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REPORT

June 2021

CITY OF
Peabody
MASSACHUSETTS

Resilient North River Canal Corridor Phase 2

FY20/21 MVP Action Grant – Final Report

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EXECUTIVE SUMMARY

In 2019, the City of Peabody (the city) was awarded its second Municipal Vulnerability Preparedness (MVP) Action Grant by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA). This grant allowed the city to further advance the 25% design concepts of Resilient North River Canal Corridor project developed during Phase I in 2018.

The Resilient North River Canal Corridor project includes a proposed Riverwalk that will be approximately 1,600 feet in length, following along the North River Canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street, as well as improvements to the stabilize the banks on the south side of the canal, as the condition of the existing canal wall in this area varies drastically in condition from good to poor. In addition, this comprehensive project will improve flood resilience, address site contamination from historic use as a tannery district and provide a park resource that will enhance public access and vitality of the area.

Weston & Sampson, on behalf of the city, performed engineering and design services to support the City's FY20/21 MVP Action grant (Phase II). Activities included, but were not limited to: 1) a detailed hydrologic and hydraulic (H&H) study to update and broaden the Project's preliminary resilience evaluation conducted during Phase I and to inform the 75% design of the project; 2) additional geotechnical explorations to fill in data gaps and provide specific recommendations for the design of the proposed Riverwalk and the preferred bank stabilization alternative; 3) survey activities to create the base site plan to take the preliminary design from 25% to a 75% permitting ready set; 4) the preparation of 75% design drawings, technical specifications, structural analyses and/or design calculations; 5) the generation of associated permitting submittals; 6) the development of a strategy for soil management and regulatory compliance under the MCP; 7) community engagement activities, and 8) other project management and related services to support the project.

Utilizing the velocity data compiled during H&H modeling efforts, the Weston & Sampson's engineering and design teams determined the appropriate slope and nature-based method of protection for the vegetated embankment for the proposed wall repair alternative. In addition, Weston & Sampson evaluated site conditions to determine appropriate footings and abutments for both the boardwalk and bridge of Strongwater Brook. These important elements of the design are necessary so that the lifetime of these structures can be enhanced and are also able to be sustained during future flooding events.

In addition, over the course of the grant, representatives from the city and Weston & Sampson developed iterative conceptual and preferred 75% design plans for the Riverwalk and park that reflect the needs of a diverse community. These iterative design plans were generated in response to the needs of the city, as expressed by various stakeholders and community representatives in focus group meetings and through two public meetings. The design includes elements for the core parcel owned by the city at 24 Caller Street, including a cantilevered section of the board walk, as well as how the reminder of the riverwalk will be constructed. The project has been received favorably by the public. This report summarizes the key design elements as well as summarizes and includes the individual components of the study, including permitting, structural, resilience and environmental evaluations for the project.

The Resilient North River Canal Corridor project will create a new recreational open green space in a disadvantaged part of the community and provide the public with a corridor for multimodal transportation which will ultimately have numerous benefits beyond the additional stormwater and riverine flood storage capacity in Downtown Peabody.

1.0 INTRODUCTION

1.1 Project Overview

The City of Peabody (the city) suffers from recurring flooding which is expected to worsen from climate change, including sea level rise and increased precipitation frequency and intensity. In 2018, the city was awarded its first Municipal Vulnerability Preparedness (MVP) Action Grant by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA). The MVP grant allowed the city to explore options for improving flood resilience and evaluate a proposed Riverwalk and park resource along the southern side of the North River Canal that would enhance public access and vitality of the area, see ***Figure 1 – Site Locus***. The North River Canal is a channeled and walled reach of the North River connecting Peabody Square to the tidal reach of the North River near the Salem-Peabody municipal boundary. The North River drainage basin discharges into Salem Sound.

The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street (the Site / the Project). The south side of the canal abuts five (5) privately owned properties and one (1) municipally acquired property at 24 Caller Street (from west to east: 13 Wallis Street, 24 Caller Street, 21 Caller Street, 18 Howley Street, 20 Howley Street, 166R Main Street), see ***Figure 2** - **Site Plan***. The existing wall on the south side of the canal over the length of the proposed Riverwalk varies drastically in condition from good to poor. In 2017, Weston & Sampson concluded that prior to the construction of the Riverwalk, the south canal wall would need to be repaired/replaced to support the construction of the proposed Riverwalk.

Phase I of the project conducted in 2018 resulted in: a resiliency evaluation to determine how best to accommodate flood waters along the canal; subsurface explorations and preliminary geotechnical and structural analyses to evaluate wall replacement / bank stabilization design alternatives; environmental sampling activities to better understand potential regulatory obligations under the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000; a 25% preliminary design of the south bank stabilization and Riverwalk; and development of a permitting strategy to support the Project.

In 2019, the city was successful in applying to EEA for additional MVP action grant assistance for Phase II of the project, which allowed the city to further develop the 75% design concepts of Resilient North River Canal Corridor project. The following chapters of this report summarize the activities conducted as part of the city's FY 20/21 MVP grant (Phase II) and the final deliverables that were generated for each major task. Copies of the complete reports and design plans and specifications are provided in the appendices.

- South Wall – 75% Design
    - Geotechnical Evaluation
    - Survey
    - Structural Analysis and Calculations
- Riverwalk – 75% Design
- Environmental Permitting
- MCP Strategy for Soil Management and Hazardous Building Materials Assessment
- Community Engagement
- Updated Resiliency Evaluation
- Project Management of the Grant

The recommendations presented in this report are based on Weston & Sampson's understanding of the proposed project as described herein, subsurface conditions encountered at discrete exploration locations, and the provisions of the Limitations, provided in Section 11 of this report.

1.2 Project Understanding

The project site is in an urban industrial area of Peabody, between Wallis and Howley Streets, and crosses Caller Street, as shown in ***Figure 1 – Site Locus***. Refer to ***Figure 2 – Site Plan*** for the property limits, and ***Table 1 – Summary of Existing Conditions*** for a summary of existing conditions within the project area. Construction of the park and Riverwalk will require property acquisition and/or easements on these private properties. The city has already acquired one of the parcels located at 24 Caller Street and is negotiating with other property owners for easements and/or acquisition of portions or all the property.

As part of the proposed project, the existing south wall of the canal will be demolished within the project limits, and replaced with a new full-height wall, consisting of driven steel sheet piles. or combination partial-height wall and vegetated or armored slope. The new wall will tie-in to the existing canal walls at the Caller Street bridge. Proposed wall heights range from approximately 3 to 6 feet, and slope heights range from approximately 2 to 4 feet. Currently there are grade changes between property boundaries that are addressed as part of the design.

The new Riverwalk will be located along the top of the new wall and/or slope and will consist of a paved path with sections of wooden boardwalk. The Riverwalk will include a pedestrian bridge over the Strongwater Brook canal within the 166R Main Street property. A cantilevered boardwalk "overlook" structure is proposed at 21 Caller Street, and will be partially supported by the new canal wall. Additional proposed improvements include landscaped park areas, new tree plantings, park benches, pedestrian lighting, raingardens, and drainage improvements.

The North River Canal has a history of flooding. The overall goal of the MVP grant project is to evaluate and incorporate resilient design measures, where feasible, to provide additional flood protection during storm events, which may include flood and/or storm water storage.

2.0 DESCRIPTION OF EXISTING SITE CONDITIONS

2.1 Existing Wall Structure

The south canal wall along the length of the project limits consists of multiple sections including earthen embankment (or possible buried wall), a stacked timber railroad tie structure behind an earth embankment, reinforced concrete, granite blocks, or stone or stone rubble sections. Wall heights range from about 4 to 6 feet above the canal bottom. The wall's condition varies over its length, ranging from good, in need of minor or no repairs, to poor, requiring full or partial reconstruction. A copy of Weston & Sampson's report titled "*Riverwalk along North River Corridor – South Wall Evaluation,*" dated June 2, 2017, is provided in *Appendix A,* and provides a detailed description of the existing wall types and conditions along the project alignment.

In the report, Weston & Sampson recommended repair or replacement to sections of the wall for support of new loads associated with the proposed Riverwalk. The visual inspection performed on the south wall of the North River Corridor revealed that the wall's condition varies drastically over its length. Conditions range from "good," which need minor or no repairs, to "poor," which require full or partial reconstruction. Causes of deterioration include waterflow, overgrown vegetation (roots), and changes in the surrounding land conditions due to lack of maintenance. Materials used in construction of the wall vary along the wall's length and include earth embankment or buried wall, a timber tie structure behind earth embankment, reinforced concrete, granite blocks, and stone or stone rubble.

2.2 Existing Soil Contamination

There is known or suspected soil contamination along the proposed Riverwalk area that will need to be addressed as part of proposed wall repair activities and construction of the Riverwalk. Most of the area was formerly a tannery and it has known and potential environmental impacts. Weston & Sampson, on behalf of the city, conducted limited subsurface environmental assessments at several of the properties within the proposed Riverwalk area between 2017 and 2020. Additional information regarding known, existing current environmental conditions and recommendations to comply with the requirements of the Massachusetts Contingency Plan (MCP) are provided in more detail in Section 6.

2.3 Existing Flood Issues

The City of Peabody has suffered from recurring flooding events since the 1950s, with the most significant flooding occurring downtown in Peabody Square. Significant floods occurred in 1954, 1968, 1979, 1987, 1996, and 2006. In the past, flooding was largely attributed to post-WWII development and decreased discharge capacity of watercourses in downtown Peabody. However, flooding events have become more frequent in recent years with several major floods in the past 20 years. Based on predicted climate change modeling, flooding will continue to be an issue in the North River watershed.

As noted in the 2008 Preliminary Design of Flood Mitigation Facilities for Peabody Square Area Report, developed for the city, Peabody experienced flooding in October 1996, June 1998, March 2001, April 2004, and May 2006. Three of these events were declared Federal Disasters and caused significant impacts to public safety and public health, substantial property damage, and widespread economic losses. Major transportation arterials that connect to I-95 and MA Routes 128 and 114 as well as commercial rail service were closed for several days. The May 2006 event alone caused the following significant impacts:

- The city's main fire station and police department were isolated by floodwaters for several days. FEMA estimated the cost of this impact at $1.4 million.
- Emergency responses during the flooding cost the city approximately $360,000.
- FEMA estimated the loss of associated with road closures, delays, and detours cost $4.2 million.
- FEMA insurance claims were paid to home and business owners to a total of more than $4.6 million.

The city also experienced significant flooding in March 2010, October 2011, and December 2014 from short duration and intense rain events.

Flooding in the project area is largely due to high flows in the North River Canal caused by precipitation in the upgradient watersheds of Procter Brook, Goldthwaite Brook, and the North River (Metcalf & Eddy-AECOM, 2008). Precipitation events are projected to be more extreme due to climate change, which would exacerbate riverine flooding in the project area. Currently, tidal influences at Mean Higher High Water (MHHW) extend approximately 230 feet upstream of Howley Street (Metcalf & Eddy-AECOM, 2008). Sea level rise is expected to extend tidal influences further upstream into the project area. The flood events negatively impact area businesses and make it difficult for Fire and Police Department staff to respond to emergencies. Importantly, the city has taken measures to mitigate flood impacts by constructing several flood detention structures upstream in the watershed. Those structures are designed to hold back flood water and release them slowly to mitigate potential flooding.

3.0 SOUTH WALL – 75% DESIGN

3.1 Introduction

The existing wall on the south side of the canal over the length of the proposed Riverwalk varies drastically in condition from good to poor. In 2017, Weston & Sampson concluded that prior to the construction of the Riverwalk, the south canal wall would need to be repaired/replaced to support the construction of the proposed Riverwalk. During Phase I of the project in 2018, Weston & Sampson, on behalf of the city, performed subsurface explorations immediately behind the Canal wall to obtain existing wall information, including wall type, dimensions, and subsurface conditions. Using the subsurface investigation information, Weston & Sampson was able to perform preliminary geotechnical and structural analyses to evaluate repair/replacement design alternatives for the wall.

Weston & Sampson evaluated the following five (5) wall alternatives for the repair of the south wall of the North River Canal from Wallis Street to Howley Street:

- Alternative A – Rip Rap Slope
    - Option 1, build out from Toe of existing wall.
    - Option 2, build out from inside of existing wall.
- Alternative B – Vegetative Berm Over Rip Rap Slope
    - Option 1, build out from Toe of existing wall.
    - Option 2, build out from inside of existing wall.
- Alternative C – Sheet Pile Wall
    - Option 1, Sheet Pile with Concrete Cap
    - Option 2, Sheet Pile with Sloped Bank (rip rap and/or vegetated berm)
- Alternative D – Cantilever Concrete Retaining Wall
- Alternative E – Stone Masonry Wall

Weston & Sampson then conducted a preliminary analysis to evaluate the alternatives based on factors such as resiliency, anticipated durability, environmental impact, permitting, schedule, and costs. This was used to rank and prioritize alternatives for the wall.

Based upon the findings and comparative evaluations, Alternative C – Sheet Pile Option 2 with Sloped Bank, ranked as the highest scoring alternative. This alternative would provide the most additional flood storage with relatively low total cost and minimal maintenance when compared to other alternatives, requires a reasonable easement width from private property owners, does not require any material to be dredged from the canal, and had the highest total permitting favorability. However, while this alternative works from a conceptual engineering and permitting evaluation perspective, it is not feasible along the entire length of the wall due to existing structures and grade. The feasibility in such areas was further evaluated during the preliminary 25% design process complete in 2019.

As the project design progressed during Phase II, additional geotechnical explorations and survey activities were required to fill in data gaps and provide specific recommendations to inform the 75% design of the proposed Riverwalk and the selected canal wall replacement alternative(s). This section of the report presents the results of Weston & Sampson's engineering and 75% South Wall Design related activities that were conducted in the target area along the North River Canal as part of FY20/21 MVP Grant activities.

3.2 Geotechnical Evaluation

3.2.1 Subsurface Explorations

Weston & Sampson oversaw the advancement of two (2) test borings at 13 Wallis Street (B-101 and B-102) on April 14, 2020, to fill in data gaps and support the final design of the proposed wall repair alternative and Riverwalk. The borings extended to depths of approximately 29.5 and 40.5 ft feet below grade. The borings were completed using an ATV-mounted drill rig using hollow-stem-auger and drive and wash drilling methods and extended to approximately 29.5 and 40.5 ft. below grade. Standard penetration tests (SPTs) were completed in each boring.

Weston & Sampson geotechnical engineering staff monitored drilling activities in the field and prepared logs for each boring. Weston & Sampson reviewed existing data and made preliminary recommendations for allowable soil bearing capacity, lateral earth pressures, frictional resistance, and seismic design considerations.

3.2.2 Subsurface Conditions

Subsurface conditions encountered in the explorations were generally consistent with the regional geology and past subsurface investigations, and generally consisted of FILL overlying native SAND and SILT to the depths explored. ORGANIC SOILS were observed below the fill in eight of the eighteen total borings advanced at the Site. Typically, organic soil was encountered at approximately 8-14 feet below grade. Variations may occur and should be expected outside of the exploration locations.

3.2.3 Groundwater

Groundwater was encountered during drilling at a depth of 4.5 feet in B-101 and 5.0 feet in B-102. Historical logs for borings identify groundwater depths ranging from 8 feet to 10.5 feet. Groundwater levels are expected to be influenced by the water level in the North River Canal and may fluctuate due to local and regional factors including, but not limited to, precipitation events, seasonal changes, and periods of wet or dry weather.

3.2.4 Geotechnical Laboratory Analysis

Select soil samples from the 2020 explorations were submitted to GeoTesting Express of Acton, Massachusetts for grain size analysis and/or organic content testing to confirm field classification and estimate engineering properties. Geotechnical Laboratory analytical results are included on the boring logs and in a copy is provided in ***Appendix B- Geotechnical Engineering Report – May 2020.***

3.2.5 Summary and Future Considerations

Weston & Sampson has provided the following geotechnical design considerations, which were incorporated into the 75% design of the proposed wall and Riverwalk. Additional details, including construction considerations and information on the use of these geotechnical recommendations is provided in the document titled “Important Information about this Geotechnical Engineering Report” by Geoprofessional Business Association (GBA), Inc., also included in ***Appendix B***:

- Subsurface conditions encountered at the Site include undocumented fill, debris, and organic soils to depths of up to 15 feet, overlying native sand and/or silt at locations explored. The existing fill and organic soils are not suitable for support of rigid structures due to the risk of differential settlement from variable rates of compression/decomposition. The in-place existing fill can provide adequate support of flexible site improvements, including the paved Riverwalk, provided subgrades are prepared and evaluated as recommended below.

- Over-excavation and replacement of unsuitable soils (existing fill and organics) is not considered feasible below the proposed pedestrian bridge at Strongwater Brook and the overlook structure at 21 Caller Street due to anticipated required depth of excavation, the need for construction dewatering, and the proximity to existing structures. Therefore, Weston & Sampson recommends supporting these structures on deep foundations (helical piles or drilled micro piles - DMPs) extending to suitable bearing stratum of native, inorganic sand and/or silt.

- Proposed canal walls consisting of driven sheet piles or DMPs and lagging should extend through the existing fill and organics and into the native sand and/or silt soils.

- Excavations up to approximately 8 feet below grade will be required to remove existing canal walls and construct the proposed improvements. Excavations will encounter fill, debris, organics, and layers of loose to medium dense sand, and moderate to severe caving and possible flowing conditions should be anticipated where seepage is present.

3.3 Survey

Weston & Sampson conducted a topographic survey for the project area along the North River canal between Wallis Street and Howley Street and the entirety of the 24 Caller Street parcel in May 2020. The Topographic Survey limits extended approximately 10 feet past the property and/or proposed easement lines.

In conducting the survey, Weston & Sampson performed the following services:

- Data was collected regarding the location of existing physical features and representative ground elevations.

- Weston & Sampson processed field data and performed computations and drafting as necessary to prepare topographic mapping of the subject area. The mapping depicts the following physical features, as applicable:

    - Contours of the ground surface at one (1) foot intervals extending at least to the project limits.

    - Spot elevations at approximately fifty (50) foot intervals along sidewalks, curbs, gutter lines, edges and centerlines of paved roadways, and edges of driveways within the project area.

    - Ground elevations at numerous points and physical structures in the proposed work area.

    - The location of ditches, channels, existing drainage pipes and/or culverts passing under or through the site, which were visible and accessible at the time of the field survey.

    - The approximate location of utility poles, gate valves, catch basins, manholes, light standards, and other evidence of utilities readily available at the ground surface.

  - Isolated or specimen trees of 6" caliper or larger were located and identified as to size and general type.

  - The bottom, top, front, and back edges, and material of existing walls in the project area.

  - The limits of the Activity and Use Limitation (AUL) at 20-22 Howley Street.

  - Benchmarks, established during the field survey, are also described.

- Stream Transects – Weston & Sampson surveyed any changes in slope at 15 transects across parts of the canal, with a minimum of approximately 15 shots per transect, including at least 5 below the water line, as well as the ordinary high water (OHW) elevation. Transects across parts of the stream were recorded to aid in design and resilience evaluations.

- Weston & Sampson surveyed the inverts and roadway elevations of all four crossings (2 railroad, Caller Street, Howley Street)

The results of the topographic survey were added to the Property Survey Weston & Sampson previously prepared for the city, which identified the parcels and proposed easements associated with the proposed Riverwalk, which was then used to create the base site survey plan presented in **Appendix C – Property and Topographic Survey**. In addition, construction sheets depicting the canal wall are also included in Appendix C. The base site plan helped the engineering and design teams understand the location and extent of existing and abandoned infrastructure and buildings, as well as natural resources, including wetlands, riverfront, and floodplain, that exist in the project area and allowed the team to take the preliminary design from 25% to a permitting ready 75% design set.

3.4 Structural

3.4.1 Preliminary 25% Design – Phase I – 2018 MVP Action Grant

Following the completion of the engineering evaluation and design alternative analysis of the existing south wall during Phase I, the city decided to pursue the highest scoring wall repair alternative option, Alternative C - Sheet Pile Wall Option 2 with Sloped Bank. The proposed sheet pile wall would be installed behind the existing south wall. The existing wall would then be removed down to at least the streambed elevation. The top of the sheet pile would be set at approximately the ordinary high-water level or higher based on constraints to provide a sloped embankment behind it. The sheet pile will protect the toe of the slope from scouring and the rip rap/vegetation will protect the slope from erosion during flood events. This alternative provides the most additional flood storage, will provide a long service life, requires minimal maintenance, can be modified to accommodate future flood events, minimizes environmental and right-of-way impacts, and was anticipated to have a high regulatory favorability. Conceptually, MassDEP fully supported preferred alternative and is looking forward to working with the city on the next phase of the project.

The 25% conceptual design phase work for the replacement of the south wall of North River Canal required evaluating the alignment of the new sheet pile wall along the canal, and the location of the new wall with respect to the existing wall. For construction feasibility, the alignment of the sheet pile wall was designed to follow a straight line behind the existing canal wall alignment, and only curving at necessary locations. The sheet pile wall will extend at minimum 15 feet below the top of the riverbed. The sheet pile wall height above the riverbed will vary depending on location. At most locations, the sheet pile wall height will be between two and three feet above the riverbed, with a sloped bank behind the sheet pile wall. The top of the sloped bank will be designed to match the current height of the existing wall. By matching the existing wall height, the sloped portion of the bank will provide additional flood storage for the canal, without creating new flooding to other parcels of land nearby. The sheet pile wall will be installed one foot (from back face of existing wall to front face of sheet pile) behind the existing wall. This will allow enough room for demolition and removal of the existing south wall after installation of the sheet pile wall is complete.

At a few locations along the canal alignment, it is not feasible to provide the sloped bank because of existing driveways, retaining walls or other design constraints and physical obstacles. At these locations, particularly 13 Wallis Street, the east edge of 24 Caller Street, the entirety of 21 Caller Street, and either side of Strongwater Brook, the sheet pile wall will extend to a height matching the existing wall at that location, and no sloped bank will be provided. The sloped banks adjacent to these locations will be graded to come up to the sheet pile wall height on the sides of the wall. At Strongwater Brook, a new bridge structure will need to be constructed.

Weston & Sampson worked with the city to develop proposed permanent and temporary property easements along the length of the canal. The permanent easements range from 15 feet to 31 feet behind the proposed sheet pile wall to allow space for the proposed 8-foot-wide Riverwalk at the top of the sloped bank, with 4 feet of vegetative area on either side of the path to allow for stormwater management. The temporary easement will be used during construction and is 15-feet wide along the length of the canal, except at 21 Caller Street, where it is 20-feet wide.

3.4.2 75% Design – Phase II – FY20/21 MVP Action Grant

Building upon the 25% design completed during Phase I and the additional data collected in Phase II, Weston & Sampson's structural engineering team was able to advance the preliminary South Wall design from the 25% level to a 75% design set. The 75% design included a more detailed analysis and refinement of the proposed design elements which included the following:

- Sheet Pile Wall Design.
    - Weston & Sampson determined the size and thickness of the retaining wall necessary to complete the Project. This included an analysis of the required sheet pile sections and embedment depth based on the anticipated scour for the design flood event.

- Vegetated Supporting Slope:
    - Working with the Landscape Architect (LA) design team and utilizing velocity data compiled during H&H modeling efforts, the structural team worked with the Landscape Architects to determine the appropriate slope and method of protection for the vegetated embankment. A 2.5:1 slope will be utilized, and bio-stabilization/nature-based solutions, including turf-reinforced mats, will be necessary to protect the vegetated embankment.

Working with LA design team, Weston & Sampson's structural team evaluated site conditions to determine appropriate footings and abutments for both the boardwalk and bridge of Strongwater Brook. These important elements of the design are necessary so that the lifetime of these structures can be enhanced. Since the project is located within a floodplain, different stressors will be encountered, and the boardwalk and bridge structure must be able to be sustained during flooding events and function as the Landscape Architects intend.

- Timber Boardwalk Structure from Sta. 13+50 to Sta. 16+30.
    - The timber boardwalk structure is a low-profile structure along the Riverwalk that allows for additional area of flood storage below. The structure is to be supported on helical piles with typical pier spacings of 8'-0". The timber boardwalk structure will also have several overlook areas as well. A timber railing will be utilized across the length of the structure.

- Boardwalk Overlook Structure from Sta. 19+10 to Sta. 21+50.
    - The Boardwalk Overlook Structure consists of timber decking and a timber railing supported on steel beams cantilevering over the sheet pile wall. The steel beams will be supported on helical piles at the end of the span and on a concrete cap over the sheet piling. The overlook structure cantilevering over the river will be curved in plan.

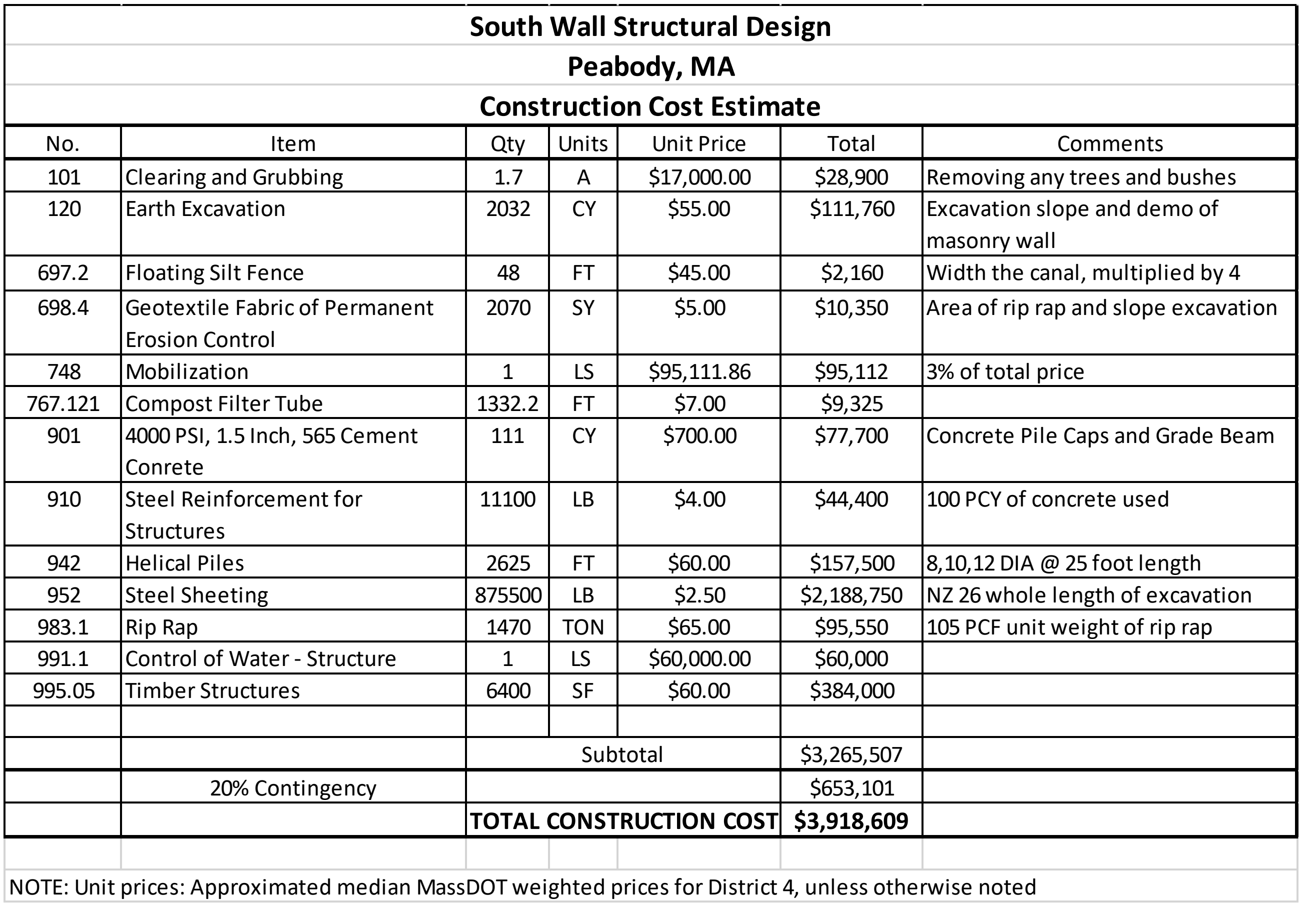
- Timber Pedestrian Bridge over Strongwater Brook.
    - The timber pedestrian bridge is a simple span bridge with timber stringers, decking, and railings supported on concrete caps and helical piles.

- Timber Overlook Structure at Sta. 23+75.
    - The timber overlook structure is a timber deck structure supported by timber framing on concrete pier footings with helical piers. A timber railing will be installed along the sides of the overlook adjacent to the river and the railroad tracks.

Coordination between the Structural Engineering and the Landscape Architects teams was continuous throughout Phase II of the project. Coordination included, but was not limited to, the proposed grading and alignment of the Riverwalk and the type and magnitude of the structures to be incorporated in the project.

In addition to advancing the design of the above structures to a 75% level, a coordination meeting with Peabody Municipal Light Plant (PMLP) was held to discuss installation of the sheet piling adjacent to the Caller Street Bridge and the possible impacts it would have on the electric service in the area. PMLP provided input as to when the service could potentially and temporarily be taken offline for installation of the sheet piling and how best to protect the utility lines during construction.

The following construction cost estimate was developed for the proposed 75% design of the south wall and is incorporated into the overall 75% Construction Cost Estimate provided in Section 10. ***A copy of the Final 75% Structural Design Plans and Specifications, as well as a copy of the calculations package, are included in Appendix D.***



South Wall Structural Design

Peabody, MA

Construction Cost Estimate

No.	Item	Qty	Units	Unit Price	Total	Comments
101	Clearing and Grubbing	1.7	A	$17,000.00	$28,900	Removing any trees and bushes
120	Earth Excavation	2032	CY	$55.00	$111,760	Excavation slope and demo of masonry wall
697.2	Floating Silt Fence	48	FT	$45.00	$2,160	Width the canal, multiplied by 4
698.4	Geotextile Fabric of Permanent Erosion Control	2070	SY	$5.00	$10,350	Area of rip rap and slope excavation
748	Mobilization	1	LS	$95,111.86	$95,112	3% of total price
767.121	Compost Filter Tube	1332.2	FT	$7.00	$9,325	
901	4000 PSI, 1.5 Inch, 565 Cement Conrete	111	CY	$700.00	$77,700	Concrete Pile Caps and Grade Beam
910	Steel Reinforcement for Structures	11100	LB	$4.00	$44,400	100 PCY of concrete used
942	Helical Piles	2625	FT	$60.00	$157,500	8,10,12 DIA @ 25 foot length
952	Steel Sheeting	875500	LB	$2.50	$2,188,750	NZ 26 whole length of excavation
983.1	Rip Rap	1470	TON	$65.00	$95,550	105 PCF unit weight of rip rap
991.1	Control of Water - Structure	1	LS	$60,000.00	$60,000	
995.05	Timber Structures	6400	SF	$60.00	$384,000	
		Subtotal			$3,265,507	
	20% Contingency				$653,101	
		TOTAL CONSTRUCTION COST			**$3,918,609**	

NOTE: Unit prices: Approximated median MassDOT weighted prices for District 4, unless otherwise noted

Please note that the cost estimate above includes only those soils associated with wall repair activities and assumes soils are removed, transported, and disposed of at a licensed, out-of-state non-hazardous disposal/recycling facility, and are not subject to federal/EPA land ban disposal restrictions.

4.0 RIVERWALK - 75% DESIGN

The City of Peabody's proposed Riverwalk will be a shared-use path along the south bank of the North River. Pedestrians and bicyclists will enjoy a continuous community open space corridor that will provide new transportation and recreational opportunities between Wallis and Howley Streets. Importantly, the Riverwalk will also optimize and maximize green infrastructure, resiliency, and flood storage, where feasible, as part of its integrated design.

The Riverwalk project includes a comprehensive community participation component. Coordination with various city entities and engagement with community stakeholders has been ongoing. Understanding the community's vision for this important open space has led to consideration of available space and includes addressing property ownership. The project will require permanent and temporary right-of-way easements, and/or property acquisitions, to ensure the vision can be brought to fruition, and has been an on-going effort by the City of Peabody.

Weston & Sampson prepared a Preliminary Design of the preferred Riverwalk design scheme as part of Phase I during the 2018 MVP Grant. Complementing improvements to the river's edge with the new wall and embankment treatment is the design of the 16-foot wide (minimum) Riverwalk Zone which begins at the top of the embankment slope. Within that Zone, an 8-foot minimum pathway will accommodate pedestrian and bicycle traffic. An additional 4-feet of vegetation on each side of the path will provide stormwater management. On either side of Caller Street (about 172 feet of 24 Caller St. and the entirety of 21 Caller St.) the Riverwalk Zone will have a reduced width because of existing constraints.

Various surface material treatments and details have been considered to ensure contextually appropriate design elements are as practical and durable as they are delightful. The Riverwalk will take advantage of its proximity along the North River to capture water-side views, share Peabody's history along North River, and inform the public about the river and corridor's new use as an important community space and community infrastructure resource. Vegetated pathway edges will enhance the user experience while serving a pragmatic stormwater and flood storage management use. All Riverwalk areas will be designed and constructed to accommodate flooding. Low maintenance groundcover and tree plantings will supplement the existing vegetation, provide shade, and reduce the heat island effect.

The design of the multi-use path includes various access/rest-stop/activity areas along the length of the linear park, which provides access to the City of Peabody's Central Business/Industrial District. The project involves the creation of an open space area at 24 Caller Street, with seating, tree shelter. Major pedestrian gateways at Howley and Wallis Streets will denote the entrance to the Riverwalk, and be designed with a sensitivity to the area's history, and enhance economic development in the business district.

At the onset of the Phase II 75% design process, and throughout the design development work, Weston & Sampson frequently toured the Site to assess the existing conditions, design constraints, safety, and maintenance issues, and identify opportunities for the Riverwalk and adjacent open space at 24 Caller Street. Over the course of the past year, representatives from the City of Peabody and Weston & Sampson developed iterative conceptual and preferred design plans for the parcels connecting Wallis Street with Howley Street that reflect the needs of a diverse community. These iterative design plans and improvements were generated in response to the needs of the city, as expressed by various stakeholders and community representatives in focus group meetings and through two public meetings.

In addition to designing a multi-use, riverwalk path and the open space / park at 24 Caller Street, there was a concerted focus to identify other important initiatives that promote environmental stewardship and resiliency related to North River. To achieve this, the landscape architecture team worked closely with other environmental-related disciplines within Weston & Sampson to generate a dynamic and responsive riverwalk and park design.

A copy of the Riverwalk 75% Design and Specifications are provided in Appendix E. The overall 75% Construction Cost Estimate for the project, including the repair of the south wall, construction of the Riverwalk and park at 24 Caller Street and LSP Services, is provided in Section 10.

5.0 ENVIRONMENTAL PERMITTING

Weston & Sampson developed environmental permit applications and submittals necessary for the approval of the Peabody Resilient North River Canal Corridor project, using the 75% design sets for the proposed canal wall improvements and Riverwalk.

Prior to the commencement of permitting activities, representatives from the City of Peabody and Weston & Sampson met with MassDEP and the city's Conservation Commission and Engineering Department on February 25, 2021, regarding the proposed stormwater management strategy at the Site and to better understand what additional information may be needed as part of the permitting and approval process for the proposed project.

The regulating community agreed that traditional infiltration through recharge would not work well at the Site given the contamination and shallow groundwater constraints in the area. Rachel Freed, Deputy Regional Director – Bureau of Water Resources (NERO), requested Weston & Sampson include a detailed discussion regarding the "maximum extent practical approach" when filing permits with MassDEP. Ms. Freed also recommended Weston & Sampson address upland sheet flow and flood flow erosive concerns and how the vegetative slope stability will be managed.

5.1.1 Threshold Channel Design Study

Weston & Sampson conducted a threshold channel design study to evaluate the need for a protective surface treatment for the ground upslope (i.e., vegetative slope) of the proposed new south canal wall. The study area was limited to the south side of the canal along the approximately 1,350-foot-long reach between the railroad crossing adjacent to 15 Wallis Street and the railroad crossing just west of Howley Street. The proposed south canal wall improvements include the installation of permanent interlocking steel sheet piles assembled into a linear wall. The sheet pile wall is expected to have exposed heights ranging from approximately 1.1 feet to 6.5 feet above the canal bottom. The new wall will reduce peak flood elevations, provide a non- erodible flow boundary along a portion of the canal cross-section, and retain the ground upslope above the wall.

The canal alignment within the study area is generally straight (flowing from west to east) except for a sharp northerly bend at the railroad crossing. The downstream end of the new wall will terminate in a concrete abutment to be located just south of the railroad crossing. Design development plans for the proposed project currently indicate that the overall planform of the canal will not change considerably. Changes to the cross-sectional geometry of the canal will include modest widening attributed to replacement of the existing south wall with thinner sheet piles and re-grading of the upslope above the new wall.

A modified cross-section of the canal was developed for the study to simplify the variable geometry of the existing and proposed cross-section. Since floodwaters are expected to overtop the canal wall and overbank areas during several of the design storm events, use of infinitely long side slopes is considered a conservative approach. It is noted that the design flow condition for a threshold channel boundary is not necessarily the "worst case" flood. Instead, the design condition is considered to be the combination of concurrent hydrologic/hydraulic factors that produces the largest shear stress along the flow boundary.

Based upon the findings of the Threshold Channel Study, it is recommended that the ground upslope (i.e., vegetative slope) of the proposed sheet pile wall be protected by Turf Reinforced Mat (TRM) that is fully vegetated with a native grass mixture. TRM provides permanent support for vegetation on slopes and permanent armoring for vegetated channels. TRM also provides protection against wind and raindrop erosion during the weeks between seeding and vegetation emergence. Effectiveness of TRM is dependent upon TRM type, surface preparation, installation practices, and site conditions. ***A copy of the Threshold Channel Study Memo is included in Appendix F – Environmental Permitting Materials***

5.1.2 Wetland Delineation

Weston and Sampson conducted a wetland delineation on April 1, 2021, to accurately identify protected environmental resources within the project area. The wetland resources identified in the field were geo-located using a high-accuracy GPS unit. The resource area limit locations were downloaded and converted to CAD where they were added to the plan set. ***A wetland delineation report was prepared as required for permitting submissions and is included in Appendix F – Environmental Permitting Materials.***

5.1.3 Environmental Permits

Applicable environmental permits were developed based on the 75% plan sets for the South Wall and Riverwalk developed during the FY21 grant period. Applicable environmental permits for this project include the following:

- MassDEP Notice of Intent (NOI)
- MEPA Environmental Notification Form (ENF)
- US Army Corps of Engineers (ACOE) Pre-Construction Notification (PCN)

As part of the NOI submission, a full stormwater design was developed for the site that meets the Massachusetts stormwater standards. During Phase I of the project, it was anticipated that other environmental permits would likely be required (i.e., MassDEP 401 Water Quality Certificate and MassDEP Chapter 91 waterways license), however final 75% design resulted in this project no longer requiring those permits.

Draft permit submissions were developed and provided to the City of Peabody for review. Comments from the city were addressed and permits updated. The final ENF permit was submitted to MEPA in June 2021. The City of Peabody is retaining Weston & Sampson to update and submit the remaining permits (ACOE and NOI) based on comments received from MEPA on the ENF submittal.

Copies of the final permitting applications are provided in Appendix F.

5.1.4 Summary and Future Considerations

The permit with the longest regulatory review time is the ACOE PCN, which is estimated to take up to approximately 6 months. However, based upon Weston & Sampson's recent experience, this timeline may be extended due to the recent COVID pandemic. Therefore, it is anticipated that the city will likely receive all permitting approvals by approximately the end of 2021.

The following is a summary of how long each permit approval is valid for. Request for extensions may be appropriate based upon the construction schedule of the project:

- NOI – An Order of Conditions (NOI approval) is valid for 3 years from date of approval. Requests for extensions may be granted for up to 3 years. The request for extension would need to occur at least one (1) month before the permit expires.

- ENF – The project needs to start construction within 5 years of the MEPA Certificate (approval) being issued.

- ACOE PCN – The ACOE General Conditions (GC) are updated every 5 years. The current GC expires on April 5, 2023. Therefore, the project would need to be completed by April 5, 2024, if no extension is requested. The reason for the 2024 completion date is because of the duration of authorization of the GCs. As noted in GC 44 – Duration of Authorization, if work is not completed by April 5, 2024, the city would need to obtain an extension and additional approval from the ACOE, presumably under the new GCs. This is not anticipated to be an issue, and is more of a formality, as this is typical for the ACOE since they update their GCs every 5 years.

6.0 MCP AND SOIL MANAGEMENT STRATEGY

6.1.1 Introduction

There is known or suspected soil contamination located in subsurface soil along the proposed area of the Riverwalk and canal wall that will need to be addressed during construction. Historically, the area south of the North River Canal was developed to support the leather industry beginning in the 1700s. Previous uses of the six parcels located along the proposed Riverwalk included tanneries, chemical companies, machine shops, a foundry, and various tannery support operations, most of which had ceased operations by the middle of the 20th century. Additionally, the area between Howley Street and Caller Street was also the location of a large fire in the early 1980s that destroyed what remained of the former tannery complexes.

Five of the six parcels are identified Disposal Sites as defined by the Massachusetts Contingency Plan (MCP); 310 CMR 40.0000. As the city is evaluating property acquisition or easements on private property as part of the repair/replacement options for the southern canal wall and construction of the Riverwalk, is important for the city to develop a compliance strategy for the redevelopment of the properties in accordance with the MCP.

The primary contaminants of concern in the area are related to fill material that includes industrial by-products (coal, coal and wood ash, tannery scraps and building materials). Fill materials appear to be present throughout the project area to an expected depth of 8-10 feet. The contaminants of concern are primarily arsenic, chromium, lead, and polycyclic aromatic hydrocarbons (PAHs) / semi-volatile organic compounds (SVOCs). Some sites also have a history of PCBs and petroleum-related impacts. A summary of soil conditions and MCP status at each parcel is presented below.

6.1.2 Previous Investigations and Release History

<u>13 Wallis Street</u>
The property located at 13 Wallis Street is not listed as Disposal Site by MassDEP; however, it has a long, industrial history primarily in tannery operations. Currently, a US Post Office occupies the northwestern corner of the property, and the remainder of the property is used to store miscellaneous construction equipment.

Subsurface investigations conducted in 2009 (by others) and 2017 (by Weston & Sampson) indicated the presence of fill material containing arsenic, chromium, lead, and PAHs at concentrations in equal to or exceeding the MassDEP Reportable Concentrations (RCs) for S-1 soil (RCS-1) at depths of 0-5 feet below ground surface (bgs). Several additional metals and PCBs were detected at concentrations below the applicable MassDEP RCS-1 thresholds in shallow soil and PAHs were also detected below the RCS-1 thresholds in deeper soil (5-10 feet below ground surface).

To date, the concentrations of arsenic, chromium, lead, and PAHs detected at/above the RCS-1 thresholds have not been reported to the MassDEP by the property owner. If the city acquires the property, then notification will be required by the city.

<u>24 Caller Street</u>
The property located at 24 Caller Street has a documented history of environmental releases and is regulated under the MCP under Release Tracking Number (RTN) 3-18180. In 2000, the RTN was closed under the MCP with a Class A-3 Release Action Outcome (RAO) supported by an Activity and Use

Limitation (AUL). The AUL restricted activity in an approximately 15,000 square foot area in the northwestern portion of the property. Uses which were likely to include the presence of a child (residential, daycare, park, etc.) were prohibited by the AUL.

The AUL was invalidated when the property was transferred from the former owner (Clark Barrel) to the city in June 2019. On November 6, 2019, MassDEP issued a Notice of Audit Findings (NOAF) for an AUL Audit Inspection to the city for an audit conducted in September 2019. The NOAF identified a violation, specifically that when the property was transferred, the AUL was not incorporated in full or by reference into the June 2019 deed, and a copy of the deed was not submitted to MassDEP. The corrective action identified by MassDEP was to terminate the existing AUL and submit a new AUL by the Interim Deadline of March 30, 2020.

Weston & Sampson, on behalf of the City of Peabody, responded to MassDEP in the form of a letter requesting an extension of the Interim Deadline. Weston & Sampson described the on-going assessment activities being performed by the city and the proposed plans for redevelopment, and requested either a 6-month or 18-month extension of the Interim Deadline. After a telephone call with Mr. Peter Richards of MassDEP, it was agreed upon that the city would receive an extension of 18 months for the Interim Deadline to resubmit the AUL for the site. It is anticipated that the City of Peabody will request another extension from MassDEP prior to the September 2021 deadline, to accommodate the on-going work associated with the project.

Contaminants of concern at the 24 Caller Street site included metals (lead, chromium, cadmium, and arsenic), PAHs and VOCs, and to a lesser extent polychlorinated biphenyl (PCBs). In addition, the file for RTN 3-18180 indicated that a historical 'landfill' was identified in the northeast portion of parcel. The nature of the landfilled materials is unknown.

Based on the history of the site and the continued use as a drum reclamation facility, Weston & Sampson conducted several subsurface investigation events at 24 Caller Street from 2017 to 2020. The results of the subsurface investigations were summarized in a Letter Report in 2017 and Phase II Environmental Site Assessment (ESA) Report in July 2020.

The results of Weston & Sampson's 2017-2020 soil and groundwater investigations indicated that concentrations of metals, PCBs, petroleum constituents, and semi-volatile organic compounds (SVOCs) are present in soil above the applicable Method 1 S-1 Cleanup Standards. Lead and PCBs in soil are the primary contaminants of concern, and the highest concentrations are generally limited to the western portion of the Site (rear of the building).

Additionally, Weston & Sampson identified an area of light non-aqueous phase liquid (LNAPL) beneath the former building foundation. Additional sampling to further define the extent of the LNAPL impacts and additional targeted soil sampling to support reuse planning activities is being conducted under the City of Peabody's EPA funded Community Wide Brownfields Assessment Grant. Field work is expected to occur in the Summer of 2021.

21 Caller Street

The 21 Caller Street property has a documented history of releases to the environment and is regulated by MassDEP under RTN 3-0577. A Permanent Solution Statement (PSS) with Conditions was submitted for 21 Caller Street in May of 2014. The PSS relies on an AUL that restricts activities that involve the excavation, removal and/or disturbance of soils greater than 3 feet below the ground surface unless under the oversight of a Licensed Site Professional (LSP), and prohibits the use of the property to grow agricultural produce. The AUL is applicable to the entire parcel.

A review of historical MCP reports (by others) and an investigation conducted by Weston & Sampson in 2017, indicated contaminants of concern within the Project alignment on 21 Caller Street include arsenic and lead in soil exceeding the applicable Method 1 S-1 Cleanup Standards.

18 Howley Street

The property located at 18 Howley Street has a documented history of environmental releases and is also regulated by MassDEP under RTN 3-0577. A Class B-2 RAO and AUL (i.e., a PSS with Conditions) was submitted for 18 Howley Street in 2013.

The AUL prohibits the use of the property as a residence, school, daycare, nursery recreational area (e.g., park or athletic field) and/or any other use in which a child's presence is likely. The AUL also restricts long-term (greater than 1 month) activities at the property that are likely to result in the excavation, relocation and/or removal of soils, unless such activity is first evaluated by an LSP. The AUL is applicable to the entire parcel.

A review of historical MCP reports (by others) and an investigation conducted by Weston & Sampson in 2017 indicate the primary contaminants of concern are antimony, arsenic, barium, trivalent chromium, lead, and PAHs in soil exceeding the applicable Method 1 Cleanup Standards.

166R Main Street

The property located at 166R Main Street has a documented history of environmental releases and is regulated by MassDEP under RTNs 3-14440 and 3-4322.

RTN 3-4322 was closed under the MCP in 1997 with a Class A-2 RAO. A Class A-2 RAO is a Permanent Solution for which contamination has not been reduced to background concentrations, but does not rely on an AUL.

RTN 3-14440 was closed under the MCP in 2007 with a Class A-3 RAO and AUL [i.e., a Permanent Solution Statement with Conditions]. The AUL restricts the use of the property for single family residential use or for growing of produce for human consumption. The AUL also restricts activity at the property that is likely to cause physical or chemical deterioration, breakage, or damage to the pavement or building foundations, unless such activity is first evaluated by an LSP. The AUL is applicable to the entire parcel.

The primary contaminants of concern at the 166R Main Street property are metals (i.e., arsenic, chromium, and lead), PAHs, and petroleum compounds. Historical fill has also been observed in the top 8 to 10 feet of soil. To date, Weston & Sampson has not been able to access 166R Main Street to collect soil samples within the Project alignment.

20 Howley Street

The property located at 20 Howley Street has a documented history of environmental releases and is regulated by MassDEP under RTN 3-17492. The property was closed under a Class B-2 RAO, which relied on an AUL to restrict future use and development. The AUL is applicable to approximately 31,800 square feet in the northern portion of the 38,385-square foot total parcel area, which includes the Project Area.

Under the AUL, engineering controls such as bituminous pavement and building foundations must remain in good condition to prevent exposures to underlying impacted soils. Semi-annual inspections are required to confirm and document the condition of the engineering controls.

Based on a review of historical MCP reports and data collected by Weston & Sampson in 2017, the primary contaminants of concern at 20 Howley Street are arsenic, chromium, lead, PAHs, and petroleum impacts in soil exceeding the applicable Method 1 Cleanup Standard.

6.1.3 MCP and Soil Management Strategy

As part of the internal coordination required between Weston & Sampson's environmental, permitting, and design teams, the following tasks were completed as part of the FY20/21 MVP Action Grant:

- Coordinated with landscape architects to make sure design features are appropriately located based on existing soil and groundwater data.
- Coordinated with permitting and design team to evaluate the appropriate stormwater management strategy.
    - Summarized environmental impacts in a letter to MassDEP staff and met with MassDEP and city staff to discuss stormwater management strategy and environmental impacts.
- Calculated estimated surplus soil volumes based on the 75% design documents.
    - Organized estimated surplus soil volumes by parcel and soil disposal category (based on current dataset).
    - Calculated estimated soil management (transportation and disposal) costs based on 75% design documents.
- Reviewed and updated MCP regulatory compliance and soil management costs based on updated dataset and 75% design documents.

The regulatory compliance and soil management strategy for each individual property is detailed in the MCP Strategy and Considerations Memo provided in Appendix G.

6.1.4 Hazardous Materials Assessment – 166R Main Street

Weston & Sampson also conduct a hazardous materials assessment of foundations scheduled for demolition and removal within the Project limit on the166R Main Street parcel in September 2020. A total of five test pits were dug adjacent to each individual foundation to assess for damp proofing potentially applied to foundation walls. Five, approximately three (3) inch concrete cores were drilled through each individual slab to examine the underside for a vapor barrier.

A total of seven (7) samples of suspect asbestos-containing materials were collected. Weston & Sampson performed the bulk sampling in the subject area according to methods outlined in the U.S. Environmental Protection Agency (EPA) guidance document titled, "Guidance for Controlling Asbestos-Containing Materials in Buildings" (Document No. 560/5-85/024). Samples were analyzed by EMSL Analytical, Inc. in Woburn, Massachusetts. No asbestos-containing materials (ACMs) were detected.

In addition, no suspect PCB-impacted materials, or lead based paint / coatings, were observed in the subject area during assessment activities. ***A copy of the Hazardous Building Materials Investigation for 166R Main Street is provided in Appendix H.***

6.1.5 Summary and Future Considerations

In summary, the properties that will be impacted as part the proposed Project are known or suspected to be contaminated. Construction activities will require management of soils in accordance with the MCP and under Release Abatement Measure (RAM) Plans. Excess soils will likely be required to be disposed of at a licensed non-hazardous disposal facility, which may include an In-State Landfill or an out-of-state disposal facility.

Additional MCP regulatory compliance requirements will also include: RAM Status Reports; additional sampling to support new risk characterization for Riverwalk area; Method 3 Risk Assessments for Riverwalk Area; Revised Permanent Solution Statements (PSSs) and Activity and Use Limitations (AULs) for Riverwalk Area (and associated land surveys); RAM Completion Reports; Soil Management & Bills of Lading (BOLs); and Construction Administration, Coordination, and Oversight.

Weston & Sampson recommends that if any suspect ACM are uncovered during demolition or renovation activities that were not identified during the survey, that the materials be sampled and analyzed for asbestos content prior to disturbance.

7.0 COMMUNITY ENGAGEMENT

Weston & Sampson assisted the City of Peabody in engaging the public throughout the MVP Action Grant process to ensure that the viewpoint and interests of residents, adjacent property owners, local businesses, etc. are understood and considered during the project. The city hosted two (2) interactive sessions at which the community was offered the opportunity to provide feedback on the draft and final designs so that the park's features satisfy everyone's needs. The project has generated considerable attention in the community.

The first community engagement event was held virtually on January 12, 2021. Weston & Sampson assisted the city by providing an overview of Phase I of the project (25% design of the Riverwalk), progress updates, programming options for 24 Caller Street and how the community's input from Phase I was addressed and incorporated into the 50% design. 72 people registered to attend the January 2021 meeting and approximately 38 people actively participated by providing great feedback through interactive polls and the Question & Answer (Q&A) session, which helped inform final 75% designs of the Riverwalk.

The second community engagement event, held virtually on May 20, 2021, followed a similar agenda, and provided the city and Weston & Sampson an opportunity to report out on the status of the project, an update on the site plans and the design of the park at 24 Caller Street, and provided the community an opportunity to provide feedback on the 75% design.

19 people registered to attend the meeting and approximately 11 people actively participated by providing feedback through interactive polls and the Q&A session, which will be used to inform final 100% designs of the Riverwalk so that the park's features consider the viewpoints and interests of the community.

A summary of results from the on-line polling conducted throughout the virtual meetings and a copy of the presentations are provided in Appendix I - Community Engagement Materials & Feedback. Information about the project and video recordings of the webinars are also available on the City of Peabody's website.

The project was generally very well received by the public. Weston & Sampson anticipates that the city will continue to host interactive sessions with the community at the project progresses.

8.0 UPDATED RESILIENCE EVALUATION

8.1 Introduction

To address the city’s priority action of addressing flooding along the North River Canal and to enable the city to address climate change and continue its efforts to increase resilience against flooding in the watershed, Weston & Sampson conducted a resilience evaluation of the floodplain along the proposed 1,600-foot-long park adjacent to the canal during Phase I of the Peabody North River Canal Resilient Wall, Riverwalk, and Park Project The evaluation assessed the suitability and potential benefit of incorporating additional flood storage capacity in both the rehabilitation alternatives for the southern canal wall as well as on nearby public and private properties. This evaluation considered both existing and future potential climate conditions. However, the preliminary evaluation focused solely on flooding patterns within the study area from Wallis Street to Howley Street in the city and did not include a detailed hydrologic analysis of the drainage area (both upstream and downstream), as well as hydraulic analysis of potential changes to the geometry of the North River Canal.

The current phase of this Project, Phase II, included a detailed hydrologic and hydraulic (H&H) study, which included:

- Updating the City’s existing H&H model, which was last significantly updated in 2008 or 2009.
- Re-calibrating the model to ensure its continued accuracy and usefulness in the study area.
- Simulating site-specific flooding from design storm events under both baseline and future climate scenarios.
- Employing the updated and calibrated H&H model to support design of the preferred wall alternative.
- Evaluating the potential benefits of creating additional flood storage on three (3) parcels adjacent to the North River Canal using the updated model.

8.2 Phase II Resilience Evaluation

The city’s existing H&H model was updated in several ways during the current phase (Phase II) of the project, including: a review of recent stormwater detention/retention projects in the North River watershed; a windshield survey and spot-check of the size of key culverts and pond outlets; a more detailed representation of the Canal and its floodplain based on a May 2020 survey that included both topographic and bathymetric elements; and the inclusion of updated design rainfall events based on the best available design rainfall and tidal data for both baseline and 2070 climate conditions. After these updates were incorporated, the model was recalibrated against historical observations to ensure its continued accuracy and usefulness in evaluating changes to the North River Canal.

Specifically, Weston & Sampson calibrated the updated model based on rainfall and flooding observations from the March 2010 flood event, which caused significant flooding in the Peabody Square area. As the original H&H model reflected hydrology of the North River watershed and hydraulics of the Canal as they were in 2008, the selection of a more recent historical flood event allowed Weston & Sampson to independently calibrate the model after making significant updates. In addition, Weston & Sampson had been previously hired by the city to survey flood levels during the 2010 event, which provided an unusually detailed dataset against which to compare simulated flood levels.

The updated model was then used to evaluate the potential reductions in peak flood elevations considering the proposed 25% Design of the preferred wall alternative. Model results suggest that the proposed wall design may result in:

- Reduced peak flood elevations by 0.4 to 1.2 feet in the area between Wallis Street and just downstream of Caller Street during the 10- to 100-year events under a baseline climate. However, benefits were not expected to extend as far downstream as Howley Street, as the hydraulics in that area are controlled by the tidal influence of Salem Harbor.

- Modest reduction in peak flood elevations, generally ranging from 0.3 to 0.8 feet, between Wallis Street and Caller Street by 2070.

- The proposed wall design is not expected to result in significant flood elevation changes either upstream in Peabody Square or downstream in Salem.

In addition, the updated model was also used to evaluate the potential benefits of creating additional flood storage on three specific parcels near the study area. Based on the model results discussed in more detail in **Appendix J – Resilience Evaluation**, creating additional flood storage at 13 Wallis Street and 24 Caller Street may provide modest reductions in peak flood elevations under a wide range of design storms and under both baseline and 2070 climate scenarios, generally ranging from 0.1 to 0.5 feet. However, benefits would likely be localized to the reach of the North River Canal from Wallis Street to Caller Street. No significant change is expected upstream near Peabody Square or downstream in Salem.

As Phase II of the project progressed, Weston & Sampson also developed an alternative model geometry to represent the Final 75% Design of the preferred wall alternative, which included modest additional flood storage on the 24 Caller Street parcel. The model was used to evaluate changes in flooding within the 1,600-foot-long project site area as well as upstream near Peabody Square and downstream in Salem. The impacts of the 75% wall design on peak flood elevations at key locations along the project site, upstream near Peabody Square and downstream in Salem under baseline climate and 2070 climate scenarios are presented in Tables 6A and 6B, respectively, in Appendix J.

The 75% wall design will increase the hydraulic capacity of the North River Canal from Wallis Street to Caller Street and from Caller Street to the railroad crossing just upstream of Howley Street. As shown in Tables 6A and 6B in Appendix J, these improvements result in modest reductions of peak flood elevations from Wallis Street down to just downstream of Caller Street. The reduction ranges from 0.1 to 0.7 feet under a baseline climate, depending on the precise location and the design event, with smaller storms, such as the 10- and 25-year events experiencing slightly greater benefits. Flood reductions are limited to 0.1 feet under the 10- and 25-year events for areas downstream of the railroad crossing and upstream of Grove Street. Flood reductions do not reach as far downstream as Flint Street as that area is primarily controlled by tidal influences extending upstream from Salem Harbor.

A similar pattern emerges under the 2070 climate scenario with reductions in peak flood elevations generally ranging from 0.1 to 0.5 feet in the area between Wallis and Caller Streets during each of the events. In both baseline and 2070 climate scenarios, model results indicate that the benefits of the wall design do not extend up into Peabody Square, nor are conditions worsened downstream on the North River in Salem. The benefits of widening the North River Canal are likely localized due to the hydraulic restrictions of bridges and stormwater conduits upstream and downstream of the site. Figures 5 and 6 in Appendix J depict the anticipated benefits of the 75% design in terms of flooding extents for both baseline and 2070 climate scenarios, respectively.

A copy of the Phase II Resilience Evaluation Report is provided in Appendix J.

8.3 Summary and Future Considerations

Based on our resilience evaluation, Weston & Sampson identified the following:

- Under existing climate conditions and under expected mid-century (2050) conditions, flooding in the North River Canal will largely be a function of runoff generated upstream (i.e., riverine flooding). However, by the end of the 21st century, tidal flooding due to sea level rise is expected to equal or exceed riverine flooding in the project area. The creation of additional flood storage provides a modest benefit to the properties and infrastructure in the study area in the existing- and mid-century timeframe, but those benefits are significantly reduced over the long term by the end of the century (2100).

- The creation of additional flood storage in and/or near the North River Canal is only effective in areas of riverine flooding. Projects that create compensatory storage and projects that floodproof flood prone properties will have a greater and longer lasting benefit the further upstream they are.

- The final 75% design of the proposed project includes modest additional flood storage on the 24 Caller Street parcel and provides potential peak flood elevation reductions between 0.1 and 0.7 feet in the area between Wallis Street and just downstream of Caller Street during the 10- to 100-year events under a baseline climate. By 2070, the peak flood elevations are expected to be reduced by 0.1 to 0.3 feet during the 10- to 100-year events; however, limited flood reduction is expected downstream of Caller Street.

In addition, the city may want to consider the following to further address climate change and continue its efforts to increase resilience against flooding in the watershed:

- An assessment of potential parcel-specific compensatory storage and flood control design options.

- A cost-benefit analysis of floodproofing individual buildings rather than eliminating flooding on a parcel scale.

- A more detailed evaluation of “retreat” alternatives and the potential benefit of a tide gate to limit tidal flooding under future climate conditions. While the potential benefits of a tide gate were not specifically considered as part of this project, a tide gate could be used to reduce flooding and improve resiliency in the North River area, but would likely need to be constructed at or near the North Street (Rte. 114) crossing in Salem, beyond Peabody’s municipal boundary.

- Complete a resiliency zoning and regulatory review for climate resilience opportunities. For example, assess the feasibility and develop language for a Flood Overlay District for the downtown area.

9.0 PROJECT MANAGEMENT OF THE GRANT

Weston & Sampson assisted the city in completing grant programmatic requirements, including monthly progress reports and the generation of this final project report for submittal to the MassEEA. In addition, Weston & Sampson participated in monthly check-in meetings, and other correspondence, with the city to discuss project progress and findings. Weston & Sampson also performed project management activities including work plan implementation; correspondence and coordination with appropriate site contacts and subcontractors, the laboratory, and the city; project staffing oversight; schedule, budget tracking, and control; invoice preparation and submittal; and other general programmatic and project management activities.

Copies of the monthly progress reports are provided in Appendix K - Project Management - Monthly Progress Reports.

10.0 ESTIMATED CONSTRUCTION COSTS AND SCHEDULE

Weston & Sampson developed the following construction cost estimate and anticipated schedule for the proposed 75% design of the Resilient North River Canal Corridor project, including the replacement of the south wall and construction of the riverwalk and park. Unit prices for the construction of the south wall were approximated using median Massachusetts Department of Transportation (MassDOT) weighted prices from District 4, unless otherwise noted.

City of Peabody, Massachusetts
Riverwalk MVP
75% Design Construction Cost Estimate - June 2021

		Unit	Unit Price	Cost	Notes
SITE PREPARATION/ DEMOLITION					
Temporary Construction Fence 6'-HT	2,000	LF	$ 8	$ 16,000	
Mobilization	1	LS	$ 201,275	$ 201,275	3% of Project Subtotal
Construction Entrance	4	EA	$ 3,000	$ 12,000	
Excavation & Demo of Masonry Wall	2,035	CY	$ 55	$ 111,925	
Floating Silt Fence	50	FT	$ 45	$ 2,250	Width the canal, multiplied by 4
Compost Filter Tube	1,350	LF	$ 7	$ 9,450	
Geotextile Fabric of Permanent Erosion Control	2,070	SY	$ 5	$ 10,350	Area of rip rap and slope excavation
Tree Protection	1	LS	$ 20,000	$ 20,000	
Tree Stump Grinding (24")	30	EA	$ 500	$ 15,000	
Tree Pruning, Clearing and Grubbing	1	LS	$ 40,000	$ 40,000	
R&D Paving (Asphalt and Concrete)	950	SY	$ 10	$ 9,500	
R&D Existing Fence	125	LF	$ 12	$ 1,500	
Modify Catch Basin	1	EA	$ 1,000	$ 1,000	
Strip & Dispose Topsoil	410	CY	$ 8	$ 3,280	
Demolition of Existing Footbridge	1	LS	$ 5,000	$ 5,000	
Demolition and Disposal of Existing Building Foundation at 166R Main St	1	LS	$ 45,000	$ 45,000	Assume proposed easement area only
R&R Monitoring Well	1	EA	$ 1,250	$ 1,250	
Misc. Demolition	1	LS	$ 20,000	$ 20,000	
			Subtotal	**$ 524,780**	
DRAINAGE					
Relocated Catch Basin	1	EA	$ 6,500	$ 6,500	
Drop Inlet	1	EA	$ 2,500	$ 2,500	
			Subtotal	**9,000**	
AMENITIES					
Street Life Bench - Solid Skirt Top Seating	12	LF	$ 700	$ 8,400	
Bench - At Path (excluding 24 Caller St)	2	EA	$ 4,000	$ 8,000	May vary. To be determined based upon final bench type selected by City.
Bollard	2	EA	$ 1,500	$ 3,000	
Trash and Recycling	4	EA	$ 1,200	$ 4,800	
Roadway Striping	1	LS	$ 1,500	$ 1,500	
Park Granite Block Signage	1	LS	$ 8,000	$ 8,000	
Riverwalk Entry Arch	1	LS	$15,000	$ 15,000	
Signage	4	EA	$ 1,400	$ 5,600	
			Subtotal	**$ 54,300**	
PLANTING					
Tree Planting (3.5" cal.)	48	EA	$ 1,500	$ 72,000	
Shrub Planting	525	EA	$ 65	$ 34,125	
Perennial and Groundcover Planting	3250	EA	$ 25	$ 81,250	
Loam and Seed - Conservation Mix (DEP Req.)	750	SY	$ 8.00	$ 6,000	3780 SF
Loam and Seed	2,044	SY	$ 6.00	$ 12,267	18400 SF
			Subtotal	**$ 205,642**	
ELECTRICAL					
Electrical Service	1	LS	$ 30,000	$ 30,000	
Electrical Conduit + Wiring	1,850	LF	$ 11	$ 20,350	
Empty conduit and utility bollard	2	EA	$ 2,500	$ 5,000	
Pedestrian Lights	15	EA	$ 6,000	$ 90,000	
Street Lights	4	EA	$ 8,000	$ 32,000	
Rapid Flashing Beacon	5	EA	$ 8,500	$ 42,500	
Art Feature Lighting	8	EA	$ 8,500	$ 68,000	
New Electrical Service	1	LS	$ 2,000	$ 2,000	
Handhole	32	EA	$ 2,300	$ 73,600	
			Subtotal	**$ 363,450**	

SITE IMPROVEMENTS					
4000 PSI, 1.5 Inch, 565 Cement Conrete	111	CY	$ 700	$ 77,700	Concrete Pile Caps and Grade Beam
Steel Reinforcement for Structures	11,100	LB	$ 4	$ 44,400	100 PCY of concrete used
Helical Piles	2,625	FT	$ 60	$ 157,500	8,10,12 DIA @ 25 foot length
Steel Sheeting	875,500	LB	$ 3	$ 2,188,750	NZ 26 whole length of excavation
Rip Rap	1,470	TON	$ 65	$ 95,550	105 PCF unit weight of rip rap
Control of Water - Structure	1	LS	$ 60,000	$ 60,000	
Timber Structures	6,400	SF	$ 60	$ 384,000	
Bituminous Concrete - Pedestrian (3" depth)	170	TON	$ 150	$ 25,452	
Gravel Borrow at Bit Conc. Pavement (8" depth)	225	CY	$ 35	$ 7,859	
Cast-In-Place Concrete Pavement (4" depth)	128	SY	$ 65	$ 8,349	
Gravel Borrow at Conc. Pavement (8" depth)	29	CY	$ 35	$ 1,000	
Bituminous Pavement	65	TON	$ 120	$ 7,844	Driveway to Private Property
Gravel Base, 12" d for Bit. Vehicular	130	CY	$ 35	$ 4,540	Driveway to Private Property
24 Caller Street Design					
Bituminous Concrete - Pedestrian (3" depth)	48	TON	$ 150	$ 7,200	
Gravel Borrow at Bit Conc. Pavement (8" depth)	61	CY	$ 35	$ 2,124	
Precast Concrete Unit Pavers	300	SF	$ 50	$ 15,000	
Gravel Borrow at Conc. Pavement (8" depth)	60	CY	$ 35	$ 2,100	
Etched Granite Stage Area	20	SY	$ 150	$ 2,933	
Gravel Borrow at Stage Area (8" depth)	2	CY	$ 35	$ 76	
Stabilized Stonedust @4"	60	SY	$ 20	$ 1,209	
stabilized Stonedust @4"	108	LF	$ 15	$ 1,620	
Reclaimed Canal Stone Retaining Wall	1	LS	$ 8,500	$ 8,500	
Mow Curb	10	LF	$ 25	$ 250	
CIP Concrete Seat Walls	23	CY	$ 700	$ 15,867	68 LF
Granite Blocks	60	TON	$ 400	$ 24,000	Assume 3'x3'x3' (27 blocks)
Greenscreen	380	SF	$ 20	$ 7,600	
Bike Racks	10	EA	$ 900	$ 9,000	
Composite Wood Decking	900	SF	$ 75	$ 67,500	
Wood Guard Rail	215	LF	$ 50	$ 10,750	
Granite Curb	115	LF	$ 30	$ 3,450	
Handrail	1,250	LF	$ 115	$ 143,750	
CIP Concrete Retaining Wall	92	CY	$ 700	$ 64,167	275 LF
4' HT BVCL FENCE	275	LF	$ 75	$ 20,625	
			Subtotal	**3,470,664**	
SOIL DISPOSAL					
In-State Comm-97 (Non-Hazardous) Landfill	3,358	TON	$ 60	$ 201,480	
Out-of-State (Non-Hazardous) Landfill	3,646	TON	$ 120	$ 437,520	Assumes Turnkey or similar
Additional Remediation Activities at 24 Caller Street[1]	1	LS	$ 990,000	$ 990,000	Estimate based upon Draft ABCA - Costs will need to be revised following supplemental assessment activities
			Subtotal	**$ 1,629,000**	
LSP SERVICES					
RAM Plan & HASP (1 per parcel)	6	EA	$ 10,000	$ 60,000	
RAM Status Report (2 per parcel)	12	EA	$ 5,000	$ 60,000	
RAM-Completion Report (1 per parcel)	6	EA	$ 10,000	$ 60,000	
LSP / Soil Management Packages (2 per parcel)	12	EA	$ 3,000	$ 36,000	Assume 2 per parcel
Method 3 Risk Characterization and MCP Closure / PSS (1 per parcel)	6	EA	$ 35,000	$ 210,000	Will vary from site to site and depend on ownership/easment and impacts left in-place.
AUL Docs (1 per parcel)	6	EA	$ 30,000	$ 180,000	LSP opinion and others may need a new AUL and/or Survey.
			Subtotal	**$ 606,000**	
<u>Total Cost for Site Improvements</u>					
SUBTOTAL				***$ 6,862,836***	
Construction Administration, Coordination & Oversight[2]				***$ 892,169***	*(Total estimated construction is 18-24 months - assumes 13% of total)*
15% Markup (excludes LSP services)				$ 938,525	
Contingency 20%				$ 1,372,567	
COVID-19 Contingency 5%				$ 343,142	
PROJECT TOTAL				**$ 10,409,239**	

Estimated Construction Duration

	Months																							
Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Contractor Mobilization/Clearing/Site Prep	■																							
Sheet Pile Installation		■	■	■	■																			
Temporary Cofferdam/Exist Wall Demo/Bank Excavation					■	■	■	■																
Site Remediation								■	■	■														
Winter Shutdown											■	■	■											
Site Grading														■	■									
Construction of Boardwalk/Overhang/Bridge															■	■	■	■						
Final Site Grading/Path Construction/Site Furnishings																		■	■	■				
Site Lighting/Electrical																					■	■		
Substantial Completion/Punchlist items																							■	■

Notes & Assumptions:

- Cost prepared June 2021 and should be escalated appropriately for construction in future years. Please note that recent cost estimates are highly variable due to the escalating costs of raw materials, particularly wood products and steel, due to the COVID pandemic and supply chain issues.

- Cost do not include permits / meetings / scheduling / access and coordination / flaggers / etc. that are anticipated to be needed before and during the construction of the Riverwalk with the railroad owner and/or operator. Weston & Sampson recommends the city earmark approximately $200k - $500k for this task until a meeting with the MBTA and Pan Am can be conducted and requirements are clearly established.

- Soil disposal costs based upon current transportation and disposal rates and currently available disposal characterization analytical data. Cost assumes all impacted soil/sediment are NOT subject to federal/EPA land ban disposal restrictions.

1) Additional soil remediation, separate from what is required for project construction, will be required to reduce concentrations of lead, PCBs, and petroleum impacts to soil at 24 Caller Street to achieve regulatory closure. These costs were presented in the July 2020 Draft Analysis of Brownfields Cleanup Alternatives (Draft ABCA), and are provide here as an estimated place holder, utilizing the upper cost estimated range of Alternative #2 (limited excavation of grossly contaminated soils and on-site capping with an activity and use limitation (AUL)) and the lower cost estimated range of Alternative #3 (Excavation and off-site disposal of contaminated soil to achieve Method 1 S-1 Standards and no AUL). Alternative #2 is a more cost effective alternative capable of reducing risk while having a smaller impact on the surrounding community and the environment. The remedial cost estimates for 24 Caller Street will need to be updated following the completion of proposed supplemental assessment activities.

2) Assumes: 24-month construction duration and bi-weekly construction meetings for PM (every 2 weeks). Resident Representative at 40 hours per week; Project Engineer / Architect at ~15hrs per week; 2 Team Leaders at ~1 hour per week; Project Manager at ~1 hour per week; and LSP at ~0.5 hours per week, etc.

11.0 LIMITATIONS

This report has prepared for the use by the City of Peabody and the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA), exclusively. The findings provided by Weston & Sampson in this report are based solely on the information reported in this document. Future subsurface investigations, sampling, and/or other information that was not available to Weston & Sampson at the time of the study, may result in a modification of the findings stated in this report.

Should additional information become available concerning this project or neighboring properties, which could directly impact the project site in the future, that information should be made available to Weston & Sampson for review so that, if necessary, conclusions presented in this report may be modified. The conclusions of this report are based on project site conditions observed by Weston & Sampson personnel at the time of the study, information provided by the City of Peabody, and samples collected and analyzed on the dates shown or stated in this report. Any modification of the report without written verification or adaptation by Weston & Sampson, as appropriate for the specific purpose intended, will be at the city and MassEEA's sole risk and without liability or legal exposure to Weston & Sampson or to Weston & Sampson's consultants. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty, expressed or implied, is given.

FIGURES

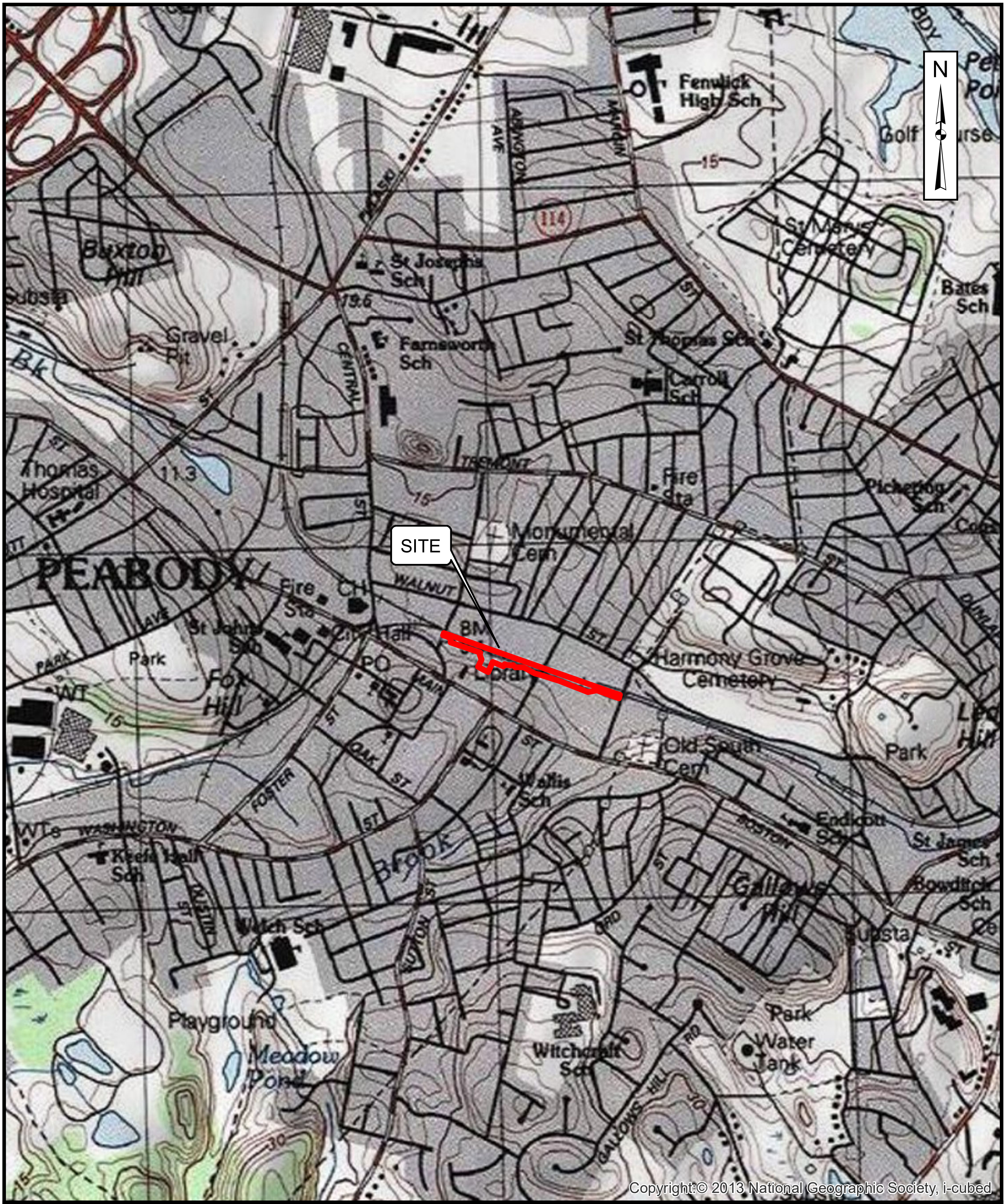


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FIGURE 1
RESILIENT NORTH RIVER CANAL CORRIDOR
PEABODY, MASSACHSUETTS

Legend

🟥 RIVERWALK PROJECT AREA

LOCUS MAP

0 2,000 4,000 Feet

Weston & Sampson

<BOL>Path:</BOL> C:\Users\spencerj\OneDrive - WESTON & SAMPSON ENGINEERS, Inc\Documents\ArcGIS\Peabody\RNRC_Locus Map.mxd <BOL>User:</BOL> SpencerJ <BOL>Saved:</BOL> 6/15/2021 3:13:51 PM <BOL>Opened:</BOL> 6/15/2021 3:14:03 PM

\\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2018\Task 2 – Engineering Services & Alternatives Analysis\Geotechnical\CAD\Site Plan 2020.04.28.dwg

FIGURE 2 – SITE PLAN

PEABODY RIVERWALK & PARK
PEABODY, MASSACHUSETTS

RESILIENT NORTH RIVER CANAL CORRIDOR
PHASE 2

DESIGNED BY:	FD	CHECKED BY:	SD	DATE:	JUNE 2021

Weston & Sampson

TABLES

TABLE 1 - SUMMARY OF EXISTING CONDITIONS

Property	Approximate Station Boundaries	Approximate Ground Surface Elevations at Back of Canal Wall (Feet NAVD88)	Surface Conditions
13 Wallis St	0+00 to 02+80	12 to 13	The property is currently a vacant lot with debris, gravel, and vegetation. The area adjacent to the canal is covered with trees and overgrown vegetation.
24 Caller St	02+80 to 08+16	11 to 12	The property is currently vacant. The building has been demolished but the foundation an asphalt concrete paved driveway remain. Trees and vegetation line the edge of the canal wall.
Caller Street Bridge	08+16 to 08+65	12	Asphalt concrete paved roadway bridge with concrete sidewalks
21 Caller St	08+65 to 10+55	10 to 12	The property is currently developed with a three story commercial and residential building with a paved parking lot. The parking lot is retained by an approximately 3 to 6 foot high masonry retaining wall which runs parallel to the south wall of the canal. The area in between the retaining wall and the canal is about 10 feet wide, and is covered with trees, vegetation, and debris.
18 Howley St	10+55 to 11+49	8 to 9	The property is currently vacant. The area adjacent to the canal is covered with trees, vegetation, and debris including a granite rock pile.
166R Main St	11+49 to 14+25	7 to 9	The property is currently vacant. The Strongwater Brook canal meets the North River Canal at about Sta. 11+49 to 11+57. Asphalt pavement, rail ties, and old building foundations (raised slabs) exist close to the canal wall east of Strongwater Brook.

APPENDIX A

Riverwalk along North River Corridor – South Wall Evaluation – 2017

5 Centennial Drive, Peabody, MA 01960
Tel: 978.532.1900

June 02, 2017

Brendan Callahan
Planner
City of Peabody
24 Lowell Street
Peabody MA 01960-3111

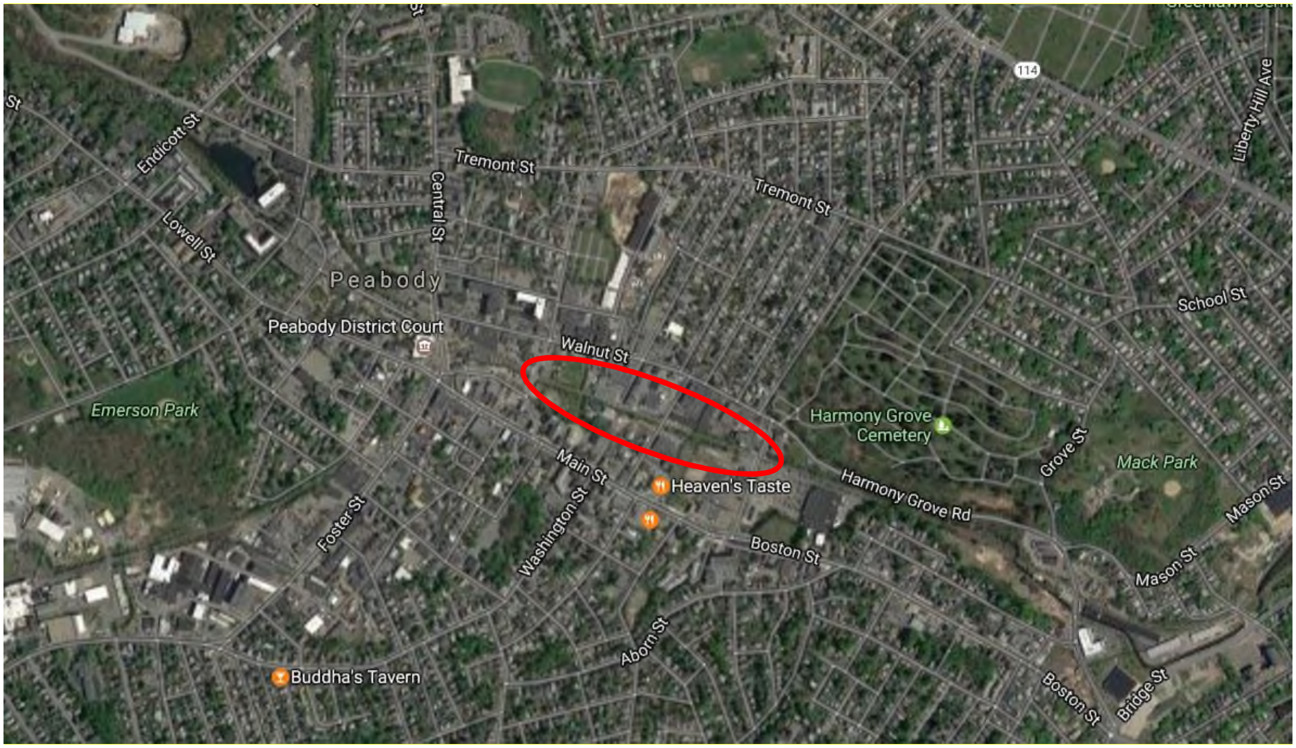
Re: Riverwalk along North River Corridor – South Wall Evaluation

Dear Mr. Callahan:

Weston and Sampson has completed the inspection and evaluation of the South Wall of the North River Corridor. This report provides a description of the structure, a summary of the observed conditions, evaluation of the overall condition, and recommendations for future action.

Purpose of the Inspection and Evaluation

The City of Peabody is investigating the possibility of constructing a Riverwalk along the south side of the North River Corridor between Wallis Street and Howley Street (See Project Location Map below). In 2008, sections of the walls forming the north side of the channel were repaired. At that time, the walls forming the south side of the channel were not included in the improvements. The purpose of this inspection and evaluation is to determine the general condition of the south wall, note observations, and recommend future actions. Observations and evaluation are broken up into two sections; those pertaining to the wall in its existing state and future considerations if a Riverwalk is to be constructed.



Project Location Map

Existing Information and Method of Inspection

Weston and Sampson reviewed existing information including previous work performed on the north canal wall, existing survey information, and existing subsurface investigation data. Existing plans of the wall were not available at the time of inspection.

Weston & Sampson performed a visual inspection of the wall and surrounding area. Measurements were taken using a survey wheel, survey tape, and tape measure. The canal was accessed in isolated areas with hip waders. Light probing of isolated scoured areas was performed using a ½" diameter steel foundation probe and a piece of steel reinforcing bar.

Wall Description

To aid in description of the wall a project stationing was chosen and used throughout this report to help illustrate extents and relative locations of observations. The stationing chosen matches the stationing previously used for the north wall repairs. This will avoid confusion in the future if both projects are reviewed simultaneously. The portion of wall nearest Wallis St is located between station 00-25 and 00-19. The western edge of the Howley St bridge is located at station 15+58. The limits of inspection and observation contained in this report extend from stations 00-25 to 15+58. See attached plan sheets (Appendix C) for a graphic illustration of the plan view and stationing. Additionally, a series of photos (Appendix A) and a summary table (Appendix B) are included to further illustrate/describe conditions and extents.

Starting near Wallis St the canal is initially oriented North/South and extends from the property at 15 Wallis St. beneath a timber railroad bridge. In this location, the west wall was inspected since it transitions into what will be the south wall for most of the canal. The west wall for this portion of the canal (STA. 00-25 to STA. 00-19) is of reinforced concrete construction and doubles as the bridge abutment and wingwall (See photo 001). South of the bridge the canal makes a 90 degree turn and transitions into an East/West orientation. Around the bend (STA. 00-19) the wall transitions from reinforced concrete construction to stone with mortar construction (See photos 002 to 003). The stone with mortar construction wall continues for 349 feet (STA. 00-19 to STA. 03+30) (See photos 003 to 009). The next 40 feet of wall (STA. 03+30 to STA. 03+70) consist of concrete construction on top of stone with mortar construction (See photos 009 to 011). At the end of the concrete construction the stone with mortar portion continues for 330 feet (STA. 03+70 to STA. 07+00) (See photos 012 to 017). At this point in the structure another concrete wall begins on top of the stone with mortar construction. This concrete on top of stone with mortar construction extends for 116 feet (STA. 07+00 to STA. 08+16) until it reaches the Caller Street Bridge (See photos 018 to 021).

The Caller Street Bridge appears to be founded on the next portion of wall which extends to the eastern edge of the bridge (STA. 08+16 to STA. 08+65) and is of granite block and mortar construction (See photos 022 to 026). East of the Caller Street Bridge the wall is of stone with mortar construction which extends for 100 feet (STA. 08+65 to STA. 09+65) (See photos 027 to 029). The next 95 feet of wall (STA. 09+65 to STA. 10+60) consist of stacked granite blocks on top of stone rubble without mortar (See photos 030 to 033). This is followed by an 89-foot section (STA. 10+60 to STA. 11+49) of full height stacked granite block construction which extends to the west bank of the Strongwater Brook canal (See photos 034 to 036).

The Strongwater Brook canal which is approximately 6-8ft wide meets the North River canal at this point. There is an abandoned railroad bridge (STA. 11+49 to STA. 11+57) which crosses the Strongwater Brook which is centered about 6 feet behind the south wall of the North River canal (See photos 037 to 038). East of the Strongwater Brook is a 68-foot section (STA. 11+57 to STA. 12+25) of earth embankment or buried wall (See photos 039 to 040). The next 100 feet of wall (STA. 12+25 to STA. 13+25) consist of stacked granite blocks without mortar (See photo 041 to 043). The following section of wall (STA. 13+25 to 13+35) is collapsed or missing (See photos 044 to 045). This section leads up to and continues through a 90-degree bend in the canal which transitions the canal into a North/South orientation. Following the bend (STA 13+35 to STA 13+36), the Eastern canal wall is made up of stacked granite blocks on top of stone rubble which extends to a timber railroad bridge (See photos 046 to 047).

The railroad bridge appears to rest on a granite slab which sits on top of the next section of wall which consists of a concrete cap on top of stacked granite blocks (See photo 048). This section of wall extends northward (STA. 13+40 to STA. 13+46) until the canal makes another 90-degree bend which transitions the canal back into an East/West orientation. East of the bend, the south canal wall is made up of a timber tie structure behind earth embankment (See photos 049 to 050). This section of wall extends until it meets the building located at 26 Howley St. which extends over the canal (STA. 13+46 to STA. 14+09). The timber tie structure continues behind the building's concrete columns for approximately 100 feet (STA. 14+09 to STA. 15+09) (See photos 051 to 052). East of the building is a section of earth embankment or buried wall which extends until it meets the Southwest wingwall for the Howley St. Bridge (STA. 15+09 to STA. 15+53) (See photo 053). The Howley St. Bridge Southwest wingwall which is of reinforced concrete construction protected by riprap slope extends approximately 5 feet until it meets the Howley St. Bridge (See photo 054).

Observations

See condition table in appendix for observations pertaining to both the existing condition and to future Riverwalk considerations.

Evaluation - Existing State

The wall condition varies drastically over the length of the structure ranging from good to poor. Wall conditions specific to each section along the length are noted in the photos in Appendix A, in the summary table in Appendix B, and in the plan sheets in Appendix C. Sections labeled as good are assumed to require minor or no repair to continue functioning acceptably. Sections labeled as fair are assumed to require more substantial repairs to continue functioning acceptably. Sections labeled as poor are assumed to require either full or partial reconstruction in order to function in an acceptable manor. The above assumed conditions are based on review of available existing materials and limited visual observation of the wall only. In general, most of the noted issues with the wall appear to be driven/exacerbated by waterflow, overgrown vegetation (such as trees with invasive roots), and changes in the surrounding conditions. In addition to addressing the issues it is recommended that addressing the cause of the issues be considered where possible.

Evaluation – Future Considerations for Riverwalk

In addition to the items mentioned above in the existing state evaluation, a number of additional items should be considered for the future Riverwalk. The proposed Riverwalk directly behind the south canal wall would apply additional loading to the wall beyond what it is currently subject to. Analysis of the wall for additional proposed loading would be required. As a result, modifications to sections noted as fair or good above may be required. Near Wallis street the proposed Riverwalk location appears to be close to the existing railroad line. A buffer or fencing may be required for safety. The land directly south of the wall is heavily vegetated containing plants, bushes, and trees. The vegetation would need to be cleared to install a walkway. The existing grading is not adequate for an ADA compliant walkway. The walkway would need to be relatively level both along the width and along the length of the walkway. To achieve ADA compliant grading sections of wall would need to be constructed or demolished and existing soil grades would need to be lowered or raised. Lowering and raising of grades is problematic with the existing grade occupying a flood zone. Adjusting the existing grades may require construction of new sections of wall south of the Riverwalk. Majority of the walkway adjacent to the canal would require railing. Some of the adjacent property lines appear to be very close to the south canal wall and property acquisition may be required to construct a Riverwalk. Caller Street Bridge railing termination extends beyond the bridge limits and appears to extend into the proposed Riverwalk location. Additionally, utilities and what appears to be a storm drain both appear to conflict with the proposed Riverwalk location. Any modifications to the Caller Street Bridge or it's railing may be subject to MassDOT Chapter 85 review. East of the Caller Street Bridge there is a large wall behind the south canal wall. Analysis of this wall would be required if the grades are modified or the loading condition is changed. At the Strongwater brook canal location the existing abandoned bridge structure does not appear to be adequate to carry a Riverwalk over Strongwater brook. A new bridge structure or extensive modifications to the existing structure may be required. East of the Strongwater brook canal it appears that existing railroad ties and possibly rail may be abandoned in place and covered with asphalt. If present this could add difficultly to excavation or construction. An abandoned building foundation exists close to the south canal wall east of the Strongwater Brook Canal. Land may need to be acquired and this foundation would need to be partially demolished and a retaining structure may be required south of the Riverwalk to ensure any remaining portion is stable. Near Howley street the proposed Riverwalk location appears to be close to an active railroad line operated by Pan Am. A buffer or fencing may be required for safety.

Recommended Actions

1) Delineate the corridor to determine wetlands extents, and identify bordering vegetated wetlands.
2) Conduct additional field survey to supplement and update the existing survey.
3) Perform additional subsurface investigation to explore wall type and possible repair options. Recommended additional investigation measures and locations as shown on the attached plan sheets S-01 through S-03. Additional subsurface investigation may be necessary as design progresses.
4) Following the additional investigation mentioned in action items 1-3 above, create an alternative analysis report evaluating repair options which take into account the information gained in the above investigations to determine the correct course of action for wall repairs. The alternative analysis report would take into account structural, geotechnical, and environmental permitting considerations for each repair alternative and compare them based on anticipated durability, environmental impact, construction schedule, and cost.
5) Develop contract documents including detailed plans, specifications, and estimate to perform chosen wall repairs from report generated in action item 4.

If you have any questions regarding the above evaluation, please contact me at (978) 977-0110, ext 7402.

Sincerely,

WESTON & SAMPSON

Richard A. Campbell, PE
Senior Associate

Nathan L. Rosencranz, PE
Project Engineer

APPENDIX A

(PHOTOS)

Photo 001: STA 00-25 to STA 00-19 (Bridge Abutment – Good Condition)

Photo 002: STA 00-25 to STA 00-19 (Bridge Wing – Separating from Abutment)

Photo 003: STA 00-19 to 01+50 (Stone with Mortar – Good Condition)

Photo 004: STA 00-19 to 01+50 (Stone with Mortar – Good Condition)

Photo 005: STA 00-19 to 01+50 (Stone with Mortar – Good Condition)

Photo 006: STA 01+50 to 01+70 (Stone with Mortar – Poor Condition - Tree Growing Through Wall)

Photo 007: STA 01+70 to 02+30 (Stone with Mortar – Fair Condition)

Photo 008: STA 02+30 to 03+20 (Stone with Mortar – Good Condition)

Photo 009: STA 03+20 to 03+30 (Stone with Mortar – Poor Condition – Cap Stones Displaced by Tree)

Photo 010: STA 03+30 to 03+50 (Concrete over Stone with Mortar – Poor Condition – Rotation)

Photo 011: STA 03+50 to 03+70 (Concrete over Stone with Mortar – Poor Condition – Crack)

Photo 012: STA 03+70 to 04+80 (Stone with Mortar – Fair Condition)

Photo 013: STA 04+80 to 06+35 (Stone with Mortar – Fair with Isolated Poor Condition)

Photo 014: STA 04+80 to 06+35 (Stone with Mortar – Fair with Isolated Poor Condition – Example of Poor Area)

Photo 015: STA 04+80 to 06+35 (Stone with Mortar – Fair with Isolated Poor Condition)

Photo 016: STA 04+80 to 06+35 (Stone with Mortar – Fair with Isolated Poor Condition)

Photo 017: STA 06+35 to 07+00 (Stone with Mortar – Fair Condition – Aggressive Slope Behind)

Photo 018: STA 07+00 to 07+35 (Concrete over Stone with Mortar – Poor Condition – Broken up with Voids)

Photo 019: STA 07+35 to 08+16 (Concrete on top of Stone with Mortar – Fair Condition – Rotating)

Photo 020: STA 07+35 to 08+16 (Concrete on top of Stone with Mortar – Fair Condition – Middle Joint)

Photo 021: STA 07+35 to 08+16 (Concrete on top of Stone with Mortar – Fair Condition – Joint at Bridge)

Photo 022: STA 08+16 to 08+35 (Concrete Abutment on Granite Block with Mortar – Fair Condition)

Photo 023: STA 08+16 to 08+35 (Concrete Abutment on Granite Block with Mortar – Fair Condition)

Photo 024: STA 08+16 to 08+35 (Concrete Abutment on Granite Block with Mortar – Fair Condition)

Photo 025: STA 08+16 to 08+35 (Caller St. Bridge – Bridge Rail)

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Photo 028: STA 08+65 to 09+65 (Stone with Mortar – Closeup of Isolated Poor Condition)

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Photo 034: STA 10+60 to 11+49 (Stacked Granite Block – Fair with Isolated Poor Condition)

Photo 035: STA 10+60 to 11+49 (Stacked Granite Block – Fair with Isolated Poor Condition)

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Photo 046: STA 13+35 to 13+40 (Stacked Granite Block on Stone Rubble – Poor Condition)

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Photo 053: STA 15+09 to 15+53 (Earth Embankment or Buried Wall – Poor Condition)

Photo 054: STA 15+09 to 15+53 (Reinforced Concrete with Riprap Protection – Good Condition)

APPENDIX B

(SUMMARY TABLE)

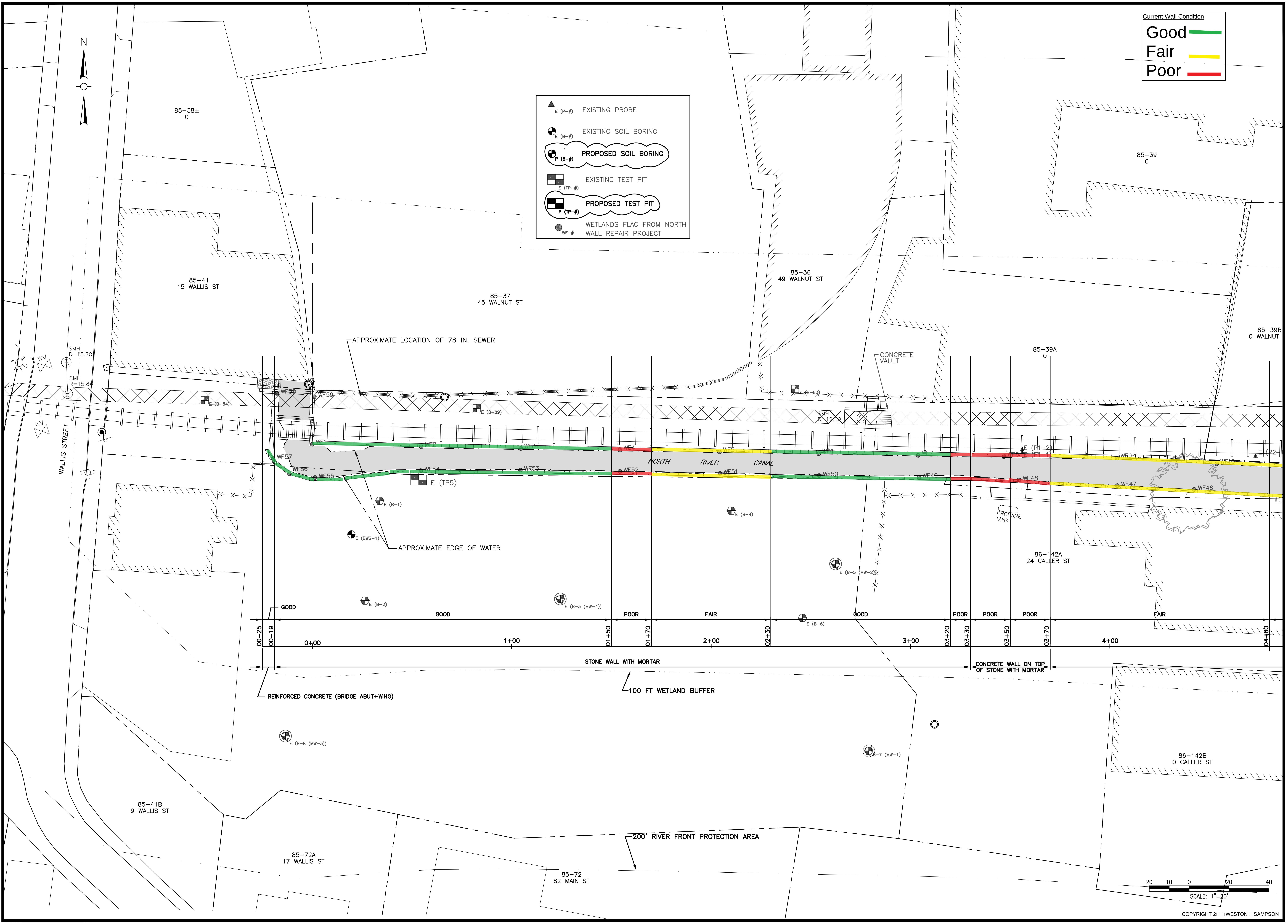
STATION	WALL TYPE	Observations - Existing Condition	Observations - Riverwalk Considerations	PHOTOS
00-25				
	Reinforced Concrete	Bridge Abutment - Good Condition Bridge Wing - Seperating from Abutment w/ minor vegetation growth in seperation		001 - 002
00-19				
	Stone w/ Mortar	Good Condition w/ isolated scour locations below the water line	Heavy vegetation behind. Ground behind wall slopes down to top of wall	003 - 005
01+50				
	Stone w/ Mortar	Poor Condition - Tree growing through wall - breaking joints and dislodging stones	Heavy vegetation behind. Ground behind wall slopes down to top of wall	006
01+70				
	Stone w/ Mortar	Fair Condition - Failing mortar joints and dislodged stones	Heavy vegetation behind. Ground behind wall slopes down to top of wall	007
02+30				
	Stone w/ Mortar	Good Condition w/ isolated scour locations below the water line	Heavy vegetation behind. Ground behind wall approximately level	008
03+20				
	Stone w/ Mortar	Poor Condition - Cap stones displaced by tree	Heavy vegetation behind. Ground behind wall approximately level	009
03+30				
	Concrete Wall on top of Stone wall w/ Mortar	Poor Condition - Concrete section rotating due to tree	Heavy vegetation behind. Ground behind wall approximately level	010
03+50				
	Concrete Wall on top of Stone wall w/ Mortar	Poor Condition - Concrete section cracked	Heavy vegetation behind. Ground behind wall approximately level	011
03+70				
	Stone w/ Mortar	Fair Condition - Failing mortar joints and dislodged stones	Heavy vegetation behind. Ground behind wall slopes down to top of wall	012
04+80				
	Stone w/ Mortar	Fair Condition with Isolated Poor Areas Failing mortar joints and dislodged stones stones displaced by trees in poor areas abandoned foundation behind appears to be forcing tree roots into wall	Abandonded Foundation behind wall appears to conflict with proposed riverwalk Removing the abandoned foundation may require additional wall south of riverwalk It appears that property acquisition would likely be requred at this location Heavy vegetation behind wall Ground behind wall slopes down to top of wall	013 - 016
06+35				
	Stone w/ Mortar	Fair Condition - failing mortar joints and dislodged stones	Aggressive slope behind wall. About a 3 ft drop over a 3 ft width Slope retained by loose granite blocks, some appear to have slid into the water May need to cut slope and add wall or retain with riprap Heavy vegetation on slope	017
07+00				
	Concrete Wall on top of Stone wall w/ Mortar	Poor Condition - Concrete section broken up w/ large voids	Heavy vegetation behind. Ground behind sloped down to wall.	018
07+35				
	Concrete Wall on top of Stone wall w/ Mortar	Fair Condition - Concrete Wall looks to be in good shape, but appears to be rotating	Heavy vegetation behind. Ground behind wall approximately level	019 - 021

STATION	WALL TYPE	Observations - Existing Condition	Observations - Riverwalk Considerations	PHOTOS
08+16				
	Caller Street Bridge Concrete Bridge abutment on top of granite block w/ mortar	Fair Condition - Concrete Abutment appears to be in good shape, Failing mortar joints and dislodged blocks in granite below Repairing joints may be subject to MassDOT Chapter 85 review process	Approach guardrail is damaged and appears to conflict with proposed riverwalk location Modifying guardrail may be subject to MassDOT Chapter 85 review process	022 - 026
08+65				
	Stone w/ Mortar	Fair Condition with Isolated Poor Areas Local Poor area around 08+90 Local Poor area about 09+35 to 09+45	Heavy vegetation behind. Ground behind sloped down to wall. Tall wall south of canal wall may require analysis for changed conditions	027 - 029
09+65				
	Stacked Granite Block on Stone Rubble (No Mortar)	Poor Condition - Top section of wall missing or collapsed Tree growing through wall.	Heavy vegetation behind. Ground behind sloped down to wall. Tall wall south of canal wall may require analysis for changed conditions	030
09+75				
	Stacked Granite Block on Stone Rubble (No Mortar)	Fair Condition with Isolated Poor Areas Trees disrupting/Growing through wall Irregular spaces between blocks / blocks misaligned	Heavy vegetation behind. Ground behind sloped down to wall. Tall wall south of canal wall may require analysis for changed conditions	031
10+10				
	Stacked Granite Block on Stone Rubble (No Mortar)	Poor Condition - Granite Blocks missing or collapsed Blocks/Stones in canal adjacent to wall Trees disrupting/Growing through wall	Heavy vegetation behind. Ground behind sloped down to wall. Tall wall south of canal wall may require analysis for changed conditions	032-033
10+60				
	Stacked Granite Block (No Mortar)	Fair Condition with Isolated Poor Areas Trees disrupting/Growing through wall Irregular spaces between blocks / blocks misaligned	Heavy vegetation behind. Ground behind sloped down to wall. Pile of granite behind wall would need to be moved or removed	034 - 036
11+49				
	Strongwater Brook Abandoned RR Bridge	No Wall in this region	Existing bridge consists of Rolled Steel beams encased in concrete at each end Beam spacing is about 5~ which does not appear adequate for proposed riverwalk Beam webs are heavily deteriorated and bridge has no deck Bridge would require repair and additional beams and deck to support walkway New bridge may be a better option	037 - 038
11+57				
	Earth Embankment or Buried Wall	Poor Condition - Wall is missing or buried	Heavy vegetation behind. Ground sloped down to wall. Ground behind is paved over existing railroad ties and possibly rails	039 - 040
12+25				
	Stacked Granite Block (No Mortar)	Poor Condition Irregular spacing between blocks. Blocks misaligned. Some blocks appear to be missing.	Heavy vegetation behind. Ground sloped down to wall. Ground behind is paved over existing railroad ties and possibly rails Abandoned foundation close behind canal wall Abandoned foundation would require demolition and possibly new wall construction It appears that property acquisition would likely be requred at this location	041 - 043

STATION	WALL TYPE	Observations - Existing Condition	Observations - Riverwalk Considerations	PHOTOS
13+25				
	Collapsed or missing wall	Poor Condition - Wall is collapsed or missing	Heavy vegetation behind. Ground sloped down to wall. Ground behind is paved over existing railroad ties and possibly rails Abandoned foundation close behind canal wall Abandoned foundation would require demolition and possibly new wall construction It appears that property acquisition would likely be requred at this location	044 - 045
13+35				
	Stacked Granite Block on Stone Rubble	Poor Condition Irregular joint spacing Misaligned Blocks	Heavy vegetation behind. Abandoned foundation close behind canal wall Abandoned foundation would require demolition and possibly new wall construction It appears that property acquisition would likely be requred at this location	046 - 047
13+40				
	Stacked Granite Block with Concrete Cap	Fair Condition with Isolated Poor Areas Irregular joint spacing Large crack with apparent differential settlement	Proposed riverwalk is not anticipated to impact this section of wall	048
13+46				
	Timber Tie behind Earth Embankment	Poor Condition Timber ties appear to be heavily deteriorated and rotated Earth Embankment is overgrown	Proposed riverwalk is not anticipated to impact this section of wall	049 - 050
14+09				
	Timber Tie behind Concrete Columns	Fair Condition Timber ties appear deteriorated Concrete columns exhibit cracking	Proposed riverwalk is not anticipated to impact this section of wall	051 - 052
15+09				
	Earth Embankment or Buried Wall	Poor Condition - Wall is missing or buried	Proposed riverwalk is not anticipated to impact this section of wall	053
15+53				
	Reinforced Concrete with Riprap Protection	Good Condition	Proposed riverwalk is not anticipated to impact this section of wall	054
15+58				

APPENDIX C

(PLANS)



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No.	Date	Dr.B□	C□B□	A□B□	Descri□□□□

APPROVED

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

RIVERWALK ALONG NORTH RIVER CANAL

South Wall Evaluation STA. □□2□ to □4□□□

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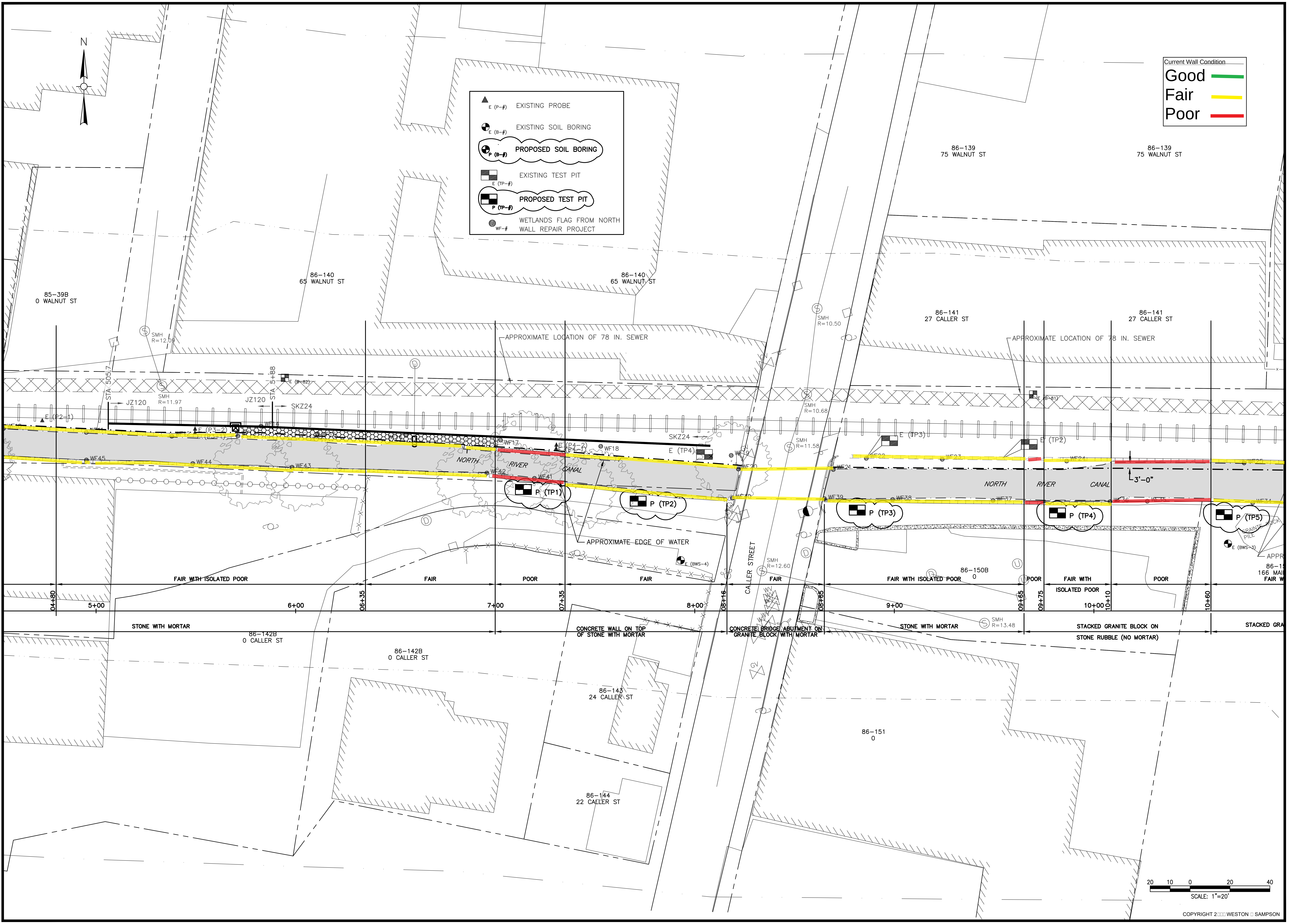

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No.	Date	Dr.By	Ch.By	App.By	Description

APPROVED

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

RIVERWALK ALONG NORTH RIVER CANAL

South Wall Evaluation STA. 4

SCALE:	CONTRACT:	JOB NO.	DR.BY	DSN.BY	CHK.BY	APP.BY
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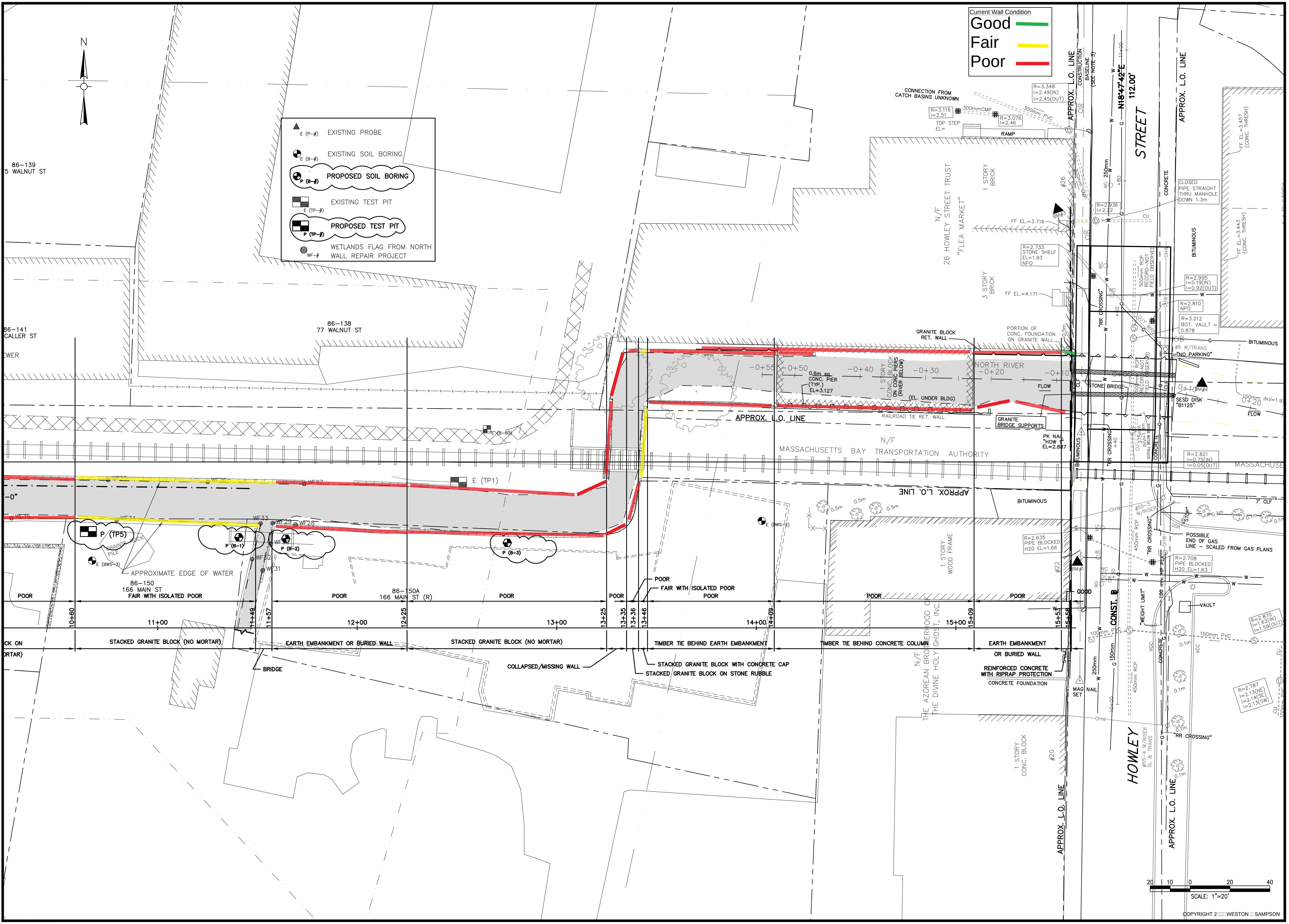

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CITY OF PEABODY

RIVERWAL ALONG NORTH RIVER CANAL

South Wall Evaluation STA.

