


Town Park Retaining Wall Evaluation
Hopedale, Massachusetts

ENGINEERING ALTERNATIVES ANALYSIS REPORT

Town of Hopedale

November 22, 2023

Tighe&Bond

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Section 1: Introduction

Tighe & Bond is pleased to present this Engineering Alternatives Analysis Report for the Hopedale Town Park Retaining Walls, located in Hopedale, MA. This report summarizes the findings of an evaluation of the existing walls and geotechnical field investigations, as well as provides several retaining wall replacement alternatives. This report was completed in general accordance with our agreement dated June 30, 2023. The vertical datum referenced in this report is The North American Vertical Datum of 1988 (NAVD 88).

On April 20, 2023, we had previously performed a preliminary investigation of the existing conditions of the retaining walls boarding Hopedale Town Park. This preliminary investigation consisted solely of a visual evaluation of the existing retaining walls and our initial observations and recommendations were subsequently provided in a Technical Memorandum, dated April 26, 2023. In this Memorandum, we outlined our initial findings and recommendations for two approximately 100-foot-long sections of the existing retaining walls that appeared to be unstable and at risk of failure. We recommended that the areas in the immediate vicinity of these wall sections be fenced off to block public access until further engineering studies could be performed and corrective action could take place.

1.1 Scope of Work

The Hopedale Parks Commission (The Town) retained Tighe & Bond to complete an investigation of the existing retaining walls on the north, east, and southern borders of Hopedale Town Park. The walls on the western and south-western border of the park were more recently constructed and were therefore excluded from this scope of work. See the below Figure 1: Approximate Limits of Retaining Wall for additional information.

Figure 1: Approximate Limits of Retaining Wall Evaluation

The investigation consisted of a visual examination of the retaining walls and a subsurface exploration program to evaluate the soils underlying the subject area for suitability for reuse during construction. A survey of the park was also performed and can be seen in Appendix F.

Note that Tighe & Bond has been involved in the planning process of the future Town Park improvements including renovations to the baseball field. The proposed retaining wall alternatives, which are the subject of this report, should be coordinated with those future work activities, if initiated.

1.2 Site Description

Hopedale Town Park (The Park) is located in Hopedale, MA and is bounded by Northrop Street to the North, Dutcher Street to the West, Freedom Street to the South, and six residential abutters to the East. The Park is approximately 6-acres in size and consists of one baseball field, a batting cage, three tennis/pickleball courts, one basketball court, a bandstand, an open field, and a playground area. Approximately 1,090 linear feet of stone retaining walls, which are the subject of this report, surround the Park on the northern, eastern, and southern sides. The Park currently slopes from an approximate elevation of 312-feet in the northeast corner of the site to an approximate elevation of 290-feet along the southwestern length of the site.

1.3 Evaluation Methodology

The retaining wall evaluation was performed on August 31, 2023, by two Tighe & Bond engineers. The evaluation was focused on the 1,090 linear feet of stone retaining walls surrounding the park on the northern, eastern, and southern sides. The goal of the evaluation was to identify structural deficiencies and safety concerns with the walls which typically include displaced stones, voids in the walls, missing pointing, localized erosion and scour, and wall bulging/leaning. The assessment was limited to a visual evaluation with no elements of the existing structures removed to inspect concealed conditions. A photolog of the existing conditions as observed is included in **Appendix A** and the photos are referenced throughout this report.

In order to locate deficiencies in the retaining walls, Tighe & Bond established a stationing system starting at STA 0+00, adjacent to the intersection of Park Street and Northrop Street, and ending at STA 13+10, adjacent to the intersection of Freedom Street and Dutcher Street. A condition rating system was also established to assign conditions to sections of the wall based on field observations observed. The condition rating system used a scale from Good to Critical/Failed, with Good representing a wall in "Suitable" Condition and Critical/Failed representing a wall in "imminent need of repair". See Table 1 below for additional information pertaining to the condition rating system.

See the attached Figure 2: Evaluation Stationing and Conditions for additional information regarding the stationing system and wall conditions observed during the assessment.

Table 1 General Condition Rating System	
Definition	**Description**
GOOD	Wall appears to be in overall stable condition with no significant deficiencies noted.
FAIR	A component that requires maintenance.
POOR	A component that has deteriorated beyond a maintenance issue and requires repair; the component no longer functions as it was originally intended.
CRITICAL/FAILED	The condition is such that an unreasonable risk of failure exists that may result in destruction of property, major economic loss, and/or possible loss of human life. Among the conditions that would result in this determination are: excessive vegetation that does not allow for complete visual evaluation to be performed, significant erosion problems, inadequate condition of structure(s), serious structural deficiencies including movement of the structure, major cracking, or failure.

Table 1: General Condition Rating System

Section 2: Existing Conditions

This section provides the findings of the evaluation that was performed based on the methodology presented in Section 1.3.

See, Figure 2: Evaluation Stationing and Conditions below for a summary of the findings.

Figure 2: Evaluation Stationing and Conditions

2.1 STA 0+00 to 2+20

This section of wall boarders Northop Street and supports the roadway, the sidewalk, a pedestrian guardrail, and the utilities behind the wall. The wall ranged in height from 0-feet, at the west end to approximately 10-feet, at the east end. The wall consisted of stones between 24 and 48-inches in size, that were chinked with smaller stones to fill spaces between the larger stones (Photo No. 1). This section of wall appeared to be more recently constructed than the adjacent walls to the southeast.

This wall section was in overall good condition. See below for a list of deficiencies noted:

- STA 2+08 to STA 2+20 - Voids between stones up to 12-inches wide and 18-inches deep where chinking stones appeared to have fallen out over time (Photo No. 2).

2.2 STA 2+20 to 2+80

This section of wall begins at the northern corner of the Park where the wall transitions to support the abutting property at 25 Northrop Street. The wall height ranged from approximately 10 feet (adjacent to Northop Street) to 4.5 feet (at the southeastern end). Wall construction consisted of stacked stone blocks capped with a 6 to 12-inch thick layer of mortared stone followed by 2 additional rows of stone blocks connected with mortar to create the top of the wall (Photo No. 3).

Condition of the wall ranged from poor to critical/failed condition with multiple stones missing from the wall and severe outward leaning of the wall (±12”). See below for a list of deficiencies noted:

- Entire Length - Voids that ranged between 20 to 36-inches deep with vegetation growing through the exposed voids.
- Entire Length - Vegetation observed growing directly behind the top of the wall stem. Multiple large trees growing directly in front of this wall section.
- 2+55 to 2+80 - Failure of the wall where 12 to 24-inch stones have fallen out of the wall leaving a void approximately 3’ W x 3’ H x 2’ D. Wall pushed outward by approximately 12-inches (Photo No. 4).

2.3 STA 2+80 to 4+30

The wall in this section runs along the northern border of the park and abuts the properties at 25 Northrop Street and 44 Freedom Street. This wall section transitions from more uniform blocks at the northern end to boulders of various sizes and shapes, with the typical stone size ranging between 12 to 16-inches. The wall had a concrete leveling cap to provide a consistent top elevation (Photo No. 5). The wall height ranged from approximately 4 to 4.5-feet tall.

This section of wall was in poor condition. Deficiencies noted include the following:

- Entire Length - Pointing between stones almost completely missing with only a few random locations remaining.
- Entire Length - Voids in this wall ranged from 6 to 24-inches deep with small vegetation growing within the voids on the wall face.
- Entire Length - Large vegetation and small trees growing directly behind and through some of the voids present along the wall (Photo Nos. 6 and 7). Large trees were also growing directly in front of this wall section.
- STA 2+95 – A single 4-inch diameter clay drainpipe protruded through the wall. The pipe appeared to be clogged and its origins are unknown.
- STA 3+50 to 4+00 –The wall was bulging outward in numerous locations by up to ±8” and had an irregular alignment. (Photo No. 6).

2.4 STA 4+30 to 7+40

This wall section runs along the eastern border of the park and abuts the properties at 44, 50, and 54 Freedom Street. The wall ranges in height form 3 to 3.5 feet, and is freestanding, with no difference in grade on either side of the wall. The wall consists of dry stacked stones ranging in size from approximately 18 to 36-inches (Photo No. 8).

The wall was in poor condition. Deficiencies noted include the following:

- STA 4+80 to 5+20, 6+10 to 6+70, and 6+90 to 7+40 – Vegetation partially or completely overgrown the wall (Photo No. 9).
- STA 4+80 to 5+20, 5+75, 6+10 to 6+50, and 6+90 – Stones from the top 1’ to 2’ of the wall have fallen off of the wall and are laying adjacent to it (Photo No. 10).
- Entire Length - Large trees growing directly in front of this wall section.

2.5 STA 7+40 to 9+60

There was a break in the retaining walls between STA 7+40 and 9+60. No wall evaluation occurred in this section.

2.6 STA 9+60 to 10+15

This wall section runs along a portion of the southeastern corner of the Park, abutting 62 Freedom Street. The height of wall was approximately 3 feet, and the wall was comprised of 6-to-12-inch mortared stones.

This section of wall was in critical/failed condition. Deficiencies noted include the following:

- Entire Length – Wall severely leaning outwards towards the Park and/or toppled over and failed (Photo Nos. 11 and 12).
- Entire Length – Loose stones 6 to 12-inches in size have fallen out of the wall structure and are no longer held together by mortar.
- Entire Length - Large trees and vegetation observed growing directly behind the wall stem.

2.7 STA 10+15 to 10+60

This wall section runs along the southeast corner of the Park abutting 62 Freedom Street, and supports the side yard of that property. The wall is approximately 3.5-feet high and consists of mortared stones varying in size from 6 to 12-inches. Four, 4-inch diameter weep drains are visible along this wall section, however, they are completely filled with sediment and no longer appear to be providing drainage (Photo No. 13).

The wall was in fair condition with no significant instability. Deficiencies noted include the following:

- Entire Length - Minor cracking visible in the mortar between the wall stones.
- Entire Length - Minor vegetation growing within the wall cracking and/or overtop the wall.
- STA 10+17, 10+30, 10+46, & 10+52 - Weep drains filled with sediment and are no longer providing drainage from behind the wall.

2.8 STA 10+60 to 11+60

This wall section begins at the southeastern corner of the Park, adjacent to 62 Freedom Street, and runs southwest. It supports Freedom Street, the sidewalk, a pedestrian guardrail, and the existing utilities behind the wall. The wall ranged in height from 5 to 5.5-feet and is comprised of stones varying in size between 12 and 24-inches with occasional stones up to approximately 36-inches in size. Smaller chinking stones are used to fill the spaces between the larger stones (Photo No. 14). This section of wall had a guardrail installed on top of the wall with the posts installed into the top layer of wall stones.

This wall section was in in fair condition with no significant instability. See below for a list of deficiencies noted:

- Entire Length - Voids present ranging between 12 to 36-inches deep with an average depth of 18-inches.
- Entire Length – The guardrail on the top is in fair condition with minor to moderate corrosion throughout and spacing between the rails of approximately 18”
- Vegetation growing through the exposed voids.

- Entire Length - The wall appears to have been backfilled with large aggregate fill. Little to no fines were observed in the voids behind the walls.

2.9 STA 11+60 to 12+10

This wall section runs southwest along Freedom Street, supporting the roadway, the sidewalk, and the existing utilities behind the wall. The wall ranges in height from 5 to 5.5-feet and is comprised of stones varying in size from 12 and 36-inches with smaller chinking stones used to fill the spaces between the larger stones (Photo No. 15).

Condition of the wall ranged from poor to critical/failed condition with severe outward leaning and dislodged wall stones observed (Photo No. 16). Periodic pointing between the stones was also observed in this wall section. See below for a list of deficiencies noted:

- Entire Length - Voids present ranging between 12 to 36-inches deep with an average depth of 18-inches.
- Entire Length – The guardrail on the top is in fair condition with minor to moderate corrosion throughout and spacing between the rails of approximately 18”
- Vegetation growing through the exposed voids.
- Entire Length - The wall appears to have been backfilled with large aggregate fill. Little to no fines were observed in the voids behind the wall.
- STA 11+70 to 12+00 - Failure of the wall where 12 to 36-inch stones have become completely dislodged from the wall structure. Wall pushed outward by approximately 24-inches. The wall is being temporarily supported by concrete blocks in front of it.
- STA 11+80 to 12+00 - Significant cracking and deterioration of the asphalt sidewalk and handrailing located above (Photo No. 17).

2.10 STA 12+10 to 13+10

This wall section continues to run southwest along Freedom Street and supports the roadway, sidewalk, pedestrian guardrail, and the existing utilities behind the wall structure. The wall descends in height from approximately 5.5-feet at station 12+10 to approximately 2.5-feet at station 13+10. The wall consists of stones varying in size between 12 and 36-inches with smaller chinking stones used to fill the spaces between the larger stones.

This section of wall was in poor condition. Deficiencies noted include the following:

- Entire Length - Voids ranging between 12 to 36-inches deep with an typical depth of 18-inches.
- Entire Length – The guardrail on the top is in fair condition with minor to moderate corrosion throughout and spacing between the rails of approximately 18”
- Entire Length - Vegetation growing through the exposed voids.
- Entire Length – the wall was backfilled with large aggregate fill. Little to no fines were observed in the voids behind the wall.
- STA 12+30 to 12+50 – The wall was bulging outward by about 8” (Photo No. 18).
- STA 12+30 to 12+50 – Cracking and deterioration of the asphalt sidewalk and handrail on top of wall.
- STA 12+90 - Approximate 24-inch stone completely dislodged from the wall (Photo No. 19).

