

DESIGN MEMORANDUM

Date: April 8, 2025

To: Mr. Vince Amato, Burgess & Niple, Inc.

From: Brendan P. Andrews P.E., NEAS Inc.

RE: Geotechnical Design Memorandum Project HAM-75-1.05, PID 113361/122048 Retaining Wall 2 City of Cincinnati, Hamilton County, Ohio

INTRODUCTION

Per your request, this memorandum presents foundation design information for the proposed Retaining Wall 2 (RW-2) as part of the overall Ohio Department of Transportation (ODOT) HAM-75-1.05 (PID 113361) project located in the City of Cincinnati, Hamilton County, Ohio. A summary of: 1) the proposed structure; 2) the existing site conditions; 3) the surficial and subsurface conditions via historical and project borings; and, 4) our recommendations for retaining foundation design is presented below.

NEAS's analyses have been performed in accordance with Load and Resistance Factor Design (LRFD) method as set forth in AASHTO's Publication LRFD Bridge Design Specifications, 9th Edition (BDS) (AASHTO, 2020) and ODOT's 2021 LRFD Bridge Design Manual (BDM) (ODOT, 2022).

PROPOSED/EXISTING SITE CONDITIONS

Proposed Construction

The eastern limits of Interstate Route 75 (IR-75) northbound (NB) from Linn Street to the Freeman Avenue (Ave) Bridge and IR-75 NB entrance ramp is planned to be realigned and improved as part of the referenced project. The improvements to IR-75 at this location will also include alterations to Winchell Ave and Ramp V as well as the addition of a 12 foot wide shared use path planned along Winchell Ave. In order to facilitate the proposed improvements, RW-2 is planned to provide grade separation between the new shared use path, Winchell Ave and the existing, upslope grades located east of the referenced roadways.

Based on design information provided within the Retaining Wall 2, Stage 2/3 Plan Set developed by B&N, dated January 6, 2025, the proposed RW-2 will have a total wall length of approximately 1,010 ft and comprised of three different wall types. The first 280 ft (Sta. 1+00 to Sta. 3+80, RW-2 Alignment), starting adjacent to the Linn St Bridge, is planned to be a soldier pile and lagging (SPL) type wall with a max height of about 15 ft. The SPL portion is followed by approximately 610 ft of wall (Sta. 3+80 to Sta. 9+90.5, RW-2 Alignment) designed as a tangent drilled shaft wall with a max exposed height of about 20 ft (top of copping to bottom of footing). The remaining 120 ft (Sta. 9+90.5 to Sta. 11+10, RW-2 Alignment) is planned to be a cast-in-place (CIP) concrete retaining wall with a max height of 10.5 ft. The SPL and tangent

drilled shaft wall will be supported on deep foundation elements while the proposed CIP wall will likely be supported on a shallow foundation.

Historical Records

A historic record search was performed through ODOT's Transportation Information Mapping System (TIMS). However, no geotechnical data or information was available for review within the immediate vicinity of the proposed retaining wall site. Therefore, historic borings are not referenced within this report nor pictured within the associated developed Structure Foundation Exploration Sheets.

Site Reconnaissance

A field reconnaissance visit for the proposed RW-2 was conducted on January 13, 2022, during which site conditions were noted and photographed. During our field reconnaissance, no geohazards were observed within the immediate vicinity of the proposed retaining wall site. Land use of the area surrounding the proposed project site can be described as commercial property.

A portion of RW-2 is proposed to be constructed adjacent to the Linn St Bridge northern abutment. The land in this area slopes up from IR-75 to meet the northern abutment roadway embankment with slopes of roughly 3 Horizontal to 1 Vertical (3H:1V). The area is lightly vegetated with no signs of standing water observed. The area appeared to be stable with no signs of geotechnical instability.

The remaining portions of RW-2 are proposed to be constructed on the west shoulder of the West Court Street (St) and the east shoulder of Winchell Ave. An existing retaining is present along the west shoulder of the West Court St which provides grade separation between West Court St and the lower Winchell Ave. The existing wall terminates as Winchell Ave travels upslope to the north, northeast and West Court St ends. The existing wall appeared to be stable with no signs of geotechnical instability. Atop the existing wall at West Court St grades (Photograph 1), the land in this area is relatively flat with the exception of an embankment leading down to Winchell Ave near the end of the existing wall. This embankment is lightly vegetated for the most part with no signs of standing water observed, however freezing conditions during the site visit made this difficult to determine. In general, the pavement condition along West Court St was observed to be fair to good with signs of surface wear. Moderate severity longitudinal and transverse cracking was observed along this section as well as occasional map cracking and crack sealing deficiencies. The roadway drains to drainage basins on each shoulder of the roadway. The area appeared to be stable with no signs of geotechnical instability.

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Photograph 1: West Court St atop existing retaining wall

SUBSURFACE EXPLORATION

The exploration for the RW-2 was conducted by NEAS between November 29, 2021 and March 10, 2022. The exploration for the referenced structure included 7 borings drilled to depths ranging from 21.5 to 106.5 ft below ground surface (bgs). Boring logs for the borings performed are attached. A summary of the exploration locations including latitude/longitude location information and elevations of the subject structure exploration are shown in Table 1 below. Additional information with respect to the subsurface exploration can be found in the Geotechnical Exploration Report for the overall project, HAM-75-1.05 (PID 113361).

| Boring Number | Latitude | Longitude | Elevation (NAVD 88) (ft) | Depth (ft) | | |
|--|-----------|------------|-----------------------------|------------|--|--|
| B-010-0-21 | 39.105334 | -84.528510 | 518.0 | 106.5 | | |
| B-014-0-21 | 39.105714 | -84.529250 | 505.4 | 51.5 | | |
| B-015-0-21 | 39.105820 | -84.529597 | 506.7 | 50.0 | | |
| B-018-0-21 | 39.106145 | -84.529913 | 507.1 | 51.5 | | |
| B-021-0-21 | 39.106357 | -84.530089 | 504.8 | 50.0 | | |
| B-022-0-21 | 39.106626 | -84.530240 | 506.9 | 21.5 | | |
| B-026-0-21 | 39.107057 | -84.530375 | 505.6 | 85.0 | | |
| Notes: 1. As-drilled boring location and corresponding ground surface elevation was surveyed in the field by NEAS 1. As-drilled boring location and corresponding ground surface elevation was surveyed in the field by NEAS | | | | | | |

Table 1: Structure Boring Summary

SUBSURFACE CONDITIONS

At the site of the proposed structure, three different materials were encountered below the surficial material. In general, the three different overburden materials consisted of historical or embankment "man-made" fill

soils, natural alluvial deposits, followed by natural sands. These materials and the general profile underlying the site is further described below.

Fill soils were encountered in each of the borings performed for the proposed structure with the fill being encountered immediately below the pavement section and extended to depths ranging from 9.5 to 27.5 ft bgs (approximate elevations 497.7 to 477.8 ft above mean sea level (amsl)). Based on laboratory testing results and a visual review of the soil samples obtained, the fill at the site is comprised of both cohesive fine-grained and non-cohesive coarse-grained material and is classified on the boring logs as Gravel and Stone Fragments with Sand and Silt (A-2-4), Gravel with Sand (A-1-b), Silt and Clay (A-6a), Silty Clay (A-6b), Sandy Silt (A-4a), Silt (A-4b), Coarse and Fine Sand (A-3a), and Clay (A-7-6). With respect to the soil strength, the non-cohesive fill soils can be described as having a relative compactness of medium dense to dense correlating to converted SPT-N values (N_{60}) between 13 and 36 blows per foot (bpf). Natural moisture contents of the non-cohesive fill ranged from 5 to 24 percent. With respect to the soil strength of the cohesive fill, these soils can be described as having a consistency of medium stiff to hard correlating to N_{60} values between 6 and 30 bpf and unconfined compressive strengths (estimated by means of hand penetrometer) between approximately 0.75 and 4.5 tons per square foot (tsf). Natural moisture contents of the cohesive fill ranged from 12 to 34 percent. Based on Atterberg Limits tests performed on representative samples of the cohesive fill material, the liquid and plastic limits ranged from 21 to 45 percent and from 15 to 24 percent, respectively.

The stratum encountered immediately beneath the fill consisted of natural alluvial soils comprised predominantly of fine-grained non-cohesive soils and extends to depths ranging from 70.5 to 78.3 ft bgs (approximate elevations 435.1 and 439.7 ft amsl). Based on laboratory testing results and a visual review of the soil samples obtained within this stratum, these soils are comprised of non-cohesive material classified on the boring logs as Coarse and Fine Sand (A-3a), Silt (A-4b) and Sandy Silt (A-4a). With respect to the soil strength, the non-cohesive alluvium can be described as having a relative compactness of loose to dense correlating to N_{60} values between 4 and 31 bpf. Natural moisture contents of the non-cohesive soils ranged from 3 to 31 percent.

The stratum encountered immediately beneath the alluvium, consisted of a natural sand layer which extended to termination depth of the borings between 85.0 and 106.5 ft bgs (approximate elevations 420.6 and 411.5 ft amsl). Based on laboratory testing results and a visual review of the soil samples obtained within this stratum, these soils are comprised of granular material and are classified on the boring logs as Coarse and Fine Sand (A-3a). With respect to the soil strength, the natural sands can be described as having a relative compactness of medium dense to dense correlating to N_{60} values between 18 and 31 bpf. Natural moisture contents of the sands ranged from 12 to 24 percent.

Groundwater

Groundwater measurements were taken during the boring drilling procedures at each borehole location. Groundwater was encountered during drilling in the 3 of the 7 project borings performed at the retaining wall site. Groundwater was encountered at depths ranging from 17.5 to 68.2 ft bgs (elevations 489.2 to 449.8 ft amsl). It should be noted that groundwater is affected by many hydrologic characteristics in the area and may vary from those measured at the time of the exploration. The specific groundwater readings are included on the attached boring logs.

ANALYSES AND RECOMMENDATIONS

Soil Profile for Analysis

For analysis purposes, each boring log was reviewed and a generalized material profile was developed for analysis. Utilizing the generalized soil profile, engineering properties for each soil strata was estimated based on their field (i.e., SPT N60 Values, hand penetrometer values, etc.) and laboratory (i.e., Atterberg Limits, grain size, etc.) test results using correlations provided in published engineering manuals, research reports and guidance documents. The developed soil profile and estimated engineering soil properties (with sited correlation/reference material) used in our analysis is summarized per boring location within Tables 2 through 8, below.

 Table 2: Soil Profile and Estimated Engineering Properties - At Boring B-010-0-21

| Potaining Wall 2: Drillod Shaft /SPI /CIP Wall R-010-0-21 | | | | | | |
|---|-------------------|-----------------------------------|-----------------------------|---------------------------------------|--|--|
| Soil Description | Unit Weight (pcf) | Undrained Shear Strength (psf) | Effective Cohesion (psf) | Effective Friction Angle (degrees) | | |
| Gravel with Sand and Silt Depth (518 ft - 471 ft) | 122 | - | - | 34 | | |
| Silt Depth (471 ft - 453 ft) | 125 | - | - | 30 | | |
| Fine Sand Depth (453 ft - 411.5 ft) | 128 | - | - | 32 | | |
| Notes: | | | | | | |

Values calculated per ODOT GDM Section 404/1304 and/or ODOT BDM Table 305-2.

| Table 3: | Soil Profile and | Estimated | Engineering | Properties - | - At Boring B-014-0-21 |
|----------|------------------|-----------|-------------|--------------|------------------------|
|----------|------------------|-----------|-------------|--------------|------------------------|

| Retaining Wall 2: Drilled Shaft /SPL/CIP Wall, B-014-0-21 | | | | | | | |
|---|-------------------|-----------------------------------|-----------------------------|---------------------------------------|--|--|--|
| Soil Description | Unit Weight (pcf) | Undrained Shear Strength (psf) | Effective Cohesion (psf) | Effective Friction Angle (degrees) | | | |
| Silt and Clay Depth (505.4 ft - 477.8 ft) | 122 | 1900 | 190 | 24 | | | |
| Silt Depth (477.8 ft - 453.9 ft) | 128 | - | - | 33 | | | |
| Votes: 1 Values calculated per ODOT GDM Section 404/1304 and/or ODOT RDM Table 305-2 | | | | | | | |

Table 4: Soil Profile and Estimated Engineering Properties - At Boring B-015-0-21

| Retaining Wall 2: Drilled Shaft /SPL/CIP Wall, B-015-0-21 | | | | | | | |
|---|-------------------|--|-----|---------------------------------------|--|--|--|
| Soil Description | Unit Weight (pcf) | Jnit Weight (pcf) Undrained Shear Ef Strength (psf) | | Effective Friction Angle (degrees) | | | |
| Sandy Silt Depth (506.7 ft - 497.2 ft) | 122 | - | - | 33 | | | |
| Silt and Clay Depth (497.2 ft - 487.2 ft) | 118 | 1200 | 120 | 22 | | | |
| Silt Depth (487.2 ft - 456.7 ft) | 125 | - | - | 31 | | | |
| | | | | | | | |

'alues calculated per ODOT GDM Section 404/1304 and/or ODOT BDM Table 305-2.

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| T-1-1-5. | C - 1 D C1 | Estimate 1 | ······································ | D | A + D | D 010 0 21 |
|----------|---------------|-------------|--|--------------|-----------|------------|
| Table 5: | Son Prome and | Estimated r | ngineering | Properties - | At Boring | B-018-0-21 |
| | | | | | 0 | |

| Retaining Wall 2: Drilled Shaft /SPL/CIP Wall, B-018-0-21 | | | | | | | | |
|--|-------------------|-----------------------------------|-----------------------------|---------------------------------------|--|--|--|--|
| Soil Description | Unit Weight (pcf) | Undrained Shear Strength (psf) | Effective Cohesion (psf) | Effective Friction Angle (degrees) | | | | |
| Gravel with Sand and Silt Depth (507.1 ft - 487.6 ft) | 128 | - | - | 36 | | | | |
| Silt Depth (487.6 ft - 455.6 ft) | 128 | - | - | 33 | | | | |
| Depth (507.1 ft - 487.6 ft) Silt Depth (487.6 ft - 455.6 ft) | 128 | - | - | | | | | |

Values calculated per ODOT GDM Section 404/1304 and/or ODOT BDM Table 305-2.

Table 6: Soil Profile and Estimated Engineering Properties - At Boring B-021-0-21

| Retaining Wall 2: Drilled Shaft /SPL/CIP Wall, B-021-0-21 | | | | | | |
|---|-------------------|-----------------------------------|-----------------------------|---------------------------------------|--|--|
| Soil Description | Unit Weight (pcf) | Undrained Shear Strength (psf) | Effective Cohesion (psf) | Effective Friction Angle (degrees) | | |
| Clay Depth (504.8 ft - 492.8 ft) | 110 | 1000 | 100 | 21 | | |
| Coarse and Fine Sand Depth (492.8 ft - 473.5 ft) | 125 | - | - | 33 | | |
| Silt Depth (473.5 ft - 463.3 ft) | 125 | - | - | 31 | | |
| Silt Depth (463.3 ft - 454.8 ft) | 120 | - | - | 27 | | |
| Notes: | ODM 0+ 404/4004 | | 0.5.0 | | | |

1. Values calculated per ODOT GDM Section 404/1304 and/or ODOT BDM Table 305-2.

| Table 7: | Soil Profile | and Estimated | l Engineerin | g Properties | - At Boring | B-022-0-21 |
|----------|--------------|---------------|--------------|--------------|-------------|------------|
| | | | 0 | | 0 | |

| Retaining Wall 2: Drilled Shaft /SPL/CIP Wall, B-022-0-21 (w/ B-021-0-21 & B-026-0-21) | | | | | | |
|--|-------------------|-----------------------------------|-----------------------------|---------------------------------------|--|--|
| Soil Description | Unit Weight (pcf) | Undrained Shear Strength (psf) | Effective Cohesion (psf) | Effective Friction Angle (degrees) | | |
| Silt and Clay Depth (506.9 ft - 497.4 ft) | 110 | 1000 | 100 | 22 | | |
| Coarse and Fine Sand Depth (497.4 ft - 482.3 ft) | 125 | - | - | 34 | | |
| Silt Depth (482.3 ft - 463.3 ft) | 125 | - | - | 31 | | |
| Silt Depth (463.3 ft - 441.9 ft) | 120 | - | - | 28 | | |
| Coarse and Fine Sand Depth (441.9 ft - 420.6 ft) | 125 | - | - | 32 | | |
| Notes: | | | | | | |

1. Values calculated per ODOT GDM Section 404/1304 and/or ODOT BDM Table 305-2.

Table 8: Soil Profile and Estimated Engineering Properties - At Boring B-026-0-21

| Retainir | ng wali 2: Drilleo | i Shaπ/SPL/CIP | wall, B-026-0-21 | | |
|---|------------------------|-----------------------------------|-----------------------------|---------------------------------------|--|
| Soil Description | Unit Weight (pcf) | Undrained Shear Strength (psf) | Effective Cohesion (psf) | Effective Friction Angle (degrees) | |
| Sandy Silt Depth (505.6 ft - 492.6 ft) | 125 | - | - | 33 | |
| Silt Depth (492.6 ft - 474.1 ft) | 125 | - | - | 32 | |
| Silt Depth (474.1 ft - 454.1 ft) | 115 | - | - | 29 | |
| Silt Depth (454.1 ft - 440.6 ft) | 110 | - | - | 27 | |
| Coarse and Fine Sand Depth (440.6 ft - 420.6 ft) | 125 | - | - | 33 | |
| Notes: 1. Values calculated per ODOT G | DM Section 404/1304 an | nd/or ODOT BDM Table 3 | 305-2 | | |

RETAINING WALL 2 (STA. 1+00.0 TO STA. 9+90.5)

SPL Retaining Wall Design Assumptions

As a portion of RW-2 is planned as a SPL retaining wall, ODOT's BDM and AASHTO's LRFD BDS dictate analysis parameters and design minimums/constraints to be used in analysis and design process. The referenced parameters and design minimums/constraints that were significant to our analysis consist of the following:

- Minimum SPL wall embedment depths (as measured from top of drilled shaft to the proposed ground surface) shall be 3 ft;
- SPL wall analyses performed assuming a simplified earth distribution as shown in LRFD BDS Figure 3.11.5.6-4 "Unfactored Simplified Earth Pressure Distribution for Temporary Nongravity Cantilevered Walls with Discrete Vertical Elements Embedded in Cohesive Soils and Retaining Granular Soils";
- Simplified Earth Pressure "Design Grade" is equal to top of shaft/bottom of facing elevation of the proposed wall;
- Soldier pile analyzed in software L-pile as an "Elastic Section (Non-yielding)" type with "Circular without Void" shape with section properties equal to that of the steel section assuming a yield strength of 50 kips per square inch (ksi) and an elastic modulus of 29,000 ksi;
- Retained Fill soils will be compacted on-site fill material as specified and meeting the minimum design soil parameters per ODOT BDM Table 307-1 and provided in Table 9 below.

| Fill Zone | Type of Soil | Soil Unit Weight (pcf) | Friction Angle (°) | Cohesion (psf) | | |
|---|--|---------------------------|-----------------------|-------------------|--|--|
| SPL Wall Backfill | On-site soil varying from sandy lean clay to silty sand, per 703.16.A | 120 | 30 | 0 | | |
| Notes: 1. Per Section Table 307-1 of the ODOT BDM. | | | | | | |

 Table 9: Design Soil Parameters for Fill Materials

With respect to design constraints and assumptions specific to the portion of SPL retaining wall, the geometry of the proposed wall (i.e., exposed heights, existing ground elevations, proposed final grade behind/at the toe of the well, etc.) is assumed to be consistent with the Retaining Wall 2, Stage 2/3 Plan Set developed by B&N, dated January 6, 2025.

Tangent Drilled Shaft Retaining Wall Design Assumptions

As a portion of RW-2 is planned as tangent drilled shaft wall type with a reinforced concrete wall facing, ODOT's BDM and AASHTO's LRFD BDS dictate analysis parameters and design minimums/constraints to be used in the analysis and design process. The referenced parameters and design minimums/constraints that were significant to their analyses consist of the following:

- Measure the design retained height (H) of drilled shaft walls from the top of the retained earth to the design grade, according to LRFD Figures 3.11.5.6-1 through 3.11.5.6-7.
- Minimum embedment (D) for drilled shaft walls shall be equal to the retained height (H) such that the embedment-to-length ratio (D/L) shall not be less than 0.5.
- For drilled shaft walls with a cast-in-place concrete facing, provide a structural attachment between the facing and the exposed face of the discrete vertical wall elements.; and,

• For tangent drilled shaft walls with a permanent cast-in-place facing, place wall drainage between the permanent facing and the drilled shafts at the joints between the adjacent drilled shafts. Provide vertical drainage paths with a minimum width of 18-inch.

With respect to design constraints and assumptions specific to the RW-2, the geometry of the proposed walls (i.e., exposed wall heights, existing ground elevations, proposed final grade behind/at the toe of the wall, etc.) is assumed to be consistent with that shown in the available the Retaining Wall 2, Stage 2/3 Plan Set developed by B&N, dated January 6, 2025.

Parameters for Lateral Load Analysis

Deep foundation elements subjected to horizontal loads and/or moments should be analyzed for maximum bending moments and lateral deflections. The required lateral load capacity can be obtained by increasing the diameter or the embedment depth of the foundation element. The generalized soil parameters, including recommended lateral soil modulus, and soil strain to be used to analyze the laterally loaded shaft by the p-y curve method are presented in Table 10 below. Furthermore, a resistance factor of 1.0 should be used when estimating the lateral geotechnical resistance of a single shaft/pile or shaft/pile group in accordance with LRFD BDS Tables 10.5.5.2.3-1 and 10.5.5.2.4-1.