No.	Date	Dr.By	Ch.By	App.By	Description

A P P R O V E D

REGISTERED PROFESSIONAL ENGINEER

DATE

SCALE	CONTRACT	JOB NO.	DR.BY	DSN.BY	CH.BY	APP.BY
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SHEET 3 OF 3

APPENDIX B

Geotechnical Engineering Report – May 2020

Weston & Sampson

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REPORT

May 2020

Geotechnical Engineering Report
North River Canal
Wall, Riverwalk, and Park

PREPARED FOR CITY OF
Peabody
MASSACHUSETTS

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1.0 INTRODUCTION

Weston & Sampson Engineers, Inc. (Weston & Sampson) is pleased to present this geotechnical engineering report for the North River Canal Resilient Wall, Riverwalk, and Park project in Peabody, Massachusetts. The proposed project includes replacement of canal wall portions and a new park, including an approximately 1,600-foot-long pedestrian pathway ("Riverwalk") along the south side of the North River Canal. Weston & Sampson previously completed a feasibility level subsurface investigation program for the project in November 2018. The results of our explorations, preliminary geotechnical recommendations, and a discussion of proposed wall replacement alternatives for the project were included in our Engineering Evaluation & Design Alternative Analysis Report, dated March 2019.

For important information about the use of this report, please refer to the ***Limitations*** section at the end of this report, and the document "Important Information about this Geotechnical Engineering Report" by the Geoprofessional Business Association (GBA), included in ***Appendix F***.

1.1 Existing Conditions

The project site is in an urban industrial area of Peabody, between Wallis and Howley Streets, and crossing Caller Street as shown in ***Figure 1 – Site Locus***. The south side of the North River Canal along the project limits abuts six properties, from west to east: 13 Wallis Street, 24 Caller Street, Caller Street bridge (a public roadway), 21 Caller Street, 18 Howley Street, 166 Main Street (R), and MBTA property. Refer to ***Figure 2 – Site Plan*** for the property limits. Construction of the proposed project will require property acquisition or easements on properties.

Existing surface conditions within the project site are variable, and include areas of grass-cover, vegetation, debris, rubble, and areas developed with existing industrial buildings and asphalt concrete (AC) paving. An existing 3 to 6-foot-high stone masonry retaining wall that retains a parking lot at 21 Caller Street runs parallel to and approximately 15 ft south of the canal wall. Refer to ***Table 1 – Project Site Summary*** for a detailed summary of existing conditions within the project area.

Portions of the south canal wall along the length of the project limits consist of earthen embankment (or possible buried wall), a stacked timber railroad tie structure behind an earth embankment, reinforced concrete, granite blocks, or stone or stone rubble sections. Wall heights range from about 4 to 6 feet above the canal bottom. The wall's condition varies over its length, ranging from good, in need of minor repair, to poor, requiring full or partial reconstruction. Refer to Weston & Sampson's report titled "Riverwalk along North River Corridor – South Wall Evaluation," dated June 2, 2017 for detailed description of the existing wall types and conditions along the project alignment.

1.2 Proposed Conditions

The North River Canal has a history of flooding, and flooding is predicted to worsen due to climate change. The proposed project is partially funded by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA) through its 2019 Municipal Vulnerability Preparedness (MVP) Action

Grant Program, and will incorporate resilient design elements aimed to increase stormwater storage, reduce downstream flooding, and enhance public access to open space.

As part of the proposed project, the existing south wall of the canal will be demolished within the project limits, and replaced with a new full-height wall, or combination partial-height wall and vegetated or armored slope. The new wall will tie-in to the existing canal walls at the Caller Street bridge. Proposed wall heights range from about 3 to 6 feet, and slope heights range from about 2 to 4 feet. The new wall will consist of driven steel sheet piles along most of the project alignment. We understand the Structural Engineer is considering an alternative wall system consisting of drilled micro-piles (DMPs) and concrete lagging at 21 Caller Street in order to minimize construction vibrations and impacts to the existing retaining wall further south.

The new Riverwalk will be located along the top of the new wall and/or slope, and will consist of an asphalt concrete paved path with sections of wooden boardwalk. The Riverwalk will include a pedestrian bridge over the Strongwater Brook canal within the 166R Main Street property. A cantilevered boardwalk “overlook” structure is proposed at 21 Caller Street, and will be partially supported by the new canal wall. Additional proposed improvements include landscaped park areas, new tree plantings, park benches, pedestrian lighting, raingardens, and drainage improvements.

Proposed grades along the Riverwalk are within about 1 foot of existing grades, and generally range from about elevation (El.) 8 to El. 12. Elevations provided in this report and shown on ***Figure 2*** are in feet and reference the North American Vertical Datum of 1988 (NAVD88). Proposed utility plans are not available at this time. In preparation of this report we have assumed proposed utilities at the site will include new drain pipes with invert depths up to about 6 feet below existing grades.

1.3 Purpose and Scope

The purpose of our geotechnical evaluation was to explore subsurface conditions at the Site and provide geotechnical engineering recommendations for design and construction of the proposed wall, Riverwalk, and park improvements. Our scope included subsurface explorations, geotechnical laboratory testing, geotechnical engineering analyses and preparation of this report summarizing geotechnical considerations and recommendations.

2.0 SUBSURFACE CONDITIONS

2.1 Geologic Setting

Based on information available from the Massachusetts Office of Geographic Information (MassGIS), surficial geology conditions at the site are mapped as fine glaciomarine deposits overlying thin till and bedrock at depths less than 50 feet. Bedrock in the area of the site is mapped as the Peabody Granite formation. The nearest mapped bedrock outcrops are located approximately a quarter mile from the site, north of the North River Canal.

2.2 Subsurface Explorations

A total of 18 borings and 6 test pits, which were completed in the past and as part of our current scope of work, provide subsurface data relevant to our geotechnical assessment. The explorations are described below.

2.2.1 2002 Explorations by Geotechnical Services, Inc

Six (6) borings, herein referred to as B-1(GSI) through B-6(GSI), were completed at the 13 Wallis Street property between October 31 and November 4, 2002 for a multi-family housing development proposed at the time. Boring depths ranged from 17 to 40 feet. The borings were performed by New Hampshire Boring, Inc. (now New England Boring Contractors) of Derry, New Hampshire, and logged by Geotechnical Services, Inc. (GSI) of Goffstown, New Hampshire. Approximate boring locations are shown in ***Figure 2,*** and the boring logs prepared by GSI are included in ***Appendix A***.

2.2.2 2007 Explorations by Weston & Sampson

Weston & Sampson explored subsurface conditions in the project area by advancing four borings (WS-1 through WS-4) between March 21 and 23, 2007 during a previous phase of the North River Canal project. The borings were advanced to depths up to 41 feet below grade at the approximate locations shown on ***Figure 2***. Geologic Earth Explorations, Inc of Norfolk, MA performed the borings using drive and wash drilling methods***.*** Boring logs from the 2007 explorations are included in ***Appendix B.***

The 2007 explorations also included five test pits (TP-1 through TP-5) to observe the back of the canal wall. Test pits TP-1 through TP-4 were located at the north wall of the canal, outside of the current project area. TP-5 was located within the project area at 13 Wallis Street, at the approximate location shown on ***Figure 2*** (labelled TP-5(2007) on the figure)***.*** Photographs showing the conditions observed in the test pit are included in ***Appendix B***.

2.2.3 2018 Explorations by Weston & Sampson

As part of the conceptual design phase, Weston & Sampson explored subsurface conditions in the project area by advancing six borings (B-1 through B-6) and six (6) test pits (TP-1 through TP-6) between November 5 and 9, 2018. The borings extended to depths of up to 22 feet. The test pit excavations were terminated due to groundwater seepage at depths ranging from 5.6 to 6.8 feet. The approximate exploration locations are shown on ***Figure 2***.

New England Boring Contractors (NEBC) of Derry, New Hampshire advanced the borings using an ATV or truck-mounted drill rig and drive and wash drilling methods. Standard penetration tests (SPTs) were conducted at 2-foot to 5-foot intervals using a standard 24-inch long by 1-3/8-inch inside diameter (2-inch outside diameter) split spoon sampler driven by blows from a 140-pound safety hammer falling 30 inches. Following completion of drilling, the borings were backfilled with soil cuttings.

NEBC excavated the test pits along the back of the existing canal wall using a Kubota U17 excavator with a toothed bucket. The test pits were backfilled with the excavated soil upon completion.

Weston & Sampson geotechnical engineering staff monitored drilling and test pit activities in the field and prepared logs for each boring. A Weston & Sampson structural engineer was also onsite to observe the structural characteristics of the back of the canal wall during test pit activities. A description of the existing canal wall observed in the test pits is provided in ***Table 2B*** and in the Wall Alternatives Analysis Report, prepared by Weston & Sampson's structural engineers and submitted under a separate cover. Boring and test pit logs from the 2018 explorations are included in ***Appendix C***.

2.2.4 2020 Explorations

Weston & Sampson completed additional subsurface explorations at the project site consisting of two borings (B-101 and B-102) on April 14, 2020 as part of the final design phase. The exploration locations are shown on Figure 2.

The explorations were completed by NEBC. The borings were completed using an ATV-mounted drill rig using hollow-stem-auger and drive and wash drilling methods and extended to approximately 29.5 and 40.5 ft. below grade. Standard penetration tests (SPTs) were completed in each boring as described above.

Weston & Sampson geotechnical engineering staff monitored exploration activities in the field and prepared logs for each boring. Logs from the 2020 explorations are provided in ***Appendix D***.

2.2.5 Environmental Sampling

Soil samples were collected by Weston & Sampson for environmental analytical testing and disposal characterization during the 2018 exploration program. The results of the environmental testing have been provided under a separate cover.

2.3 Subsurface Conditions

Subsurface conditions encountered in the borings and test pits were generally consistent with the regional geology and our understanding of the site history, and generally consisted of FILL overlying native SAND and SILT to the depths explored. ORGANIC SOILS were observed below the fill in eight of the eighteen borings.

The major soil groups encountered are described below, in general order of their occurrence with depth. Descriptions of the soils encountered are also included in the attached exploration logs. Refer to ***Table 2A/B – Summary of Subsurface Conditions*** for a summary of the explorations. Variations may occur and should be expected outside of the exploration locations.

Fill: Very loose to very dense FILL (or probable fill) was encountered below surface materials (i.e. topsoil, bare earth, asphalt concrete pavement, or concrete) in all explorations except WS-3. The fill extended to depths ranging from about 4 to 15 feet, and generally consisted of fine to coarse sand with varying amounts of silt, gravel, organic matter, and debris including brick, glass, wood, asphalt, metal, and weathered mortar. Cobbles and boulders up to 28 inches in diameter were observed within the fill in test pits TP-2, TP-3, TP-5, and TP-6. Each of the test pits terminated within the fill.

Native soils: Loose to medium dense or very soft to medium stiff ORGANIC SOIL and/or PEAT was encountered below the fill in borings B-1, B-3 through B-6, and WS-2. The organic soils extended to depths ranging from about 8 to 14 feet below existing grade.

Native SAND was encountered below the surface materials, fill, or organic soils in all borings. The sand was fine to coarse-grained or fine-grained, and contained varying amounts of silt and gravel. The sand was generally described as medium dense to dense, except in borings advanced at 13 Wallis Street, where most of the sand samples were described as loose to medium dense. Roller bit grinding was noted within the sand in some borings, which may be indicative of the presence of cobbles and/or boulders.

Medium stiff to hard SILT with varying amounts of sand and gravel was encountered below or interlayered with the sand in borings WS-2, WS-3, WS-4, B-101, B-102, B-3, and B-5.

Each of the borings terminated within the sand or silt, or upon refusal as noted below.

Refusal: Borings B-101, B-102, B-1(GSI) and B-4(GSI) encountered auger refusal at depths ranging from about 29.5 to 40.5 feet. Rock coring was not performed, and therefore refusal could have been on cobbles, boulders, and/or bedrock.

2.4 Groundwater

Logs for borings B-1(GSI) through B-6(GSI) report groundwater depths ranging from 8 feet to 10.5 feet at the completion of drilling. Groundwater was encountered during drilling at a depth of 4.5 feet in B-101 and 5.0 feet in B-102. Groundwater seepage was observed at depths ranging from about 4.6 to 6.7 feet below grade in TP-1 through TP-6. Groundwater depths were not measured in borings WS-1 through WS-4 or B-1 through B-6 due to the drilling method (drive and wash) which introduces water into the borehole during drilling.

Groundwater levels are expected to be influenced by the water level in the North River Canal and may fluctuate due to local and regional factors including, but not limited to, precipitation events, seasonal changes, and periods of wet or dry weather.

2.5 Laboratory Testing

Select soil samples from the 2018 and 2020 explorations were submitted to GeoTesting Express of Acton, Massachusetts for grain size analysis and/or organic content testing to confirm field classification and estimate engineering properties. Laboratory test results are included on the boring logs and in ***Appendix E.***

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3.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

3.1 General

Subsurface conditions encountered at the site include undocumented fill, debris, and organic soils to depths of up to 15 feet, overlying native sand and/or silt at locations explored. The existing fill and organic soils are not suitable for support of rigid structures due to the risk of differential settlement from variable rates of compression/decomposition. The in-place existing fill can provide adequate support of flexible site improvements, including the paved Riverwalk, provided subgrades are prepared and evaluated as recommended below.

Over-excavation and replacement of unsuitable soils (existing fill and organics) is not considered feasible below the proposed pedestrian bridge at Strongwater Brook and the overlook structure at 21 Caller Street due to anticipated required depth of excavation, the need for construction dewatering, and the proximity to existing structures. Therefore, we recommend supporting these structures on deep foundations (helical piles or DMPs) extending to suitable bearing stratum of native, inorganic sand and/or silt. Recommendations for deep foundations are provided in Section **Error! Reference source not found.**.

Proposed canal walls consisting of driven sheet piles or DMPs and lagging should extend through the existing fill and organics and into the native sand and/or silt soils. Recommendations for design of new canal walls are provided in Section 3.2.

Excavations up to about 8 feet below grade will be required to remove existing canal walls and construct the proposed improvements. Excavations will encounter fill, debris, organics, and layers of loose to medium dense sand, and moderate to severe caving and possible flowing conditions should be anticipated where seepage is present. Recommendations for earthwork, excavations, temporary excavation support, and dewatering are provided in Section 4.0.

3.2 Canal Walls

Permanent canal walls consisting of driven steel sheet piles or DMPs and lagging should extend through the existing fill and organics and derive lateral capacity within the native sand and/or silt soils. Design of canal walls should include a structural assessment of the required wall section to provide adequate shear and moment capacities. Wall embedment depths should provide stability against sliding and overturning. We recommend walls be designed and installed to provide temporary excavation support during removal of the existing canal walls. Lateral pressure recommendations for design of canal walls are provided in Section 3.3.

We recommend DMP casing and sheet pile sections include 1/16” section loss due to corrosion. Sheet pile walls shall be designed to not act as a groundwater cut-off between the canal and surrounding areas. This can be accomplished by providing large holes within the sheetpile wall, or by extending every other sheetpile section only through the fill (and not into the native sands), such that groundwater can flow through the openings and equilibrate on both sides of the sheetpile wall.

Based on discussions with the Structural Engineer, we understand a DMP and concrete lagging wall at 21 Caller Street would provide partial vertical support for the proposed boardwalk overlook structure. Estimated vertical load-carrying capacities for DMPs are provided in Section **Error! Reference source not found.**.

3.3 Lateral Pressures

Design of below-grade structures including canal walls and pedestrian bridge abutments should consider appropriate lateral loading conditions including earth pressures, hydrostatic, wind, seismic, and surcharge loads from sloped backfill, structures and adjacent traffic as appropriate. Hydrostatic pressures should be computed assuming groundwater level at the site to be at ground surface unless drainage is provided. Lateral earth pressures may be computed using the soil parameters provided in the table below:

Recommended Soil Design Parameters

Parameter	Values for			
	Existing Fill	Organics	Native Sand and Silt	Compacted Structural Fill
Angle of Internal Friction, ϕ	28°	26°	30°	34°
Total Unit Weight, γ (pounds per cubic foot)	125	115	125	130
Buoyant Unit Weight, γ' (pounds per cubic foot)	62.6	52.6	62.6	37.6
Wall Interface Friction (Steel), δ	14°	11°	15°	20°
Wall Interface Friction (Concrete), δ	19°	17°	20°	24°

If the structure is restrained from lateral movement, at-rest earth pressures should be used in the analyses. If the structure is free to rotate, active earth pressures may be used. Rotation associated with development of active pressures is expected to be approximately 1 percent the exposed wall height.

We recommend a minimum 150 psf lateral surcharge pressure be assumed over the full height of the wall or abutment, intended to account for vertical areal surcharge pressures at the ground surface up to 300 psf. Additional lateral pressures equal to 0.5 times the additional surcharge pressures should be added where surcharge pressures exceed 300 psf. Where sloped ground surface is proposed behind the wall, we recommend an additional vertical areal surcharge equal to 125 pcf times the height of the slope above the top of the wall.

Existing and proposed structures and other improvements located above and behind proposed walls or abutments and within a zone defined by a plane extending upward at 1H:1V from the back of the bottom of the structure will increase lateral pressures on the structure. We should be consulted if footings or surcharges are located within this zone.

When computing resistance to lateral loads, passive earth pressures in front of the wall should be ignored to a depth of 2 feet, or to the design scour depth, whichever is deeper.

3.3.1 Drainage

The build-up of hydrostatic pressures behind below grade structures and walls may be avoided by design of drainage systems. A typical backdrain system consists of an 18-inch wide (horizontal measure) zone of crushed, free-drainage gravel with less than five-percent fines, wrapped in a geotextile filter fabric immediately behind the walls. The gravel section should be drained by weep holes and/or a perforated pipe placed at the base of the wall. The pipe should drain by gravity and discharged at a suitable, erosion-protected location as determined by the Civil Engineer. Geotextile filter fabric should have an AOS of a #70 sieve, a minimum permittivity of 1.0 sec-1, and a minimum puncture resistance of 80 pounds (such as Mirafi 160N or approved equivalent).

3.4 Deep Foundations

As discussed above, the proposed pedestrian bridge abutments and boardwalk overlook structure should be supported on deep foundations extending through the existing fill and organic soils and bearing within native, inorganic sand or silt deposits. The proposed structures are lightly loaded, and can be supported on helical piles, which are relatively inexpensive, quick to install, and produce minimal spoils. However, we understand DMPs may be used to construct portions of the canal wall along 21 Caller Street, in which case it may be advantageous to also support the overlook and pedestrian bridge structures on DMP foundations. Selection of the appropriate foundation system involves a cost evaluation of the trade-offs. Due to their higher unit cost, DMP foundations would have to be used at a higher capacity and greater spacing than helical piles as a cost trade-off. Recommended design criteria for both systems are provided below.

3.4.1 Helical Piles

Helical piles should bear within the native sand and/or silt underlying the existing fill and organic deposits at the site. Preliminary capacity calculations indicate that a 3-inch diameter (0.13 in. wall thickness) pile section with a 10”-12”-14” lead helix section installed to minimum pile tip elevations corresponding to depths of 20 feet (about 10 feet of embedment in the native sand and/or silt) can provide a minimum allowable downward vertical capacity of about 20 kips per pile. Additional downward capacity may be possible with greater embedment depths and higher capacity (larger helix diameter) pile. We recommend that ultimate capacities be factored by at least 3.0 to calculate allowable capacities unless static load testing is completed. Friction along the shaft of the helical pile should be neglected.

We recommend that helical piles be installed to suitable embedment and installation torques in the medium dense (or denser) sand or medium stiff (or stiffer) silt strata. Actual pile lengths may vary depending on variabilities in the thickness of the existing fill and organics, and consistency of the underlying materials. Piles should have a minimum horizontal spacing of three times the largest helix diameter.

The helical pile contractor should provide a helical pile design submittal for capacities required by the structural engineer. The helical pile design submittal should be stamped by a Professional Engineer licensed in the Commonwealth of Massachusetts and include calculations that demonstrate adequate geotechnical and structural capacities including resistance to buckling. The design submittal should also specify required installation torques. The helical pile and installation equipment must be capable of installation to the estimated embedment and suitable torques. All steel helical pile components must be galvanized. Weston & Sampson should observe installation of all helical piles to document minimum embedment depths and capacities.

Lateral loads should be resisted by buried foundation elements such as pile caps. Lateral resistance against pile caps can be calculated using a passive equivalent fluid pressure of 250 pcf assuming pile caps are backfilled with compacted Structural Fill as recommended herein. Passive resistance should be ignored in the top 2-feet of embedment. Lateral resistance from the helical pile shafts should be ignored.

3.4.2 Drilled Micropiles (DMPs)

DMPs should be designed in accordance with the latest edition of the American Association of State Highway Transportation Officials (AASHTO) LRFD Bridge Design Specifications. Casing for DMPs should extend through the existing fill and organic soils, and DMPs should be designed to derive their support entirely by side resistance within the native sand and/or silt. End bearing resistance should be ignored. The table below provides preliminary estimated axial capacity for various-sized DMPs at the site, assuming a gravity-grouted DMP with a bond zone within the native sand and/or silt.

Estimated Axial DMP Capacities

Micropile Diameter	Factored Skin Friction Capacities per unit length	Total Factored Axial Pile Capacity for 15-foot long bonded length within sand and/or silt
(inches)	(kip/ft)	(kips)
6	1.3	19
10	2.2	32
12	2.6	39

The estimated capacities presented above are geotechnical capacities only, and are based on an LRFD resistance factor of 0.55. The capacities are equivalent in compression and tension (uplift). The structural capacity of the DMP section should be evaluated separately by the project structural engineer. A minimum of 1/16-inch corrosion loss should be applied to pile casing.

DMP bond lengths should be designed based on final design structural loads (including axial, lateral and uplift loads). The final design of the drilled micropile bond length and stratum should be confirmed by the specialty drilled micropile contractor engaged by the general site contractor, who is experienced in design, construction, and testing DMPs of similar load and similar subsurface conditions anticipated for this project. The DMP design should be stamped by a Professional Engineer licensed in the Commonwealth of Massachusetts and include calculations that demonstrate adequate vertical and lateral geotechnical and structural capacities.

A resistance factor of 0.55 be used for determining geotechnical capacities. Higher resistance values may be used if verification load testing is completed in accordance with AASHTO. Weston & Sampson should be contacted for full-time observation of DMP installation and to evaluate minimum embedment depths and allowable capacities.

The bottoms of pile caps should be located at least 4 feet below lowest adjacent ground surface exposed to freezing or be supported over non-frost susceptible material to at least 4 feet below final grades. The minimum center to center spacing of the DMPs should be at least 3 times the pile diameter.

The table below provides recommended soil and rock parameters for lateral pile analysis of DMPs using computer software such as LPile by Ensoft or RSPile by RocScience.

Lateral Load Analysis Design Parameters

Stratum	Material Model	Effective Unit Weight (pcf)	Friction Angle (degrees)	Reaction, k (pci)
Existing Fill	Sand (Reese)	62.6	28	15
Organics	Sand (Reese)	52.6	26	10
Silt and Sand	Sand (Reese)	62.6	30	40

The lateral resistance and lateral deflection of the piles should be analyzed based on the anticipated maximum lateral load combinations in accordance with the latest edition of the AASHTO LRFD Bridge Design Specifications. The lateral deflection analysis should include the effects of group interaction.

3.5 Seismic Design

Seismic site class was determined in accordance with the AASHTO Guide Specifications for LRFD Seismic Bridge Design Manual – 2nd Edition, 2011 (with interims through 2015). Based on the data from the borings conducted at the site, the subsurface profile of this site (from the ground surface down) is representative of Site Class E. We recommend the following seismic design parameters for the site:

Seismic Parameters

Parameter	Value
Peak ground acceleration, PGA	0.087g
Short-period spectral acceleration, S_s	0.170g
Long-period spectral acceleration, S_1	0.041g
Spectral acceleration coefficient, A_S	0.217g
Short period acceleration coefficient, S_{DS}	0.425g
1-sec period acceleration coefficient, S_{D1}	0.144g

3.5.1 Liquefaction Potential

Liquefaction is the sudden drop in shear strength between soil particles that can occur in saturated, cohesionless soils as a result of ground acceleration during a seismic event. Liquefaction typically results in soil densification and subsequent settlement of overlying features and structures. Conditions most likely to contribute to liquefaction include a soil matrix containing loose, uniform medium to fine sand (poorly graded sand) below the groundwater table.

Layers of loose silty sand were encountered below groundwater in several borings at 13 Wallis Street. We evaluated liquefaction potential using the subsurface information and SPT and laboratory test data from our borings. Based on our evaluation and the proposed structure types, the risk of structurally damaging ground deformations is low.

3.6 Slopes and Erosion Protection

Proposed vegetated or armored slopes behind the canal walls should be inclined no steeper than 2H:1V. All slopes should be protected from erosion during and immediately following construction. Riprap slope armoring, where proposed, should be underlain by a minimum 12-inch thick bedding layer of crushed stone. Armoring and riprap blankets should include a layer of geotextile filter fabric between the soils and the bedding layer.

4.0 CONSTRUCTION CONSIDERATIONS

4.1 Site and Subgrade Preparation

Initial site preparation should include removal of existing structures, slabs, foundations, pavements, debris, curbing, vegetation, topsoil, and roots greater than one-inch in diameter within areas of site improvements. Deeper stripping depths and removal of loose surficial organic soil should be anticipated in areas of landscaping, shrubs, and trees. All material disturbed during site preparation should be removed to undisturbed subgrade. Any existing utilities within the proposed development areas should be identified and properly removed, re-routed, or evaluated and approved to remain

Based on the subsurface conditions encountered in our explorations and proposed site grades, stripping and subgrade preparation will likely expose fill materials with varying amounts of sand, gravel, and silt, and possibly organic deposits. Weston & Sampson geotechnical engineering staff should be contacted to evaluate the exposed subgrade prior to placement of overlying materials. Unsaturated, granular soils should be proof-compacted with at least four passes of a 700-pound vibratory plate compactor, or equivalent effort. Subgrades consisting of silt or silty soils should not be proof compacted.

Soft and/or disturbed areas will require over-excavation and backfilling with compacted angular crushed stone or compacted Structural Fill. A geosynthetic separation layer between the excavation subgrade and crushed stone backfill may also be required. We recommend that a geosynthetic used for stabilization consist of a woven geosynthetic with an AOS of #70 to # 100 sieve, and a minimum puncture resistance of at least 120 pounds (such as Mirafi FW700 or equivalent).

Soils containing more than trace amounts of silt or clay are highly susceptible to softening and disturbance by construction activity during wet or freezing weather. A few inches of angular crushed stone can be placed and compacted at the base of excavations to protect subgrades from disturbance during construction or wet weather conditions. If construction occurs during freezing conditions, insulating blankets, heaters, or other suitable measures should be employed to prevent subgrades from freezing. The contractor is responsible for subgrade protection.

4.2 Excavation Considerations and Water Control

Excavations up to about 8 feet below grade will be required to remove existing canal walls and construct the proposed improvements. Excavations will encounter fill, debris, organics, and layers of loose to medium dense sand. Groundwater was observed in soil borings and test pits at depths ranging from about 4.5 to 10 feet. Groundwater levels and water levels within the North River Canal should be expected to fluctuate due to tidal, local and regional factors. Excavations may encounter groundwater, and moderate to severe caving and possible flowing conditions should be expected where seepage is present. Temporary excavation support will be required for excavation depths greater than 4 feet where sloping is not feasible or where groundwater seepage is present.

The type and design of shoring systems should be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation. New permanent canal walls may be utilized as excavation support to facilitate removal of the existing canal walls. All excavations should be made in accordance with applicable OSHA safety regulations.

Depending on excavation depth and amount of groundwater seepage, dewatering may be necessary. Flow rates for dewatering are likely to vary depending on location, soil type, and the season during which the excavation occurs. The dewatering systems should be designed by the contractor and be capable of adapting to variable flows and conditions. Dewatering efforts and discharge of pumped groundwater must satisfy requirements of local, state and federal environmental and conservation authorities.

Earthwork during rainy months will require extra effort and caution by the contractors. The soils may be too wet to compact which will require processing to dry the soil. The grading contractor should be responsible to protect his work to avoid damage by rainstorms, including smooth rolling to seal off a pad or subgrade surface to facilitate drainage and to reduce rain damage. Ponded water should be pumped out of excavations and subgrade areas immediately. Surface water should also be controlled during construction and prevented from eroding temporary slopes, retaining walls and disturbing subgrade materials.

4.3 Sheet Pile Installation

Construction vibrations during sheet pile driving may result in densification and settlement of surrounding soils, particularly loose soils such as the existing fill at the site. High-frequency pile driving techniques should be used to minimize vibrations when installing sheet piles adjacent to existing structures. During sheet pile installation, we recommend the contractor perform vibratory monitoring and settlement monitoring of sensitive utilities and structures including the Caller Street Bridge and existing retaining wall at 21 Caller Street.

The existing fill contains debris, cobbles, and boulders which may interfere with installation of sheet piles. Pre-trenching may be required prior to sheet pile installation to remove obstructions within the fill.

4.4 Fill

Structural Fill should be used as backfill below or adjacent to walls and structures, and within 2 feet below finished grade in proposed pavement or boardwalk areas. Structural Fill should meet the requirements of material specification M1.03.0 Gravel Borrow, type b or dense graded crushed stone meeting the requirements of M2.01.7 in the latest edition of the Massachusetts DOT Standard Specifications for Highways and Bridges

Common Fill may be used as fill in landscape areas and within 2 feet below finished grade in proposed pavement or boardwalk areas. Common Fill shall contain less than approximately 20 percent fines and be free of organics, contamination (including metals, VOCs, SVOCs, etc.), and other deleterious materials. The existing fill at the site may be suitable for reuse as Common Fill provided it can be moisture conditioned and compacted to the required degree. Moisture conditioning, if required, could consist of drying by scarification and frequent mixing in thin lifts during warm, dry conditions.

Crushed stone used as bedding for structures or drainage shall be wrapped in filter fabric, consisting of a woven geosynthetic with an AOS of #70 to #100 sieve, and a minimum puncture resistance of at least 120 pounds (such as Mirafi FW700 or equivalent).

Fill should be placed in lifts no greater than 9 inches in loose (uncompacted) thickness. In confined areas and where only hand-guided compaction equipment can be used, lift thicknesses should be reduced to not more than 6 inches. Earthwork observation and quality control testing of fill and backfill densities is critical throughout construction. Fill material shall be properly moisture controlled, and should be compacted to at least 95 percent below pavements and structures, and 92 percent in landscape areas, relative to ASTM D1557.

The contractor should not place backfill or fill material on subgrade surfaces that are muddy, frozen, or contain frost/ice. Frozen soils are not suitable fill sources.

4.5 Pavement Subgrade Preparation and Base Materials

Subgrades should be prepared as recommended above. Prior to placing granular base material, the prepared subgrade should be proof rolled using a vibratory drum roller or fully loaded 10-wheeled dump truck. We should be contacted to observe proof rolling and identify soft, disturbed, or yielding materials. Unsuitable areas should be repaired by scarifying and compacting or by over-excavation and replacement with a well graded, angular crushed stone (or gravel subbase material) compacted as recommended for Structural Fill. If a stabilization geosynthetic is required, we recommend a woven geosynthetic with an AOS of #70 to #100 sieve, and a minimum puncture resistance of 120 pounds (such as Mirafi FW700 or equivalent).

Granular base material should be angular crushed stone or stone conforming to MassDOT Material Specification M2.01.7 (Dense-graded Crushed Stone). Granular base material should be placed in maximum 10 inch thick lifts (measured prior to compaction) and compacted to at least 95 percent of maximum dry density as determined by ASTM D1557 (modified proctor).

5.0 LIMITATIONS

5.1 Observation of Construction

Satisfactory earthwork and foundation performance depends to a large degree on the quality of construction. Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions often requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated. In addition, sufficient monitoring of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications.

5.2 Variations of Subsurface Conditions and Use of Report

We have prepared this report for use by the City of Peabody and members of the design and construction team for the subject project and site, only. The data and report can be used for estimating purposes, but our report, conclusions, and interpretations should not be construed as a warranty of the subsurface conditions and are not applicable to other sites.

Subsurface explorations indicate soil conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect subsurface conditions that may exist between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, reevaluation will be necessary.

Site improvement plans were not finalized at the time this report was prepared. If changes are made in site grades, configuration or design loads, the conclusions and recommendations may not be applicable. If design changes are made, we should be retained to review our conclusions and recommendations and provide a written evaluation or modification.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, expressed or implied, are given.

For important information on the use of this report, please refer to ***Appendix F*** for the document titled "***Important Information about This Geotechnical-Engineering Report***".

TABLE 1 - SUMMARY OF EXISTING CONDITIONS

Property/Location	Approximate Station Boundaries	Approximate Ground Surface Elevations at Back of Canal Wall (Feet NAVD88)	Surface Conditions
13 Wallis St	0+00 to 02+80	12 to 13	The property is currently a vacant lot with debris, gravel, and vegetation. The area adjacent to the canal is covered with trees and overgrown vegetation.
24 Caller St	02+80 to 08+16	11 to 12	The property is currently developed with several warehouse buildings, a gravel lot used for vehicle and drum storage, and an asphalt concrete paved driveway. Trees and vegetation line the edge of the canal wall.
Caller Street Bridge	08+16 to 08+65	12	Asphalt concrete paved roadway bridge with concrete sidewalks.
21 Caller St	08+65 to 10+55	10 to 12	The property is currently developed with a three story commercial and residential building with a paved parking lot. The parking lot is retained by an approximately 3 to 6 foot high masonry retaining wall which runs parallel to the south wall of the canal. The area in between the retaining wall and the canal is about 10 feet wide, and is covered with trees, vegetation, and debris.
18 Howley St	10+55 to 11+49	8 to 9	The property is currently vacant. The area adjacent to the canal is covered with trees, vegetation, and debris including a granite rock pile.
Strongwater Brook Canal	11+49 to 11+57	8	Approximately 6 to 8-foot-wide canal with stacked masonry sidewalls. Water flows south to north into the North River Canal. An abandoned railroad bridge crosses the Strongwater Brook Canal, and is centered about 6 feet behind the south wall of the North River Canal.
166R Main St	11+49 to 14+25	7 to 9	The property is currently vacant and generally grass-covered. Asphalt pavement, rail ties, and old building foundations (raised slabs) exist close to the canal wall and east of Strongwater Brook.

TABLE 2 - SUMMARY OF SUBSURFACE CONDITIONS

TABLE 2A - TEST BORINGS

Property	Exploration ID	Date of Exploration	Depth to Bottom of Fill (ft) (2)	Depth to Bottom of Organics (ft) (2)	Bottom of Exploration Depth (ft)	Approximate Groundwater Depth (ft)(3)
13 Wallis St	B-1 (GSI)(1)	11/4/2002	10	N/A	40	8
	B-2 (GSI)(1)	10/31/2002	10	N/A	25	8
	B-3 (GSI)(1)	10/31/2002	13	N/A	22	10.5
	B-4 (GSI)(1)	11/1/2002	14	N/A	32	8
	B-5 (GSI)(1)	10/31/2002	10	N/A	17	10
	B-6 (GSI)(1)	10/31/2002	10	N/A	22	8.5
	WS-1	3/21/2007	15	N/A	21	Not Reported
	B-101	4/14/2020	5.5	8.5	29.5	4.5
	B-102	4/14/2020	7	10.5	40.5	5
24 Caller St	WS-4	3/23/2007	10	N/A	41	Not Reported
	B-1	11/8/2018	8	14	22	Not Reported
	B-2	11/8/2018	8	N/A	21	Not Reported
	B-3	11/5/2018	7	8.5	21	Not Reported
21 Caller St	B-4	11/8/2018	6	8	21	Not Reported
18 Howley St	WS-3	3/22/2007	N/A	N/A	41	Not Reported
166R Main St	WS-2	3/22/2007	10	15	41	Not Reported
	B-5	11/9/2018	6.5	8.5	21	Not Reported
	B-6	11/9/2018	4	12	21	Not Reported

NOTES:

(1) Subsurface conditions reported herein are based on soil boring logs prepared by Geotechnical Services, Inc. Soil samples have not been reviewed by Weston & Sampson.

(2) N/A indicates stratum was not observed/encountered at the boring location

(3) Depth to groundwater is not reported for borings advanced using drive and wash method, which introduces water into the borehole during drilling.

TABLE 2 - SUMMARY OF SUBSURFACE CONDITIONS

TABLE 2B - TEST PITS

Property	Exploration ID	Date of Exploration	Bottom of Exploration Depth (ft)	Approximate Groundwater Depth (ft)	Comments
13 Wallis St	TP-5 (2007)	3/8/2007	6.1	6	Vertical, mortared, granite block wall observed in the test pit.
24 Caller St	TP-1	11/7/2018	6.2	5.8	34-inch thick, boulder wall observed to bottom of test pit. Mortar observered at canal side, but no mortar visible at back of wall.
	TP-2	11/7/2018	6	5.3	17 to 21-inch thick CIP concrete vertical wall observed to 4 feet. Below 4 feet, wall consists of dry-stacked boulders up to 34-inch diameter.
	TP-3	11/6/2018	5.7	5.3	21-inch thick, vertical, CIP concrete wall encountered to bottom of test pit.
21 Caller St	TP-4	11/6/2018	6.8	5.7	16 to 21-inch thick, vertical, mortared, stone wall observed to bottom of test pit.
	TP-5	11/6/2018	5.6	4.6	20-inch thick vertical, dry-stacked, granite block wall observed to bottom of test pit.
	TP-6	11/6/2018	5.6	5.3	No wall structure visible in test pit.

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No.	Date	Dr.By	Ck.By	App.By	Description

A P P R O V E D

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

RIVERWALK ALONG NORTH RIVER CANAL

Figure 1 - Locus Plan

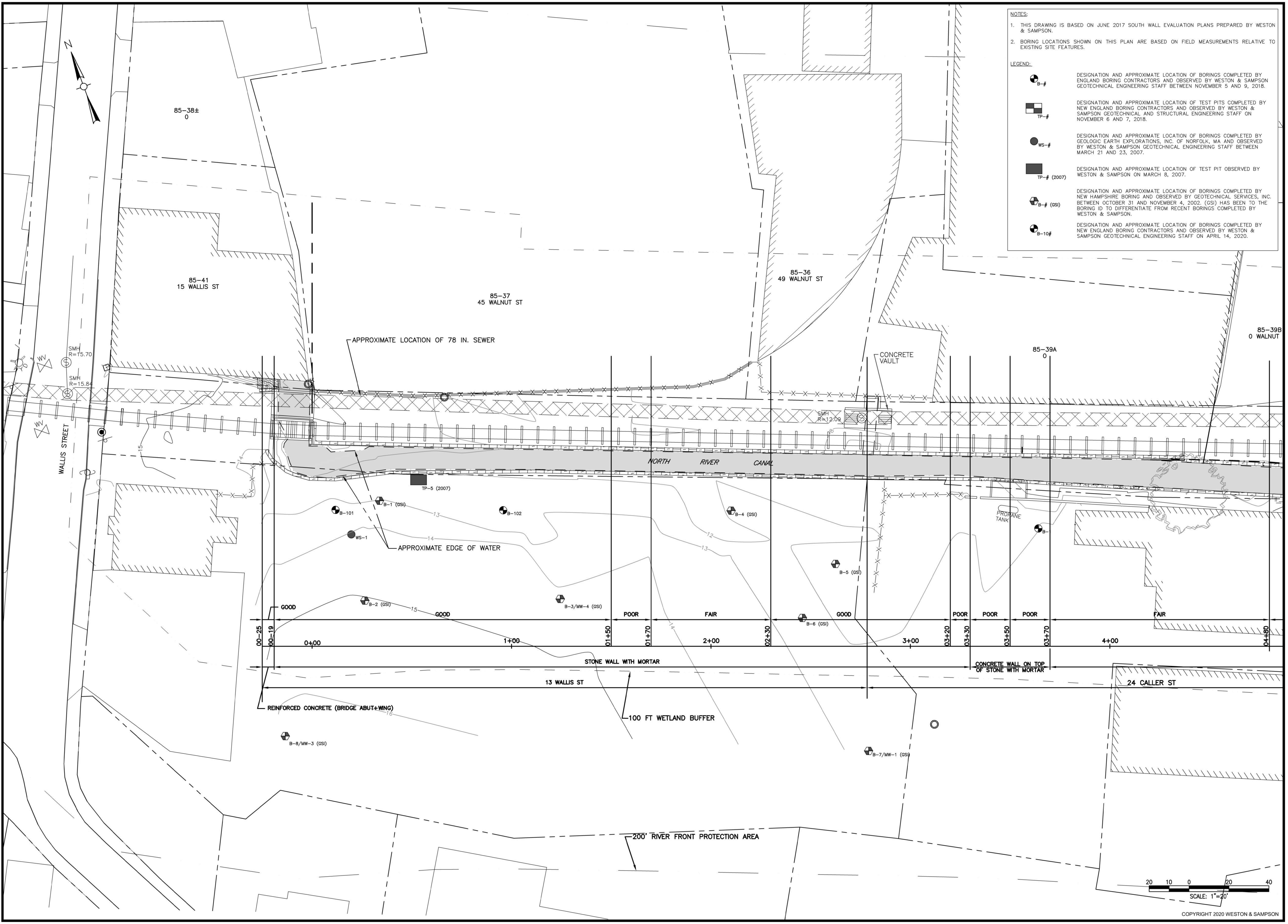
SCALE:	CONTRACT:	JOB NO.	DR.BY	DSN.BY	CHK.BY	APP.BY
AS NOTED	1	2180658	-	-	-	-

CADD NO.

FILE NO.

S-1

SHEET 1 OF 1



NOTES:

1. THIS DRAWING IS BASED ON JUNE 2017 SOUTH WALL EVALUATION PLANS PREPARED BY WESTON & SAMPSON.
2. BORING LOCATIONS SHOWN ON THIS PLAN ARE BASED ON FIELD MEASUREMENTS RELATIVE TO EXISTING SITE FEATURES.

LEGEND:

● B-#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF BETWEEN NOVEMBER 5 AND 9, 2018.
▨ TP-#	DESIGNATION AND APPROXIMATE LOCATION OF TEST PITS COMPLETED BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL AND STRUCTURAL ENGINEERING STAFF ON NOVEMBER 6 AND 7, 2018.
● WS-#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY GEOLOGIC EARTH EXPLORATIONS, INC. OF NORFOLK, MA AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF BETWEEN MARCH 21 AND 23, 2007.
■ TP-# (2007)	DESIGNATION AND APPROXIMATE LOCATION OF TEST PIT OBSERVED BY WESTON & SAMPSON ON MARCH 8, 2007.
● B-# (GSI)	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY NEW HAMPSHIRE BORING AND OBSERVED BY GEOTECHNICAL SERVICES, INC. BETWEEN OCTOBER 31 AND NOVEMBER 4, 2002. (GSI) HAS BEEN TO THE BORING ID TO DIFFERENTIATE FROM RECENT BORINGS COMPLETED BY WESTON & SAMPSON.
● B-10#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF ON APRIL 14, 2020.

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No.	Date	Dr.By	Ck.By	App.By	Description

A P P R O V E D

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

RIVERWALK ALONG NORTH RIVER CANAL

Figure 2 - Site Plan STA. 00-25 to 04+80

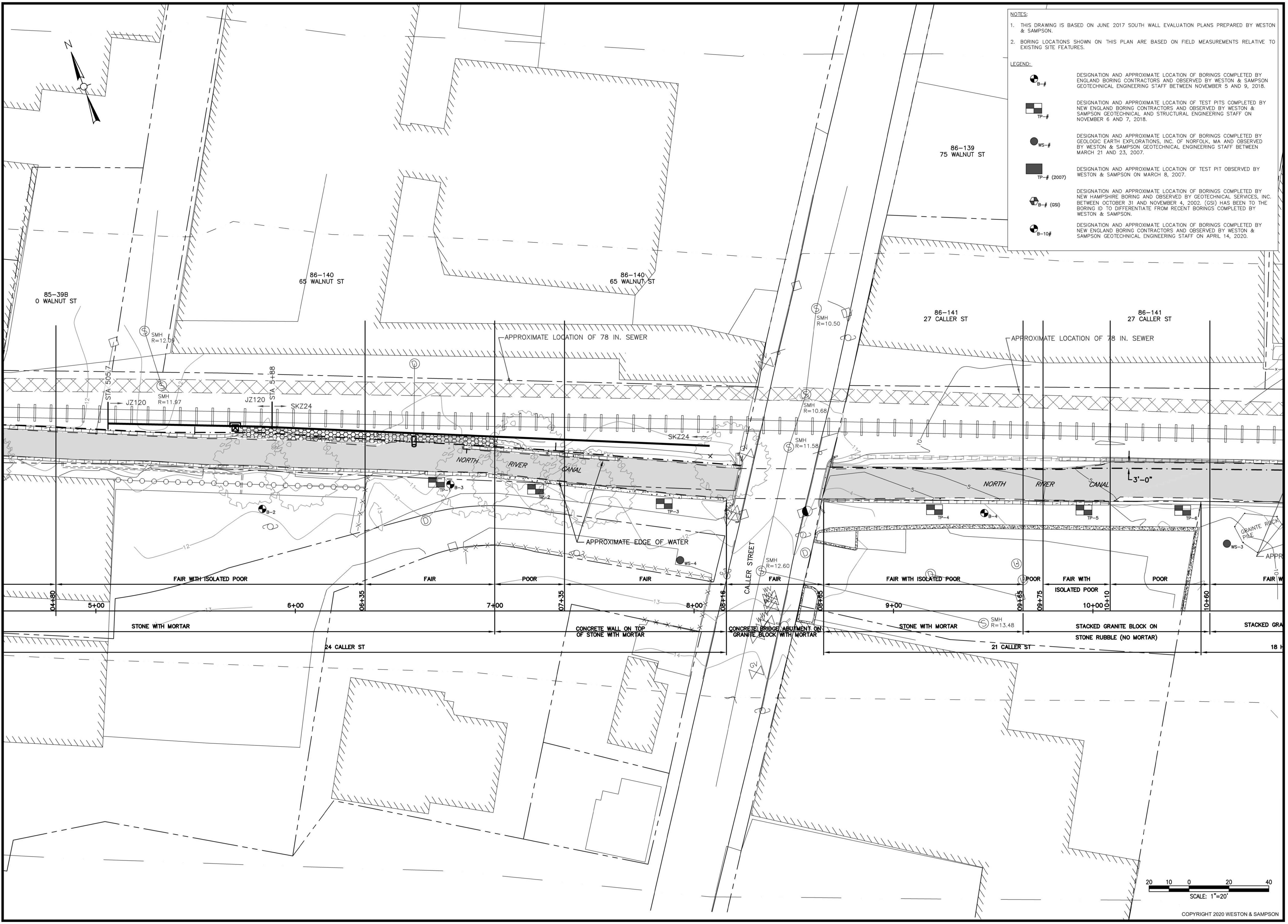
SCALE:	CONTRACT:	JOB NO.	DR.BY	DSN.BY	CHK.BY	APP.BY
AS NOTED	1	2180658	-	-	-	-

CADD NO.

FILE NO.

S-2

SHEET 1 OF 3



NOTES:

1. THIS DRAWING IS BASED ON JUNE 2017 SOUTH WALL EVALUATION PLANS PREPARED BY WESTON & SAMPSON.
2. BORING LOCATIONS SHOWN ON THIS PLAN ARE BASED ON FIELD MEASUREMENTS RELATIVE TO EXISTING SITE FEATURES.

LEGEND:

B-#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF BETWEEN NOVEMBER 5 AND 9, 2018.
TP-#	DESIGNATION AND APPROXIMATE LOCATION OF TEST PITS COMPLETED BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL AND STRUCTURAL ENGINEERING STAFF ON NOVEMBER 6 AND 7, 2018.
● WS-#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY GEOLOGIC EARTH EXPLORATIONS, INC. OF NORFOLK, MA AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF BETWEEN MARCH 21 AND 23, 2007.
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B-10#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF ON APRIL 14, 2020.

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No.	Date	Dr.By	Ck.By	App.By	Description

A P P R O V E D

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

RIVERWALK ALONG NORTH RIVER CANAL

Figure 2 - Site Plan STA. 04-80 to 10+60

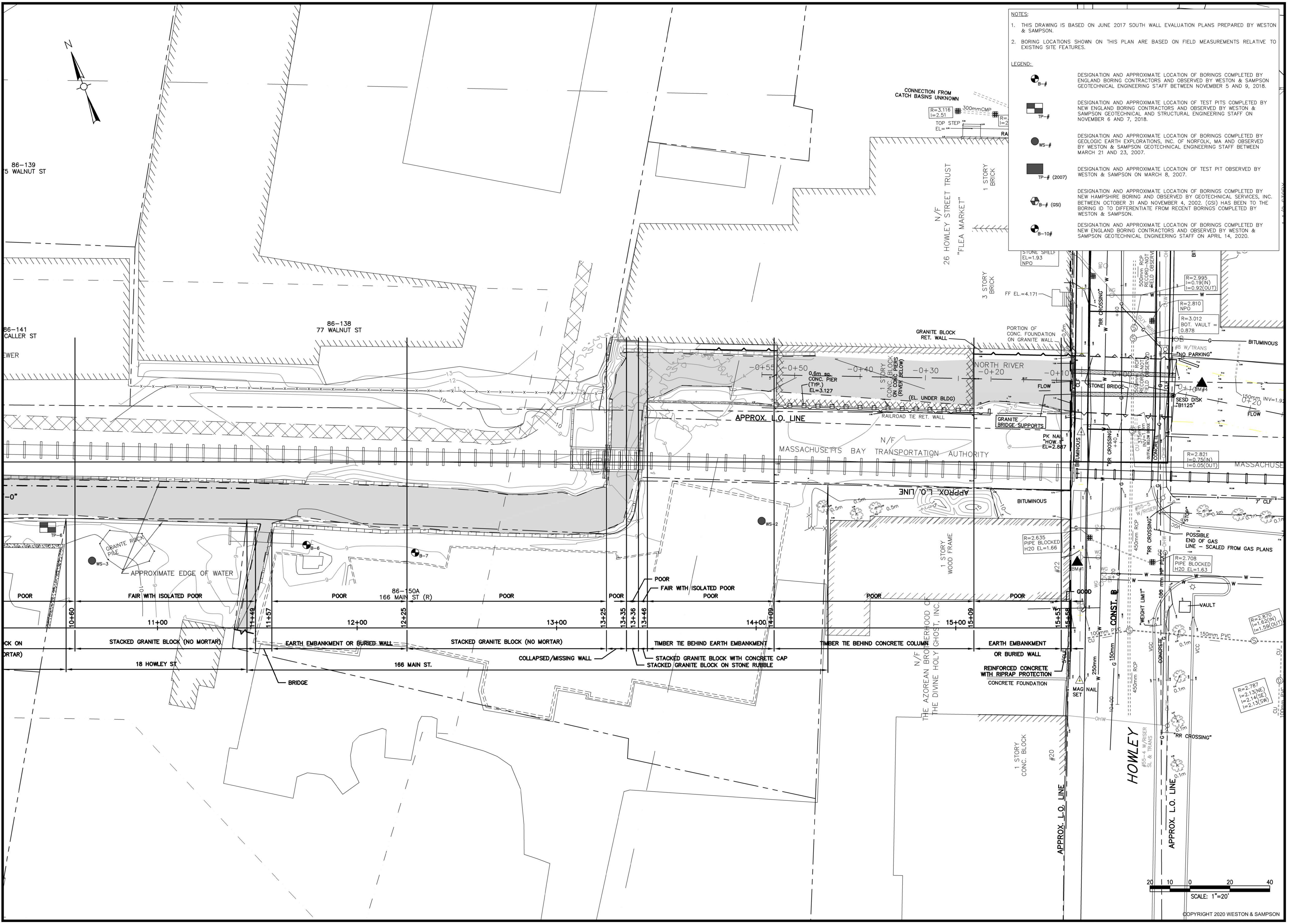
SCALE:	CONTRACT:	JOB NO.	DR.BY	DSN.BY	CHK.BY	APP.BY
AS NOTED	1	2180658	-	-	-	-

CADD NO.

FILE NO.

S-3

SHEET 2 OF 3



NOTES:

1. THIS DRAWING IS BASED ON JUNE 2017 SOUTH WALL EVALUATION PLANS PREPARED BY WESTON & SAMPSON.
2. BORING LOCATIONS SHOWN ON THIS PLAN ARE BASED ON FIELD MEASUREMENTS RELATIVE TO EXISTING SITE FEATURES.

LEGEND:

B-#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF BETWEEN NOVEMBER 5 AND 9, 2018.
TP-#	DESIGNATION AND APPROXIMATE LOCATION OF TEST PITS COMPLETED BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL AND STRUCTURAL ENGINEERING STAFF ON NOVEMBER 6 AND 7, 2018.
● WS-#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY GEOLOGIC EARTH EXPLORATIONS, INC. OF NORFOLK, MA AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF BETWEEN MARCH 21 AND 23, 2007.
■ TP-# (2007)	DESIGNATION AND APPROXIMATE LOCATION OF TEST PIT OBSERVED BY WESTON & SAMPSON ON MARCH 8, 2007.
B-# (GSI)	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY NEW HAMPSHIRE BORING AND OBSERVED BY GEOTECHNICAL SERVICES, INC. BETWEEN OCTOBER 31 AND NOVEMBER 4, 2002. (GSI) HAS BEEN TO THE BORING ID TO DIFFERENTIATE FROM RECENT BORINGS COMPLETED BY WESTON & SAMPSON.
B-10#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF ON APRIL 14, 2020.

Weston & Sampson
Weston & Sampson Engineers, Inc.
55 Walkers Brook Dr #100, Reading, MA 01867
(978) 532-1900 800.SAMPSON
www.westonandsampson.com

No.	Date	Dr.By	Ck.By	App.By	Description
		A	P	P	R O V E D

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

RIVERWALK ALONG NORTH RIVER CANAL

Figure 2 - Site Plan STA. 10-60 to 15+58

CADD NO.	SCALE:	CONTRACT:	JOB NO.	DR.BY	DSN.BY	CHK.BY	APP.BY
	AS NOTED	1	2180658	-	-	-	-

FILE NO.

S-4

SHEET 3 OF 3

APPENDIX A

Boring Logs from 2002 Explorations by Geotechnical Services, Inc.

13 Wallis St

PROJECT: 9 Wallis Street
LOCATION: Peabody, MA
PROJECT NO.: 202367

BORING CONTRACTOR: New Hampshire Boring, Inc.
FOREMAN: Sam Shaw
RIG: Mobile B-59

TEST BORING LOG

GEOTECHNICAL SERVICES, INC.

18 Cote Avenue
Goffstown, NH 03045

BORING NO: B-1 B-1(GSI)
SHEET: 1 of 2
START: November 4, 2002
FINISH: November 4, 2002
PREPARED BY: B. Levesque
CHECKED BY: H. Wetherbee, PE

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HAS		SS	
SIZE ID (IN)	2 3/4		2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE November 4, 2002
DEPTH (FT) 8 ft
CASING AT (FT) 40 ft
TIME (HR) Upon Completion
☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ INSTRUMENTATION

DEPTH	SAMPLE DATA				SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)
	SAMPLE NUMBER	DEPTH (ft)	RECOVERY (IN)	SPT (BLOWS/ 6 IN.)	
0	S-1	0-2	17	6-3	Black-brown, loose to med. dense f-m SAND, little Silt, Organics (roots, odor), little-trace f-c Gravel. (TOPSOIL/FILL)
1				2-2	
2					
3					
4					
5	S-2	5-7	13	1-1	Black to dk.gray, very loose f-c SAND, little Silt, little Organics, trace Debris (glass) (FILL)
6				1-1	
7					
8					
9					*fill*
10	S-3	10-12	13	2-1	Dk. brown, loose f-c SAND, little-trace Silt, trace f Gravel. *natural*
11				2-1	
12					
13					
14					
15	S-4	15-17	11	1-3	Lt. brown, loose f SAND, little Silt, trace f Gravel. (OUTWASH)
16				1-2	
17					
18					
19					
20	S-5	20-22	19	3-5	Orange-brown, f SAND, little Silt, trace f. Gravel. (OUTWASH)
21				7-9	
22					
23					
24					
25	S-6	25-27	11	5-9	Lt brown f SAND, little Silt, trace f Gravel. (OUTWASH)
26				12-13	

SAMPLE IDENTIFICATION
S SPLIT SPOON
U UNDISTURBED
OR OPEN END ROD
C ROCK CORE

COHESIVE SOILS (Blows per ft.)
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30: Very Stiff
Over 30: Hard

GRANULAR SOILS (Blows per ft.)
0 to 4: Very Loose
4 to 10: Loose
10 to 30: Medium Dense
30 to 50: Dense
Over 50: Very Dense

PROPORTIONS USED
trace (0-10%)
little (10-20%)
some (20-35%)
and (35-50%)

COHESIVE SOIL THREAD
1/4 = Clayey Silt
1/8 = Silt & Clay
1/16 = Clay & Silt
1/32 = Silty Clay
1/64 = Clay

Standard Penetration Test (SPT) = 140# hammer falling 30", Blows are per 6" taken with an 18" long x 2" I.D. split spoon sampler in accordance with ASTM D 1586, unless otherwise noted.

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

NOTES:

13 Wallis St

PROJECT: 9 Wallis Street
LOCATION: Peabody, MA
PROJECT NO.: 202367

BORING CONTRACTOR: New Hampshire Boring, Inc.
FOREMAN: Sam Shaw
RIG: Mobile B-59

TEST BORING LOG

GEOTECHNICAL SERVICES, INC.
18 Cote Avenue
Goffstown, NH 03045

BORING NO: B-1 B-1(GSI)
SHEET: 2 of 2
START: November 4, 2002
FINISH: November 4, 2002

PREPARED BY: B. Levesque
CHECKED BY: H. Wetherbee, PE

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HAS		SS	
SIZE ID (IN)	2 3/4		2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	November 4, 2002
DEPTH (FT)	8 ft
CASING AT (FT)	40 ft
TIME (HR)	Upon Completion

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ INSTRUMENTATION

DEPTH	SAMPLE DATA				SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)
	SAMPLE NUMBER	DEPTH (ft)	RECOVERY (IN)	SPT (BLOWS/ 6 IN.)	
27					
28					
29					
30	S-7	30-32	7	17-28	
31				32-33	
32					— Continued augering to find refusal.
33					
34					
35					
36					
37					
38					
39					
40					— Auger refusal. B.O.E. @ 40 ft
41					
42					
43					
44					
45					
46					
47					
48					
49					
50					
51					
52					
53					

SAMPLE IDENTIFICATION	COHESIVE SOILS (Blows per ft.)	GRANULAR SOILS (Blows per ft.)	PROPORTIONS USED	COHESIVE SOIL THREAD
S SPLIT SPOON	0 to 2: Very Soft	0 to 4: Very Loose	trace (0-10%)	1/4 = Clayey Silt
U UNDISTURBED	2 to 4: Soft	4 to 10: Loose	little (10-20%)	1/8 = Silt & Clay
OR OPEN END ROD	4 to 8: Medium Stiff	10 to 30: Medium Dense	some (20-35%)	1/16 = Clay & Silt
C ROCK CORE	8 to 15: Stiff	30 to 50: Dense	and (35-50%)	1/32 = Silty Clay
	15 to 30: Very Stiff	Over 50: Very Dense		1/64 = Clay
	Over 30: Hard			

Standard Penetration Test (SPT) = 140# hammer falling 30", Blows are per 6" taken with an 18" long x 2" I.D. split spoon sampler in accordance with ASTM D 1586, unless otherwise noted.

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

NOTES:

13 Wallis St

PROJECT: 9 Wallis Street
LOCATION: Peabody, MA
PROJECT NO.: 202367

BORING CONTRACTOR: New Hampshire Boring, Inc.
FOREMAN: Sam Shaw
RIG: Mobile B-59

TEST BORING LOG

GEOTECHNICAL SERVICES, INC.

18 Cote Avenue
Goffstown, NH 03045

BORING NO: B-2 B-2(GSI)
SHEET: 1 of 1
START: October 31, 2002
FINISH: October 31, 2002

PREPARED BY: B. Levesque
CHECKED BY: H. Wetherbee, PE

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HAS		SS	
SIZE ID (IN)	2 3/4		2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	October 31, 2002
DEPTH (FT)	9 ft
CASING AT (FT)	20 ft
TIME (HR)	Upon Completion

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ INSTRUMENTATION

DEPTH	SAMPLE DATA				SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)
	SAMPLE NUMBER	DEPTH (ft)	RECOVERY (IN)	SPT (BLOWS/ 6 IN.)	
0	S-1	0-2	5	3-4	Brown, med. dense f-m SAND, little Silt, little to trace Organics (roots, odor), trace f-c Gravel. (TOPSOIL/FILL)
1				7-7	
2					
3					
4					
5	S-2	5-7	8	2-2	Brown, loose f-m SAND, little Silt, trace Organcis, trace Debris (concrete, ash). (FILL)
6				3-4	
7					
8					
9					fill
10	S-3	10-12	9	5-5	Black-brown, med. dense f-c SAND, little-trace Silt, little-trace f-c Gravel, trace Organics (peat fibers, silt). natural
11				6-6	
12					(OUTWASH)
13					
14					
15	S-4	15-17	8.5	3-4	Black-brown , loose f-c SAND, little Silt, little f Gravel.
16				3-2	
17					(OUTWASH)
18					
19					— 2 ft of blow-in @ 20 ft. Drove spoon an additional 2 ft. —
20	S-5	20-22	17	6-8	Tan-orange, med. dense f-m SAND, trace Silt, trace f Gravel.
21				13-15	
22					— Attempted to continue drilling and sampling. —
23					— Cuttings same as for S-5 —
24					Driller reports 5 to 7 ft of blow –in at 25 ft. Boring terminated.—
25					B.O.E. @ 25 ft.
26					

SAMPLE IDENTIFICATION	COHESIVE SOILS (Blows per ft.)	GRANULAR SOILS (Blows per ft.)	PROPORTIONS USED	COHESIVE SOIL THREAD
	0 to 2: Very Soft	0 to 4: Very Loose	trace (0-10%)	1/4 = Clayey Silt
S SPLIT SPOON	2 to 4: Soft	4 to 10: Loose	little (10-20%)	1/8 = Silt & Clay
U UNDISTURBED	4 to 8: Medium Stiff	10 to 30: Medium Dense	some (20-35%)	1/16 = Clay & Silt
OR OPEN END ROD	8 to 15: Stiff	30 to 50: Dense	and (35-50%)	1/32 = Silty Clay
C ROCK CORE	15 to 30: Very Stiff	Over 50: Very Dense		1/64 = Clay
	Over 30: Hard			

Standard Penetration Test (SPT) = 140# hammer falling 30", Blows are per 6" taken with an 18" long x 2" I.D. split spoon sampler in accordance with ASTM D 1586, unless otherwise noted.

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

NOTES:

13 Wallis St

TEST BORING LOG

GEOTECHNICAL SERVICES, INC.
18 Cote Avenue
Goffstown, NH 03045

PROJECT: 9 Wallis Street
LOCATION: Peabody, MA
PROJECT NO.: 202367

BORING CONTRACTOR: New Hampshire Boring, Inc.
FOREMAN: Sam Shaw
RIG: Mobile B-59

BORING NO: B-3 B-3(GSI)
SHEET: 1 of 1
START: October 31, 2002
FINISH: November 1, 2002

PREPARED BY: B. Levesque
CHECKED BY: H. Wetherbee, PE

EQUIPMENT	**AUGER**	**CASING**	**SAMPLER**	**CORE BAR**
TYPE	HAS		SS	
SIZE ID (IN)	2 3/4		2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	November 1, 2002
DEPTH (FT)	10.5 ft
CASING AT (FT)	20 ft
TIME (HR)	Upon Completion

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
X MONITORING WELL INSTALLED
☐ INSTRUMENTATION

DEPTH	SAMPLE DATA				SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)	
	SAMPLE NUMBER	DEPTH (ft)	RECOVERY (IN)	SPT (BLOWS/ 6 IN.)		
0	S-1	0-2	5	3-5	Black-brown, loose f-m SAND, little Silt, little Organics (roots, odor), little trace f-c Gravel.	(TOPSOIL/FILL)
1				2-2		
2						
3						
4						
5	S-2	5-7	4	1-3	Black, very loose ORGANICS (peat fibers, silt) little f-m Sand, little-trace Silt, trace Debris (brick).	(FILL)
6				1-1		
7						
8						
9						
10	S-3A	10-11	6	2-3	Dk. red-brown, very loose f-c SAND, little Silt, trace Debris (brick, glass).	(FILL)
11	S-3B	11-12	5	5-6	Black, loose ORGANICS (peat fibers, silt) little f-m Sand, little-trace Silt, trace Debris (brick).	(FILL)
12						
13						*fill*
14						*natural*
15	S-4	15-17	19	3-5	Brown to orange-brown, loose f-c SAND, little Silt, trace f Gravel.	(OUTWASH)
16				5-3		
17						
18						
19						
20	S-5	20-22	11	2-3	Orange-brown, loose f-c SAND, little Silt, trace f Gravel.	(OUTWASH)
21				3-3		
22					B.O.E. @ 22 ft.	
23						
24						
25						
26						

SAMPLE IDENTIFICATION	COHESIVE SOILS (Blows per ft.)	GRANULAR SOILS (Blows per ft.)	PROPORTIONS USED	COHESIVE SOIL THREAD
S SPLIT SPOON	0 to 2: Very Soft	0 to 4: Very Loose	trace (0-10%)	1/4 = Clayey Silt
U UNDISTURBED OR OPEN END ROD	2 to 4: Soft	4 to 10: Loose	little (10-20%)	1/8 = Silt & Clay
C ROCK CORE	4 to 8: Medium Stiff	10 to 30: Medium Dense	some (20-35%)	1/16 = Clay & Silt
	8 to 15: Stiff	30 to 50: Dense	and (35-50%)	1/32 = Silty Clay
	15 to 30: Very Stiff	Over 50: Very Dense		1/64 = Clay
	Over 30: Hard			

Standard Penetration Test (SPT) = 140# hammer falling 30", Blows are per 6" taken with an 18" long x 2" I.D. split spoon sampler in accordance with ASTM D 1586, unless otherwise noted.

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

NOTES:

13 Wallis St

PROJECT: 9 Wallis Street
LOCATION: Peabody, MA
PROJECT NO.: 202367

BORING CONTRACTOR: New Hampshire Boring, Inc.
FOREMAN: Sam Shaw
RIG: Mobile B-59

TEST BORING LOG

GEOTECHNICAL SERVICES, INC.

18 Cote Avenue
Goffstown, NH 03045

BORING NO: B-4 B-4(GSI)
SHEET: 1 of 1
START: November 1, 2002
FINISH: November 4, 2002

PREPARED BY: B. Levesque
CHECKED BY: H. Wetherbee, PE

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HAS		SS	
SIZE ID (IN)	2 3/4		2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE November 4, 2002
DEPTH (FT) 8 ft
CASING AT (FT) 20 ft
TIME (HR) Upon Completion

☐ No GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ INSTRUMENTATION

DEPTH	SAMPLE DATA				SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)
	SAMPLE NUMBER	DEPTH (ft)	RECOVERY (IN)	SPT (BLOWS/ 6 IN.)	
0	S-1	0-2	5	2-5	Black-brown, med. dense f-m SAND, little Silt, little Organics (roots, odor), little trace f-c Gravel. (TOPSOIL/FILL)
1				2-2	
2					
3					
4					
5	S-2	5-7	11	2-1	Black, very loose ORGANICS (peat fibers, silt) little f-m Sand, little-trace Silt, trace Debris (brick). (FILL)
6				1-3	
7					
8					
9					
10	S-3	10-12	6	2-2	Black, loose f SAND, some Silt, little Organics (peat fibers, silt), trace Debris (brick, concrete). (FILL)
11				5-2	
12					
13					*fill*
14					*natural*
15	S-4	15-17	20	6-10	Tan, med. dense f-c SAND, little Silt, little f Gravel. (OUTWASH)
16				13-6	
17					
18					
19					
20	S-5	20-22	19	10-7	Tan, med. dense f-m SAND, little Silt, trace f Gravel. (OUTWASH)
21				6-11	
22					
23					
24					
25	S-6	25-27	12	6-8	Tan, med. dense f-c SAND, little-trace Silt, trace f Gravel. (OUTWASH)
26				9-7	— Auger probed to find bedrock. Auger refusal at 32 ft. B.O.E. @ 32 ft.

SAMPLE IDENTIFICATION

S SPLIT SPOON
U UNDISTURBED
OR OPEN END ROD
C ROCK CORE

COHESIVE SOILS (Blows per ft.)
0 to 2: Very Soft
2 to 4: Soft
4 to 8: Medium Stiff
8 to 15: Stiff
15 to 30: Very Stiff
Over 30: Hard

GRANULAR SOILS (Blows per ft.)
0 to 4: Very Loose
4 to 10: Loose
10 to 30: Medium Dense
30 to 50: Dense
Over 50: Very Dense

PROPORTIONS USED
trace (0-10%)
little (10-20%)
some (20-35%)
and (35-50%)

COHESIVE SOIL THREAD
1/4 = Clayey Silt
1/8 = Silt & Clay
1/16 = Clay & Silt
1/32 = Silty Clay
1/64 = Clay

Standard Penetration Test (SPT) = 140# hammer falling 30", Blows are per 6" taken with an 18" long x 2" I.D. split spoon sampler in accordance with ASTM D 1586, unless otherwise noted.

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

NOTES:

13 Wallis St

PROJECT: 9 Wallis Street
LOCATION: Peabody, MA
PROJECT NO.: 202367

BORING CONTRACTOR: New Hampshire Boring, Inc.
FOREMAN: Sam Shaw
RIG: Mobile B-59

TEST BORING LOG

GEOTECHNICAL SERVICES, INC.
18 Cote Avenue
Goffstown, NH 03045

BORING NO: B-5 (MW-2) B-5(GSI)
SHEET: 1 of 1
START: October 31, 2002
FINISH: October 31, 2002
PREPARED BY: B. Levesque
CHECKED BY: H. Wetherbee, PE

EQUIPMENT	AUGER	CASING	SAMPLER	CORE BAR
TYPE	HAS		SS	
SIZE ID (IN)	2 3/4		2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS
DATE October 31, 2002
DEPTH (FT) 10 ft
CASING AT (FT) 20 ft
TIME (HR) Upon Completion
☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
X MONITORING WELL INSTALLED
☐ INSTRUMENTATION

DEPTH	SAMPLE DATA				SOIL AND ROCK CLASSIFICATION-DESCRIPTION BURMISTER SYSTEM (SOIL) U.S. CORPS OF ENGINEERS SYSTEM (ROCK)	
	SAMPLE NUMBER	DEPTH (ft)	RECOVERY (IN)	SPT (BLOWS/ 6 IN.)		
0	S-1	0-2	3	1-2	Black-brown, loose f-m SAND, little Silt, little Organics (roots, odor), little trace f-c Gravel.	(TOPSOIL/FILL)
1				1-2		
2						
3						
4						
5	S-2	5-7	7	5-7	Black to dk.gray f-c SAND, little Silt, trace Organics, trace Debris (glass)	(FILL)
6				2-2		
7						
8						
9						*fill*
10	S-3	10-12	17	7-7	Brown, med. dense f-c SAND, trace Silt, trace f Gravel.	*natural*
11				3-2		(OUTWASH)
12						
13						
14						
15	S-4	15-17	22	3-5	Orange-brown, loose f-m SAND, little Silt, trace f Gravel.	(OUTWASH)
16				3-3		
17					B.O.E. @ 17 ft.	
18						
19						
20						
21						
22						
23						
24						
25						
26						

SAMPLE IDENTIFICATION	COHESIVE SOILS (Blows per ft.)	GRANULAR SOILS (Blows per ft.)	PROPORTIONS USED	COHESIVE SOIL THREAD
	0 to 2: Very Soft	0 to 4: Very Loose	trace (0-10%)	1/4 = Clayey Silt
S SPLIT SPOON	2 to 4: Soft	4 to 10: Loose	little (10-20%)	1/8 = Silt & Clay
U UNDISTURBED	4 to 8: Medium Stiff	10 to 30: Medium Dense	some (20-35%)	1/16 = Clay & Silt
OR OPEN END ROD	8 to 15: Stiff	30 to 50: Dense	and (35-50%)	1/32 = Silty Clay
C ROCK CORE	15 to 30: Very Stiff	Over 50: Very Dense		1/64 = Clay
	Over 30: Hard			

Standard Penetration Test (SPT) = 140# hammer falling 30", Blows are per 6" taken with an 18" long x 2" I.D. split spoon sampler in accordance with ASTM D 1586, unless otherwise noted.

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

NOTES:

13 Wallis St

PROJECT: 9 Wallis Street **LOCATION:** Peabody, MA **PROJECT NO.:** 202367 **BORING CONTRACTOR:** New Hampshire Boring, Inc. **FOREMAN:** Sam Shaw **RIG:** Mobile B-59	**TEST BORING LOG** **GEOTECHNICAL SERVICES, INC.** 18 Cote Avenue Goffstown, NH 03045	**BORING NO:** B-6 B-6(GSI) **SHEET:** 1 of 1 **START:** October 31, 2002 **FINISH:** October 31, 2002 **PREPARED BY:** B. Levesque **CHECKED BY:** H. Wetherbee, PE

EQUIPMENT	**AUGER**	**CASING**	**SAMPLER**	**CORE BAR**
TYPE	HAS		SS	
SIZE ID (IN)	2 3/4		2.0	
HAMMER WT (LB)			140	BIT
HAMMER FALL (IN)			30	

GROUNDWATER OBSERVATIONS

DATE	October 31, 2002
DEPTH (FT)	8.5 ft
CASING AT (FT)	20 ft
TIME (HR)	Upon Completion

☐ NO GROUNDWATER ENCOUNTERED
☐ LIQUID INTRODUCED DURING DRILLING

☐ FIELD TESTING
☐ LABORATORY TESTING
☐ MONITORING WELL INSTALLED
☐ INSTRUMENTATION

DEPTH	**SAMPLE DATA**				**SOIL AND ROCK CLASSIFICATION-DESCRIPTION** **BURMISTER SYSTEM (SOIL)** **U.S. CORPS OF ENGINEERS SYSTEM (ROCK)**
	SAMPLE NUMBER	**DEPTH (ft)**	**RECOVERY (IN)**	**SPT (BLOWS/ 6 IN.)**	
0	S-1	0-2	15	3-7	Black-brown, loose to med. dense f-m SAND, little Silt, Organics (roots, odor), little-trace f-c Gravel. (TOPSOIL/FILL)
1				3-2	
2					
3					
4					
5	S-2	5-7	NR	1-1	Black to dk.gray, very loose f-c SAND, littla Silt, trace Organics, trace Debris (glass) (FILL)
6				1-1	
7					
8					
9					*fill*
10	S-3	10-12	17	3-5	*natural* Dk. brown, loose f-c SAND, little-trace Silt, trace f Gravel.
11				4-5	
12					
13					
14					
15	S-4	15-17	14	3-5	Lt. brown, loose f SAND, little Silt, trace f Gravel. (OUTWASH)
16				3-3	
17					
18					
19					
20	S-5	20-22	11	3-3	Orange-brown, f SAND, little Silt, trace f. Gravel. (OUTWASH)
21				4-3	
22					B.O.E. @ 22 ft
23					
24					
25					
26					

SAMPLE IDENTIFICATION

S SPLIT SPOON
U UNDISTURBED
OR OPEN END ROD
C ROCK CORE

COHESIVE SOILS (Blows per ft.)	**GRANULAR SOILS** (Blows per ft.)	**PROPORTIONS USED**	**COHESIVE SOIL THREAD**
0 to 2: Very Soft	0 to 4: Very Loose	trace (0-10%)	1/4 = Clayey Silt
2 to 4: Soft	4 to 10: Loose	little (10-20%)	1/8 = Silt & Clay
4 to 8: Medium Stiff	10 to 30: Medium Dense	some (20-35%)	1/16 = Clay & Silt
8 to 15: Stiff	30 to 50: Dense	and (35-50%)	1/32 = Silty Clay
15 to 30: Very Stiff	Over 50: Very Dense		1/64 = Clay
Over 30: Hard			

Standard Penetration Test (SPT) = 140# hammer falling 30", Blows are per 6" taken with an 18" long x 2" I.D. split spoon sampler in accordance with ASTM D 1586, unless otherwise noted.

REMARKS: The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated on the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

NOTES:

APPENDIX B

2007 Explorations by Weston & Sampson

- Boring Logs
- Photos of TP-5(2007)

Weston & Sampson	PROJECT Peabody - North River Canal Rehabilitation Project	REPORT OF BORING No. WS-1 SHEET 1 OF 1 Project No. 2070047.B CHKD BY B. Green

BORING Co. Geologic Earth Exploration, Inc.
FOREMAN Ray / John
WSE GEOLOGIST: April Prezioso
BORING LOCATION See attached plan
GROUND SURFACE ELEV. El. 14.0 +/- DATUM NAVD 1988
DATE START 3/21/07 DATE END 3/21/07

SAMPLER: Sampler consists of 2 in. Spilt Spoon Sampler driven using a140-LB Hammer falling 30-inches
CASING: 4 in. casing driven using a 300-LB Hammer falling 24 in.
CASING SIZE: I.D. 4.00 in. Method Drive and Wash

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3/21/07	-	~3.5 ft.	-	Water introduced during drilling, may not represent stable groundwater condition

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
		S-1	24/16	0.0-2.0	2-8	NA	M.dense, dark brown, coarse to fine SAND, some coarse to fine gravel and organics, trace silt.	(1)	Fill
					16-2				
5									
		S-2	24/24	4.0-6.0	1 for 24 in.		V.soft, beige, CLAY, trace dark brown organics.	(2)	
10									
		S-3	24/6	9.0-11.0	1-1		Loose, dark brown, medium to fine SAND, trace fine gravel, wood.		
					6-8				
15									
		S-4	24/16	14.0-16.0	2-3		Loose, light brown, fine SAND, trace silt.		Sand
					3-4				
20									
		S-5	24/12	19.0-21.0	2-3		Loose, light brown, fine SAND, trace silt.	(3)	
					4-6				EOB - 21.0 ft.

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:
(1) Sample frozen
(2) Strong odor; appears to be decomposed ash.
(3) Grain size analysis conducted.

EOB at 21.0 ft. due to the availability of boring logs in the area.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. WS-1

Weston & Sampson

PROJECT
Peabody - North River Canal Rehabilitation Project

REPORT OF BORING No. WS-2
SHEET 1 OF 2
Project No. 2070047.B
CHKD BY B. Green

BORING Co. Geologic Earth Exploration, Inc.
FOREMAN Ray / Chip
WSE GEOLOGIST: April Prezioso

BORING LOCATION See attached plan
GROUND SURFACE ELEV. El. 10.0 +/- DATUM NAVD 1988
DATE START 3/22/07 3/22/07

SAMPLER: Sampler consists of 2 in. Spilt Spoon Sampler driven using a140-LB Hammer falling 30-inches
CASING: 4 in. casing driven using a 300-LB Hammer falling 24 in.
CASING SIZE: I.D. 4.00 in. Method Drive and Wash

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3/22/07	-	~3.0 ft.	-	Water introduced during drilling, may not represent stable groundwater condition

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
		S-1	24/6	0.0-2.0	43-29 116 - ref	NA	V.dense, light brown, coarse to fine SAND, some fine gravel.	(1)	Concrete, 0 to 4 in. Probable Fill
5									
		S-2	24/0	4.0-6.0	32-6 2-1		No recovery, cobble was lodged in spoon. (Stratum Loose)	(2)	
10									
		S-3	24/6	9.0-11.0	25-8 16-24		M. dense, dark grey, medium to fine SAND, some organics, little fine gravel. Cobbles observed.		Organic Soils
15									
		S-4	24/6	14.0-16.0	35-34 10-6		Dense, dark grey, coarse to fine SAND, some coarse to fine gravel. Cobbles observed.		Sand
20									
		S-5	24/22	19.0-21.0	13-9 5-7		M. stiff, light grey SILT, some Clay, little fine sand		Silt
25									
		S-6	24/24	24.0-26.0	9-12 20-30		Hard, light grey SILT, some clay, little fine sand		
30									
		S-7	24/24	29.0-31.0	8-12 3-10		V. stiff, light grey SILT, some clay, little fine sand		
35									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:

(1) 4 in. of concrete
(2) While washing, organics were observed with coarse to fine gravel
(3) Grain size analysis conducted.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. WS-2

Weston & Sampson	PROJECT Peabody - North River Canal Rehabilitation Project	REPORT OF BORING No. SHEET 2 OF 2 Project No. CHKD BY	WS-2 2070047.B B. Green

BORING Co. Geologic Earth Exploration, Inc.
FOREMAN Ray / Chip
WSE GEOLOGIST: April Prezioso
BORING LOCATION See attached plan
GROUND SURFACE ELEV. El. 10.0 +/- DATUM NAVD 1988
DATE START 3/22/07 DATE END 3/22/07

SAMPLER: Sampler consists of 2 in. Spilt Spoon Sampler driven using a140-LB Hammer falling 30-inches
CASING: 4 in. casing driven using a 300-LB Hammer falling 24 in.
CASING SIZE: I.D. 4.00 in. Method Drive and Wash

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3/22/07	-	~3.0 ft.	-	Water introduced during drilling, may not represent stable groundwater condition

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
35		S-8	24/24	34.0-36.0	4-4	NA	M. stiff, light grey SILT, some clay, little fine sand		Silt
					3-7	☒			
						☒			
						☒			
						☒			
40		S-9	24/24	39.0-41.0	5-7	☒	Stiff, light grey SILT, some clay, little fine sand	(3)	
					9-26	☒			
									EOB - 41.0 ft.

GRANULAR SOILS BLOWS/FT	GRANULAR SOILS DENSITY	COHESIVE SOILS BLOWS/FT	COHESIVE SOILS DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:

(3) Grain size analysis conducted.

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. WS-2

Weston & Sampson	PROJECT Peabody - North River Canal Rehabilitation Project	REPORT OF BORING No. WS-3 SHEET 1 OF 2 Project No. 2070047.B CHKD BY B. Green

BORING Co. Geologic Earth Exploration, Inc.
FOREMAN Ray / Chip
WSE GEOLOGIST: April Prezioso
BORING LOCATION See attached plan
GROUND SURFACE ELEV. El. 10.5 +/- DATUM NAVD 1988
DATE START 3/22/07 DATE END 3/22/07

SAMPLER: Sampler consists of 2 in. Spilt Spoon Sampler driven using a140-LB Hammer falling 30-inches
CASING: 4 in. casing driven using a 300-LB Hammer falling 24 in.
CASING SIZE: I.D. 4.00 in. Method Drive and Wash

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3/22/07	-	~4.0 ft.	-	Water introduced during drilling, may not represent stable groundwater condition

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
		S-1	24/10	0.0-2.0	11-30	NA	V.dense, dark brown, coarse to fine SAND, little coarse to fine gravel, trace silt.	(1)	Topsoil, 0 to 2.0 ft.
					33-36				
5									
		S-2	24/6	4.0-6.0	28-4		Loose, dark brown, coarse to fine SAND, some coarse to fine gravel, trace silt.		
					6-10				
10									
		S-3	24/8	9.0-11.0	20-5		Loose, dark brown, SILTY coarse to fine SAND, trace fine gravel.		
					5-6				
15									
		S-4	24/12	14.0-16.0	28-40		V.dense, tan, coarse to fine SAND, trace silt.		Sand
					54-47				
20									
		S-5	24/16	19.0-21.0	14-14		Dense, grey, fine SAND, trace silt.		
					20-25				
25									
		S-6	24/6	24.0-26.0	24-30		V. dense, gray, fine SAND, trace silt.		
					22-26				
30									
		S-7	24/22	29.0-31.0	8-10		V stiff, grey SILT, some clay, trace fine sand.		Silt
					27-25				
35									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:

(1) Ground frozen
(2) Grain size analysis conducted.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. WS-3

Weston & Sampson

PROJECT	REPORT OF BORING No.	WS-3
Peabody - North River Canal Rehabilitation Project	SHEET	2 OF 2
	Project No.	2070047.B
	CHKD BY	B. Green

BORING Co. Geologic Earth Exploration, Inc.
FOREMAN Ray / Chip
WSE GEOLOGIST: April Prezioso
BORING LOCATION See attached plan
GROUND SURFACE ELEV. El. 10.5 +/- DATUM NAVD 1988
DATE START 3/22/07 DATE END 3/22/07

SAMPLER: Sampler consists of 2 in. Spilt Spoon Sampler driven using a140-LB Hammer falling 30-inches
CASING: 4 in. casing driven using a 300-LB Hammer falling 24 in.
CASING SIZE: I.D. 4.00 in. Method Drive and Wash

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3/22/07	-	~4.0 ft.	-	Water introduced during drilling, may not represent stable groundwater condition

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	SAMPLE PEN/REC (in)	SAMPLE DEPTH (ft)	SAMPLE BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
35		S-8	24/24	34.0-36.0	8-15 23-13	NA	V. stiff, grey SILT, some clay, trace fine sand.	(2)	Silt
40		S-9	24/24	39.0-41.0	13-18 30-29		V. stiff, grey SILT, some clay, trace fine sand.		
									EOB - 41.0 ft.

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:
(2) Grain size analysis conducted.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. WS-3

Weston & Sampson	PROJECT Peabody - North River Canal Rehabilitation Project	REPORT OF BORING No. WS-4 SHEET 1 OF 2 Project No. 2070047.B CHKD BY B. Green

BORING Co. Geologic Earth Exploration, Inc.
FOREMAN Ray / Chris
WSE GEOLOGIST: April Prezioso
BORING LOCATION See attached plan
GROUND SURFACE ELEV. El. 12.5 +/- DATUM NAVD 1988
DATE START 3/23/07 DATE END 3/23/07

SAMPLER: Sampler consists of 2 in. Spilt Spoon Sampler driven using a140-LB Hammer falling 30-inches
CASING: 4 in. casing driven using a 300-LB Hammer falling 24 in.
CASING SIZE: I.D. 4.00 in. Method Drive and Wash

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3/23/07	-	~4.0 ft.	-	Water introduced during drilling, may not represent stable groundwater condition

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
		S-1	24/18	0.0-2.0	70-40	NA	V.dense, dark brown, coarse to fine SAND, trace silt.	(1)	Asphalt, 0 to 3.0 in.
					23-13				Probably Fill
5									
		S-2	24/12	4.0-6.0	8-7		M. dense, tan, coarse to fine SAND, wood.	(2)	
					6-12				
10									
		S-3	24/16	9.0-11.0	24-41		V.dense, orange/brown, coarse to fine SAND, little coarse to fine gravel. Cobbles observed.		Sand
					74-70				
15									
		S-4	24/10	14.0-16.0	40-24		Dense, tan, fine SAND.	(3)	
					22-31				
20									
		S-5	24/24	19.0-21.0	15-11		V. stiff, light grey SILT, some clay, trace fine sand.		Silt
					19-18				
25									
		S-6	24/20	24.0-26.0	8-15		Dense, tan, fine SAND, trace silt.	(4)	Sand
					16-16				
30									
		S-7	24/18	29.0-31.0	15-20		Dense, tan, fine SAND, trace silt.	(5)	
					24-29			(6)	
35									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

REMARKS:

(1) Ground frozen
(2) Organics observed from 7 to 9 ft. while washing
(3) Iron stained Seam at 8 in. (14.8 ft.) ~ 1/4 in. thick
(4) Iron stained Seam throughout ~ 1/8 in. thick
(5) Iron stained Seam throughout ~ 1/4 in. thick
(6) Grain size analysis conducted.

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

BORING No. WS-4

Weston & Sampson

PROJECT
Peabody - North River Canal Rehabilitation Project

REPORT OF BORING No. WS-4
SHEET 2 OF 2
Project No. 2070047.B
CHKD BY B. Green

BORING Co. Geologic Earth Exploration, Inc.
FOREMAN Ray / Chip
WSE GEOLOGIST: April Prezioso
BORING LOCATION See attached plan
GROUND SURFACE ELEV. El. 12.5 +/- DATUM NAVD 1988
DATE START 3/22/07 DATE END 3/22/07

SAMPLER: Sampler consists of 2 in. Spilt Spoon Sampler driven using a140-LB Hammer falling 30-inches
CASING: 4 in. casing driven using a 300-LB Hammer falling 24 in.
CASING SIZE: I.D. 4.00 in. Method Drive and Wash

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
3/22/07	-	~3.0 ft.	-	Water introduced during drilling, may not represent stable groundwater condition

DEPTH (feet)	CASING (lb/ft)	SAMPLE No.	PEN/REC (in)	DEPTH (ft)	BLOWS/6"	PID (ppm)	SAMPLE DESCRIPTION Burmister Classification	NOTES	STRATUM DESCRIPTION
35		S-8	24/22	34.0-36.0	10-17 20-22	NA	Dense, tan, fine SAND, trace silt.		Sand
40		S-9	24/22	39.0-41.0	10-21 33-41		Hard, greenish grey SILT, some clay, little fine sand.		
									EOB - 41.0 ft.

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0-4	V. LOOSE	0-2	V. SOFT
4-10	LOOSE	2-4	SOFT
10-30	M. DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
> 50	V. DENSE	15-30	V. STIFF
		> 30	HARD

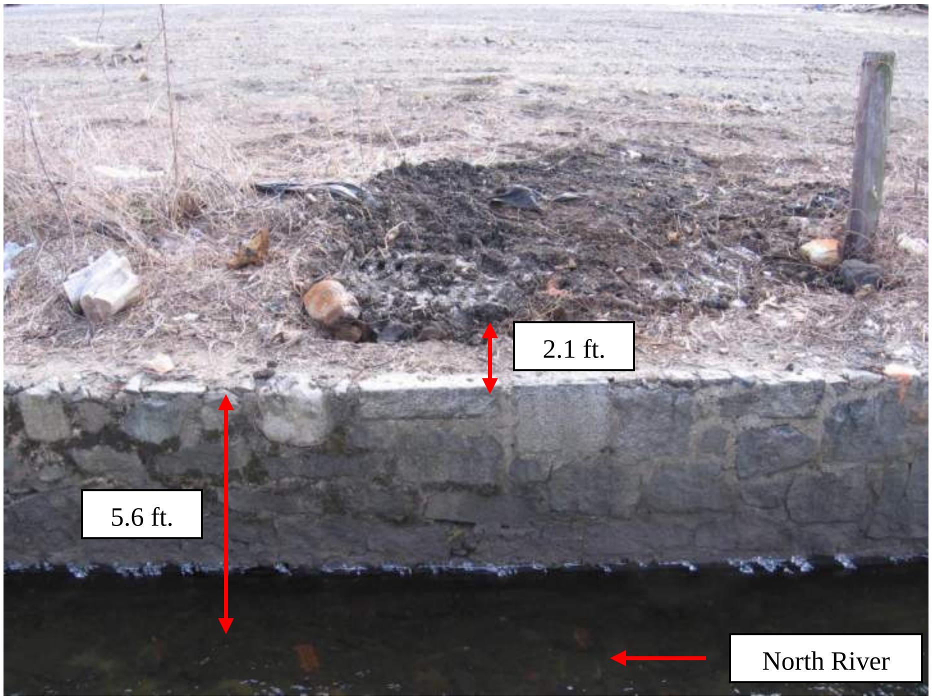
REMARKS:

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES. TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THIS BORING LOG. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS ARE MADE.

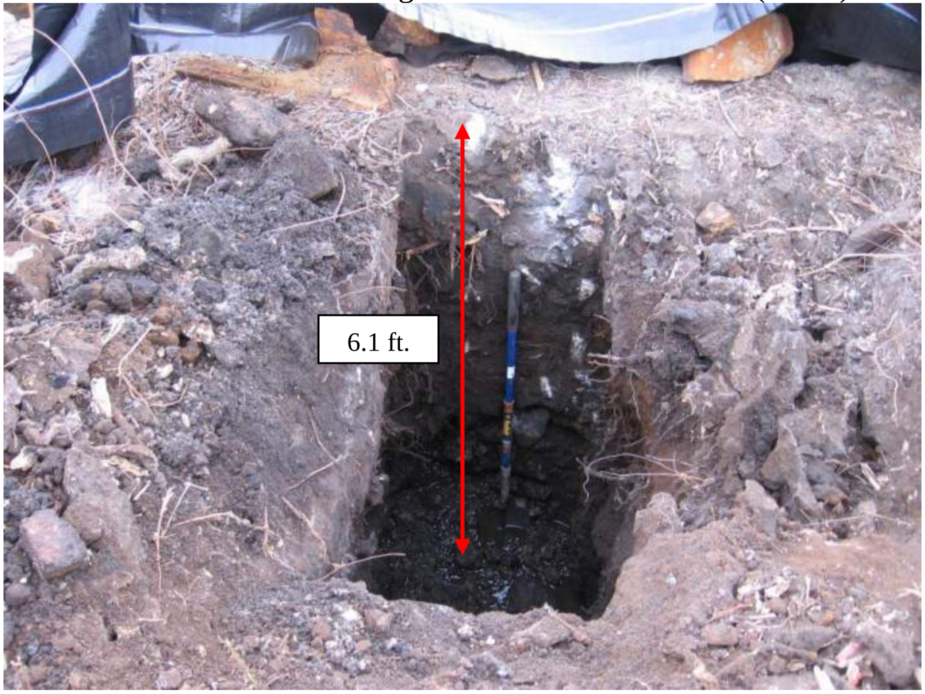
BORING No. WS-4

Test Pit Photographs (March 8, 2007)

TEST PIT #5



The face of the mortared granite wall at this location (1 of 3)



The mortared, vertical back of the granite wall looking towards the North River (2 of 3)


The vertical backside of the mortared granite wall looking upstream (3 of 3)

APPENDIX C

2018 Explorations by Weston & Sampson

- Boring Logs
- Test Pit Logs

Weston & Sampson

BORING NUMBER: **B-1**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractors
FOREMAN/DRILLER: Brett Raiche
DRILL RIG TYPE: Acker Soil Scout tracked rig
OTHER EQUIPMENT: -
DRILLING METHOD: Fluid rotary with driven casing
CASING/AUGER SIZE: 4.0" flush joint casing
SAMPLING METHOD: Standard penetration test (SPT)
SAMPLER HAMMER: 140-lb. w/ rope and cathead
BORING LOCATION: 24 Caller St.
GROUND ELEV: 12 ft. +/- (NAVD 88)
DATE STARTED: 11/8/2018
DATE COMPLETED: 11/8/2018

Sample Description

General Format: Density/consistency, color, classification name
(secondary PRIMARY, additional); moisture, additional information.
[UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL ■ MC ▲ LL ■

In-Situ Test Data
● SPT N-Value

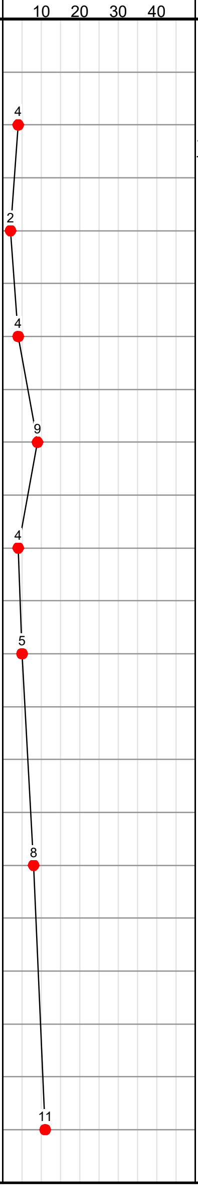
Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/8/2018
▼ Depth: 2.6 ft. +/-

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Remarks and Additional Tests
0-1						(3") ORGANIC MATTER. (9") REINFORCED CONCRETE.	
1-3	☒	4 2 2 1	4	6/24	FILL	Very loose, dark brown to black, gravelly fine to coarse SAND, trace silt, trace debris (coal, weathered mortar), trace organics (roots); moist to wet. [FILL]	▼
3-5	☒	WOH 1 1 3	2	4/24		Very loose, brown, gravelly fine to coarse SAND, some debris (brick fragments, weathered mortar), trace silt, trace organics (roots); wet. [FILL]	
5-7	☒	1 1 3 5	4	3/24		Very loose, brown, gravelly fine to coarse SAND, trace debris (weathered mortar), trace silt, trace organics (roots); wet. [FILL]	
7-9	☒	5 4 5 5	9	13/24		Top 5" - Dark brown, ORGANIC SILT, some fine to coarse sand, some debris (brick fragments, weathered mortar), trace gravel; wet. [FILL] Bottom 8" - Brown/gray, fine to medium SAND, some organics (roots, fibers), little silt; wet.	
9-11	☒	2 2 2 3	4	0/24	ORGANIC SOILS	No recovery.	
11-13	☒	2 3 2 4	5	8/24		Loose, gray, fine to coarse SAND, some organics (wood, roots, fibers), little silt, trace gravel; wet.	Gravel = 0.0 % Sand = 86.7 % Fines = 13.3 %
13-15							Casing terminated at 14 ft.
15-17	☒	5 4 4 3	8	10/24	SAND	Loose, yellowish brown, fine SAND, little silt; wet.	
17-20							
20-22	☒	6 5 6 6	11	14/24		Medium dense, yellowish brown to reddish yellow, fine SAND, little silt; wet.	



End of boring at 22 ft.

SAMPLE LEGEND

☒ Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)

■ Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)

▯ NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)

⧗ Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

BORING NUMBER: **B-2**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractors
FOREMAN/DRILLER: Brett Raiche
DRILL RIG TYPE: Acker Soil Scout tracked rig
OTHER EQUIPMENT: -
DRILLING METHOD: Fluid rotary with driven casing
CASING/AUGER SIZE: 4.0" flush joint casing
SAMPLING METHOD: Standard penetration test (SPT)
SAMPLER HAMMER: 140-lb. w/ rope and cathead
BORING LOCATION: 24 Caller St.
GROUND ELEV: 12 ft. +/- (NAVD 88)
DATE STARTED: 11/8/2018
DATE COMPLETED: 11/8/2018

Sample Description

General Format: Density/consistency, color, classification name
(secondary PRIMARY, additional); moisture, additional information.
[UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL ■ MC ▲ LL ■

In-Situ Test Data
● SPT N-Value

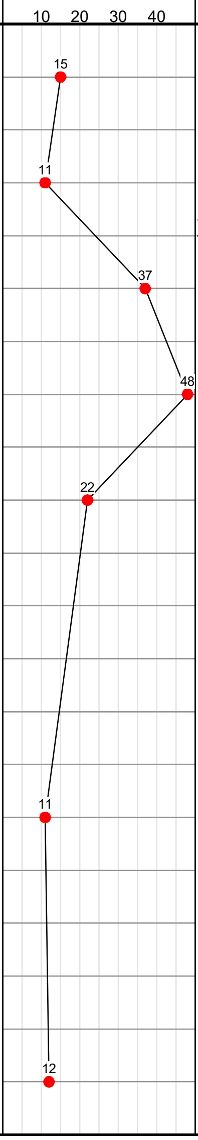
Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/8/2018
▼ Depth: 4 ft. +/-

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Remarks and Additional Tests
0-2	☒	5 10 5 5	15	18/24	FILL	Top 2" - Wood panel. Middle 12" - Black, fine to coarse SAND, some silt, some organics, little gravel, trace debris (brick fragments, coal); moist. [FILL] Bottom 4" - Brown, fine to coarse SAND, trace debris (weathered mortar, coal), trace silt, trace gravel, trace organics; moist. [FILL]	
2-4	☒	5 6 5 3	11	6/24		Medium dense, brown to black, fine to coarse SAND, some organics (roots, fibers), little silt, trace debris (wood/lumber), trace gravel; moist. [FILL]	▼
4-6	☒	24 29 8 10	37	10/24		Top 4" - Dense, brown, fine to coarse SAND, some organics (roots), little silt, trace debris (brick fragments), ; wet. [FILL] Bottom 6" - Lumber/wood.	
6-8	☒	15 22 26 21	48	0/24		No recovery.	Possibly pushing piece of lumber.
8-10	☒	6 10 12 13	22	14/24	SAND	Top 10" - Medium dense, brown to yellowish brown, gravelly medium to coarse SAND, trace silt; wet. Bottom 4" - Yellowish brown, fine SAND, some silt; wet.	Gravel = 0.0 % Sand = 74.1 % Fines = 25.9 % Casing terminated at 10 ft.
14-16	☒	4 6 5 7	11	10/24		Medium dense, yellowish brown, fine SAND, some silt; wet.	
19-21	☒	6 6 6 6	12	10/24		Medium dense, yellowish brown, fine SAND, some silt; wet.	



End of boring at 21 ft.

