



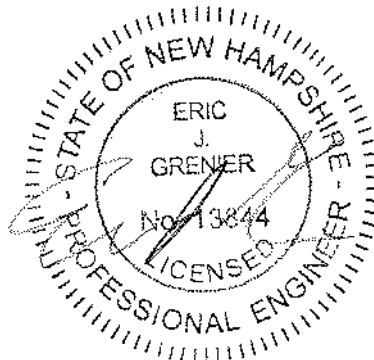
ALTERNATIVES ANALYSIS

**MAPLEWOOD HILL ROAD
BETHLEHEM, NEW HAMPSHIRE**

Project #2024-090

**Prepared for the:
Town of Bethlehem**

September 19, 2025



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**ALTERNATIVES ANALYSIS
for the
MAPLEWOOD HILL ROAD
in
BETHLEHEM, NEW HAMPSHIRE**



I.	INTRODUCTION	2
II.	EXISTING CONDITIONS	2
III.	GEOTECHNICAL INVESTIGATIONS	2
IV.	ENVIRONMENTAL CONSIDERATIONS	3
V.	PROPOSED ALTERNATIVES.....	5
VI.	SUMMARY.....	5
VII.	OPINION OF PROBABLE COST	6

APPENDIX A:	Photo Pages
APPENDIX B:	Existing-Features Plans
APPENDIX C:	Wetland Delineation Report
APPENDIX D:	Geotechnical Report
APPENDIX E:	Conceptual Sketches
APPENDIX F:	Engineer's Opinion of Probable Costs

I. INTRODUCTION

The Town of Bethlehem (Town) has received a grant through the Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) Program for the design and permitting of the reconstruction of Maplewood Hill Road. HEB Engineers, Inc. (HEB) was engaged by the Town to prepare an Engineering Study for the improvements to Maplewood Hill Road. The goal of this study is to analyze existing conditions, evaluate alternatives, and assist the Town with arriving at a preferred alternative. The work conducted is in accordance with our Agreement with the Town dated September 17, 2024.

II. EXISTING CONDITIONS

General

The project limits consist of approximately 4,100 linear feet (LF) of Maplewood Hill Road from US Route 302 intersection to the intersection with NH Route 142 (Maple Street). Maplewood Hill Road is a local road under the jurisdiction of the Town of Bethlehem with a posted speed limit of 25 MPH throughout the project limits. The existing pavement width along Maplewood Hill Road generally ranges between 18 to 20-feet-wide. There are no existing sidewalks along the roadway and no identified pedestrian crossings. The existing roadway is in poor condition and generally has undersized drainage infrastructure. The existing roadway shoulders are failing, causing damage along the edge of the pavement.

Stormwater

The existing drainage system along Maplewood Hill Road consists of shallow roadside ditches with multiple drainage relief areas on both the east and west sides of the roadway. On the east side, three drainage reliefs collect and convey stormwater parallel to the road before re-entering the eastern roadside ditch and ultimately discharging through a 24-inch corrugated metal culvert near the Maple Street intersection.

The west side includes four drainage reliefs, three of which receive flow from culverts crossing the roadway. The fourth relief drains only the western roadside ditch and directs runoff through a culvert beneath an adjacent trail. Collectively, flow from the west-side culverts and turnouts discharge westward toward the Ammonoosuc River.

At the intersection of Maplewood Hill Road and Maple Street, an additional culvert directs runoff across Maple Street to a roadside ditch. However, the majority of the runoff entering this culvert originates from outside the project area and does not significantly impact the immediate drainage conditions.

The existing drainage system is generally in poor condition, driveway culverts are buried or filled with sediment, and the ditch lines have evidence of scouring and erosion from limited armoring on steeper sections of the roadway.

Hydraulic & Hydrologic (H&H) Assessment

A Hydraulic and Hydrologic (H&H) assessment was conducted for the three existing cross culverts along Maplewood Hill Road. The culverts were evaluated under the 2% Annual Exceedance Probability (AEP) storm event (100-year storm). The analysis determined that the existing culverts are undersized for this design storm. It is recommended that the culverts be replaced with 30-inch, 36-inch, and 36-inch HDPE culverts (from south to north, respectively) to adequately convey the 2% AEP flows and comply with New Hampshire Department of Environmental Services (NHDES) Tier 1 stream crossing standards.

Utilities

There are minimal existing underground utilities located in the project area. Underground utilities include a municipal sewer crossing at the Bethlehem Trails Associated trail crossing. Minimal impacts are anticipated as part of this project.

Overhead communication and electric utilities generally run along the east edge of the road. These utilities will need to be accommodated during construction. Utilities are located on the Existing-Features Plans in Appendix B.

III. GEOTECHNICAL INVESTIGATIONS

S.W. Cole Engineering, Inc. (S.W. Cole) completed geotechnical investigations along Maplewood Hill Road in February 2025. In total, 8 soil boring explorations and 8 ledge probes were completed within the project limits. Soils were generally sampled to a depth of 6 feet below the existing pavement using the Standard Penetration Testing

(SPT) procedure. Existing pavement depths ranged from 2 to 3 inches. The soils underlying the roadway generally consist of silty, gravelly sand with some organics being present. Saturated soils were experienced in three of the boring samples (B-1 through B-3) at depths ranging from 4 to 8 feet. A few borings experienced refusal at depths varying from 2.5 to 10.4 feet, which could indicate the presence of ledge or large boulders.

As part of the geotechnical investigation program, soil samples were collected and analyzed to evaluate alternatives for roadway rehabilitation, including pavement reclamation and full-depth reconstruction. The following is a summary of both rehabilitation methods:

Pavement Reclamation

Based on laboratory analysis of soil samples collected in the field, the existing soils do not conform to traditional processed aggregates typically used in roadway construction. Additionally, materials below the roadway did not include traditional uniform layers of aggregate road base materials. Where granular fills exist, the silt content ranges from 12 to 37 percent and are generally considered poor draining and frost susceptible.

S.W. Cole performed blend analyses to simulate the gradation of reclaimed pavement compared to the New Hampshire Department of Transportation (NHDOT) Standard Specification 306 Reclaimed Stabilized Base. Based on the high silt content and thickness of existing pavement, reclamation will not provide a product that meets NHDOT specifications, even with the augmentation with crushed stone. Therefore, pavement reclamation is not a recommended alternative for roadway rehabilitation.

Full Depth Reconstruction

The recommended approach for rehabilitation of Maplewood Hill Road is full-depth reconstruction (box cut) and construction of a new uniform pavement section with traditional aggregate base products. The recommended typical section for rehabilitation is as follows

- » 12-inch-thick gravel subbase – NHDOT Item 304.2
- » 6-inch-thick crushed gravel base – NHDOT Item 304.3
- » 2.5-inch-thick binder course pavement, NHDOT Superpave $\frac{3}{4}$ " aggregate
- » 1.5-inch-thick wearing course pavement, NHDOT Superpave $\frac{1}{2}$ " aggregate

It should be noted that frost penetration can reach 6 feet deep in this area of the state; therefore, the Town should expect some frost heaving and pavement distress in the absence of full frost depth excavation (6 feet). Deeper roadside ditches and underdrains should be considered to reduce the amount of water intrusion into the roadway subgrade. Additionally, the Town should consider the implementation of life-cycle maintenance (i.e., crack cleaning and sealing) and continue seasonal road posting to reduce truck traffic loads during spring thaw.

The Geotechnical Report is included in Appendix D.

IV. ENVIRONMENTAL CONSIDERATIONS

A. Right-of-Way

While the majority of the proposed project is anticipated to take place within the Town-owned right-of-way, temporary and permanent easements (slope and drainage easements) may be required on private property to complete the project. Easements will be identified during Preliminary Design. No significant or long-term adverse impacts to the affected properties are anticipated.

B. Cultural Resources

The project will likely require consultation with the NH State Historic Preservation Office (NHSHPO), as a NHDES Wetlands Permit is anticipated for impacts to jurisdictional wetland areas. This process has begun via the submission of a New Hampshire Department of Historical Resources (NHDHR) Request for Project Review (RPR), which was submitted on June 3, 2025. Approximately 1,000 feet of Maplewood Hill Road is located within the Bethlehem Historic District.

Initial feedback provided by NHSHPD was that National Register eligible or listed properties exist within the project's Area of Effect. However, NHSHPD has indicated the project will have No Adverse Effect, as the project will not alter any of the characteristics of historic properties that qualify them for inclusion in the National Register of Historic Places in a manner that would diminish integrity.

NHSHPD provided additional commentary regarding the widened roadway alternative (further discussed below). Should the increased roadway width and associated drainage improvements within the Bethlehem Historic District impact contributing historic buildings, further consultation with NHSHPD will be required.

C. Wetlands/Surface Water

Jurisdictional wetlands in the project area were delineated on November 5, 2024 by Gregory Howard, Certified Wetland Scientist, of North Country Soil Services. Jurisdictional wetlands are associated with intermittent streams located within excavated roadside ditches and three culvert crossings. Impacts on these jurisdictional areas are anticipated as part of the potential reconstruction of the existing culverts. If needed, proposed wetland impacts would be permitted through the NHDES Wetlands Bureau and would be expected to be covered under the "Department of the Army General Permits for the State of New Hampshire" dated September 29, 2022.

D. Floodways/Floodplains

No portion of the proposed project would take place in, or adjacent to, a mapped 100-year floodplain. The proposed project would have no impact on any floodplains or the flood storage or other functions that they provide.

E. Water Quality

The proposed project would include improvements to the stormwater management system in the project area. This is anticipated to result in a net improvement in water quality. It is anticipated that the proposed project would qualify for a waiver from the requirements of Env-Wq 1503.03(b) and would qualify for Permit-By-Rule from the NHDES Alteration of Terrain Bureau. The proposed project would require NPDES Construction General Permit (CGP) coverage, and a Stormwater Pollution Prevention Plan would be required during construction.

F. Endangered Species

The proposed project would not be likely to jeopardize the continued existence of any threatened or endangered species or have the potential to result in the destruction or adverse modification of critical habitat that has been designated under the Endangered Species Act.

The NH Natural Heritage Bureau (NHNHB) online DataCheck tool was utilized to screen the project area for records of threatened or endangered species, associated habitats, and/or exemplary natural communities. This review returned no threatened or endangered species with known ranges or exemplary natural communities near the project area. No further coordination with NHNHB or NH Fish & Game (NHF&G) would be required.

The US Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC) online tool was also utilized to review the project area. This tool reported that there are no critical habitats within the project area.

G. Other

Contaminated Materials

The NHDES OneStop Data Mapper, as well as the NHDES PFAS Sampling Map, were used to research the project area for proximity to, and potential concern for impacts, to known point source remediation sites. The NHDES OneStop Data Mapper shows two remediation sites, the former Maplewood Garage and the Champman Residence, directly adjacent to the project area on Maplewood Hill Road, one of which has been closed by NHDES (former Maplewood Hill Garage). The report at the Champman Residence is still open and unassigned as of 11/06/2024. The NHDES PFAS Sampling Map does not show any sites of concern within 4,000 feet of the proposed project area.

V. PROPOSED ALTERNATIVES

The following roadway layout alternatives were developed for consideration:

- » Maintain existing roadway width with improved ditching.
- » Widen roadway with reinforced ditching.
- » Widen roadway with granite curb.
- » Widen roadway with a combination of vegetated swales and granite curb.

Based on the results of the geotechnical investigation, each alternative assumes full depth reconstruction of the roadway section. Roadway reclamation is not recommended.

Alternative 1: 20-foot-wide Roadway with Improved Ditching

This alternative consists of the reconstruction of Maplewood Hill Road at its current paved width of 20 feet. The existing centerline alignment and roadway width will stay the same, in addition to a 1-foot gravel shoulder. Vegetated swales are proposed on profile slopes up to 8%. Swales will be reinforced with erosion stone on slopes greater than 8%. Existing cross culverts will be appropriately sized to accommodate the 100-year storm event. Refer to Schematic Roadway Layout Plan – Alternative 1 for more information regarding this alternative.

Alternative 2: 22-foot-wide Roadway with Reinforced Ditching

This alternative consists of widening Maplewood Hill Road to a paved width of 22 feet. The proposed centerline alignment will generally follow the existing alignment with a typical section consisting of 11-foot lanes and 1-foot gravel shoulders. All drainage ditches will be upgraded to stone-lined ditching throughout the extent of the project. Existing cross culverts will be sized appropriately for the drainage areas and flow rates. Refer to Schematic Roadway Layout Plan – Alternative 2 for more information regarding this alternative.

Alternative 3: 22-foot-wide Roadway with Closed Drainage System

This alternative consists of widening Maplewood Hill Road to a paved width of 22 feet along with the installation of granite curb. The proposed centerline alignment will generally follow the existing alignment with a typical section consisting of 11-foot lanes and granite curbing. Proposed drainage improvements will consist of a closed drainage system with new outfalls in the locations of existing culvert crossings. Refer to Schematic Roadway Layout Plan – Alternative 3 for more information regarding this alternative.

Alternative 4: 22-foot-wide Roadway with Vegetated Swales and Closed Drainage System

This alternative consists of widening Maplewood Hill Road to a paved width of 22 feet with the proposed centerline alignment generally following the existing alignment. A 1-foot gravel shoulder is shown in areas where the roadway consists of slopes less than 8%. Drainage improvements within this section of roadway will be vegetated swales with erosion control fabric. The roadway will then transition to granite curbing at the edge of the 11-foot travel lanes. Proposed drainage improvements will consist of a closed drainage system with new outfalls in the locations of existing culvert crossings. Refer to Schematic Roadway Layout Plan – Alternative 4 for more information regarding this alternative.

VI. SUMMARY

All proposed alternatives include full-depth reconstruction of the roadway section, including installation of new subbase and base gravels, and new pavement as determined during geotechnical investigations and subsequent material analyses. All proposed materials shall meet NHDOT standard specifications. HEB would recommend the Town consider full-depth reconstruction as the preferred method of roadway rehabilitation.

Several roadway widths were evaluated as part of this study, including maintaining the existing 20-foot width (Alternative 1) and widening the road to 22 feet (Alternatives 2, 3, and 4). Alternatives 1 and 2 include deepened roadside drainage ditches as the primary consideration for managing stormwater runoff. The deepened ditches will provide more adequate drainage controls than the existing ones, and also function to drain the roadway base materials. Alternative 3 includes a curbed roadway with a closed drainage system. Due to the overall steep grade of Maplewood Hill Road (in excess of 8%), the use of curbing will help prevent erosion of roadway shoulders and ditches. A closed drainage system (catch basins and pipes) would be required to manage roadway runoff. Alternative 4 considers both deepened roadside drainage ditches and the use of a curbed roadway (where slopes are in excess of 8%) with a closed drainage system to manage stormwater runoff. Alternative 3 is generally the

most expensive option due to the widened roadway and inclusion of curbing and closed drainage system along the entire roadway length.

Several alternatives were considered to mitigate damage from future storm events. The following alternatives were considered:

- » Upsizing culverts to handle the 100-year storm event. Based on the H&H Assessment, existing roadway cross culverts are undersized.
- » Constructing improved and deepened roadside ditches. Proposed ditches to be 2-feet deep to provide appropriate storage capacity and provide drainage of roadway subbase and base materials.
- » Reinforcing roadside ditches with stone for stabilization and to prevent erosion during future storm events.
- » Installation of granite curb with a closed drainage system. If a closed drainage system is implemented, it is unlikely that improved roadside ditching is necessary.

Costs for the various alternatives are summarized in the next section.

VII. OPINION OF PROBABLE COST

The following Engineer's Opinion of Probable Costs (OPC) are presented for the proposed alternatives. A detailed breakdown of each item is included in Appendix F. The costs shown are based on NHDOT standard specifications and weighted average bid prices from recent HEB and NHDOT projects. These costs include a 20% construction contingency and 15% for construction engineering. Compensatory wetland mitigation was not included as it is not anticipated to be required for any of the alternatives presented.

Alternatives

Alternative 1: 20-foot-wide Roadway with Improved Ditching	\$ 2,892,000
Alternative 2: 22-foot-wide Roadway with Reinforced Ditching.....	\$ 3,072,000
Alternative 3: 22-foot-wide Roadway with Closed Drainage System	\$ 3,427,000
Alternative 4: 22-foot-wide Roadway with Vegetated Swales and Closed Drainage System	\$ 3,031,000

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APPENDIX A

Photo Pages



Photo 1: Looking north across US Route 302 towards Maplewood Hill Road.



Photo 2: View looking north of roadway and roadside ditching.



Photo 3: Looking east towards Maplewood Hill Road at Cross Country Sewer.



Photo 4: View of roadway condition looking north.



Photo 5: View of roadside ditch turnouts.



Photo 6: Existing stone wall on the east side of Maplewood Hill Road.



Photo 7: Existing culvert head wall and drainage ditch on the east side of Maplewood Hill Road.



Photo 8: Looking northeast at existing stonewall.



Photo 9: Looking south at existing stonewall.



Photo 10: Looking south at roadside ditching along Maplewood Hill Road.



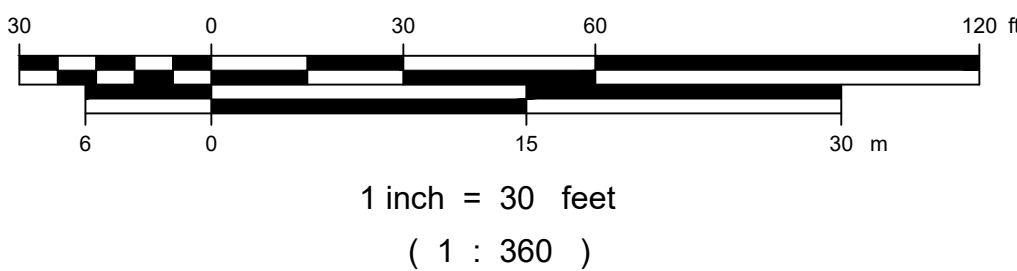
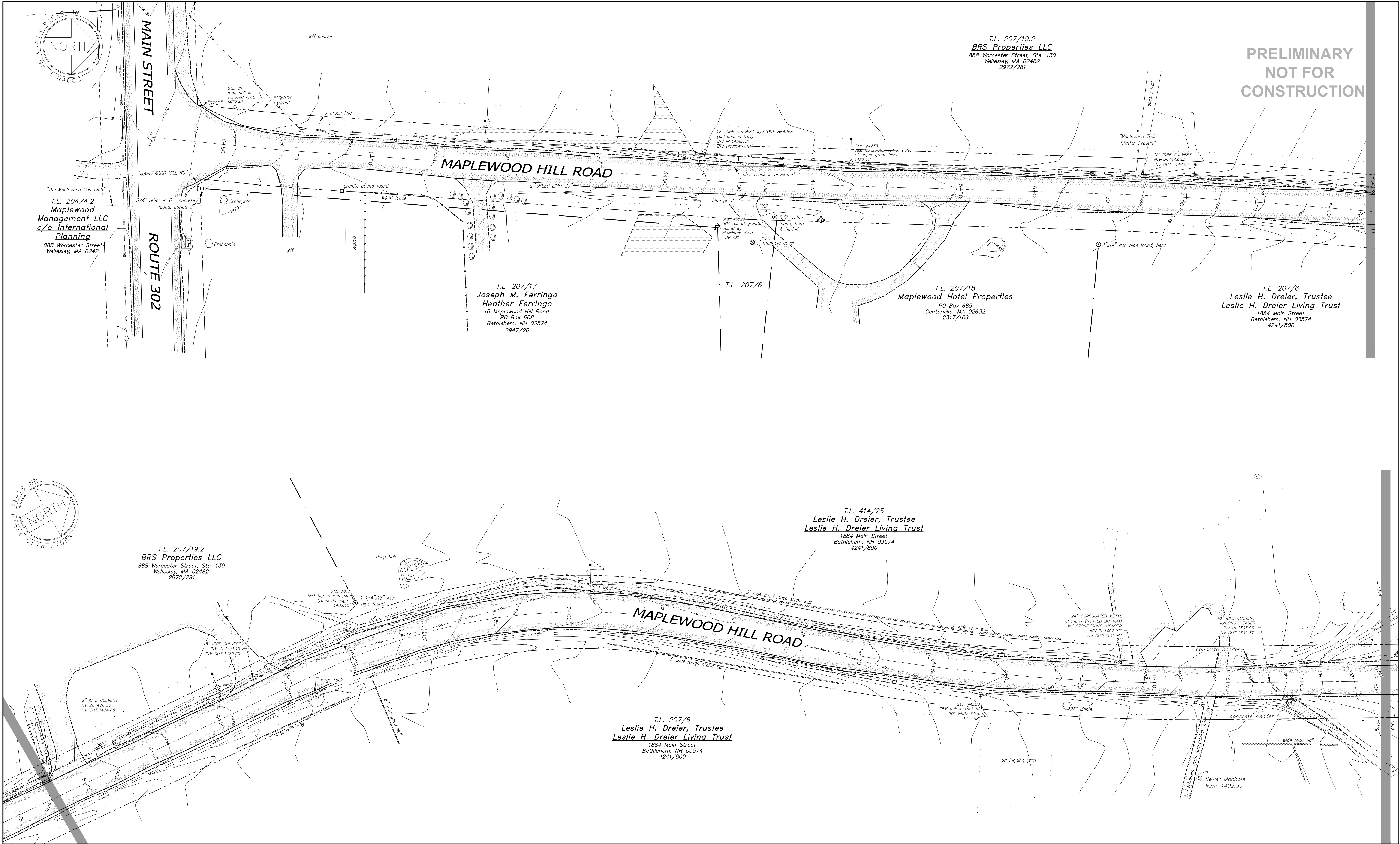
Photo 11: Looking north down Maplewood Hill Road.



Photo 12: Looking north towards intersection of Maplewood Hill Road
and Maple Street.

APPENDIX B

Existing-Features Plans



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No.	Revision			DATE	BY



SURVEYED BY	OTHERS
DESIGNED BY	—
DRAWN BY	CFX
CHECKED BY	EJG
FIELD BOOK	—
SCALE	1"=30'
DATE	12/04/2024

Existing-Features Plan
for
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem, New Hampshire

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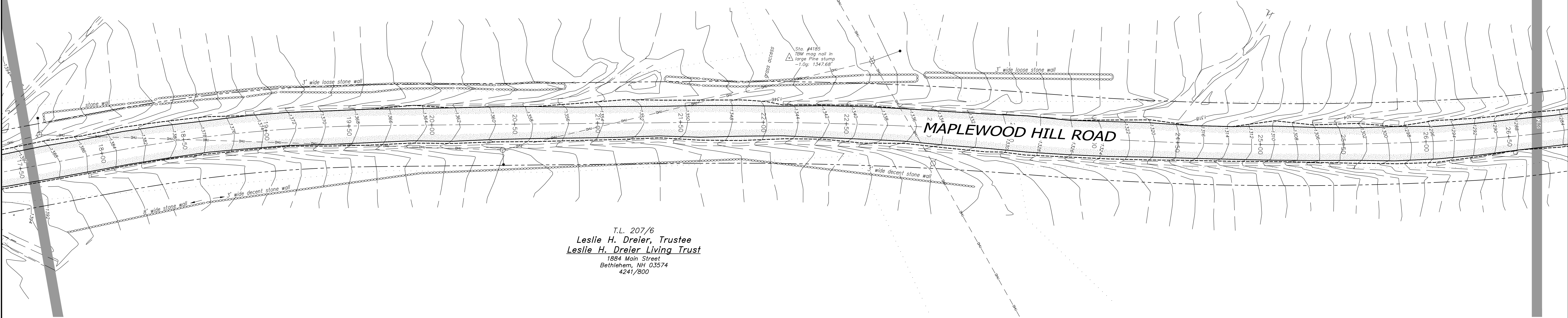
2024-090
Existing-Features Plan
Maplewood Hill Road

V1.01
SHEET 2 OF 3

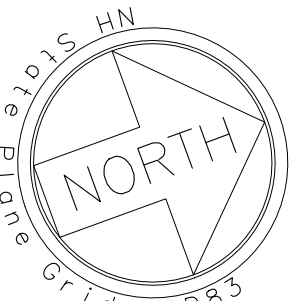


T.L. 414/25
Leslie H. Dreier, Trustee
Leslie H. Dreier Living Trust
1884 Main Street
Bethlehem, NH 03574
4241/800

PRELIMINARY
NOT FOR
CONSTRUCTION



T.L. 207/6
Leslie H. Dreier, Trustee
Leslie H. Dreier Living Trust
1884 Main Street
Bethlehem, NH 03574
4241/800



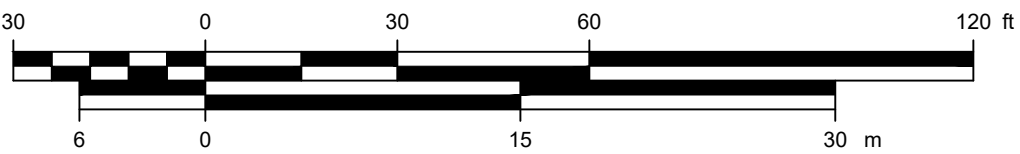
T.L. 414/25
Leslie H. Dreier, Trustee
Leslie H. Dreier Living Trust
1884 Main Street
Bethlehem, NH 03574
4241/800



T.L. 414/38.1
Clinton C. Ness, Sr.
PO Box 543
Bethlehem, NH 03574
4276/961

T.L. 414/38.2
Clinton C. Ness, Sr.
PO Box 543
Bethlehem, NH 03574
4276/961

12" IDPE CULVERT
INV IN:1175.80'
INV OUT:1174.72'



1 inch = 30 feet
(1 : 360)

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No.	Revision			DATE	BY

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ENGINEERS
PO Box 440, North Conway, NH 03860
(603) 356-6936 - www.hebengineers.com

SURVEYED BY	OTHERS
DESIGNED BY	—
DRAWN BY	CFX
CHECKED BY	EJG
FIELD BOOK	—
SCALE	1"=30'
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Existing-Features Plan
for
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem, New Hampshire

2024-090
V1.01
SHEET 2 OF 3

**PRELIMINARY
NOT FOR
CONSTRUCTION**

T.L. 414/25
Leslie H. Dreier, Trustee
Leslie H. Dreier Living Trust
1884 Main Street
Bethlehem, NH 03574
4241/800

T.L. 414/33
Michael Callahan, Jr.
Danielle M. Zimmerman
3 Tracey Avenue
Nashua, New Hampshire 03063
4694/655

T.L. 414/38.2
Clinton C. Ness, Sr.
PO Box 543
Bethlehem, NH 03574
4276/961

Maplewood Hill Road

Maple Street

Rte. 142

3" CONCRETE CULVERT
INV IN: 1175.80'
INV OUT: 1174.72'

24" METAL CORRUGATED CULVERT
INV IN: 1128.79'
INV OUT: 1126.77'

concrete box outlet:
24"x41"

15" PSP CULVERT - 3.0%
INV IN: 1118.77'
INV OUT: 1115.86'

Drainage Structure (1/2 PIPE)

directional arrow

cable & post guardrail

adelineator post

Sta. #4165
control point NHDOT
mag nail in pavement
"Spt 13"/"Spt 24"
1156.74'

Sta. #410
control point NHDOT
mag nail in pavement
"Spt 13"/"Spt 24"
1118.87'

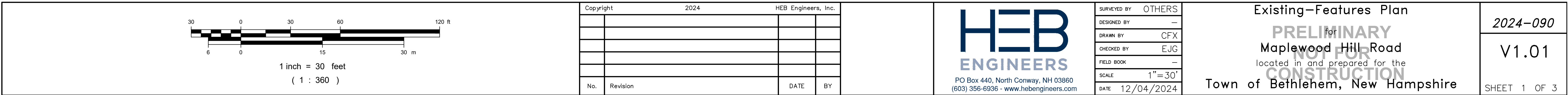
Sta. #223
control point NHDOT
mag nail in pavement
"Spt 13"/"Spt 24"
1110.17'

LOAD LIMIT

WELDED

ROCK WALL

NORTH
Plane Gull
NAD83



APPENDIX C

NCSS Wetland Delineation Report

North Country Soil Services
Environmental Professionals

November 7, 2024

HEB ENGINEERS, INC.

