SUBSURFACE SOILS
AND
PAVEMENT INVESTIGATION REPORT

STH 57
(Teutonia Avenue - STH 167)
Milwaukee and Ozaukee Counties, WI
WisDOT Project ID: 2270-04-70

Prepared for:

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January 2011

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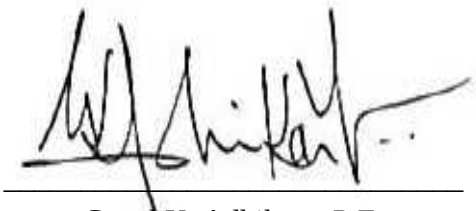

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

AASHTO	American Association of State Highway Transportation Officials
ASTM	American Society of Testing Materials
B-x	Soil boring number
BAOG	Base Aggregate Open Graded
bgs	Below ground surface
bpf	Blows per foot
E/B	Eastbound
EBS	Excavation Below Subgrade
ECRM	Erosion Control Revegetative Mat
N/B	Northbound
NRCS	Natural Resources Conservation Service
PAL	Product Acceptability List
PSI	Professional Service Industries, INC.
q_{est}	Unconfined compressive strength
S/B	Southbound
SPT	Standard Penetration Test
STH	State Highway
tsf	Tons per square foot
USH	United States Highway
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
W/B	Westbound
WDNR	Wisconsin Department of Natural Resources
WisDOT	Wisconsin Department of Transportation

1.0 INTRODUCTION

Himalayan Consultants, LLC (Himalayan) has performed a subsurface and pavement investigation for State Highway (STH) 57 from Teutonia Avenue to Mequon Road (STH 167) in Milwaukee and Ozaukee Counties, Wisconsin (hereafter referred to as project area). The purpose of this investigation was to determine the thickness of the existing pavement, and to evaluate the subsurface conditions along the project area in order to obtain pavement design parameters for use in rehabilitation and reconstruction of the roadway.

Wisconsin Department of Transportation (WisDOT) is the unit of government having jurisdiction in the proposed reconstruction.

2.0 PROJECT DESCRIPTION

WisDOT is planning to mainly resurface the 5-mile segment of STH 57 between Teutonia Avenue (Station 103+00) and STH 167 (Station 289+00), in Milwaukee and Ozaukee Counties (see Figure 1, Appendix A for general location of the project area). The exceptions to the proposed resurfacing are the following locations: STH 57 Bridge over STH 100 (Brown Deer Road) and the intersection of STH 57 with Donges Bay Road. The STH 57 and STH 100 interchange will be reconfigured to accommodate three through lanes and double left turn lanes on Brown Deer Road at the ramp terminals. The profile of STH 57 will also be raised at the bridge in order to attain proper vertical clearance over Brown Deer Road. The reconstruction at the intersection of STH 57 and Donges Bay Road will consist of adding channelizing left turn lanes on Donges Bay Road and more left turn lane capacity on STH 57.

3.0 SOIL SURVEY INFORMATION

The project area runs through the northern part of Milwaukee County and the southern section of Ozaukee County. A review of the USDA Natural Resources Conservation Service (NRCS) Soil Survey for Milwaukee County, Wisconsin indicates that the soils in the southern section of the project area (south of County Line Road) consist predominantly of Martinton silt loam (MgA) and Aztalan loam (AzA). These soil types are formed in loamy outwash over silty lacustrine deposits and are considered to be somewhat poorly drained [Ref. 1].

A typical MgA soil profile consists of: 0-11 inches: silt loam, 11-35 inches: silty clay loam, and 35-60 inches: stratified sandy loam to silty clay. Similarly, a typical profile of AzA consists of: 0-11 inches: loam, 11-27 inches: loam, and 27-60 inches: silty clay loam.

A review of the NRCS Soil Survey of Ozaukee County, Wisconsin indicates that the soils in the northern section of the project area (North of County Line Road) mainly consist of Casco loam

(CeB2) and Fox loam (FoA). These soil types are formed in fine loamy glaciofluvial deposits over sandy and gravelly outwash [Ref. 1].

A typical profile of CeB2 consists of: 0-7 inches: loam and 7-18 inches: clay loam. Similarly, a typical profile of FoA consists of: 0-14 inches: loam, 14-31 inches: clay loam, 31-36 inches: gravelly loam, and 36-60 inches: sand and gravel.

It appears that the soils in the northern part of the project area are relatively well drained in comparison to the soils from the southern section of the project area. The depth to water table in these soils range from 12 to 36 inches in the south and 60 to 80 inches in the north [Ref. 1].

Soils belonging to other soil series include Colwood, Grays, Ashkum, Matherton, Sebewa, Fabius and Dresden. These soils occur sporadically throughout the project area. These minor soil types present include: Colwood silt loam (Cw), Grays silt loam (GrB), Ashkum silt loam (AsA), Matherton silt loam (MmA), Sebewa silt loam (Sm), Fabius loam (FaA), and Dresden silt loam (DsA).

See Table 1 for a summary of major soil series and soil types present in the project area based on USDA NRCS Soil Survey of Milwaukee and Ozaukee Counties.

Table 1: Soil Types and Series along STH-57
STH-57 Reconstruction/Improvement Project
(Teutonia Avenue – STH 167)
Milwaukee and Ozaukee Counties, Wisconsin
Project ID: 2270-04-70

Improvement Type	Station		Boring*	Predominant Soil Type	Predominant Soil Series
	From	To			
Reconstruction	712+00	710+63, 45.90' LT	B-1	Cw, GrB	Colwood, Grays
	710+63, 45.90' LT	704+13, 19.43' RT	B-1 to B-2	GrB, MgA	Grays, Martinton
	105+00	109+20, 17.80' RT	B-3	AsA, Lu	Ashkum, Loamy Land**
	109+20, 17.80' RT	118+47, 37.22' RT	B-3 to B-4	Lu	Loamy Land**
	118+47, 37.22' RT	128+54, 11.04' LT	B-4 to B-5	Lu, MgA	Loamy Land**, Martinton
	128+54, 11.04' LT	139+63, 34.04' RT	B-5 to B-6	MgA, Cw	Martinton, Colwood
	139+63, 34.04' RT	151+95, 19.31' LT	B-6 to B-7	Cw, GrA	Colwood, Grays
	151+95, 19.31' LT	160+95, 37.25' RT	B-7 to B-8	GrA, AzA	Grays, Aztalan
	160+95, 37.25' RT	171+30, 38.61' LT	B-8 to B-9	AzA, Lu, MmA	Aztalan, Loamy Land**, Matherton
Resurfacing	171+30, 38.61' LT	183+31, 5.90' RT	B-9 to B-10	Lu, MmA	Loamy Land**, Matherton
	183+31, 5.90' RT	205+58, 10.41' LT	B-10 to B-11	MmA, FoA, CeB2, Sm	Matherton, Fox, Casco, Sebewa
	205+58, 10.41' LT	225+31, 12.68' RT	B-11 to B-12	Sm, CeB2, FaA, FoA	Sebewa, Casco, Fabius, Fox
Reconstruction	804+00	806+00, 3.91' RT	B-13	Aza, FoA	Aztalan, Fox
	806+00, 3.91' RT	809+19, 11.94' RT	B-13 to B-14	FoA, MmA	Fox, Matherton
Resurfacing	225+31, 12.68' RT	238+50, 17.01' RT	B-12 to B-15	FoA	Fox
	238+50, 17.01' RT	259+90, 8.43' LT	B-15 to B-16	FoA, Dsa, CeB2	Fox, Dresden, Casco
	259+90, 8.43' LT	277+38, 9.80' RT	B-16 to B-17	CeB2, Dsa,	Casco, Dresden
	277+38, 9.80' RT	289+00	B-17	CeB2	Casco

Note:
*Refer to section 4.0; **Loamy land is not a soil series but a soil type; RT = Right; LT = Left

4.0 SUBSURFACE INVESTIGATION

4.1 Field Investigation

On November 29 and 30, 2010 Professional Service Industries, Inc. (PSI), under a contract with Himalayan, advanced 17 test borings (B-1 through B-17) in the project area. Except for four borings (B-1, B-2, B-13 and B-14 located on STH 100 and Donges Bay Road respectively), the remaining thirteen borings were located on STH 57. The thirteen borings located on STH 57 were advanced through the existing pavement on the southbound (S/B) and northbound (N/B) lanes of STH 57 and alternated through the travel lanes. Similarly, four borings located on STH 100 and Donges Bay Road were advanced through the existing pavement on the eastbound (E/B) and

westbound (W/B) lanes and alternated through the travel lanes. All borings were advanced to 5 feet below ground surface (bgs). See Figures 2-1 through 2-13, Appendix A for boring locations. The boring locations were determined by Crispell-Snyder, Inc (CSI) and marked in the field by Himalayan. Some of these locations were slightly adjusted in the field by Himalayan to avoid conflicts with the existing utilities.

Ground surface elevations and stationing of the boring locations were provided by CSI (see Soil Boring Logs, Appendix B).

Borings were advanced with a rotary drilling rig in general accordance with the specifications for the Standard Penetration Test (SPT) ASTM D-1586 (AASHTO T206) [Ref. 2]. Soil sampling was performed at every 2.5-foot interval, using a 2-inch outside diameter by 1.375-inch inside diameter split-spoon sampler. The split-spoon sampler is driven 18 inches using a 140-pound hammer, and the blow counts are recorded for every six-inch penetration. The SPT "N" value is the total number of blows required to penetrate the last 12 inches (Standard Penetration Resistance).

During field activities, the total thickness of the pavement including the pavement type (asphaltic concrete or Portland Cement Concrete) and individual thickness of each pavement type was measured and recorded along with the observed thickness of base course present. In addition, Himalayan visually classified the soils and prepared a field log of each boring.

Upon completion of the drilling operations, the soil samples were taken to Himalayan's office for further examination and determination of natural water content. Each sample was examined and classified by Himalayan in accordance with the Unified Soil Classification System (USCS).

Upon completion of sampling and water level observations, all boreholes were properly abandoned/backfilled as per the April 20, 1992 guidelines titled "Wisconsin Department of Transportation Geotechnical Section – Drilled Borehole and Monitoring Well Abandonment Procedures" [Ref. 4]. The existing pavement surface through which the boreholes were drilled was patched with asphalt.

4.2 Field and Laboratory Testing

Estimates of unconfined compressive strengths (q_{est}) were conducted on cohesive samples in the field using a pocket penetrometer. The q_{est} values for the subsurface soils ranged from 0.75 to 4.5 tons/square foot (tsf). The standard penetration resistance (N value) for the soils recorded during drilling ranged from 4 to 48 blows per foot (bpf). The natural water content determinations were performed on all cohesive samples obtained in accordance with applicable ASTM/AASHTO specifications. The natural water content for the cohesive soils ranged from 9 to 27 percent. Refer

to the Soil Boring Logs in Appendix B for q_{est} values, N values, and water content determination test results.

5.0 SITE CONDITIONS

5.1 Surface Conditions

The pavement on STH 57 consists of an asphalt overlay followed by a concrete base. Visual inspection of the pavement found cracks in asphalt occurring over the joints in the concrete base and high severity reflection cracking is occurring at these joints in the asphaltic overlay. From riding the road, it is evident that the joints in the concrete base are also faulting. One other common pavement distress noted were numerous spalled interconnected cracks, also known as alligator cracks, potentially due to repeated traffic loading in the traveled lanes.

5.2 Subsurface Conditions

5.2.1 Pavement

Table 2 presents the summary of the pavement type (asphaltic concrete or concrete), individual thickness of each pavement type, and total thickness of the pavement encountered at each boring location (along with the observed base course thickness) throughout the project area.