SAMPLE LEGEND

☒ Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)

■ Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)

▯ NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)

⧗ Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

W&S BORING LOG - MODIFIED - DATA TEMPLATE - WSE STANDARD LOGS.GDT - 1/4/19 11:20 - \\WSE03.LOCAL\WSE\PROJECTS\MA\PEABODY MA\MVP ACTION GRANT 2018\TASK 2 - ENGINEERING SERVICES & ALTERNATIVES ANALYSIS\GEOTECHNICAL\FIELD\2018.11.05 - BDG - BORINGS\PEABODY RIVERWALK BORING LOGS.GPJ

Weston & Sampson

BORING NUMBER: **B-3**

PAGE 1 OF 1

CLIENT: City of Peabody	**PROJECT:** MVP Action Grant	**LOGGED BY:** BDG
PROJECT NUMBER: 2180658	**LOCATION:** Peabody, MA	**CHECKED BY:** SJB
CONTRACTOR: New England Boring Contractors	**DRILLING METHOD:** Fluid rotary with driven casing	**BORING LOCATION:** 24 Caller St.
FOREMAN/DRILLER: Mike Matarozzo	**CASING/AUGER SIZE:** 4.0" flush joint casing	**GROUND ELEV:** 12 ft. +/- (NAVD 88)
DRILL RIG TYPE: Mobile Drill B-47 truck rig	**SAMPLING METHOD:** Standard penetration test (SPT)	**DATE STARTED:** 11/5/2018
OTHER EQUIPMENT: -	**SAMPLER HAMMER:** 140-lb. automatic hammer	**DATE COMPLETED:** 11/5/2018

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL ■ MC ▲ LL ■

In-Situ Test Data
● SPT N-Value

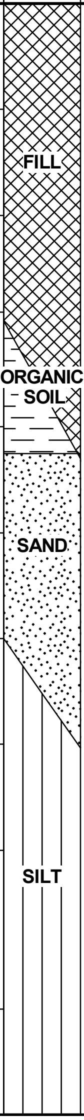
Remarks and Additional Tests

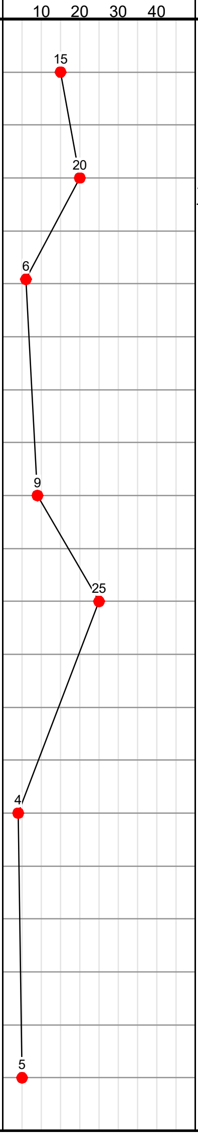
WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/5/2018

▼ Depth: 3.5 ft. +/-





Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. / Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Remarks and Additional Tests
1 2	☒	9 10 5 11	15	15/24		Top 5" - Gray-brown GRAVEL, little fine to coarse SAND, trace silt; moist. [FILL] Bottom 11" - Medium dense, dark brown, ORGANIC SILT, trace sand, trace gravel, trace debris (asphalt millings); moist. [FILL]	
3 4	☒	4 11 9 9	20	0/24	FILL	No recovery.	▼
5	☒	4 3 3 100	6	2/22		Loose, brown, gravelly fine to coarse SAND, trace silt; wet. [FILL]	
6 7 8					ORGANIC SOIL		
9 10	☒	2 3 6 10	9	9/24		Top 3" - Brown to dark brown, gravelly fine to coarse SAND, some organics, some silt; wet. Bottom 6" - Medium dense, yellowish brown, fine to coarse SAND, little gravel, little silt; wet.	Gravel = 16.6 % Sand = 69.3 % Fines = 14.1 %
11	☒	11 11 14 14	25	16/24	SAND	Medium dense, yellowish brown, fine SAND, little silt; wet.	
12 13 14							
15 16	☒	2 2 2 3	4	21/24		Medium stiff, yellow/bluish gray, clayey SILT, little fine sand; wet.	Casing terminated at 14 ft.
17 18 19					SILT		
20	☒	1 3 2 1	5	19/24		Medium stiff, yellowish brown, fine sandy SILT; wet.	
21						End of boring at 21 ft.	

SAMPLE LEGEND

☒	Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)	▯	NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
■	Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)	⧗	Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson℠

BORING NUMBER: **B-4**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractors
FOREMAN/DRILLER: Brett Raiche
DRILL RIG TYPE: Acker Soil Scout tracked rig
OTHER EQUIPMENT: -
DRILLING METHOD: Fluid rotary with driven casing
CASING/AUGER SIZE: 4.0" flush joint casing
SAMPLING METHOD: Standard penetration test (SPT)
SAMPLER HAMMER: 140-lb. w/ rope and cathead
BORING LOCATION: 21 Caller St.
GROUND ELEV: 11 ft. +/- (NAVD 88)
DATE STARTED: 11/8/2018
DATE COMPLETED: 11/8/2018

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil			Organic Soils		
	GRAVEL, SAND, SILT, CLAY	> 50%		PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL ■ MC ▲ LL ■

In-Situ Test Data
● SPT N-Value

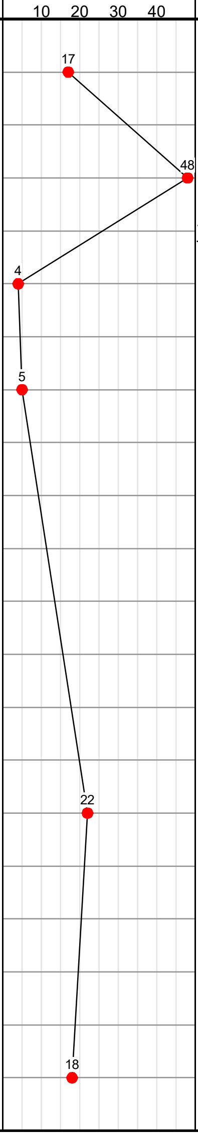
Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/8/2018
Depth: 4.2 ft. +/-

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sampler Penetration, in.	Strata Description and Graphic Log	Sample Description	Remarks and Additional Tests
0-2	☒	2 8 9 10	17	11/24	FILL	Top 6" - Dark brown, fine to coarse SAND, some gravel, some organics (roots, fibers), little silt; moist. [FILL] Bottom 5" - Medium dense, brown, gravelly fine to coarse SAND, trace silt; moist. [FILL]	
2-4	☒	13 38 10 6	48	7/24	FILL	Very dense, brown to black, gravelly fine to coarse SAND, little silt, little debris (glass, wood/lumber), trace organics; moist. [FILL]	Auger grinding from about 1.5 to 4 ft. When advancing casing to 4 ft, bouncing observed at about 2 ft. Boring moved 1 ft N. Bouncing observed again at about 2 ft. Boring moved another 1 ft W.
4-6	☒	3 2 2 3	4	8/24	FILL	Loose, brown to gray, fine to medium SAND, some debris (brick fragments, weathered mortar), little silt, trace gravel, trace organis (roots, wood); wet. [FILL]	Gravel = 3.3 % Sand = 72.1 % Fines = 24.6 % Casing terminated at 4 ft.
6-8	☒	3 3 2 3	5	8/24	ORGANIC SOIL	Loose, dark brown, fine sandy ORGANIC SILT, trace gravel; wet.	
8-10	☒	WOH/12" 2 13		22/24	SAND	Top 13" - Very loose, dark gray, silty fine SAND, trace gravel; organic odor; wet. Bottom 9" - Dark gray, silty fine to coarse SAND, little gravel; organic odor; wet.	Auger grinding from about 9 to 10 ft.
10-14					SAND		
14-16	☒	11 11 11 11	22	6/24	SAND	Medium dense, gray, fine SAND, little silt; wet.	
16-19					SAND		
19-21	☒	7 9 9 11	18	13/24	SAND	Medium dense, brownish gray, fine SAND, little silt; wet.	



End of boring at 21 ft.

SAMPLE LEGEND

☒ Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)

■ Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)

▯ NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)

⧗ Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

W&S BORING LOG - MODIFIED - DATA TEMPLATE - WSE STANDARD LOGS.GDT - 1/4/19 11:20 - \\WSE03.LOCAL\WSE\PROJECTS\MA\PEABODY MA\MVP ACTION GRANT 2018\TASK 2 - ENGINEERING SERVICES & ALTERNATIVES ANALYSIS\GEOTECHNICAL\FIELD\2018.11.05 - BDG - BORINGS\PEABODY RIVERWALK BORING LOGS.GPJ

Weston & Sampson

BORING NUMBER: **B-5**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractors
FOREMAN/DRILLER: Brett Raiche
DRILL RIG TYPE: Acker Soil Scout tracked rig
OTHER EQUIPMENT: -
DRILLING METHOD: Fluid rotary with driven casing
CASING/AUGER SIZE: 4.0" flush joint casing
SAMPLING METHOD: Standard penetration test (SPT)
SAMPLER HAMMER: 140-lb. w/ rope and cathead
BORING LOCATION: 166R Main St.
GROUND ELEV: 9 ft. +/- (NAVD 88)
DATE STARTED: 11/9/2018
DATE COMPLETED: 11/9/2018

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL ■—▲—■ LL (MC)

In-Situ Test Data
● SPT N-Value

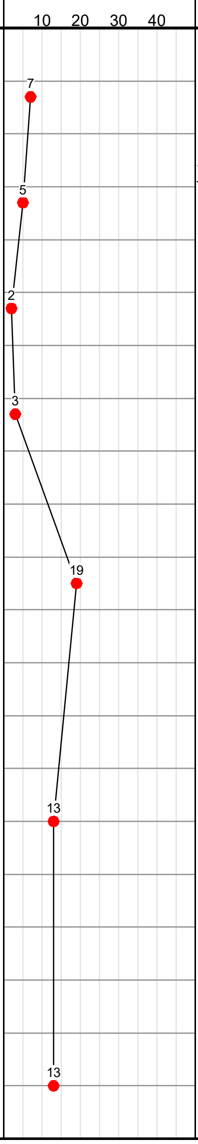
Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/9/2018
▼ Depth: 2.9 ft. +/-

Depth Scale, ft.	**Sample Type**	**Blows on Sampler/6"** *Blows on Casing/12"*	**N-Value, Blows/ft.**	**Sample Recovery, in. / Sampler Penetration, in.**	**Strata Description and Graphic Log**	**Sample Description**	**Remarks and Additional Tests**
1 2	☒	2 3 4 5	7	9/24	FILL	(3") ASPHALT CONCRETE. Loose, dark brown, medium to coarse SAND, little gravel, little silt, trace organics (roots, fibers), trace debris (glass, wood); moist. [FILL]	
3 4	☒	5 3 2 3	5	6/24	FILL	Loose, gray-brown, fine to coarse SAND, some silt, little gravel, trace gravel trace organic (roots); moist to wet. [FILL]	▼
5 6	☒	1 1 1 2	2	10/24	FILL	Top 4" - Dark brown, gravelly medium to coarse SAND, little silt, trace organics (roots); wet. [FILL] Bottom 6" - Dark brown to black, ORGANIC SILT, little fine to coarse sand, trace gravel; wet. [FILL]	
7 8	☒	3 1 2 2	3	18/24	ORGANIC SOIL	Top 4" - Dark brown, gravelly medium to coarse SAND, little silt, trace organics (fibers); wet. [FILL] Bottom 14" - Soft, gray-brown SILT, some organics (fibers); wet.	
9							Auger grinding from about 8.5 to 9.5 ft. Casing terminated at 9 ft.
10 11	☒	14 12 7 9	19	6/24	SAND	Medium dense, gray, gravelly fine to coarse SAND, little silt; wet.	Rock fragments at bottom of spoon.
12 13							
14 15	☒	9 5 8 9	13	5/24	SILT	Stiff, gray SILT, some fine sand, trace gravel; wet.	Gravel = 3.1 % Sand = 33.0 % Fines = 63.9 % Rock fragments at top of spoon.
16 17 18							
19 20 21	☒	7 7 6 7	13	19/24		Stiff, gray SILT, some fine sand; wet.	



End of boring at 21 ft.

SAMPLE LEGEND

☒	Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)	▯	NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
■	Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)	⧗	Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

BORING NUMBER: **B-6**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractors
FOREMAN/DRILLER: Brett Raiche
DRILL RIG TYPE: Acker Soil Scout tracked rig
OTHER EQUIPMENT: -
DRILLING METHOD: Fluid rotary with driven casing
CASING/AUGER SIZE: 4.0" flush joint casing
SAMPLING METHOD: Standard penetration test (SPT)
SAMPLER HAMMER: 140-lb. w/ rope and cathead
BORING LOCATION: 166R Main St.
GROUND ELEV: 9 ft. +/- (NAVD 88)
DATE STARTED: 11/9/2018
DATE COMPLETED: 11/9/2018

Sample Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Data Plots

Laboratory Test Data:
PL = Plastic Limit, %
MC = Moisture content, %
LL = Liquid Limit, %

PL ■ MC ▲ LL ■

In-Situ Test Data
● SPT N-Value

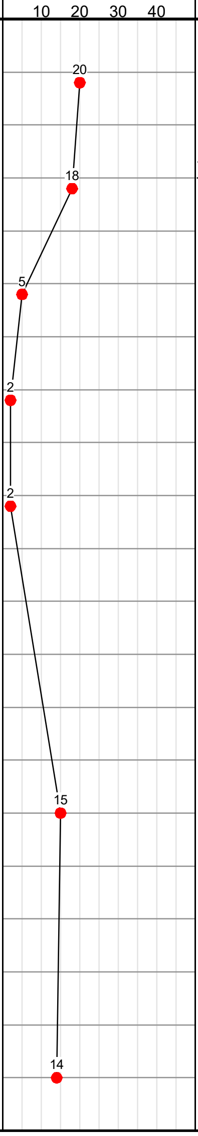
Remarks and Additional Tests

WOR = Weight of rods
WOH = Weight of hammer
P200 = Percent passing the #200 sieve (laborator value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/9/2018
▼ Depth: 3 ft. +/-

Depth Scale, ft.	Sample Type	Blows on Sampler/6" *Blows on Casing/12"*	N-Value, Blows/ft.	Sample Recovery, in. Sample Penetration, in.	Strata Description and Graphic Log	Sample Description	Remarks and Additional Tests
1 2	☒	2 5 15 14	20	6/24	FILL	(2") ASPHALT CONCRETE. Medium dense, light brown to brown, fine to coarse SAND, some gravel, little silt, little debris (wood), trace organics (roots, fibers); moist. [FILL]	
3 4	☒	12 10 8 6	18	10/24		Top 5" - Brown, medium to coarse sandy GRAVEL, trace silt, trace debris (wood); wet. [FILL] Bottom 5" - Orange brown to brown, fine to coarse SAND, little silt, trace gravel, trace debris (wood); wet. [FILL]	▼
5 6	☒	2 3 2 2	5	9/24		Dark brown, fine to coarse SAND, some silt, little gravel, trace to some organics; wet.	
7 8	☒	2 1 1 1	2	14/24	ORGANIC SOILS	Top 7" - Very soft, black, PEAT, trace sand, trace gravel; wet. Bottom 7" - Dark brown, ORGANIC SILT; wet.	
9 10	☒	2 1 1 1	2	8/24		Very soft, brown, CLAY with some organics, some fine sand, trace gravel; wet.	MC = 93% OC = 10.6 % Gravel = 1.6 % Sand = 33.5 % Fines = 64.9 % Casing terminated at 9 ft.
11 12 13 14							
15 16	☒	10 11 4 3	15	17/24	SAND	Top 4" - Medium dense, gray, fine to coarse gravelly SAND, little silt; wet. Bottom 13" - Gray, silty fine SAND; wet.	
17 18 19							
20 21	☒	8 8 6 7	14	9/24		Top 6" - Gray, fine SAND, little silt; wet. Bottom 3" - Light brown, silty fine SAND; wet.	



End of boring at 21 ft.

SAMPLE LEGEND

☒	Standard split spoon sampler driven w/ 140-lb. hammer (24" long, 2" OD, 1-3/8" ID)	▯	NX rock core sampler advanced using rotary drilling methods (5' long, 3" ID)
■	Thin-walled tube sampler pushed w/ rig hydraulics (30" long, 3" ID)	⧗	Modified split spoon sampler driven w/ 140-lb. hammer (24" long, 3" OD, 2-3/8" ID)

N-VALUE RELATIONSHIPS

N-VALUE BLOWS/FT.	DENSITY OF GRANULAR SOILS	N-VALUE BLOWS/FT.	CONSISTENCY OF COHESIVE SOILS
0 - 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very Dense	15 - 30	Very Stiff
		> 30	Hard

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Water level readings have been made in the drill holes at the times and conditions stated on the boring log. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements are made.

Weston & Sampson

TEST PIT NUMBER: **TP-1**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractor
OPERATOR: Brett Raiche
EXCAVATOR: Kubota U17
BUCKET TYPE: Toothed, 1-ft wide
TEST PIT LOCATION: 24 Caller St.
GROUND ELEVATION: 11 ft. +/- (NAVD 88)
DATE STARTED: 11/7/2018
DATE COMPLETED: 11/7/2018

6 ft. +/-
Plan Sketch
(NTS)
4.5 ft. +/-

Material Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil			Organic Soils		
	GRAVEL, SAND, SILT, CLAY	> 50%		PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Remarks and Tests

P200 = Percent passing the #200 sieve (laborator value)
MC = Moisture content, % (laboratory value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/7/2018
▼ Depth: 5.8 ft. +/-

Depth Scale, ft.	**Strata Description and Graphic Log**	Material Description		Remarks and Tests
		(5") TOPSOIL.	0.4'	Approx. 34-inch-thick stacked boulder wall. No mortar visible at back of wall.
1 2 3 4 5	FILL	Brown, fine to coarse SAND, trace to little gravel, trace to little silt, with trace to some organics (roots), with trace debris (coal, glass, plastics, concrete fragments); moist. [FILL]		
6	▼	*Wet below 5.8 ft due to seepage.*	6.2'	Minor caving below approximately 5.3 ft.

End of test pit at 6.2 ft.

34-inch thick stacked boulder wall

Photo 1 - Overview of TP-1.

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Relative soil densities and consistencies, where noted, are estimates based on visual observation only.
3. Water level observations were made at time of excavation. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements were made.

Weston & Sampson

TEST PIT NUMBER: **TP-2**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractor
OPERATOR: Brett Raiche
EXCAVATOR: Kubota U17
BUCKET TYPE: Toothed, 1-ft wide
TEST PIT LOCATION: 24 Caller St.
GROUND ELEVATION: 11 ft. +/- (NAVD 88)
DATE STARTED: 11/7/2018
DATE COMPLETED: 11/7/2018

6 ft. +/-
Plan Sketch
(NTS)
2.5 ft. +/-

Material Description

General Format: Density/consistency, color, classification name
(secondary PRIMARY, additional); moisture, additional information.
[UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Remarks and Tests

P200 = Percent passing the #200 sieve (laborator value)
MC = Moisture content, % (laboratory value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/7/2018
▼ Depth: 5.3 ft. +/-

Depth Scale, ft.	Strata Description and Graphic Log	Material Description		Remarks and Tests
		(4") TOPSOIL.	0.3'	17 to 21-in. thick vertical CIP concrete wall to about 4 ft.
1 2 3 4 5	FILL	Brown, fine to coarse SAND, some gravel to gravelly, trace to little silt, with trace to some organics (roots), with trace debris (tile, glass, metals, brick fragements, weathered mortar), with occasioal cobbles and occasional boulders; moist. [FILL]		
	▼	*Wet below 5.3 ft due to seepage.*	5.9'	Base of wall below 4 ft consists of stacked stones up to 34-inches diameter.

End of test pit at 5.9 ft.

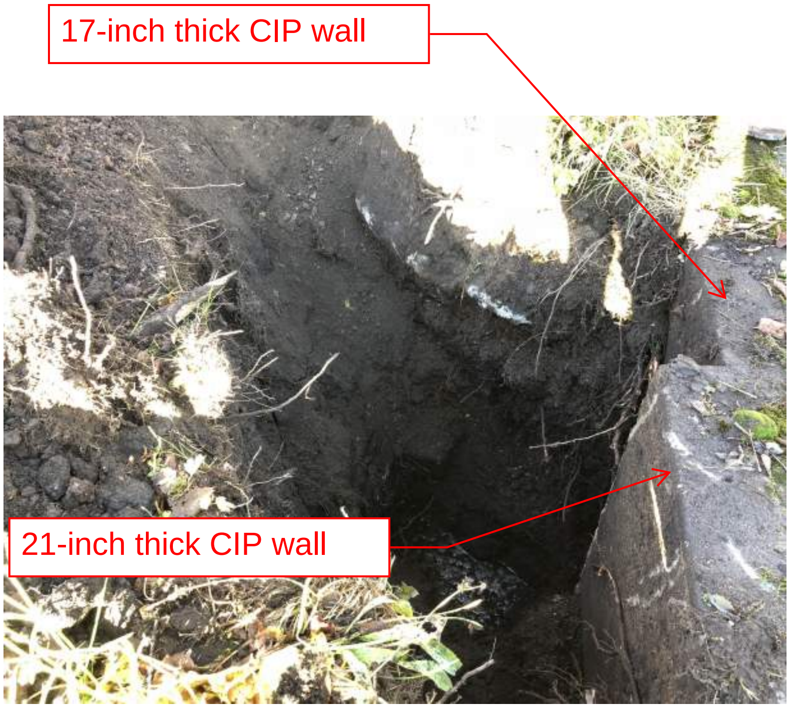


Photo 1 - Overview of TP-2.

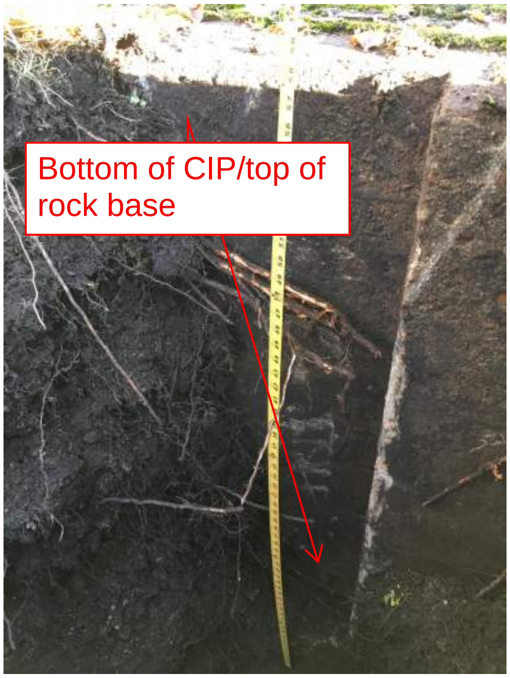


Photo 2 - Concrete wall and rock base.

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.

2. Relative soil densities and consistencies, where noted, are estimates based on visual observation only.

3. Water level observations were made at time of excavation. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements were made.

Weston & Sampson

TEST PIT NUMBER: **TP-3**

PAGE 1 OF 1

CLIENT: City of Peabody

PROJECT NUMBER: 2180658

PROJECT: MVP Action Grant

LOCATION: Peabody, MA

LOGGED BY: BDG

CHECKED BY: SJB

CONTRACTOR: New England Boring Contractor

OPERATOR: Brett Raiche

EXCAVATOR: Kubota U17

BUCKET TYPE: Toothed, 1-ft wide

TEST PIT LOCATION: 24 Caller St.

GROUND ELEVATION: 11 ft. +/- (NAVD 88)

DATE STARTED: 11/6/2018

DATE COMPLETED: 11/6/2018

6 ft. +/-

Plan Sketch
(NTS)

2.5 ft. +/-

Material Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Remarks and Tests

P200 = Percent passing the #200 sieve (laborator value)

MC = Moisture content, % (laboratory value)

OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/6/2018

▼ Depth: 5.3 ft. +/-

Depth Scale, ft.	Strata Description and Graphic Log	Material Description		Remarks and Tests
		(5") TOPSOIL.	0.4'	
1 2 3 4 5	FILL	Light brown to brown, fine to coarse SAND, trace to little gravel, trace to little silt, with trace to some organics (roots), with trace to some debris (ash, coal, plastics, metals, glass, brick fragments, concrete pieces, weathered mortar), with occasional cobbles, and few boulders (up to 28 in); moist. [FILL]		Approx. 21-in.-thick vertical CIP concrete wall encountered to bottom of test pit.
	▼	*Wet below 5.3 ft due to seepage.*	5.7'	Minor caving below approximately 4.8 ft.

End of test pit at 5.7 ft.

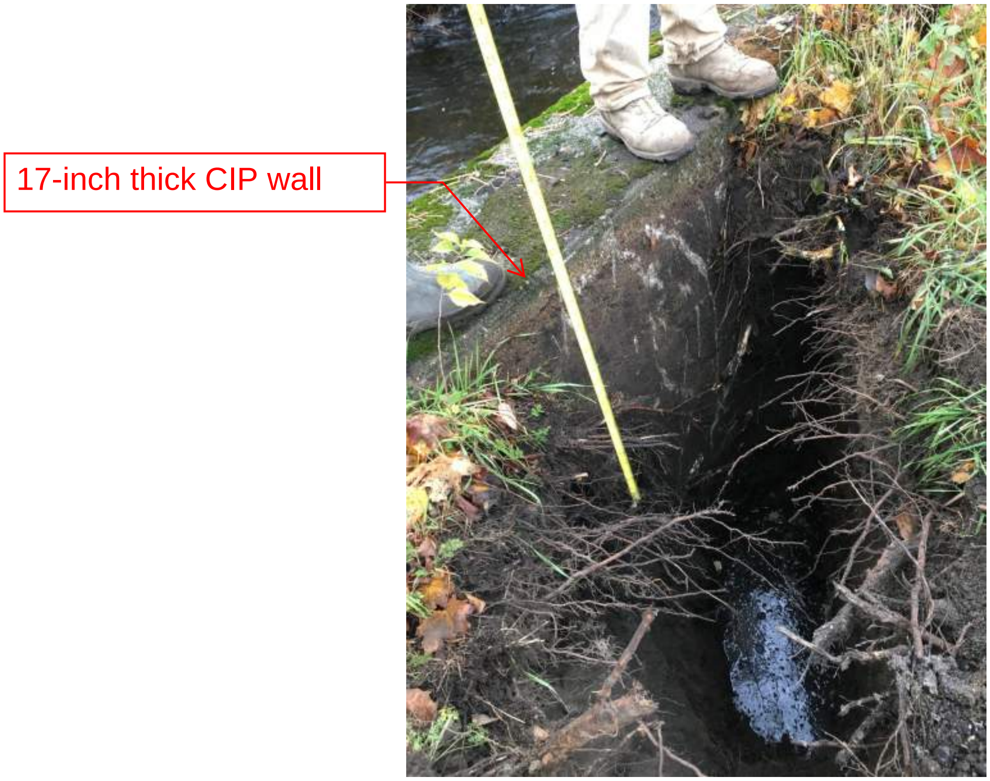


Photo 1 - Overview of TP-3.

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Relative soil densities and consistencies, where noted, are estimates based on visual observation only.
3. Water level observations were made at time of excavation. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements were made.

W&S TEST PIT LOG - DATA TEMPLATE - WSE STANDARD LOGS.GDT - 12/11/18 15:23 - \\WSE03.LOCAL\WSE\PROJECTS\MA\PEABODY MA\MVP ACTION GRANT 2018\TASK 2 - ENGINEERING SERVICES & ALTERNATIVES ANALYSIS\GEOTECHNICAL\FIELD\2018.11.06 - BDG - TEST PITS\PEABODY RIVERWALK TEST PIT LOGS.GPJ

Weston & Sampson

TEST PIT NUMBER: **TP-4**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractor
OPERATOR: Brett Raiche
EXCAVATOR: Kubota U17
BUCKET TYPE: Toothed, 1-ft wide
TEST PIT LOCATION: 21 Caller St.
GROUND ELEVATION: 11 ft. +/- (NAVD 88)
DATE STARTED: 11/6/2018
DATE COMPLETED: 11/6/2018

2 ft. +/-
Plan Sketch
(NTS)
7 ft. +/-

Depth Scale, ft. | **Strata Description and Graphic Log**

Material Description

General Format: Density/consistency, color, classification name
(secondary PRIMARY, additional); moisture, additional information.
[UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%
	gravelly, sandy, silty, clayey	35 - 50%
	some	20 - 35%
	little	10 - 20%
	trace	0 - 10%

Organic Soils	PEAT	> 50%
	organic (soil name)	15 - 50%
	(soil name) with some organics	5 - 15%
	trace organics	< 5%

Remarks and Tests

P200 = Percent passing the #200 sieve (laborator value)
MC = Moisture content, % (laboratory value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/6/2018
▼ Depth: 6.7 ft. +/-

Depth Scale, ft.	Strata	Material Description	Remarks and Tests
0 - 5.8'	FILL	Light brown to brown, fine to coarse SAND, trace to little gravel, trace to little silt, with trace to some organics (roots), with trace debris (plastics, brick fragments), with occasional cobbles, and few AC pavement pieces; moist. [FILL] *With some debris (brick fragments, wood/lumber, glass, tiles, coal, ash, metal wires, weathered mortar) below 1.7 ft.*	Approx. 16 to 21-in.-thick mortared stone wall observed to bottom of test pit. Backwall was roughly vertical.
5.8' - 6.8' ▼	FILL	Gray, fine to medium SAND, trace to little gravel, trace to little silt, with some debris (brick fragments, tile, weathered mortar, coal), with trace organics (roots, fibers); moist. [FILL] *Wet below 6.7 ft due to seepage.*	Minor caving below approximately 5.9 ft.

Depth scale: 1, 2, 3, 4, 5, 6

End of test pit at 6.8 ft.

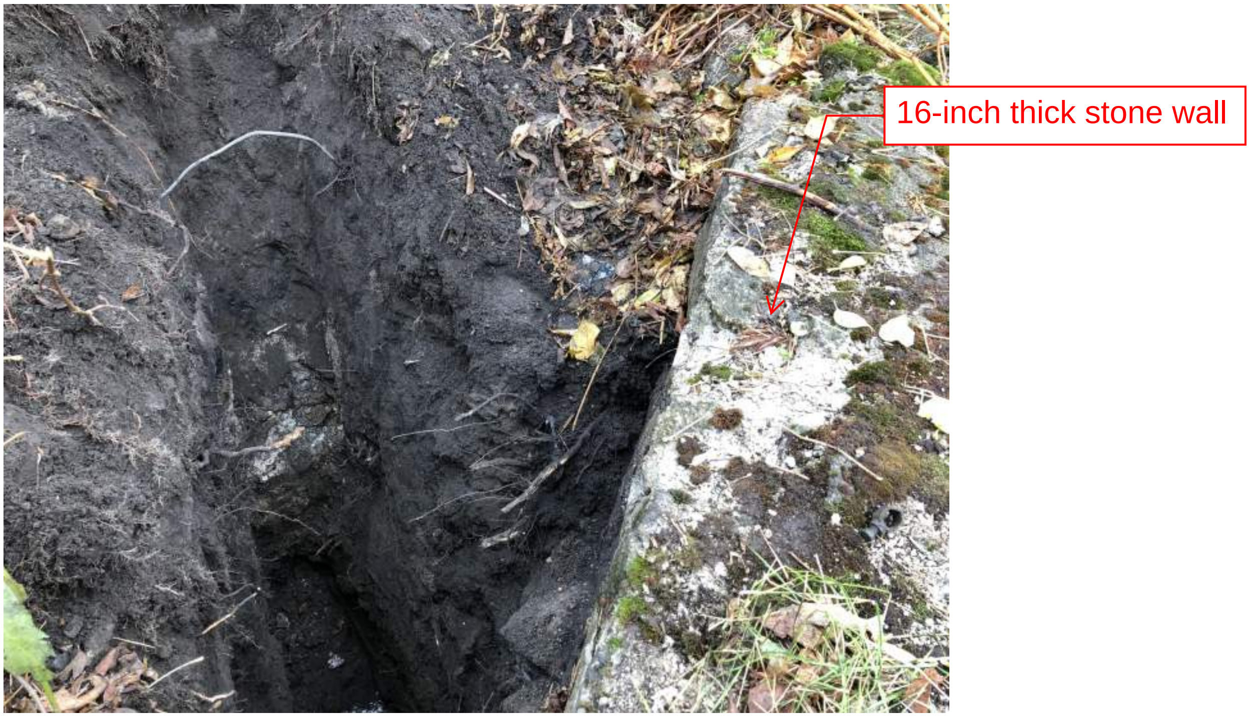


Photo 1 - Overview of TP-4.

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.

2. Relative soil densities and consistencies, where noted, are estimates based on visual observation only.

3. Water level observations were made at time of excavation. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements were made.

TEST PIT NUMBER: **TP-5**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractor
OPERATOR: Brett Raiche
EXCAVATOR: Kubota U17
BUCKET TYPE: Toothed, 1-ft wide
TEST PIT LOCATION: 21 Caller St.
GROUND ELEVATION: 10 ft. +/- (NAVD 88)
DATE STARTED: 11/6/2018
DATE COMPLETED: 11/6/2018

3.5 ft. +/-
Plan Sketch
(NTS)
1.5 ft. +/-

Material Description

General Format: Density/consistency, color, classification name (secondary PRIMARY, additional); moisture, additional information. [UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%	Organic Soils	PEAT	> 50%
	gravelly, sandy, silty, clayey	35 - 50%		organic (soil name)	15 - 50%
	some	20 - 35%		(soil name) with some organics	5 - 15%
	little	10 - 20%			
	trace	0 - 10%		trace organics	< 5%

Remarks and Tests

P200 = Percent passing the #200 sieve (laborator value)
MC = Moisture content, % (laboratory value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/6/2018
▼ Depth: 4.6 ft. +/-

Depth Scale, ft.	Strata Description and Graphic Log	Material Description	Remarks and Tests
1 2 3 4	FILL	Brown, fine to coarse SAND, trace to some gravel, trace to little silt, with trace to some organics (roots), with trace debris (coal), with few cobbles; moist. [FILL] 4.0'	20-in.-thick dry-stacked granite block wall observed to bottom of test pit. Backwall was roughly vertical.
5		▼ Gray, fine to medium SAND, trace to some gravel, trace to some silt, with trace to some debris (coal, brick fragments), with trace organics (roots, fibers); moist. [FILL] *Wet below 4.6 ft due to seepage.* 5.6'	

End of test pit at 5.6 ft.

20-inch thick dry-stacked stone wall

Photo 1 - Overview of TP-5.

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.
2. Relative soil densities and consistencies, where noted, are estimates based on visual observation only.
3. Water level observations were made at time of excavation. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements were made.

Weston & Sampson

TEST PIT NUMBER: **TP-6**

PAGE 1 OF 1

CLIENT: City of Peabody
PROJECT NUMBER: 2180658
PROJECT: MVP Action Grant
LOCATION: Peabody, MA
LOGGED BY: BDG
CHECKED BY: SJB

CONTRACTOR: New England Boring Contractor
OPERATOR: Brett Raiche
EXCAVATOR: Kubota U17
BUCKET TYPE: Toothed, 1-ft wide
TEST PIT LOCATION: 21 Caller St.
GROUND ELEVATION: 9 ft. +/- (NAVD 88)
DATE STARTED: 11/6/2018
DATE COMPLETED: 11/6/2018

5.5 ft. +/-
Plan Sketch
(NTS)
1.5 ft. +/-

Depth Scale, ft. | **Strata Description and Graphic Log**

Material Description

General Format: Density/consistency, color, classification name
(secondary PRIMARY, additional); moisture, additional information.
[UNIT NAME and/or ORIGIN]

Soil Classification Name Guide based on Constituent Percentages

Mineral Soil	GRAVEL, SAND, SILT, CLAY	> 50%
	gravelly, sandy, silty, clayey	35 - 50%
	some	20 - 35%
	little	10 - 20%
	trace	0 - 10%

Organic Soils	PEAT	> 50%
	organic (soil name)	15 - 50%
	(soil name) with some organics	5 - 15%
	trace organics	< 5%

Remarks and Tests

P200 = Percent passing the #200 sieve (laborator value)
MC = Moisture content, % (laboratory value)
OC = Organic content, % (laboratory value)

Groundwater Observations

Date: 11/6/2018
▼ Depth: 5.3 ft. +/-

Depth Scale, ft.	Strata	Material Description	Depth	Remarks and Tests
0 - 3.8	FILL	Brown, fine to coarse SAND, little to gravelly, trace to little silt, with trace to some organics (roots), with occasional cobbles; moist. [FILL]	3.8'	No wall structure visible in test pit.
3.8 - 5.6	FILL	Gray to blueish gray, fine to medium SAND, trace to little gravel, trace to little silt, with trace debris (glass, brick fragments), with trace organics (roots, fibers), with few cobbles; moist. [FILL] ▼ *Wet below 5.3 ft due to seepage.*	5.6'	

End of test pit at 5.6 ft.

Photo 1 - Overview of TP-6.

GENERAL NOTES

1. The stratification lines represent the approximate boundary between soil types; actual transitions may be gradual.

2. Relative soil densities and consistencies, where noted, are estimates based on visual observation only.

3. Water level observations were made at time of excavation. Fluctuations in the level of groundwater may occur due to other factors than those presented at the time measurements were made.

APPENDIX D

Boring logs from 2020 Explorations by Weston & Sampson

GUIDE TO SUBSURFACE EXPLORATION LOGS

Weston & Sampson℠

INDEX SHEET 1
GENERAL INFORMATION

GENERAL NOTES AND USE OF LOGS

1.) Explorations were made by ordinary and conventional methods and with care adequate for Weston & Sampson's study and/or design purposes. The exploration logs are part of a specific report prepared by Weston & Sampson for the referenced project and client, and are an integral part of that report. Information and interpretations are subject to the explanations and limitations stated in the report. Weston & Sampson is not responsible for any interpretations, assumptions, projections, or interpolations made by others.

2.) Exploration logs represent general conditions observed at the point of exploration on the date(s) stated. Boundary lines separating soil and rock layers (strata) represent approximate boundaries only and are shown as solid lines where observed and dashed lines where inferred based on drilling action. Actual transitions may be gradual and changes may occur over time.

3.) Soil and rock descriptions are based on visual-manual examination of recovered samples, direct observation in test pits (when permissible), and laboratory testing (when conducted).

4.) Water level observations were made at the times and under the conditions stated. Fluctuations should be be expected to vary with seasons and other factors. Use of fluids during drilling may affect water level observations. The absence of water level observations does not necessarily mean the exploration was dry or that subsurface water will not be encountered during construction.

5.) Standard split spoon samplers may not recover particles with any dimension larger than 1-3/8 inches. Reported gravel conditions or poor sample recovery may not reflect actual in-situ conditions.

6.) Sections of this guide provide a general overview of Weston & Sampson's practices and procedures for *identifying* and *describing* soil and rock. These procedures are predominantly based on ASTM D2488, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedures)*, the International Society of Rock Mechanics (ISRM) standards, and the *Engineering Geology Field Manual* published by the Bureau of Reclamation. Not all aspects of this guide relating to description and identification procedures of soil and rock may be applicable in all circumstances.

SAMPLER GRAPHICS

◣	Split Spoon (Standard) 2" OD, 1-3/8" ID
⧗	Split Spoon (Oversize) 3" OD, 2-3/8" ID
■	Shelby or Piston Tube 3" OD, 2-7/8" ID
▌▐	Double-Tube Rock Core Barrel 2" Core Diameter
▌	Direct Push with Acetate Liner Various Liner Sizes
A	Auger Sample *(from cuttings or hand auger)*
G	Grab Sample *(manual, from discrete point)*
C	Composite Sample *(multiple grab samples)*

WELL GRAPHICS

▒	Cement concrete seal around casing or riser pipe
▨	Bentonite seal around casing or riser pipe
□	Cement grout seal around casing or riser pipe
▩	Soil backfill around riser pipe or beneath screen
▦	Gravel backfill around screen or riser pipe
▤	Sand backfill around screen or riser pipe (filter sand)
▥	Solid-wall riser; Sch. 40 PVC, 1" ID unless noted otherwise
☰	Slotted screen; Sch. 40 PVC, 1" ID with machined slots

CAVING / SEEPAGE TERMS

The following caving and/or seepage terms may appear on a test pit log.

Caving Term	Criteria
Minor	less than 1 cubic ft.
Moderate	1 to 3 cubic ft.
Severe	greater than 3 cubic ft.

Seepage Term	Criteria
Slow	less than 1 gpm
Moderate	1 to 3 gpm
Fast	greater than 3 gpm

KEY TO WATER LEVELS

▼	Observed in exploration during advancement.
▽	Measured in exploration at completion, prior to backfilling or well installation.
⧩	Measured in exploration after the stated stabilization period, prior to backfilling, or in well installation if noted.

DEFINITIONS OF COMMON TERMS

Sample Recovery Ratio - The length of material recovered in a drive or push type sampler over the length of sampler penetration, in inches (e.g. 18/24).

Standard Penetration Test (*SPT*) - An in-situ test where a standard split-spoon sampler is driven a distance of 12 or 18 inches (after an initial 6-inch seating interval) using a 140-lb. hammer falling 30 inches for each blow.

SPT Blows - The number of hammer blows required to drive a split-spoon sampler each consecutive 6-inch interval during a *Standard Penetration Test*. If no discernable advancement of a split spoon sampler is made after 50 consecutive hammer blows, 50/X indicates *sampler refusal* and is the number of blows required to drive the sampler X inches.

SPT N-Value (*N*) - The uncorrected blow count representation of a soil's penetration resistance over a 12-inch interval after an initial 6-in. seating interval, reported in blows per foot (bpf). The N-value is correlated to soil engineering properties.

Auger Refusal - No discernable advancement of the auger over a period of 5 minutes with full rig down pressure applied.

Casing Refusal (Driven) - Casing penetration of less than 6 inches after a minimum 50 blows of a drop hammer weighing 300 lbs. or a minimum 100 blows of a drop hammer weighing 140 lbs.

PID Measurement - A measurement (electronic reading) taken in the field using a photoionization detector (PID) to detect the presence of volatile organic compounds in a soil sample. Values are reported as benzene equivalent units in parts per million (ppm) unless noted otherwise.

Rock Quality Designation (RQD) - A qualitative index measure of the degree of jointing and fracture of a rock core taken from a borehole. The RQD is defined as the sum length of solid core pieces 4 inches or longer divided by the run (cored) length, expressed as a percentage. Higher RQD values may indicate fewer joints and fractures in the rock mass.

Fill (Made Ground) - A deposit of soil and/or artificial waste materials that has been placed or altered by human processes.

LABORATORY TESTS AND FIELD MEASUREMENTS

MC	Moisture Content	IC	1D Incremental Consolidation
OC	Organic Content	VS	Laboratory Vane Shear
PL	Plastic Limit	US	Unconfined Compression
LL	Liquid Limit	TC	Triaxial Compression
GC	Gravel Content	PP	Pocket (Hand) Penetrometer
SC	Sand Content	TV	Torvane (Hand Vane)
FC	Fines Content	PID	Photoionization Detector
DS	Direct Shear	FID	Flame Ionization Detector

BORING ADVANCEMENT METHODS

Hollow-Stem Auger Drilling - Utilizes continuous flight auger sections with hollow stems to advance the borehole. Drill rods and a plug are inserted into the auger stem to prevent the entrance of soil cuttings into the augers.

Rotary Wash Drilling - Utilizes downward pressure and rotary action applied to a non-coring bit while washing the cuttings to the surface using a circulating fluid injected down the drill rods. The borehole is supported with either steel casing or the drilling fluid. Where a casing is used, the borehole is advanced sequentially by driving the casing to the desired depth and then cleaning out the casing. The process of driving and cleaning the casing is commonly referred to as the 'drive-and-wash' technique.

Continuous Sampling - Includes a variety of methods and procedures during which the borehole is advanced via continuous recovery of soil samples. *Direct Push* sampling is a common method that uses static downward pressure combined with percussive energy to drive a steel mandrel into the ground at continuous intervals while recovering soil samples in disposable acetate liners.

Rock Coring - Utilizes downward pressure and rotary action applied to a core barrel equipped with a diamond-set or tungsten carbide coring bit. During conventional coring, the entire barrel is retrieved from the hole upon completion of a core run. Wireline coring allows for removal of the inner barrel assembly containing the actual core while the the drill rods and outer barrel remain in the hole. Various types and sizes of core barrels and bits are used.

GUIDE TO SUBSURFACE EXPLORATION LOGS

Weston & Sampson℠

INDEX SHEET 2
SOIL DESCRIPTION

SOIL CONSTITUENTS

Naturally occurring soils consist of one or more of the following matrix constituents defined in terms of particle size.

Constituent		U.S. Sieve Size			Observed Size (in.)		
Gravel	(Coarse)	3/4 in.	-	3 in.	3/4	-	3
Gravel	(Fine)	No. 4	-	3/4 in.	1/5	-	3/4
Sand	(Coarse)	No. 10	-	No. 40	1/16	-	1/5
Sand	(Medium)	No. 40	-	No. 10	1/64	-	1/16
Sand	(Fine)	No. 200	-	No. 40	1/300	-	1/64
Fines	(Silt or Clay)	Smaller than		No. 200	Less than		1/300

SOIL IDENTIFICATION

Soil identification refers to the grouping of soils with similar physical characteristics into a category defined by a **group name** and corresponding **group symbol** based on estimation of the matrix soil constituents to the nearest 5% and simple manual tests. Proportions of cobbles, boulders, and other non-matrix soil materials are not considered during this procedure but are included in the overall soil description if observed or thought to be present. Refer to the following descriptions and tables adapted from ASTM D2488.

Coarse-Grained Soil - Coarse-grained soils contain fewer than 50% fines and are identified based on the following table.

Primary Constituent	Fines Percent	Type of Fines and Gradation		Group Symbol	Group Name (1)
GRAVEL *% gravel* > *% sand*	≤ 5%	well graded		GW	Well graded gravel
		poorly graded		GP	Poorly graded gravel
	10%	clayey fines	well graded	GW-GC	Well graded gravel with clay
			poorly graded	GP-GC	Poorly graded gravel with clay
		silty fines	well graded	GW-GM	Well graded gravel wth silt
			poorly graded	GP-GM	Poorly graded gravel with silt
	15% to 45%	clay fines		GC	Clayey gravel
		silt fines		GM	Silty gravel
SAND *% sand* ≥ *% gravel*	≤ 5%	well graded		SW	Well graded sand
		poorly graded		SP	Poorly graded sand
	10%	clayey fines	well graded	SW-SC	Well graded sand with clay
			poorly graded	SP-SC	Poorly graded sand with clay
		silty fines	well graded	SW-SM	Well graded sand with silt
			poorly graded	SP-SM	Poorly graded sand with silt
	15% to 45%	clay fines		SC	Clayey sand
		silt fines		SM	Silty sand

(1) If soil is a gravel and contains 15% or more sand, add "with sand" to the group name. If soil is a sand and contains 15% of more gravel, add "with gravel" to the group name.

Inorganic Fine-Grained Soil - Fine-grained soils contain 50% or more fines and are identified based on the following table.

Plasticity Criteria	Dry Strength	Coarse Fraction S = Sand, G = Gravel		Group Symbol	Group Name (1)
Medium	Medium to high	< 15% S + G		CL	Lean clay
		≥ 30% S + G	% S ≥ % G	CL	Sandy lean clay
			% S < % G	CL	Gravelly lean clay
Non-plastic	None to low	< 15% S + G		ML	Silt
		≥ 30% S + G	% S ≥ % G	ML	Sandy silt
			% S < % G	ML	Gravelly silt
High	High to very high	< 15% S + G		CH	Fat clay
		≥ 30% S + G	% S ≥ % G	CH	Sandy fat clay
			% S < % G	CH	Gravelly fat clay
Low to Medium	Low to medium	< 15% S + G		MH	Elastic silt
		≥ 30% S + G	% S ≥ % G	MH	Sandy elastic silt
			% S < % G	MH	Gravelly elastic silt

(1) If soil contains 15% to 25% sand or gravel, add "with sand" or "with gravel" to the group name.

Organic Fine-Grained Soil - Fine-grained soils that contain enough organic particles to influence the soil properties are identified as Organic Soil and assigned the group symbol **OL** or **OH**.

Highly Organic Soil (Peat) - Soils composed primarily of plant remains in various stages of decomposition are identified as Peat and given the group symbol **PT**. Peat usually has an organic odor, a dark brown to black color, and a texture ranging from fibrous (original plant structure intact or mostly intact) to amorphous (plant structure decomposed to fine particles).

SOIL DESCRIPTION

Soils are *described* in the following general sequence. Deviations may occur in some instances.

Identification Components

(1) Group Name and Group Symbol

Description Components

(2) Consistency (Fine-Grained) or Apparent Density (Coarse-Grained)
(3) Color (*note, the term "to" may be used to indicate a gradational change*)
(4) Soil Moisture
(5) Matrix Soil Constituents (Gravel, Sand, Fines)
  └→ Proportion (*by weight*), particle size, plasticity of fines, angularity, etc.
(6) Non-Matrix Soil Materials and Proportions (*by volume*)
(7) Other Descriptive Information (Unusual Odor, Structure, Texture, etc.)
(8) [Geologic Formation Name or Soil Survey Unit]

SPT N-VALUE CORRELATIONS

Consistency	SPT N-Value	Apparent Density	SPT N-Value
Very soft	0 - 2	Very loose	0 - 5
Soft	2 - 4	Loose	5 - 10
Medium stiff	4 - 8	Medium dense	10 - 30
Stiff	8 - 15	Dense	30 - 50
Very stiff	15 - 30	Very dense	> 50
Hard	> 30		

SOIL MOISTURE

Dry............................... Apparent absence of moisture; dry to the touch.
Moist...........................Damp but no visible water.
Wet............................. Visible free water; saturated.

PROPORTIONS / PERCENTAGES

Proportions of gravel, sand, and fines (excluding cobbles, boulders, and other constituents) are stated in the following terms indicating a range of percentages by weight (to nearest 5%) of the minus 3-in. soil fraction and add up to 100%.

Mostly	50%	-	100%
Some	30%	-	45%
Little	15%	-	25%
Few	5%	-	10%
Trace........................	Less than		5%

Proportions of cobbles, boulders, and other non-matrix soil materials including artificial debris, roots, plant fibers, etc. are stated in the following terms indicating a range of percentages by volume (to the nearest 5%) of the total soil.

Numerous	40%	-	50%
Common	25%	-	35%
Occasional	10%	-	20%
Trace.......................	Less than		5%

PLASTICITY (FINES ONLY)

Non-plastic..................Dry specimen ball falls apart easily. Cannot be rolled into thread at any moisture content.
Low.............................Dry specimen ball easily crushed with fingers. Can be rolled into 1/8-in. thread with some difficulty.
Medium........................Difficult to crush dry specimen ball with fingers. Easily rolled into 1/8-in. thread.
High............................ Cannot crush dry specimen ball with fingers. Easily rolled and re-rolled into 1/8-in. thread.

COBBLES AND BOULDERS

Cobbles - Particles of rock that will pass a 12-in. square opening and be retained on a 3-in. sieve.

Boulders - Particles of rock that will not pass a 12-in. square opening.

Note: Where the percentage (by volume) of cobbles and/or boulders cannot be accurately or reliably estimated, the terms "with cobbles", "with boulders", or "with cobbles and boulders" may be used to indicate observed or inferred presence.

GUIDE TO SUBSURFACE EXPLORATION LOGS

Weston & Sampson℠

INDEX SHEET 3
ROCK DESCRIPTION

ROCK DEFINITION

Where reported on an exploration log, *rock* is defined as any naturally formed aggregate of mineral matter occurring in larges masses or fragments. This definition of rock should not be taken as a replacement for any definitions relating to rock and/or rock excavation defined in construction documents. Intensely weathered or decomposed rock that is friable and can be reduced to gravel size particles or smaller by normal hand pressure is identified and described as soil. Poorly indurated formational materials which display both rock-like and soil-like properties are identified and described as rock followed by the soil description. In such cases, the term "poorly indurated" or "weakly cemented" is added to the rock name (e.g. weakly cemented sandstone).

ROCK IDENTIFICATION

Rock is identified by a combination of *rock type* (igneous, metamorphic, or sedimentary) followed by the the *rock name* (e.g. granite, schist, sandstone).

ROCK DESCRIPTION

Rock descriptions are presented in the following general sequence. The detail of description is dictated by the complexity and objectives of the project.

Identification Components

(1) Rock Type and Name

Description Components

(2) Rock Grain Size (*for clastic sedimentary rock*)
(3) Crystal Size (*for igneous and metamorphic rock*)
(4) Bedding Spacing (*for sedimentary rock*)
(5) Color
(6) Hardness and Weathering Descriptors
(7) Fracture Density
(8) [Geologic Formation Name]

ROCK QUALITY DESIGNATION

$$\text{RQD (\%)} = \frac{\Sigma \text{ Length of intact core pieces} \geq 4 \text{ inches}}{\text{Total length of core run (inches)}} \times 100$$

The RQD should correlate with the fracture density in most cases. Higher RDQ values generally indicate fewer joints and fractures.

GRAIN / CRYSTAL SIZE

Grain Size for Clastic Sedimentary Rock

The names of clastic sedimentary rocks are generally based on their predominant clast or grain size (e.g. fine sandstone, medium sandstone, coarse gravel conglomerate, cobble conglomerate, siltstone, claystone).

Crystal Size for Igneous and Metamorphic Rock

Grain Size Description	Average Crystal Size (in.)
Very coarse grained (pegmatitic)	Greater than or equal to 3/8
Coarse-grained	Between 3/16 and 3/8
Medium-grained	Between 1/32 and 3/16
Fine-grained	Between 1/250 and 1/32
Aphanitic	Less than or equal to 1/250

BEDDING SPACING

Bedding Description	Thickness / Spacing
Massive	Less than 10 ft.
Very thickly bedded	3 ft. to 10 ft.
Thickly bedded	1 ft. to 3 ft.
Moderately bedded	4 in. to 1 ft.
Thinly bedded	1 in. to 4 in.
Very thinly bedded	1/4 in. to 1 in.
Laminated	Less than 1/4 in.

Note: Bedding is generally only applicable to sedimentary or bedded volcanic rocks.

HARDNESS

Hardness	Criteria
Extremely hard	Cannot be scratched with a pocketknife or sharp pick. Can only be chipped with repeated heavy hammer blows.
Very hard	Cannot be scratched with a pocketknife or sharp pick with difficulty. Breaks with repeated heavy hammer blows.
Hard	Can be scratched with with a pocketknife or sharp pick with difficulty. Breaks with heavy hammer blows.
Moderately hard	Can be scratched with a pocketknife or sharp pick with light or moderate pressure. Breaks with moderate hammer blows.
Moderately soft	Can be grooved 1/16 in. deep with a pocketknife or sharp pick with moderate or heavy pressure. Breaks with light hammer blow or heavy manual pressure.
Soft	Can be grooved or gouged easily with a pocketknife or sharp pick. Breaks with light to moderate manual pressure.
Very soft	Can be readily indented, grooved, or gouged with fingernail, or carved with a pocketknife. Breaks with light manual pressure.

WEATHERING (INTACT ROCK)

Weathering Description	Discoloration and/or Oxidation	General Characteristics
Fresh	Body of rock and fracture surfaces are not discolored or oxidized.	Rock texture unchanged. Hammer rings when crystalline rocks are struck.
Slightly weathered	Discoloration or oxidation limited to surface of, or short distance from, fractures. Most surfaces exhibit minor to complete discoloration.	Rock texture preserved. Hammer rings when crystalline rocks are struck. Body of rock not weakened.
Moderately weathered	Discoloration or oxidation extends usually throughout. Fe-Mg minerals appear rusty. All fracture surfaces are discolored or oxidized.	Rock texture generally preserved. Hammer does not ring when rock is struck. Body of rock slightly weakened.
Intensely weathered	Discoloration or oxidation throughout. Feldspar and Fe-Mg minerals altered to clay to some extent. All fracture surfaces are discolored or oxidized and friable.	Rock texture altered by chemical disintegration. Can usually be broken with moderate to heavy manual pressure or by light hammer blow . Body of rock is significantly weakened.
Decomposed	Discoloration or oxidation throughout but resistant minerals such as quartz may be unaltered. All feldspar and Fe-Mg minerals are completely altered to clay.	Resembles a soil; partial or complete remnant rock structure may be preserved. Can be granulated by hand. Resistant minerals may present as stringers or dikes.

FRACTURE DENSITY

Description	Observed Fracture Density
Unfractured	No fractures
Very slightly fractured	Core lengths greater than 3 ft.
Slightly fractured	Core lengths mostly from 1 ft. to 3 ft.
Moderately fractured	Core lengths mostly from 4 in. to 1 ft.
Intensely fractured	Core lengths mostly from 1 in. to 4 in.
Very intensely fractured	Mostly chips and fragments

Note: Fracture density is based on the fracture spacing in recovered core, measured along the core axis (excluding mechanical breaks).

Weston & Sampson℠

WSE Project: 2000145

North River Walk
13 Wallis Street, Peabody, MA
City of Peabody

BORING ID: B-101

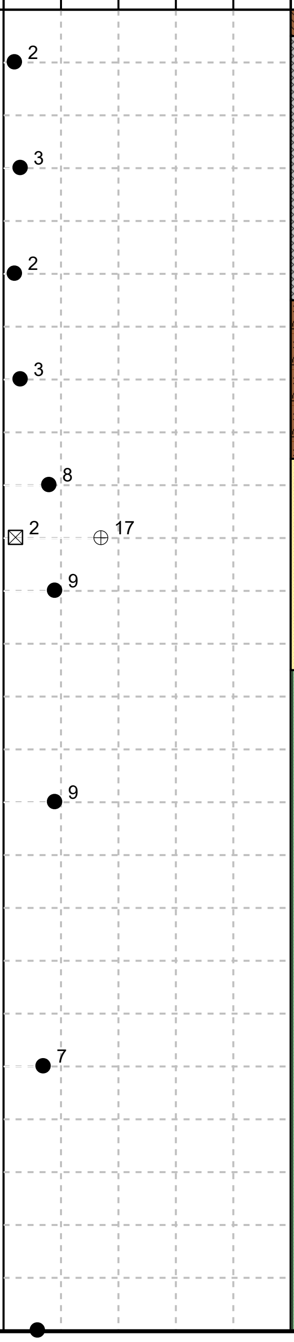
Page 1 of 2

CONTRACTOR:	**NE Boring Contractors, Inc.**	BORING LOCATION:	**See Attached Figure**	DATE START:	**April 14, 2020**
FOREMAN:	**Mike**	ADVANCE METHOD:	**Hollow-Stem Auger to Rotary Wash**	DATE FINISH:	**April 14, 2020**
LOGGED BY:	**J. Westgate, EIT**	AUGER DIAMETER:	**3-1/4" ID (Stem), 6-5/8" OD (Flights)**	GROUND EL:	**13.0 ± (NAVD88)**
CHECKED BY:	**S. Bridges, PE**	SUPPORT CASING:	**Driven Flush-Joint Casing (4" ID)**	FINAL DEPTH:	**29.5 ft. (Refusal)**
EQUIPMENT:	**All-Terrain Drill Rig**	CORING METHOD:	**N/A**	GRID COORDS:	**N:3017142 ± / E:811353 ±**
SPT HAMMER:	**Automatic (140-lb.)**	BACKFILL MATERIAL:	**Drill Cuttings**	GRID SYSTEM:	**NAD83 State Plane (MA)**

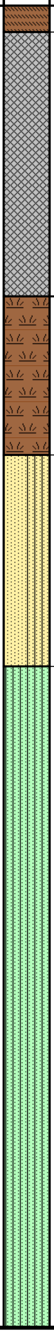
DEPTH BELOW GROUND SURFACE [VERTICAL FT.]	SAMPLE ID NUMBER AND RECOVERY RATIO [IN./IN.]	SPT BLOWS / 6 IN. (OR) CORE RATE / 12 IN. [MIN.]	SPT RESISTANCE, RQD, AND LABORATORY DATA	ELEVATION SCALE SHOWN TO NEAREST FT.
	S-1 6/24	1 1 1 2	● 2	
	S-2 12/24	2 2 1 2	● 3	
5	S-3 12/24	1 1 1 2	● 2	8
	S-4 11/24	1 1 2 3	● 3	
	S-5 0/24	2 2 6 9	● 8	
10	S-6 12/24	9 4 5 12	☒ 2 ⊕ 17 ● 9	3
15	S-7 11/24	3 4 5 4	● 9	-2
20	S-8 12/24	2 4 3 5	● 7	-7
	S-9 13/24	1 3	●	

SPT RESISTANCE, RQD, AND LABORATORY DATA

- ● N-Value, Raw (bpf)
- ⊕ Moisture Content (%)
- ▶ Plastic Limit (%)
- ◀ Liquid Limit (%)
- ☒ Organic Content (%)



STRATIGRAPHY LOG



STRATUM IDENTIFICATION AND DESCRIPTION

Surface: Grass field.

Topsoil- 6 inches.

Silty sand (SM) - Very loose to loose; black to brown; moist; mostly fine to coarse SAND, few fine to coarse gravel; with few organic's and ash mixed throughout. **[FILL]**

with white and pink chalk-like material

Peat (PT) - Soft; black; wet; little fine to medium sand, trace fine gravel.

with very soft, dark gray clay

Poorly graded sand with silt and gravel (SP-SM) - Loose; dark gray; wet; mostly fine to coarse SAND, some fine gravel; trace organics.

Silty sand (SM) - Loose; brown with gray; wet; mostly fine SAND, little non plastic fines.

with trace gravel

REMARKS, OTHER TESTS, AND INSTALLATIONS

[4.5] Water level measured on 04/14/20 (during drilling).

[6.0] Switched to Rotary Wash Drilling below 6 feet.

[10.0] GC: 27%, SC: 67%, FC: 7%

Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

DEPTH BELOW GROUND SURFACE [VERTICAL FT.]	SAMPLE TYPE GRAPHIC	SAMPLE ID NUMBER AND RECOVERY RATIO [IN./IN.]	SPT BLOWS / 6 IN. (OR) CORE RATE / 12 IN. [MIN.]	SPT RESISTANCE, RQD, AND LABORATORY DATA ● N-Value, Raw (bpf) ⊕ Moisture Content (%) ▶ Plastic Limit (%) ◀ Liquid Limit (%) ☒ Organic Content (%) 10 20 30 40	STRATIGRAPHY LOG	STRATUM IDENTIFICATION AND DESCRIPTION	ELEVATION SCALE SHOWN TO NEAREST FT.	REMARKS, OTHER TESTS, AND INSTALLATIONS
			3 4	6				
		S-10 2/2	50/2			**Sandy silt (ML)** - Hard; gray; wet; mostly non plastic FINES, some fine to coarse sand, trace fine gravel; possible rock fragments or cobbles in the sample tip. **[GLACIAL TILL]**		***Sampler and auger refusal at 29.5 ft. (exploration ended).***
30							-17	
35							-22	
40							-27	
45							-32	
50							-37	

Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

Weston & Sampson

WSE Project: 2000145

North River Walk
13 Wallis Street, Peabody, MA
City of Peabody

BORING ID: B-102

Page 1 of 2

CONTRACTOR: **NE Boring Contractors, Inc.**
FOREMAN: **Mike**
LOGGED BY: **J. Westgate, EIT**
CHECKED BY: **S. Bridges, PE**
EQUIPMENT: **All-Terrain Drill Rig**
SPT HAMMER: **Automatic (140-lb.)**

BORING LOCATION: **See Attached Figure**
ADVANCE METHOD: **Hollow-Stem Auger to Rotary Wash**
AUGER DIAMETER: **3-1/4" ID (Stem), 6-5/8" OD (Flights)**
SUPPORT CASING: **Driven Flush-Joint Casing (4" ID)**
CORING METHOD: **N/A**
BACKFILL MATERIAL: **Drill Cuttings**

DATE START: **April 14, 2020**
DATE FINISH: **April 14, 2020**
GROUND EL: **13.0 ± (NAVD88)**
FINAL DEPTH: **40.5 ft. (Refusal)**
GRID COORDS: **N:3017108 ± / E:811449 ±**
GRID SYSTEM: **NAD83 State Plane (MA)**

DEPTH BELOW GROUND SURFACE [VERTICAL FT.]	SAMPLE TYPE GRAPHIC	SAMPLE ID NUMBER AND RECOVERY RATIO [IN./IN.]	SPT BLOWS / 6 IN. (OR) CORE RATE / 12 IN. [MIN.]	SPT RESISTANCE, RQD, AND LABORATORY DATA ● N-Value, Raw (bpf) ⊕ Moisture Content (%) ▶ Plastic Limit (%) ◀ Liquid Limit (%) ☒ Organic Content (%) 10 20 30 40	STRATIGRAPHY LOG	STRATUM IDENTIFICATION AND DESCRIPTION	ELEVATION SCALE SHOWN TO NEAREST FT.	REMARKS, OTHER TESTS, AND INSTALLATIONS
						Surface: Grass field.		
		S-1 4/24	1 2 2 2	● 4		Topsoil- 6 inches. **Silty sand (SM)** - Loose; black to brown; moist; mostly fine SAND, some non plastic fines; with few organic's and ash mixed throughout. **[FILL]**		
		S-2 6/24	2 3 3 2	● 6				
5		S-3 3/24	3 2 1 1	● 3		▼	8	[5.0] Water level measured on 04/14/20 (during drilling).
		S-4 0/24	0 0 1 1	● 1				[6.0] Switched to Rotary Wash Drilling below 6 feet.
		S-5 5/24	0 0 3 2	● 3		**Peat (PT)** - Very soft to soft; black; wet; little fine to medium sand, trace fine gravel.		
10		S-6 12/24	1 2 4 8	● 6		**Poorly graded sand with silt and gravel (SP-SM)** - Loose; dark gray to brown; wet; mostly fine to coarse SAND, some fine gravel, few non plastic fines.	3	[10.0] GC: 32%, SC: 63%, FC: 5%
								[13.0 - 13.5] roller bit grinding on possible cobbles/boulders.
15		S-7 13/24	3 2 2 3	● 4		**Silty sand (SM)** - Very loose to loose; brown; wet; mostly fine to medium SAND, little non plastic fines, trace fine gravel.	-2	
20		S-8 12/24	2 2 4 5	● 6			-7	[19.0] GC: 2%, SC: 82%, FC: 16%
		S-9 14/24	3 3	●				

Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

Weston & Sampson

WSE Project: 2000145

North River Walk
13 Wallis Street, Peabody, MA
City of Peabody

BORING ID: B-102

DEPTH BELOW GROUND SURFACE [VERTICAL FT.]	SAMPLE TYPE GRAPHIC	SAMPLE ID NUMBER AND RECOVERY RATIO [IN./IN.]	SPT BLOWS / 6 IN. (OR) CORE RATE / 12 IN. [MIN.]	SPT RESISTANCE, RQD, AND LABORATORY DATA ● N-Value, Raw (bpf) ⊕ Moisture Content (%) ▶ Plastic Limit (%) ◀ Liquid Limit (%) ☒ Organic Content (%) 10 20 30 40	STRATIGRAPHY LOG	STRATUM IDENTIFICATION AND DESCRIPTION	ELEVATION SCALE SHOWN TO NEAREST FT.	REMARKS, OTHER TESTS, AND INSTALLATIONS
			7 8					
		S-10 13/24	1 3 3 4					[29.0] GC: 0%, SC: 67%, FC: 33%
30				6			-17	
		S-11 16/24	2 4 6 5					
35				10			-22	
						Sandy silt (ML) - Hard; gray; wet; mostly non plastic FINES, some fine to coarse sand, few fine gravel. **[GLACIAL TILL]**		
		S-12 12/18	7 17 50/3					
40							-27	
								Sampler and auger refusal at 40.5 ft. (exploration ended).
45							-32	
50							-37	

Refer to the attached index sheets for important information about this log including general notes, legends, and guidance on description methods and procedures.

APPENDIX E

Laboratory Test Results

Client:	Weston & Sampson Engineers				
Project:	Peabody Riverwalk				
Location:	Peabody, MA			Project No:	GTX-309194
Boring ID:	B-7	Sample Type:	jar	Tested By:	GA
Sample ID:	S5	Test Date:	12/06/18	Checked By:	emm
Depth :	8-10 ft	Test Id:	483764		

Test Comment: ---

Visual Description: Moist, dark gray sandy clay with organics

Sample Comment: ---

Moisture, Ash, and Organic Matter - ASTM D2974

Boring ID	Sample ID	Depth	Description	Moisture Content,%	Ash Content,%	Organic Matter,%
B-7	S5	8-10 ft	Moist, dark gray sandy clay with organics	93	89.4	10.6

Notes: Moisture content determined by Method A and reported as a percentage of oven-dried mass;
dried to a constant mass at temperature of 105º C
Ash content and organic matter determined by Method C; dried to constant mass at temperature 440º C

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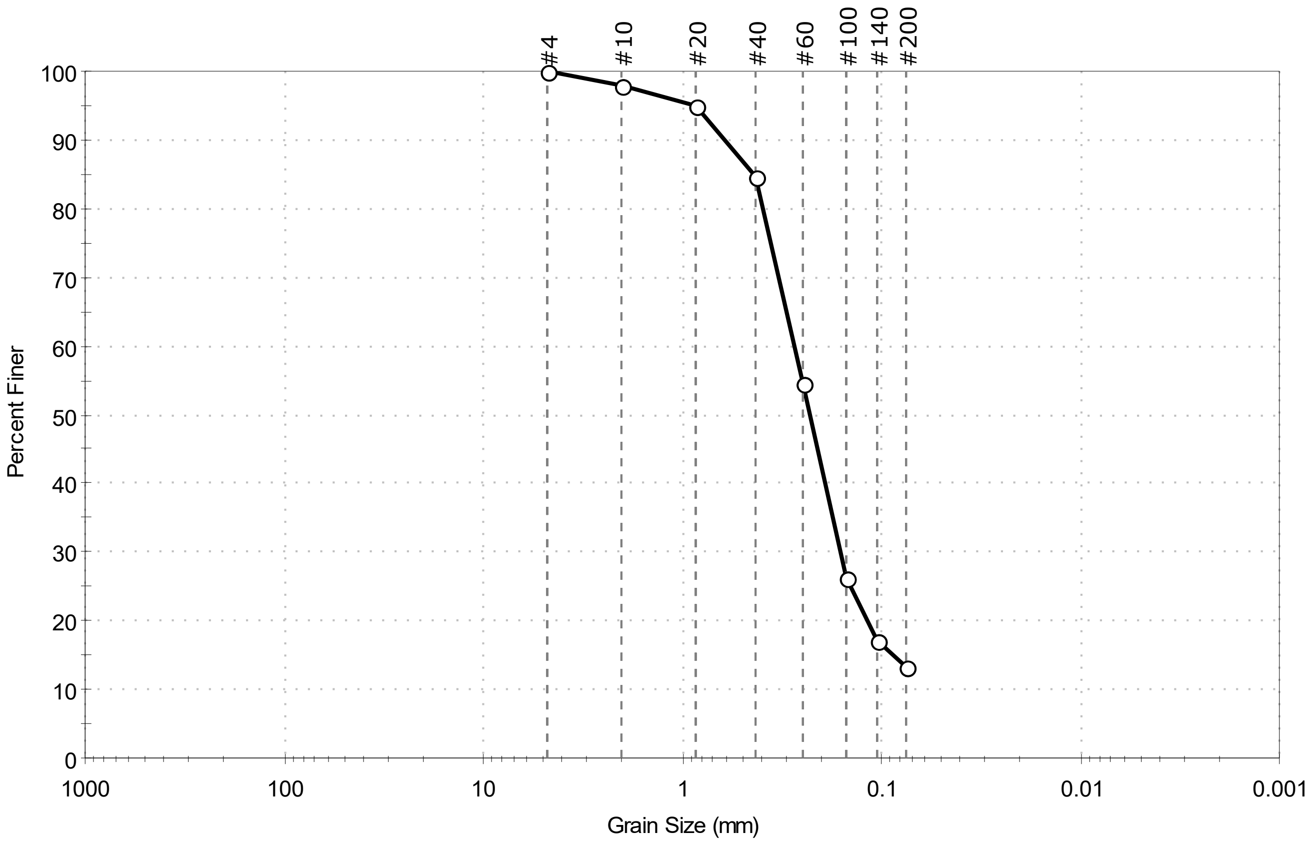
Client:	Weston & Sampson Engineers				
Project:	Peabody Riverwalk				
Location:	Peabody, MA			Project No:	GTX-309194
Boring ID:	B-1	Sample Type:	jar	Tested By:	GA
Sample ID:	S6	Test Date:	12/06/18	Checked By:	emm
Depth :	11-13 ft	Test Id:	483340		

Test Comment: ---
Visual Description: Moist, very dark gray silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	86.7	13.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	98		
#20	0.85	95		
#40	0.42	85		
#60	0.25	55		
#100	0.15	26		
#140	0.11	17		
#200	0.075	13		

Coefficients

D_{85} =0.4375 mm	D_{30} =0.1606 mm
D_{60} =0.2749 mm	D_{15} =0.0873 mm
D_{50} =0.2300 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM	N/A
AASHTO	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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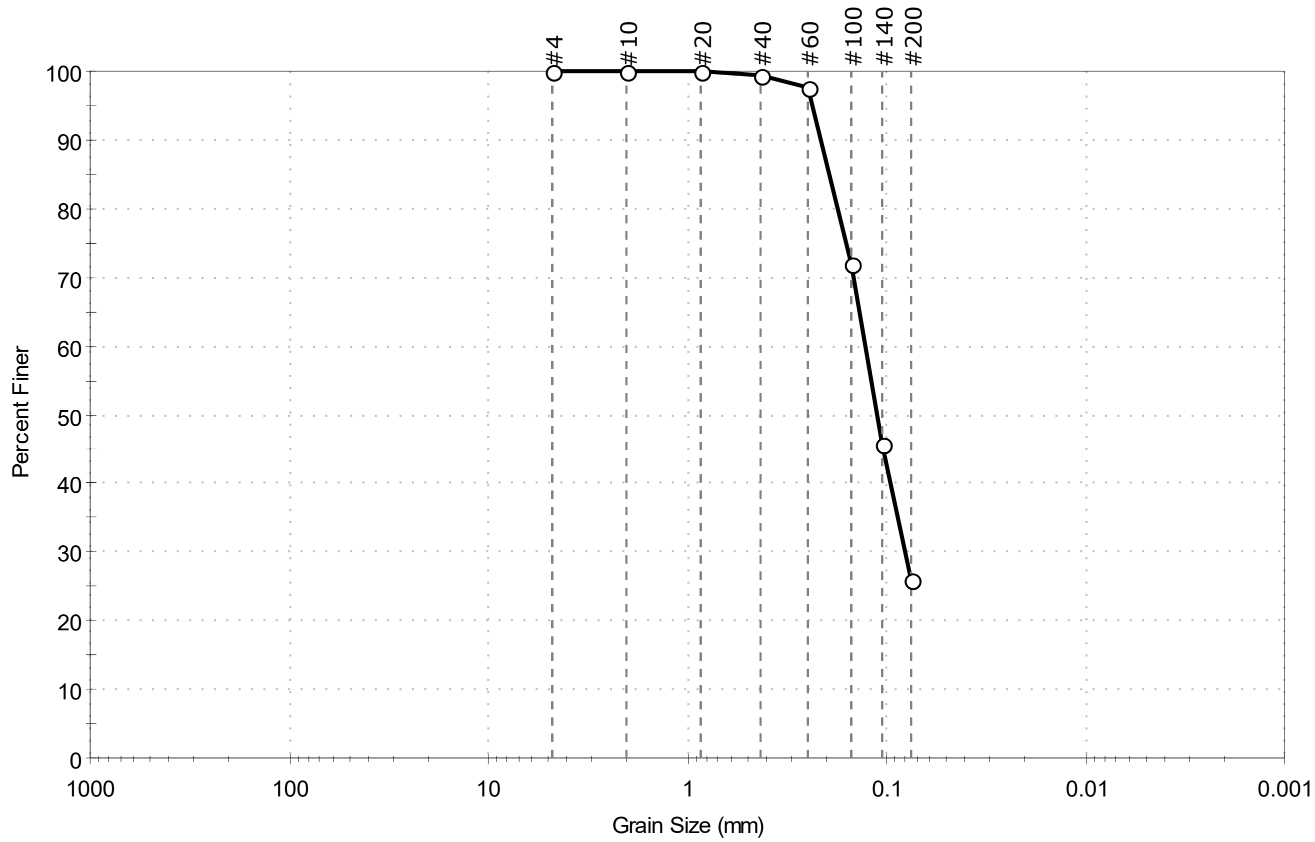
Client:	Weston & Sampson Engineers		
Project:	Peabody Riverwalk		
Location:	Peabody, MA	Project No:	GTX-309194

Boring ID:	B-2	Sample Type:	jar	Tested By:	GA
Sample ID:	S5 (bottom)	Test Date:	12/06/18	Checked By:	emm
Depth :	9-10 ft	Test Id:	483341		

Test Comment: ---
Visual Description: Moist, light grayish brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	74.1	25.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	98		
#100	0.15	72		
#140	0.11	46		
#200	0.075	26		

Coefficients

D_{85} =0.1946 mm	D_{30} =0.0806 mm
D_{60} =0.1282 mm	D_{15} =N/A
D_{50} =0.1123 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

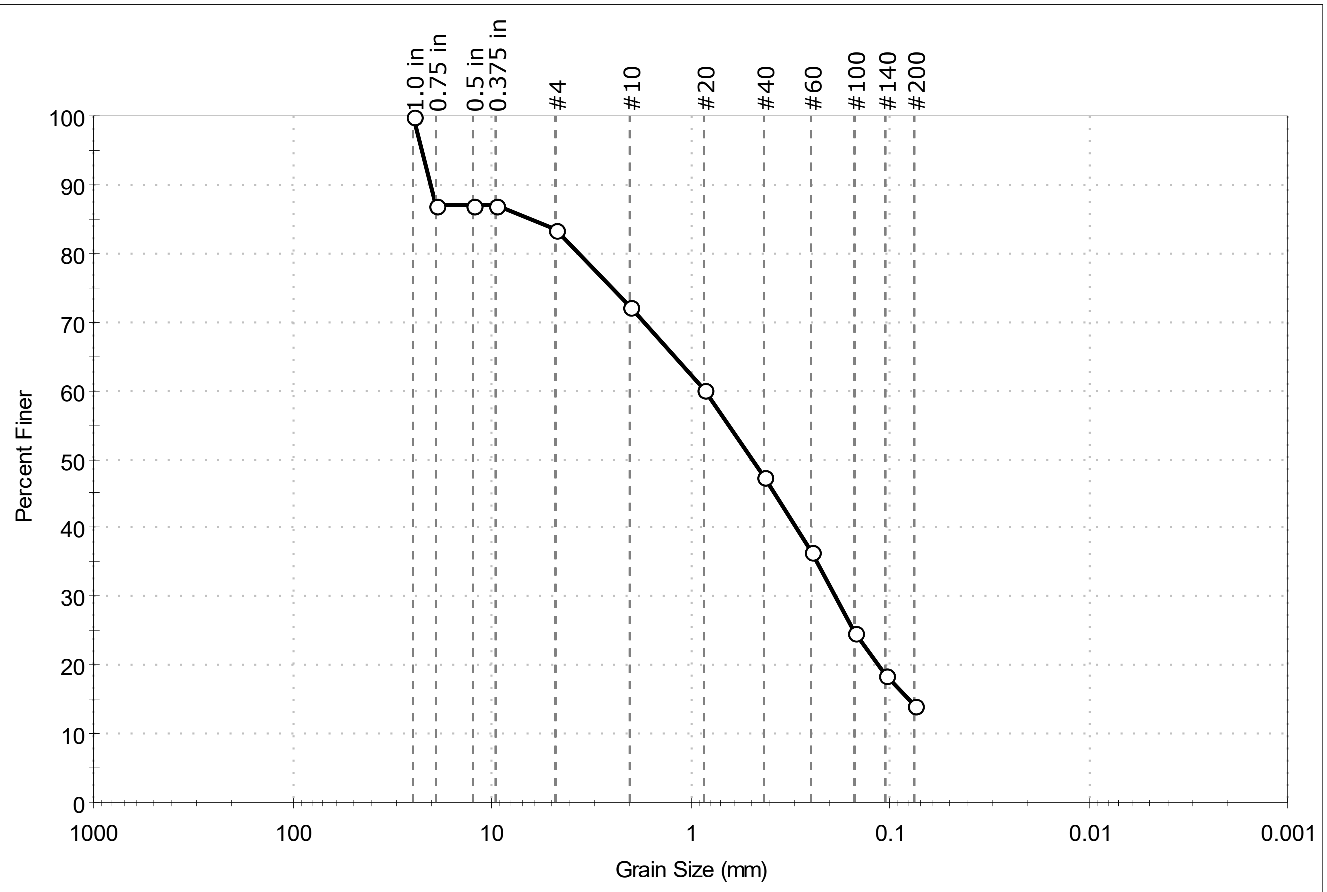
printed 12/6/2018 8:40:53 AM

Client:	Weston & Sampson Engineers		
Project:	Peabody Riverwalk		
Location:	Peabody, MA	Project No:	GTX-309194

Boring ID:	B-3	Sample Type:	jar	Tested By:	GA
Sample ID:	S4 (bottom)	Test Date:	12/06/18	Checked By:	emm
Depth :	9-10 ft	Test Id:	483342		

Test Comment: ---
Visual Description: Moist, dark yellowish brown silty sand with gravel
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	16.6	69.3	14.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.0 in	25.00	100		
0.75 in	19.00	87		
0.5 in	12.50	87		
0.375 in	9.50	87		
#4	4.75	83		
#10	2.00	72		
#20	0.85	60		
#40	0.42	48		
#60	0.25	37		
#100	0.15	25		
#140	0.11	19		
#200	0.075	14		

Coefficients

D_{85} =6.4529 mm
D_{30} =0.1878 mm
D_{60} =0.8359 mm
D_{15} =0.0803 mm
D_{50} =0.4863 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

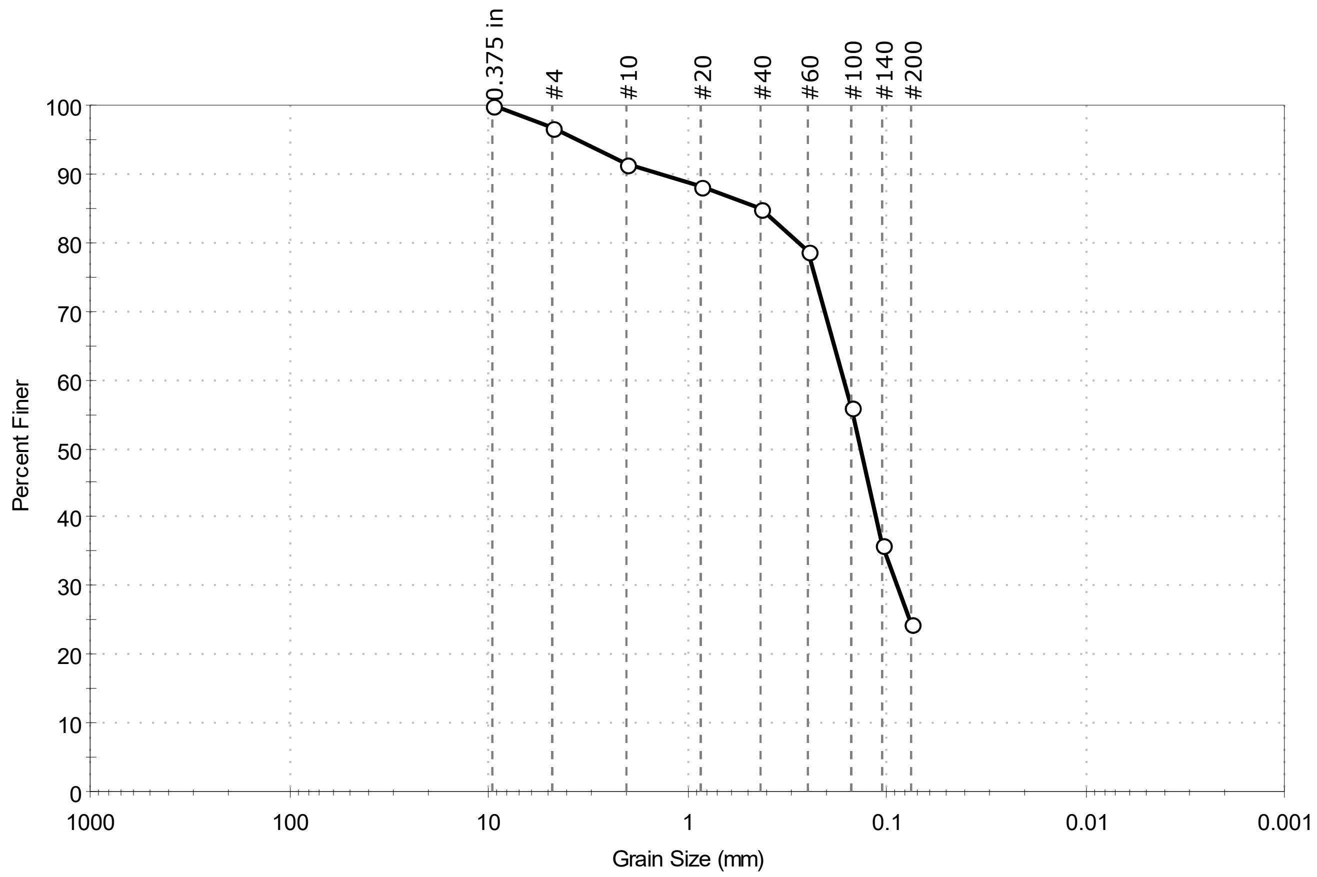
Sand/Gravel Hardness : HARD

printed 12/6/2018 8:40:55 AM

Client:	Weston & Sampson Engineers				
Project:	Peabody Riverwalk				
Location:	Peabody, MA			Project No:	GTX-309194
Boring ID:	B-4	Sample Type:	jar	Tested By:	GA
Sample ID:	S3	Test Date:	12/06/18	Checked By:	emm
Depth :	4-6 ft	Test Id:	483343		

Test Comment: ---
Visual Description: Moist, dark gray silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	3.3	72.1	24.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	97		
#10	2.00	92		
#20	0.85	88		
#40	0.42	85		
#60	0.25	79		
#100	0.15	56		
#140	0.11	36		
#200	0.075	25		

Coefficients

D_{85} =0.4313 mm	D_{30} =0.0885 mm
D_{60} =0.1639 mm	D_{15} =N/A
D_{50} =0.1352 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

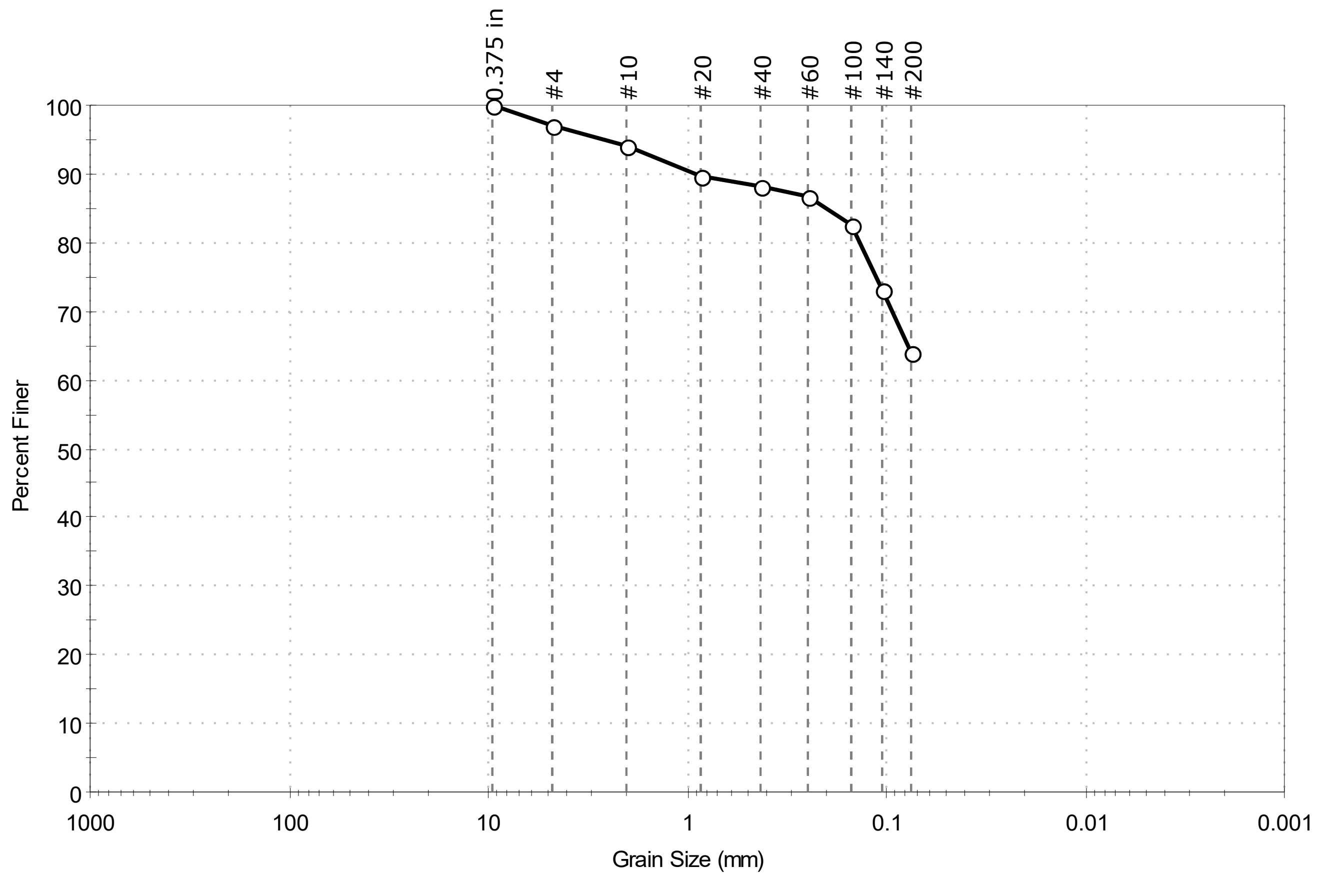
Sand/Gravel Hardness : HARD

printed 12/6/2018 8:40:55 AM

Client:	Weston & Sampson Engineers				
Project:	Peabody Riverwalk				
Location:	Peabody, MA			Project No:	GTX-309194
Boring ID:	B-6	Sample Type:	jar	Tested By:	GA
Sample ID:	S6	Test Date:	12/06/18	Checked By:	emm
Depth :	14-16 ft	Test Id:	483344		

Test Comment: ---
Visual Description: Moist, gray sandy silt
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	3.1	33.0	63.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	97		
#10	2.00	94		
#20	0.85	90		
#40	0.42	88		
#60	0.25	87		
#100	0.15	83		
#140	0.11	73		
#200	0.075	64		

Coefficients

D_{85} =0.2000 mm
D_{30} =N/A
D_{60} =N/A
D_{15} =N/A
D_{50} =N/A
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

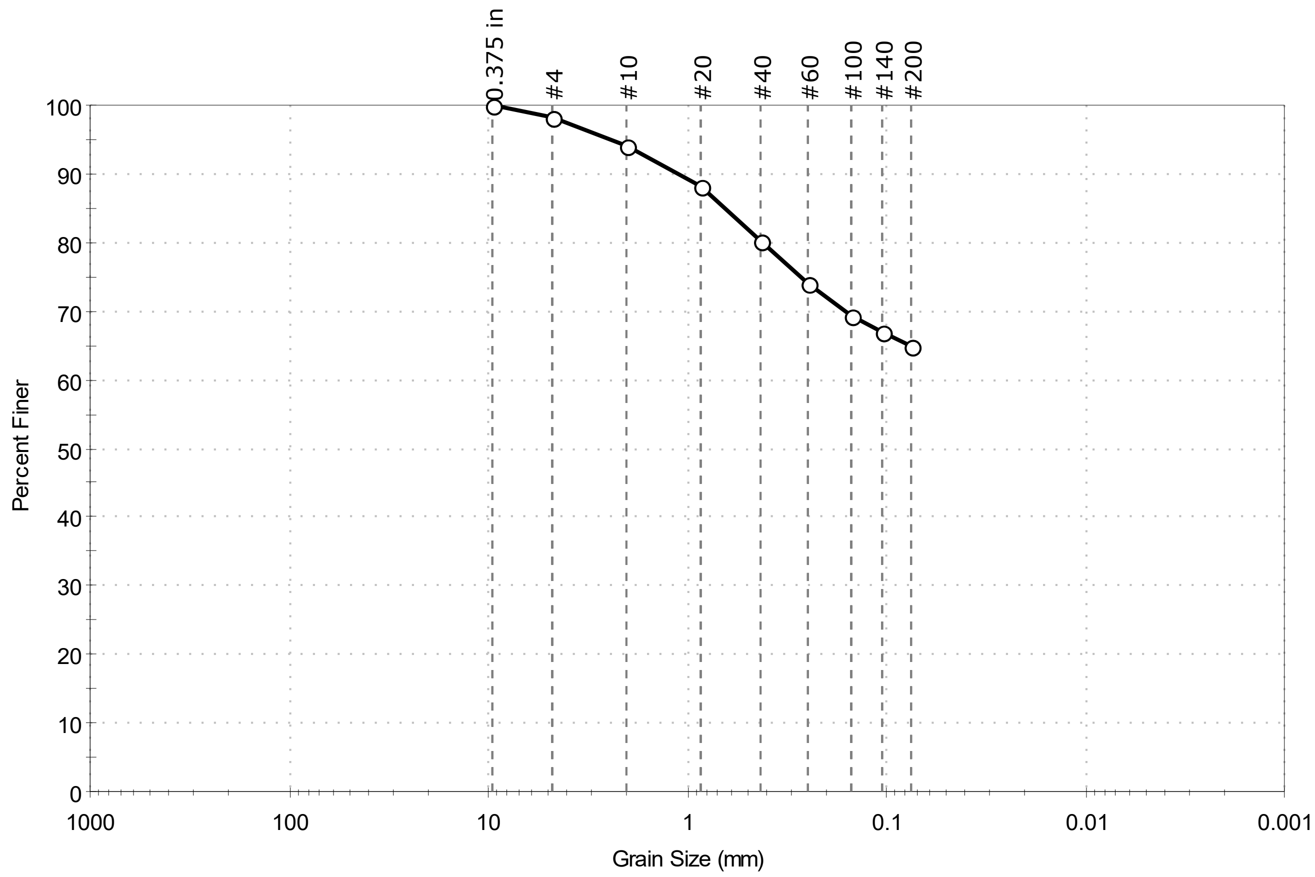
printed 12/6/2018 8:40:56 AM

Client: Weston & Sampson Engineers
Project: Peabody Riverwalk
Location: Peabody, MA
Project No: GTX-309194

Boring ID:	B-7	Sample Type:	jar	Tested By:	GA
Sample ID:	S5	Test Date:	12/06/18	Checked By:	emm
Depth :	8-10 ft	Test Id:	483345		

Test Comment: ---
Visual Description: Moist, dark gray sandy clay with organics
Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.6	33.5	64.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	94		
#20	0.85	88		
#40	0.42	80		
#60	0.25	74		
#100	0.15	69		
#140	0.11	67		
#200	0.075	65		

Coefficients

D_{85} =0.6414 mm	D_{30} =N/A
D_{60} =N/A	D_{15} =N/A
D_{50} =N/A	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

printed 12/6/2018 8:40:57 AM

Client:	Weston & Sampson Engineers		
Project:	Peabody N. River Canal		
Location:	Peabody, MA	Project No:	GTX-311686

Boring ID:	B-101	Sample Type:	jar	Tested By:	cam
Sample ID:	S6	Test Date:	05/04/20	Checked By:	jsc
Depth :	10-12 ft	Test Id:	556168		

Test Comment: ---
Visual Description: Moist, very dark brown sand with silt and gravel
Sample Comment: ---

Moisture, Ash, and Organic Matter - ASTM D2974

Boring ID	Sample ID	Depth	Description	Moisture Content,%	Ash Content,%	Organic Matter,%
B-101	S6	10-12 ft	Moist, very dark brown sand with silt and gravel	17	97.8	2.2

Notes: Moisture content determined by Method A and reported as a percentage of oven-dried mass;
dried to a constant mass at temperature of 105º C
Ash content and organic matter determined by Method C; dried to constant mass at temperature 440º C

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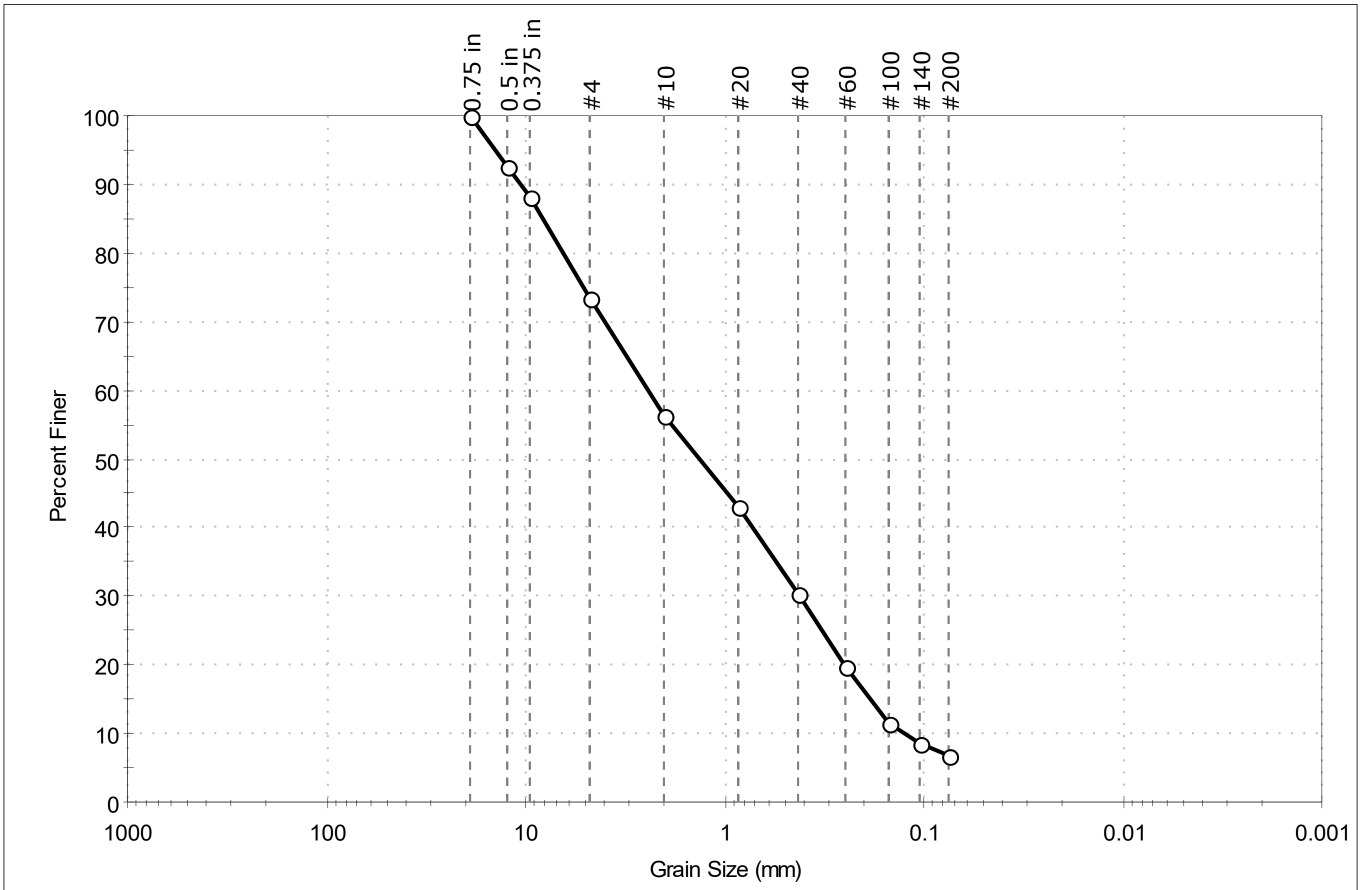
GeoTesting EXPRESS

Client:	Weston & Sampson Engineers		
Project:	Peabody N. River Canal		
Location:	Peabody, MA	Project No:	GTX-311686
Boring ID: B-101	Sample Type: jar	Tested By:	ckg
Sample ID: S6	Test Date: 04/30/20	Checked By:	jsc
Depth : 10-12 ft	Test Id: 556165		

Test Comment: ---
Visual Description: Moist, very dark brown sand with silt and gravel
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	26.6	66.7	6.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	93		
0.375 in	9.50	88		
#4	4.75	73		
#10	2.00	56		
#20	0.85	43		
#40	0.42	30		
#60	0.25	20		
#100	0.15	12		
#140	0.11	9		
#200	0.075	6.7		

Coefficients

D_{85} =8.2150 mm	D_{30} =0.4149 mm
D_{60} =2.3988 mm	D_{15} =0.1854 mm
D_{50} =1.3236 mm	D_{10} =0.1255 mm
C_u =19.114	C_c =0.572

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

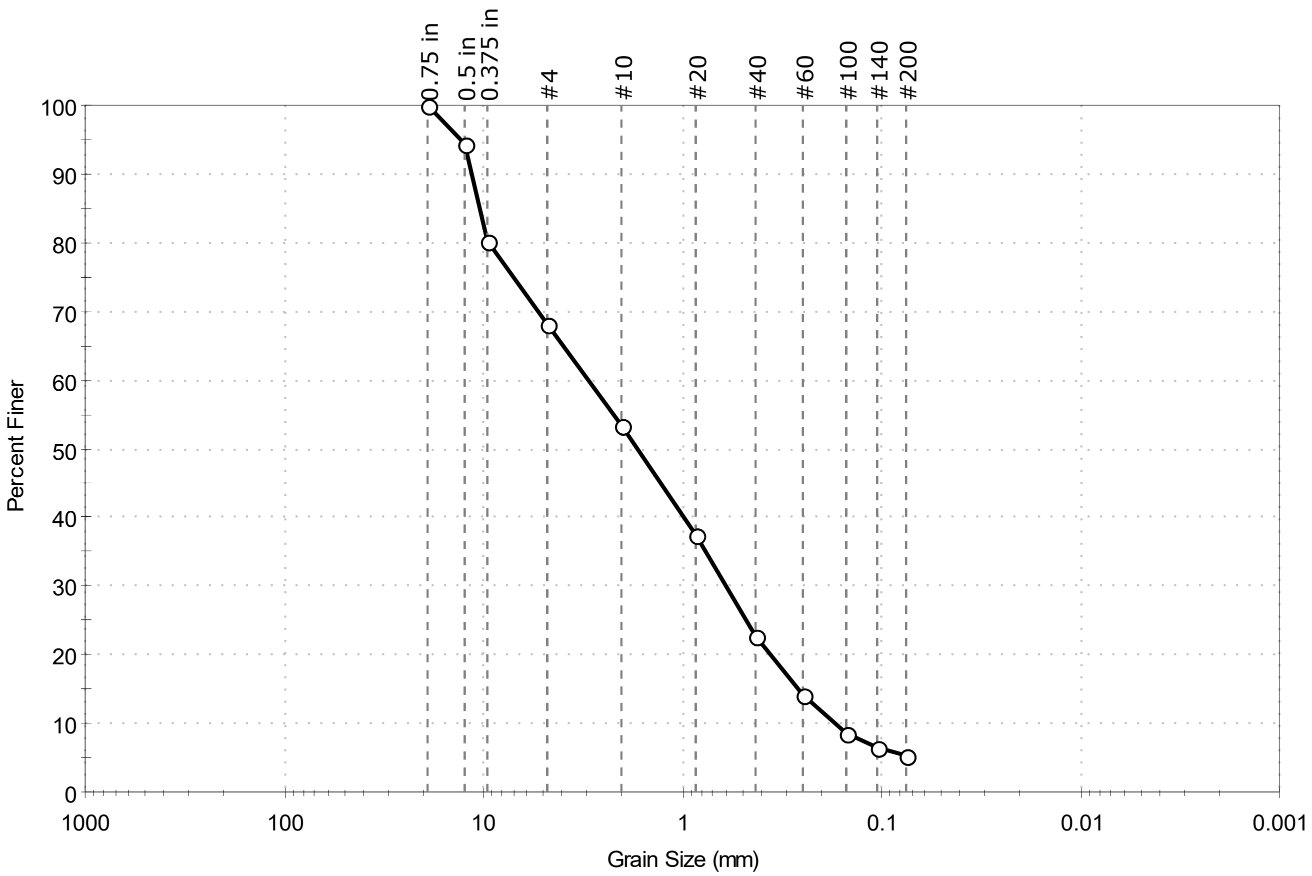
printed 5/4/2020 12:11:36 PM

Client: Weston & Sampson Engineers
Project: Peabody N. River Canal
Location: Peabody, MA
Project No: GTX-311686

Boring ID: B-102 Sample Type: jar Tested By: ckg
Sample ID: S6 Test Date: 04/30/20 Checked By: jsc
Depth : 10-12 ft Test Id: 556166

Test Comment: ---
Visual Description: Moist, very dark gray sand with silt and gravel
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	32.0	62.8	5.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	94		
0.375 in	9.50	80		
#4	4.75	68		
#10	2.00	53		
#20	0.85	37		
#40	0.42	23		
#60	0.25	14		
#100	0.15	9		
#140	0.11	7		
#200	0.075	5.2		

Coefficients

D_{85} =10.4256 mm D_{30} =0.6005 mm
D_{60} =2.9509 mm D_{15} =0.2648 mm
D_{50} =1.6667 mm D_{10} =0.1706 mm
C_u =17.297 C_c =0.716

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

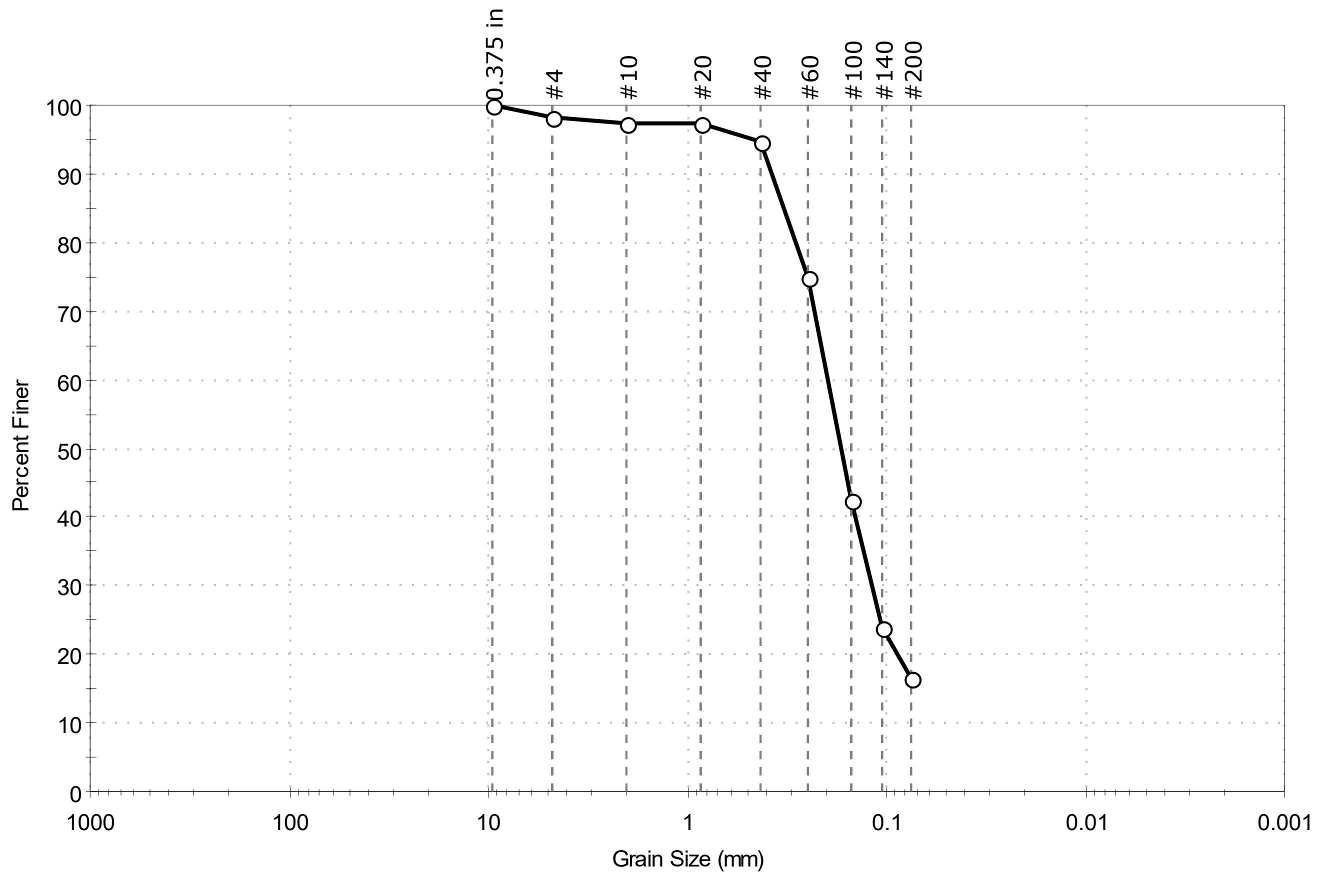
printed 5/4/2020 12:11:37 PM

Client: Weston & Sampson Engineers
Project: Peabody N. River Canal
Location: Peabody, MA
Project No: GTX-311686

Boring ID: B-102
Sample ID: S8
Depth : 19-21 ft
Sample Type: jar
Test Date: 04/30/20
Test Id: 556167
Tested By: ckg
Checked By: jsc

Test Comment: ---
Visual Description: Moist, yellowish brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	1.7	81.9	16.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	98		
#10	2.00	97		
#20	0.85	97		
#40	0.42	95		
#60	0.25	75		
#100	0.15	42		
#140	0.11	24		
#200	0.075	16		

Coefficients

D_{85} =0.3280 mm
D_{30} =0.1189 mm
D_{60} =0.1978 mm
D_{15} =N/A
D_{50} =0.1691 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

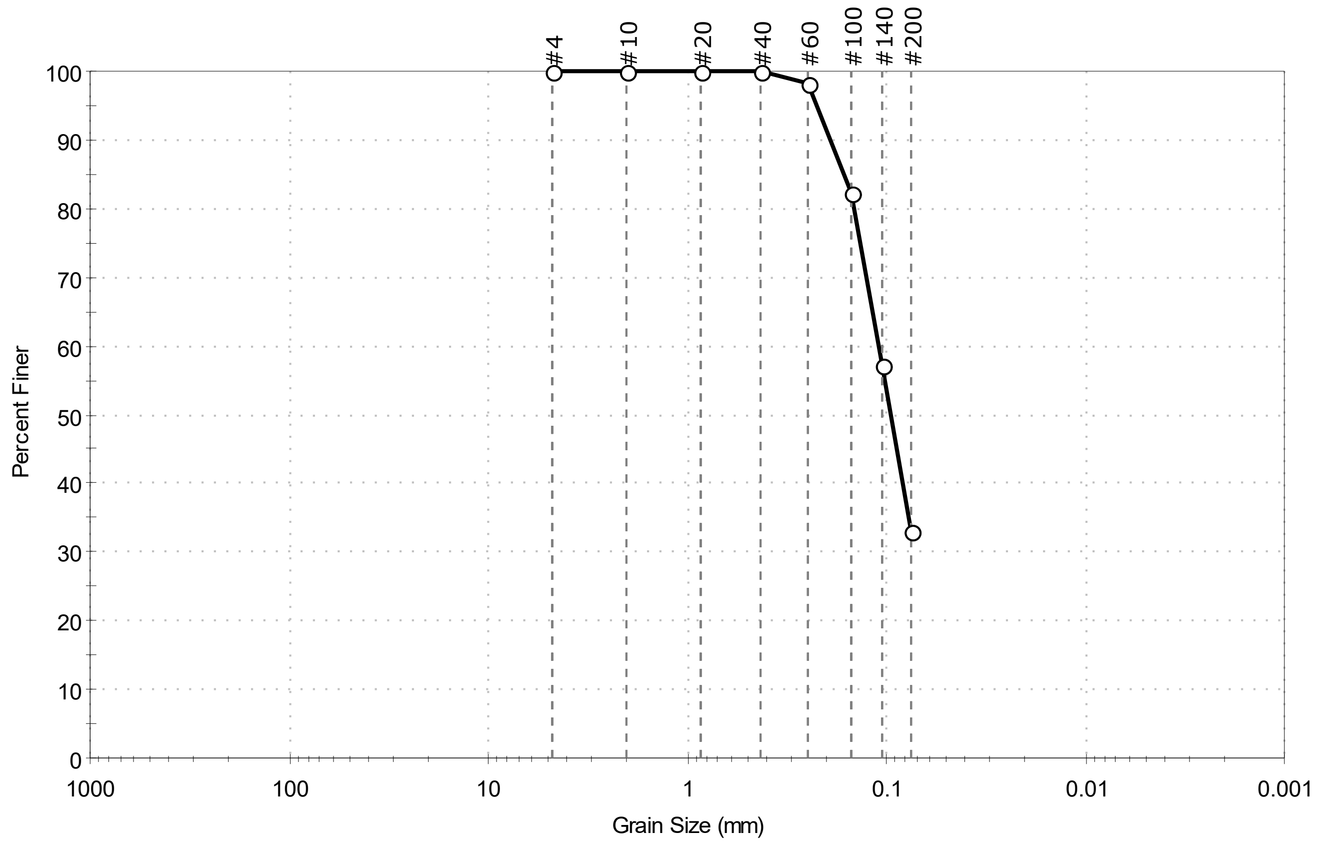
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

printed 5/4/2020 12:11:38 PM

Client: Weston & Sampson Engineers
Project: Peabody N. River Canal
Location: Peabody, MA
Project No: GTX-311686
Boring ID: B-102
Sample Type: jar
Tested By: ckg
Sample ID: S9
Test Date: 04/30/20
Checked By: jsc
Depth : 29-31 ft
Test Id: 556164
Test Comment: ---
Visual Description: Moist, light olive brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	66.8	33.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	98		
#100	0.15	82		
#140	0.11	57		
#200	0.075	33		

Coefficients

D_{85} =0.1639 mm
D_{30} =N/A
D_{60} =0.1102 mm
D_{15} =N/A
D_{50} =0.0956 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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Appendix F

"Important Information about this Geotechnical Engineering Report" by GBA, Inc.