Section 3: Evaluation and Assessment

The condition of the retaining walls typically ranges from fair to poor condition with isolated areas of critical and failed condition. Typical deficiencies noted include bulging of the wall and missing stone or dislodged stones. These conditions significantly affect the structural integrity and stability of the walls. It is important to note that many of these retaining walls support abutting properties / homes, sidewalks, roadways, and utilities where the consequences of a wall failure could be significant.

3.1 STA 0+00 to 2+20

This section of the wall is generally in good condition with only the northmost 10' having numerous dislodged chinking stones. The dislodged stones are a structural concern and are indicative of movement of the stones, likely due to freeze-thaw action and/or poor drainage behind the wall. The critical / failed condition of the adjacent section of wall may also be contributing to this isolated area of deterioration. The fence on top of the wall, which protects pedestrians from the grade change, is supported by wall stones and was solid at the time of the evaluation. While not a current issue, continued deterioration of this section of wall will likely affect the structural integrity fence.

3.2 STA 2+20 to 2+80

This section of wall ranges from critical to failed condition with severe leaning of the wall numerous dislodged stones / voids. These deficiencies are likely due to a poorly designed original wall, poor drainage behind the wall, and freeze-thaw cycles. The combination of these deficiencies shows that this section of wall is in an active state of failure and is a major structural concern. The consequences of a collapse of this wall could be significant due to the height of the wall (± 10 feet) and the close proximity of the home at 25 Northrop Street (about 12 feet back from the face of the wall), as the foundation of the home could become unsupported. This section of wall is also lacking a guardrail on top, which is required by code for a wall with a grade change of over 30 inches.

The deficiencies between 2+55 and 2+80 were one of the two critical areas that were previously recommended to be blocked off to public access during the previous site visit on April 20, 2023.

3.3 STA 2+80 to 4+30

This section of the wall is in overall poor condition with severe bulging and missing pointing throughout. These deficiencies are likely due to a poorly designed original wall, poor drainage behind the wall and freeze-thaw action. The deficiencies noted greatly reduce the load capacity of the retaining wall and are a significant structural concern. This section of wall is shorter than the adjacent wall (±6 feet) and does not appear to support any structures behind it, therefore damage to the adjacent property in the event of a collapse would likely be limited to the yard and not structures. This section of wall is also lacking a guardrail on top, which is required by code for a wall with a grade change of over 30 inches.

3.4 STA 2+80 to 4+30

This section of the wall is in overall poor condition with vegetation growing out of the wall and numerous stones having fallen from the top of the wall. These deficiencies are likely due poor drainage behind the wall and freeze-thaw action. The deficiencies noted do reduce the load capacity of the retaining wall and are a significant structural concern. This section of wall is shorter than the adjacent wall (±4 feet) and does not appear to support any structures behind it, therefore damage to the adjacent property in the event of a collapse would likely be limited to the yard / wooded area behind the wall and not structures. This section of wall lacks a guardrail on top, which is required by code for a wall with a grade change of over 30 inches.

3.5 STA 4+30 to 7+40

This section of wall is generally in poor condition with vegetation growing over large portions of the wall and numerous portions of the wall having partially collapsed. These deficiencies are likely due to lack of a proper foundation under the wall and freeze-thaw action. This section of wall is freestanding and does not retain any soil (i.e. the grade is the same on both sides of the wall). It appears to serve as a property line delineation and is not structural in nature.

3.6 STA 7+40 to 9+60

There is no retaining wall present along this part of the station line, therefore no evaluation was performed.

3.7 STA 9+60 to 10+15

This section of wall is in critical/failed condition with numerous collapsed sections and loose stones throughout. These deficiencies are likely due to a poorly designed original wall, poor drainage behind the wall and freeze-thaw action. The deficiencies noted greatly reduce the load capacity of the retaining wall and are a significant structural concern. This section of wall is relatively short (±4 feet) and does not appear to support any structures behind it, therefore damage to the adjacent property, in the event of a collapse, would likely be limited to the yard / wooded area behind the wall and not structures.

3.8 STA 10+15 to 10+60

This section of wall is in fair condition with minor cracking of the pointing and minor vegetation growing out of the wall. These deficiencies are likely due to poor drainage behind the wall and freeze-thaw action. This section did appear to have drainage installed behind the wall with four weep pipes visible on the face of the wall. All four pipes were full of sediment, likely indicative of a non-functioning drainage system. The deficiencies noted do not reduce the load capacity of the retaining wall and are not a structural concern. The home at 62 Freedom Street is approximately 10 feet off of the face of this wall, but since this section of wall is only about 3 feet tall, the foundation of the home would likely remain supported in the event of a complete failure, but there would likely be damage to the yard.

3.9 STA 10+60 to 11+60

This section of wall is in fair condition with visible voids behind the face of the wall, and minor vegetation growing out of the voids. The sidewalk behind the wall did not have signs of settlement or cracking. The voids behind the face of the wall likely indicate that fine material has migrated through the spaces between stones over time and left voids behind the wall. The guardrail installed on this section of wall is has spacing of approximately 18” between the rails and does not meet modern code requirements of no spaces greater than 4”. This section of wall shows no significant signs of instability.

3.10 11+60 to 12+10

This section of wall is in critical/failed condition with a portion of the wall bulging outwards ±18” and a large sink hole in the sidewalk behind the wall. The bulged section of wall has been temporarily supported by stacked concrete blocks on front of the wall, and is likely the only thing keeping the wall from collapsing. The pedestrian guardrail has also failed at the location of the wall bulge and pieces of the rail are hanging. These deficiencies are likely due to a poorly designed original wall, poor drainage behind the wall and freeze-thaw action. The deficiencies noted greatly reduce the load capacity of the retaining wall and are a significant structural concern. This section of wall is relatively tall (±6 feet) and supports the adjacent sidewalk, buried sewer main, guardrail, and roadway. Due to the proximity of the sewer main, sidewalk and a main roadway, the consequences of collapse of this section of wall could be significant.

The deficiencies in this section of wall were one of the two critical areas that were previously recommended to be blocked off to public access during the previous site visit on April 20, 2023.

3.11 STA 12+10 to 13+10

This section of wall was in poor condition with dislodged stones, bulging of the wall, and cracking/deterioration of the sidewalk behind the wall. These deficiencies are likely due to a poorly designed original wall, poor drainage behind the wall and freeze-thaw action. The deficiencies noted greatly reduce the load capacity of the retaining wall and are a significant structural concern. This section of wall is shorter than the adjacent and supports the adjacent sidewalk, buried sewer main, guardrail and roadway. Due to the proximity of the sewer main, sidewalk, and a main roadway, the consequences of a collapse of this section of wall could be significant.

Section 4: Subsurface Conditions

The generalized subsurface conditions described in the section below summarize trends observed in the explorations. The boundaries between soil strata are approximate and are based on interpretations of widely spaced explorations and samples. Actual conditions could be more variable.

Subsurface Explorations – Five test borings designated TB-01 through TB-05 were drilled by Geologic Earth Explorations of Norfolk, MA, on September 5 and September 6, 2023. The test borings were drilled with an ATV-mounted Acker Soil Scout Drill Rig. Logs of the explorations are included in **Appendix B**, and their locations are shown on **Figure 3: Hopedale Town Park Boring Location Plan,** below.

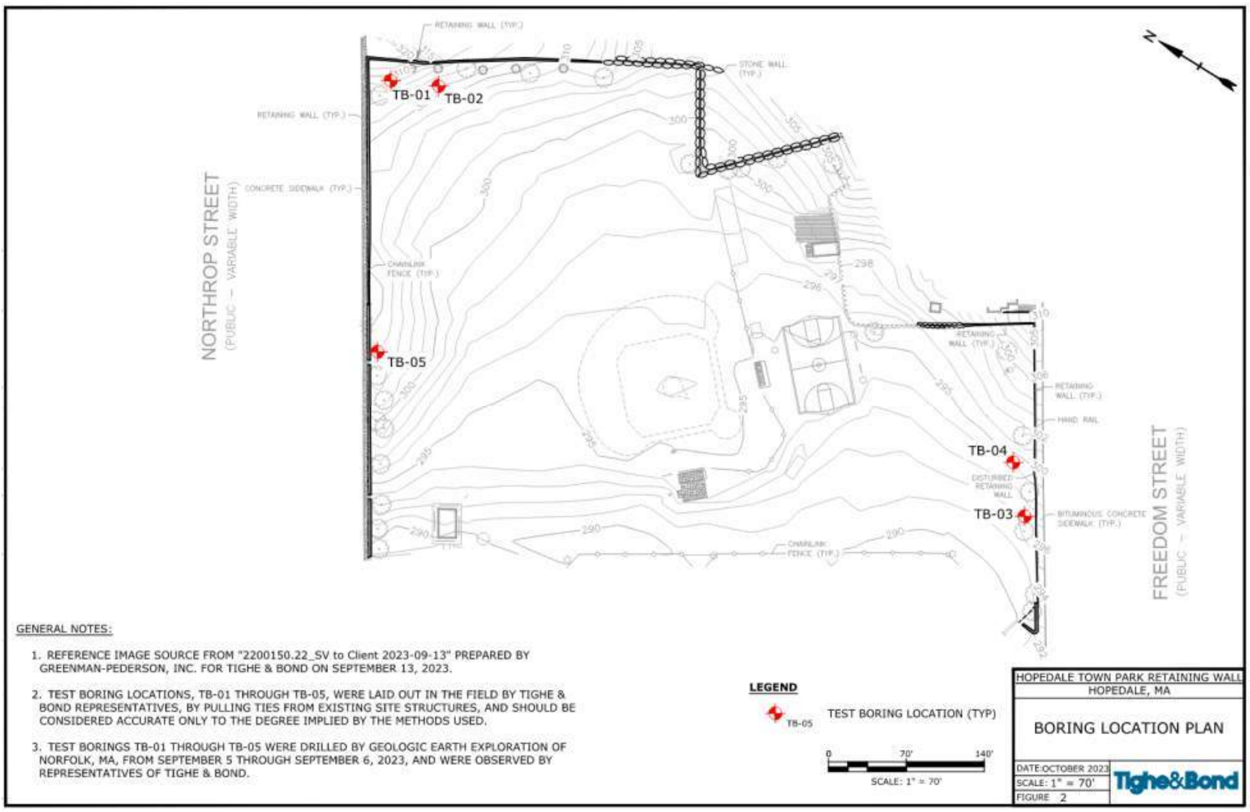


Figure 3: Hopedale Town Park Boring Location Plan

Test Borings - The test borings were advanced with 4-inch inner diameter flush joint casing and drive and wash drilling methods to depths ranging between approximately 5 and 14 feet below the existing ground surface. Split-spoon sampling and Standard Penetration Tests (SPTs) were conducted continuously or at maximum 5-foot intervals in general accordance with ASTM D-1586, Standard Test Method for Standard Penetration Test.

All test borings were drilled to refusal. A 5-foot bedrock core was taken at TB-02 and TB-03 to confirm the presence of bedrock and assess the quality of the stone. Each test boring encountered bedrock at approximate depths ranging between 4.5 and 9 feet below grade corresponding to approximate elevations ranging between 283 and 304 feet (NAVD88). Refusal is defined as the inability to advance the drilling equipment under the maximum drill rig pressure, and may be an indicator of bedrock, boulders, nested cobbles, or very dense or "boney" (i.e., high gravel/cobble content) material.

As mentioned above, two 5-foot bedrock cores were taken in borings TB-02 and TB-03 using a 2-inch ID (NV-II) double-tube core barrel. Pictures of the obtained rock core samples are included in **Appendix C**. No groundwater wells were installed as part of this subsurface exploration program.

Laboratory Testing – Three soil samples from the subsurface exploration program were submitted to Thielsch Engineering, Inc. of Cranston, RI. Each soil sample was tested for mechanical particle size analysis in general accordance with ASTM D6913, to aid in soil classification, evaluate liquefaction potential, and evaluate soil re-use potential. Laboratory test results are included in **Appendix D**.

4.1 Summary of Subsurface Conditions

The generalized subsurface profile encountered at the site consisted of approximately 6 to 12-inches of topsoil at the ground surface underlain by approximately 1 to 2 feet of subsoil, underlain by naturally deposited glacial till, and bedrock. The encountered subsoil consisted of fine to coarse sand with up to 35-percent by weight fine to coarse Gravel, up to 35-percent fine grained soils (Fines), and up to 10-percent Organics such as roots. Medium dense to very dense glacial till was encountered below the subsoil stratum at approximate depths ranging between 1 and 9 feet below grade and typically consisted of fine to coarse sand or fine to coarse gravel, with up to 35-percent fines. Hard to very hard, slightly fractured to sound, granite bedrock underlaid the glacial till in each boring ranging between approximate depths of 4.5 and 9 feet below grade, corresponding to approximate elevations 283 to 304 feet (NAVD88). Table 2 below presents the general stratigraphy encountered during the subsurface exploration program in descending depth from the ground surface.

