	100	55
	Shale Component (%)	45	65	55
	Limestone Component (%)	35	55	45

Table 6. Laboratory Test Result Summary of Bedrock

		Samples Tested	Minimum	Maximum	Average
Shale Specimens	Moisture Content (%)	18	7	27	14
	Uniaxial Compressive Strength (psi)	8 ¹	255	973	638
	Splitting Tensile Strength (psi)	22	6.6	262.2	81.4
	Slake Durability Index (%)	4	19.5	54.3	35.2
	CERCHAR Abrasiveness Index	2	0.24	0.27	0.26
	Punch Penetration Peak Slope Index (kips/in.)	1	7.7		
Limestone Specimens	Uniaxial Compressive Strength (psi)	3 ¹	1,182	12,452	5,727
	CERCHAR Abrasiveness Index	2	0.82	1.03	0.93

1. All Uniaxial compressive strength specimens were from the S&ME borings.

3.3 Groundwater

Groundwater was observed during and at the completion of drilling in the 16 recent borings drilled for the trunk line. Additionally, long-term groundwater level readings were obtained in four of these borings where observation wells were installed.

In general, groundwater was encountered in the borings within the granular or silty alluvial soils between El. 450 and 480 feet. However, north of Bank Street, groundwater was encountered as high as El. 516.2 feet. At the observation wells, groundwater was typically between 460-470 feet.

The groundwater table in the alluvial soils is expected to fluctuate with the river level, as it varies with time, location, season of the year, and amounts of precipitation, but will likely lag behind in rising and falling with the river level. Additionally, groundwater seepage may occur in saturated zones of fill or native soils that are within perched groundwater zones above the groundwater table.

Table 7. Summary of Aquifer Testing Results

Aquifer Parameter	Minimum	Maximum	Average
Hydraulic Conductivity - K (ft/day)	2.18	15.02	6.52
Saturated Thickness (ft)	13.39	23.05	19.58
Transmissivity - T (gpd/ft)	49.72	201.12	108.31

4.0 DESIGN CONSIDERATIONS

4.1 General

This section describes the design considerations for the tunnel and shafts. Some elements of the project are being designed by others as part of other ongoing work, these items will be identified below.

4.2 Main Trunk Line Sewer Tunnel

The tunnel will be constructed using trenchless excavation methods. As the water table is located within or above the tunnel profile, continuous face support will be control the ground and groundwater pressure and minimize surface settlement.

The D-B team will be responsible for the final alignment of the tunnel between the Gest Street shaft and the termination point within the infield of the Existing I-75 northbound off-ramp to the Western Hills Viaduct. The pre-design Project Plans show additional launch and receiving shafts along the alignment; however the final quantity and locations of these shafts are to be determined by the D-B team according to their final tunnel alignment and means and methods of construction.

The pipe is required to be either Reinforced Concrete Pipe (RCP), with European-type joints, or Centrifugally-Cast Fiber Reinforced Polymer Mortar (CCFRPM). All joints are to be watertight, and the pipe and appurtenances shall be of a material that is resistant to hydrogen sulfide attack. Pipes shall be designed to withstand all load conditions during operation and construction and have a minimum factor of safety under maximum jacking load conditions of 3.0. Intermediate jacking stations and jack control should be used as needed to maintain cutterhead thrust and reduce the stress in pipes resulting from jacking pressures to a level below those recommended by the manufacturer.

The I-75 corridor contains numerous utility crossings that the D-B team will need to address during development of the tunnel alignment. A few notable crossings include the following:

- 84" Prestressed Concrete Combined Sewer beneath Hopkins Street, approx. Inv EL 470
- 36" Storm Sewer near Hopkins Street, approx. Inv EL 470.5
- 120" Brick Combined Sewer beneath West Liberty Street, approx. Inv EL 479
- 78" Brick Combined Sewer near Banks Street, approx. Inv EL 475
- 60" Brick Combined Sewer near Harrison Avenue, approx. Inv EL 484

This is not an extensive list; the D-B team should investigate all utilities that will be crossed by their chosen alignment to determine the appropriate level of support needed for each. The utility owners have limited the movement of the existing utilities to 0.0". The D-B team will need to monitor the ground at and around utility crossings according to their instrumentation and monitoring plan and be prepared to support impacted utilities prior to and during tunneling.

4.3 Gest Street Shaft

The Gest Street Shaft is being designed and constructed by others as part of a separate contract. The shaft will have an inside diameter of 80' with a bottom of shaft elevation of 455.5 ft.

The Gest Street Shaft will be used as a launch shaft for the 78" Main Trunk Sewer (Inv EL 458.2), the 54" BSB Trunk Sewer (Inv EL 469.2), and the 54" NE Storm Sewer (Inv EL 459.4).