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

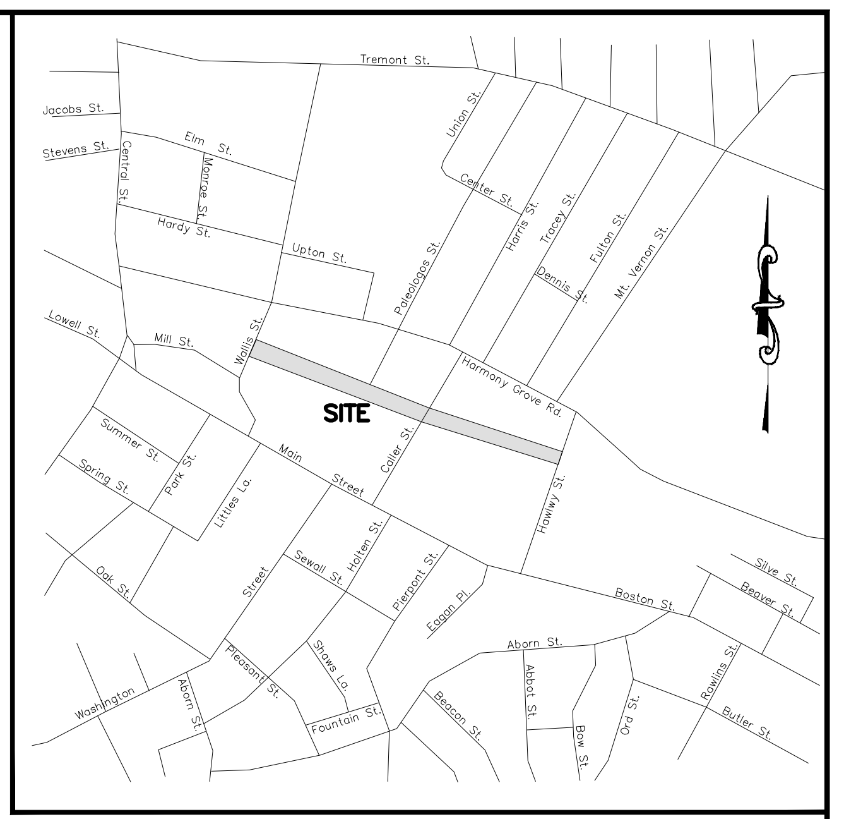
GBA
GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org   www.geoprofessional.org

APPENDIX C

Property & Topographic Survey – May 2020

FOR REGISTRY USE



LOCATION MAP
SCALE: 1"=1000'±

LEGEND

⌒⌒⌒⌒⌒	EDGE OF WOODS
	DECIDUOUS TREE
	CONIFEROUS TREE
	SHRUB/BUSH
	SIGN
	UTILITY POLE
	LIGHT POLE
	HYDRANT
WSO	WATER SHUTOFF
GV ⋈	GAS VALVE
WV ⋈	WATER VALVE
⊡	MONUMENT
◎	IRON PIN / IRON ROD
♿	HANDICAP SPACE
——— – – ———	PROPERTY LINE
—— —— ——	EASEMENT
—— ST ——	STORM SEWER LINE
—— SS ——	SANITARY SEWER LINE
—— W ——	WATER LINE
—— . ——	GAS LINE
—— S ——	SIGNAL WIRE LINE
—— C ——	CABLE LINE
—— FO ——	FIBER OPTIC LINE
—— LPS ——	LOW PRESSURE SEWER LINE
—— E ——	ELECTRIC LINE
—— H ——	HEATING LINE
—— T ——	TELEPHONE LINE
Ⓢ (SS)	SANITARY MANHOLE (SMH)
(ST)	STORM MANHOLE (STMH)
□ Ⓒ	CATCHBASIN (CB)
○	METAL POST/BOLLARD (BOL)
Ⓔ	ELECTRIC MANHOLE (MHE)
·	UNKNOWN MANHOLE
Ⓣ	TELEPHONE MANHOLE (MHT)
—— 10 ——	MAJOR CONTOUR LINE
—— 9 ——	MINOR CONTOUR LINE

NOTES□

□. BEARINGS REFER TO THE MASSACHUSETTS NAD □3 STATE PLANE COORDINATE SYSTEM □MAINLAND □ONE□

2. ELEVATIONS REFER TO THE NORTH AMERICAN VERTICAL DATUM OF □□□□.

3. REFERENCE IS MADE TO THE FOLLOWING MAPS□

A. "LAND OF ANNABLE BROS. PEABODY", BY GUY W. RICKER, SCALE 1"=20', DATED SEPT. 1902, RECORDED IN BOOK 1683, PLAN 438 OF THE ESSEX SOUTH REGISTRY OF DEEDS.

B. "LAND OF MORRILL LEATHER CO. PEABODY MASS.", BY GUY W. RICKER, SCALE 1"=20', DATED DEC. 1902, RECORDED AS MAP 1669 - 600.

C. "STATION MAP - LANDS BOSTON AND MAINE R.R. STATION 45+0 TO STATION 95+0", SCALE 1"=100', DATED JUNE 30, 1914, REVISED TO DEC. □, □□□□, RECORDED IN PLAN BOO□ □4□, PLAN 2□ OF THE ESSEX SOUTH REGISTRY OF DEEDS.

D. "PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, SCALE 1"=20', DATED OCT. 2□, □□□4, LAND COURT PLAN □□3□A.

E. "PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, SCALE 1"=20', DATED AUGUST □□□□, RECORDED IN PLAN BOO□ 3□, PLAN 3□ OF THE ESSEX SOUTH REGISTRY OF DEEDS.

F. PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, SCALE 1"=20', DATED OCT. □□□□, LAND COURT PLAN □□□□A.

G. "PLAN OF LAND - PEABODY, MASS. BELONGING TO THE MORRILL LEATHER CO.", BY SHAY & SHAY, SCALE 1"=20', DATED FEB. 14, 1930, RECORDED AS PLAN □□□ OF □□3□ OF THE ESSEX SOUTH REGISTRY OF DEEDS.

H. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER, SCALE 1"=40', DATED SEPTEMBER 1952, LAND COURT PLAN 6997C.

I. "PLAN OF LAND IN PEABODY PROPERTY OF HOWLEY REALTY TRUST OF PEABODY", BY OSBORN PALMER, INC., SCALE 1"=20', DATED FEB, 26, □□□□, RECORDED IN PLAN BOO□ □□4, PLAN □2 OF THE ESSEX SOUTH REGISTRY OF DEEDS.

□. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER INC, SCALE 1"=50', DATED MAY 26, 1966, LAND COURT PLAN 5137B.

□. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER INC, SCALE 1"=50', DATED FEBRUARY 5, 1967, LAND COURT PLAN 5137C.

L. "EASEMENT PLAN PEABODY-SALEM INTERCEPTING SEWER FROM SALEM-PEABODY LINE TO PEABODY SQUARE PEABODY, MASS.", BY RAYMOND C. PRESSEY, INC., SCALE 1"=20', DATED APRIL 15, 1971, REVISED □UNE □□, □□□□, RECORDED IN PLAN BOO□ □2□ PLAN □4 OF THE ESSEX SOUTH REGISTRY OF DEEDS.

M. "PLAN OF LAND IN PEABODY PREPARED FOR E.H. PORTER CONSTRUCTION COMPANY", BY ESSEX SURVEY SERVICE, INC., SCALE 1"=20', DATED NOV. 28, 1975, RECORDED IN PLAN BOOK 136, PLAN 37 OF THE ESSEX SOUTH REGISTRY OF DEEDS.

N. "PLAN OF LAND IN PEABODY PREPARED FOR BOB-KAT TANNING CO., INC.", BY ESSEX SURVEY SERVICE INC., SCALE 1"=20', DATED APRIL 27, □□□□, RECORDED IN PLAN BOO□ □44, PLAN □2 OF THE ESSEX SOUTH REGISTRY OF DEEDS.

O. "COUNTY OF ESSEX, MASSACHUSETTS PLAN OF A PORTION OF WALLIS STREET FROM MAIN STREET TO WALNUT STREET IN THE CITY OF PEABODY AS RELOCATED", SCALE 1"=20', DATED MARCH 5, 1985, REVISED DEC. 4, □□□□, COUNTY RECORD NUMBER 32□4.

P. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"=40', DATED JULY □4, □□□□, REVISED NOVEMBER □, □□□□, RECORDED IN PLAN BOO□ 2□□, PLAN 4□ OF THE ESSEX SOUTH REGISTRY OF DEEDS.

Q. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASS. PREPARED FOR EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"=40', DATED APRIL 2, 2□□□, RECORDED IN PLAN BOO□ 3□□, PLAN □3 OF THE ESSEX SOUTH REGISTRY OF DEEDS.

R. "EASEMENT PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"=20', DATED OCTOBER □□, 2□□4, RECORDED IN PLAN BOO□ 3□□, PLAN □□ OF THE ESSEX SOUTH REGISTRY OF DEEDS.

S. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASSACHUSETTS", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"40', DATED AUGUST 22, 2008, RECORDED IN PLAN BOOK 416, PLAN □ OF THE ESSEX SOUTH REGISTRY OF DEEDS.

T. "PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"=40', DATED MAY 17, 2010, RECORDED IN PLAN BOO□ 424, PLAN □□ OF THE ESSEX SOUTH REGISTRY OF DEEDS.

U. "PLAN OF LAND LOCATED IN PEABODY, MASSACHUSETTS (ESSEX COUNTY□PREPARED FOR MASSACHUSETTS BAY TRANSPORTATION AUTHORITY - CITY OF PEABODY", BY MERIDIAN ASSOCIATES, SCALE □□3□□DATED MARCH 3□, 2□□2, RECORDED IN PLAN BOO□ 433, PLAN □□ OF THE ESSEX SOUTH REGISTRY OF DEEDS.

THIS PLAN HAS BEEN PREPARED IN CONFORMITY WITH THE RULES AND REGULATIONS OF THE REGISTERS OF DEEDS OF THE COMMONWEALTH OF MASSACHUSETTS.

I CERTIFY THAT THE PROPERTY LINES SHOWN ARE THE LINES DIVIDING EXISTING OWNERSHIPS, AND THE LINES OF STREETS AND WAYS SHOWN ARE THOSE OF PUBLIC OR PRIVATE STREETS OR WAYS ALREADY ESTABLISHED, AND THAT NO NEW LINES FOR DIVISION OF EXISTING OWNERSHIP OR FOR NEW WAYS ARE SHOWN.

Michael G. Wilmes, L.S. 34322 *Date*

20 10 0 20 40 60
GRAPHIC SCALE 1"= 20'

REVISIONS

DATE	DESCRIPTION

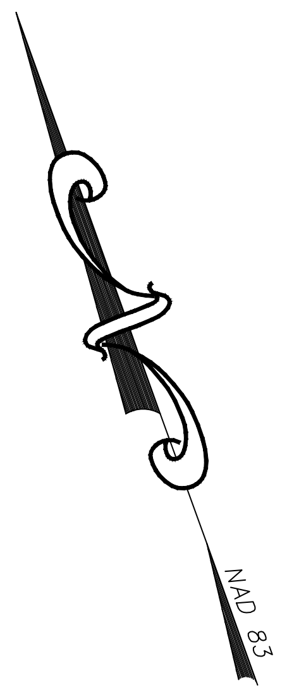
PROPERTY AND TOPOGRAPHIC SURVEY
NORTH RIVER CANAL RIVERWALK PROJECT
CITY OF PEABODY

COUNTY OF ESSEX **COMMONWEALTH OF MASSACHUSETTS**

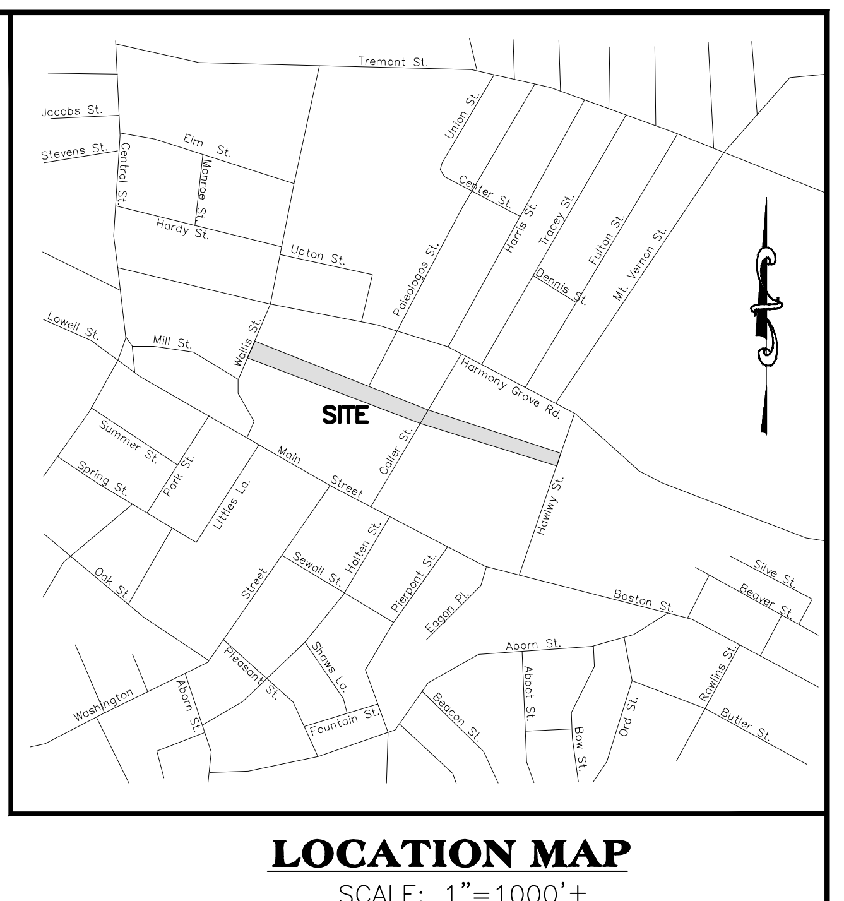
Weston & Sampson℠

Weston & Sampson Engineers, Inc.
5 Centennial Drive, Peabody, MA 01960 Tel:(978)532-1900

CAD FILE: **ENG20–0145 RiverWalk MVP**
DATE: **MAY 19, 2020**
SHEET **1** OF **2**
SCALE: **1"=20'**
DRAWING No.

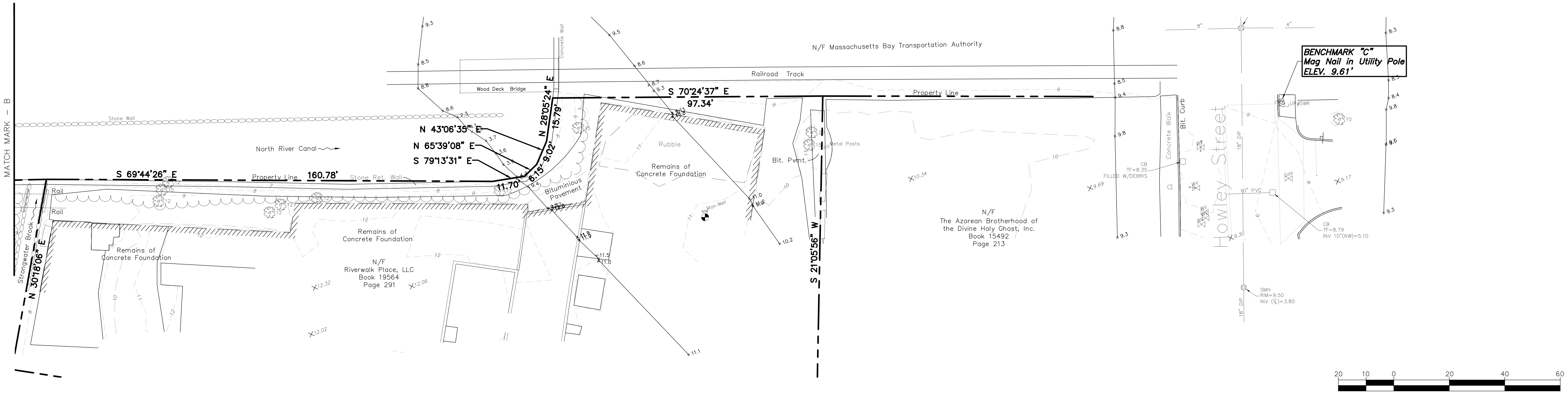


FOR REGISTRY USE



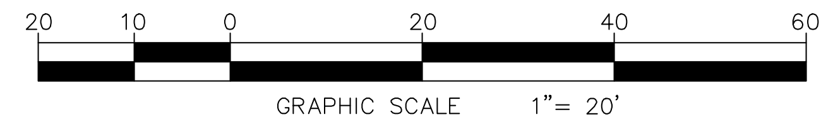
LOCATION MAP

SCALE: 1"=1000'±



LEGEND

⌒⌒⌒⌒⌒	EDGE OF WOODS
✿	DECIDUOUS TREE
✹	CONIFEROUS TREE
☁	SHRUB/BUSH
⊥	SIGN
○	UTILITY POLE
☼	LIGHT POLE
⊙	HYDRANT
WSO	WATER SHUTOFF
GV ⋈	GAS VALVE
WV ⋈	WATER VALVE
⊡	MONUMENT
◎	IRON PIN / IRON ROD
♿	HANDICAP SPACE
— – – —	PROPERTY LINE
— — —	EASEMENT
— ST —	STORM SEWER LINE
— SS —	SANITARY SEWER LINE
— W —	WATER LINE
— . —	GAS LINE
— S —	SIGNAL WIRE LINE
— C —	CABLE LINE
— FO —	FIBER OPTIC LINE
— LPS —	LOW PRESSURE SEWER LINE
— E —	ELECTRIC LINE
— H —	HEATING LINE
— T —	TELEPHONE LINE
Ⓢ	SANITARY MANHOLE (SMH)
Ⓢ	STORM MANHOLE (STMH)
☐ Ⓒ	CATCHBASIN (CB)
○	METAL POST/BOLLARD (BOL)
Ⓔ	ELECTRIC MANHOLE (MHE)
·	UNKNOWN MANHOLE
Ⓣ	TELEPHONE MANHOLE (MHT)
— 10 —	MAJOR CONTOUR LINE
— 9 —	MINOR CONTOUR LINE



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NORTH RIVER CANAL RIVERWALK PROJECT
CITY OF PEABODY

COUNTY OF ESSEX **COMMONWEALTH OF MASSACHUSETTS**

Weston & Sampson℠

Weston & Sampson Engineers, Inc.
5 Centennial Drive, Peabody, MA 01960 Tel:(978)532-1900

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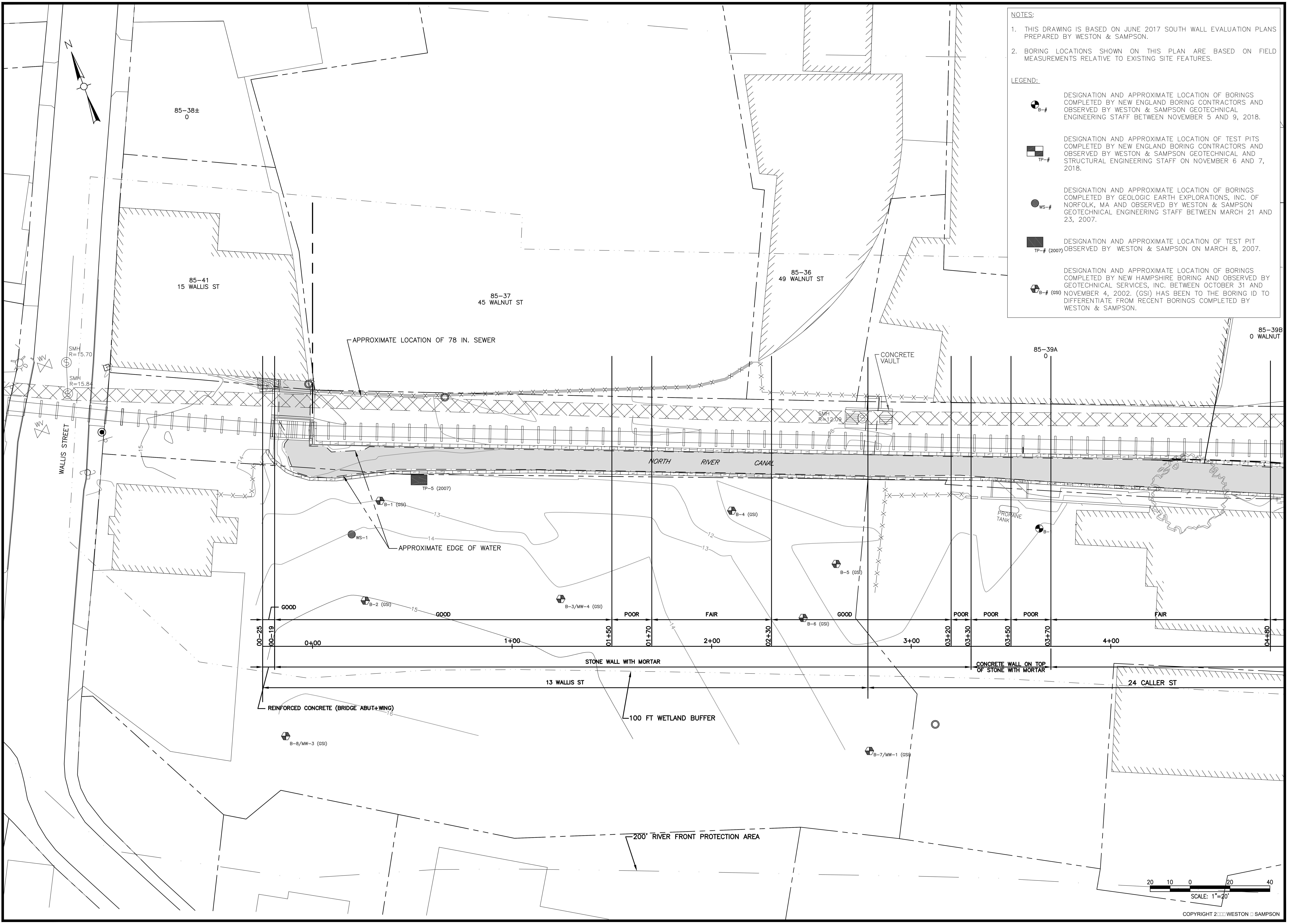
SHEET **2** OF **2**
SCALE: **1"=20'**
DRAWING No.



NOTES:

1. THIS DRAWING IS BASED ON JUNE 2017 SOUTH WALL EVALUATION PLANS PREPARED BY WESTON & SAMPSON.
2. BORING LOCATIONS SHOWN ON THIS PLAN ARE BASED ON FIELD MEASUREMENTS RELATIVE TO EXISTING SITE FEATURES.

LEGEND:

◐ B-#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF BETWEEN NOVEMBER 5 AND 9, 2018.
▚ TP-#	DESIGNATION AND APPROXIMATE LOCATION OF TEST PITS COMPLETED BY NEW ENGLAND BORING CONTRACTORS AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL AND STRUCTURAL ENGINEERING STAFF ON NOVEMBER 6 AND 7, 2018.
● WS-#	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY GEOLOGIC EARTH EXPLORATIONS, INC. OF NORFOLK, MA AND OBSERVED BY WESTON & SAMPSON GEOTECHNICAL ENGINEERING STAFF BETWEEN MARCH 21 AND 23, 2007.
■ TP-# (2007)	DESIGNATION AND APPROXIMATE LOCATION OF TEST PIT OBSERVED BY WESTON & SAMPSON ON MARCH 8, 2007.
◐ B-# (GSI)	DESIGNATION AND APPROXIMATE LOCATION OF BORINGS COMPLETED BY NEW HAMPSHIRE BORING AND OBSERVED BY GEOTECHNICAL SERVICES, INC. BETWEEN OCTOBER 31 AND NOVEMBER 4, 2002. (GSI) HAS BEEN TO THE BORING ID TO DIFFERENTIATE FROM RECENT BORINGS COMPLETED BY WESTON & SAMPSON.

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Five Centennial Drive, Peabody, MA □□□□□
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□□□.westonandsampson.com

No.	Date	Dr.By	Ck.By	App.By	Description

A P P R O V E D

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

RIVERWALK ALONG NORTH RIVER CANAL

Figure 2 Site Plan STA. □□2□ to □4□□□

SCALE:	CONTRACT:	JOB NO.	DR.BY	DSN.BY	CH.BY	APP.BY
AS NOTED	□	2□□□□□□	□	□	□	□

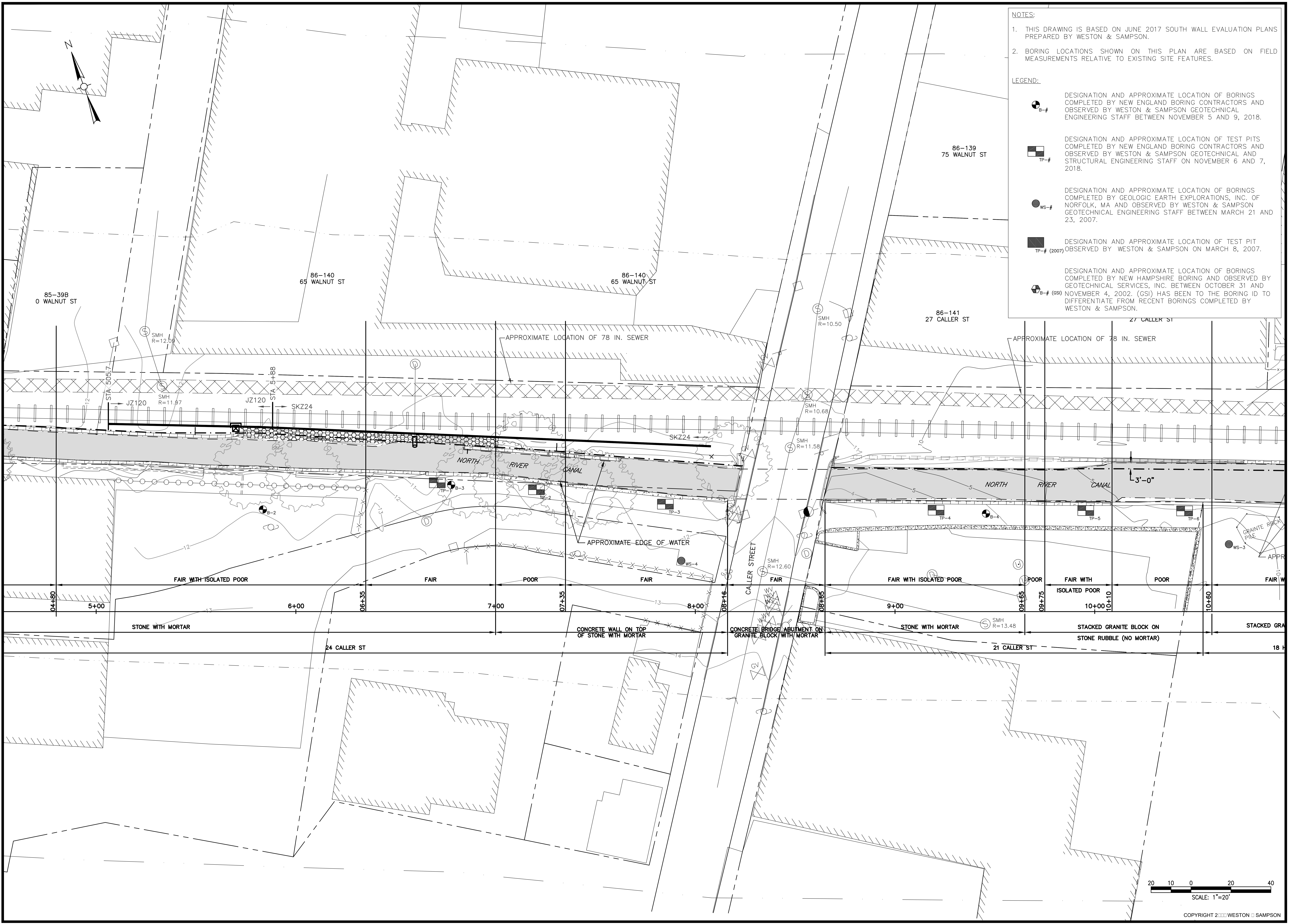
CADD NO.

FILE NO.

S□2

SHEET □ OF 3

\\wse03.local\WSE\Projects\MA\Peabody MA\WP Action Grant 2018\Task 2 - Engineering Services & Alternatives Analysis\Geotechnical\CAD\North River - South Wall Eval new.dwg



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No.	Date	Dr.By	Ch.By	App.By	Description

APPROVED

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

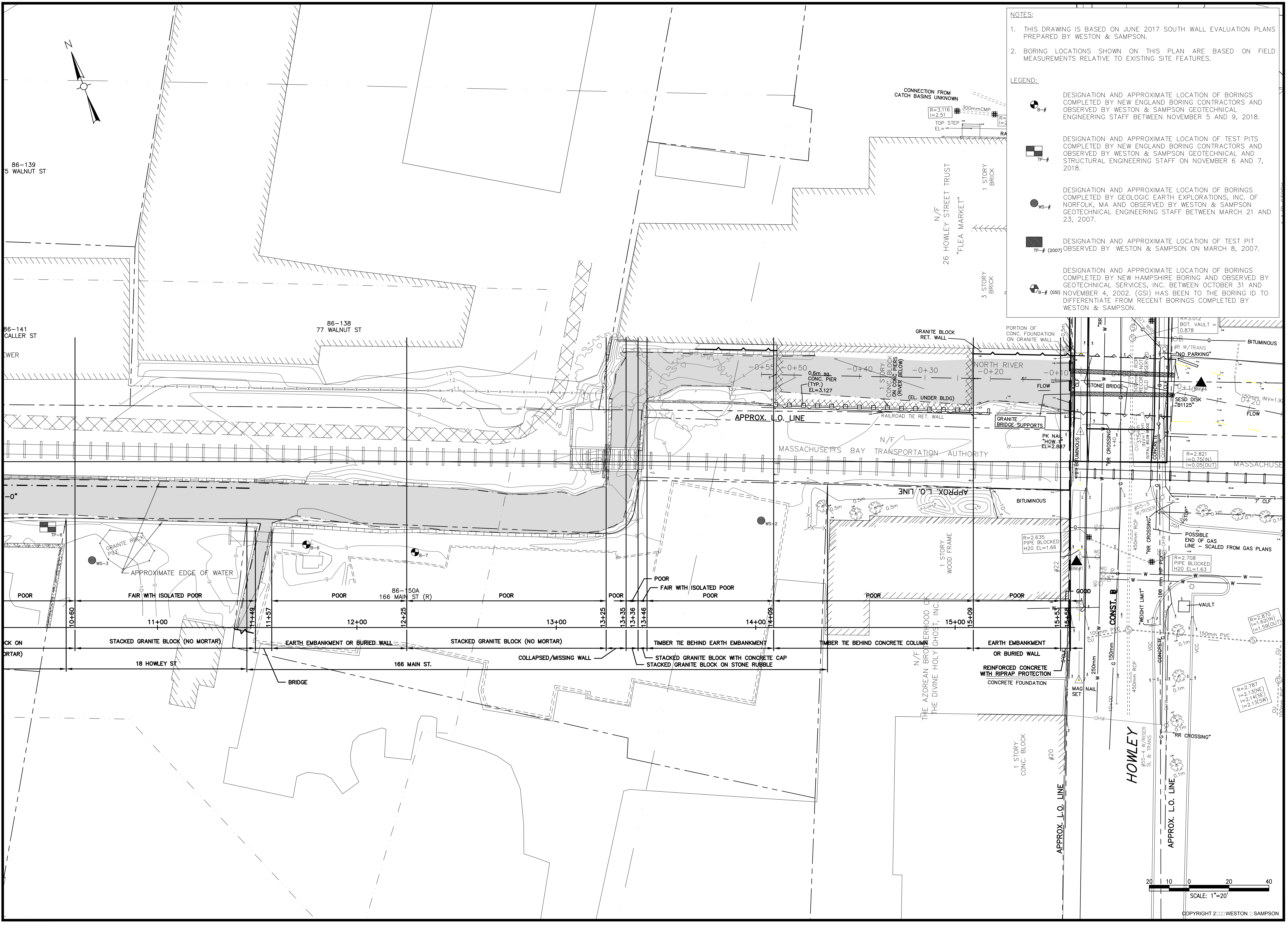
RIVERWALK ALONG NORTH RIVER CANAL

Figure 2 Site Plan STA. 4 to

APP.BY	
CH.BY	
DSN.BY	
DR.BY	
JOB NO.	2
CONTRACT	
SCALE	AS NOTED
CADD NO.	
FILE NO.	

S3

SHEET 2 OF 3



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No.	Date	Dr.By	C.By	A.By	Description

APPROVED

REGISTERED PROFESSIONAL ENGINEER

DATE

CITY OF PEABODY

RIVERWALK ALONG NORTH RIVER CANAL

Figure 2 Site Plan STA. [illegible] to [illegible]

SCALE	CONTRACT	JOB NO.	DR.BY	DSN.BY	CH.BY	APP.BY
AS NOTED		2[illegible]				

CADD NO.

S4

FILE NO.

SHEET 3 OF 3

\\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2018\Task 2 - Engineering Services & Alternatives Analysis\Geotechnical\CAD\North River - South Wall Eval new.dwg

Appendix D

South Wall –75% Design Plans & Specifications - 2020

Weston & Sampson

westonandsampson.com

WESTON & SAMPSON ENGINEERS, INC.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

CONTRACT DOCUMENTS

September 16, 2020

CITY OF
Peabody
MASSACHUSETTS

FY20-21 MVP Action Grant
North River Canal Resilient Corridor

75% SPECIFICATIONS

Task 1 Wall

TABLE OF CONTENTS

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 -GENERAL

1.01 GENERAL PROVISIONS:

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 – GENERAL REQUIREMENTS, which are hereby made part of this Section of the Specifications.

1.02 DESCRIPTION OF WORK:

A. Work Included: This Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes for the following:

1. Footings/Pile Caps
2. Grade Beams
3. Concrete Wall Infill
4. Grout

B. Items To Be Installed Only: Not Applicable

C. Items To Be Furnished Only: Not Applicable

D. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 06 10 00, ROUGH CARPENTRY
2. Section 31 00 00, EARTHWORK; Excavation and establishment of subgrade elevations.

1.03 SUBMITTALS:

A. Refer to Section 01 33 23, SUBMITTALS for submittal provisions and procedures.

B. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water-stops, joint systems, curing compounds, dry-shake finish materials, and others if requested by the Engineer or SER.

C. Shop drawings for reinforcement detailing, fabricating, bending, and placing concrete reinforcement. Comply with ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing and supports for concrete.

D. Submit shop drawings for all formwork for Architecturally Exposed Concrete (Concrete Exposed to View) showing cone tie patterns.

E. Concrete mix design for each mix specified. Supporting test data shall be submitted if requested.

    1. Submit alternate mix designs when the characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
    2. Indicate the amounts of mixing water to be withheld for later addition at the Project site.

F. Proposed method of curing and associated products.

G. Proposed precautions for hot weather and cold weather concreting.

H. Samples: For waterstops and vapor retarder.

    1. Submit samples of materials as requested by the Engineer or SER, including names, sources, and descriptions.

I. Laboratory test reports for concrete materials and mix design test.

J. Material test reports for the following, from a qualified testing agency, indicating compliance with specification requirements:

    1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

K. Material certificates for each of the following, signed by the manufacturers:

    1. Cementitious material.
    2. Admixtures
    3. Form materials and form-release agents.
    4. Steel reinforcement and accessories.
    5. Non-metallic shrinkage resistant grout.
    6. Waterstops.
    7. Curing compounds.
    8. Floor and slab treatments.

9. Bonding agents.
10. Adhesives.
11. Vapor retarders.
12. Semi-rigid joint filler.
13. Joint-filler strips.
14. Repair materials.

L. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

M. Qualification Data: For Installer and Manufacturer.

1.04 QUALITY ASSURANCE:

A. Installer Qualifications: A qualified installer who employs on the Project personnel qualified as ACI certified Flatwork Technician and Finisher and a supervisor who is an ACI certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mix concrete products that complies with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency for Mix Design Qualifications: An independent agency, registered in the Commonwealth of Massachusetts as an approved testing agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician – Grade 1. The Testing Agency Laboratory supervisor shall be an ACI certified Concrete Laboratory Testing Technician – Grade II.

D. Source Limitations: Obtain each type of class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. ACI Publications:

1. Comply with the following unless modified by requirements in the Contract Documents:
    a. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials.”
    b. ACI 211.1, “Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.”
    c. ACI 214, “Evaluation of Strength Test Results of Concrete.”
    d. ACI 301, “Specification for Structural Concrete.”
    e. ACI 304, “Guide for Measuring, Mixing, Transporting and Placing Concrete.”
    f. ACI 305, “Hot Weather Concreting.”
    g. ACI 306, “Cold Weather Concreting.”
    h. ACI 308, “Guide to Curing Concrete.”
    i. ACI 309, “Guide for Consolidation of Concrete.”
    j. ACI 311.1, “ACI Manual of Concrete Inspection.”
    k. ACI 315, “Details and Detailing of Concrete Reinforcement.”
    l. ACI 318, “Building Code Requirements for Structural Concrete and Commentary.”
    m. ACI 347, “Guide for Formwork for Concrete.”
2. Where the language in any of the documents referred to herein is in the form of a recommendation or suggestion, such recommendations or suggestions shall be deemed to be mandatory under this Contract.

F. American Society for Testing and Materials (ASTM):

1. ASTM C309 "Liquid Membrane-Forming Compounds for Curing Concrete."
2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."
3. ASTM C979 "Standard Specification for Pigments for Integrally Colored Concrete."

G. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M194 "Chemical Admixtures."

H. Pre-installation Conference: Conduct a conference at the Project site to comply with requirements in Division 1 Section “Project Management and Coordination.”

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend including the following:

    a. Contractor’s superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete subcontractor.
    e. Structural Engineer.
    f. Independent testing agency responsible for field testing.
    g. Owner’s Authorized Representative.
    h. Engineer.

2. Review inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint filler strips, semi-rigid joint fillers, forms and form removal limitations, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor slab and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

<u>PART 2 - PRODUCTS</u>

2.01 FORM-FACING MATERIALS:

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, ¾-inch by ¾-inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral earth pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

G. Furnish units that will leave no corrodible metal closer than 1-inch to the plane of exposed concrete surface.

H. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT:

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 NON-METALLIC SHRINKAGE RESISTANT GROUT:

A. Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time. The minimum ultimate compressive strength of the grout shall be 5000 psi at 7 days and 7500 psi at 28 days.

2.04 REINFORCEMENT ACCESSORIES:

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolster, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice", of greater of compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless steel bar supports.
2. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Concrete bricks may be used to support reinforcing steel where application allows.

2.05 CONCRETE MATERIALS:

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout the Project:

   1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:

B. Fly Ash: ASTM C 618, Class C or F.

C. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Cementitious Materials: Percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

   1. Fly Ash or Ground Granulated Blast Furnace Slag: 25 percent, minimum.
   2. Combined Fly Ash and Pozzolan: 35 percent, maximum.
   3. Ground Granulated Blast Furnace Slag: 50 percent, maximum.
   4. Combined Fly Ash or Pozzolan and Ground Granulated Blast Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 35 percent.

E. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

   1. Maximum Coarse Aggregate Size: ¾-inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

F. Water: ASTM C 94 and potable.

2.06 ADMIXTURES:

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor,; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

1. Products:
2. Euclid Chemical Company; Eucon CIA.
3. Grace Construction Products, W.R. Grace & Co.; DCI.
4. BASF Admixtures, Inc.; Rheocrete CNI.
5. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products:
    a. Grace Construction Products, W.R. Grace & Co.; DCI-S.

2.07 WATERSTOPS:

A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, ¾-inch by 1-inch.

1. Colloid Environmental Technologies Company; Volclay Waterstop-RX.
2. Concrete Sealants, Inc.; Conseal CS-231.
3. Greenstreak; Swellstop.
4. Henry Company, Sealants Division; Hydro-Flex.
5. Progress Unlimited, Inc.; Superstop.
6. TCMiraDRI; Mirastop.

B. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete, 3/8-inch by ¾-inch.

1. Deneef Construction Chemicals; Swellseal.
2. Greenstreak; Hydrotite.
3. Mitsubishi International Corporation; Adeka Ultra Seal.
4. Progress Unlimited, Inc.; Superstop.

C. Waterstops: Provide ribbed, dumbbell type or center bulb type waterstops at construction joints and other joints as indicated.

1. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.

2.08 FLOOR AND SLAB TREATMENTS:

A. Unpigmented Mineral Dry-Shake Floor Hardener: Factory-packaged dry combination of Portland cement, graded quartz aggregate, and plasticizing admixture.

1. Products:
   a. Burke by Edoco; NonMetallic Floor Hardener.
   b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Conshake 500.
   c. Dayton Superior Corporation; Quartz Tuff.
   d. Euclid Chemical Company; Surflex.
   e. Lambert Corporation; Colorhard.
   f. L&M Construction Chemicals, Inc.; Quartzpalte FF.
   g. Scofield, L.M. Company; Lithochrome Color Hardener.
   h. Symons Corporation, a Dayton Superior Company; Hard Top.

B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products:
   a. Burke by Edoco; Titan Hard.
   b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
   c. Curecrete Distribution Inc.; Ashford Formula.
   d. Dayton Superior Corporation; Day-Chem Sure Hard.
   e. Euclid Chemical Company; Euco Diamond Hard.

    f. Kaufman Products, Inc.; SureHard.
    g. L&M Construction Chemicals, Inc.; Seal Hard.
    h. Meadows, W.R., Inc.; Liqui-Hard.
    i. Symons Corporation, a Dayton Superior Company; Buff Hard.

2.09 CURING MATERIALS:

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. /sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor coverings.

  1. Products:
    a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; High Seal.
    b. Dayton Superior Corporation; Safe Cure and Seal (J-19).
    c. Euclid Chemical Company; Diamond Clear VOX.
    d. Lambert Corporation; Glazecote Sealer-20.
    e. L&M Construction Chemicals, Inc.; Dress & Seal WB.
    f. Meadows, W.R., Inc.; Vocomp-20.
    g. Nox-Crete Products Group, Kinsman Corporation; Cure & Seal 200E.
    h. Sonneborn, Div. Of ChemRex; Kure-N-Seal.
    i. Symons Corporation, a Dayton Superior Company; Cure & Seal 18 Percent E.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

  1. Products:
    a. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
    b. Euclid Chemical Company; Super Diamond Clear VOX.
    c. Lambert Corporation; UV Safe Seal.
    d. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.

    e. Meadows, W.R., Inc.; Vocomp-30.
    f. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.

2.10 RELATED MATERIALS:

A. Expansion and Isolation Joint Filler Strips: ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

    1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.11 REPAIR MATERIALS:

A. Repair Underlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.

    1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
    2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
    3. Aggregate: Well-graded, washed gravel, 1/8-inch to ¼-inch or coarse sand as recommended by the underlayment manufacturer.
    4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C 109.

B. Repair Overlayment: Cement based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8-inch to ¼-inch or coarse sand as recommended by the topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested in accordance with ASTM C 109.

2.12 CONCRETE MIXTURES, GENERAL:

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.
3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer’s written instructions.

1. Use water-reducing, high-range water reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water cementitious materials ratio below 0.50.

4. Use retarding admixture in combination with Set accelerating Corrosion Inhibitor. Retarder is not required for non-set accelerating corrosion inhibitor.
5. Use corrosion inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS:

A. Footings and Foundation Walls: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4-inches for concrete with verified slump of 2-inch to 4-inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1-inch.
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Minimum Cementitious Materials Content: 540 lb. /cu. yd.
3. Slump Limit: 4-inches, plus or minus 1-inch.
4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.
5. Corrosion Inhibiting Admixture: Apply to all slabs at a rate of 4 gallons per cubic yard of concrete.

2.14 FABRICATING REINFORCEMENT:

A. Fabricate steel reinforcement according to CRSI’s “Manual of Standard Practice”.

2.15 CONCRETE MIXING:

A. Ready-Mix Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.

B. When air temperature is between 85 and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 GENERAL:

A. Coordinate the installation of joint materials, vapor retarder/barrier, and other related materials with placement of forms and reinforcing.

3.02 FORMWORK:

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

   1. Class A, 1/8-inch for smooth-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

   1. Install keyways, reglets, recesses, and the like for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspections ports where interior area formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.03 EMBEDDED ITEMS:

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges".
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

3.04 REMOVING AND REUSING FORMS:

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form removal operations and curing and protection operations are maintained.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Engineer.

3.05 STEEL REINFORCEMENT:

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire ties.

3.06 JOINTS:

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or approved by the Engineer.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2-inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at the underside of floors, slabs, beams, and girders and at the top of footings and floor slabs.
5. Space vertical joints in walls at 60-feet on center maximum. Locate joints besides piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge joint to a radius of 1/8-inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Terminate full-width joint filler strips not less than ½-inch or more than 1-inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants", are indicated.
2. Install joint filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 CONCRETE PLACEMENT:

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6-inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in continuous operation, within limits of construction joints, until placement of panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 degrees F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 degrees F at time of placement.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing of concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.08 FINISHING FORMED SURFACES:

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with minimum number of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.09 FINISHING FLOORS AND SLABS:

A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straightening until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 for a randomly trafficked floor surface:
3. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

D. Broom Finish: Apply a broom finish to exterior platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

E. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to all surfaces with truck traffic according to manufacturer's written instructions and as follows:

1. Uniformly apply dry-shake floor hardener at a rate of 100 lb. /100 sq. ft. unless greater amount is recommended by manufacturer.
2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.10 MISCELLANEOUS CONCRETE ITEMS:

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING:

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Curing all slabs in the project with moisture curing. Keep surfaces continually moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in the widest practicable width, with sides and ends lapped at least 12-inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer’s written instructions. Recoat areas subject to heavy rainfall within three hours after initial applications. Maintain continuity of coating and repair damage during curing period.
   a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer’s written instructions. Recoat areas subject to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply second coat. Maintain continuity of coating and repair damage during curing period.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.12 LIQUID FLOOR TREATMENTS:

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment to concrete floors exposed to view according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Comply with Manufacturer's written instructions for application.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING:

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.14 CONCRETE SURFACE REPAIRS:

A. Defective Concrete: repair and patch defective areas when approved by the Engineer. Remove and replace concrete that cannot be repaired and patched to the Engineer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than ½-inch in any dimension in solid concrete, but not less than

1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush coat holes and voids with bonding agent. Fill and compact patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Engineer.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14-days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1-inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least ¾-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

6. Repair random cracks and single holes 1-inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72-hours.

E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to the Engineer's approval.

3.15 FIELD QUALITY CONTROL:

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample of each day's pour of each concrete mixture exceeding 5 cubic yards, but less than 25 cubic yards, plus one set for each additional 50 cubic yards or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 degrees F and below and when 80 degrees F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31.
6. Cast and laboratory cure five standard cylinder specimens for each composite sample.
7. Compressive Strength Tests: ASTM C 39; test one set of two-laboratory-cured specimens at 7 days and one set of two specimens at 28 days. Test remaining specimen at 28 days if previous results are satisfactory or retain this specimen for 56 day testing if results are not satisfactory.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive strength tests equals or exceeds specified compressive strength and no compressive strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to the Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7 and 28 day tests.

1. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as the sole basis for approval or rejection of concrete.
2. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as required by the Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as required by the Engineer.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
4. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

3.16 GROUTING:

A. Mix grout in accordance with the approved manufacturer's instructions to a consistency which will permit placement. Place grout so as to ensure complete bearing and elimination of air pockets.

3.17 TEST FOR WATERTIGHTNESS:

A. All concrete shall be watertight against leakage or groundwater infiltration. Special care shall be taken in the construction joints and any noticeable leakage or seepage causing wet spots on the concrete walls or slabs shall be repaired by and at the expense of the Contractor and by methods approved by the Engineer. See Section 03150, WATERSTOPS.

B. All liquid holding concrete structures shall be tested for leakage before backfilling and after the concrete has attained the specified minimum 28-day design strength, as indicated by test cylinders.

C. The structure shall be filled with water to the overflow level, allowed to stand for at least 24-hours, and refilled to overflow to begin the test. After 72 hours, the liquid loss per 24 hour period shall be determined, either by measuring the amount required to refill the tank to overflow, by measuring the drop in water level, or by an equivalent procedure approved by the Engineer. Evaporative losses shall be calculated and deducted from the measured loss to determine net liquid loss (leakage). If the leakage per 24-hour period exceeds the allowable, the structure shall be repaired and retested until the leakage falls within the allowable limit.

D. For structures designed to hold water, one twentieth of one percent leakage will be allowed during a 24-hour period. No leakage (zero leakage) will be permitted for structures designed to hold liquid chemicals or fuels.

E. The Contractor shall pay all costs (including water) incurred in the testing for watertightness.

F. The Engineer shall be given a minimum notice of 48 hours prior to commencement of the leakage test.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers tools, equipment, labor, and materials necessary to perform rough carpentry work complete and miscellaneous carpentry items not specified elsewhere including fasteners and supports.

B. Nails, screws, bolts, anchors, brackets, and other hardware for fastening and securing items provided under this section of the specification shall be furnished under this section.

1.02 RELATED WORK:

A. Section 03 30 00, CAST-IN-PLACE CONCRETE

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330, SUBMITTALS, SUBMIT THE FOLLOWING:

Certificates of wood treatment upon delivery of treated wood product. Treated wood product shall bear appropriate American Wood Preservers Bureau (AWPB) quality mark.

1.04 DELIVERY:

Lumber, plywood, and other wood material shall be delivered to the job dry, and shall be protected from injury, dirt, dampness, and extreme changes of temperature and humidity at all times.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. LUMBER:

1. The grades of all materials under this section shall be defined by the rules of the recognized associations of lumber manufacturers producing the material specified, but the maximum defects and blemishes permissible in any specified grades shall not exceed the limitations of the American Lumber Standards.

2. Lumber shall bear the grade and trademark of the association under whose rules it is produced, and a mark of mill identification. Lumber shall be of sound stock, thoroughly seasoned, kiln dried to a moisture content not exceeding 15 percent.

3. Exposed surfaces of wood which are to be painted shall be free from defects or blemishes that will show after the second coat of paint is applied.

4. All lumber for nailers, furring, and blocking shall be seasoned No. 1 Dimension of Common pine, fir, or spruce, S4S.

5. Framing Lumber for joists, rafters, plates, headers, stair stringers and carriages, and sleepers shall be Hem-Fir #1 with the following minimum properties:

   $E = 1.5 \times 10^6$ PSI
   Density = 0.01736 lb/in.^3
   F_b = 1400 PSI
   F_v = 75 PSI
   F_c = 1050 PSI
   F_t = 800 PSI

6. Studding shall be 2- inch x 4- inch Western or Eastern Species, Construction Grade, or KD Stud Grade Southern Yellow Pine or studgrade Spruce-pine-fir. Where two or more studs are nailed together, such assemblies may be No. 2 or Better Grade Southern Yellow Pine and stud grade Southern Yellow Pine.

7. Roof Sheathing shall be 5/8- inch thick B-D exterior grade plywood.

8. Wall Sheathing shall be 3/4- inch thick B-D exterior grade plywood.

9. Soffits shall be 5/8- inch thick medium density overlay plywood with exterior glue.

10. Materials not specifically listed shall be of an accepted grade dictated by good practice.

B. WOOD PRESERVATION TREATMENT:

1. The nailers, blocking, sills, and similar items encased in or in contact with concrete, masonry, or the ground shall be pressure treated with a pentachlorophenol preservative solution. The pentachlorophenol shall meet the requirements of the American Wood-Preserver's Association, AWPA Standard P-8, "Standards for Oil-Borne Preservatives." The solvent carrier shall meet the requirements of AWPA Standard P-9 "Standard for Hydrocarbon Solvents for Oil-Borne Preservatives." The preservative solution shall be equivalent to five percent of pure pentachlorophenol.

2. The treatment shall be applied in accordance with AWPA Standard C-2 (lumber, timber, etc.), C-9 (plywood) or C-28 (lumber treated before laminating). Penetration of pentachlorophenol shall be determined using the penta check method, Section 5, AWPA Standard A-3. Retention of pentachlorophenol shall be a minimum of 0.40 pounds per cubic foot of wood for inground exposures. The treating company shall furnish a notarized certificate of treatment that indicates all pertinent details of the treatment.

3. Before the preservative treatment is applied, the lumber to be treated shall be sawed to exact lengths required, and bored ready for use in the work so far as practicable, in order to reduce to a minimum cutting or boring of lumber after treatment. Only lumber of the same kind and approximately the same size and seasoning shall be treated in any one charge. All surfaces of treated lumber cut after treatment shall receive two heavy brush coats of pentachlorophenol solution before the lumber is placed in the work.

C. WOOD FIRE RETARDANT TREATMENT:

1. Exposed wood blocking and sheeting shall receive fire-retardant treatment conforming to American Wood Preservers Association, AWPA Standard C20 for lumber and AWPA C27 for plywood.

2. Fire retardant treated lumber shall bear UL label and shall have UL Fire-Hazard Classification "FR-S", when tested in accordance with ASTM E84.

3. Material to receive interior grade fire-retardant treatment shall be pressure impregnated with "Dricon" fire-retardant chemicals manufactured by Hickson Corporation, Atlanta, Georgia, in accordance with manufacturer's instructions.

Material to receive interior grade fire retardant treatment shall be as indicated, specified, and as required by Article 9 of Massachusetts State Building Code.

PART 3 - EXECUTION

3.01 CONSTRUCTION:

A. Work shall be erected plumb, true and square.

B. Coordinate delivery and erection of prefabricated components. Field applied items shall be installed in accordance with good trade practices. Cutting and carpentry for other trades shall be performed. Cut ends of lumber previously treated with preservative specified shall be brushcoated with the same material.

C. Except as otherwise indicated on the design drawings, fasteners for roof nailers and for other wood members used as nailers or anchorage material shall be the equivalent of 1/2-inch diameter bolts at 2'-6" o.c. for 2-inch material, and 3/8-inch diameter bolts at 2'-0" o.c. for 1-inch material. Wood members in general shall be fastened to masonry with masonry nails, power-driven fasteners, or bolts in expansion shields, except where otherwise indicated.

D. Minimum length of nails shall be twice the thickness of wood being fastened.

E. Furring, blocking, nailers, and similar items shall be provided wherever required for the support, proper erection, fastening, or installation of carpentry or other materials, and as shown on the drawings.

F. Roofs require wood nailing strips and/or curbs at eaves, edges, walls, roof openings, etc., for proper securing of metal flanges. Nailers and/or curbs must be securely and firmly attached to the adjacent deck or concrete.

G. Nailers that serve as insulation vents shall have 1/2-inch vent hole openings 18-inches on center before installation. If wood nailers with vent holes are installed before the vapor barrier, then the vapor barrier shall not cover the holes when installed.

H. Roof Sheathing shall be installed with face grain across rafters except where otherwise noted. Nail at 6- inches o.c. along panel edges and 12- inches o.c. at intermediate supports with 6d common nails or approved nailing system. Temporary wood planking, sized to provide safe walking areas and protection against rough usage in construction, shall be placed over sheathing during construction operations. Where wheeling of building material is necessary, special provision shall be made to protect sheathing. Make necessary allowance for expansion of sheathing at roof edges as required by the A.P.A.

END OF SECTION

Document2

SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED:

The Contractor shall make excavations of normal depth in earth for trenches and structures, shall backfill and compact such excavations to the extent necessary, shall furnish the necessary material and construct embankments and fills, and shall make miscellaneous earth excavations and do miscellaneous grading.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 11 00, CONTROL OF WORK AND MATERIALS

C. Section 01 57 19, ENVIRONMENTAL PROTECTION

D. Section 31 05 19.13, GEOTEXTILE FABRICS

E. Section 31 11 00, CLEARING AND GRUBBING

G. Section 31 23 19, DEWATERING

H. Section 31 50 00, SUPPORT OF EXCAVATION

I. Section 32 12 00, PAVING

J. Section 32 91 19, LOAMING AND SEEDING

1.03 REFERENCES:

American Society for Testing and Materials (ASTM)

ASTM	C131	Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM	C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM	C330	Specification for Lightweight Aggregate for Structural Concrete.
ASTM	D1556	Test Method for Density of Soil in Place by the Sand Cone Method.

ASTM	D1557	Test Methods for Moisture-density Relations of Soils and Soil Aggregate Mixtures Using Ten-pound (10 Lb.) Hammer and Eighteen-inch (18") Drop.
ASTM	D2922	Test Methods for Density of Soil and Soil-aggregate in Place by Nuclear Methods (Shallow Depth).

Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges.

Code of Massachusetts Regulations (CMR) 310.40.0032 Contaminated Media and Contaminated Debris

Code of Massachusetts Regulations (CMR) 520 CMR 14.00 Excavation & Trench Safety Regulation

1.04 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Samples of all materials proposed for the project shall be submitted to the Engineer for review. Size of the samples shall be as approved by the Engineer.

1.05 PROTECTION OF EXISTING PROPERTY:

A. The work shall be executed in such manner as to prevent any damage to facilities at the site and adjacent property and existing improvements, such as but not limited to streets, curbs, paving, service utility lines, structures, monuments, bench marks, observation wells, and other public or private property. Protect existing improvements from damage caused by settlement, lateral movements, undermining, washout and other hazards created by earthwork operations.

B. In case of any damage or injury caused in the performance of the work, the Contractor shall, at its own expense, make good such damage or injury to the satisfaction of, and without cost to, the Owner. Existing roads, sidewalks, and curbs damaged during the project work shall be repaired or replaced to at least the condition that existed at the start of operations. The Contractor shall replace, at his own cost, existing benchmarks, observation wells, monuments, and other reference points, which are disturbed or destroyed.

C. Buried drainage structures and pipes, observation wells and piezometers, including those which project less than eighteen inches (18") above grade, which are subject to damage from construction equipment shall be clearly marked to indicate the hazard. Markers shall indicate limits of danger areas, by means which will be clearly visible to operators of trucks and other construction equipment, and shall be maintained at all times until completion of project.

1.06 DRAINAGE:

A. The Contractor shall provide, at its own expense, adequate drainage facilities to complete all work items in an acceptable manner. Drainage shall be done in a manner so that runoff will not adversely affect construction procedures or cause excessive disturbance of underlying natural ground or abutting properties.

1.07 FROST PROTECTION AND SNOW REMOVAL:

A. The Contractor shall, at its own expense, keep earthwork operations clear and free of accumulations of snow as required to carry out the work.

B. The Contractor shall protect the subgrade beneath new structures and pipes from frost penetration when freezing temperatures are expected.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. GRAVEL BORROW:

Gravel Borrow shall satisfy the requirements listed in MassDOT Specification Section M1.03.0, Type b.

B. CRUSHED STONE:

Crushed stone shall satisfy the requirements listed in MassDOT Specification SectionM2.01.

C. SAND BORROW:

Sand Borrow shall satisfy the requirements listed in MassDOT Specification Section M1.04.0.

D. PEASTONE:

Peastone shall be smooth, hard, naturally occurring, rounded stone meeting the following gradation requirements:

Passing 5/8 inch square sieve opening	-	100%
Passing No. 8 sieve opening	-	0%

E. BACKFILL MATERIALS:

1. Class B Backfill:

Class B backfill shall be granular, well graded friable soil; free of rubbish, ice, snow, tree stumps, roots, clay and organic matter; with 30 percent or less passing the No. 200

sieve; no stone greater than two-third (2/3) loose lift thickness, or six inches, whichever is smaller.

2. Select Backfill:

Select backfill shall be granular, well graded friable soil, free of rubbish, ice, snow, tree stumps, roots, clay and organic matter, and other deleterious or organic material; graded within the following limits:

Sieve Size	Percent Finer by Weight
3"	100
No. 10	30-95
No. 40	10-70
No. 200	0-10

Note to Specifier: Delete the following subsection on the use of Controlled Density Fill if it is not required on the project.

F. STATE HIGHWAY TRENCH BACKFILL:

When required by Permit, Controlled Density Fill (CDF) shall be used to backfill trenches. The CDF shall satisfy the requirements listed in MassDOT Specification Section M4.08.0.

NOTE: Section on lightweight fill should be deleted if not needed.

G. LIGHTWEIGHT FILL:

1. Lightweight Fill shall be rotary kiln expanded shale meeting all the requirements of ASTM C330. Particles shall be tough, durable, non-corrosive and have the following properties:

Delivered Gradation:

Sieve Size	% Retained
1"	0
3/4"	0 to 20
#4	85 to 100

b. The dry loose unit weight shall be less than 55 PCF.

c. The Contractor shall submit verification of a compacted density of less than 70 PCF. Density shall be verified by testing in accordance with Standard AASHTO Test Designation T99.

d. The maximum soundness loss when tested with five cycles of magnesium sulphate shall be ten percent in accordance with ASTM C131.

e. Moisture content shall be determined by the Engineer.

f. Provide manufacturer's certificate stating materials provided comply with the standards specified.

Note to Specifier: Delete the following subsection on the use of Special Pipe Bedding Material if it is not required on the project.

H. SPECIAL PIPE BEDDING MATERIAL

1. The special pipe bedding material shall consist of a filter fabric installed on the trench bottom before backfilling with crushed stone as specified and as shown on the contract drawings. Filter fabric shall be as specified in Section 02071, GEOTEXTILE FABRICS.

I. PROCESSED GRAVEL:

1. Processed gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam and clay, surface coatings and deleterious materials. The coarse aggregate shall have a percentage of wear, by the Los Angeles Abrasion Test, of not more than 50.

2. The gradation shall meet the following requirements:

Sieve Designation	Percentage Passing
3 in.	100
1 1/2 in.	70-100
3/4 in.	50-85
No. 4	30-60
No. 200	0-10

3. The approved source of bank-run gravel material shall be processed by mechanical means. The equipment for producing crushed gravel shall be of adequate size with sufficient adjustments to produce the desired materials. The processed material shall be stockpiled in such a manner to minimize segregation of particle sizes. All processed gravel shall come from approved stockpiles.

J. STONE FILL FOR GABIONS:

1. The stone for gabions shall be hard, angular to round, durable and of such quality that they will not disintegrate on exposure to water or weathering during the life of the structure. Gabion rocks shall range between 4-inches and 8-inches. The range in sizes may allow for a variation of 5 percent oversize and/or 5 percent undersize rock, provided it is not placed on the gabion-exposed surface. The size shall be such that a minimum of two layers of rock must be achieved then filling the gabion.

PART 3 - EXECUTION

3.01 DISTURBANCE OF EXCAVATED AND FILLED AREAS DURING CONSTRUCTION:

A. Contractor shall take the necessary steps to avoid disturbance of subgrade during excavation and filling operations, including restricting the use of certain types of construction equipment and their movement over sensitive or unstable materials, dewatering and other acceptable control measures.

B. All excavated or filled areas disturbed during construction, all loose or saturated soil, and other areas that will not meet compaction requirements as specified herein shall be removed and replaced with a minimum 12-inch layer of compacted crushed stone wrapped all around in non-woven filter fabric. Costs of removal and replacement shall be borne by the Contractor.

C. The Contractor shall place a minimum of 12-inch layer of special bedding materials and crushed stone wrapped in filter fabric over the natural underlying soil to stabilize areas which may become disturbed as a result of rain, surface water runoff or groundwater seepage pressures, all at no additional cost to the Owner. The Contractor also has the option of drying materials in-place and compacting to specified densities.

3.02 EXCAVATION:

A. GENERAL:

1. The Contractor shall perform all work of any nature and description required to accomplish the work as shown on the Drawings and as specified.

2. Excavations, unless otherwise required by the Engineer, shall be carried only to the depths and limits shown on the Drawings. If unauthorized excavation is carried out below required subgrade and/or beyond minimum lateral limits shown on Drawings, it shall be backfilled with gravel borrow and compacted at the Contractor's expense as specified below, except as otherwise indicated. Excavations shall be kept in dry and good conditions at all times, and all voids shall be filled to the satisfaction of the Engineer.

3. In all excavation areas, the Contractor shall strip the surficial topsoil layer and underlying subsoil layer separate from underlying soils. In paved areas, the Contractor shall first cut pavement as specified in paragraph 3.02 B.1 of this specification, strip pavement and pavement subbase separately from underlying soils. All excavated materials shall be stockpiled separately from each other within the limits of work.

4. The Contractor shall follow a construction procedure, which permits visual identification of stable natural ground. Where groundwater is encountered, the size of the open excavation shall be limited to that which can be handled by the

Contractor's chosen method of dewatering and which will allow visual observation of the bottom and backfill in the dry.

5. The Contractor shall excavate unsuitable materials to stable natural ground where encountered at proposed excavation subgrade, as required by the Engineer. Unsuitable material includes topsoil, loam, peat, other organic materials, snow, ice, and trash. Unless specified elsewhere or otherwise required by the Engineer, areas where unsuitable materials have been excavated to stable ground shall be backfilled with compacted special bedding materials or crushed stone wrapped all around in non-woven filter fabric.

B. TRENCHES:

1. Prior to excavation, trenches in pavement shall have the traveled way surface cut in a straight line by a concrete saw or equivalent method, to the full depth of pavement. Excavation shall only be between these cuts. Excavation support shall be provided as required to avoid undermining of pavement. Cutting operations shall not be done by ripping equipment.

2. The Contractor shall satisfy all dewatering requirements specified in Section 31 23 19 DEWATERING, before performing trench excavations.

3. Trenches shall be excavated to such depths as will permit the pipe to be laid at the elevations, slopes, and depths of cover indicated on the Drawings. Trench widths shall be as shown on the Drawings or as specified.

4. Where pipe is to be laid in bedding material, the trench may be excavated by machinery to, or just below, the designated subgrade provided that the material remaining in the bottom of the trench is not disturbed.

5. If pipe is to be laid in embankments or other recently filled areas, the fill material shall first be placed to a height of at least 12-inches above the top of the pipe before excavation.

6. Pipe trenches shall be made as narrow as practicable and shall not be widened by scraping or loosening materials from the sides. Every effort shall be made to keep the sides of the trenches firm and undisturbed until backfilling has been completed.

7. If, in the opinion of the Engineer, the subgrade, during trench excavation, has been disturbed as a result of rain, surface water runoff or groundwater seepage pressures, the Contractor shall remove such disturbed subgrade to a minimum of 12 inches and replace with crushed stone wrapped in filter fabric. Cost of removal and replacement shall be borne by the Contractor.

8. The Contractor shall obtain a trench permit from the municipality where the trench is located prior to making any excavations of trenches (any subsurface excavation greater than three (3) feet in depth and fifteen (15) feet or less between soil walls as measured from the bottom).

9. All trenches required to be permitted must be attended, covered, barricaded, or backfilled. Covers must be road plates at least ¾-inch thick or equivalent, barricades must be fences at least 6-feet high with no openings greater than 4-inches between vertical supports and all horizontal supports required to be located on the trench-side of the fencing.

C. BUILDING AND FOUNDATION EXCAVATION:

1. Excavations shall not be wider than required to set, brace, and remove forms for concrete, or perform other necessary work.

2. After the excavation has been made, and before forms are set for footings, mats, slabs, or other structures, and before reinforcing is placed, all loose or disturbed material shall be removed from the subgrade. The bearing surface shall then be compacted to meet the requirements of this specification.

3. If, in the opinion of the Engineer, the existing material at subgrade elevation is unsuitable for structural support, the Contractor shall excavate and dispose of the unsuitable material to the required width and depth as required by the Engineer. If, in the opinion of the Engineer, filter fabric is required; the Contractor shall place filter fabric, approved by the Engineer, as per manufacturer's recommendations. Crushed stone shall then be placed in lifts and compacted to required densities. Backfill shall be placed to the bottom of the proposed excavation.

D. EXCAVATION NEAR EXISTING STRUCTURES:

1. Attention is directed to the fact that there are pipes, manholes, drains, and other utilities in certain locations. An attempt has been made to locate all utilities on the drawings, but the completeness or accuracy of the given information is not guaranteed.

2. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and excavation shall be done by means of hand tools, as required. Such manual excavation, when incidental to normal excavation, shall be included in the work to be done under items involving normal excavation.

3. Where determination of the exact location of a pipe or other underground structure is necessary for properly performing the work, the Contractor shall excavate test pits to determine the locations.

3.03 BACKFILL PLACEMENT AND COMPACTION:

A. GENERAL:

1. Prior to backfilling, the Contractor shall compact the exposed natural subgrade to the densities as specified herein.

2. After approval of subgrade by the Engineer, the Contractor shall backfill areas to required contours and elevations with specified materials.

3. The Contractor shall place and compact materials to the specified density in continuous horizontal layers, not to exceed nine (9) inches in uncompacted lifts. The degree of compaction shall be based on maximum dry density as determined by ASTM Test D1557, Method C. The minimum degree of compaction for fill placed shall be as follows:

Location	Percent of Maximum Density
Below pipe centerline	95
Above pipe centerline	92
Below pavement (upper 3 ft.)	95
Embankments	95
Below pipe in embankments	95
Adjacent to structures	92
Below structures	95

4. The Engineer reserves the right to test backfill for conformance to the specifications and Contractor shall assist as required to obtain the information. Compaction testing will be performed by the Engineer or by an inspection laboratory designated by the Engineer, engaged and paid for by the Owner. If test results indicate work does not conform to specification requirements, the Contractor shall remove or correct the defective Work by recompacting where appropriate or replacing as necessary and approved by the Engineer, to bring the work into compliance, at no additional cost to the Owner. All backfilled materials under structures and buildings shall be field tested for compliance with the requirements of this specification.

5. Where horizontal layers meet a rising slope, the Contractor shall key each layer by benching into the slope.

6. If the material removed from the excavation is suitable for backfill with the exception that it contains stones larger than permitted, the Contractor has the option to remove the oversized stones and use the material for backfill or to provide replacement backfill at no additional cost to the Owner.

7. The Contractor shall remove loam and topsoil, loose vegetation, stumps, large roots, etc., from areas upon which embankments will be built or areas where material will be placed for grading. The subgrade shall be shaped as indicated on the Drawings and shall be prepared by forking, furrowing, or plowing so that the first layer of the fill material placed on the subgrade will be well bonded to the subgrade.

8. Where called for on the Drawings, Lightweight Fill shall be placed and compacted as recommended by the manufacturer. The exact number of passes shall be approved by the Engineer to insure stability of the layer. As soon as the compaction of each

layer has been completed, the next layer shall then be placed. The Contractor shall take all necessary precautions during construction activities in operations on or adjacent to the Lightweight Fill to insure that the material is not over-compacted. Construction equipment, other than for compaction, shall not operate on the exposed Lightweight Fill. The top surface of the Lightweight Fill lying directly below the gravel course shall be chinked by additional rolling of the Lightweight Fill to prevent infiltration of fines.

9. In areas where noted on the Drawings, the Contractor shall surcharge the organic layers to control post construction consolidation settlement. The Contractor shall apply the surcharge loads in a manner and for a duration acceptable to the Engineer. The lateral extent of surcharge load should be as narrow as practical to provide stable slopes and within the restriction of the project permits. The surcharge load in these areas shall remain for a minimum of 6 months or as required by the Engineer. After approval by the Engineer, remove the surcharge load and grade to the proposed elevation. During surcharge loading in this location, the Contractor shall provide survey results of settlement on the top of the berm. The frequency of the survey data shall be as follows:

1	survey per day during 1st week
2	surveys per week during 2nd & 3rd week
1	survey per week for 2 months thereafter
1	survey per month for the remaining period

The periodic surveys for settlement monitoring shall be taken at the same locations, not more than 100 feet apart.

B. TRENCHES:

1. Bedding as detailed and specified shall be furnished and installed beneath the pipeline prior to placement of the pipeline. A minimum bedding thickness shall be maintained between the pipe and undisturbed material, as shown on the Drawings.

2. As soon as practicable after pipes have been laid, backfilling shall be started.

3. Unless otherwise indicated on the Drawings, select backfill shall be placed by hand shovel in 6-inch thick lifts up to a minimum level of 12-inches above the top of pipe. This area of backfill is considered the zone around the pipe and shall be thoroughly compacted before the remainder of the trench is backfilled. Compaction of each lift in the zone around the pipe shall be done by use of power-driven tampers weighing at least 20 pounds or by vibratory compactors. Care shall be taken that material close to the bank, as well as in all other portions of the trench, is thoroughly compacted to densities required.

4. Class B backfill shall be placed from the top of the select backfill to the specified material at grade (loam, pavement subbase, etc.). Fill compaction shall meet the density requirements of this specification.

5. Water Jetting:

    a. Water jetting may be used when the backfill material contains less than 10 percent passing the number 200 sieve, but shall be used only if approved by the Engineer.

    b. Contractor shall submit a detailed plan describing the procedures he intends to use for water jetting to the Engineer for approval prior to any water jetting taking place.

    c. Compaction of backfill placed by water jetting shall conform to the requirements of this specification.

6. If the materials above the trench bottom are unsuitable for backfill, the Contractor shall furnish and place backfill materials meeting the requirements for trench backfill, as shown on the drawings or specified herein.

7. Should the Engineer order crushed stone for utility supports or for other purposes, the Contractor shall furnish and install the crushed stone as directed.

8. In shoulders of streets and road, the top 12-inch layer of trench backfill shall consist of processed gravel for sub-base, satisfying the requirements listed in MassDOT standard specification M1.03.1.

9. Trenches in state highways shall be backfilled with Controlled Density Fill, in accordance with the state highway permit included in Section 00 31 43, PERMITS.

C. BACKFILLING UNDER BUILDINGS AND FOUNDATIONS:

Material to be used as structural fill under structures shall be special bedding material or gravel borrow, as shown on the Drawings or as required by the Engineer. Where gravel borrow fill is required to support proposed footings, walls, slabs, and other structures, the material shall be placed in a manner accepted by the Engineer. Compaction of each lift shall meet the density requirements of this specification.

D. BACKFILLING ADJACENT TO STRUCTURES:

1. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads to which they will be subjected. Excavated material approved by the Engineer may be used in backfilling around structures. Backfill material shall be thoroughly compacted to meet the requirements of this specification.

2. Contractor shall use extra care when compacting adjacent to pipes and drainage structures. Backfill and compaction shall proceed along sides of drainage structures so that the difference in top of fill level on any side of the structure shall not exceed two feet (2') at any stage of construction.

3. Where backfill is to be placed on only one side of a structural wall, only hand-operated roller or plate compactors shall be used within a lateral distance of five feet (5') of the wall for walls less than fifteen feet (15') high and within ten feet (10') of the wall for walls more than fifteen feet (15') high.

3.04 DISPOSAL OF SURPLUS MATERIALS:

A. Surplus excavated materials, which are acceptable to the Engineer, shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill. Upon written approval of the Engineer, surplus excavated materials shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes as indicated by the Owner, within its jurisdictional limits; all at no additional cost to the Owner.

B. Surplus excavated material not needed as specified above shall be hauled away and disposed of by the Contractor at no additional cost to the Owner, at appropriate locations, and in accordance with arrangements made by him. Disposal of all rubble shall be in accordance with all applicable local, state and federal regulations.

C. No excavated material shall be removed from the site of the work or disposed of by the Contractor unless approved by the Engineer.

D. The Contractor shall comply with Massachusetts regulations (310 CMR 40.0032) that govern the removal and disposal of surplus excavated materials. Materials, including contaminated soils, having concentrations of oil or hazardous materials less than an otherwise Reportable Concentration and that are not a hazardous waste, may not be disposed of at locations where concentrations of oil and/or hazardous material at the receiving site are significantly lower than the levels of those oil and /or hazardous materials present in the soil being disposed or reused.

END OF SECTION

Document2

SECTION 31 05 19.13

GEOTEXTILE FABRICS

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section covers furnishing of all labor, materials, and equipment necessary to install specified geotextile fabrics in locations shown on the drawings and as required by the Engineer.

1.02 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF SECTION 01330 SUBMITTALS, SUBMIT THE FOLLOWING:

Shop drawings or working drawings and material specifications shall be submitted to the Engineer for review for each type of geotextile fabric furnished. General installation practices and installation schedule shall be included.

PART 2 - PRODUCTS

2.01 EROSION CONTROL FABRIC "A":

A. Erosion control fabric "A" shall be composed of continuous-filament fibers bonded together to form a sheet. The fabric shall be an average of 20 mils thick and possess the pore-size distribution of Tencate Mirafi 600X Fabric.

B. Erosion Control fabric "A" shall be Tencate Mirafi 600X as manufactured by Tencate Geosynthetics, Pendergrass, GA; or approved equal.

2.02 EROSION CONTROL FABRIC "B":

A. Erosion Control Fabric "B" shall be of the best quality proven design and construction and shall be entirely suitable in every respect for the intended service.

B. Erosion Control fabric "B" shall be Tencate Miramesh as manufactured by Tencate Geosynthetics, Pendergrass, GA; Enkamat Soil Erosion Matting as manufactured by Bonar, Asheville, N.C.; Tenax Radix Erosion Control Netting as manufactured by Tenax Corp., Baltimore, MD or approved equal.

2.03 SOIL REINFORCEMENT FABRIC:

A. The soil reinforcement fabric shall be an integrally formed structure with aperture geometry and rib thickness sufficient to permit mechanical interlock with the surrounding particle media. The soil reinforcement fabric shall have flexural rigidity and high tensile modulus with continuity of tensile strength through all ribs and junctions of the structure. The fabric shall be composed of polypropylene stabilized with carbon black to resist ultraviolet degradation and be resistant to biological and chemical degradation due to all naturally occurring organisms or reagents normally encountered in natural soil environments.

B. The soil reinforcement fabric shall be a Tensar SS-2 (BX1200) Geogrid, by Contech Construction Products Inc., Marlboro, MA; Tencate Mirafi 500X fabric, by Tencate Geosynthetics, Pendergrass, GA; or approved equal.

2.04 SOIL REINFORCEMENT GRID:

A. The soil reinforcement grid shall permit free passage of moisture, be of sufficient strength to prevent deformation and impairment of function when subjected to wheel loads and interact with overlying soil to stabilize the overburden on slopes as steep as three to one.

B. Soil reinforcement grid shall by Tencate Mirafi Miragrid, by Tencate Geosynthetics; or approved equal.

2.05 FILTER/DRAINAGE FABRIC:

A. The filter/drainage fabric shall be composed of continuous-filament fibers bonded together to form a sheet. The fabric shall be an average of 20 mils thick and possess the characteristics of Tencate Mirafi 140N.

B. The filter/drainage fabric shall be Tencate Mirafi 140N as manufactured by Tencate Geosynthetics, Pendergrass, GA; Foss-65 by Foss Manufacturing Co., Hampton, NH; US 120NW, as manufactured by US Fabrics, Cincinnati, OH, or approved equal.

2.06 GEOTEXTILE LINER PROTECTOR:

A. The geotextile liner protector shall be a non-woven, needle punched polyester or extruded polypropylene, not less than 110 mils thick.

B. The geotextile liner protector shall be Tencate Mirafi 180 N, by Tencate Geosynthetics, Pendergrass, GA; or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. GENERAL:

Installation of geotextile fabrics shall be strictly in accordance with manufacturer's instructions and specific layout plans and details reviewed by the Engineer.

B. EROSION CONTROL FABRIC “A”:

Erosion control fabric “A” shall be installed on detention basin slopes and at drainage swale ends prior to placement of riprap and at other locations as shown on the drawings or as required by the Engineer. The fabric in place shall cover the entire riprap area. Each width of fabric shall be overlapped by the subsequent width a minimum of two feet. The Contractor shall follow the manufacturer's installation recommendations to ensure proper completion of the fabric installation, including top toe-in and bottom toe wrap.

C. EROSION CONTROL FABRIC “B”:

Erosion control fabric “B” shall be placed over the prepared surface in drainage swales and other locations as required by the Engineer. The fabric shall be unrolled, placed in the direction of water flow, overlapped, pinned down with wood stakes, and seeded. All installation work shall be in accordance with manufacturer's recommendations or as required by the Engineer.

D. SOIL REINFORCEMENT FABRIC:

The soil reinforcement fabric shall be installed on the prepared subgrade prior to placement of the gravel base and bituminous concrete pavement. The fabric in place shall be beneath the entire proposed paved area. Each width of fabric shall be overlapped by the subsequent width a minimum of two feet. The Contractor shall follow the manufacturer's installation recommendations.

E. SOIL REINFORCEMENT GRID:

The soil reinforcement grid shall be placed on the flexible membrane liner, securely fastened at the top of all slopes and interlocked to form a continuous grid below the supports, all in accordance with manufacturer's recommendations and specific project details. The reinforcement grid shall provide stability for the overlying soil drainage layer, while permitting free passage of moisture.

F. FILTER/DRAINAGE FABRIC:

1. The filter/drainage fabric shall be installed in the final graded trench bottom prior to placement of the crushed stone bedding and at other locations shown on the drawings or designated by the Engineer. The drainage fabric in place shall cover the entire trench bottom and trench sides as shown on the drawings. Each width of drainage fabric shall be overlapped in accordance with manufacturer’s recommendations, but not less than 2 feet, to prevent intrusion of soil fines into the bedding.

2. On landfill projects, the filter/drainage fabric shall be installed over the drainage layer prior to loaming and seeding, per manufacturer’s installation recommendations.

G. GEOTEXTILE LINER PROTECTOR:

The geotextile liner protector shall be installed on top of the gas-venting layer and shall be covered by the flexible membrane liner. The protector shall provide a smooth surface to support the liner and protect against liner damage due to projections. The installation shall be strictly in accordance with manufacturer's recommendations.

3.02 FINAL INSPECTION AND ACCEPTANCE:

A. The Contractor shall, at his expense, have a manufacturer's representative inspect the work at completion of the installation. Any work found to be unsatisfactory shall be corrected at the Contractor's expense.

B. The Engineer, at the Contractor's expense, reserves the right to have a manufacturer's representative inspect the installation process at any time during construction.

END OF SECTION

Document2

SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. The Contractor shall do all required clearing and grubbing as indicated on the drawings or herein specified in the area required for construction operations on the Owner's land or in the Owner's permanent or temporary easements and shall remove all debris resulting therefrom.

B. Unless otherwise noted, all areas to be cleared shall also be grubbed.

C. The Contractor shall not clear and grub outside of the area required for construction operations.

1.02 RELATED WORK:

Any trees and shrubs specifically designated by the Owner not to be cut, removed, destroyed, or trimmed shall be saved from harm and injury in accordance with Section 01 57 19, ENVIRONMENTAL PROTECTION.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 RIGHT TO WOOD AND LOGS:

The Owner shall have the right to cut and remove logs and other wood of value in advance of the Contractor's operations. All remaining logs and other wood to be removed in the course of clearing shall become the property of the Contractor.

3.02 CLEARING:

A. Unless otherwise indicated, the Contractor shall cut or otherwise remove all trees, saplings, brush and vines, windfalls, logs and trees lying on the ground, dead trees and stubs more than 1-foot high above the ground surface (but not their stumps), trees which have been partially uprooted by natural or other causes (including their stumps), and other vegetable matter such as shags, sawdust, bark, refuse, and similar materials.

B. The Contractor shall not remove mature trees (4-inches or greater DBH) in the Owner's temporary easements.

C. Except where clearing is done by uprooting with machinery or where stumps are left longer to facilitate subsequent grubbing operations, trees, stumps, and stubs to be cleared shall be cut as close to the ground as practicable but not more than 6-inches above the ground surface in the case of small trees, and 12-inches in the case of large trees. Saplings, brush and vines shall be cut close to the ground.

3.03 GRUBBING:

A. Unless otherwise indicated, the Contractor shall completely remove all stumps and roots to a depth of 18-inches, or if the Contractor elects to grind the stumps, they shall be ground to a minimum depth of 6-inches.

B. Any depression remaining from the removal of a stump and not filled in by backfilling shall be filled with gravel borrow and/or loam, whichever is appropriate to the proposed ground surface.

3.04 DISPOSAL:

All material collected in the course of the clearing and grubbing, which is not to remain, shall be disposed of in a satisfactory manner away from the site or as otherwise approved. Such disposal shall be carried on as promptly as possible and shall not be left until the final clean-up period.

END OF SECTION

Document2

SECTION 31 23 19

DEWATERING

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section specifies designing, furnishing, installing, maintaining, operating and removing temporary dewatering systems as required to lower and control water levels and hydrostatic pressures during construction; disposing of pumped water; constructing, maintaining, observing and, except where indicated or required to remain in place, removing of equipment and instrumentation for control of the system.

1.02 RELATED WORK:

A. Section 00 31 43, PERMITS

B. Section 01 57 19, ENVIRONMENTAL PROTECTION

C. Section 31 00 00, EARTHWORK

D. Section 31 50 00, SUPPORT OF EXCAVATION

1.03 SYSTEM DESCRIPTION:

A. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from the slopes or bottom of the excavation; increasing the stability of excavated slopes; preventing loss of material from beneath the slopes or bottom of the excavation; reducing lateral loads on sheeting and bracing; improving the excavation and hauling characteristics of sandy soil; preventing rupture or heaving of the bottom of any excavation; and disposing of pumped water.

1.04 QUALITY ASSURANCE:

A. The Contractor is responsible for the adequacy of the dewatering systems.

B. The dewatering systems shall be capable of effectively reducing the hydrostatic pressure and lowering the groundwater levels to a minimum of 2 feet below excavation bottom, unless otherwise required by the Engineer, so that all excavation bottoms are firm and dry.

C. The dewatering system shall be capable of maintaining a dry and stable subgrade until the structures, pipes and appurtenances to be built therein have been completed to the extent that they will not be floated or otherwise damaged.

D. The dewatering system and excavation support (see Section 31 50 00, SUPPORT OF EXCAVATION) shall be designed so that lowering of the groundwater level outside the excavation does not adversely affect adjacent structures, utilities or wells.

1.05 SUBMITTALS:

A. In accordance with Section 01 33 23, Contractor shall submit a plan indicating how it intends to control the discharge from any dewatering operations on the project, whether it is discharge of groundwater from excavations or stormwater runoff during the life of the project.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION

3.01 DEWATERING OPERATIONS:

A. All water pumped or drained from the work shall be disposed of in a manner that will not result in undue interference with other work or damage to adjacent properties, pavements and other surfaces, buildings, structures and utilities. Suitable temporary pipes, flumes or channels shall be provided for water that may flow along or across the site of the work. All disposal of pumped water shall conform to the provisions of Section 01 57 19 ENVIRONMENTAL PROTECTION and Section 00 31 43 PERMITS.

B. Dewatering facilities shall be located where they will not interfere with utilities and construction work to be done by others.

C. Dewatering procedures to be used shall be as described below:

1. Crushed stone shall encapsulate the suction end of the pump to aid in minimizing the amount of silt discharged.

2. For dewatering operations with relatively minor flows, pump discharges shall be directed into hay bale sedimentation traps lined with filter fabric. Water is to be filtered through the hay bales and filter fabric prior to being allowed to seep out into its natural watercourse.

3. For dewatering operations with larger flows, pump discharges shall be into a steel dewatering basin. Steel baffle plates shall be used to slow water velocities to increase the contact time and allow adequate settlement of sediment prior to discharge into waterways.

4. Where indicated on the contract drawings or in conditions of excess silt suspended in the discharge water, silt control bags shall be utilized in catch basins.

D. The Contractor shall be responsible for repair of any damage caused by his dewatering operations, at no cost to the Owner.

END OF SECTION

Document2

SECTION 31 25 00

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. Furnish all labor, materials, tools and equipment, and perform all operations necessary for erosion and sedimentation control work indicated on contract drawings and as specified herein.

1.02 RELATED WORK:

A. Section 01 14 19.16, DUST CONTROL

B. Section 01 57 19, ENVIRONMENTAL PROTECTION

C. Section 31 05 19.13, GEOTEXTILE FABRICS

1.03 PROJECT CONDITIONS:

A. Earthmoving activities in the project area shall be conducted in such a manner as to prevent accelerated erosion and the resulting sedimentation.

B. The Contractor shall implement and maintain erosion and sedimentation control measures as shown on the contract drawings or as required by the Owner or Engineer from the start of construction until provisional acceptance of seeded areas, to effectively prevent accelerated erosion and sedimentation.

1.04 SUBMITTALS IN ACCORDANCE WITH SECTION 01330, SUBMITTALS:

A. The Contractor shall submit to the Engineer certification that the materials used for silt fence and straw wattle construction meet the specifications.

1.05 GENERAL METHODOLOGY:

A. Erosion and sedimentation control methods shall consider all factors which contribute to erosion and sedimentation including, but not limited to, the following:

1. Topographic features of the Project area.
2. Types, depth, slope and areal extent of the soils.

3. Proposed alteration of the area.

4. Amount of run-off from the Project area and the upgradient watershed areas.

5. Staging of earthmoving activities.

6. Temporary control measures and facilities for use during earthmoving.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Straw wattle shall consist of 99.9% weed-free wheat, oat, barley, or rice straw, compacted. Diameter may vary +/- 13 percent. Wattle netting shall be non-woven photodegradable HDPE with a 1 year UV inhibitor.

B. Silt Fence shall be a woven polypropylene and/or polyester material, which meets or exceeds the minimum average roll values requirements tabulated below:

Fabric Property	**Test Method**	**Fabric Requirement**
Tensile strength, lbs	ASTM D-4632 Grab	100 minimum
Elongation at 50% minimum tensile strength	ASTM D-4632 Grab	50% maximum
Permittivity, sec^{-1}	ASTM D-4491	0.1 minimum
Apparent opening size, mm	ASTM D-4751	0.84 maximum
Ultraviolet degradation at 500 hours	ASTM D-4355	minimum 70% strength retained

C. Mulch, if used to protect the hydroseed from erosion, shall consist of cured straw free from primary noxious weed seeds, twigs, debris and rough or woody materials. Mulch shall be free from rot or mold and shall be acceptable to the Engineer or Owner. Alternately, mulch shall be specially processed cellulose homogeneous fiber containing no growth or germination-inhibiting factors. Processed cellulose fiber shall be manufactured in such a manner that after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a slurry when sprayed on the ground. The material shall allow homogeneous absorption and percolation of moisture. The manufacturer shall show the air-dry weight content on each package of the cellulose fiber. Mulch shall be utilized on all newly graded subgrade and topsoil areas that cannot be seeded within five (5) days.

PART 3 - EXECUTION

3.01 CONSTRUCTION SEQUENCE:

A. Construction of erosion control measures as depicted on drawings will be completed prior to any site work.

B. Sediment barriers shall be used at locations shown on the drawings. Sediment barriers are temporary berms, diversions, or other barriers that are constructed to retain sediment on-site by retarding and filtering stormwater runoff.

C. All temporary erosion control measures will be maintained throughout the course of site construction activities until provisional acceptance of the site vegetation by the Engineer or Owner, at which time the Contractor shall remove all remaining temporary erosion control structures, and properly dispose of accumulated sediment on-site in areas approved by the Owner.

D. The Engineer or Owner may order additional erosion and sediment controls be installed. The Contractor shall comply with Engineer or Owner's request and immediately install the required controls.

E. The Contractor shall inspect all erosion control measures after any storm event to ensure they are in proper working order.

3.02 CONSTRUCTION METHODS:

A. Silt fences and/or straw wattles shall be installed at the site downgradient of work areas as required by Owner or Engineer in the field. The silt fence shall be installed in accordance with manufacturer’s instructions. Straw wattles shall be placed at locations shown on the contract drawings or approved by the Engineer. The base of all straw wattles and silt fencing shall be embedded to the depths shown on the contract drawings.

B. Straw mulch, if used, shall be applied at a rate of 100-lbs/1000 ft^2.

C. On slopes, the Contractor shall provide protection against washouts by an approved method. Any washout, which occurs either in the Contractor's work area or in areas topographically below his work, shall be regraded and reseeded at the Contractor's expense until an accepted vegetative stand is established.

END OF SECTION

Document2

SECTION 31 37 00

RIPRAP

PART 1 - GENERAL

1.01 WORK INCLUDED:

A. This Section covers riprap for slope protection, drainage swales and pipe ends, complete.

B. Grading and compaction of earth slopes and other slope preparation for the riprap are included under other sections of the specification.

1.02 RELATED WORK:

A. Section 31 00 00, EARTHWORK.

B. Section 31 05 19.13, GEOTEXTILE FABRICS.

1.03 REFERENCES:

A. The following standard forms a part of these specifications and indicates minimum standards required:

Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. SLOPE PROTECTION:

Stone for slope protection shall be angular and shall be in accordance with MassDOT Specification Section M2.02.2, Dumped Riprap.

B. PIPE ENDS:

Stone for pipe ends shall be angular and shall be in accordance with MassDOT Specification Section M2.02.3, Stone for Pipe Ends.

C. DRAINAGE SWALES:

Stone for drainage swale ends shall conform to MassDOT Specification Section M2.02.3, and shall be not weigh less than 50 pounds or more than 125 pounds and least 75% of the volume shall consist of stones not less than 75 pounds each. The stones shall be so graded that when placed with larger stones, the entire mass will be compact.

D. GEOTEXTILE FABRIC:

Geotextile fabric shall be Erosion Control Fabric “A” as specified in Section 31 05 19.13, GEOTEXTILE FABRICS.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Geotextile fabric shall be installed where shown on the drawings, prior to placing the riprap.

B. Riprap for slope protection and pipe ends shall be placed on the prepared slope or area in a manner which will produce a reasonably well-graded mass of stone with the minimum practicable percentage of voids and a maximum void of 12-inches.

C. Riprap shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Placing of riprap in layers or by dumping into chutes or by other similar methods likely to cause segregation will not be permitted.

D. Riprap stones shall be placed and distributed such that there will be no large accumulation of either the larger or smaller stones in any given area.

E. It is the intent of these specifications to produce compact riprap protection in which all required sizes of stone are placed in the proper proportions. Hand placing or rearranging of individual stones by mechanical equipment shall be utilized to the extent necessary to secure the desired results.

END OF SECTION

DOCUMENT2

SECTION 31 41 16.13

STEEL SHEET PILING

PART 1 - GENERAL

1.01 WORK INCLUDED:

1.02 QUALITY ASSURANCE:

A. The Contractor shall furnish, drive to the depths required or approved, cut off and leave in place steel sheet piling where indicated on the drawings or required by the Engineer in writing.

B. Sheet piling shall be of sufficient strength and be provided with adequate bracing. If, in the opinion of the Engineer, sufficient or proper supports have not been provided, he may order additional supports put in at the expense of the Contractor.

C. The sheeting and bracing shall be designed to prevent any movement of earth that would diminish the width of the excavation or endanger adjacent structures. The Contractor shall submit design calculations, sketches and installation procedure for steel sheeting and bracing stamped by a Professional Engineer registered in the state where the project is located, to the Engineer prior to installation.

1.03 REFERENCES:

Steel sheet piling shall conform to Standard Specification for Steel Sheet Piling, ASTM A328.

PART 2 - PRODUCTS

2.01 MATERIALS:

Where steel sheet piling is indicated on the drawings or is ordered by the Engineer for installation, the material shall be of proper length, straightness, and otherwise acceptable to the Engineer.

PART 3 - EXECUTION

3.01 DRIVING AND CUTTING:

A. The steel sheet piling shall be furnished in suitable lengths for the work required, and shall be driven by approved means to the required depths. If boulders are encountered making it impractical to drive a section to the desired depth, the section shall, as required, be cut off.

The sections of steel piling shall be interlocked and every effort shall be made to avoid breaking the continuity of the lock during driving.

B. Steel sheet piling to be left in place shall be cut off three feet below ground surface.

END OF SECTION

DOCUMENT2

SECTION 31 52 00

PORTABLE COFFERDAM

PART 1 - GENERAL

1.01 WORK INCLUDED:

This section includes furnishing all equipment, labor and materials to install and subsequently remove a portable cofferdam as shown on the drawings.

1.02 SYSTEM DESCRIPTION:

The portable cofferdam shall consist of a combination metal frame and synthetic fabric membrane installed on the river bottom in the configuration shown on the drawings, with the synthetic fabric membrane providing a dam to restrain the water. The portable cofferdam shall be 7 feet high.

1.03 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

Provide manufacturer's literature on proposed system, including description of installation procedures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

The portable cofferdam shall be PORTADAM, as provided by PORTADAM, INC. of Laurel Springs, N.J., or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION:

The portable cofferdam shall be installed in accordance with manufacturer's instructions, with minimum disruption of the river bottom and minimum damage to the surrounding area.

3.02 REMOVAL:

On completion of the project, the portable cofferdam shall be promptly removed, with minimum disruption of the river bottom and minimum damage to the surrounding area.

END OF SECTION

DOCUMENT2

SECTION 31 63 00

HELICAL STEEL FOUNDATION SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED:

This Section includes all labor, materials, equipment, appliances, transportation, services, and other items necessary to furnish and install completely all steel helical foundation piers and related work for the entire project as shown on the plans and specified herein, including:

1. Furnishing and installing helical steel foundation piers including splicing, to the required bearing stratum and/or installation resistance to provide support for the required loads. All components of the foundation system shall be as manufactured by A.B. Chance, of Houston, Texas, or approved equal.
2. Establishing lines and grades, including layout of piers in the field.
3. Providing temporary benchmarks at selected locations for the use of the Engineer during and after pier installations.
4. Cutting off all piers at the proper elevation as shown on the drawings.
5. The Contractor's attention is called to the sensitivity of the project and close proximity to existing structures when proposing an alternative system.

1.02 SYSTEM DESCRIPTION:

It is the intent of this section to provide complete structural steel piers to support a maximum ultimate load of one hundred kips (100K).

1.03 RELATED WORK:

A. Section 31 00 00, EARTHWORK.

B. Section 31 09 16.23, PILE LOAD TESTS.

1.04 SUBSURFACE SOIL DATA AND SITE CONDITIONS:

A. SOIL DATA:

1. It is the obligation of the Contractor to examine the site, to verify all dimensions in the field, and to review logs of borings, jar soil samples, records of construction and

existing lines, and other pertinent data, and to employ all other means at his disposal to familiarize himself completely with conditions existing at the site. At his own expense, the Contractor may take whatever additional borings or explorations he deems necessary.

2. Logs of borings are appended hereto and are hereby made part of these specifications. Jar soil samples may be examined upon request to the Engineer.

3. The aforementioned data is for general information only. It is the Contractor's sole responsibility to make interpretations and draw conclusions with respect to the character of the materials to be encountered and their impact upon his work, based on his knowledge of the area and of pier installation techniques. Neither the Owner nor the Engineer assumes responsibility for the accuracy of the data other than the particular locations and at the time the subsurface explorations were made.

B. UTILITIES:

The Contractor shall visit the premises to familiarize himself thoroughly with all details of the work and of working conditions, to verify all dimensions in the field, and to advise the Engineer in writing of any discrepancy before performing any work. The Contractor shall consult official records of existing utilities, both surface and subsurface, and their connections, and shall fully inform himself of all existing conditions and limitations as they apply to his work and of the extent and character of the work required under this section and its relation to all other related construction work.

C. UTILITIES LEFT IN PLACE:

Existing utilities found on the project site which are to remain shall not be disturbed or damaged. Provisions for protection of same shall be made in accordance with the requirements of authorities having jurisdiction over same.

1.05 QUALIFICATION REQUIREMENT:

The Contractor providing this work shall submit evidence of suitable experience in this type of installation and of the competence and experience of the person in charge of the site. As a minimum, the Contractor shall provide evidence of having successfully completed at least three projects of a scope comparable to this project. Approval of the Contractor's experience by the Engineer shall in no way imply acceptance of responsibility by the Engineer for the Contractor's ability to perform the work.

1.06 SUBMITTALS: IN ACCORDANCE WITH REQUIREMENTS OF GENERAL SPECIFICATIONS, SUBMIT THE FOLLOWING:

A. PIERS:

Mill certificates for all steel pier and appurtenant devices (tips, splice plates, etc.) shall be provided to the Engineer five (5) days prior to delivery of piers to the site. Certificates shall state chemical composition, yield point, and ultimate strength of steel proposed for use.

B. INSTALLATION EQUIPMENT:

1. Submit manufacturer's data on pier-installation equipment.
2. Submit drawing showing details of installation equipment and drive head assembly.

C. PIER SPLICING:

Submit technical details of method for splicing pier segments.

D. AS-INSTALLED LOCATION DATA:

1. Weekly drawings of as-installed pier locations.
2. Final as-installed pier location plan certified by a Registered Land Surveyor or a Registered Professional Engineer.

1.07 STANDARDS:

All work performed under this section shall conform to manufacturer standards and specifications and shall be of highest quality workmanlike construction, acceptable to the Engineer.

PART 2 - MATERIALS

2.01 STEEL PIERS:

Helical steel piers shall be grade-A50 hot-dip galvanized steel, standard steel section of 8 inch. The piers shall be of new material, straight and free from dents and subject to the approval of the Engineer.

2.02 SPLICES:

A. Piers shall be spliced in a manner which will develop one hundred percent(100%) of the section strength, both in direct stress and in bending. The two (2) spliced sections shall be kept in alignment in both directions throughout the splicing operation and when splicing is complete. Contractor shall submit to the Engineer his proposed method of splicing.

B. Alternative methods of splicing different from manufacturer’s recommendations may be submitted to the Engineer for approval, with appropriate back-up material, provided that the alternative splice will develop one hundred percent (100%) of the strength in direct stress and in bending and will maintain alignment.

2.03 HEAVY DUTY BRACKETS:

Heavy duty brackets for support of manholes shall be as manufactured by A.B. Chance Col, No. C150-0147, or approved equal. Brackets should be of the type that is compatible with the size of pier used for support.

PART 3 - EXECUTION

3.01 LAYOUT AND RECORDS:

A. Piers shall be located and staked by the Contractor, and the Contractor shall maintain all location stakes, establish all elevations required, and be responsible for the correct locations of all piers.

B. Full-time observation and logging of all pier installation operation shall be provided by the manufacturer or his representative. In addition, the Owner will provide an authorized representative to observe all pier installations. No piers shall be installed except in the presence of the Engineer and the manufacturer’s representative.

C. The Contractor shall employ a licensed Registered Land Surveyor or a Registered Civil Engineer, familiar with this type of work, who shall establish lines and levels and the accurate locations of all piers after installation. The Contractor shall be responsible for the correct locations of piers.

D. The Contractor shall keep a record of all pertinent data relative to the installation of piers. The record shall be available for the Engineer's review, and shall include for each pier:

1. Date and time of installation.

2. Total penetration as shown by point elevation.

3. Cutoff elevation.

4. Location of each pier as prepared by the Contractor's Surveyor or engineer.

3.02 INSTALLATION EQUIPMENT:

A. INSTALLING UNITS:

1. Installation unit shall consist of a rotary type, torque motor with forward and reverse capabilities. The units shall be either electrically or hydraulically powered.

2. The units shall be capable of developing the maximum torque required to install piers that will provide the ultimate loads of 100 kips specified.

3. The units shall be capable of positioning the helical pier at the proper installation angle, which varies between 0 (vertical) to 5 degrees, depending upon the location of the piers.

4. The units shall be in good working condition and capable of being operated in a safe manner.

B. INSTALLATION TOOLING:

1. Adapters approved by the Engineer, shall be employed to safely connect the installation units to the helical piers and extensions.

2. The adapters shall have a torque capacity rating at least equal to the maximum torque rating to develop the helical piers ultimate capacity as specified.

3. The adapters shall be securely connected to the helical pier during installation so as to prevent accidental separation.

C. TORQUE MONITORING DEVICES:

1. The torque applied by the installing units shall be monitored throughout the installation process.

2. Torque monitoring devices shall be either a part of the installing unit or an independent device in-line with the installing unit. Calibration data for either unit shall be available for review by the Engineer.

D. The proposed pier installation equipment shall be subject to the approval of the Engineer. Approval shall be obtained in writing before pier installation starts. The same equipment shall be used for all production piers and test piers. Approval by the Engineer of the Contractor's equipment shall merely signify that the Contractor may make an initial trial installation with the proposed equipment. Approval will not relieve the Contractor of his responsibility for providing and installing piers capable of supporting the design loads by whatever means necessary, including changing the equipment and procedures from those used in the initial trial.

3.03 INSTALLATION:

A. GENERAL:

1. All piers in any one group shall be driven before moving to other locations. Pier installation shall be continuous, without interruption, for the final one foot of penetration.

2. No pier shall be installed unless the installation is observed by the Manufacturer's representative and Engineer.

3. The Contractor shall mark off each foot of the pier and log installation effort per foot for the final six feet.

4. Piers shall be installed through fill, peat, organic silt, into the bearing stratum and develop the full capacity required by contract.

B. CRITERIA:

1. The Contractor is responsible for installing piers to a depth that will develop one hundred kips (100K) ultimate capacity. Provisional torque criteria over the last six feet shall be 11,000 ft-lbs rated torque resistance of installation, pending completion of load tests.

2. The Contractor will be permitted the use of an installation device of a type and size which he has found to be adequate to install the specified piers.

3. Any pier that has been stopped short of final grade and has taken up by regaining soil shear strength or freeze because of a delay in continuous installation shall be started

and installed to grade in a manner which will not be damaging to the pier. Any pier which cannot be safely started or which is damaged in the process shall be deemed defective and shall be replaced at no cost to the Owner.

C. PIER HEAVE:

1. In locations in which the installation of piers may cause the points of previously installed piers to heave, special consideration shall be given to the sequence of pier installation.

2. Where pier point heave is indicated, redrive of the piers will be required in sufficient pattern to establish that all piers have the required specified final resistance.

D. TOLERANCES:

1. All piers shall be located within three inches (3") of the design position in plan, except as noted below.

2. All piers within a group shall be located in a final position such that the centroid of the group is not more than two inches (2") from the design position in plan.

3. Where a pier is found to exceed the tolerance in Item D.1 above, prior to completing all piers within that group, the Engineer may issue revised locations for remaining piers as to attempt compliance with Item D.2 above.

4. Where piers as installed exceed the specified tolerance, the Engineer shall determine the total loads on individual piers based upon as-driven locations and the need for corrective measure. If the load on any pile exceeds the specified load capacity, correction shall be made by installing additional piers or by other methods of load distribution as approved by the Engineer, at no additional cost to the Owner.

5. The installation of replacement piers and other corrective measures shall, in all cases, be subject to Engineer approval and shall be performed by the Contractor at no additional cost to the Owner.

6. Whenever misalignment of piers necessitates structural redesign, the cost of such redesign shall be deducted from sums due to the Contractor under the Contract.