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| | | LPILE Paramete | ers Retaining W | all 2 | | | |
|--------------------------------|----------------------|------------------------|-------------------------------|-------------------|---|--|--|
| Soil Description | p-y model | Elevation (ft amsl) | Total Unit Weight (pcf) | Friction Angle | Undrained Shear Strength (psf) | Lateral Soil Modulus Parameter, k (pci) | Soil Strain Parameter, E ₅₀ (%) |
| | | Soil Profile at | Boring B-010-0 | -21 | | | |
| Silty, Clayey Sand & Gravel | Sand (Reese) | 518.0 - 471.0 | 122 | 34 | | 85 | |
| Non-Cohesive Silt / Sandy Silt | Sand (Reese) | 471.0 - 453.0 | 125 | 30 | - | 35 | - |
| Coarse and Fine Sand | Sand (Reese) | 453.0 - 411.5 | 128 | 32 | - | 50 | - |
| | | Soil Profile at | Boring B-014-0 | -21 | | | |
| Silt and Clay | Stiff Clay w/o Water | 505.4 - 477.8 | 122 | - | 1,900 | 635 | 0.0064 |
| Non-Cohesive Silt / Sandy Silt | Sand (Reese) | 477.8 - 453.9 | 128 | 33 | - | 70 | - |
| | | Soil Profile at | Boring B-015-0 | -21 | | | |
| Sand / Silty Sand | Sand (Reese) | 506.7 - 497.2 | 122 | 33 | - | 105 | - |
| Silt and Clay | Stiff Clay w/o Water | 497.2 - 487.2 | 118 | - | 1,200 | 330 | 0.0083 |
| Non-Cohesive Silt / Sandy Silt | Sand (Reese) | 487.2 - 456.7 | 125 | 31 | - | 45 | - |
| | | Soil Profile at | Boring B-018-0 | -21 | | • | |
| Silty, Clayey Sand & Gravel | Sand (Reese) | 507.1 - 487.6 | 128 | 36 | - | 225 | - |
| Non-Cohesive Silt / Sandy Silt | Sand (Reese) | 487.6 - 455.6 | 128 | 33 | - | 70 | - |
| | | Soil Profile at | Boring B-021-0 | -21 | | | |
| Silt and Clay | Stiff Clay w/o Water | 504.8 - 492.8 | 110 | - | 1,000 | 230 | 0.0094 |
| Coarse and Fine Sand | Sand (Reese) | 492.8 - 473.5 | 125 | 33 | - | 65 | - |
| Non-Cohesive Silt | Sand (Reese) | 473.5 - 463.3 | 125 | 31 | - | 45 | - |
| Non-Cohesive Silt | Sand (Reese) | 463.3 - 454.8 | 120 | 27 | - | 15 | - |
| | Soil Profile | at Boring B-022-0 |)-21 (w/ B-021-0 | -21 and B- | 026-021) | • | |
| Silt and Clay | Stiff Clay w/o Water | 506.9 - 497.4 | 110 | - | 1,000 | 230 | 0.0094 |
| Sand / Silty Sand | Sand (Reese) | 497.4 - 482.3 | 125 | 34 | - | 140 | - |
| Non-Cohesive Silt / Sandy Silt | Sand (Reese) | 482.3 - 463.3 | 125 | 31 | - | 45 | - |
| Non-Cohesive Silt | Sand (Reese) | 463.3 - 441.9 | 120 | 28 | - | 20 | - |
| Sand / Silty Sand | Sand (Reese) | 441.9 - 420.6 | 125 | 32 | - | 60 | - |
| | | Soil Profile at | Boring B-026-0 | -21 | | | |
| Sand / Silty Sand & Gravel | Sand (Reese) | 505.6 - 492.6 | 125 | 33 | - | 105 | - |
| Non-Cohesive Silt / Sandy Silt | Sand (Reese) | 492.6 - 474.1 | 125 | 32 | - | 55 | - |
| Non-Cohesive Silt / Sandy Silt | Sand (Reese) | 474.1 - 454.1 | 115 | 29 | - | 25 | - |
| Non-Cohesive Silt | Sand (Reese) | 454.1 - 440.6 | 110 | 27 | - | 15 | - |
| Sand / Silty Sand | Sand (Reese) | 440.6 - 420.6 | 125 | 33 | - | 70 | - |

Table 10: Soil Parameters for Lateral Load Analysis - RW-2

Global Stability

For purposes of evaluating the stability of the SPL and tangent drilled shaft wall type segments of the proposed RW-2, NEAS reviewed the available cross-sections that were interpreted to represent conditions that posed the greatest potential for slope instability. In general, cross-sections along the proposed wall alignment were reviewed to determine sections that would represent a combination of existing subsurface conditions and planned site grading that would be most critical to slope stability (i.e., maximum total wall height, maximum embankment height measured from toe of slope to top of wall coping, proposed cut into existing embankment slopes, weak or thick soil layer, etc.). Based on our review of the available information at the referenced locations and the associated soil properties, two (2) cross-sections were estimated to be most "critical" and were analyzed for global stability. The cross-sections analyzed for global stability were the maximum total wall height section of each individual wall type (i.e., SPL and tangent drilled shaft). The analyzed cross-sections include the section at approximate STA. 1+00 (RW-2 alignment) and approximate STA. 6+90 (RW-2 alignment) for the for the SPL and tangent drilled shaft wall type segments, respectively.

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For each of the referenced cross-sections, NEAS developed a representative cross-sectional model to use as the basis for global stability analyses. The models were developed from NEAS's interpretation of the available information which included: 1) the available Retaining Wall 2, Stage 2/3 Plan Set developed by B&N, dated January 6, 2025; 2) a live load surcharge of 250 pounds per square foot (psf), accounting for traffic induced loads; and 3) test borings and laboratory data developed as part of this memo. With respect to the soil's engineering properties, the provided Soil Profile and Estimated Engineering Properties of borings B-010-0-21 and B-021-0-21 presented in the *Soil Profile for Analysis* section of this memo were used in our analyses at approximate STA. 1+00 (RW-2 alignment) and STA. 6+90 (RW-2 alignment), respectively.

The above referenced slope stability model was analyzed for long-term (Effective Stress) and short-term (Total Stress) slope stability utilizing the software entitled Slide2 by Rocscience, Inc. Specifically, the Spencer analysis method was used to calculate a factor of safety (FOS) for circular and non-circular type slope failures. The FOS is the ratio of the resisting forces and the driving forces, with the desired safety factor being more than about 1.33 which equates to an AASHTO resistance factor less than 0.75 (per AASHTO's LRFD BDS the specified resistance factors are essentially the inverse of the FOS that should be targeted in slope stability programs). For this analysis, a resistance factor of 0.75 or lower is targeted as the retaining wall does not contain or support a structural element.

Based on our slope stability analysis for the referenced retaining wall sections, the minimum slope stability safety factor is about 1.38 (0.72 resistance factor). The graphical output of the slope stability program (cross-sectional model, calculated safety factor, and critical failure plane) is attached.

Tangent Drilled Shaft and SPL Retaining Wall Analyses

Internal and external stability analyses of the proposed RW-2 tangent drilled shaft and SPL wall including lateral load analysis of the proposed drilled shaft foundations has been performed by the project design team. These calculations will be provided to ODOT as part of a separate submission.

RETAINING WALL 2 (STA. 9+90.5 TO STA. 11+10.0)

Cast-In-Place Wall and Spread Footing Design Assumptions

As a portion of the RW-2 structure is proposed to be a cast-in-place (CIP) wall founded on the existing soil at the site, ODOT's BDM, AASHTO's LRFD BDS, and the project conditions dictate analysis parameters and design minimums/constraints to be used in the analysis and design process. The referenced parameters and design minimums/constraints that where significant to our analyses consist of the following:

- Retained soils are to consist of material placed and compacted in accordance with Item 203, Roadway Excavation and Embankment, of the ODOT CMS;
- The soil parameters of the new fill were assumed to be consistent with those recommended in the ODOT BDM Section 307.1 for "On-site soil varying from sandy lean clay to silty sand" for behind the wall heel and for Granular Embankment for wall backfill and are presented in Table 11 below.

| Type of Soil | Soil Unit Weight (pcf) | Effective Friction Angle (°) | Effective Cohesion (psf) |
|--|------------------------------|------------------------------------|--------------------------------|
| On-site soil varying from sandy lean clay to silty sand, per 703.16A | 120 | 30 | 0 |
| Granular Embankment, per 703.16B | 120 | 32 | 0 |
| Notes: 1. Per Section 307.1 of the 2020 ODOT BDM. | | | |

| Table 11: Design Soil Parameters for | or Fill Materials |
|--------------------------------------|-------------------|
|--------------------------------------|-------------------|

With respect to design constraints and assumptions specific to RW1, the geometry of the proposed wall (i.e., exposed wall heights, existing ground elevations, proposed final grade behind/at the toe of the wall, etc.) is assumed to be consistent with that shown in the Retaining Wall 2, Stage 2/3 Plan Set developed by B&N, dated January 6, 2025.

External Stability Analysis

Based on our estimated engineering soil properties and the RW-2 CIP design assumptions provided in previous sections of this memo, an external stability analysis of the proposed CIP wall was performed. The cross-section selected for external stability analysis is the tallest wall section with a footing width of 7-ft and 1.5 ft key located near STA. 9+90.5 (RW-2 alignment). This cross-section was evaluated for resistance to bearing pressure, sliding forces, and overturning at the Strength Limit State in accordance with Section 11.5.3 of the AASHTO's LRFD BDS.

The capacity to demand ratios (CDRs) calculated for the referenced cross-sections with respect to bearing, sliding and overturning, as well as the calculated factored bearing resistances are presented in Table 12 below. (External Stability Results are attached). A CDR ratio greater than 1.0 indicates an acceptable design per AASHTO's LRFD.

| Detaining Mall 0 OID Forte meet A | |
|--|-------------------------------|
| Retaining wall 2 CIP External A | nalysis Summary |
| Estimated Top of Wall (feet) | 505.0 |
| Estimated Bottom of Footing (feet) | 494.5 |
| Exposed Wall Height (feet) | 5.8 |
| Design Wall Height (feet) | 10.5 |
| Depth of Key (feet) | 1.5 |
| Approximate Station ⁽¹⁾ | 9+90.5 |
| Capacity Demand Ratio | o (CDR) |
| Sliding | 1.9 |
| Overturning / Eccentricity | 2.3 |
| Bearing Capacity (Undrained/Drained) | 7.8/7.8 |
| Factored Bearing Resistance (ksf) ⁽²⁾ | 12.5 |
| Notes: | - |
| 1. Stationing in reference to the proposed | Retaining Wall 2 alignment |
| 2. Bearing Resistance calculated in accor | dance to Section 11.10.5.4 of |
| 2021 LRFD BDS and factored using Res | sistance Factor provided in |
| Table 11.5 7-1 of 2021 RED BDS | |

| T 1 1 1 0 | E (10(1)) | A 1 ° C |
|-----------|--------------------|------------------|
| Table 12: | External Stability | Analysis Summary |

Global Stability

For purposes of evaluating the stability of the CIP type segment of the proposed RW-2, NEAS reviewed the available cross-sections that were interpreted to represent conditions that posed the greatest potential for slope instability. In general, cross-sections along the proposed CIP wall alignment were reviewed to determine sections that would represent a combination of existing subsurface conditions and planned site

Retaining Wall 2 HAM-75-1.05 Hamilton County, Ohio PID:113361/122048

grading that would be most critical to slope stability (i.e., maximum total wall height, maximum embankment height measured from toe of slope to top of wall coping, proposed cut into existing embankment slopes, weak or thick soil layer, etc.). Based on our review of the available information at the referenced locations and the associated soil properties, one (1) cross-section was estimated to be most "critical" and was analyzed for global stability. The cross-section analyzed for global stability was the maximum total CIP wall height section at approximate STA. 9+90.5 (RW-2 alignment).

For the referenced cross-section, NEAS developed a representative cross-sectional model to use as the basis for global stability analyses. The model was developed from NEAS's interpretation of the available information which included: 1) the available Retaining Wall 2, Stage 2/3 Plan Set developed by B&N, dated January 6, 2025; 2) a live load surcharge of 250 pounds per square foot (psf), accounting for traffic induced loads; and 3) test borings and laboratory data developed as part of this memo. With respect to the soil's engineering properties, the provided Soil Profile and Estimated Engineering Properties of boring B-026-0-21 presented in the *Soil Profile for Analysis* section of this memo were used in our analyses.

The above referenced slope stability model was analyzed for long-term (Effective Stress) and short-term (Total Stress) slope stability utilizing the software entitled Slide2 by Rocscience, Inc. Specifically, the Spencer analysis method was used to calculate a factor of safety (FOS) for circular and non-circular type slope failures. The FOS is the ratio of the resisting forces and the driving forces, with the desired safety factor being more than about 1.33 which equates to an AASHTO resistance factor less than 0.75 (per AASHTO's LRFD BDS the specified resistance factors are essentially the inverse of the FOS that should be targeted in slope stability programs). For this analysis, a resistance factor of 0.75 or lower is targeted as the retaining wall does not contain or support a structural element.

Based on our slope stability analysis for the referenced retaining wall section, the minimum slope stability safety factor is about 2.56 (0.39 resistance factor). The graphical output of the slope stability program (cross-sectional model, calculated safety factor, and critical failure plane) is attached.

Settlement

Settlement is not anticipated to be a concern at the proposed wall location as minimal amount of new fill is planned as part of the proposed construction of the wall and therefore the increase in loading is minimal.

Temporary Excavations

It is recommended that all temporary excavations comply with the most recent Occupational Safety and Health Administration (OSHA) Excavating and Trenching Standard, Title 29 of the Code of Federal Regulation (CFR) Part 1926, Subpart P. The contractor is responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. Per Title 29 CFR Part 1926, the contractor's competent person should evaluate the soil exposed in the excavations as part of their safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. Based on the natural soils encountered at the site (Type C Soil), it is recommended that temporary excavation slopes (exceeding a depth of 3 ft and less than 20 ft) be laid back to at least 1.5H:1V and these slopes should be braced or backfilled if the excavation slope will be maintained for more than a day

SOIL BORING LOGS

| LES/HAI | | | | | | | | | | | | | | | | | | | | | |
|-------------------|--|---|---|------------|---------------------------------|-------------|-----------------|-------|----------------|-------------|----|------|-------|-------|------------|-------|--------------|---------|---------|--------------------|----------|
| | OJECT: | HAM-75-1.05 | DRILLING FIRM / OPEF | RATOR: N | NEAS / ASHBAUGH | DRIL | L RIG | i: | CME 5 | 5T | | STA | TION | / OF | FSE | T: 1 | 110+2 | 26, 28 | 5' LT. | EXPLOR | ATION IE |
| TT 🖁 | PE: | BRIDGE | SAMPLING FIRM / LOG | GER: N | EAS / ASHBAUGH | HAM | IMER: | C | ME AUTO | MATIC | > | ALIG | NME | NT: | | L | INN | ST | | B-010 | 0-0-21 |
| | D: <u>113361</u> S | SFN: | _ DRILLING METHOD: _ | 3 | 3.25" HSA | CAL | BRAT | ION D | ATE: | 12/5/19 | 9 | ELE) | VATIO | ON: _ | 518. | 0 (MS | <u>SL)</u> I | EOB: | 10 | 06.5 ft | |
| ≍ ST | ART: <u>11/29/2</u> | 1_ END: <u>11/30/21</u> | _ SAMPLING METHOD: | | SPT | ENE | RGY I | RATIO | (%): | 68.4 | | LAT | / LON | NG: _ | | 39.1 | 0533 | 84, -84 | 1.5285 | 510 | T OF 4 |
| E\HA | | MATERIAL DESCRI | PTION | ELEV. | DEPTHS | SPT/ | N ₆₀ | REC | SAMPLE | HP (tof) | | GRAD | | DN (% | 6) Cl | | | ERG | WC | ODOT CLASS (GI) | |
| ≧ | 0" ASPHALT AN | AND NOTES | ID 5 0" BASE XX | 518.0 X | | NQD | | (%) | | (ISI) | GR | 0.5 | FS | 51 | | | PL | PI | WC | | JLALL |
| D) ARO | RILLERS DESC | RIPTION) | | 516.6 | | | | | | | | | | | | | | | | | |
| HIVE BY YEAR\2024 | EDIUM DENSE FONE FRAGME LAY, CONTAINS AMP ILL) | , BROWN AND GRAY, NTS WITH SAND AND S TRACE BRICK FRAC | GRAVEL AND | | | 4 5 7 | 14 | 11 | SS-1 | - | - | - | - | - | - | - | - | - | 14 | A-2-4 (V) | - |
| | | | | 511.0 | | 4 7 8 | 17 | 22 | SS-2 | - | - | - | - | - | - | - | - | - | 9 | A-2-4 (V) | - |
| | ERY STIFF TO D SOME GRAVI DME SAND, CC ILL) | HARD, BROWN, SILT EL AND STONE FRAG INTAINS BRICK FRAG | AND CLAY, LITTLE MENTS, LITTLE TO MENTS, DAMP | | | 5 6 6 | 14 | 56 | SS-3 | 4.25 | 28 | 12 | 13 | 28 | 19 | 30 | 17 | 13 | 12 | A-6a (3) | |
| JECISACIIV | | | | | | 5 4 5 | 10 | 39 | SS-4 | 4.50 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | - |
| ACIIVE PRO | | | | | - 12 - 13 - 14 | 2 3 2 | 6 | 50 | SS-5 | 4.25 | - | - | - | - | - | - | - | - | 16 | A-6a (V) | - |
| 25 12:05 - X:\1 | | | | 501.0 | - 15 - - - 16 - - 17 - | 3 4 5 | 10 | 44 | SS-6 | 2.50 | - | - | - | - | - | - | - | - | 17 | A-6a (V) | |
| 1014/10/ | EDIUM DENSE Ragments Wit Amp | , BROWN, GRAVEL AN TH SAND, TRACE SILT | ID STONE , TRACE CLAY, | 499.3 | - 18 | 4 6 7 | 15 | 61 | SS-7A SS-7B | - | - | - | - | - | - | - | - | - | 6 18 | A-1-b (V) | |
| | RAVEL, DAMP | TO MOIST | | | - 20 - | 3 3 3 | 7 | 72 | SS-8 | 2.25 | 13 | 12 | 9 | 33 | 33 | 36 | 18 | 18 | 21 | A-6b (9) | |
| DG (8:5 X | EDIUM DENSE NE SAND , TRA | TO DENSE, BROWN, CE TO LITTLE SILT, T | COARSE AND RACE GRAVEL, | 496.0 | - 22 22 23 - | 5 7 | 17 | 56 | SS-9 | - | - | - | - | - | - | - | - | - | 3 | A-3a (V) | |
| DIL BURING I | 25.0' TO 29.0'; | CONTAINS IRON STA | INING | | - 24 | 8 6 7 | 15 | 67 | SS-10 | - | 5 | 44 | 31 | 18 | 2 | NP | NP | NP | 6 | A-3a (0) | |
| | | | | • | | 8 | 05 | 70 | | | | | | | | | | | | | |
| SLANDAK | | | | • | 29 | 9 13 | 25 | /8 | 55-11 | - | - | - | - | - | - | - | - | - | 6 | A-3a (V) | _ |

| L L | PID: 113361 SFN: | PROJECT: H | M-75-1.05 | STATION | / OFFSE | T: _ | 110+2 | 26, 28' LT. | S | TAR | Г: <u>11</u> / | /29/2 | 1 E | ND: | 11/3 | 30/21 | _ P | G 2 O | F 4 B-01 | 0-0-21 |
|-------------------------------|--|--|--|--------------------------------------|----------------|-----------------|-------|-------------|----|-----|----------------|-------|-------|-----------|------|-------|-----|-------|--------------------|--------|
| .05\GI | MATERIAL DESCR | IPTION | ELEV. | DEPTHS | SPT/ | N ₆₀ | REC | SAMPLE | HP | | GRAD | | DN (% | 6) 0 | ATT | ERB | ERG | | ODOT CLASS (GI) | HOLE |
| ARCHIVE\HAM-75-1 | MEDIUM DENSE TO DENSE, BROWN, FINE SAND, TRACE TO LITTLE SILT, T TRACE CLAY, DAMP TO MOIST (contin | COARSE AND RACE GRAVEL, bued) | 488.0 | - 31 - - 32 - - 33 - | 10 11 16 | 31 | 100 | SS-12 | - | - | - | - | - | - | - | - | - | 4 | A-3a (V) | |
| RCHIVE BY YEAR/2024 | | | | - 34 - - 35 - - 36 - - 37 - | 5 4 6 | 11 | 100 | SS-13 | - | - | - | - | - | - | - | - | - | 5 | A-3a (V) | - |
| TIVE SOIL PROJECTS/1/ | @40.0' TO 46.5'; CONTAINS INTERBEI | DDED SILT SEAMS | | | 4 6 7 | 15 | 67 | SS-14 | - | - | - | - | - | - | - | - | - | 11 | A-3a (V) | - |
| ACTIVE PROJECTS/AC | | | 474.0 | - 43 - - 44 - - 45 - - 46 - | 5 6 7 | 15 | 61 | SS-15 | - | - | - | - | - | - | - | - | - | 14 | A-3a (V) | - |
| F - 4/10/25 12:05 - X:\1 I | MEDIUM DENSE, BROWN BECOMING GRAY, SILT , LITTLE SAND, TRACE TO TRACE GRAVEL, WET | BROWN AND | 4/1.0 +++ +++ +++ +++ +++ +++ +++ +++ +++ + | - 47 - - 48 - - 49 - - 50 - | 5 | | | | | | | | | | | | | | | _ |
| 3.5 X 11) - OH DOT.GD1 | | * | * * * * * * * * | 51 - 52 - 53 - 54 - | 7 7 | 16 | 72 | SS-16 | - | 0 | 1 | 12 | 78 | 9 | NP | NP | NP | 26 | A-4b (8) | - |
| BORING LOG (8 | | *************************************** | + + + + + + + + | 55 - _ 56 - _ 57 - | 5 8 6 | 16 | 67 | SS-17 | - | - | - | - | - | - | - | - | - | 27 | A-4b (V) | - |
| RD ODOT SOIL | | + + + + + + + + + + + + + + + + | + + + + + + + + | 58 - 59 - 60 - | 4 | | | | | | | | | | | | | | | |
| ANNA | | +++++++++++++++++++++++++++++++++++++++ | + + + + + + + + + + + + | 61 - | 78 | 17 | 78 | SS-18 | - | - | - | - | - | - | - | - | - | 27 | A-4b (V) | |

| IN I | PID: 113361 | SFN: | PROJECT: | HAM- | 75-1.05 | S1 | TATION | OFFS | ET: _ | 110+2 | 26, 28' LT. | S | TART | Г: <u>11</u> | /29/2 | 1 E | ND: | 11/3 | 30/21 | _ P | G 3 O | F4 B-01 | 0-0-21 |
|--------------------|---|---|-------------------------------|---|----------------------------|---------|----------------------------|------------------|-----------------|---------|--------------|-------------|------|--------------|-------|-------|----------|------|-----------|-----------|-------|--------------------|----------------|
| 1.05\G | | MATERIAL DESCR AND NOTES | RIPTION S | | ELEV. | DEPT | HS | SPT/ RQD | N ₆₀ | REC (%) | SAMPLE ID | HP (tsf) | GR | GRAD | ATIC | DN (% | 6) CL | | ERB PL | ERG PI | wc | ODOT CLASS (GI) | HOLE SEALED |
| CHIVE\HAM-75- | MEDIUM DEN GRAY, SILT , I TRACE GRA\ | ISE, BROWN BECOMING LITTLE SAND, TRACE TO /EL, WET <i>(continued)</i> | G BROWN AND D LITTLE CLAY, | + | +35.5 | | - 63 - - 64 - | | | | | (10.) | | | | | | | | | | | |
| R\2024 AR | | | | + + + + + + + + + + + + + + + + + + + | • + + + + + | | - 65 - - 66 - | 6 10 11 | 24 | 78 | SS-19 | - | - | - | - | - | - | - | - | - | 25 | A-4b (V) | |
| HIVE BY YEA | | ISE TO DENSE, GRAY, S | SANDY SILT, TRACE | +++++++++++++++++++++++++++++++++++++++ | 449.7 | ₩ 449.8 | - 67 - - 68 - - 69 - | - | | | | | | | | | | | | | | | |
| ECTS/1ARC | CLAY, TRACE | E GRAVEL, WET | | | | | - 70 - - 71 - | 7 14 13 | 31 | 67 | SS-20 | - | 0 | 1 | 49 | 45 | 5 | NP | NP | NP | 28 | A-4a (3) | - |
| VE SOIL PROJI | | | | | | | - 72 - - 73 - - 73 - | | | | | | | | | | | | | | | | |
| OJECTSACT | | | | | | | - 75 - - 76 - | 7 12 11 | 26 | 72 | SS-21 | - | - | - | - | - | - | - | - | - | 31 | A-4a (V) | |
| K:\1ACTIVE PR I | | ISE TO DENSE, GRAY, C | | | 439.7 | - | 77 78 79 | - - - | | | | | | | | | | | | | | | |
| 0/25 12:05 -) | WET | | | | | | - 80 - - 81 - | 7 11 11 | 25 | 78 | SS-22 | - | - | - | - | - | - | - | - | - | 20 | A-3a (V) | - |
| DOT.GDT - 4/ | | | | | | | - 82 - - 83 - - 83 - | - - - - | | | | | | | | | | | | | | | |
| .5 X 11) - OH | | | | | | | - 85 - - 86 - | 8 10 12 | 25 | 78 | SS-23 | - | 1 | 3 | 85 | 9 | 2 | NP | NP | NP | 21 | A-3a (0) | |
| RING LOG (8 | | | | | | | - 87 - - 88 - - 88 - | - | | | | | | | | | | | | | | | |
| DOT SOIL BO | | | | | | | 90 90 91 | 9 10 12 | 25 | 78 | SS-24 | - | - | - | - | - | - | - | - | - | 21 | A-3a (V) | |
| TANDARD OL | | | | | | | - 92 - - 93 - | | | | | | | | | | | | | | | | |