Soft eyes to accommodate up to a 78" diameter pipe are being built into the launch shaft along with additional reinforcement to counter anticipated jacking forces. The D-B team will be required to verify that installed reinforcement is sufficient for their planned jacking forces or provide supplemental reinforcement. Pre-grouting around the breakout areas to control groundwater inflow into the shaft as needed will be the responsibility of the D-B contractor.

4.4 Brent Spence Bridge (BSB) Trunk Sewer & MH D1316 Shaft

The BSB trunk sewer is being designed by ELRE and will be constructed up to MH D1316 prior to awarding the HAM-75-1.25 Trunk Line Project. Both MH D1316 and the segment of the BSB Tunnel from MH D1316 to the Gest Street Shaft are to be constructed as part of this project. A sheet pile support of excavation pit has been left in place at the tie-in locations for MH D1316. The sheeting will have been backfilled with sand/fill to approximately 3 feet below grade then capped with clay to reduce water infiltration.

4.5 54" NE Storm Sewer & MH D-1 Shaft

The 54" NE Storm Sewer is being designed by B&N. Manhole MH D-1 and the segment of the 54" Storm Tunnel from MH D-1 to the Gest Street Shaft are to be constructed as part of this project. The remainder of the NE Storm Sewer will be constructed by others at a later date.

4.6 Additional Launch and Receiving Shafts

The D-B team shall select and design the shaft initial support, but steel sheet piling with internal bracing or other viable methods such as steel liner plates and steel ribs, secant pile walls, or slurry walls are expected for the majority of shaft locations. In the area of the Western Hills Viaduct the top of rock was encountered as high as EL 514. Shaft excavations in these areas will need to be designed to prevent soil loss at the rock interface.

The shafts should be designed to support soil loads, hydrostatic loading, and construction surcharges. As the groundwater table will be at or above the tunnel invert, the D-B team

will need to manage groundwater inflows at the tunnel breakout, the bottom of shaft and through the selected excavation support system. Settlement of the surrounding area and utilities due to dewatering must also be estimated and managed throughout construction.

4.7 Geotechnical Instrumentation and Monitoring

The geotechnical instrumentation program shall be designed to monitor ground behavior during the excavation and construction of the tunnel and associated structures, to monitor the impact of the construction on nearby utilities and other structures, and to monitor groundwater conditions at proposed excavation locations. The intent of the instrumentation program is to monitor construction activities, to detect ground movements and vibrations in advance, and to monitor groundwater conditions at the shafts so that corrective measures can be initiated by the D-B team, as required.

The program planned for this project shall include instruments to measure horizontal and vertical ground movement along the tunnel alignment, horizontal ground movements at the shaft locations, and groundwater conditions at proposed excavation locations. Specifically, the type of instruments required for the project will include the following:

- Subsurface Shallow Settlement Indicators to measure settlement near the ground surface in the vicinity of the shafts.
- Inclinometers to measure horizontal movement of the ground near the shaft excavations.
- Groundwater observation wells to observe and measure groundwater levels within the soil materials and bedrock at the shafts.

5.0 CONSTRUCTION CONSIDERATIONS

While the final alignment will be determined by the D-B team, the vast majority of the tunnel will be constructed within the alluvial material. The alluvial material profile varies from boring to boring, and while tunneling the contractor can expect to encounter a wide variety of ground conditions including stiff clay, soft clay, silty clay, silt, sandy silt, fine sand, coarse sand, and gravel. The machine selected should be equipped to properly excavate in this full range of material. However, the makeup is predominantly fine sand and silt with a unit weight of 105 pcf, a cohesion of 200 psf and a friction angle of 28°. Above the water table, the material will behave like a raveling ground due to the high fines content, while below the water table the material will behave like a running ground due to the high concentration of fine sand and silt. As such, a trenchless method utilizing a pressurized face will be required for the tunnel construction. Pressurized face machines can successfully stabilize the tunnel heading in soft ground and mixed face conditions under significant external hydrostatic pressure while preventing uncontrolled soil or water inflows into the tunnel. The machine must be designed to withstand hydrostatic pressures equivalent to 1.5x the maximum water head at the invert of the tunnel.

In borings taken around the Western Hills Viaduct, highly weathered shale interbedded with limestone was encountered as high as EL 514. The rock appears to fall off quickly to the

west and south; however, the D-B team can expect to encounter mixed face conditions and potentially full rock face in the tunnel depending on their selected alignment in this area. The contractor should be prepared to encounter rock with an RQD that varies from 0 up to 100 and a compressive strength of up to 12,500 psi when tunneling along the east side of I-75 in the vicinity of the Western Hills Viaduct. The machine selected for this project should be equipped with a cutterhead capable of excavating through silt, clay, sand, mixed face conditions and shale interbedded with limestone. The CERCHAR Abrasiveness Index values for shale and limestone are up to approximately 1.0, indicating low abrasivity.