7. All piers shall be cut off within one-half inch (2") of the elevations indicated on the Drawings.

8. Any pier damage or location tolerance excesses or excessive installation force resulting from the use of equipment not suited for the work shall be corrected by the Contractor as required by the Engineer at no cost to the Owner.

3.04 REJECTED PIERS:

A. OBSTRUCTIONS:

1. Where obstructions or very dense granular layers make it impossible to install certain piers at locations shown on the Drawings and/or to the proper depths, the Contractor shall resort to all usual methods for the installation of piers. Excavating to a depth of ten feet (10') below cutoff elevation and removing obstructions up to one cubic yard in volume shall be considered a usual method and shall be at the Contractor's expense. If, after resorting to the usual method, the Engineer orders that an additional pier or piers be installed or that other remedial action be taken, the Contractor will be paid in accordance with the unit prices established in this contract. Any pier abandoned because of obstructions encountered before reaching an anticipated depth shall be cut at cutoff elevation or pulled out, and the open hole filled with concrete at the discretion of the Engineer, at no cost to the Owner.

2. If the Engineer determines that obstructions more than ten feet below cutoff elevation or greater than one cubic yard in volume should be removed by excavation, the Contractor will be reimbursed for the additional work of removing obstructions and backfilling beyond that included in the usual methods on a time and materials basis. No payment for removal of any obstruction will be made unless such work, including agreement for extra compensation, has been approved in writing by the Engineer in advance of execution of the work.

3. Piers abandoned because of obstructions encountered shall be cut off or pulsed out at the discretion of the Engineer. In either case, the Contractor will be paid on the basis of the pier length driven for those piers which cannot be driven to the required depth by the usual method.

B. DEFECTIVE PIERS:

1. Defective piers shall be replaced either by extracting the defective piers or by enlarging the group and installing additional piers, as the Engineer may approve. Such replacement or addition shall be solely at the expense of the Contractor.

2. A pier exhibiting any one of the following conditions will be deemed to be defective:

   a. Piers exceeding any one of the conditions in Section 3.03D.

   b. Piers exceeding the three-inch (3") placement tolerance, unless otherwise specifically accepted by the Engineer. Piers exceeding this location tolerance will be corrected by installing one or more additional piers, as required by the Engineer, after a structural analysis of the pier group as driven.

   c. Any pier which shows signs of buckling.

   d. Any pier which cannot be properly installed (except as described in 3.04A).

3.05 OBSERVATION AND TESTING:

A. OBSERVATION:

All work performed under this Contract shall be subject to observation and testing by the Engineer. The Contractor shall cooperate with the Engineer and shall furnish all materials and facilities as may be required and shall provide convenient access to all parts of the Work so that the Engineer may observe and check for compliance with the plans and specifications. No pier shall be installed except in the presence of the Engineer.

B. ACCESS:

The Contractor shall provide the Engineer free and safe access to the Work at all times. The Contractor shall also provide and employ safety equipment as required by OSHA, at no extra cost.

C. LENGTH MARKINGS:

Each Pier shall be marked in readily visible markings showing length from the tip in at least one-foot (1') intervals. Provide a rule marked in inches close to each installed pier location to permit observation of final penetration resistance.

3.06 INDICATOR PIERS:

A. INDICATOR PIERS:

1. Install twenty piers at production pier locations to be selected by the Engineer. The piers shall be installed at designated locations in order to evaluate installation experience and required pier lengths.

2. Ten of the twenty indicator piers will be selected by the Engineer to accept pile load tests as specified in Section 31 09 16.23, PILE LOAD TESTS.

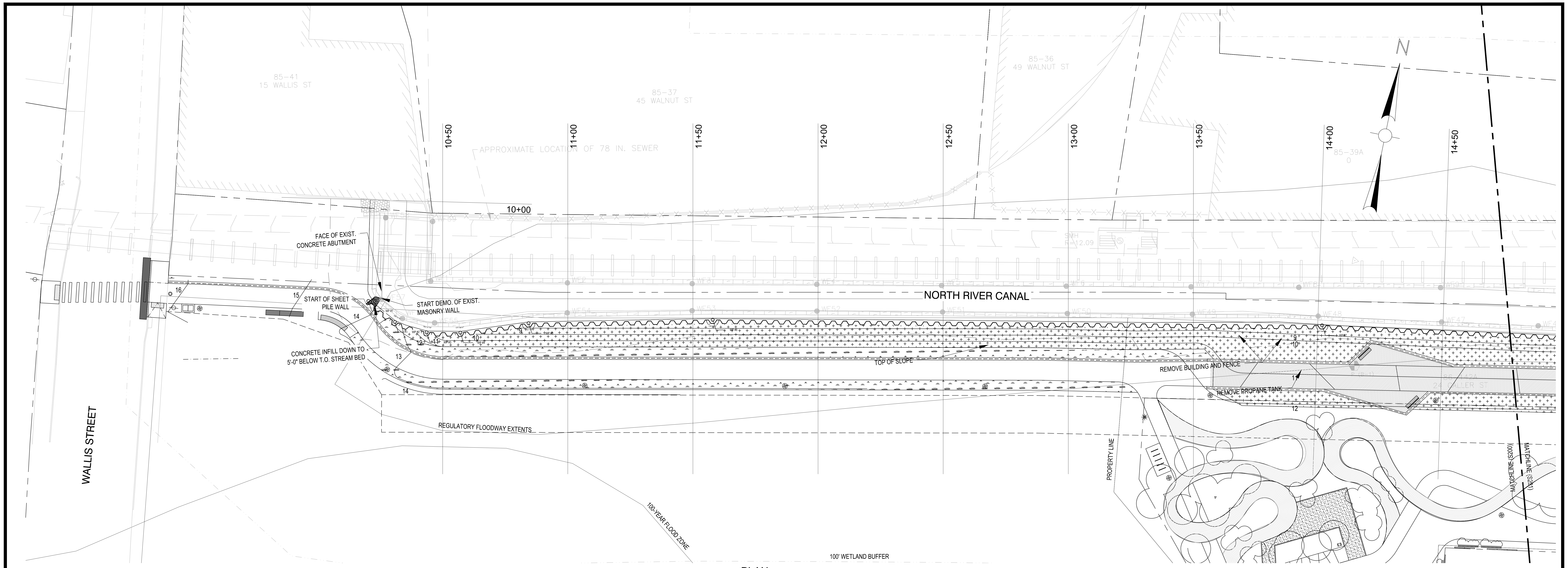
3. No additional piers shall be installed until completion of the load test and establishment of final installed criterion.

B. LOAD TEST:

Each test shall be carried out to a maximum load of twice design load (50 kips). The test shall be executed in accordance with Section 31 09 16.23, PILE LOAD TESTS.

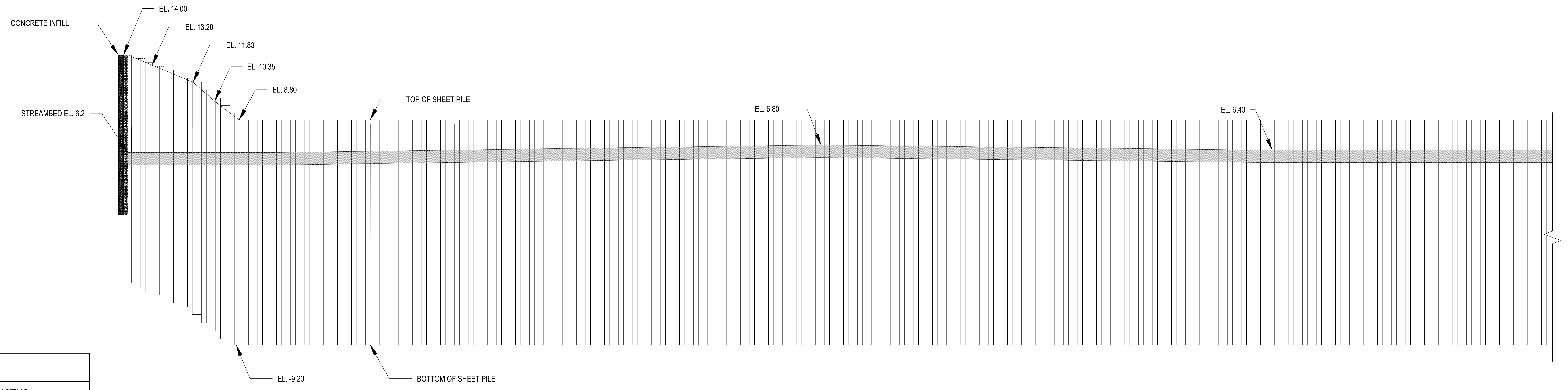
END OF SECTION

DOCUMENT2



PLAN

SCALE: 1" = 20'-0"



ELEVATION - SHEET PILE WALL

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = X'

WORKING POINT TABLE		
WP #	NORTHING	EASTING
1	3120217.9090	-160733.36930
2	3120209.38300	-160722.86670
3	3120205.11650	-160710.25810
4	3120204.84670	-160696.80040
5	3120208.31540	-160669.47910
6	3120208.85690	-160595.88510
7	3120204.00420	-160352.44290

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Project:

PEABODY RIVERWALK

RIVERWALK PARK DESIGN
PLANS

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PEABODY, MA. 01960

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617-412-4480

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No.	Date	Description

Seal:

Issued For:

75% DESIGN PLANS

Scale: 1" = 20'

Date: 03/11/2021

Drawn By: HLB

Reviewed By: SYC

Approved By: SRB

W&S Project No.: ENG20-0145

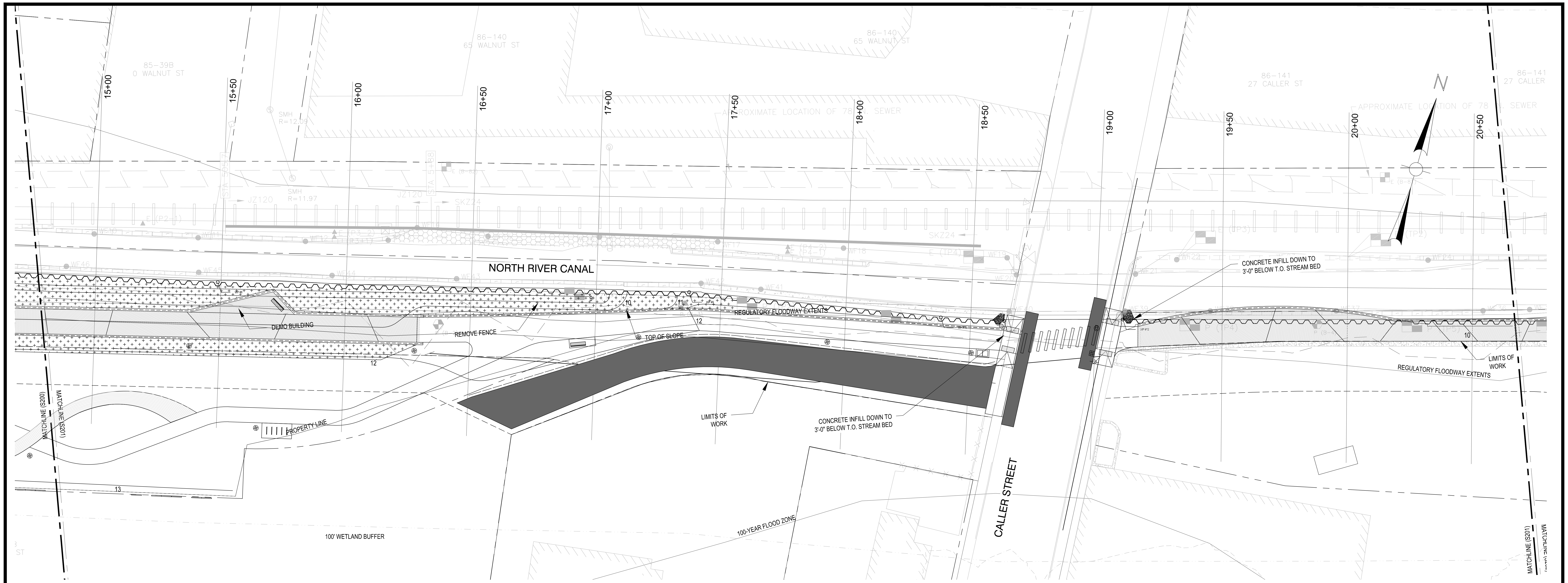
W&S File No.:

Drawing Title:

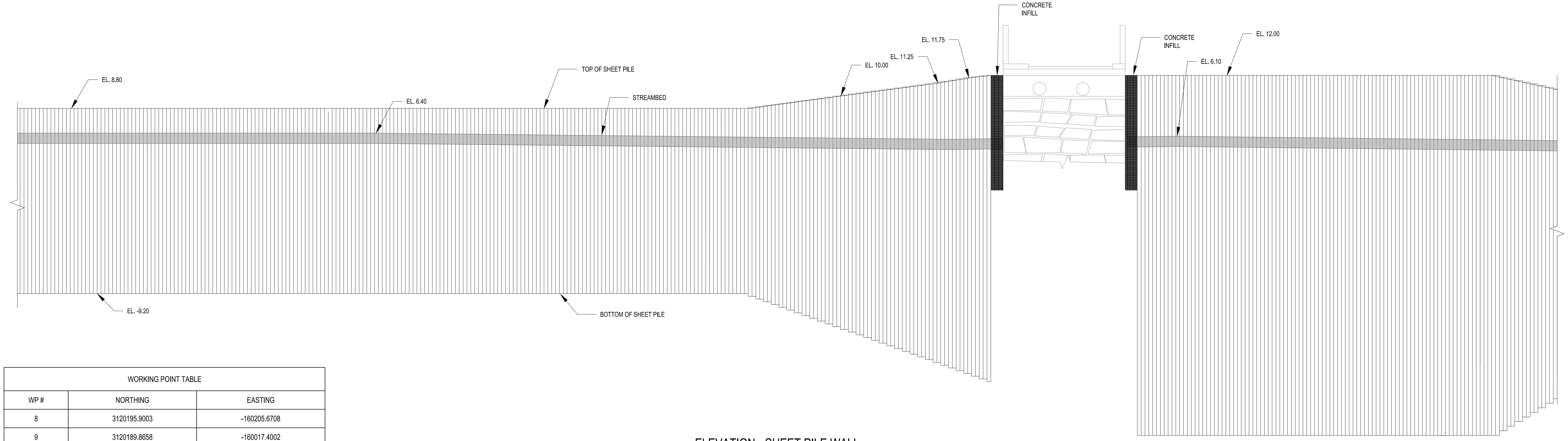
PROPOSED LAYOUT
PLAN I

Sheet Number:

S200



PLAN
SCALE: 1" = 20'-0"



WORKING POINT TABLE		
WP #	NORTHING	EASTING
8	3120195.9003	-160205.6708
9	3120189.8658	-160017.4002
10	3120178.6442	-159916.9494
11	3120177.0231	-159891.7712
12	3120177.0638	-159844.1990

ELEVATION - SHEET PILE WALL
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = X'

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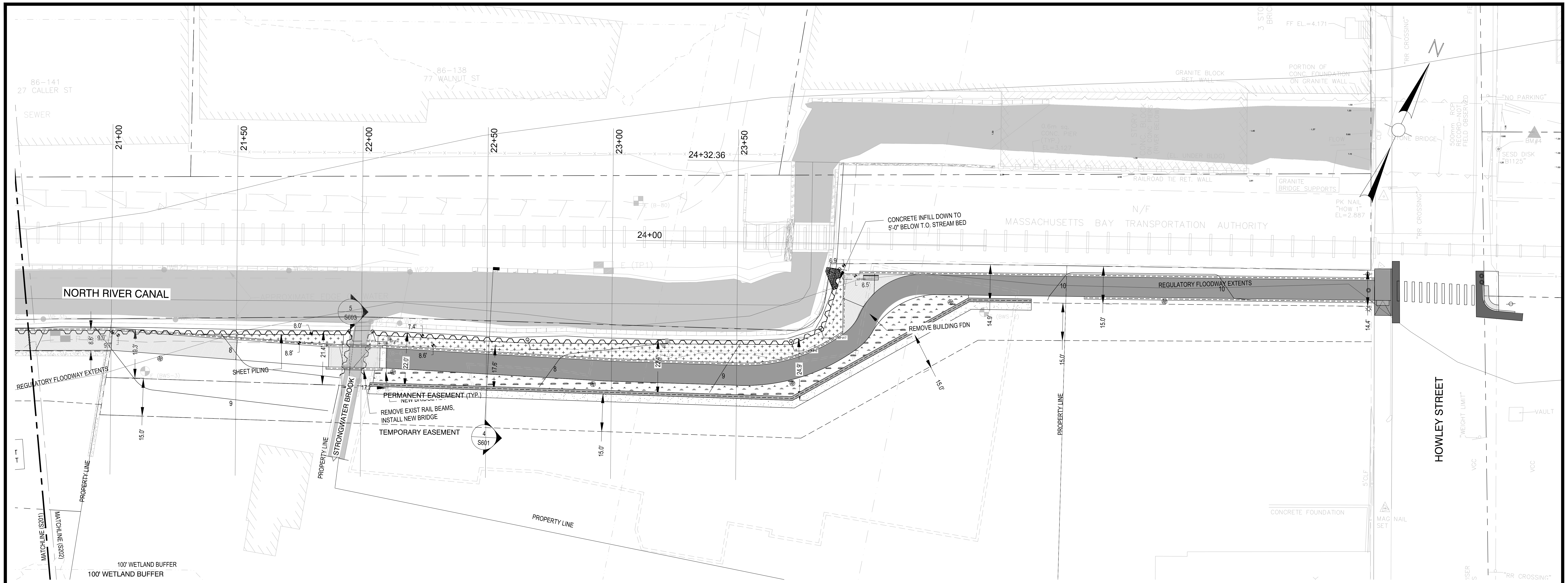
Reviewed By: SYC
Approved By: SRB
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

PROPOSED LAYOUT PLAN II

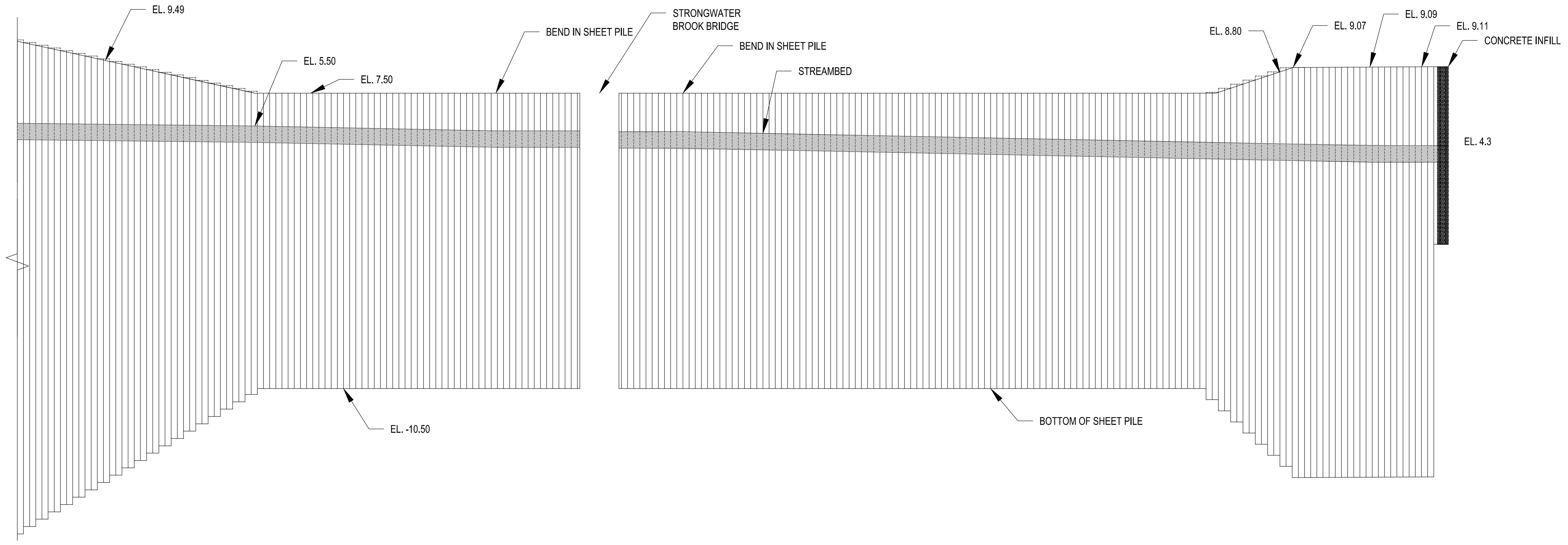
Sheet Number:

S201



PLAN

SCALE: 1" = 20'-0"



ELEVATION - SHEET PILE WALL

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = X'

WORKING POINT TABLE

WP #	NORTHING	EASTING
13	3120173.1015	-159559.3888
14	3120172.8502	-159550.1588
15	3120168.9470	-159488.2683
16	3120167.2228	-159382.9704
17	3120172.3121	-159371.1687
18	3120195.6586	-159363.2979

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Project:

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Approved By:	SRB
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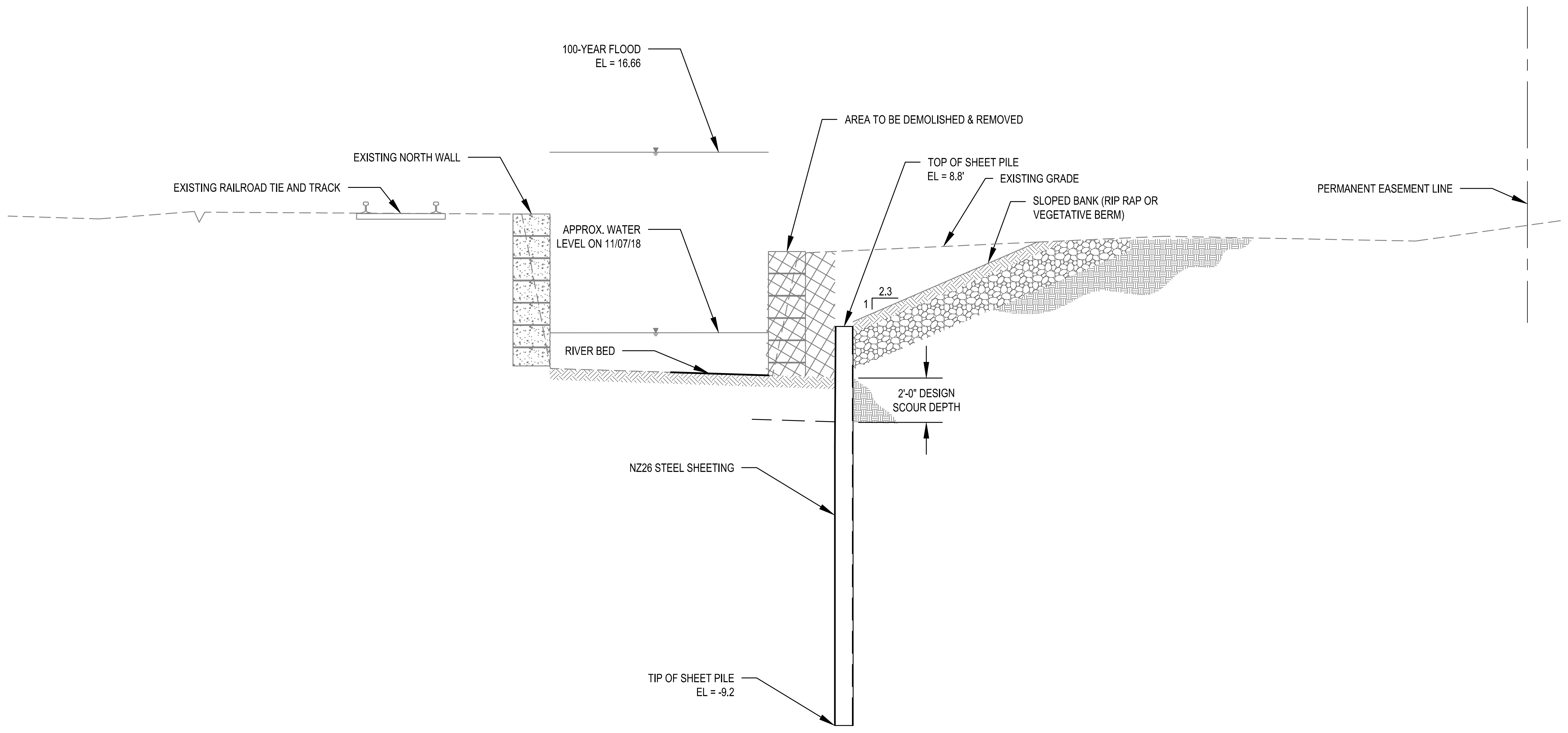
W&S File No.:	

Drawing Title:

PROPOSED LAYOUT PLAN III

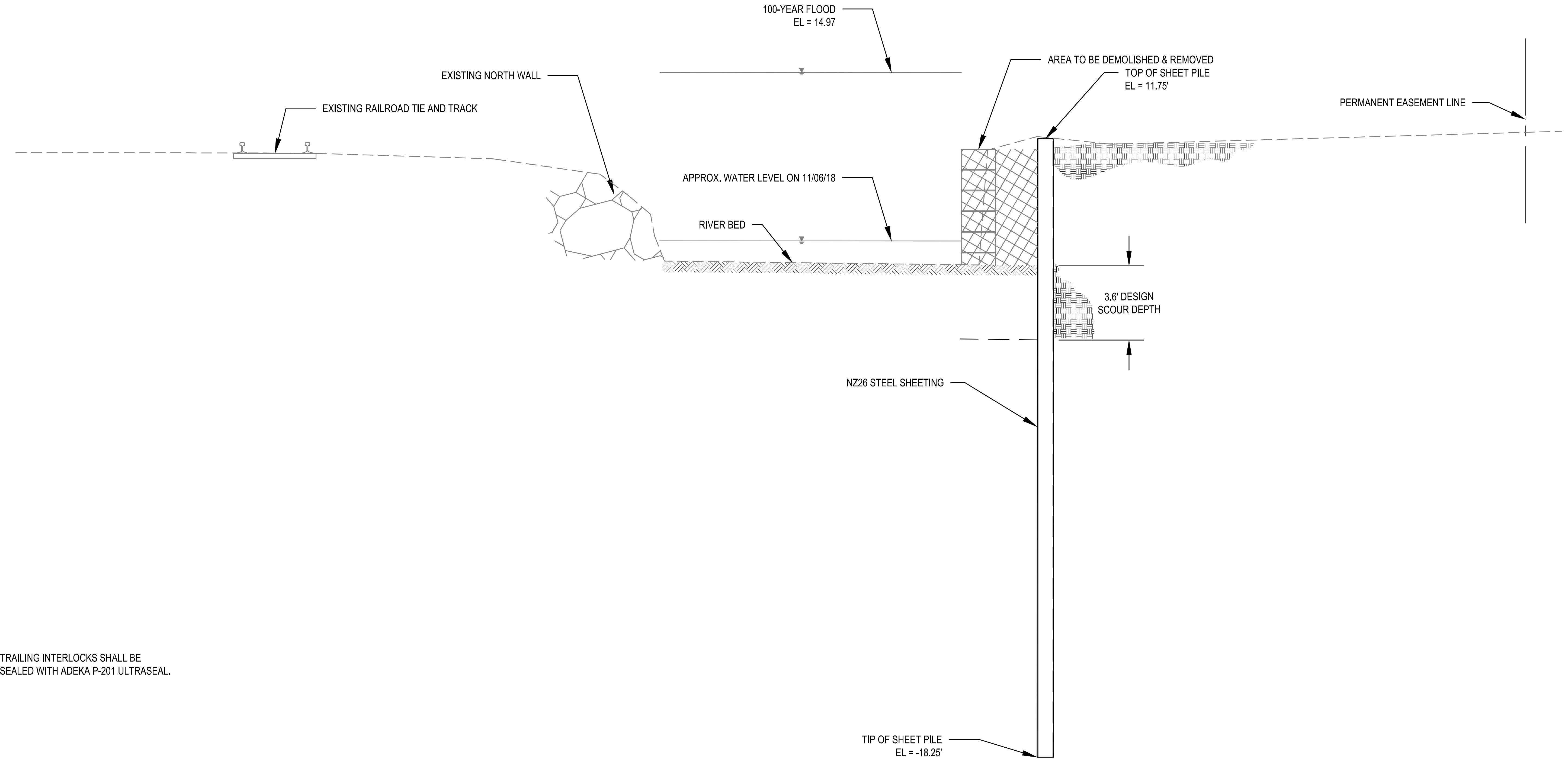
Sheet Number:

S202



1 SECTION @ STATION 11+50

SCALE: 1"=4'-0"

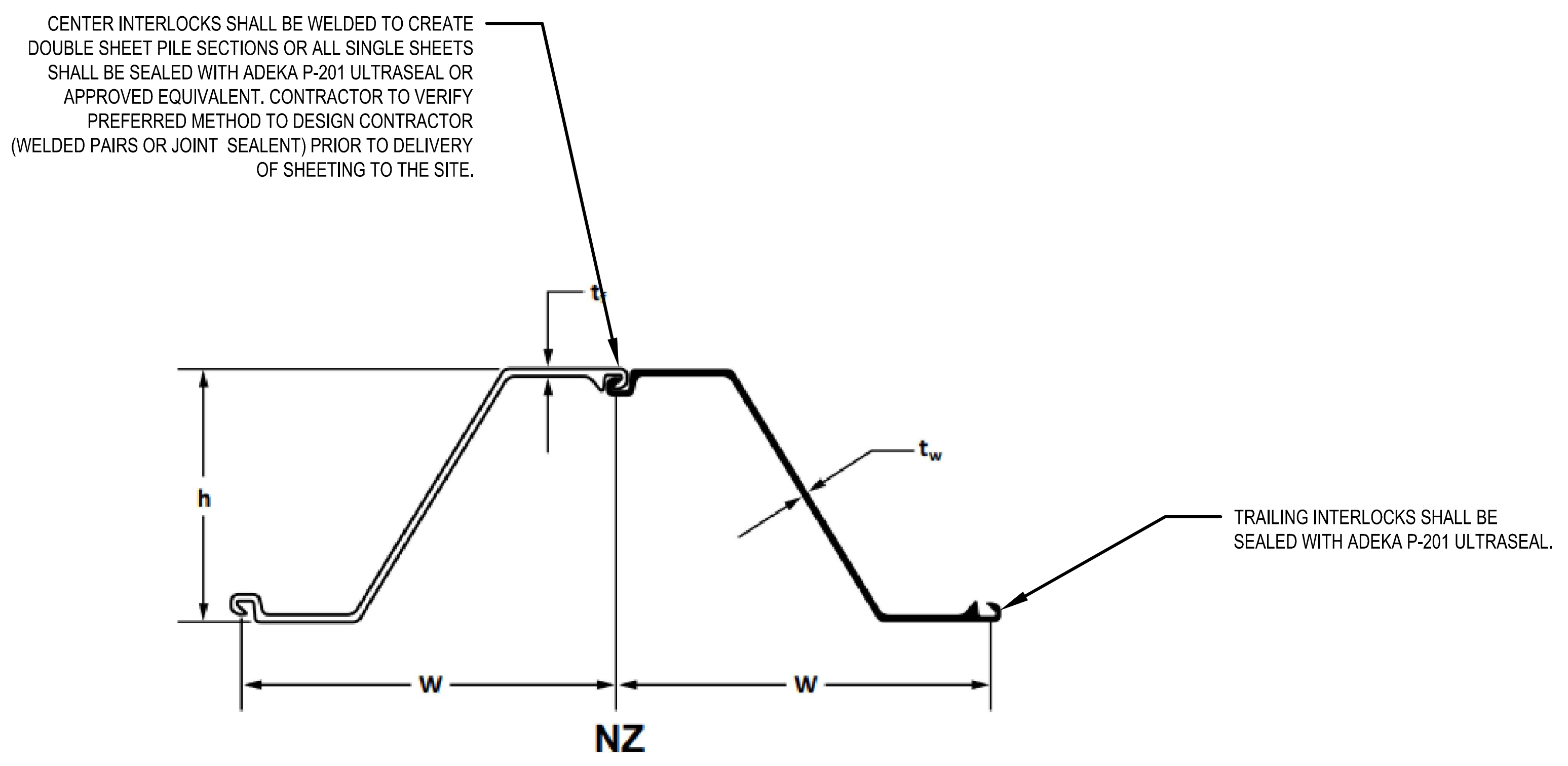


2 SECTION @ STATION 18+50

SCALE: 1"=4'-0"

NZ/PZ HOT ROLLED STEEL SHEET PILE

NTS



CENTER INTERLOCKS SHALL BE WELDED TO CREATE DOUBLE SHEET PILE SECTIONS OR ALL SINGLE SHEETS SHALL BE SEALED WITH ADEKA P-201 ULTRASEAL OR APPROVED EQUIVALENT. CONTRACTOR TO VERIFY PREFERRED METHOD TO DESIGN CONTRACTOR (WELDED PAIRS OR JOINT SEALENT) PRIOR TO DELIVERY OF SHEETING TO THE SITE.

TRAILING INTERLOCKS SHALL BE SEALED WITH ADEKA P-201 ULTRASEAL.

SECTION	WIDTH (W) (IN)	HEIGHT (H) (IN)	THICKNESS		CROSS SECTIONAL AREA (IN^2/FT)	WEIGHT		SECTION MODULUS		MOMENT OF INERTIA (IN^4/FT)	COATING AREA	
			FLANGE (T_F) (IN)	WEB (T_W) (IN)		PILE (LB/FT)	WALL (LB/FT^2)	ELASTIC (IN^3/FT)	PLASTIC (IN^3/FT)		BOTH SIDES (FT^2/FT) OF SINGLE	WALL SURFACE (FT^2/FT^2)
NZ26	27.56	17.32	0.50	0.50	9.08	71	30.99	48.50	57.01	419.90	6.49	1.41

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Date: 03/11/2021
Drawn By: HLB
Reviewed By: SYC
Approved By: SRB

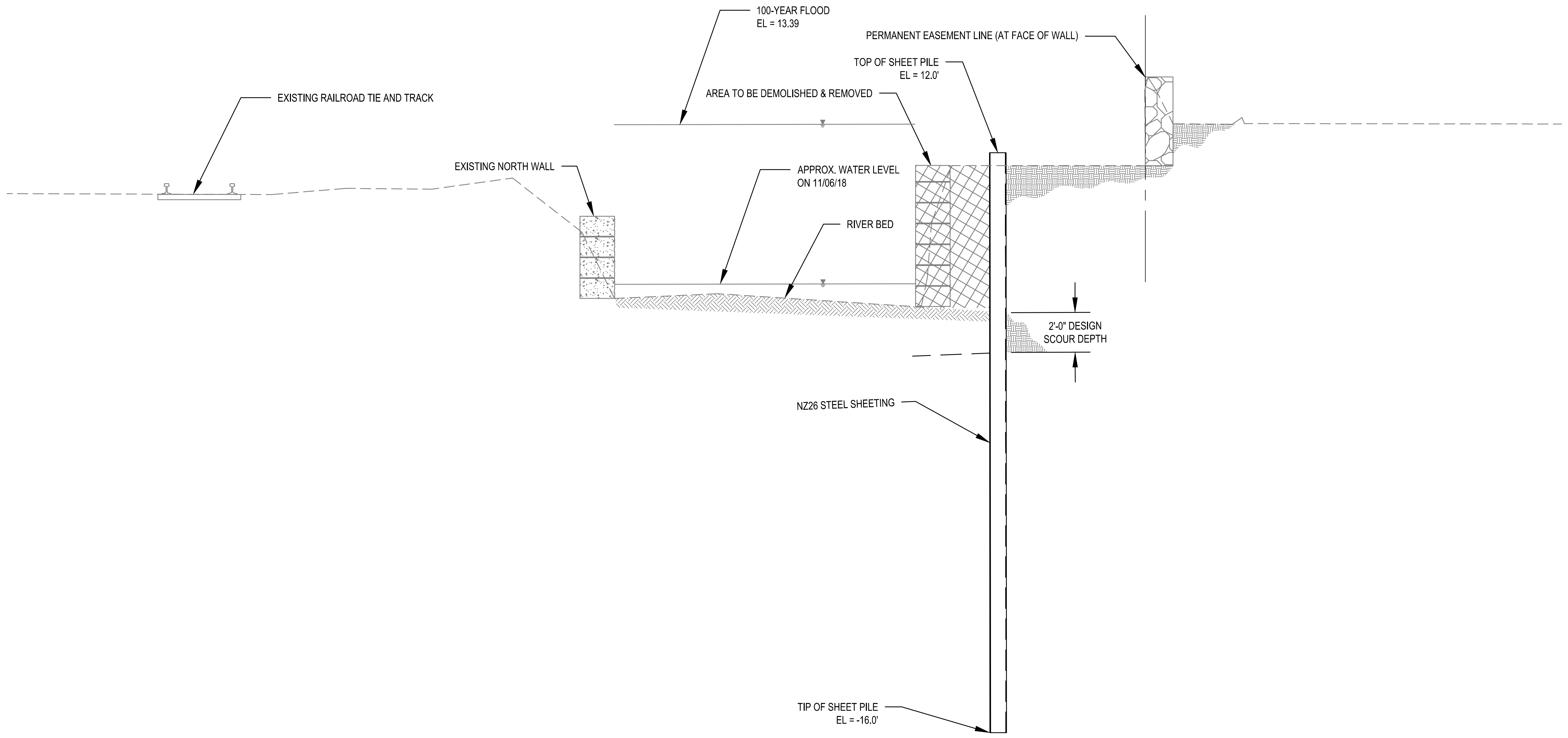
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

WALL SECTIONS AND DETAILS I

Sheet Number:

S600



③ SECTION @ STATION 19+50

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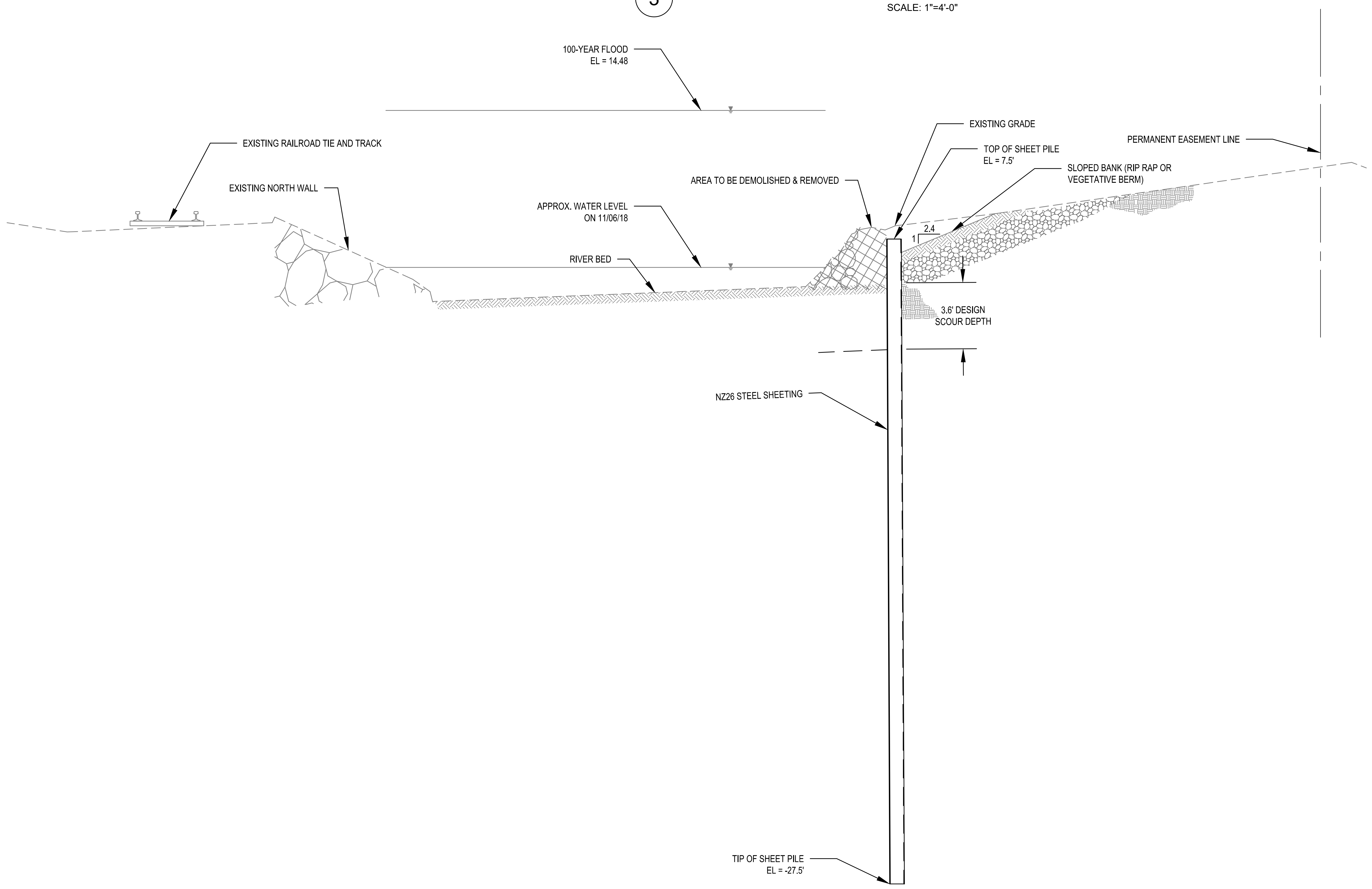

④ SECTION @ STATION 22+50

SCALE: 1"=4'-0"

Project:

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Approved By: SRB

W&S Project No.: ENG20-0145

W&S File No.:

Drawing Title:

WALL SECTIONS AND DETAILS II

Sheet Number:

S601

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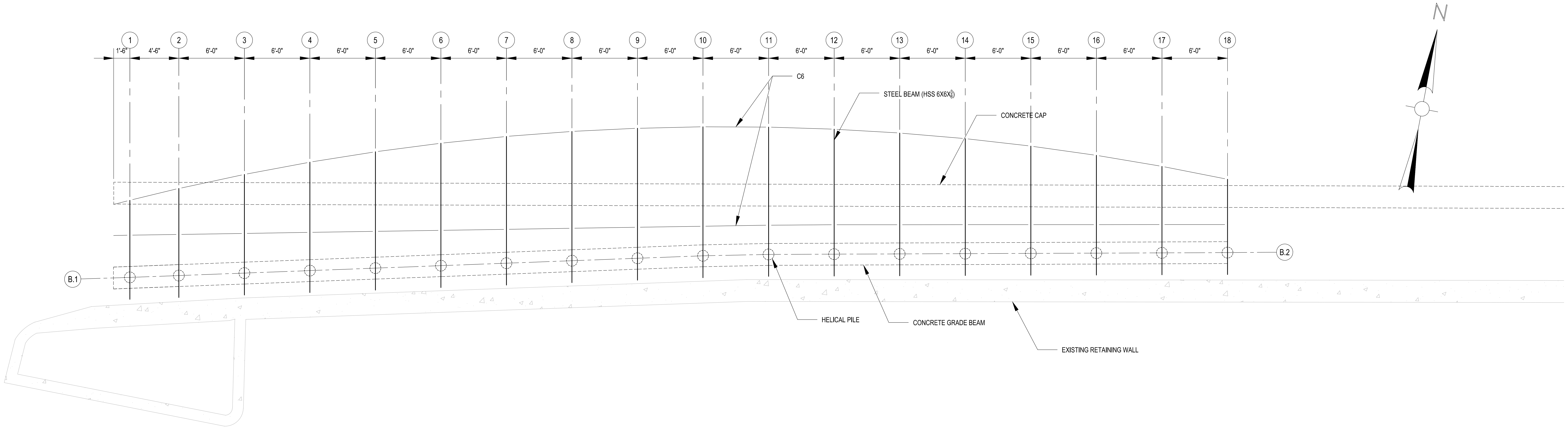
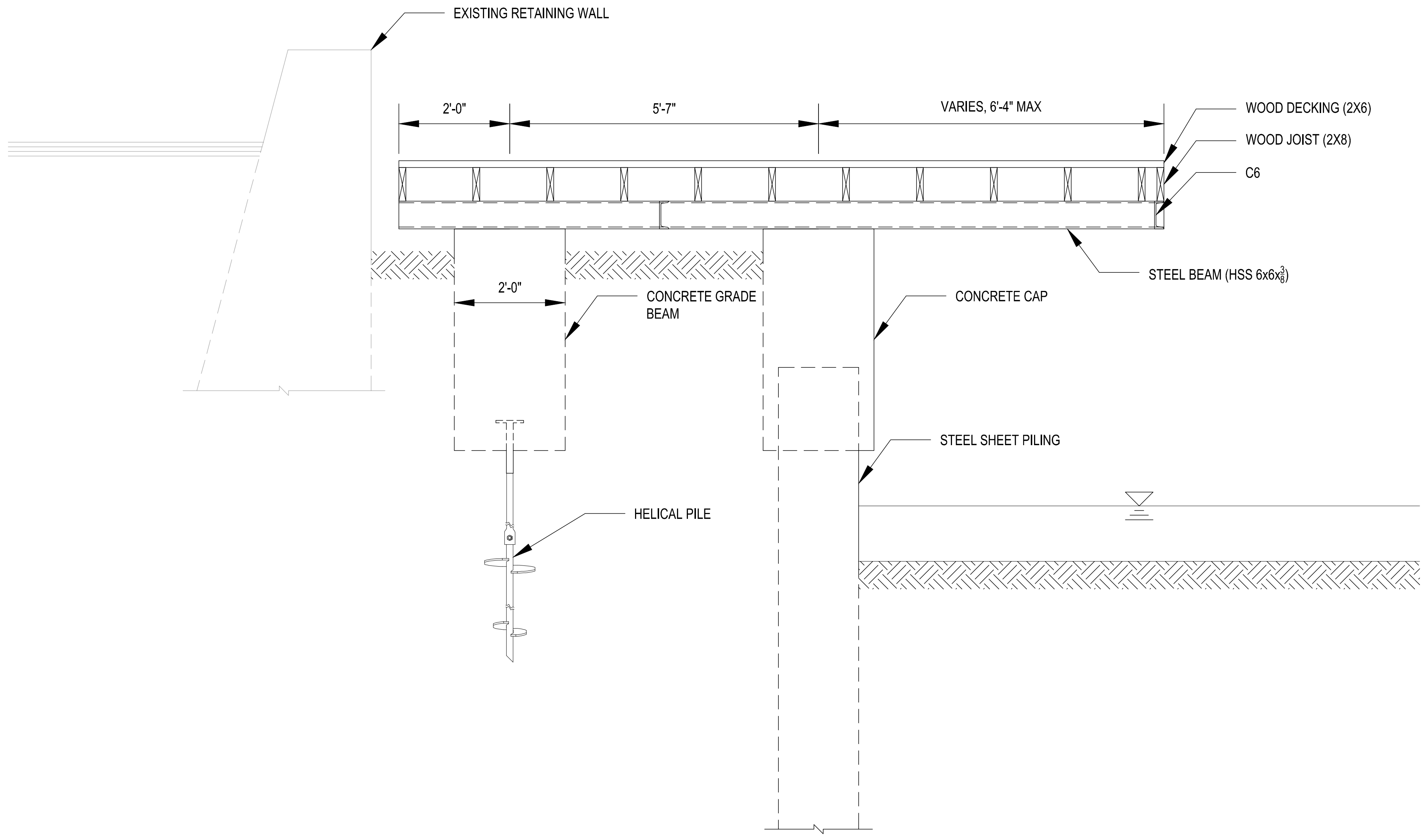


FRAMING PLAN
SCALE: 1" = 5'-0"



ELEVATION VIEW
SCALE: $\frac{1}{2}$" = 1'-0"

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Project:

PEABODY RIVERWALK

RIVERWALK PARK DESIGN PLANS

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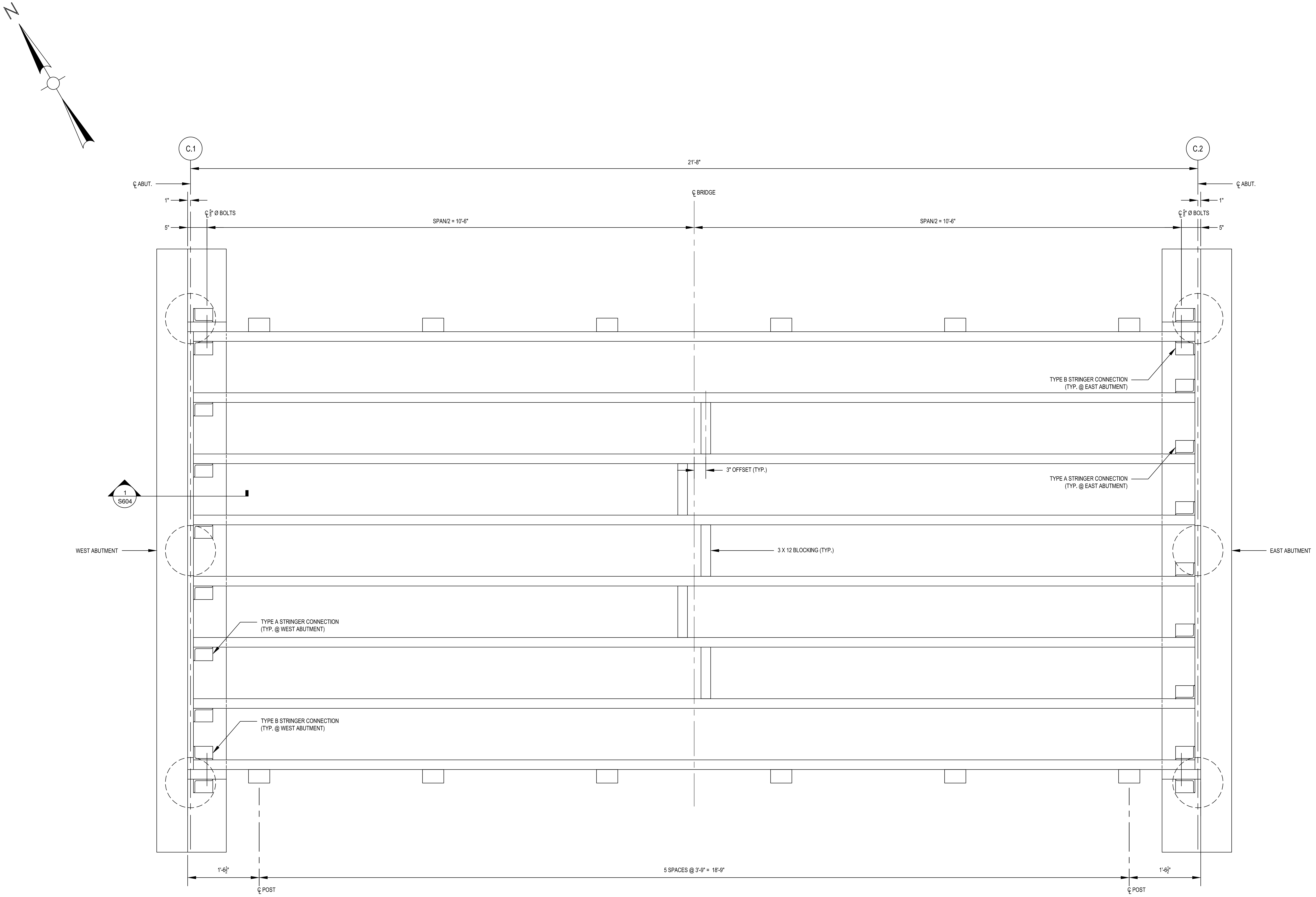
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

OVERLOOK FRAMING PLAN, SECTIONS, & DETAILS

Sheet Number:

S602



NOTE: RAILING POST ATTACHMENTS ARE
NOT SHOWN FOR CLARITY.

TIMBER BRIDGE FRAMING PLAN

SCALE: 1" = 1'-0"

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S603-S604.dwg

Project:

PEABODY RIVERWALK

RIVERWALK PARK DESIGN
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Date: 03/11/2021
Drawn By: HLB
Reviewed By: SYC
Approved By: SRB

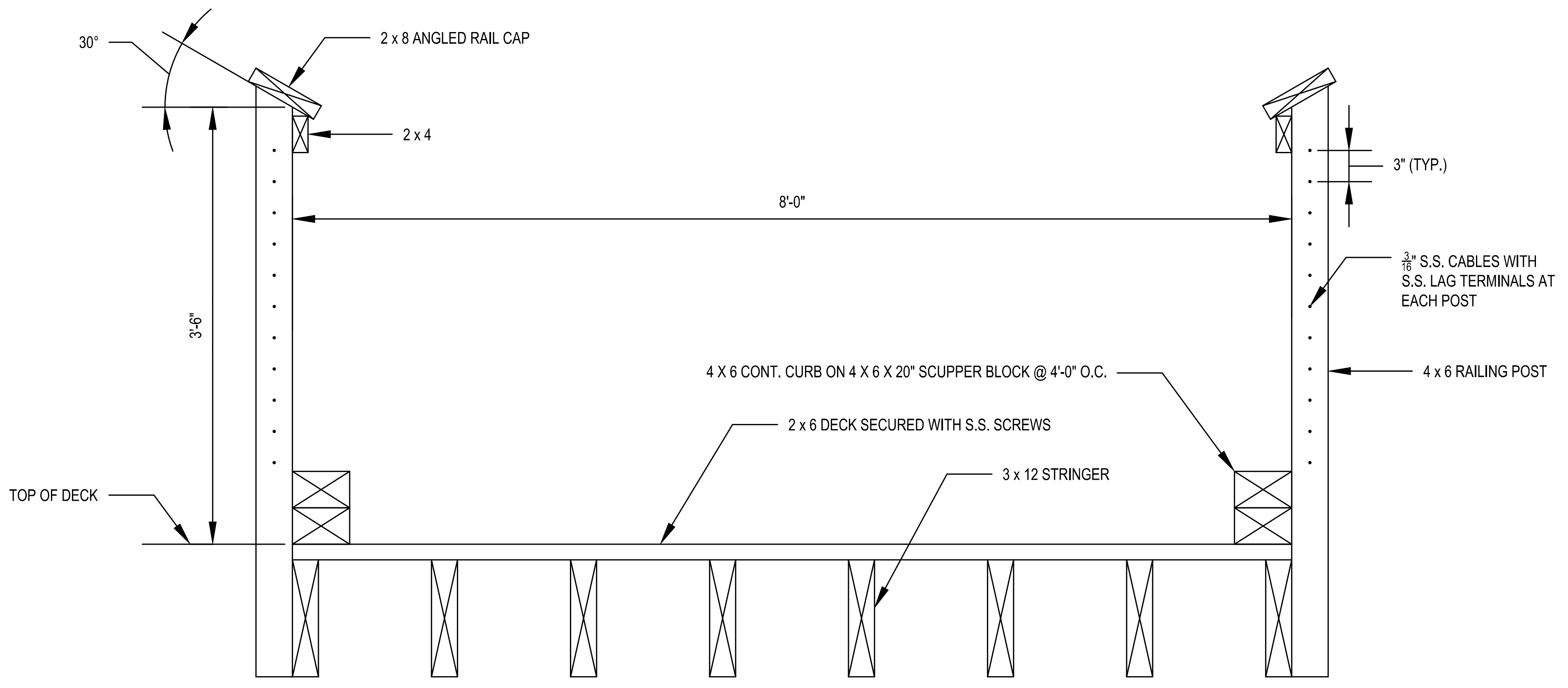
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

TIMBER BRIDGE PLAN
& TYP. SECTION

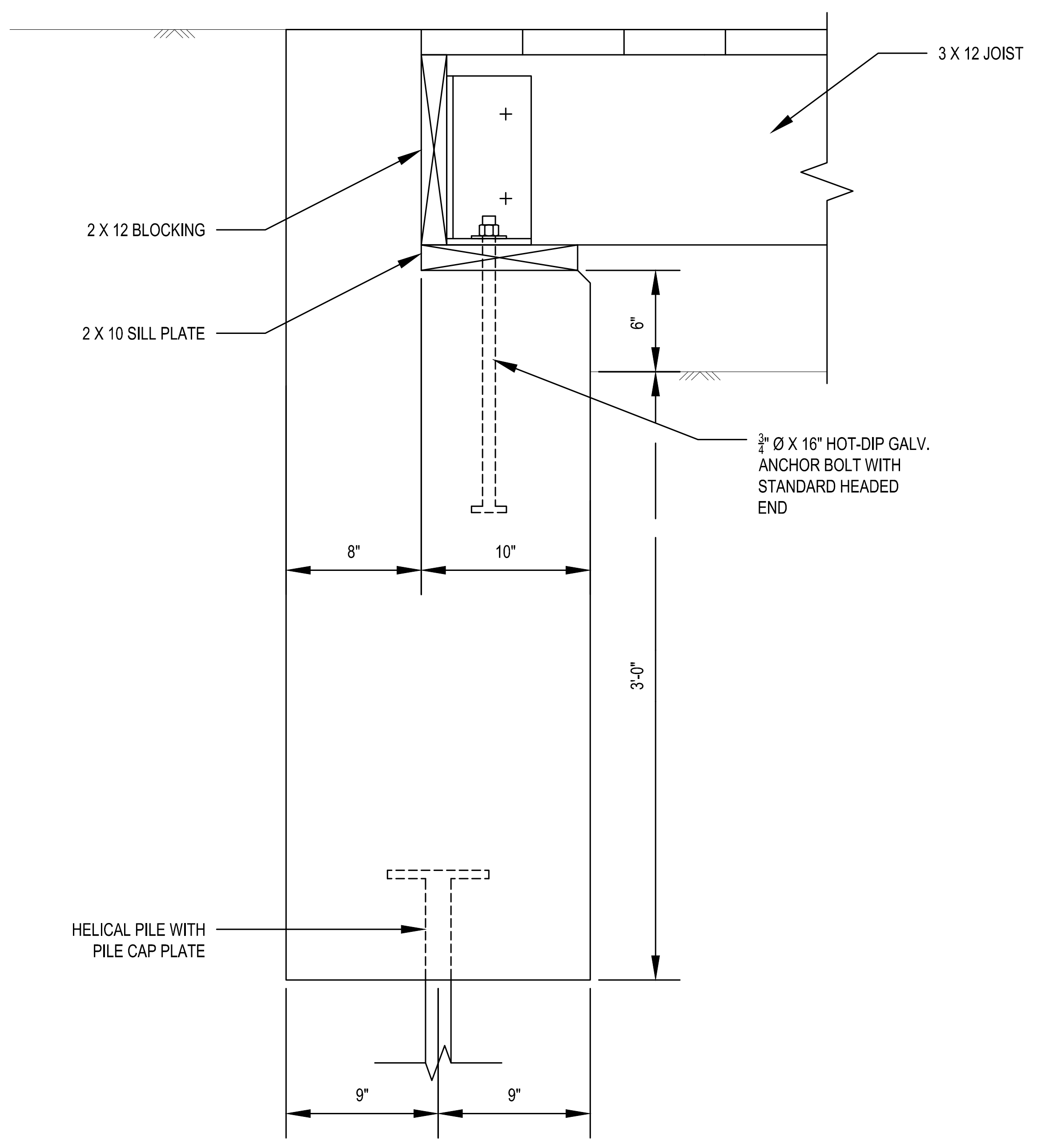
Sheet Number:

S603



TYP. TIMBER BRIDGE SECTION

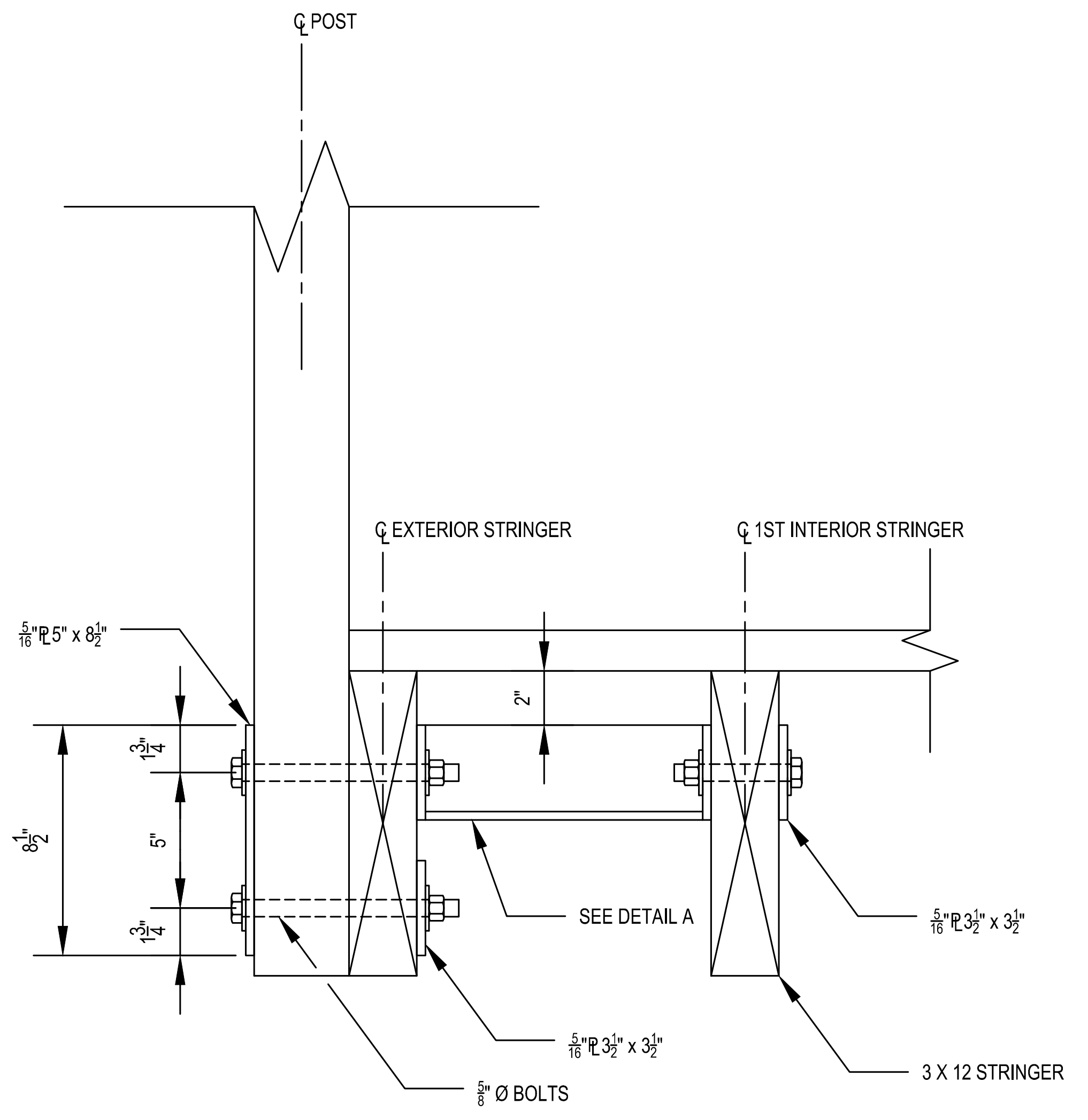
SCALE: 1" = 1'-0"

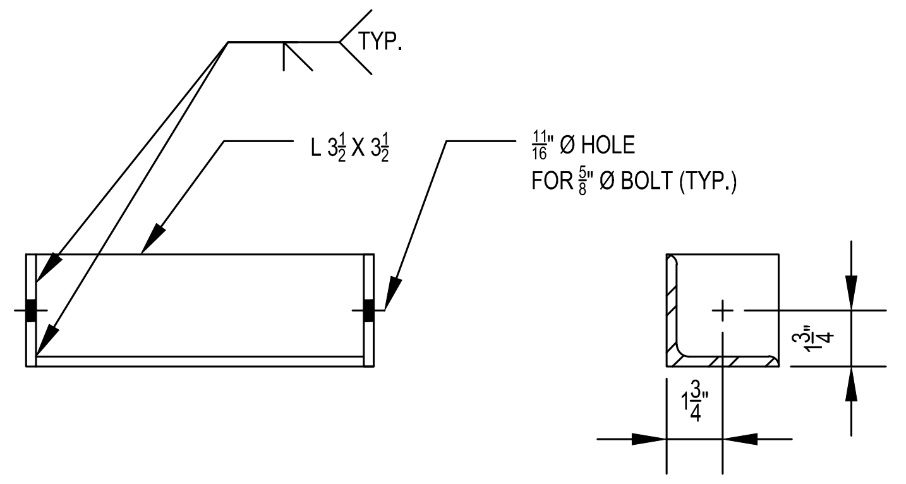


TYP. ABUTMENT SECTION

1
S603

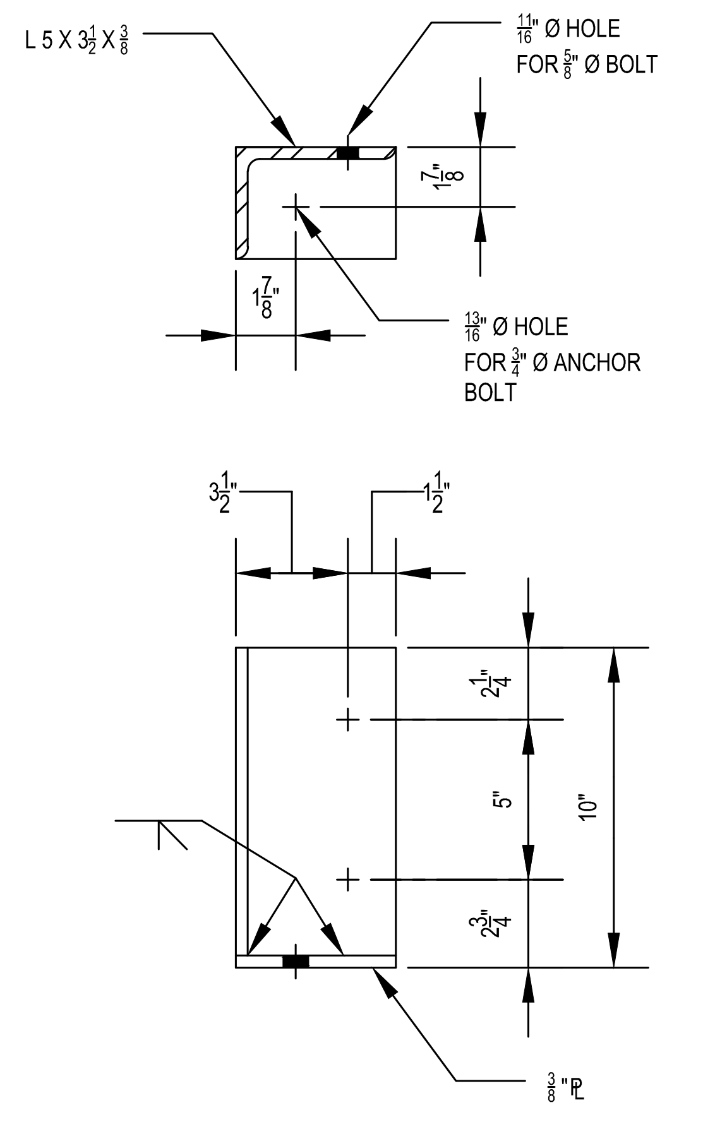
SCALE: $1\frac{1}{2}$" = 1'-0"





DETAIL A

SCALE: 2" = 1'-0"



TYPE A (AS SHOWN)
TOTAL REQ'D = 16

TYPE B (SIMILAR)
TOTAL REQ'D = 4

TYP. STRINGER CONNECTION DETAILS

SCALE: 2" = 1'-0"

Project:
PEABODY RIVERWALK

RIVERWALK PARK DESIGN PLANS

CALLER STREET - HOWLEY STREET
PEABODY, MA. 01960

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W&S File No.:

Drawing Title:

TIMBER BRIDGE DETAILS

Sheet Number:

S604

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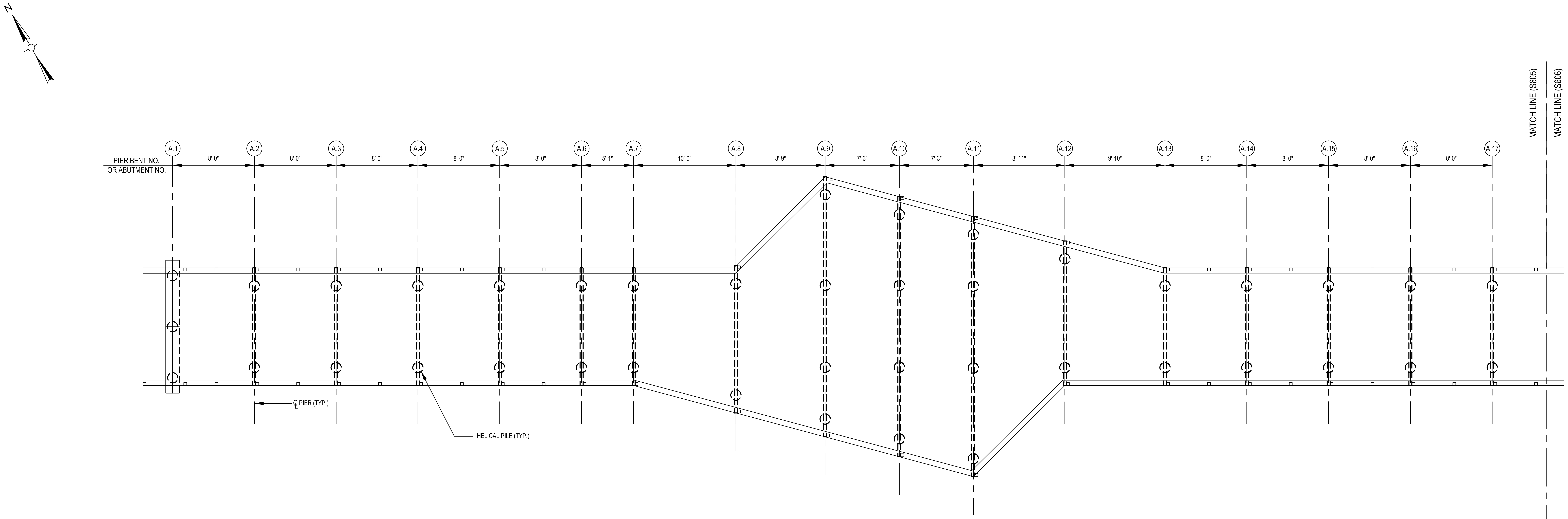
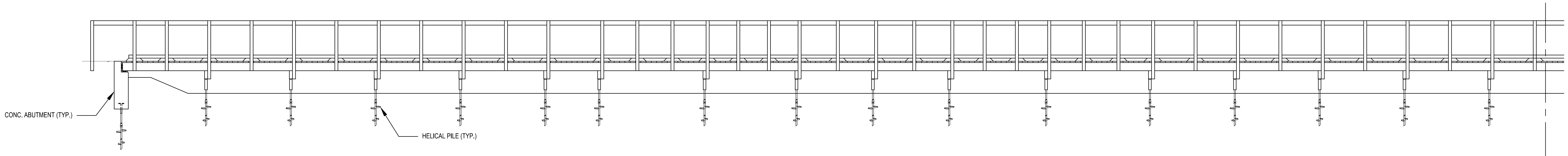


BOARDWALK PLAN

SCALE: 1" = 5'-0"



BOARDWALK ELEVATION

SCALE: 1" = 5'-0"

MATCH LINE (S605)
MATCH LINE (S606)

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S605-S608.dwg

Project:

PEABODY RIVERWALK

RIVERWALK PARK DESIGN PLANS

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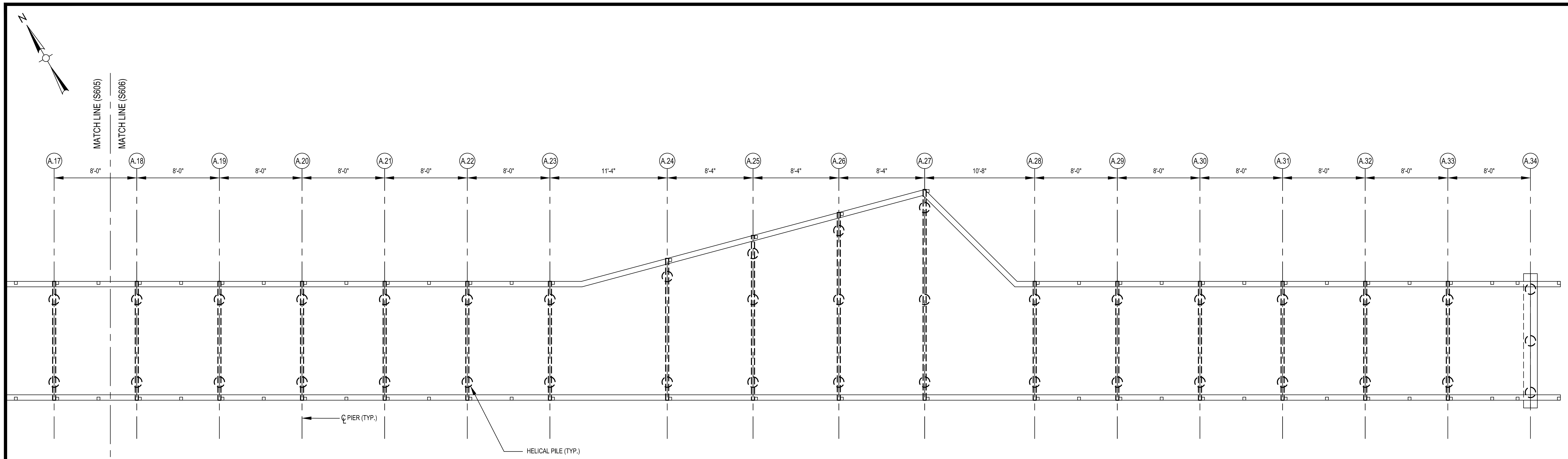
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

BOARDWALK PLAN & ELEVATION

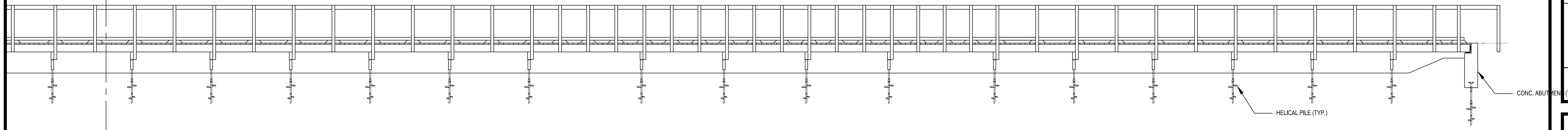
Sheet Number:

S605



BOARDWALK PLAN

SCALE: 1" = 5'-0"



BOARDWALK ELEVATION

SCALE: 1" = 5'-0"

MATCH LINE (S605)
MATCH LINE (S606)

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S605-S608.dwg

Project:

PEABODY RIVERWALK

RIVERWALK PARK DESIGN
PLANS

CALLER STREET - HOWLEY STREET
PEABODY, MA. 01960

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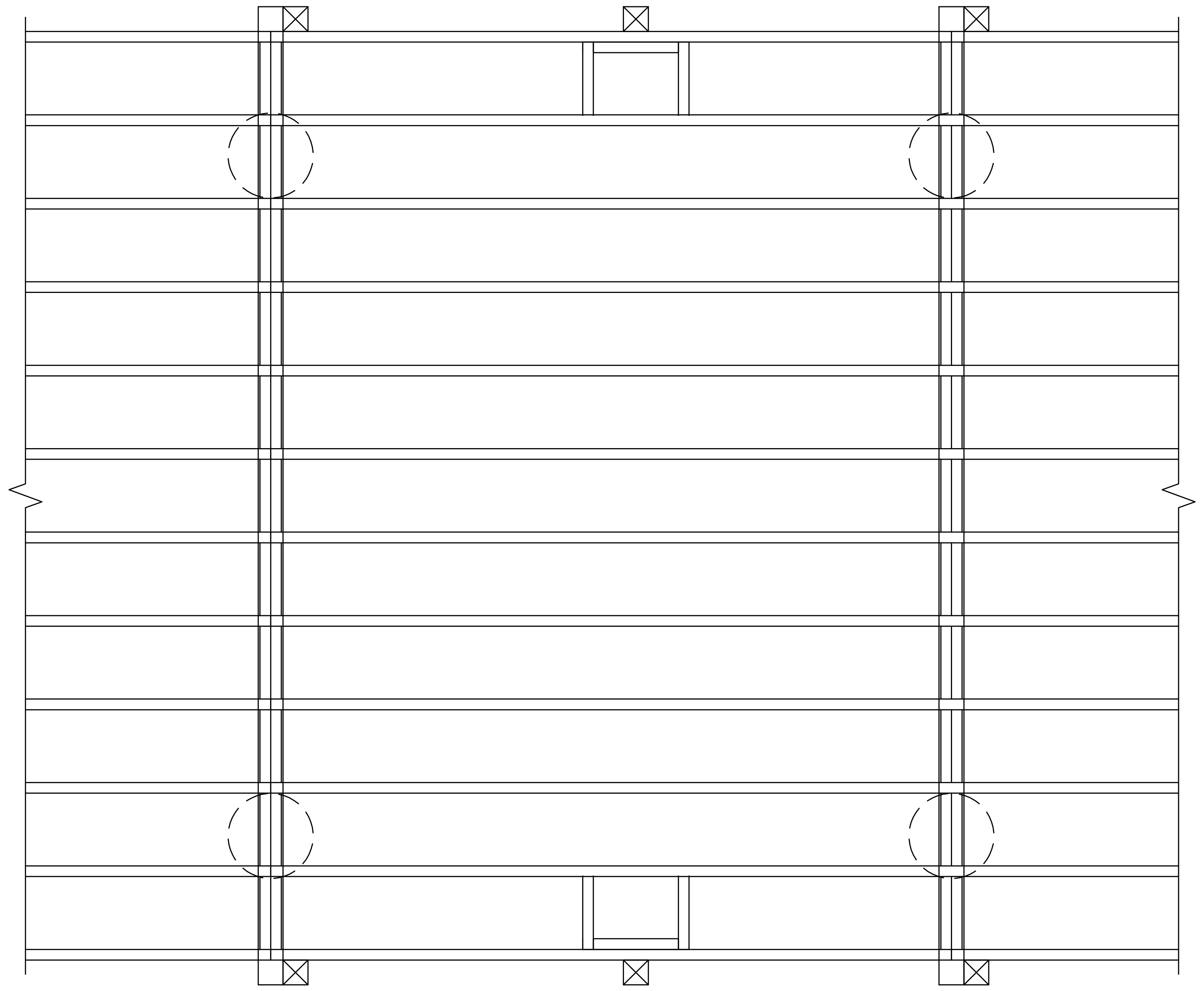
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

BOARDWALK PLAN &
ELEVATION

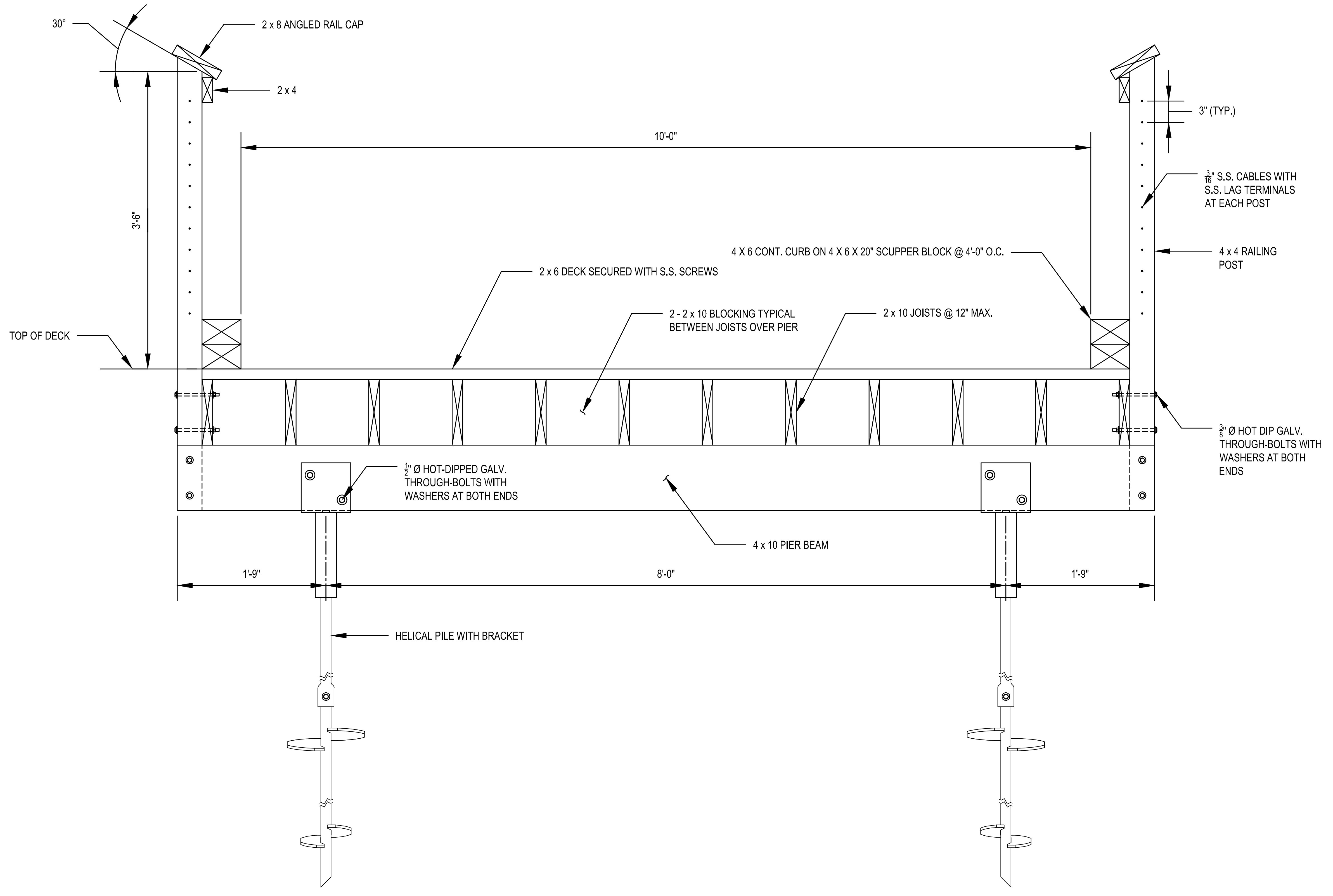
Sheet Number:

S606



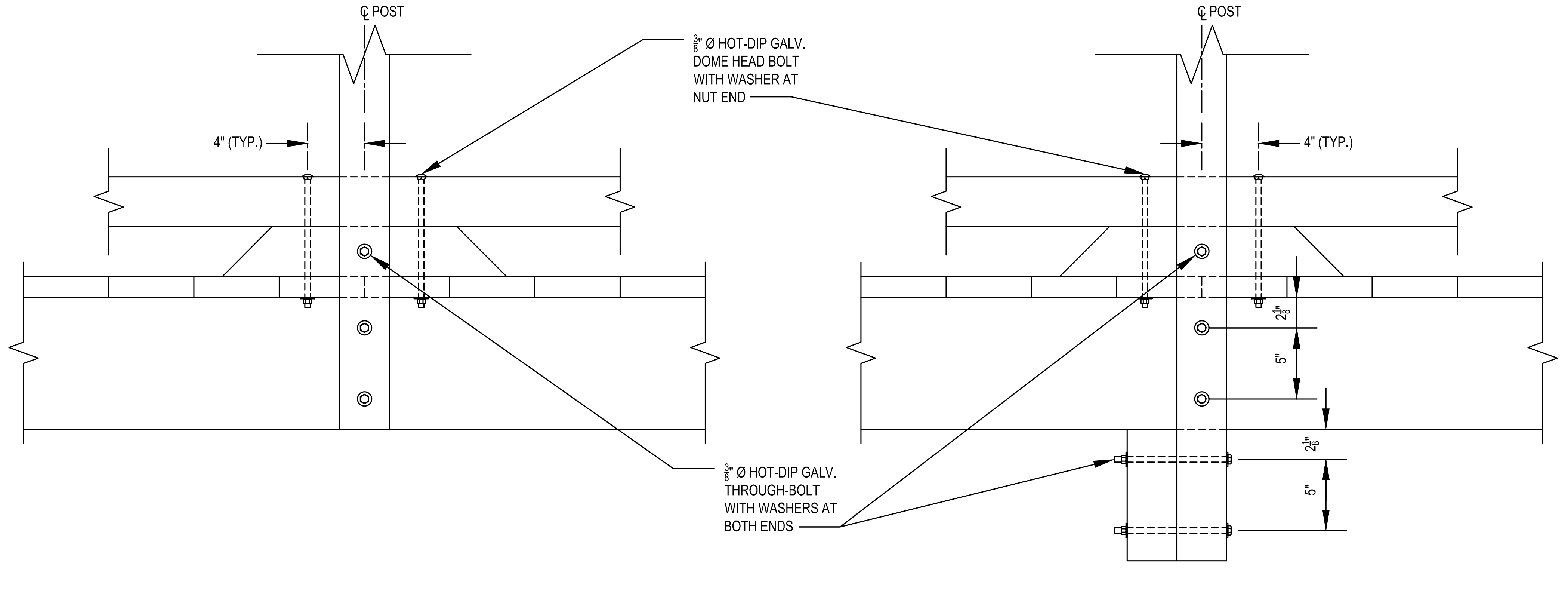
TYP. BOARDWALK FRAMING PLAN

SCALE: $\frac{3}{4}$" = 1'-0"



TYP. BOARDWALK SECTION

SCALE: 1" = 1'-0"



AT INTERMEDIATE RAILING POST

AT PIER BENT

TYP. RAILING POST & CURB ATTACHMENT

SCALE: $1\frac{1}{2}$" = 1'-0"

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S605-S608.dwg

Project:

PEABODY RIVERWALK

RIVERWALK PARK DESIGN PLANS

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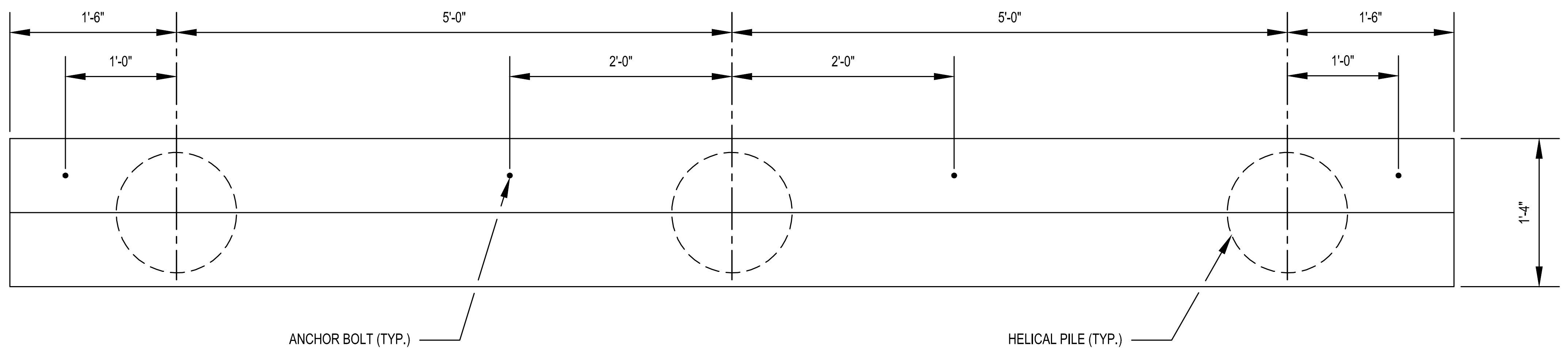
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

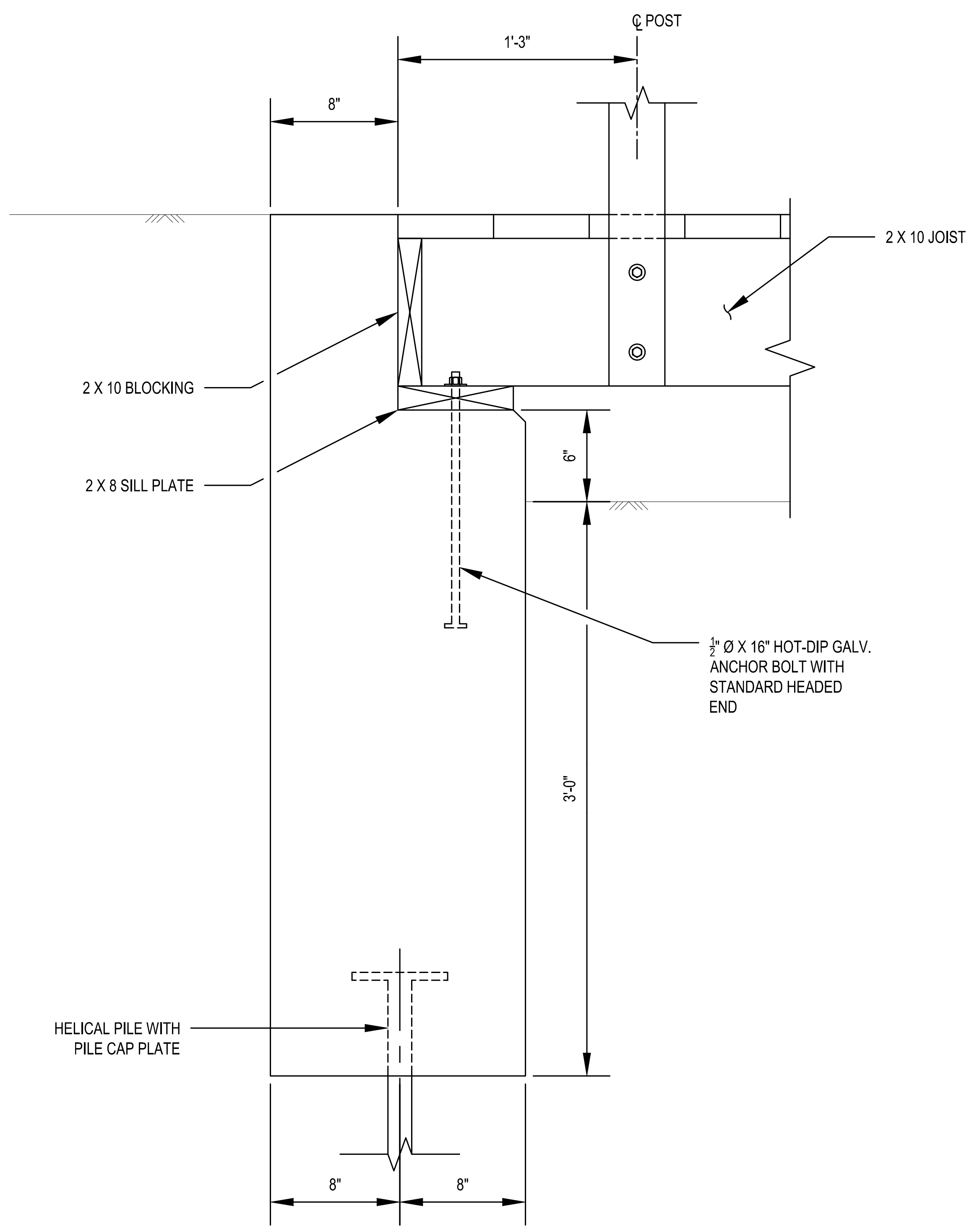
BOARDWALK TYP. SECTIONS

Sheet Number:

S607



TYP. ABUTMENT PLAN
SCALE: 1" = 1'-0"



TYP. ABUTMENT SECTION
SCALE: 1 1/2"=1'-0"

Project:
PEABODY RIVERWALK

RIVERWALK PARK DESIGN PLANS

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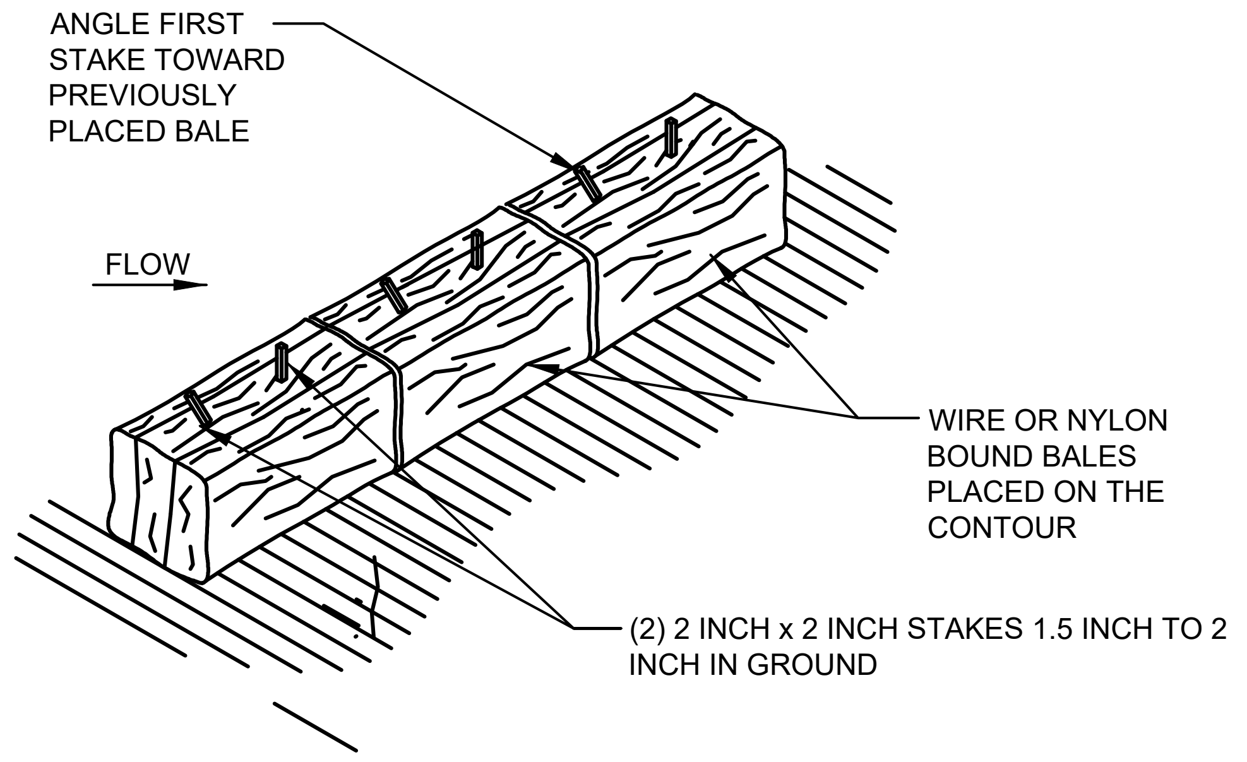
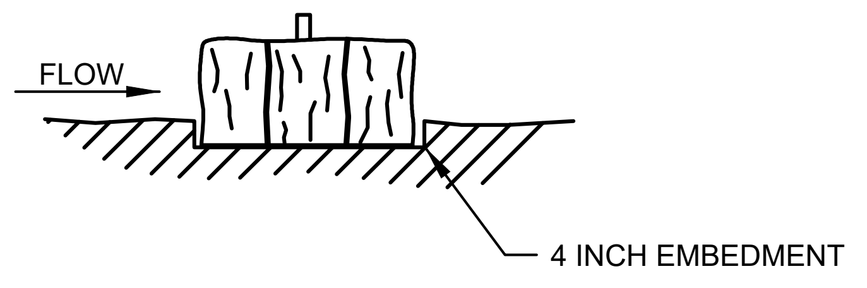
W&S File No.:

Drawing Title:
BOARDWALK ABUTMENT TYP. SECTIONS

Sheet Number:
S608



ANCHORING DETAIL

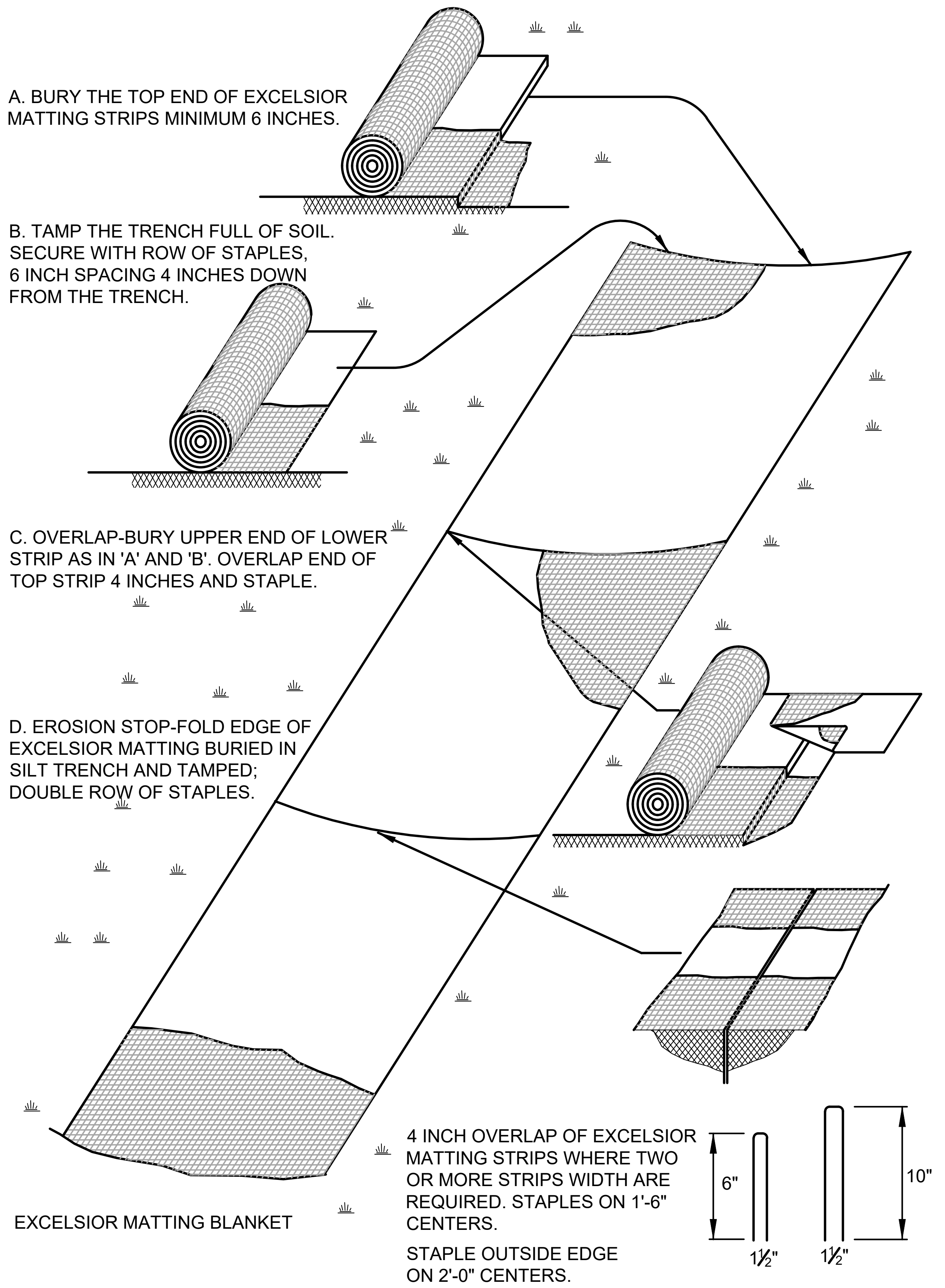


EMBEDDING DETAIL

③ STAKED HALE BALES- EROSION CONTROL

SCALE: N.T.S.

1. EROSION CONTROL MEASURES SHALL BE INCORPORATED IN THE SEQUENCE OF CONSTRUCTION TO PREVENT SEDIMENT LADEN WATER FROM LEAVING THE SITE.
2. AREAS SUBJECT TO EROSION SHALL BE MINIMIZED IN TERMS OF TIME AND AREA.
3. IN GENERAL, WORK REQUIRING EROSION CONTROL INCLUDES EXCAVATIONS, FILLS, DRAINAGE, SWALES AND DITCHES, ROUGH AND FINISH GRADING, AND STOCKPILING OF EARTH.
4. DO NOT DISTURB VEGETATION AND TOPSOIL BEYOND THE PROPOSED LIMIT OF SILT FENCE ACTIVITIES.
5. TEMPORARY SILT CONTROLS SHALL BE PLACED AS SHOWN ON THE PLAN. PERMANENTLY STABILIZE EACH COMPLETED SEGMENT OF CONSTRUCTION.
6. THE CONTRACTOR SHALL REMOVE TEMPORARY SILT CONTROLS AND ALL ACCUMULATED SILT AND DEBRIS AFTER COMPLETION OF CONSTRUCTION OPERATIONS.
7. SILT CONTROLS SHALL BE IN PLACE AT ALL TIMES DURING CONSTRUCTION.
8. THE CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL SILT AND DEBRIS FROM EACH DRAINAGE STRUCTURE UPON COMPLETION OF THE PROJECT.
9. OBJECTS AND/OR AREAS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
10. ALL DISTURBED AREAS SHALL BE RESTORED TO EXISTING GRADE. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE AS NEEDED.
11. SILT CONTROLS SHALL BE REMOVED UPON THE SATISFACTORY COMPLETION OF ALL WORK SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
12. SITE PERIMETER SHALL HAVE STRAW WATTLES INSTALLED AT THE LIMIT OF WORK.


A. BURY THE TOP END OF EXCELSIOR MATTING STRIPS MINIMUM 6 INCHES.

B. TAMP THE TRENCH FULL OF SOIL. SECURE WITH ROW OF STAPLES, 6 INCH SPACING 4 INCHES DOWN FROM THE TRENCH.

C. OVERLAP-BURY UPPER END OF LOWER STRIP AS IN 'A' AND 'B'. OVERLAP END OF TOP STRIP 4 INCHES AND STAPLE.

D. EROSION STOP-FOLD EDGE OF EXCELSIOR MATTING BURIED IN SILT TRENCH AND TAMPED; DOUBLE ROW OF STAPLES.

4 INCH OVERLAP OF EXCELSIOR MATTING STRIPS WHERE TWO OR MORE STRIPS WIDTH ARE REQUIRED. STAPLES ON 1'-6" CENTERS.

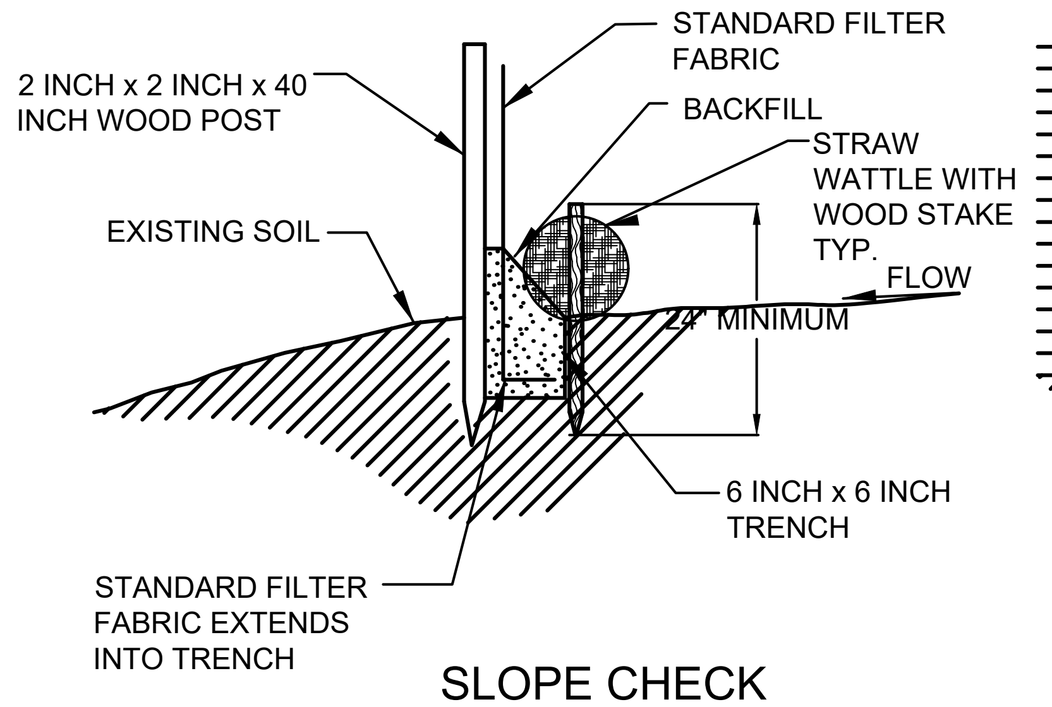
STAPLE OUTSIDE EDGE ON 2'-0" CENTERS.

TYPICAL STAPLES
#8 GAUGE WIRE

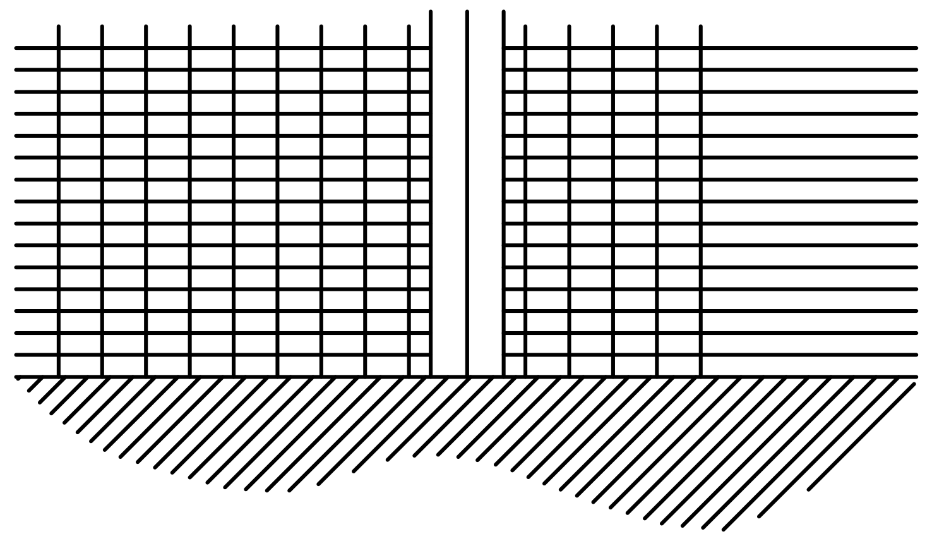
NOTE:
JUTE NETTING TO BE USED ON ALL SLOPES GREATER THAN 4H:1V AS INDICATED ON GRADING PLANS

④ EROSION CONTROL BLANKET

SCALE: N.T.S.



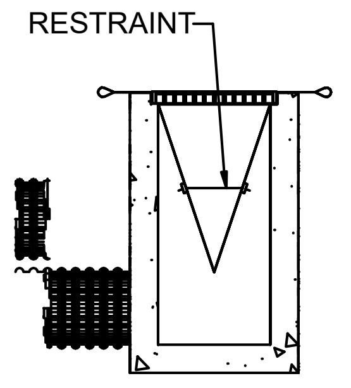
SLOPE CHECK


WHEN JOINING TWO OR MORE SILTATION FENCES TIE THE TWO END POSTS TOGETHER WITH NYLON CORD.

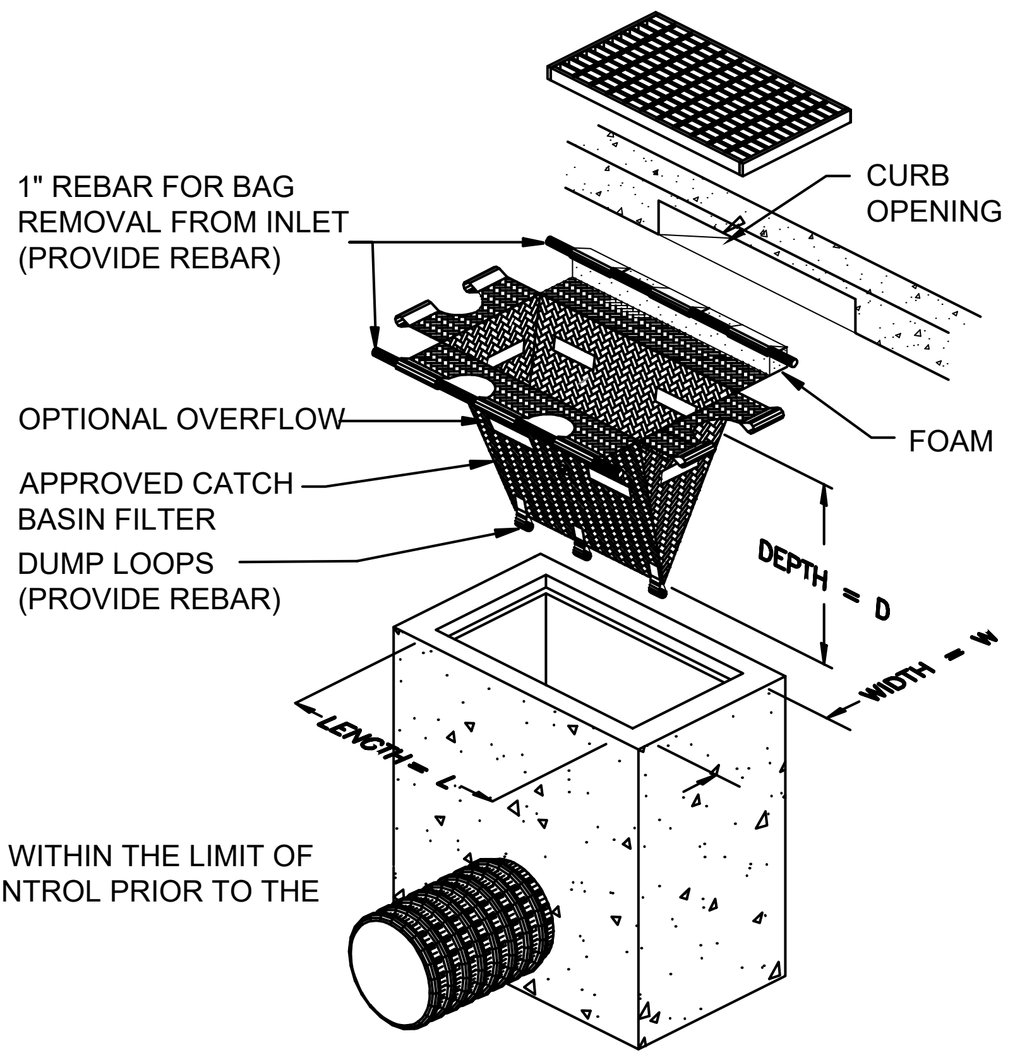
DITCH CHECK

④ SILT FENCE- EROSION CONTROL

SCALE: N.T.S.



