Subgrade Exploration Report - Final
LIC-661-01.64 Intersection Improvements
PID 112799 Licking County, Ohio
S&ME Project No. 214050

PREPARED FOR:

Fishbeck
1 E. Campus View Blvd., Suite 310
Columbus, Ohio 43235

PREPARED BY:

S&ME, Inc.
6190 Enterprise Court
Dublin, OH 43016

April 25, 2023

April 25, 2023

Fishbeck
1 E. Campus View Blvd., Suite 310
Columbus, Ohio 43235

Attention: Mr. Jerod A. Hiller, P.E.

Reference: **Subgrade Exploration Report - Final**
LIC-661-01.64 Intersection Improvements
PID 112799 Licking County, Ohio
S&ME Project No. 214050

Mr. Hiller:

In accordance with our revised proposal dated May 3, 2021, which was authorized with Fishbeck's Subconsultant Agreement executed on July 27, 2021, S&ME, Inc. (S&ME) has completed a Subgrade Exploration for the proposed intersection improvements planned at the intersection of SR 661 and New Burg Street in Granville, Licking County, Ohio (see Vicinity Map, Figure 1 in Appendix A).

In accordance with Section 701 of the current ODOT Specifications for Geotechnical Explorations (SGE), S&ME is herewith submitting a "final" version of this report, as we understand that no Stage 1 review comments were received on our draft report. This final report is also to be provided to the ODOT District Geotechnical Engineer. Geotechnical Profile - Roadway sheets are also being submitted under separate cover.

We appreciate having been given the opportunity to be of service. Please do not hesitate to contact us if you have any questions regarding this submission.

Respectfully,

S&ME, Inc.

Paul E. Leiter III, E.I.
Staff Professional

Richard S. Weigand, P. E.
Senior Engineer/Senior Reviewer

Submitted: E-mail Copy (jahiller@fishbeck.com)

Table of Contents

List of Tables

Appendices

Appendix A

Appendix B

Appendix C

1.0 Executive Summary

S&ME understands that ODOT proposes to improve the existing intersection of SR 661 and New Burg Street in Granville, Licking County, Ohio, by providing a three-legged roundabout. Based on plan information provided by Fishbeck, S&ME understands the center of the roundabout will be shifted into the northwest quadrant of the existing intersection, with SR 661 being realigned slightly to the west. Improvements to the roadway approaches will extend approximately 300 south, 350 feet west, and 475 feet north of the roundabout. Preliminary profile information indicates the roadway approaches will require only minor profile adjustments, but up to 4 feet of fill will be required on the western half of the roundabout.

S&ME performed two (2) subgrade borings through the existing SR 661, one through the existing New Burg Street pavement, and one (1) roadway embankment boring for this subgrade exploration. See Table 5-1 on page 4 for a summary of existing pavement thicknesses.

Beneath the existing pavement materials, Borings B-001-0-21, B-003-0-021 and B-004-0-21 encountered 4.5 to 6.1 feet of possible fill/existing fill consisting of either stiff to very-stiff brown and gray SANDY SILT (A-4a), brown, reddish-brown and dark-gray SILT AND CLAY (A-6a), brown SILTY CLAY (A-6b), and reddish-brown CLAY (A-7-6), or granular soil consisting of loose to medium-dense brown to dark-gray GRAVEL WITH SAND AND SILT (A-2-4, A-2-5) and SILT (A-4b). Boring B-001-0-21 was terminated in existing fill after encountering 1.5 feet of stiff brown SILTY CLAY (A-6b).

Beneath the fill, Borings B-003-0-21 and B-004-0-21 were terminated after encountering 1.5 feet of natural medium-stiff to stiff gray-brown SILT AND CLAY (A-6a) over 1.5 feet of medium-dense gray SANDY SILT (A-4a). Beneath the rootmat/topsoil, Boring B-002-0-21 encountered 6.0 feet loose to medium-dense brown to gray GRAVEL WITH SAND, SILT AND CLAY (A-2-6), COARSE AND FIND SAND (A-3a), and medium-dense brown SANDY SILT (A-4a) over 3.0 feet of stiff to very-stiff brown SILT AND CLAY (A-6a) or gray SANDY SILT (A-4a).

During drilling, groundwater seepage was noted in Borings B-002-0-21 and B-004-0-21 at the depths of 4.0 and 2.5 feet below the existing ground surface, respectively. At the completion of drilling, no groundwater accumulation was noted in any of the borings.

Based on conditions encountered in the borings, a summary of recommendations with respect to the subgrade conditions/remediation, new embankment construction, and pavement design is presented as follows:

- Using the ODOT Geotechnical Bulletin 1 (*GB1*) spreadsheet (Ver. 14.5, dated 1/18/19), the average California Bearing Ratio (CBR) of the existing/anticipated subgrade soils encountered during this exploration is 7%.
- The results of the ODOT *GB1* spreadsheet indicate the subgrade soils in three (3) of the four (4) borings (75%) possessed characteristics defined as problematic. ODOT *GB1* recommends that global subgrade remediation be considered when more than 30 percent of the subgrade requires remediation.
- No soils characterized as unsuitable by classification and requiring removal were encountered.
- Based on the results of the borings and the ODOT *GB1* analysis, S&ME recommends that global chemical stabilization program using cement as the modifier be performed to remediate the subgrade on this project. The stabilized layer should extend 14 inches below the subgrade level. See Sections 6.2.5 and 6.2.6 for more detailed recommendations.

2.0 Introduction

S&ME understands that a roundabout is being proposed to improve the existing intersection of SR 661 and New Burg Street in Granville, Licking County, Ohio. Plan information provided by Fishbeck indicates the center of the roundabout will be shifted into the northwest quadrant of the existing intersection, with SR 661 being realigned slightly to the west. Improvements to the roadway approaches will extend approximately 300 south, 350 feet west, and 475 feet north of the roundabout. Preliminary profile information indicates that as much as 3 to 4 feet of embankment fill will need to be placed to attain the proposed subgrade profile near the roundabout, whereas most of the roadway approaches will require only minor profile adjustments.

The Subgrade Exploration for this project was performed in general accordance with the January 2021 updates to the ODOT SGE.

3.0 Geology and Observations of the Project

3.1 Available Information

A review of the ODOT Transportation Information Management System located several historic embankment borings; however, none of these borings meet current ODOT SGE requirements for sampling and were not suitable for re-use.

3.2 Geology

Geologic references indicate that this project site is located within the Galion Glaciated Low Plateau Till Plain physiographic region, where the soil overburden consists primarily of medium- to low-lime Wisconsinan-age glacial till. The uppermost bedrock near this consists of Mississippian-age shales and sandstones and, based on ODNR water well log information, is more than 50 feet below the existing ground surface at this site.

3.3 Reconnaissance

On April 22, 2021, S&ME performed a site reconnaissance of the project site to observe current site conditions, look for potential utility conflicts, to select boring locations, to assess traffic control requirements at the proposed boring locations. Evidence of multiple existing above and below ground utilities were noted in the project area. The existing SR 661 and New Burg Street pavements were observed to be generally in good condition with few longitudinal and transverse cracking throughout. The frequency of cracking increased near the intersection.

4.0 Exploration

4.1 Field Investigation

On August 25, 2021, three (3) ODOT Type A existing pavement subgrade borings (designated as B-001-0-21, B-003-0-21, and B-004-0-21), one (1) ODOT Type B roadway boring (designated B-002-0-21) were performed for this Subgrade Exploration. The approximate locations of the borings are shown on the Plan of Borings included as Figure 2 in Appendix A. Surveyed locations, stations, offsets, and elevations of the borings were provided by Fishbeck. The borings were generally spaced at 400-foot maximum horizontal intervals, with 2 borings planned to be advanced through existing pavement and 2 borings in realignment areas. However, Boring B-004-0-21 had to

be relocated into the existing pavement because the drill rig could not access the embankment sideslope, and because of the presence of and existing underground utility at the toe of the slope.

The borings were performed by a truck-mounted drilling rig using a 2¼-inch I.D. hollow-stem auger to advance the borings between sampling attempts. Disturbed but representative soil samples were obtained by lowering a 2-inch O.D. split-barrel sampler to the bottom of the boring and then driving the sampler into the soil with blows from a 140-pound hammer freely falling 30 inches (ASTM D1586 - Standard Penetration Test). Six (6) feet of continuous SPT sampling was attempted beginning beneath the existing pavement subgrade level in the approach leg borings, and Boring B-002-0-21 was advanced to a depth of 10 feet with continuous SPT sampling near the roundabout. SPT samples were examined immediately after recovery and representative portions were preserved in airtight glass jars. The existing New Burg Street pavement was cored at Boring B-004-0-21 using a portable, generator-driven coring machine equipped with a diamond-impregnated bit. The photograph of the recovered pavement core is included on Plate 8 of Appendix A.

In accordance with the current ODOT SGE, the hammer system on the drill rig was calibrated on March 1, 2021, in accordance with ASTM D 4633 to determine the drill rod energy ratio (82.0%). At the completion of drilling, the borings were backfilled in accordance with ODOT specifications using cuttings mixed with bentonite chips. Where advanced through existing pavement, the surface of the roadway was repaired using cold-patch asphalt.

In the field, experienced S&ME personnel performed the following: 1) examined all samples recovered from the borings; 2) preserved representative portions of all samples in airtight glass jars; 3) prepared a log of each boring; 4) made seepage and groundwater observations; 5) made hand-penetrometer measurements in soil specimens exhibiting cohesion; and, 6) provided liaison between the field work and the Project Engineer so the exploration program could be modified in the event unusual or unexpected subsurface conditions were encountered. All recovered samples were transported to the soil laboratory of S&ME for further examination and testing.

4.2 Laboratory Testing

In the laboratory, all soil samples were visually identified and subjected to moisture-content testing. Classification testing (liquid/plastic limit determinations and grain-size analyses) was performed on two (2) soil samples recovered from each boring. In addition, sulfate testing was performed on a selected representative specimen from within 3 feet of the proposed pavement subgrade level in each approach leg boring. An additional test was also performed on a sample from just below the existing ground surface at Boring B-002-0-21, as the amount of new fill required to attain the proposed subgrade level was not known at the time of lab testing. The results of these laboratory tests are recorded numerically on individual boring logs.

Based upon the results of the laboratory testing program, the field logs were modified, if necessary, and copies of the laboratory corrected boring logs are submitted as Plates 4 through 7 of Appendix A. Shown on these logs are: descriptions of the soil stratigraphy encountered; depths from which samples were preserved; sampling efforts (blow-counts) required to obtain the specimens in the borings; calculated N_{60} values; laboratory testing results; seepage and groundwater observations made at the time of drilling; and, values of hand-penetrometer measurements made in soil samples exhibiting cohesion. For your reference, hand-penetrometer values are roughly equivalent to the unconfined compressive strength of the cohesive fraction of the soil sample.
Soils have been classified in accordance with Section 603 of the ODOT SGE and described in general accordance with Section 602. An explanation of the symbols and terms used on the boring logs, definitions of the special adjectives used to denote the minor soil components, and information pertaining to sampling and identification

are presented on Plate 3 of Appendix A. Group Indices determined from the results of the laboratory testing program are also provided on the boring logs.