During tunneling in the soft ground, the D-B team can expect to encounter an obstruction that will stop the progress of the machine and require an intervention once for the project. A lump sum bid item specifically for trenchless intervention and recovery has been included in the bid sheet to allow for this possibility.

When tunneling through the soft ground, the majority of which contains varying amounts of silt and clay soils with a Miller number greater than 100, the D-B team should consider the use of ground conditioners. The ground conditioning agent improves lubrication, reduces clogging of the cutterhead, and reduces wear in the system from the abrasive materials.

Shafts around Western Hills viaduct may encounter highly weather shale at elevations as high as EL 514. Blasting is prohibited for shaft excavations. Rock that may be encountered in these shaft excavations should be able to be excavated with conventional methods, such as a backhoe with a ripper tool attachment or laborers with jackhammers. However, in some areas where limestone is encountered it may be necessary to break up larger high strength zones with a hydraulic breaker or equivalent. The D-B team should have equipment available capable of excavating interbedded shale and limestone rock with compressive strength of up to 12,500 psi and RQDs of 0-100.

Sensitive utilities along the alignment will need to have operations continuously maintained throughout construction with no disturbance or movement while the tunnel progresses under them. The D-B team will need to identify and prepare a plan to protect utilities that may be impacted by the construction. Potential options include ground modification, strong-backing, or otherwise supporting the utilities. Bypass pumping will be allowed on MSDGC utilities. The D-B team will need to work with each individual utility owner to determine the necessary support required for the utilities.

Preliminary Geotechnical Baseline Report (GBR-B)
HAM-75-1.25 Trunk Line | Cincinnati, Hamilton County, Ohio
October 6, 2026 | Terracon Project No. N1245017