SIDE VIEW INSTALLED



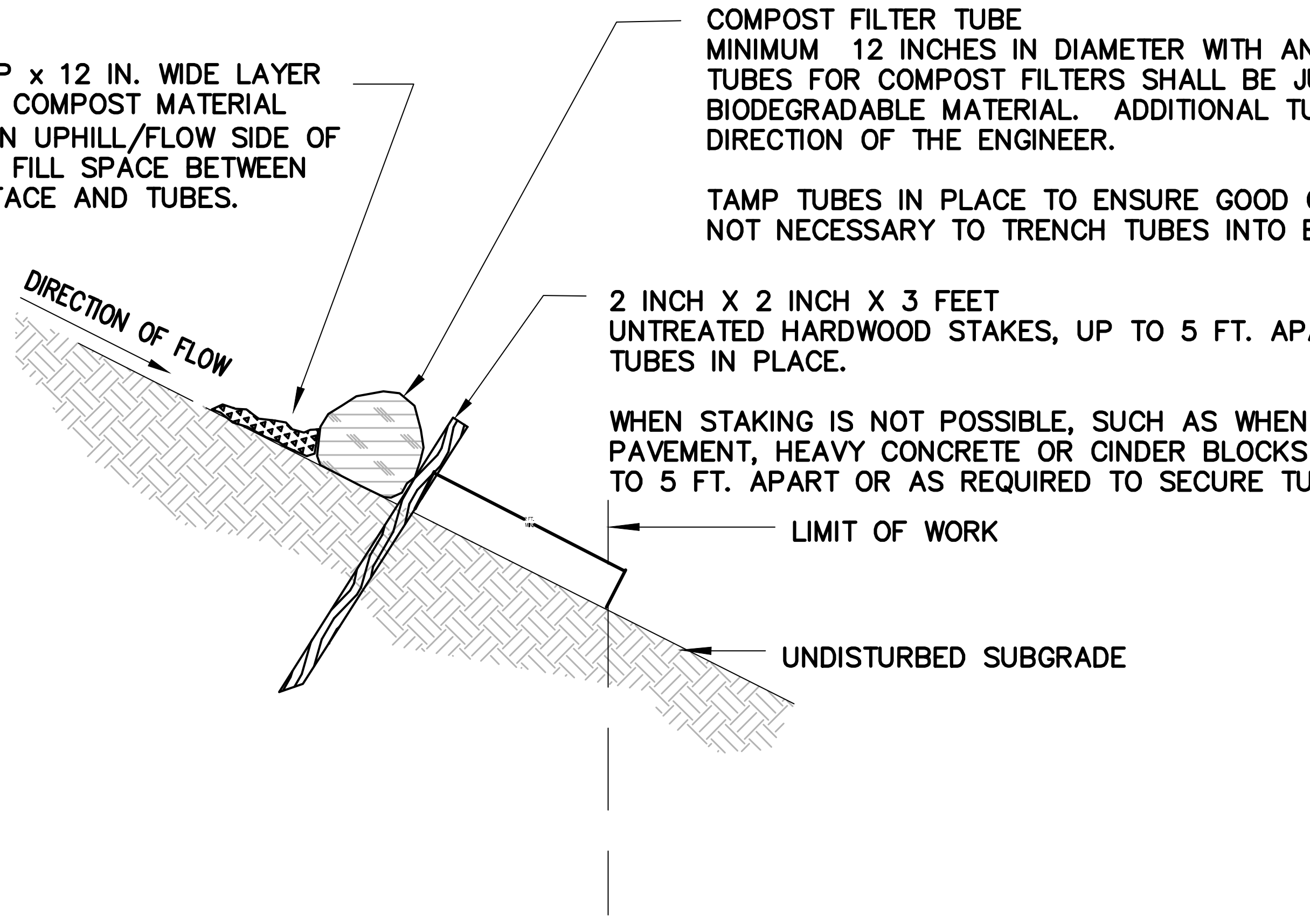
NOTE:
ALL EXISTING CATCH BASINS WITHIN THE LIMIT OF WORK SHALL HAVE INLET CONTROL PRIOR TO THE START OF CONSTRUCTION.

① INLET SEDIMENT CONTROL

SCALE: N.T.S.

GENERAL NOTES:

1. PROVIDE A MINIMUM TUBE DIAMETER OF 12 INCHES FOR SLOPES UP TO 50 FEET IN LENGTH WITH A SLOPE RATIO OF 3H:1V OR STEEPER. LONGER SLOPES OF 3H:1V MAY REQUIRE LARGER TUBE DIAMETER OR ADDITIONAL COURSING OF FILTER TUBES TO CREATE A FILTER BERM. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SITUATIONS WITH LONGER OR STEEPER SLOPES.
2. INSTALL TUBES ALONG CONTOURS AND PERPENDICULAR TO SHEET OR CONCENTRATED FLOW.
3. DO NOT INSTALL IN PERENNIAL, EPHEMERAL OR INTERMITTENT STREAMS.
4. CONFIGURE TUBES AROUND EXISTING SITE FEATURES TO MINIMIZE SITE DISTURBANCE AND MAXIMIZE CAPTURE AREA OF STORMWATER RUN-OFF.
5. MULCH MATERIAL FOR THE FILTER TUBES SHALL BE WEED-FREE STRAW, WOOD EXCELSIOR, COMPOST, OR WOOD CHIPS, OR COIR. STRAW SHALL BE WEED FREE AND DERIVED FROM THRESHING OF GRAIN CROP.
6. CURVE ENDS UPHILL TO PREVENT DIVERSION OF UNFILTERED RUN-OFF.



2 IN. DEEP x 12 IN. WIDE LAYER OF LOOSE COMPOST MATERIAL PLACED ON UPHILL/FLOW SIDE OF TUBES TO FILL SPACE BETWEEN SOIL SURFACE AND TUBES.

COMPOST FILTER TUBE
MINIMUM 12 INCHES IN DIAMETER WITH AN EFFECTIVE HEIGHT OF 9.5 INCHES. TUBES FOR COMPOST FILTERS SHALL BE JUTE MESH OR APPROVED BIODEGRADABLE MATERIAL. ADDITIONAL TUBES SHALL BE USED AT THE DIRECTION OF THE ENGINEER.

TAMP TUBES IN PLACE TO ENSURE GOOD CONTACT WITH SOIL SURFACE. IT IS NOT NECESSARY TO TRENCH TUBES INTO EXISTING GRADE.

2 INCH X 2 INCH X 3 FEET
UNTREATED HARDWOOD STAKES, UP TO 5 FT. APART OR AS REQUIRED TO SECURE TUBES IN PLACE.

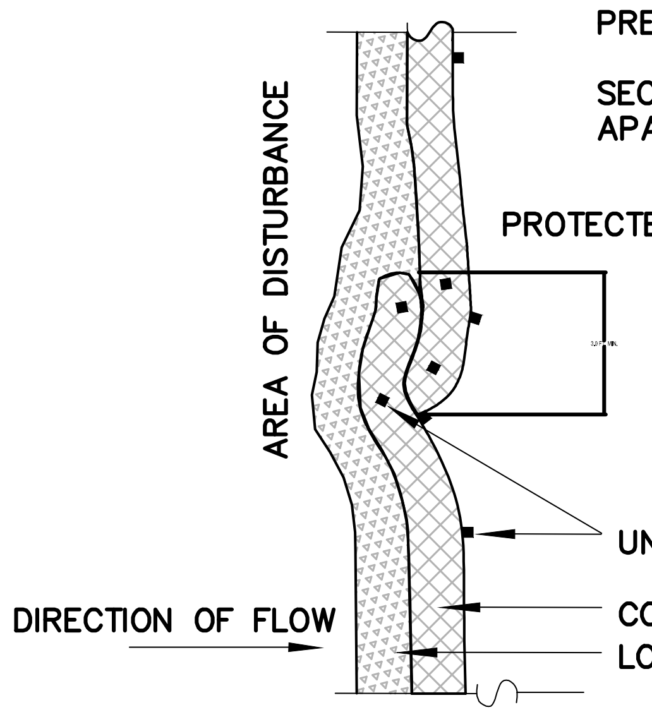
WHEN STAKING IS NOT POSSIBLE, SUCH AS WHEN TUBES MUST BE PLACED ON PAVEMENT, HEAVY CONCRETE OR CINDER BLOCKS CAN BE USED BEHIND TUBES UP TO 5 FT. APART OR AS REQUIRED TO SECURE TUBES IN PLACE.

LIMIT OF WORK

UNDISTURBED SUBGRADE

PROVIDE A 3 FT. MINIMUM OVERLAP AT ENDS OF TUBES TO JOIN IN A CONTINUOUS BARRIER AND MINIMIZE UNIMPEDED FLOW.
STAKE JOINING TUBES SNUGLY AGAINST EACH OTHER TO PREVENT UNFILTERED FLOW BETWEEN THEM.

SECURE ENDS OF TUBES WITH STAKES SPACED 18 IN. APART THROUGH TOPS OF TUBES.



PLAN VIEW – JOINING DETAIL

③ SINGLE COMPOST FILTER TUBE DETAIL

SCALE: N.T.S.

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Project:
PEABODY RIVERWALK

RIVERWALK PARK DESIGN PLANS

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PEABODY, MA. 01960

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Reviewed By: SYC
Approved By: SRB
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:
EROSION AND SEDIMENT CONTROL DETAILS

Sheet Number:
C601

APPENDIX E

Riverwalk –75% Design Plans & Specifications

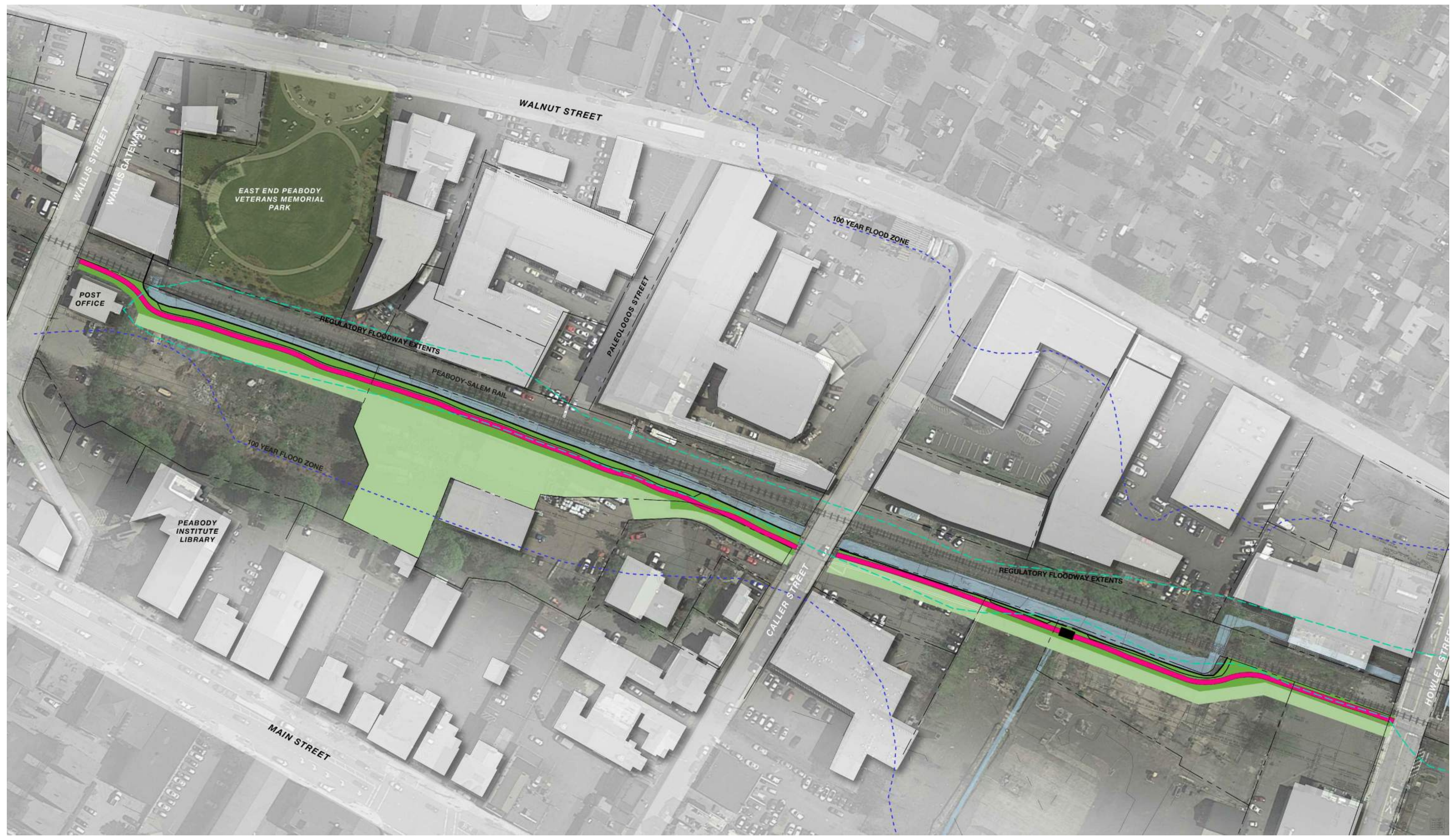
PEABODY RIVERWALK

RIVERWALK PARK

WALLIS STREET - CALLER STREET - HOWLEY STREET,
PEABODY, MA 01960

SHEET INDEX

	COVER SHEET
L001	SITE INDEX PLAN
L100 - L102	EXISTING CONDITIONS PLAN
L110 - L112	SITE DEMOLITION AND PREPARATION PLAN
L120 - L122	MATERIALS PLAN
L130 - L132	LAYOUT PLAN
L140 - L142	GRADING AND DRAINAGE PLAN
L150 - L152	PLANTING PLAN
L500 - L504	CONSTRUCTION DETAILS
S200-S202	PROPOSED LAYOUT PLAN I - III
S600-S601	WALL SECTIONS AND DETAILS I - II
S602	OVERLOOK FRAMING PLAN, SECTIONS, & DETAILS
S603	TIMBER BRIDGE PLAN & TYP. SECTION
S604	TIMBER BRIDGE DETAILS
S605-S606	BOARDWALK PLAN & ELEVATION
S607	BOARDWALK TYP. SECTIONS
S608	BOARDWALK ABUTMENT TYP. SECTIONS
C601	EROSION AND SEDIMENT CONTROL DETAILS
E001	ELECTRICAL LEGEND, NOTES AND ABBREVIATIONS
E101 - E103	ELECTRICAL SITE PLAN A - C
E501	ELECTRICAL DETAILS
E601	ELECTRICAL RISER AND SCHEDULES



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APRIL 2021

Prepared By

Weston & Sampson℠
design studio

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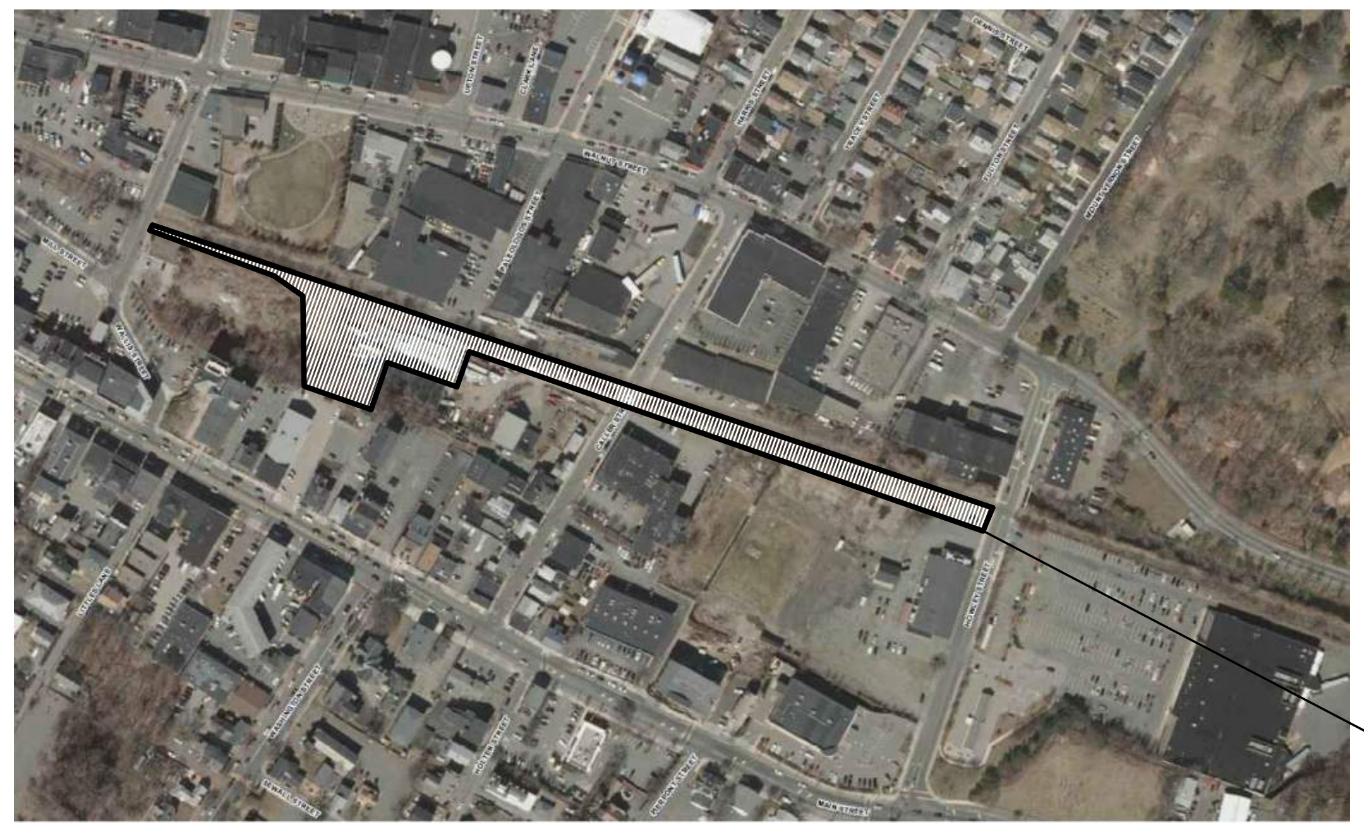
Boston, MA 02109
(617) 412-4480
www.westonandsampson.com

MASSACHUSETTS
CHERILYN F. RUANE
NO. 1220
REGISTERED LANDSCAPE ARCHITECT

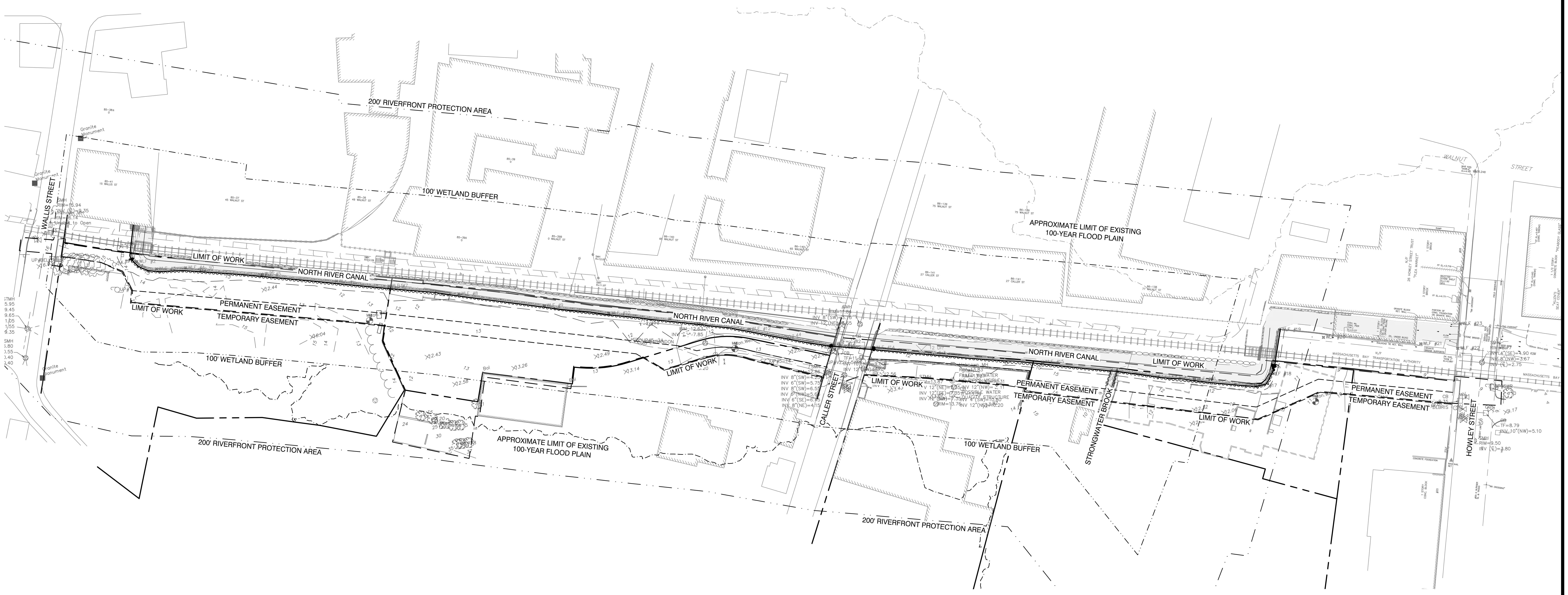
Locus Map

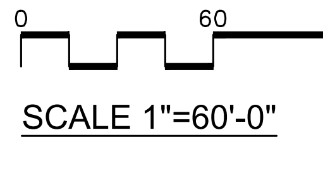


PEABODY RIVERWALK VICINITY MAP
PEABODY, MA 01960

LEGEND

——— — - ———	PROPERTY LINE
— — — — —	LIMIT OF WORK
━ ━ ━ ━ ━	EASEMENTS
—·—·—·—	100-FT WETLAND BUFFER
— · — · —	200-FT RIVERFRONT PROTECTION AREA
- · - · - · -	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN





SCALE 1"=60'-0"

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Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

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NO. 1220

Key Plan:

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Reviewed By:	CC
Approved By:	CFR
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

SITE INDEX PLAN

Sheet Number:

L001

LEGEND

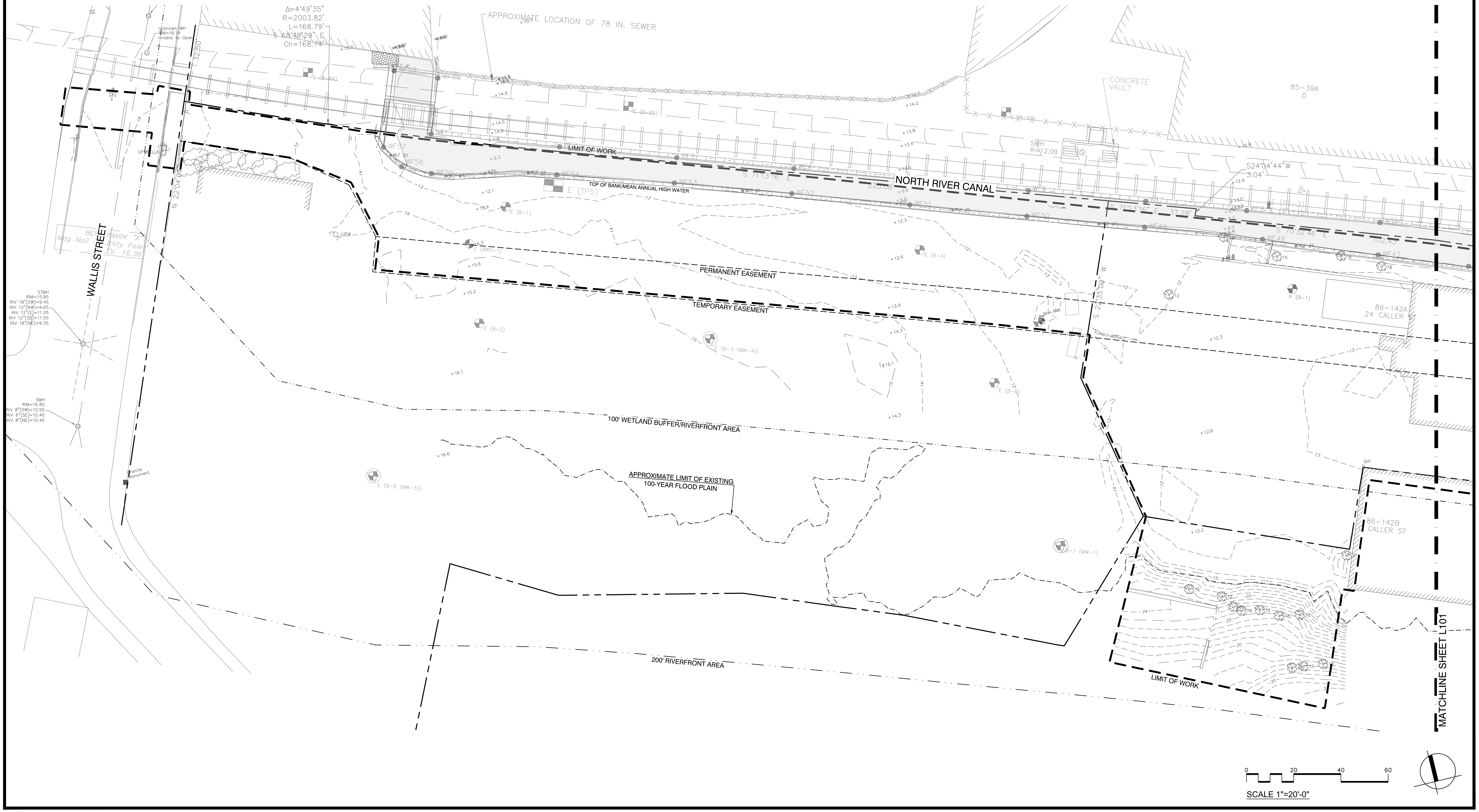
- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 200' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE

- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB/BUSH
- SIGN
- UTILITY POLE
- LIGHT POLE
- HYDRANT
- WATER SHUTOFF
- GAS VALVE
- WATER VALVE

- MONUMENT
- IRON PIN / IRON ROD
- HANDICAP SPACE
- SANITARY MANHOLE (SMH)
- STORM MANHOLE (STMH)
- CATCHBASIN (CB)
- METAL POST/BOLLARD (BOL)
- ELECTRIC MANHOLE (MHE)
- UNKNOWN MANHOLE
- TELEPHONE MANHOLE (MHT)

GENERAL NOTES

1. BEARINGS REFER TO THE MASSACHUSETTS NAD 83 STATE PLANE COORDINATE SYSTEM (MAINLAND ZONE).
2. ELEVATIONS REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
3. REFERENCE IS MADE TO THE FOLLOWING MAPS:
   A. "LAND OF ANNABLE BROS. PEABODY", BY GUY W. RICKER, SCALE 1"=20', DATED SEPT. 1902, RECORDED IN BOOK 1683, PLAN 438 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   B. "LAND OF MORRILL LEATHER CO. PEABODY MASS.", BY GUY W. RICKER, SCALE 1"=20', DATED DEC. 1902, RECORDED AS MAP 1669 - 600.
   C. "STATION MAP - LANDS BOSTON AND MAINE R.R. STATION 45+0 TO STATION 95+0", SCALE 1"=100', DATED JUNE 30, 1914, REVISED TO DEC. 1, 1975, RECORDED IN PLAN BOOK 141, PLAN 20 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   D. "PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, SCALE 1"=20', DATED OCT. 27, 1914, LAND COURT PLAN 5137A.
   E. "PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, SCALE 1"=20', DATED AUGUST 1916, RECORDED IN PLAN BOOK 30, PLAN 39 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   F. PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, SCALE 1"=20', DATED OCT. 1918, LAND COURT PLAN 6997A.
   G. "PLAN OF LAND - PEABODY, MASS. BELONGING TO THE MORRILL LEATHER CO.", BY SHAY & SHAY, SCALE 1"=20', DATED FEB. 14, 1930, RECORDED AS PLAN 110 OF 1930 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   H. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER, SCALE 1"=40', DATED SEPTEMBER 1952, LAND COURT PLAN 6997C.
   I. "PLAN OF LAND IN PEABODY PROPERTY OF HOWLEY REALTY TRUST OF PEABODY", BY OSBORN PALMER, INC., SCALE 1"=20', DATED FEB, 26, 1965, RECORDED IN PLAN BOOK 104, PLAN 12 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   J. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER INC, SCALE 1"=50', DATED MAY 26, 1966, LAND COURT PLAN 5137B.
   K. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER INC, SCALE 1"=50', DATED FEBRUARY 5, 1967, LAND COURT PLAN 5137C.
   L. "EASEMENT PLAN PEABODY-SALEM INTERCEPTING SEWER FROM SALEM-PEABODY LINE TO PEABODY SQUARE PEABODY, MASS.", BY RAYMOND C. PRESSEY, INC., SCALE 1"=20', DATED APRIL 15, 1971, REVISED JUNE 15, 1971, RECORDED IN PLAN BOOK 121 PLAN 64 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   M. "PLAN OF LAND IN PEABODY PREPARED FOR E.H. PORTER CONSTRUCTION COMPANY", BY ESSEX SURVEY SERVICE, INC., SCALE 1"=20', DATED NOV. 28, 1975, RECORDED IN PLAN BOOK 136, PLAN 37 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   N. "PLAN OF LAND IN PEABODY PREPARED FOR BOB-KAT TANNING CO., INC.", BY ESSEX SURVEY SERVICE INC., SCALE 1"=20', DATED APRIL 27, 1976, RECORDED IN PLAN BOOK 144, PLAN 52 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   O. "COUNTY OF ESSEX, MASSACHUSETTS PLAN OF A PORTION OF WALLIS STREET FROM MAIN STREET TO WALNUT STREET IN THE CITY OF PEABODY AS RELOCATED", SCALE 1"=20', DATED MARCH 5, 1985, REVISED DEC. 4, 1990, COUNTY RECORD NUMBER 3204.
   P. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"=40', DATED JULY 14, 1986, REVISED NOVEMBER 7, 1989, RECORDED IN PLAN BOOK 260, PLAN 46 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   Q. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASS. PREPARED FOR EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"=40', DATED APRIL 2, 2001, RECORDED IN PLAN BOOK 350, PLAN 53 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   R. "EASEMENT PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"=20', DATED OCTOBER 18, 2004, RECORDED IN PLAN BOOK 386, PLAN 11 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   S. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASSACHUSETTS", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"40', DATED AUGUST 22, 2008, RECORDED IN PLAN BOOK 416, PLAN 7 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   T. "PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE 1"=40', DATED MAY 17, 2010, RECORDED IN PLAN BOOK 424, PLAN 17 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   U. "PLAN OF LAND LOCATED IN PEABODY, MASSACHUSETTS (ESSEX COUNTY) PREPARED FOR MASSACHUSETTS BAY TRANSPORTATION AUTHORITY - CITY OF PEABODY", BY MERIDIAN ASSOCIATES, SCALE 1'=30', DATED MARCH 30, 2012, RECORDED IN PLAN BOOK 433, PLAN 91 OF THE ESSEX SOUTH REGISTRY OF DEEDS.



Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

Weston & Sampson
WESTON & SAMPSON ENGINEERS, INC
85 DEVONSHIRE STREET, 3RD FLOOR
BOSTON, MA 02109
617-412-4480
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Revisions:

No.	Date	Description

Seal:

NO. 1220

Key Plan:

Issued For:

75% PERMITTING SET
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Scale:	1" = 20'
Date:	APRIL 2021
Drawn By:	FD, TY, SG
Reviewed By:	CC
Approved By:	CFR
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

EXISTING
CONDITIONS PLAN

Sheet Number:

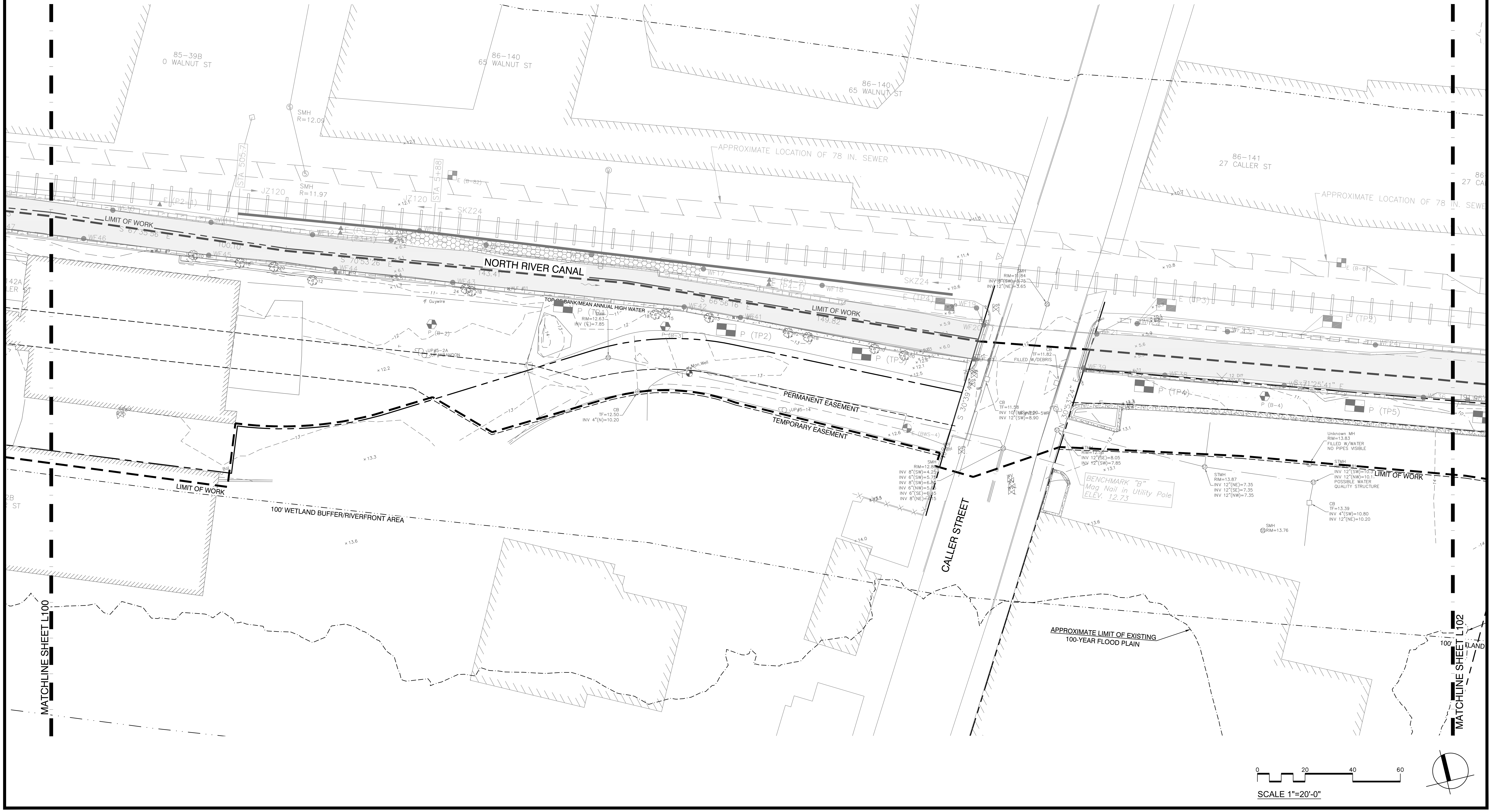
L100

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 200' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE

- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB/BUSH
- SIGN
- UTILITY POLE
- LIGHT POLE
- HYDRANT
- WATER SHUTOFF
- GAS VALVE
- WATER VALVE

- MONUMENT
- IRON PIN / IRON ROD
- HANDICAP SPACE
- SANITARY MANHOLE (SMH)
- STORM MANHOLE (STMH)
- CATCHBASIN (CB)
- METAL POST/BOLLARD (BOL)
- ELECTRIC MANHOLE (MHE)
- UNKNOWN MANHOLE
- TELEPHONE MANHOLE (MHT)



Project:

PEABODY RIVERWALK
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Approved By: CFR

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Drawing Title:

EXISTING CONDITIONS PLAN

Sheet Number:

L101

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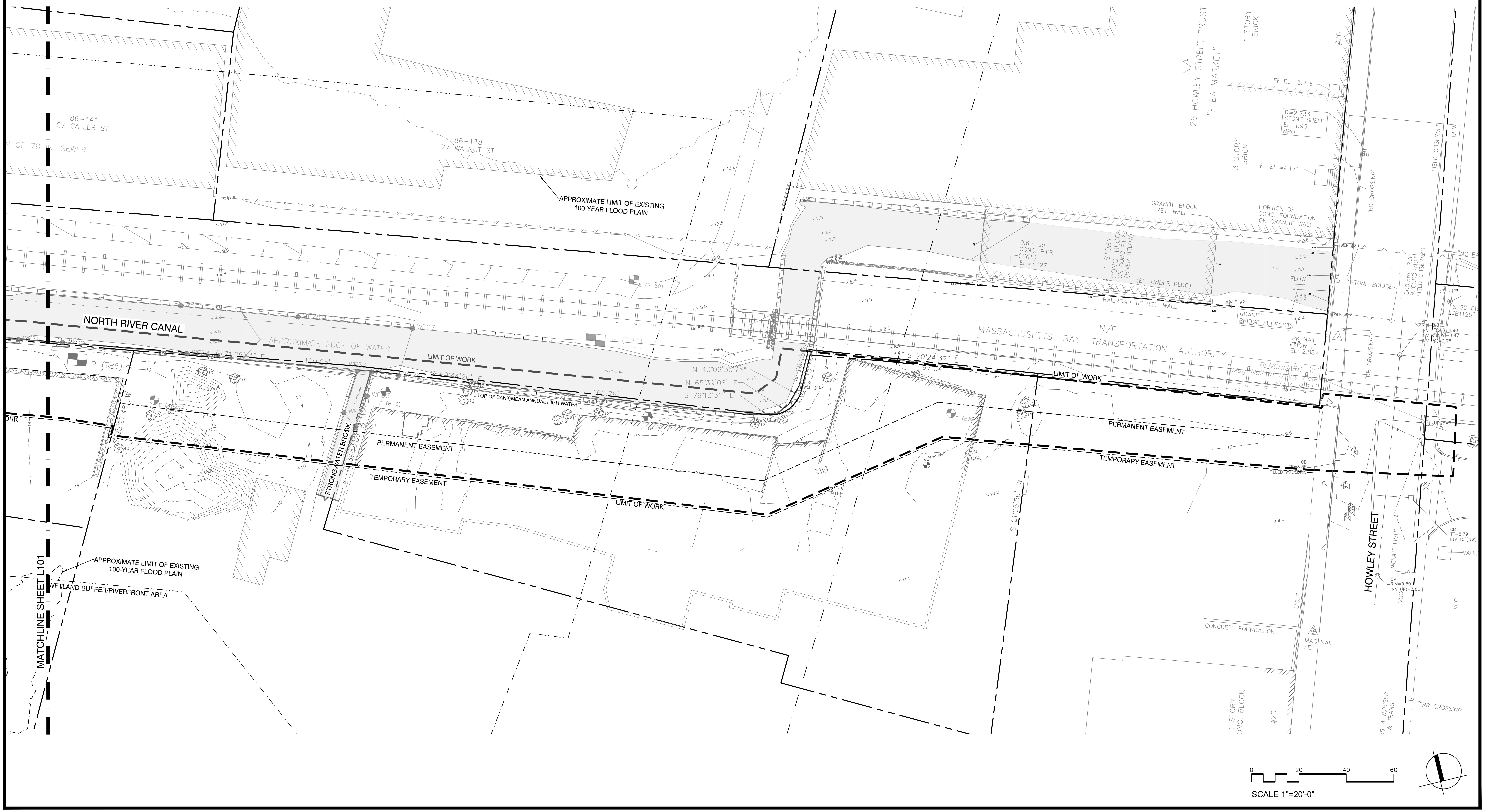
LEGEND

——— - - ———	PROPERTY LINE	✿	DECIDUOUS TREE	▭	MONUMENT
— — —	LIMIT OF WORK	✺	CONIFEROUS TREE	○	IRON PIN / IRON ROD
- - - - -	EASEMENTS	⬭	SHRUB/BUSH	♿	HANDICAP SPACE
—··—··—	100' WETLAND BUFFER	⊥	SIGN	Ⓢ	SANITARY MANHOLE (SMH)
— · — · —	200' RIVERFRONT PROTECTION AREA	⚲	UTILITY POLE	Ⓓ	STORM MANHOLE (STMH)
- · - · -	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN	☼	LIGHT POLE	□ Ⓒ	CATCHBASIN (CB)
— — 10 — —	MAJOR CONTOUR LINE	⌂	HYDRANT	○	METAL POST/BOLLARD (BOL)
— — — —	MINOR CONTOUR LINE	⊗	WATER SHUTOFF	Ⓔ	ELECTRIC MANHOLE (MHE)
		⋈	GAS VALVE	·	UNKNOWN MANHOLE
		⋈	WATER VALVE	Ⓣ	TELEPHONE MANHOLE (MHT)



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Drawing Title:

EXISTING CONDITIONS PLAN

Sheet Number:

L102

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- COMPOST SOCKS

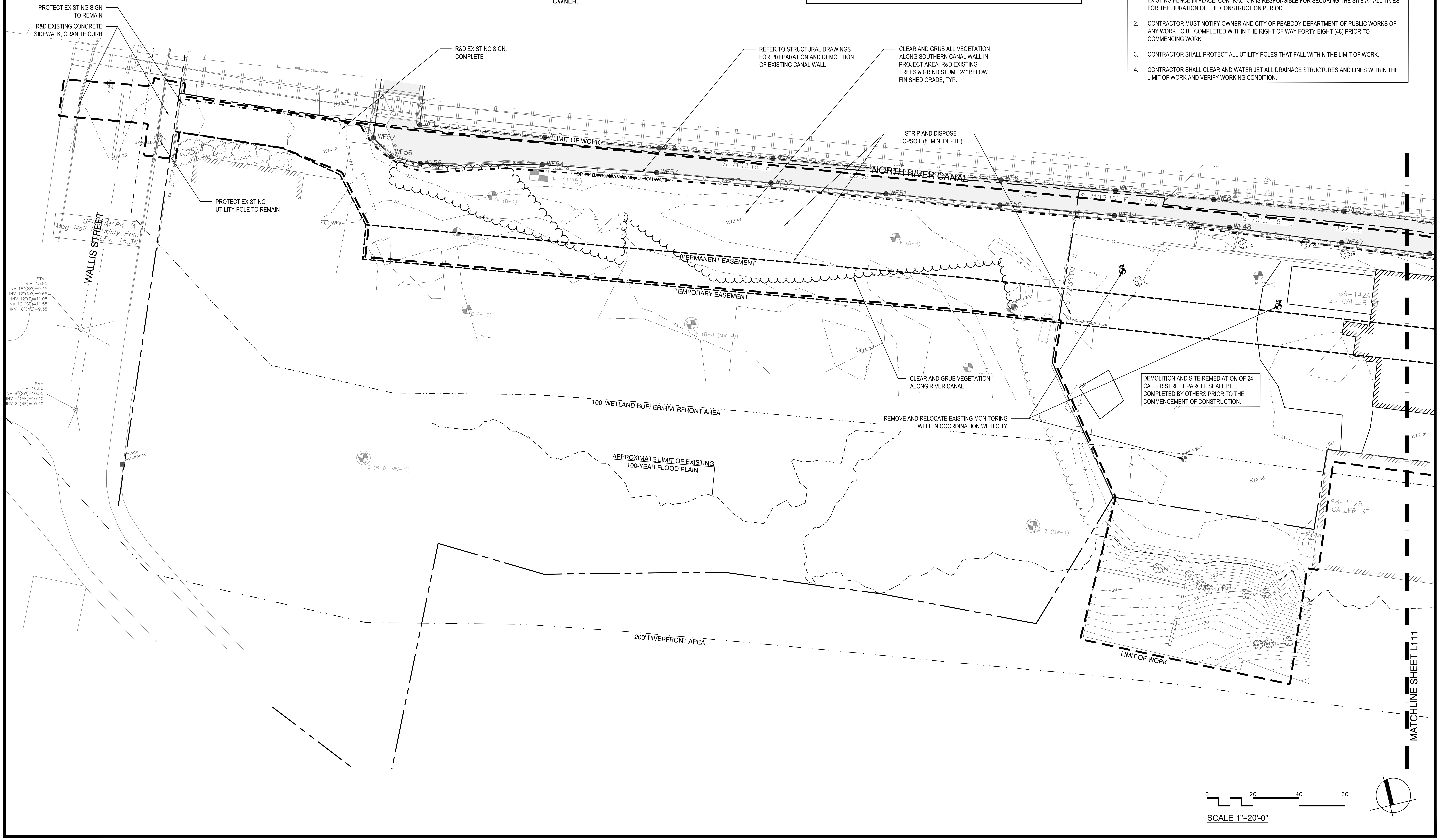
TYP.	TYPICAL
EX.	EXISTING
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
R&S	REMOVE AND STORE

DEMOLITION & SITE PREPARATION NOTES

1. THE CONTRACTOR SHALL INCLUDE IN THE BID THE COST OF REMOVING ANY EXISTING SITE FEATURES NECESSARY TO ACCOMPLISH THE CONSTRUCTION OF THE PROPOSED SITE IMPROVEMENTS. THE CONTRACTOR SHALL ALSO INCLUDE IN THE BID THE COST NECESSARY TO RESTORE SUCH ITEMS IF THEY ARE DISTURBED YET SCHEDULED TO REMAIN AS PART OF THE FINAL SITE IMPROVEMENTS. REFER TO PLANS TO DETERMINE EXCAVATION AND DEMOLITION REQUIRED TO RECEIVE PROPOSED SITE IMPROVEMENTS AND TO DETERMINE THE LOCATION OF PROPOSED SITE IMPROVEMENTS.
2. THE OWNER RESERVES THE RIGHT TO REVIEW ALL MATERIALS DESIGNATED FOR REMOVAL AND TO RETAIN OWNERSHIP OF SUCH MATERIALS. IF THE OWNER RETAINS ANY MATERIAL THE CONTRACTOR SHALL MAKE ARRANGEMENTS WITH THE OWNER TO HAVE THOSE MATERIALS DELIVERED TO FRANKLIN PARK YARD AT NO ADDITIONAL EXPENSE TO THE OWNER.
3. UNLESS SPECIFICALLY NOTED TO BE SAVED OR REUSED, ALL SITE FEATURES CALLED FOR REMOVAL SHALL BE TRANSPORTED FROM THE SITE AND DISPOSED OF IN A LAWFUL MANNER AT AN ACCEPTABLE DISPOSAL SITE AT NO COST TO THE OWNER.
4. ALL EXISTING SITE FEATURES TO REMAIN SHALL BE PROTECTED THROUGHOUT THE CONSTRUCTION PERIOD. ANY FEATURES DAMAGED DURING CONSTRUCTION OPERATIONS SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE OWNER AND OWNER'S REPRESENTATIVE AT NO ADDITIONAL COST TO THE OWNER.
5. DURING EARTHWORK OPERATIONS, CONTRACTOR SHALL TAKE CARE TO NOT DISTURB EXISTING MATERIALS TO REMAIN, OUTSIDE THE LIMITS OF EXCAVATION AND BACKFILL AND SHALL TAKE WHATEVER MEASURES NECESSARY, AT THE CONTRACTOR'S EXPENSE, TO PREVENT ANY EXCAVATED MATERIAL FROM COLLAPSING. ALL BACKFILL MATERIALS SHALL BE PLACED AND COMPACTED AS SPECIFIED TO THE SUBGRADE REQUIRED FOR THE INSTALLATION OF THE REMAINDER OF THE CONTRACT WORK.
6. ALL ITEMS CALLED FOR REMOVAL (COMPLETE) SHALL BE REMOVED TO FULL DEPTH INCLUDING ALL FOOTINGS, FOUNDATIONS, AND OTHER APPURTENANCES, EXCEPT AS SPECIFICALLY NOTED OTHERWISE.
7. CONTRACTOR SHALL INSTALL TREE PROTECTION BARRIER AT DRIPLINE AFTER CLEARING UNDERBRUSH AND TAKE DUE CARE TO PREVENT INJURY TO TREES DURING CLEARING OPERATIONS. TREES TO REMAIN SHALL BE PRUNED.
8. THE STORAGE OF MATERIALS AND EQUIPMENT WILL BE PERMITTED AT LOCATIONS DESIGNATED BY OWNER OR OWNER'S REPRESENTATIVE. PROTECTION OF STORED MATERIALS AND EQUIPMENT SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THERE SHALL BE NO STORAGE OF MATERIALS OR PARKING OF CONSTRUCTION VEHICLES WITHIN DRIPLINE OF TREES.
9. **DEMOLITION AND SITE REMEDIATION OF 24 CALLER STREET SHALL BE COMPLETED BY OTHERS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION**
10. **ALL SEDIMENT AND EROSION CONTROL DEVICES SHALL BE PUT INTO PLACE PRIOR TO BEGINNING ANY CONSTRUCTION OR DEMOLITION.**
11. **THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONTINUAL MAINTENANCE OF ALL EROSION CONTROL DEVICES THROUGHOUT THE DURATION OF THE PROJECT.**
12. **CONTRACTOR SHALL MEET ALL THE COMMONWEALTH OF MASSACHUSETTS D.E.P. AND THE CITY OF PEABODY'S WETLAND ORDINANCE REGULATIONS FOR SEDIMENT AND EROSION CONTROL.**
13. **THE CONTRACTOR SHALL PROVIDE DUST CONTROL FOR CONSTRUCTION OPERATIONS AS APPROVED BY OWNER.**
14. **ALL POINTS OF CONSTRUCTION EGRESS OR INGRESS SHALL BE MAINTAINED TO PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC / PRIVATE ROADS.**

NOTES:

1. CONTRACTOR SHALL PROVIDE 6'-HT CONSTRUCTION FENCE PLACED AT LIMIT OF WORK OR USE EXISTING FENCE IN PLACE. CONTRACTOR IS RESPONSIBLE FOR SECURING THE SITE AT ALL TIMES FOR THE DURATION OF THE CONSTRUCTION PERIOD.
2. CONTRACTOR MUST NOTIFY OWNER AND CITY OF PEABODY DEPARTMENT OF PUBLIC WORKS OF ANY WORK TO BE COMPLETED WITHIN THE RIGHT OF WAY FORTY-EIGHT (48) PRIOR TO COMMENCING WORK.
3. CONTRACTOR SHALL PROTECT ALL UTILITY POLES THAT FALL WITHIN THE LIMIT OF WORK.
4. CONTRACTOR SHALL CLEAR AND WATER JET ALL DRAINAGE STRUCTURES AND LINES WITHIN THE LIMIT OF WORK AND VERIFY WORKING CONDITION.



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Project:

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RIVERWALK PARK

WALLIS STREET -
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HOWLEY STREET
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No.	Date	Description

Seal:

CHERILYN F. RUANE
NO. 1220

Key Plan:

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- NOT FOR CONSTRUCTION -

Scale:	1" = 20'
Date:	APRIL 2021
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Approved By:	CFR
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W&S File No.:	

Drawing Title:

SITE DEMOLITION AND PREPARATION PLAN

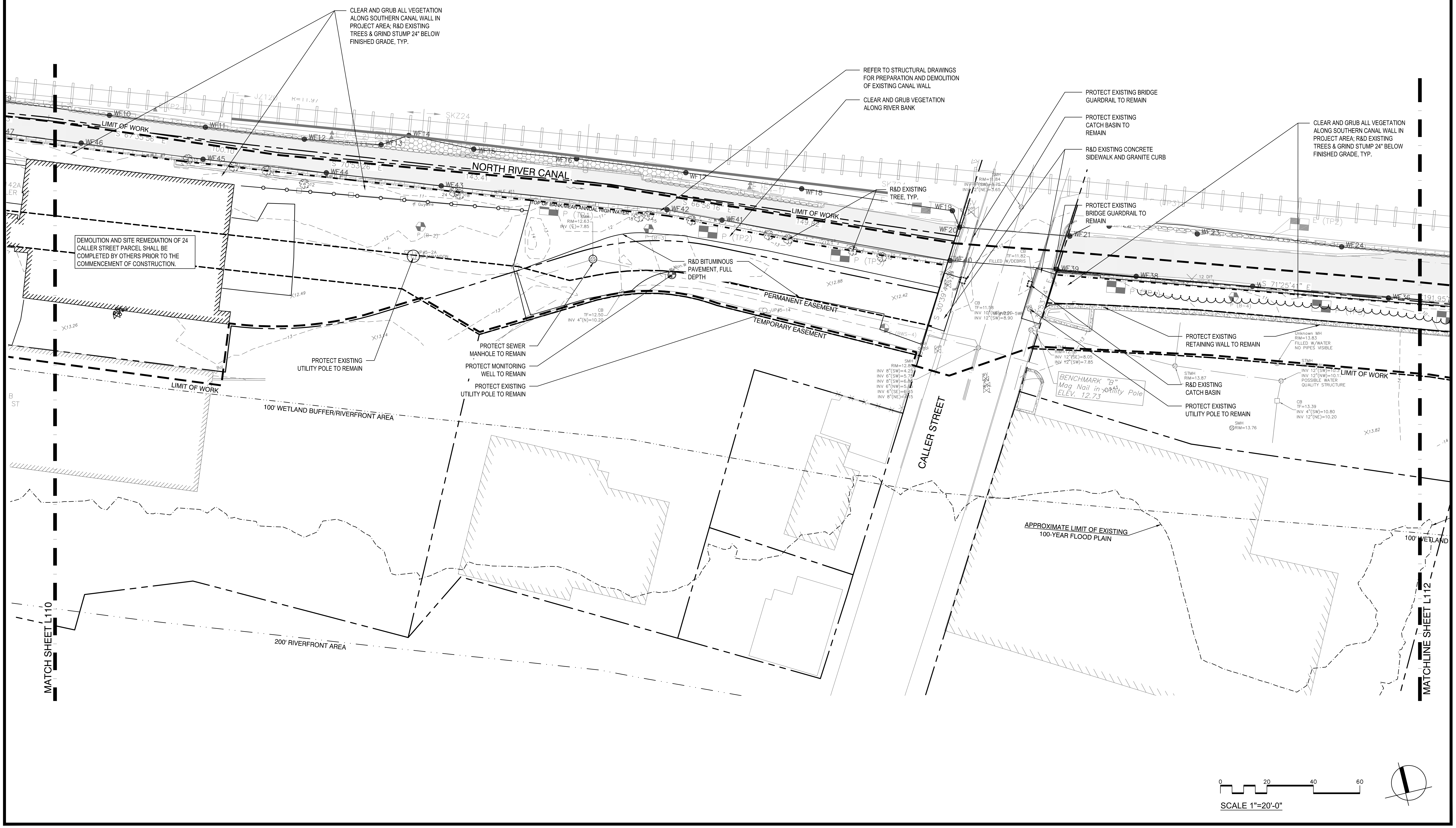
Sheet Number:

L110

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- COMPOST SOCKS

TYP.	TYPICAL
EX.	EXISTING
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
R&S	REMOVE AND STORE



Project:

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CAROLYN F. RUNG
NO. 1220

Key Plan:

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W&S File No.:	

Drawing Title:

SITE DEMOLITION AND PREPARATION PLAN

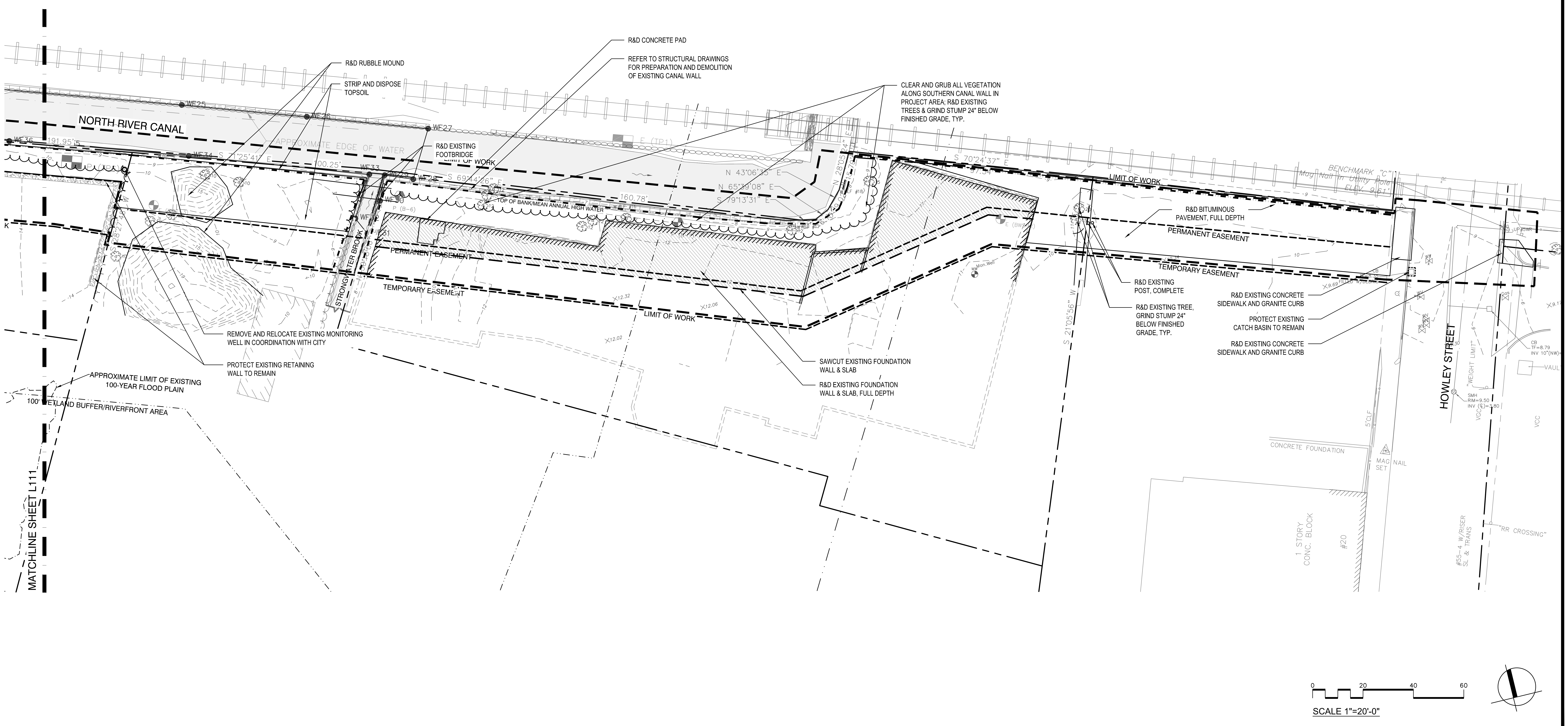
Sheet Number:

L111

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- COMPOST SOCKS
- ☐ INLET SEDIMENT CONTROL
- CLEAR AND GRUB VEGETATION

TYP.	TYPICAL
EX.	EXISTING
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
R&S	REMOVE AND STORE



Project:

PEABODY RIVERWALK
RIVERWALK PARK

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Drawing Title:

SITE DEMOLITION
AND PREPARATION
PLAN

Sheet Number:

L112

LEGEND

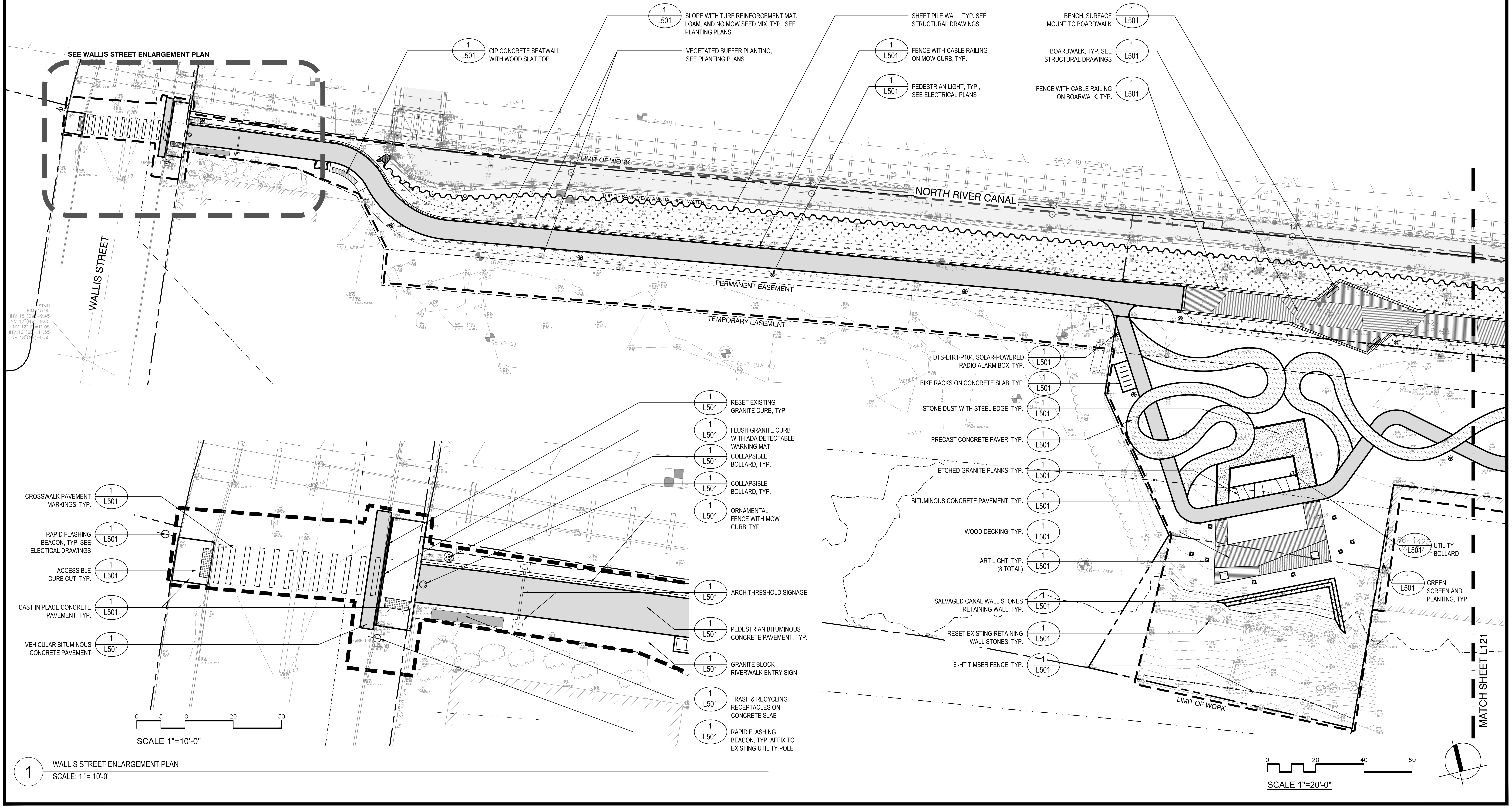
PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
200' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
SHEET PILE WALL
FENCE WITH CABLE RAILING ON BOARWALK
FENCE WITH CABLE RAILING ON MOW CURB
PEDESTRIAN BITUMINOUS CONCRETE PAVEMENT

VEHICULAR BITUMINOUS CONCRETE PAVEMENT
BOARDWALK
SLOPE WITH TURF REINFORCEMENT MAT, LOAM, AND NO MOW SEED MIX
VEGETATED BUFFER PLANTING
CIP CONCRETE PAVEMENT
EXPANSION JOINT (EJ)
SCORE JOINT (SJ)
BENCH WITH BACK

☼ STREET LIGHT
◎ PEDESTRIAN LIGHT
-⊖- RAPID FLASHING BEACON
✷ EMERGENCY CALL BOX
○ COLLAPSIBLE BOLLARD
◫ TRASH AND RECYCLE RECEPTACLES ON CONCRETE SLAB
Ⓓ DRAIN MANHOLE
⊞ CATCH BASIN

MATERIALS NOTES

1. REFER TO EXISTING CONDITIONS PLAN FOR SURVEY INFORMATION.
2. REFER TO PLANTING PLAN FOR PLANT TYPES AND LOCATIONS.
3. ALL PROPOSED PAVEMENTS SHALL MEET THE LIEN AND GRADE OF EXISTING ADJACENT PAVEMENT SURFACES AND SHALL BE TREATED WITH RS-1 TACK COAT AND INFRARED LIGHT AT ALL POINTS OF CONNECTION AND ALL SAWCUT EDGES WHERE PROPOSED PAVEMENT METS EXISTING PAVEMENT.
4. THE DEPTH OF LOAM TOP SOIL FOR ALL RESTORED LAWN AREAS SHALL BE 6" MINIMUM. ALL DISTURBED AREAS SHALL BE RESTORED WITH LOAM AND SEED UNLESS OTHERWISE NOTED.
5. ALL LIGHTING CONTROLS TO BE COORDINATED WITH THE CITY OF PEABODY.



1 WALLIS STREET ENLARGEMENT PLAN
SCALE: 1" = 10'-0"

Project:
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RIVERWALK PARK

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CALLER STREET -
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MASSACHUSETTS
CHERILYN F. RUANE
NO. 1220
REGISTERED LANDSCAPE ARCHITECT

Key Plan:

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Reviewed By:	CC
Approved By:	CFR
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:
MATERIALS PLAN

Sheet Number:
L120

LEGEND

PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
200' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
SHEET PILE WALL
FENCE WITH CABLE RAILING ON BOARWALK
FENCE WITH CABLE RAILING ON MOW CURB
PEDESTRIAN BITUMINOUS CONCRETE PAVEMENT

VEHICULAR BITUMINOUS CONCRETE PAVEMENT
BOARDWALK
SLOPE WITH TURF REINFORCEMENT MAT, LOAM, AND NO MOW SEED MIX
VEGETATED BUFFER PLANTING
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SCORE JOINT (SJ)
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STREET LIGHT
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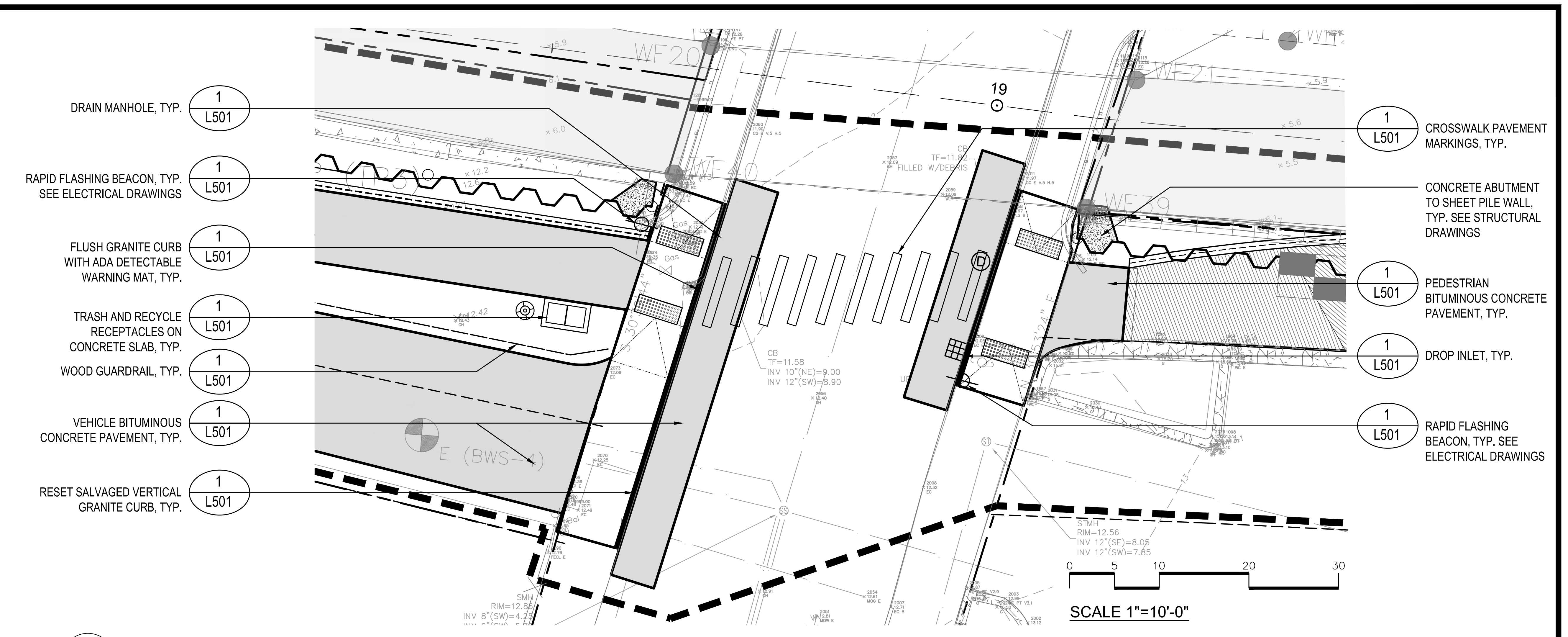
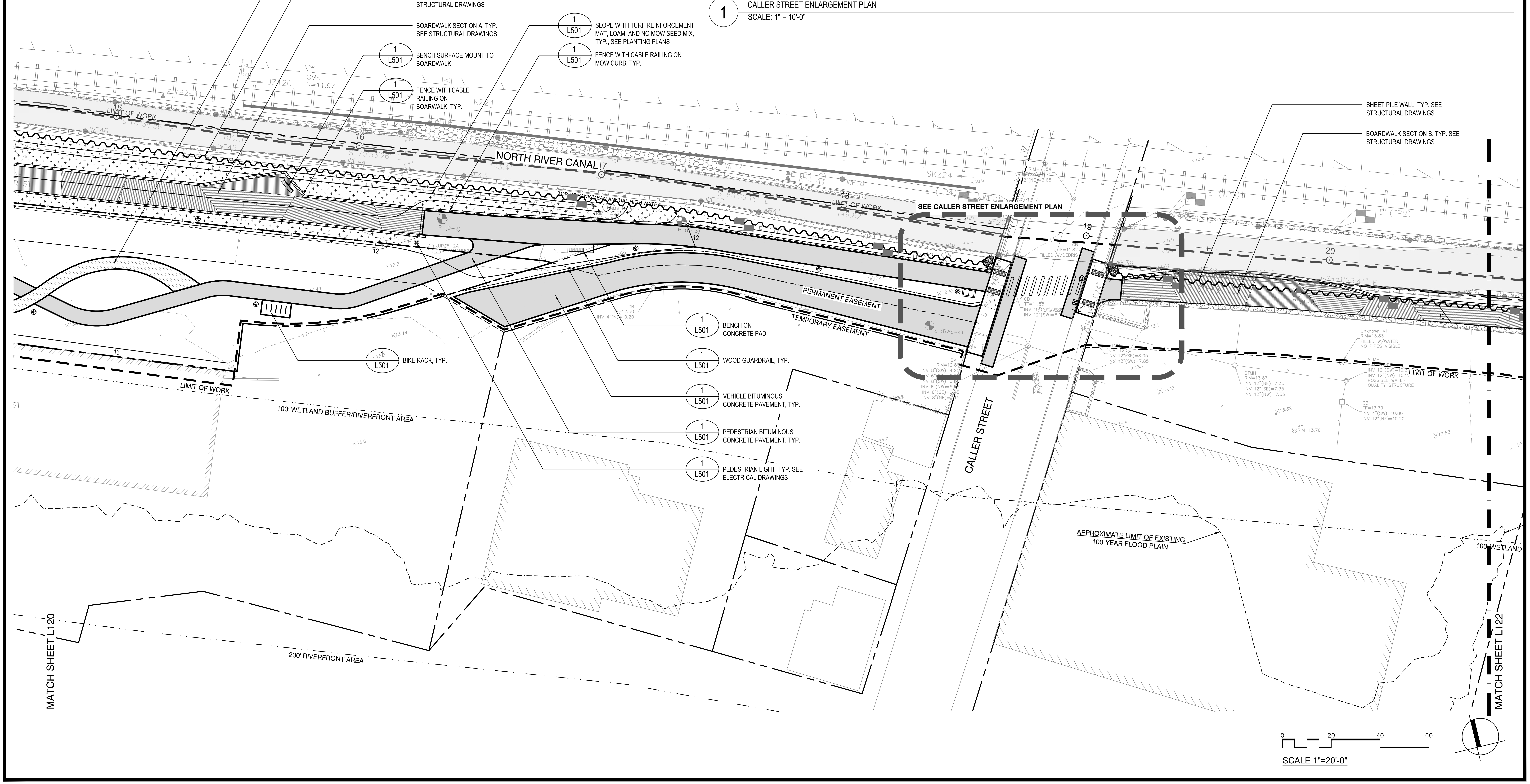


1 **CALLER STREET ENLARGEMENT PLAN**
SCALE: 1" = 10'-0"



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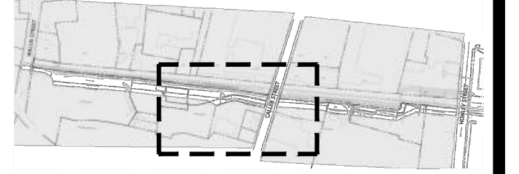
NO. 1220

Key Plan:



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Reviewed By:	CC
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W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

MATERIALS PLAN

Sheet Number:

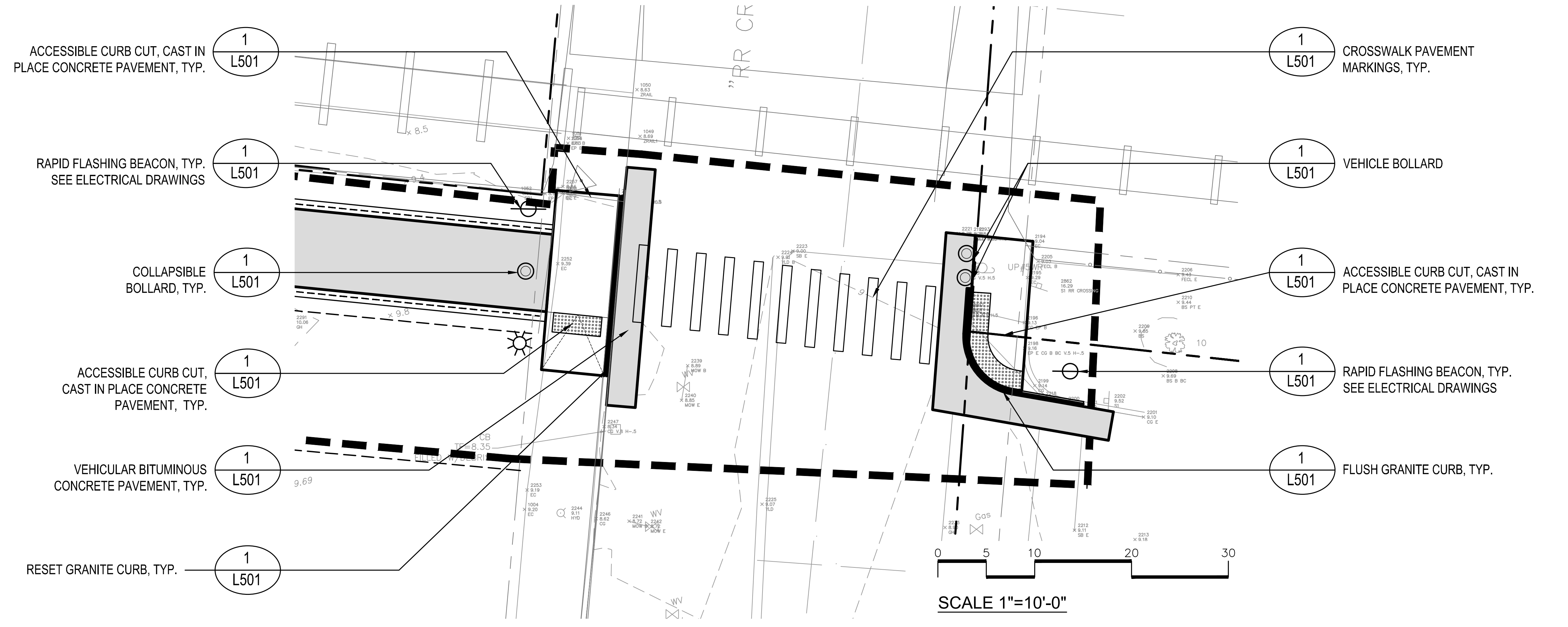
L121

LEGEND

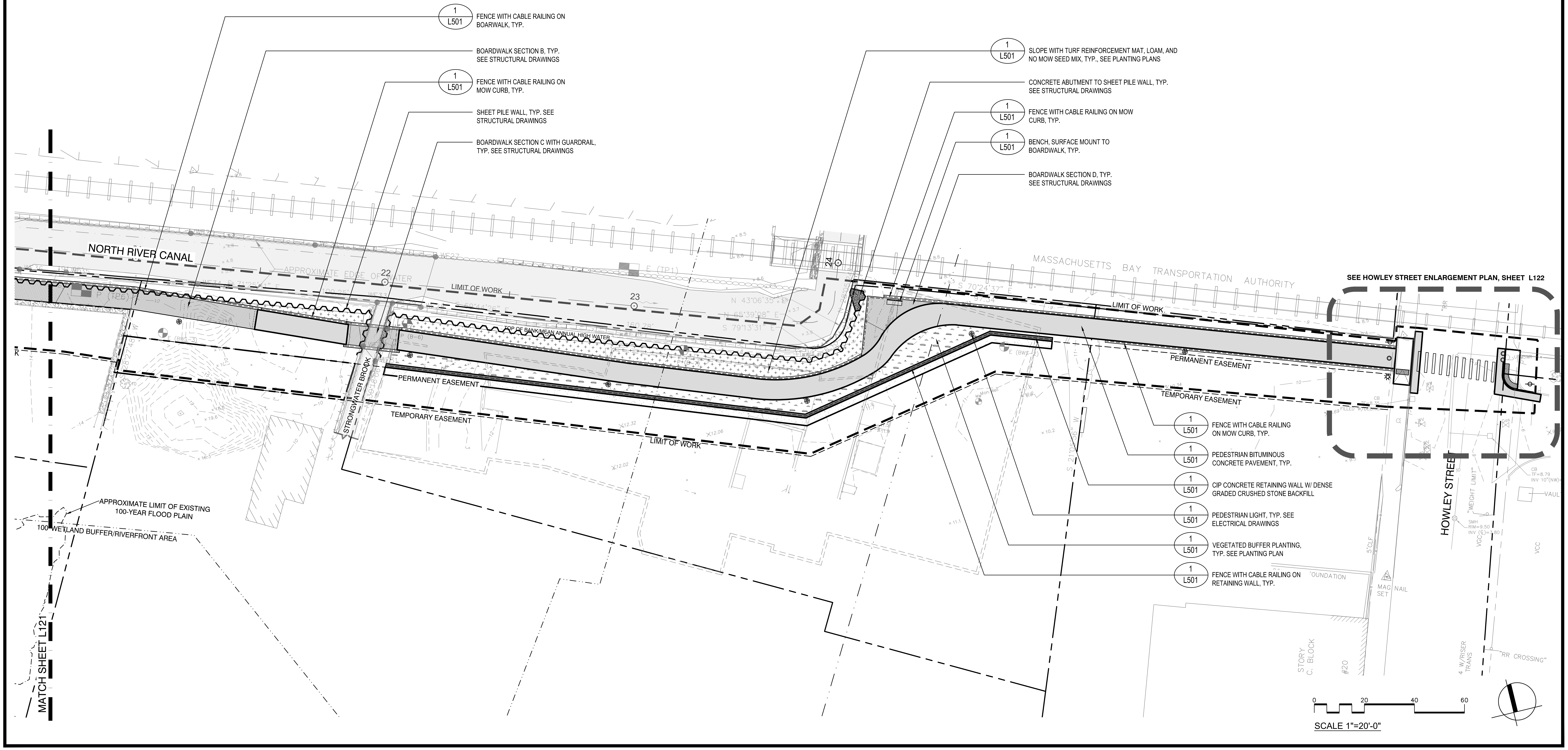
- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 200' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- SHEET PILE WALL
- FENCE WITH CABLE RAILING ON BOARWALK
- FENCE WITH CABLE RAILING ON MOW CURB
- PEDESTRIAN BITUMINOUS CONCRETE PAVEMENT

- VEHICULAR BITUMINOUS CONCRETE PAVEMENT
- BOARDWALK
- SLOPE WITH TURF REINFORCEMENT MAT, LOAM, AND NO MOW SEED MIX
- VEGETATED BUFFER PLANTING
- CIP CONCRETE PAVEMENT
- EXPANSION JOINT (EJ)
- SCORE JOINT (SJ)
- BENCH WITH BACK

- STREET LIGHT
- PEDESTRIAN LIGHT
- RAPID FLASHING BEACON
- EMERGENCY CALL BOX
- COLLAPSIBLE BOLLARD
- TRASH AND RECYCLE RECEPTACLES ON CONCRETE SLAB
- DRAIN MANHOLE
- CATCH BASIN



1 HOWLEY STREET ENLARGEMENT PLAN
SCALE: 1" = 10'-0"



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Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
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W&S File No.:	

Drawing Title:

MATERIALS PLAN

Sheet Number:

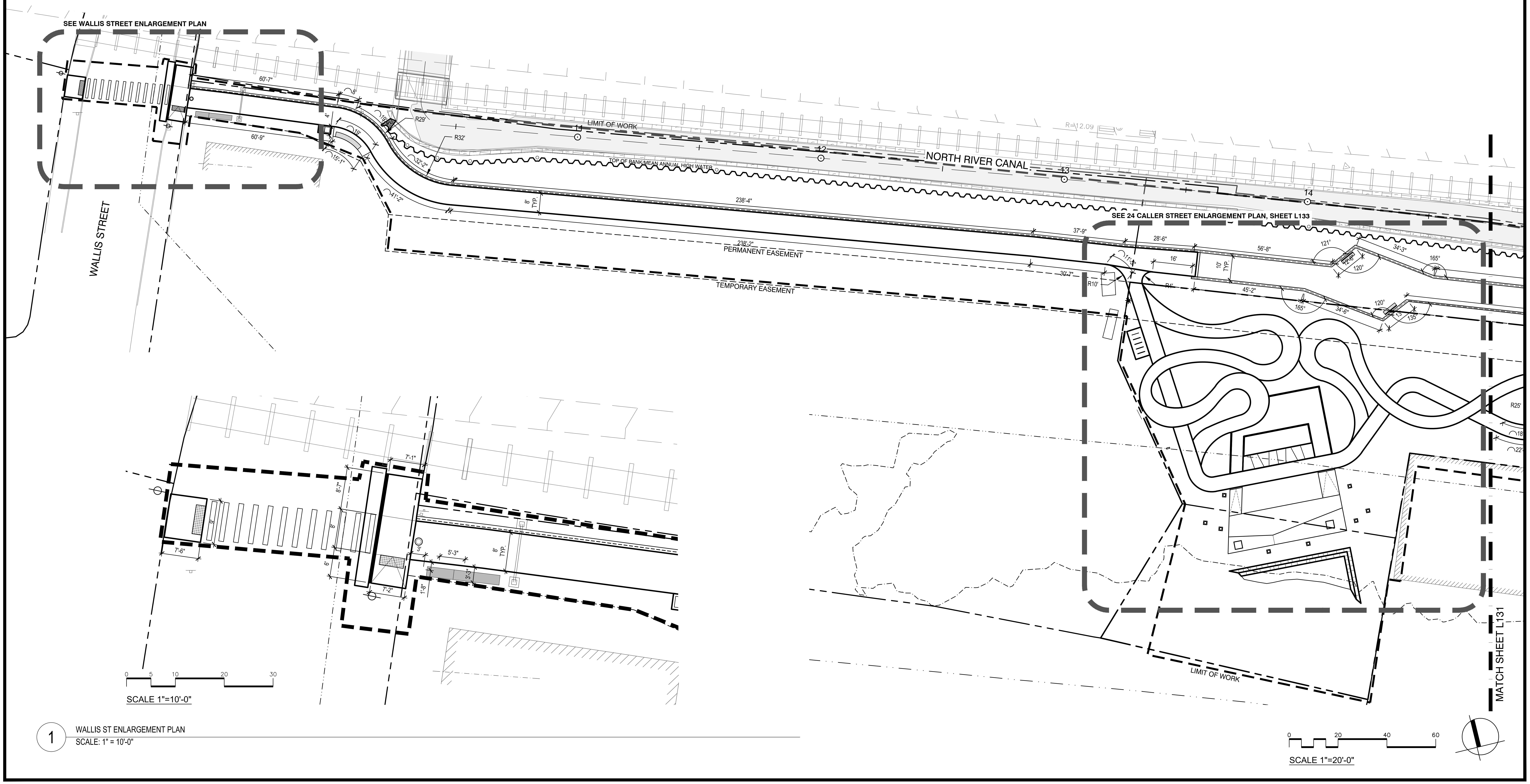
L122

LEGEND

— - —	PROPERTY LINE
— — —	LIMIT OF WORK
- - - -	EASEMENTS
—·—·—	100' WETLAND BUFFER
— · — ·	100' RIVERFRONT PROTECTION AREA
— - - —	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
—·—·—	CENTER LINE
X'-X"	TYP. DIMENSION
⌒X'-X"	TYP. ARC DIMENSION
RX' +	TYP. RADIUS
X°	TYP. ANGLE DIMENSION

LAYOUT NOTES

1. COORDINATE ALL LAYOUT ACTIVITIES WITH THE SCOPE OF WORK CALLED FOR BY DEMOLITION, GRADING, AND UTILITIES OPERATIONS ENCOMPASSED BY THIS CONTRACT. SET, PROTECT, AND REPLACE REFERENCE STAKES AS NECESSARY OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. ALL LINES AND GRADING WORK AS PER DRAWINGS AND SPECIFICATIONS SHALL BE LAID OUT BY A MASSACHUSETTS REGISTERED CIVIL ENGINEER OR LICENSED SURVEYOR ENGAGED BY THE GENERAL CONTRACTOR.
3. ALL LAYOUT LINES, OFFSETS, OR REFERENCES TO LOCATING OBJECTS ARE EITHER PARALLEL OR PERPENDICULAR UNLESS OTHERWISE DESIGNATED WITH ANGLE OFFSETS NOTED.
4. ALL PROPOSED SITE FEATURES SHALL BE LAID OUT AND STAKED FOR REVIEW AND APPROVAL BY THE OWNER'S REPRESENTATIVE PRIOR TO COMMENCEMENT OF INSTALLATION. ANY REQUIRED ADJUSTMENTS TO THE LAYOUT SHALL BE UNDERTAKEN AS DIRECTED AT NO ADDITIONAL COST TO THE OWNER.
5. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND GRADES ON THE GROUND AND REPORT ANY DISCREPANCIES IMMEDIATELY TO THE OWNER AND OWNER'S REPRESENTATIVE.
6. LAYOUT AND DIMENSIONS PROVIDED FOR BIDDING PURPOSED ONLY. CONTRACTOR SHALL COORDINATE WITH OWNER'S REPRESENTATIVE FOR FINAL LAYOUT AND DIMENSION PLAN.



1 WALLIS ST ENLARGEMENT PLAN
SCALE: 1" = 10'-0"

Project:

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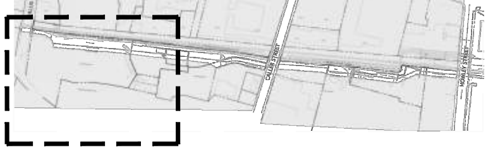
CHERILYN F. [illegible]
NO. 1220

Key Plan:



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Drawing Title:

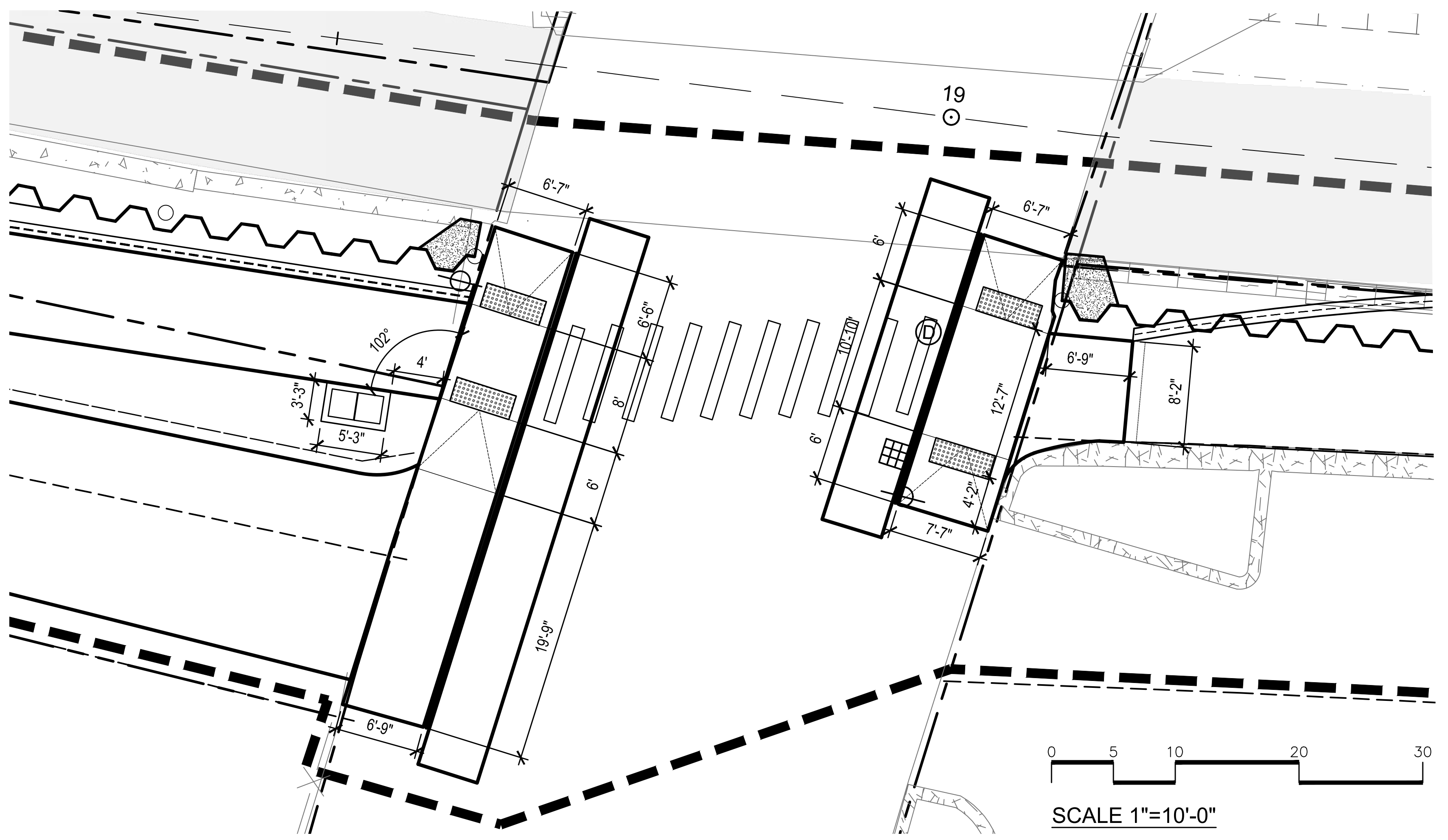
LAYOUT PLAN

Sheet Number:

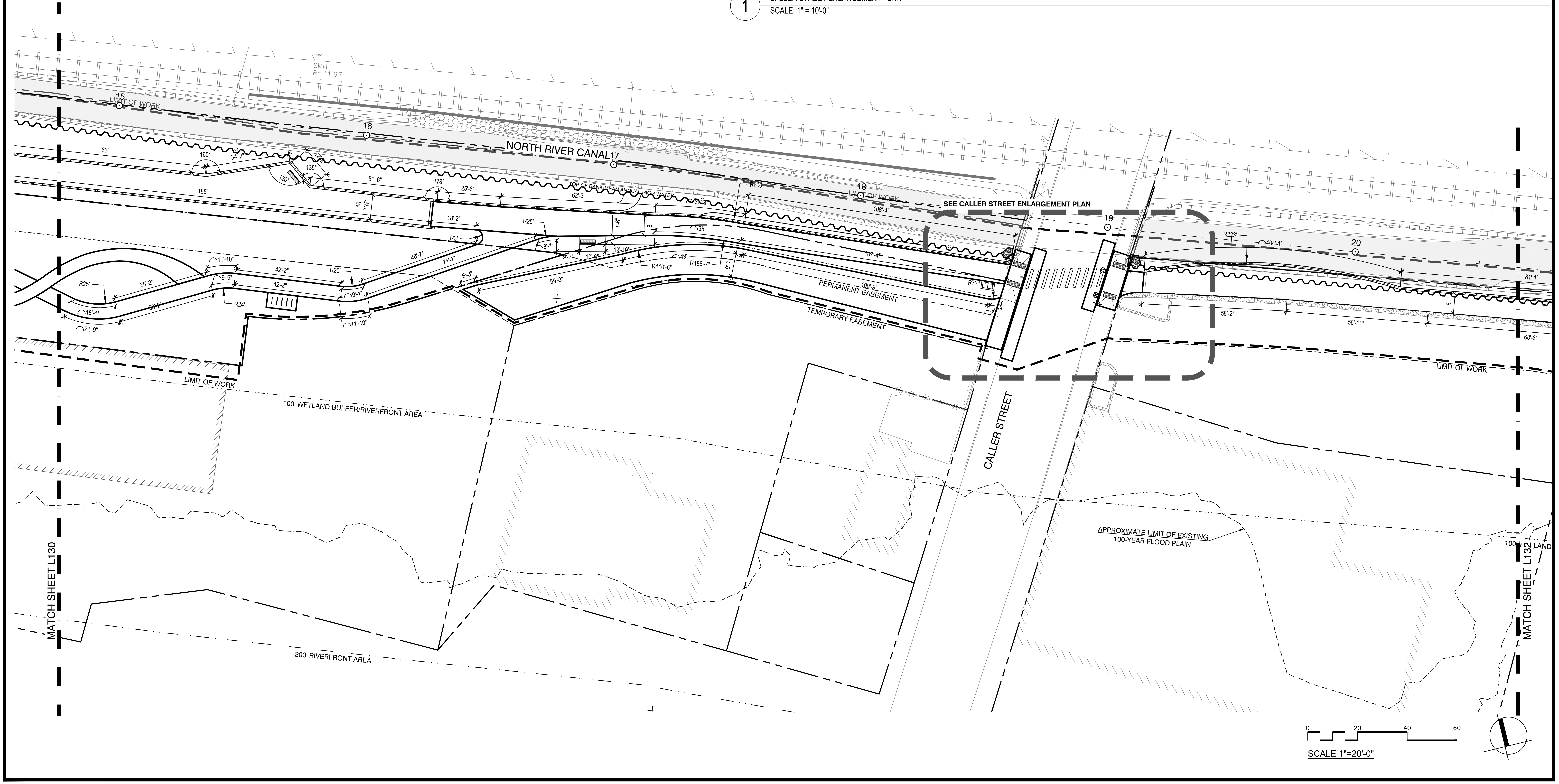
L130

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- CENTER LINE
- X'-X" TYP. DIMENSION
- X'-X" TYP. ARC DIMENSION
- RX' TYP. RADIUS
- X° TYP. ANGLE DIMENSION



1 CALLER STREET ENLARGEMENT PLAN
SCALE: 1" = 10'-0"



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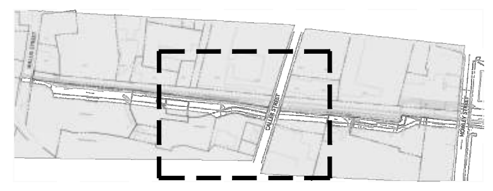
Key Plan:



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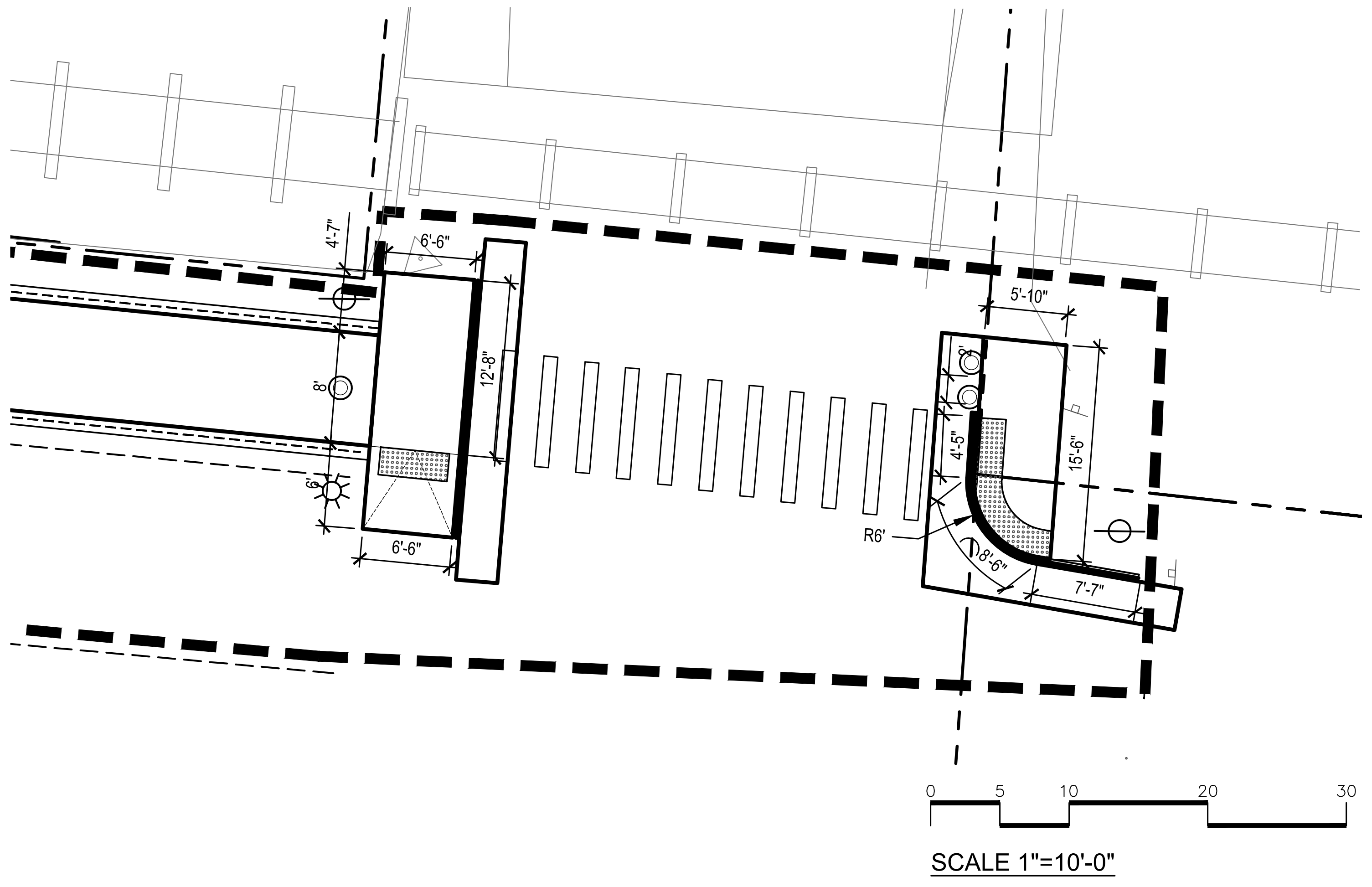
LAYOUT PLAN

Sheet Number:

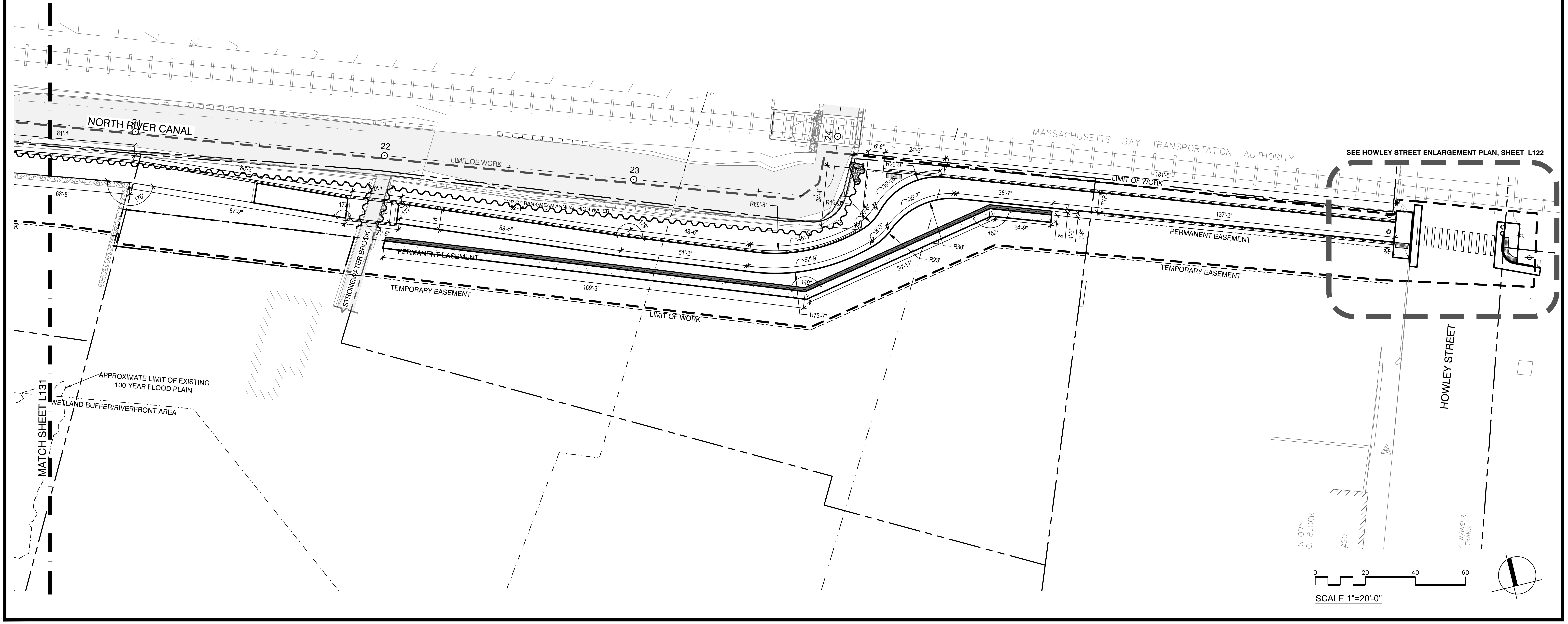
L131

LEGEND

— · —	PROPERTY LINE
▬ ▬	LIMIT OF WORK
- - -	EASEMENTS
— · · —	100' WETLAND BUFFER
— · —	100' RIVERFRONT PROTECTION AREA
— · · —	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
— - —	CENTER LINE
X'-X"	TYP. DIMENSION
X'-X"	TYP. ARC DIMENSION
RX'	TYP. RADIUS
X°	TYP. ANGLE DIMENSION



1 HOWLEY STREET ENLARGEMENT PLAN
SCALE: 1" = 10'-0"



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Reviewed By: CC

Approved By: CFR

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Drawing Title:

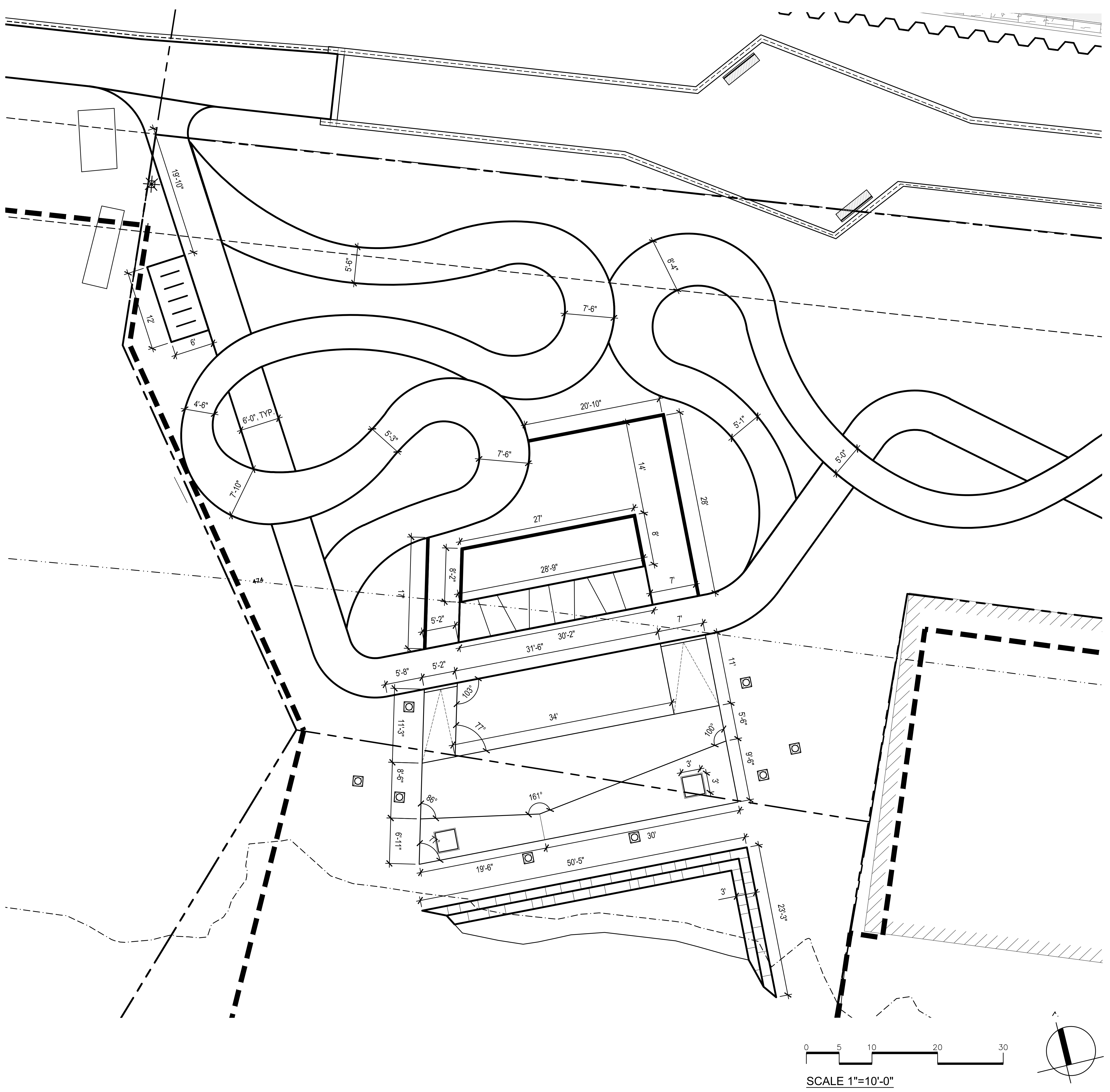
LAYOUT PLAN

Sheet Number:

L132

LEGEND

PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
100' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
CENTER LINE
X'-X" TYP. DIMENSION
⌒X'-X" TYP. ARC DIMENSION
RX' TYP. RADIUS
X° TYP. ANGLE DIMENSION



1 24 CALLER STREET ENLARGEMENT PLAN
SCALE: 1" = 10'-0"

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W&S File No.:	

Drawing Title:

LAYOUT PLAN

Sheet Number:

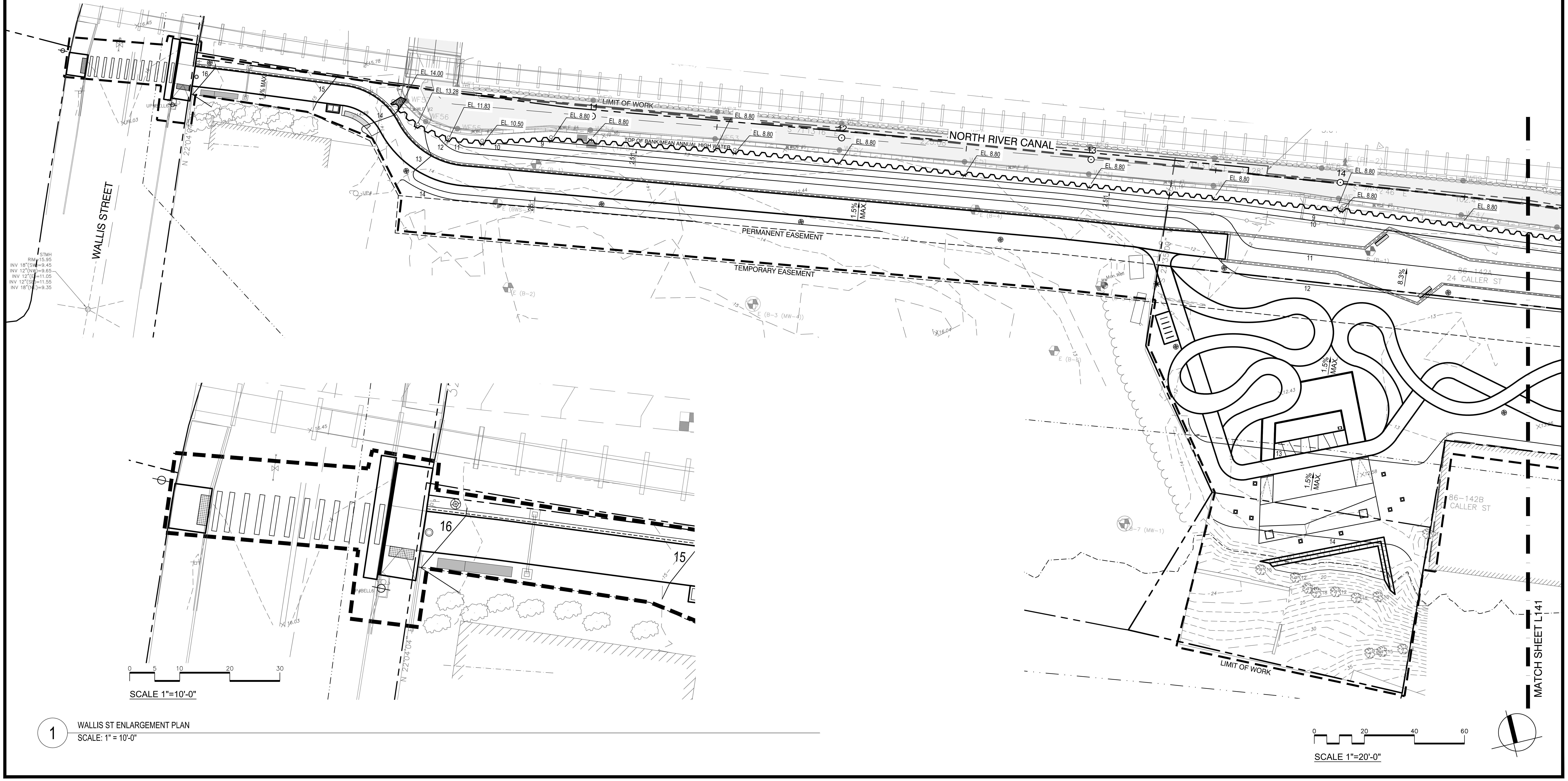
L133

LEGEND

	PROPERTY LINE	14 15	PROPOSED CONTOURS
	LIMIT OF WORK	1.5%	PROPOSED SLOPE
	EASEMENTS	8.25	PROPOSED SPOT ELEVATION
	100' WETLAND BUFFER		
	200' RIVERFRONT PROTECTION AREA	HDPE PERF. DRAIN PIPE	HDPE PERFORATED DRAIN PIPE, DIAMETER VARIES
	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN		GRADE BREAK
⊞ Ⓓ	EXISTING DRAINAGE STRUCTURE. SEE UTILITIES PLAN	HP	HIGH POINT
		LP	LOW POINT
		TW	TOP OF WALL
		BW	BOTTOM OF WALL
		EL	ELEVATION
12	EXISTING CONTOURS		
95.10	EXISTING SPOT ELEVATION		

GRADING & DRAINAGE NOTES

1. ALL WORK RELATING TO INSTALLATION, RENOVATION OR MODIFICATION OF WATER, UTILITY STORMWATER DRAINAGE AND/OR SEPTIC UTILITIES SHALL BE PERFORMED IN ACCORDANCE WITH THE STANDARDS OF THE CITY, AND STATE OF MASSACHUSETTS.
2. THE CONTRACTOR SHALL VERIFY ALL GRADES ON THE GROUND AND REPORT ANY DISCREPANCIES IMMEDIATELY TO THE OWNER'S REPRESENTATIVE.
3. ALL GRADING IS TO BE SMOOTH AND CONTINUOUS WHERE PROPOSED SURFACE MEETS EXISTING SURFACE, BLEND THE TWO PAVEMENTS AND ELIMINATE ROUGH SPOTS AND ABRUPT GRADE CHANGES AND MEET LINE AND GRADE OF EXISTING CONDITIONS WITH NEW IMPROVEMENTS.
4. CONTRACTOR SHALL ENSURE ALL AREAS ARE PROPERLY PITCHED TO DRAIN, WITH NO SURFACE WATER PONDING OR PUDDLING.
5. ALL NEW WALKWAYS MUST CONFORM TO CURRENT AMERICANS WITH DISABILITIES ACT (ADA), AND MASSACHUSETTS ARCHITECTURAL ACCESS BOARD (MAAB) REGULATIONS: WALKWAYS SHALL MAINTAIN A CROSS PITCH OF NOT MORE THAN ONE AND A HALF (1.5%) PERCENT AND THE RUNNING SLOPE (PARALLEL TO THE DIRECTION OF TRAVEL) BETWEEN 1% MIN. AND 4.5% MAX. ANY DISCREPANCIES NOT ALLOWING THIS TO OCCUR SHALL BE REPORTED TO THE OWNER'S REPRESENTATIVE PRIOR TO CONTINUING WORK.
6. ALL UTILITY GRATES, COVERS OR OTHER SURFACE ELEMENTS INTENDED TO BE EXPOSED AT GRADE SHALL BE FLUSH WITH THE ADJACENT FINISHED GRADE AND ADJUSTED TO PROVIDE A SMOOTH TRANSITION AT ALL EDGES.
7. THE CONTRACTOR SHALL CONFIRM AND/OR SET SUBGRADE ELEVATIONS TO ALLOW FOR POSITIVE DRAINAGE AND PROVIDE EROSION CONTROL DEVICES, STRUCTURES, MATERIALS AND CONSTRUCTION METHODS TO DIRECT SILT MIGRATION AWAY FROM DRAINAGE AND OTHER UTILITY SYSTEMS, PUBLIC/PRIVATE STREETS AND WORK AREAS. CLEAN BASINS REGULARLY AND AT THE END OF THE PROJECT.
8. EXCAVATION REQUIRED WITHIN PROXIMITY OF KNOWN EXISTING UTILITY LINES SHALL BE DONE BY HAND. CONTRACTOR SHALL REPAIR ANY DAMAGE TO EXISTING UTILITY LINES OR STRUCTURES INCURRED DURING CONSTRUCTION OPERATIONS AT NO COST TO THE OWNER.
9. WHERE NEW EARTHWORK MEETS EXISTING EARTHWORK, CONTRACTOR SHALL BLEND NEW EARTHWORK SMOOTHLY INTO EXISTING, PROVIDING VERTICAL CURVES OR ROUNDS AT ALL TOP AND BOTTOM OF SLOPES.
10. WHERE A SPECIFIC LIMIT OF WORK LINE IS NOT OBVIOUS OR IMPLIED, BLEND GRADES TO EXISTING CONDITIONS WITHIN 5 FEET OF PROPOSED CONTOURS.
11. RESTORE ALL DISTURBED AREAS AND LIMITS OF ALL REMOVALS TO LOAM AND SEED UNLESS OTHERWISE NOTED.
12. SEE EARTHWORK SECTION OF SPECIFICATIONS FOR EXCAVATION AND FILLING PROCEDURES.