Strata (In Descending Depth)	General Description
Topsoil	Fine to coarse SAND, some Silt, trace fine Gravel, trace Organics (grass, roots)
Subsoil	Brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, trace Organics (roots)
Glacial Till	Medium dense to very dense, light brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt
Bedrock	Hard to Very hard, slightly weathered to fresh, slightly fractured to sound, medium grained, pink/gray, GRANITE. Joints close to wide, thick, subhorizontal to subvertical, semi-rough, Silt in Joints.

Definition of Soil Description Terms: "trace" = 0-10%, "little" = 10-20%, "some" = 20-35%, "and" = 35-50%, by weight

Table 2: Description of Generalized Subsurface Conditions Encountered

Groundwater was not encountered during drilling of the test borings, however, for design, it should be assumed that groundwater is present between the bottom of the overlying soil stratums and the top of the encountered bedrock. It should also be noted that the seasonally lowest groundwater levels typically occur during summer and early fall months, and the highest levels typically occur during the later winter and spring months. Water levels can fluctuate with season, precipitation, and nearby construction or other below grade activities, such as excavation, dewatering, wells, or infiltration basins.

4.2 Implications of Subsurface Conditions

The subsurface conditions encountered confirm that that the proposed retaining wall can be supported on conventional spread footing foundations, supported by undisturbed naturally deposited glacial till or bedrock. The topsoil and subsoil encountered across the site are considered unsuitable for structural applications and would need to be excavated prior to constructing shallow foundations for the proposed retaining walls.

The onsite soils typically had more than 10 percent silt and therefore do not consistently meet the gradation requirements for structural backfill in their current condition. Due to the silty nature of the existing site soils, these materials may be difficult to compact if they become wet during construction. Excavation subgrades are also anticipated to be susceptible to disturbance from wheeled vehicle traffic if excessively wet. It will therefore be critical that the onsite soils be protected from moisture after excavation and be managed prior to reuse by protecting stockpiles and loose lifts from precipitation and maintaining positive drainage during earthwork operations to avoid ponding of stormwater runoff.

The onsite soils may be re-used as site or structural fill (at the discretion of the project's Geotechnical Engineer) provided they are culled of oversized material, organic soils, and other deleterious materials, and can be properly compacted. Silty soils will be particularly difficult to work with when wet and may require discing or harrowing to reduce the moisture content prior to compaction. It is not recommended that the on-site soils be used where free draining materials are desired, such as retaining wall backfill or as base and subbase layers for pavement.

Excavated glacial till will contain cobbles and boulders, which will require handling, screening, or sorting prior to reuse. Boulders greater than 2/3 of the loose lift thickness of fill placed are not recommended to be used in the fill. Settlements due to poor compaction around large rocks, or from material washing into void spaces between rocks, could occur if the boulders are used in the fill or buried on site. The boulders may be used as rip-rap, crushed and reused as fill, or buried in non-critical areas such as under landscaping areas.

Bedrock was encountered at depths ranging between 4.5 and 9 feet below existing grade. The bedrock surface may also be highly irregular and could be encountered at shallower depths than reported on the exploration logs. Depending upon proposed final site grades, bedrock removal may be necessary for the construction of the new retaining walls. Removal techniques such as hoe-ramming and excavation with a large excavator may be sufficient to remove encountered bedrock to proposed grades. Ripped or fractured bedrock and excavated boulders within the glacial till stratum could be crushed and reused as site fill if properly graded and compacted.

It is possible that groundwater may be encountered during foundation excavation. It is anticipated that any groundwater encountered during construction could be readily controlled through the use of sumps and other open pumping techniques to allow excavation, observation of the subgrade, and footing construction in-the-dry. Issues with groundwater and dewatering can be minimized if construction is carried out during the period of lowest groundwater elevations which typically occur during the summer and early fall months.

Section 5: Alternatives Analysis

Tighe & Bond has developed six retaining wall alternatives to support the rehabilitation of the Park retaining walls. The retaining wall alternatives evaluated include the following:

1.) Do Nothing (Not Viable Option)
2.) Dismantle and Restack the Existing Wall
3.) In-place, Modular Block Concrete Wall
4.) In-front, Modular Block Concrete Wall
5.) In-place, Cast-In-Place Concrete Wall with a Stone Façade
6.) In-front, Cast-In-Place Concrete Wall with a Stone Façade

A description of each alternative is presented below, and each alternative is compared based on construction cost, construction schedule, construction impacts, aesthetics, and change in footprint of the Park.

The alternatives presented in this section assume that the final construction project would consist of repair/replacement of the sections of existing wall that are in poor to failed condition (about 400 linear feet).

For each alternative, we developed an Opinion of Probable Construction Cost (OPCC), utilizing recent construction cost data from similar projects and engineering experience. We additionally reached out to modular block wall manufacturers to acquire preliminary pricing. Each OPCC also includes a 10-percent contingency for bid phase and construction phase engineering services, along with a 25-percent construction contingency due to the broad assumptions made during these early phases of this design process. See Appendix E for a detailed breakdown of each OPCC.

Other than the *Alternative 1: Do Nothing*, the wall alternatives presented below should be backfilled with compacted free draining granular fill. A drainage layer consisting of a minimum of 2-feet of ¾-inch crushed stone wrapped in non-woven filter fabric, should be placed directly behind the new wall structures to provide drainage and limit the movement of fines. A 6-inch diameter perforated PVC pipe should then be installed at the base of each wall, within the crushed stone drainage layer. The pipe should either be directly tied into a site drainage system or should daylight through the wall periodically via weep holes. If weep holes are chosen, they should consist of 4-inch diameter PVC pipe spaced no further than 20 feet on center.

Additionally, trees or large vegetation currently present within 15 feet of either side of the wall, should be completely removed prior to construction. Voids created from this removal process should be backfilled with compacted granular fill.

5.1 Alternative 1 – Do Nothing

Significant portions of the retaining walls are in poor or failed condition and are showing signs of imminent collapse. See Section 2: Existing Conditions for the location and type of wall deficiencies. Locations in the most significant deficiencies will require action by the Town in the near future.

We do not consider this Do Nothing Alternative to be a viable option as the existing wall systems will continue to deteriorate. The close proximity of adjacent structures, such as sidewalks, utilities, and public roadways greatly increases the potential consequences of collapse.

5.2 Alternative 2 – Dismantle and Restack the Existing Wall

Under this alternative, the area around the wall would be cleared and grubbed before construction. The existing walls would be demolished and the area behind the wall would be excavated and sloped back. The Contractor would sort through existing stones to separate stones of sufficient shape and size for reuse in the wall. The Contractor would have import new stone as needed, install drainage behind the wall, restack the wall, and reconstruct the area behind the wall. It is assumed that the wall stones would be mortared together to provide a cohesive masonry structure, instead of dry stacked like the existing walls.

Cost

This alternative has an Opinion of Probable Cost of $1,630,000 to reconstruct 400 LF of wall, which includes the contingencies stated previously. The key drivers of cost for this alternative include the need for temporary shoring along Freedom Street and at 25 Northrop Street, the slow nature of building a natural stone wall, the need to sort through existing stones and import additional stone to build the wall, and reconstruction of the roadway and sidewalk behind the wall.

Construction Schedule

This alternative is anticipated to have a construction timeline of about 4 months.

Construction Impacts

Due to the close proximity of existing structures at 25 Northrop Street and the sewer line along Freedom Street, temporary shoring would likely be required at these locations. Additional impacts to the public would include temporary lane closures on Northrop Street and Freedom Street during construction.

Aesthetics

The aesthetic of the existing stone walls would generally be maintained although the color of the imported stone may vary from the existing walls. The imported stone could be thoroughly mixed with the original stone to minimize this color difference.

Change in Footprint

The proposed wall would be restacked in the location of the existing wall, therefore there would be no change in footprint to the park.

5.3 Alternative 3A – In-Place, Concrete Modular Block Retaining Wall

Modular block retaining walls are comprised of large precast concrete blocks that rely on the mass of the blocks to resist the lateral loads on the wall. These blocks are typically manufactured utilizing structural grade concrete that provides resistance to abrasion, freeze-thaw action, and deicing chemicals. Modular block manufacturers can provide many different block shapes, sizes, and finishes that allow for a wall system that is both structurally competent and can mimic aesthetic of the existing walls.

Under this alternative, the area around the wall would be cleared and grubbed before construction. The existing walls would be demolished and the area behind the wall would be excavated and sloped back. Temporary shoring would be installed as required to maintain stability of adjacent structures and roadways. The Contractor would install the modular block wall in the same location of the existing wall. The Contractor would install drainage, backfill behind the wall, and reconstruct the area behind the wall. See Figure 4 below for a generalized cross section of this alternative.

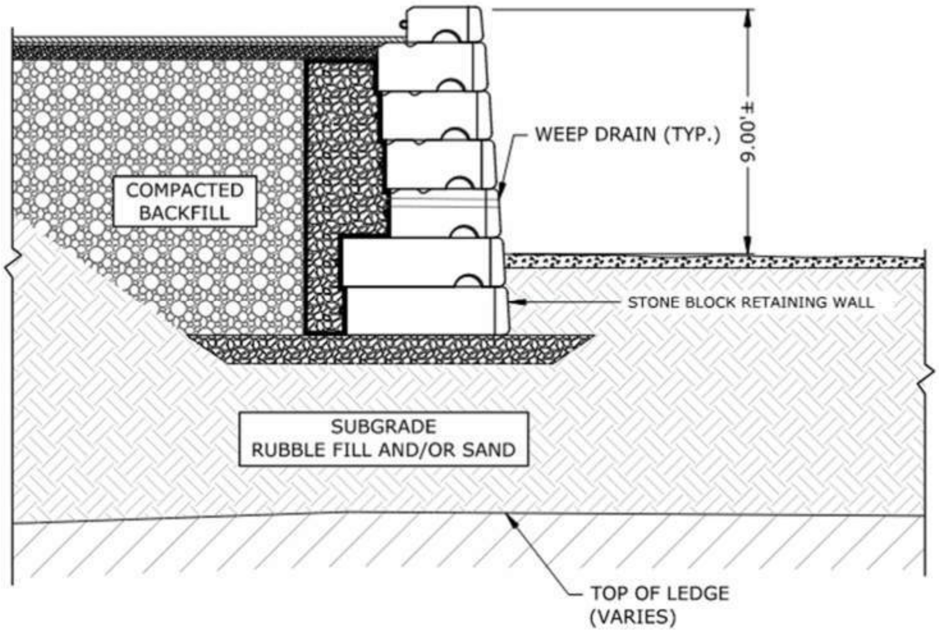


Figure 4: Alternative No. 3A – In-Place, Concrete Modular Block Retaining Wall

Cost

This alternative has an Opinion of Probable Cost of $1,120,000 to reconstruct 400 LF of wall. The key drivers of cost for this alternative include the need for temporary shoring along Freedom Street and at 25 Northrop Street and the cost to reconstruct the roadway/sidewalk behind the retaining wall.

Construction Schedule

This alternative is anticipated to have a construction timeline of about 3 months.

Construction Impacts

Due to the close proximity of existing structures at 25 Northrop Street and the sewer line along Freedom Street, temporary shoring would likely be required at these locations. Additional impacts to the public would include temporary lane closures on Northrop Street and Freedom Street during construction.

Aesthetics

The aesthetic and color of the modular blocks will differ from the existing retaining walls. The modular block will have a repetitive pattern and will have linear joints, whereas the existing wall patters is random and varying. See Figure 5 below for comparison.

Figure 5: Modular Block (Left), Existing Stone Wall (Right)

Change in Footprint

The proposed wall would be constructed in the location of the existing wall, therefore there would be no change in footprint to the park.

5.4 Alternative 3B – In Front Concrete Modular Block Retaining Wall

Under this alternative, the area around the wall would be cleared and grubbed before construction. The existing wall would be left in place, and the area in front of the existing wall would be excavated. Areas of the existing wall that are already unstable would be selectively demolished to avoid hazards during construction. The Contractor would install the modular block wall approximately 8 feet in front of the existing wall. The Contractor would install drainage, backfill and fill in existing voids behind the wall with imported material, and reconstruct the area behind the wall, which could either be paved or planted. See Figure 6 below for a generalized cross section of this alternative.