Appendices

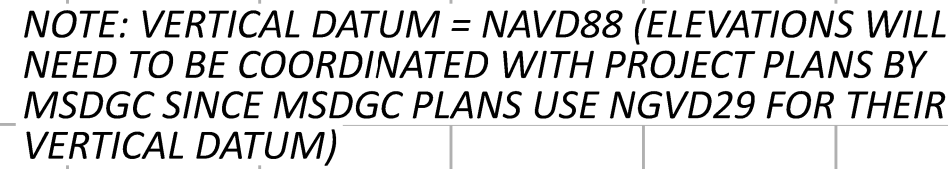
Appendix A – Geologic Profile

NOT FOR
CONSTRUCTION
INFORMATION ONLY

Appendix A – Geologic Profile

HAM IR 75-1.25 TRUNK LINE

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HAM IR 75-1.25 TRUNK LINE
GEOLOGIC PROFILE
STA. 0+00 TO STA. 7+50

DESIGN AGENCY



DESIGNER

JDH

REVIEWER

MJB 4-2-26

PROJECT ID

122902

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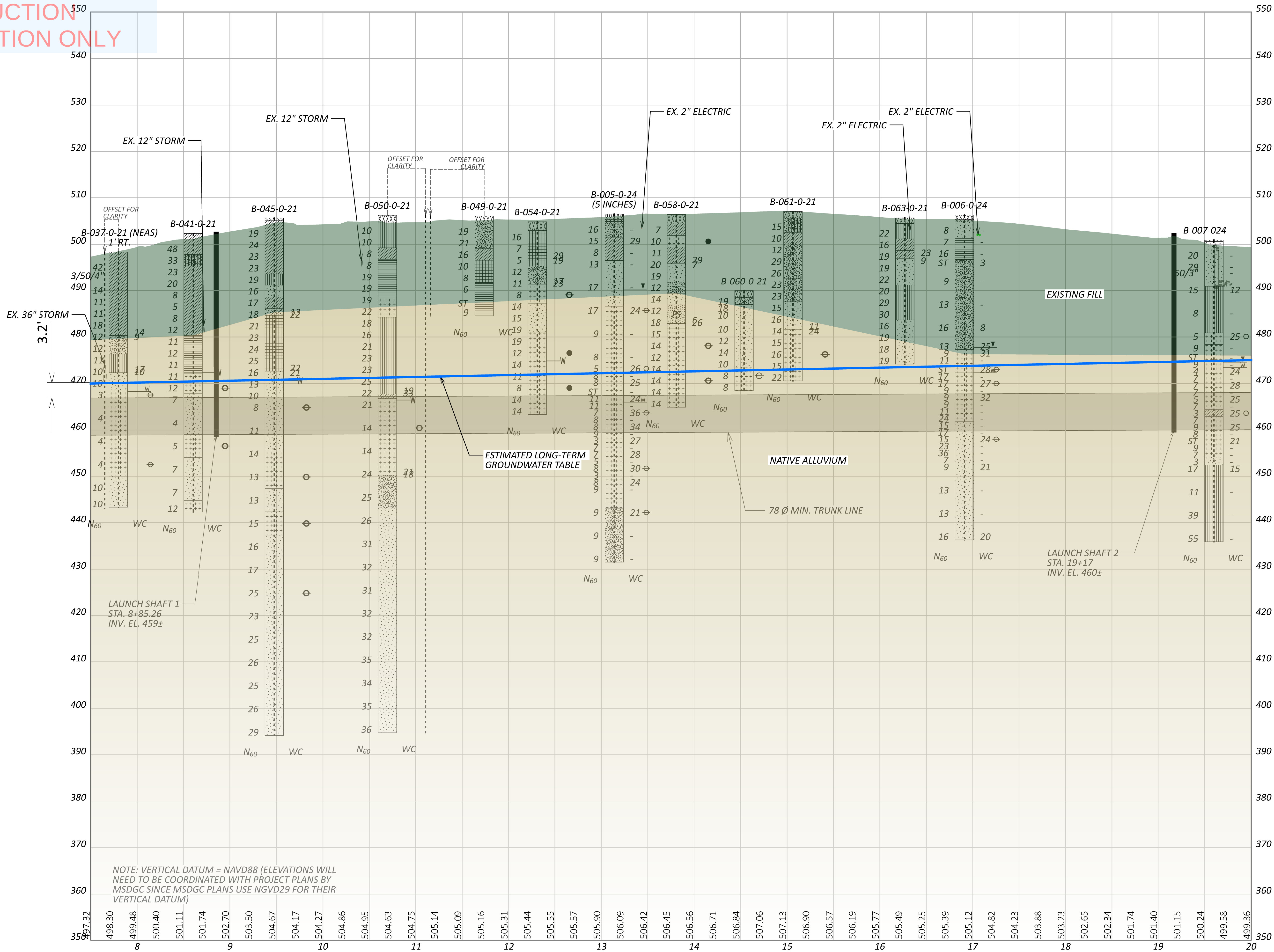