Based on 17 borings advanced in the project area (eight on the N/B lanes and five on the S/B lanes and four off of STH 57 at STH 100 and Donges Bay Road), the approximate thickness of the pavement encountered was:

- Asphaltic concrete = 4 to 12 inches
- Concrete base = 0 to 11 inches
- Aggregate base course = 4 to 6 inches
- Total pavement thickness = 6 to 18 inches

Table 2. Existing Pavement Information
STH-57 Reconstruction/Improvement Project
(Teutonia Avenue - STH 57)
Milwaukee and Ozaukee Counties
Project ID: 2270-04-70

Improvement Type	Boring	Location Along STH-57		Asphaltic Concrete (Inch)	Concrete (Inch)	Base Course (Inch)	Pavement Thickness (Inch)
		Location	Approximate Station (feet)				
Reconstruction	B-1	STH 100 WB	710+63, 45.90' LT	4.0	9.0	5.0	13.0
	B-2	STH 100 EB	704+13, 19.43' RT	4.0	9.0	6.0	13.0
	B-3	STH 57 NB	109+20, 17.80' RT	4.0	8.0	6.0	12.0
	B-4	STH 57 NB	118+47, 37.22' RT	3.0	9.0	6.0	12.0
	B-5	STH 57 SB	128+54, 11.04' LT	4.0	9.0	6.0	13.0
	B-6	STH 57 NB	139+63, 34.04' RT	4.0	10.0	6.0	14.0
	B-7	STH 57 SB	151+95, 19.31' LT	4.0	11.0	6.0	15.0
	B-8	STH 57 NB	160+95, 37.25' RT	4.0	9.0	5.0	13.0
	B-9	STH 57 SB	171+30, 38.61' LT	4.0	9.0	6.0	13.0
Resurfacing	B-10	STH 57 NB	183+31, 5.90' RT	12.0	6.0	6.0	18.0
	B-11	STH 57 SB	205+58, 10.41' LT	9.0	6.0	6.0	15.0
	B-12	STH 57 NB	225+31, 12.68' RT	10.0	4.0	4.0	14.0
Reconstruction	B-13	Donges Bay EB	806+00, 3.91' RT	6.0	0.0	5.0	6.0
	B-14	Donges Bay EB	809+19, 11.94' RT	6.0	0.0	6.0	6.0
Resurfacing	B-15	STH 57 NB	238+50, 17.01' RT	6.0	0.0	6.0	6.0
	B-16	STH 57 SB	259+90, 8.43' LT	8.0	8.0	6.0	16.0
	B-17	STH 57 NB	277+38, 9.80' RT	6.0	8.0	6.0	14.0

Note:
NB = Northbound; SB = Southbound; RT = Right; LT = Left

5.2.2 Information from Test Borings

Below is a summary of the soil and groundwater conditions observed in the project area based on the subsurface conditions observed at the boring locations.

A. <u>Southern Section: Teutonia Avenue to County Line Road (Includes STH 100 Brown Deer Road Borings):</u>

Based on the soils encountered in borings B-1 through B-8, fill and/or possible fill materials consisting of sandy lean clays and clayey sands were encountered below the pavement to depths ranging from 2 to boring terminal depths (5 feet bgs) in borings B-1 through B-4, B-6, and B-8. Except in B-3, B-4, and B-6, native lean clays with trace amounts of sand and gravel at varying

proportions were encountered below the fill or possible fill materials to 5 feet bgs. Native lean clays and silty sands were encountered below the pavement to 5 feet bgs in borings B-5 and B-7, respectively.
The N values for the soils ranged from 4 to 48 bpf and the q_{est} values for cohesive soils ranged from 0.75 to 4.5 tsf.

Based on observations made during and completion of drilling activities, no groundwater was encountered in any of the borings.

B. <u>Northern Section: County Line Road to STH 167 Mequon Road (Includes Donges Bay Road Borings):</u>

Based on the subsurface soils observed in borings B-9 to B-17, possible fill materials containing silty sands, clayey sands, and lean clays were encountered to 3 feet bgs in borings B-8 through B-12, B-15 and B-17. Native silty/clayey sands with varying amounts of gravel were encountered below the possible fill materials to the boring terminal depths (5 feet bgs) in borings B-9 through B-12, B-15, and B-17 and below the pavement to 5 feet bgs in borings B-13 and B-14.

The N values for the soils ranged from 5 to 29 bpf and the q_{est} values for the cohesive fill or possible fill materials encountered was 4.0 tsf.

Based on observations made upon completion of drilling activities, groundwater was encountered at 2 feet bgs in B-5 (see Appendix B).

The soil profiles observed in the test borings correlated well with the soil data obtained from the USDA NRCS Soil Survey of Milwaukee and Ozaukee Counties.

In view of the above observations, the pavement subgrade in the project area is comprised of the following soils:

- Southern Section: Fill or possible fill materials consisting of sandy lean clays and lean clays, and/or native soils consisting of native lean clays
- Northern Section: Possible fill materials consisting of silty sands, clayey sands, and lean clays and/or native soil consisting of silty sands with gravels at varying proportions.

It appears that this transition in the subgrade soils (from lean clays to silty sands) within the project area occurs at approximately the location of County Line Road.

6.0 EROSION CONTROL

6.1 Vegetation

Vegetation should be established as soon as possible following excavation, grading, and compaction in order to obtain temporary and permanent stabilization of the project area during and after construction. Based upon the project area, a No. 30 mix could be used for seeding because of the urban cross section and the exposure to salt that is expected to occur within 15 feet of shoulders, ditches, and inslopes. In permanent seeding areas, permanent seed should be mixed with temporary seed to ensure rapid germination.

Permanent seeding and temporary seeding should be mulched and fertilized. Based on the information obtained from Section 629 of WisDOT Standard Specifications for Highway and Structure Construction, type B fertilizer, containing not less than 16 percent sum total of nitrogen, not less than 6 percent of phosphoric acid, and not less than 24 percent of potash, with an application rate of about 300 pounds per acre (7 pounds/1000 square feet) could be used for permanent seeding, temporary seeding and sod [Ref. 4].

To reduce surface erosion and promote a rapid establishment of permanent grass cover, organic control revegetative mat (ECRM) may be used in the seeded areas.

6.2 Silt Fence

Silt fence should be used to intercept and detain small amounts of sediments from disturbed areas during construction operations and to decrease the velocity of sheet flows. Silt fence should be placed by the contractor according to the latest WisDOT Standard Specifications under section 628 regarding silt fence [Ref 4]. The type of material used for silt fence should comply with WisDOT's Product Acceptability List (PAL). Silt fence can be used with erosion bales in ditch areas in order to prevent sediments from entering the storm sewer inlets located in the project area.

6.3 Riprap

Depending on the type of culverts, riprap should be considered at the downstream sides of culverts as per Sections 520 to 530 and 606 of WisDOT Standard Specifications for Highway and Structure Construction to prevent scouring and to minimize the potential for downstream erosions [Ref. 4].

Suitable WisDOT PAL geotextile fabric could also be installed directly below the riprap to minimize the loss of underlying soil.

7.0 PAVEMENT DESIGN PARAMETERS

Pavement design parameters have been developed using the pedological design tables with soil support values selected using the empirical correlations between the observed soil type and design parameters published in the WisDOT Soils Manual and Geotechnical Bulletin No.1. See Table 3 for the recommended design parameters for the project.

Table 3. Pavement Design Parameters
STH 57 Reconstruction/Improvement Project
(Teutonia Ave to STH 167 Mequon Rd)
Milwaukee and Ozaukee Counties, Wisconsin
Project ID: 2270-04-70

SOUTHERN SECTION (Teutonia Ave to County Line Road)	
Estimated AASHTO Classification	A-6
Unified Soil Classification	CL
Design Group Index (DGI)	14
Soil Support Value (SSV)	4.0
Modulus of Subgrade Reaction (k, psi/in)	125
Frost Index (FI)	F-3
Shrinkage Factor (%)	30
NORTHERN SECTION (County Line Road to STH 167 Mequon Road)	
Estimated AASHTO Classification	A-2
Unified Soil Classification	SC
Design Group Index (DGI)	12
Soil Support Value (SSV)	4.5
Modulus of Subgrade Reaction (k, psi/in)	150
Frost Index (FI)	F-3
Shrinkage Factor (%)	20

8.0 EXCAVATION BELOW SUBGRADE

Based on the near surface and subsurface soils encountered at boring locations, no significant excavation below subgrade (EBS) is anticipated. However, the location in and around boring B-4 in the southern section and B-12 in the northern section indicated an area of loose or soft soils with low N values (ranging from 4 to 5 for soils below or immediately below the base course). These are considered isolated areas and may constitute a limited EBS. Other areas with soft/loose soils may be encountered that may require a limited EBS as well. Undistributed quantities of EBS should be used for this scenario as field point load tests will be conducted by engineers in the field if they encounter soft or loose soil during construction. Unsuitable soils should be undercut to

expose stable soil conditions and backfilled with competent materials to obtain a stable subgrade. Areas requiring such fill treatment may be addressed in one of the two manners:

- Partially undercutting soft/loose soils and placing a 6 to 12 inch thick compacted layer of clean, coarse crushed rock (breaker run) into the subgrade, or

- Entirely replacing the unstable soils with compacted granular fill.

Alternatively, the usage of fly-ash soil stabilization could be considered an alternative to EBS. Fly-ash stabilization could be applicable from Teutonia Avenue to Deerwood Drive due to the minimal cross traffic in this area. Fly-ash stabilization was used previously in this area back in 2009 on the STH 100 Brown Deer Road Rehabilitation Project (ID: 2320-00-70) directly east of the STH 57 project area with very similar soils.

9.0 DRAINAGE

9.1 Southern Section

Given the pavement subgrade of predominantly lean clays present in the project area and relatively impermeable nature of these soils, a permeable base aggregate open graded (BAOG), minimum 4-inch thick, with an edge drain system consisting of a conventional circular pipe underdrain with a 6-inch diameter could be considered to facilitate pavement drainage. A filter layer of 6 inches of crushed aggregate base course or a geotextile fabric could be used over the existing subgrade of silty and lean clays to prevent the BAOG layer from contamination, which will act as a good working platform and also minimize frost action.

If sections of the project area are stabilized with breaker run or fly ash, then a standard 6-inch minimum 1.25-inch dense graded base course could be used over the top of the stabilized areas. Underdrains should be used in low areas and sags of vertical curves.

9.2 Northern Section

Given the pavement subgrade of predominantly silty sands with gravel in the project area and relatively permeable nature of these soils, a typical dense base aggregate 1.25 inch, minimum 6-inches thick could be used for a base course to accommodate the pavement. The use of underdrains should also be considered to drain the pavement structure especially in low areas and sags of vertical curves. With an urban cross section underdrains are to be placed longitudinally beneath the curb (refer to WisDOT Standard Detail Drawing 8D15-4a for underdrains in an urban

section). For 500 foot longitudinal spacing or less the usage of a non-metallic perforated pipe with a 6-inch diameter could be considered to facilitate sub base drainage.

10.0 LIMITATIONS

Himalayan prepared this report for CSI's use as part of the evaluation of subsurface conditions in the project area. It was prepared in accordance with the current WisDOT's guidelines and currently accepted geotechnical engineering practices as conducted within the site region by similar qualified consultants. Because the evaluation is based upon subsurface physical data obtained from soil borings only at specific locations and time and only to the depths sampled, the report does not reflect potential variations in the subsurface conditions that could occur between or beyond the limits of the test borings that were used for analysis. The conclusions or recommendations contained in this report represent our professional opinions. No warranty or guarantee is expressed or implied. If variations are encountered and/or the project scope is altered, further evaluation and testing should be performed by a geotechnical engineer.