1 WALLIS ST ENLARGEMENT PLAN
SCALE: 1" = 10'-0"

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
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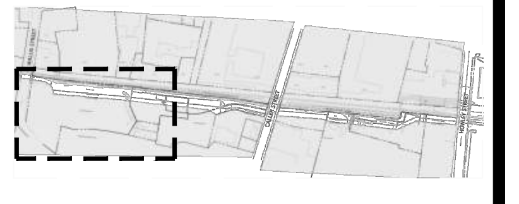

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Drawing Title:

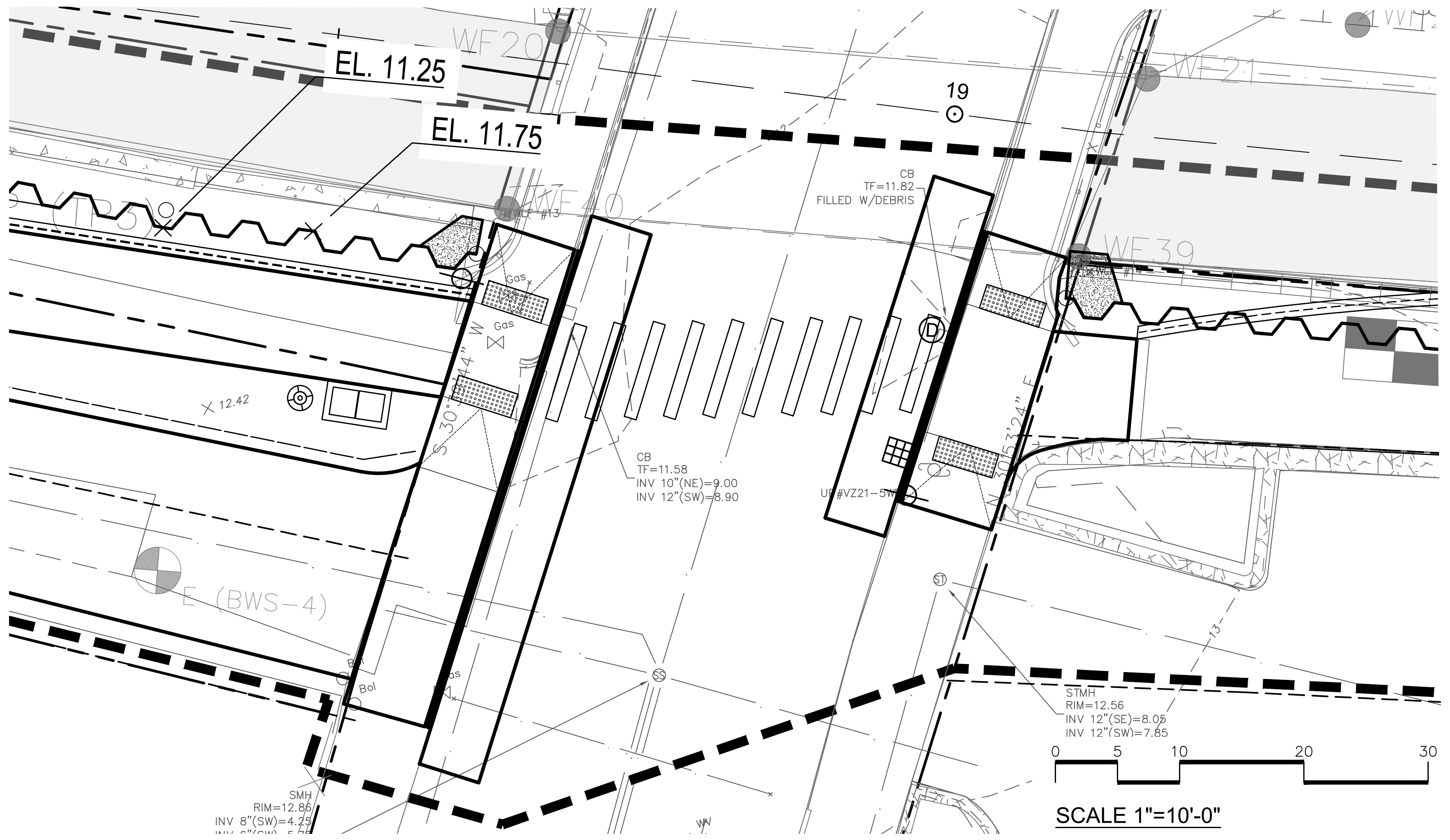
GRADING AND DRAINAGE PLAN

Sheet Number:

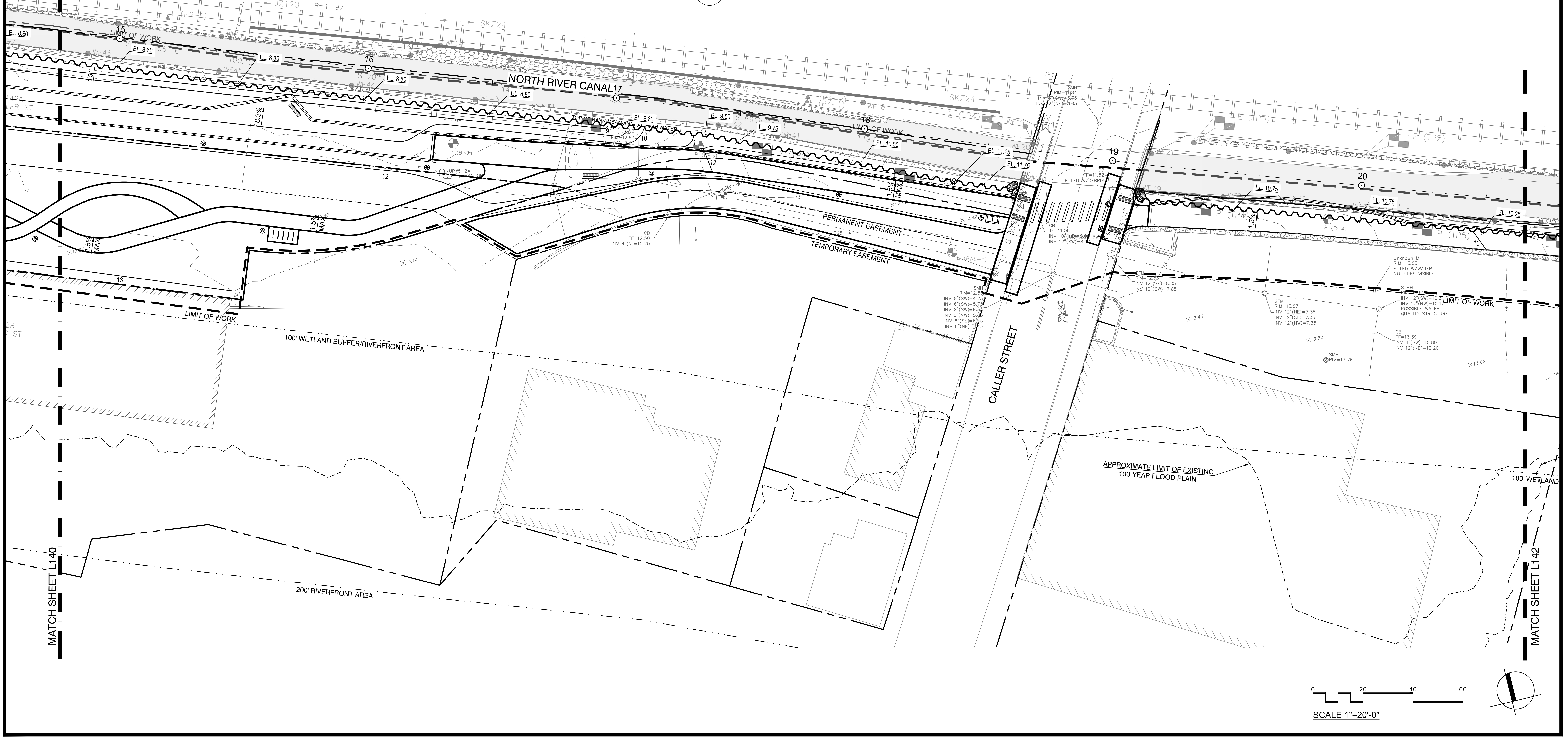
L140

LEGEND

▬ ─ ─ ▬	PROPERTY LINE	14 / 15	PROPOSED CONTOURS
▬ ▬ ▬	LIMIT OF WORK	1.5% →	PROPOSED SLOPE
─ ─ ─ ─	EASEMENTS	×─8.25	PROPOSED SPOT ELEVATION
─ ·· ─ ·· ─	100' WETLAND BUFFER	HDPE PERF. DRAIN PIPE	HDPE PERFORATED DRAIN PIPE, DIAMETER VARIES
─ ·· ─	200' RIVERFRONT PROTECTION AREA	─ ─ ─ ─	GRADE BREAK
─ · ─ · ─	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN	HP	HIGH POINT
⊞ Ⓓ	EXISTING DRAINAGE STRUCTURE. SEE UTILITIES PLAN	LP	LOW POINT
		TW	TOP OF WALL
		BW	BOTTOM OF WALL
		EL	ELEVATION
12	EXISTING CONTOURS		
95.10 +	EXISTING SPOT ELEVATION		



1 CALLER STREET ENLARGEMENT PLAN
SCALE: 1" = 10'-0"



Project:

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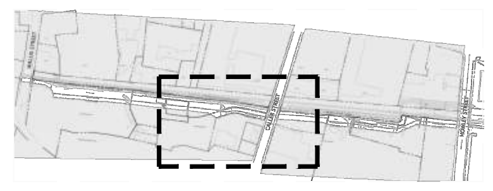

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Drawing Title:

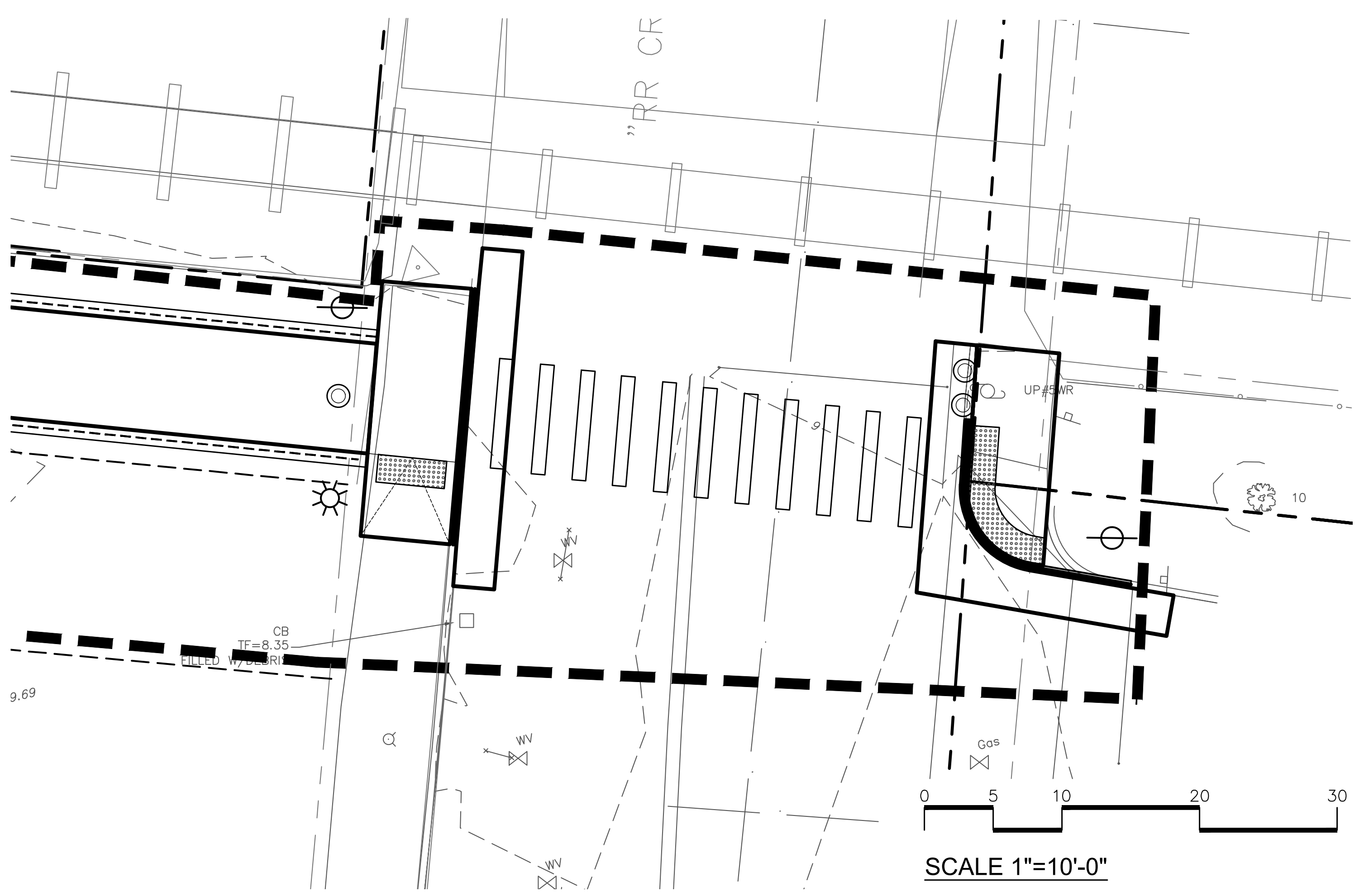
GRADING AND
DRAINAGE PLAN

Sheet Number:

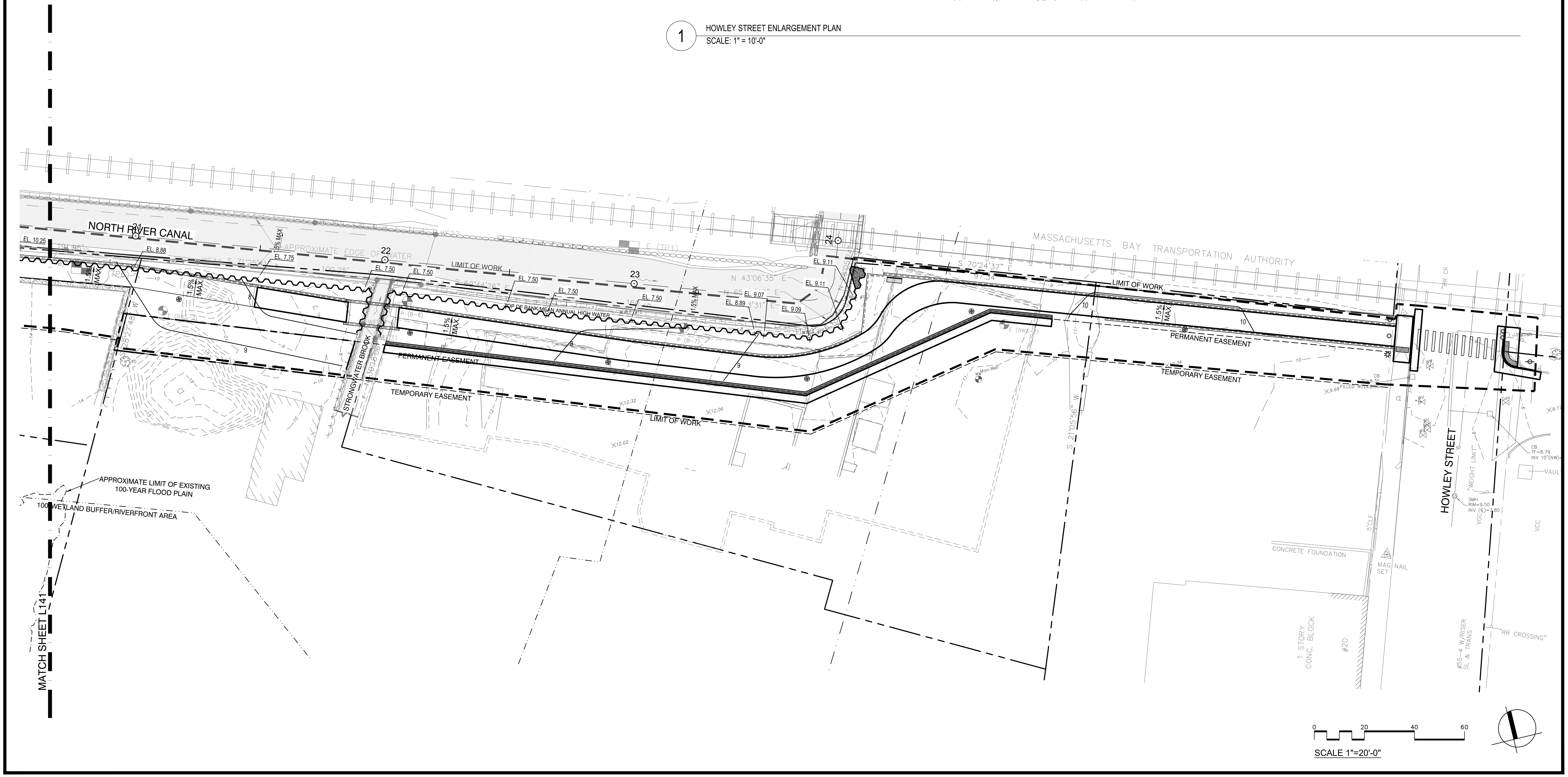
L141

LEGEND

	PROPERTY LINE	14 15	PROPOSED CONTOURS
	LIMIT OF WORK		
	EASEMENTS	1.5%	PROPOSED SLOPE
	100' WETLAND BUFFER	8.25	PROPOSED SPOT ELEVATION
	200' RIVERFRONT PROTECTION AREA	HDPE PERF. DRAIN PIPE	HDPE PERFORATED DRAIN PIPE, DIAMETER VARIES
	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN		GRADE BREAK
⊞ Ⓓ	EXISTING DRAINAGE STRUCTURE. SEE UTILITIES PLAN	HP	HIGH POINT
		LP	LOW POINT
		TW	TOP OF WALL
12	EXISTING CONTOURS	BW	BOTTOM OF WALL
		EL	ELEVATION
95.10	EXISTING SPOT ELEVATION		



1 HOWLEY STREET ENLARGEMENT PLAN
SCALE: 1" = 10'-0"



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Approved By: CFR

W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

GRADING AND
DRAINAGE PLANS

Sheet Number:

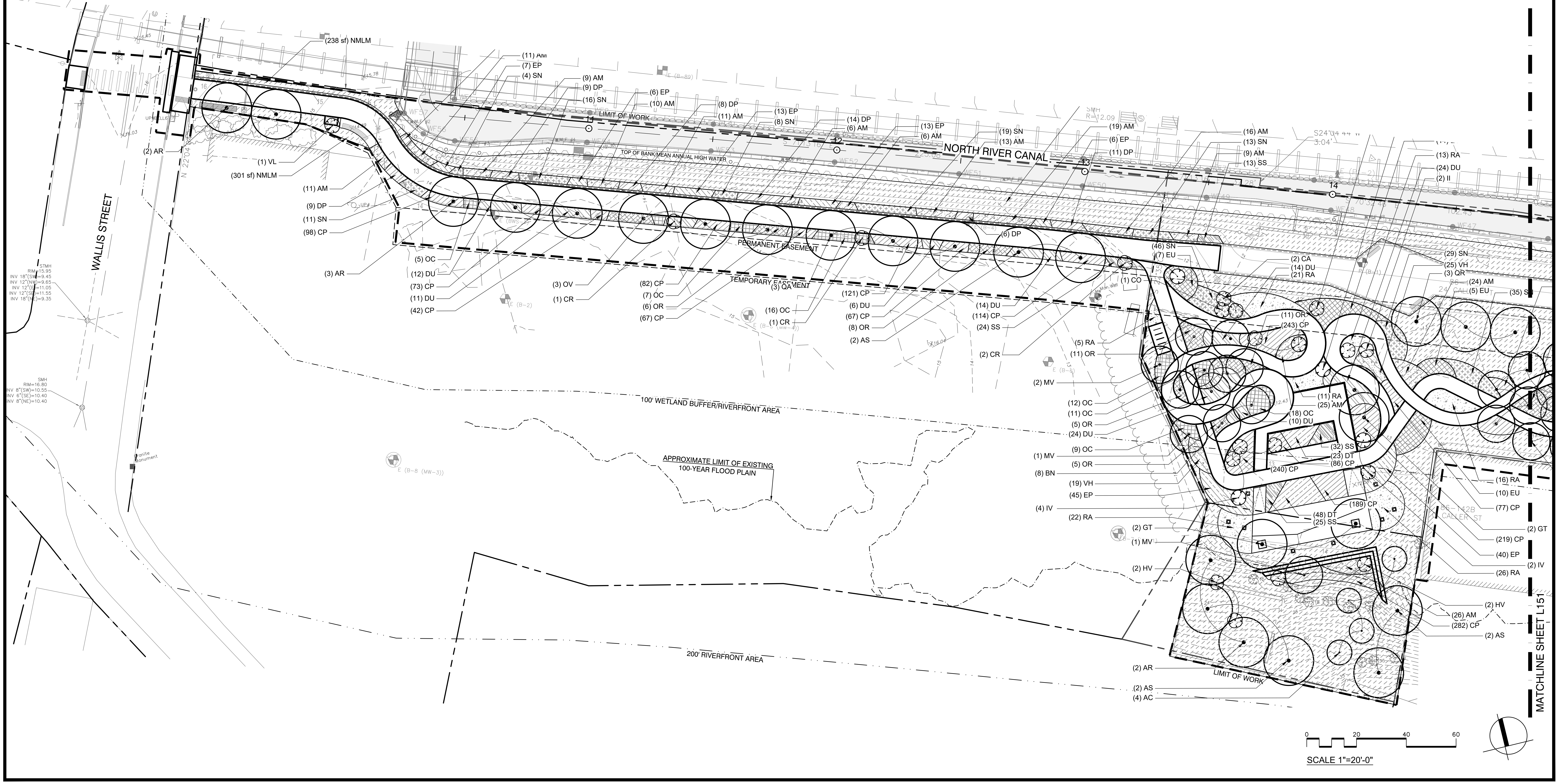
L142

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- SHEET PILE WALL
- ▨ NO-MOW SEED MIX
- PROPOSED TREES
- PROPOSED SHRUBS

PLANT SCHEDULE L150

TREES	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
AR	Acer rubrum	Red Maple	3" Cal.		7
AS	Acer saccharum	Sugar Maple	---		6
AC	Amelanchier canadensis `Autumn Brilliance`	Autumn Brilliance Serviceberry	3" Cal.		4
BN	Betula nigra "Dura-Heat"	River Birch "Dura-Heat"	3" Cal.		8
BP	Betula papyrifera	Paper Birch	3" Cal.		2
GT	Gleditsia triacanthos	Honey Locust	---		4
MV	Magnolia virginiana	Sweet Bay	3" Cal.		4
OV	Ostrya virginiana	American Hophornbeam	3" Cal.		3
QA	Quercus alba	White Oak	3" Cal.		3
QR	Quercus rubra	Red Oak	---		3
SHRUBS	BOTANICAL NAME	COMMON NAME	SIZE		QTY
CO	Cephalanthus occidentalis	Buttonbush	#2 Pot		1
CA	Clethra alnifolia	Summersweet	#3 Pot		2
CR	Cornus racemosa	Gray Dogwood	#3 Pot		4
HV	Hamamelis virginiana	Common Witch Hazel	#3 Pot		4
IV	Ilex verticillata "Winter Red"	Winterberry "Winter Red"	#3 Pot		6
II	Itea virginica	Virginia Sweetspire	#2 Pot		5
VL	Viburnum lentago	Nannyberry	#3 Pot		2
SHRUB AREAS	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
RA	Rhus aromatica "Gro-Low"	Fragrant Sumac "Gro-Low"	#3 Pot	36" o.c.	114
GROUND COVERS	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
AM	Achillea millefolium	Common Yarrow	1 gal.	24" o.c.	196
CP	Carex pensylvanica		---	10" o.c.	2,207
DP	Dalea purpurea		---	24" o.c.	61
DU	Dennstaedtia punctilobula	Hay-scented Fern	---	30" o.c.	124
DT	Deschampsia cespitosa	Tufted Hair Grass	---	24" o.c.	71
EP	Echinacea purpurea	Coneflower	---	24" o.c.	130
EU	Eutrochium purpureum		---	48" o.c.	36
OC	Osmunda cinnamomea		---	30" o.c.	82
OR	Osmunda regalis		---	36" o.c.	55
SS	Schizachyrium scoparium	Little Bluestem	---	18" o.c.	94
SN	Solidago nemoralis		---	24" o.c.	181
VH	Verbena hastata	Blue Vervain	---	24" o.c.	44
SEEDING	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
NMLM	No Mow Lawn Mix		---		12,764 sf



Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
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No.	Date	Description

Seal:

NO. 1220

Key Plan:

Issued For:

75% PERMITTING SET
- NOT FOR CONSTRUCTION -

Scale:	1" = 20'
Date:	APRIL 2021
Drawn By:	SG
Reviewed By:	CC
Approved By:	
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

PLANTING PLAN

Sheet Number:

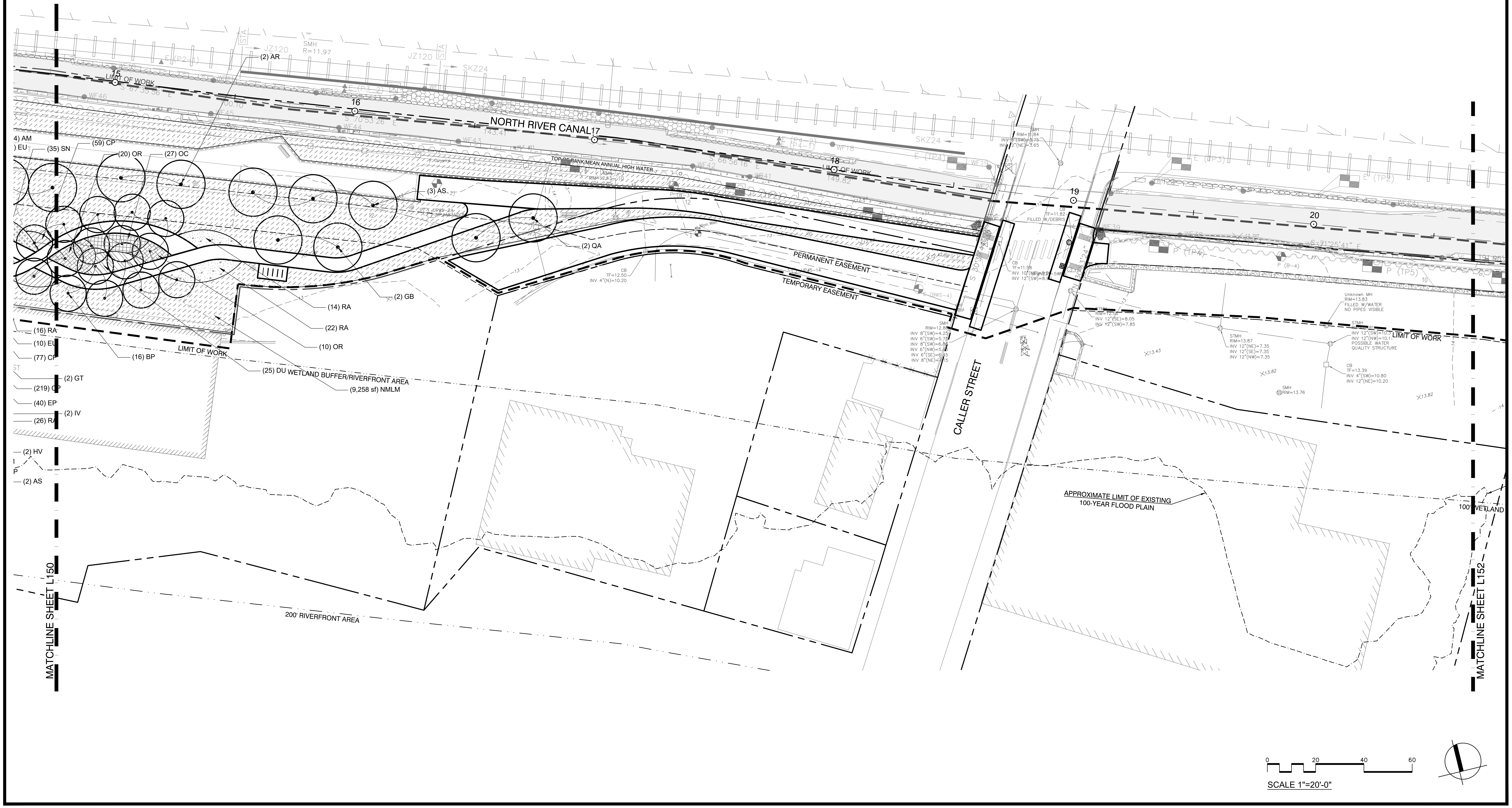
L150

LEGEND

— - —	PROPERTY LINE
— — —	LIMIT OF WORK
- - -	EASEMENTS
-·-·-	100' WETLAND BUFFER
—·—·—	100' RIVERFRONT PROTECTION AREA
-··-··-	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
∿∿∿	SHEET PILE WALL
▨	NO-MOW SEED MIX
○	PROPOSED TREES
○	PROPOSED SHRUBS

PLANT SCHEDULE L151

TREES	BOTANICAL NAME	COMMON NAME	SIZE		QTY
AR	Acer rubrum	Red Maple	3" Cal.		2
AS	Acer saccharum	Sugar Maple	---		3
BP	Betula papyrifera	Paper Birch	3" Cal.		14
GB	Ginkgo biloba	Maidenhair Tree	3" Cal.		2
QA	Quercus alba	White Oak	3" Cal.		2
SHRUB AREAS	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
RA	Rhus aromatica "Gro-Low"	Fragrant Sumac "Gro-Low"	#3 Pot	36" o.c.	36
GROUND COVERS	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
DU	Dennstaedtia punctilobula	Hay-scented Fern	---	30" o.c.	25
OC	Osmunda cinnamomea		---	30" o.c.	27
OR	Osmunda regalis		---	36" o.c.	30
SEEDING	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
NMLM	No Mow Lawn Mix		---		8,777 sf



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Seal:

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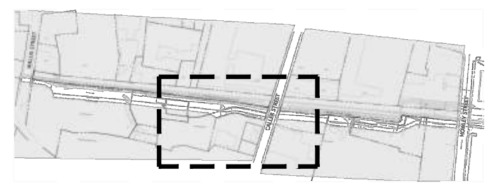
NO. 1220

Key Plan:



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W&S Project No.:	ENG20-0145
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PLANTING PLAN

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L151

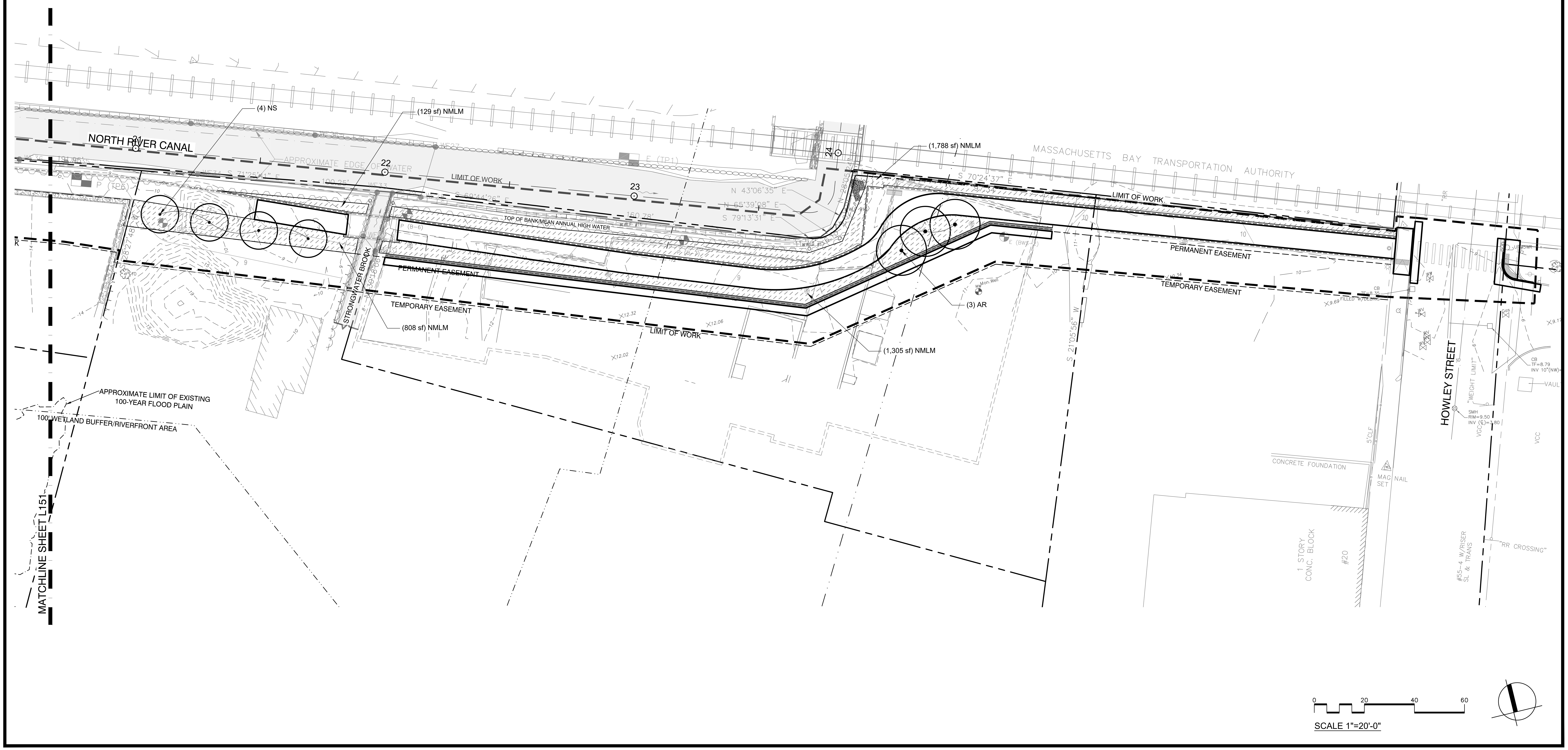
LEGEND

PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
100' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
SHEET PILE WALL
▨ NO-MOW SEED MIX
PROPOSED TREES
PROPOSED SHRUBS

PLANT SCHEDULE L152

TREES	BOTANICAL NAME	COMMON NAME	SIZE		QTY
AR	Acer rubrum	Red Maple	3" Cal.		3
NS	Nyssa sylvatica	Sour Gum	3" Cal.		4

SEEDING	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
NMLM	No Mow Lawn Mix		---		4,031 sf



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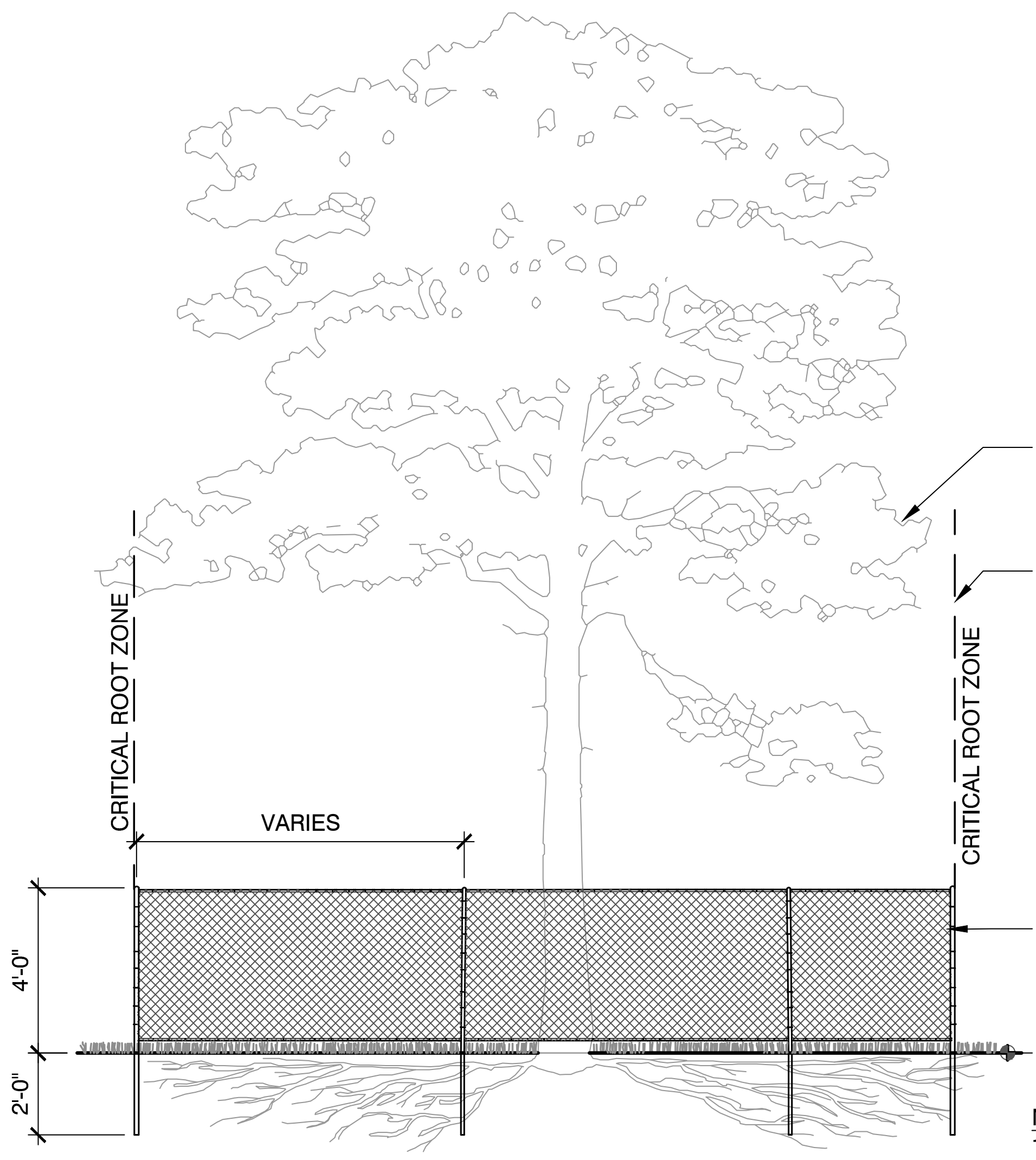
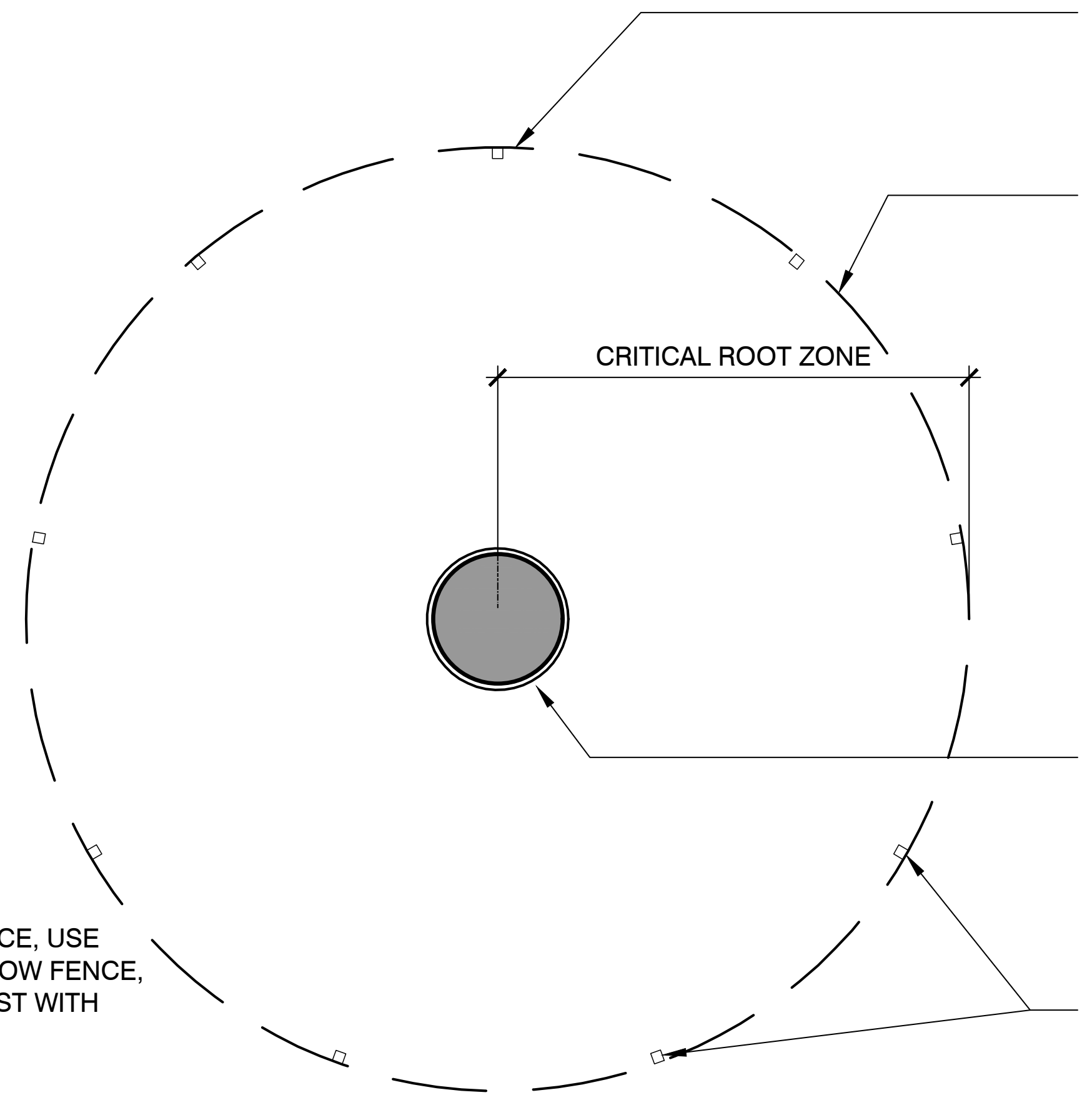


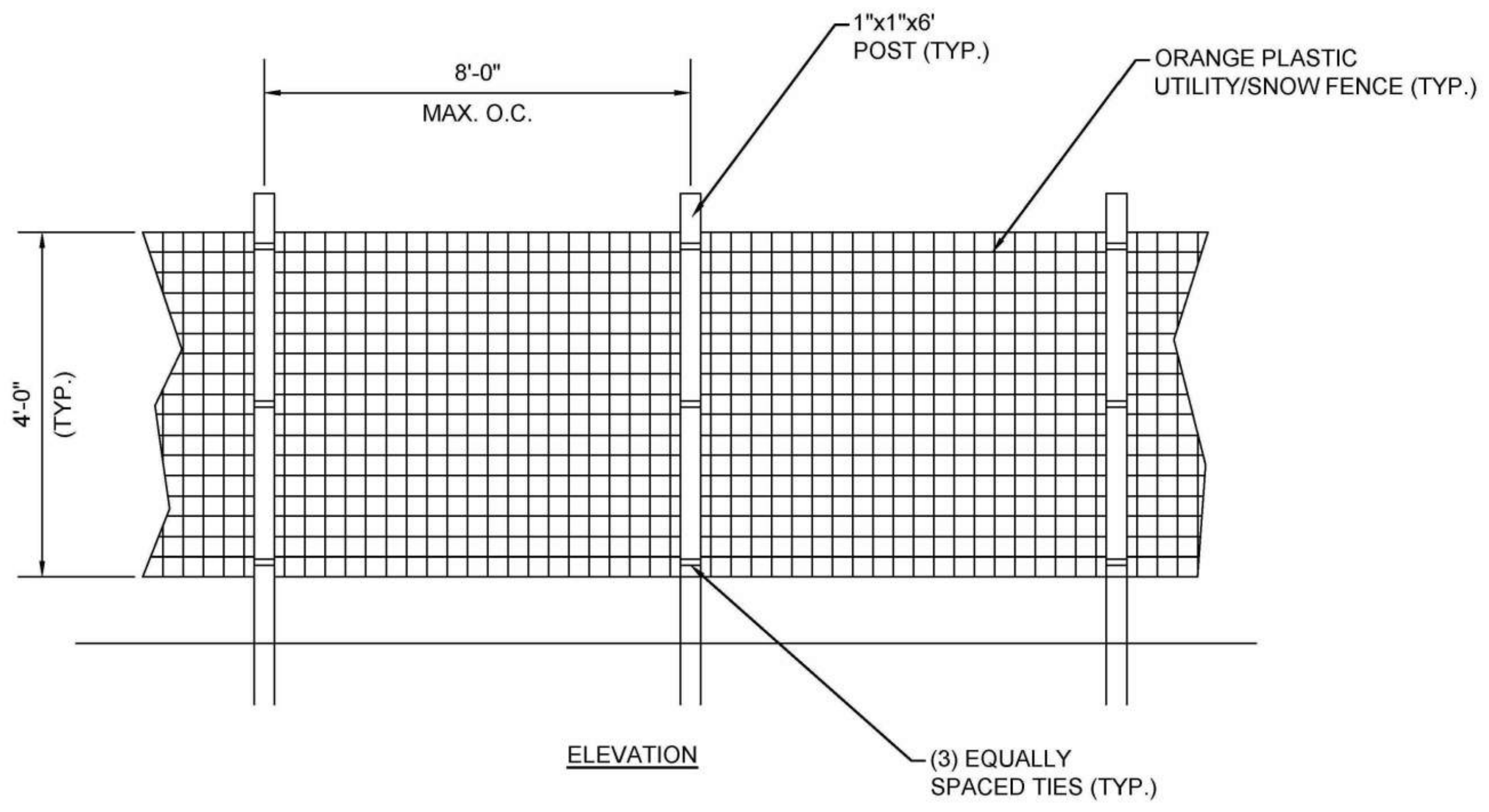


NOTES:

1. WHERE SPACE IS AVAILABLE, TREE PROTECTION FENCE TO BE PLACED A MINIMUM OF 10'-0" FROM BASE OF TREE. ADD AN ADDITIONAL 1'-0" FOR EACH ADDITIONAL DBH INCH FOR TREES GREATER THAN 10" DBH (DIA. AT BREAST HT.).
2. ALL WORK DONE WITHIN TREE PROTECTION FENCE IS TO BE DONE BY HAND AND WITH LIGHT EQUIPMENT.
3. ROOTS EXPOSED DURING EXCAVATION SHALL BE NEATLY CUT AND COVERED WITH SOIL IMMEDIATELY.
4. FOR TREES THAT OCCUR IN GROUPS, PROVIDE TREE PROTECTION FENCE AROUND ENTIRE AREA.
5. MAINTAIN FENCE PROTECTION IN SOUND CONDITION UNTIL CONSTRUCTION COMPLETION.
6. A CERTIFIED ARBORIST SHALL DELINEATE LIMIT OF TREE PROTECTION FENCE AS IT RELATES TO THE LIMITS OF THE CRITICAL ROOT ZONE.
7. CRITICAL ROOT ZONE TO BE PROTECTED. ALL WORK NECESSARY WITHIN THE CRITICAL ROOT ZONE SHALL BE PERFORMED BY HAND.

1 TREE PROTECTION

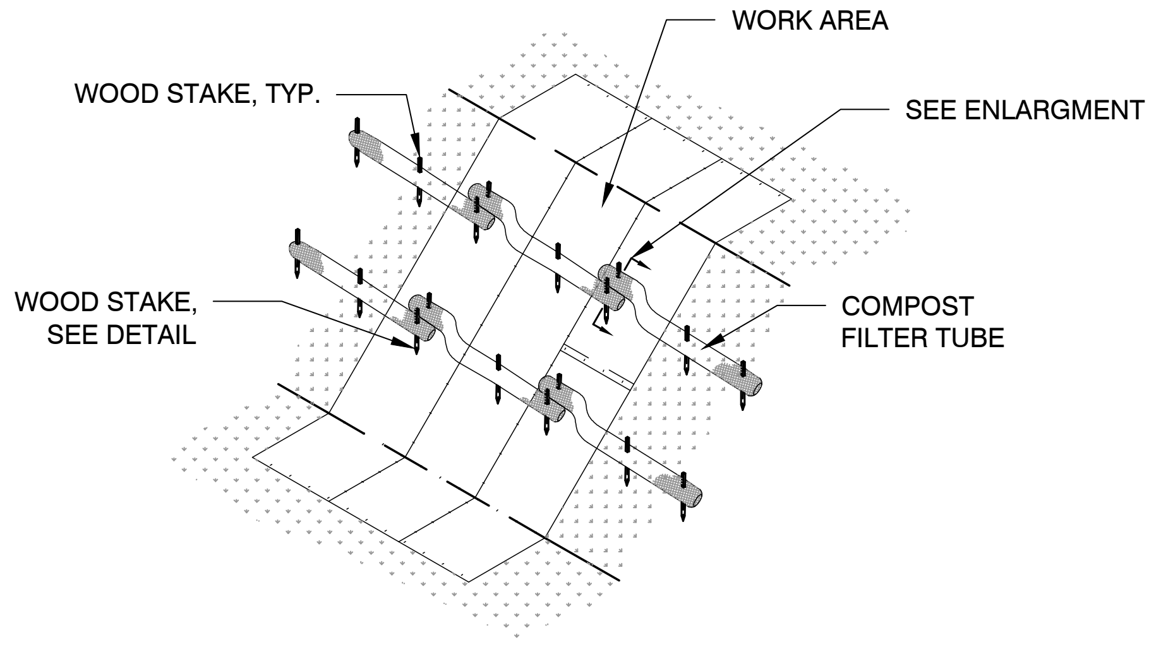
SCALE: N.T.S.



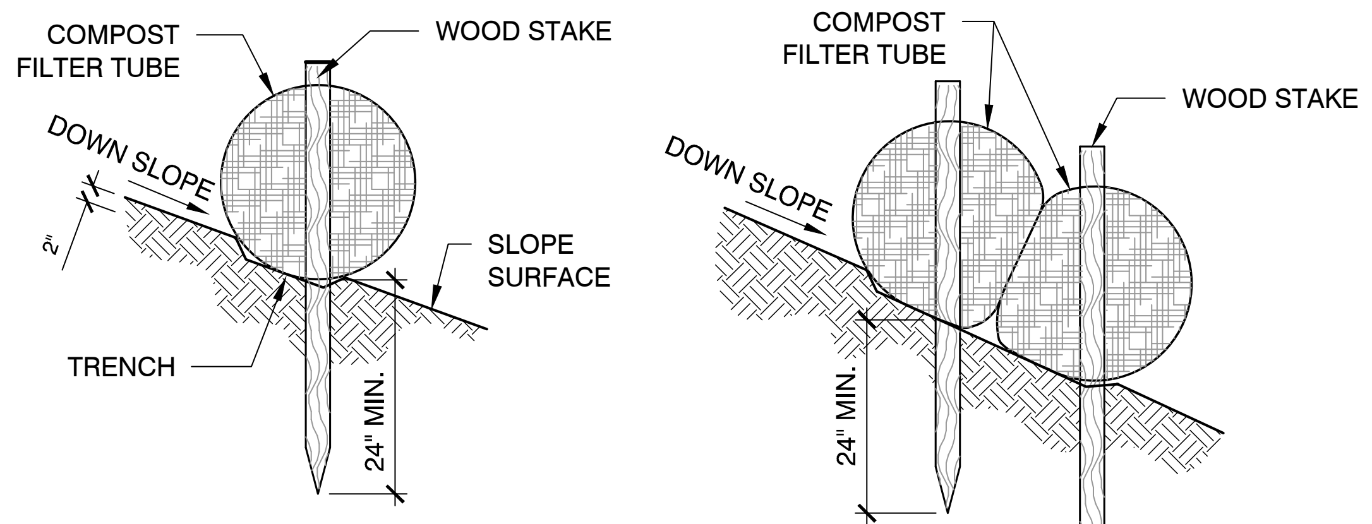
ELEVATION

2 TEMPORARY CONSTRUCTION FENCE

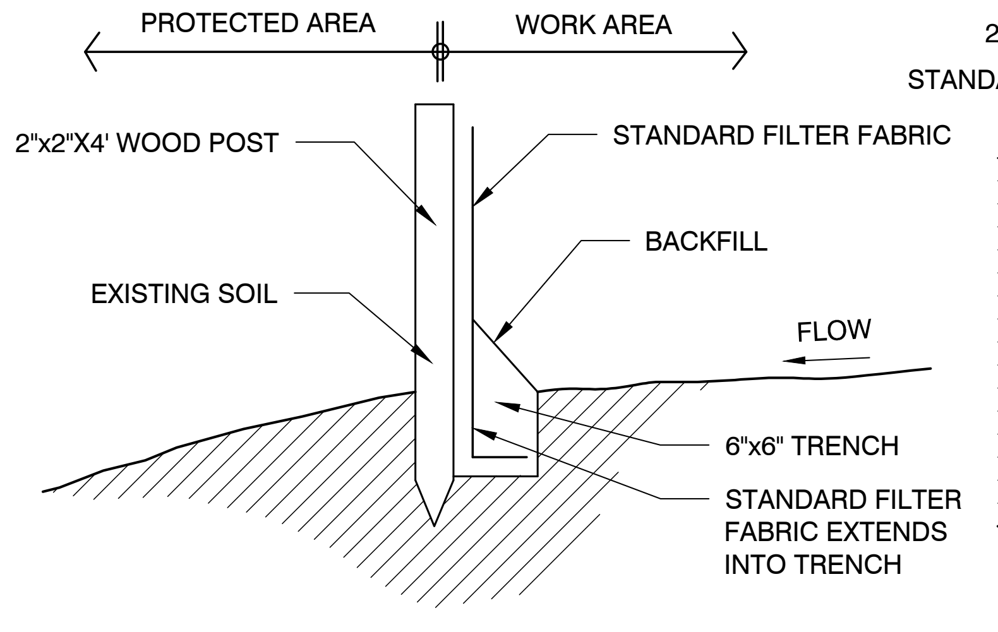
SCALE: N.T.S.



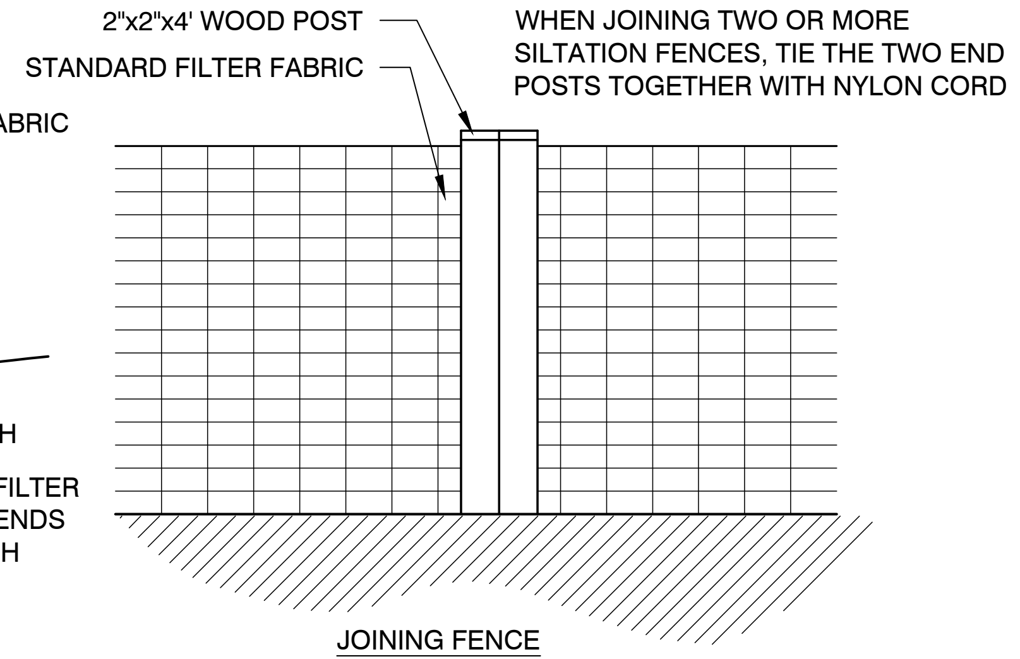
COMPOST FILTER TUBE LAYOUT ON SLOPE



COMPOST FILTER TUBE STAKING DETAILS



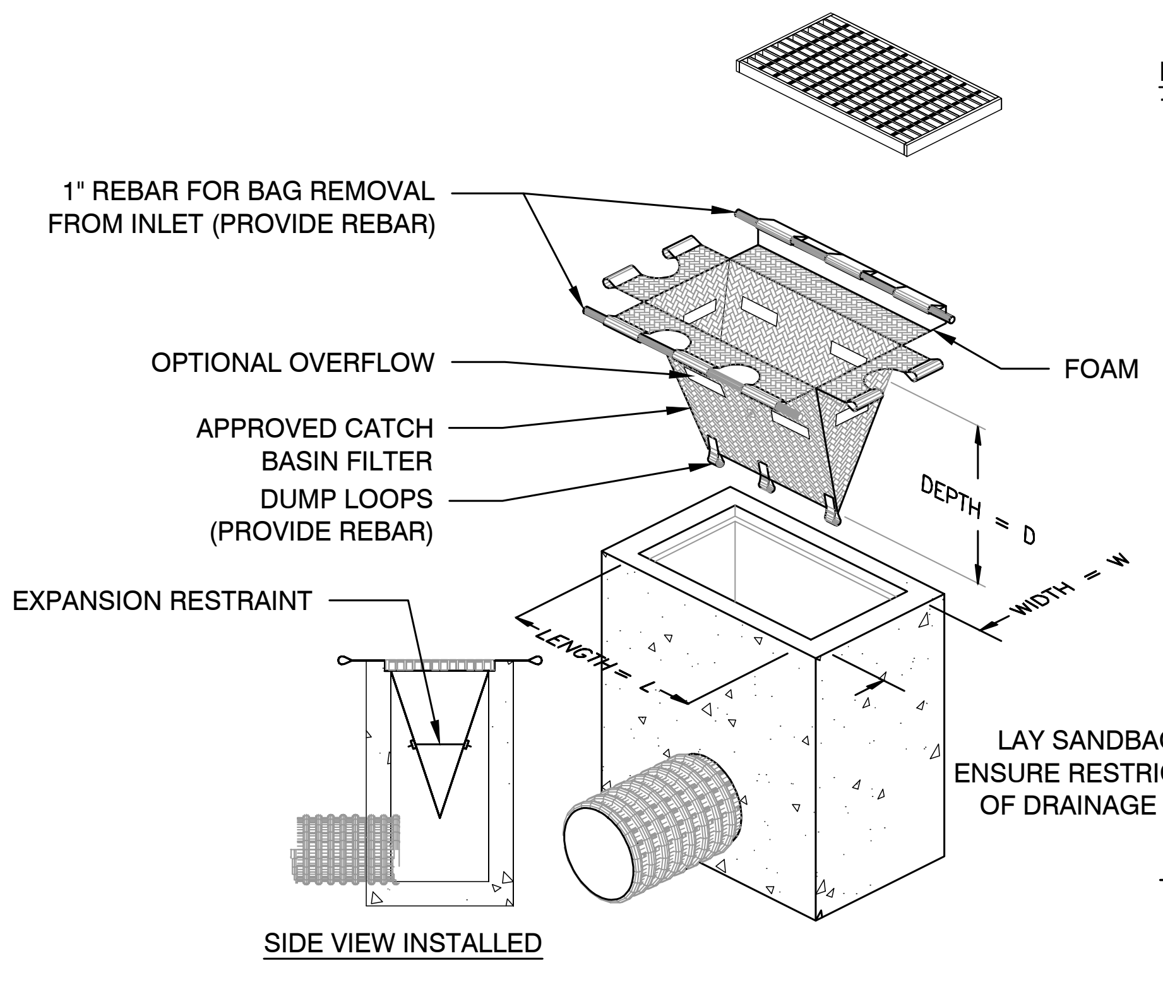
SLOPE DETAIL



JOINING FENCE

3 EROSION CONTROL - COMPOST FILTER TUBE

SCALE: N.T.S.

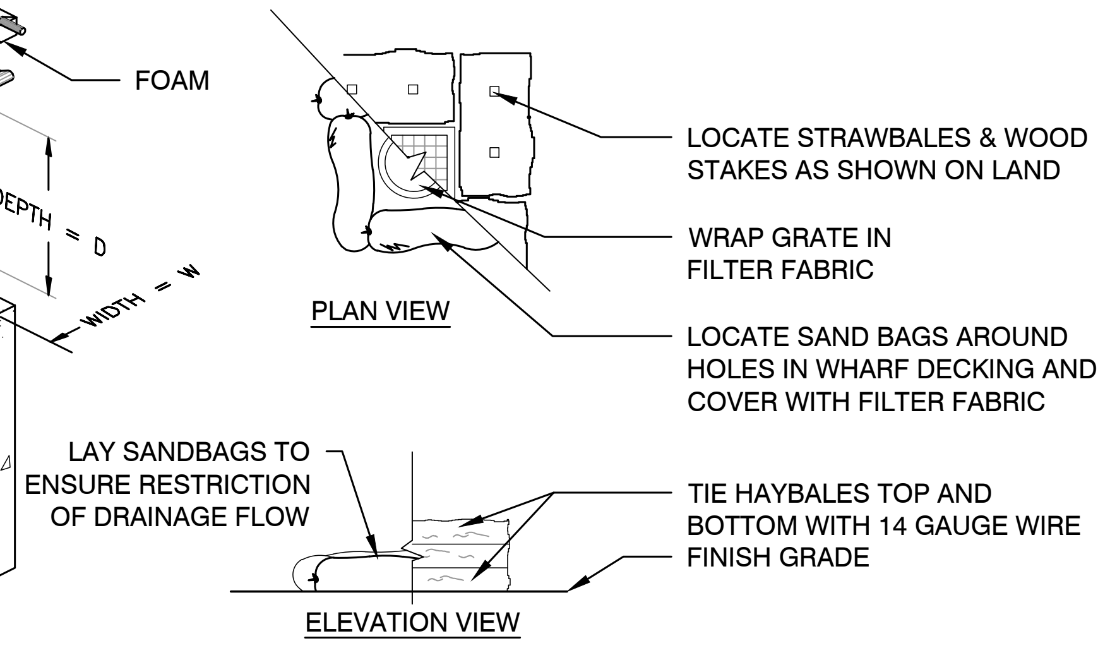


SIDE VIEW INSTALLED

INSTALLATION IN PAVED AREAS

NOTES:

1. HAYBALE/SANDBAG PROTECTION OR CATCH BASIN FILTER FOR PAVED AREAS SHALL BE PROVIDED FOR ALL DRAINAGE STRUCTURES WITHIN THE LIMIT OF WORK AND ANY STRUCTURES OUTSIDE THE PROJECT TERMINII THAT ARE AFFECTED BY CONSTRUCTION.



PLAN VIEW

ELEVATION VIEW

INSTALLATION IN GRASS AREAS

4 INLET SEDIMENT CONTROL

SCALE: N.T.S.

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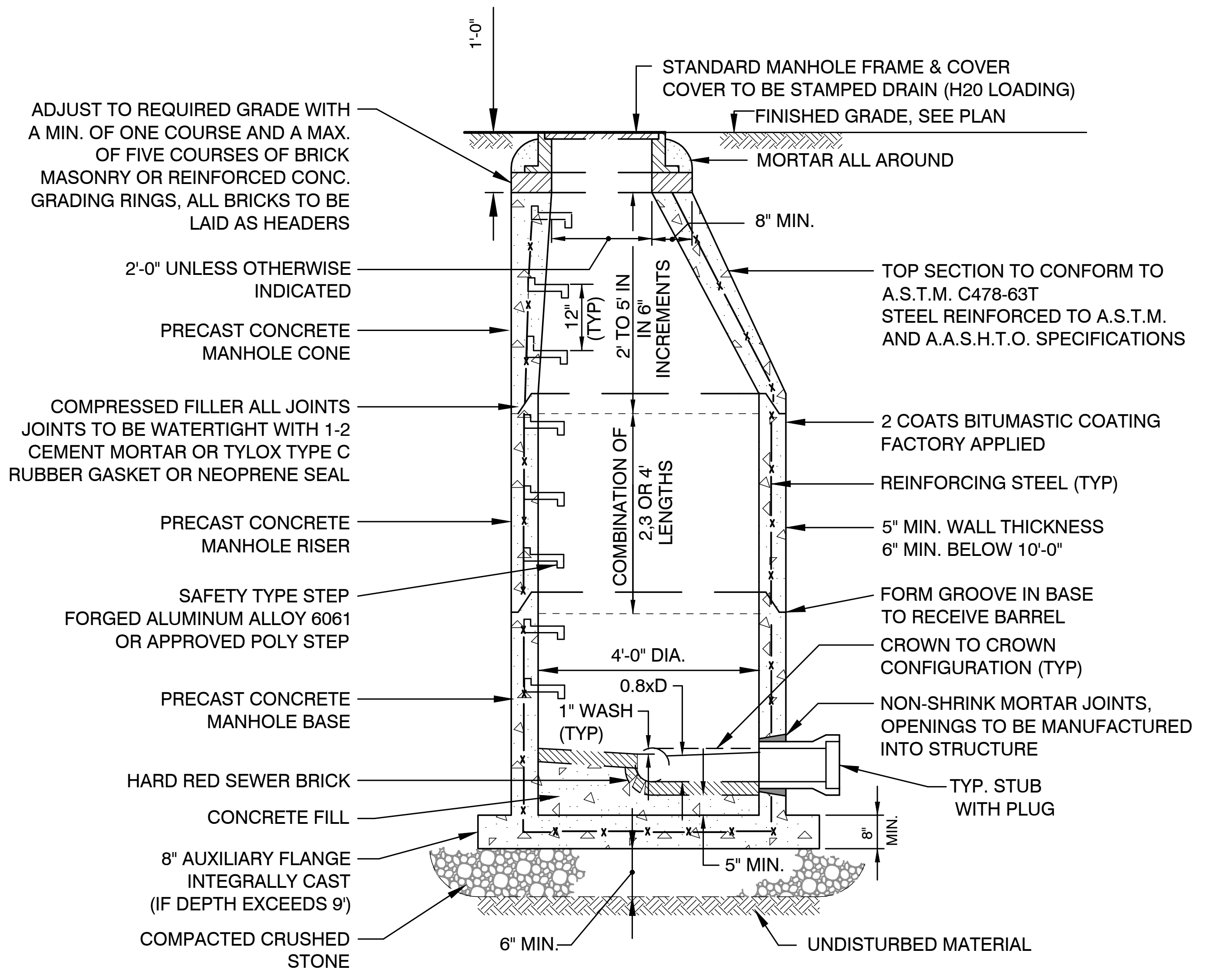
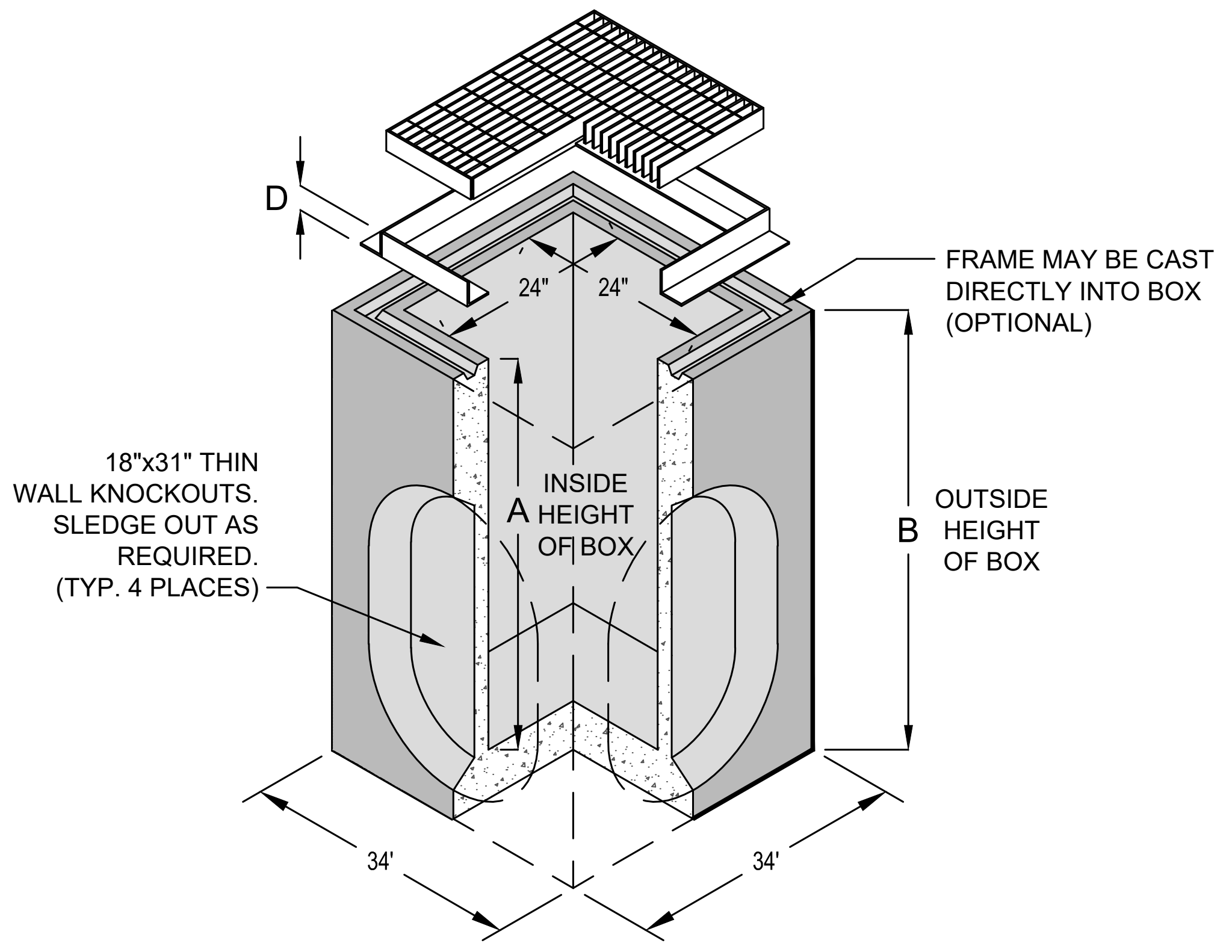


1 DRAIN MANHOLE

SCALE: N.T.S.



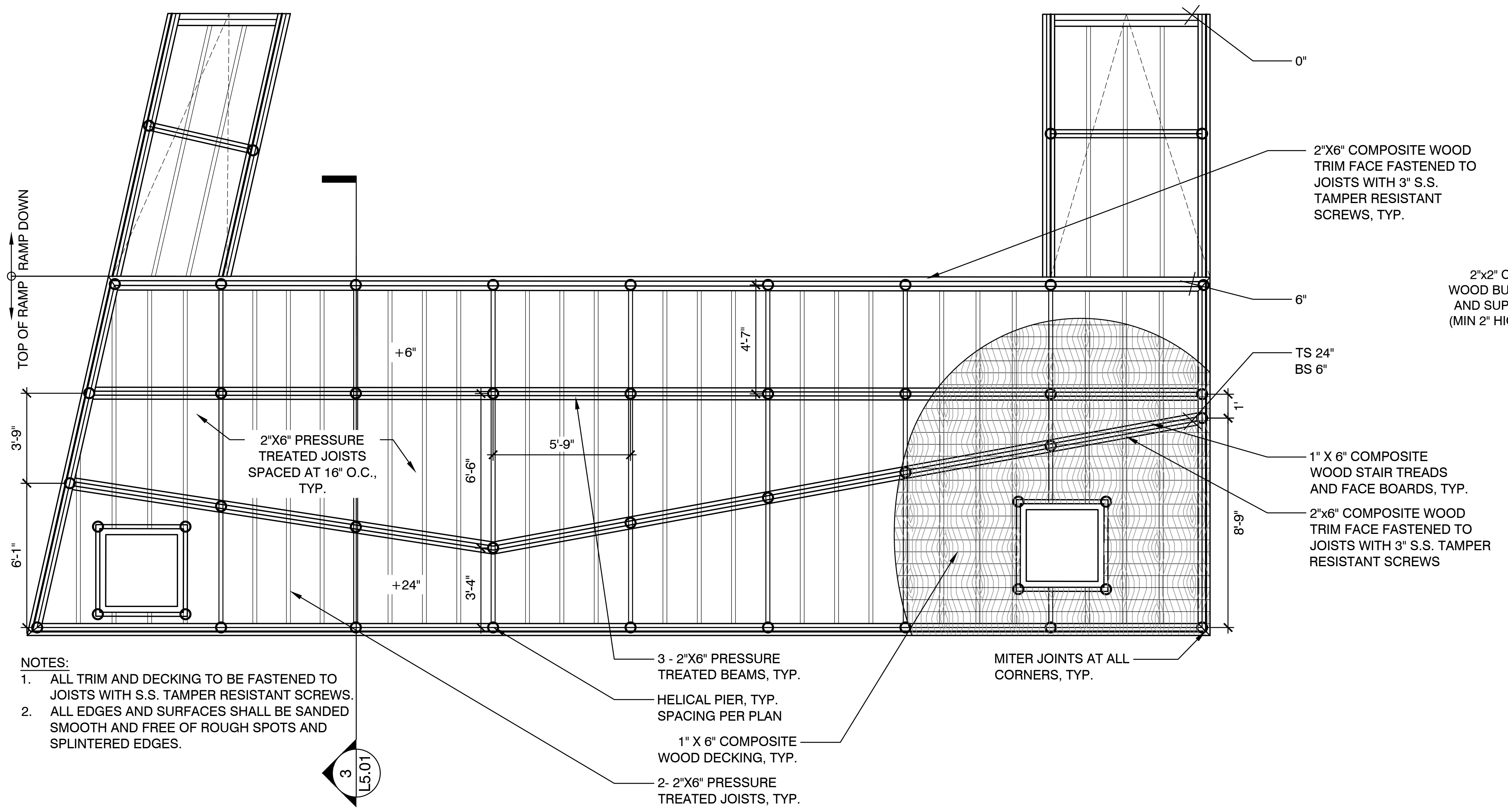
DROP INLET			
MODEL NO.	A	B	* WEIGHT
DI242436	36"	42"	1900 LBS.

* BOX ONLY

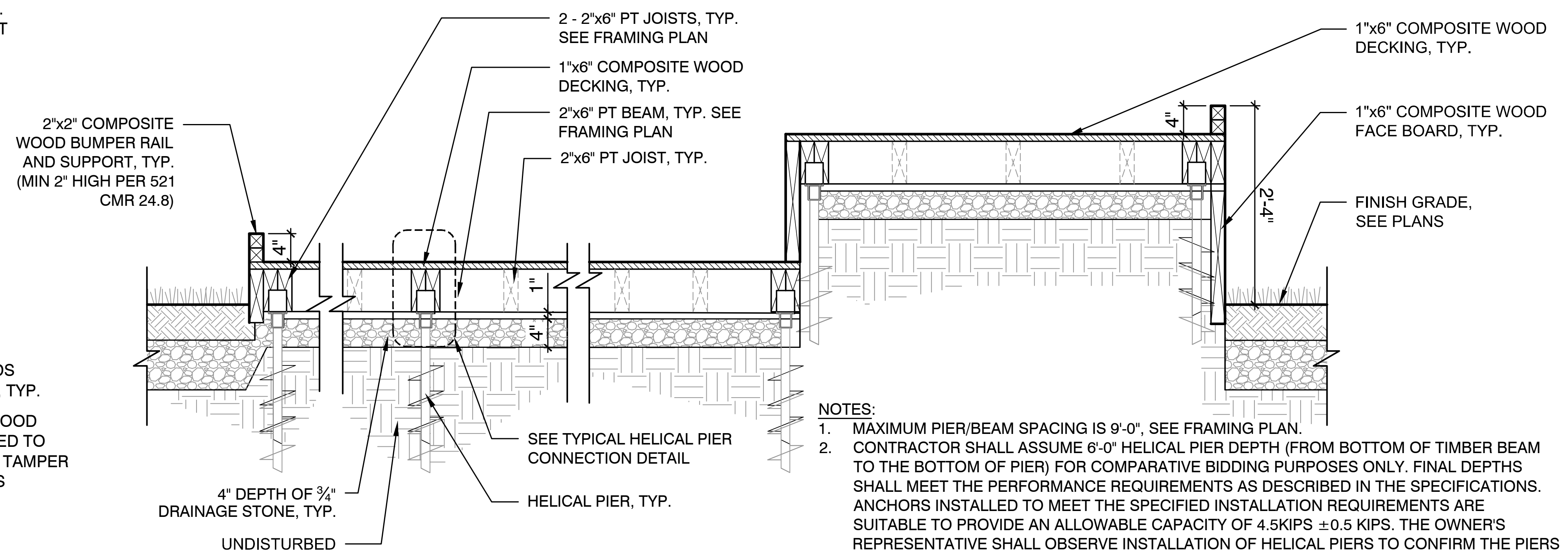
FRAME AND GRATE			
MODEL NO.	RATING	D	WEIGHT
SG2424-DIT	TRAFFIC	3"	120 LBS.

2 DROP INLET

SCALE: N.T.S.

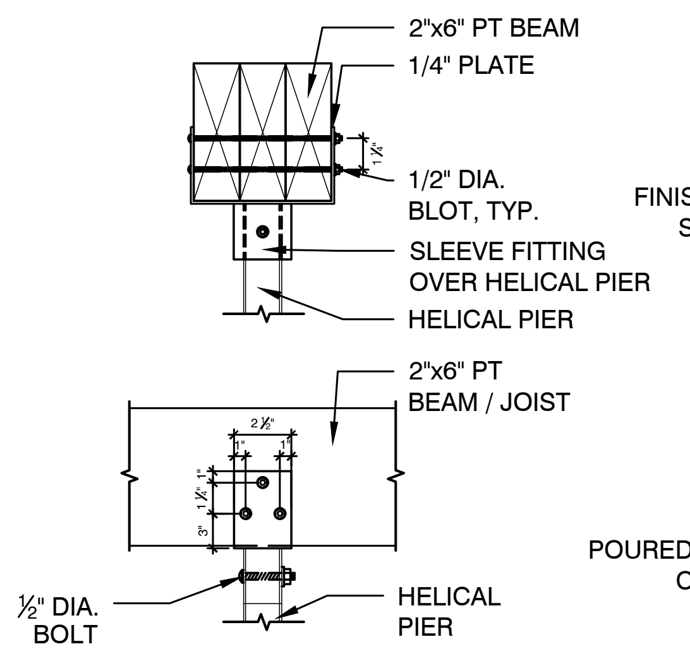


NOTES:
1. ALL TRIM AND DECKING TO BE FASTENED TO JOISTS WITH S.S. TAMPER RESISTANT SCREWS.
2. ALL EDGES AND SURFACES SHALL BE SANDED SMOOTH AND FREE OF ROUGH SPOTS AND SPLINTERED EDGES.

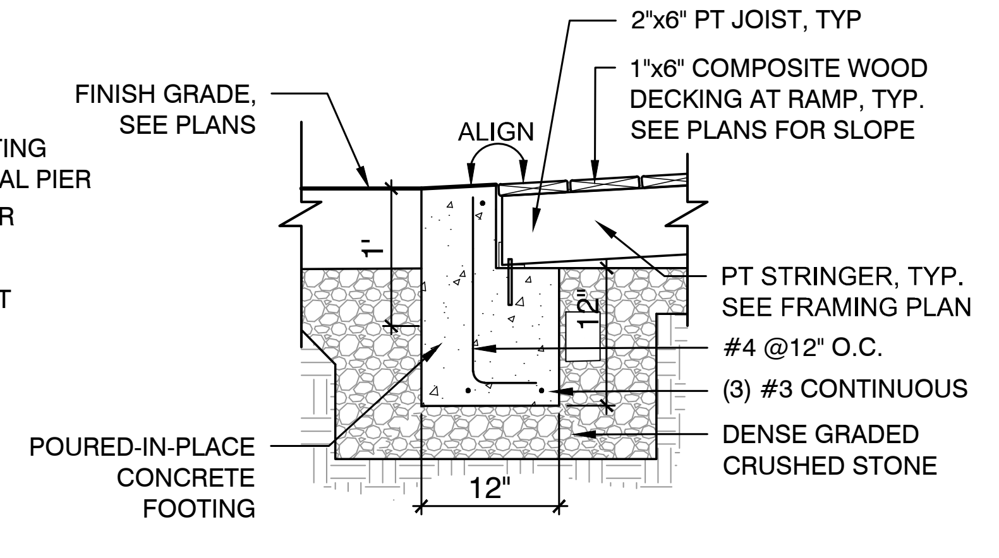


NOTES:
1. MAXIMUM PIER/BEAM SPACING IS 9'-0", SEE FRAMING PLAN.
2. CONTRACTOR SHALL ASSUME 6'-0" HELICAL PIER DEPTH (FROM BOTTOM OF TIMBER BEAM TO THE BOTTOM OF PIER) FOR COMPARATIVE BIDDING PURPOSES ONLY. FINAL DEPTHS SHALL MEET THE PERFORMANCE REQUIREMENTS AS DESCRIBED IN THE SPECIFICATIONS. ANCHORS INSTALLED TO MEET THE SPECIFIED INSTALLATION REQUIREMENTS ARE SUITABLE TO PROVIDE AN ALLOWABLE CAPACITY OF 4.5KIPS ±0.5 KIPS. THE OWNER'S REPRESENTATIVE SHALL OBSERVE INSTALLATION OF HELICAL PIERS TO CONFIRM THE PIERS ARE INSTALLED TO REQUIRED EMBEDMENT DEPTHS AND CAPACITIES.
3. ALL TRIM AND DECKING TO BE FASTENED TO JOISTS WITH S.S. TAMPER RESISTANT SCREWS.
4. CONTRACTOR SHALL PROVIDE 2" EDGE CURB AT ALL VERTICAL REVEALS ALONG LENGTH OF RAMP.

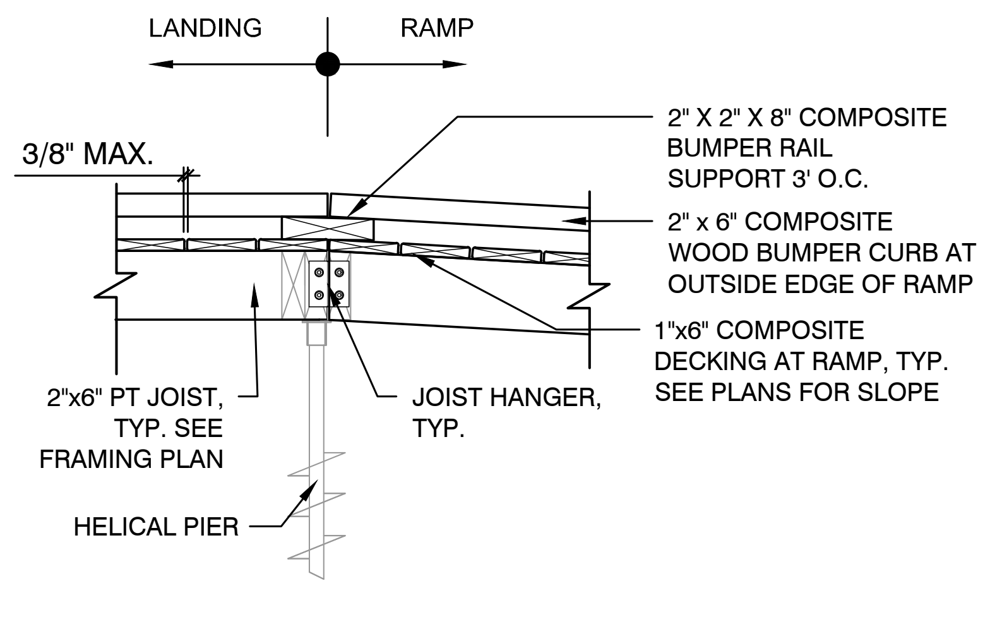
DECK SECTION



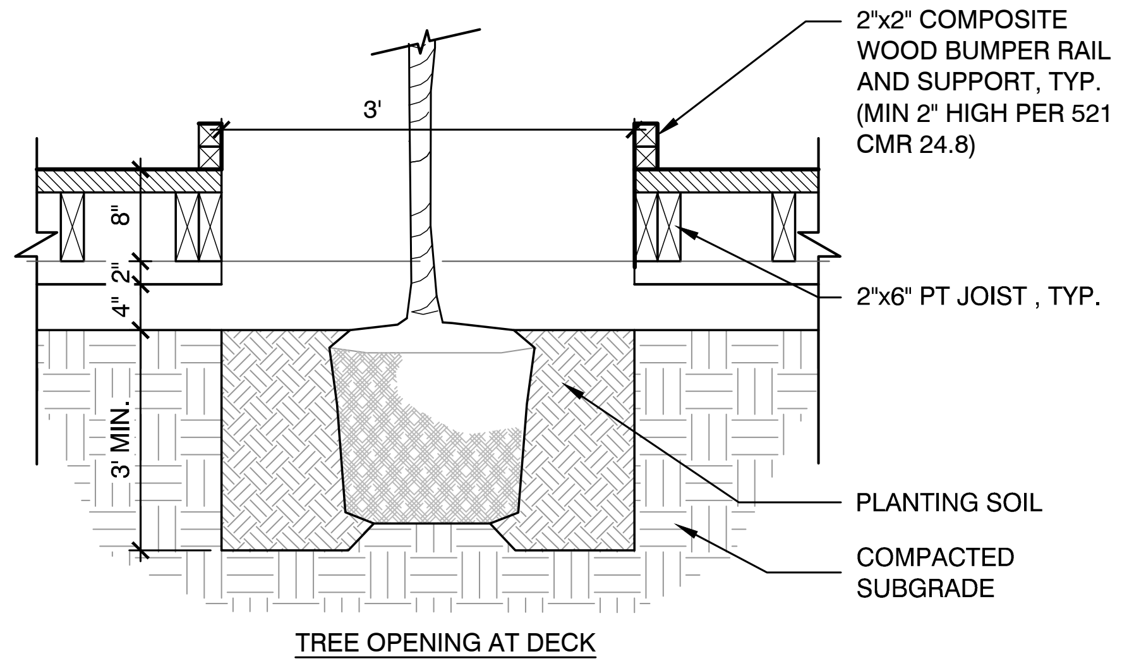
PILE CONNECTION



BOTTOM OF RAMP



TOP OF RAMP



TREE OPENING AT DECK

3 WOOD DECKING

SCALE: N.T.S.

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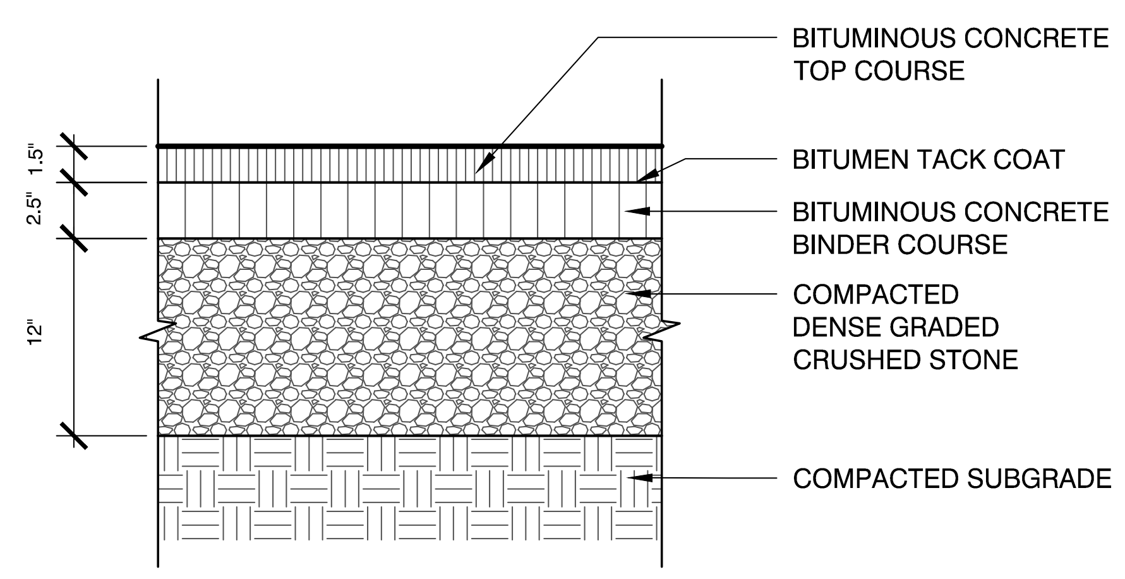
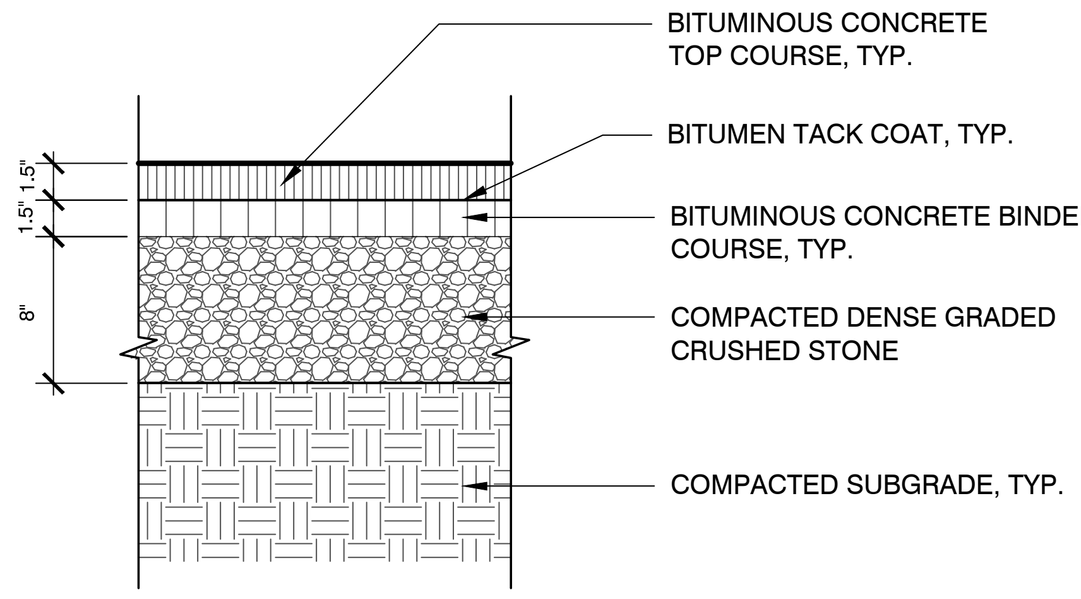


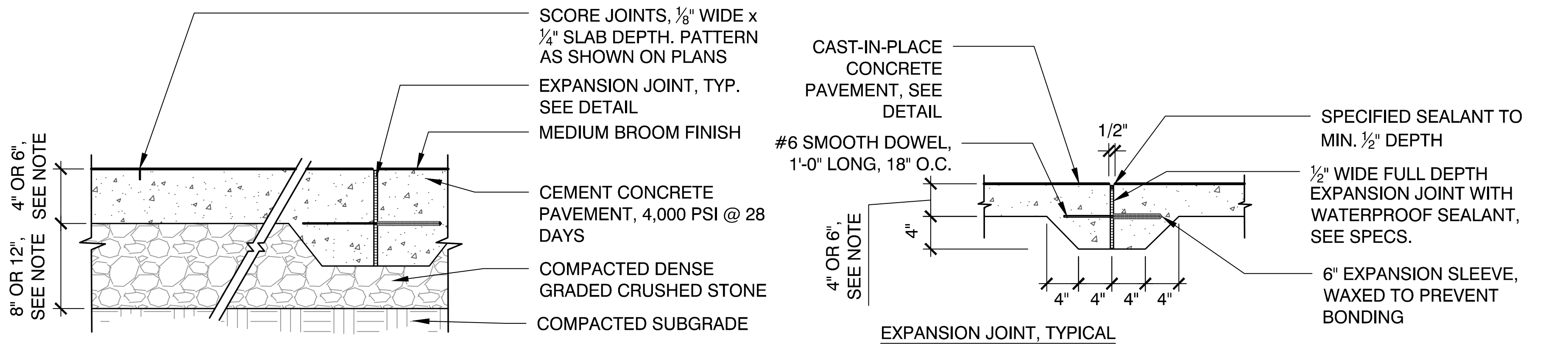
NOTES:
1. CONTRACTOR TO PROVIDE SMOOTH TRANSITION WHERE NEW PAVEMENT ABUTS EXISTING PAVEMENT, TYP.

1 VEHICULAR BITUMINOUS CONCRETE PAVEMENT
SCALE: N.T.S.



NOTE:
1. CONTRACTOR TO PROVIDE SMOOTH TRANSITION WHERE NEW PAVEMENT ABUTS EXISTING PAVEMENT, TYP.

2 PEDESTRIAN BITUMINOUS CONCRETE PAVEMENT
SCALE: N.T.S.



CAST-IN-PLACE CONCRETE PAVEMENT

EXPANSION JOINT, TYPICAL

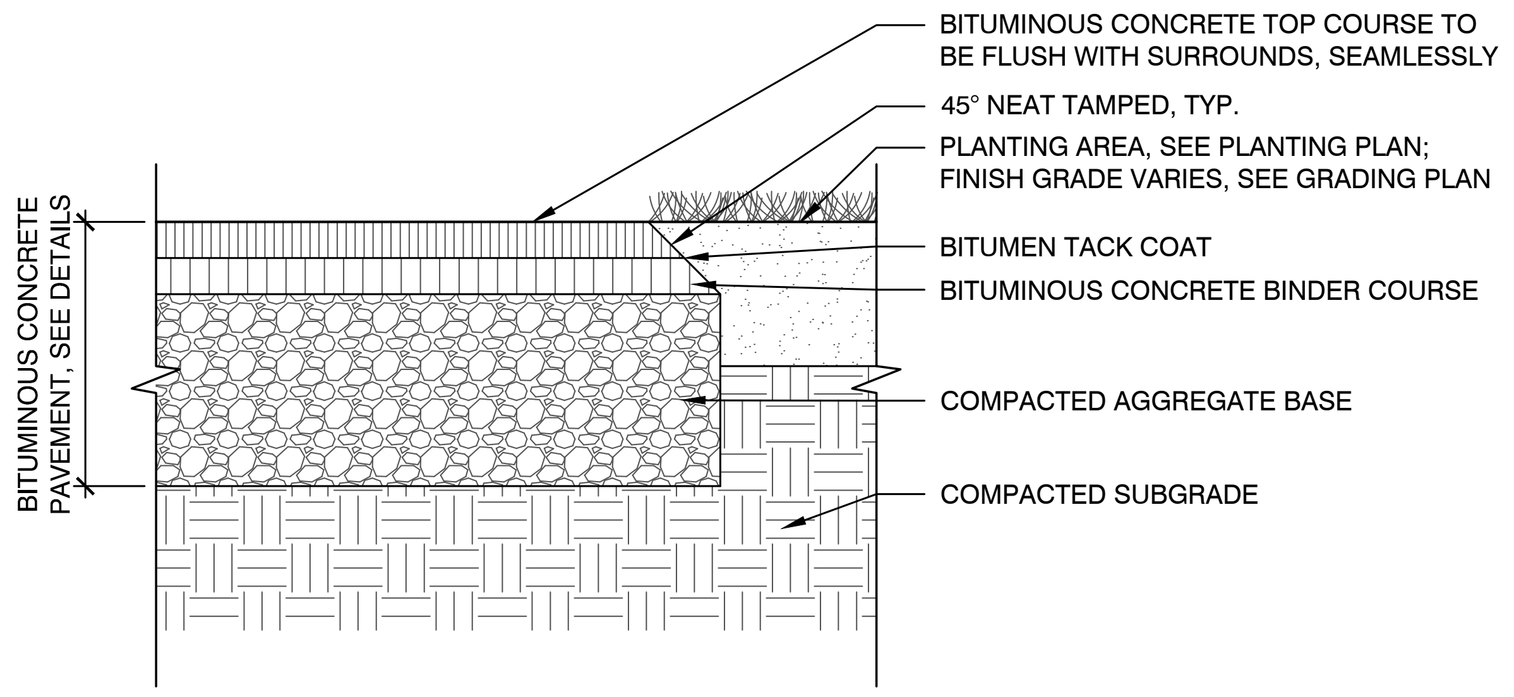
CAST-IN-PLACE CONCRETE NOTES:

1. PEDESTRIAN CAST-IN-PLACE CONCRETE PAVEMENT TO BE 4" THICK, WITH 8" COMPACTED DENSE CRUSHED STONE.
2. VEHICULAR CAST-IN-PLACE CONCRETE PAVEMENT TO BE 6" THICK, WITH 12" COMPACTED DENSE GRADED CRUSHED STONE.

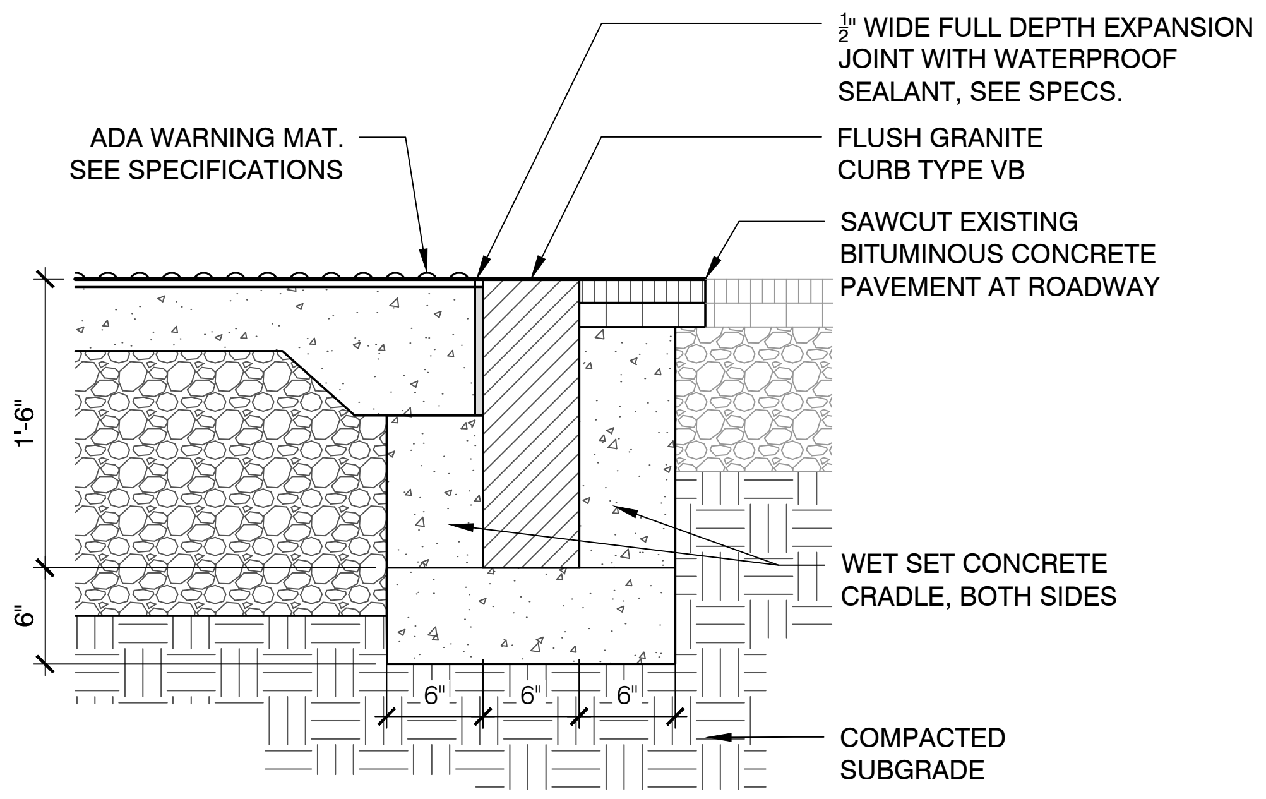
EXPANSION JOINT INSTALLATION NOTES:

1. DOWEL IS TYPICAL AT ALL EXPANSION JOINTS (18" O.C.) WITHIN CONCRETE PAVING AND BETWEEN NEW CONCRETE PAVING AND EXISTING CONCRETE PAVING TO REMAIN.
2. DELETE EXPANSION SLEEVE AND DOWEL WHERE JOINT ABUTS WALL, CURBS, OR OTHER VERTICAL SURFACES, UNLESS OTHERWISE NOTED.
3. EXPANSION JOINTS MAX. 25'-0" O.C. UNLESS SHOWN OTHERWISE.
4. ALL SCORE JOINTS SHALL BE TOOLED.