| ILES/HAI | | | | | | | | | | | | | | | | | | | | | | | |
|---|--------------------|-------------------------------|------------|-------|---------|------|----------------------------|----------------|-------|-------|------------|-------|-----|----------------|-------|-------------|-----|------|------|------|--------|-----------|---------|
| ΝTΗ | PID: <u>113361</u> | SFN: | PROJECT: | HAM-7 | 75-1.05 | S1 | ATION / | OFFS | ET: | 110+2 | 26, 28' LT | S | TAR | Г: <u>11</u> / | /29/2 | <u>1</u> EN | ND: | 11/3 | 0/21 | _ P(| G 4 OI | F4 B-0 | 10-0-21 |
| 05/GI | | MATERIAL DESCRIF | PTION | | ELEV. | DEPT | HS | SPT/ | Naa | REC | SAMPLE | HP | | GRAD | ATIC |)N (% | b) | ATT | ERB | ERG | | ODOT | HOLE |
| 5-1.0 | | AND NOTES | | | 423.8 | DEI | | RQD | • •60 | (%) | ID | (tsf) | GR | CS | FS | SI | CL | LL | PL | PI | WC | CLASS (GI | SEALED |
| RCHIVE/HAM-7 | SAND, TRACE | E SILT, TRACE CLAY, TRA d) | CE GRAVEL, | | | | 95 96 97 | 11 11 12 | 26 | 72 | SS-25 | - | - | - | - | - | - | - | - | - | 23 | A-3a (V) | |
| / YEAR\2024 AF | | | | | | | - 98 - - 98 - - 99 - | | | | | | | | | | | | | | | | |
| S\1ARCHIVE BY | | | | | | | 100 101 102 | 10 13 13 | 30 | 83 | SS-26 | - | - | - | - | - | - | - | - | - | 24 | A-3a (V) | |
| OIL PROJECTS | | | | | | | | 12 | | | | | | | | | | | | | | | |
| VE S | | | | | 111 5 | | -106- | 13 | 31 | 78 | SS-27 | - | - | - | - | - | - | - | - | - | 21 | A-3a (V) | |
| 514NDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 4/10/25 12:05 - X:\1ACTIVE PROJEC | | | | | | | | | | | | | | | | | | | | | | | |

| PID: 113361 SFN: Shiftig ELEVATION: 325' HSA CALIBRATION DATE: Shiftig ELEVATION: ELEVATION: START: 224/22 END: 2124/22 SAMPLING METHOD: SPT CALIBRATION DATE: Shiftig ELEVATION: LAT / LONG: MATERIAL DESCRIPTION AND NOTES SOG SPT DPTHS SPT RCC SAMPLIA CBSCRIPTION AND NOTES SST 504.2 STRFT OV VERY STIFF, BROWN AND GRAY, SILT AND CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST 504.2 5 1 100 SS-1 3.50 VERY STIFF, BROWN AND GRAY, SILT, SOME CLAY, TRACE GANUE, MOIST 495.9 9 1 100 SS-2 2.75 1 3 5 4 . | / OFFS | | STATIC ALIGNM | STA | -[| IC | T ATIC | 5T MATIO | 5T MATIC | T ATIC | | ST/ | | | |) NC MEN | N / /EN | N/ | ON IME | | TAT _IGI | STA ALIC | | STA ALI | - | S1 AI | - | _ | <u> </u> | ; | ; | | ; | ; | ; | | ; | | | ; | | ; | ; | | | | | ; | 2 | С | С | | TIC | UT. | Г АТ | Т АТ | 5Т //АТ | 5T MA [:] | 5T MAT | 5T MA | 251 Μ | 75 DN | : / :0 | IE JT | N NU | C A | IE | M | CN | С | _ | j: | G: }: | ER | . r 1Ef | ∟ Mi | ᇝ | ١٢ M | | L F | L | • | <u>'</u> | <u>-</u> | 1 | <u>''</u> + | H | H | 3 | ית ה | <u>)</u> | <u> </u> | <u></u> | 1 | A | 3/ | В | IF | н | Ť | s | S | 15 | <u>^</u> | Á | ŀ | / | ; / | S. | 4.5 | A | E | 1 | N | | | 2: | 2 | EI | E | ۰ 31 | G | Ģ | 30 | G |
|---|--------|------------------|------------------|-----|-------|-----------|-------------|-------------|-------------|-------------|-----|-------------|------------|------------|------------|--------------|------------|----------|-----------|-----------|--------------|-------------|---|------------|---|-----------|----|---------|----------|----|----|----|----|----|----|----|----|--------------|--------------|----------|--------------|---|---|----|----|----|----|---|--------|----------|--------|---------|-----------|-----------|------------|-----------|------------|-----------------------|-----------|----------|----------|----------|-----------|----------|----------|--------|----|-----|--------|----------|----------|------------|----------|-----------------|----------------|---------|-----------|---------|----------|----------|---|---|----------|----------|---|----------------|---|---|-----------------|----------|----------|----------|---------|---|----|----|---|----|---|--------|---|---|----|----------|----|-----|----|-----|----|-----|---|-----|---|---------|----|----------|------------|---|----|---|---------|-------|-------------|---|---|
| START: 2/24/22 SAMPLING METHOD: SPT ENERGY RATIO (%): 89 LAT / LONG: MATERIAL DESCRIPTION AND NOTES 504.2 DEPTHS SRT/F No (%) ID ID ID <t< th=""><th>JN: 50</th><th>LEVATIO</th><th>ELEVA</th><th>ELE</th><th>— í</th><th>19</th><th>/1/19</th><th>5/1/19</th><th>5/1/19</th><th>5/1/19</th><th>3</th><th>ELE</th><th>ELEV</th><th>VATI</th><th></th><th></th><th>ΓΙΟ</th><th>TIO</th><th></th><th>/ATI</th><th>LEV</th><th>ELE</th><th>Ē</th><th>ELE</th><th>-</th><th>EL</th><th>_</th><th>_</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th><u>-</u> </th><th><u>-</u> </th><th>-</th><th><u>-</u> </th><th>-</th><th></th><th></th><th></th><th></th><th></th><th>-</th><th>-)</th><th><u> </u></th><th>9</th><th>19</th><th>/19</th><th>/1</th><th>1/1</th><th>/1/</th><th>5/1/1</th><th>5/1/</th><th>5/1/</th><th>5/1</th><th>5/</th><th>5</th><th>Ť</th><th></th><th></th><th>TE</th><th>41</th><th>DA</th><th>D</th><th>N</th><th>ON</th><th></th><th></th><th>RA⁻</th><th>R/</th><th>BF</th><th>IB</th><th>۱L</th><th>CAI</th><th>Ċ</th><th>L</th><th>1</th><th>-</th><th>-</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>_</th><th>-</th><th></th><th></th><th></th><th></th><th></th><th></th><th>\ \</th><th>Ă</th><th>A</th><th>5/</th><th>ŝ</th><th>S</th><th>-19</th><th>H</th><th>' </th><th>5" </th><th>25'</th><th>2</th><th>3.2</th><th>3</th><th></th><th>_</th><th></th><th></th><th></th><th></th><th></th><th></th><th>Ū</th><th>Ĭ</th><th></th><th>Ĩ</th></t<> | JN: 50 | LEVATIO | ELEVA | ELE | — í | 19 | /1/19 | 5/1/19 | 5/1/19 | 5/1/19 | 3 | ELE | ELEV | VATI | | | ΓΙΟ | TIO | | /ATI | LEV | ELE | Ē | ELE | - | EL | _ | _ | | | | | | | | | | <u>-</u> | <u>-</u> | - | <u>-</u> | - | | | | | | - | -) | <u> </u> | 9 | 19 | /19 | /1 | 1/1 | /1/ | 5/1/1 | 5/1/ | 5/1/ | 5/1 | 5/ | 5 | Ť | | | TE | 41 | DA | D | N | ON | | | RA ⁻ | R/ | BF | IB | ۱L | CAI | Ċ | L | 1 | - | - | | | | | | | | _ | - | | | | | | | \ \ | Ă | A | 5/ | ŝ | S | -19 | H | ' | 5" | 25' | 2 | 3.2 | 3 | | _ | | | | | | | Ū | Ĭ | | Ĩ |
| MATERIAL DESCRIPTION AND NOTES ELEV. 505.4 DEPTHS SPUT (%) Nov (%) SPUT (%) Nov (%) CRADATION (*) (%) 7.0° ASPHALT AND 7.5° BASE (DRILLERS DESCRIPTION) 504.2 504.2 1 | 1G: | AT / LON | LAT / L | LAT | I | | 89 | 89 | 89 | 89 | | LA | AT / | / LO | LON | ON | ONC | ONC | | / LO | Α Τ / | LAT | L | LAT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 | 9 | 89 | 89 | 89 | 89 | 89 | 8 | 1 | | | _ | : | %) | (% |) (| 0 | тι | AT | R/ | R | iΥ | G١ | 20 | ER | ١E | ENI | Е | L | | _ | _ | | | | | | | | | | | | | | | | | | | | • | Г | Т | רי | P | SF | S | | | | | | | | | | | | | | | |
| 7.0° ASPHALT AND 7.5° BASE (DRILLERS DESCRIPTION) 500.2 STIFF TO VERY STIFF. BROWN AND GRAY. SILT AND CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST 504.2 9 5 7 6 19 100 SS-1 3.50 . . . VERY STIFF. BROWN AND GRAY. SILT, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST 495.9 495.9 . | N (%) | RADATIC cs fs | CS F | | GR | 5 f) (| HP (tsf) | HP (tsf) | HP (tsf) | HP (tsf) | GR | GRA R CS | RAD/ cs | DATI FS | ATIO FS | TIOI ⁼s ∣ | 101 s | 101 s | TIO FS | ATI FS | AD/ | CS | G | GRA cs | G | GR R C | GR | (GR | GF | GR | GF | GR | GF | GR | GF | GF | GF | G | G | G | G | G | G | GF | GF | GF | GF | G | | |)) | P f) | lP sf) | HP tsf | HF (tst | HI (ts | HF (tst | H (ts | H (ts | ⊦ (t | | E | LE | PL) | MF ID | AN | S/ | | C) | EC %) | RE (% | F | , | l ₆₀ | N ₆ | 1 | | T/ D | PT. | SF R(| S | | | | | | | | | | | | | 5 | 15 | ł | Н | Γŀ | Т | 5- | F | Ē | Ξ | E |)E | כ | D | [| | | | | | /. 1 | EV | E 5 | _E } | L | 5 | E | | | | | |
| STIFF TO VERY STIFF. BROWN AND GRAY, SILT AND CLAY, TRACE TO LITTLE SAND, TRACE GRAVEL, MOIST Image: Constraint of the second seco | | | | | | | | | | <u> </u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | T | T | ĺ | / | | | | | | | | | | | | | | | | | / | | ` | | | | | | | | | | | | | _ | - | - | | _ | | 1 | 1 | , | | _ | | _ | | | | | | | | | | | | | | | | | | 2 | | 4 |) <u>/</u> | 0 | 5 | | | | X | $\hat{\boldsymbol{\lambda}}$ | Ś |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | _ | - | - | | _ | | 2 | 2 | 2 | | - | - | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VERY STIFF. BROWN AND GRAY, SILT, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST 495.9 495.9 495.9 MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME GRAVEL, MOIST 494.0 11 7 4 4 5 16 100 SS-3 2.00 - - - - 8 5 6 16 100 SS-3 2.00 - | | | | - | - | 0 | 3.50 | 3.50 | 3.50 | 3.50 | - | - | - | - | - | - | | | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | - | - | - | - | - | | | | 0 | 50 | 50 | .50 | 3.5 | 3.5 | 3.5 | 3. | 3.9 | 3 | 3 | | | -1 | S- | S | | |) | 00 | 10 | . | | 9 | 19 | | 6 | 6 | 7 | 5 | 5 | 5 | ļ | | | | | _ | | 3 4 | 3 4 | 2 | | - | - | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN AND GRAY, SILT, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST 495.9 495.9 7 2 <td< td=""><td>47 4</td><td>3 5</td><td>3 5</td><td>3</td><td>1</td><td>5</td><td>2.75</td><td>2.75</td><td>2.75</td><td>2.75</td><td>5 1</td><td>3</td><td>3</td><td>5</td><td>5</td><td>5</td><td>;</td><td>5</td><td>5</td><td>5</td><td>3</td><td>3</td><td></td><td>3</td><td>1</td><td>1 :</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td></td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td></td><td></td><td>;</td><td>5</td><td>75</td><td>75</td><td>.75</td><td>2.7</td><td>2.7</td><td>2.7</td><td>2.</td><td>2.7</td><td>2</td><td>2</td><td></td><td>2</td><td>-2</td><td>S-</td><td>S</td><td></td><td></td><td>)</td><td>00</td><td>10</td><td></td><td></td><td>3</td><td>13</td><td></td><td></td><td></td><td>4</td><td>ļ ,</td><td>4</td><td>4</td><td>4</td><td></td><td></td><td></td><td></td><td>_</td><td></td><td>5</td><td>5</td><td>Ę</td><td>:</td><td>-</td><td>-</td><td>_</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<> | 47 4 | 3 5 | 3 5 | 3 | 1 | 5 | 2.75 | 2.75 | 2.75 | 2.75 | 5 1 | 3 | 3 | 5 | 5 | 5 | ; | 5 | 5 | 5 | 3 | 3 | | 3 | 1 | 1 : | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | ; | 5 | 75 | 75 | .75 | 2.7 | 2.7 | 2.7 | 2. | 2.7 | 2 | 2 | | 2 | -2 | S- | S | | |) | 00 | 10 | | | 3 | 13 | | | | 4 | ļ , | 4 | 4 | 4 | | | | | _ | | 5 | 5 | Ę | : | - | - | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 495.9 VERY STIFF, BROWN AND GRAY, SILT, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME SILT, LITTLE CLAY, TRACE GRAVEL, MOIST 490.9 STIFF, BROWN AND GRAY, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 490.9 STIFF, BROWN AND GRAY, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 487.7 MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME GRAVEL, MOIST 487.7 MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME GRAVEL, MOIST 487.7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | 5 | | | 5 | 5 | | | 1 | - | _ | _ | | 7 | 7 | 7 | | - | | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VERY STIFF, BROWN AND GRAY, SILT, SOME CLAY, TRACE SAND, TRACE GRAVEL, MOIST 10 7 10 7 10 5 1 1 3 61 MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME SILT, LITTLE CLAY, TRACE GRAVEL, MOIST 494.0 11 4 13 100 SS-4 2.25 1 1 3 61 STIFF, BROWN AND GRAY, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 490.9 487.7 14 5 15 100 SS-6 1.50 - | | | | - | - | 0 | 2.00 | 2.00 | 2.00 | 2.00 | - | - | - | - | - | - | | | - | - | - | - | | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | | | | | - | - | - | - | - | | |) | 0 | 00 | 00 | .00 | 2.0 | 2.0 | 2.0 | 2. | 2.(| 2 | 2 | _ | ; | -3 | S- | S | | |) | 00 | 10 | | | 6 | 16 | | 5 | 6 | 5 | , | 5 | | | | | | _ | _ | | 8 9 | 8 9 | 5 | | - | | _ | | | | | | | | | | | | | | | | | | Э | | 5. | 95 | 9 | 4 | 4 | | | | | |
| MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME SILT, LITTLE CLAY, TRACE GRAVEL, MOIST 490.9 STIFF, BROWN AND GRAY, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 490.9 STIFF, BROWN AND GRAY, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 487.7 MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME GRAVEL, TRACE SILT, TRACE CLAY, DAMP 487.7 MEDIUM DENSE, BROWN, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 483.4 MEDIUM STIFF, BROWN, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 483.4 MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST 483.4 MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST 483.4 | 61 3. | 1 3 | 1 3 | 1 | 1 | 5 | 2.25 | 2.25 | 2.25 | 2.25 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | ; | 5 | 25 | 25 | .25 | 2.2 | 2.2 | 2.2 | 2. | 2.2 | 2 | 2 | | | -4 | S- | S | | |) | 00 | 10 | | | 5 | 15 | | | 6 | 4 | | 7 | 7 | | | | | | _ |) · | 0 1 | 1(1 | 1 1 | 1 1 | - | _ | _ | | | | | | | | | | | | | | | | | |) | (| 4 | <u>-</u> | 9 | 4 | 4 | | | + + + + + + | + | + + + + + + |
| STIFF, BROWN AND GRAY, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 490.9 487.7 MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME GRAVEL, TRACE SILT, TRACE CLAY, DAMP 487.7 MEDIUM STIFF, BROWN, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 483.4 MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST 483.4 MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST 483.4 MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST 483.4 | | | | | | 1 | | | | | | _ | | | | _ | | | | | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | + | 0 | | ŀ | 4 | 4 | 4 | | | | _ | _ | , . | 2 | 12 | 1 | 1 | - | - | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STIFF, BROWN AND GRAY, SILT AND CLAY, LITTLESAND, TRACE GRAVEL, MOIST 487.7 MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME GRAVEL, TRACE SILT, TRACE CLAY, DAMP 485.9 STIFF, BROWN, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 483.4 MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST 483.4 MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST 483.4 470.0 470.0 | - - | | | - | - | + | - | - | - | - | - | - | - | - | - | - | | • | - | - | - | - | | - | - | • | - | - | - | - | - | - | - | - | - | - | - | - | . | | . | . | - | - | - | - | - | · | | | | | - | - | - | - | - | | - | | | | , | -5 | S- | S | | |) | 00 | 10 | | | 3 | 13 | | 5 | 5 | 4 | | | | | | | | | _ | ļ | 4 | 14 | 1 | 1 | - | - | _ | | | | | | | | | | | | | | | | | | 9 | .9 | 0. | 90 | 9 | 4 | 4 | | | | / | |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | | | | - | - | 0 | 1.50 | 1.50 | 1.50 | 1.50 | - | - | - | - | - | - | | | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | | | - | - | - | - | - | | | , | D | 50 | 50 | .50 | 1.5 | 1.5 | 1.5 | 1. | 1. | 1 | - | | 6 | -6 | S- | s | | |) | 00 | 10 | | | 5 | 15 | , | 5 | 5 | 5 |) ; | 6 | 6 | (| | | | | _ | ; · | 5 6 | 15 | 1 1 | 1 | - | - | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SOME GRAVEL, TRACE SILT, TRACE CLAY, DAMPSTIFF, BROWN, SILT AND CLAY, LITTLE SAND, TRACE GRAVEL, MOIST 19 7 10 10 12 1 1 1 1 MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST 483.4 483.4 100 SS-8 1.25 1 7 7 54 483.4 483.4 483.4 100 SS-8 1.25 1 7 7 54 483.4 483.4 100 SS-8 1.25 1 7 7 54 483.4 100 SS-9 0.75 $ 23$ 6 7 21 100 SS-9 0.75 $ 24$ 7 $ 24$ $ -$ < | | | | - | _ | + | - | - | _ | - | - | | - | - | - | - | | | - | - | - | - | | _ | - | - | _ | - | - | - | _ | - | _ | - | - | - | - | | | | | | - | _ | _ | _ | _ | | | | | | _ | - | _ | _ | _ | | | | | | , | -7 | S- | S | | |) | 00 | 10 | | _ | 6 | 16 | | | | 4 | 5 | 5 | 5 | ų | | | | _ | _ | , . ; . | 7 8 | 17 | 1 1 | 1 | - | | _ | | | | | | | | | | | | | | | | | | 7 | .7 | 7. | 37 | 8 | 4 | 4 | | | | | |
| $\begin{array}{c} 20 \\ \text{GRAVEL, MOIST} \\ \hline \\ \text{MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE GRAVEL, MOIST \\ \hline \\ 100 \\ \text{SS-8} \\ 1.25 \\ 1 \\ 7 \\ 7 \\ 100 \\ 100 \\ \text{SS-9} \\ 0.75 \\ - 1 \\ - 21 \\ - 21 \\ - 6 \\ - 21 \\ - 6 \\ - 21 \\ - 6 \\ - 21 \\ - 6 \\ - 21 \\ - 6 \\ - 21 \\ - 6 \\ - 21 \\ - 6 \\ - 21 \\ - 6 \\ - 21 \\ - 6 \\ - 7 \\ - 21 \\ - 6 \\ - 7 \\ - 21 \\ - 6 \\ - 7 \\ - 21 \\ - 6 \\ - 7 \\ - 21 \\ - 6 \\ - 7 \\ - 21 \\ - 6 \\ - 7 \\ - 21 \\ - 6 \\ - 7 \\ - 21 \\ - 6 \\ - 7 \\$ | | | | | | ╉ | | | | | | | | | | | - | - | | | | | - | | | | | | | | | | | | | | | | | \vdash | | | | | | | | | ╞ | ╈ | | | | | | | | | | | | | | | | | | | _ | | | | | | | | 7 | 7 | | | | | | _ | | | _ | - |). | 9 | 19 | 1 | 1 | - | - | _ | | | | | | | | | | | | | | | | | | 9 | .9 | 5. | 35 | 8 | 4 | 4 | | | | / | 7 |
| MEDIUM STIFF TO STIFF, BROWN, CLAY, SOME SILT, TRACE SAND, TRACE GRAVEL, MOIST -22 | 54 3 | 7 7 | 7 | 7 | 1 | 5 | 1.25 | 1.25 | 1.25 | 1.25 | 5 1 | 7 | 7 | 7 | 7 | 7 | , | , | 7 | 7 | 7 | 7 | | 7 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | ; | 5 | 25 | 25 | .25 | 1.2 | 1.2 | 1.2 | 1. | 1.2 | 1 | | | } | -8 | S- | s | | |) | 00 | 10 | | | 9 | 19 | | 7 | 7 | 6 | 3 | 6 | 6 | (| | | | | _ |) · | 20 | 2(2 | 2 2 | 2 | - | | _ | | | | | | | | | | | | | | | | | | | | ^ | <u>،</u> | • | | | | | | | |
| | | | | _ | | + | | | | | - | _ | | | | _ | _ | _ | | | _ | | _ | - | | | | | | | | | | | | | | | | | | | | | | | | | | | _ | | | | | | | | | | | _ | | | | | | | | | | | _ | | | | | | | 3 | 6 | 6 | (| | 1 | [| _ | _ |) . | 22 | 22 | 2 2 | 2 | - | | _ | | | | | | | | | | | | | | | | | | + | | 3. | 5. | ð | 4 | - | | | 4 | | |
| | - - | | | - | - | 5 | 0.75 | 0.75 | 0.75 | 0.75 | - | - | - | - | - | - | - | • | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | - | . | - | - | - | - | - | · | | 5 | 5 | 75 | 75 | .75 |).7 | 0.7 | 0.7 | 0. | 0.7 | 0 | 0 | |) | -9 | S- | S | | |) | 00 | 10 | | _ | 21 | 21 | | 7 | 7 | 7 | | _ | | | | | | | _ | , · | 24 | 24 | 2 | 2 | - | - | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VERY STIEF BROWN SILT SOME CLAY TRACE SAND $\frac{111}{111}$ | | | | - | - | 5 | 1.25 | 1.25 | 1.25 | 1.25 | - | - | - | - | - | - | + | + | - | - | - | - | | - | - | . | - | - | - | - | - | - | - | - | - | - | - | | | | | | - | - | - | - | - | ŀ | ╞ | ; | 5 | 25 | 25 | .25 | 1.2 | 1.2 | 1.2 | 1. | 1.: | 1 | - | | A | 10 | 5-1 | SS | S | - |) | 00 | 10 | <u> </u> . | | 21 | 21 | | \dagger | | 6 | 5 | 5 | 5 | ! | | | | | - | ; . | 25 | 2! | 2 | 2 | - | | _ | | | | | | | | | | | | | | | | | | 9 | .9 | 9. | 79 | 7 | 4 | 4 | | | + | + | + |
| TRACE GRAVEL, CONTAINS NO INTACT SOIL FOR HP READING, MOIST -26 -27 | 70 2: | 1 7 | 1 7 | 1 | 0 | + | - | - | - | - | 0 |) 1 | 1 | 7 | 7 | / | | ' | 7 | 7 | 1 | 1 |) | 1 | 0 |) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | 0 | 0 | 0 | 0 | | | ╞ | | | - | - | - | - | - | | - | | | 3 | B | 10 | 5-1 | ss | s | | _ | | | | | | | | 3 | 8 | <u> </u> | | | | | | | | - | _ | ; · | 26 27 | 26 | 2 2 | 2 | - | - | _ | | | | | | | | | | | | | | | | | | 3 | .8 | 7 | 77 | 7 | 4 | 4 | | * * * | + + + + + | +++++++++++++++++++++++++++++++++++++++ | + |
| MEDIUM DENSE, LIGHT BROWN, COARSE AND FINE SAND, LITTLE TO SOME SILT, TRACE CLAY, TRACE | | | | - | - | | - | - | - | - | - | - | - | - | - | - | | | - | - | - | - | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | . | | . | - | - | - | - | - | - | | | T | | | - | - | - | - | - | | - | | | | 1 | 11 | S-' | ss | ę | | | 72 | 72 | | | 24 | 24 | : | 2 | 9 | 7 | | 7 | 7 | | | | | _ | _ | 3. | 28 | 28 | 2 | 2 | - | - | _ | | | | | | | | | | | | | | | | 1 | | - | | | | | | | | | **** | | |