11.0 REFERENCES

1. United States Department of Agriculture Natural Resources Conservation Service (2007). URL: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

2. American Society for Testing and Materials (1992). Method for Penetration Test and Split Barrel Sampling of Soils.

3. Wisconsin Department of Transportation. Geotechnical Bulletin No. 1.

4. Wisconsin Department of Transportation (2011). Standard Specifications for Highway and Structure Construction.

APPENDICES

Appendix A. Figures

Figure 1: Project Area Location Map
Figures 2-1 to 2-11: Boring Location Maps

Appendix B. Soil Boring Logs and Unified Soil Classification System

APPENDIX A

MAPS AND FIGURES

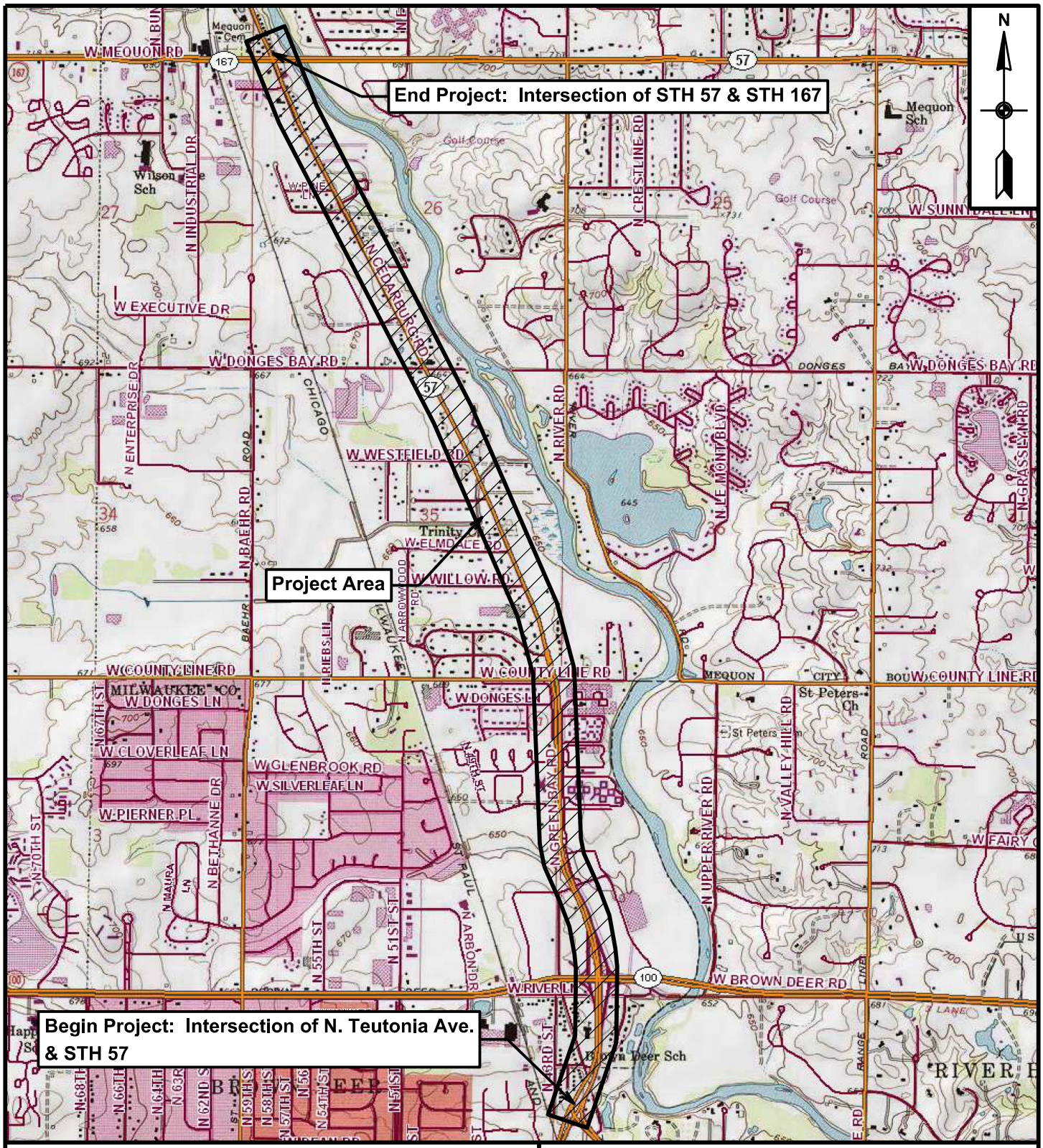

Figure 1. PROJECT AREA LOCATION MAP

Source: National Geographic
USGS 7.5' Topographic Map - Thiensville Quadrangle (1976)

Scale: 1 inch = ~2400 feet

HIMALAYAN CONSULTANTS, LLC
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Project ID:
2270-04-70
STH 57 (Teutonia Ave to Mequon Rd)
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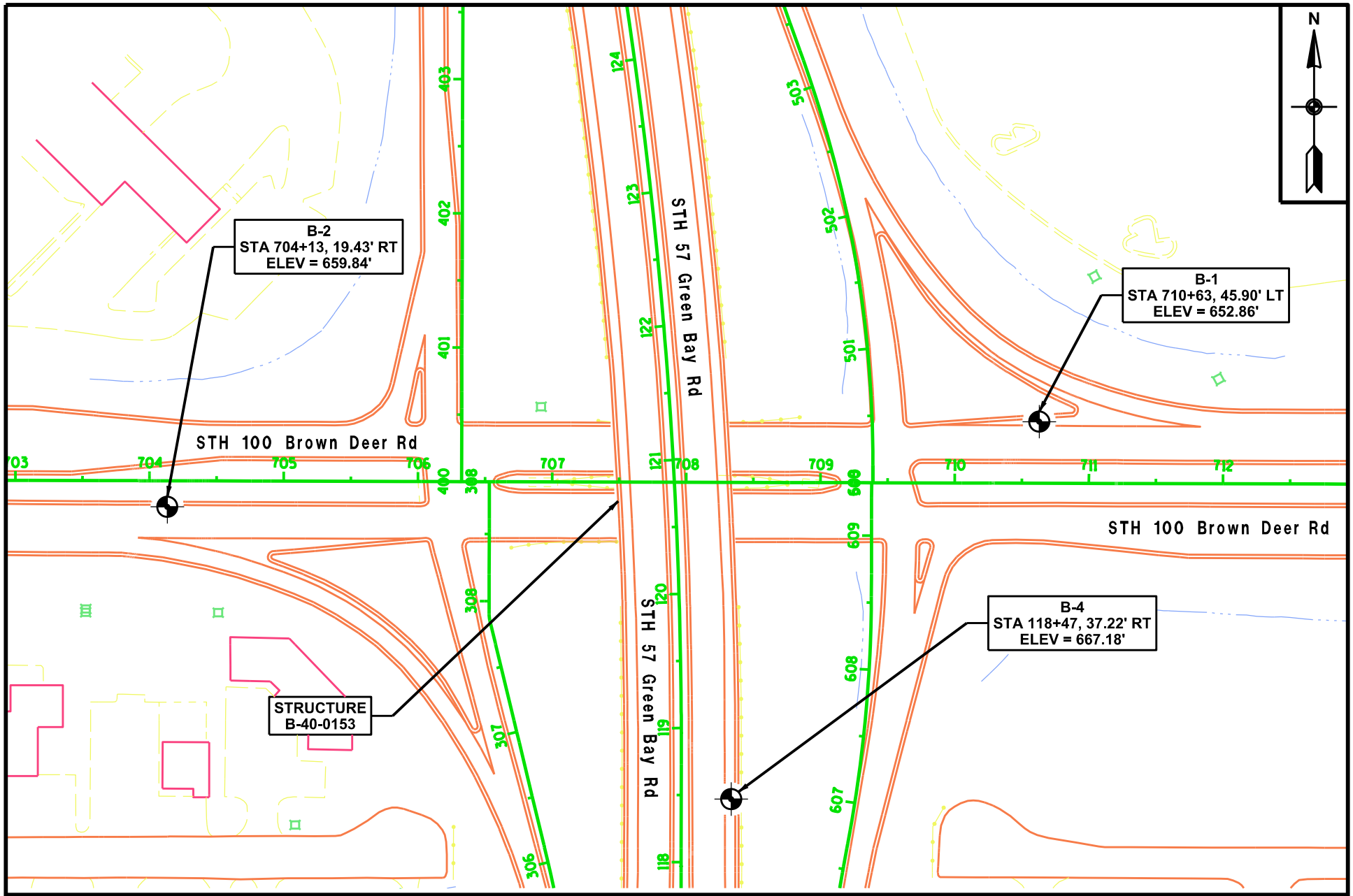


FIGURE 2-1	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100	01/12/2011	
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

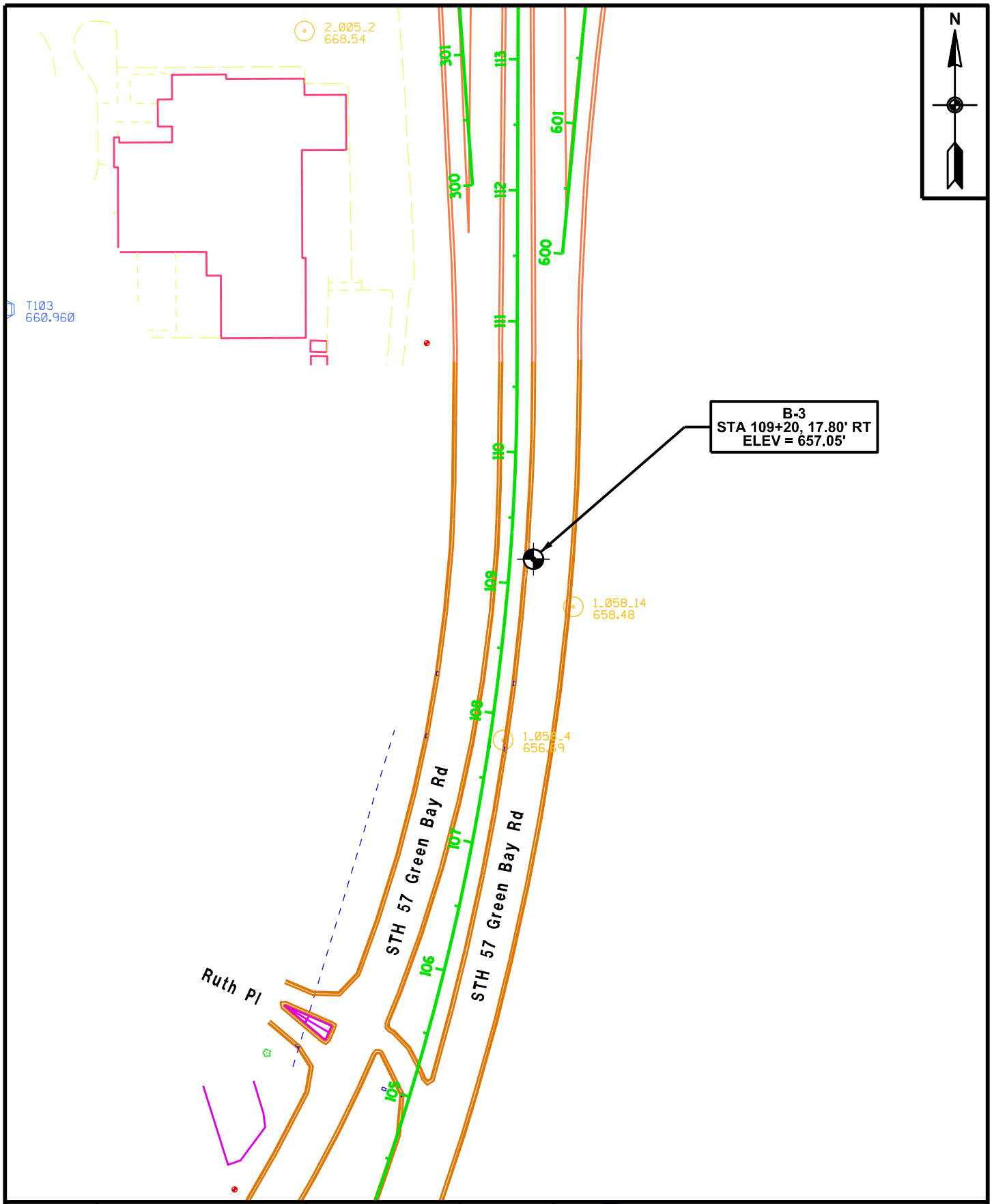


FIGURE 2-2	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE 01/12/2011	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100		
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