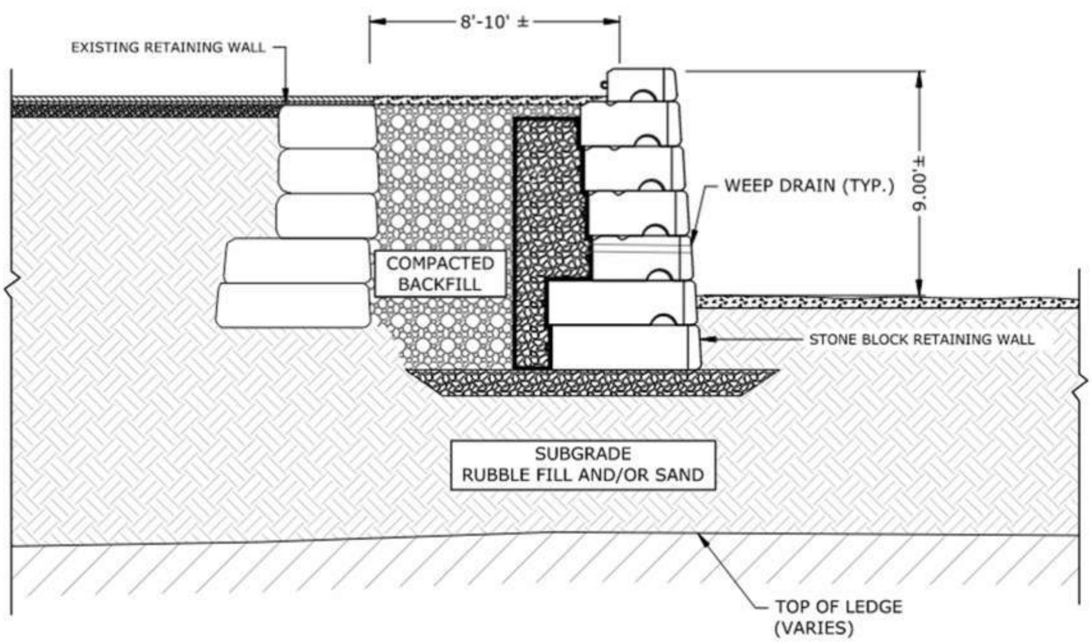


Figure 6: Alternative No. 3B – In-Front, Modular Block Retaining Wall

Cost

This alternative has an Opinion of Probable Cost of $650,000 to reconstruct 400 LF of wall. The cost of this alternative is significantly lower than Alternative 3A because there is no need for temporary shoring or demolition of the existing wall.

Construction Schedule

This alternative is anticipated to have a construction timeline of about 2.5 months.

Construction Impacts

This alternative would require the closure of the sidewalk along Freedom Street and some security fencing at 25 Northrop Street at the top of the existing wall. The existing wall would remain in place, therefore no additional temporary shoring is anticipated to maintain stability of the home a 25 Northrop Street or the sewer main along Freedom Street. No lane closures on Freedom Street are anticipated to complete this alternative.

Aesthetics

The aesthetic and color of the modular blocks will differ from the existing retaining walls. The modular block will have a repetitive pattern and will have linear joints, whereas the existing wall pattern is random and varying. See the example photos in Alternative 3A for comparison.

Change in Footprint

The proposed wall would be constructed in front of the existing wall and would encroach into the Park by about 10 feet. As a tradeoff, the usable space behind the wall would increase in width by about 8 feet.

5.5 Alternative 4A – In-Place, Cast-In-Place Concrete Wall with Stone Façade

Cast-in-place concrete walls are comprised of ready-mix concrete that is poured into forms and cured onsite to make the wall structure. The concrete used in the wall would be high-strength structural concrete that provides resistance to abrasion, freeze-thaw action, and deicing chemicals that would exceed that of a modular block wall system. Each section of wall would be poured monolithically and be strengthened with reinforcing steel bars within the wall structure itself. This provides a structural wall that exceeds the strength and rigidity of a modular block wall system.

Under this alternative, the area around the wall would be cleared and grubbed before construction. The existing walls would be demolished and the area behind the wall would be excavated. Temporary shoring would be installed as required to maintain stability of adjacent structures and roadways. The Contractor would form and pour the cast-in-place concrete wall in the same location as the existing wall. The Contractor would install drainage, backfill behind the wall, and reconstruct the area behind the wall. See Figure 7 below for a generalized cross section of this alternative.

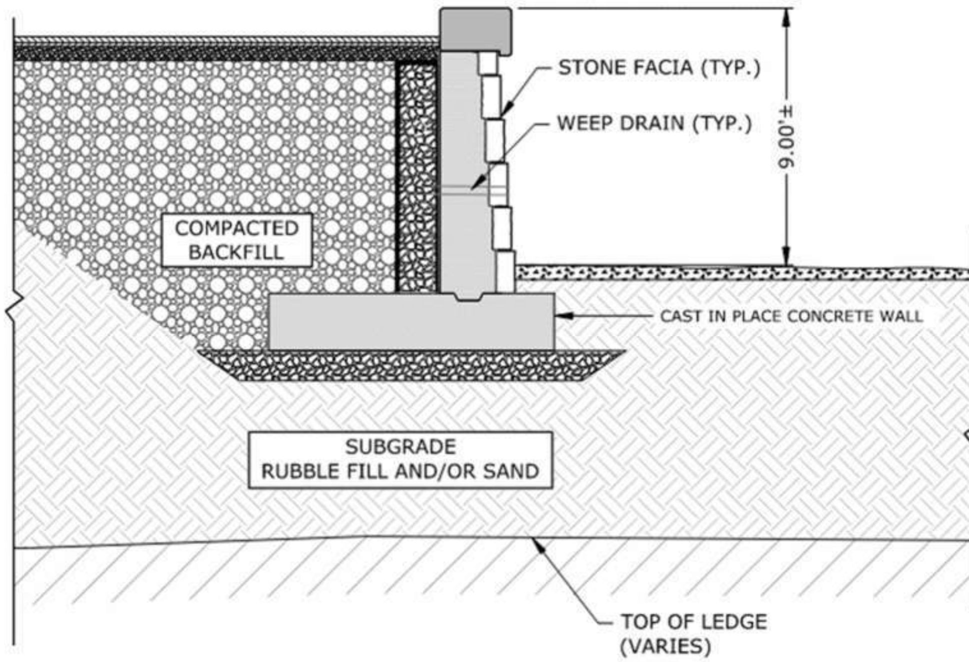


Figure 7: Alternative No. 4A – Cast-In-Place Concrete Wall with Stone Façade

Cost

This alternative has an Opinion of Probable Cost of $1,880,000 to reconstruct 400 LF of wall. The key drivers of cost for this alternative include the need for temporary shoring along Freedom Street and at 25 Northrop Street, the significant additional labor of a cast-in-place wall over a modular block wall, and the stone fascia on the wall. If the stone fascia were removed from the job, the estimate could be reduced by ±$270,000.

Schedule

This alternative is anticipated to have a construction timeline of about 4 to 5 months.

Constructability / Construction Impacts

Due to the close proximity of existing structures at 25 Northrop Street and the sewer line along Freedom Street, temporary shoring would likely be required at these locations. Additional impacts to the public would include temporary lane closures on Northrop Street and Freedom Street during construction.

Aesthetics

The aesthetic and color of the final wall would be similar to the existing wall, as the wall would be covered with a stone fascia similar to the existing wall. As a cost saving method, instead of using a stone veneer, a concrete form liner could be used to cast a pattern onto the wall. This casted pattern can also be painted for additional aesthetic options. See Figure 8 below for a comparison of stone veneer and form liner.


Figure 8: Stone Veneer (left), Form Liner (right)

5.6 Alternative 4B – In-Front, Cast-In-Place Concrete Wall with Stone Façade

Under this alternative, the area around the wall would be cleared and grubbed before construction. The existing wall would be left in place, and the area in front of the existing wall would be excavated. Areas of the existing wall that are already unstable would be selectively demolished to avoid hazards during construction. The Contractor would form and pour a cast-in-place concrete wall approximately 8 feet in front of the existing wall. The Contractor would install drainage, backfill and fill in existing voids behind the wall with imported material, and reconstruct the area behind the wall, which could either be paved or planted. See Figure 9 below for a generalized cross section of this alternative.

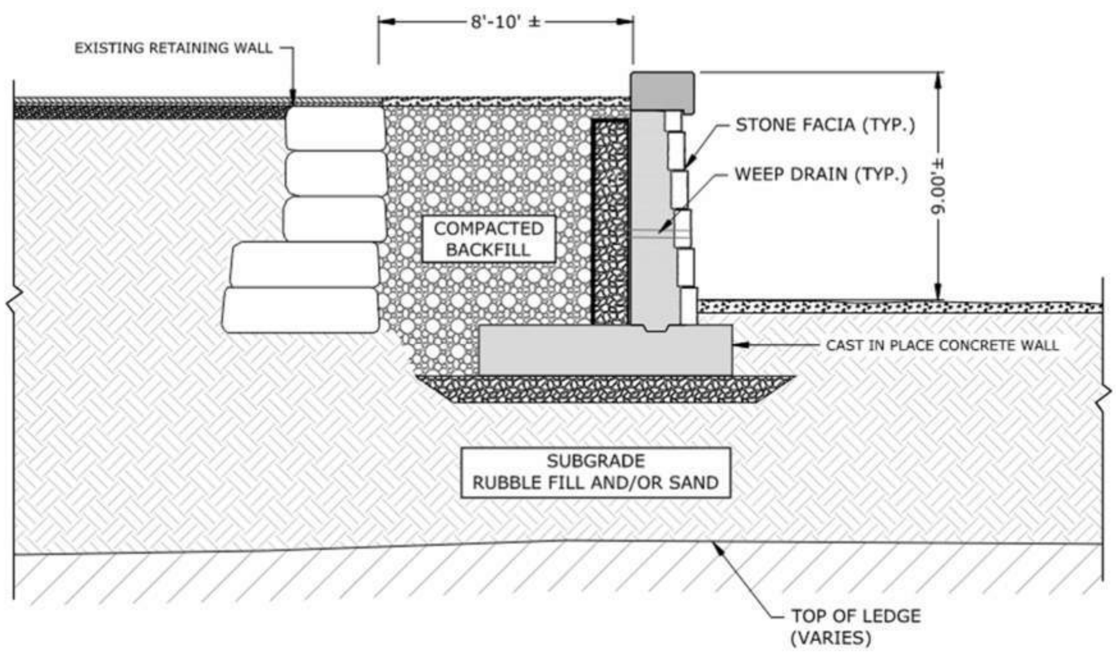


Figure 9: Alternative No. 4B – In-Front, Cast-In-Place Concrete Wall with Stone Façade

Cost

This alternative has an Opinion of Probable Cost of $1,530,000 to reconstruct 400 LF of wall. The cost of this alternative is significantly lower than Alternative 4A because there is no need for temporary shoring or demolition of the existing wall. Additionally, as with Alternative 4A, if the stone fascia were removed from the job, the estimate could be reduced by ±$270,000.

Schedule

This alternative is anticipated to have a construction timeline of about 3.5 months.

Constructability / Construction Impacts

This alternative would require the closure of the sidewalk along Freedom Street and some security fencing at 25 Northrop Street at the top of the existing wall. The existing wall would remain in place, therefore we do not anticipate that additional temporary shoring would be needed to maintain stability of the home a 25 Northrop Street or the sewer main along Freedom Street. No lane closures on Freedom Street are anticipated to complete this alternative.

Aesthetics

The aesthetic and color of the final wall would be similar to the existing wall, as the wall would be covered with a stone fascia similar to the existing wall. As a cost saving method, instead of using a stone veneer, a concrete form liner could be used to cast a pattern onto the wall. This casted pattern can also be painted for additional aesthetic options.

Change in Footprint

The proposed wall would be constructed in front of the existing wall and would encroach into the Park by about 10 feet. As a tradeoff, the usable space behind the wall would increase in width by about 8 feet.

Section 6: Summary

A full Existing Conditions Assessment of the retaining structures boarding Hopedale Town Park was performed to identify their overall current condition. It was determined through this assessment that approximately 400 linear feet of wall was either in poor, critical, or failed condition. Six retaining wall alternatives were developed to address the deficiencies observed in the existing walls. A synopsis of the Pros/Cons of each alternative, including OPCC are presented below:

Alternative 1 – Do Nothing

A Pros/Cons list was not developed for this alternative as we believe this is not a viable option the Town should consider pursuing. The existing retaining wall systems boarding the Park are significantly deteriorated and without intervention, pose a risk to adjacent properties, utilities, roadways, and the public.

Alternative 2 – Dismantle and Restack the Existing Wall

Pros:

- Reuse of existing stones currently onsite with no change in the aesthetic of the current walls.
- Footprint of the park remains unchanged.

Cons:

- Second most expensive alternative.
- High level of construction difficulty working with variable stone configurations and sizes. Would require a skilled contractor to properly build.
- One of the longest anticipated construction schedules due to the tedious nature of retaining wall construction with natural stone.
- Would require temporary shoring to stabilize areas adjacent to 25 Northrop Street and the sewer line in Freedom Street
- Would require temporary lane closure on Freedom Street for construction access.
- Will require the import of significant amounts of stone which may not exactly match the existing stone.
- Does not provide a code compliant guardrail at the top of the wall.

Conceptual Opinion of Probable Construction Cost = **$1,630,000**

Alternative 3A – In-Place, Concrete Modular Block Retaining Wall

Pros:

- The footprint of the park remains unchanged.
- Reduced construction time over a cast-in-place concrete wall.
- Lower construction cost that a cast-in-place concrete wall or restack of the existing wall.
- Does provide a code compliant guardrail at the top of the wall.

Cons:

- Would require temporary shoring to stabilize areas adjacent to 25 Northrop Street and the sewer line in Freedom Street
- Would require temporary lane closure on Freedom Street for construction access.