5.0 Findings

5.1 Existing Pavement

Three (3) of the borings were performed within the existing pavement. Table 5-1 present the thicknesses of pavement materials encountered in each boring.

Table 5-1: Summary of Existing Pavement Thicknesses

Boring No.	Asphalt (in.)	Aggregate Base (in.)
B-001-0-21	12	11
B-003-0-21	11	13
B-004-0-21	11½	10½

A photograph of the recovered core of the existing pavement at Boring B-004-0-21 is included as Plate 8 in Appendix A.

5.2 Subsurface Stratigraphy

Beneath the existing pavement, 4.5 to 6.1 feet of possible or existing fill were encountered in Borings B-001-0-21, B-003-0-021 and B-004-0-21. The existing fill consisted of either stiff to very-stiff brown and gray SANDY SILT (A-4a), brown, reddish-brown and dark-gray SILT AND CLAY (A-6a), brown SILTY CLAY (A-6b), and reddish-brown CLAY (A-7-6), or granular fill consisting of loose to medium-dense brown to dark-gray GRAVEL WITH SAND AND SILT (A-2-4, A-2-5) and SILT (A-4b). Boring B-001-0-21 was terminated in existing fill after encountering 1.5 feet of stiff brown SILTY CLAY (A-6b).

Beneath the existing/possible fill, Borings B-003-0-21 and B-004-0-21 were terminated after encountering 1.5 feet of natural medium-stiff to stiff gray-brown SILT AND CLAY (A-6a) over 1.5 feet of medium-dense gray SANDY SILT (A-4a). Beneath the rootmat/topsoil, Boring B-002-0-21 encountered 6.0 feet loose to medium-dense brown to gray GRAVEL WITH SAND, SILT AND CLAY (A-2-6), COARSE AND FIND SAND (A-3a), and medium-dense brown SANDY SILT (A-4a) over 3.0 feet of stiff to very-stiff brown SILT AND CLAY (A-6a) or gray SANDY SILT (A-4a).

5.3 Groundwater Observations

During drilling, groundwater seepage was noted in Borings B-002-0-21 and B-004-0-21 at the depths of 4.0 and 2.5 feet below the existing ground surface, respectively. At the completion of drilling, no groundwater accumulation was noted in any of the borings. All groundwater levels should be considered as temporary, short-term observations and should not be assumed to be representative of the long-term static groundwater level.

5.4 Soil Sulfate Test Results

Results of the sulfate content testing (ODOT Supplement 1122) performed on soil samples obtained near the anticipated subgrade level for this project ranged from 47 to 459 parts per million (ppm). These results are below

the threshold value of 5,000 ppm that has been identified by ODOT *GB1* as the sulfate content concentration above which chemical stabilization should not be performed. The results of these tests are reported on the individual boring logs, and a summary of the test results is presented on Plate 9 of Appendix A.

6.0 Analyses and Recommendations

6.1 General Discussion

S&ME understands a roundabout is proposed to improve the existing intersection of SR 661 and New Burg Street in Granville, Licking County, Ohio. New embankment fill will be required to attain the proposed profile of the roundabout, with improvements to the approach roadways extending approximately 300 feet south, 350 feet west, and 475 feet north of the roundabout. Minimal profile adjustments are anticipated on the approach roadways. Recommendations for embankment construction and subgrade remediation, along with subgrade support parameters for use during new pavement design are presented in the following sections of this report.

6.2 Subgrade Analyses

6.2.1 ODOT Geotechnical Bulletin GB1 Analysis

The ODOT Geotechnical Bulletin *GB1* "Plan Subgrades" (GB1) document provides a standard approach to performing explorations and assessing roadway subgrades. The associated spreadsheet (Ver. 14.5, updated 1/18/19) created by the ODOT Office of Geotechnical Engineering (OGE) is used to estimate roadway subgrade support parameters and identify areas requiring remediation. The spreadsheet (see Appendix B) summarizes the soil type (by ODOT/HRB classification), group indices, depth, blow-counts, Atterberg Limits, and sulfate content values of the proposed subgrade soils encountered in the borings drilled for this project. Using this data, this table computes an average of the estimated values of the California Bearing Ratio (CBR) for the soils encountered at or below the anticipated subgrade level of the proposed roadway profile.

ODOT *GB1* considers subgrade soils to be "unsuitable" either by classification (A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b), or if the Liquid Limit value is greater than 65%. In general, these unsuitable soils should be completely removed or excavated to 36 inches below proposed subgrade, whichever is less, or be chemically stabilized. ODOT *GB1* also considers subgrade soil to be potentially "unstable" and possibly requiring subgrade remediation by comparing the lab-measured moisture content to the estimated optimum moisture content of the subgrade soil, and/or by comparing the normalized blow-count (N_{60}) and the lowest N value (N_{60L}) from SPT sampling.

Based on these comparisons and correlations, the ODOT *GB1* spreadsheet provides alternative approaches to remediate and establish a stable soil subgrade using either "excavate and replace" (ODOT *Construction and Materials Specifications* (*CMS*) Item 204) or chemical stabilization (*CMS* Item 206 and Supplement 1120). However, soils with a sulfate content above 5,000 ppm are generally prohibited from being chemically stabilized.

The subgrade remediation depths identified by the ODOT *GB1* spreadsheet presented in Appendix B are based on the conditions encountered in the borings during this subsurface exploration. However, because the required amount of remediation is dependent on the moisture content of the subgrade soil at the time of construction, ODOT *GB1* states that the ultimate decision on required remediation depths and limits should be based on observations during either proofrolling or test-rolling operations.

6.2.2 Subgrade Support Parameters

Based on the available profile information, the proposed roadway approaches will require minimal adjustment of subgrade level; however, roughly 3 to 4 feet of fill placement will be required on the western portion of the new roundabout. Based on the anticipated vertical profile, the following average California Bearing Ratio (CBR) was computed by the ODOT *GB1* spreadsheet for the anticipated subgrade soils encountered during this exploration:

CBR = 7%

Based on this average value and Section 203.1 of the current ODOT Pavement Design Manual, the following value of Resilient Modulus (M_R) correlates to this average CBR value:

M_R = 8,400 psi

Section 203.4.1 of the current ODOT Pavement Design Manual states when the entire subgrade is chemically stabilized, the resilient modulus of the subgrade soil may be increased by 1.36. If global chemical stabilization is utilized, the following value of Resilient Modulus ($M_{R\text{-}GCS}$) may be used:

$M_{R\text{-}GCS}$ = 11,420 psi

These subgrade support values may be used during new pavement thickness design for this project provided that the entire proposed pavement subgrade is prepared in strict accordance with Items 204 and 206 of the 2019 ODOT *CMS*, and that all borrow soil placed within 3 feet of the final subgrade elevation of the new pavement provides average subgrade support parameters which meet or exceed the above values. Additionally, soil placed as borrow or backfill within 2 feet of the proposed subgrade level must possess a Plasticity Index (PI) less than 20.

This subgrade evaluation also assumes that the subgrade for the new roadway is composed of the materials encountered in the borings. If, at the time of construction, it is determined that the subgrade consists of materials different than those encountered in the borings, the pavement design subgrade criteria should be reviewed and, if necessary, modified.

6.2.3 Unsuitable Subgrade Materials

None of the borings encountered soil within 3 feet of the proposed subgrade level which ODOT GB1 considers to be unsuitable either by classification (A-4b, A-2-5, A-5, A-7-5, A-8a, A-8b), or which has a Liquid Limit value exceeding 65%. However, it should be noted that Boring B-004-0-21 encountered a 3-inch wood fragment within the existing SILT AND CLAY fill present from 3.5 to 5 feet below the existing pavement surface. Many wood fragments were also encountered in the granular soil beneath this fill in Boring B-004-0-21. Because of the wide spacing of the explorations, it is possible that areas of unsuitable organic, elastic, or silt materials not encountered in any of the borings may be encountered during earthwork and proofrolling operations.

6.2.4 Recommended GB1 Subgrade Remediation

The results of the *GB1* analysis indicate that three (3) of the four (4) borings (75%) encountered soil at the anticipated subgrade level which possessed characteristics defined as problematic (excessive soil moisture content or a low hand penetrometer value) and which may require remediation by the procedures recommended in *GB1*. Typical options for subgrade remediation per *GB1* include Item 204 "excavate and replace", either with or without

geogrid, or chemical stabilization. According to *GB1*, where 30% or more of the subgrade area requires remediation, consideration should be given to stabilizing the entire project where new pavement is proposed (global stabilization).

S&ME recommends that a 14-inch-thick global chemical stabilization program utilizing cement as the additive be performed to stabilize the subgrades for all new pavement constructed as part of this project.

6.2.5 Global Chemical Subgrade Stabilization

Based on the average Plasticity Index of 12 computed for the subgrade soils (see Plate 4 of Appendix B), the *GB1* spreadsheet indicates that cement should be utilized as the global chemical additive. The *GB1* spreadsheet also recommends that the subgrade cement stabilization extend to a depth of 14 inches below the proposed subgrade level. The lateral limits of the chemical stabilization should extend to at least 18 inches outside the outside edge of the proposed widened pavement or paved shoulder, including beneath any curbs and gutters.

To utilize the improved Resilient Modulus value for a globally stabilized soil subgrade ($M_{R\text{-}GCS}$) discussed in Section 6.2.2 of this report, S&ME recommends that the mixture design for the cement stabilized subgrade be performed in accordance with ODOT *CMS* Item 206, including Item 206.06, "Mixture Design for Chemically Stabilized Soils." Section G of ODOT *GB1* presents additional pay items for the chemical stabilization which should be included in the project plans, and which items are not necessary for a chemically stabilized subgrade.

As previously discussed, implementation of this recommended chemical stabilization program will also restrict the type of borrow soil which may be utilized as new fill across the remainder of the project. Project plans should specify that all borrow soil placed within 2 feet of the proposed subgrade be tested in the laboratory to determine that the Plasticity Index of the borrow soil is 20 or less (suitable for cement stabilization). We also recommend that lab testing of the borrow soils be performed prior to importing borrow to the site.

Additionally, the proposed roundabout configuration and potential Maintenance of Traffic (MoT) requirements may create small/narrow areas, or areas with tight radii, that the chemical stabilization equipment has difficulty accommodating. As such, it may be necessary to perform more chemical stabilization than necessary in areas of the project where minimum stabilization equipment widths exceed the width of subgrade area to be remediated.

The estimated *GB1* subgrade remediation depths are based on conditions encountered in the borings during this subsurface exploration. However, because the required amount of remediation is dependent on the moisture content of the subgrade soil at the time of construction, ODOT *GB1* states that the ultimate decision on required remediation depths and limits should be based on observations during proof rolling operations.