| PIPOLE IMARTINAL DESCRIPTION IPOLECT HAM-75-L0 ETATLON OFFSET: 758-24.9 KTR STATUS Viscon Call IP IS CONTON IP IS C | ILES\HAI | | | | | | | | | | | | | | | | | | | | | | | |
|---|-----------------|---|---|--|---|-----------------------|---------|--------------------------|--------------|-------|-------|------------|-------|-----|---------|-------|-------|------------|-----|------|-----|--------|------------------------|---------|
| MATERIAL DESCRIPTION MEDIUM DENSE: LIGHT BROWN, COARSE AND FINE SMOULTLE TO SOME SILT, TRACE CAY. FLEX. (A73.4) DEPTHS STV No. (RC) RCC (M) DUIL (M) CARSE (M) ATTERENCS | ЧL | PID: <u>113361</u> | SFN: | PROJECT: | HAM- | 75-1.05 | S | TATION | / OFFS | ET: _ | 758+2 | 24, 54' RT | S | TAR | Г: _2/2 | 24/22 | 2_ EI | ND: | 2/2 | 4/22 | _ P | G 2 OI | = 2 B-0 ⁻ | 14-0-21 |
| AND MOTES ATSA Disk in the image in the |)5/GI | | MATERIAL DES | CRIPTION | | ELEV. | DEPT | THS | SPT/ | N. | REC | SAMPLE | HP | | GRAD | ATIC |)N (% | 6) | ATT | ERB | ERG | | ODOT | HOLE |
| Bit Monto Unit Di Soluti Di Sulti Tin Conce CAMP PROE DRAVEL, MORIS CONTUNIO CLANT TRACE CLAY, TRACE GRAVEL, WET 473.4 MEDIUM DENSE 'BROWN, SULT TRACE CLAY, TRACE GRAVEL, WET 470.9 470.9 470.9 470.9 470.9 470.9 470.4 40.0 0.0 2.0 80.8 NP NP NP 22 A.4b.(8) MEDIUM DENSE 'BROWN, SULT TRACE CLAY, TRACE GRAVEL, WET 470.9 <td< td=""><td>75-1.0</td><td></td><td></td><td></td><td></td><td>475.4</td><td>DEI</td><td></td><td>RQD</td><td>• •60</td><td>(%)</td><td>ID</td><td>(tsf)</td><td>GR</td><td>CS</td><td>FS</td><td>SI</td><td>CL</td><td>LL</td><td>PL</td><td>PI</td><td>WC</td><td>CLASS (GI)</td><td>SEALED</td></td<> | 75-1.0 | | | | | 475.4 | DEI | | RQD | • •60 | (%) | ID | (tsf) | GR | CS | FS | SI | CL | LL | PL | PI | WC | CLASS (GI) | SEALED |
| Image: Stand, TRACE BROWN, SILT TRACE CLAY, WET 470.9 470.9 470.9 470.9 470.9 470.0 55.13 0 0 2.9 65 6 NP NP NP 23 A4b (8) 400000 DENSE: BROWN SILT, SOME SAND, TRACE 467.1 47.1 47.1 | E\HAM-7 | SAND, LITTLE GRAVEL, MOI | SE, LIGHT BROWN, C TO SOME SILT, TRA IST <i>(continued)</i> | CE CLAY, TRACE | | 473.4 | | | 8 8 | 24 | 61 | SS-12 | - | - | - | - | - | - | - | - | - | 16 | A-3a (V) | _ |
| MEDUW DENSE BROWN SILT SOME SAND, TRACE 467.1 467.4 467.4 90 100 90 | ARCHIV | MEDIUM DEN TRACE SAND | SE, LIGHT BROWN, S , TRACE GRAVEL, WI | SILT , TRACE CLAY, ET | +++++++++++++++++++++++++++++++++++++++ | 473.4 | | - 32 - - - 33 - | 7 8 | 25 | 83 | SS-13 | | 0 | 0 | 2 | 90 | 8 | | | ND | 23 | A_4h (8) | _ |
| 000000000000000000000000000000000000 | 4R\2024 | | | | ++++ ++++ ++++ ++++ ++++ | _470.9_ | | - 34 - | 9 | 20 | 00 | 33-13 | - | | | 2 | 30 | | | | | 25 | A-40 (0) | - |
| MEDIUM DENSE TO DENSE, BROWN, SILT LITTLE TO WET TO MOIST 467.1 47.7 38 - - - - 23 A4b (V) 447 44 - - - - - 23 A4b (V) 443 - - - - - - 22 A4b (V) 443 - - - - - - - - 22 A4b (V) 443 - - - - - - - 22 A4b (V) 443 - - - - - - - - - - - - 22 A4b (V) | /Е ВҮ ҮЕ/ | CLAY, TRACE | SE, BROWN, SILT , SC EGRAVEL, WET | JME SAND, TRACE | + | • | | - 35 - - - 36 - | 6 8 10 | 27 | 100 | SS-14 | - | 0 | 0 | 29 | 65 | 6 | NP | NP | NP | 24 | A-4b (7) | |
| MEDIUM DENSE: OPOWN, SLT, LITTLE TO SOME CANCE, SAND, TRACE GRAVEL, WET TO MOIST 40 41 7 11 27 78 29 453.9 208 208 208 208 208 208 208 208 208 208 208 208 208 208 <t< td=""><td>N1ARCHIV</td><td></td><td></td><td></td><td>+++++++++++++++++++++++++++++++++++++++</td><td>467.1</td><td></td><td>- 37 - - - 38 -</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<> | N1ARCHIV | | | | +++++++++++++++++++++++++++++++++++++++ | 467.1 | | - 37 - - - 38 - | | | | | | | | | | | | | | | | |
| 1000000000000000000000000000000000000 | ROJECTS | MEDIUM DEN SOME CLAY, WET TO MOIS | SE TO DENSE, BROW LITTLE TO SOME SAM | VN, SILT , LITTLE TO ND, TRACE GRAVEL, | +++++++++++++++++++++++++++++++++++++++ | | | - 39 - | - | | | | | | | | | | | | | | | |
| | E SOIL PI | | | | +++++++++++++++++++++++++++++++++++++++ | - - - - | | - 40 - - 41 - | 7 7 11 | 27 | 78 | SS-15 | - | - | - | - | - | - | - | - | - | 23 | A-4b (V) | _ |
| | TSACTIV | | | | +++++++++++++++++++++++++++++++++++++++ | + + + + | | - 42 - - - 43 - | | | | | | | | | | | | | | | | |
| | : PROJEC | | | | +++++++++++++++++++++++++++++++++++++++ | - - - | | - 44 - - 45 - | - | | | | | | | | | | | | | | | _ |
| | :\1ACTIVE | | | | +++++++++++++++++++++++++++++++++++++++ | + + + | | - 46 - | 9 11 | 30 | 94 | SS-16 | - | - | - | - | - | - | - | - | - | 22 | A-4b (V) | - |
| | 10/25 12:05 - X | | | | +++++++++++++++++++++++++++++++++++++++ | - - - - - | | - 47 - 48 - - 49 - | - | | | | | | | | | | | | | | | |
| | .GDT - 4/ | | | | +++++++++++++++++++++++++++++++++++++++ | 453.9 | 505 | - 50 - - - 51 - | 9 8 13 | 31 | 100 | SS-17 | - | - | - | - | - | - | - | - | - | 20 | A-4b (V) | - |
| | - OH DOT | | | | | | EOB- | | | | • | | | | • | | | | | | | | | |
| | (8.5 X 11) | | | | | | | | | | | | | | | | | | | | | | | |
| | NG LOG | | | | | | | | | | | | | | | | | | | | | | | |
| | SOIL BORI | | | | | | | | | | | | | | | | | | | | | | | |
| | ODOT S | | | | | | | | | | | | | | | | | | | | | | | |
| | STANDARI | | | | | | | | | | | | | | | | | | | | | | | |
| NOTES. GROUNWATER NOT ENCOUNTERED DURING DRILLING. HOLE DID NOT GAVE. DRILLED AS STARED. | S | NOTES: GRO | OUNWATER NOT ENC | COUNTERED DURING D | RILLIN | G. HOLE | DID NOT | CAVE. I | DRILLEI | DASS | STAKE | ED. | | | | | | | | | | | | |
| ABANDONMENT METHODS, MATERIALS, QUANTITIES: PUMPED 110 GAL. BENTONITE GROUT | Ľ | ABANDONME | NT METHODS, MATE | RIALS, QUANTITIES: F | | D 110 GA | L BENTC | NITE G | ROUT | | | | | | | | | | | | | | | |

| ILES/HAI | | | | | | | | | | | | | | | | | | | | |
|---------------|--|--|---|----------------------------|------------------------|-----------------|-------|--------|-------|----------|------|------|-------|------------|-------|------|-------|--------|------------|----------|
| INT F | PROJECT: HAM-75-1.05 | DRILLING FIRM / OPER | | NEAS / J. HODGES | DRIL | L RIG | : | CME 5 | 5X | | STAT | ION | / OF | FSET | Г: _7 | 59+2 | 2, 10 | ' RT. | EXPLOR | ATION ID |
| .05\G | TYPE: RETAINING WALL | SAMPLING FIRM / LOG | GER: <u>N</u> | EAS / J. HODGES | | IMER: | | | MATIC | <u>;</u> | | NME | NT: | 506 | | | | E 5 | | PAGE |
| -75-1 | START: 3/10/22 END: 3/10/22 | SAMPLING METHOD: | | SPT | ENE | RGY F | RATIO | (%): | 81.9 | | LAT | | NG: | 500.1 | 39.1 | 0582 | _084 | 4.5295 | 97 | 1 OF 2 |
| HAM- | MATERIAL DESCRIP | TION | ELEV. | DEDTUO | SPT/ | | REC | SAMPLE | HP | | GRAD | ATIC | DN (% | 6) | ATT | ERB | ERG | | ODOT | HOLE |
| IIVE | AND NOTES | | 506.7 | DEPTHS | RQD | N ₆₀ | (%) | ID | (tsf) | GR | CS | FS | SI | CL | LL | PL | PI | wc | CLASS (GI) | SEALED |
| 4 ARCH | 3.0" ASPHALT AND 8.0" CONCRETE AND (DRILLERS DESCRIPTION) | 6.0" BASE | 505.3 | | | | | | | | | | | | | | | | | |
| E BY YEAR\202 | HARD, BROWN, SANDY SILT , SOME CL/ GRAVEL, CONTAINS BRICK FRAGMENT (FILL) | YY, TRACE S, DAMP | 502.2 | | ³ 4 6 | 14 | 100 | SS-1 | 4.25 | - | - | - | - | - | - | - | - | 15 | A-4a (V) | |
| ECTS\1ARCHIV | MEDIUM DENSE, BROWN, COARSE AND LITTLE SILT, TRACE GRAVEL, TRACE C BRICK FRAGMENTS, DAMP (FILL) | D FINE SAND, LAY, CONTAINS | 499.7 | | 3 5 6 | 15 | 100 | SS-2 | - | - | - | - | - | - | - | - | - | 10 | A-3a (V) | |
| E SOIL PROJE | VERY STIFF, BROWN, SANDY SILT , LITT LITTLE GRAVEL, CONTAINS BRICK FRA (FILL) | LE CLAY, GMENTS, DAMP | 497.2 | - 8 - | 4 4 7 | 15 | 100 | SS-3 | 3.00 | 14 | 20 | 26 | 26 | 14 | 21 | 11 | 10 | 11 | A-4a (1) | |
| DJECTS/ACTIV | VERY STIFF, BROWN, SILT AND CLAY , S TRACE GRAVEL, DAMP | SOME SAND, | | - 10 - - 11 - - 12 - | 3 3 4 | 10 | 100 | SS-4 | 2.75 | 7 | 15 | 11 | 35 | 32 | 33 | 19 | 14 | 19 | A-6a (8) | |
| 11ACTIVE PRO | MEDIUM DENSE, BROWN, GRAVEL WIT SILT, TRACE CLAY, DAMP | H SAND, LITTLE | 494.1 | - 13 14 | 3 4 10 | 19 | 100 | SS-5 | - | 17 | 45 | 20 | 12 | 6 | NP | NP | NP | 5 | A-1-b (0) | |
| 25 12:05 - X | STIFF, BROWN, SANDY SILT , LITTLE CL GRAVEL, DAMP | AY, TRACE | 489.7 | | 3 3 4 | 10 | 100 | SS-6 | 1.50 | 5 | 28 | 10 | 37 | 20 | 24 | 16 | 8 | 16 | A-4a (4) | |
| 3DT - 4/10/2 | SOFT TO MEDIUM STIFF, BROWN, SILT TRACE SAND, TRACE GRAVEL, MOIST | AND CLAY, | 487.9 | ₩ 489.2 17 - 18 - 10 | 2 2 4 | 8 | 100 | SS-7 | 0.50 | - | - | - | - | - | - | - | - | 27 | A-6a (V) | |
| 11) - OH DOT. | CLAY, TRACE GRAVEL, MOIST | 5AIND, IRACE +++ +++ +++ +++ +++ +++ +++ +++ +++ | + + + + + + + + + | 20 - 21 - | 3 7 10 | 23 | 100 | SS-8 | - | - | - | - | - | - | - | - | - | 17 | A-4b (V) | |
| VG LOG (8.5 X | MEDIUM DENSE, BROWN, SILT , TRACE SAND, TRACE GRAVEL, WET | CLAY, TRACE | <u>+ 484.7</u> | - 22 - 23 - - 24 | 4 7 8 | 20 | 100 | SS-9 | - | 0 | 0 | 0 | 94 | 6 | NP | NP | NP | 25 | A-4b (8) | |
| - SOIL BORIN | MEDIUM DENSE, BROWN, SILT , SOME S CLAY, TRACE GRAVEL, MOIST | SAND, TRACE | + + + + + + + + + + + + + + + + + + + | - 25 26 - | 5 6 7 | 18 | 44 | SS-10 | - | - | - | - | - | - | - | - | - | 16 | A-4b (V) | <, v < , |
| NDARD ODOT | MEDIUM DENSE, BROWN, SILT , TRACE SAND, TRACE GRAVEL, WET | CLAY, TRACE | <u>+_</u> + <u>+</u> + + + + + + + + + + + | - 27 - 28 - - 29 | 4 7 8 | 20 | 100 | SS-11 | - | - | - | - | - | - | - | - | - | 25 | A-4b (V) | |
| STA | | +++++++++++++++++++++++++++++++++++++++ | + | | | | | | | | | | | | | | | | | |

| LES\HAI | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------|---------------------------|---------------------------|--|-----------------------|---|---------|-------------|--------|----------|------------------|--------|-----------|--------|------|---------------|------|-------|--------------|-----|------|------|-------|------------|--------|
| Ξ | PID: 113361 | SFN: | | PROJECT: | HAM- | 75-1.05 | ST | TATION | / OFFS | ET: | 759+2 | 2, 10' RT | S | TART | : 3/ <i>°</i> | 0/22 | E E | ND: | 3/1 | 0/22 | P | G 2 O | F 2 B-01 | 5-0-21 |
| 5\GI | | MATE | RIAL DESCRIP | TION | | ELEV. | | ·ue | SPT/ | NI | REC | SAMPLE | HP | 0 | RAD | ATIC | DN (% | 5) - | ATT | ERB | ERG | | ODOT | HOLE |
| 5-1.0 | | | AND NOTES | | | 476.7 | DEPT | по | RQD | IN ₆₀ | (%) | ID | (tsf) | GR | CS | FS | SI | CL | LL | PL | PI | WC | CLASS (GI) | SEALED |
| HAM-7 | MEDIUM DEN SAND, TRACI | ISE, BROWN E GRAVEL, V | I, SILT , TRACE NET <i>(continued)</i> | CLAY, TRACE) | +++++++++++++++++++++++++++++++++++++++ | | | - 31 - | 5 7 | 19 | 100 | SS-12 | - | - | - | - | - | - | - | - | - | 24 | A-4b (V) | |
| HIVE | | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 32 - | - ' | | | | | | | | | | | | | | | |
| 4 ARC | | | | | ++++ ++++ ++++ | | | - 33 - | 2 3 | 11 | 100 | SS-13 | - | 0 | 0 | 2 | 89 | 9 | NP | NP | NP | 26 | A-4b (8) | |
| AR\202 | | | | | ++++ ++++ ++++ | | | - 34 - | <u>5</u> | | | | | | | | | | | | | | | |
| вү үе/ | | | | | ++++ ++++ ++++ | | | - 35 - | 3 4 | 14 | 100 | SS-14 | - | - | - | - | - | _ | - | - | - | 25 | A-4b (V) | |
| HIVE | | | | | ++++ ++++ ++++ | | | - 37 - | 6 | | | | | | | | | | | | | | | - |
| S\1ARC | | | | | ++++ ++++ ++++ | | | - 38 - | - | | | | | | | | | | | | | | | |
| DJECT | | | | | + | | | _ 39 - | | | | | | | | | | | | | | | | |
| IL PRO | | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 40 - | 3 | 12 | 100 | SS-15 | _ | | _ | _ | _ | _ | | _ | | 24 | A-4h (\/) | - |
| VE SC | | | | | +++++++++++++++++++++++++++++++++++++++ | | | 41 - | 5 | 12 | 100 | 00-10 | _ | | _ | | _ | _ | | - | | 27 | 7-46 (V) | - |
| SVACT | | | | | ++++ ++++ ++++ | 463.4 | | - 43 - | _ | | | | | | | | | | | | | | | |
| DJECT | MEDIUM DEN | ISE, BROWN /EL. WET | I, SANDY SILT, | TRACE CLAY, | | | | - 44 - | - | | | | | | | | | | | | | | | |
| /E PR(| | , | | | | | | _ 45 - | 2 | | | | | | | | | | | | | | | - |
| 1ACTIV | | | | | | | | - 46 - | 3 | 14 | 100 | SS-16 | - | 0 | 0 | 50 | 46 | 4 | NP | NP | NP | 28 | A-4a (3) | - |
| :05 - X:\ | | | | | | | | - 47 - | - | | | | | | | | | | | | | | | |
| 0/25 12 | | | | | | | | - 49 - | 2 4 | 12 | 100 | SS-17 | - | - | - | - | - | - | - | - | - | 21 | A-4a (V) | - |
| T - 4/1 | | | | | | 456.7 | EOB | 50 | 5 | | | | | | | | | | | | | | . , | |
| OT.GD | | | | | | | | | | | | | | | | | | | | | | | | |
| - OH D | | | | | | | | | | | | | | | | | | | | | | | | |
| X 11) | | | | | | | | | | | | | | | | | | | | | | | | |
| JG (8.5 | | | | | | | | | | | | | | | | | | | | | | | | |
| ING LO | | | | | | | | | | | | | | | | | | | | | | | | |
| L BOR | | | | | | | | | | | | | | | | | | | | | | | | |
| DT SOI | | | | | | | | | | | | | | | | | | | | | | | | |
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| ANDAF | | | | | | | | | | | | | | | | | | | | | | | | |
| ST. | NOTES: GR | | | RED AT 17 5' DUI | | | י חוח F וחו | | | | ASS | | | | | | | | | | | | | |
| t | ABANDONME | ENT METHOD | DS, MATERIAL | <u>S, QUANTITIES:</u> | PLACED | 0.5 BAG | ASPHAL | T PATC | H; PUM | PED 5 | 50 GAL | BENTO | NITE (| GROI | JT; S | HOV | ELEC |) <u>s</u> (| | UTT | INGS | | | |