Conceptual Opinion of Probable Construction Cost = **$1,020,000**

Alternative 3B – In Front, Concrete Modular Block Retaining Wall

Pros:
- Not anticipated to need additional temporary shoring or a lane closure on Freedom Street to construct.
- Sidewalk area behind the wall will increase in width and provides an opportunity for various improvements.
- Lowest cost of all construction alternatives
- Shortest schedule of all construction alternatives
- Does provide a code compliant guardrail at the top of the wall.

Cons:
- Usable footprint of the Park will decrease.
- The aesthetic of the will be different than the existing wall.

Conceptual Opinion of Probable Construction Cost = **$650,000**

Alternative 4A – In-Place Cast-In-Place Wall with a Rock Face Façade

Pros:
- Provides a code compliant guardrail at the top of the wall.
- Provides similar aesthetic to the existing walls.
- Usable footprint within the Park remains unchanged.

Cons:
- Most expensive alternative.
- Longest anticipated construction schedule.
- Would require temporary shoring to stabilize areas adjacent to 25 Northrop Street and the sewer line in Freedom Street
- Would require temporary lane closure on Freedom Street for construction access.

Conceptual Opinion of Probable Construction Cost = **$1,880,000**

Alternative 4B – In-Front Cast-In-Place Wall with a Rock Face Façade

Pros:
- Not anticipated to need additional temporary shoring or a lane closure on Freedom Street to construct.
- Sidewalk area behind the wall will increase in width and provides an opportunity for various improvements.
- Does provide a code compliant guardrail at the top of the wall.
- Provides similar aesthetic to the existing walls.

Cons:
- Third most expensive alternative.
- Second longest anticipated construction schedule.
- Usable footprint of the Park will decrease.

Conceptual Opinion of Probable Construction Cost = **$1,530,000**

Section 7: Conclusion

The walls surrounding Hopedale Town Park range in condition from good to failed. Approximately 400 linear feet of the walls were in poor or failed condition, but two specific areas, (one adjacent to 25 Northrop Street and one approximately mid-way along the border of Freedom Street) were severely leaning and in danger of collapse. These wall sections support adjacent structures and/or buried utilities, therefore the consequences of collapse could be significant. Per our previous memorandum to the Town dated April 26, 2023, it is recommended that these areas be blocked off to public access immediately, and that these sections of the wall be replaced in the near future.

Tighe & Bond has provided six alternatives which include do nothing, restacking the existing wall, building a new concrete block wall, and building a new cast-in-place concrete wall. These alternatives were compared based on construction cost, construction schedule, construction impacts, aesthetics, and change in park footprint.

If you have any questions regarding this Report, please contact Oliver Cavallini, at ocavallini@tighebond.com or at 413-374-9871.

Very truly yours,

TIGHE & BOND, INC.

Oliver J. Cavallini, PE
Project Engineer

Daniel Ciaramicoli, PE
Project Manage

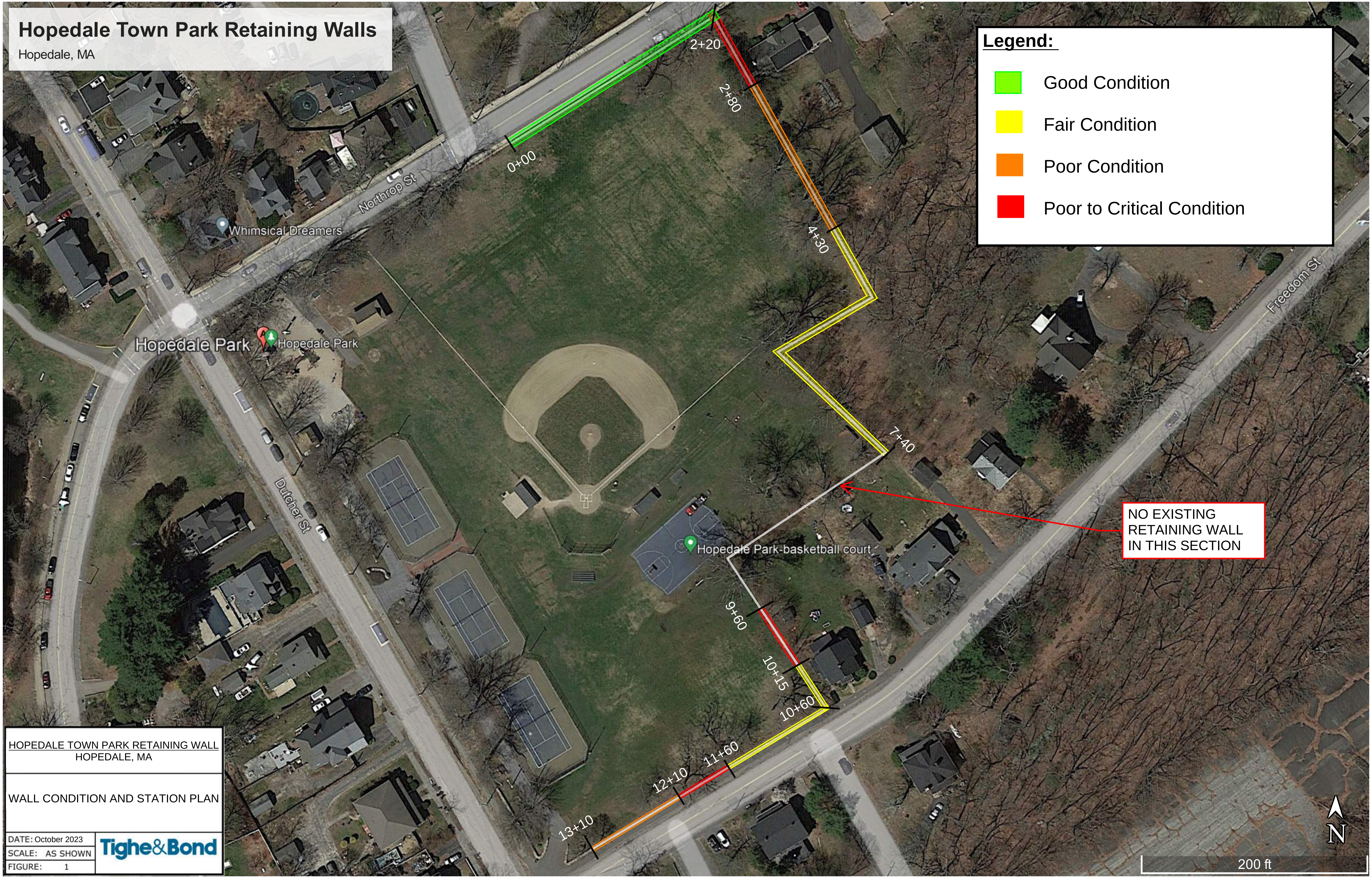
Joesph M. Persechino, PE
Vice President

Attachments:

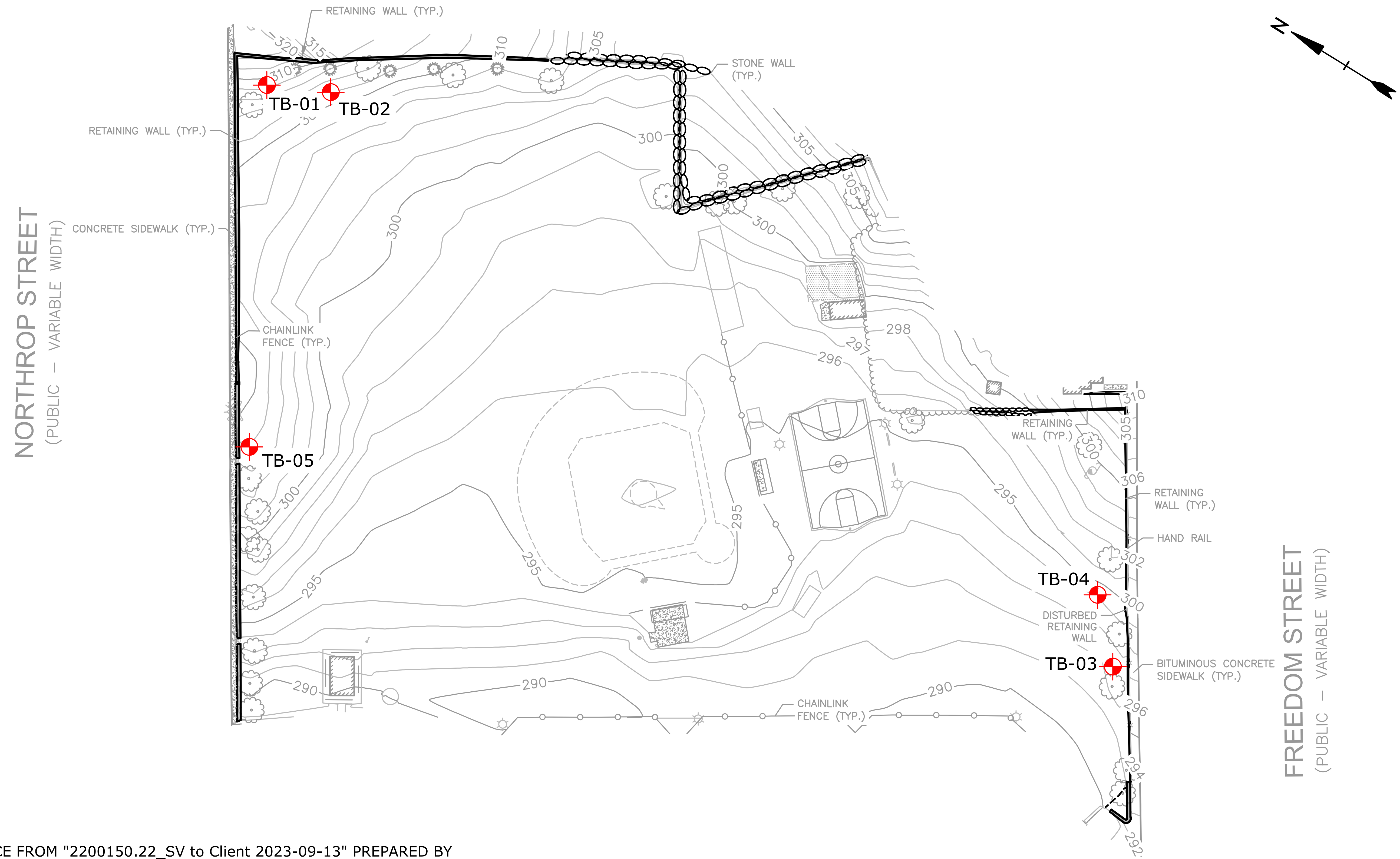
Figure 2: Evaluation Stationing and Conditions
Figure 3: Hopedale Town Park Boring Location Plan:
Appendix A: Assessment Photo Log
Appendix B: Test Boring Logs
Appendix C: Rock Core Photo Log
Appendix D: Laboratory Test Results
Appendix E: Opinions of Probable Construction Cost
Appendix F: Survey Plan

J:\H\H5025 Hopedale\011 - Hopedale Town Park Retaining Wall\Reports\Engineering Alternatives Analysis\Hopedale Town Park Alternatives Analysis 11212023.docx

FIGURES



Hopedale Town Park Retaining Walls
Hopedale, MA
Legend:
Good Condition
Fair Condition
Poor Condition
Poor to Critical Condition
0+00
2+20
2+80
4+30
7+40
9+60
10+15
10+60
11+60
12+10
13+10
Northrop St
Whimsical Dreamers
Hopedale Park
Hopedale Park
Dutcher St
Hopedale Park-basketball court
Freedom St
NO EXISTING
RETAINING WALL
IN THIS SECTION
HOPEDALE TOWN PARK RETAINING WALL
HOPEDALE, MA
WALL CONDITION AND STATION PLAN
DATE: October 2023
SCALE: AS SHOWN
FIGURE: 1
Tighe&Bond
N
200 ft



GENERAL NOTES:

1. REFERENCE IMAGE SOURCE FROM "2200150.22_SV to Client 2023-09-13" PREPARED BY GREENMAN-PEDERSON, INC. FOR TIGHE & BOND ON SEPTEMBER 13, 2023.

2. TEST BORING LOCATIONS, TB-01 THROUGH TB-05, WERE LAID OUT IN THE FIELD BY TIGHE & BOND REPRESENTATIVES, BY PULLING TIES FROM EXISTING SITE STRUCTURES, AND SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHODS USED.

3. TEST BORINGS TB-01 THROUGH TB-05 WERE DRILLED BY GEOLOGIC EARTH EXPLORATION OF NORFOLK, MA, FROM SEPTEMBER 5 THROUGH SEPTEMBER 6, 2023, AND WERE OBSERVED BY REPRESENTATIVES OF TIGHE & BOND.

LEGEND

TB-05 TEST BORING LOCATION (TYP)

0 70' 140'

SCALE: 1" = 70'

HOPEDALE TOWN PARK RETAINING WALL
HOPEDALE, MA

BORING LOCATION PLAN

DATE: OCTOBER 2023
SCALE: 1" = 70'
FIGURE 2

Tighe&Bond

APPENDIX A - EXISTING CONDITIONS PHOTO LOG

Photo 1: View of northwest wall adjacent to Northrop Street, facing north at sta. 1+30

Photo 2: View of northwest wall adjacent to 25 Northrop Street, facing northwest at sta. 2+20

Photo 3: View of wall adjacent to 25 Northrop Street , facing north at sta. 2+40

Photo 4: View of wall failure, facing northeast at sta. 2+75

Photo 5: View of northeast wall with grouted stone cap, facing southeast at sta. 3+25

Photo 6: View of northeast wall, facing southeast at sta. 3+55.