6.2.6 Additional Subgrade Remediation Considerations

S&ME recommends that attention be given to the drainage swales adjacent to the existing roadway embankments, as unsuitable (e.g., soft, saturated, possibly organic) soil or very weak/unstable soil requiring removal may be present in these areas. S&ME recommends these areas be closely examined and the lower elevations be probed prior to commencing earthwork operations, with all weak, wet, or organic soil removed prior to commencing fill placement. For this reason, Fishbeck may consider including a 1- to 2-foot deep overexcavation of existing drainage swales in the project excavation quantities. These drainage swale overexcavations should be backfilled with properly compacted soil (ODOT *CMS* Item 203, or Item 204 if within 12 inches of proposed subgrade).

Existing underground utility lines are present beneath and adjacent to the existing roadways, and the type of material used and the relative compactness of backfill within any such utility trenches are unknown. Some instability of utility trench backfill may occur during earthwork operations, and some recompaction of granular utility trench backfill may become necessary prior to stabilization. Additionally, S&ME recommends that the depth of all utilities beneath the proposed pavement be determined so that the utility lines are not disturbed or damaged during subgrade stabilization or overexcavation activities.

S&ME recommends that construction traffic be minimized once the required subgrade level has been attained. Construction traffic resulting from cyclical haul routes or limited access points may increase the quantity of soil identified by final proof rolling as required for removal, particularly during periods of moist weather.

6.3 Earthen Embankment Construction

Plan and profile information provided by Fishbeck indicates most of the proposed roadway approach embankments will be constructed at approximately the same elevation as the existing roadways; however, in realigned areas, minor amounts of cut and fill will be needed to attain the proposed subgrade level. Additionally, profiles indicate that as much as 3 to 4 feet of new fill placement will be required to attain the proposed subgrade level for the roundabout.

6.3.1 Embankment Foundation Preparation

Prior to commencing earthwork operations, all existing pavement, granular base, grass, topsoil, vegetation, and other miscellaneous materials be completely removed from the entire footprint of the proposed roadway embankment. Following removal of these materials, it is recommended that the entire exposed subgrade and embankment foundation surface be examined by the Geotechnical Engineer of Record or their designated representative to identify any weak, wet, organic, or otherwise unsuitable soils that were not encountered during the subsurface exploration, especially in the widening/realignment areas. Any unsuitable materials identified should be removed and replaced with suitable compacted fill (Item 203, or Item 204 when within 12 inches of the proposed subgrade).

It should be noted that Boring B-004-0-21 encountered a 3-inch diameter wood fragment between 1.5 and 2.5 feet below the proposed subgrade level, with additional wood fragments encountered more than 3 feet below the anticipated subgrade level. S&ME recommends that the existing embankment of New Burg Road in the vicinity of Boring B-004-0-21 be closely examined during site preparation, and wood fragments or similar organic matter be removed from the exposed embankment foundation level or the sides of the existing embankments being regraded or widened.

Existing underground utility lines may be present beneath and adjacent to the existing roadway, and the type of material used and the relative compactness of backfill within any such utility trenches are unknown. S&ME recommends any planned utility relocation be performed prior to proofrolling. Some instability of utility trench backfill may occur during earthwork operations and/or proofrolling, and some recompaction of granular utility trench backfill may become necessary. Additionally, if water has accumulated within the utility backfill, the subgrade soil in the vicinity of any saturated utility trenches may have become sufficiently weak, soft, and/or wet that proofrolling may identify these additional areas as requiring overexcavation and replacement. In any case, care should be taken not to disturb any shallow utilities during proofrolling or overexcavation activities.

6.3.1.1 "Fill" Areas

Prior to commencing fill placement in approach roadway embankment realignment/widening areas, or where construction of new earthen embankment is required for the roundabout, S&ME recommends that consideration be given to performing Item 204.06 Test Rolling on all exposed embankment foundation areas beneath areas where new fill is required. Test rolling, performed in accordance with Item 204.06 of the ODOT *CMS* and Section 204 of the ODOT Construction Administration Manual of Procedures, would assist in identifying soft, wet, or weak zones, or areas of unsuitable, organic, or highly plastic soil that may be present in ditches, swales or wetland areas. If any such zones of soft, wet, or weak soils are present, the materials contained in these zones should be either scarified, dried, and thoroughly recompacted in place in accordance with ODOT CMS Item 203.07. If unsuitable or organic soils are encountered, they should be completely removed and the overexcavation filled in a controlled manner with compacted, suitable embankment material (Item 203.02). If unsuitable high plasticity soils are encountered, they should be removed and replaced to a depth of 3 feet below the proposed subgrade level.

Soft, weak, wet, or unsuitable soils that are not removed from beneath a thin layer of fill may result in difficulties in achieving the compaction percentages required for the new fill (ODOT *CMS* Items 203.07 or 204.03) such that final subgrade acceptance proofrolling may require overexcavation of the new fill where weak soils were "bridged" by a minimal thickness of new fill. Although ODOT *CMS* Item 203.05 permits the use of a "bridge lift" to aid in spanning soft or wet foundation areas, S&ME recommends that this practice not be permitted unless more than 3 feet of new embankment fill placement is required. Additionally, even if more than 3 feet of new fill is required in existing roadway ditches, S&ME does not recommend that a bridge lift be permitted in these areas because of the potential for organic soil in the existing ditches. Long term settlement within any organic soil left in the existing ditch lines may result in the development of a depression in the pavement surface.

6.3.1.2 "Cut" Areas

Once the proposed subgrade level has been achieved in these areas, the recommendations in Section 6.2.5 apply for chemical stabilization of the subgrade.

6.3.2 Benching and Embankment Slopes

It is recommended that horizontal benches be cut into all existing sloping surfaces to permit placement and compaction of new fill in horizontal lifts. Where new fill is to be placed on an existing ground surface which is sloping more steeply than 8(H):1(V), S&ME recommends that benching of the existing ground be performed in accordance with 2019 ODOT *CMS* Item 203.05.

However, at locations where the existing ground surface is steeper than 4(H):1(V), S&ME recommends "Special Benching" procedures as outlined in the ODOT Geotechnical Bulletin *GB2*, "Special Benching and Sidehill Embankment Fills" and the 2017 ODOT Construction Inspection Manual of Procedures should be performed. Sketches illustrating several "typical" Special Benching configurations for sidehill fills on various slopes are included in Figures 1, 2 and 3 on pages 3 and 6 of the ODOT Geotechnical Bulletin *GB2* document.

During any required Special Benching procedures, S&ME also recommends the followings: 1) only one bench be exposed at any given time and that excavation of the next bench should not be permitted until embankment fill placement and compaction has been completed to the top of the backslope of the previous bench; and, 2) the length of any given bench that is exposed should not exceed the quantity of embankment fill which may be properly placed and compacted in one day. Additionally, S&ME recommends that the final, completed side slopes of embankments, either cut slopes or fill embankments, be constructed no steeper than 2(H):1(V).

As stated in ODOT *GB2*, wherever "Special Benching" is used, Plan Note G109 from the ODOT L&D Manual, Vol. 3, should be included in the General Notes.

6.3.3 Borrow Requirements and Compaction Criteria

New fill should consist of inorganic soil free of all miscellaneous materials, cobbles, and boulders, which is placed in uniform, thin layers and then compacted in accordance with either ODOT *CMS* Item 203, *"Roadway Excavation and Embankment"*, or when within 12 inches of the proposed subgrade level, ODOT *CMS* Item 204 *"Subgrade Compaction and Proofrolling"*. Borrow materials should not be placed in a frozen condition or upon a frozen surface, and any sloping surfaces on which new fill is to be placed should first be benched in accordance with either ODOT *CMS* Item 203.05 or ODOT *GB2*, depending on the slope of the existing ground surface at each location.

As previously discussed in Section 6.2.2 of this report, any borrow materials to be used as new fill or backfill within 3 feet of the proposed subgrade level should be tested in the laboratory to determine that the borrow materials exhibit subgrade support characteristics that are no less than the CBR value used during the pavement design. Also, as previously discussed, all new fill placed within 2 feet of the proposed chemically stabilized subgrade level must have a Plasticity Index (PI) less than 20

Compaction requirements for the construction of earthen embankments are based on ODOT *CMS* Item 203.07.B (or Item 204.03 when within 12 inches of subgrade level), which specifies a minimum percent compaction based on the dry unit weight of the type of soil fill being placed as borrow. S&ME recommends that once the source of borrow for this project is determined, sampling and testing of this borrow material be performed prior to construction to verify the borrow soils are suitable for the planned construction.

6.3.4 Compaction/Moisture Conditioning Concerns

The cohesive soils encountered in the borings performed for this project, if exposed to inclement weather or rainfall, may rapidly absorb additional moisture, and weaken. It is imperative that these soil types not be exposed to rainfall while in a loosened state (such as during discing and drying for moisture conditioning during fill placement). Should these materials become sufficiently saturated that additional moisture conditioning is impractical, the material should be wasted. Therefore, it is recommended that moisture conditioning only be performed when extended periods of suitable weather are anticipated, and that only the amount of borrow soil be exposed that may be moisture conditioned and properly compacted during suitable weather periods.

6.3.5 Final Proofrolling

Following the completion of chemical mixing and compaction of the subgrade, the stabilized area shall be protected in accordance with Item 206.05.F and allowed to cure (Item 206.05.E) before final proofrolling (Item 204). During the required curing period, no construction traffic should be permitted on the compacted subgrade. Chemically stabilized subgrade soils subjected to traffic loading, excessive moisture, or cold weather (freezing) conditions may weaken or not achieve the necessary stability.

6.4 Groundwater Considerations for Roadway Construction

Based upon observations made at the time of this exploration, significant groundwater problems are not anticipated for the proposed intersection improvements.

The new roadway subgrade should be graded to prevent surface runoff from pooling on the cohesive soils during construction as exposure of cohesive soils to moisture will result in a decrease in strength and an increase in compressibility. Soil softened by standing water or disturbed by construction activities should be removed before proceeding with construction.

The presence of water bearing granular layers or seams in the walls of any utility excavations may also result in caving or sloughing of the excavation walls. S&ME recommends that all excavations be braced, or sloped back at a safe angle, in accordance with current OSHA Excavation Regulations.