NOV 08 2024

RECEIVED

HEB Engineers, Inc.
P.O. Box 440
2605 White Mountain Highway
North Conway, NH 03860

Re: Wetland Delineation of Maplewood Hill Road, Bethlehem, NH

Dear Ms. Lewis:

The wetland delineations of the road right-of-way of Maplewood Hill Road located in Bethlehem, New Hampshire has been completed. The wetland delineations were conducted to confirm the existence of and the location and extent of the jurisdictional wetlands associated with the Maplewood Hill Road system. This investigation has been prepared from data collected by on-site observations. The presence of jurisdictional wetlands was evaluated utilizing the criteria noted in the NH Code of Administrative Rules CHAPTER Env-Wt 400, PART Env-Wt 406, Section Env-Wt 406.02 "Delineation of wetland boundaries" effective December 15, 2019.

Methods:

The project site was investigated and delineated using the Routine Method outlined in the 1987 Federal Manual for Identifying and Delineating Jurisdictional Wetlands to identify those wetlands that meet the current New Hampshire Wetlands Board (NHWB) definition for freshwater wetlands. Under the NH RSA 482-A:2 (X) "Freshwater Wetlands" means an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The current regulations Env-Wt 406.01 References for Delineation of Wetland Boundaries (a) states "shall base the delineation on the presence of hydrophytic vegetation, hydric soils, and wetlands hydrology in accordance with the federal delineation method". The federal delineation method is outlined in the "Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1, January 1987" and the "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, January 2012". Referencing the above-mentioned Federal Manual, PART IV "Methods" it was decided to use one of the recommended on-site methodologies, the routine determination. The specific routine methodology utilized involves delineating the boundary of the vegetation community, and then confirming the presence of hydric soils and looking for signs of wetland hydrology.

Routine Determination: Observe the plant community and visually estimate the dominant vegetation and determine whether it is dominated by hydrophytic vegetation. Dominant vegetation is defined as the most abundant plant species that exceed 50 percent of the total dominance measure for a given stratum, plus any additional species comprising 20 percent or more of the total dominance measure for that stratum are also considered dominant species for the stratum. If the area is dominated by hydrophytic vegetation then verify the presence of hydric soil by digging a hole at least 20 inches deep

P.O. Box 442
West Ossipee, NH 03890
Voice: (603) 539-9152 e-mail: wetsoil1@roadrunner.com

with a tile spade and soils auger. The presence of hydric soils was determined utilizing the criteria presented in the *"Field Indicators for Identifying Hydric Soils in New England- Version 4, April 2019, New England Hydric Soils Technical Committee, New England Interstate Water Pollution Control Commission"*. If hydric soils are present then determine if obvious signs of wetland hydrology are present. If the area meets the hydrophytic vegetation community, hydric soil and wetland hydrology criteria then the area is a jurisdictional wetland. Repeat the process along the perceived boundary between the plant communities to delineate the wetland boundary.

Findings:

The wetland delineation of the project site was conducted by Gregory Howard-North Country Soil Services on November 5, 2024. The investigation identified six (6) jurisdictional wetland areas associated with the project. The majority of the identified wetland areas have been human disturbed at some level by the construction of the road system and its associated stormwater system. The boundaries of the identified wetland areas were then flagged with pink flagging. The pink flagging delineating the jurisdictional wetland boundaries were labeled "EOW" for edge of wetland and numbered sequentially so that they could be located by you for the site plan and used as field reference points. Refer to the attached Figure 1- Site Sketch that indicate the approximate location of the delineated wetland areas.

Wetland #1 is a small intermittent stream and a scrub-shrub wetland along its banks. The U.S. Fish and Wildlife Service Wetland Classification for the small intermittent stream is Riverine, Intermittent, Streambed, Cobble-Gravel, Intermittently Flooded, Excavated (R4SB3Jx) wetland. The identified vegetation found in the scrub-shrub portion of the wetland are Speckled Alder, White Meadowsweet and Sensitive Fern. The indicator status of Speckled Alder is FACW (facultative wetland), White Meadowsweet is FACW (facultative wetland) and Sensitive Fern is FACW (facultative wetland) on the "National List of Plant Species that Occur in Wetlands: Northeast (Region 1)". The hydrophytic vegetation criterion is thus satisfied in the delineated wetlands because more than 50 percent of the dominants of all strata are OBL (obligate), FACW (facultative wetland), or FAC (facultative) species. The U.S. Fish and Wildlife Service Wetland Classification for the scrub-shrub portion of the identified wetland area is Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded/Saturated (PSS1E) wetland.

Wetland #1 is dominated by poorly drained hydric soils. The poorly drained loamy sandy glacial till most closely correlate to the Pillsbury soil series. The Pillsbury soil series is found on the List of Hydric Soils of the United States, developed by the National Technical Committee for Hydric Soils (NTCHS).

Wetland #2 is an excavated ditch functioning as an intermittent stream. The U.S. Fish and Wildlife Service Wetland Classification for intermittent stream is Riverine, Intermittent, Streambed, Cobble-Gravel, Intermittently Flooded, Excavated (R4SB3Jx) wetland.

Wetland #2 is dominated by poorly drained hydric soils. The poorly drained loamy sandy glacial till most closely correlate to the Pillsbury soil series. The Pillsbury soil series is found on the List of Hydric Soils of the United States, developed by the National

Technical Committee for Hydric Soils (NTCHS).

Wetlands #3, #4 and #6 are excavated ditches that extends along Maplewood Hill Road that receives stormwater and are functioning as a very small intermittent streams located in a channel. The U.S. Fish and Wildlife Service Wetland Classification for these intermittent stream channels is Riverine, Intermittent, Streambed, Cobble-Gravel, Intermittently Flooded, Excavated (R4SB3Jx) wetland.

Wetlands #3, #4 and #6 are dominated by poorly drained hydric soils. The poorly drained loamy sandy glacial till most closely correlate to the Pillsbury soil series. The Pillsbury soil series is found on the List of Hydric Soils of the United States, developed by the National Technical Committee for Hydric Soils (NTCHS).

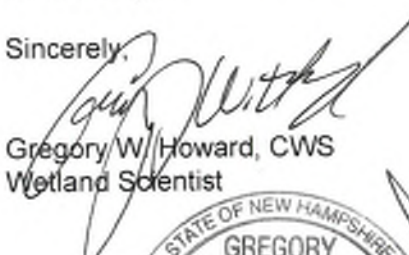
Wetland #5 is a wooded swamp located in a subtle swale that is bisected by Maplewood Hill Road. The identified vegetation found in the wooded swamp is Quaking Aspen, Red Maple, White Meadowsweet and Sensitive Fern. The indicator status of Quaking Aspen is FACU (facultative upland), Red Maple is FAC (facultative), White Meadowsweet is FACW (facultative wetland) and Sensitive Fern is FACW (facultative wetland) on the "National List of Plant Species that Occur in Wetlands: Northeast (Region 1)". The hydrophytic vegetation criterion is thus satisfied in the delineated wetlands because more than 50 percent of the dominants of all strata are OBL (obligate), FACW (facultative wetland), or FAC (facultative) species. The U.S. Fish and Wildlife Service Wetland Classification for the identified wetland area is Palustrine, Forested, Broad-Leaved Deciduous, Saturated (PFO1B) wetland.

Wetland #5 is dominated by poorly drained hydric soils. The poorly drained stony loamy sandy glacial till most closely correlate to the Pillsbury soil series. The Pillsbury soil series is found on the List of Hydric Soils of the United States, developed by the National Technical Committee for Hydric Soils (NTCHS).

The delineated freshwater wetlands are under the protective jurisdiction of the New Hampshire Wetlands Bureau. Any proposed construction or alteration within the delineated jurisdictional wetland areas will require a Permit from the New Hampshire Wetlands Bureau.

If you have any questions regarding this investigation of the project site, please do not hesitate to contact me directly at 539-9152 or via e-mail at wetsoil1@roadrunner.com. I thank you for the opportunity to provide my professional services to you.

Sincerely,


Gregory W. Howard, CWS
Wetland Scientist

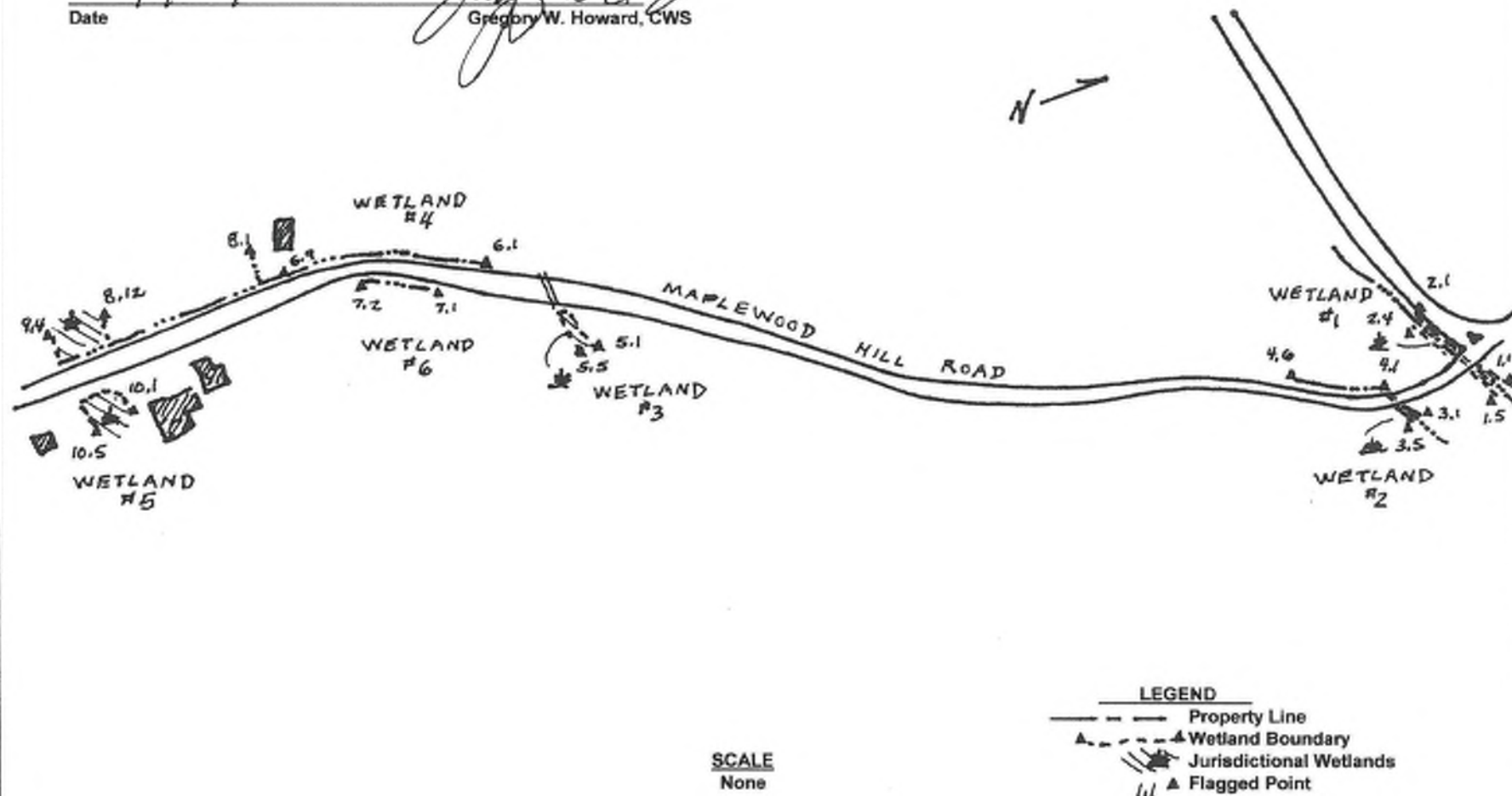


CERTIFICATION

This Wetlands Delineation is a representation of a compilation of field data collected during November 5, 2024 by myself. Every aspect of this plan is based on my best knowledge and opinion thereof as of the date of this mapping.

11/7/2024
Date

Gregory W. Howard, CWS



REVISIONS			DRAWN BY: Gregory W. Howard	TITLE: Site Sketch Maplewood Hill Road Project Bethlehem, New Hampshire	CLIENT: HEB Engineers Inc. P.O. Box 440 North Conway, NH	DATE: 11/5/2024
NO.	DATE	BY				
			APPROVED BY:	NORTH COUNTRY SOIL SERVICES P.O. BOX 442, WEST OSSIPEE, NH (603) 539-9152	PROJECT NO.: #H3132	FIGURE 1

APPENDIX D

Geotechnical Report



REPORT

24-1697 S

March 10, 2025

Explorations and Geotechnical Engineering Services

Proposed Road Improvement
Maplewood Hill Road
Bethlehem, New Hampshire

Prepared For:

HEB Engineers, Inc
Attention: Eric Grenier, P.E.
2605 White Mountain Highway
PO Box 440
North Conway, NH 03860

Prepared By:

S. W. Cole Engineering, Inc.
10 Centre Road
Somersworth, NH 03878
T: 603-692-0088

www.swcole.com | info@swcole.com

TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 Scope and Purpose	1
1.2 Site and Proposed Construction	1
2.0 EXPLORATION AND TESTING	2
2.1 Explorations	2
2.2 Laboratory Testing	2
3.0 SUBSURFACE CONDITIONS	2
3.1 Soil and Bedrock	2
3.2 Groundwater	3
4.0 EVALUATION AND RECOMMENDATIONS	3
4.1 General Findings	3
4.2 Blend Analysis	4
4.3 Box Cut and New Pavement Section	5
4.4 General Considerations	6
4.5 Excavation and Dewatering Considerations	6
4.6 Weather Considerations	7
4.7 Design Review and Construction Testing	7
5.0 CLOSURE	8
 Appendix A	Limitations
Appendix B	Figures
Appendix C	Exploration Logs & Key
Appendix D	Laboratory Test Results

24-1697 S

March 10, 2025

HEB Engineers, Inc.
Attention: Eric Grenier, P.E.
2605 White Mountain Highway
P.O. Box 440
North Conway, NH 03860

Subject: Explorations and Geotechnical Engineering Services
Proposed Road Improvement
Maplewood Hill Road
Bethlehem, New Hampshire

Dear Eric:

In accordance with our Proposal dated August 29, 2024, we have performed subsurface explorations for the subject project. This report summarizes our findings and geotechnical recommendations, and its contents are subject to the limitations set forth in Appendix A.

1.0 INTRODUCTION

1.1 Scope and Purpose

The purpose of our services was to explore subsurface conditions at the site and provide geotechnical recommendations for pavement associated with proposed construction. Our scope of services included test boring and probe explorations, soils laboratory testing, a geotechnical evaluation of the findings, and preparation of this report.

1.2 Site and Proposed Construction

We understand the project includes reconstruction of Maplewood Hill Road from Main Street (U.S. Route 302) north to Maple Street (NH Route 142), an approximately 0.75-mile length in Bethlehem, New Hampshire. We understand that most of the existing roadway consists of a relatively thin layer of asphalt pavement and that some limited

repaired sections may not have asphalt pavement. We understand you wish to evaluate reclamation of existing pavement and base/sub-base materials for new roadway construction and determine depth to bedrock for design of underground utilities.

Existing site features are shown on the “Exploration Location Plan” provided in Appendix B.

2.0 EXPLORATION AND TESTING

2.1 Explorations

Eight test borings (B-1 through B-8) and eight test probes (P-1 through P-8) were made at the site on February 11th and 12th, 2025, by Seaboard Drilling, LLC. The test borings and test probes were advanced utilizing solid-stem auger drilling techniques. Standard Penetration Testing (SPT) and split-spoon sampling were performed at continuous intervals at the test borings. Auger samples were obtained from the probes at depths of approximately 1 to 2 feet below the existing ground surface. The exploration locations were selected and established in the field by S. W. Cole Engineering, Inc. (S.W.COLE) using GPS methods.

The approximate exploration locations are shown on the “Exploration Location Plan,” included in Appendix B. Exploration logs and a key to the notes and symbols used on the logs are included in Appendix C. Elevations shown on the logs were estimated based on topographic information shown on the “Exploration Location Plan.”

2.2 Laboratory Testing

Soil samples obtained from the explorations were returned to our laboratory for further classification and testing. Gradation and moisture content testing was performed on twelve select soil samples collected from the borings and probes. Gradation test results are included in Appendix D. Moisture content test results are shown on the boring logs.

3.0 SUBSURFACE CONDITIONS

3.1 Soil and Bedrock

All test borings and probes encountered a thin asphalt layer of 2 to 3 inches overlaying fills of silty gravelly sand to depths of 3 to 6 feet with some organics being present in the fill at

B-2. Based on our observations, the materials below the road did not include a traditional uniform layer of aggregate road base materials. Fills generally overlie medium dense to dense silty fine sands with varying amount of gravel until refusal surfaces were encountered. Refusal surfaces varied throughout the alignment with depths ranging from 2.5 to 10.4 feet on probable boulders.

Not all strata were encountered in each test boring. For more detailed subsurface information, refer to the attached boring logs.

3.2 Groundwater

Saturated soils were encountered along the southern portion of Maplewood Hill Road at the first three test borings (B-1 through B-3) with depths ranging from 4 to 8 feet at the time of exploration work. Long term groundwater information is not available. It should be anticipated that groundwater levels will fluctuate, particularly in response to periods of snowmelt and precipitation, and changes in site use.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General Findings

Based on the subsurface findings, the existing pavement ranges from about 2 to 3 inches along the roadway and is underlain by granular fills with high proportions of silt. The existing granular fills generally range in thickness of 3 to 6 feet below the pavement. Based on our observations, the materials below the road did not include a traditional uniform layer of aggregate road base materials.

Based on laboratory gradation testing, the existing base soils do not conform to a traditional processed aggregate base commonly used in current roadway construction. Where granular fills exist, silt contents of the existing base vary from about 12 to 37 percent. Given the significant changes in site grades along the roadway alignment and poor drainage characteristics of the native soils, we recommend design for reconstruction consider base and subbase soils that are free draining, containing low silt contents.

We performed blend analyses that mathematically blend gradations of the soils below the pavement and a simulated gradation of reclaimed pavement. Blend analyses are

compared to gradation specification for NHDOT 306 Reclaimed Stabilized Base, which does not have a specification for percent passing the No. 200 sieve. This specification is typically used in situations where the silt content of the parent base material is low. Based on our blend analysis, we estimate a full depth reclamation of 12 inches in areas where existing granular fill base materials are present will not create a material that meets the NHDOT 306 gradation specification for Reclaimed Stabilized Base (modified to include a specification of 0 to 10% passing the No. 200 sieve). Further, the thickness of the pavement and the high silt content of the existing fills result in a product that can not be augmented with crushed stone to result in a product meeting the gradation for NHDOT 306.

An alternative is to remove the existing pavement and add a uniform layer of NHDOT 304.3 or 304.4, but that requires raising the road grade and results in a relatively thin aggregate base section. We understand this option would not satisfy the vertical tolerance of the project. We suggest roadway reconstruction consist of box cutting existing pavement and base materials in favor of the construction of new uniform pavement section with traditional aggregate base products.

4.2 Blend Analysis

We performed blend analyses of the existing pavement and base materials to simulate the proposed reclamation of the existing pavement section during reconstruction. Our blend analyses were performed by mathematically blending gradation results on the existing material below the pavement with gradation results on typical crushed existing pavement samples. The intent is to estimate the gradation of the blended product. The gradation of the actual reclaimed pavement needs to be determined after the reclaiming/crushing process. We have a database of gradation results on crushed pavement that we physically crushed in our laboratory to create an approximate $\frac{3}{4}$ -inch minus crushed product which was then tested for gradation. Based on our experience, this method typically generates a reasonable representation of the resulting product.

We compared our blend analyses results to gradation requirements for NHDOT 306 Reclaimed Stabilized Base, modified to include a 0 to 10% passing specification of the No. 200 sieve. A typical reclaimer extends to a depth of 12 inches grinding the asphalt pavement into the underlying base soil. Based on our blend analyses of existing pavement and base materials, the reclaimed material results in silt contents varying

from about 10 to 22.8% percent and does not conform to a traditional processed aggregate base commonly used in current roadway construction. To achieve gradation requirements for NHDOT 306 Reclaimed Stabilized Base, existing conditions would require the addition of crushed stone resulting in a raise in roadway grades up to 10 to 12 inches.

Due to the variable, high silt content of existing base material and the subsequent need to raise roadway grades, pavement and base reclamation does not appear feasible for the roadway reconstruction.

4.3 Box Cut and New Pavement Section

As an alternative to full depth reclamation, we recommend the existing roadway pavement and base materials be box cut to a predetermined depth and replaced with traditional aggregate base and subbase materials and a new pavement layer. This option comes with less variability and uncertainty than reclaiming and is likely more straight forward in terms of grading design, but it is typically a more costly approach.

Traffic loading is not available for this roadway, however we assume this rural road is subjected to primary passenger vehicle traffic with occasional medium duty and heavy duty truck traffic. Considering the findings from our explorations and laboratory testing, we offer the following recommendations for pavement section based on the “2016 NHDOT Specifications for Road and Bridge Construction”.

FLEXIBLE (HMA) PAVEMENT SECTION – 2016 NHDOT Standard Specs	
Pavement Layer	Material Thickness
NHDOT ½ inch Superpave Wearing Course	1 ½ inches
NHDOT ¾ inch Superpave Binder Course	2 ½ inches
NHDOT Crushed Gravel (304.3) Base Course or Crushed Stone (fine) (304.4)	6 inches
NHDOT Gravel (304.2) Subbase Course	12 inches

Hot mix bituminous asphalt pavement should be compacted to 92 to 97 percent of its theoretical maximum density as determined by ASTM D-2041. A tack coat should be used between lifts of asphalt.

Frost penetration can be on the order of 6.0 feet in this area of the state. In the absence of full frost depth excavation and replacement of frost-susceptible soils, or the use of insulation, some frost heaving and pavement distress must be anticipated. Use of a pavement section extending to the frost depth is not common for this type of road in New England and is generally deemed to be cost-prohibitive. It is very important to reduce the amount of water infiltration into the pavement section to reduce the potential for frost heaving. Grading of the subgrade and hydraulic connection to perimeter drainage features are typical measures to promote positive drainage away from the pavement section.

We recommend the implementation of life-cycle maintenance for the new pavement. This should include crack cleaning and sealing on a periodic basis to reduce the potential for surface water from infiltrating the pavement section.

Given the severity of the winter climate in this region and frost susceptible subgrade soils, it our recommendation that the Town implement seasonal road posting following reconstruction to reduce the truck traffic during spring thaw.

4.4 General Considerations

Boring B-2 encountered very soft soils containing organics at the bottom of the fill materials. The lateral extent of this material is not known. Further, the impact of these materials on subgrade stability may not become known until subgrade preparation begins. Construction-phase test pits targeted at this area are recommended to evaluate this condition. Subgrades that are unstable at this location or at other locations during subgrade preparation should be evaluated by S.W.COLE. Remediation might include over-excavation and replacement or use of a geotextile reinforcing fabric.

4.5 Excavation and Dewatering Considerations

The excavations will generally encounter gravelly silty sand fill materials overlying native deposits of silty sand and glacial till at depth. Final excavation to subgrade should be performed with a smooth-edge bucket to reduce disturbance. Excavations for road reconstruction are anticipated to generally be above observed groundwater levels. Some of the deeper utility excavations may extend below groundwater. The contractor should be prepared to control the water levels to at least one foot below planned

excavation depths to help stabilize subgrades during construction. Surface water should be diverted from entering the excavations.

Excavations must be properly shored and/or sloped to prevent sloughing and caving of the sidewalls during construction. All excavations should be performed in accordance with OSHA requirements. The contractor is responsible for developing an appropriate dewatering and excavation plans to install the foundations and maintain stable subgrades.

4.6 Weather Considerations

Construction activity should be limited during wet and freezing weather and the site soils may require drying or thawing before construction activities may continue. The contractor should anticipate the need for water to temper fills to facilitate compaction during dry weather. If construction takes place during cold weather, subgrades must be protected during freezing conditions.

4.7 Design Review and Construction Testing

We recommend S.W.COLE be provided the opportunity to review recommendations in this report and make modifications as necessary once the final designs for this project have been determined. S.W.COLE should be retained to review the final design and specifications to determine that our pavement recommendations have been properly interpreted and implemented.

Further, we recommend S.W.COLE be retained to provide soils engineering and testing services during the excavation and pavement phases of the work. This is to observe compliance with the design concepts, specifications, and design recommendations and to allow design changes in the event that subsurface conditions are found to differ from those anticipated prior to the start of construction. S.W.COLE is available to provide testing of soil and asphalt construction materials.

5.0 CLOSURE

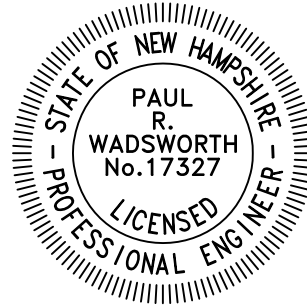
It has been a pleasure to be of assistance to you with this phase of your project. We look forward to working with you during the construction phase of the project.

Sincerely,

S. W. Cole Engineering, Inc.

Emma Dennis, E.I.T.
Staff Geotechnical Engineer

Paul R. Wadsworth, P.E.
Senior Geotechnical Engineer



EJD/PRW:cbm

APPENDIX A

Limitations

This report has been prepared for the exclusive use of HEB Engineers, Inc. for specific application to the Proposed Road Improvement on Maplewood Hill Road in Bethlehem, New Hampshire. S. W. Cole Engineering, Inc. (S.W.COLE) has endeavored to conduct our services in accordance with generally accepted soil and foundation engineering practices. No warranty, expressed or implied, is made.

The soil profiles described in the report are intended to convey general trends in subsurface conditions. The boundaries between strata are approximate and are based upon interpretation of exploration data and samples.

The analyses performed during this investigation and recommendations presented in this report are based in part upon the data obtained from subsurface explorations made at the site. Variations in subsurface conditions may occur between explorations and may not become evident until construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and to review the recommendations of this report.