| Image: Product Cite HAM-75-105 District of Firm / OPERATOR: MEAS / ASHBAUGH District of Firm / OPERATOR: MEAS | T: | | - SE 507. - - 19 - 10 | | 7 OF NT: IG: IG: IG: NN (% SI 26 | ON / MEN .TIOI .ON(TION =s - - - - - | | ALIGI ELEV LAT / RAD CS - 20 | ST AL EL C GR/ C C C C C C C C C C C C C C C C C C C | - GR - 18 | | C 9) GF 5 -) 18 | C 9) Gi 5 -) 18 | C (GR GR - 18 | C GR 18 | | | | ALI ELE LA1 GRA CS - 20 | ALI ELE LAT GRA CS - 20 | ALI ELE LAT GRA CS | ALIU ELE LAT GRA CS | STA ALIG ELE LAT GRA CS - - 20 | ALII ELE LAT CS - 20 | STA ALII ELE LAT GRA CS | ALI ELE LAT RA CS - 20 | ALI ELE LA1 RA CS | ALI ELI LA GRA CS - 20 | | ST AL LA GR/ C C | | ST AL EL A GR/ C: C: C: C: C: C: C: C: C: C: C: C: C: | | | ST AL EL A SR/ C: - - 20 | | | | | | | (| - - - - - | | | GR | GF | GF | GF | GF | GI | G | G | | | | | | C 9 | C 9 | C 9 | | | TI /1 2 P sf) | T 1/1 19 HF tsf | AT 1/ 89 HI (ts | T A ⁻ /1/ 89 H (ts | AA 5/1 8 − (t | 5T //A 5/1 8 | 57 MA 5/1 8 F (t | 57 5/1 8 1 (1 | 57 5/1 8 1 (1 | 5T VIA 5/1 8 H (1 | 5T //A 5/1 8 F (t | MA 5/1 8 1 (t | AA 5/1 8 H (t: | 5 <u>7</u> <u>AA</u> 5/1 8 H (t: | 51 <u>AA</u> 5/1, 8! H (ts | 6T 1A 5/1, 89 H (ts | 1 <u>A</u> 5/1, 8 H (t: | 1 <u>A</u> <u>1</u> <u>A</u> <u><u>1</u><u>A</u> <u>1</u><u>A</u><u><u>1</u><u>A</u><u><u>1</u><u>A</u><u><u>1</u><u>A</u><u><u>1</u><u>A</u><u><u>1</u><u>A</u><u><u>1</u><u>A</u><u></u><u>1</u><u>A</u><u></u><u>A</u><u><u>1</u><u>A</u><u></u><u>A</u><u><u>1</u><u>A</u><u></u><u>A</u><u></u><u>A</u><u></u><u>A</u><u></u><u>A</u><u><u>A</u><u></u></u></u></u></u></u></u></u></u></u></u> | 1 <u>A</u> <u>5/1,</u> <u>8</u> <u>H</u> (t: | 1 <u>4</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> <u>1</u> | 51 <u>4A</u> 5/1 8 H (t: | 5 //A 5/1 8 F (t | 51 //A 5/1 8 | 5T //A 5/1 8 F (t | 5T //A 5/1 8 F (t | 5T //A 5/1 8 F (t | 5T //A 5/1 8 F (t | 5T //A 5/1 8 F (t | 51 1A 5/1 8 F (t | 1A 5/1 8 (t | 1A 5/1 8 (t | 1A 5/1 8 F (t | 1A 5/1 8 F (t | 1A 5/1 8 (t | 1A 5/1 8 F (t | 1A 5/1 8 F (t | 1A 5/1 8 F (t | 5T //A 5/1 8 1 (1 | 57 5/^ 8 1 | 51 // 5/^ 8 | 57 7 6 1 (| 51 // 5/ 8 | 57 7 6 1 (| 5/1 8 1 1 1 1 | 51 M/ 5/ E | 51 M/ 5/' { [| <u>5</u> <u>№</u> 5 <u></u> | T DI E | E L | | | | | IE ۹٦ (۶ | /IE (| | |
|---|---|-------------------------------|---|----------------------------|---|---|-------------------------------------|--|---|--------------------|--------------------|--|--|---------------|-------------------|---------------------|---------|------------|---|---|------------------------------------|---------------------------------|--|-------------------------------------|--|--|---|--|------------|---------------------------------|------------|--|--------------|---------|--|--------------|----|---|--------------|----------------|---|---------------------------------|-----------------------|----------------------------|---------|----|----|----|----|----|----|--------|-----|-----|---|-----|------------------|--------------|--------|--------|--------|-----------|--|---------------------|-----------------------------|-------------------------------|---|----------------------------|---------------------------|---------------------------------|---------------------------|---------------------------|----------------------------------|----------------------------------|-----------------------------|----------------------------|---|---|------------------------------------|-------------------------------------|--|--|--|---|---------------------------------|---------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|---------------------------------|----------------------|----------------------|---------------------------|---------------------------|----------------------|---------------------------|---------------------------|---------------------------|----------------------------------|---------------------|--------------------------|------------------------|------------------------------|------------------------|------------------------------|----------------------|-------------------------------|-----------------------------------|--------------|------------|---------|-----------|-----------------|-----------|----------------------|---------------|---|---|
| ITTPE: TRAINING WALL OWNELING FINDUCES DEADS ASTREADED PARMER: DUE AUDITION ALIGNMENT: UNLEXASTASTEDUCE START: 2/23/22 END: 2/23/22 SAMPLING METHOD: 32.5° FISA ELEV. BERGY RATIO (%): 89 LLT / LONG: TAT/ION: 50'' ASPHADATE STONE SOTI STONE SOTI < | 1 (MSL 39.10 ATTE LL - 26 - 26 - NP | - 19 10 | 507. CL - 19 - 10 | 507 %) CL - 15 | NT: DN: IG: N (% SI | | | ALIG ELEV _AT / RAD cs - 20 | AL EL LA GR/ C - | - GR - 18 | | <u>9</u> <u>-</u> <u>5</u>) <u>GF</u> <u>5</u> -) 18 | <u>9</u> <u></u> <u></u> <u></u>) 18 <u></u>) 18 | GR - 18 | C | C 18 | | | ALI ELE LA1 3RA CS - | ELE LAT GRA CS - 20 | ELE LAT GRA CS - 20 | ELE LAT CS CS | ALIO ELE LAT BRA CS - - 20 | | | | ALI ELE LA1 SRA CS - 20 | ELI LA SRA CS - 20 | | | | | | | | | | | | | - - - - - - - | - - - - - - - | - - - - | - - - - - - | | GR | GF | GF | GF | GF | GI | , G | G | G | |) (| | 9 | 9 | 9 | 9 | | <u>1(1)</u> <u>1(1)</u> <u>P</u> <u>7</u> <u>7</u> | | | A 1 [1/ 89 HI (ts | /1/ 89 H (ts | //A 5/1 8 F (t | 5/1 8 (t | 5/1 8 | 5/1 8 | 5/1 8 | 5/1 8 | 5/1 8 | //A 5/1 8: F (t | 5/1 8 (t: | 5/1 8 | 5/1 8 H (t: | 6/1 8 (t: | <u>14</u> 5/1, 8 H (t: | <u>14</u> 5/1, 8 H (t: | <u>14</u> 5/1, 8 1 (t: | 1 <u>A</u> 5/1. 8! H (t: | 5/1 8 (t: | 5/1 8 F (t | 5/1 8 F (t | 5/1 8 F (t | 5/1 8 F (t | //A 5/1 8 F (t | 5/1 8 F (t | 5/1 8 F (t | //A 5/1 8 F (t | 6/1 8 − (t | 5/1 8 (t | 5/1 8 | 5/1 8 | 1/1 8 (t | 5/1 8 | 5/1 8 (t | 5/1 8 F (t | 5/1 5/1 8 1 | 5/* 5/* 8 | 5/* 5/* 1 | 5/* 5/* 1 | 5/* 5/* 1 | 5/* 5/* 1 | 5/1 5/1 | <u>5/</u> 5/ (| | 5 | E | | | | | | ו⊑ 41 (% S, | /11 A (| | |
| TID T | 39.10 ATTE LL - 26 NP |) |) CL - 19 - 10 | | IG: N (% | | / LO DATII FS - 17 - | - 20 | | GR | | 5) GF 5 -) 18 |) GI ; - | - - | (| (| | | | LLL LAT GRA CS - | LLL LAT GRA CS - | LLL LAT GRA CS | LLLL LAT CS - 20 | LLLL LAT GRA | LLLL LAT GRA CS - - 20 | LLLI LAI BRA CS L LAI CS L LAI CS L LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS LAI CS CS CS LAI CS CS CS CS CS CS CS CS CS CS CS CS CS | | SRA CE 20 | | LA GR/ C | | | | | | | | | | G ₂ | (| - - - | - - - | - | - GR | GR | GF | GF | GF | GF | GI | G | G | 6 | 6 | (| | |) |) |) | <u> </u> | <u></u> <u></u> <u></u> | 2 9 IP sf) | HF tsf | 17 89 Hi (ts | 7 1/ 89 H (ts | 8: | 8 F (t | 8 | 8 | 8 | 8 | 8 | 8: ⊢ (t | 8 ⊢ (t: | 8 ⊢ (t: | 8 H (t: | <u>8</u> 9 ⊢ (t: | 8: 8: (t: | // 1. 8! H (t: | 8 H (t: | // 1 8: (t: | <u>8</u> ⊢ (t: | <u>8</u> ⊢ (t | <u>8</u> ⊦ (t | 8 F (t | 8 F (t | <u>8</u> F (t | 8 F (t | 8 F (t | <u>8</u> ⊦ (t | <u>∦</u> 8 (t | <u>∦</u> 8 (t | // 8 (t | // 8 (t | 8 ⊢ (t | // 8 (t | // 8 | 8 F (t | 8 | 8 | 8 | ،ر ۱ (| ر ۱ ۲) | ،ر ۱ (| 8 (1 | 5, E (| | | E | L | Pl) | /I D | <u>):</u> .N | % A | (% S, | ((| | |
| MATERIAL DESCRIPTION AND NOTES ELEV. DEPTHS SPT/ RQD No. REC SAMPLE (%) HP (sh) GRADATION (%) 5.0" ASPHALT AND 6.0" CONCRETE AND 5.0" BASE (ORILLERS DESCRIPTION) 505.8 1 | ATTE LL - 26 - NP |) CL - 19 - 10 |) CL - 19 - 10 | - - - | - 26 | - - - - | DATI(FS - 17 | - 20 | | - 18 | G G |) GF 5 -) 18 |) Gi Gi 5 -) 18 | - 18 | (| (| | | GRA CS - 20 | GRA CS - 20 | GRA CS - 20 | GRA CS - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | 20 | | 3R/ c | | GR/ C: 20 | | | | GR C C | | | | G <u>2</u> | (| - - | | | GR | GR | GF | GF | GF | GF | GI | G | G | G | | (| (| |) |) |) | <u> </u> | , P ; <u>f</u>) - ,5 | 5 IP sf | HF tsf | (ts | 1 (ts 2 | + (t | (t | (t | | (1 | (1 | ⊢ (t | ⊢ (t | + (t | (t | ⊢ (t: | H (t: | H (t: | H (t: | H (t: | ⊢ (t: | ⊢ (t | ⊢ (t | ⊦ (t | ⊦ (t | ⊦ (t | ⊦ (t | + (t | + (t | ⊢ (t | 6 } (t | 6 + (t | ⊦ (t | ⊦ (t | ⊢ (t | ⊦ (t | ⊦ (t | ⊦ (t | | (| (| (| (| (| (1 | (| | | E | L | PI) | | .N | ;A | S, | S | | |
| Image: Description String MEDIUM DENSE TO DENSE, BROWN, | - 26 | - - 19 - 10 | 10 | - - 19 - | | | - 17 | - 20 | 2 | - 18 | |) GF 5 -) 18 |) GI 5 - 7 - 9 18 | - - 18 | - 18 | | | | | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | | - 20 | - 20 | - | | | - 20 | | | - 20 | 2 | | | | | | <u>-</u> | SR - | GR | GR - | GR | GF | GF | GF | GF | GI | G | G | G | 6 | (| (| |) |) |) | <u>f)</u> | <u>f)</u> | <u>sf</u> | TSf | (ts | 2 · | (t | (t | (t | (1 | (1 | (1 | (t | (t | (t | (t | (t: | (t: | (t: | (t: | <u>(t</u> : | (t: | (t | (t | (t | (t | (t | (t | (t | (t | (t | ' (t | ' (t | (t | (t | י (t | (t | (t | (t | (1 | (| (| (| (| (| (1 | (| (| - | | |) | | <u> </u> | _ | | | | _ |
| 5.0" ASPHALT AND 6.0" CONCRETE AND 5.0" BASE (DRULLERS DESCRIPTION) 505.8 505.8 505.8 1 <td< td=""><td>- 26 -</td><td>- 19 - 10</td><td>- 19 - 10</td><td></td><td>- 26</td><td>-</td><td>- 17</td><td>- 20</td><td>2</td><td>- 18</td><td></td><td>- - - - -</td><td>5 - 5 - 18 -</td><td>- 18</td><td>- 18</td><td>- 18</td><td>; 2</td><td>20</td><td>- 20</td><td>- 20</td><td>. 2</td><td>2</td><td>-</td><td></td><td>2</td><td>-</td><td>2</td><td>-</td><td></td><td>+</td><td></td><td></td><td>-</td><td>-</td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>/</td><td>/</td><td>/</td><td></td><td>·<u>·</u></td><td>75</td><td>7</td><td>2.7</td><td>2</td><td><u>,</u></td><td></td><td></td><td></td><td></td><td></td><td></td><td>(-</td><td></td><td></td><td><u> </u></td><td>(-</td><td>(-</td><td>(-</td><td>(-</td><td></td><td></td><td>(-</td><td>(-</td><td></td><td></td><td>(-</td><td></td><td></td><td>(-</td><td>(-</td><td>(-</td><td>(-</td><td>(-</td><td>(-</td><td>(-</td><td>(-</td><td>(.</td><td></td><td>_</td><td>_</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td><u> </u></td><td></td><td></td><td></td><td></td><td>,</td></td<> | - 26 - | - 19 - 10 | - 19 - 10 | | - 26 | - | - 17 | - 20 | 2 | - 18 | | - - - - - | 5 - 5 - 18 - | - 18 | - 18 | - 18 | ; 2 | 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | . 2 | 2 | - | | 2 | - | 2 | - | | + | | | - | - | - | | | | | | | | | | | | | | | / | / | / | | · <u>·</u> | 75 | 7 | 2.7 | 2 | <u>,</u> | | | | | | | (- | | | <u> </u> | (- | (- | (- | (- | | | (- | (- | | | (- | | | (- | (- | (- | (- | (- | (- | (- | (- | (. | | _ | _ | | | | | | | | | | | | <u> </u> | | | | | , |
| VERY STIFF TO HARD, BROWN, SILT AND CLAY, "AND" SAND, LITTLE GRAVEL, DAMP (FILL) MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, DAMP (FILL) MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, DAMP (FILL) MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STOME FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, CAMP (FILL) MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STOME FRAGMENTS WITH SAND AND SILT, TRACE CLAY, (GRAVEL AND GRAVEL AND STOME FRAGMENTS, DAMP (FILL) 13 9 14 16 | - 26 - - | - 19 - 10 | - 19 - | - | - 26 | - 7 : | - 17 | - 20 - | 2 | - 18 | ; - ; - ; 1; | - - - - - - - - | 5 -) 18 | - 18 | - 18 | - | ; 2 | 20 | - | - 20 | - 20 | - 20 | - 20 | - 20 | 20 | 20 | - 20 | - 20 | - 20 | 2 | 2 | 20 | | 2 | - | 2 | - | | - | - | - | - | - | - | | | - | | _ | | | | - | | | | | | | | | | '5 | | 7 | 2.7 | 2 | <u> </u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | l | | | | | | | | | | | | | |
| (FILL) 3 6 7 27 100 SS-1 2.75 - | - 26 - - NP | - 19 - 10 | - 19 - 10 | - | - 26 | - 7 : - | - 17 | - 20 - | 2 | - 18 | | 5 - | 5 - | - 18 - | - 18 | - 18 | 2 | 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | - 20 | 2 | 2 | 20 | | 2 | 20 | 2 | - | | + | _ | - | - | - | - | - | _ | _ | _ | - | _ | _ | | . | | | | | | | - 1 | | - | 15 | 75 | 7 | 2.7 | 2. | S | _ | | _ | | | | | | | | | | | | | | | | _ | _ | | | _ | | | | | | | | | | | | | | | | ⊢ | L | | | | | | | _ | | | | | |
| 499.6 MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, DAMP (FILL) MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, DAMP (FILL) MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, (GRAVEL WITH SAND AND CONCRETE FRAGMENTS, DAMP 495.1 10 SS-5 - - - - - 10 10 10 10 SS-5 - - - - - - | 26 - NP | 19 - 10 | 19 - 10 | - | 26 | - | 17 | 20 | 2 | 18 | 1, - |) 18 |) 18 | 18 | 18 | 18 | 3 2 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 2 | 2 | 20 | | 2 | 20 | 2 | 2 | | _ | + | | _ | | | | | | | | | - | - | I 1 | I 1 | | | | 5 | 5 | 5 | 5 | 5 | 5 | rC | . ' | | | Ζ. | 2. | 2 | 2 | 2 | 2 | 2 | 2. | 2. | 2. | 2. | 2. | 2. | 2. | 2. | 2. | 2. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2. | 2. | 2 | 2 | 2. | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | 1 | -1 | S- | 38 | Ś | | | | ļ |
| MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, DAMP (FILL) 499.6 MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, GRAVEL WITH SAND AND SILT, TRACE CLAY, (GRAVEL WITH SAND AND SILT, TRACE CLAY, (GRAVEL WITH SAND INTERBEDDED WITH SANDY SILT LAYERS), SS-7 CONTAINS BRICK AND CONCRETE FRAGMENTS, DAMP (FILL) 495.1 MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, (GRAVEL WITH SAND INTERBEDDED WITH SANDY SILT LAYERS), SS-7 CONTAINS BRICK AND CONCRETE FRAGMENTS, DAMP (FILL) 495.1 MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND INTERBEDDED WITH SANDY SILT LAYERS), SS-7 CONTAINS BRICK AND CONCRETE FRAGMENTS, DAMP 495.1 13 9 28 100 SS-5 - - - 14 10 33 SS-6 - - - - - 18 9 28 30 78 SS-7 - 31 26 14 19 10 | 26 - NP | 19 - 10 | 19 - 10 | - | - | - | - | 20 | 2 | - |) 1, |) 18 |) 1; | - | 18 | 18 | 3 2 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 2 | 2 | 21 | _ | 2 | 2 | 2 | 1 | | | | | | | _ | | | | | | | | | | | | | | ļ | | | | | | | | | | | | | | | | | | | | | | _ | _ | _ | _ | _ | | | | | | | | | | | | | | | | | | | | | | | - | Ĺ | L | ļ | | | _ | _ | _ | | | | | _ |
| 499.6 -7 - <td>- NP</td> <td>- 10</td> <td>- 10</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td> -</td> <td>-</td> <td>+-</td> <td>-</td> <td>_</td> <td></td> <td>_</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td></td> <td>+</td> <td>-</td> <td>2</td> <td>-</td> <td>\downarrow</td> <td>;</td> <td>8</td> <td>8</td> <td>8</td> <td>8</td> <td>18</td> <td>18</td> <td>18</td> <td>18</td> <td>18</td> <td>18</td> <td>18</td> <td>18</td> <td>1</td> <td>1</td> <td>1</td> <td>ſ</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>0</td> <td>50 </td> <td>50</td> <td>.5</td> <td>4.5</td> <td>4.</td> <td>4.</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>4.</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>4</td> <td>4.</td> <td>4.</td> <td>4</td> <td>4</td> <td>4.</td> <td>4</td> <td></td> <td></td> <td>2</td> <td>-2</td> <td>3-</td> <td>38</td> <td>5</td> <td></td> <td></td> <td></td> <td>-</td> | - NP | - 10 | - 10 | - | - | - | - | - | - | - | - | - | +- | - | _ | | _ | | | | | | | 1 | | | | | | | | | | | + | - | 2 | - | \downarrow | ; | 8 | 8 | 8 | 8 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 1 | 1 | 1 | ſ | | | | | | 0 | 50 | 50 | .5 | 4.5 | 4. | 4. | 4 | 4 | 4 | 4 | 4 | 4 | 4. | 4. | 4. | 4. | 4. | 4. | 4. | 4. | 4. | 4. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4. | 4. | 4 | 4 | 4. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | | 2 | -2 | 3- | 38 | 5 | | | | - |
| STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACE CLAY, DAMP (FILL) 7 28 100 SS-3 - | - NP | - 10 | - | - | - | - | - | - | - | - | · · | - 1 | - 1 | - 1 | | | | 1 | | | | | | <u> </u> | | <u> </u> | \vdash | - | | | | + | + | + | ╞ | | | | + | + | _ | _ | _ | | | | | | | | | | | | | - | + | + | + | + | | _ | | | | | | | | | | | | | | | | | | _ | _ | _ | | _ | | | | | | | | | | | | | | | | | | | | | | | | ╞ | ╞ | + | | | _ | _ | _ | _ | | | | - |
| Image: constraint of the second se | NP | 10 | 10 | 10 | | | | | | | | + | + | ├── | | - | _ | <u> </u> - | <u> </u> - | - | - | - | - | - | - | - | <u> </u> | - | - | · | | - | + | + | <u> </u> | · | - | | + | + | | - | - | - | - | - | - | - | - | - | - | - | - | | | + | ╞ | ╞ | + | + | _ | | | | - | - | | | | | | | | | | | | | | _ | _ | _ | | | | | | | | | | | | | | | | | | | | | | | | | | L | ╞ | + | | 5 | -3 | | - - | - | | | | _ |
| MEDIUM DENSE TO DENSE, BROWN, GRAVEL AND STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, (GRAVEL WITH SAND INTERBEDDED WITH SANDY SILT LAYERS), SS-7 CONTAINS BRICK AND CONCRETE FRAGMENTS, DAMP (FILL) 11 12 | + | | | 110 | 15 | 17 | 17 | 25 | 2 | 33 | 3 | 3: | 3; | 33 | 33 | 33 | 3 2 | 2! | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 2! | 2 | 2 | 2! | - | 2 | 2 | 2 | 2 | | _ | 3 | 3 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 3 | 3 | 3 | 3 | | | t | + | + | | | | - | - | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | - | | 1 | -4 | | | ę | | | | , |
| STONE FRAGMENTS WITH SAND AND SILT, TRACE CLAY, (GRAVEL WITH SAND INTERBEDDED WITH SANDY SILT LAYERS), SS-7 CONTAINS BRICK AND CONCRETE FRAGMENTS, DAMP (FILL) 10 113 9 9 12 10 14 10 14 10 14 15 8 10 15 8 10 16 14 16 14 17 18 9 18 9 18 18 18 12 12 13 | | | | | | + | + | | | | + | + | + | - | | | | + | \vdash | | | | | | | | - | | | | | + | + | - | - | | | | + | + | | | | | | | | | | | | | | | | ┢ | ╞ | ╁ | ┥ | ┥ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | _ | - | + | | | | | | | | | | + |
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| DENSE, BROWN, SILT , TRACE CLAY, TRACE SAND, | | _ | | - | | + | \vdash | _ | + | | ╞ | + | + | \vdash | | | + | + | \vdash | | | | | | | | \vdash | | | $\left \right $ | + | \vdash | + | ╞ | ╞ | | | | + | + | _ | _ | _ | _ | _ | | | | | | | | | | | | $\left \right $ | + | + | + | | _ | _ | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ╞ | ╞ | + | | | _ | _ | _ | _ | | | | _ |
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| MEDIUM DENSE, BROWN, COARSE AND FINE SAND, SOME SILT, TRACE CLAY, TRACE GRAVEL, MOIST 484.5 -23 10 30 39 SS-9 - <t< td=""><td>- </td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td> .</td><td>-</td><td><u>†</u>.</td><td>+-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td> .</td><td></td><td>-</td><td>t</td><td></td><td>-</td><td> .</td><td></td><td></td><td>+</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td></td><td></td><td>t</td><td>t</td><td>t</td><td></td><td></td><td></td><td></td><td></td><td>-</td><td>-</td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td> </td><td>-</td><td></td><td>-</td><td></td><td>)</td><td>-9</td><td>s.</td><td></td><td>ξ</td><td></td><td></td><td></td><td>+</td></t<> | - | - | - | - | - | - | - | - | . | - | <u>†</u> . | +- | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | . | | - | t | | - | . | | | + | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | | t | t | t | | | | | | - | - | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | - | | - | |) | -9 | s. | | ξ | | | | + |
| MEDIUM DENSE, BROWN, SILT, TRACE CLAY, TRACE | | | | | | \mp | <u> </u> | | 1 | | ŧ | Ŧ | Ŧ | | | | \mp | F | F | | | | | | | | | F | | F | | F | + | ŧ | F | | | | + | + | _ | | _ | _ | | | | | | | | | | F | | | | 1 | | | | | _ | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | F | + | | | | _ | _ | | | | | + |
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| | ┨╶┤ | - | - | ┼╌ | | -+- | | - | ┼╴ | ┝╼┤ | ┢ | ╀╴ | ╀╴ | <u> -</u> | | - | + | +- | – | | <u>├</u> - | | - | <u> </u> | | <u> </u> | <u>⊢</u> | ├ | ├ - | ┝ | \uparrow | | ╀ | + | – | <u> </u> | ┝╴ | ╀ | + | ┥ | - | - | - | - | - | - | - | - | - | - | - | - | - | ⊢ | ┞ | ┢ | ╀ | ╀ | ┨ | ┨ | 1 | ~ | _ | <u>.</u> | - | - | - | ~ | - | - | ┢─ | ┢─ | ┝ | - | ~ | ~ | ~ | | _ | | | | | | ~ | ~ | - | - | ~ | - | - | ~ | - | - | - | - | _ | - | - | - | ~ | 1 | 1 | 1 | 1 | 1 | \sim | \vdash | ┝ | ╀ | <u>\</u> | 1 <i>F</i> | 1 | <u>·1</u> | <u>-د</u> | <u>אכ</u> | 5 | 4 | ŀ | ł |
| TRACE SILT, TRACE CLAY, TRACE GRAVEL, DAMP 477.6 12 30 55-11B - < | - | - | - | - | - | - | | - | | | ⊢ | +- | +- | <u> -</u> | - | - | + | +- | - | - | - | - | - | - | - | - | <u> </u> | - | - | - | - | – | + | + | ┣- | ' | - | | + | \downarrow | | - | - | - | - | - | - | - | - | - | - | - | ' | | ┞ | ┞ | | \downarrow | | 4 | | _ | | _ | - | - | - | | | | | | | | | | | | | _ | | | | | | | | | | | | | | | | | | | | | | | | | | | ⊢ | \vdash | ╞ | + | 5 | IE | 1 | -1 | >- | აბ — | 5 | ; | ╞ | 4 |