7.0 Final Considerations

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

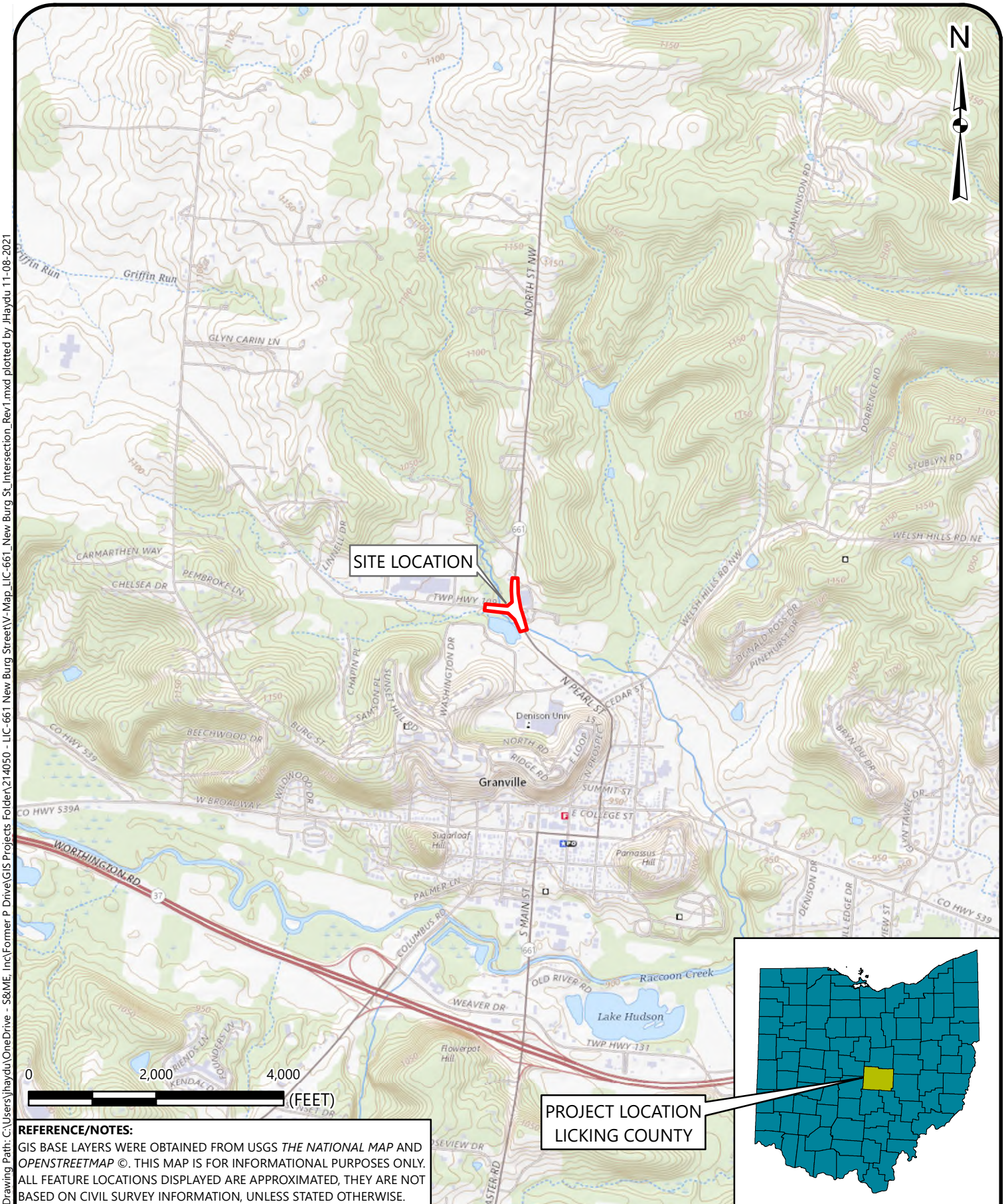
Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Unless specifically noted otherwise, our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). If there is a concern about these items, other studies should be performed. S&ME can provide a proposal and perform these services if requested.

S&ME should be retained to review the final plans and specifications to confirm that earthwork and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and construction activities.

Appendices

Appendix A



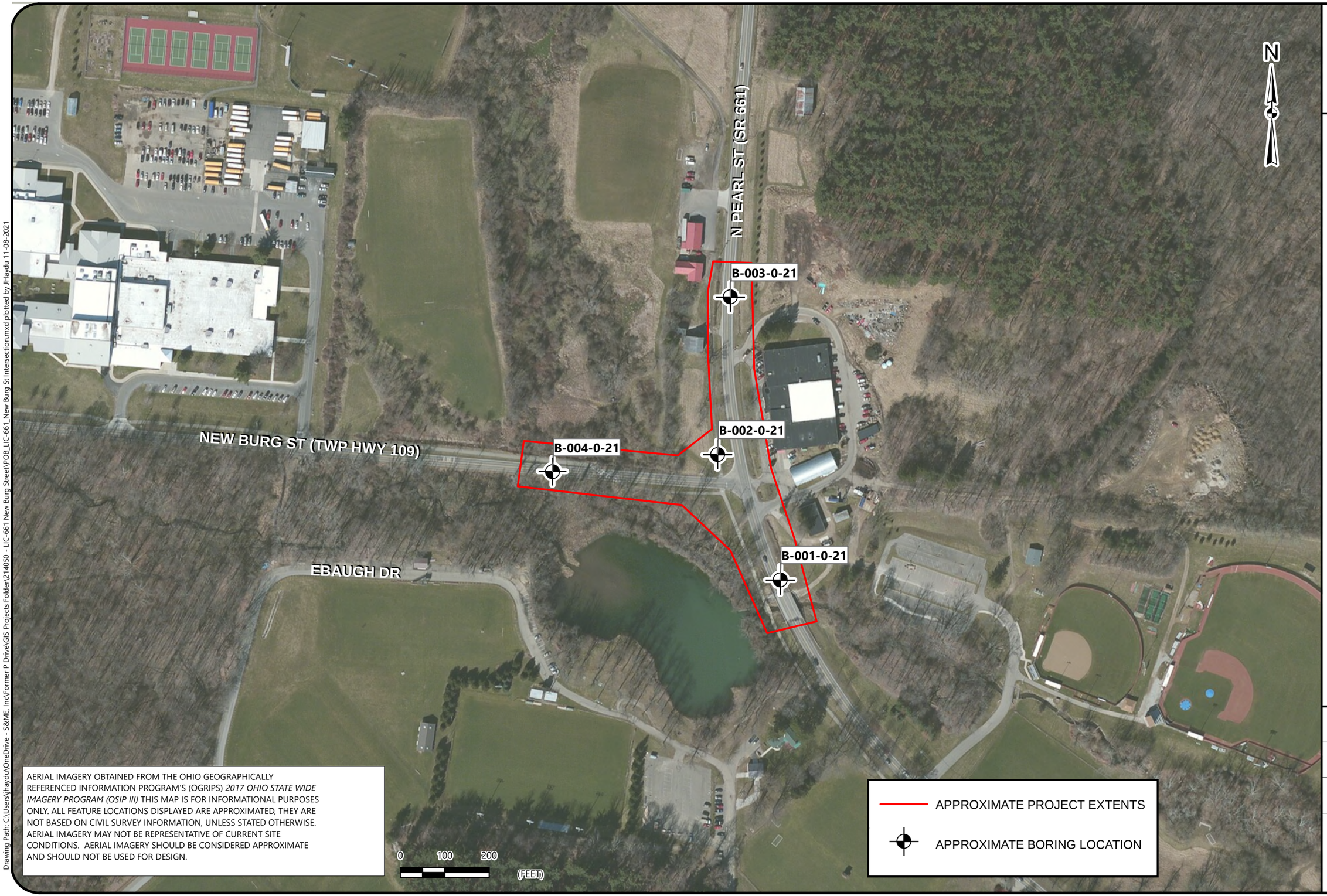
REFERENCE/NOTES:
GIS BASE LAYERS WERE OBTAINED FROM USGS *THE NATIONAL MAP* AND *OPENSTREETMAP* ©. THIS MAP IS FOR INFORMATIONAL PURPOSES ONLY. ALL FEATURE LOCATIONS DISPLAYED ARE APPROXIMATED, THEY ARE NOT BASED ON CIVIL SURVEY INFORMATION, UNLESS STATED OTHERWISE.

Drawing Path: C:\Users\jhaydu\OneDrive - S&ME, Inc\Former P Drive\GIS Projects Folder\214050 - LIC-661 New Burg Street\V-Map_LIC-661_New Burg St_Intersection_Rev1.mxd plotted by JHaydu 11-08-2021

VICINITY MAP

LIC-661-01.64 INTERSECTION IMPROVEMENTS (PID 112799)
GRANVILLE, LICKING COUNTY, OHIO

SCALE:	1 " = 2,000 '
DATE:	11-8-21
PROJECT NUMBER	214050
PLATE No.	1



Drawing Path: C:\Users\jhaydu\OneDrive - S&ME, Inc\Former P Drive\GIS Projects Folder\214050 - LIC-661 New Burg Street\POB_LIC-661_New Burg St Intersection.mxd plotted by JHaydu 11-08-2021

PLAN OF BORINGS

LIC-661-01.64 INTERSECTION IMPROVEMENTS (PID 112799)
GRANVILLE, LICKING COUNTY, OHIO

SCALE:
1 " = 200 '

DATE:
11-8-21

PROJECT NUMBER
214050

PLATE NO.
2

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS FOR SAMPLING AND DESCRIPTION OF SOIL

SAMPLING DATA

 - Indicates sample was attempted within this depth interval.

2
3
5 - The number of blows required for each 6-inch increment of penetration of a "Standard" 2-inch O.D. split-barrel sampler, driven a distance of 18 inches by a 140-pound hammer freely falling 30 inches (SPT). The raw "blowcount" or "N" is equal to the sum of the second and third 6-inch increments of penetration.

N_{60} - Corrected Blowcount = [(Drill Rod Energy Ratio) / (0.60 Standard)] X N

SS - Split-barrel sampler, any size.

ST - Shelby tube sampler, 3″ O.D., hydraulically pushed.

R - Refusal of sampler in very-hard or dense soil, or on a resistant surface.

50-0.3′ - Number of blows (50) to drive a split-barrel sampler a certain distance (0.3 feet), other than the normal 6-inch increment.

DEPTH DATA

W - Depth of water or seepage encountered during drilling.

▼ AD - Depth to water in boring after drilling (AD) is terminated.

▼ 5 days - Depth to water in monitoring well or piezometer in boring a certain number of days (5) after termination of drilling.

TR - Depth to top of rock.