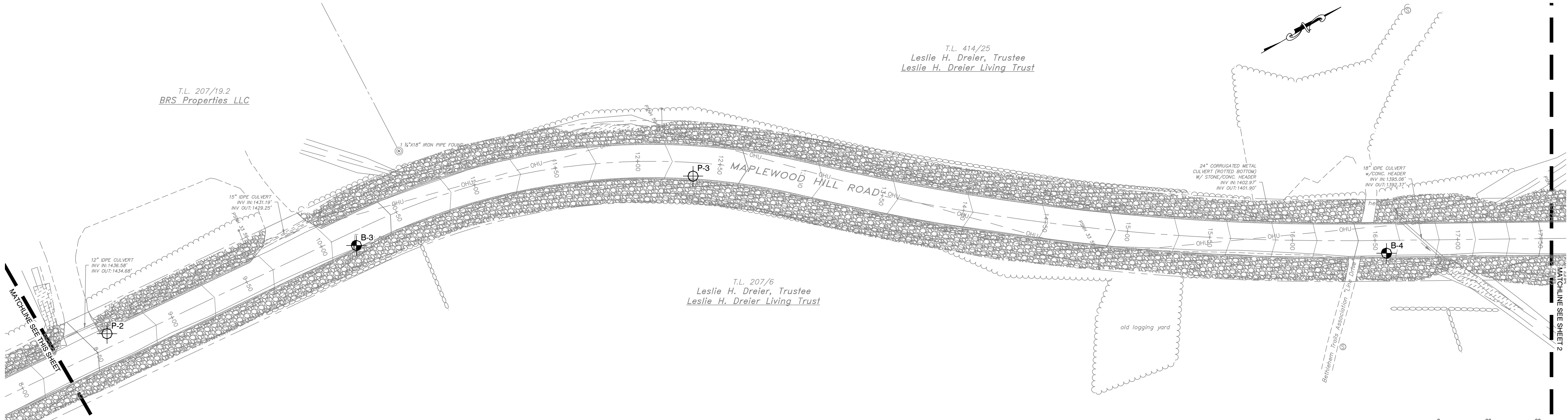
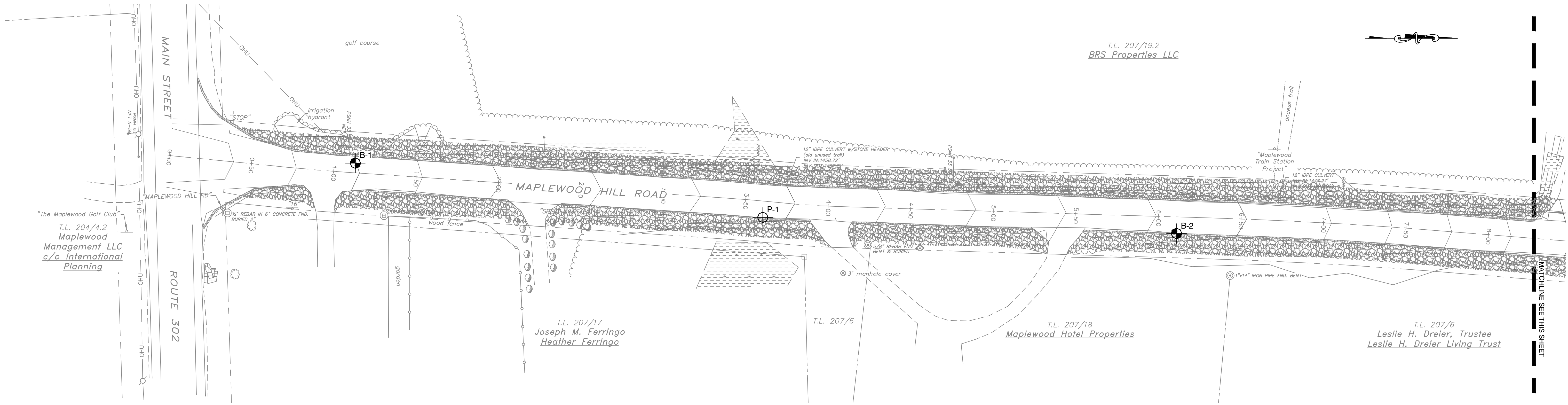
Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, temperature, and other factors.

S.W.COLE's scope of services has not included the investigation, detection, or prevention of any Biological Pollutants at the project site or in any existing or proposed structure at the site. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and the byproducts of any such biological organisms.

Recommendations contained in this report are based substantially upon information provided by others regarding the proposed project. In the event that any changes are made in the design, nature, or location of the proposed project, S.W.COLE should review such changes as they relate to analyses associated with this report. Recommendations contained in this report shall not be considered valid unless the changes are reviewed by S.W.COLE.

APPENDIX B

Figures



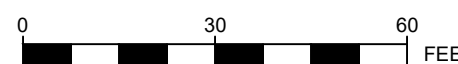
LEGEND:

-  APPROXIMATE BORING LOCATION
-  APPROXIMATE PROBE LOCATION

NOTES:

- EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=30' SCALE PLAN OF THE SITE TITLED "EXPLORATIONS AND GEOTECHNICAL LAYOUT," PREPARED BY HEB ENGINEERS (HEB), DATED 12/11/2024.

- THE EXPLORATION LOCATIONS WERE SELECTED BY HEB AND SUBSEQUENTLY ESTABLISHED IN THE FIELD BY S. W. COLE ENGINEERING, INC. USING A MAPPING GRADE GPS RECEIVER.
- THIS PLAN SHOULD BE USED IN CONJUNCTION WITH THE ASSOCIATED S. W. COLE ENGINEERING, INC. GEOTECHNICAL REPORT.
- THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.



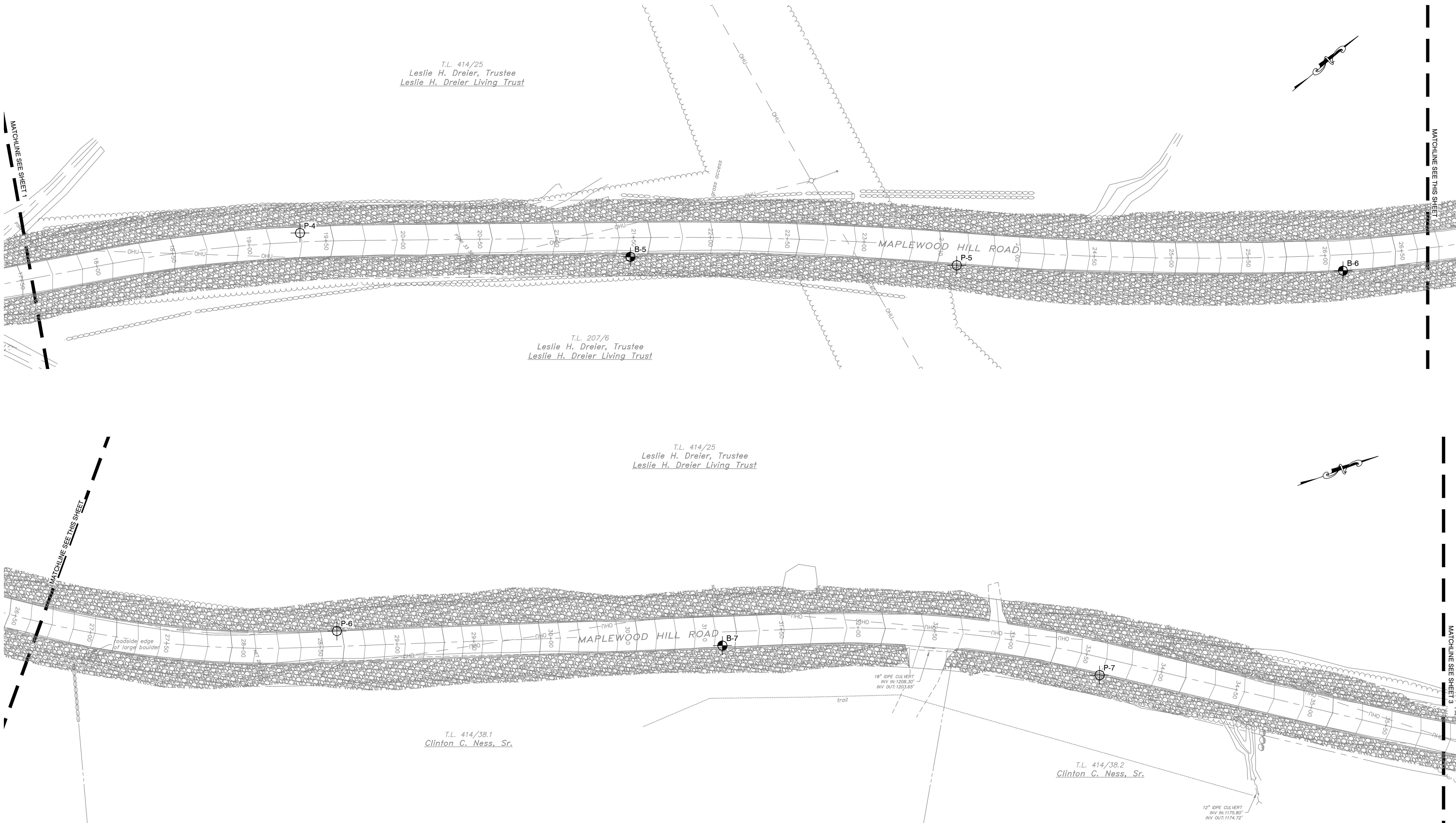


HEB ENGINEERS

EXPLORATION LOCATION PLAN

PROPOSED ROAD RECONSTRUCTION
MAPLEWOOD HILL ROAD
BETHLEHEM, NEW HAMPSHIRE

Job No.:	24-1697	Scale:	1" = 30'
Date :	03/03/2025	Sheet:	1



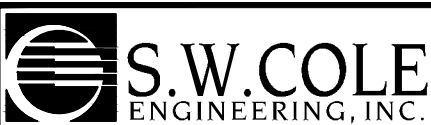
LEGEND:

- APPROXIMATE BORING LOCATION
- APPROXIMATE PROBE LOCATION

NOTES:

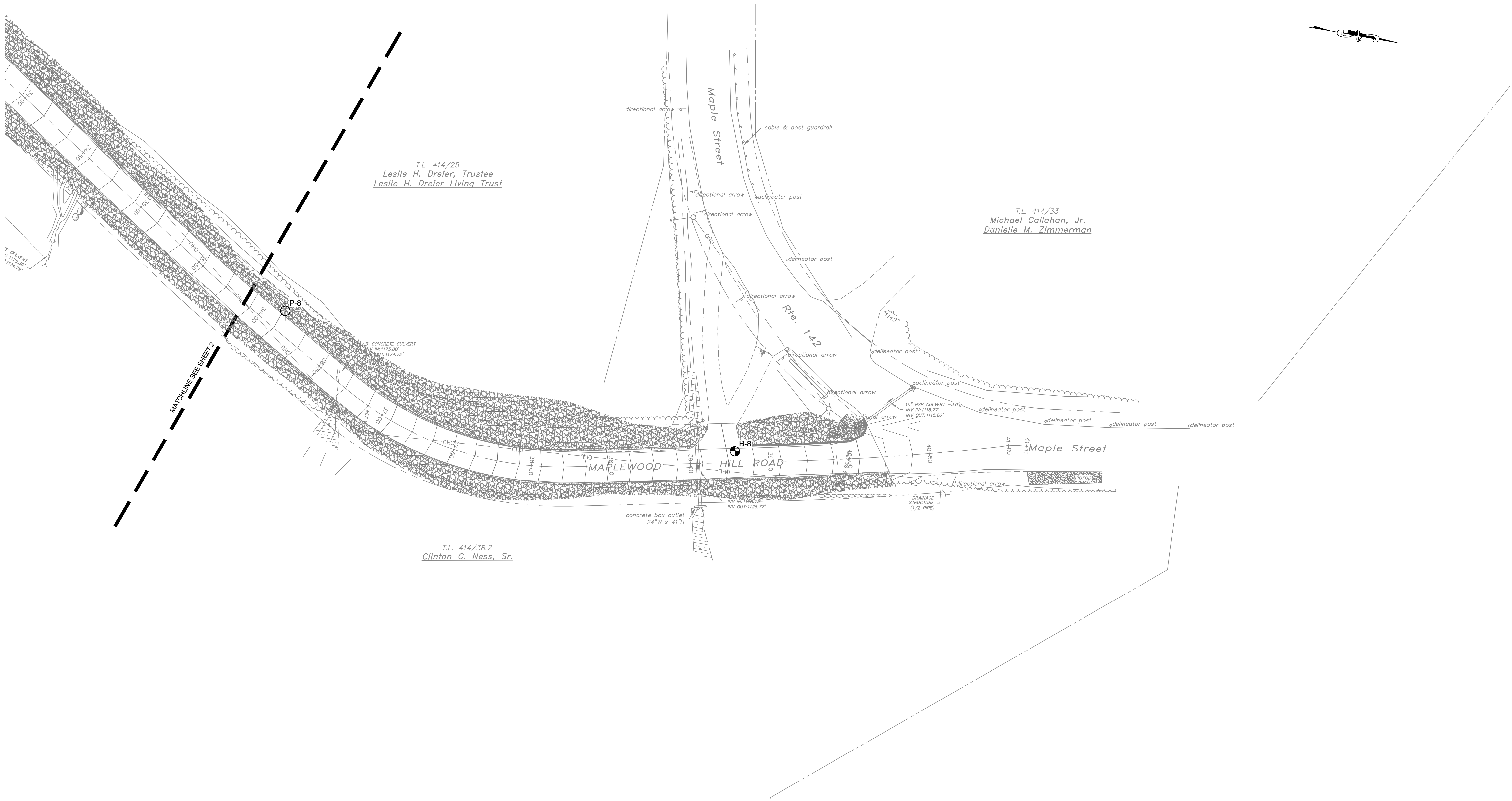
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HEB ENGINEERS
EXPLORATION LOCATION PLAN
PROPOSED ROAD RECONSTRUCTION
MAPLEWOOD HILL ROAD
BETHLEHEM, NEW HAMPSHIRE

Job No.: 24-1697 Scale: 1" = 30'
Date: 03/03/2025 Sheet: 2



LEGEND:

-  APPROXIMATE BORING LOCATION
-  APPROXIMATE PROBE LOCATION

NOTES:

- EXPLORATION LOCATION PLAN WAS PREPARED FROM A 1"=30' SCALE PLAN OF THE SITE TITLED "EXPLORATIONS AND GEOTECHNICAL LAYOUT," PREPARED BY HEB ENGINEERS (HEB), DATED 12/11/2024.

- THE EXPLORATION LOCATIONS WERE SELECTED BY HEB AND SUBSEQUENTLY ESTABLISHED IN THE FIELD BY S. W. COLE ENGINEERING, INC. USING A MAPPING GRADE GPS RECEIVER.
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- THE PURPOSE OF THIS PLAN IS ONLY TO DEPICT THE LOCATION OF THE EXPLORATIONS IN RELATION TO THE EXISTING CONDITIONS AND PROPOSED CONSTRUCTION AND IS NOT TO BE USED FOR CONSTRUCTION.



HEB ENGINEERS
EXPLORATION LOCATION PLAN
PROPOSED ROAD RECONSTRUCTION
MAPLEWOOD HILL ROAD
BETHLEHEM, NEW HAMPSHIRE

Job No.: 24-1697 Scale: 1" = 30'
Date : 03/03/2025 Sheet: 3

APPENDIX C

Exploration Logs and Key



BORING LOG

BORING NO.: **B-2**
SHEET: 1 of 1
PROJECT NO. 24-1697
DATE START: 2/11/2025
DATE FINISH: 2/11/2025

CLIENT: HEB Engineers
PROJECT: Proposed Maplewood Hill Road Reconstruction
LOCATION: Maplewood Hill Road, Bethlehem, NH

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 1452' +/- TOTAL DEPTH (FT): 12.0 LOGGED BY: Emma Dennis
DRILLING CO.: Seaboard Drilling DRILLER: Jeff Lee DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Truck Mounted Acker AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:
HAMMER CORRECTION FACTOR: 1.5 HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): 8 ft 2/11/2025 Saturated soils encountered below a depth of 8 feet

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
1450			1D		1-2	12/10	30-50		0.1 2" Asphalt Dark brown, Silty Gravelly SAND (FILL)		Frozen soils to 3 feet
			2D		3-5	24/20	1/18"-2		3.0 Very soft, dark brown, SILT and fine SAND trace gravel with buried organics and roots (FILL)		
5			3D		5-7	24/21	2-5-15- 22		6.0 Medium dense to dense, gray and orange-brown Silty fine SAND trace gravel		
1445			4D		10-12	24/19	10-14- 25-36		10.0 Dense, gray-brown, Silty fine SAND some gravel (Glacial Till)		
1440											Bottom of Exploration at 12.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-2**



BORING LOG

BORING NO.: **B-3**
SHEET: 1 of 1
PROJECT NO. 24-1697
DATE START: 2/11/2025
DATE FINISH: 2/11/2025

CLIENT: HEB Engineers
PROJECT: Proposed Maplewood Hill Road Reconstruction
LOCATION: Maplewood Hill Road, Bethlehem, NH

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 1427' +/- TOTAL DEPTH (FT): 11.5 LOGGED BY: Emma Dennis
DRILLING CO.: Seaboard Drilling DRILLER: Jeff Lee DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Truck Mounted Acker AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:
HAMMER CORRECTION FACTOR: 1.5 HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): 4 ft 2/11/2025 Saturated soils encountered below a depth of 4 feet

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
▽ At time of Drilling
▽ At Completion of Drilling
▽ After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
1425			1D	⊗	1-1.2	2/2	50/2"	0.2	3" Asphalt Gray-brown, Silty Gravelly SAND (FILL)		Frozen soils to 3 feet
			2D	⊗	3-5	24/15	7-4-2-8	3.0	Loose, brown, Silty fine to medium SAND some gravel (FILL)	▽	
	5		3D	⊗	5-7	24/22	5-6-8-8	5.0	Medium dense, brown, Silty fine SAND trace gravel		
1420			4D	⊗	10-11.5	18/18	19-31- 50	10.0	Dense, gray-brown, Silty fine SAND some gravel (Glacial Till)		Rock in sampler tip
	10							12.0	Split Spoon Refusal at 11.5 feet Probable boulder or bedrock		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-3**



BORING LOG

BORING NO.: **B-4**
SHEET: 1 of 1
PROJECT NO. 24-1697
DATE START: 2/11/2025
DATE FINISH: 2/11/2025

CLIENT: HEB Engineers
PROJECT: Proposed Maplewood Hill Road Reconstruction
LOCATION: Maplewood Hill Road, Bethlehem, NH

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 1402' +/- TOTAL DEPTH (FT): 10.4 LOGGED BY: Emma Dennis
DRILLING CO.: Seaboard Drilling DRILLER: Jeff Lee DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Truck Mounted Acker AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:
HAMMER CORRECTION FACTOR: 1.5 HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft):
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
1400			1D	×	2-2.9	11/7	32- 50/5"		0.1' 2" Asphalt Cobbles; auger advanced to 2 feet		Frozen soils to 4 feet
	5		2D	×	5-7	24/16	15-21- 27-35		2.0' Gray-brown, Silty Gravelly SAND (FILL)		
1395			3D	×	10-10.4	5/5	50/5"		5.0' Dense to very dense, gray-brown, SILT and fine SAND some gravel (Glacial Till)		
	10										Rock in sampler tip

Split Spoon Refusal at 10.4 feet
Probable boulder or bedrock

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-4**



BORING LOG

BORING NO.: **B-5**
SHEET: 1 of 1
PROJECT NO. 24-1697
DATE START: 2/12/2025
DATE FINISH: 2/12/2025

CLIENT: HEB Engineers
PROJECT: Proposed Maplewood Hill Road Reconstruction
LOCATION: Maplewood Hill Road, Bethlehem, NH

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 1353' +/- TOTAL DEPTH (FT): 12.0 LOGGED BY: Sean Hlywa
DRILLING CO.: Seaboard Drilling DRILLER: Jeff Lee DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Truck Mounted Acker AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:
HAMMER CORRECTION FACTOR: 1.5 HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): No Free Water Observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
V = Field Vane Shear V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
1350	5		1D	×	1-1.9	11/11	34- 50/5"	ID 24680S	0.2 2" Asphalt Very dense, brown, SILT and SAND, some gravel (FILL)		Frozen soils to 3.0'
									3.0 Very dense, brown, fine SAND, some silt, trace gravel		
1345	10								5.0 Dense to very dense, brown, fine SAND and GRAVEL, trace silt		

Bottom of Exploration at 12.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-5**



BORING LOG

BORING NO.: **B-6**
SHEET: 1 of 1
PROJECT NO. 24-1697
DATE START: 2/12/2025
DATE FINISH: 2/12/2025

CLIENT: HEB Engineers
PROJECT: Proposed Maplewood Hill Road Reconstruction
LOCATION: Maplewood Hill Road, Bethlehem, NH

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 1295' +/- TOTAL DEPTH (FT): 2.5 LOGGED BY: Sean Hlywa
DRILLING CO.: Seaboard Drilling DRILLER: Jeff Lee DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Truck Mounted Acker AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:
HAMMER CORRECTION FACTOR: 1.5 HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): No Free Water Observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
								0.2	2" Asphalt Brown, gravelly silty SAND; with cobbles and boulders		Couldn't sample due to frozen ground/boulders

Auger Refusal at 2.5 feet
(Probable Boulder or Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-6**



BORING LOG

BORING NO.: **B-7**
SHEET: 1 of 1
PROJECT NO. 24-1697
DATE START: 2/12/2025
DATE FINISH: 2/12/2025

CLIENT: HEB Engineers
PROJECT: Proposed Maplewood Hill Road Reconstruction
LOCATION: Maplewood Hill Road, Bethlehem, NH

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 1221' +/- TOTAL DEPTH (FT): 12.0 LOGGED BY: Sean Hlywa
DRILLING CO.: Seaboard Drilling DRILLER: Jeff Lee DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Truck Mounted Acker AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:
HAMMER CORRECTION FACTOR: 1.5 HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): No Free Water Observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS:
Water Level
At time of Drilling
At Completion of Drilling
After Drilling
D = Split Spoon Sample
U = Thin Walled Tube Sample
R = Rock Core Sample
V = Field Vane Shear
Pen. = Penetration Length
Rec. = Recovery Length
bpf = Blows per Foot
mpf = Minute per Foot
WOR = Weight of Rods
WOH = Weight of Hammer
RQD = Rock Quality Designation
PID = Photoionization Detector
S_v = Field Vane Shear Strength, kips/sq.ft.
q_u = Unconfined Compressive Strength, kips/sq.ft.
Ø = Friction Angle (Estimated)
N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
1220			1D		3-5	24/18	26-32- 24-11	ID 24681S	0.2' 2" Asphalt Cobbles, advanced augers to 3.0'		Frozen soils to 3.0'
	5		2D		5-7	24/16	7-7-9- 10		3.0' Very dense, brown, silty gravelly fine SAND; with cobbles (FILL)		
1215			3D		10-12	24/16	7-14- 19-27		5.0' Medium dense, brown, silty gravelly fine SAND (TILL)		
1210	10										

Bottom of Exploration at 12.0 feet

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-7**



BORING LOG

BORING NO.: **B-8**
SHEET: 1 of 1
PROJECT NO. 24-1697
DATE START: 2/12/2025
DATE FINISH: 2/12/2025

CLIENT: HEB Engineers
PROJECT: Proposed Maplewood Hill Road Reconstruction
LOCATION: Maplewood Hill Road, Bethlehem, NH

Drilling Information

LOCATION: See Exploration Location Plan ELEVATION (FT): 1124' +/- TOTAL DEPTH (FT): 4.9 LOGGED BY: Sean Hlywa
DRILLING CO.: Seaboard Drilling DRILLER: Jeff Lee DRILLING METHOD: Hollow Stem Auger
RIG TYPE: Truck Mounted Acker AUGER ID/OD: 2 1/4 in / 5 5/8 in SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic HAMMER WEIGHT (lbs): 140 / 300 CASING ID/OD: N/A / N/A CORE BARREL:
HAMMER CORRECTION FACTOR: 1.5 HAMMER DROP (inch): 30 / 16
WATER LEVEL DEPTHS (ft): No Free Water Observed

GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level
▽ At time of Drilling D = Split Spoon Sample Pen. = Penetration Length WOR = Weight of Rods S_v = Field Vane Shear Strength, kips/sq.ft.
▽ At Completion of Drilling U = Thin Walled Tube Sample Rec. = Recovery Length WOH = Weight of Hammer q_u = Unconfined Compressive Strength, kips/sq.ft.
▽ After Drilling R = Rock Core Sample bpf = Blows per Foot RQD = Rock Quality Designation Ø = Friction Angle (Estimated)
V = Field Vane Shear mpf = Minute per Foot PID = Photoionization Detector N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION					Graphic Log	Sample Description & Classification	H ₂ O Depth	Remarks
			Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD				
1120			1D	⊗	1-1.9	11/3	23- 50/5"		0.2 2" Asphalt		Frozen soils to 3.0'
			2D	⊗	3-3.8	10/3	18- 50/4"		Very dense, brown, gravelly fine SAND, trace silt; with frequent cobbles (FILL)		

Auger Refusal at 4.9 feet
(Probable Boulder or Bedrock)

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: **B-8**



SUMMARY OF LEDGE PROBES

PROJECT:	Proposed Maplewood Hill Road Reconstruction	PROJECT NO:	24-1697
CLIENT:	HEB Engineers	DATE:	2/11/25 to 2/12/25
LOCATION:	Maplewood Hill Road; Bethlehem, NH	S.W.COLE REP:	Emma Dennis / Sean Hlywa

EXPLORATION	APPROXIMATE GROUND SURFACE ELEVATION (FT)	PROBE DEPTH (FT)	APPROXIMATE B.O. PROBE ELEVATION (FT)	NOTE
P-1	1460.5	10.0	1450.5	Lab ID 24683S
P-2	1438.5	10.0	1428.5	Lab ID 24684S
P-3	1416	4.5	1411.5	REFUSAL Lab ID 24685S
P-4	1378	10.0	1368.0	Lab ID 24686S
P-5	1328.5	10.0	1318.5	Lab ID 24687S
P-6	1261	10.0	1251.0	Lab ID 24688S
P-7	1196	10.0	1186.0	Lab ID 24689S
P-8	1170	10.0	1160.0	Lab ID 24690S

Notes:

KEY TO NOTES & SYMBOLS

Test Boring and Test Pit Explorations

Stratification lines represent the approximate boundary between soil types and the transition may be gradual.

Key to Symbols Used:

w	-	water content, percent (dry weight basis)
q _u	-	unconfined compressive strength, kips/sq. ft. - laboratory test
S _v	-	field vane shear strength, kips/sq. ft.
L _v	-	lab vane shear strength, kips/sq. ft.
q _p	-	unconfined compressive strength, kips/sq. ft. – pocket penetrometer test
O	-	organic content, percent (dry weight basis)
W _L	-	liquid limit - Atterberg test
W _P	-	plastic limit - Atterberg test
WOH	-	advance by weight of hammer
WOM	-	advance by weight of man
WOR	-	advance by weight of rods
HYD	-	advance by force of hydraulic piston on drill
RQD	-	Rock Quality Designator - an index of the quality of a rock mass.
γ _T	-	total soil weight
γ _B	-	buoyant soil weight

Description of Proportions:

Trace:	0 to 5%
Some:	5 to 12%
"Y"	12 to 35%
And	35+%
With	Undifferentiated

Description of Stratified Soils

Parting:	0 to 1/16" thickness
Seam:	1/16" to 1/2" thickness
Layer:	1/2" to 12" thickness
Varved:	Alternating seams or layers
Occasional:	one or less per foot of thickness
Frequent:	more than one per foot of thickness

REFUSAL: Test Boring Explorations - Refusal depth indicates that depth at which, in the drill foreman's opinion, sufficient resistance to the advance of the casing, auger, probe rod or sampler was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

REFUSAL: Test Pit Explorations - Refusal depth indicates that depth at which sufficient resistance to the advance of the backhoe bucket was encountered to render further advance impossible or impracticable by the procedures and equipment being used.