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INFORMATION ONLY

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HAM IR 75-1.25 TRUNK LINE
GEOLOGIC PROFILE
STA. 7+50 TO STA. 20+00

DESIGN AGENCY



DESIGNER

JDH

REVIEWER

MJB 4-2-26

PROJECT ID

122902

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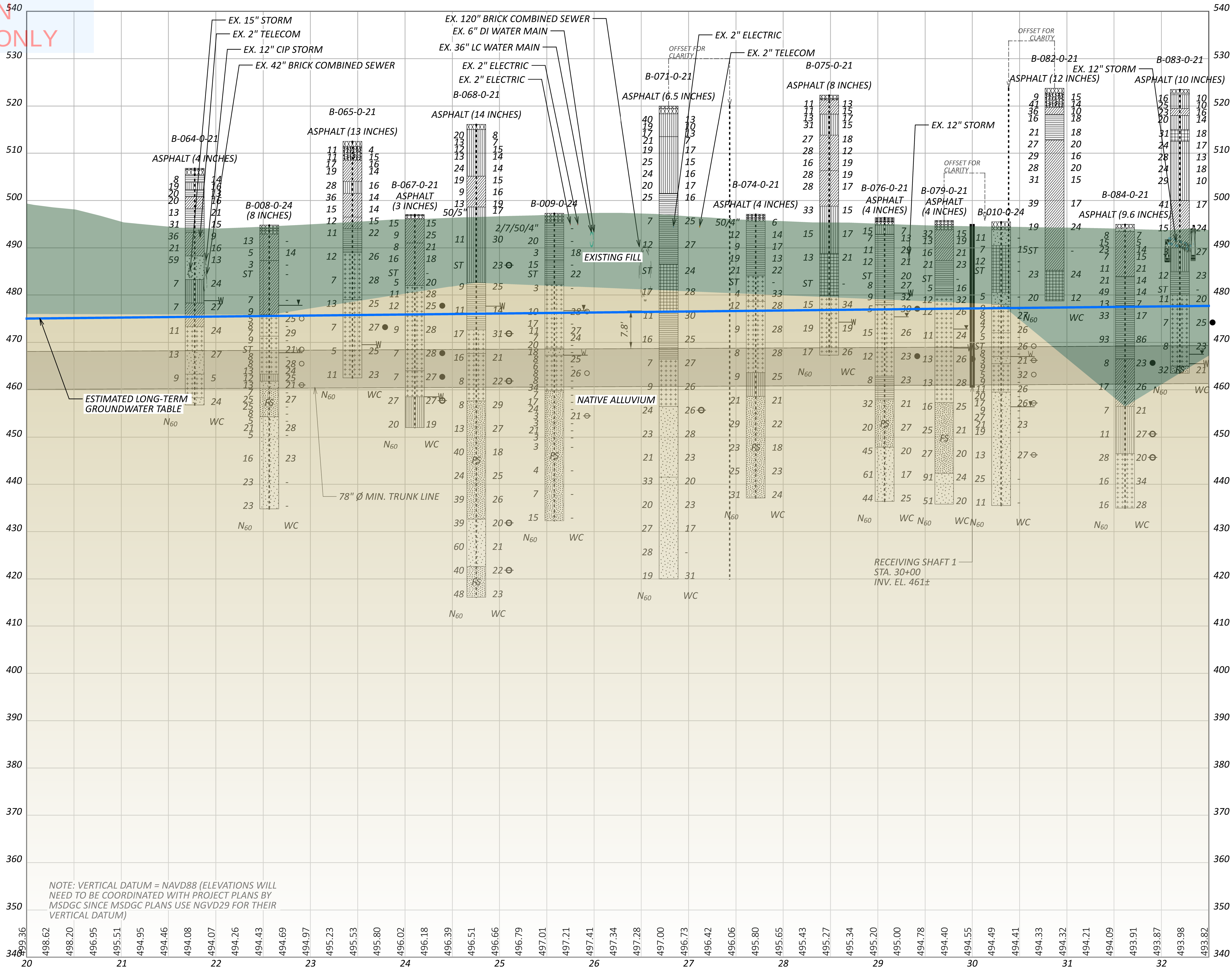
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INFORMATION ONLY