SOIL DESCRIPTIONS

Soils have been classified in general accordance with Section 603 of the most recent ODOT SGE, and described in general accordance with Section 602, including the use of special adjectives to designate approximate percentages of minor components as follows:

Adjective	Percent by Weight
trace	1 to 10
little	10 to 20
some	20 to 35
"and"	35 to 50

The following terms are used to describe density and consistency of soils:

Term (Granular Soils)	Blows per foot (N_{60})
Very-loose	Less than 5
Loose	5 to 10
Medium-dense	11 to 30
Dense	31 to 50
Very-dense	Over 50

Term (Cohesive Soils)	Qu (tsf)
Very-soft	Less than 0.25
Soft	0.25 to 0.5
Medium-stiff	0.5 to 1.0
Stiff	1.0 to 2.0
Very-stiff	2.0 to 4.0
Hard	Over 4.0

S&ME JOB: 214050

PROJECT: LIC-661-01.64	DRILLING FIRM / OPERATOR: S&ME / C. BRUMMAGE	DRILL RIG: S&ME 45B TRUCK (R52)	STATION / OFFSET: 20+06, 7' RT	EXPLORATION ID B-001-0-21
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: S&ME / C. BRUMMAGE	HAMMER: CME AUTOMATIC	ALIGNMENT: REF LINE "SR"	
PID: 112799 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 3/1/21	ELEVATION: 975.2 (MSL) EOB: 8.0 ft.	PAGE 1 OF 1
START: 8/25/21 END: 8/25/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	LAT / LONG: 40.076919 N, 82.520976 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 975.2	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
ASPHALT - 12 INCHES	974.2																		
GRANULAR BASE - 11 INCHES	973.3																		
Fill: Stiff to very-stiff gray and brown **SANDY SILT**, some fine to coarse gravel, little clay, damp.	971.7	1-2-3-4	2 3 4	10	56	SS-1	1.5-2.5	25	7	7	43	18	25	18	7	17	A-4a (5)	459	
Fill: Medium-dense brown **GRAVEL WITH SAND AND SILT**, trace clay, damp.	970.2	4-5	5 4 5	12	39	SS-2	-	-	-	-	-	-	-	-	-	13	A-2-4 (V)	-	
Fill: Loose brown **SILT**, some fine to coarse sand, some clay, trace fine to coarse gravel, contains asphalt fragments and possible slag, damp.	968.7	5-6	3 3 4	10	44	SS-3	-	2	9	12	54	23	24	17	7	15	A-4b (8)	-	
Fill: Stiff brown **SILTY CLAY**, some fine to coarse sand, little fine to coarse gravel, contains possible slag, damp..	967.2	7-EOB-8	4 4 4	11	44	SS-4	1.0-1.2	-	-	-	-	-	-	-	-	14	A-6b (V)	-	

- No groundwater noted.
- Upon removal of HSA, boring caved at 3.2'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT SULFATE (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/13/21 16:14 - Z:\SHARED\SME\OPS\CS\RESOURCES\COLUMBUS\GINT\PROJECTS\214050.GPJ

PLATE 4

S&ME JOB: 214050

PROJECT: LIC-661-01.64	DRILLING FIRM / OPERATOR: S&ME / C. BRUMMAGE	DRILL RIG: S&ME 45B TRUCK (R52)	STATION / OFFSET: 2+65, 38' LT
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: S&ME / C. BRUMMAGE	HAMMER: CME AUTOMATIC	ALIGNMENT: REF LINE "CC"
PID: 112799 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 3/1/21	ELEVATION: 979.0 (MSL) EOB: 10.0 ft.
START: 8/25/21 END: 8/25/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	LAT / LONG: 40.077693 N, 82.521481 W

EXPLORATION ID **B-002-0-21**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 979.0	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
ROOTMAT/TOPSOIL - 11 INCHES	978.1																		
Loose to medium-dense brown **GRAVEL WITH SAND, SILT AND CLAY**, contains iron oxide stains, damp to moist.	975.0	W 975.0	3 3 3	8	78	SS-1	-	37	16	15	13	19	39	18	21	15	A-2-6 (2)	47	
			3 3 5	11	67	SS-2	-	-	-	-	-	-	-	-	-	18	A-2-6 (V)	-	
Loose brown **COARSE AND FINE SAND**, little fine gravel, little silt, trace clay, moist.	973.5		2 2 2	5	67	SS-3	-	18	18	38	18	8	NP	NP	NP	20	A-3a (0)	-	
Medium-dense brown **SANDY SILT**, some fine gravel, trace clay, moist.	972.0		2 4 7	15	67	SS-4	-	-	-	-	-	-	-	-	-	12	A-4a (V)	-	
Stiff to very-stiff brown **SILT AND CLAY**, some fine to coarse sand, little fine to coarse gravel, damp.	970.5	W 971.5	4 5 8	18	67	SS-5	1.7-3.0	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
Stiff to very-stiff gray **SANDY SILT**, little fine gravel, trace clay, damp.	969.0	EOB	4 7 11	25	67	SS-6	1.5-4.0	-	-	-	-	-	-	-	-	14	A-4a (V)	-	

- Seepage noted at 4.0'.
- Groundwater noted at 7.5'.
- Upon removal of HSA, boring caved at 4.5'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT SULFATE (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/13/21 16:14 - Z:\SHARED\SME\OPS\CS\RESOURCES\COLUMBUS\GINTW\PROJECTS\214050.GPJ

PLATE 5

S&ME JOB: 214050

PROJECT: LIC-661-01.64	DRILLING FIRM / OPERATOR: S&ME / C. BRUMMAGE	DRILL RIG: S&ME 45B TRUCK (R52)	STATION / OFFSET: 33+27, 7' RT
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: S&ME / C. BRUMMAGE	HAMMER: CME AUTOMATIC	ALIGNMENT: REF LINE "NL"
PID: 112799 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 3/1/21	ELEVATION: 988.3 (MSL) EOB: 8.0 ft.
START: 8/25/21 END: 8/25/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	LAT / LONG: 40.078666 N, 82.521378 W

EXPLORATION ID **B-003-0-21**

PAGE 1 OF 1

MATERIAL DESCRIPTION AND NOTES	ELEV. 988.3	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
ASPHALT - 11 INCHES	987.4																		
GRANULAR BASE - 13 INCHES	986.3																		
Possible Fill: Stiff to very-stiff brown **SANDY SILT**, little clay, trace fine gravel, damp.	984.8		3 5 5	14	78	SS-1	1.5-2.7	7	23	19	37	14	20	17	3	13	A-4a (3)	139	
Possible Fill: Stiff to very-stiff reddish-brown **CLAY**, "and" silt, trace fine to coarse sand, trace fine gravel, damp.	983.3		3 3 4	10	89	SS-2	1.5-2.5	1	1	2	59	37	48	20	28	23	A-7-6 (17)	-	
Possible Fill: Stiff to very-stiff reddish-brown and brown **SILT AND CLAY**, "and" fine to coarse sand, little fine gravel, damp.	981.8		5 6 5	15	67	SS-3	1.0-3.0	-	-	-	-	-	-	-	-	17	A-6a (V)	-	
Medium-stiff to stiff grayish-brown **SILT AND CLAY**, "and" fine to coarse sand, little fine gravel, moist.	980.3	EOB	4 4 5	12	56	SS-4	0.5-1.5	-	-	-	-	-	-	-	-	19	A-6a (V)	-	

- No groundwater noted.
- Upon removal of HSA, boring caved at 4.1'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; SOIL CUTTINGS MIXED WITH BENTONITE

S&ME ODOT SULFATE (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/13/21 16:15 - Z:\SHARED\SME\OPS\CS\RESOURCES\COLUMBUS\GINT\PROJECTS\214050.GPJ

PLATE 6

S&ME JOB: 214050

PROJECT: LIC-661-01.64	DRILLING FIRM / OPERATOR: S&ME / C. BRUMMAGE	DRILL RIG: S&ME 45B TRUCK (R52)	STATION / OFFSET: 3+71, 9' RT	EXPLORATION ID B-004-0-21
TYPE: ROADWAY	SAMPLING FIRM / LOGGER: S&ME / C. BRUMMAGE	HAMMER: CME AUTOMATIC	ALIGNMENT: CL EX NEW BURG	
PID: 112799 BR ID:	DRILLING METHOD: 2.25" HSA	CALIBRATION DATE: 3/1/21	ELEVATION: 979.8 (MSL) EOB: 8.0 ft.	PAGE 1 OF 1
START: 8/25/21 END: 8/25/21	SAMPLING METHOD: SPT	ENERGY RATIO (%): 82	LAT / LONG: 40.077588 N, 82.522809 W	

MATERIAL DESCRIPTION AND NOTES	ELEV. 979.8	DEPTHS	SPT/ RQD	N_{60}	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%) GR	CS	FS	SI	CL	ATTERBERG LL	PL	PI	WC	ODOT CLASS (GI)	SO4 ppm	BACK FILL
ASPHALT - 11-1/2 INCHES	978.9																		
GRANULAR BASE - 10-1/2 INCHES	978.0																		
Fill: Stiff to very-stiff grayish-brown **SILT AND CLAY**, some fine to coarse sand, trace fine gravel, damp.	976.3	W 977.3	10 6 4	14	78	SS-1	1.2-3.7	9	13	14	37	27	29	18	11	17	A-6a (6)	239	
Fill: Stiff dark-gray **SILT AND CLAY**, little fine to coarse gravel, little fine to coarse sand, contains 3" wood fragment, moist.	974.8		6 5 3	11	67	SS-2	1.0-1.2	-	-	-	-	-	-	-	-	26	A-6a (V)	-	
Possible Fill: Medium-dense dark-gray and brown **GRAVEL WITH SAND AND SILT**, little clay, slightly organic, many wood fragments, moist.	973.3		2 3 5	11	39	SS-3	-	42	13	13	20	12	42	34	8	28	A-2-5 (0)	-	
Medium-dense gray **SANDY SILT**, little fine to coarse gravel, little clay, wet.	971.8	EOB	7 9 11	27	33	SS-4	-	-	-	-	-	-	-	-	-	29	A-4a (V)	-	

- Seepage noted at 2.5'.
- Upon removal of HSA, boring caved at 3.0'.

NOTES: SEE ABOVE.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: ASPHALT PATCH; SOIL CUTTINGS MIXED WITH BENTONITE

PLATE 7

S&ME ODOT SULFATE (8.5X11) - SGE 07/2018 - OH DOT.GDT - 12/13/21 16:15 - Z:\SHARED\SME\OPS\CS\RESOURCES\COLUMBUS\GINTW\PROJECTS\214050.GPJ

Date: 9/13/2021

Photographer: PEL

1	**Location**	B-004-0-21, CL Ex New Burg Street, Sta. 3+71, 9' RT
	Remarks	Asphalt - 11½ inches

OHIO DEPARTMENT OF TRANSPORTATION

DETERMINING SULFATE CONTENT IN SOILS

SUPPLEMENT 1122

Project C-R-S: LIC-661-01.64

PID No: 112799

Report Date: 9/24/2021

Consultant: Alloway

Technician: BRM

Boring ID and Sample Number	Station	Offset	Latitude & Longitude or State Plane Coordinates		Elevation	Soaking Time (hr)	Replicate Sample Readings						Sulfate Content (ppm)
							1		2		3		
							Dilution	Reading	Dilution	Reading	Dilution	Reading	
B-001-0-21/SS-1X	20+06	7' RT	N40.076919°	W82.520976°	975.2	21:04	20	23.17	20	21.17	20	24.47	458.71
B-002-0-21/SS-1X	2+65	38' LT	N40.077693°	W82.521481°	979.0	21:05	20	1.05	20	0.86	20	5.21	47.45
B-003-0-21/SS-1X	33+27	7' RT	N40.078666°	W82.521378°	988.3	21:05	20	10.81	20	8.07	20	1.96	138.89
B-004-0-21/SS-1	3+71	9' RT	N40.077588°	W82.522809°	979.8	21:05	20	8.39	20	13.8	20	13.62	238.67

PLATE 9

Important Information About Your
Geotechnical Engineering Report

Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.