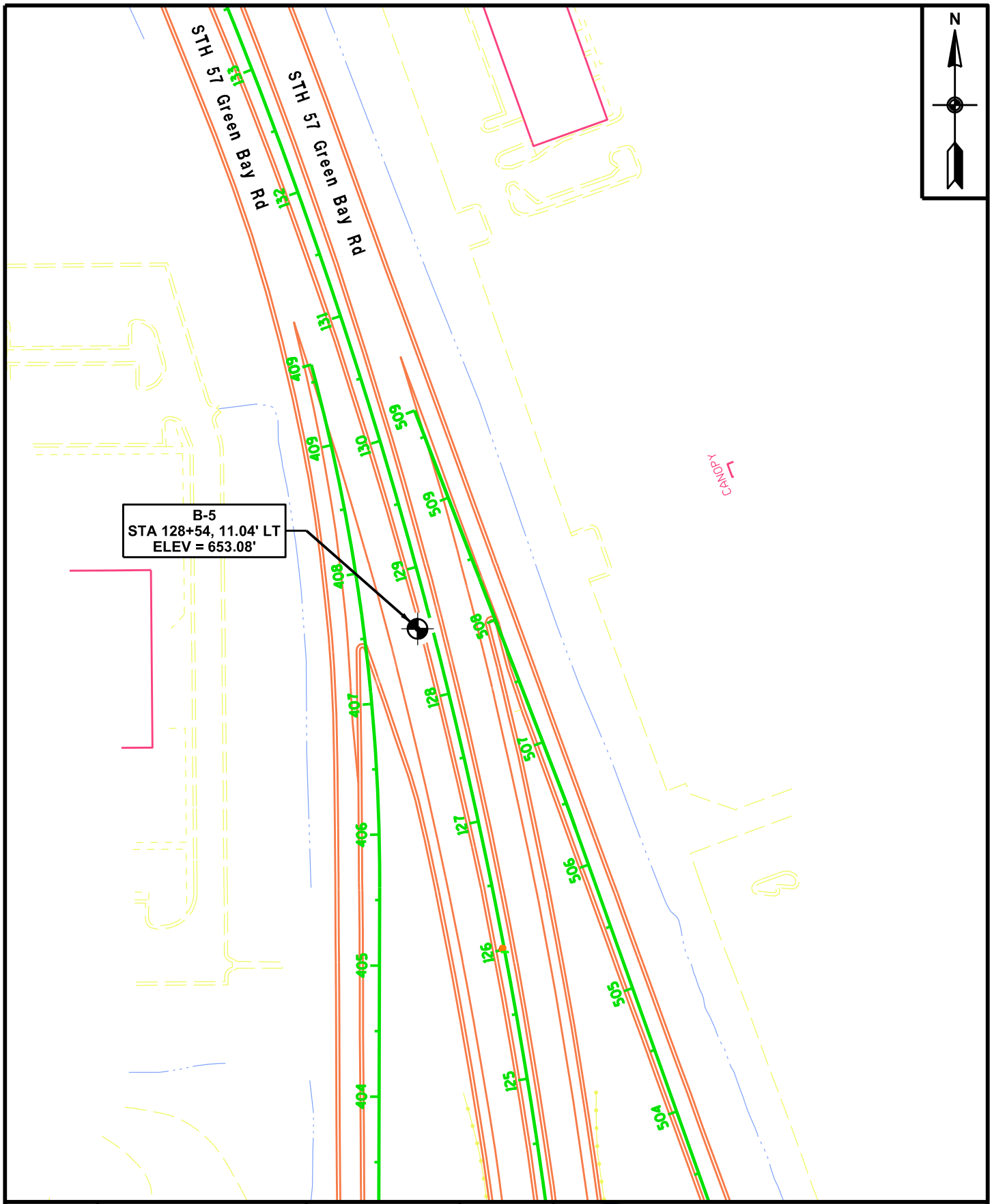


FIGURE 2-3	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100	01/12/2011	
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

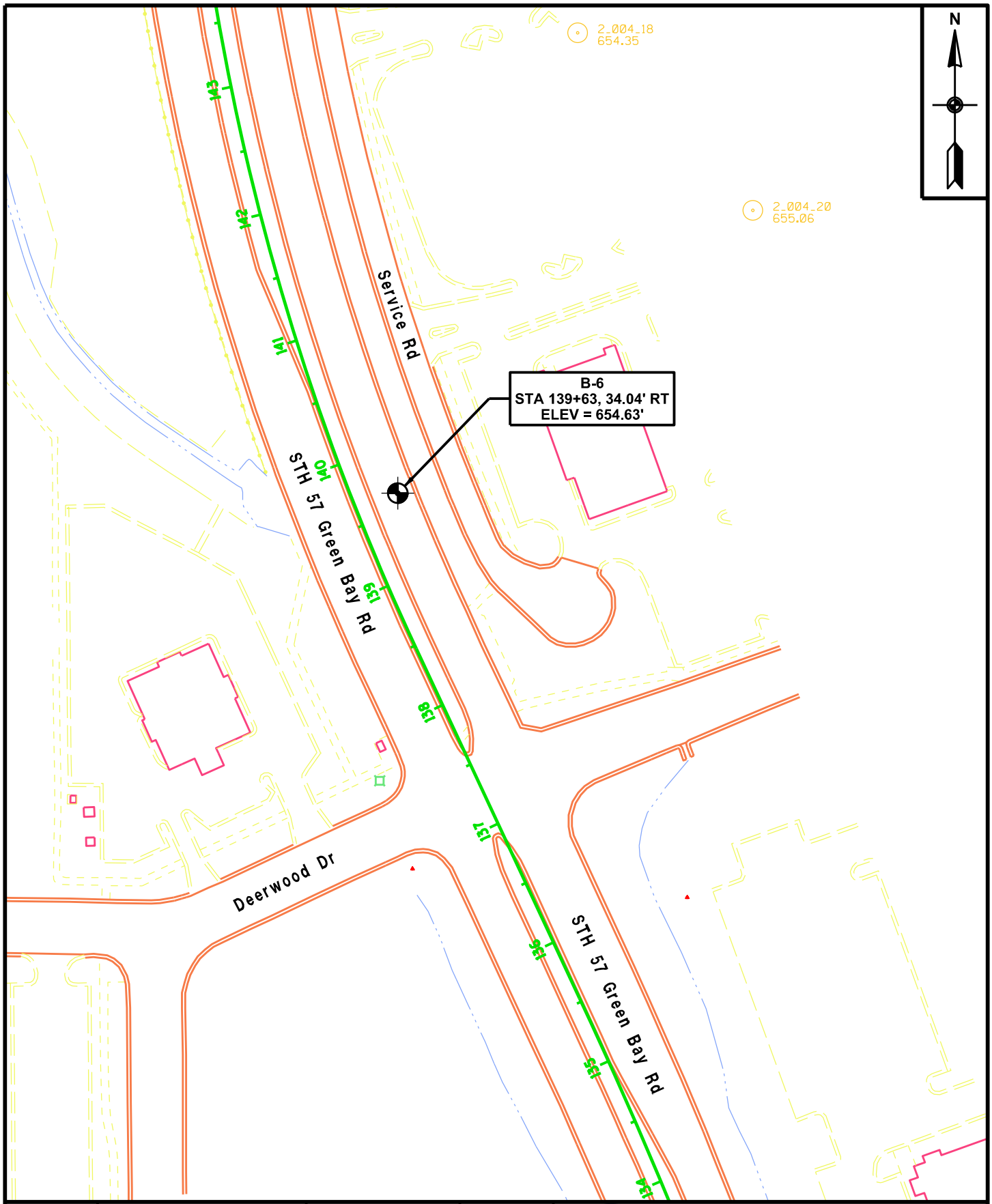


FIGURE 2-4	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100	01/12/2011	
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

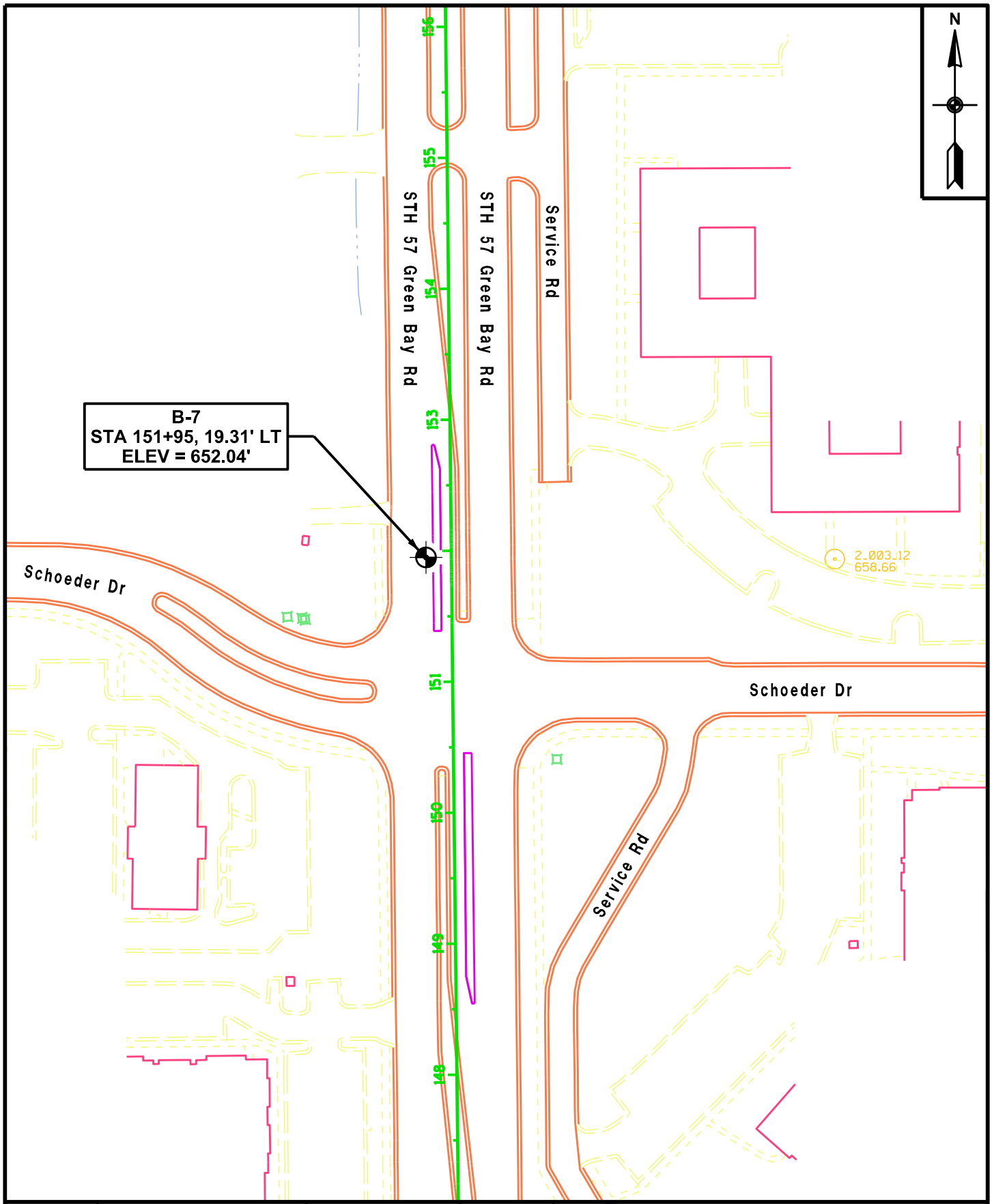


FIGURE 2-5	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE 01/12/2011	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100		
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