Photo 7: View of northeast wall tree growing behind wall stem, facing east at sta. 3+80.

Photo 8: View of dry stacked stone wall, facing southeast at sta. 4+50.

Photo 9: View of drystacked stone wall overgrown with vegetation, facing northeast at sta. 5+19

Photo 10: View of drystacked stone wall toppled over and overgrown with vegetation, facing northeast at sta. 6+50

Photo 11: View of failed stone wall adjacent to 62 Freedom Street, facing southeast at sta. 9+60

Photo 12: View of failed wall overground with vegetation, facing north at sta. 10+15

Photo 13: View of cobble wall adjacent to 62 Freedom Street, facing north at sta. 10+60

Photo 14: View of Freedom Street wall, facing south at sta. 11+00

Photo 15: View of bowing Freedom Street wall, facing southwest at sta. 11+60

Photo 16: View of Freedom Street wall where failure occurred, facing east at sta. 12+10

Photo 17: View of deteriorated sidewalk above Freedom Street wall where failure occurred, facing east at sta. 12+10

Photo 18: View of Freedom Street wall, facing south at sta. 12+50

Photo 19: View of loose stone in Freedom Street wall, facing southeast at sta. 12+90

APPENDIX B - TEST BORING LOGS

Tighe&Bond

Boring No.	**TB-01**
Page	1 of 1
File No.	175025011
Checked by:	O. Cavallini

Project: Hopedale Town Park Retaining Walls
Location: Hopedale, MA
Client: City of Hopedale

Drilling Co.: Geologic Earth Explorations
Foreman: J. Martinelli
T&B Rep.: O. Cavallini
Date Start: 09/05/23 End: 09/05/23
Location: See Exploration Location Plan
GS. Elev. 309 Datum: NAVD 88

	Casing	Sampler
Type	FJC	Split Spoon
I.D./O.D.	4" I.D.	1-3/8"/2"
Hammer Wt.	140#	140#
Hammer Fall	30"	30"
Rig Make/Model	Acker Soil Scout (Donut)	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Not Encountered				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	Blows Per 6"	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/12"	0-2	8-62		Top 4": Top Soil Mid 3": Brown, fine to coarse SAND, little Silt, trace fine to coarse Gravel, trace Organics (roots, grass), moist Bot 5": Light Brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt, moist	0.3' **TOPSOIL** 1' **SUBSOIL**		No Well Installed
				21-7					
		S-2/20"	2-4	12-22		Very Dense, Light Brown, fine to coarse SAND, some Silt, little fine Gravel, moist	**GLACIAL TILL**		
				34-50					
5							5'	1 2	
						End of Exploration at 5' (Refusal)			
10									
15									
20									
25									
30									

Notes:
1. Roller bit refusal at approx. 5 feet BGS. Inferred bedrock encountered.
2. Upon completion, boring was backfilled to the gound surface using drill cuttings and sand.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Tighe&Bond

Boring No.	**TB-02**
Page	1 of 1
File No.	175025011
Checked by:	O. Cavallini

Project: Hopedale Town Park Retaining Walls
Location: Hopedale, MA
Client: City of Hopedale

Drilling Co. Geologic Earth Explorations
Foreman: J. Martinelli
T&B Rep.: O. Cavallini
Date Start: 09/05/23 End: 09/05/23
Location: See Exploration Location Plan
GS. Elev. 306 Datum: NAVD 88

	Casing	Sampler
Type	FJC	Split Spoon
I.D./O.D.	4" I.D.	1-3/8"/2"
Hammer Wt.	140#	140#
Hammer Fall	30"	30"
Rig Make/Model	Acker Soil Scout (Donut)	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Not Encountered				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	Blows Per 6"	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/7"	0-2	7-18		Dense, Dark Brown, fine to coarse SAND, little Silt, trace fine Gravel, trace Organics (roots, grass), moist	0.5' **TOPSOIL**	1	No Well Installed
				13-16			**SUBSOIL** 2.5'		
		S-2/9"	2-3.5	15-54		Top 4": Brown, fine to coarse SAND, some fine to coarse Gravel, little silt, trace Organics (roots), moist Bot 5": Brown, fine to coarse GRAVEL and fine to coarse SAND, some Silt, moist	**GLACIAL TILL** 4.5'		
				56				2	
5									
	4:05	C-1/42"	4.5-9.5			Very Hard, slightly weathered to fresh, extremely fractured to sound, medium grained, pink/gray GRANITE, joints close to wide, thick, subvertical fractures, semi-rough, Silt in joints. REC: 42"/60"=70% RQD: 58.3%	**BEDROCK**	3	
	6:52								
	6:00								
	3:43								
	4:10						9.5'	4 5	
10						End of Exploration at 9.5'			
15									
20									
25									
30									

Notes:
1. Coarse Gravel stuck in tip of split spoon in sample S-1.
2. Very slow tough drilling from 3.5 to 4.5 ft BGS.
3. Ran out of drilling water during rock coring at approx. 6 ft BGS, possible fractures.
4. Bottom 18" of rock core broke off and got stuck in the hole. Was not able to retrieve after multiple attempts.
5. Upon completion, boring was backfilled to the gound surface using drill cuttings.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Tighe&Bond

Boring No.	**TB-03**
Page	1 of 1
File No.	175025011
Checked by:	O. Cavallini

Project: Hopedale Town Park Retaining Walls
Location: Hopedale, MA
Client: City of Hopedale

Drilling Co.	Geologic Earth Explorations		Casing	Sampler
Foreman:	J. Martinelli	Type	FJC	Split Spoon
T&B Rep.:	C. Cicerone	I.D./O.D.	4" I.D.	1-3/8"/2"
Date Start:	9/6/2023 End: 09/06/23	Hammer Wt.	140#	140#
Location	See Exploration Location Plan	Hammer Fall	30"	30"
GS. Elev.	292 Datum: NAVD 88	Rig Make/Model	Acker Soil Scout (Donut)	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Not Encountered				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	Blows Per 6"	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/13"	0-2	5-3		Loose, Dark Brown, fine to coarse SAND, some Silt, trace fine Gravel, trace Organics (roots, grass), moist	**TOP SOIL** 1'		No Well Installed
				4-6			**SUBSOIL**		
		S-2/15"	2-4	5-27		Top 7": Brown, fine to coarse SAND and fine to coarse Gravel, little silt, trace Organics (roots), moist	2.5'		
				49-39		Bot 8": Light Brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt, moist			
5							**GLACIAL TILL**	1	
							9'	2	
10	3:59	C-1/ 56"	9-14						
	4:14					Hard, moderately weathered to fresh, slightly fractured to sound, medium grained, gray GRANITE, joints close to wide, thick, subhorizontal, semi-rough, Silt in joints.	**BEDROCK**		
	4:20								
	4:40					REC: 56"/60" = 93.3% RQD: 91.7%			
	4:00						14'	3	
15						End of Exploration at 14'			
20									
25									
30									

Notes:
1. Rig chatter during rollerbit advancement at approx. 5 ft BGS.
2. Roller bit refusal at approx. 9 ft BGS.
3. Upon completion, boring was backfilled to the gound surface using drill cuttings and sand.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Tighe&Bond

Boring No.	TB-04
Page	1 of 1
File No.	175025011
Checked by:	O. Cavallini

Project: Hopedale Town Park Retaining Walls
Location: Hopedale, MA
Client: City of Hopedale

			Casing	Sampler
Drilling Co.	Geologic Earth Explorations			
Foreman:	J. Martinelli	Type	FJC	Split Spoon
T&B Rep.:	C. Cicerone	I.D./O.D.	4" I.D.	1-3/8"/2"
Date Start:	9/6/2023 9/6/2023	Hammer Wt.	140#	140#
Location	See Exploration Location Plan	Hammer Fall	30"	30"
GS. Elev.	294 Datum: NAVD 88	Rig Make/Model	Acker Soil Scout (Donut)	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Not Encountered				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	Blows Per 6"	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/10"	0-2	11-6		Top 6": Dark Brown, fine to coarse SAND, little Silt, trace fine Gravel, trace Organics (roots, grass), moist	0.5' TOPSOIL		No Well Installed
				5-11		Bot 4": Red/Brown, fine to coarse SAND, some Silt, trace fine Gravel, moist	SUBSOIL 2'	1	
		S-2/4"	2-4	15-6		Medium Dense, Light Brown, fine to coarse SAND and fine to coarse GRAVEL, little Silt, moist	GLACIAL TILL		
				21-59					
5									
							7'	2 3	
						End of Exploration at 7' (Refusal)			
10									
15									
20									
25									
30									

Notes:
1. Coarse gravel stuck in tip of split spoon in sample S-1.
2. Roller bit refusal at approx. 7 ft BGS. Inferred bedrock encountered.
3. Upon completion, boring was backfilled to the gound surface using drill cuttings and sand.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Tighe&Bond

Boring No.	**TB-05**
Page	1 of 1
File No.	175025011
Checked by:	O. Cavallini

Project: Hopedale Town Park Retaining Walls
Location: Hopedale, MA
Client: City of Hopedale

Drilling Co.: Geologic Earth Explorations
Foreman: J. Martinelli
T&B Rep.: C. Cicerone
Date Start: 9/6/2023 End: 09/06/23
Location: See Exploration Location Plan
GS. Elev. 303 Datum: NAVD 88

	Casing	Sampler
Type	FJC	Split Spoon
I.D./O.D.	4" I.D.	1-3/8"/2"
Hammer Wt.	140#	140#
Hammer Fall	30"	30"
Rig Make/Model	Acker Soil Scout (Donut)	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Not Encountered				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	Blows Per 6"	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/11"	0-2	7-9		Medium Dense, Light Brown, fine to coarse SAND, some Silt, little fine Gravel, little Organics (roots, grass), moist	**TOPSOIL** 1'		No Well Installed
				20-22			**SUBSOIL** 2.3'		
		S-2/8"	2-3.5	13-10		Top 4": Light Brown, fine to coarse SAND, little fine Gravel, trace Silt, trace Organics (roots), moist			
				56-25/0"		Bot 4": Light Brown, fine to coarse SAND, little fine Gravel, trace Silt, moist	**GLACIAL TILL** 5'	1 2 3 4	
5						End of Exploration at 5' (Refusal)			
10									
15									
20									
25									
30									

Notes:
1. Split Spoon refusal at approx. 3.5 ft BGS.
2. Rig chatter during rollerbit advancement from approx. 4 to 5 feet BGS.
3. Roller bit refusal at approx. 5 ft BGS. Inferred bedrock encountered.
4. Upon completion, boring was backfilled to the gound surface using drill cuttings and sand.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

APPENDIX C - ROCK CORE PHOTO LOG

Photo 1: View of rock core C-01 taken from boring TB-02 from 4.5 to 9.5-feet below the existing ground surface.

Photo 2: View of rock core C-01 taken from boring TB-03 from 9 to 14-feet below the existing ground surface.

APPENDIX D - LABRATORY TEST RESULTS

Thielsch DIVISION OF THE RISE GROUP	195 Frances Avenue Cranston RI, 02910 Phone: (401)-467-6454 Fax: (401)-467-2398 cts.thielsch.com *Let's Build a Solid Foundation*	Client Information: Tighe & Bond North Kingstown, RI Project Manager: Oliver Cavallini Assigned By: Oliver Cavallini Collected By: Oliver Cavallini, Christa Cicerone	Project Information: **Hopedale Town Park Retaining Wall Evalution** **Hopedale, MA** Project Number: 17-5025-011 Summary Page: 1 of 1 Report Date: 09.18.23