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| NT F | PID: <u>113361</u> | SFN: | PROJECT: | HAM- | 75-1.05 | S1 | TATION | / OFFS | ET: | 760+7 | 71, 35' RT | S | TART | r: <u>2/</u> 2 | 23/22 | 2_ EI | ND: | 2/2 | 3/22 | _ P | G 2 O | F 2 B-01 | 8-0-21 |
| 05/GI | | MATERIAL DESCRIP | TION | | ELEV. | DEPT | HS | SPT/ | N., | REC | SAMPLE | HP | 0 | RAD | ATIC |)N (% | b) | ATT | ERB | ERG | | ODOT | HOLE |
| 75-1.0 | | | | 1++++ | 477.1 | DEIT | | RQD | • •60 | (%) | ID | (tsf) | GR | CS | FS | SI | CL | LL | PL | PI | WC | CLASS (GI) | SEALED |
| AM-7 | SILT. TRACE | SE TO DENSE, BROWN B | TO LITTLE SAND. | ++++ | - | | - 31 - | 57 | 22 | 78 | SS-12 | - | - | - | - | - | - | - | - | - | 25 | A-4b (V) | |
| /E/H | TRACE GRAV | EL, WET (continued) | , | +++++++++++++++++++++++++++++++++++++++ | + | | | 8 | | | | | | | | | | | | | | | - |
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| 4 AR | SS-13 CONTA | INS IRON STAINING | | ++++ | • | | - 33 - | 8 | 25 | 78 | SS-13 | - | 0 | 2 | 3 | 83 | 12 | NP | NP | NP | 25 | A-4b (8) | |
| ۲ <u>2</u> 02 | | | | ++++ | ł | | - 34 - | 9 | | | | | | | | | | | | | | | - |
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| BΥ | | | | ++++ | ł | | - 36 - | <u>5</u> | 18 | 89 | SS-14 | - | - | - | - | - | - | - | - | - | 28 | A-4b (V) | |
| ΠVE | | | | ++++ | - | | - 27 | - / | | | | | | | | | | | | | | | - |
| ARCH | | | | ++++ | + | | - 37 - | - | | | | | | | | | | | | | | | |
| LS/1 | | | | ++++ | - | | - 38 - | 1 | | | | | | | | | | | | | | | |
| JEC ⁻ | | | | +++++++++++++++++++++++++++++++++++++++ | - | | - 39 - | - | | | | | | | | | | | | | | | |
| PRO | | | | ++++ | + | | - 40 - | 6 | | | | | | | | | | | | | | | - |
| OIL | | | | ++++ | - | | - 41 - | 8 | 28 | 100 | SS-15 | - | - | - | - | - | - | - | - | - | 22 | A-4b (V) | |
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| ACTI | | | | ++++ | + | | - 42 - | - | | | | | | | | | | | | | | | |
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| OUE(| | | | ++++ | - | | - 44 - | - | | | | | | | | | | | | | | | |
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| TIVE | | | | ++++ | | | - 46 - | [′] 8 | 31 | 100 | SS-16 | - | 0 | 0 | 18 | 74 | 8 | NP | NP | NP | 25 | A-4b (8) | |
| 11AC | | | | ++++ | | | - 47 | 13 | | | | | | | | | | | | | | | - |
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| T.GDT | | | | +++++++++++++++++++++++++++++++++++++++ | 455.6 | EOB- | - 51 - | 8 12 | 30 | 100 | SS-17 | - | - | - | - | - | - | - | - | - | 25 | A-4b (V) | |
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| Ű | NOTES: GRO | OUNWATER NOT ENCOUN | NTERED DURING DF | RILLIN | G. HOLE | DID NOT | CAVE. I | DRILLE |) AS S | STAKE | D. | | | | | | | | | | | | |
| t | ABANDONME | NT METHODS, MATERIAL | S, QUANTITIES: PL | JMPE | D 110 GA | L. BENTO | NITE G | ROUT | | | | | | | | | | | | | | | |
| L | ABANDONME | NT METHODS, MATERIAL | <u>S, QUANTITIES:</u> PL | JMPE | D 110 GA | L. BENTO | NITE G | ROUT | | | | | | | | | | | | | | | |

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| PROJECT: <u>HAM-75-1.05</u> | DRILLING FIRM / OPEF | RATOR: I | NEAS / J. HODGES | DRIL | L RIG | : | CME 5 | 5X | | STAT | ΓΙΟΝ | / OF | FSE | T: <u>7</u> | 761+6 | 6, 11 | ' RT. | EXPLOR | ATION II |
| P TYPE: RETAINING WALL | SAMPLING FIRM / LOG | GER: N | EAS / J. HODGES | | MER: bdat | | | | ; | | | :NI: ON: | 504 9 | WIN Q (MG | | | <u>E</u> 5 | 0.0 # | PAGE |
| START: 2/21/22 END: 2/21/22 | SAMPLING METHOD: | | SPT | ENE | RGY F | | (%): | 81.9 | | | | NG: | 304.0 | 39.1 | 0635 | _ОВ. 5784 | 4.530 |)89 | 1 OF 2 |
| MATERIAL DESCRIP | TION | ELEV. | DEDTUO | SPT/ | | REC | SAMPLE | HP | | GRAD | ATIC | DN (% | 6) | ATT | ERB | ERG | | | HOLE |
| AND NOTES | | 504.8 | DEPTHS | RQD | N ₆₀ | (%) | ID | (tsf) | GR | CS | FS | SI | CL | LL | PL | PI | wc | CLASS (GI) | SEALEI |
| 2.0" ASPHALT AND 12.0" CONCRETE AN (DRILLERS DESCRIPTION) | D 6.0" BASE | 503.3 | | | | | | | | | | | | | | | | | $\leq L^{N} \leq$ |
| SI STIFF TO VERY STIFF, BROWN, SILT A SAND, LITTLE GRAVEL, CONTAINS BRI DAMP (FILL) | ND CLAY , "AND" CK FRAGMENTS, | | | 4 4 3 | 10 | 44 | SS-1 | 1.75 | - | - | - | - | - | - | - | - | 14 | A-6a (V) | |
| | | 497.8 | | 2 3 3 | 8 | 44 | SS-2 | 2.00 | 11 | 20 | 17 | 28 | 24 | 32 | 17 | 15 | 14 | A-6a (5) | |
| VERY STIFF, BROWN WITH TRACE GR CLAY, SOME SILT, TRACE SAND, TRAC CONTAINS IRON STAINING, MOIST | AY MOTTLES, E GRAVEL, | | - 8 - | 2 2 2 | 5 | 100 | SS-3 | 2.50 | - | - | - | - | - | - | - | - | 31 | A-7-6 (V) | |
| | | 492.8 | - 10 - - 11 - - 12 - | 2 2 1 | 4 | 100 | SS-4 | 2.50 | 0 | 1 | 3 | 31 | 65 | 43 | 24 | 19 | 30 | A-7-6 (12) | $\begin{array}{c} 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 \\ 7 $ |
| LOOSE TO MEDIUM DENSE, BROWN, C FINE SAND, LITTLE TO SOME SILT, TRA TRACE GRAVEL, DAMP | COARSE AND CE CLAY, | | - 13 - | 2 2 2 | 5 | 100 | SS-5 | - | - | - | - | - | - | - | - | - | 12 | A-3a (V) | |
| | | | - 15 - - 16 - - 17 - | 2 5 6 | 15 | 100 | SS-6 | - | 1 | 40 | 44 | 12 | 3 | NP | NP | NP | 4 | A-3a (0) | |
| | | 485.3 | 18 19 | 2 3 5 | 11 | 39 | SS-7 | - | - | - | - | - | - | - | - | - | 4 | A-3a (V) | |
| LOOSE, BROWN, GRAVEL WITH SAND A TRACE CLAY, DAMP | AND SILT, | 482.8 | - 20 21 - | 2 3 4 | 10 | 56 | SS-8 | - | - | - | - | - | - | - | - | - | 9 | A-2-4 (V) | - - - - - - - - - - - - - - - - - - - |
| MEDIUM DENSE, BROWN, COARSE ANI LITTLE SILT, TRACE CLAY, TRACE GRA | D FINE SAND, WEL, DAMP | 102.0 | | 3 6 7 | 18 | 44 | SS-9 | - | - | - | - | - | - | - | - | - | 6 | A-3a (V) | |
| | | | - 25 26 - | 6 8 9 | 23 | 50 | SS-10 | - | 0 | 1 | 84 | 12 | 3 | NP | NP | NP | 5 | A-3a (0) | |
| | | | 27 28 | 4 7_ | 19 | 72 | SS-11 | - | - | - | - | - | - | - | - | - | 8 | A-3a (V) | - |
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| | DID: 112261 | SEN | | HAM_75 1 05 | | | | =т. | 761+4 | 6 11' DT | 6 | тлрт | ງ/ | 21/22 | | ND. | 2/2 | 1/22 | D | | = 2 B_02 | 21_0_21 |
|---------|----------------------------|--|-------------------------------------|---|----------------|------------|----------------|-----------------|-------|----------|------------|------|-------|-------|-------|-----|-----|------|-----|-----|------------|---------|
| | <u>10. 113301</u> | MATERIAL DESCRI | | ELEV | <u> </u> | | SPT/ | | REC | SAMPLE | - <u> </u> | | RAD | | DN (% | 5) | ATT | ERB | ERG | 920 | | HOLE |
| 5-1.05 | | AND NOTES | | 474.8 | 3 DEPT | HS | RQD | N ₆₀ | (%) | ID | (tsf) | GR | CS | FS | si | CL | LL | PL | PI | WC | CLASS (GI) | SEALED |
| AM-7 | MEDIUM DEN LITTLE SILT, | ISE, BROWN, COARSE AN TRACE CLAY, TRACE GR | ND FINE SAND , AVEL, DAMP | 473 5 | 5 | - 31 - | 56 | 18 | 100 | SS-12 | - | - | - | - | - | - | - | - | - | 23 | A-3a (V) | |
| Η Δ | (continued) | IES WET | | / + + + + + + + + + + + + + + + + + + + | - | _ 32 - | | | | | | | | | | | | | | | | 1 |
| ARCH | LOOSE TO M | EDIUM DENSE, BROWNIS | SH GRAY | + + + + + + + + + + + + | W 472.3 | - 33 - | 2 | | 400 | 00.40 | | | | | | | | | | | | 1 |
| 2024 / | BECOMING G | RAY, SILT , LITTLE TO SC , TRACE GRAVEL, WET | DME SAND, | + + + + + + + + + + + + | | | 46 | 14 | 100 | 55-13 | - | - | - | - | - | - | - | - | - | 28 | A-40 (V) | |
| 'EAR\' | | | | + + + + + + + + + + + + | | - 35 - | 4 | | | | | | | | | | | | | | | - |
| ΒΥ | | | | ++++++++++++++++++++++++++++++++++++ | | - 36 - | ⁴ 7 | 20 | 100 | SS-14 | - | 0 | 0 | 30 | 61 | 9 | NP | NP | NP | 26 | A-4b (7) | |
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| s\1AR | | | | ++++ ++++ ++++ | | - 38 - | | | | | | | | | | | | | | | | |
| JECT: | | | | ++++++++++++++++++++++++++++++++++++ | | - 39 - | - | | | | | | | | | | | | | | | |
| PRO | | | | + + + + + + + + + + + + | | - 40 - | 2 | | | | | | | | | | | | | | | - |
| SOIL | | | | + + + + + + + + + + + + | | - 41 - | 6 6 | 16 | 100 | SS-15 | - | - | - | - | - | - | - | - | - | 27 | A-4b (V) | |
| CTIVE | | | | +++++++++++++++++++++++++++++++++++++++ | | - 42 - | | | | | | | | | | | | | | | | |
| CTS/A | | | | + + + + + + + + + + + + | | - 43 - | | | | | | | | | | | | | | | | |
| COLEC | | | | + + + + + + + + + + + + | | 44 | | | | | | | | | | | | | | | | |
| VE PR | | | | +++++++++++++++++++++++++++++++++++++++ | | 45 | 2 | | 400 | 00.40 | | | | 10 | 70 | | | | | | A 41 (0) | |
| IACTI | | | | + + + + + + + + + + + + | | 46 | 3 | 8 | 100 | 55-16 | - | 0 | 0 | 12 | 79 | 9 | NP | NP | NP | 28 | A-4b (8) | |
| - X:/- | | | | + + + + + + + + + + + + | | - 47 - | | | | | | | | | | | | | | | | |
| 12:05 | | | | +++++++++++++++++++++++++++++++++++++++ | | - 48 - | 1 | | | | | | | | | | | | | | | 4 |
| 4/10/25 | | | | ++++ ++++ +++++ 454.8 | B EOB | - 49 - | 22 | 5 | 100 | SS-17 | - | - | - | - | - | - | - | - | - | 29 | A-4b (V) | |
| .GDT - | | | | | 202 | 00 | | | | | | | | | | | | | | | | |
| I DOT | | | | | | | | | | | | | | | | | | | | | | |
| р-(| | | | | | | | | | | | | | | | | | | | | | |
| 5 X 11 | | | | | | | | | | | | | | | | | | | | | | |
| 0G (8. | | | | | | | | | | | | | | | | | | | | | | |
| NGLO | | | | | | | | | | | | | | | | | | | | | | |
| BORI | | | | | | | | | | | | | | | | | | | | | | |
| SOIL | | | | | | | | | | | | | | | | | | | | | | |
| DOT | | | | | | | | | | | | | | | | | | | | | | |
| ARD C | | | | | | | | | | | | | | | | | | | | | | |
| [AND/ | | | | | | | | | | | | | | | | | | | | | | |
| ST | NOTES: GRO | | ERED AT 32.5' DURIN | IG DRILLING | HOLE DID | NOT CA | VE. DR | ILLED | ASS | TAKED. | | | | | | | | | | | | |
| F | | | | | | T DATO | | | | | | | IT. C | | | | | | NCC | | | |

| PROJE | CT: HAM-7 | 75-1.05 | DRILLING FIRM / | OPERA | | EAS / J. HODGES | DRIL | L RIG | : | CME 5 | 5X | | STA | TION | / OF | FSET | [: <u>7</u> | 62+7 | 4, 17 | ' RT. | EXPLOR | ATI(|
|-------------------|-------------------------------------|-------------------|--|------------------------|---------------|-----------------|--------------|-----------------|-----|------------------|-------|----------|-----|------|-------|-------|-------------|------|---------------|--------------------|------------|-------------------|
| TYPE: | | 5 WALL | | LOGGI | ER: <u>NE</u> | AS / J. HODGES | HAM | MER: | | | | ; | | | NT: | | | | | E | | 0-2 |
| START | 2/1/22 FND | 2/1/22 | SAMPLING METH | ор нор [.] | 3.4 | SPT | | RGY | | (%) [.] | 81.9 | <u>,</u> | LLE | | JG | 500.8 | 39.1 | 0662 | =ОБ. 6 -84 | <u>∠</u> 1,5302 | 40 | 1(|
| 517 4 (1. | <u></u> | | | <u> </u> | FLEV | | SDT/ | .011 | REC | | HP | | RAD | |)N (% | 5) | | FRB | FRG | | | |
| | | AND NOTES | | | 506.9 | DEPTHS | RQD | N ₆₀ | (%) | ID | (tsf) | GR | CS | FS | SI | CL | LL | PL | PI | wc | CLASS (GI) | F |
| 2.0" AS (DRILL | SPHALT AND 12.0" ERS DESCRIPTION | CONCRETE AN I) | D 6.0" BASE | | 505.0 | | | | | | | | | | | | | | | | | \bigotimes |
| HARD, | , BROWN, SILT AN | D CLAY, SOME | SAND, LITTLE | | 505.2 | - 2 - | | | | | | | | | | | | | | | | 72 |
| | | | | | 502.4 | - 3 - | 6 13 9 | 30 | 28 | SS-1 | 4.50 | 11 | 9 | 14 | 32 | 34 | 31 | 19 | 12 | 15 | A-6a (7) | 7 2 |
| TIFF | TO HARD, BROWN | AND ORANG | SH BROWN, SILT /EL, CONTAINS | | 502.4 | - 5 - | 2 | 44 | 400 | | 4 50 | | | | | | | | | 07 | | |
| RON S | STAINING, MOIST | | | | | - 6 - | 3 5 | 11 | 100 | 88-2 | 4.50 | - | - | - | - | - | - | - | - | 27 | A-6a (V) | |
| | | | | | | - 8 - | 3 3 | 11 | 100 | SS-3 | 2.00 | 1 | 1 | 7 | 55 | 36 | 34 | 23 | 11 | 26 | A-6a (8) | -74 -74 -74 |
| IEDIU | JM DENSE, BROWI | N, COARSE ANI | D FINE SAND, | | 497.4 | - 9 - 10 - | | | | | | | | | | | | | | | | |
| RACE | E SILT, TRACE GRA | AVEL, TRACE (| CLAY, DAMP | | 404.0 | - - 11 - | 2 5 6 | 15 | 56 | SS-4 | - | - | - | - | - | - | - | - | - | 3 | A-3a (V) | 1 4 4 |
| EDIU RACE | IM DENSE, BROWI E GRAVEL, DAMP | N, SANDY SILT, | TRACE CLAY, | | 494.9 | - 12 - 13 | 1 4 8 | 16 | 100 | SS-5 | - | 1 | 24 | 35 | 33 | 7 | NP | NP | NP | 13 | A-4a (1) | VF7VF7 |
| IEDIU | JM DENSE, BROWI | | D FINE SAND, | | 492.4 | 14 15 | 3 | | | | | | | | | | | | | | | |
| ACE | SILT, TRACE GR | AVEL, TRACE (| LAT, DAIVIP | | | - 16 - | 9 10 | 26 | 100 | SS-6 | - | - | - | - | - | - | - | - | - | 3 | A-3a (V) | 1 2 4 1 |
| | | | | | | - 17 | 2 6 | 18 | 100 | SS-7 | - | - | - | _ | _ | - | - | - | - | 7 | A-3a (V) | -7VF7 |
| | | | | | | 19 | 7 | | | | | | | | | | | | | | | - VF 7 1 |
| | | | | | 485.4 | - 21 - | 5 8 8 | 22 | 100 | SS-8 | - | - | - | - | - | - | - | - | - | 4 | A-3a (V) | 777 |

| PROJECT: | HAM-75-1.05 | DRILLING FIRM / O | PER/ | ATOR: N | IEAS / J. HODGES | DRIL | L RIG | : | CME 5 | 5X | | STAT | ΓΙΟΝ | / OFI | FSET | :_6 | 5+05 | 5, 211 | ' RT. | EXPLOR | ATION |
|--|---|---------------------------------------|---|---------------|-----------------------|-------------|-----------------|------|-----------------------|---------|----------|------|------|-------|----------|-------|--------------|---------|-------------|--------------------|--|
| | BRIDGE | SAMPLING FIRM / | LOGO | GER: <u>N</u> | EAS / J. HODGES | HAM | MER: | | | MATIC | ; | ALIG | NME | NT: | | | IR-7 | 5 | | B-020 | |
| PID: <u>113361</u> | _ SFN: | |): | 3 | .25" HSA | | BRAT | | ATE: | 12/5/19 | <u>)</u> | ELEV | |)N: _ | 505.6 | 3 (MS | <u>SL)</u> E | EOB: | 8 | 5.0 ft. | 1 OF |
| START: 1/20/ | <u>22END:1/2//22</u> | | טע: | | <u> </u> | ENE | KGYF | | (%): | 81.9 | <u> </u> | | | | ` | 39.1 | 0705 | 07, -84 | 4.5303 I | 5/5 | |
| | MATERIAL DESCR AND NOTES | | | ELEV. | DEPTHS | SPT/ RQD | N ₆₀ | REC | | (tsf) | GR | | FS | SI (% | 5) CI | | ERB | | wc | ODOT CLASS (GI) | HOL |
| MEDIUM DENS | SE, BROWN, SANDY SIL | | | 000.0 | | | | (1-) | | () | - | | | | | | | | | | JLV |
| FRAGMENTS, | MOIST | D DRIOR | | | | | | | | | | | | | | | | | | | YLV TLV |
| () | | | | | - 3 - | 6 5 | 11 | 22 | SS-1 | - | - | - | - | - | - | - | - | - | 14 | A-4a (V) | |
| | | | | | - 4 - | 3 | | | | | | | | | | | | | | | - <i>7L</i> V 1>r |
| | | | | | - 5 - - - 6 - | 1 5 6 | 15 | 39 | SS-2 | - | 5 | 18 | 35 | 32 | 10 | NP | NP | NP | 16 | A-4a (1) | |
| | | | | | - 7 - | | | | | | | | | | | | | | | | |
| | | | | 497.1 | - 8 - | 8 5 | 19 | 100 | SS-3A | - | - | - | - | - | - | - | - | - | 15 | A-4a (V) | 1 > 1 |
| HARD, BROWN | NISH GRAY, CLAY , SON | 1E SILT, TRACE | | | - 9 - | 9 | | | SS-3B | 4.50 | 0 | 1 | _1 | 32 | 66 | 45 | 24 | 21 | 25 | A-7-6 (13) | 176 |
| (FILL) | GRAVEL, MOIST | | | 105 1 | - 10 - | 7 | | | SS 44 | 4.50 | | | | | | | | | 24 | | - 7 LV |
| MEDIUM DENS | E, BROWN AND GRAY | , GRAVEL WITH | R | 433.1 | - 11 - | ′5 | 19 | 100 | <u>55-4A</u> SS-4B | 4.50 | - | - | - | - | - | - | - | 1 | 24 | A - 7 - 6(V) | - 4 > r - < , v |
| SAND, TRACE (FILL) | SILT, TRACE CLAY, DA | MP | | | - 12 | 9 | | | 00-40 | | | _ | _ | _ | | - | | | 2 | 7-1-5 (V) | - 7 2 - 7 - 7 2 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 |
| | | | | 492.6 | - 13 - | 8 _ | 10 | 100 | SS-5A | - | - | - | - | - | - | - | - | - | 6 | A-1-b (V) | 1<2 |
| VERY STIFF, E TRACE GRAVE (FILL) | BROWN, CLAY , SOME S EL, MOIST | ILT, TRACE SAND, | ++++ | 491.1 | - 14 - | 5 9 | 19 | 100 | SS-5B | 4.00 | - | - | - | - | - | - | - | - | 28 | A-7-6 (V) | |
| MEDIUM DENS SAND, TRACE | SE, BROWN, SILT , LITTI GRAVEL, WET | E CLAY, LITTLE | + + + + + + + + + + + + + + + + | | - 15 - - - 16 - | 3 6 7 | 18 | 100 | SS-6 | - | 0 | 0 | 13 | 73 | 14 | NP | NP | NP | 22 | A-4b (8) | |
| (1122) | | | +++++++++++++++++++++++++++++++++++++++ | | - 17 | ~` | | | | | | | | | | | | | | | JLV |
| | | | + + + + | 487.6 | | 3 | | | SS-7A | - | - | - | - | - | - | - | - | - | 21 | A-4b (V) | 1<2/ |
| MEDIUM DENS SAND, TRACE | SE, BROWN AND GRAY SILT, TRACE CLAY, CC | , GRAVEL WITH INTAINS BRICK | $^{\circ}$ | 486 1 | 19 | 11 10 | 29 | 100 | SS-7B | - | - | - | - | - | - | - | - | - | 10 | A-1-b (V) | 7 L 1 2 2 1 1 2 2 1 1 2 2 1 |
| FRAGMENTS, (FILL) | DAMP | | - a | 400.1 | - 20 - | 3 | | | | | | | | | | | | | | | - 1 L - 1 > L - 1 > L |
| MEDIUM DENS | SE, BROWN AND ORAN ACE COARSE SAND, T | GISH BROWN, RACE SILT, | ++++ | 484.2 | 21 | 8 | 20 | 100 | SS-8 | - | - | - | - | - | - | - | - | - | 6 | A-3 (V) | 7 L 7 > N 7 < L V |
| STAINING, DAI | TRACE GRAVEL, CONT MP | | + | | - 22 | 2 | | | | | | | | | | | | | | | |
| SAND, TRACE | GRAVEL, WET | JE CLAY, IRACE | +++++++++++++++++++++++++++++++++++++++ | | - 24 - | 4 8 | 16 | 100 | SS-9 | - | - | - | - | - | - | - | - | - | 27 | A-4b (V) | |
| | | | +++++++++++++++++++++++++++++++++++++++ | | - 25 - | 2 | 12 | 100 | SS 10 | | | 0 | 6 | 95 | 0 | | | ND | 24 | A 46 (8) | |
| | | | + + + + + + + + + + + + + + + + | | - 26 - - - 27 - | 5 | 12 | 100 | 00-10 | - | | | 0 | 00 | 3 | | | | <u>_</u> | A-40 (0) | - 7 LV |
| | | | +++++++++++++++++++++++++++++++++++++++ | | - 28 | | | | | | | | | | | | | | | | YLV YXL |
| | | | +++++ | | | | | | | | | | | | | | | | | | 1LV |
| | | | +++++++++++++++++++++++++++++++++++++++ | | 29 | | | | | | | | | | | | | | I | | 1<1 |