Although refusal may indicate the encountering of the bedrock surface, it may indicate the striking of large cobbles, boulders, very dense or cemented soil, or other buried natural or man-made objects or it may indicate the encountering of a harder zone after penetrating a considerable depth through a weathered or disintegrated zone of the bedrock.

APPENDIX D

Laboratory Test Results



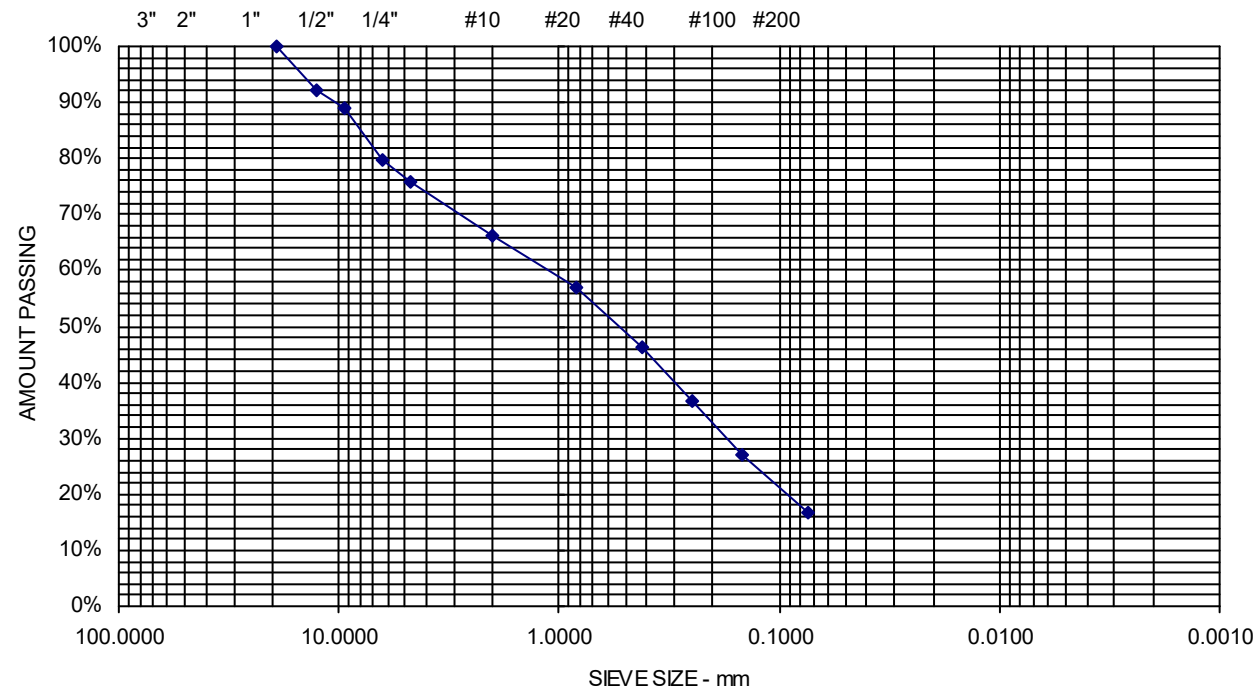
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **B-1 1D 1-3**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24678S
Date Received 2/13/2025
Date Completed 2/17/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	92	
9.5 mm	3/8"	89	
6.3 mm	1/4"	80	
4.75 mm	No. 4	76	24.2% Gravel
2.00 mm	No. 10	66	
850 μm	No. 20	57	
425 μm	No. 40	46	59.1% Sand
250 μm	No. 60	36	
150 μm	No. 100	27	
75 μm	No. 200	16.7	16.7% Fines



Comments:

Sheet



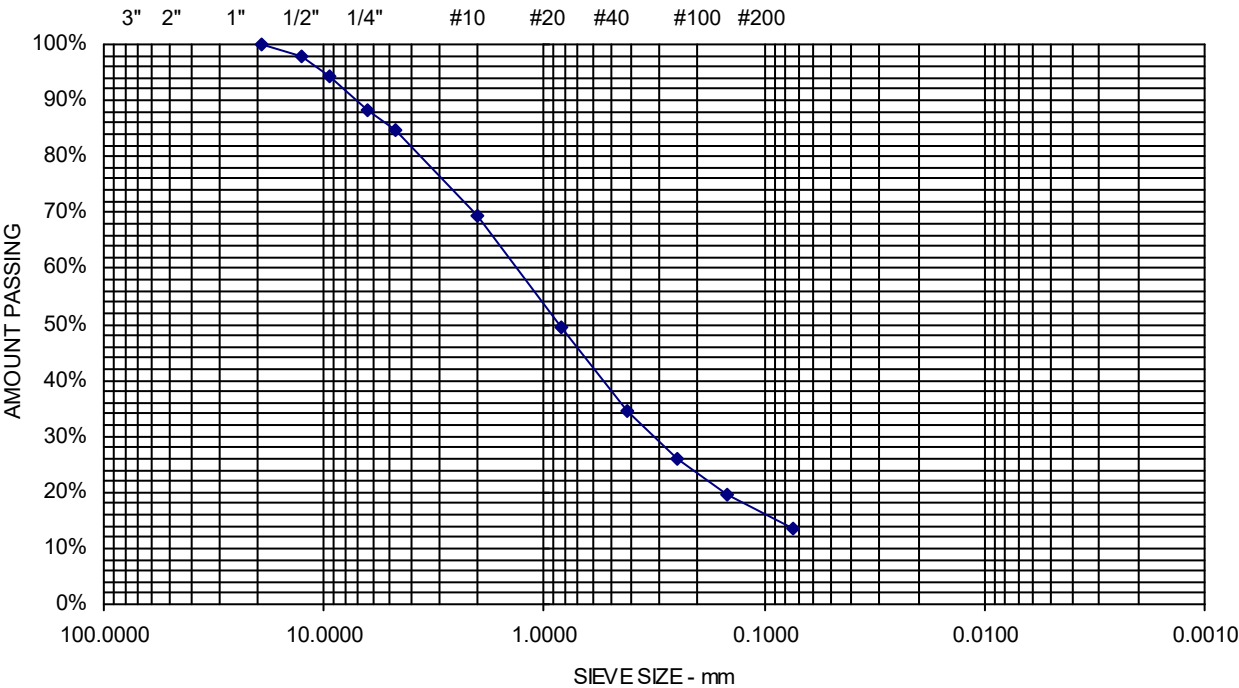
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **B-2 1D 1-3**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24679S
Date Received 2/13/2025
Date Completed 2/17/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	98	
9.5 mm	3/8"	94	
6.3 mm	1/4"	88	
4.75 mm	No. 4	85	15.1% Gravel
2.00 mm	No. 10	70	
850 μm	No. 20	49	
425 μm	No. 40	35	71.4% Sand
250 μm	No. 60	26	
150 μm	No. 100	20	
75 μm	No. 200	13.5	13.5% Fines



Comments:



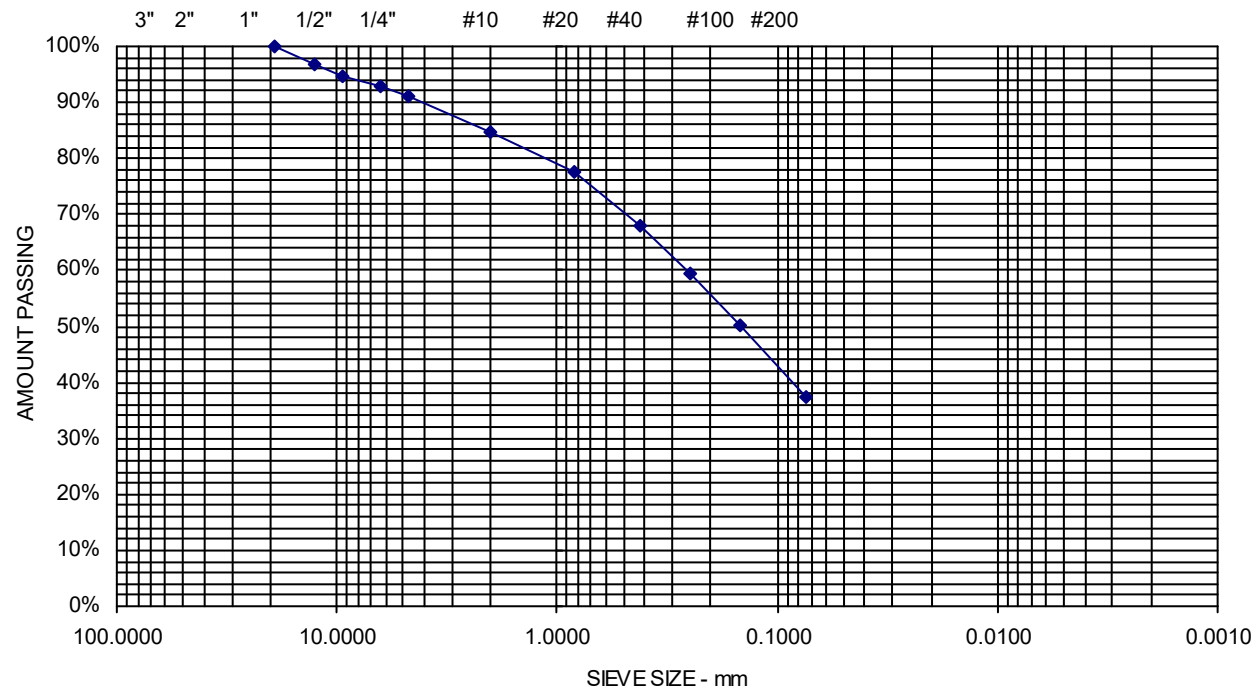
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **B-5 1D 1-1.9**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24680S
Date Received 2/13/2025
Date Completed 2/17/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	97	
9.5 mm	3/8"	95	
6.3 mm	1/4"	93	
4.75 mm	No. 4	91	9.1% Gravel
2.00 mm	No. 10	85	
850 μm	No. 20	78	
425 μm	No. 40	68	53.4% Sand
250 μm	No. 60	59	
150 μm	No. 100	50	
75 μm	No. 200	37.5	37.5% Fines



Comments:

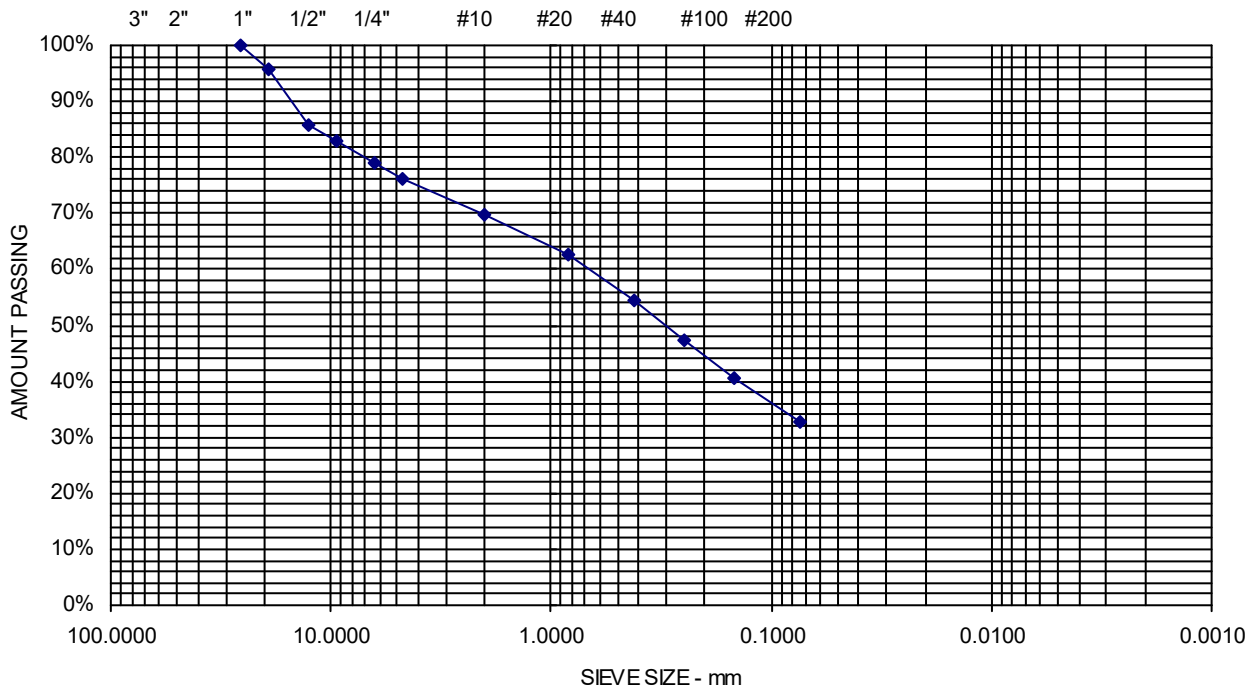
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **B-7 1D 3-5**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24681S
Date Received 2/13/2025
Date Completed 2/17/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
25.0 mm	1"	100	
19.0 mm	3/4"	96	
12.5 mm	1/2"	86	
9.5 mm	3/8"	83	
6.3 mm	1/4"	79	
4.75 mm	No. 4	76	23.9% Gravel
2.00 mm	No. 10	70	
850 μm	No. 20	63	
425 μm	No. 40	55	43.5% Sand
250 μm	No. 60	47	
150 μm	No. 100	41	
75 μm	No. 200	32.7	32.7% Fines



Comments:

Sheet



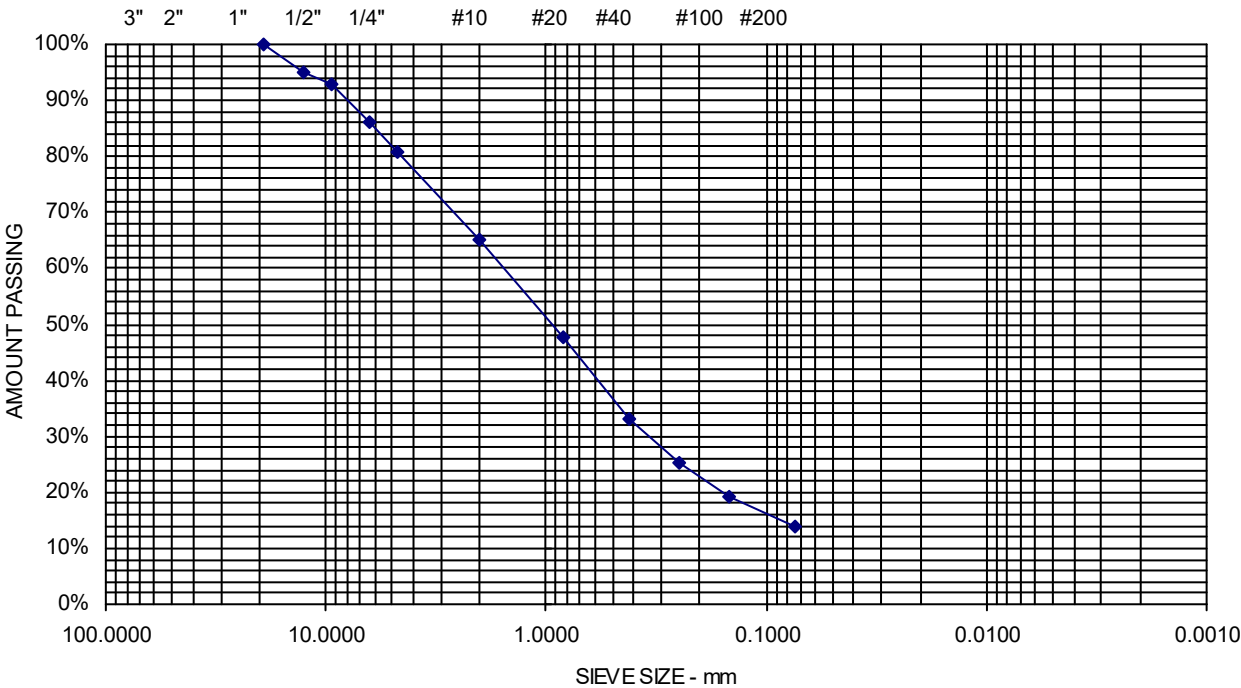
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **P-1 S-1 1.5'**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24683S
Date Received 2/13/2025
Date Completed 2/19/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	95	
9.5 mm	3/8"	93	
6.3 mm	1/4"	86	
4.75 mm	No. 4	81	19.2% Gravel
2.00 mm	No. 10	65	
850 μm	No. 20	48	
425 μm	No. 40	33	66.9% Sand
250 μm	No. 60	25	
150 μm	No. 100	19	
75 μm	No. 200	13.9	13.9% Fines



Comments: Moisture Content = 7.3%

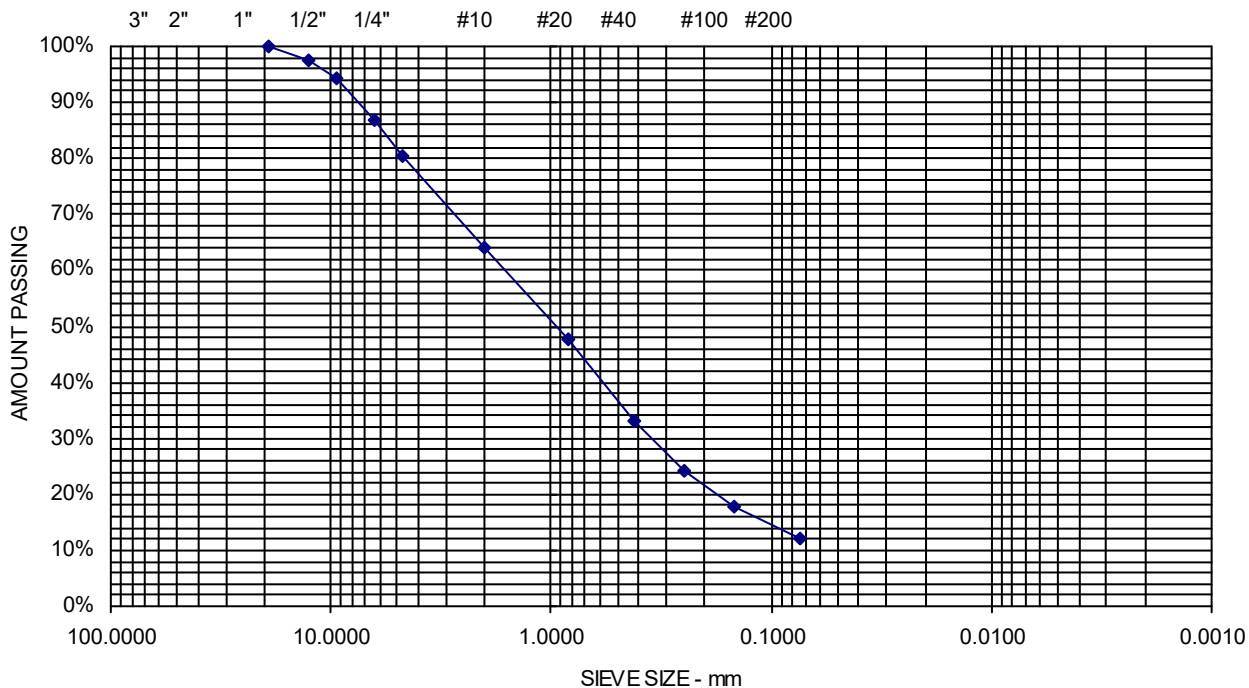
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **P-2 S-1 1'**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24684S
Date Received 2/13/2025
Date Completed 2/19/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	97	
9.5 mm	3/8"	94	
6.3 mm	1/4"	87	
4.75 mm	No. 4	80	19.6% Gravel
2.00 mm	No. 10	64	
850 μm	No. 20	48	
425 μm	No. 40	33	68.2% Sand
250 μm	No. 60	24	
150 μm	No. 100	18	
75 μm	No. 200	12.1	12.1% Fines



Comments: Moisture Content = 8.2%

Sheet



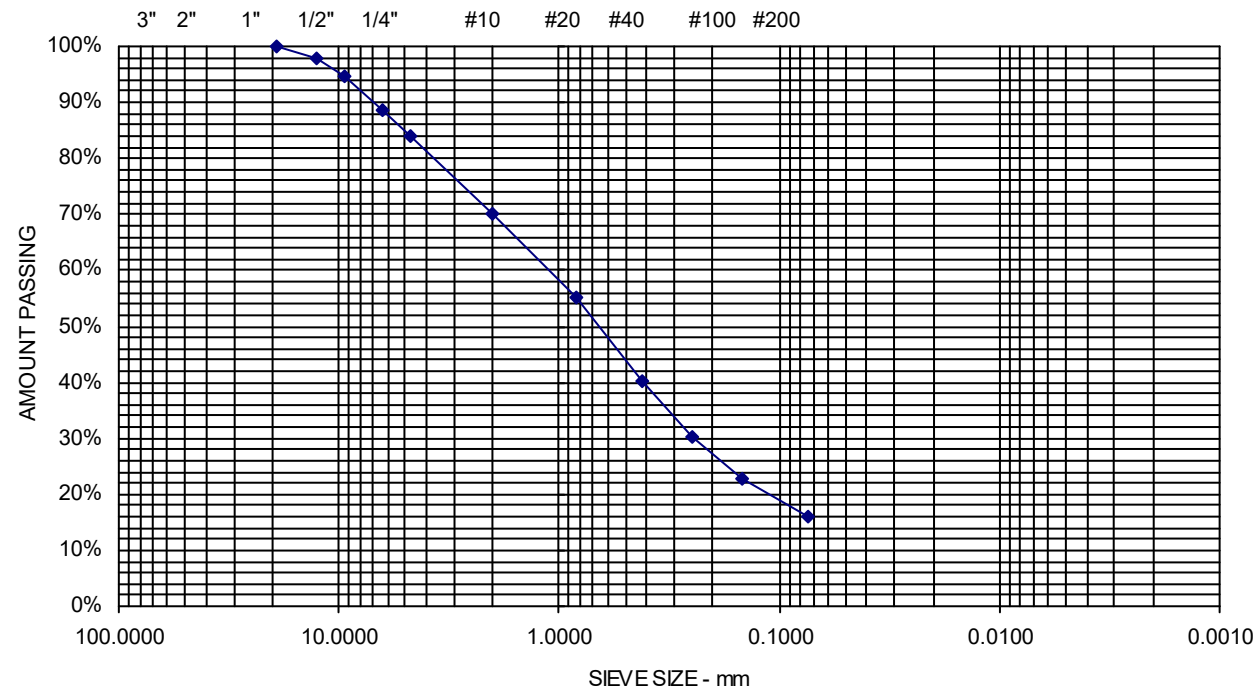
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **P-3 S-1 2'**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24685S
Date Received 2/13/2025
Date Completed 2/19/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	98	
9.5 mm	3/8"	95	
6.3 mm	1/4"	89	
4.75 mm	No. 4	84	15.9% Gravel
2.00 mm	No. 10	70	
850 μm	No. 20	55	
425 μm	No. 40	40	68.1% Sand
250 μm	No. 60	30	
150 μm	No. 100	23	
75 μm	No. 200	16.0	16% Fines



Comments: Moisture Content = 10.3%



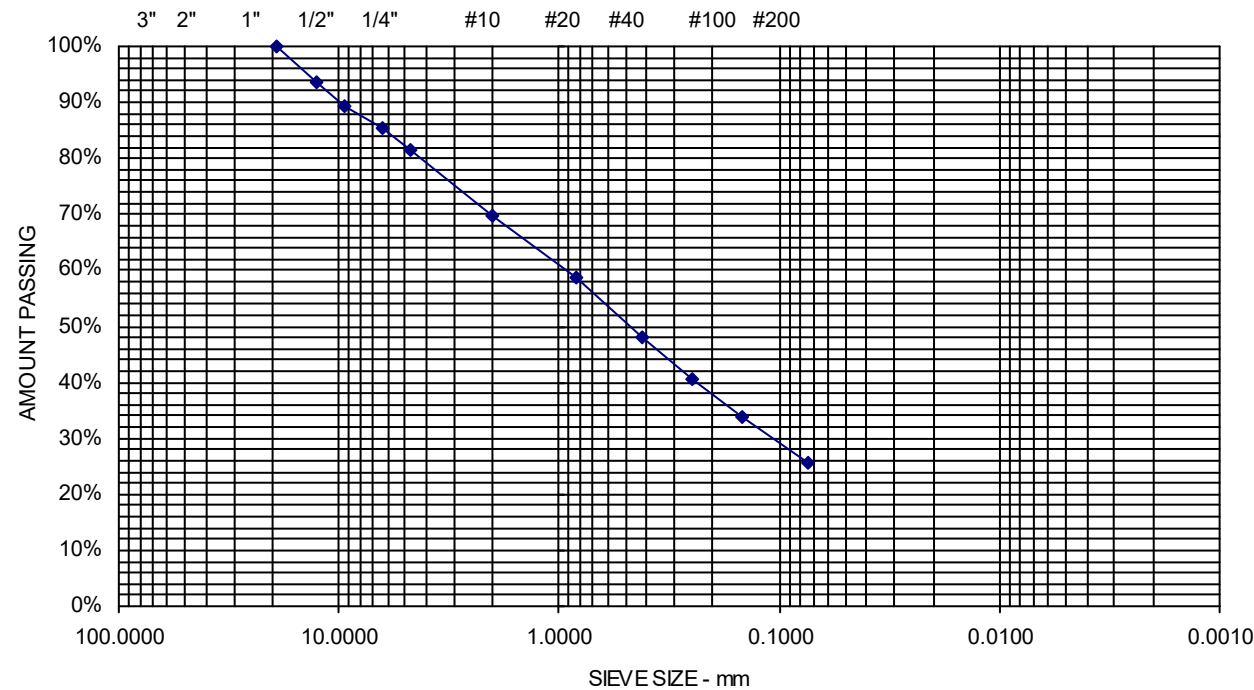
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **P-4 S-1 2'**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24686S
Date Received 2/13/2025
Date Completed 2/19/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	93	
9.5 mm	3/8"	89	
6.3 mm	1/4"	85	
4.75 mm	No. 4	81	18.7% Gravel
2.00 mm	No. 10	70	
850 μm	No. 20	59	
425 μm	No. 40	48	55.6% Sand
250 μm	No. 60	41	
150 μm	No. 100	34	
75 μm	No. 200	25.8	25.8% Fines