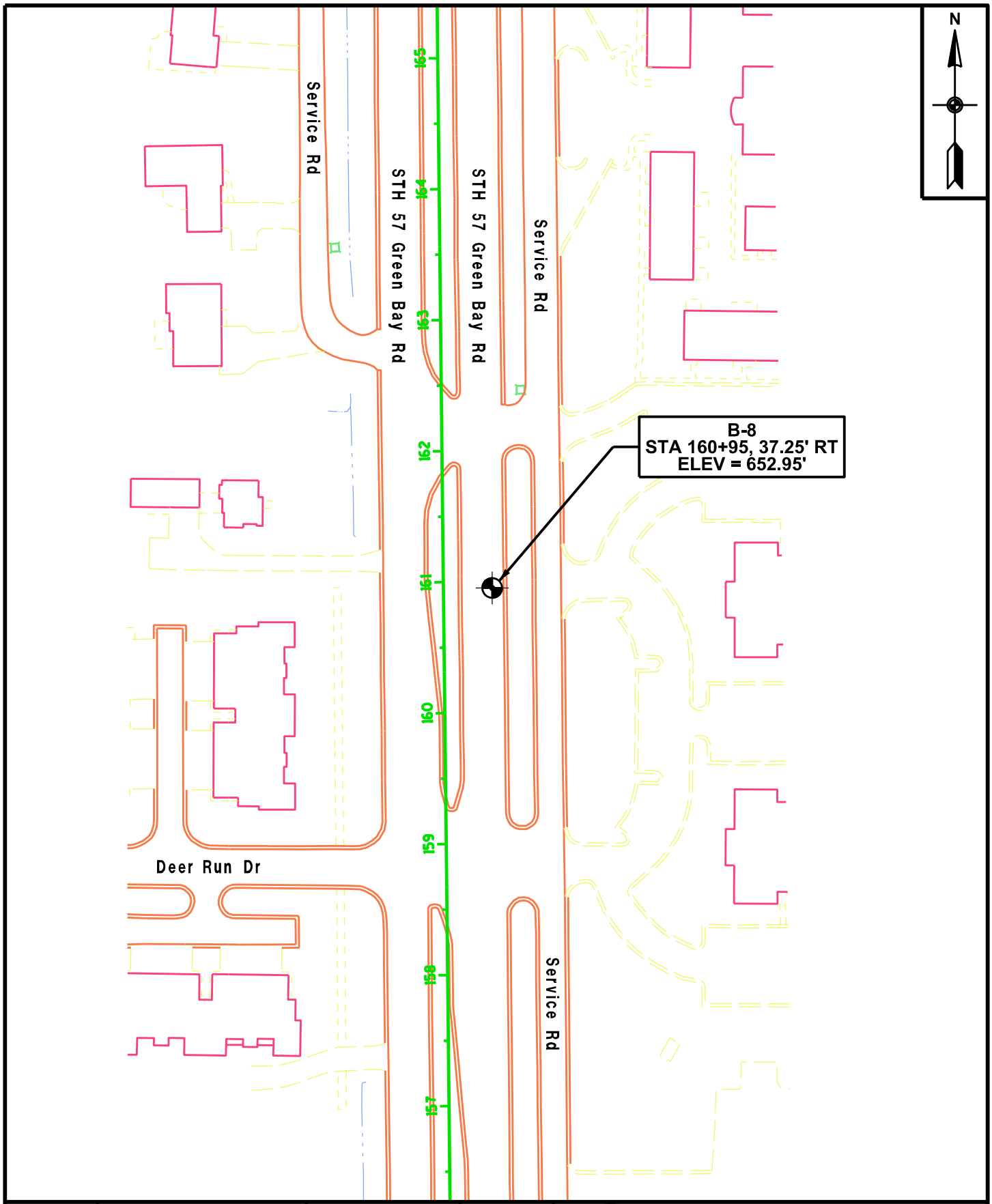


FIGURE 2-6	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE 01/12/2011	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100		
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

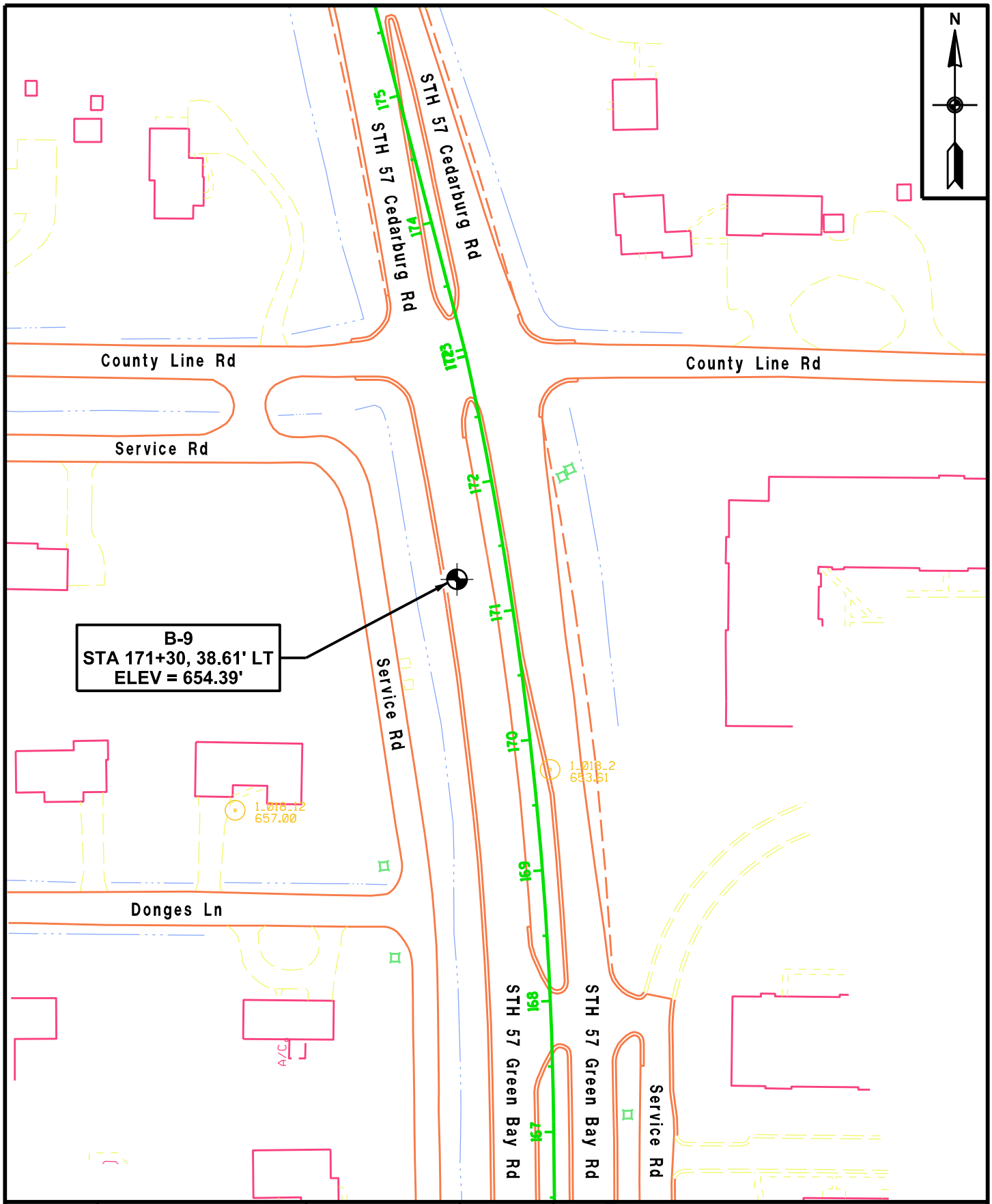


FIGURE 2-7	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100	01/12/2011	
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

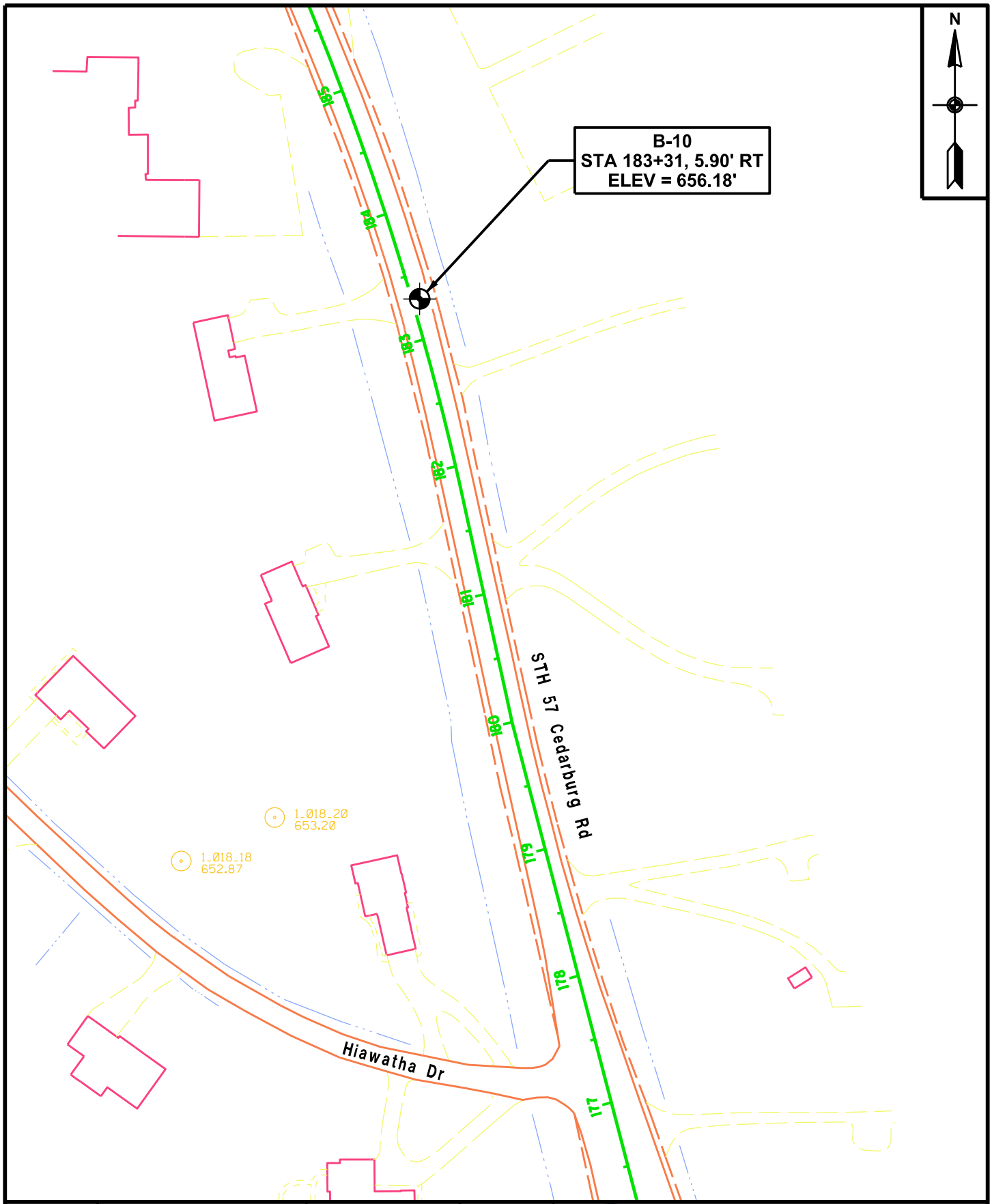


FIGURE 2-8	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE 01/12/2011	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100		
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