Geotechnical Findings Are Professional Opinions

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

Geotechnical Findings Are Professional Opinions

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

Services Are Performed for Specific Projects

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project.

Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

Geo-Environmental Issues

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

Geotechnical Recommendations Are Not Final

Recommendations are developed based on the geotechnical engineer's understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.

Appendix B

OHIO DEPARTMENT OF TRANSPORTATION

OFFICE OF GEOTECHNICAL ENGINEERING

PLAN SUBGRADES
Geotechnical Bulletin GB1

LIC-661-01.64

PID 112799

PROJECT DESCRIPTION - Proposed roundabout at the SR 661 and New Burg Street intersection in Licking County.

S&ME, Inc

Prepared By: Richard S. Weigand, P.E.
Date prepared: Monday, December 13, 2021

S&ME, Inc
6190 Enterprise Court
Dublin, OH 43016

614-793-2226
rweigand@smeinc.com

NO. OF BORINGS: 4

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring ID	Alignment	Station	Offset	Dir	Drill Rig	ER	Boring EL.	Proposed Subgrade EL	Cut Fill
1	B-001-0-21	Ref Line "SR"	20+06	7	R	CME TRK 45	82.0	975.2	973.9	1.3 C
2	B-002-0-21	Ref Line "CC"	2+65	38	L	CME TRK 45	82.0	979.0	983.2	4.2 F
3	B-003-0-21	Ref Line "NL"	33+27	7	R	CME TRK 45	82.0	988.3	986.3	2.0 C
4	B-004-0-21	CL Ex New Burg	3+71	9	R	CME TRK 45	82.0	979.8	978.5	1.3 C

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

#	Boring	Sample	Sample Depth		Subgrade Depth		Standard Penetration		HP (tsf)	Physical Characteristics						Moisture		Ohio DOT		Sulfate Content (ppm)	Problem		Excavate and Replace (Item 204)		Recommendation (Enter depth in inches)
			From	To	From	To	N_{60}	N_{60L}		LL	PL	PI	% Silt	% Clay	P200	M_C	M_{OPT}	Class	GI		Unsuitable	Unstable	Unsuitable	Unstable	
1	B	SS-1	2.0	3.5	0.7	2.2	10		1.5	25	18	7	43	18	61	17	13	A-4a	5	459		HP & Mc		12"	Exc & Replace 12" 204 Geotextile or 14" Cem. Stab.
	001-0	SS-2	3.5	5.0	2.2	3.7	13									13	10	A-2-4	0						
	21	SS-3	5.0	6.5	3.7	5.2	10			24	17	7	54	23	77	15	12	A-4b	8						
		SS-4	6.5	8.0	5.2	6.7	12	10	1.0							14	16	A-6b							
2	B	SS-1	1.0	2.5	5.2	6.7	9			39	18	21	13	19	32	15	10	A-2-6		47					
	002-0	SS-2	2.5	4.0	6.7	8.2	12									18	10	A-2-6							
	21	SS-3	4.0	5.5	8.2	9.7	6			NP	NP	NP	18	8	26	20	8	A-3a							
		SS-4	5.5	7.0	9.7	11.2	16	9								12	10	A-4a							
3	B	SS-1	2.0	3.5	0.0	1.5	15		1.5	20	17	3	37	14	51	13	12	A-4a	3	139		HP		12"	Exc & Replace 12" 204 Geotextile or 12" Cem. Stab.
	003-0	SS-2	3.5	5.0	1.5	3.0	10		1.5	48	20	28	59	37	96	23	18	A-7-6	17			HP & Mc			
	21	SS-3	5.0	6.5	3.0	4.5	16		1.0							17	14	A-6a	10						
		SS-4	6.5	8.0	4.5	6.0	13	10	0.5							19	14	A-6a	10						
4	B	SS-1	2.0	3.5	0.7	2.2	15		1.2	29	18	11	37	27	64	17	14	A-6a	6	239		HP & Mc		12"	Exc & Replace 12" 204 Geotextile or 14" Cem. Stab.
	004-0	SS-2	3.5	5.0	2.2	3.7	12		1.0							26	14	A-6a	10						
	21	SS-3	5.0	6.5	3.7	5.2	12			42	34	8	20	12	32	28	10	A-2-5	0						
		SS-4	6.5	8.0	5.2	6.7	30	12								29	10	A-4a							

OHIO DEPARTMENT OF TRANSPORTATION

Subgrade Analysis

V. 14.5 1/18/2019

PID: PID 112799

County-Route-Section: LIC-661-01.64
No. of Borings: 4

Geotechnical Consultant: S&ME, Inc
Prepared By: Richard S. Weigand, P.E.
Date prepared: 12/13/2021

Chemical Stabilization Options		
320	Rubblize & Roll	No
206	Cement Stabilization	Option
	Lime Stabilization	No
206	Depth	14"

Excavate and Replace Stabilization Options	
Global Geotextile Override(N60L):	15"
Average(HP):	12"
Global Geogrid Override(N60L):	0"
Average(HP):	0"

Design CBR	7

% Samples within 6 feet of subgrade			
$N_{60} \leq 5$	0%	HP ≤ 0.5	8%
$N_{60} < 12$	31%	0.5 < HP ≤ 1	23%
$12 \leq N_{60} < 15$	39%	1 < HP ≤ 2	31%
$N_{60} \geq 20$	8%	HP > 2	0%
M+	23%		
Rock	0%		
Unsuitable	6%		

Excavate and Replace at Surface	
Average	0"
Maximum	0"
Minimum	0"

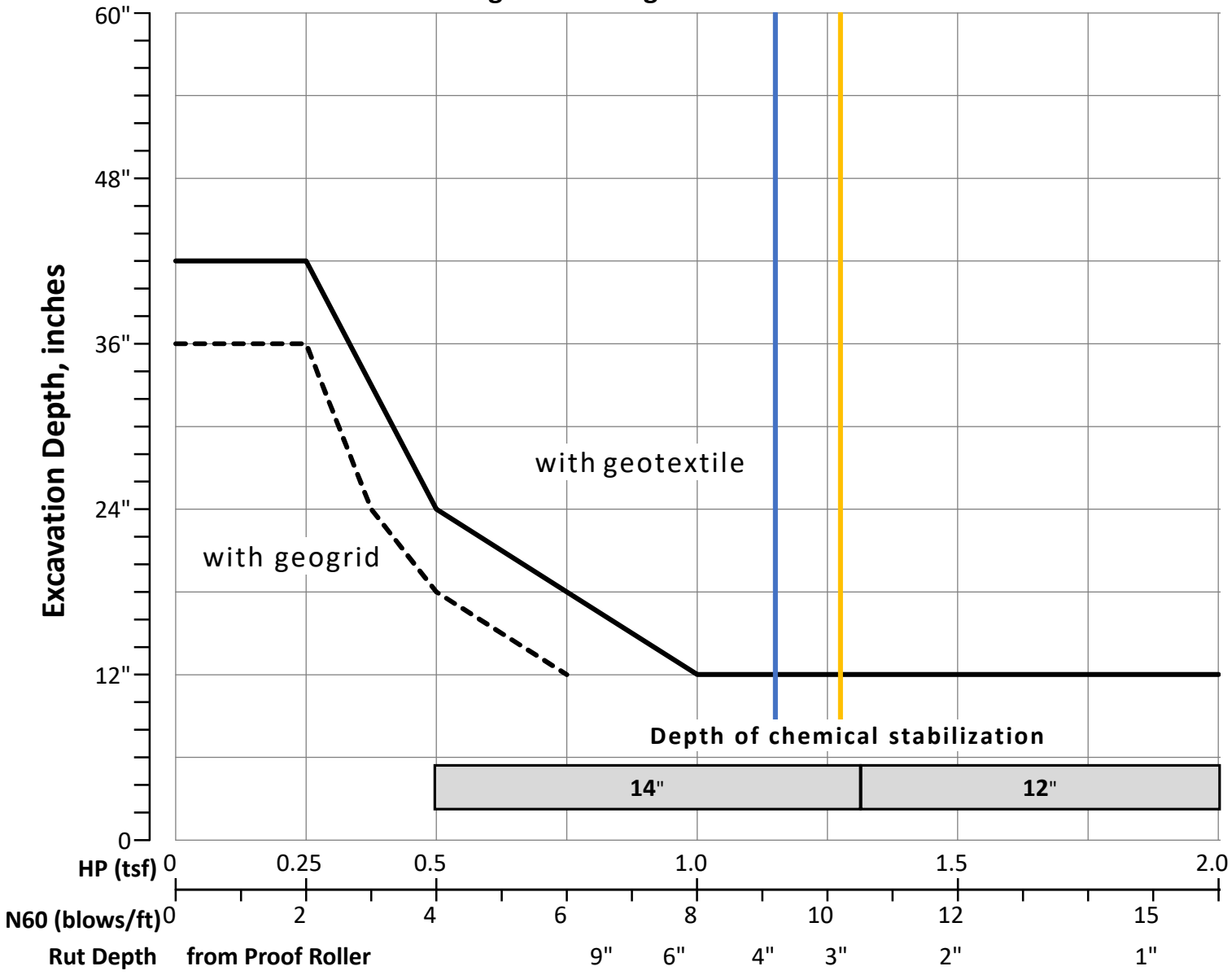
% Proposed Subgrade Surface	
Unstable & Unsuitable	67%
Unstable	67%
Unsuitable	0%

	N_{60}	N_{60L}	HP	LL	PL	PI	Silt	Clay	P 200	M_C	M_{OPT}	GI
Average	13	10	1.15	32	20	12	35	20	55	19	12	7
Maximum	30	12	1.50	48	34	28	59	37	96	29	18	17
Minimum	6	9	0.50	20	17	3	13	8	26	12	8	0

Classification Counts by Sample

ODOT Class	Rock	A-1-a	A-1-b	A-2-4	A-2-5	A-2-6	A-2-7	A-3	A-3a	A-4a	A-4b	A-5	A-6a	A-6b	A-7-5	A-7-6	A-8a	A-8b	Totals
Count	0	0	0	1	1	2	0	0	1	4	1	0	4	1	0	1	0	0	16
Percent	0%	0%	0%	6%	6%	13%	0%	0%	6%	25%	6%	0%	25%	6%	0%	6%	0%	0%	100%
% Rock|Granular|Cohesive	0%	56%									44%								100%
Surface Class Count	0	0	0	1	0	0	0	0	0	2	0	0	2	0	0	1	0	0	6
Surface Class Percent	0%	0%	0%	17%	0%	0%	0%	0%	0%	33%	0%	0%	33%	0%	0%	17%	0%	0%	100%