Comments: Moisture Content = 9.4%



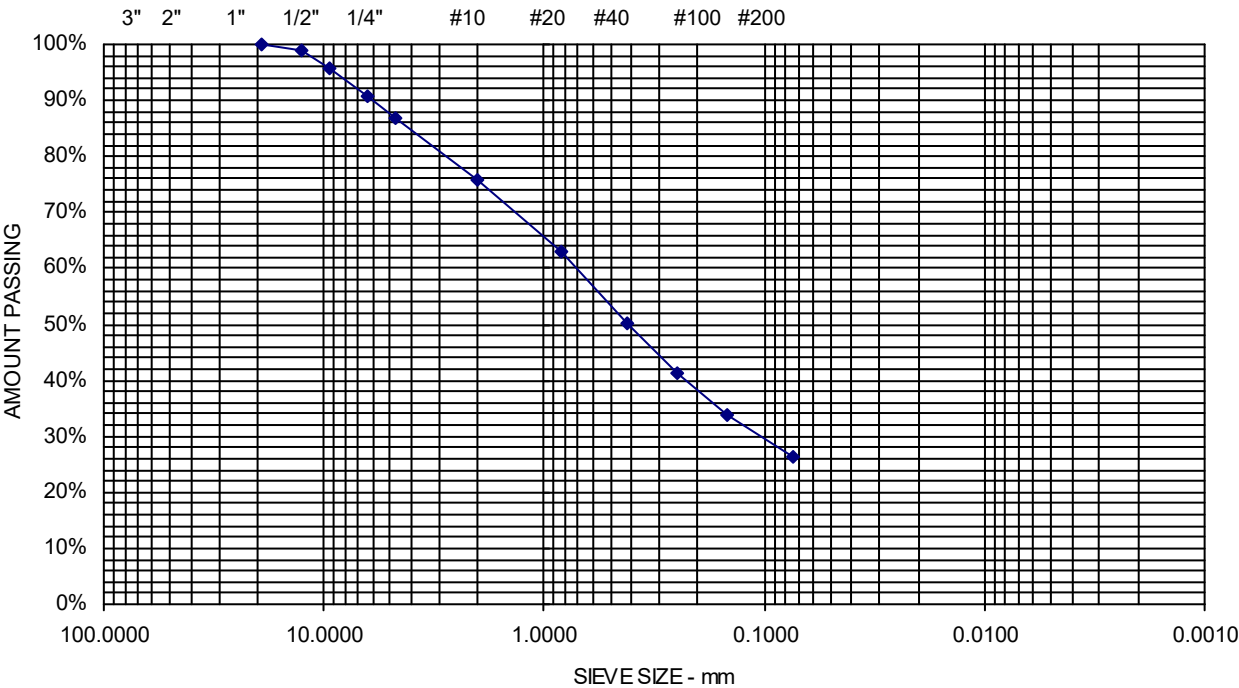
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **P-5 S-1 1.5'**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24687S
Date Received 2/13/2025
Date Completed 2/19/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	99	
9.5 mm	3/8"	96	
6.3 mm	1/4"	91	
4.75 mm	No. 4	87	13.2% Gravel
2.00 mm	No. 10	76	
850 μm	No. 20	63	
425 μm	No. 40	50	60.6% Sand
250 μm	No. 60	41	
150 μm	No. 100	34	
75 μm	No. 200	26.3	26.3% Fines



Comments: Moisture Content = 10.9%



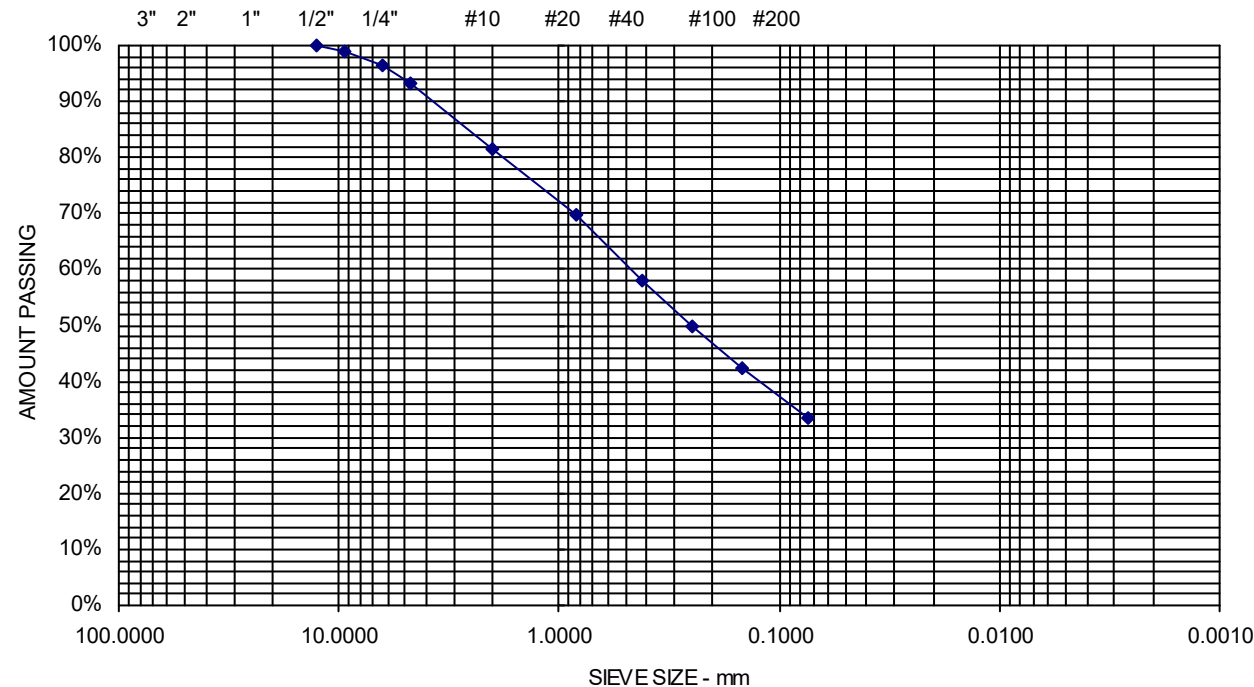
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **P-6 S-1 1'**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24688S
Date Received 2/13/2025
Date Completed 2/19/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
12.5 mm	1/2"	100	
9.5 mm	3/8"	99	
6.3 mm	1/4"	96	
4.75 mm	No. 4	93	6.6% Gravel
2.00 mm	No. 10	82	
850 μm	No. 20	70	
425 μm	No. 40	58	59.9% Sand
250 μm	No. 60	50	
150 μm	No. 100	42	
75 μm	No. 200	33.5	33.5% Fines



Comments: Moisture Content = 12.5%



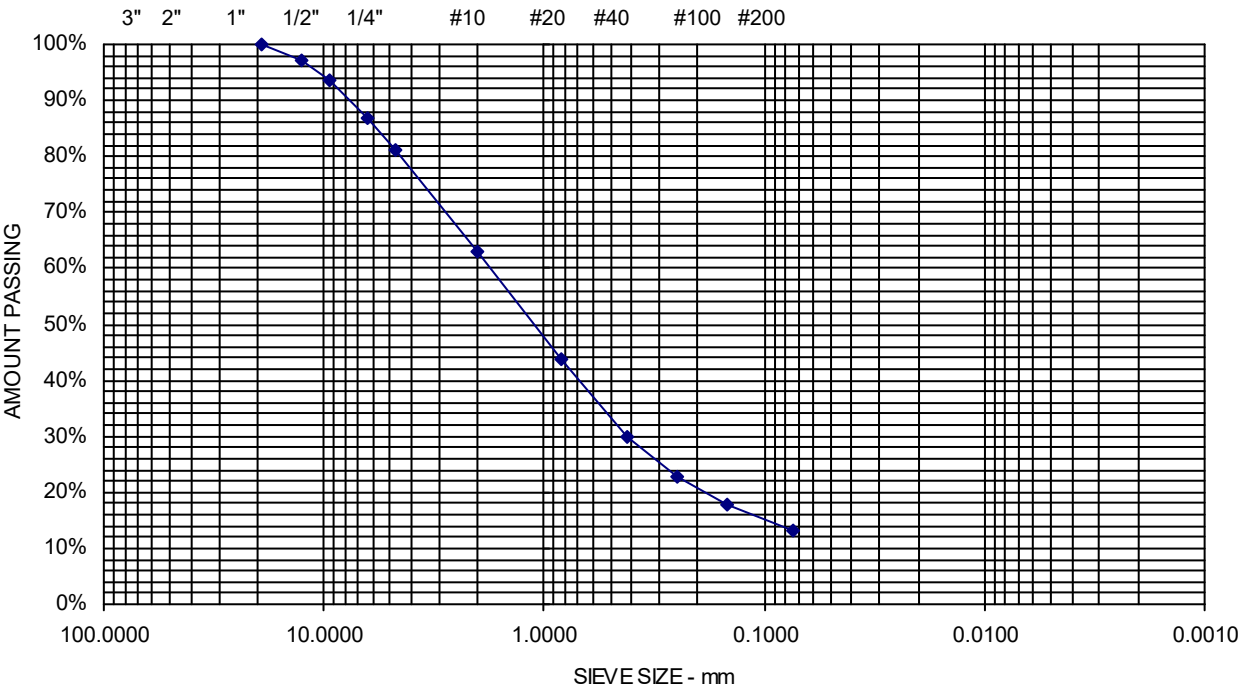
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **P-7 S-1 1.5'**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24689S
Date Received 2/13/2025
Date Completed 2/19/2025
Tested By BRADLEY GERSCHWILER

<u>STANDARD</u> <u>DESIGNATION (mm/μm)</u>	<u>SIEVE SIZE</u>	<u>AMOUNT PASSING (%)</u>	
19.0 mm	3/4"	100	
12.5 mm	1/2"	97	
9.5 mm	3/8"	94	
6.3 mm	1/4"	87	
4.75 mm	No. 4	81	18.9% Gravel
2.00 mm	No. 10	63	
850 μm	No. 20	44	
425 μm	No. 40	30	67.8% Sand
250 μm	No. 60	23	
150 μm	No. 100	18	
75 μm	No. 200	13.2	13.2% Fines



Comments: Moisture Content = 4.3%



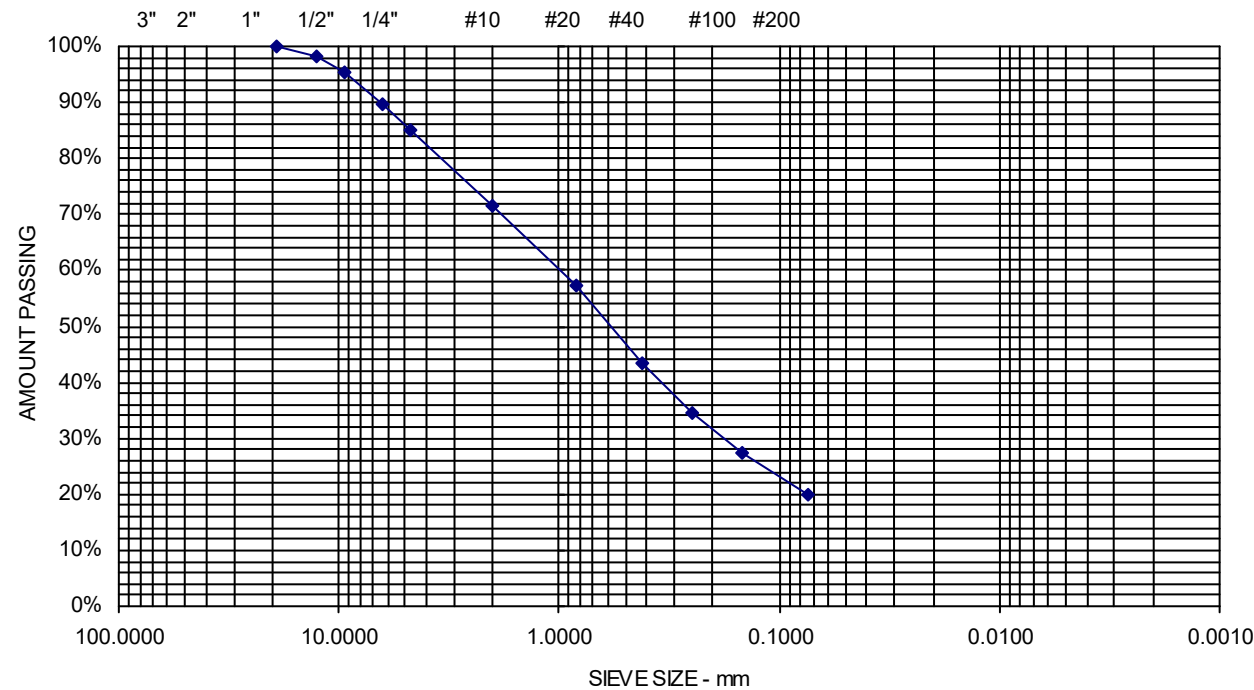
Report of Gradation

ASTM C-117 & C-136

Project Name BETHLEHEM NH - PROPOSED MAPLEWOOD HILL ROAD
IMPROVEMENT - EXPLORATIONS AND GEOTECHNICAL
Client HEB ENGINEERS, INC.
Exploration **P-8 S-1 1'**
Material Source **ON SITE**

Project Number 24-1697
Lab ID 24690S
Date Received 2/13/2025
Date Completed 2/19/2025
Tested By BRADLEY GERSCHWILER

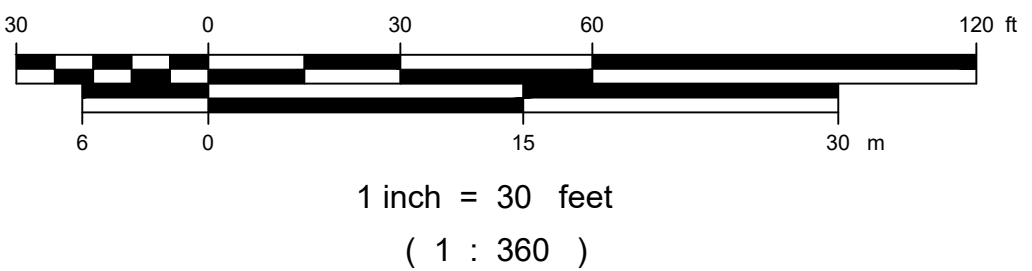
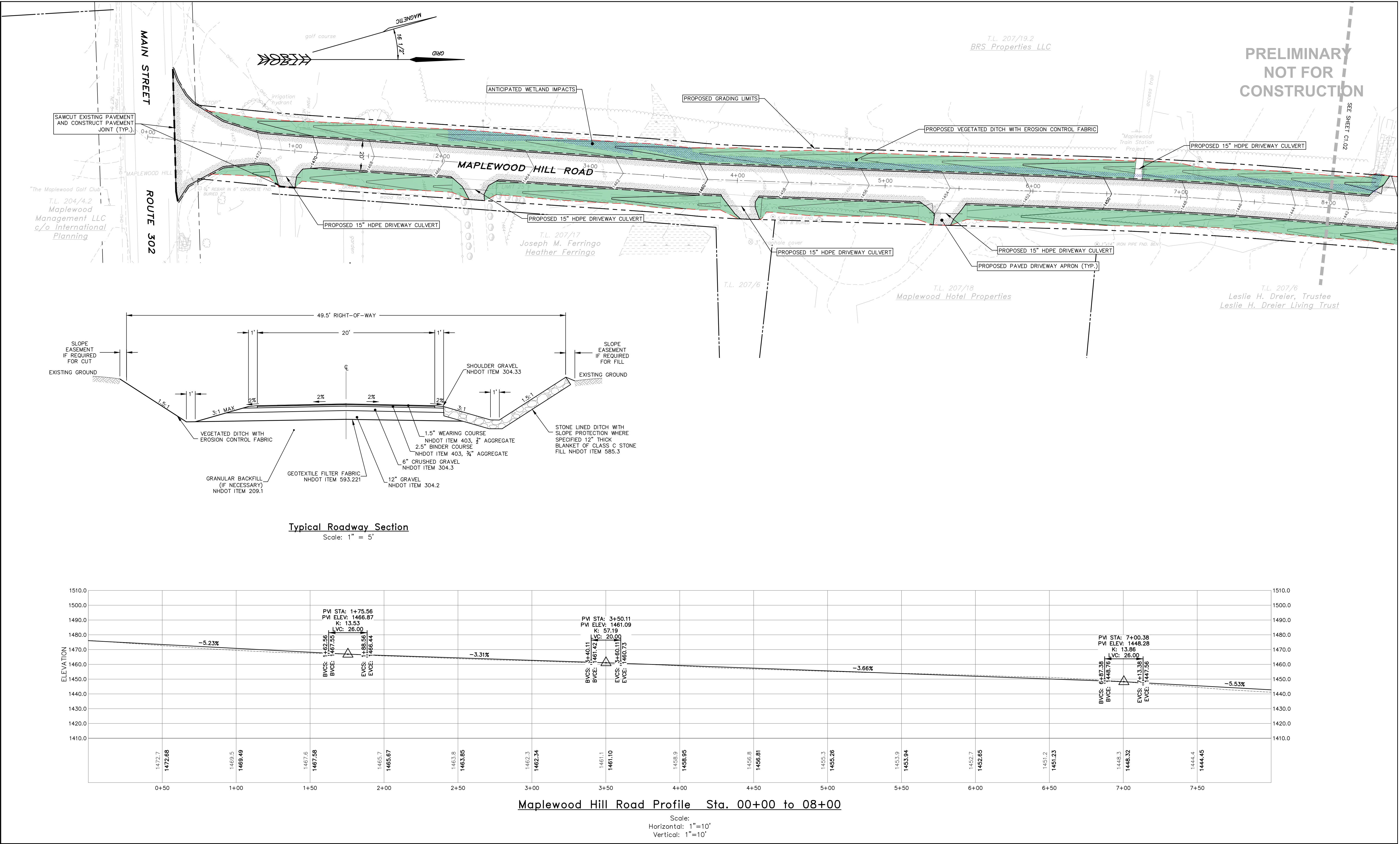
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12.5 mm	1/2"	98	
9.5 mm	3/8"	95	
6.3 mm	1/4"	90	
4.75 mm	No. 4	85	15% Gravel
2.00 mm	No. 10	72	
850 μm	No. 20	57	
425 μm	No. 40	43	65.1% Sand
250 μm	No. 60	35	
150 μm	No. 100	27	
75 μm	No. 200	19.9	19.9% Fines



Comments: Moisture Content = 8.1%

APPENDIX E

Conceptual Sketches



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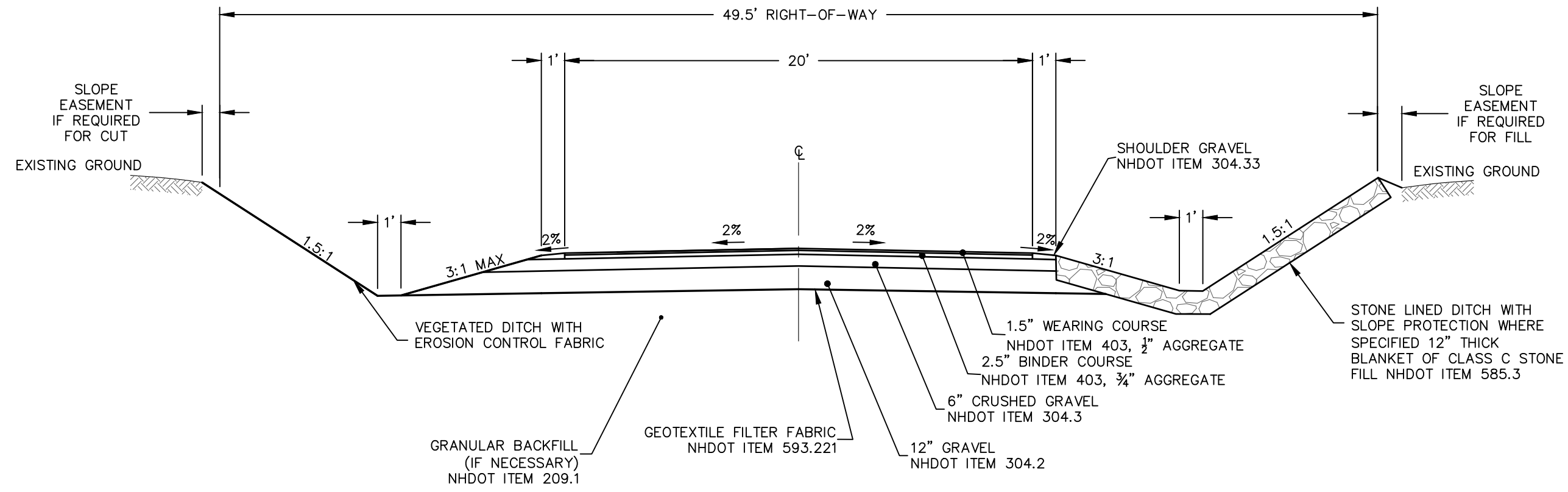
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DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

Roadway Layout Plan - Alternative 1

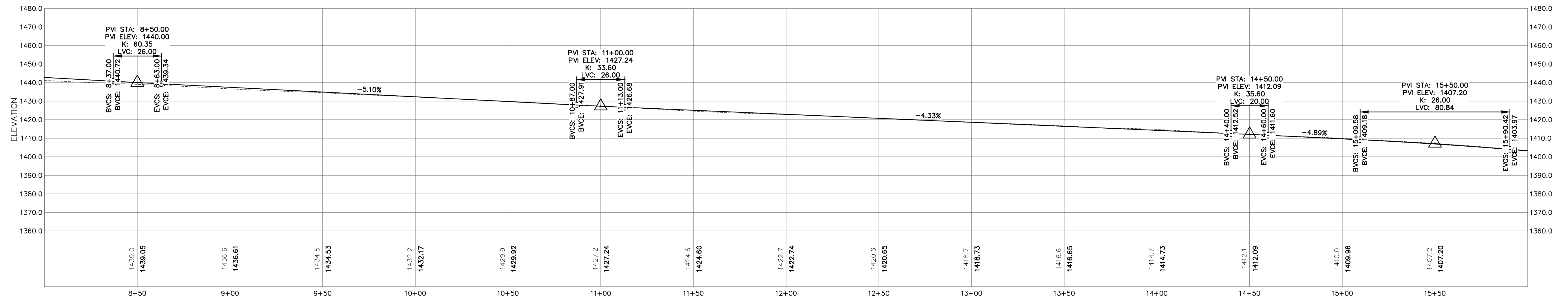
for the
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem

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2024-090
C1.01
SHEET 1 OF 5

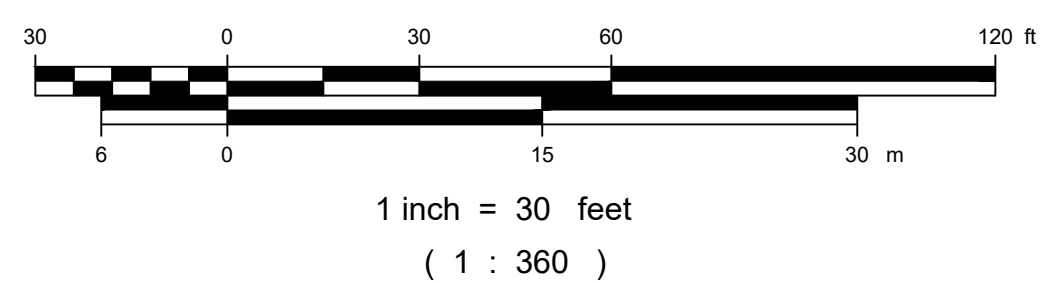


Typical Roadway Section
Scale: 1" = 5'

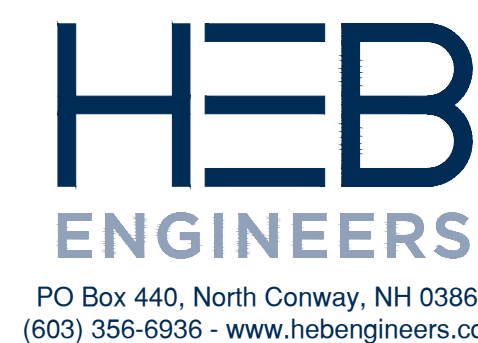


Maplewood Hill Road Profile Sta. 08+00 to 16+00

Scale:
Horizontal: 1"=10'
Vertical: 1"=10'



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SURVEYED BY	OTHERS
DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

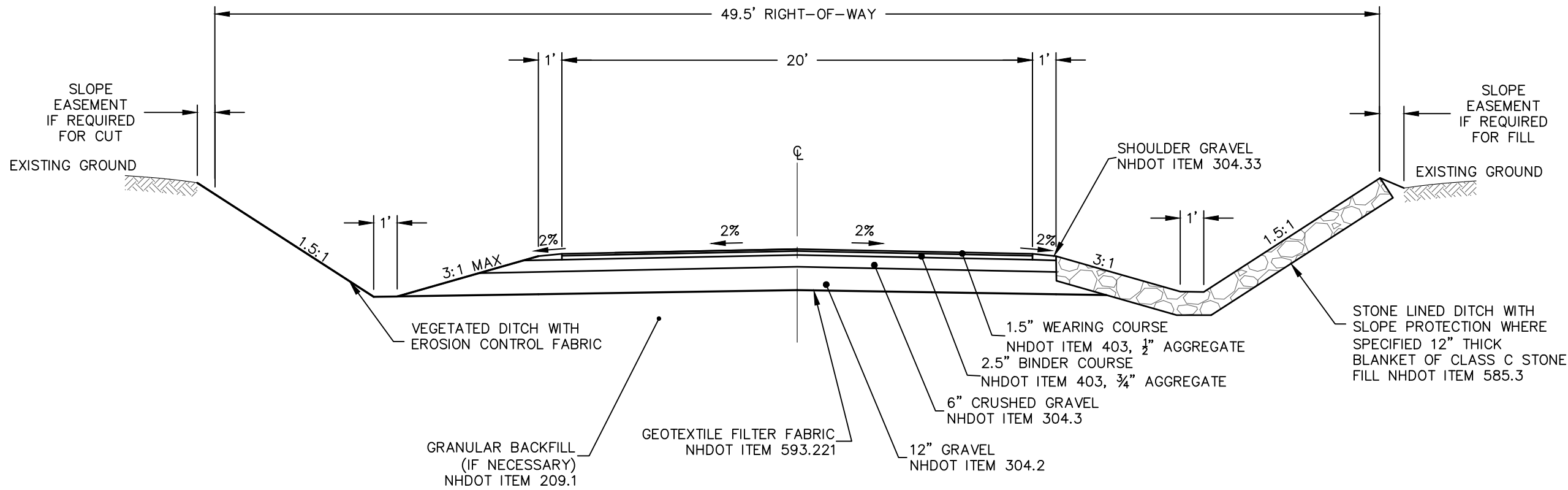
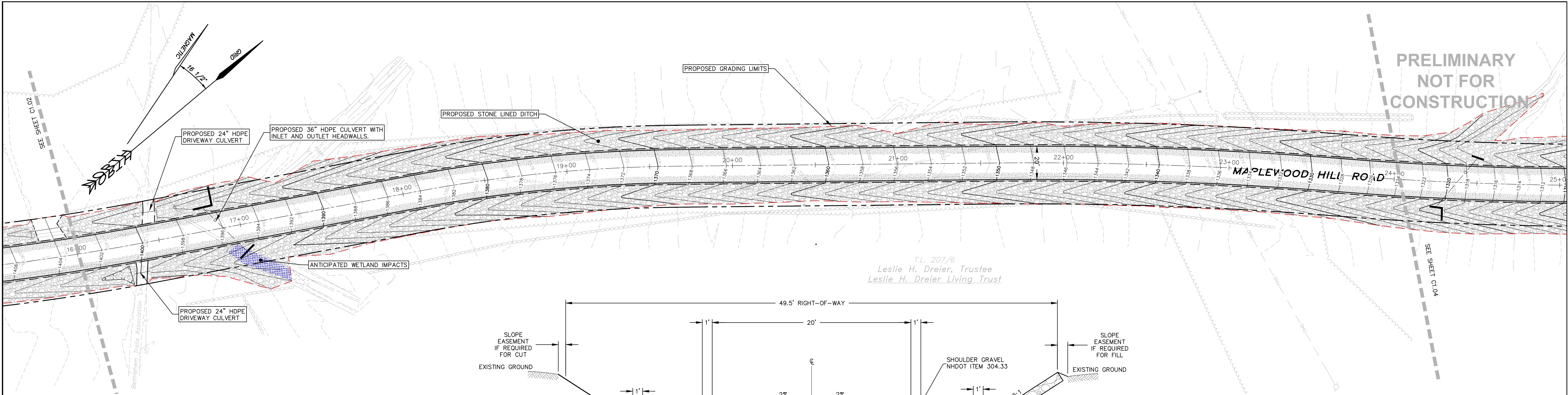
Roadway Layout Plan – Alternative 1

for the
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem

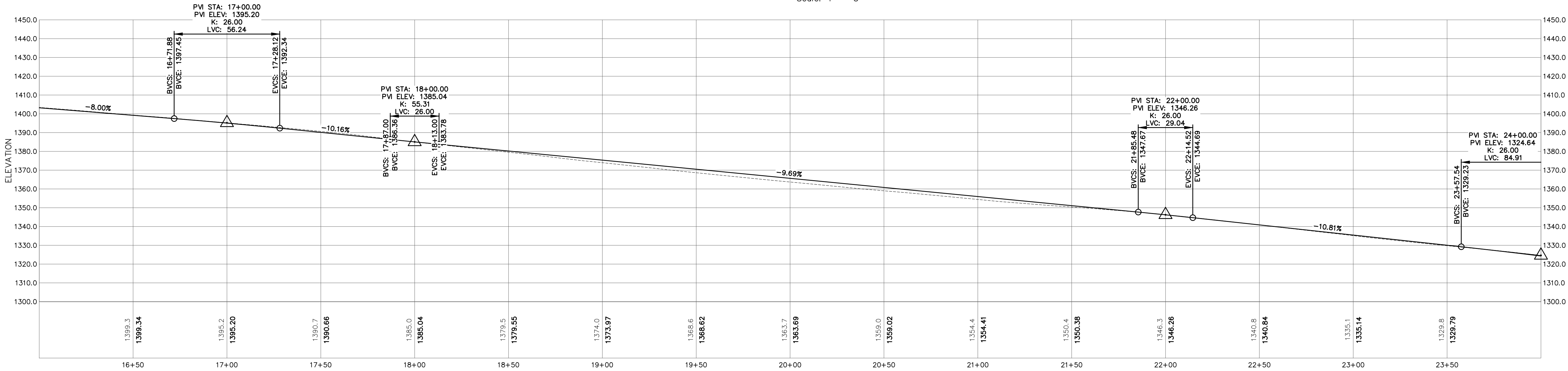
2024-090

C1.02

SHEET 2 OF 5

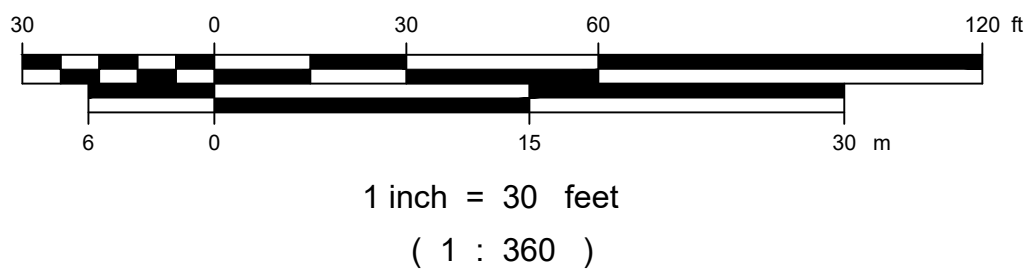


Typical Roadway Section
Scale: 1" = 5'