| FILES/HA | | 1 | I | | | | | | | | | | | | | | | | | | | | |
|------------------|--------------------|--------------------------|------------------------|---|---------|------|-------------------|----------------|-----------------|-------|-------------|----------|------|--------------|-------|------|--------|-----|------|------|--------|------------|---|
| | PID: <u>113361</u> | SFN: | PROJECT: | HAM-7 | 75-1.05 | ST | ATION | OFFSE | ET: | 65+05 | 5, 211' RT. | <u> </u> | TART | : <u>1/2</u> | 26/22 | E | ND: _ | 1/2 | 7/22 | _ P(| G 2 OI | F 3 B-02 | 26-0-21 |
| J/GU | | MATERIAL DESCRIP | TION | | ELEV. | DEPT | HS | SPT/ | N ₆₀ | REC | SAMPLE | HP | | SRAD | | N (% |)) | ATT | ERB | ERG | | ODOT | HOLE |
| | | SE BROWN SILT TRACE | CLAY TRACE | ++++ | 475.6 | | | 3 | | (%) | U. | (ISI) | GR | CS | F5 | 51 | UL | LL | PL | PI | WC | 01.00 (0.) | $ <, \vee <,$ |
| -HAIN- | SAND, TRACE | E GRAVEL, WET (continued | <i>bert, made</i> | +++++++++++++++++++++++++++++++++++++++ | | | - 31 - | 7 ₇ | 19 | 100 | SS-11 | - | - | - | - | - | - | - | - | - | 24 | A-4b (V) | 12 72 |
| ΛE/F | | | | +++++++++++++++++++++++++++++++++++++++ | | | _ 12 _ | | | | | | | | | | | | | | | | - 7 LV 7 L |
| E C E C | | | | ++++ | 470.0 | | | | | | | | | | | | | | | | | | \overrightarrow{A} |
| 24 AI | | SE BROWN FINE SAND | TRACE COARSE | ++++ | 472.3 | | - 33 - | | | | | | | | | | | | | | | | 1>1-1> |
| DZ/Y | SAND, TRACE | E SILT, TRACE CLAY, TRA | CE GRAVEL, WET | | | | 34 | | | | | | | | | | | | | | | | 7676 |
| Ч | | | | | | | - ³⁵ T | 4 | | | | | | | | | | | | | | | LV - L |
| 0 | | | | F.S | | | - 36 - | 4 | 11 | 100 | SS-12 | - | - | - | - | - | - | - | - | - | 30 | A-3 (V) | |
| 2 | | | | | | | - 37 - | | | | | | | | | | | | | | | | 1>11 |
| IAR | | | | | 467.3 | | - 38 - | | | | | | | | | | | | | | | | 7676 |
| í د | VERY STIFF, | GRAY, SILT, SOME CLAY, | TRACE SAND, | +++++++++++++++++++++++++++++++++++++++ | | | - 30 - | | | | | | | | | | | | | | | | TLV TL |
| ЧC | TRACE GRAV | EL, MOIST | | +++++++++++++++++++++++++++++++++++++++ | | | | - | | | | | | | | | | | | | | | $ <, \vee <,$ |
| 1 | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 40 - | 3 | 12 | 100 | SS 13 | 2.25 | 0 | 0 | 2 | 76 | 21 | 27 | 21 | 6 | 24 | A /h (8) | 1277 12712 |
| 20 | | | | +++++++++++++++++++++++++++++++++++++++ | | | _ 41 - | ⁴ 5 | 12 | 100 | 33-13 | 2.25 | | 0 | 3 | 10 | 21 | 21 | 21 | 0 | 24 | A-40 (0) | 7676 |
| | | | | ++++ ++++ | | | - 42 - | | | | | | | | | | | | | | | | JLV JL |
| NAC | | | | +++++ | 462.3 | | - 43 - | | | | | | | | | | | | | | | | <l 1<l<="" td=""></l> |
| J L L | VERY LOOSE | TO MEDIUM DENSE, GRA | Y, SILT , TRACE | +++++++++++++++++++++++++++++++++++++++ | | | - 44 - | - | | | | | | | | | | | | | | | 12.12 |
| したし | | AT, TRACE SAND, TRACE | GRAVEL, WET | +++++++++++++++++++++++++++++++++++++++ | | | - 45 - | | | | | | | | | | | | | | | | 1 LV 7 L |
| ⊥ < | | | | ++++ | | | - 40 | 23 | 10 | 100 | SS-14 | - | - | - | - | - | - | - | - | - | 25 | A-4b (V) | \overrightarrow{A} |
| LAC | | | | +++++ +++++ | | | _ 40 T | 4 | | | | | | | | | | | | | | | |
| - | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 47 - | - | | | | | | | | | | | | | | | 12 12 |
| 20.21 | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 48 - | | | | | | | | | | | | | | | | TLV TL |
| C7/1 | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 49 - | | | | | | | | | | | | | | | | |
| - 4/ 1/ | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 50 - | 2 | | | | | | | | | | | | | | | 1>11 |
| ק | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 51 - | ² 3 | 10 | 100 | SS-15 | - | - | - | - | - | - | - | - | - | 30 | A-4b (V) | 7671 |
| 2.12 | | | | ++++ ++++ ++++ | | | _ 52 _ | 4 | | | | | | | | | | | | | | | LV - L |
| 5 | | | | +++++++++++++++++++++++++++++++++++++++ | | | | | | | | | | | | | | | | | | | |
| - ([] | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 53 - | | | | | | | | | | | | | | | | 1>112 |
| N N | | | | +++++++++++++++++++++++++++++++++++++++ | | | _ 54 - | | | | | | | | | | | | | | | | 7676 |
| ס פ | | | | +++++++++++++++++++++++++++++++++++++++ | | | 55 T | 0 | | | | | - | | | | | | - | | | | |
| ר פ | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 56 - | 2 | 7 | 100 | SS-16 | - | 0 | 0 | 1 | 86 | 13 | NP | NP | NP | 28 | A-4b (8) | 1 > 1 |
| | | | | +++++++++++++++++++++++++++++++++++++++ | | | - 57 - | | | | | | | | | | | | | | | | |
| Ц Ц | | | | + + + + + + + + + + + + | | | - 58 - | | | | | | | | | | | | | | | | $\left \begin{array}{c} \uparrow L^{\vee} \uparrow L \\ \downarrow \downarrow$ |
| 2 | | | | + + + + + + + + + + + + | | | - 50 | | | | | | | | | | | | | | | | 1 L Y 1 L |
| | | | | +++++ | | | - 59 - | | | | | | | | | | | | | | | | 1>11> |
| ב ביי | | | | ++++++++++++++++++++++++++++++++++++ | | | F ⁶⁰ T | 0 | 4 | 100 | 00.47 | | | | | | | | | | 20 | | |
| ANU | | | | + + + + + + + + + + + + | | | - 61 - | 3 | 4 | 100 | 55-17 | - | - | - | - | - | - | - | - | - | 32 | A-40 (V) | |
| 2 | | | | ++++ | | | L _ | | | | | | | | | | | | | | | | |

| LES/HAI | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--|--|--|-----------|--|-------------|------------------|-------|------------|-------|-----|--------|-------|-------|------|-----|------|-----|-------|------------|---------|
| μ | PID: 113361 | SFN: | PROJECT: | HAM-75-1.0 | 5 5 | STATION | / OFFSI | ET: | 65+05 | , 211' RT. | S | TAR | T: 1/2 | 26/22 | EI | ND: | 1/2 | 7/22 | Р | G 3 O | F 3 B-02 | 26-0-21 |
| 5\GII | | MATERIAL DESCRIF | | ELE\ | | тце | SPT/ | NI | REC | SAMPLE | HP | | GRAD | ATIC | DN (% | ó) – | ATT | ERB | ERG | | ODOT | HOLE |
| 5-1.0 | | AND NOTES | | 443. | 5 | по | RQD | IN ₆₀ | (%) | ID | (tsf) | GR | CS | FS | SI | CL | LL | PL | PI | WC | CLASS (GI) | SEALED |
| 4 ARCHIVE\HAM-7 | VERY LOOSE TO LITTLE CI (continued) | E TO MEDIUM DENSE, GR AY, TRACE SAND, TRACI | AY, SILT , TRACE E GRAVEL, WET | + + + + + + + + + + + + + + + + | | - 63 - - 64 - - 65 - | 2 | - 10 | 100 | | | | | | 0.5 | _ | | | | | | - |
| 1ARCHIVE BY YEAR\202 | | | | ++++ ++++ ++++ ++++ ++++ ++++ ++++ ++++ ++++ | | - 66 - - 67 - - 68 - - 69 - - 70 - | 6 | 10 | 100 | 55-18 | - | U | 0 | 8 | 85 | 7 | NP | NP | NP | 26 | A-4b (8) | |
| TS/ | | ISE GRAY COARSE AND | FINE SAND | 435. | <u> </u> | - 71 | 6 | 18 | 100 | SS-19A | - | - | - | - | - | - | - | - | - | 21 | A-4b (V) | - |
| SACTIVE SOIL PROJEC | TRACE SILT, | TRACE CLAY, TRACE GR | AVEL, MOIST | | | - 71 - - 72 - - 73 - - 73 - - 74 - - 75 - | 7 | | | 55-19B | - | - | - | - | - | - | - | - | - | 16 | A-3a (V) | |
| PROJECTS | | | | | | - 76 - 77 - | 4 6 7 | 18 | 100 | SS-20 | - | - | - | - | - | - | - | - | - | 14 | A-3a (V) | - |
| :05 - X:\1ACTIVE I | | | | | | - 78 - - 78 - - 79 - - 80 - | 6 | | | | | | | | | | | | | | | - |
| - 4/10/25 12 | | | | | | - 81 - 82 | 78 | 20 | 100 | SS-21 | - | - | - | - | - | - | - | - | - | 14 | A-3a (V) | _ |
| T.GDT | | | | | | - 83 - | 7 | | | | | | | | | | | | | | | _ |
| OH DC | | | | 420. | B EOB- | - 84 - | ′7 9 | 22 | 56 | SS-22 | - | - | - | - | - | - | - | - | - | 12 | A-3a (V) | |
| STANDARD ODOT SOIL BORING LOG (8.5 X 11) - | NOTES: GR | | | | | | DRILLE | | STAK | (FD) | | | | | | | | | | | | |
| ┟ | ARANDONIAE | NT METHODS MATERIA | S OLIANTITIES D | | | | | | | | | 2 | | | | | | | | | | |
| L | ABANDONME | INT WETHOUS, MATERIAL | .S, QUANTITES: P | UNIPED 50 G | AL. BENTO | | 001; Sl | HUVE | LED | 501L CU | ITING | ið. | | | | | | | | | | |

EXTERNAL STABILITY ANALYSIS

RW-2 STA. 9+90.5 B-026-0-21

NEAS, Inc. Calculated By: BPA

| Objective: | To evaluate the external stability of CIP wall's with level backfill (no backslope). |
|------------|---|
| Method: | In accordance with ODOT Bridge Design Manual, 2019 [Sect. 204.6.2.2] LRFD Bridge Design |
| | Specifications, 8th Ed., Nov. 2017, [Sect. 11.6.1, Sect. 11.6.2, and Sect. 11.6.3]. |

Givens:

| Backfill Soil Design | <u> Parameters:</u> | |
|---|-----------------------|---|
| $\phi'_f \coloneqq 30 \ deg$ | | Effective angle of internal friction |
| $\gamma_f := 120 \ \frac{lbf}{ft^3}$ | | Unit weight |
| $c'_f \coloneqq 0 \ \frac{lbf}{ft^2}$ | | Effective Cohesion |
| $\delta := 0.67 \boldsymbol{\cdot} \phi'_f$ | $\delta = 20.1 \ deg$ | Friction angle between backfill and wall taken as specified in LRFD BDS C3.11.5.3 (degrees) |

Foundation Soil Design Parameters:

| | Drained Conditions | <u>(Effective Stress):</u> | |
|----------|--|-----------------------------|---|
| | $\phi'_{fd} \coloneqq 32 \ deg$ | | Effective angle of internal friction |
| | $\gamma_{fd} \coloneqq 120 \ \frac{lbf}{ft^3}$ | | Unit weight |
| | $c'_{fd} \coloneqq 0 \ \frac{lbf}{ft^2}$ | | Effective Cohesion |
| | $\delta_{fd} := 0.67 \cdot \phi'_{fd}$ | $\delta_{fd} = 21.4 \ deg$ | Friction angle between foundation soils and footing taken as specified in LRFD BDS C3.11.5.3 (degrees) |
| | Undrained Conditio | <u>ns (Total Stress):</u> | |
| | $\phi_{fdu} \coloneqq 32 \ deg$ | | Angle of internal friction (Same as Drained Conditions if granular soils) |
| | $\gamma_{fd} = 120 \; \frac{lbf}{ft^3}$ | | Unit weight |
| | $Su_{fdu} := 0 \ \frac{lbf}{ft^2}$ | | Undrained Shear Strength |
| | | | |
| | $\delta_{fdu} := 0.67 \cdot \phi_{fdu}$ | $\delta_{fdu} = 21.4 \ deg$ | Friction angle between foundation soils and footing taken as specified in LRFD BDS C3.11.5.3 (degrees) |
| <u> </u> | Foundation Surcha | rge Soil Parameters: | |
| | $\gamma_q \coloneqq 120 \ \frac{lbf}{ft^3}$ | | Unit weight of Soil above bearing depth (Used in Bearing Resistance of Soil Calculation LRFD 10.6.3.1.2a-1) |
| <u>0</u> | ther Parameters: | | |
| | $\gamma_c := 150 \ \frac{lbf}{ft^3}$ | | Concrete Unit weight |
| | $\gamma_p \coloneqq 150 \ \frac{lbf}{ft^3}$ | | Pavement Unit weight |

CIP Wall External Stability Analysis (last revised 9/20/2019)

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| CIP Wall External Stability Analysis |
|--------------------------------------|
| (last revised 9/20/2019) |

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| viscu 5/20/2015) | | D-020-0-2 | |
|------------------------------|------------------------------------|----------------------------------|--|
| Preliminary Wall [| <u>Dimensioning:</u> | | |
| B := 7 ft | $\frac{2}{5} \cdot H = 4.2 ft$ to | $\frac{3}{5} \cdot H = 6.3 \ ft$ | Footing base width (2/5H to 3/5H) |
| A := 5 ft | $\frac{H}{8} = 1.31 ft$ to | $\frac{H}{5} = 2.1 ft$ | Toe projection (H/8 to H/5) |
| D := 2 ft | $\frac{H}{8} = 1.31 ft$ to | $\frac{H}{5} = 2.1 ft$ | Footing thickness (H/8 to H/5) |
| Shear Key Dimen | sioning: | | |
| $D_{key} \coloneqq 1.5 \ ft$ | - | | Depth of shear key from bottom of footing Note: Footings on rock typically require shear key |
| $b_{key} \coloneqq 1.5 \ ft$ | | | Width of shear key |
| <i>XK</i> := 0 | | | Distance from toe to shear key |
| Other Wall Dimen | sions: | | |
| $h' \coloneqq H - D$ | h' = 8.5 ft | | Stem height |
| $T_l := b_l \cdot h'$ | $T_I = 0 ft$ | | Stem front batter width |
| $T_2 := b_2 \cdot h'$ | $T_2 = 0 ft$ | | Stem back batter width |
| $T_b := T_1 + T_2 + T_t$ | $T_b = 1 ft$ | | Stem thickness at bottom of wall |
| $C := B - A - T_b$ | C = 1 ft | | Heel projection |
| $\theta := 90 \ deg$ | | | Angle of back face of wall to horizontal = <i>atan(12/b2)</i> |
| <i>b</i> := 12 <i>in</i> | b=1 ft | | Concrete strip width (for design) |
| $y_1 := D_f$ | $y_1 = 4.8 f$ | ŧ. | Depth to where passive pressure may begin to be utilized in front of wall. (Typically Df) |
| $y_2 := D_f + D_{key}$ | $y_2 = 6.3 f$ | ţ | Bottom of shear key/footing depth i.e. depth to where passive pressure may no longer be utilized. |
| h := H - t | h = 10.5 f | <i>ît</i> | Height of retained fill at back of heel |
| | | | |

Live Load Surcharge Parameters:

 $\lambda := 1 ft$

$$SUR := \operatorname{if}\left(\lambda < \frac{H}{2}, 240 \ \frac{lbf}{ft^2}, 100 \ \frac{lbf}{ft^2}\right) = 240 \ \frac{lbf}{ft^2}$$

Horizontal distance from the back of the wall to point of traffic surcharge load

Live load surcharge (per LRFD BDS [3.11.6.4]) **Note:** If vehicular loading is within 1 ft of the backface of the wall and with a design height, H, less than 20 ft, see LRFD BDS Section 3.11.6.4 and Table 3.11.6.4-2 for adjusted surcharge load calculation. **Note:** when $\lambda <$ H/2, SUR equal 100 psf to account for construction loads

Calculations: Earth Pressure Coefficients:

Backfill Active Earth:

$$\Gamma := \left(1 + \sqrt{\frac{\left(\sin\left(\phi'_{f} + \delta\right) \cdot \sin\left(\phi'_{f} - \beta\right)\right)}{\left(\sin\left(\theta - \delta\right) \cdot \sin\left(\theta + \beta\right)\right)}}}\right)^{2} \qquad \Gamma = 2.687$$
$$k_{af} := \left(\frac{\left(\sin\left(\theta + \phi'_{f}\right)\right)^{2}}{\left(\Gamma \cdot \left(\sin\left(\theta\right)\right)^{2} \cdot \sin\left(\theta - \delta\right)\right)}\right) \qquad k_{af} = 0.297$$

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Foundation Soil Passive Earth:

Drained Conditions assuming($\phi'_{fd} > 0$): Input Parameters for LRFD Figure 3.11.5.4-2, assumes θ = 90 degrees

$$\frac{-\beta'}{\phi'_{fd}} = 0 \qquad \qquad \frac{-\delta_{fd}}{\phi'_{fd}} = -0.67$$

 $k'_p := 7.71$

Passive Earth Pressure Coefficient from LRFD Figure 3.11.5.4-2

Poduction Eactor

Determine Reduction Factor (R) by interpolation:

$$R_d := .839$$
Reduction Factor $k_{pd} := R_d \cdot k'_p$ $k_{pd} = 6.469$ Passive Earth Pressure Coefficient for
Drained Conditions

Undrained Conditions ($\phi_{fdu} > 0$): Note: Expand window below to complete calculation

| Input Parame | Input Parameters for LRFD Figure 3.11.5.4-2, assumes θ = 90 degrees | | | | |
|---|--|---|--|--|--|
| $\frac{-\beta'}{\phi_{fdu}}=0$ | $\frac{-\delta_{fdu}}{\phi_{fdu}} = -0.67$ | | | | |
| $k'_p := 7.71$ | | Passive Earth Pressure Coefficient from LRFD Figure 3.11.5.4-2 | | | |
| Determine Reduction Fa | ctor (R) by interpolati | on: | | | |
| $R_{du} := .839$ | | Reduction Factor | | | |
| $k_{pu} := R_{du} \cdot k'_p$ | $k_{pu} = 6.469$ | Passive Earth Pressure Coefficient for Resistance Undrained Conditions | | | |
| Undrained Conditions: | | | | | |
| $k_{pu} := \mathrm{if}\left(\phi_{fdu} > 0, k_{pu}, 1\right)$ | $k_{pu} = 6.469$ | Passive Earth Pressure Coefficient for Resistance Undrained Conditions | | | |

CIP Wall External Stability Analysis (last revised 9/20/2019)



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Moment Arm:

Moments produced from vertical loads about Point 'O'

$$\begin{aligned} d_{v1} &:= A + \frac{2}{3} \cdot T_1 = 5 \text{ ft} & MV_1 ::= V_1 \cdot d_{v1} = 0 \text{ lbf} \\ d_{v2} &:= A + T_1 + \frac{T_1}{2} = 5.5 \text{ ft} & MV_2 ::= V_2 \cdot d_{v2} = 7012.5 \text{ lbf} \\ d_{v3} &:= A + T_1 + T_1 + \frac{T_2}{3} = 6 \text{ ft} & MV_3 ::= V_3 \cdot d_{v3} = 0 \text{ lbf} \\ d_{v4} &:= \frac{B}{2} = 3.5 \text{ ft} & MV_3 ::= V_3 \cdot d_{v3} = 0 \text{ lbf} \\ d_{v5} &:= B - \frac{T_2 + C}{2} = 6.5 \text{ ft} & MV_5 ::= V_5 \cdot d_{v5} = 0 \text{ lbf} \\ d_{v6} &:= B - \frac{C}{2} = 6.5 \text{ ft} & MV_6 ::= V_6 \cdot d_{v6} = 6630 \text{ lbf} \\ d_{v7} &:= A + T_1 + T_1 + \left(\frac{2}{3} \cdot b_2 \cdot (h' - t)\right) = 6 \text{ ft} & MV_7 ::= V_7 \cdot d_{v7} = 0 \text{ lbf} \\ d_{v8} &:= B - \frac{T_2 + C}{2} = 6.5 \text{ ft} & MV_8 ::= V_8 \cdot d_{v8} = 1560 \text{ lbf} \\ d_{v9} &:= B = 7 \text{ ft} & MV_9 ::= V_9 \cdot d_{v9} = 1802 \text{ lbf} \\ d_{v10} := B = 7 \text{ ft} & MV_{10} := V_{10} \cdot d_{v10} = 4730.3 \text{ lbf} \\ d_{v11} := \frac{A}{2} = 2.5 \text{ ft} & MV_{11} := V_{11} \cdot d_{v11} = 4125 \text{ lbf} \end{aligned}$$