GB1 Figure B – Subgrade Stabilization



OVERRIDE TABLE

Calculated Average	New Values	Check to Override
1.15		☐ HP
10.25		☐ N60L

Average HP
Average N_{60L}

Appendix C

I. Geotechnical Design Checklists	
Project: LIC-661-01.64	**PDP Path:**
PID: 112799	**Review Stage:**

Checklist	Included in This Submission
II. Reconnaissance and Planning	✓
III. A. Centerline Cuts	
III. B. Embankments	
III. C. Subgrade	✓
IV. A. Foundations of Structures	
IV. B. Retaining Wall	
V. A. Landslide Remediation	
V. B. Rockfall Remediation	
V. C. Wetland or Peat Remediation	
V. D. Underground Mine Remediation	
V. E. Surface Mine Remediation	
V. F. Karst Remediation	
VI. A. Soil Profile	✓
VI. D. Geotechnical Reports	✓

II. Reconnaissance and Planning Checklist

C-R-S:	LIC-661-01.64	PID:	112799	Reviewer:	RSW	Date:	12/13/2021

Reconnaissance		(Y/N/X)	Notes:
1	Based on Section 302.1 in the SGE, have the necessary plans been developed in the following areas prior to the commencement of the subsurface exploration reconnaissance:		Plans prepared by others.
	Roadway plans	✓	
	Structures plans		
	Geohazards plans		
2	Have the resources listed in Section 302.2.1 of the SGE been reviewed as part of the office reconnaissance?	Y	
3	Have all the features listed in Section 302.3 of the SGE been observed and evaluated during the field reconnaissance?	Y	
4	If notable features were discovered in the field reconnaissance, were the GPS coordinates of these features recorded?	X	

Planning - General		(Y/N/X)	Notes:
5	In planning the geotechnical exploration program for the project, have the specific geologic conditions, the proposed work, and historic subsurface exploration work been considered?	Y	
6	Has the ODOT Transportation Information Mapping System (TIMS) been accessed to find all available historic boring information and inventoried geohazards?	Y	
7	Have the borings been located to develop the maximum subsurface information while using a minimum number of borings, utilizing historic geotechnical explorations to the fullest extent possible?	Y	
8	Have the topography, geologic origin of materials, surface manifestation of soil conditions, and any other special design considerations been utilized in determining the spacing and depth of borings?	Y	
9	Have the borings been located so as to provide adequate overhead clearance for the equipment, clearance of underground utilities, minimize damage to private property, and minimize disruption of traffic, without compromising the quality of the exploration?	Y	

II. Reconnaissance and Planning Checklist

Planning - General	(Y/N/X)	Notes:
10 Have the scaled boring plans, showing all project and historic borings, and a schedule of borings in tabular format, been submitted to the District Geotechnical Engineer?	Y	Conceptual Plan of Borings included in Proposal.
The schedule of borings should present the following information for each boring:		
a. exploration identification number	Y	
b. location by station and offset	X	Not available at time of Proposal.
c. estimated amount of rock and soil, including the total for each for the entire program.	Y	
Planning – Exploration Number	(Y/N/X)	Notes:
11 Have the coordinates, stations and offsets of all explorations (borings, probes, test pits, etc.) been identified?	Y	
12 Has each exploration been assigned a unique identification number, in the following format X-ZZZ-W-YY, as per Section 303.2 of the SGE?	Y	
13 When referring to historic explorations that did not use the identification scheme in 12 above, have the historic explorations been assigned identification numbers according to Section 303.2 of the SGE?	X	

II. Reconnaissance and Planning Checklist

Planning – Boring Types		(Y/N/X)	Notes:
14	Based on Sections 303.3 to 303.7.6 of the SGE, have the location, depth, and sampling requirements for the following boring types been determined for the project?	Y	
	Check all boring types utilized for this project:		
	Existing Subgrades (Type A)	✓	
	Roadway Borings (Type B)	✓	
	Embankment Foundations (Type B1)		
	Cut Sections (Type B2)		
	Sidehill Cut Sections (Type B3)		
	Sidehill Cut-Fill Sections (Type B4)		
	Sidehill Fill Sections on Unstable Slopes (Type B5)		
	Geohazard Borings (Type C)		
	Lakes, Ponds, and Low-Lying Areas (Type C1)		
	Peat Deposits, Compressible Soils, and Low Strength Soils (Type C2)		
	Uncontrolled Fills, Waste Pits, and Reclaimed Surface Mines (Type C3)		
	Underground Mines (C4)		
	Landslides (Type C5)		
	Rockfall (Type C6)		
	Karst (Type C7)		
	Proposed Underground Utilities (Type D)		
	Structure Borings (Type E)		
	Bridges (Type E1)		
	Culverts (Type E2 a,b,c)		
	Retaining Walls (Type E3 a,b,c)		
	Noise Barrier (Type E4)		
	CCTV & High Mast Lighting Towers (Type E5)		
	Buildings and Salt Domes (Type E6)		

III.C. Subgrade Checklist

C-R-S: LIC-661-01.64	PID: 112799	Reviewer: RSW	Date: 12/13/2021

If you do not have any subgrade work on the project, you do not have to fill out this checklist.

Subgrade	(Y/N/X)	Notes:
1 Has the subsurface exploration adequately characterized the soil or rock according to Geotechnical Bulletin 1: Plan Subgrades (GB1)?	Y	
a. Has each sample been visually classified and inspected for the presence of gypsum? Has a moisture content been performed on each sample?	Y	
b. Has mechanical classification (Plastic Limit (PL), Liquid Limit (LL), and gradation testing) been done on at least two samples from each boring within six feet of the proposed subgrade?	Y	
c. Has the sulfate content of at least one sample from each boring within 3 feet of the proposed subgrade been determined, per Supplement 1122, Determining Sulfate Content in Soils?	Y	
d. Has the sulfate content of all samples that exhibit gypsum crystals been determined?	X	
e. Have A-2-5, A-4b, A-5, A-7-5, A-8a, or A-8b soils within the top 3 feet of the proposed subgrade been mechanically classified?	X	
2 If soils classified as A-2-5, A-4b, A-5, A-7-5, A-8a, or A-8b, or having a LL>65, are present at the proposed subgrade (soil profile), do the plans specify that these materials need to be removed and replaced or chemically stabilized?	X	
a. If these materials are to be removed and replaced, have the station limits, depth, and lateral limits for the planned removal been provided?	X	
3 If there is any rock, shale, or coal present at the proposed subgrade (C&MS 204.05), do the plans specify the removal of the material?	X	
a. If removal of any rock, shale, or coal is required, have the station limits, depth, and lateral limits for the planned removal of the material at proposed subgrade been provided?	X	

III.C. Subgrade Checklist

Subgrade	(Y/N/X)	Notes:
4 In accordance with GB1, do the SPT (N_{60})/HP values and existing moisture contents for the proposed subgrade soils indicate the need for subgrade stabilization?	Y	See Appendix B.
a. If removal and replacement is applicable, has the detail of subgrade removal been shown on the plans, including depth of removal, station limits, lateral extent, replacement material, and plan notes (Item 204 - Subgrade Compaction and Proof Rolling)?	X	Plans by others
b. If chemical stabilization is applicable, has the detail of this treatment been shown on the plans, including depth, percentage of chemical, station limits, lateral extent, and plan notes?	Y	Plans prepared by others. See Section 6.2.4 of Subgrade Exploration report.
Indicate type of chemcial stabilization specified:		
cement stabilization	✓	
lime stabilization		
5 If removal and replacement has been specified, do the plans include Plan Note G121 from L&D3?	X	Plans by others
6 If drainage or groundwater is an issue with the proposed subgrade, has an appropriate drainage system (e.g., pipe, underdrains) been provided?	X	
7 Has an appropriate quantity of Proof Rolling (C&MS 204.06) and has Plan Note G111 from L&D3 been included in the plans?	X	Plans prepared by others.
8 Has a design CBR value been provided?	Y	See Section 6.2.1 of Subgrade Exploration Report.

VI.A. Soil Profile Checklist

C-R-S:	LIC-661-01.64	PID:	112799	Reviewer:	RSW	Date:	4/25/2023

General Presentation		(Y/N/X)	Notes:
1	Has an electronic copy of all geotechnical submissions been provided to the District Geotechnical Engineer (DGE)?	Y	Provided to Fishbeck for submission to DGE
2	Have the cadd files been prepared using the appropriate version of the ODOT CADD standards?	Y	
3	Has the geotechnical specification (title and date) under which the work was performed been clearly identified on every submission (reports, plans, etc.)?	Y	
4	Has the first complete version of all documents being submitted been labeled as 'Draft'?	Y	
5	Subsequent to ODOT's review and approval, has the complete version of the revised documents being submitted been labeled as 'Final'?	Y	
a.	Have the C-R-S, PID number, and product title been included in the folder name?	Y	
6	If the project includes structures, have all structure explorations been presented together under the same cover sheet? (Do not create separate Structure Foundation Exploration Sheets)	X	
7	Has a scale of 1"=1' been used for cover sheets, laboratory test data sheets, and boring log sheets, if applicable?	Y	
8	Based on the project length, has the correct horizontal scale been used to plot the project data?	Y	
	Check scale used:		
	1" = 5', 10', 20', 25', 40', or 50' for projects 1500' or less (use largest scale appropriate to present entire plan on one sheet)	✓	
	1" = 50' projects greater than 1500'		
9	Has a scale of 1" = 10' been utilized for the vertical scale of the project data?	Y	
10	If the project includes structures, has the plan and profile view been shown at the same scale as the Site Plan for the proposed structure(s), when possible?	X	

VI.A. Soil Profile Checklist

General Presentation	(Y/N/X)	Notes:
11 If the project includes culverts, have the plan and profile been presented along the flowline of the culvert?	X	
12 Have the cross-sections been plotted at a scale of 1" = 10' (preferred) or 1" = 20' (for higher or wider slopes)?	X	
Cover Sheet	(Y/N/X)	Notes:
13 Has the following general information been provided on the cover sheet:		
a. Brief description of the project, including the bridge number of each bridge involved in the plan set, if any?	Y	
b. Brief description of historic geotechnical explorations referenced in this exploration? State if no historic records are available.	Y	
c. Generalized information about the geology of the project area, including terrain, soil origin, bedrock types, and age?	Y	
d. Brief presentation of geological and topographical information derived from the field reconnaissance? Include comments on structure and pavement conditions.	Y	
e. Brief presentation of test boring and sampling methods? Include date of last calibration and drill rod energy ratio as a percent for the hammer systems used.	Y	
f. Summary of general soil, bedrock, and groundwater conditions, including a generalized interpretation of findings?	Y	
g. A statement of which version (date) of the SGE specification the exploration was performed in accordance with?	Y	
h. Statement of where geotechnical reports are available for review?	X	
i. Initials of personnel and dates they performed field reconnaissance, subsurface exploration and preparation of the soil profile?	Y	