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HAM IR 75-1.25 TRUNK LINE
GEOLOGIC PROFILE
STA. 20+00 TO STA. 32+50

DESIGN AGENCY



DESIGNER

JDH

REVIEWER

MJB 4-2-26

PROJECT ID

122902

SUBSET

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TOTAL

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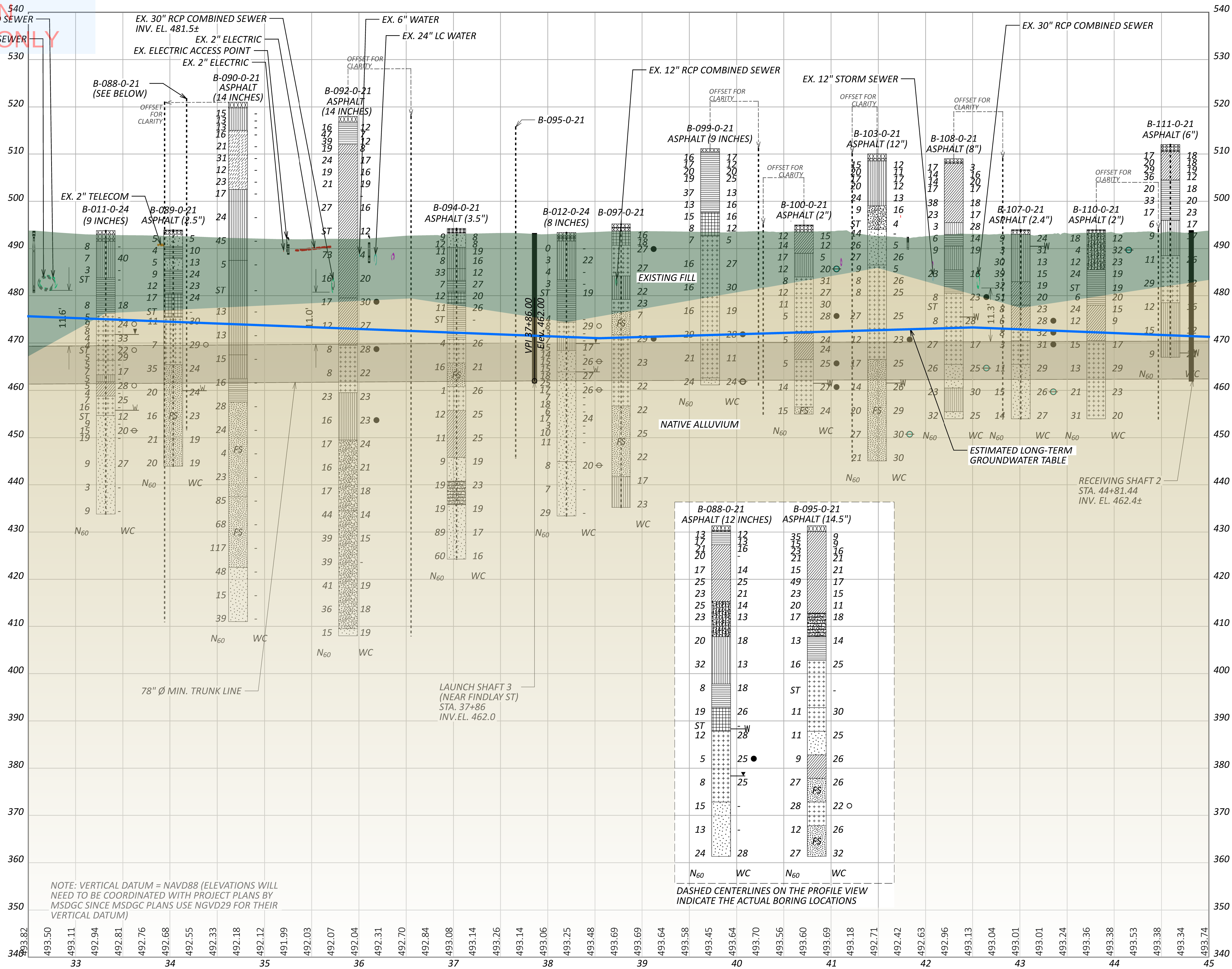
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HAM IR 75-1.25 TRUNK LINE
GEOLOGIC PROFILE
STA. 32+50 TO STA. 45+00