Horizontal Loads:

| $H_l \coloneqq F_{SUR} \cdot \cos\left(90 \cdot deg - \theta + \delta\right)$ | $H_1 = 703.5 \frac{lbf}{ft}$ |
|---|-------------------------------|
| $H_2 \coloneqq F_T \cdot \cos\left(90 \cdot deg - \theta + \delta\right)$ | $H_2 = 1846.6 \frac{lbf}{ft}$ |

Moment Arm:

$$d_{hl} := \frac{H}{2}$$
 $d_{hl} = 5.3 \ ft$
 $d_{h2} := \frac{H}{3}$ $d_{h2} = 3.5 \ ft$

Unfactored Loads by Load Type:

 $V_{DC} := V_{I} + V_{2} + V_{3} + V_{4} + V_{5} \qquad V_{DC} = 3375 \frac{lbf}{ft}$ $V_{LS_Ia} := V_{9} \qquad V_{LS_Ia} = 257.4 \frac{lbf}{ft}$ $V_{EH} := V_{10} \qquad V_{EH} = 675.8 \frac{lbf}{ft}$ $H_{EH} := H_{2} \qquad H_{EH} = 1846.6 \frac{lbf}{ft}$

Live Load Surcharge Resultant (horizontal comp. - LS) Active Earth Force Resultant (horizontal comp. - EH) <u>Moment:</u>

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Moment:

$$MH_1 := H_1 \cdot d_{h1} \qquad MH_1 = 3693.2 \frac{lbf \cdot ft}{ft}$$
$$MH_2 := H_2 \cdot d_{h2} \qquad MH_2 = 6463.1 \frac{lbf \cdot ft}{ft}$$

$$V_{EV} := V_6 + V_7 + V_{11}$$
 $V_{EV} = 2670 \frac{lbf}{ft}$

$$V_{LS_lb} := V_8 + V_9$$
 $V_{LS_lb} = 497.4 \frac{I0}{ft}$

$$H_{LS} \coloneqq H_1 \qquad \qquad H_{LS} \equiv 703.5 \ \frac{lbf}{ft}$$

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Unfactored Moments by Load Type

$$\begin{split} M_{DC} &:= MV_{1} + MV_{2} + MV_{3} + MV_{4} + MV_{5} & M_{DC} = 14362.5 \ \frac{lbf \cdot ft}{ft} \\ M_{EV} &:= MV_{6} + MV_{7} + MV_{11} & M_{EV} = 10755 \ \frac{lbf \cdot ft}{ft} \\ M_{LSV_Ia} &:= MV_{9} & M_{LSV_Ia} = 1802 \ \frac{lbf \cdot ft}{ft} \\ M_{LSV_Ib} &:= MV_{8} + MV_{9} & M_{LSV_Ib} = 3362 \ \frac{lbf \cdot ft}{ft} \\ M_{EHI} &:= MV_{10} & M_{EHI} = 4730.3 \ \frac{lbf \cdot ft}{ft} \\ M_{LSH} &:= MH_{1} & M_{LSH} = 3693.2 \ \frac{lbf \cdot ft}{ft} \\ M_{EH2} &:= MH_{2} & M_{EH2} = 6463.1 \ \frac{lbf \cdot ft}{ft} \end{split}$$

Load Combination Limit States:

.

| $\eta := 1$ | LRFD Load M | lodifier | | | |
|---|---|--------------------------------------|--------------------------|------------------|--------------------------|
| Strength Limit State I: | EV(min) = 1.0 EH(min) = 0.9 LS = 1.75 | 0 EV(max) = 1.35 0 EH(max) = 1.50 | | | |
| Strength Limit State Ia: (Sliding and Eccentricity | () | $Ia_{DC} \coloneqq 0.9$ | $Ia_{EV} := 1$ | $Ia_{EH} := 1.5$ | $Ia_{LS} \coloneqq 1.75$ |
| Strength Limit State Ib: (Bearing Capacity) | | $Ib_{DC} \coloneqq 1.25$ | $Ib_{EV} \coloneqq 1.35$ | $Ib_{EH} := 1.5$ | $Ib_{LS} \coloneqq 1.75$ |

Factored Vertical Loads by Limit State:

$$V_{Ia} \coloneqq \eta \cdot \left(\left(Ia_{DC} \cdot V_{DC} \right) + \left(Ia_{EV} \cdot V_{EV} \right) + \left(Ia_{EH} \cdot V_{EH} \right) + \left(Ia_{LS} \cdot V_{LS_Ia} \right) \right) \qquad V_{Ia} \equiv 7171.7 \frac{lbf}{ft}$$

$$V_{Ib} \coloneqq \eta \cdot \left(\left(Ib_{DC} \cdot V_{DC} \right) + \left(Ib_{EV} \cdot V_{EV} \right) + \left(Ib_{EH} \cdot V_{EH} \right) + \left(Ib_{LS} \cdot V_{LS_Ib} \right) \right) \qquad V_{Ib} \equiv 9707.4 \frac{lbf}{ft}$$

$$\frac{Factored \text{ Horizontal Loads by Limit State:}}{H_{Ia} \coloneqq \eta \cdot \left(\left(Ia_{LS} \cdot H_{LS} \right) + \left(Ia_{EH} \cdot H_{EH} \right) \right) \qquad H_{Ia} \equiv 4001 \frac{lbf}{ft}$$

$$H_{Ib} \coloneqq \eta \cdot \left(\left(Ib_{LS} \cdot H_{LS} \right) + \left(Ib_{EH} \cdot H_{EH} \right) \right) \qquad H_{Ib} \equiv 4001 \frac{lbf}{ft}$$

 $\begin{array}{ll} \hline \textbf{Factored Moments Produced by Vertical Loads by Limit State:} \\ MV_{Ia} \coloneqq \eta \cdot \left(\left(Ia_{DC} \cdot M_{DC} \right) + \left(Ia_{EV} \cdot M_{EV} \right) + \left(Ia_{EH} \cdot M_{EHI} \right) + \left(Ia_{LS} \cdot M_{LSV_Ia} \right) \right) & MV_{Ia} = 33930.3 \quad \frac{lbf \cdot ft}{ft} \\ MV_{Ib} \coloneqq \eta \cdot \left(\left(Ib_{DC} \cdot M_{DC} \right) + \left(Ib_{EV} \cdot M_{EV} \right) + \left(Ib_{EH} \cdot M_{EHI} \right) + \left(Ib_{LS} \cdot M_{LSV_Ib} \right) \right) & MV_{Ib} = 45451.5 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{Factored Moments Produced by Horizontal Loads by Limit State:} \\ MH_{Ia} \coloneqq \eta \cdot \left(\left(Ia_{LS} \cdot M_{LSH} \right) + \left(Ia_{EH} \cdot M_{EH2} \right) \right) & MH_{Ia} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} \coloneqq \eta \cdot \left(\left(Ib_{LS} \cdot M_{LSH} \right) + \left(Ib_{EH} \cdot M_{EH2} \right) \right) & MH_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16157.8 \quad \frac{lbf \cdot ft}{ft} \\ \hline \textbf{MH}_{Ib} = 16$

Compute Bearing Resistance:

Compute the resultant location about the toe of the base length (distance from "O") Strength Ib:

| $\Sigma M_R := M V_{Ib}$ | $\Sigma M_R = 45451.5 \frac{lbf \cdot f}{ft}$ | ft Sum of Resisting Moments (Strength Ib) |
|--|---|--|
| $\Sigma M_O := M H_{lb}$ | $\Sigma M_O = 16157.8 \ \frac{lbf \cdot j}{ft}$ | Sum of Overturning Moments (Strength lb) |
| $\Sigma V := V_{Ib}$ | $\Sigma V = 9707.4 \frac{lbf}{ft}$ | Sum of Vertical Loads (Strength Ib) |
| $x := \frac{\left(\Sigma M_R - \Sigma M_O\right)}{\Sigma V}$ | x = 3 ft | Distance from Point "O" the resultant intersects the base |
| $e := \left \frac{B}{2} - x \right $ | e = 0.48 ft | Wall eccentricity, Note: The vertical stress is assumed to be uniformly distributed over the effective bearing width, B', since the wall is supported by a soil foundation LRFD [11.6.3.2]. The |

the wall is supported by a soil foundation **LRFD [11.6.3.2**]. The effective bearing width is equal to B-2e. When the foundation eccentricity is negative the absolute value is used.

| Foundation Layout: | | |
|-----------------------------|------------------------------|---|
| $B' := B - 2 \cdot e$ | B' = 6 ft | Effective Footing Width |
| <i>L'</i> := 29.5 <i>ft</i> | | Effective Footing Length (Assumed) |
| $H' := H_{Ib}$ | $H' = 4001 \frac{lbf}{ft}$ | Summation of Horizontal Loads (Strength lb) |
| $V' := V_{Ib}$ | $V' = 9707.4 \frac{lbf}{ft}$ | Summation of Vertical Loads (Strength Ib) |
| $D_f = 4.8 ft$ | j. | Footing embedment |
| $d_w := 4.75 \ ft$ | | Depth of Groundwater below ground surface at front of wall. |

Drained Conditions (Effective Stress):

$$N_{q} := \operatorname{if}\left(\phi'_{fd} > 0, e^{\pi \cdot \tan(\phi'_{fd})} \cdot \tan\left(45 \ deg + \frac{\phi'_{fd}}{2}\right)^{2}, 1.0\right) \qquad N_{q} = 23.18$$
$$N_{c} := \operatorname{if}\left(\phi'_{fd} > 0, \frac{N_{q} - 1}{\tan(\phi'_{fd})}, 5.14\right) \qquad N_{c} = 35.49$$

Compute shape correction factors per LRFD [Table 10.6.3.1.2a-3]:

$$s_c := \operatorname{if}\left(\phi'_{fd} > 0, 1 + \left(\frac{B'}{L'}\right) \cdot \left(\frac{N_q}{N_c}\right), 1 + \left(\frac{B'}{5 \cdot L'}\right)\right) \qquad s_c = 1.134$$

$$\begin{split} s_q &\coloneqq \mathrm{if}\left(\phi'_{fd} > 0 \ , \ 1 + \left(\frac{B'}{L'} \cdot \tan\left(\phi'_{fd}\right)\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{if}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1\right) \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1 \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1 \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1 \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1 \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1 \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1 \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} > 0 \ , \ 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), \ 1 \\ s_\gamma &\coloneqq \mathrm{opt}\left(\phi'_{fd} &\to 0 \ , \ 1 \\ s_\gamma &\to 0 \ , \ 1 \\ s_\gamma &\mapsto 0 \ , \ 1 \\ s_\gamma &\coloneqq 0 \ , \ 1 \\ s_\gamma &\leftarrow 0 \ , \ 1 \\ s_\gamma &\leftarrow$$

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Load inclination factors:

| $i_q := 1$ | Assumed to be 1.0, see LRFD BDS C10.6.3.1.2a. |
|-------------------|---|
| $i_{\gamma} := 1$ | "Most geotechnical engineers do not used the load inclination factors". If desired, use LRFD Equations |
| $i_c := 1$ | [10.6.5.1.2a-5] thru [10.6.5.1.2a-9]. |

Compute groundwater depth correction factors per LRFD [Table 10.6.3.1.2a-2]:

$$C_{wq} := \text{if}(d_w \ge D_f, 1.0, 0.5)$$
 $C_{wq} = 1$

 $C_{wy} := \text{if} \left(d_w \ge (1.5 \cdot B) + D_f, 1.0, 0.5 \right)$ $C_{wy} = 0.5$

Depth Correction Factor per Hanson (1970):

$$d_q \coloneqq \operatorname{if}\left(\frac{D_f}{B} \le 1, 1+2 \cdot \tan\left(\phi'_{fd}\right) \cdot \left(1-\sin\left(\phi'_{fd}\right)\right)^2 \cdot \frac{D_f}{B}, 1+2 \cdot \tan\left(\phi'_{fd}\right) \cdot \left(1-\sin\left(\phi'_{fd}\right)\right)^2 \cdot \operatorname{atan}\left(\frac{D_f}{B}\right)\right)$$

 $d_q = 1.19$

Compute modified bearing capacity factors LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:

$$N_{cm} \coloneqq N_c \cdot s_c \cdot i_c \qquad \qquad N_{cm} \equiv 40.232$$

$$N_{qm} \coloneqq N_q \cdot s_q \cdot i_q \qquad \qquad N_{qm} \equiv 26.14$$

$$N_{ym} \coloneqq N_y \cdot s_y \cdot i_y \qquad \qquad N_{ym} \equiv 27.742$$

Compute nominal bearing resistance. LRFD [Eq 10.6.3.1.2a-1]:

$$q_{nd} \coloneqq c'_{fd} \cdot N_{cm} + \gamma_{fd} \cdot D_f \cdot N_{qm} \cdot d_q \cdot C_{wq} + 0.5 \cdot \gamma_{fd} \cdot B' \cdot N_{\gamma m} \cdot C_{w\gamma} \qquad q_{nd} = 22714.7 \frac{lbf}{ft^2}$$

Compute factored bearing resistance, LRFD [Eq 10.6.3.1.1]:

$$\phi_b \coloneqq .55$$

Bearing resistance factor LRFD Table 11.5.7-1.

 $q_{Rd} \coloneqq \phi_b \cdot q_{nd} \qquad \qquad q_{Rd} \equiv 12.5 \ \textit{ksf}$

Factored bearing resistance Drained Conditions

Undrained Conditions (Effective Stress):

$$N_{q} := if\left(\phi_{fdu} > 0, e^{\pi \cdot \tan(\phi_{fdu})} \cdot \tan\left(45 \ deg + \frac{\phi_{fdu}}{2}\right)^{2}, 1.0\right) \qquad N_{q} = 23.18$$

$$N_{c} := if\left(\phi_{fdu} > 0, \frac{N_{q} - 1}{\tan(\phi_{fdu})}, 5.14\right) \qquad N_{c} = 35.49$$

$$N_{u} := 2 \cdot (N_{q} + 1) \cdot \tan(\phi_{fdu}) \qquad N_{u} = 30.2$$

Compute shape correction factors per LRFD [Table 10.6.3.1.2a-3]:

$$s_{c} := \operatorname{if}\left(\phi_{fdu} > 0, 1 + \left(\frac{B'}{L'}\right) \cdot \left(\frac{N_{q}}{N_{c}}\right), 1 + \left(\frac{B'}{5 \cdot L'}\right)\right) \qquad s_{c} = 1.134$$

$$s_{q} := \operatorname{if}\left(\phi_{fdu} > 0, 1 + \left(\frac{B'}{L'} \cdot \tan\left(\phi_{fdu}\right)\right), 1\right) \qquad s_{q} = 1.128$$

$$s_{\gamma} := \operatorname{if}\left(\phi_{fdu} > 0, 1 - 0.4 \cdot \left(\frac{B'}{L'}\right), 1\right) \qquad s_{\gamma} = 0.918$$

Load inclination factors:

| $i_q := 1$ | Assumed to be 1.0, see LRFD BDS C10.6.3.1.2a. |
|-------------------|---|
| $i_{\gamma} := 1$ | "Most geotechnical engineers do not used the load inclination factors". If desired, use LRED Equations |
| $i_c := 1$ | [10.6.3.1.2a-5] thru [10.6.3.1.2a-9]. |

Compute modified bearing capacity factors LRFD [Equation 10.6.3.1.2a-2 to 10.6.3.1.2a-4]:

 $N_{cm} := N_c \cdot s_c \cdot i_c$ $N_{cm} = 40.232$ $N_{am} = 26.14$ $N_{am} := N_a \cdot s_a \cdot i_a$ $N_{\gamma m} := N_{\gamma} \cdot s_{\gamma} \cdot i_{\gamma}$ $N_{vm} = 27.742$

Depth Correction Factor per Hanson (1970):

$$d_q := \operatorname{if}\left(\frac{D_f}{B} \le 1, 1 + 2 \cdot \tan\left(\phi_{fdu}\right) \cdot \left(1 - \sin\left(\phi_{fdu}\right)\right)^2 \cdot \frac{D_f}{B}, 1 + 2 \cdot \tan\left(\phi_{fdu}\right) \cdot \left(1 - \sin\left(\phi_{fdu}\right)\right)^2 \cdot \operatorname{atan}\left(\frac{D_f}{B}\right)\right)$$

 $d_{q} = 1.19$

Compute nominal bearing resistance, LRFD [Eg 10.6.3.1.2a-1:

Compute factored bearing resistance, LRFD [Eg 10.6.3.1.1]:

$$\phi_b := .55$$
Bearing resistance factor LRFD Table 11.5.7-1. $q_{Ru} := \phi_b \cdot q_{nu}$ $q_{Ru} = 12.5$ ksfFactored bearing resistance Undrained

Factored bearing resistance Undrained Conditions

Factored Bearing Resistance Drained vs. Undrained Conditions:

Drained Conditions: $q_{Rd} = 12.5 \ ksf$

Undrained Conditions: $q_{Ru} = 12.5 \text{ ksf}$

| CIP Wall External Stability Analysis | RW-2 STA. 9 | +90.5 N | EAS, Inc. | Date: 12/31/24 Checked By: KCA |
|--|---|----------------------|---------------------------------|-----------------------------------|
| Evaluate External Stability of Wall: | | | | |
| Compute the ultimate bearing stres $e = 0.48$ ft | <u>s :</u> | | | |
| $\varepsilon = \varepsilon \log F$ | $\sigma = 1.608$ kef | | | |
| $b_{V} = \frac{B}{B-2 \cdot e}$ | $\delta \gamma = 1.000$ ks | | | |
| Drained Conditions: | $\frac{q_{Rd}}{q_{Rd}}$ | Is the CDR > or = to | 1.02 CDR | 7 77 |
| Dranca Conduons. | σ_V | | CDR Bear | ing_D — 1.17 |
| Undrained Conditions: C | $DR_{Bearing_U} := \frac{q_{Ru}}{\sigma_V}$ | Is the CDR > or = to | 1.0? <i>CDR</i> _{Bear} | $_{ing_U} = 7.77$ |

Limiting Eccentricity at Base of Wall (Strength Ia):

Compute the resultant location about the toe "O" of the base length (distance from Pivot):

| $e_{max} := \frac{B}{3}$ | $e_{max} = 2.3 ft$ | Maximum Eccentricity LRFD [11.6.3.3.] Equals B/3 for soil. |
|--|---|--|
| $\Sigma M_R := M V_{Ia}$ | $\Sigma M_R = 33930.3 \frac{lbf}{ft}$ | <u>ft</u> Sum of Resisting Moments (Strength Ia) |
| $\Sigma M_O := M H_{Ia}$ | $\Sigma M_O = 16157.8 \ \frac{lbf}{ft}$ | <i>ft</i> Sum of Overturning Moments (Strength Ia) |
| $\Sigma V := V_{Ia}$ | $\Sigma V = 7171.7 \ \frac{lbf}{ft}$ | Sum of Vertical Loads (Strength Ia) |
| $x := \frac{\left(\Sigma M_R - \Sigma M_O\right)}{\Sigma V}$ | x = 2.5 ft | Distance from Point "O" the resultant intersects the base |
| $e \coloneqq \operatorname{abs}\left(\frac{B}{2} - x\right)$ | <i>e</i> = 1.02 <i>ft</i> | Wall eccentricity, Note: The vertical stress is assumed to be uniformly distributed over the effective bearing width, B', since the wall is supported by a soil foundation LRFD [11.6.3.2]. The effective bearing width is equal to B-2e. |

Eccentricity Capacity:Demand Ratio (CDR)

$$CDR_{Eccentricity} := \frac{e_{max}}{e}$$

Is the CDR > or = to 1.0?

 $CDR_{Eccentricity} = 2.28$

Sliding Resistance at Base of Wall LRFD [10.6.3.4]:

Factored Sliding Force (Strength Ia):

$$R_u \coloneqq H_{Ia} \qquad \qquad R_u = 4001 \frac{Ibj}{ft}$$

Drained Conditions (Effective Stress):

Compute passive resistance throughout the design life of the wall LRFD [Eq 3.11.5.4-1]::

$$\begin{aligned} r_{ep1} &\coloneqq \left(k_{pd} \cdot \gamma_{fd} \cdot y_1 + 2 \cdot c'_{fd} \cdot \sqrt{k_{pd}}\right) \cdot \cos\left(\delta_{fd}\right) \\ r_{ep2} &\coloneqq \left(k_{pd} \cdot \gamma_{fd} \cdot y_2 + 2 \cdot c'_{fd} \cdot \sqrt{k_{pd}}\right) \cdot \cos\left(\delta_{fd}\right) \\ R_{ep} &\coloneqq \frac{r_{ep1} + r_{ep2}}{2} \cdot \left(y_2 - y_1\right) \\ \end{aligned}$$

Nominal passive pressure at y1

Nominal passive pressure at y2

Nominal passive resistance Drained Conditions

416 Note: Passive Resistance shall be neglected in stability computations, unless the base of the wall extends below the depth of maximum scour, freeze-thaw or other disturbances. In the latter case, only the embedment below the greater of these depths shall be considered effective LRFD [11.6.3.5].

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Compute sliding resistance between soil and foundation:

$$c := 1.0$$
 $c = 1.0$ for Cast-in-Place
 $c = 0.8$ for Precast $\Sigma V := V_{Ia}$ $\Sigma V = 7171.7 \frac{lbf}{ft}$ Sum of Vertical Loads (Strength Ia) $R_t := c \cdot \Sigma V \cdot \tan(\phi'_{fd})$ $R_t = 4481.3 \frac{lbf}{c}$ Nominal sliding resistance Cohesionless Soils

ft

Compute factored resistance against failure by sliding LRFD [10.6.3.4]:

$$\phi_{ep} := 0.5$$
Resistance factor for passive resistance specified in
LRFD Table 10.5.5.2.2-1 $\phi_r := 1.0$ Resistance factor for sliding resistance specified in
LRFD Table 11.5.7-1.

$$\phi R_n := \phi_\tau \cdot R_\tau + \phi_{ep} \cdot R_{ep}$$

 $R_R := \phi R_n$

Factored Sliding Resistance to be used in CDR Calculations:

R Calculations:
$$R_R = 7461.773 \frac{lbf}{ft}$$

Sliding Capacity:Demand Ratio (CDR)

$$CDR_{Sliding} := \frac{R_R}{R_u}$$
 Is the

ne CDR > or = to 1.0?

 $CDR_{Sliding} = 1.86$

GLOBAL STABILITY ANALYSIS

STA. 1+00 (RW-2 ALIGNMENT)

| Material Name | Color | Unit Weight (Ibs/ft3) | Saturated U.W. (lbs/ft3) | Cohesion (psf) | Phi (°) |
|------------------------------|-------|--------------------------|-----------------------------|-------------------|------------|
| SPL Wall | | 150 | | 50000 | 0 |
| Gravel with Sand and Silt | | 122 | 122 | 0 | 34 |





STA. 6+90 (RW-2 ALIGNMENT)









STA. 9+90.5 (RW-2 ALIGNMENT)