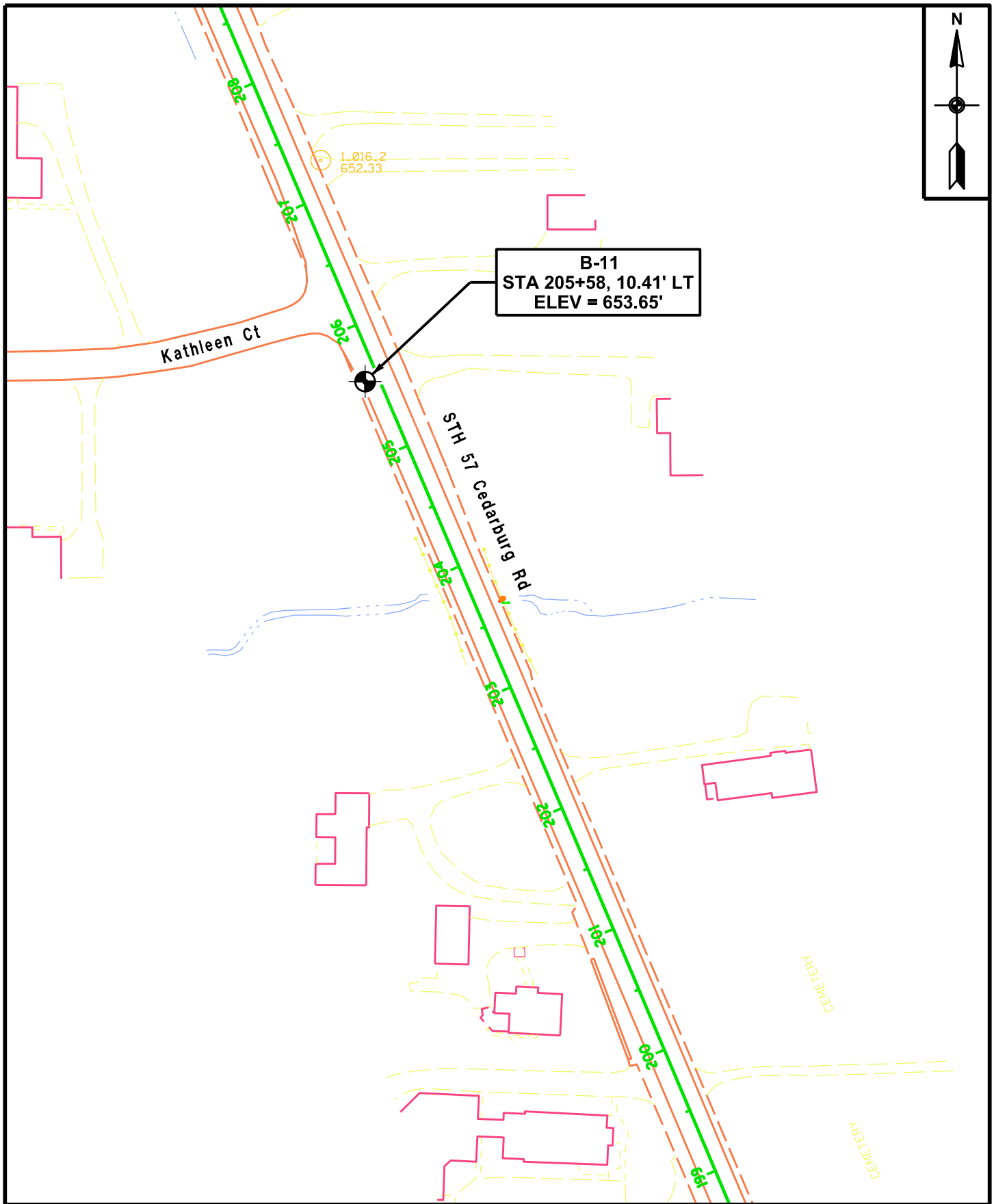


FIGURE 2-9	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE 01/12/2011	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100		
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

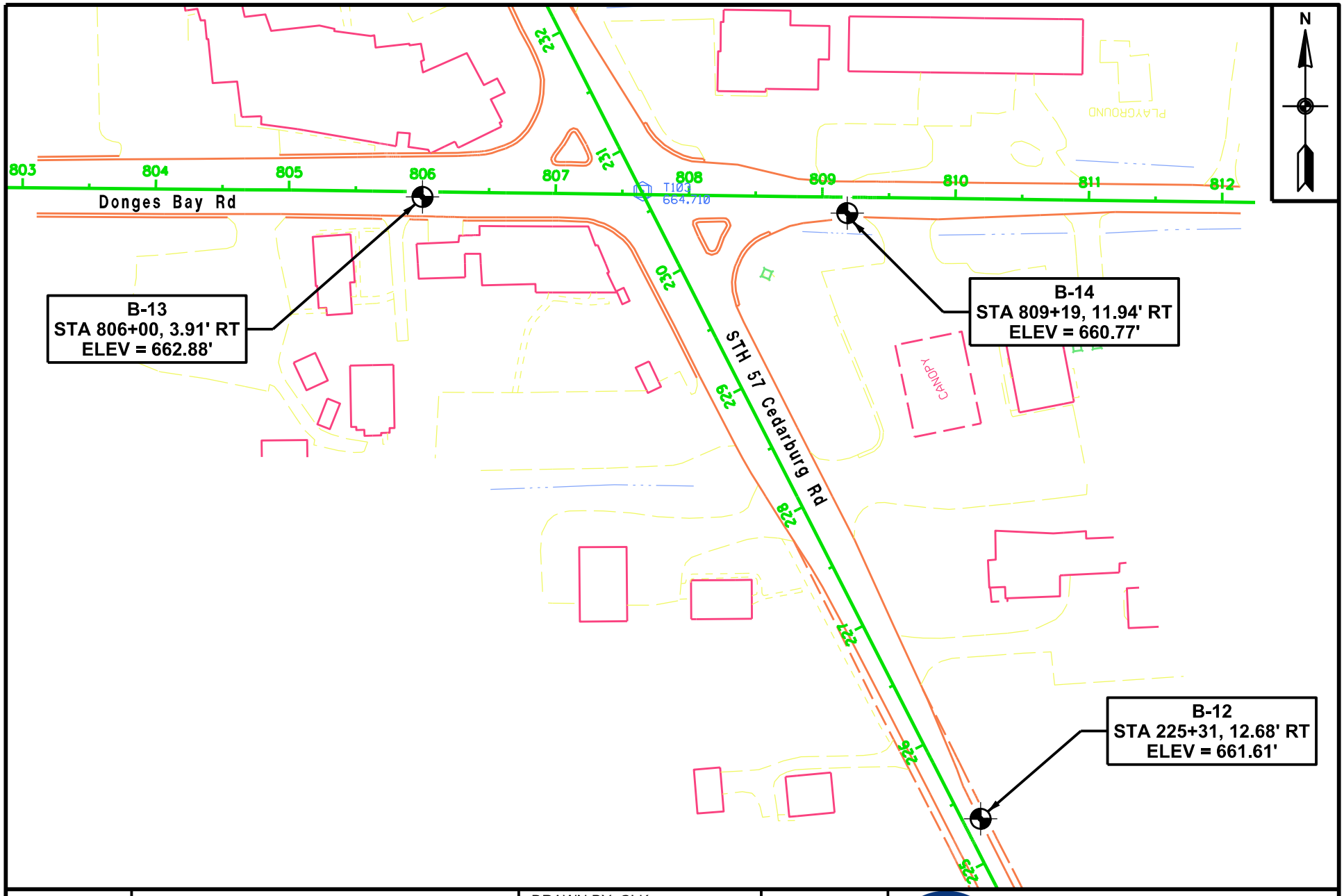


FIGURE 2-10	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100	01/12/2011	
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

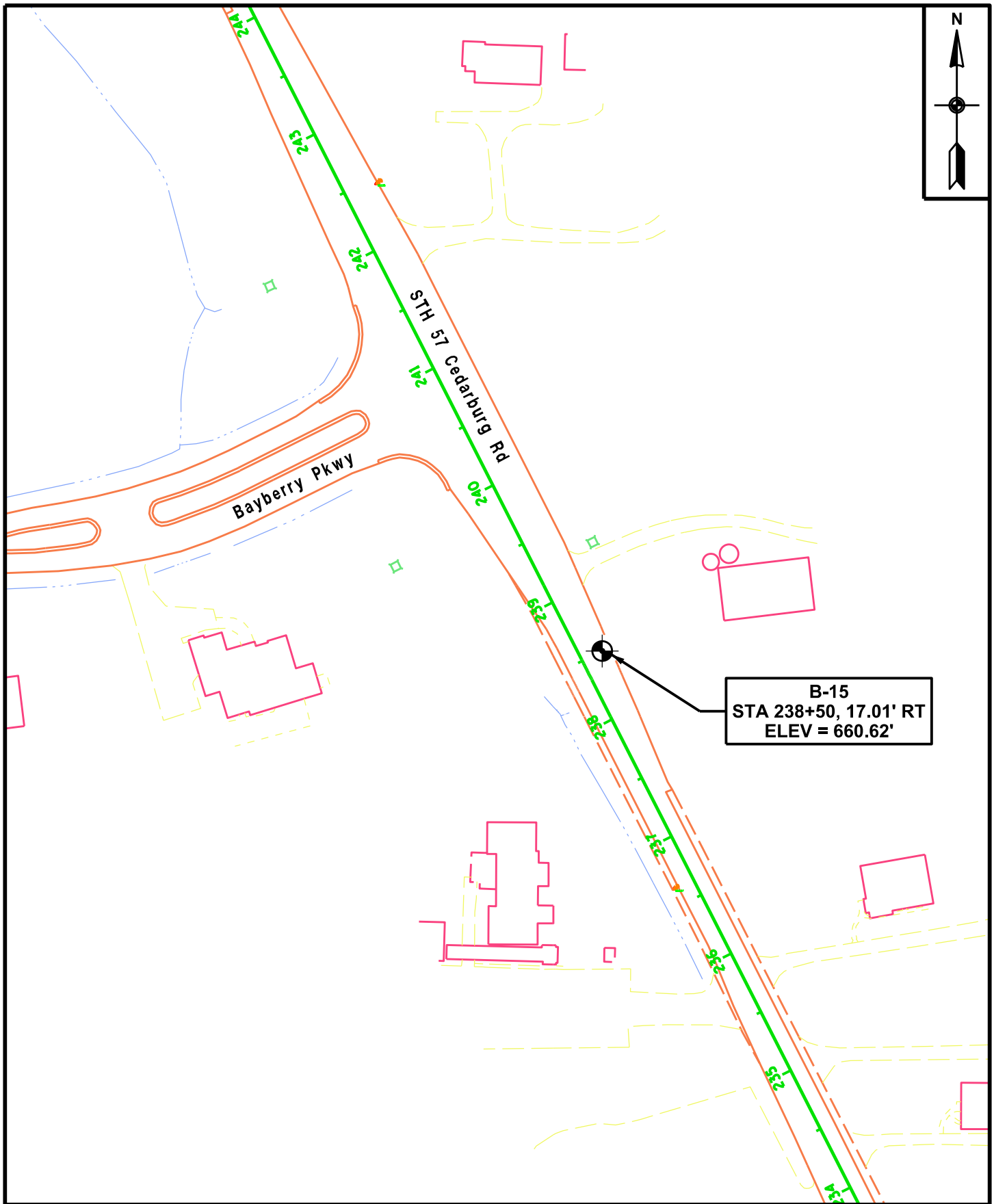


FIGURE 2-11	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE 01/12/2011	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100		
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