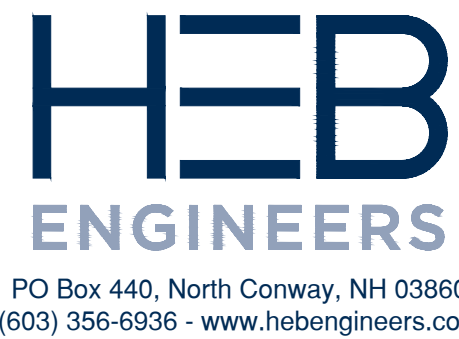


Maplewood Hill Road Profile Sta. 16+00 to 24+00

Scale:
Horizontal: 1"=10'
Vertical: 1"=10'



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DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

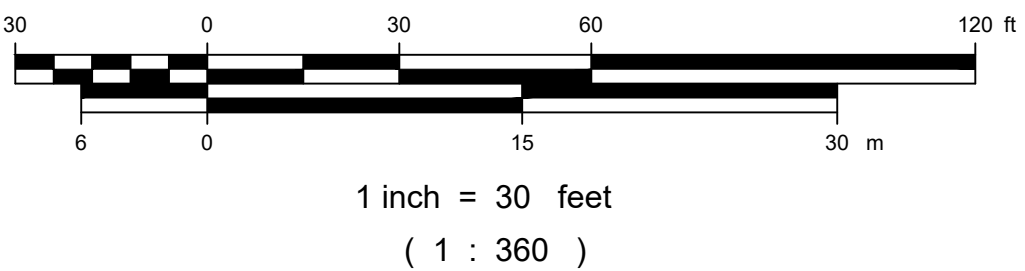
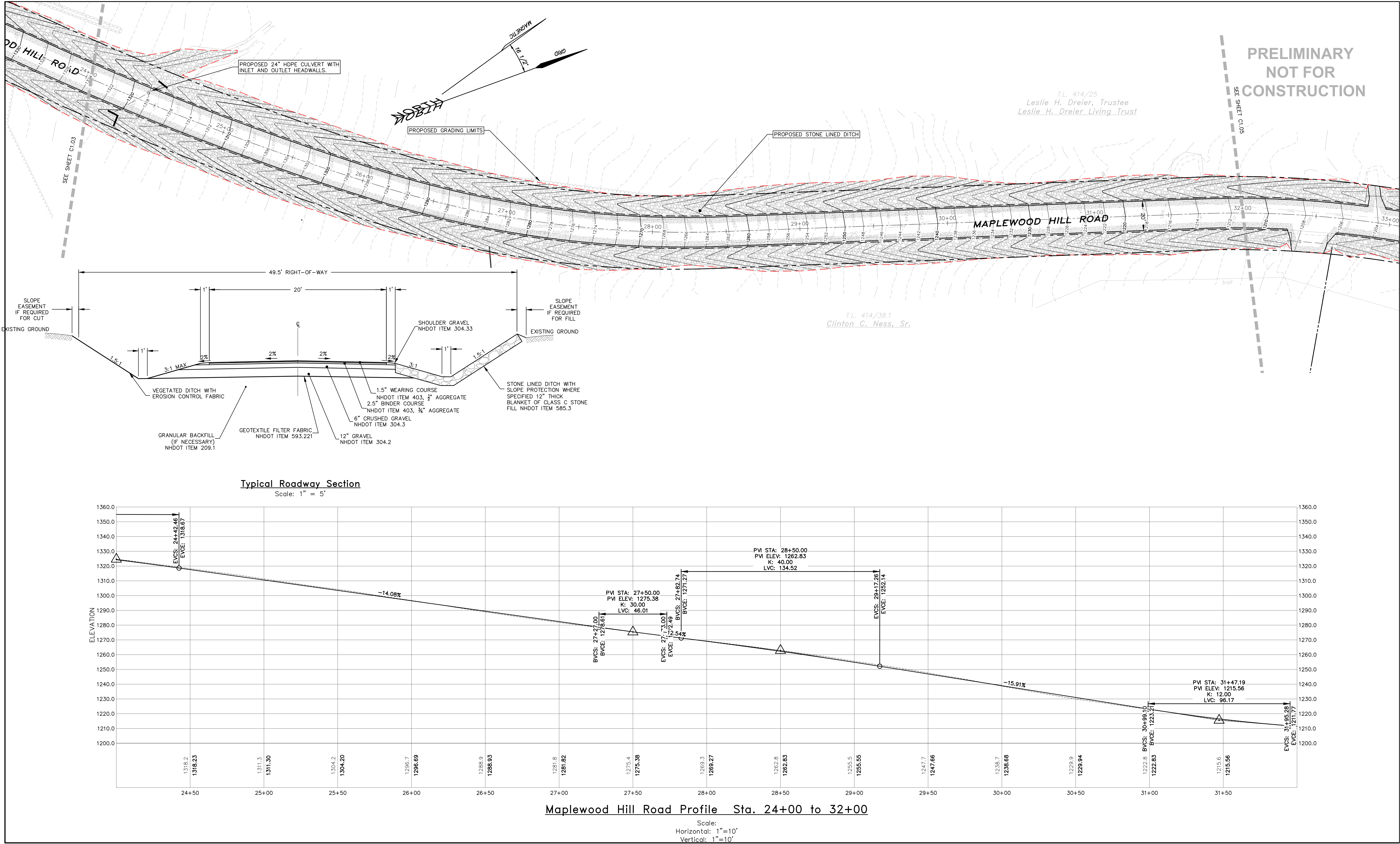
Roadway Layout Plan - Alternative 1

for the
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located in and prepared for the
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2024-090

C1.03

SHEET 3 OF 5



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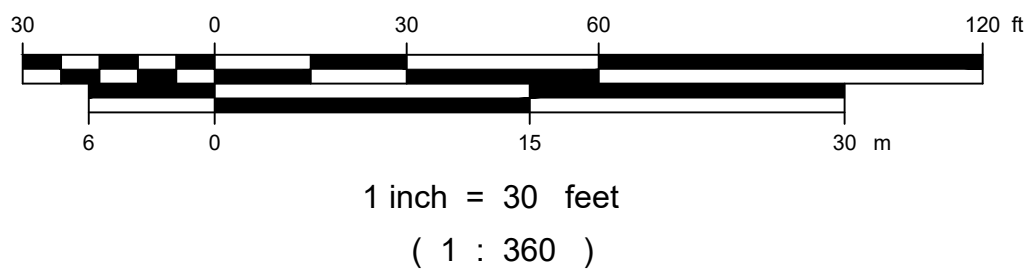
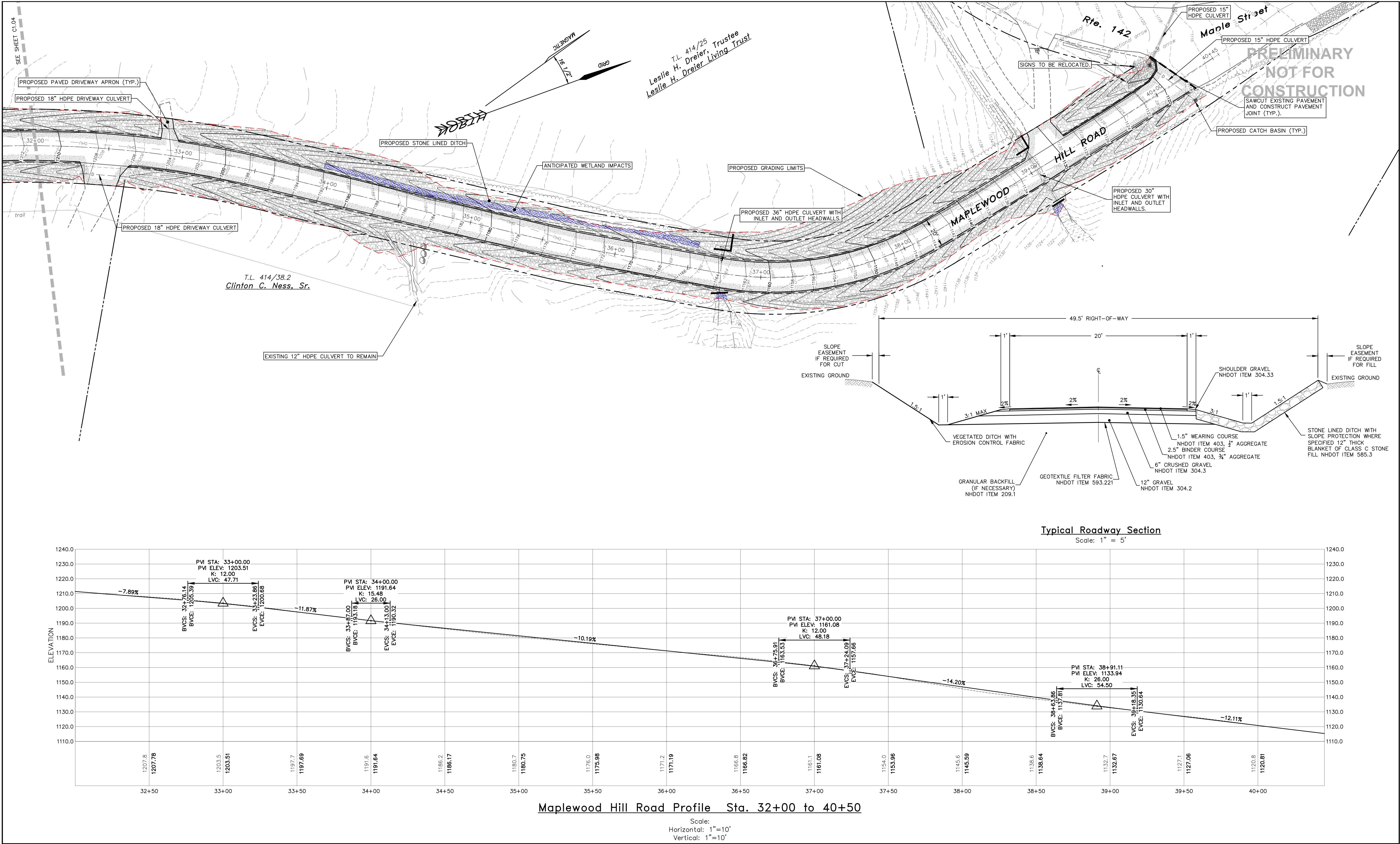


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DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

Roadway Layout Plan - Alternative 1

for the
Maplewood Hill Road
located in and prepared for the
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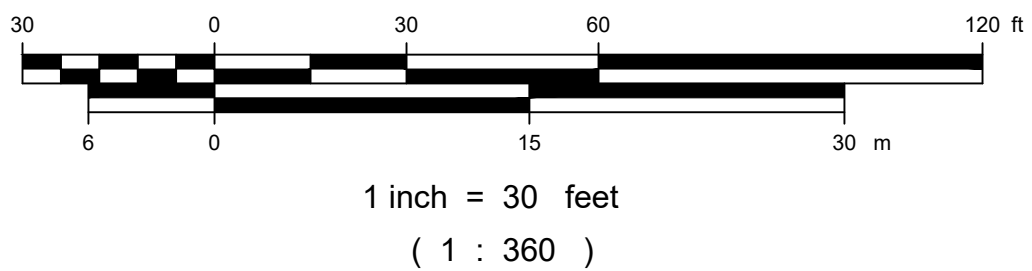
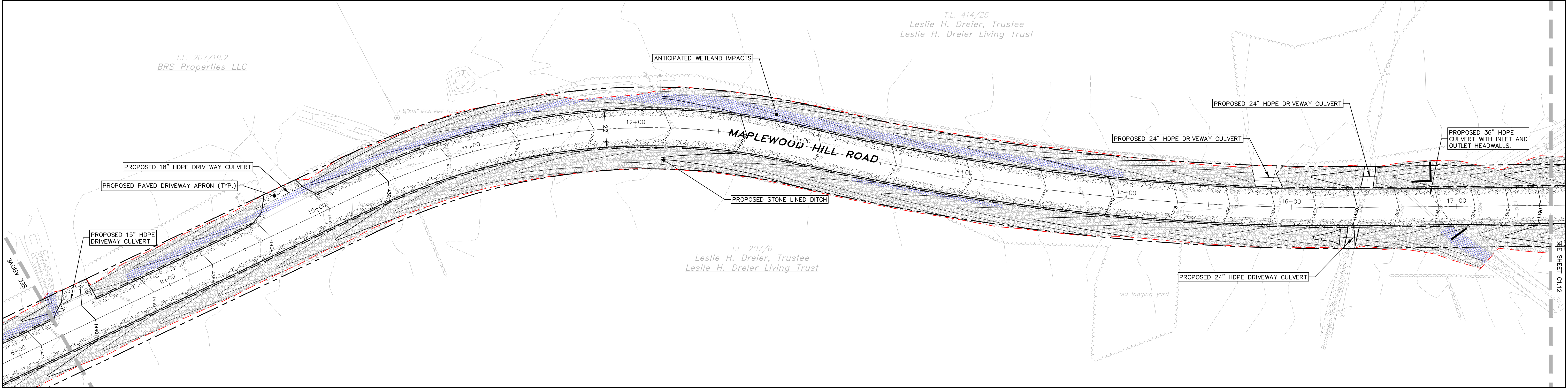
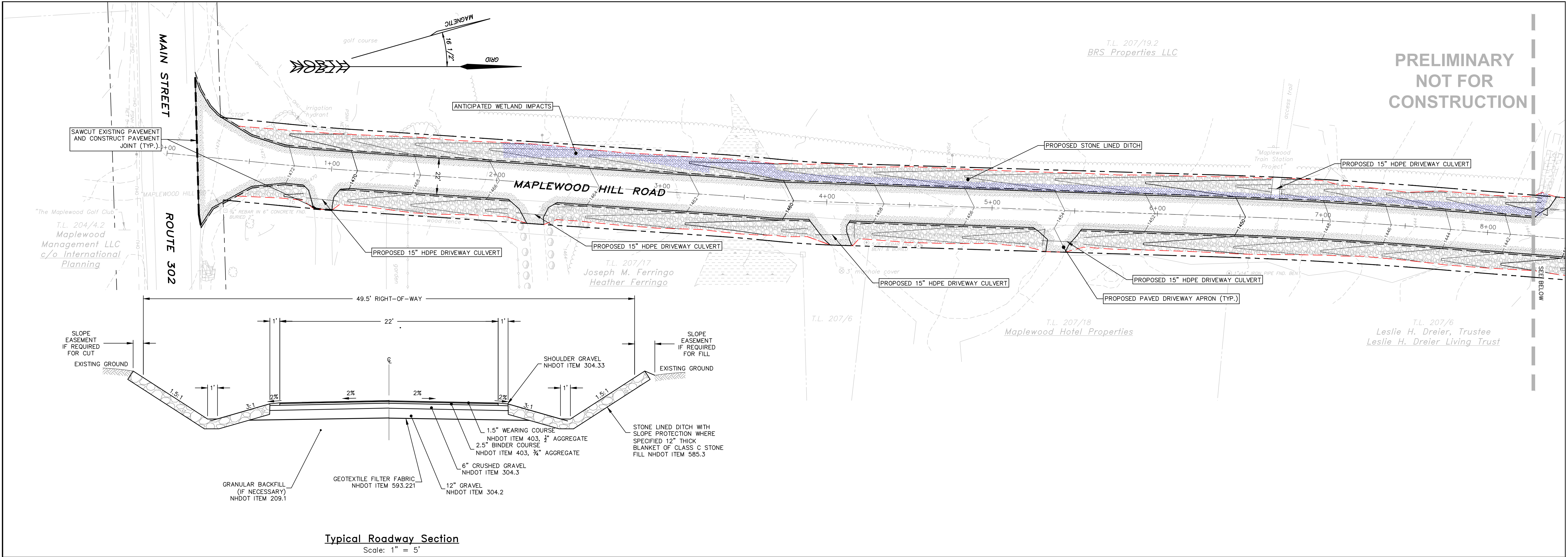
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DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
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SCALE	1"=30'
DATE	09/19/2025

Roadway Layout Plan - Alternative 1

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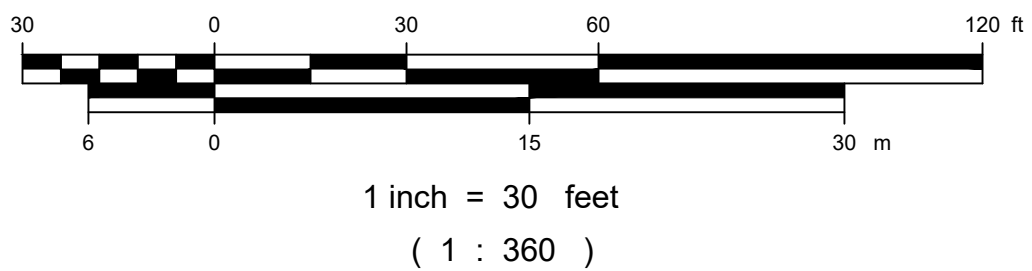
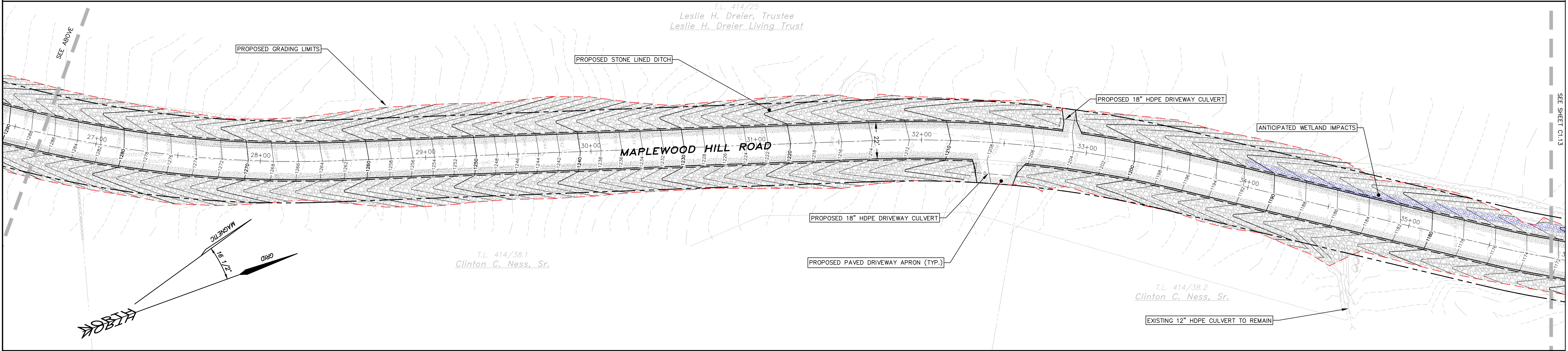
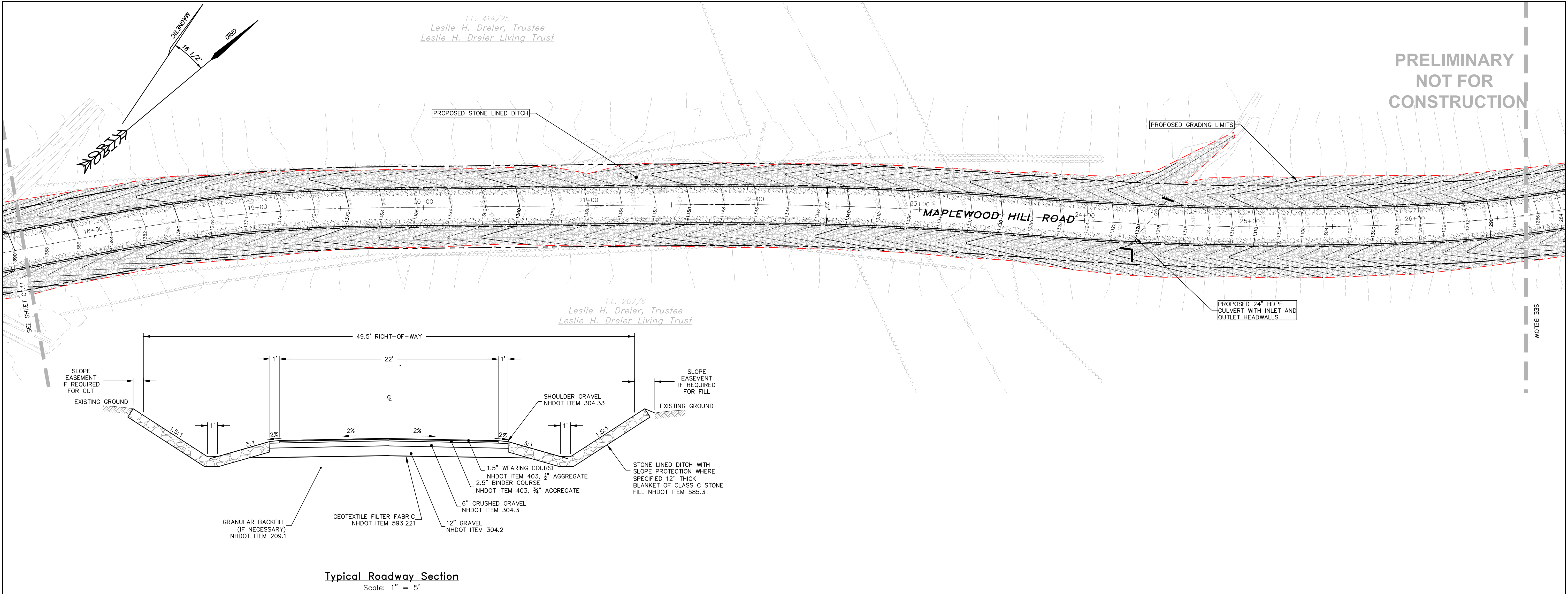


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DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

Roadway Layout Plan - Alternative 2

for the
Maplewood Hill Road
located in and prepared for the
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2024-090
C1.11
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FIELD BOOK	N/A
SCALE	1" = 30'
DATE	09/19/2025