DESIGN AGENCY



DESIGNER

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REVIEWER

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PROJECT ID

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SUBSET TOTAL

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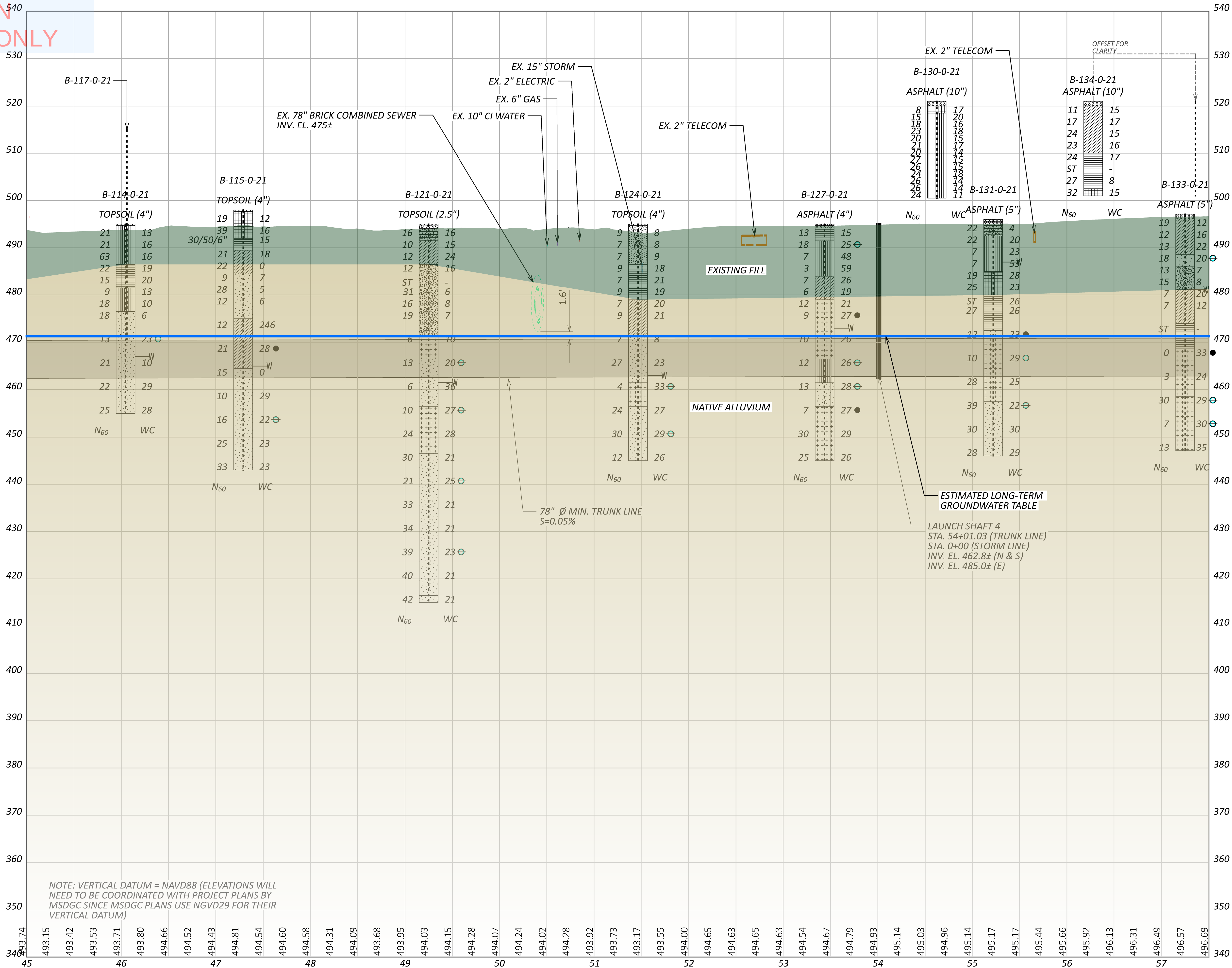
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INFORMATION ONLY