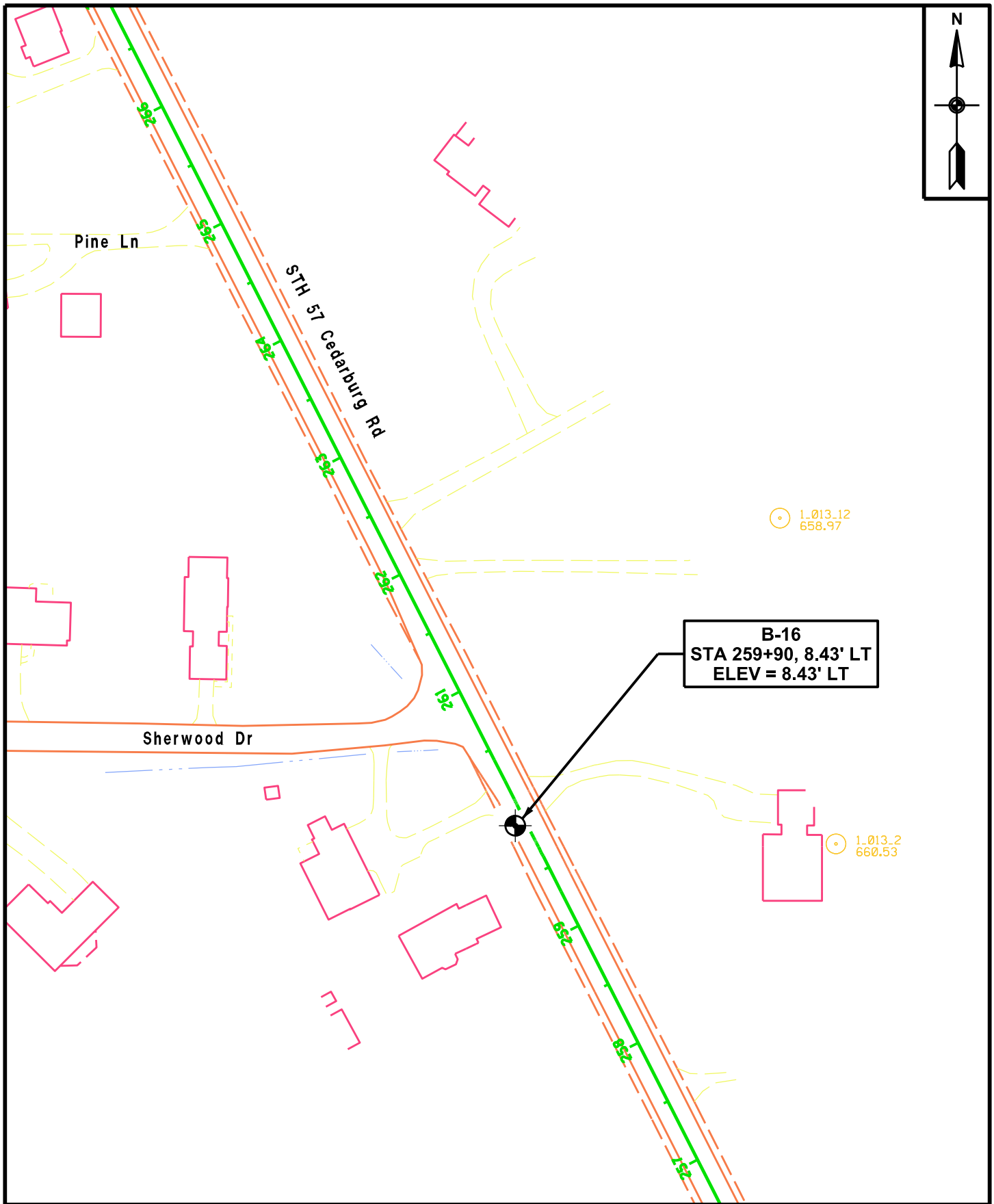


FIGURE 2-13	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE 01/12/2011	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100		
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

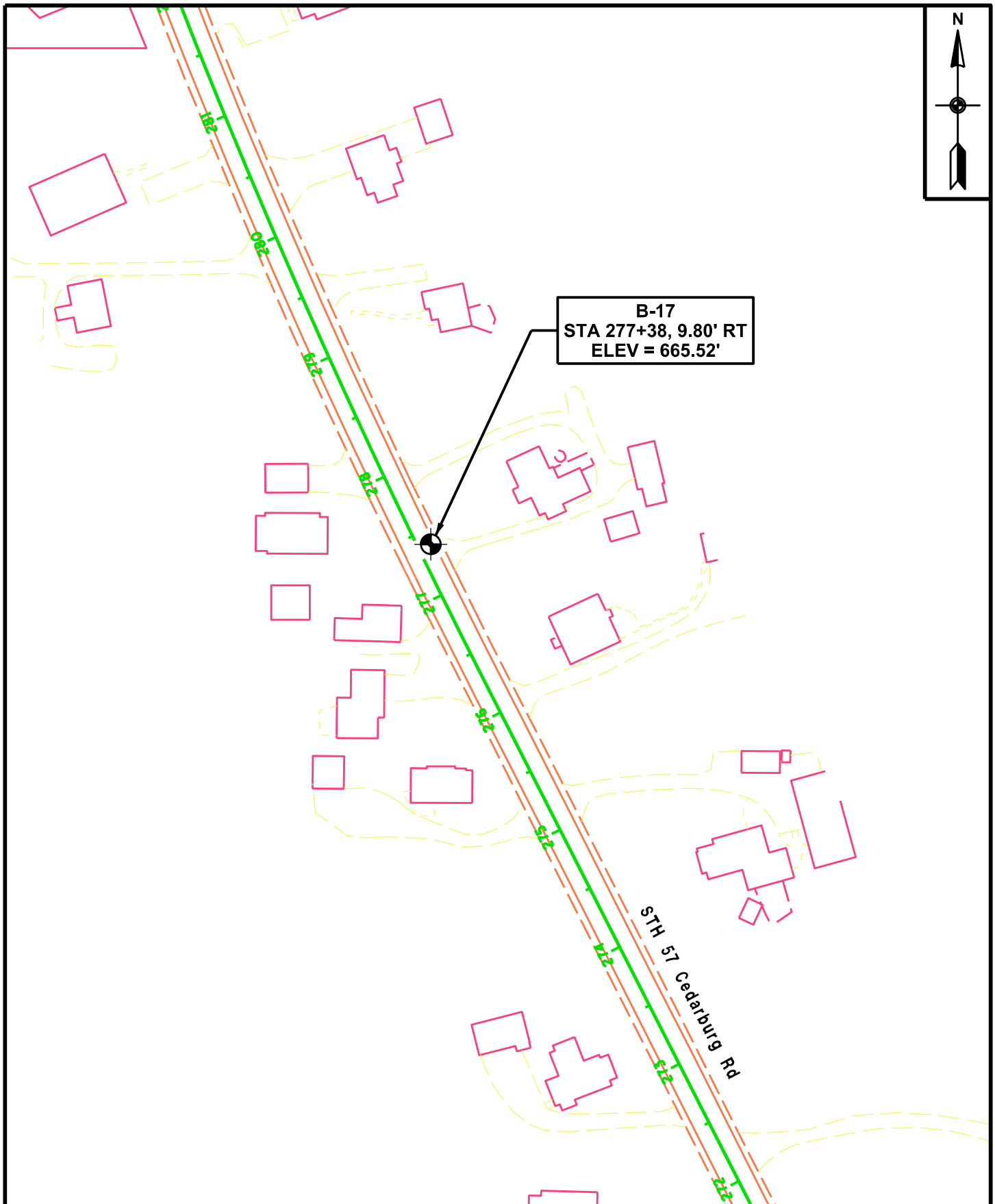


FIGURE 2-13	BORING LOCATION MAP	DRAWN BY: CLK CHECKED BY: GKA	DATE 01/12/2011	**HIMALAYAN CONSULTANTS, LLC** Engineers and Hydrogeologists W156 N11357 Pilgrim Road Germantown, Wisconsin 53022 Phone: (262) 502-0066
	PROJECT NO: 2270-04-70	SCALE, FEET 0 50 100		
	HWY: STH 57	Base map provided by Crispell-Snyder, INC.		

APPENDIX B

SOIL BORING LOGS

AND

UNIFIED SOIL CLASSIFICATION

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 710+63, 45.90' LT

Boring No. B-1
Surface Elevation 652.86 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	4-inch asphaltic concrete						
						9-inch concrete base						
					1	5-inch aggregate base course						
						SANDY LEAN CLAY (POSSIBLE FILL/CL): Hard, dark brown, moist, trace fine gravel	4.5	9				
1	SS	18"	M	16	2							
					3							
					4	LEAN CLAY (CL): Hard, gray, moist, brown mottled, trace fine gravel	4.5	16				
2	SS	18"	M	17	5							
						End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC

W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 704+13, 19.43' RT

Boring No. B-2
Surface Elevation 659.84 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	4-inch asphaltic concrete						
						9-inch concrete base						
					1	6-inch aggregate base course						
						SANDY LEAN CLAY (POSSIBLE FILL/CL): Hard, olive brown, moist	4.5	18				
					2	LEAN CLAY (CL): Hard, brown, moist, trace fine sand						
1	SS	12"	M	12								
					3							
					4		4.5	19				
2	SS	18"	M	24								
					5	End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 109+20, 17.80' RT

Boring No. B-3
Surface Elevation 657.05 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	4-inch asphaltic concrete						
						8-inch concrete base						
					1	6-inch aggregate base course						
1	SS	10"	M	7	2	SANDY LEAN CLAY (POSSIBLE FILL/CL): Stiff to medium, dark brown, moist, trace fine gravel, trace organics	2.0	17				
2	SS	18"	M	10	4		0.75	26				
					5	End of Boring = 5.0 Feet Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling	No water				
Upon Completion of Drilling	No water				
Time After Drilling					
Depth to Water					
Depth to Cave-in					

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 118+47, 37.22' RT

Boring No. B-4
Surface Elevation 667.18
Job No. ID: 2270-04-70
Sheet 1 **of** 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	3-inch asphaltic concrete						
						9-inch concrete base						
					1	6-inch aggregate base course						
1	SS	10"	M	4	2	CLAYEY SAND WITH GRAVEL (POSSIBLE FILL/ SC): Very loose to loose, olive brown, moist		20				
2	SS	16"	M	5	3			27				
					4							
					5	End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling	No water				
Upon Completion of Drilling	No water				
Time After Drilling					
Depth to Water					
Depth to Cave-in					