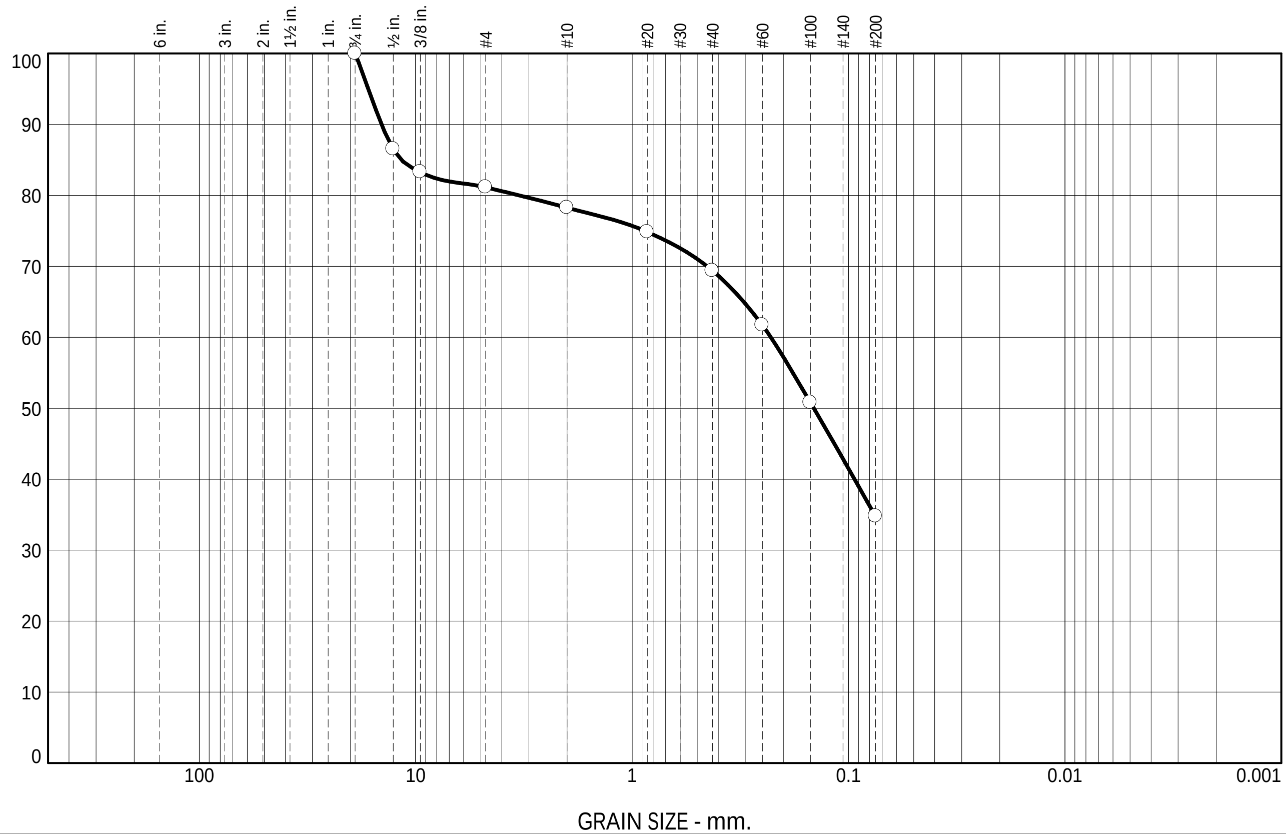
LABORATORY TESTING DATA SHEET, Report No.: 7423-J-150

Boring No.	Sample ID	Depth (ft)	Laboratory No.	Identification Tests									Proctor / CBR / Permeability Tests								Laboratory Log and Soil Description
				As Rcvd Moisture Content %	LL %	PL %	OD LL	Gravel %	Sand %	Fines %	Org. %	pH	g_d MAX (pcf) W_{opt} (%)	g_d MAX (pcf) W_{opt} (%) (Corr.)	Dry unit wt. (pcf)	Test Moisture Content %	Target Test Setup as % of Proctor	CBR @ 0.1"	CBR @ 0.2"	Permeability cm/sec	
				D2216	D4318			D6913			D2974	D4792	D1557								
TB-01	S-2	2-4	23-S-3812					18.9	46.3	34.8											Brown silty sand with gravel
TB-03	S-2B	2-4	23-S-3813					42.8	43.6	13.6											Brown silty sand with gravel
TB-02	S-2B	2-4	23-S-3814					41.7	37.1	21.2											Brown silty gravel with sand

Date Received: **09.14.23** Reviewed By: Date Reviewed: **09.19.23**

These results are for the exclusive use of the client for whom they were obtained. This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	18.9	2.8	8.9	34.6	34.8	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	86.5		
3/8"	83.3		
#4	81.1		
#10	78.3		
#20	74.8		
#40	69.4		
#60	61.7		
#100	50.8		
#200	34.8		

* (no specification provided)

Soil Description

Brown silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 14.3840 D_{85}= 11.6398 D_{60}= 0.2285
D_{50}= 0.1447 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Sample visually classified as non-plastic.

Source of Sample: Test Boring Depth: 2-4'
Sample Number: TB-01 / S-2

Date: 09.18.23

Thielsch Engineering Inc.

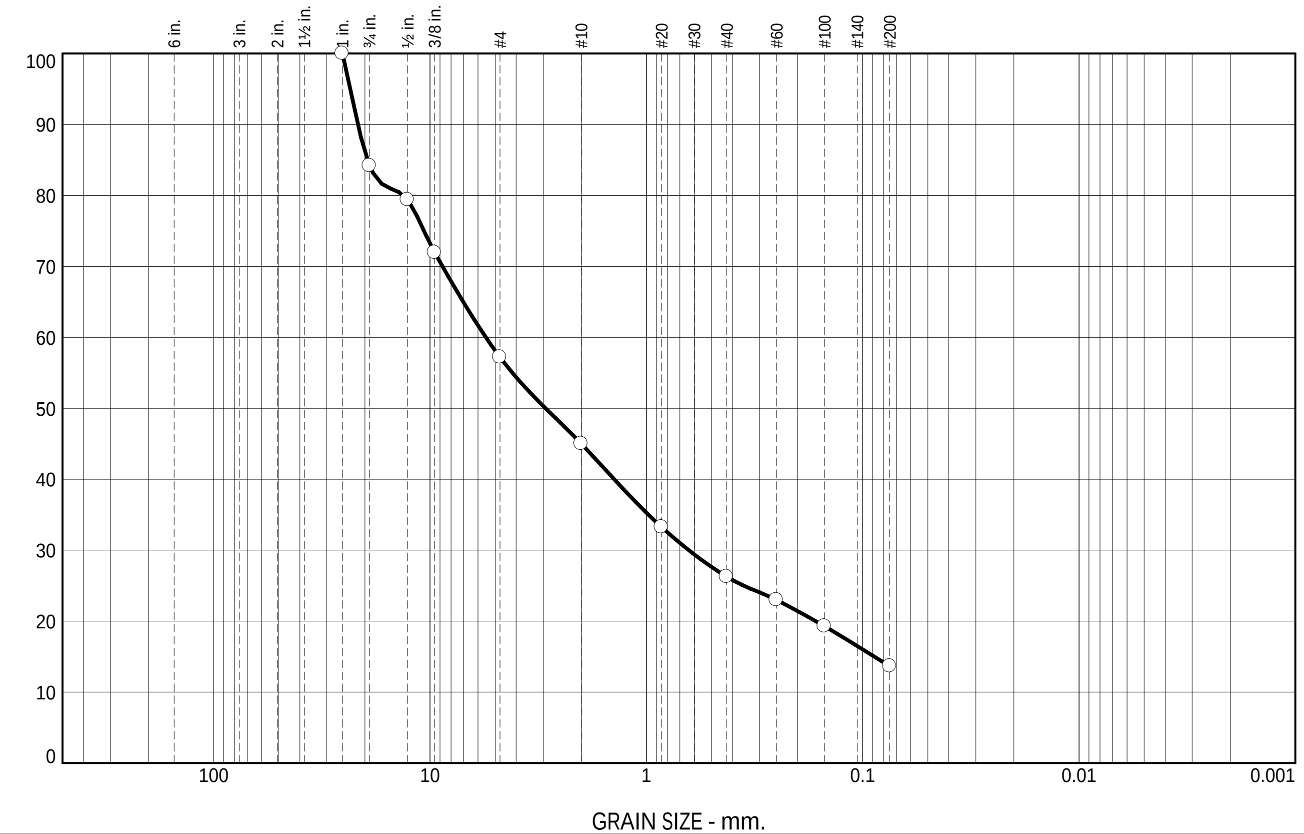
Cranston, RI

Client: Tighe & Bond
Project: Hopedale Town Park Retaining Wall Evaluation
Hopedale, MA
Project No: 17-5025-011 Figure 23-S-3812

Tested By: ML Checked By: Andrew Vanasse

These results are for the exclusive use of the client for whom they were obtained. This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.8	27.0	12.2	18.8	12.6	13.6	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	84.2		
1/2"	79.4		
3/8"	72.0		
#4	57.2		
#10	45.0		
#20	33.2		
#40	26.2		
#60	23.0		
#100	19.3		
#200	13.6		

* (no specification provided)

Soil Description

Brown silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 21.5535 D_{85}= 19.5067 D_{60}= 5.5211
D_{50}= 2.9245 D_{30}= 0.6365 D_{15}= 0.0885
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-a

Remarks

Source of Sample: Test Boring Depth: 2-4'
Sample Number: TB-03 / S-2B

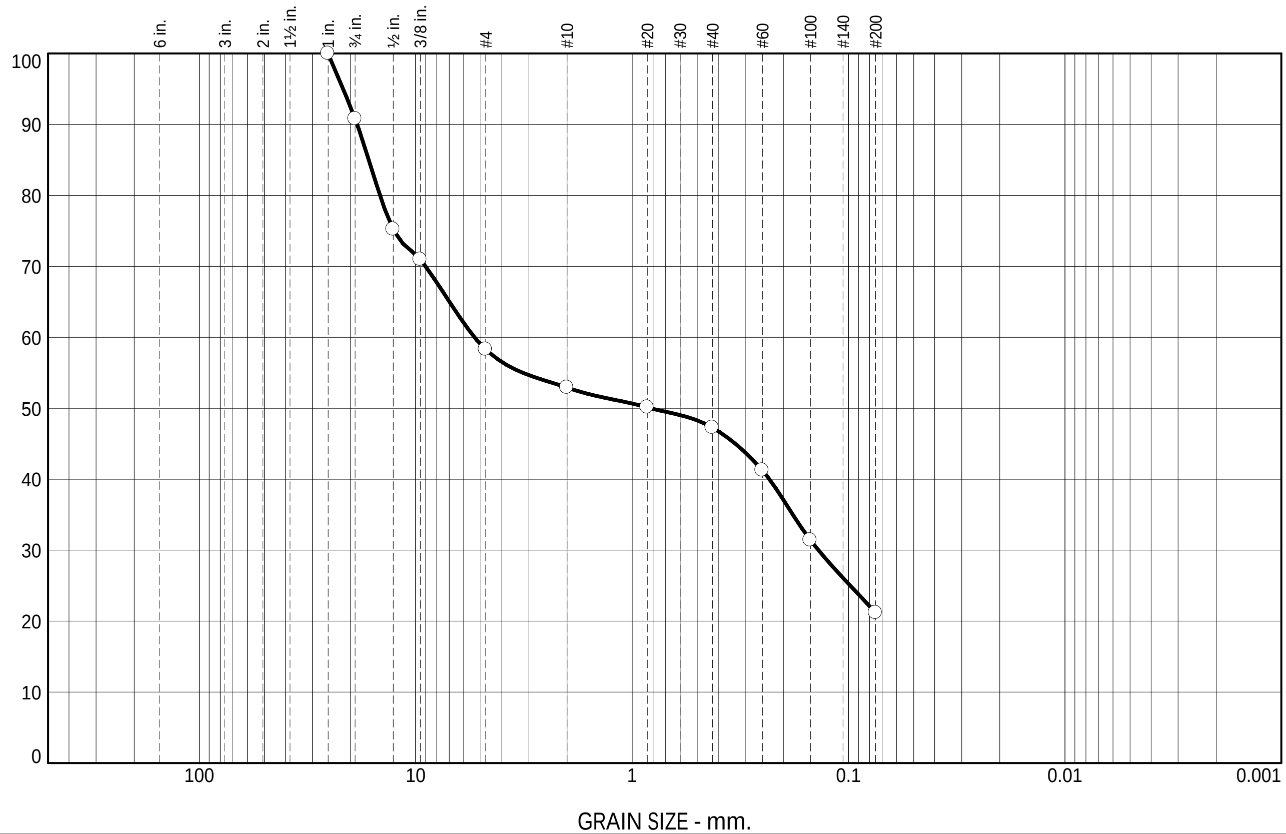
Date: 09.18.23

Thielsch Engineering Inc. Cranston, RI	Client: Tighe & Bond Project: Hopedale Town Park Retaining Wall Evaluation Hopedale, MA Project No: 17-5025-011 Figure 23-S-3813

Tested By: ML Checked By: Andrew Vanasse

These results are for the exclusive use of the client for whom they were obtained. This report only relates to items inspect and/or tested. No warranty, expressed or implied, is made.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.2	32.5	5.4	5.6	26.1	21.2	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	90.8		
1/2"	75.2		
3/8"	70.9		
#4	58.3		
#10	52.9		
#20	50.1		
#40	47.3		
#60	41.2		
#100	31.4		
#200	21.2		

* (no specification provided)

Soil Description

Brown silty gravel with sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 18.6534 D_{85}= 16.4825 D_{60}= 5.3501
D_{50}= 0.8215 D_{30}= 0.1377 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO= A-1-b

Remarks

Source of Sample: Test Boring Depth: 2-4'
Sample Number: TB-02 / S-2B

Date: 09.18.23

Thielsch Engineering Inc.