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HAM IR 75-1.25 TRUNK LINE
GEOLOGIC PROFILE
STA. 45+00 TO STA. 57+50

DESIGN AGENCY



DESIGNER

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MJB 4-2-26

PROJECT ID

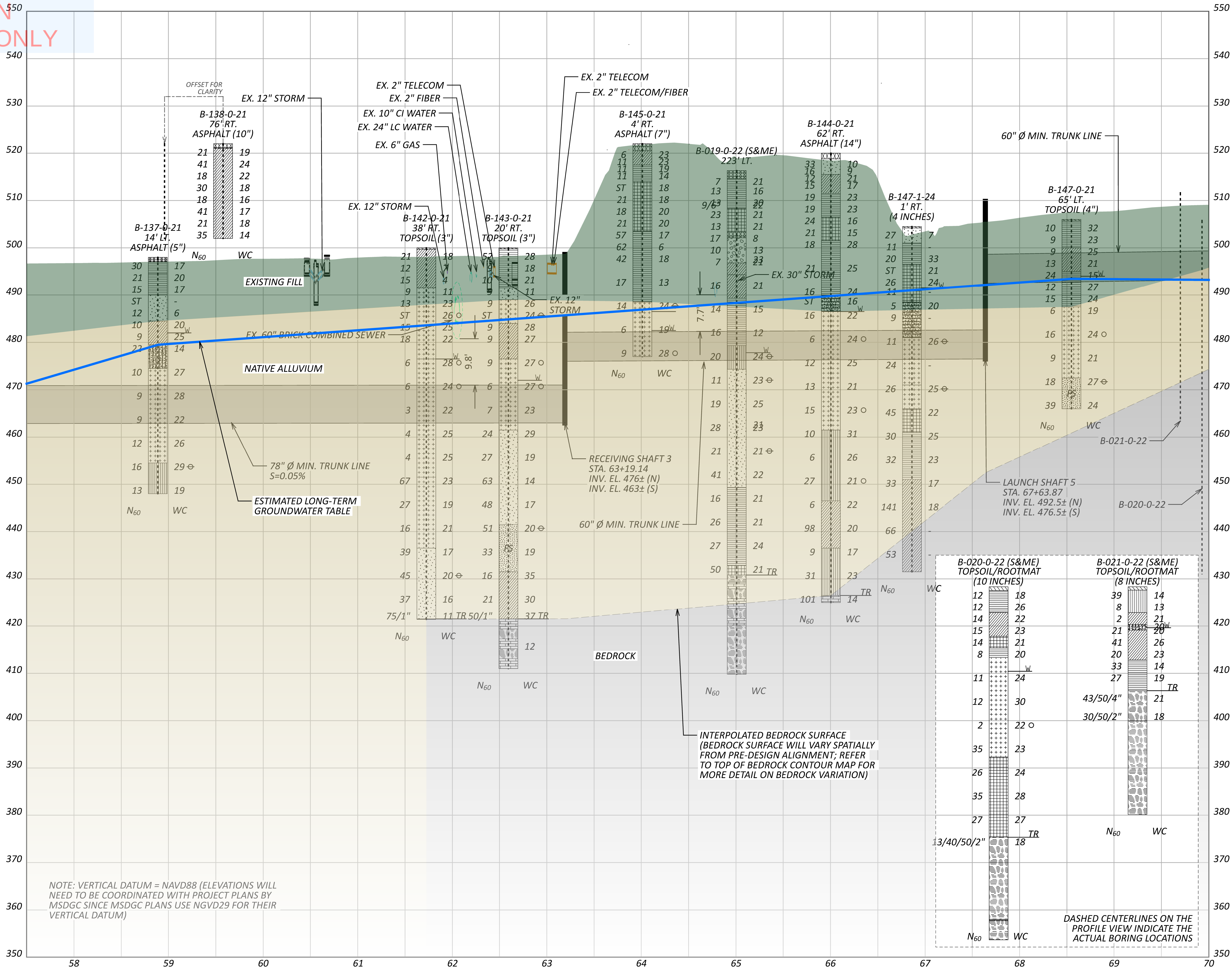
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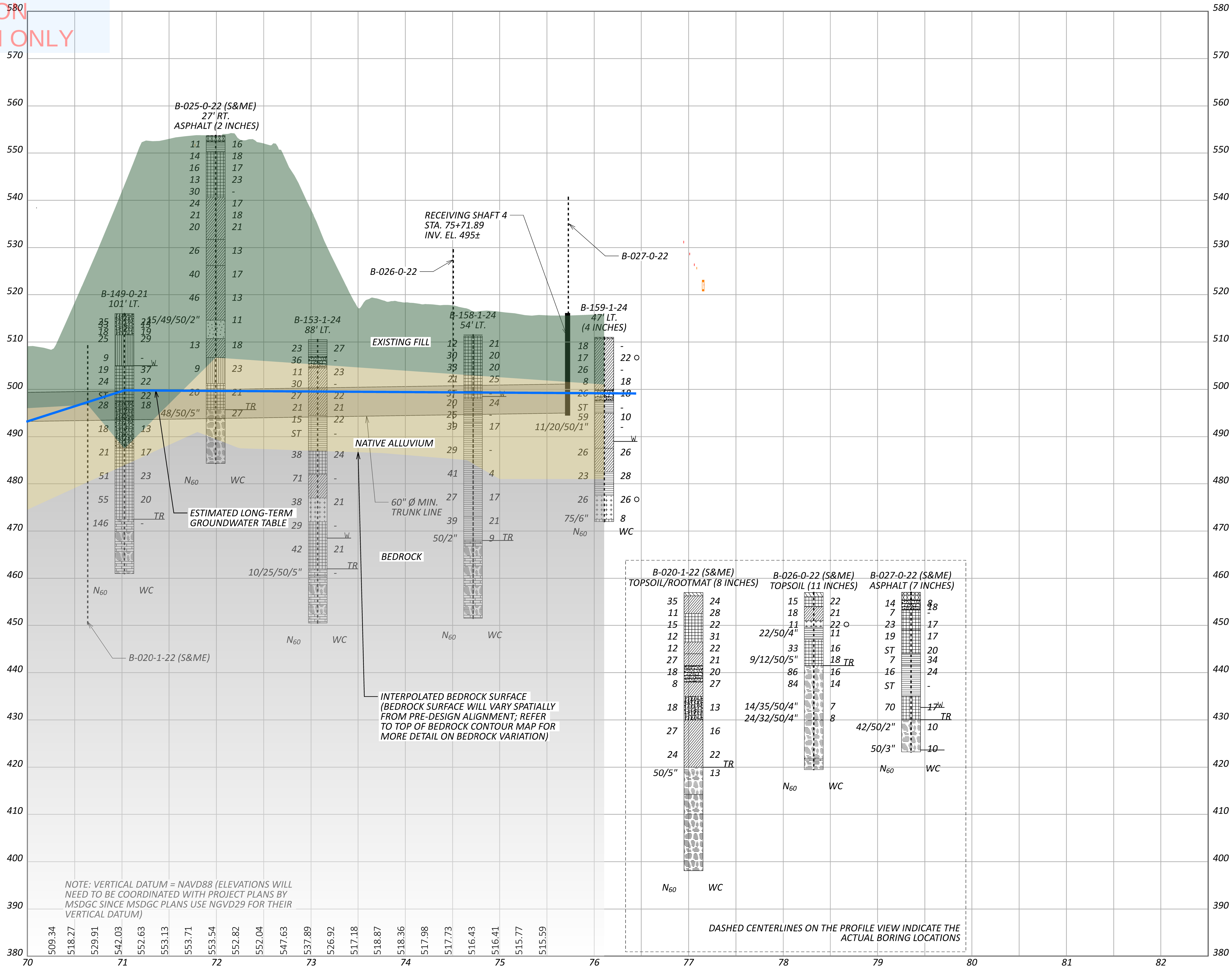
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HAM IR 75-1.25 TRUNK LINE
GEOLOGIC PROFILE
STA. 70+00 TO STA. 82+50

DESIGN AGENCY



DESIGNER

JDH

REVIEWER

MJB 4-2-26

PROJECT ID

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SUBSET TOTAL

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SHEET TOTAL

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