VI.A. Soil Profile Checklist

Cover Sheet	(Y/N/X)	Notes:
14 Has a Legend been provided?	Y	
15 Have the following items been included in the Legend:		
a. Symbols and usual descriptions for only the soil and bedrock types presented in the Soil Profile, as per the Soil and Rock Symbology Chart in Appendix D of the SGE?	Y	
b. All miscellaneous symbols and acronyms, used on any of the sheets, defined?	Y	
c. The number of soil samples for each classification that were mechanically classified and visually described in the current exploration?	Y	
16 Has a Location Map, showing the beginning and end stations for the project, been shown on the cover sheet, sized per the L&D3 Manual?	Y	
17 Have the station limits for each plan and profile sheet for projects with multiple alignments, or greater than 1500', been identified in a table?	Y	
18 Have the station limits for any cross section sheets been identified in the same table?	X	
19 Has a list of any structures for which structure foundation explorations been performed been identified in the same table?	X	
20 If sampling and testing for a scour analysis was performed, has this data been shown in tabular form?	X	
21 Has a summary table of test data for all roadway and subgrade boring samples been shown?	Y	
22 If borings from previous subsurface explorations are being used, has that data been shown in a separate table?	X	
23 In the summary table, has the data been displayed by roadway and subgrade boring in ascending stationing order for each roadway?	Y	
24 Have the centerline or baseline station, offset, and exploration identification number been provided for each boring presented in the table?	Y	

VI.A. Soil Profile Checklist

Cover Sheet	(Y/N/X)	Notes:
25 For each sample, has the following information been provided in the summary table:		
a. Sample depth interval?	Y	
b. Sample number and type?	Y	
c. N_{60}?	Y	
d. Percent recovery?	Y	
e. Hand Penetrometer?	Y	
f. Percentage of aggregate, coarse sand, fine sand, silt, and clay size particles?	Y	
g. Liquid limit, plastic limit, plasticity index, and water content, all rounded to the nearest percent or whole number?	Y	
h. ODOT classification and Group Index?	Y	
i. Visual description of samples not mechanically classified, including water content, and estimated ODOT classification with 'Visual' in parentheses?	Y	
j. Sulfate Content test results?	Y	
26 Have all undisturbed test results been displayed in graphical format on the sheet prior to the plan and profile sheets?	X	
Surface Data	(Y/N/X)	Notes:
27 Has the following information been shown on each roadway plan drawing:		
a. Existing surface features described in Section 702.5.1?	Y	
b. Proposed construction items, as described in Section 702.5.2?	N	
c. Project and historic boring locations, with appropriate exploration targets and exploration identification numbers?	Y	
d. Notes regarding observations not readily shown by drawings?	X	
28 Have the existing ground surface contours been presented?	Y	
29 If cross sections are to be developed for stationing covered on a plan sheet, has an index for the appropriate cross section sheets been included on the plan sheet?	N	

VI.A. Soil Profile Checklist

Subsurface Data	(Y/N/X)	Notes:
30 Has all the subsurface data been presented in the form of a profile along the centerline or baseline, and on cross sections where applicable?	Y	
31 Have the graphical boring logs been correctly shown, as follows:		
a. Location and depth of boring indicated by a heavy dashed vertical line?	Y	
b. Exploration identification number above the boring?	Y	
c. Logs indicate soil and bedrock layers with symbols 0.4” wide and centered on the heavy dashed vertical line where possible?	Y	
d. Bedrock exposures with 0.4” wide symbols, but without a heavy dashed vertical line?	X	
e. Soil and bedrock symbols as per ODOT Soil and Rock Symbology chart (SGE - Appendix D)?	Y	
f. Historical borings shown in same manner with the exploration identification number above the boring?	N	
32 Have the proposed groundline and existing groundline been shown on the profile view, according to ODOT CADD standards?	Y	
33 Have the locations of the proposed structure foundation elements been shown on the profile view?	X	
34 Have the offsets from centerline or baseline been indicated above the borings in the profile view?	Y	
35 Have borings located immediately adjacent to the centerline or baseline and considered representative of centerline or baseline subsurface conditions been referenced directly to the centerline or baseline?	Y	
36 Have offset borings in or near the same elevation interval of a centerline or baseline boring been plotted either on a cross section or immediately above or below the centerline boring in a box containing an elevation scale?	X	

VI.A. Soil Profile Checklist

37 Have cross-sections been developed to show subsurface conditions disclosed by a series of borings drilled transverse to centerline or baseline?	X	
Subsurface Data	(Y/N/X)	Notes:
38 Have the existing and proposed groundlines been displayed on cross section sheets according to ODOT CADD standards?	Y	
39 Have bedrock exposures shown on the cross sections been plotted along the contour of the cross section?	N	
40 Has the following information been provided adjacent to the graphical logs or bedrock exposure:		
a. Thickness, to the nearest inch, of sod/topsoil or other shallow surface material written above the boring (with corresponding symbology at top of log)?	Y	
b. Moisture content, to nearest whole percent, with the bottom of the text aligned with the bottom of the sample? Label this column as 'WC' at bottom of the boring.	Y	
c. N_{60}, aligned with the bottom of sample? Label column as 'N_{60}' at bottom of boring.	Y	
d. Free water indicated by a horizontal line with a 'w' attached, and water level at the end of drilling indicated by an open equilateral triangle, point down?	Y	
e. Complete geologic description of each bedrock unit, including unit core loss, unit RQD, SDI, and compressive strength test results? (Do not present geologic descriptions for structure borings for which this information is presented on the boring logs as described in 703.3)	X	
f. Visual description of any uncontrolled fill or interval not adequately defined by a graphical symbol?	X	
g. Organic content with modifiers, per 603.5?	X	
h. Designate a plastic soil with moisture content equal to or greater than the liquid limit minus three with a 1/8" solid black circle adjacent to the moisture content?	X	

VI.A. Soil Profile Checklist

i. Designate a non-plastic soil with moisture content exceeding 25% or exceeding 19% but appearing wet initially, with a 1/8" open circle with a horizontal line through it adjacent to the moisture content?	X	
j. The reason for discontinuing a boring prior to reaching the planned depth indicated immediately below the boring?	X	
Boring Logs	(Y/N/X)	Notes:
41 Have the boring logs of all structure borings, all geohazard borings, and any roadway borings drilled in the vicinity of the structures or geohazard been shown on the boring log sheets following the plan and profile sheets? (Create the logs in accordance with 703.3)	X	
42 Have the boring logs been developed by integrating the driller's field logs, laboratory test data, and visual descriptions?	Y	
43 Has the following boring information been included in the heading of each boring log:		
a. Exploration identification number?	Y	
b. Project designation (C-R-S) and PID?	Y	
c. Structure File Number (if applicable) and project type.	X	
d. Centerline or baseline name, station, offset, and surface elevation?	Y	
e. Coordinates?	Y	
f. Method of drilling?	Y	
g. Date started and date completed?	Y	
h. Method and material (including quantity) used for backfilling or sealing, including type of instrumentation, if any?	Y	
i. Date of last calibration and drill rod energy ratio (ER) in percent for the hammer system(s) used?	Y	
44 Has the following boring information been included in each boring log:		
a. A depth and elevation scale?	Y	
b. Indication of stratum change?	Y	
c. Description of material in each stratum?	Y	
d. Depth of bottom of boring?	Y	
e. Depth of boulders or cobbles, if encountered?	X	
f. Caving depth?	Y	
g. Water level observations?	Y	
h. Artesian water level and height of rise?	X	

VI.A. Soil Profile Checklist

i. Heaving sand?	X	
j. Cavities or other unusual conditions?	X	
k. Depth interval represented by sample?	Y	
l. Sample number and type?	Y	
m. Percent recovery for each sample?	Y	
n. Measured blow counts for each 6 inches of drive for split spoon samples?	Y	
o. N_{60} to the nearest whole number?	Y	
p. Hand penetrometer?	Y	
Boring Logs	(Y/N/X)	Notes:
q. Particle-size analysis?	Y	
r. Liquid limit, plastic limit, plasticity index?	Y	
s. Water content?	Y	
t. ODOT soil classifications, with "V" in parentheses for those samples that are not mechanically classified?	Y	
u. Top of bedrock and bedrock descriptions?	X	
v. Run rock core percent recovery?	X	
w. Run RQD?	X	
x. Unit rock core percent recovery?	X	
y. Unit RQD?	N	
z. SDI, if applicable?	X	
aa. Rock compressive strength test results, if applicable?	X	

VI.B. Geotechnical Reports

C-R-S:	LIC-661-01.64	PID:	112799	Reviewer:	RSW	Date:	12/13/2021

General		(Y/N/X)	Notes:
1	Has an electronic copy of all geotechnical submissions been provided to the District Geotechnical Engineer (DGE)?	X	Electronic copy provided to Fishbeck to be included with ODOT submission.
2	Has the first complete version of a geotechnical report being submitted been labeled as 'Draft'?	Y	
3	Subsequent to ODOT's review and approval, has the complete version of the revised geotechnical report being submitted been labeled 'Final'?	Y	
4	Has the boring data been submitted in a native format that is DIGGS (Data Interchange for Geotechnical and Geoenvironmental) compatable? gINT files may be used for this.	X	
5	Does the report cover format follow ODOT's Brand and Identity Guidelines Report Standards found at http://www.dot.state.oh.us/brand/Pages/default.aspx ?	Y	
6	Have all geotechnical reports being submitted been titled correctly as prescribed in Section 705.1 of the SGE?	Y	
Report Body		(Y/N/X)	Notes:
7	Do all geotechnical reports being submitted contain the following:		
a.	an Executive Summary as described in Section 705.2 of the SGE?	Y	
b.	an Introduction as described in Section 705.3 of the SGE?	Y	
c.	a section titled "Geology and Observations of the Project," as described in Section 705.4 of the SGE?	Y	
d.	a section titled "Exploration," as described in Section 705.5 of the SGE?	Y	
e.	a section titled "Findings," as described in Section 705.6 of the SGE?	Y	
f.	a section titled "Analyses and Recommendations," as described in Section 705.7 of the SGE?	Y	

VI.B. Geotechnical Reports

Appendices		(Y/N/X)	Notes:
8	Do all geotechnical reports being submitted contain all applicable Appendices as described in Section 705.8 of the SGE?	Y	
9	Do the Appendices present a site Boring Plan showing all boring locations as described in Section 705.8.1 of the SGE?	Y	
Appendices		(Y/N/X)	Notes:
10	Do the Appendices include boring logs and color pictures of rock, if applicable, as described in Section 705.8.2 of the SGE?	X	
11	Do the Appendices include reports of undisturbed test data as described in Section 705.8.3 of the SGE?	X	
12	Do the Appendices include calculations in a logical format to support recommendations as described in Section 705.8.4 of the SGE?	Y	See GB1 Spreadsheet in Appendix B.