Roadway Layout Plan - Alternative 2

for the
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem

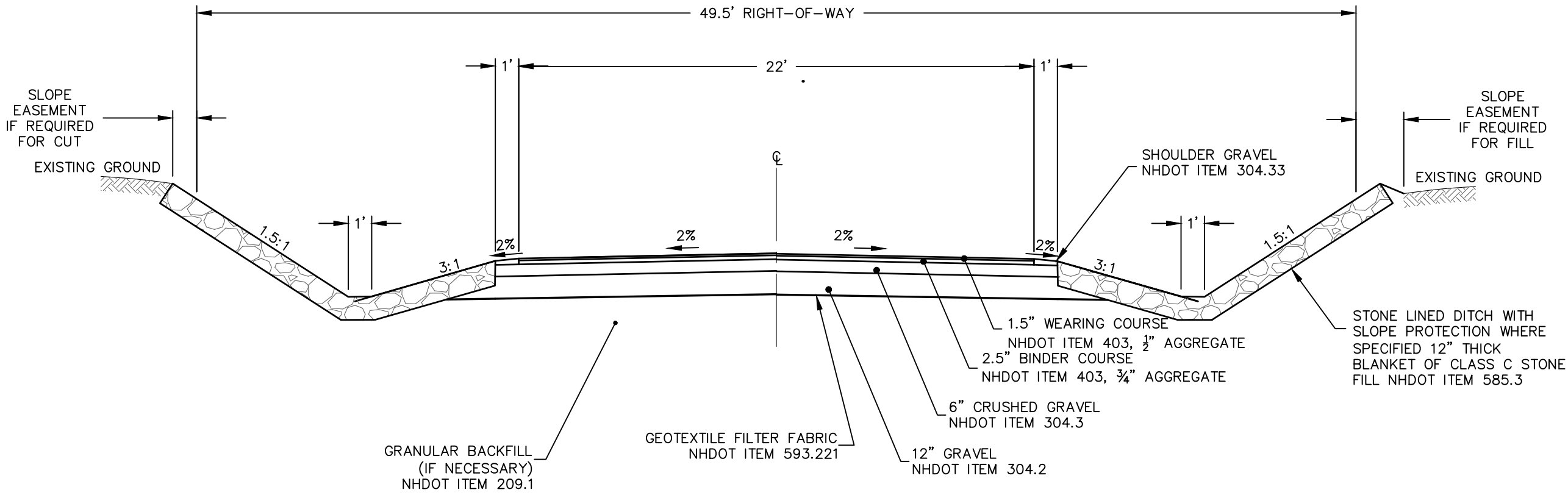
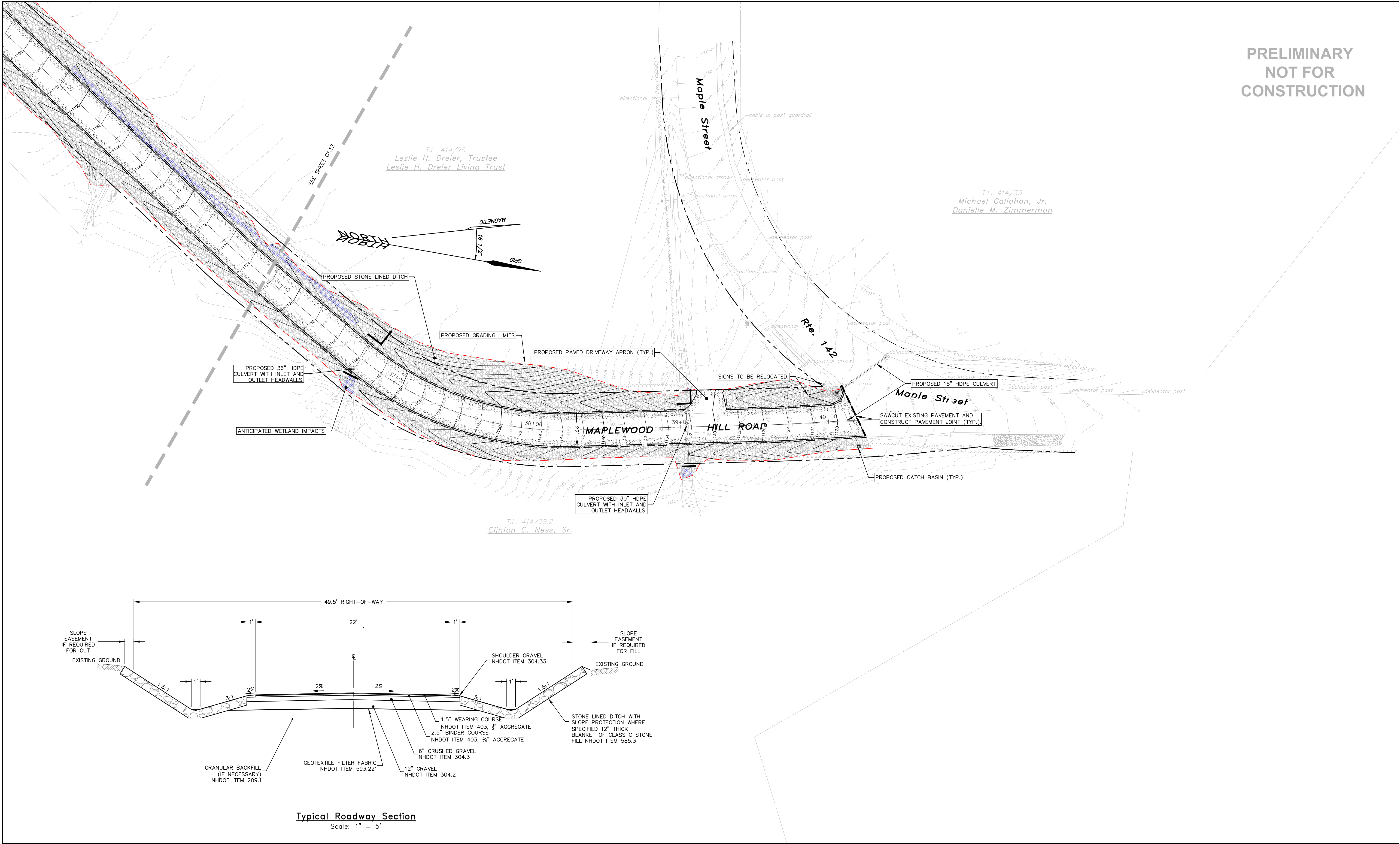
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2024-090

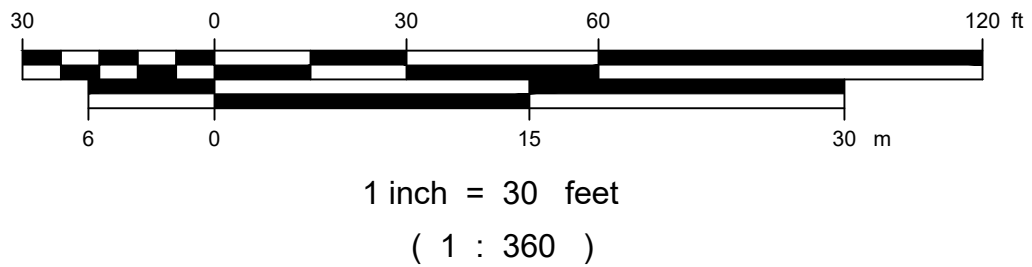
C1.12

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Typical Roadway Section
Scale: 1" = 5'



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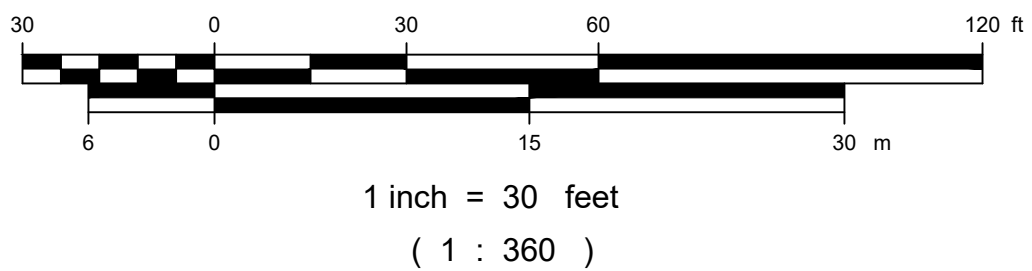
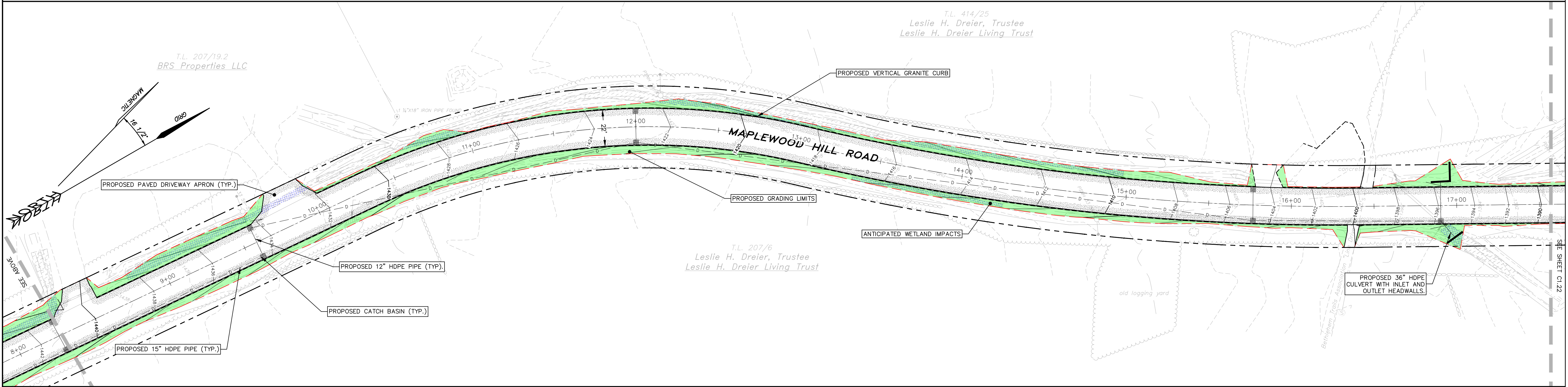
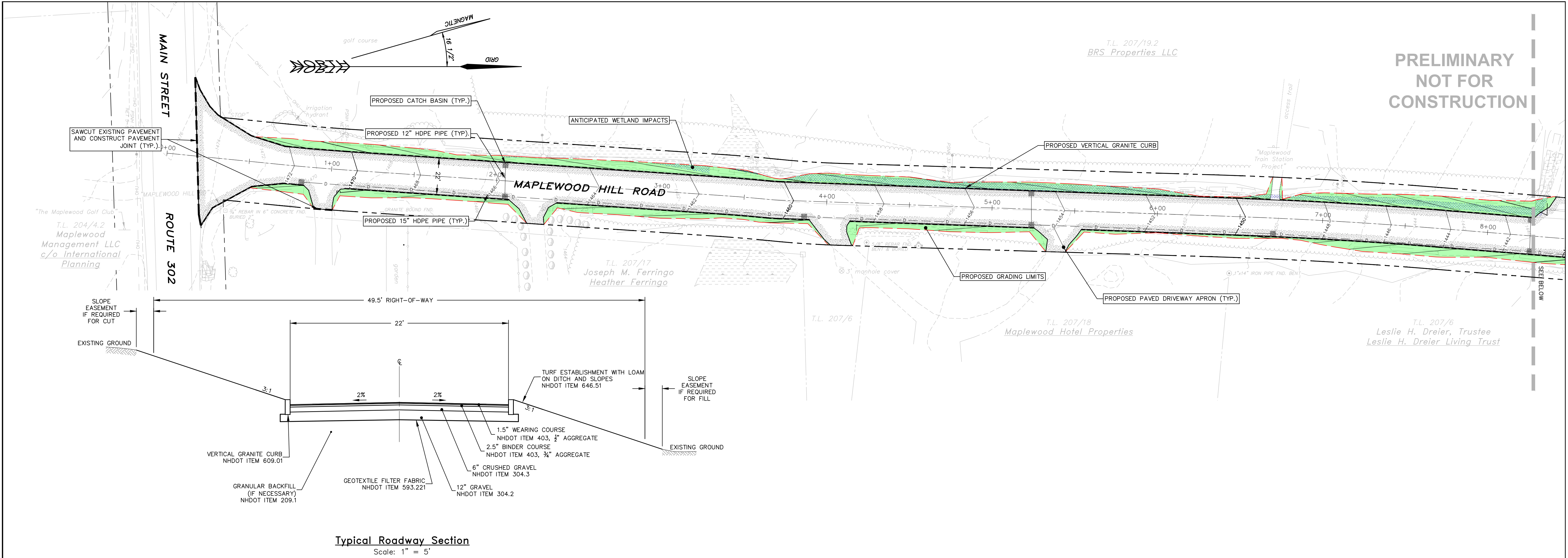
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SURVEYED BY	OTHERS
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DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

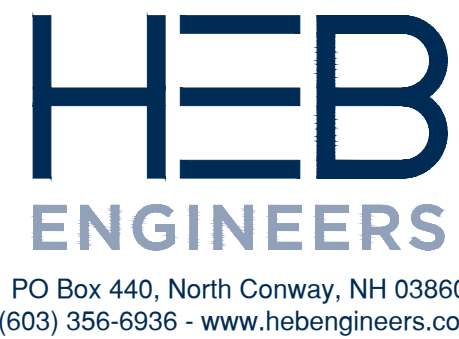
Roadway Layout Plan - Alternative 2

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DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

Roadway Layout Plan - Alternative 3

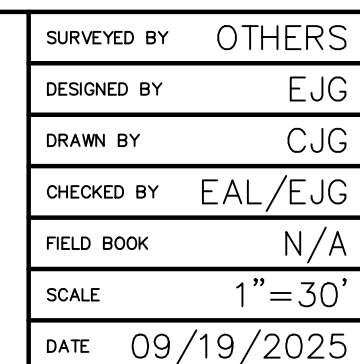
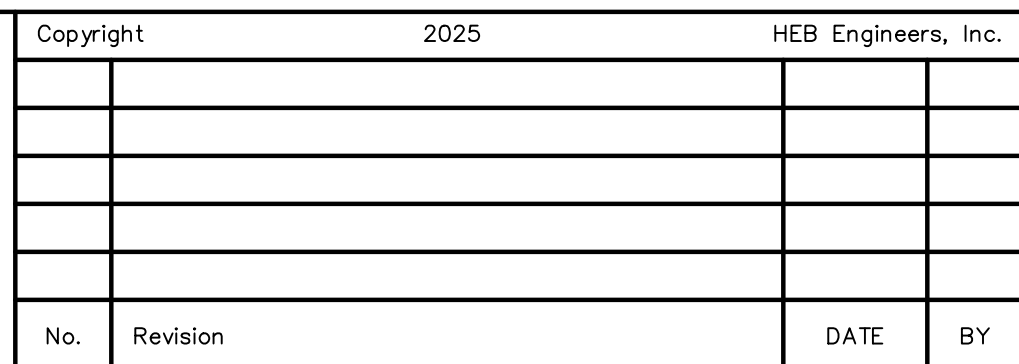
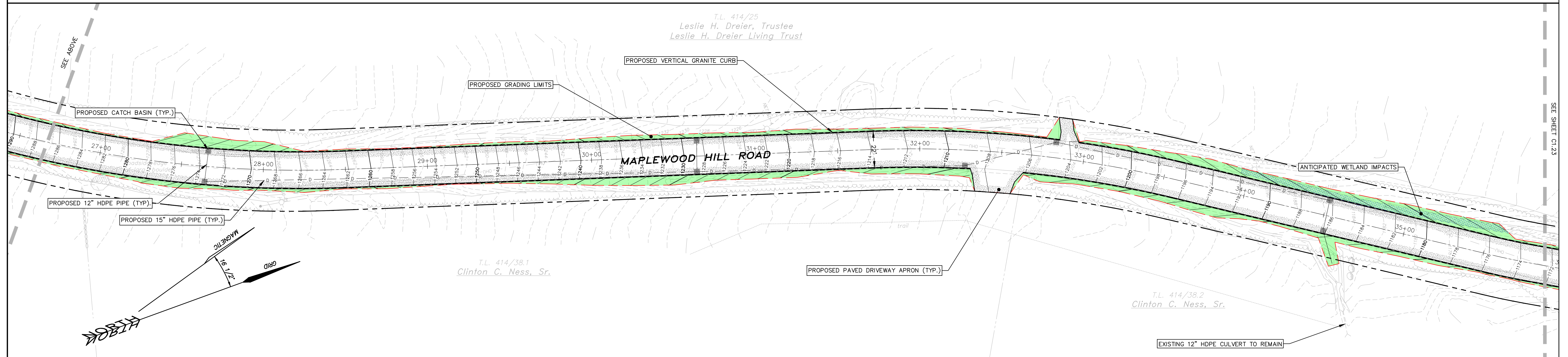
for the
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located in and prepared for the
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2024-090

C1.21

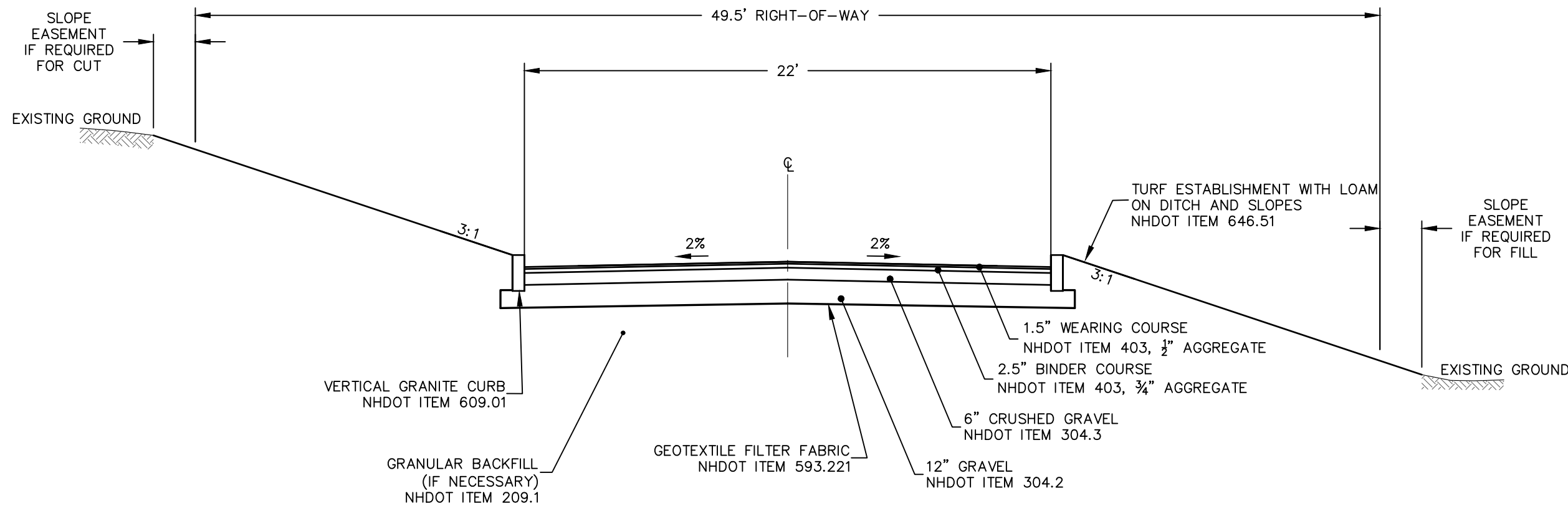
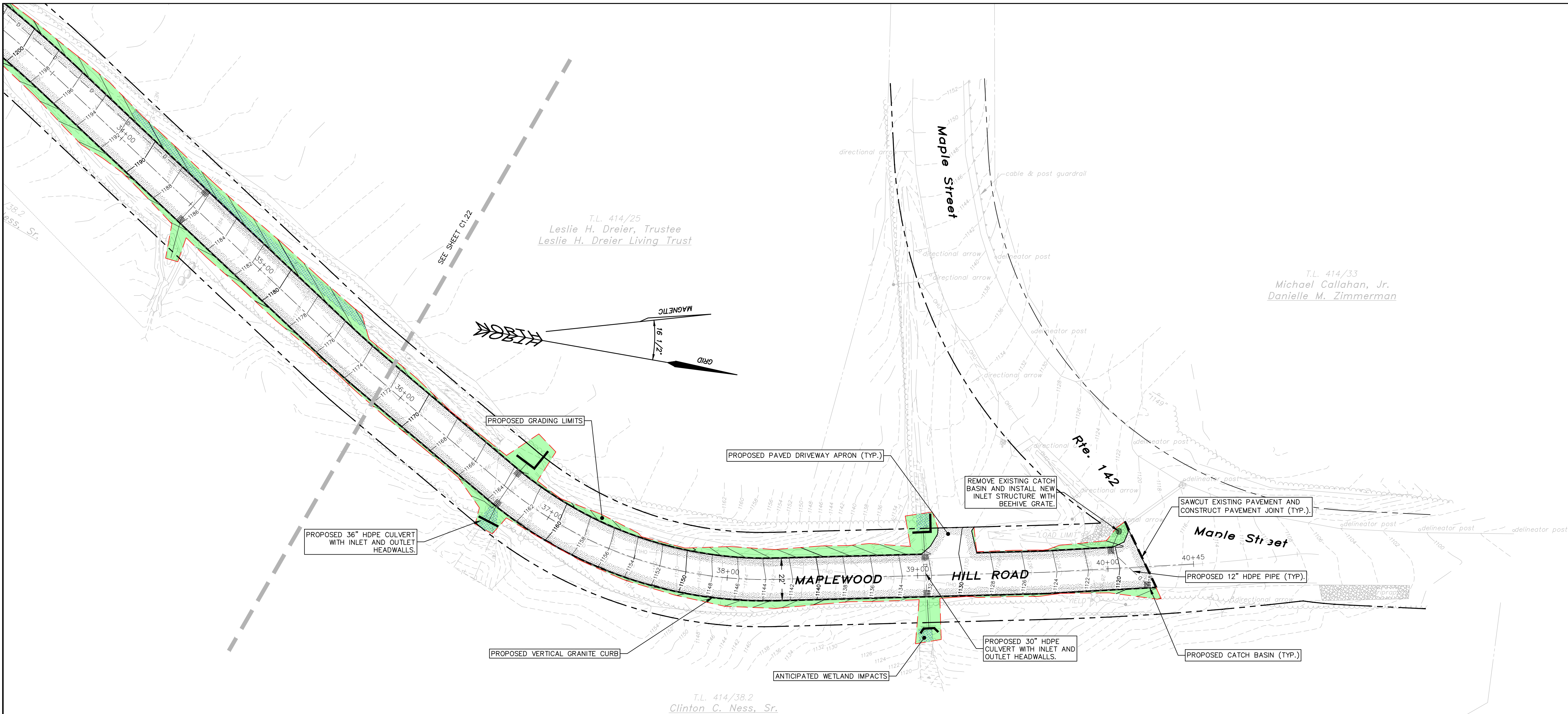
SHEET 1 OF 3



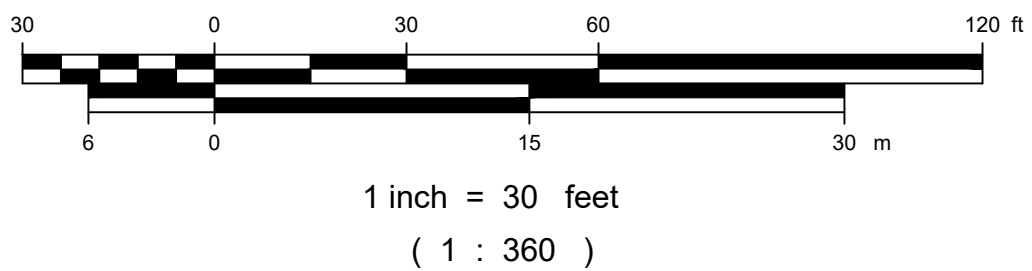
for the
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem

SHEET 2 OF 3

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Typical Roadway Section
Scale: 1" = 5'



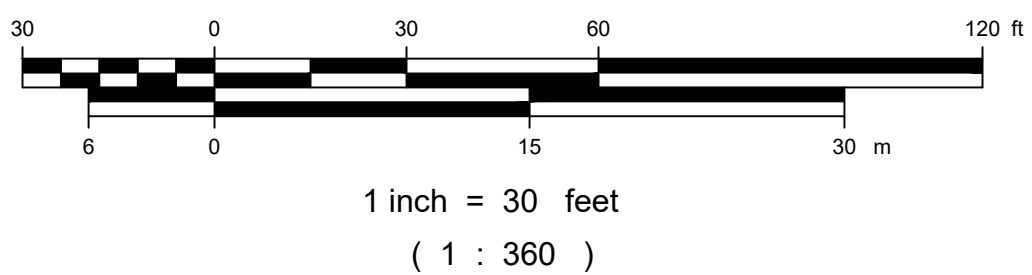
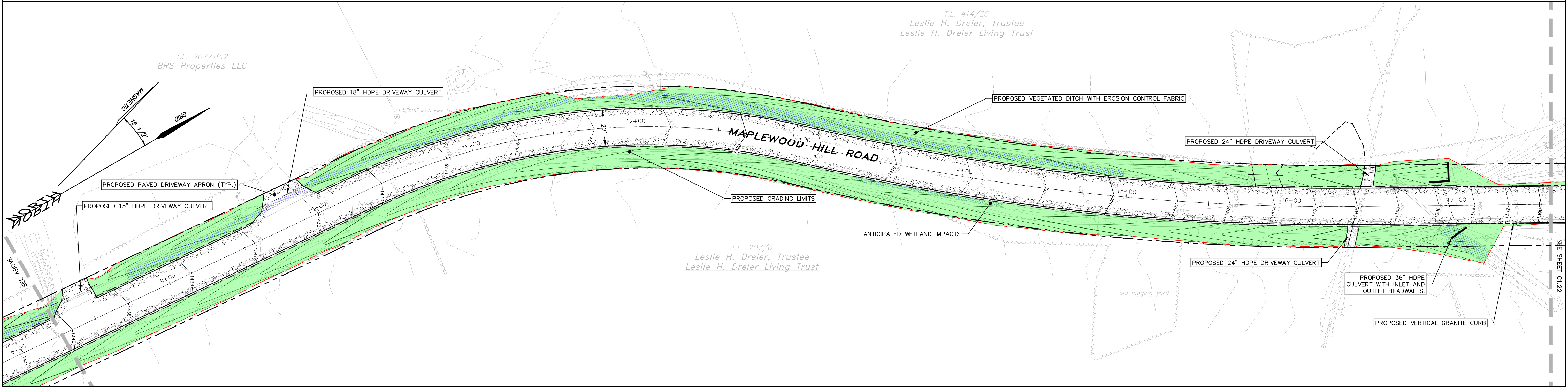
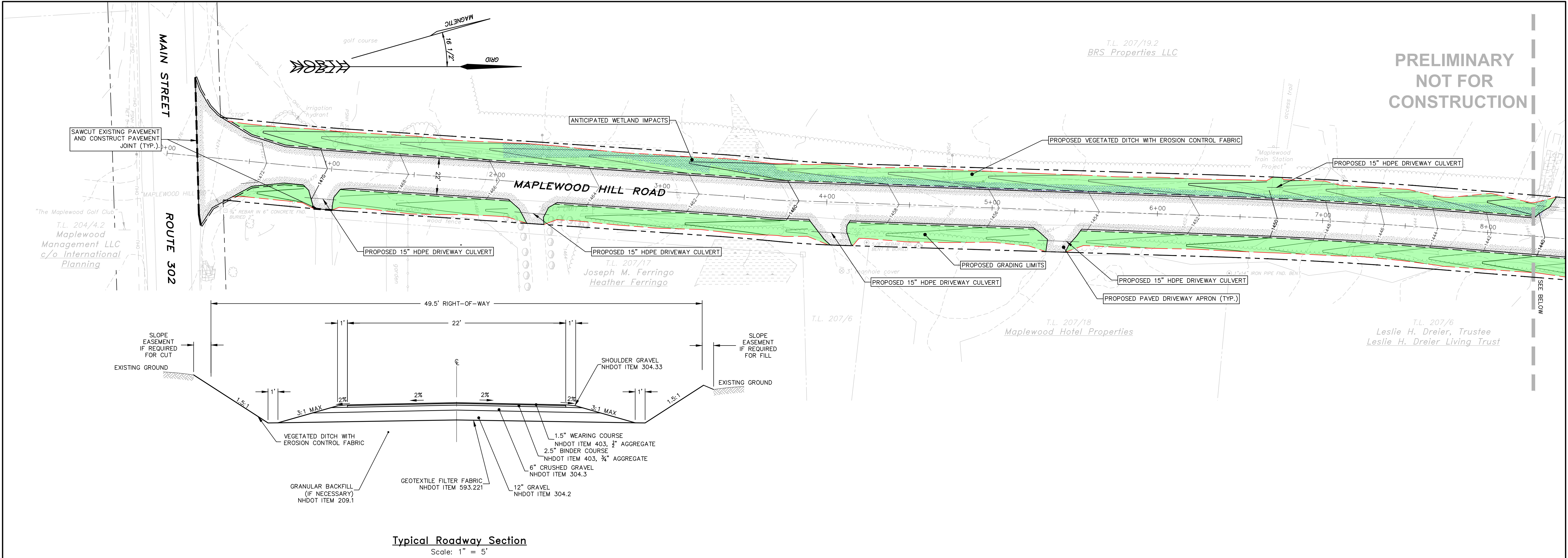
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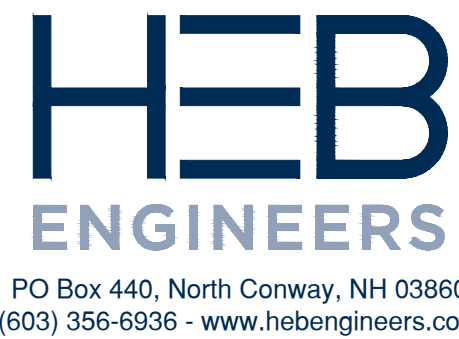
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DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