Cranston, RI

Client: Tighe & Bond
Project: Hopedale Town Park Retaining Wall Evaluation
Hopedale, MA
Project No: 17-5025-011 Figure 23-S-3814

Tested By: ML Checked By: Andrew Vanasse

APPENDIX E - CONCEPTUAL OPINIONS OF PROBABLE CONSTRUCTION COST

Hopedale Retaining Walls, Hopedale, MA
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

Date: November 13, 2023
Project: Hopedale Retaining Walls
Location: Hopedale, MA
Project #: 175025011
Est. By: OJC
Check By: DJC

ALTERNATIVE 2 - DISMANTLE AND RESTACK THE EXISTING WALL

PROJECT ESTIMATE STATUS: CONCEPTUAL/BUDGETARY

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST	SUBTOTAL
1	**MOBILIZATION**					
	Mobilization	LS	1	$61,000.00	$61,000.00	
	Site Preparation	LS	1	$25,000.00	$25,000.00	
						$86,000.00
2	**DEMOLITION AND REMOVAL**					
	Excavation and Sloping Behind Existing Structures	CY	1630	$50.00	$81,500.00	
	R&D of Roadway Materials	LS	1	$15,000.00	$15,000.00	
	Tree Removal	EA	8	$1,500.00	$12,000.00	
	Temporary Shoring	LF	400	$400.00	$160,000.00	
						$268,500.00
3	**RETAINING WALL CONSTRUCTION**					
	Lane Closure/Police Detail	DAY	30	$600.00	$18,000.00	
	Reuse Stone	TON	200	$200.00	$40,000.00	
	Dispose of Unsuitable Stone	TON	200	$75.00	$15,000.00	
	Import Stone	TON	420	$150.00	$63,000.00	
	Rebuilt Wall	SQFT	4,000	$100.00	$400,000.00	
						$536,000.00
4	**BACKFILLING & EARTHWORK**					
	Backfill and Compact Behind Retaining Wall	CY	1630	$75.00	$122,250.00	
	Paving	LS	1	$50,000.00	$50,000.00	
	Site Restoration and Planting	LS	1	$35,000.00	$35,000.00	
	Guardrail	LF	400	$150.00	$60,000.00	
						$267,250.00
5	**DEMOBILIZATION & CLEAN UP**					
	Demobilization and Clean-up	LS	1	$49,000.00	$49,000.00	
						$49,000.00

	CONSTRUCTION ESTIMATE SUBTOTAL	$	1,206,750
	Bidding & Construcion Phase Services 10%	$	120,700
	BASE ESTIMATE SUBTOTAL	$	1,327,450
	Scope & Budget Contingency 25%	$	301,700
(ROUNDED UP TO NEAREST $10,000)	**BASE ESTIMATE TOTAL**	**$**	**1,630,000**

ASSUMPTIONS/EXCLUSIONS

No ledge excavation
Will occupy one travel lane along Freedom Street

ABBREVIATIONS/ACRONYMS

LS = Lump sum, TRK = Truck, CY = Cubic Yard, SQFT = Square foot

This is an engineer's Opinion of Probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction cost are made on the basis of the Tighe & Bond's professional judgement and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the work will not vary from the estimate of the Probable Construction Cost.

Hopedale Retaining Walls, Hopedale, MA
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

Date: November 13, 2023
Project: Hopedale Retaining Walls
Location: Hopedale, MA
Project #: 175025011
Est. By: OJC
Check By: DJC

ALTERNATIVE 3A - IN-PLACE, CONCRETE MODULAR BLOCK RETAINING WALL

PROJECT ESTIMATE STATUS: CONCEPTUAL/BUDGETARY

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST	SUBTOTAL
1	**MOBILIZATION**					
	Mobilization	LS	1	$38,000.00	$38,000.00	
	Site Preparation	LS	1	$16,000.00	$16,000.00	
						$54,000.00
2	**DEMOLITION AND REMOVAL**					
	Excavation and Sloping Behind Existing Structures	CY	1630	$40.00	$65,200.00	
	R&D of Wall/Roadway Materials & Structures	LS	1	$15,000.00	$15,000.00	
	Tree Removal	EA	8	$1,500.00	$12,000.00	
	Temporary Shoring	LF	400	$400.00	$160,000.00	
						$252,200.00
3	**RETAINING WALL CONSTRUCTION**					
	Lane Closure/Police Detail	DAY	30	$600.00	$18,000.00	
	Block Delivery	TRKS	40	$800.00	$32,000.00	
	Modular Block Wall	SQFT	4,000	$35.00	$140,000.00	
						$190,000.00
4	**BACKFILLING & EARTHWORK**					
	Backfill and Compact Behind Wall	CY	1630	$55.00	$89,650.00	
	Paving	LS	1	$50,000.00	$50,000.00	
	Site Restoration and Planting	LS	1	$25,000.00	$25,000.00	
	Guardrail	LF	400	$150.00	$60,000.00	
						$224,650.00
5	**DEMOBILIZATION & CLEAN UP**					
	Demobilization and Clean-up	LS	1	$31,000.00	$31,000.00	
						$31,000.00

	CONSTRUCTION ESTIMATE SUBTOTAL	$	751,850
	Bidding & Construcion Phase Services 10%	$	75,200
	BASE ESTIMATE SUBTOTAL	$	827,050
	Scope & Budget Contingency 25%	$	188,000
(ROUNDED UP TO NEAREST $10,000)	**BASE ESTIMATE TOTAL**	**$**	**1,020,000**

ASSUMPTIONS/EXCLUSIONS

No ledge excavation
Will occupy one travel lane along Freedom Street

ABBREVIATIONS/ACRONYMS

LS = Lump sum, TRK = Truck, CY = Cubic Yard, SQFT = Square foot

This is an engineer's Opinion of Probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction cost are made on the basis of the Tighe & Bond's professional judgement and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the work will not vary from the estimate of the Probable Construction Cost.

Hopedale Retaining Walls, Hopedale, MA
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

Date: November 13, 2023
Project: Hopedale Retaining Walls
Location: Hopedale, MA
Project #: 175025011
Est. By: OJC
Check By: DJC

ALTERNATIVE 3B - IN FRONT, CONCRETE MODULAR BLOCK RETAINING WALL

PROJECT ESTIMATE STATUS: CONCEPTUAL/BUDGETARY

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST	SUBTOTAL
1	**MOBILIZATION**					
	Mobilization	LS	1	$24,000.00	$24,000.00	
	Site Preparation	LS	1	$10,000.00	$10,000.00	
						$34,000.00
2	**DEMOLITION AND REMOVAL**					
	Foundation Excavation	CY	600	$40.00	$24,000.00	
	Tree Removal	EA	8	$1,500.00	$12,000.00	
						$36,000.00
3	**RETAINING WALL CONSTRUCTION**					
	Deliver Modular Blocks to Site	TRKS	40	$800.00	$32,000.00	
	Modular Block Wall	SQFT	4,000	$35.00	$140,000.00	
						$172,000.00
4	**BACKFILLING & EARTHWORK**					
	Backfill with Existing Material	CY	600	$55.00	$33,000.00	
	Imported Fill	CY	830	$100.00	$83,000.00	
	Site Restoration and Planting	LS	1	$25,000.00	$25,000.00	
	Guardrail	LF	400	$150.00	$60,000.00	
	Paving (sidewalk only)	LS	1	$15,000.00	$15,000.00	
						$216,000.00
5	**DEMOBILIZATION & CLEAN UP**					
	Demobilization and Clean-up	LS	1	$20,000.00	$20,000.00	
						$20,000.00

	CONSTRUCTION ESTIMATE SUBTOTAL	$	478,000
	Bidding & Construcion Phase Services 10%	$	47,800
	BASE ESTIMATE SUBTOTAL	$	525,800
	Scope & Budget Contingency 25%	$	119,500
(ROUNDED UP TO NEAREST $10,000)	**BASE ESTIMATE TOTAL**	**$**	**650,000**

ASSUMPTIONS/EXCLUSIONS

No ledge excavation

This is an engineer's Opinion of Probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction cost are made on the basis of the Tighe & Bond's professional judgement and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the work will not vary from the estimate of the Probable Construction Cost.

ABBREVIATIONS/ACRONYMS

LS = Lump sum, TRK = Truck, CY = Cubic Yard, SQFT = Square foot

Hopedale Retaining Walls, Hopedale, MA
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

Date: November 13, 2023
Project: Hopedale Retaining Walls
Location: Hopedale, MA
Project #: 175025011
Est. By: OJC
Check By: DJC

ALTERNATIVE 4A - IN-PLACE, CAST-IN-PLACE CONCRETE WALL WITH STONE FAÇADE

PROJECT ESTIMATE STATUS: CONCEPTUAL/BUDGETARY

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST	SUBTOTAL
1	**MOBILIZATION**					
	Mobilization	LS	1	$56,000.00	$56,000.00	
	Site Preparation	LS	1	$28,000.00	$28,000.00	
						$84,000.00
2	**DEMOLITION AND REMOVAL**					
	Excavation and Sloping Behind Existing Structures	CY	1630	$40.00	$65,200.00	
	R&D of Wall/Roadway Materials & Structures	LS	1	$15,000.00	$15,000.00	
	Tree Removal	EA	8	$1,500.00	$12,000.00	
	Temporary Shoring	LF	400	$400.00	$160,000.00	
						$252,200.00
3	**RETAINING WALL CONSTRUCTION**					
	Lane Closure/Police Detail	DAY	30	$600.00	$18,000.00	
	Cast In Place Concrete	CY	500	$1,000.00	$500,000.00	
	Wall Stone Facing	SF	3,000	$90.00	$270,000.00	
						$788,000.00
4	**BACKFILLING & EARTHWORK**					
	Backfill and Compact Behind Wall	CY	1630	$55.00	$89,650.00	
	Paving	LS	1	$50,000.00	$50,000.00	
	Site Restoration and Planting	LS	1	$25,000.00	$25,000.00	
	Guardrail	LF	400	$150.00	$60,000.00	
						$224,650.00
5	**DEMOBILIZATION & CLEAN UP**					
	Demobilization and Clean-up	LS	1	$42,000.00	$42,000.00	
						$42,000.00

	CONSTRUCTION ESTIMATE SUBTOTAL	$	1,390,850
	Bidding & Construcion Phase Services 10%	$	139,100
	BASE ESTIMATE SUBTOTAL	$	1,529,950
	Scope & Budget Contingency 25%	$	347,800
(ROUNDED UP TO NEAREST $10,000)	**BASE ESTIMATE TOTAL**	**$**	**1,880,000**

ASSUMPTIONS/EXCLUSIONS

No ledge excavation
Will occupy one travel lane along Freedom Street

ABBREVIATIONS/ACRONYMS

LS = Lump sum, TRK = Truck, CY = Cubic Yard, SQFT = Square foot

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Hopedale Retaining Walls, Hopedale, MA
PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

Date: November 13, 2023
Project: Hopedale Retaining Walls
Location: Hopedale, MA
Project #: 175025011
Est. By: OJC
Check By: DC

PROJECT ESTIMATE STATUS: CONCEPTUAL/BUDGETARY

ALTERNATIVE 4B - IN FRONT, CAST-IN-PLACE WALL WITH A STONE FAÇADE

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST	SUBTOTAL
1	**MOBILIZATION**					
	Mobilization	LS	1	$46,000.00	$46,000.00	
	Site Preparation	LS	1	$23,000.00	$23,000.00	
						$69,000.00
2	**DEMOLITION AND REMOVAL**					
	Foundation Excavation	CY	600	$40.00	$24,000.00	
	R&D of Wall/Roadway Materials & Structures	LS	1	$15,000.00	$15,000.00	
	Tree Removal	EA	8	$1,500.00	$12,000.00	
						$51,000.00
3	**RETAINING WALL CONSTRUCTION**					
	Lane Closure/Police Detail	DAY	30	$600.00	$18,000.00	
	Cast In Place Concrete	CY	500	$1,000.00	$500,000.00	
	Wall Stone Facing	SF	3,000	$90.00	$270,000.00	
						$788,000.00
4	**BACKFILLING & EARTHWORK**					
	Backfill and Compact Behind Wall	CY	600	$55.00	$33,000.00	
	Imported Fill	CY	830	$70.00	$58,100.00	
	Paving (sidewalk only)	LS	1	$15,000.00	$15,000.00	
	Site Restoration and Planting	LS	1	$25,000.00	$25,000.00	
	Guardrail	LF	400	$150.00	$60,000.00	
						$191,100.00
5	**DEMOBILIZATION & CLEAN UP**					
	Demobilization and Clean-up	LS	1	$34,000.00	$34,000.00	
						$34,000.00

	CONSTRUCTION ESTIMATE SUBTOTAL	$	1,133,100
	Bidding & Construcion Phase Services 10%	$	113,400
	BASE ESTIMATE SUBTOTAL	$	1,246,500
	Scope & Budget Contingency 25%	$	283,300
(ROUNDED UP TO NEAREST $10,000)	**BASE ESTIMATE TOTAL**	**$**	**1,530,000**

ASSUMPTIONS/EXCLUSIONS

No ledge excavation

ABBREVIATIONS/ACRONYMS

LS = Lump sum, TRK = Truck, CY = Cubic Yard, SQFT = Square foot

This is an engineer's Opinion of Probable Construction Cost (OPCC). Tighe & Bond has no control over the cost or availability of labor, equipment or materials, or over market conditions or the Contractor's method of pricing, and that the estimates of probable construction cost are made on the basis of the Tighe & Bond's professional judgement and experience. Tighe & Bond makes no guarantee nor warranty, expressed or implied, that the bids or the negotiated cost of the work will not vary from the estimate of the Probable Construction Cost.

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