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC

W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 128+54, 11.04' LT

Boring No. B-5
Surface Elevation 653.08 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	4-inch asphaltic concrete						
						9-inch concrete base						
					1	6-inch aggregate base course						
1	SS	12"	M	9		LEAN CLAY (CL): Stiff to hard, brown, moist, trace organics, trace fine sand	2.0	22				
					2							
					3							
					4		4.25	17				
2	SS	18"	M	11								
					5	End of Boring = 5.0 Feet Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 139+63, 34.04' RT

Boring No. B-6
Surface Elevation 654.63 ft
Job No. ID: 2270-04-70
Sheet 1 **of** 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	4-inch asphaltic concrete						
						10-inch concrete base						
					1	6-inch aggregate base course						
1	SS	6"	M	14	2	SANDY LEAN CLAY (POSSIBLE FILL/CL): Very stiff to hard, dark brown mixed with gray, moist	3.0	18				
					3							
					4		4.5	19				
2	SS	12"	M	9	5							
						End of Boring = 5.0 Feet Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 151+95, 19.31' LT

Boring No. B-7
Surface Elevation 652.04 ft
Job No. ID: 2270-04-70
Sheet 1 **of** 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	4-inch asphaltic concrete						
						11-inch concrete base						
					1	6-inch aggregate base course						
1	SS	18"	M	25	2	SILTY SAND (SM): Dense, brown, moist, trace coarse gravel						
2	SS	12"	M	48	3							
					4							
					5	End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 160+95, 37.25' RT

Boring No. B-8
Surface Elevation 652.95 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	4-inch asphaltic concrete						
						9-inch concrete base						
					1	5-inch aggregate base course						
1	SS	12"	M	16	2	SANDY LEAN CLAY (POSSIBLE FILL/CL): Very stiff, dark brown, moist, trace fine gravel	3.25	18				
					3	SILTY SAND WITH GRAVEL (SM): Medium dense, brown, moist						
2	SS	14"	M	22	4							
					5	End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling	No water				
Upon Completion of Drilling	No water				
Time After Drilling					
Depth to Water					
Depth to Cave-in					

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC

W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 171+30, 38.61' LT

Boring No. B-9
Surface Elevation 654.39 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	4-inch asphaltic concrete						
						9-inch concrete base						
					1	6-inch aggregate base course						
1	SS	12"	M	13	2	SILTY SAND (POSSIBLE FILL/SM): Medium dense, dark brown, moist trace fine gravel						
2	SS	17"	M	17	3	SILTY SAND WITH GRAVEL (SM): Medium dense, brown, moist						
					4							
					5	End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/30/10 **Complete** 11/30/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 183+31, 5.90' RT

Boring No. B-10
Surface Elevation 656.18 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	12-inch asphaltic concrete						
					1	6-inch concrete base						
						6-inch aggregate base course	4.0	17				
1	SS	6"	M	25	2	SANDY LEAN CLAY WITH GRAVEL (POSSIBLE FILL/CL): Hard, brown mixed with gray and black, moist						
					3	SILTY SAND WITH GRAVEL (SM): Medium dense, brown, moist						
2	SS	10"	M	18	4			20				
					5	End of Boring = 5.0 Feet Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/29/10 **Complete** 11/29/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC

W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 205+58, 10.41' LT

Boring No. B-11
Surface Elevation 653.65 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	9-inch asphaltic concrete						
					1	6-inch concrete base						
						6-inch aggregate base course						
1	SS	8"	M	17	2	SILTY SAND (POSSIBLE FILL/SM): Medium dense, brown, moist, trace fine gravel						
2	SS	14"	M	11	3	CLAYEY SAND WITH GRAVEL (SC): Medium dense, brown, moist						
					4							
					5	End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/29/10 **Complete** 11/29/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 225+31, 12.68' RT

Boring No. B-12
Surface Elevation 661.61 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	10-inch asphaltic concrete						
					1	4-inch concrete base						
						4-inch aggregate base course						
1	SS	10"	M	5	2	CLAYEY SAND (POSSIBLE FILL/SC): Loose, brown, moist, trace coarse gravel		14				
2	SS	18"	M	26	3	SILTY SAND WITH GRAVEL (SM): Medium dense, brown, moist						
					4							
					5	End of Boring = 5.0 Feet Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/29/10 **Complete** 11/29/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 806+00, 3.91' RT

Boring No. B-13
Surface Elevation 662.88 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	6-inch asphaltic concrete						
						5-inch aggregate base course						
					1	SILTY SAND WITH GRAVEL (SM): Medium dense, brown, moist						
1	SS	18"	M	29	2							
					3							
					4							
2	SS	18"	M	12	5	End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/29/10 **Complete** 11/29/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 809+19, 11.94' RT

Boring No. B-14
Surface Elevation 660.77 ft
Job No. ID: 2270-04-70
Sheet 1 **of** 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	6-inch asphaltic concrete						
						6-inch aggregate base course						
					1	SILTY SAND WITH GRAVEL (SM): Medium dense, brown, moist						
1	SS	14"	M	11	2							
2	SS	18"	M	19	3							
					4							
					5	End of Boring = 5.0 Feet Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/29/10 **Complete** 11/29/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC

W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 238+50, 17.01' RT

Boring No. B-15
Surface Elevation 660.62 ft
Job No. ID: 2270-04-70
Sheet 1 **of** 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	**6-inch asphaltic surface**						
						6-inch aggregate base course						
					1	**SILTY SAND WITH GRAVEL (POSSIBLE FILL/ SM): Medium dense, brown, moist**						
1	SS	12"	M	14	2							
					3	**CLAYEY SAND WITH GRAVEL (SC): Loose, brown, wet** **Wet at 3.5 feet**						
2	SS	8"	W	7	4							
					5	**End of Boring = 5.0 Feet** **Backfilled with bentonite chips and patched with asphalt**						

WATER LEVEL OBSERVATIONS

While Drilling 3.5 feet
Upon Completion of Drilling 2.0 feet
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/29/10 **Complete** 11/29/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 259+90, 8.43' LT

Boring No. B-16
Surface Elevation 661.77 ft
Job No. ID: 2270-04-70
Sheet 1 **of** 1

SAMPLE No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	**8-inch asphaltic concrete**						
					1	**8-inch concrete base**						
						6-inch aggregate base course						
1	SS	10"	M	23	2	**SILTY SAND WITH GRAVEL (SM): Medium dense, dark brown, moist, pockets of clayey sand**						
2	SS	4"	M	20	3							
					4							
					5	**End of Boring = 5.0 Feet**						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

GENERAL NOTES

Start 11/29/10 **Complete** 11/29/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

LOG OF TEST BORING

Himalayan Consultants, LLC
W156 N11357 Pilgrim Rd, Germantown, WI 53022 Tel: (262) 502-0066 Fax: (262) 502-0077

Project STH 57 (Teutonia Ave to Mequon Rd)
Milwaukee and Ozaukee Counties, WI
Location STA 277+38, 9.80' RT

Boring No. B-17
Surface Elevation 665.52 ft
Job No. ID: 2270-04-70
Sheet 1 of 1

No.	Type	Recov.	Moist.	N-Value	Depth (ft.)	VISUAL CLASSIFICATION and Remarks	q_{est} (q_u) tsf	W %	LL	PL	DD pcf	PID ppm
					0	6-inch asphaltic concrete						
					1	8-inch concrete base						
						6-inch aggregate base course						
1	SS	14"	M	7	2	CLAYEY SAND (POSSIBLE FILL/SC): Loose, dark brown, moist, trace coarse gravel		17				
2	SS	18"	M	10	3	SILTY SAND WITH GRAVEL (SM): Loose, brown, moist						
					4							
					5	End of Boring = 5.0 Feet						
						Backfilled with bentonite chips and patched with asphalt						

WATER LEVEL OBSERVATIONS

While Drilling No water
Upon Completion of Drilling No water
Time After Drilling
Depth to Water
Depth to Cave-in

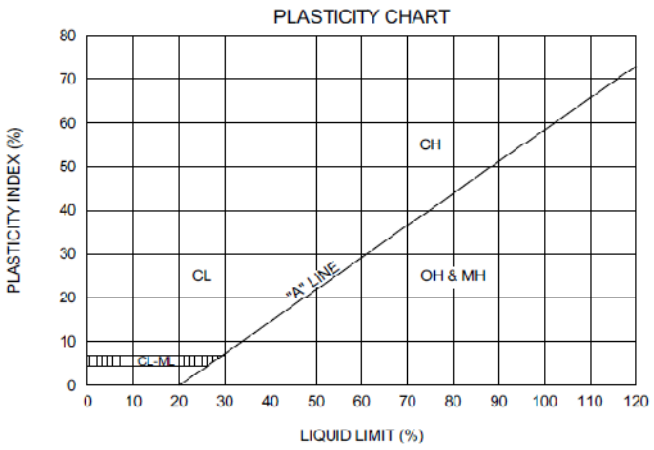
GENERAL NOTES

Start 11/29/10 **Complete** 11/29/10
Crew Chief Tim **Rig** Freightliner
Drilling Method: HSA

NOTE: Soil stratification lines represent approximate boundaries between soil types and transitions may be gradual.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Course grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of course fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mix-tures, little or no fines	Determine percentages of sand and gravel from grain size curve Depending on percentage of fines (fraction smaller than No. 200 sieve size), course grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percen GM, GC, SM, SC 5 to 12 percent Borderline cases requiring dual symbols	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mix-tures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a] d / u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I> between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mix-tures		Atterberg limits below "A" line with P.I. greater than 7	
	Sands (More than half of course fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a] d / u	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatoma-ceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt	Peat and other highly organic soils			



a Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28

b Borderline classifications: used for soils possessing characteristics of two groups; are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder

Himalayan Consultants, LLC
Engineers and Hydrogeologists

SYMBOLS AND TERMINOLOGY

SYMBOLS

DRILLING AND SAMPLING

HSA = Hollow Stem Auger
HA=Hand Auger
SS = Split Spoon Sampler
2ST = 2" Diameter Thin-Walled Tube Sample
3ST = 3" Diameter Thin-Walled Tube Sample
NX = Rock Core 2 1/8" Diameter
AS = Auger Sample
WS = Wash Sample
PTS = Peat Sample
PS = Pitcher Sample
NR = No Recovery
PMT = Borehole Pressuremeter Test
VS = Vane Shear Test
WPT = Water Pressure Test
WOH= Weight of Hammer
WOR = Weight of Rod
▽=Water Level
NW = No Water Encounted
PID = Photo-Ionization Reading, parts per million

FIELD AND LABORATORY TESTS

q_{est} = Pocket Penetrometer Rading, tons/sq. ft.
W = Moisture Content, %
LL = Liquid Limit, %
PL= Plastic Limit, %
SL = Shrinkage Limit, %
LI = Loss on Ignition, %
DD = Dry Unit Weight, lbs/cu. ft.
pH = Measure of Alkalinity or Acidity
FS = Free Swell, %
y = Moist Unit Weight, lbs/cu. ft.

TERMINOLOGY

GRAIN SIZE

Soil Fraction		Size Range
Boulders		>12"
Cobbles		3" - 12"
Gravel:		
	Coarse	3/4" - 3"
	Fine	# 4 Sieve - 3/4"
Sand:		
	Coarse	# 4 -# 10 Sieve
	Medium	# 10 - # 40 Sieve
	Fine	# 40 - # 200 Sieve
Silt		100% passing # 200 Sieve & > 0.005 mm
Clay		100% passing # 200 Sieve & < 0.005 mm

RELATIVE PROPORTION

Proportional Term	% by Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

PLASTICITY

Term	Plasticity Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
Medium to Very High	Over 22

RELATIVE DENSITY

Term	"N" Value
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

CONSISTENCY

Term	q_{est}- tons/sq. ft.
Very Soft	0.00 - 0.25
Soft	0.25 - 0.50
Medium	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	Over 4.00