Roadway Layout Plan - Alternative 3
for the
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem

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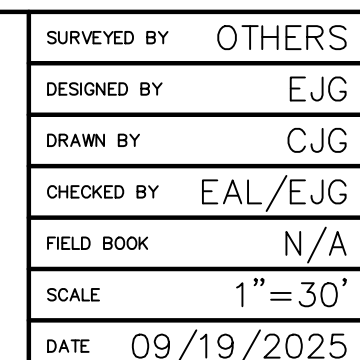
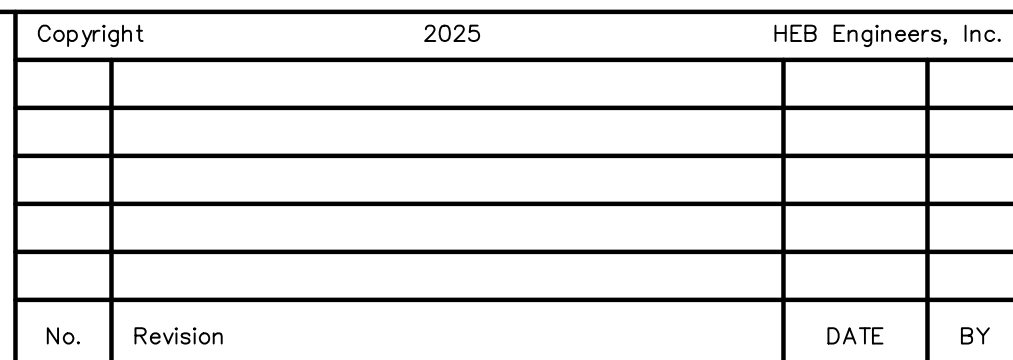
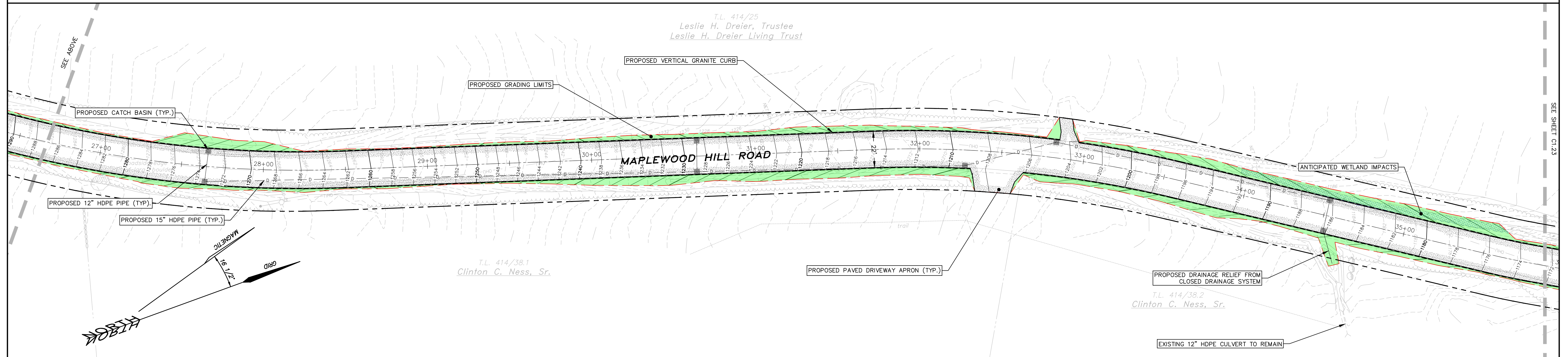


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SURVEYED BY	OTHERS
DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1" = 30'
DATE	09/19/2025

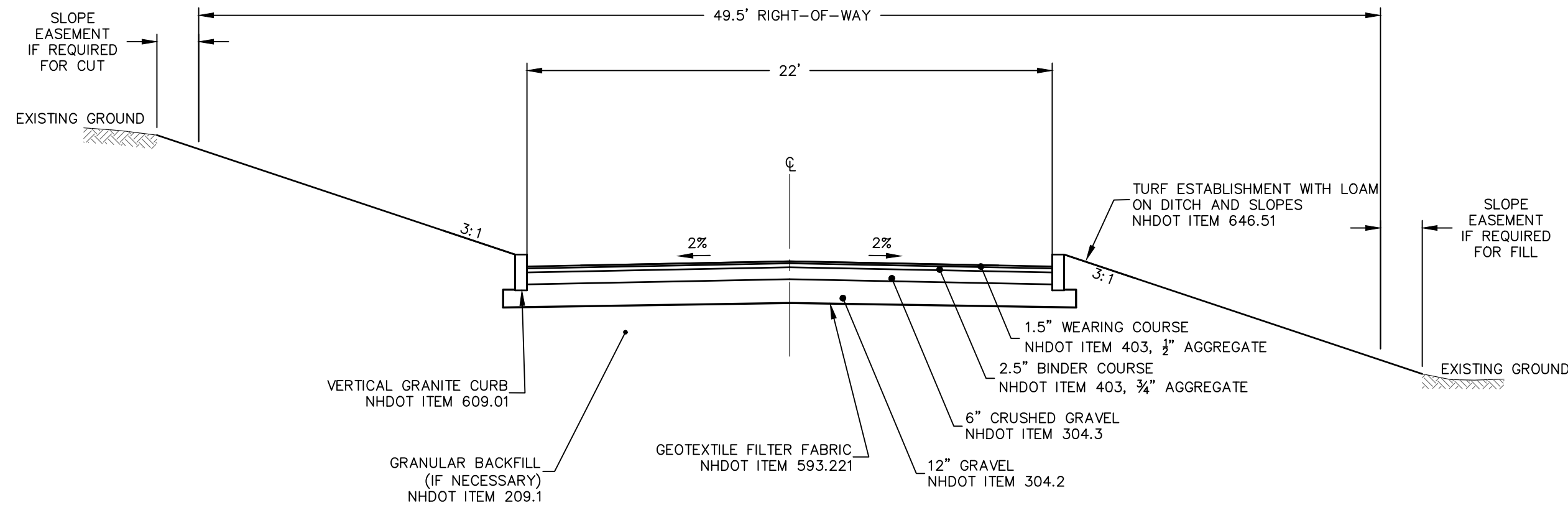
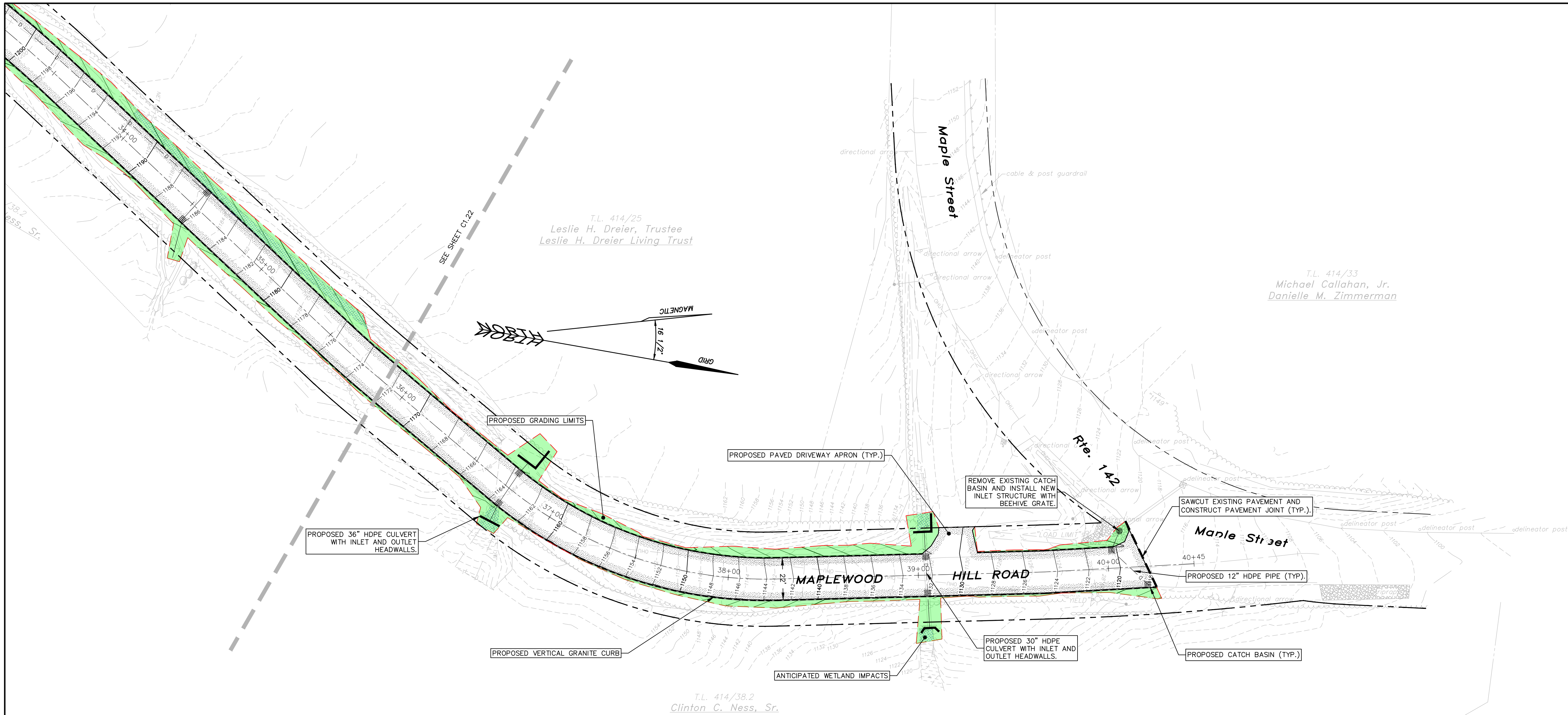
Roadway Layout Plan - Alternative 4		2024-090
for the Maplewood Hill Road located in and prepared for the Town of Bethlehem		C1.31
SHEET 1 OF 3		



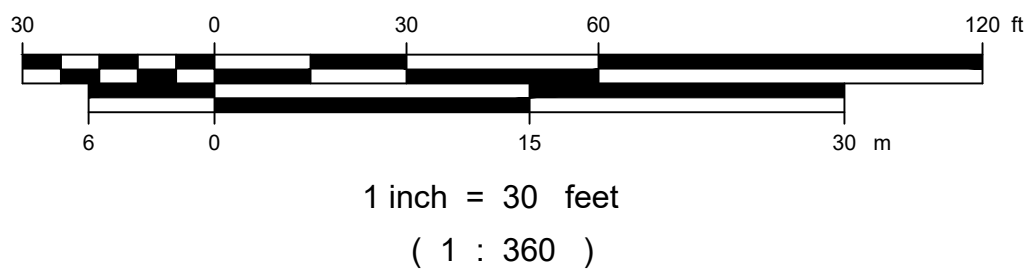
for the
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem

SHEET 2 OF 3

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CONSTRUCTION



Typical Roadway Section
Scale: 1" = 5'



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SURVEYED BY	OTHERS
DESIGNED BY	EJG
DRAWN BY	CJG
CHECKED BY	EAL/EJG
FIELD BOOK	N/A
SCALE	1"=30'
DATE	09/19/2025

Roadway Layout Plan - Alternative 4

for the
Maplewood Hill Road
located in and prepared for the
Town of Bethlehem

2024-090

C1.33

APPENDIX F

**Engineer's Opinion
of
Probable Cost**

Engineer's Opinion of Probable Construction Cost

**Maplewood Hill Road
Bethlehem, NH**

Project #: 2024-090

Date: September 19, 2025

Computed by: CJG

Checked by: EAL/EJG

20-foot-wide Roadway with Improved Ditching

NHDOT Item #	Description	Unit	Unit Cost	Quantity	Total Cost
Earthwork					
202.41	Removal of Existing Pipe 0-24" Diameter	LF	\$ 30.00	325	\$ 9,750.00
202.42	Removal of Existing Pipe Over 24" Diameter	LF	\$ 50.00	35	\$ 1,750.00
203.1	Common Excavation	CY	\$ 30.00	12,325	\$ 369,750.00
203.2	Rock Excavation	CY	\$ 150.00	924	\$ 138,656.25
209.1	Granular Backfill	CY	\$ 30.00	200	\$ 6,000.00
214	Fine Grading	U	\$ 85,000.00	1	\$ 85,000.00
Base Courses					
304.2	Gravel	CY	\$ 50.00	4,600	\$ 230,000.00
304.3	Crushed Gravel	CY	\$ 55.00	2,125	\$ 116,875.00
Pavements					
403.11023	Hot Bituminous Pavement, Machine Method, 3/4" Binder Mix	TON	\$ 110.00	1,325	\$ 145,750.00
403.11043	Hot Bituminous Pavement, Machine Method, 1/2" Surface Mix	TON	\$ 120.00	800	\$ 96,000.00
403.12	Hot Bituminous Pavement, Hand Method	TON	\$ 250.00	75	\$ 18,750.00
410.22	Asphalt Emulsion for Tack Coat	GAL	\$ 8.00	1,875	\$ 15,000.00
Structures					
-	Precast Concrete Headwall	Unit	\$ 5,000.00	8	\$ 40,000.00
583.3	Stone Fill, Class C	CY	\$ 85.00	2,725	\$ 231,625.00
593.421	Geotextile, Perm Control CL.2, Non-Woven	SY	\$ 6.00	8,075	\$ 48,450.00
Incidental Construction					
603.82215	15" HDPE Pipe	LF	\$ 100.00	225	\$ 22,500.00
603.82218	18" HDPE Pipe	LF	\$ 125.00	100	\$ 12,500.00
603.82224	24" HDPE Pipe	LF	\$ 150.00	100	\$ 15,000.00
603.8223	30" HDPE Pipe	LF	\$ 175.00	50	\$ 8,750.00
603.82236	36" HDPE Pipe	LF	\$ 200.00	75	\$ 15,000.00
604.124	Catch Basin - 4' Diameter	Unit	\$ 5,000.00	2	\$ 10,000.00
619.1	Maintenance of Traffic	U	\$ 91,030.31	1	\$ 91,030.31
628.2	Sawcut Bituminous Pavement	LF	\$ 4.00	150	\$ 600.00
645.44	Temporary Slope Stabilization Type D (Wildlife Friendly)	SY	\$ 3.00	3,375	\$ 10,125.00
646.51	Turf Establishment with Mulch, Tackifiers, and Loam	SY	\$ 25.00	3,375	\$ 84,375.00
645.7	Storm Water Pollution Prevention Plan	U	\$ 5,000.00	1	\$ 5,000.00
645.71	Monitoring SWPPP and Erosion and Sediment Controls	Hour	\$ 195.00	120	\$ 23,400.00
692	Mobilization	U	\$ 182,060.63	1	\$ 182,060.63
699	Miscellaneous Temporary Erosion and Sediment Control	ALLOW	\$ 30,000.00	1	\$ 30,000.00
1010.15	Fuel Adjustment	\$	\$ 20,000.00	1	\$ 20,000.00
1010.2	Asphalt Cement Adjustment	\$	\$ 10,000.00	1	\$ 10,000.00
<i>(F) Indicates final bid quantity</i>					
Estimated Roadway Construction Subtotal					\$ 2,094,000.00
20% Contingency					\$ 420,000.00
Total Construction Costs					\$ 2,514,000.00
Construction Engineering (15%)					\$ 377,100.00
Total Project Cost					\$ 2,892,000.00

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Engineer's Opinion of Probable Construction Cost

Maplewood Hill Road
Bethlehem, NH

Project #: 2024-090

Date: September 19, 2025

Computed by: CJG

Checked by: EAL/EJG

22-foot-wide Roadway with Reinforced Ditching

NHDOT Item #	Description	Unit	Unit Cost	Quantity	Total Cost
Earthwork					
202.41	Removal of Existing Pipe 0-24" Diameter	LF	\$ 30.00	325	\$ 9,750.00
202.42	Removal of Existing Pipe Over 24" Diameter	LF	\$ 50.00	35	\$ 1,750.00
203.1	Common Excavation	CY	\$ 30.00	13,500	\$ 405,000.00
203.2	Rock Excavation	CY	\$ 150.00	1,013	\$ 151,875.00
209.1	Granular Backfill	CY	\$ 30.00	215	\$ 6,450.00
214	Fine Grading	U	\$ 85,000.00	1	\$ 85,000.00
Base Courses					
304.2	Gravel	CY	\$ 50.00	4,900	\$ 245,000.00
304.3	Crushed Gravel	CY	\$ 55.00	2,275	\$ 125,125.00
Pavements					
403.11023	Hot Bituminous Pavement, Machine Method, 3/4" Binder Mix	TON	\$ 110.00	1,475	\$ 162,250.00
403.11043	Hot Bituminous Pavement, Machine Method, 1/2" Surface Mix	TON	\$ 120.00	900	\$ 108,000.00
403.12	Hot Bituminous Pavement, Hand Method	TON	\$ 250.00	75	\$ 18,750.00
410.22	Asphalt Emulsion for Tack Coat	GAL	\$ 8.00	2,050	\$ 16,400.00
Structures					
-	Precast Concrete Headwall	Unit	\$ 5,000.00	8	\$ 40,000.00
583.3	Stone Fill, Class C	CY	\$ 85.00	3,850	\$ 327,250.00
593.421	Geotextile, Perm Control CL.2, Non-Woven	SY	\$ 6.00	11,450	\$ 68,700.00
Incidental Construction					
603.82215	15" HDPE Pipe	LF	\$ 100.00	225	\$ 22,500.00
603.82218	18" HDPE Pipe	LF	\$ 125.00	100	\$ 12,500.00
603.82224	24" HDPE Pipe	LF	\$ 150.00	10	\$ 1,500.00
603.8223	30" HDPE Pipe	LF	\$ 175.00	50	\$ 8,750.00
603.82236	36" HDPE Pipe	LF	\$ 200.00	75	\$ 15,000.00
604.124	Catch Basin - 4' Diameter	Unit	\$ 5,000.00	2	\$ 10,000.00
619.1	Maintenance of Traffic	U	\$ 96,527.50	1	\$ 96,527.50
628.2	Sawcut Bituminous Pavement	LF	\$ 4.00	150	\$ 600.00
645.7	Storm Water Pollution Prevention Plan	U	\$ 5,000.00	1	\$ 5,000.00
645.71	Monitoring SWPPP and Erosion and Sediment Controls	Hour	\$ 195.00	120	\$ 23,400.00
692	Mobilization	U	\$ 193,055.00	1	\$ 193,055.00
699	Miscellaneous Temporary Erosion and Sediment Control	ALLOW	\$ 30,000.00	1	\$ 30,000.00
1010.15	Fuel Adjustment	\$	\$ 20,000.00	1	\$ 20,000.00
1010.2	Asphalt Cement Adjustment	\$	\$ 10,000.00	1	\$ 10,000.00
<i>(F) Indicates final bid quantity</i>					
Estimated Roadway Construction Subtotal					\$ 2,221,000.00
20% Contingency					\$ 450,000.00
Total Construction Costs					\$ 2,671,000.00
Construction Engineering (15%)					\$ 400,650.00
Total Project Cost					\$ 3,072,000.00

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Engineer's Opinion of Probable Construction Cost

**Maplewood Hill Road
Bethlehem, NH**

Project #: 2024-090

Date: September 19, 2025

Computed by: CJG

Checked by: EAL/EJG

22-foot-wide Roadway with Closed Drainage System

NHDOT Item #	Description	Unit	Unit Cost	Quantity	Total Cost
Earthwork					
202.41	Removal of Existing Pipe 0-24" Diameter	LF	\$ 30.00	100	\$ 3,000.00
202.42	Removal of Existing Pipe Over 24" Diameter	LF	\$ 50.00	35	\$ 1,750.00
203.1	Common Excavation	CY	\$ 30.00	6,000	\$ 180,000.00
203.2	Rock Excavation	CY	\$ 150.00	450	\$ 67,500.00
209.1	Granular Backfill	CY	\$ 30.00	800	\$ 24,000.00
214	Fine Grading	U	\$ 85,000.00	1	\$ 85,000.00
Base Courses					
304.2	Gravel	CY	\$ 50.00	3,425	\$ 171,250.00
304.3	Crushed Gravel	CY	\$ 55.00	1,725	\$ 94,875.00
Pavements					
403.11023	Hot Bituminous Pavement, Machine Method, 3/4" Binder Mix	TON	\$ 110.00	1,475	\$ 162,250.00
403.11043	Hot Bituminous Pavement, Machine Method, 1/2" Surface Mix	TON	\$ 120.00	900	\$ 108,000.00
403.12	Hot Bituminous Pavement, Hand Method	TON	\$ 250.00	75	\$ 18,750.00
410.22	Asphalt Emulsion for Tack Coat	GAL	\$ 8.00	2,050	\$ 16,400.00
Structures					
-	Precast Concrete Headwall	Unit	\$ 5,000.00	6	\$ 30,000.00
Incidental Construction					
603.82212	12" HDPE Pipe	LF	\$ 75.00	300	\$ 22,500.00
603.82215	15" HDPE Pipe	LF	\$ 100.00	2,800	\$ 280,000.00
603.82224	30" HDPE Pipe	LF	\$ 175.00	55	\$ 9,625.00
603.82236	36" HDPE Pipe	LF	\$ 200.00	75	\$ 15,000.00
604.124	Catch Basin - 4' Diameter	Unit	\$ 5,000.00	38	\$ 190,000.00
609.01	Vertical Granite Curb	LF	\$ 65.00	7,740	\$ 503,100.00
619.1	Maintenance of Traffic	U	\$ 107,800.00	1	\$ 107,800.00
628.2	Sawcut Bituminous Pavement	LF	\$ 4.00	150	\$ 600.00
645.7	Storm Water Pollution Prevention Plan	U	\$ 5,000.00	1	\$ 5,000.00
645.71	Monitoring SWPPP and Erosion and Sediment Controls	Hour	\$ 195.00	120	\$ 23,400.00
646.51	Turf Establishment with Mulch, Tackifiers, and Loam	SY	\$ 30.00	2,800	\$ 84,000.00
692	Mobilization	U	\$ 215,600.00	1	\$ 215,600.00
699	Miscellaneous Temporary Erosion and Sediment Control	ALLOW	\$ 30,000.00	1	\$ 30,000.00
1010.15	Fuel Adjustment	\$	\$ 20,000.00	1	\$ 20,000.00
1010.2	Asphalt Cement Adjustment	\$	\$ 10,000.00	1	\$ 10,000.00
<i>(F) Indicates final bid quantity</i>					
Estimated Roadway Construction Subtotal					\$ 2,480,000.00
20% Contingency					\$ 500,000.00
Total Construction Costs					\$ 2,980,000.00
Construction Engineering (15%)					\$ 447,000.00
Total Project Cost					\$ 3,427,000.00

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Engineer's Opinion of Probable Construction Cost

**Maplewood Hill Road
Bethlehem, NH**

Project #: 2024-090

Date: September 19, 2025

Computed by: CJG

Checked by: EAL/EJG

22-foot-wide Roadway with Ditching, Curb, and Closed Drainage System

NHDOT Item #	Description	Unit	Unit Cost	Quantity	Total Cost
Earthwork					
202.41	Removal of Existing Pipe 0-24" Diameter	LF	\$ 30.00	250	\$ 7,500.00
202.42	Removal of Existing Pipe Over 24" Diameter	LF	\$ 50.00	35	\$ 1,750.00
203.1	Common Excavation	CY	\$ 30.00	7,425	\$ 222,750.00
203.2	Rock Excavation	CY	\$ 150.00	560	\$ 84,000.00
209.1	Granular Backfill	CY	\$ 30.00	500	\$ 15,000.00
214	Fine Grading	U	\$ 85,000.00	1	\$ 85,000.00
Base Courses					
304.2	Gravel	CY	\$ 50.00	4,025	\$ 201,250.00
304.3	Crushed Gravel	CY	\$ 55.00	1,950	\$ 107,250.00
Pavements					
403.11023	Hot Bituminous Pavement, Machine Method, 3/4" Binder Mix	TON	\$ 110.00	1,475	\$ 162,250.00
403.11043	Hot Bituminous Pavement, Machine Method, 1/2" Surface Mix	TON	\$ 120.00	900	\$ 108,000.00
403.12	Hot Bituminous Pavement, Hand Method	TON	\$ 250.00	75	\$ 18,750.00
410.22	Asphalt Emulsion for Tack Coat	GAL	\$ 8.00	2,050	\$ 16,400.00
Structures					
-	Precast Concrete Headwall	Unit	\$ 5,000.00	6	\$ 30,000.00
Incidental Construction					
603.82212	12" HDPE Pipe	LF	\$ 75.00	215	\$ 16,125.00
603.82215	15" HDPE Pipe	LF	\$ 100.00	1,340	\$ 134,000.00
603.82218	18" HDPE Pipe	LF	\$ 125.00	40	\$ 5,000.00
603.82224	24" HDPE Pipe	LF	\$ 150.00	50	\$ 7,500.00
603.82224	30" HDPE Pipe	LF	\$ 175.00	55	\$ 9,625.00
603.82236	36" HDPE Pipe	LF	\$ 200.00	75	\$ 15,000.00
604.124	Catch Basin - 4' Diameter	Unit	\$ 5,000.00	22	\$ 110,000.00
609.01	Vertical Granite Curb	LF	\$ 65.00	4,600	\$ 299,000.00
619.1	Maintenance of Traffic	U	\$ 96,152.50	1	\$ 96,152.50
628.2	Sawcut Bituminous Pavement	LF	\$ 4.00	150	\$ 600.00
645.44	Temporary Slope Stabilization Type D (Wildlife Friendly)	SY	\$ 3.00	4,050	\$ 12,150.00
645.7	Storm Water Pollution Prevention Plan	U	\$ 5,000.00	1	\$ 5,000.00
645.71	Monitoring SWPPP and Erosion and Sediment Controls	Hour	\$ 195.00	120	\$ 23,400.00
646.51	Turf Establishment with Mulch, Tackifiers, and Loam	SY	\$ 30.00	5,525	\$ 165,750.00
692	Mobilization	U	\$ 175,730.00	1	\$ 175,730.00
699	Miscellaneous Temporary Erosion and Sediment Control	ALLOW	\$ 30,000.00	1	\$ 30,000.00
1010.15	Fuel Adjustment	\$	\$ 20,000.00	1	\$ 20,000.00
1010.2	Asphalt Cement Adjustment	\$	\$ 10,000.00	1	\$ 10,000.00
<i>(F) Indicates final bid quantity</i>					
Estimated Roadway Construction Subtotal					\$ 2,195,000.00
20% Contingency					\$ 440,000.00
Total Construction Costs					\$ 2,635,000.00
Construction Engineering (15%)					\$ 395,250.00
Total Project Cost					\$ 3,031,000.00

Note: In providing opinions of probable construction costs, the Client understands that HEB Engineers, Inc. has no control over the cost or availability of labor, equipment, or materials, or over market conditions or the Contractor's methods of pricing. Our Opinion of Probable Construction Costs are made on the basis of our professional judgment and experience. HEB makes no warranty, expressed or implied, that the bids or the negotiated costs of the work will not vary from the Opinion of Probable Construction Cost provided herein.