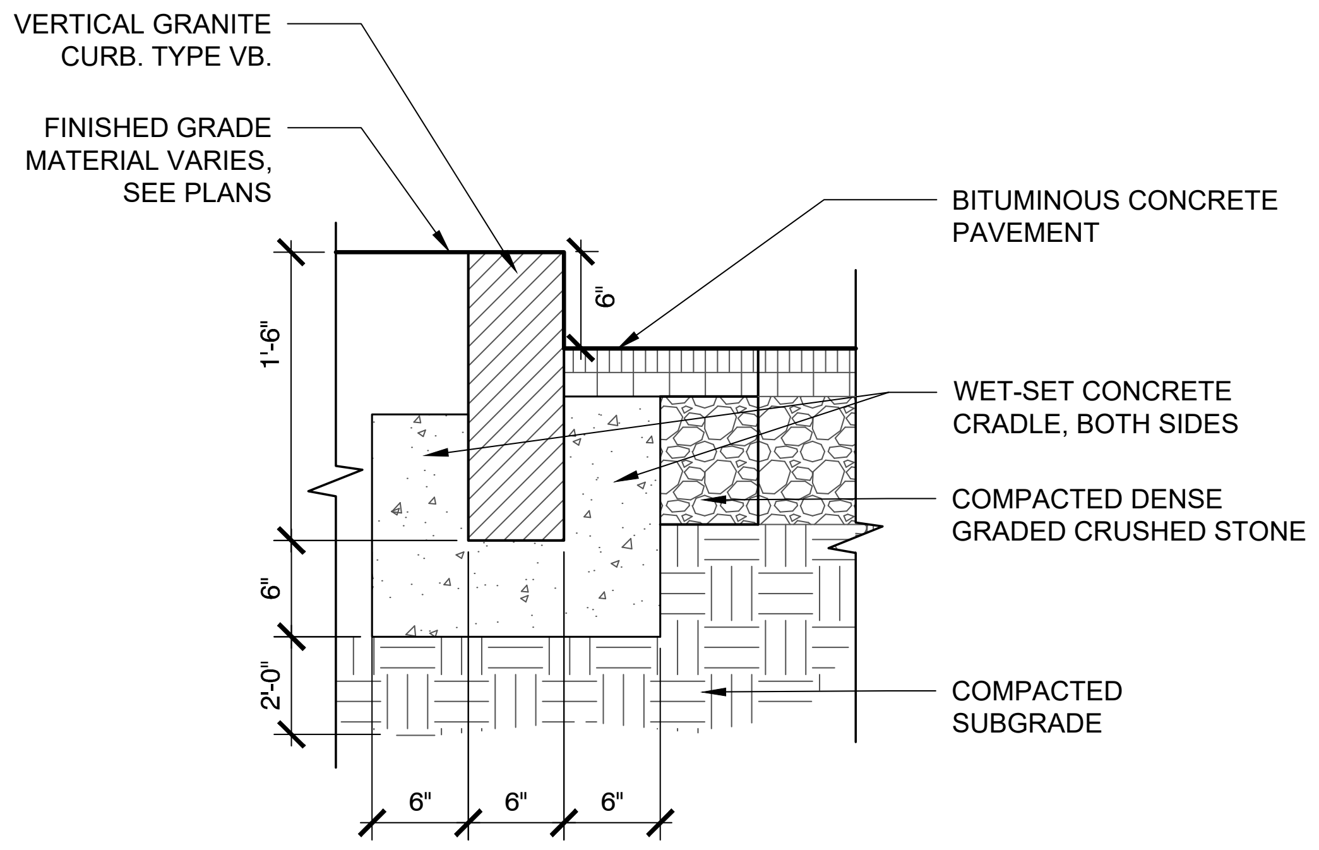
3 CIP CONCRETE PAVEMENT
SCALE: N.T.S.



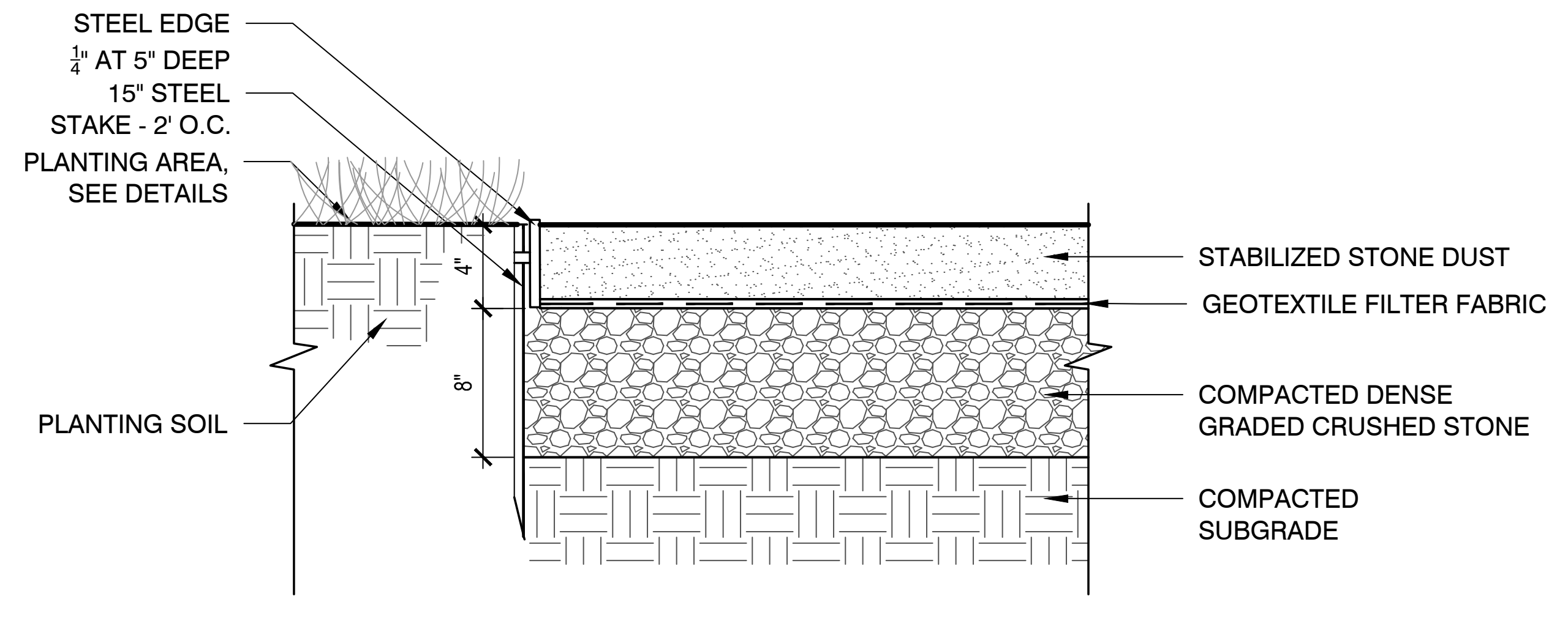
4 BITUMINOUS CONCRETE AT PLANTING
SCALE: N.T.S.



5 FLUSH GRANITE CURB WITH ADA DETECTABLE WARNING MAT
SCALE: N.T.S.



6 VERTICAL GRANITE CURB
SCALE: N.T.S.



STONE DUST AT PLANTING AREA

7 STONE DUST PAVING WITH STEEL EDGE
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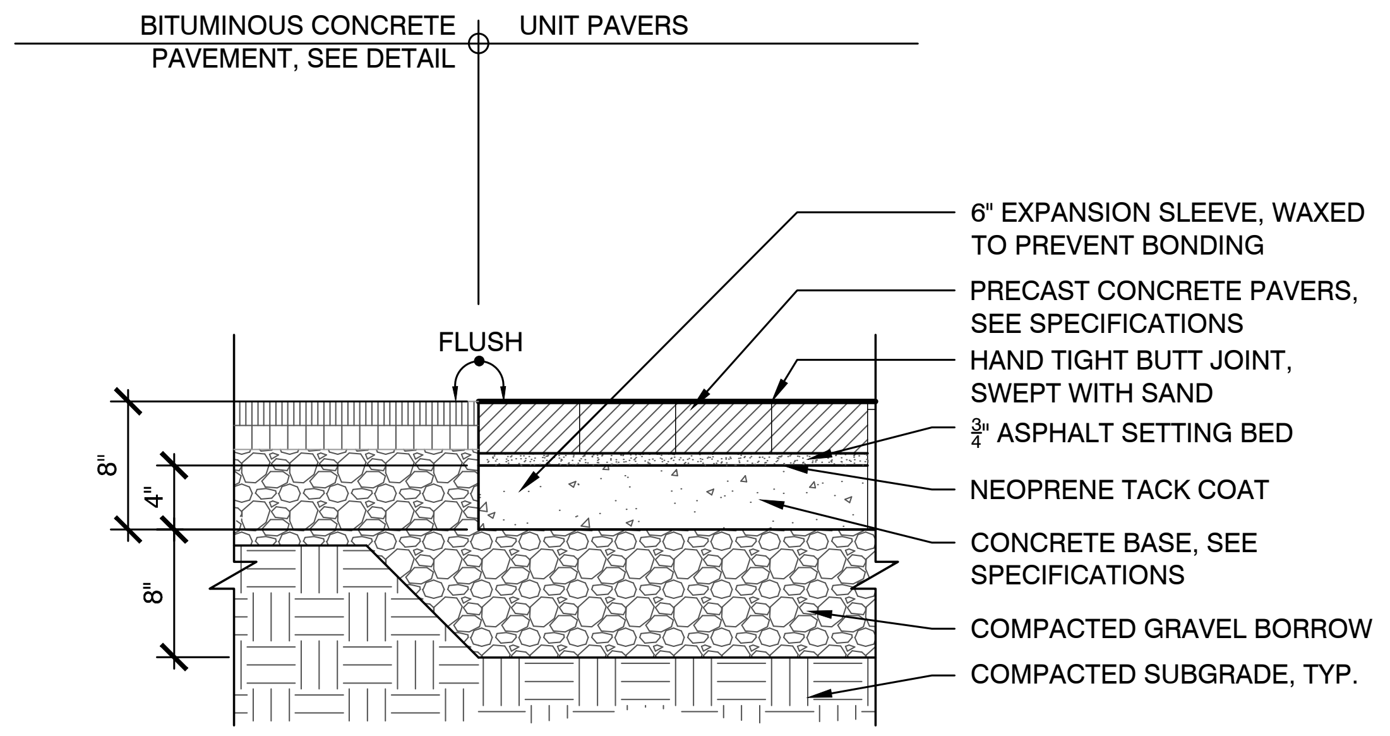
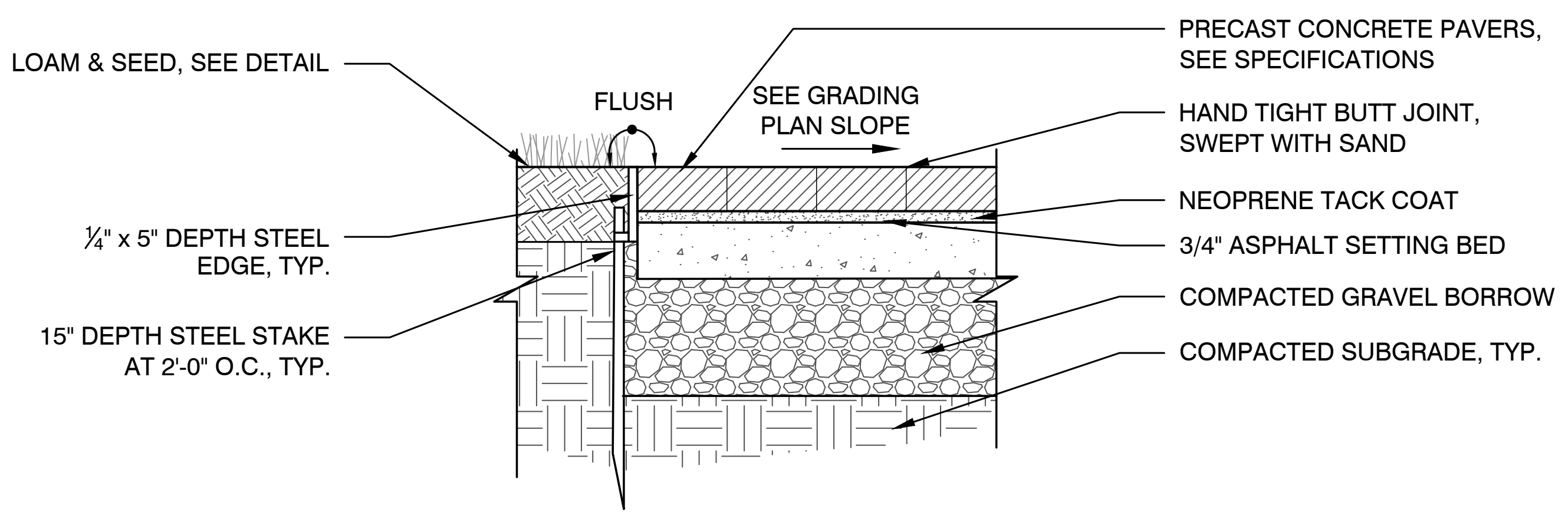
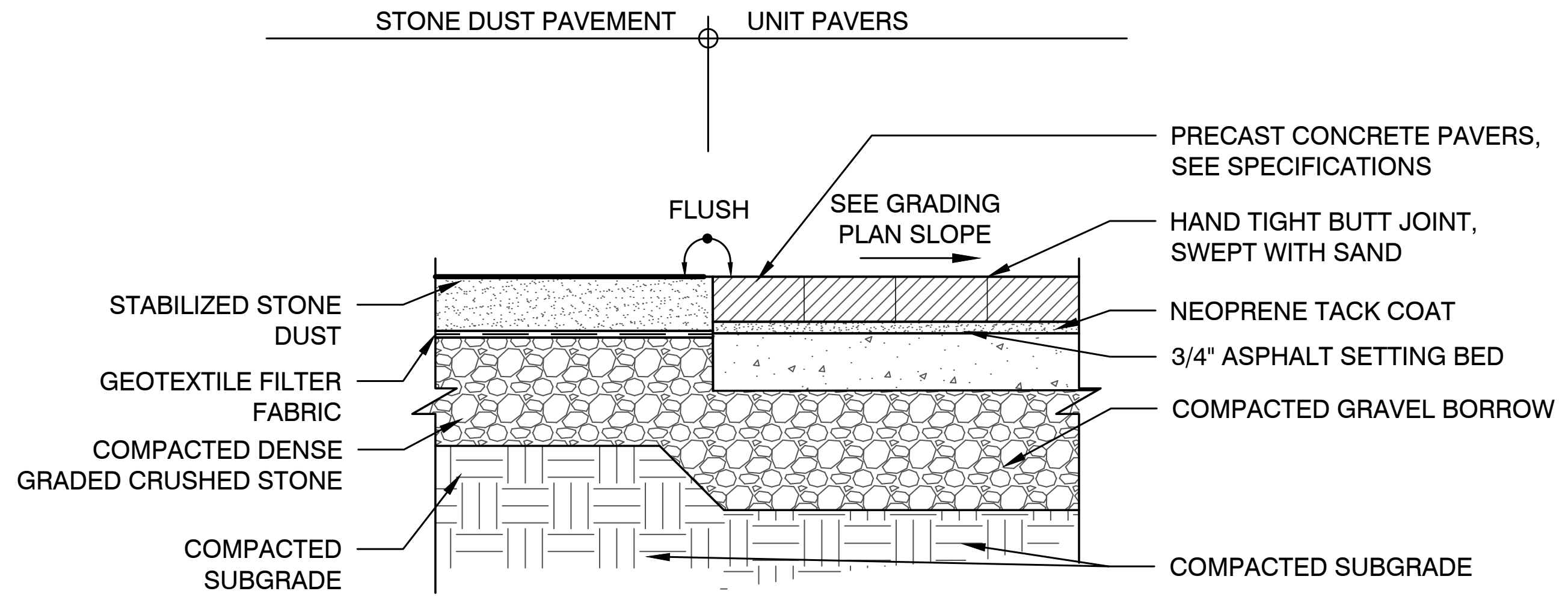


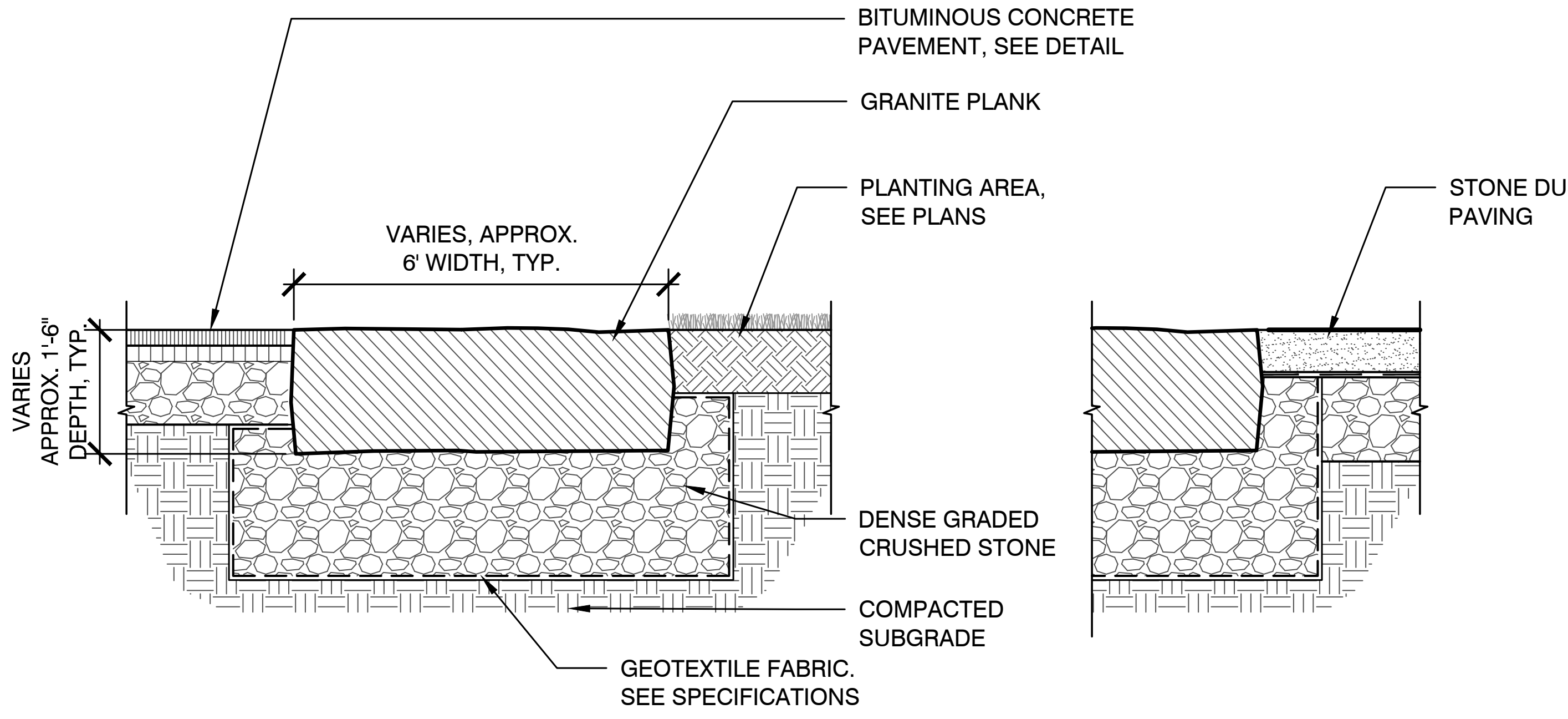
8 UNIT PAVERS AT BITUMINOUS CONCRETE PAVEMENT
SCALE: N.T.S.



9 UNIT PAVERS AT PLANTING AREA
SCALE: N.T.S.



10 UNIT PAVERS AT STONE DUST
SCALE: N.T.S.



11 ENGRAVED GRANITE PLANKS
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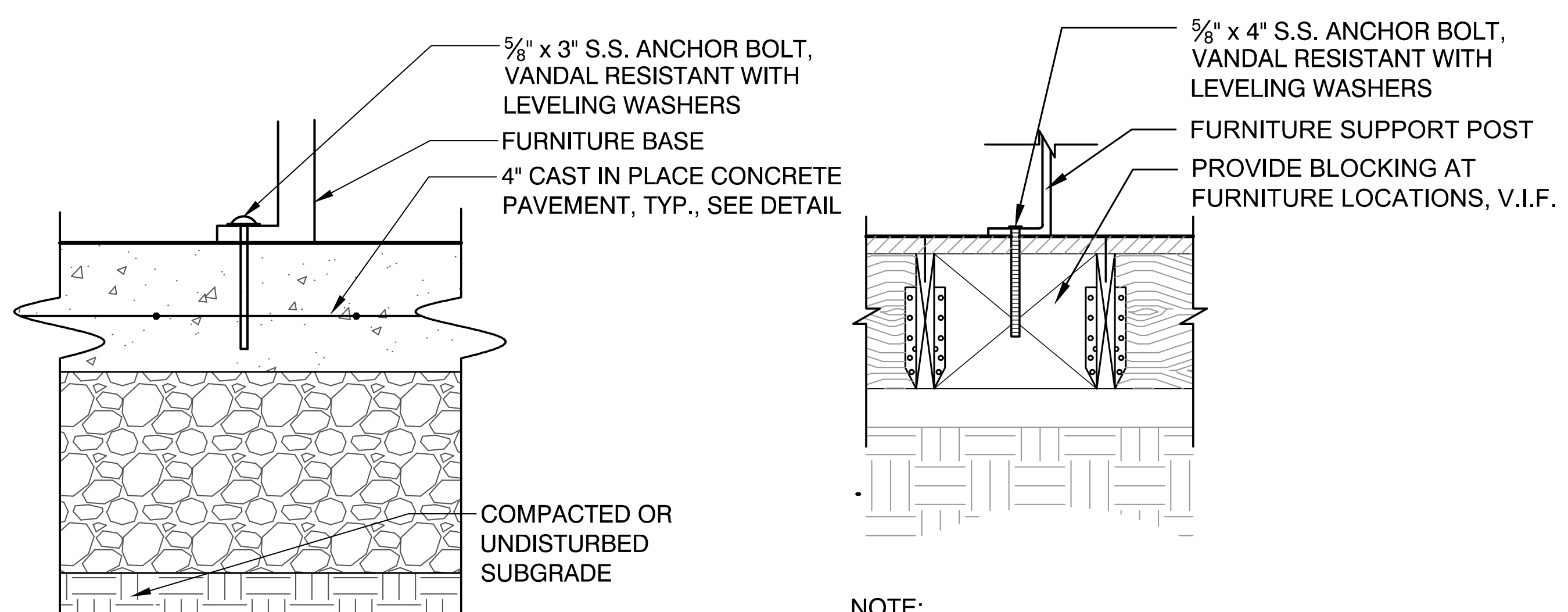


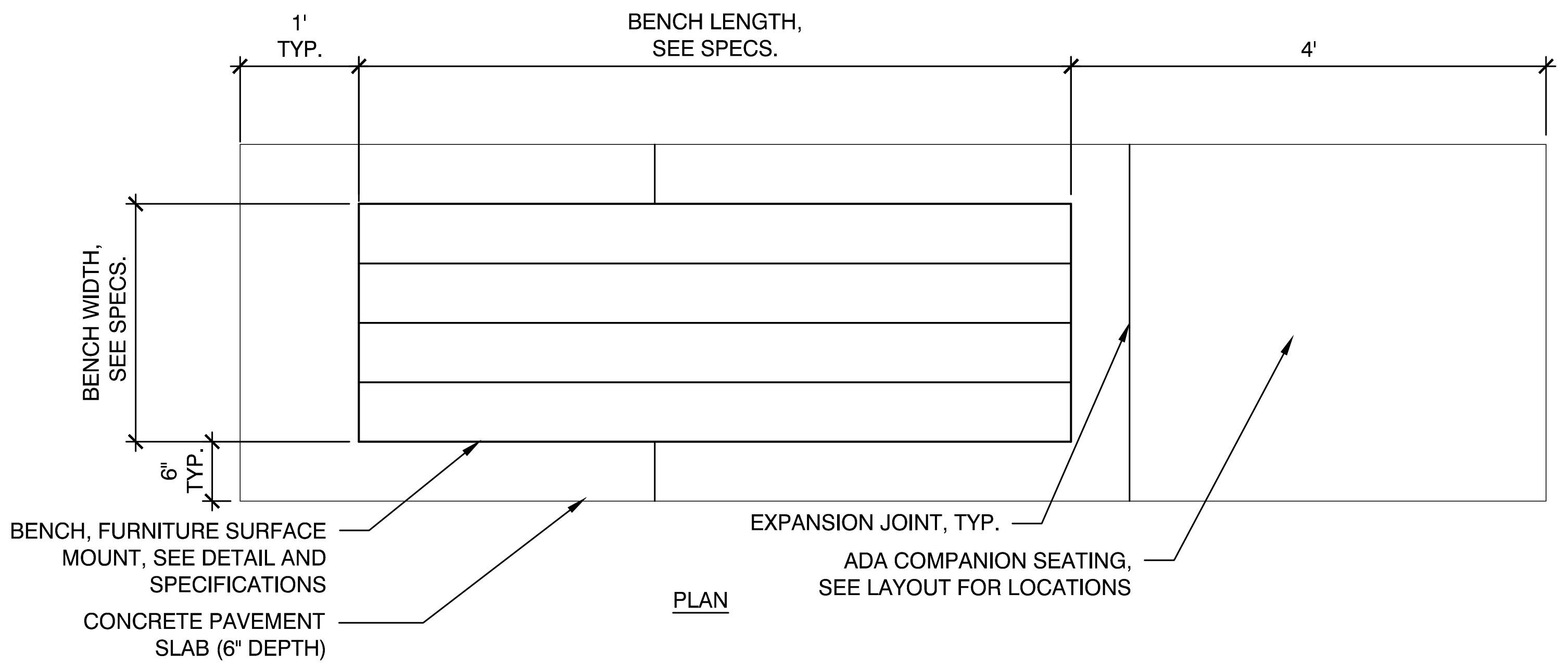
NOTES:
1. ALL SITE FURNISHINGS SHALL BE SURFACE MOUNTED PER MANUFACTURER'S RECOMMENDATIONS.

NOTE:
1. ALL SITE FURNISHINGS SHALL BE SURFACE MOUNTED PER MANUFACTURER'S RECOMMENDATIONS.

SURFACE MOUNT TO DECKING

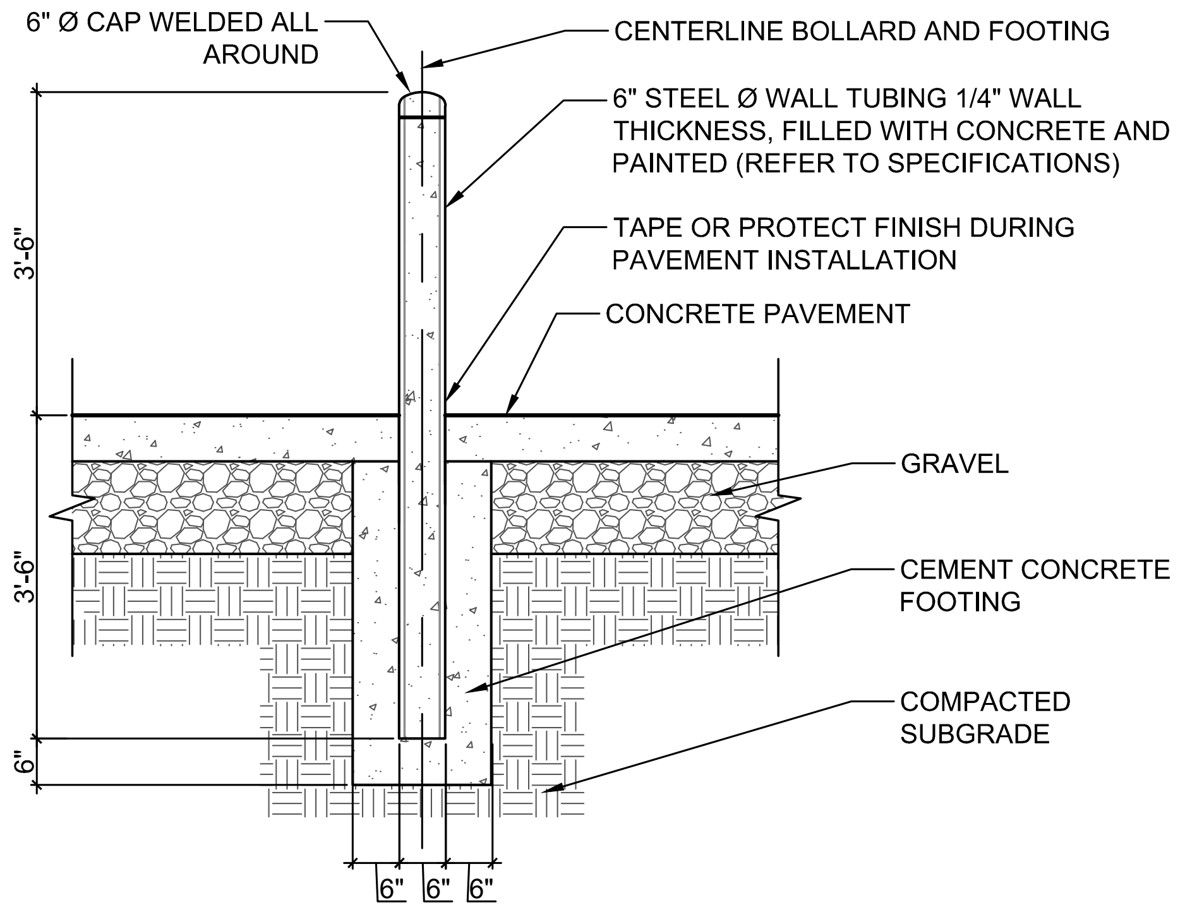
1 FURNITURE SURFACE MOUNT

SCALE: N.T.S.



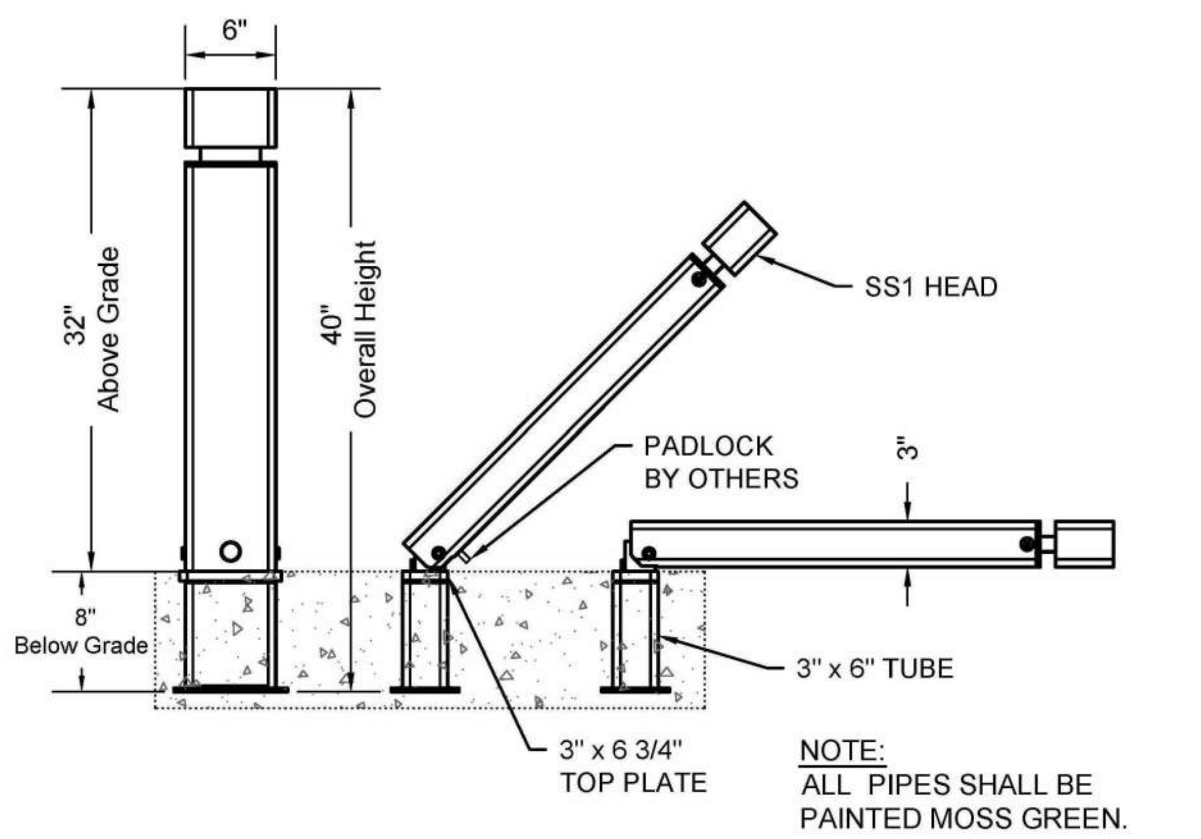
2 BENCH ON CONCRETE PAD

SCALE: N.T.S.



3 VEHICLE BOLLARD

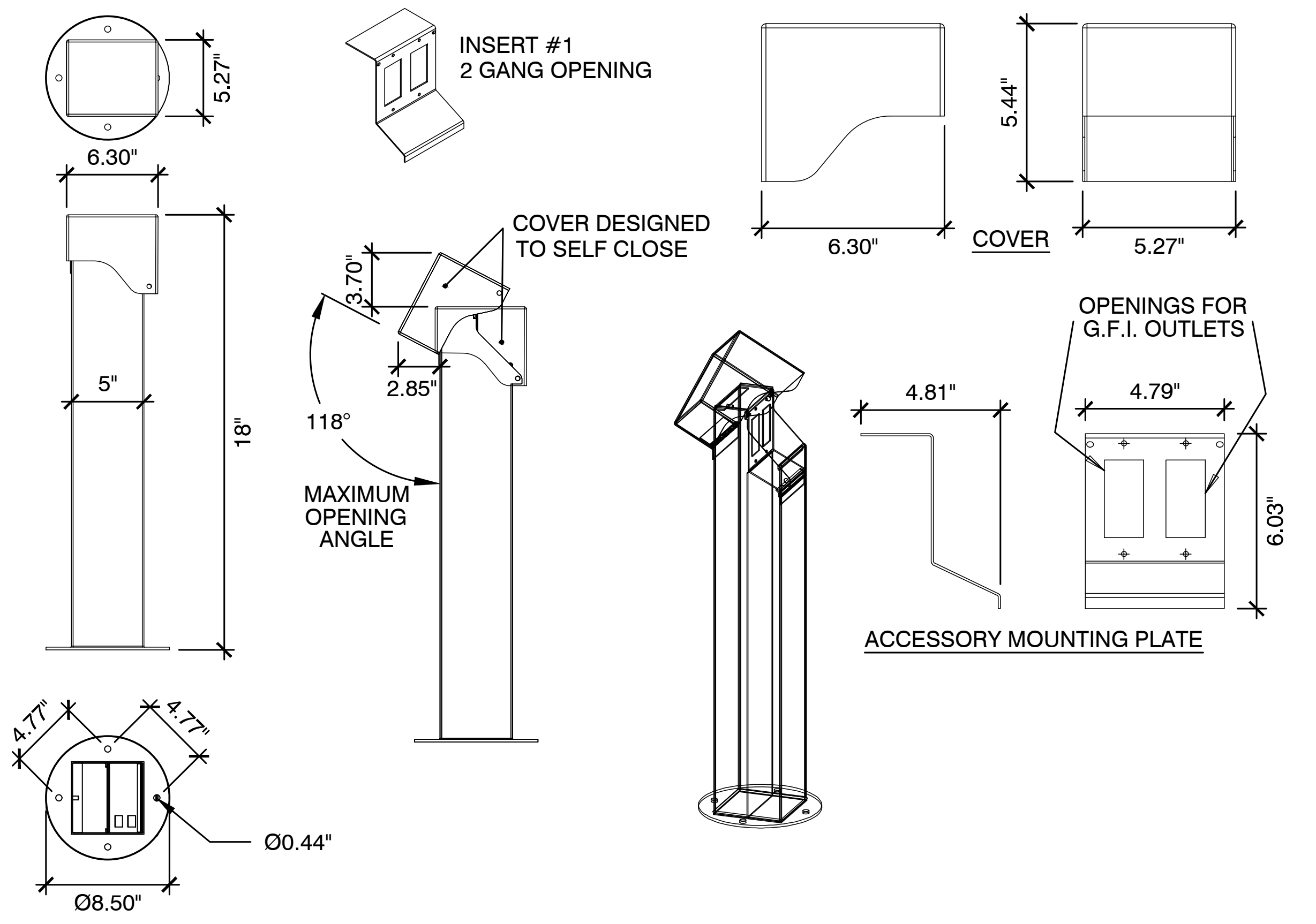
SCALE: N.T.S.



NOTE:
ALL PIPES SHALL BE PAINTED MOSS GREEN.

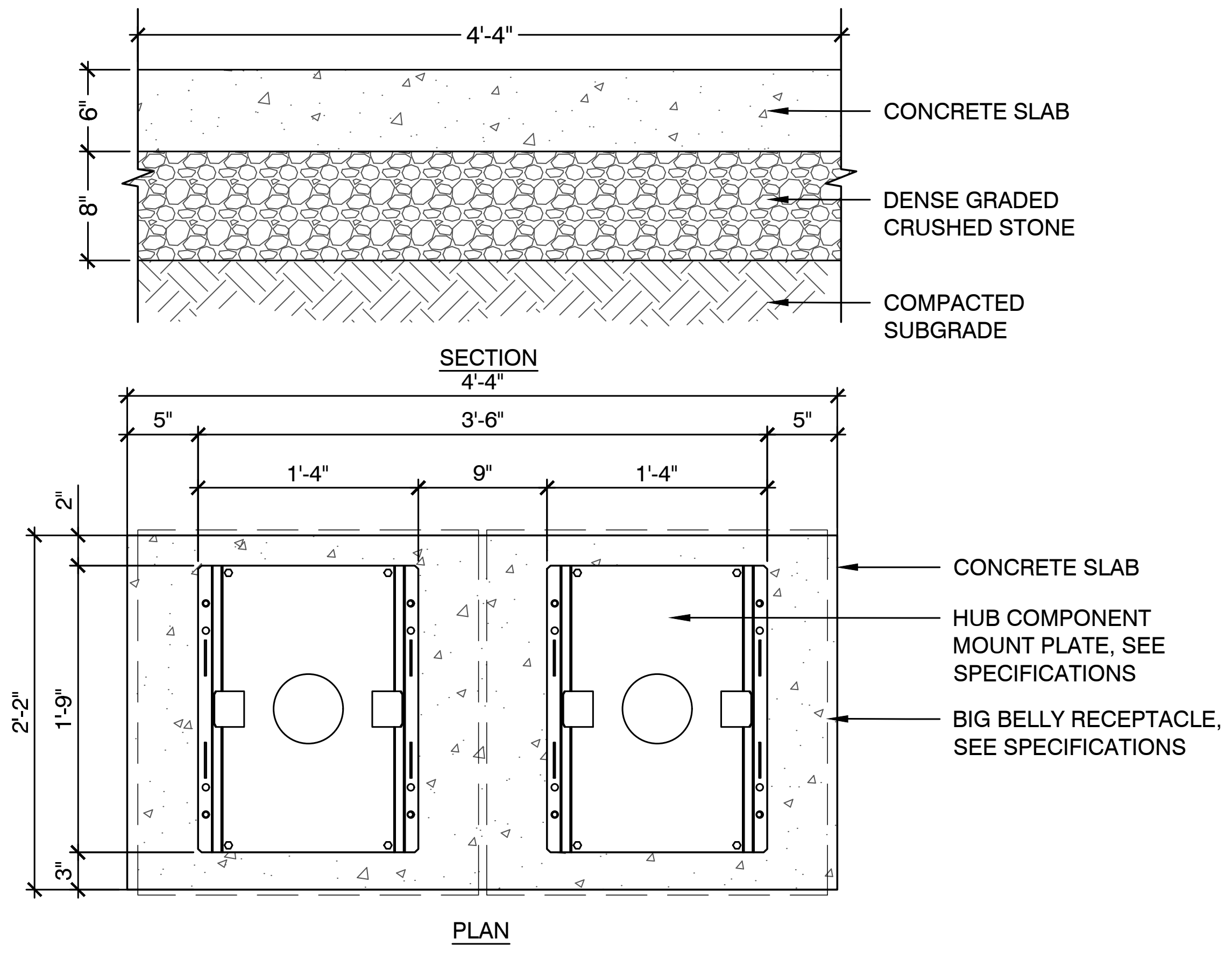
4 COLLAPSIBLE BOLLARD

SCALE: N.T.S.



5 UTILITY BOLLARD

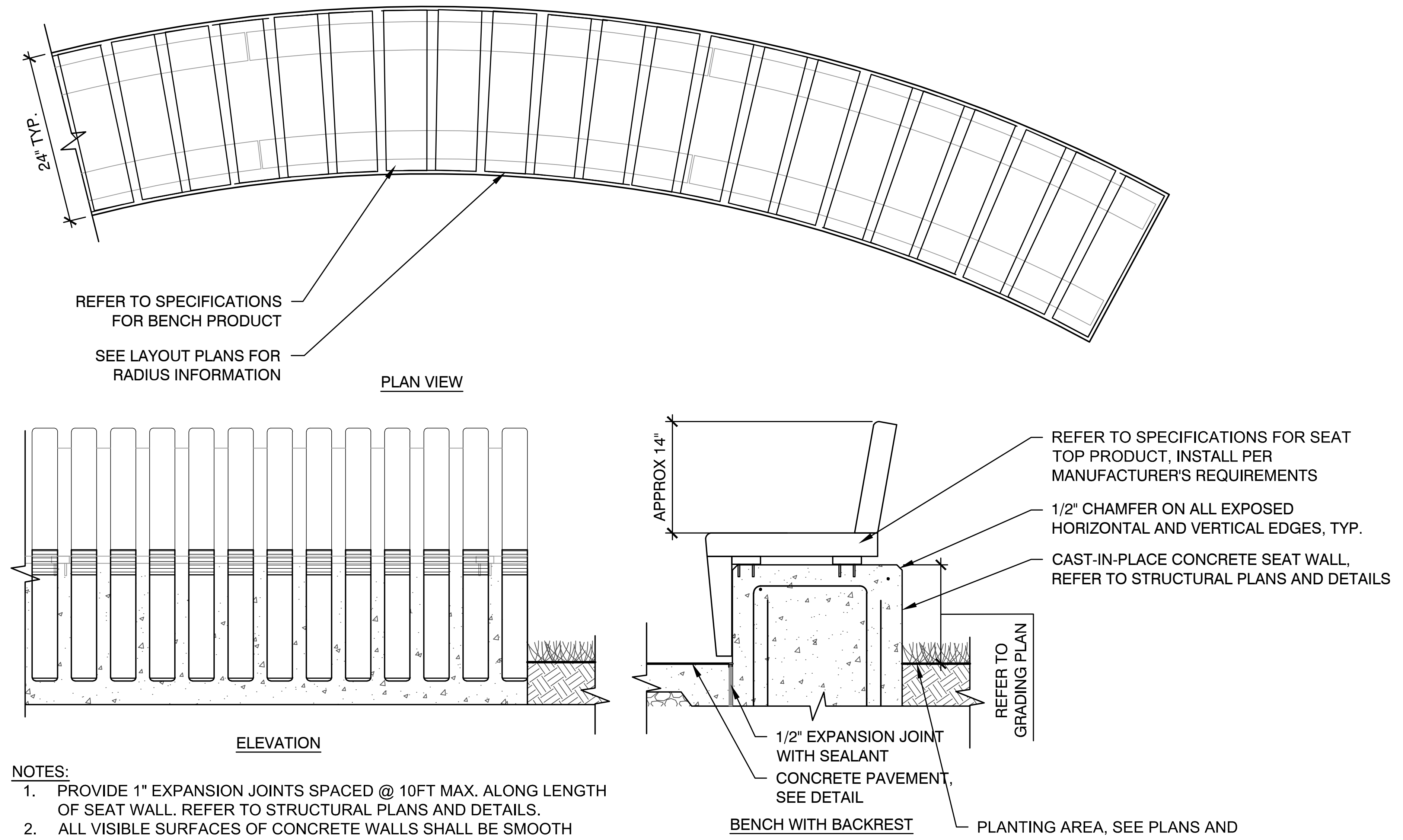
SCALE: N.T.S.



NOTE:
1. INSTALL PER MANUFACTURER INSTRUCTIONS.

6 TRASH AND RECYCLE RECEPTACLES ON CONCRETE SLAB

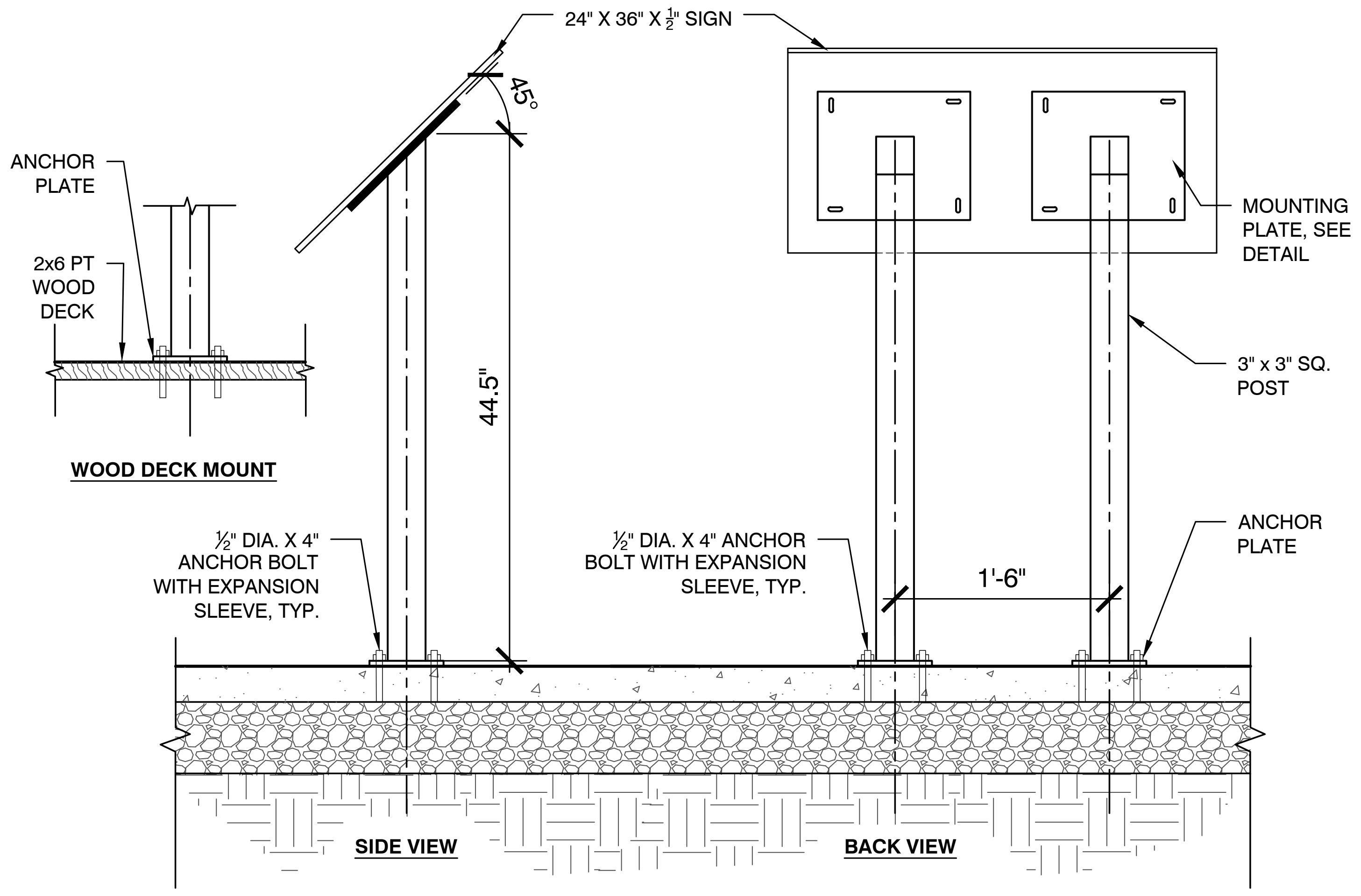
SCALE: N.T.S.



NOTES:
1. PROVIDE 1" EXPANSION JOINTS SPACED @ 10FT MAX. ALONG LENGTH OF SEAT WALL. REFER TO STRUCTURAL PLANS AND DETAILS.
2. ALL VISIBLE SURFACES OF CONCRETE WALLS SHALL BE SMOOTH RUBBED FINISH. REMOVE AND OR FILL ALL BUGHOLES, FORM TIES AND OTHER IMPERFECTIONS ON ALL VISIBLE SURFACES.
3. BENCH TOP RUNS PERPENDICULAR TO FACE OF WALL. BENCH PRODUCTS MUST BE INSTALLED PER MANUFACTURER REQUIREMENTS, USING STAINLESS STEEL TAMPER PROOF BOLTS.

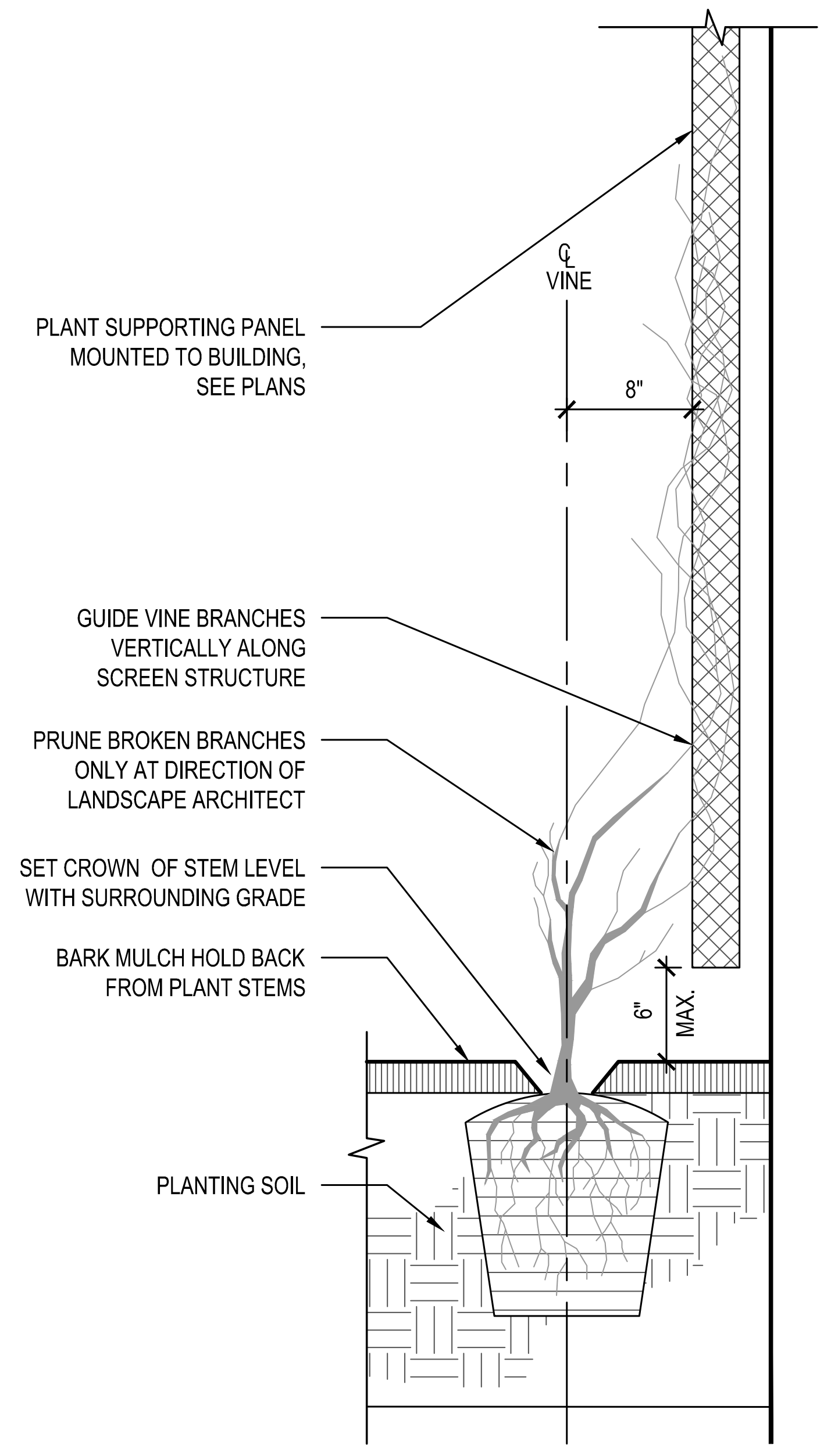
7 CIP CONCRETE SEATWALL WITH WOOD SLAT TOP

SCALE: N.T.S.



8 INTERPRETIVE SIGNAGE - DOUBLE POST

SCALE: N.T.S.



9 GREEN SCREEN PLANTING AT FACE OF BUILDING

SCALE: N.T.S.

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No.	Date	Description

Seal:
CHERILYN F. RUANE
NO. 1220

Key Plan:

Issued For:

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- NOT FOR CONSTRUCTION -

Scale: N.T.S.

Date: APRIL 2021
Drawn By: FD, TY, SG
Reviewed By: CC
Approved By: CFR

W&S Project No.: ENG20-0145
W&S File No.:

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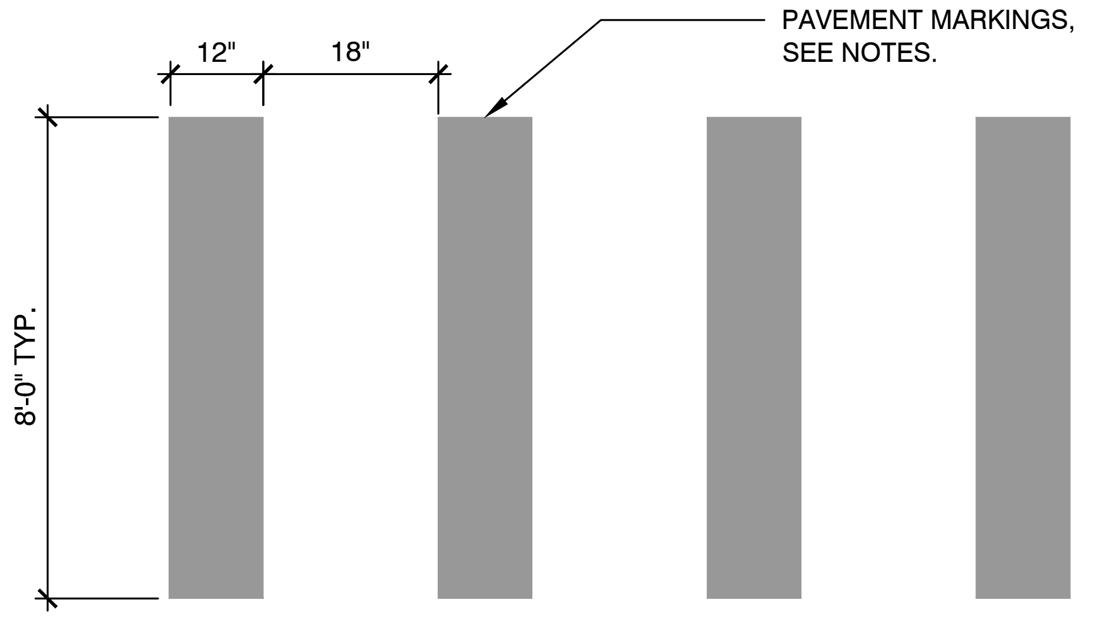
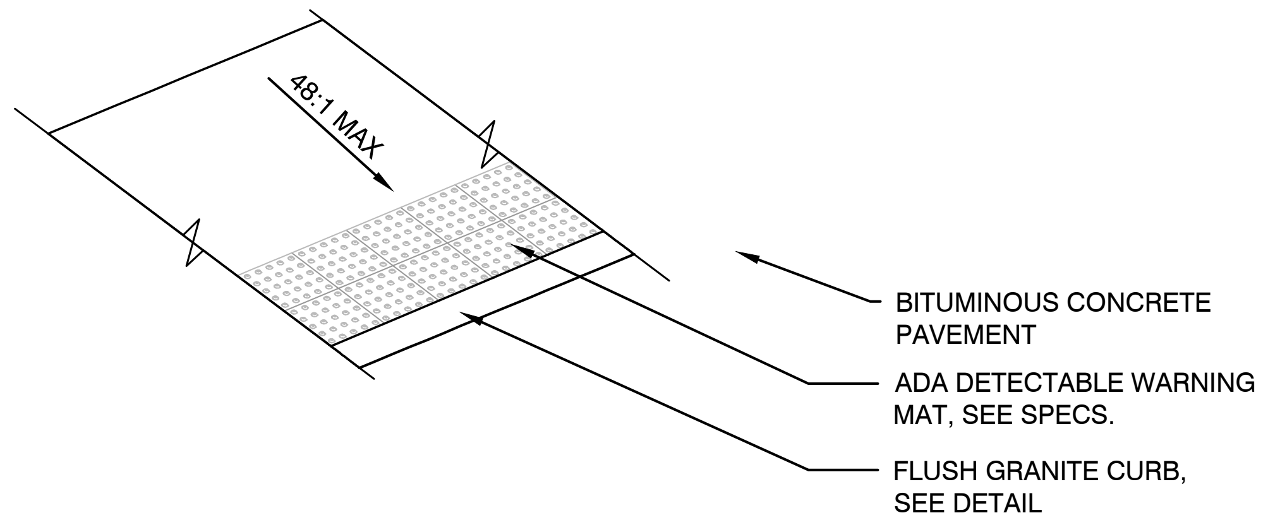
L503



NOTES:
1. PROVIDE PAVEMENT MARKINGS WHERE SHOWN ON PLANS IN ACCORDANCE WITH THIS DETAIL.
2. PAVEMENT MARKINGS SHALL BE WHITE, REFLECTORIZED TRAFFIC PAINT CONFORMING TO FEDERAL SPECIFICATION TTP-1952B TRAFFIC PAINT, TYPE I OR II.

1 CROSSWALK PAVEMENT MARKINGS

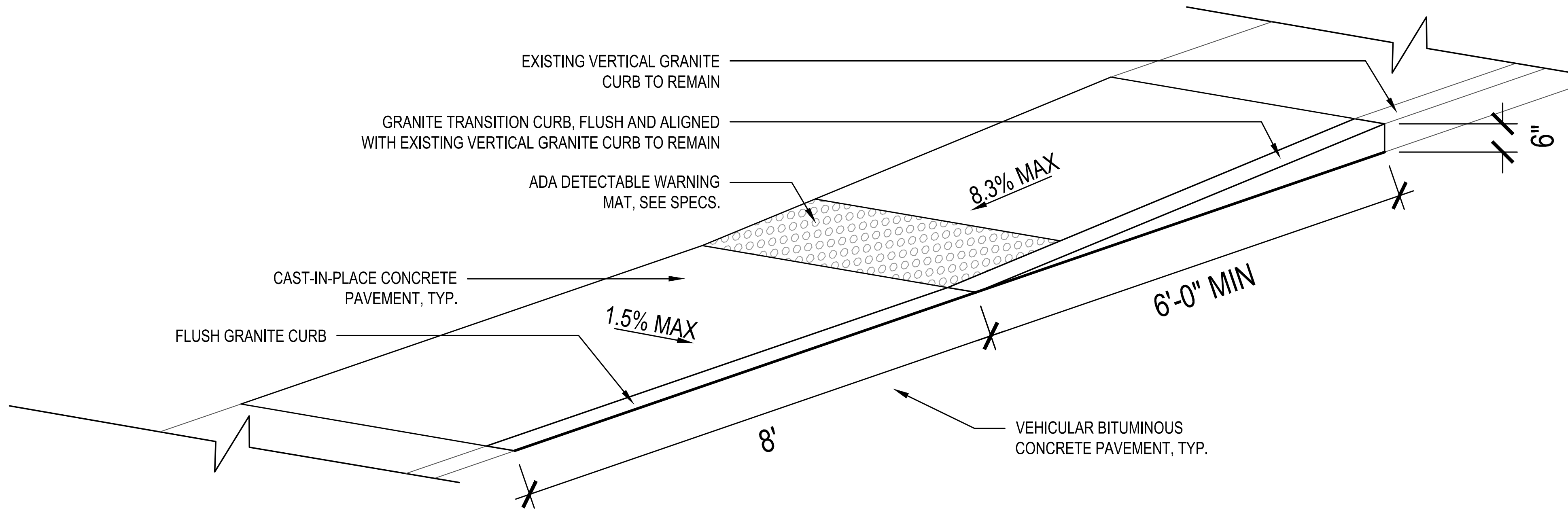
SCALE: N.T.S.



AXON VIEW
N.T.S.

2 ADA ACCESSIBLE CURB CUT AT WALLIS STREET - WEST

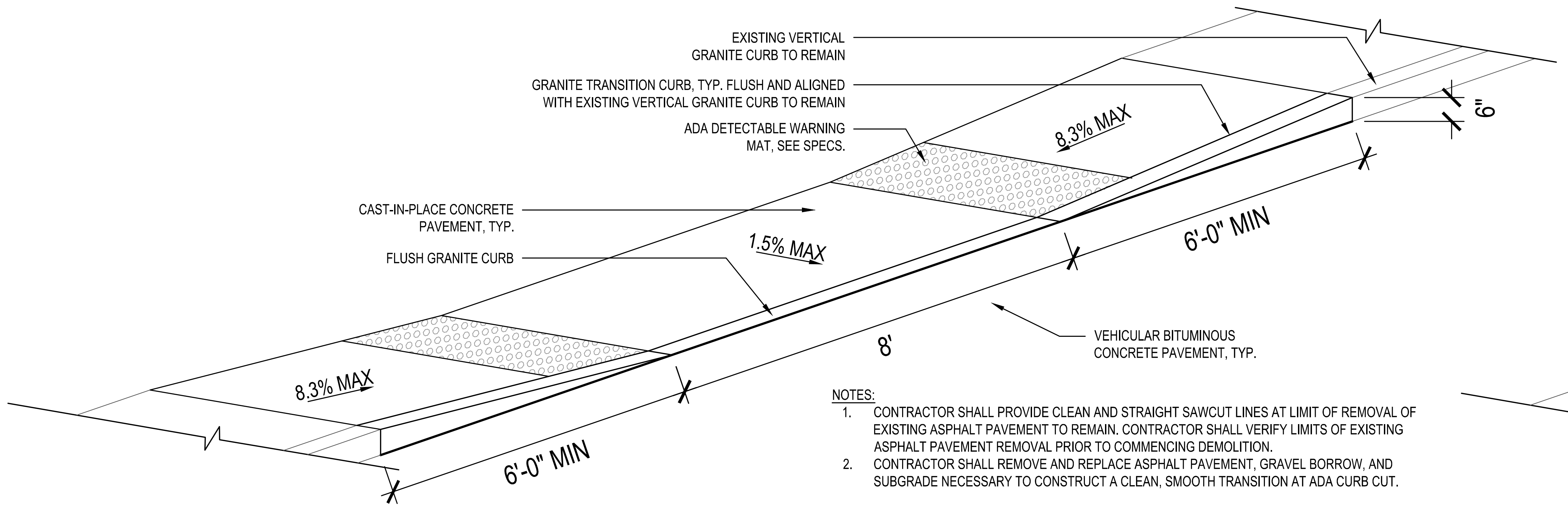
SCALE: N.T.S.



NOTES:
1. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING ASPHALT PAVEMENT TO REMAIN. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
2. CONTRACTOR SHALL REMOVE AND REPLACE ASPHALT PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

3 ADA ACCESSIBLE CURB CUT AT WALLIS STREET - EAST

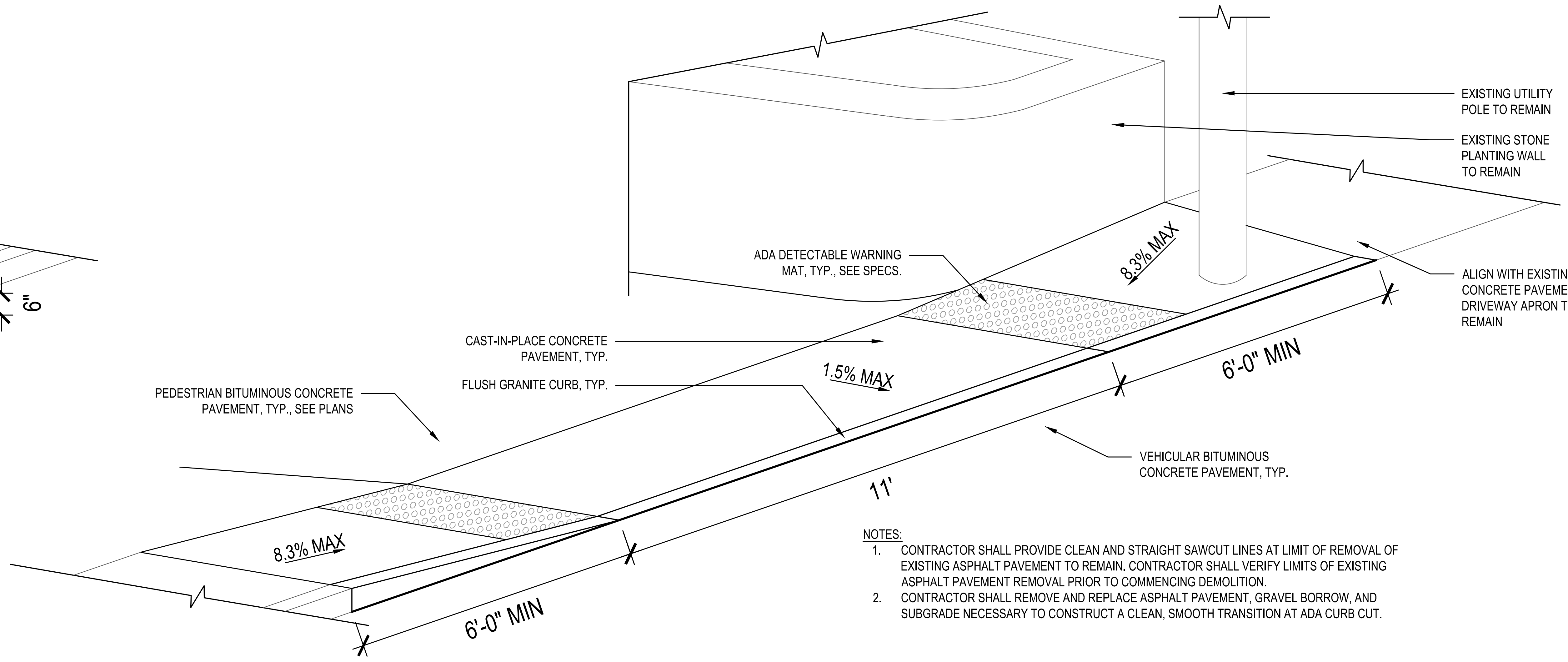
SCALE: N.T.S.



NOTES:
1. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING ASPHALT PAVEMENT TO REMAIN. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
2. CONTRACTOR SHALL REMOVE AND REPLACE ASPHALT PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

4 ADA ACCESSIBLE CURB CUT AT CALLER STREET - WEST

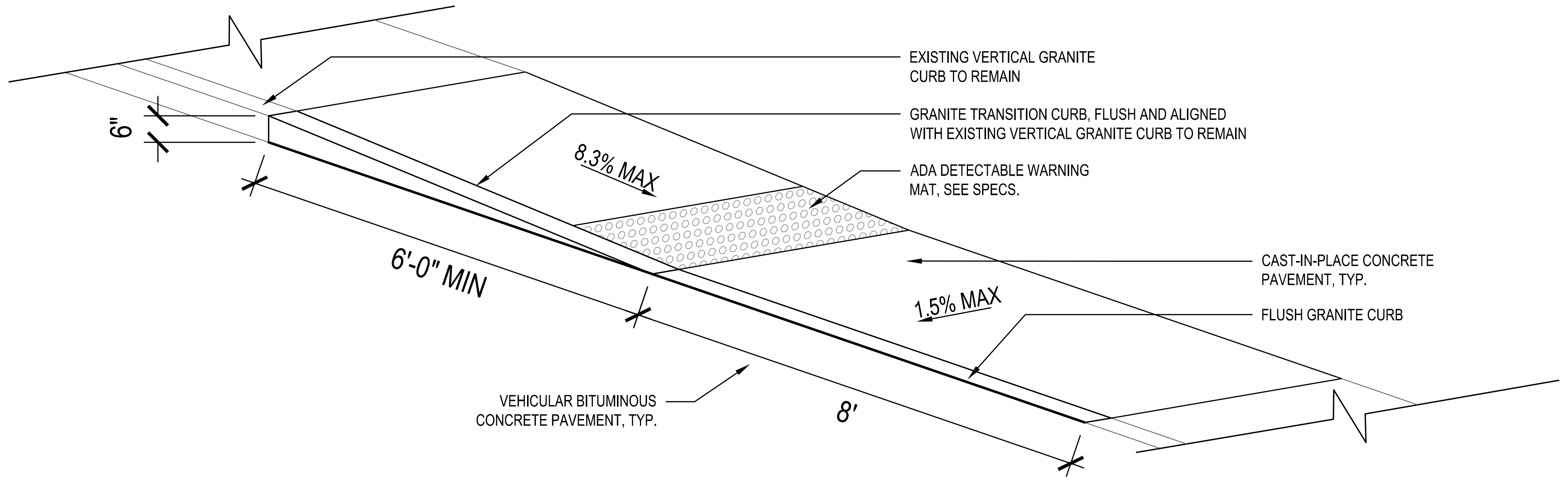
SCALE: N.T.S.



NOTES:
1. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING ASPHALT PAVEMENT TO REMAIN. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
2. CONTRACTOR SHALL REMOVE AND REPLACE ASPHALT PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

5 ADA ACCESSIBLE CURB CUT AT CALLER STREET - EAST

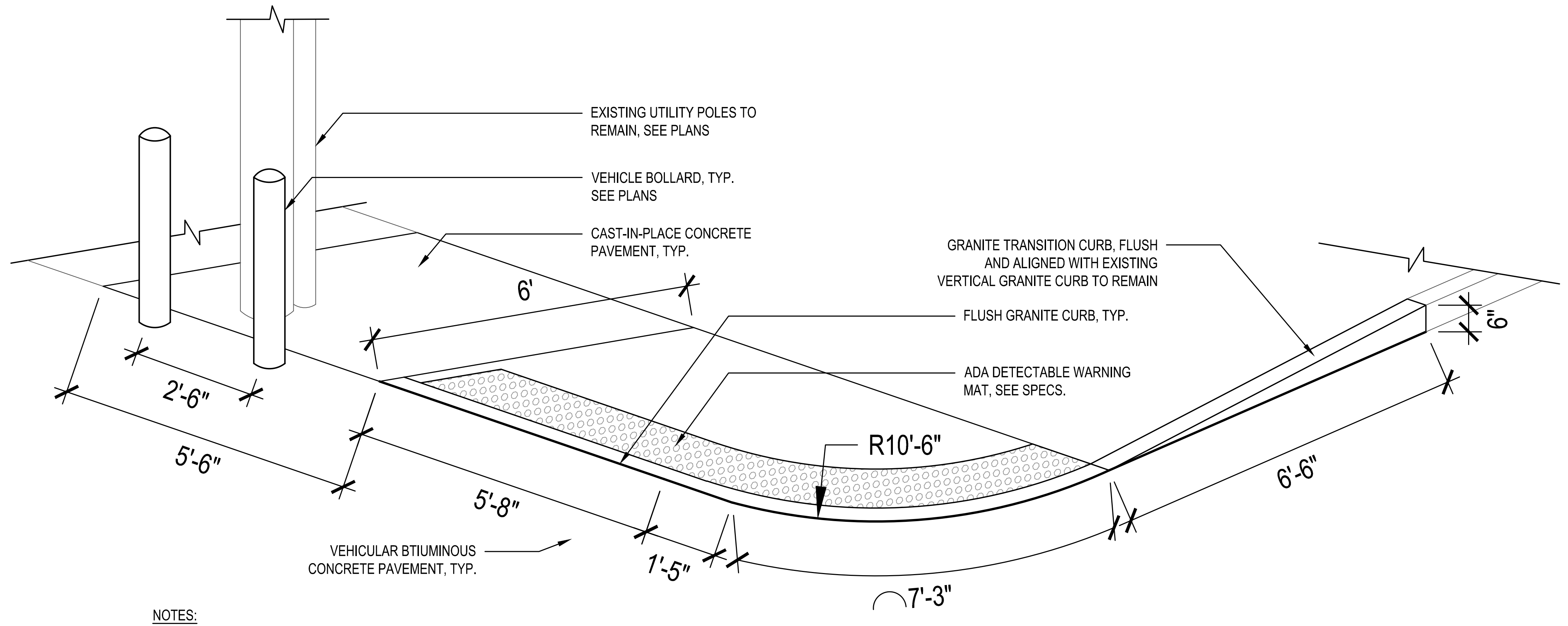
SCALE: N.T.S.



NOTES:
1. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING ASPHALT PAVEMENT TO REMAIN. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
2. CONTRACTOR SHALL REMOVE AND REPLACE ASPHALT PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

6 ADA ACCESSIBLE CURB CUT AT HOWLEY STREET - WEST

SCALE: N.T.S.



NOTES:
1. ALL CROSS SLOPES SHALL NOT EXCEED 1.50%
2. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING BITUMINOUS CONCRETE PAVEMENT TO REMAIN AT ROADWAY. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
3. CONTRACTOR SHALL REMOVE AND REPLACE BITUMINOUS CONCRETE PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

7 ADA ACCESSIBLE CURB CUT AT HOWLEY STREET - EAST

SCALE: N.T.S.

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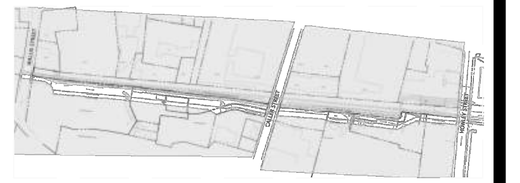

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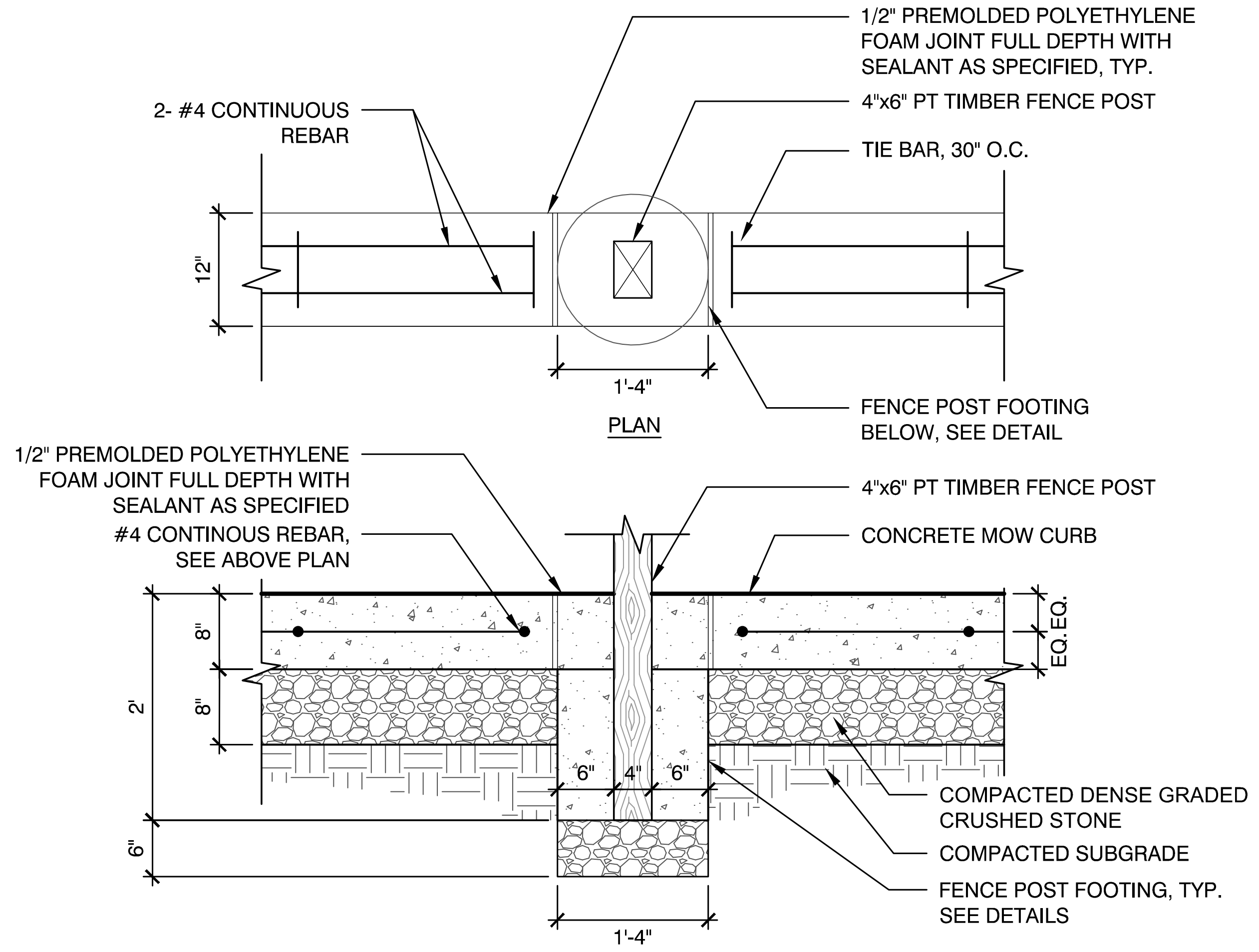
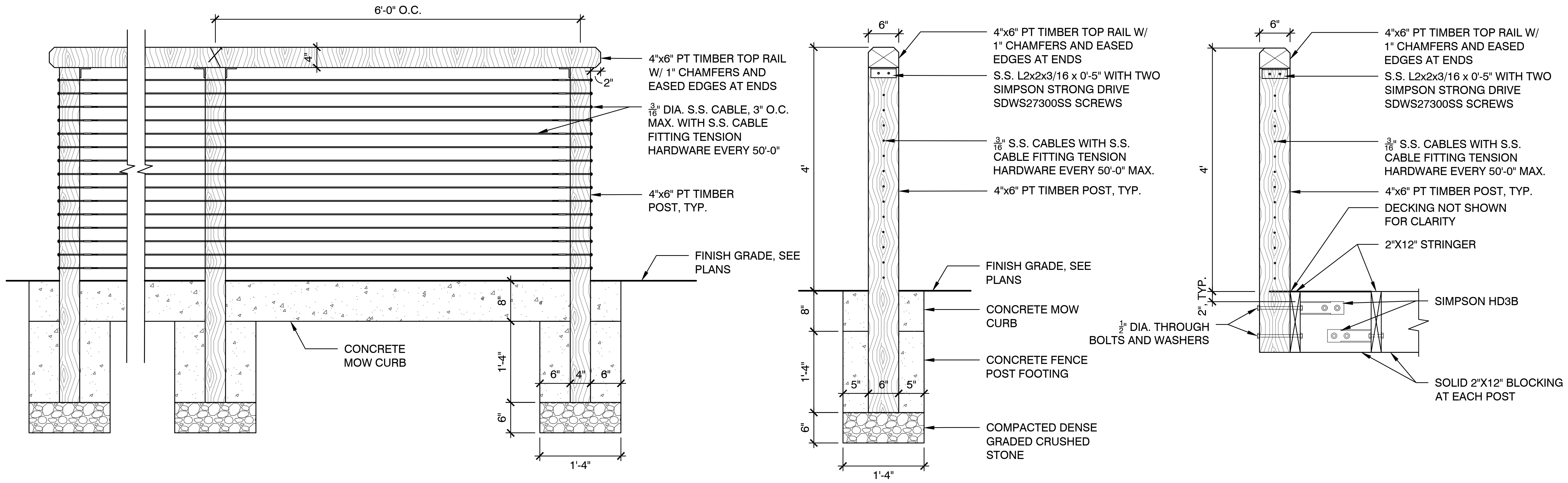


NOTES:

1. MOW CURB CORNERS ADJACENT TO WALLS AND CURBS SHALL BE SQUARE TO ENSURE SMOOTH INTERFACE BETWEEN MATERIALS.
2. MOW CURB CORNERS ADJACENT TO PLANTING BED OR LAWN AREAS SHALL HAVE 1/2" CHAMFER.
3. CONTRACTOR SHALL PROVIDE $\frac{1}{2}$" PRE-MOLDED POLYETHYLENE FOAM EXPANSION JOINT, FULL DEPTH WITH SEALANT AS SPECIFIED AT FENCE POSTS UNLESS OTHERWISE NOTED.
4. SEE CRITICAL ROOT ZONE NOTE ON SITE DEMOLITION AND PREPARATION PLAN.

1 MOW CURB AT FENCE

SCALE: N.T.S.



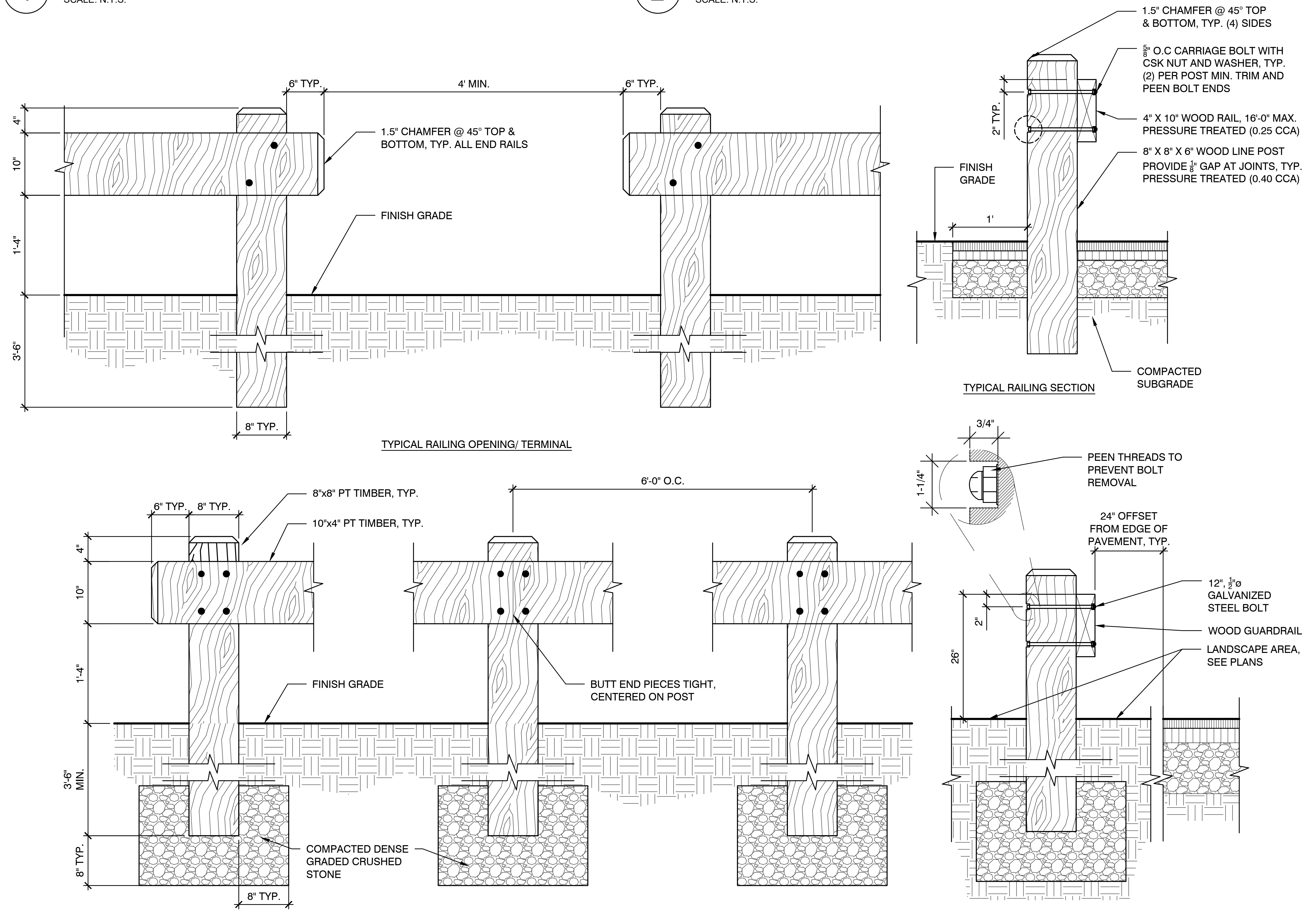
CABLE RAILING ELEVATION

AT PATHWAY

AT BOARDWALK

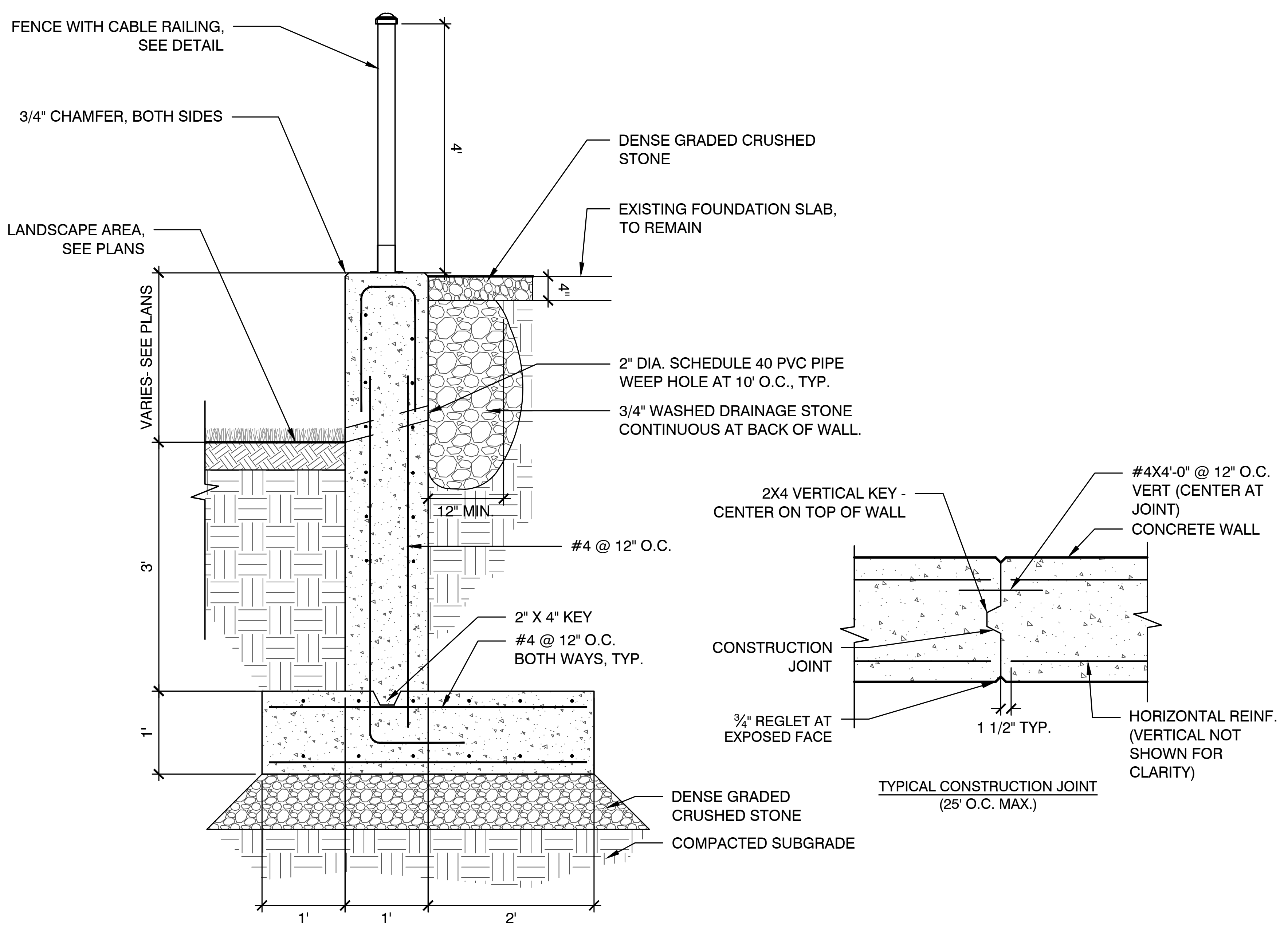
2 FENCE WITH CABLE RAILING

SCALE: N.T.S.



3 WOOD GUARDRAIL

SCALE: N.T.S.



TYPICAL CONSTRUCTION JOINT
(25' O.C. MAX.)

4 CIP CONCRETE RETAINING WALL WITH DENSE GRADED CRUSHED STONE BACKFILL

SCALE: N.T.S.

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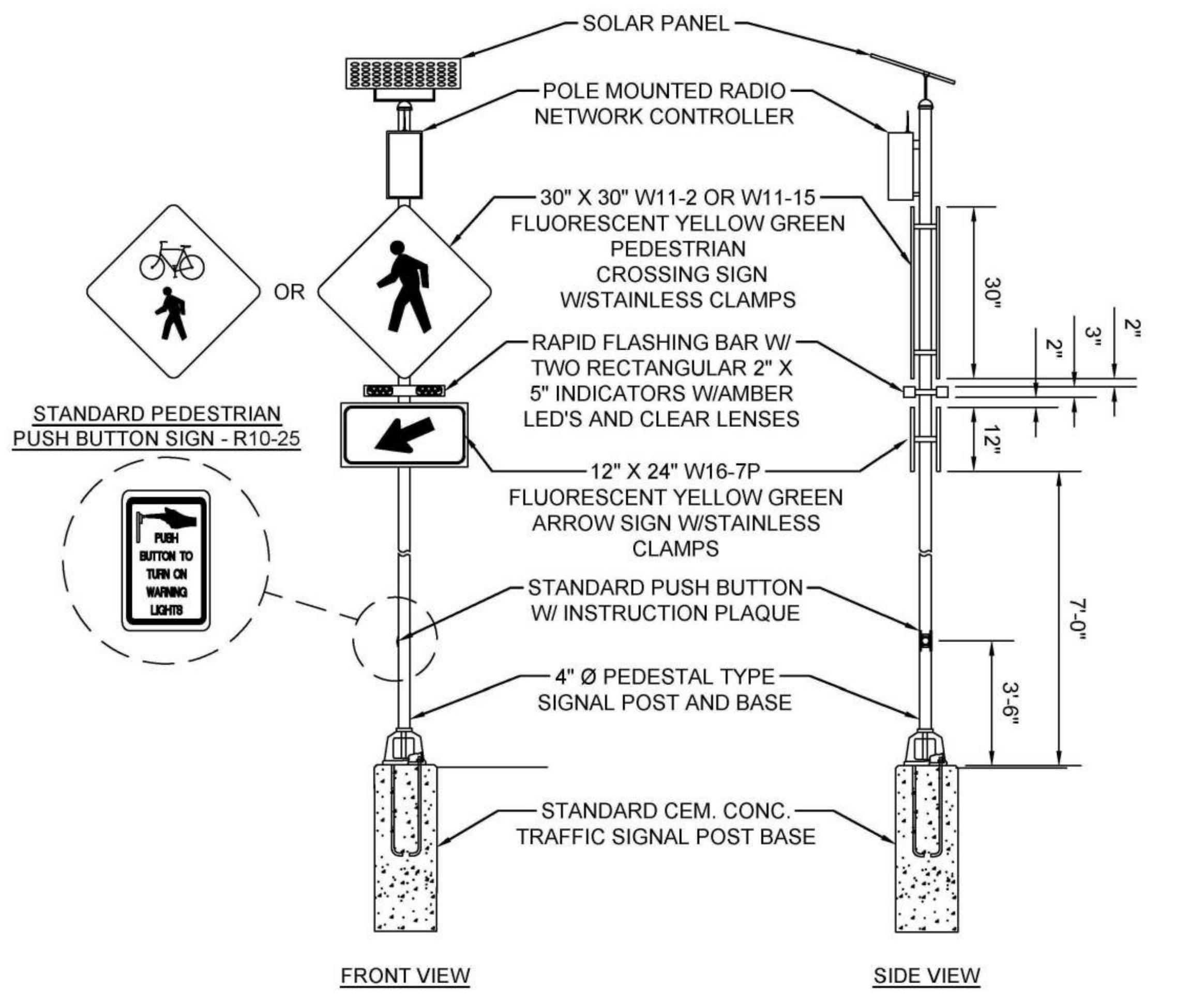


RRFB NOTES:

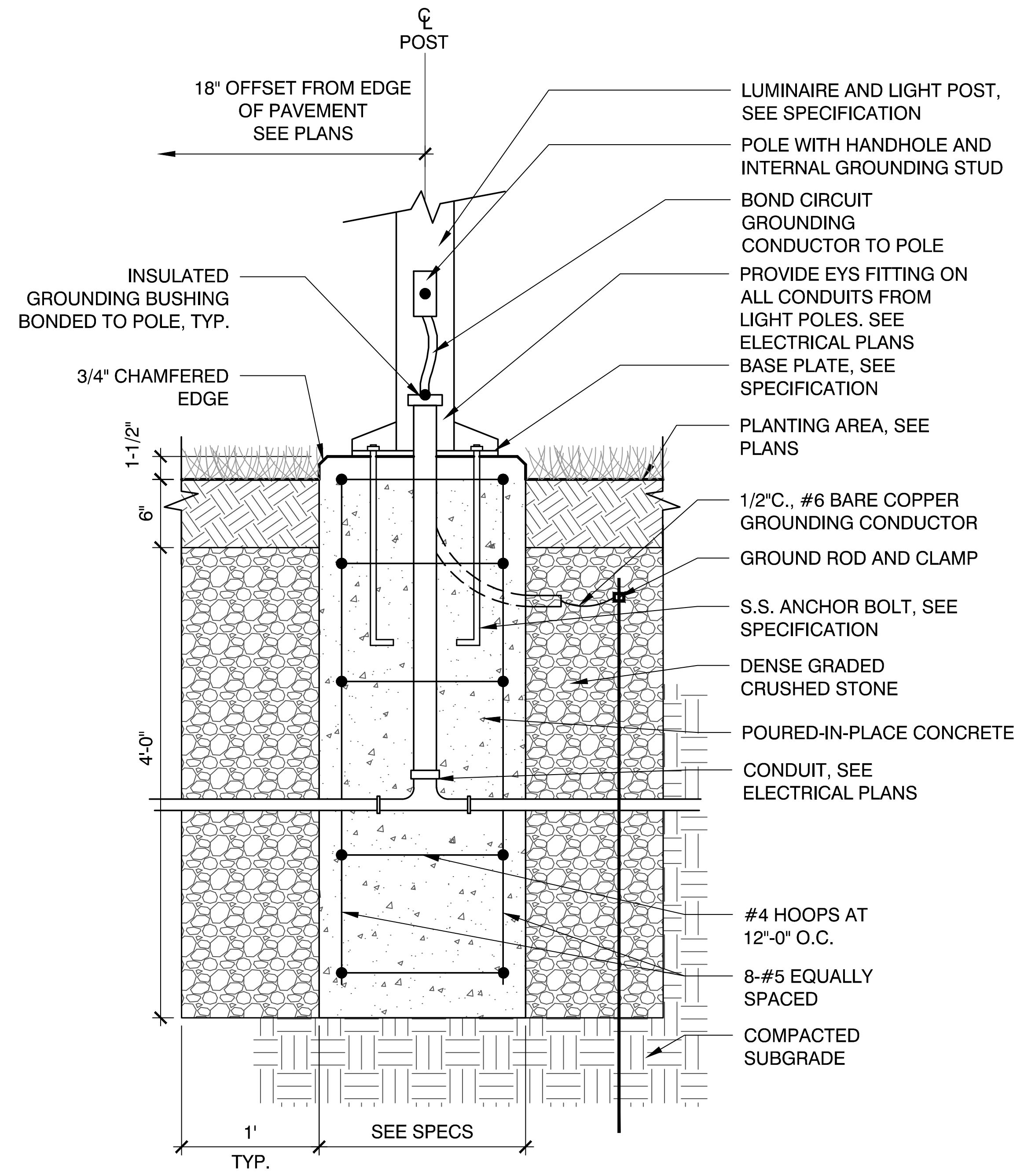
1. RECTANGULAR RAPID FLASHING BEACON (RRFB) SHALL BE SUPPLIED FROM A MANUFACTURER LISTED ON THE MASSDOT APPROVED EQUIPMENT LIST.
2. EACH LOCATION SHALL HAVE TWO (2) RRFB INSTALLED (ONE ON EACH SIDE OF THE CROSSWALK).
3. LOCATIONS 1 AND 3 WILL USE SIGN W11-15 AND LOCATION 2 WILL USE SIGN W11-2.
4. R10-25 SIGNS SHALL BE INSTALLED ABOVE ALL PEDESTRIAN PUSH BUTTONS.
5. OPERABLE CONTROLS ON RRFB SHALL BE LOCATED PER ADA STANDARDS 305-309
6. WARNING SIGNS AND INSTRUCTIONAL SIGNS ARE PAID SEPARATELY UNDER ITEM 832.

RRFB CLEARANCE TIME

APPROACH	LENGTH (ft)	CLEARANCE (s)
LOCATION 1	40	14
LOCATION 2	36	12
LOCATION 3	34	12

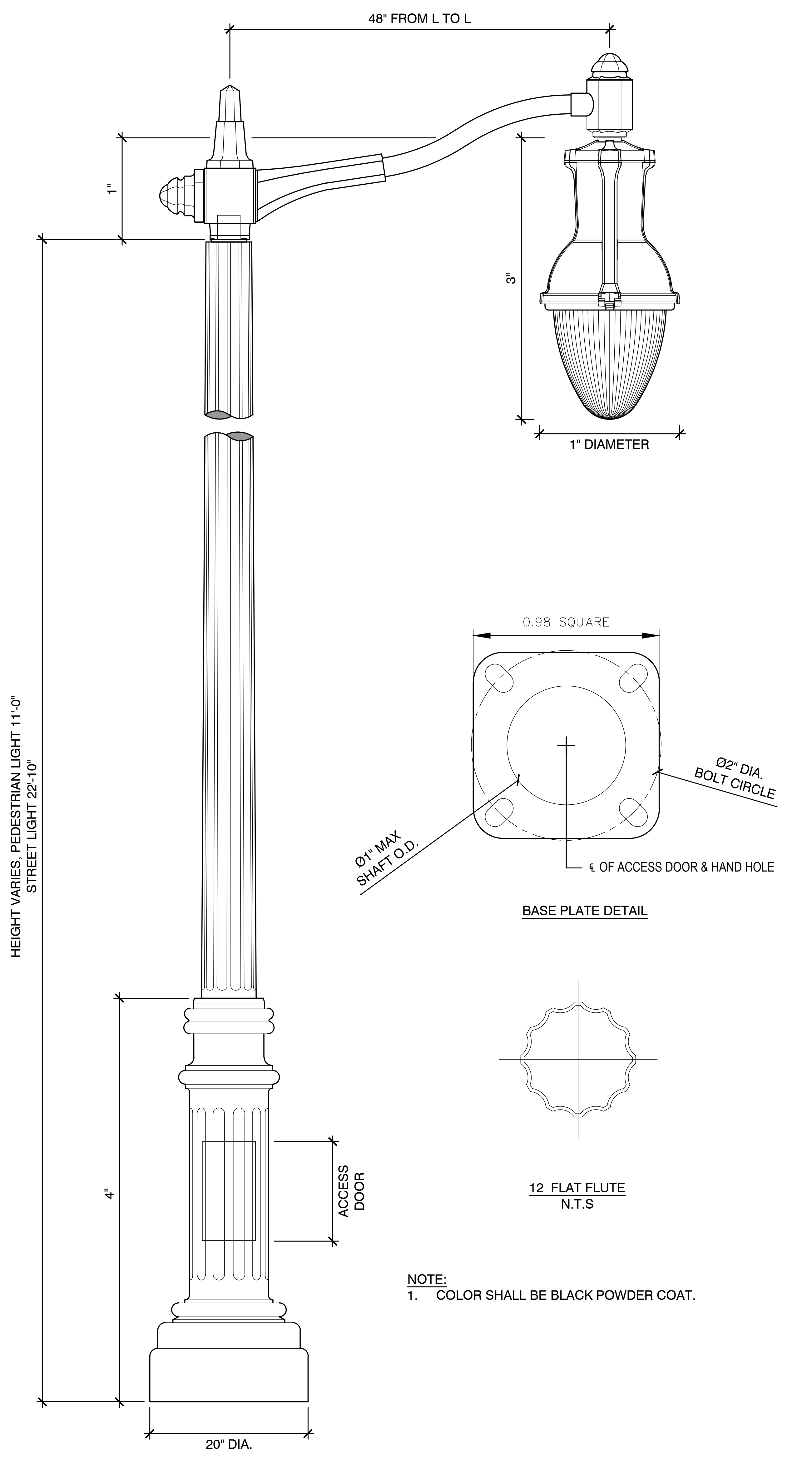
1 RAPID FLASHING BEACON

SCALE: N.T.S.



2 LIGHT POST FOOTING

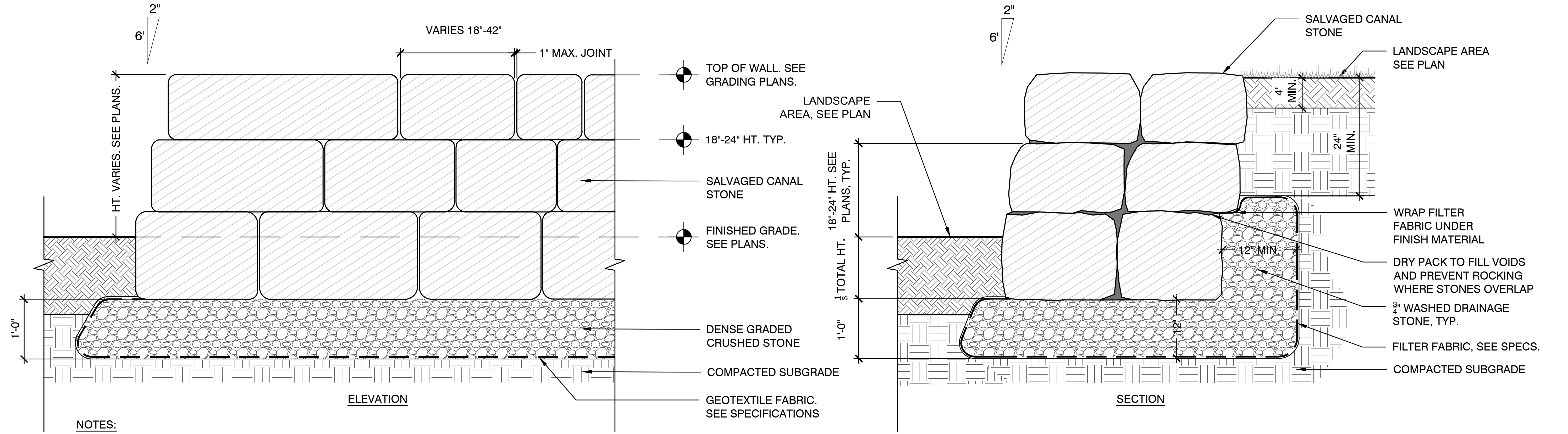
SCALE: N.T.S.



NOTE:
1. COLOR SHALL BE BLACK POWDER COAT.

3 PEDESTRIAN AND STREET LIGHT

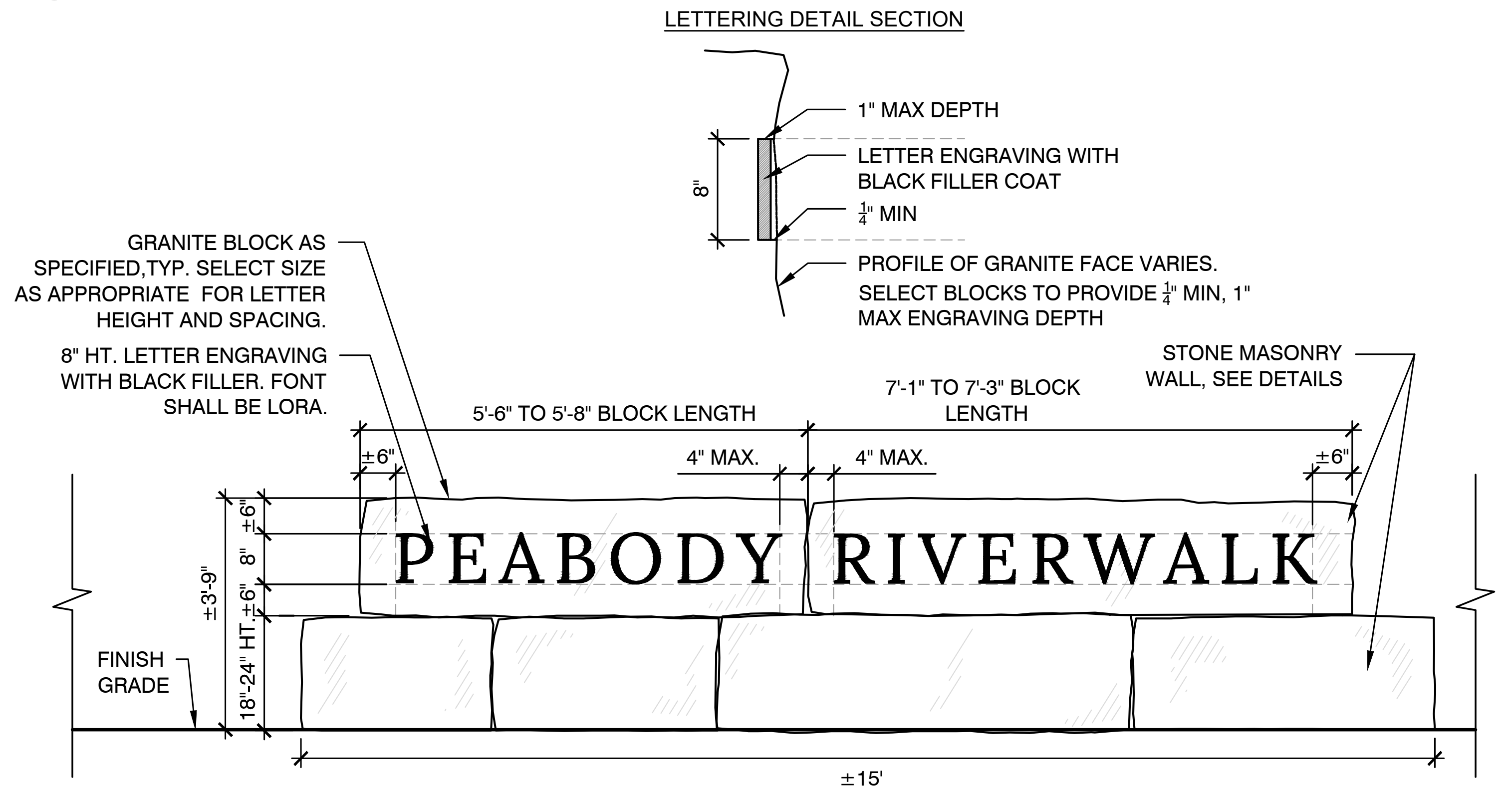
SCALE: N.T.S.



NOTES:
1. BLOCK SELECTION SHALL BE BY OWNER'S REPRESENTATIVE.
2. FINAL LOCATION AND LAYOUT SHALL BE BY OWNER'S REPRESENTATIVE IN FIELD. CONTRACTOR SHALL ASSUME PLACEMENT OF EACH BLOCK A MINIMUM OF 3 TIMES.
3. CONTRACTOR SHALL PROVIDE 6' x 2" BATTER FOR EACH ROW OF STONE.
4. JOINT BETWEEN BOULDER AND ADJACENT MATERIAL SHALL NOT EXCEED ½". STRIPPED TOP SHALL BE FILLED WITH POLYMERIC SAND.
5. CONTRACTOR SHALL FILL VOIDS BETWEEN STONES USING TRAP ROCK. TRAP ROCK SHALL BE SECURELY PLACED TO PREVENT REMOVAL.

4 SALVAGED CANAL STONE RETAINING WALL

SCALE: N.T.S.



5 GRANITE BLOCK RIVERWALK ENTRY SIGN

SCALE: N.T.S.

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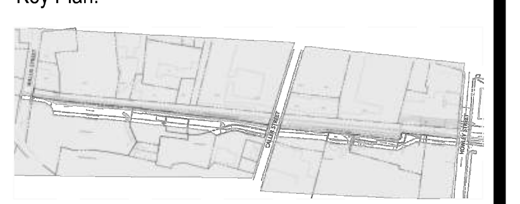

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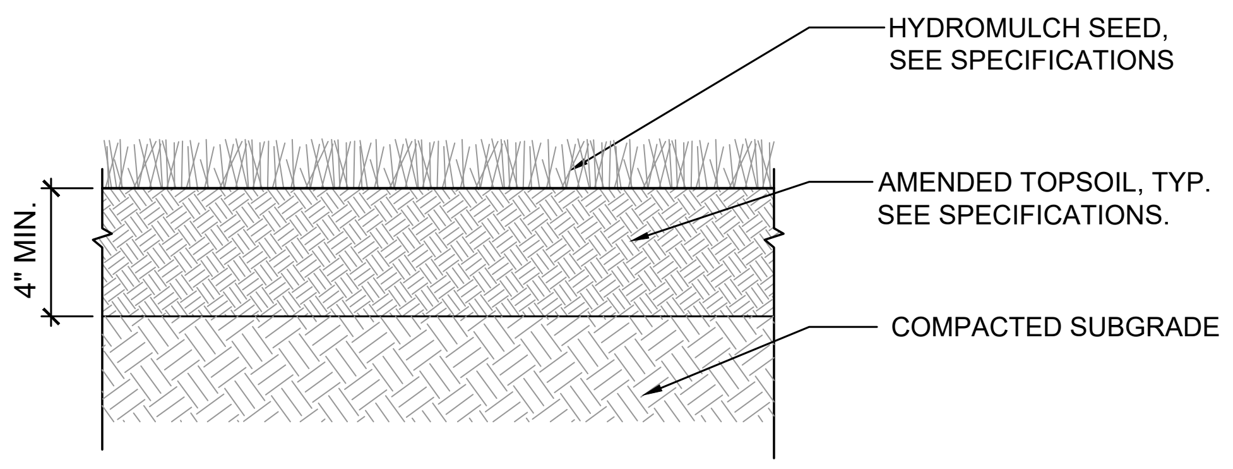
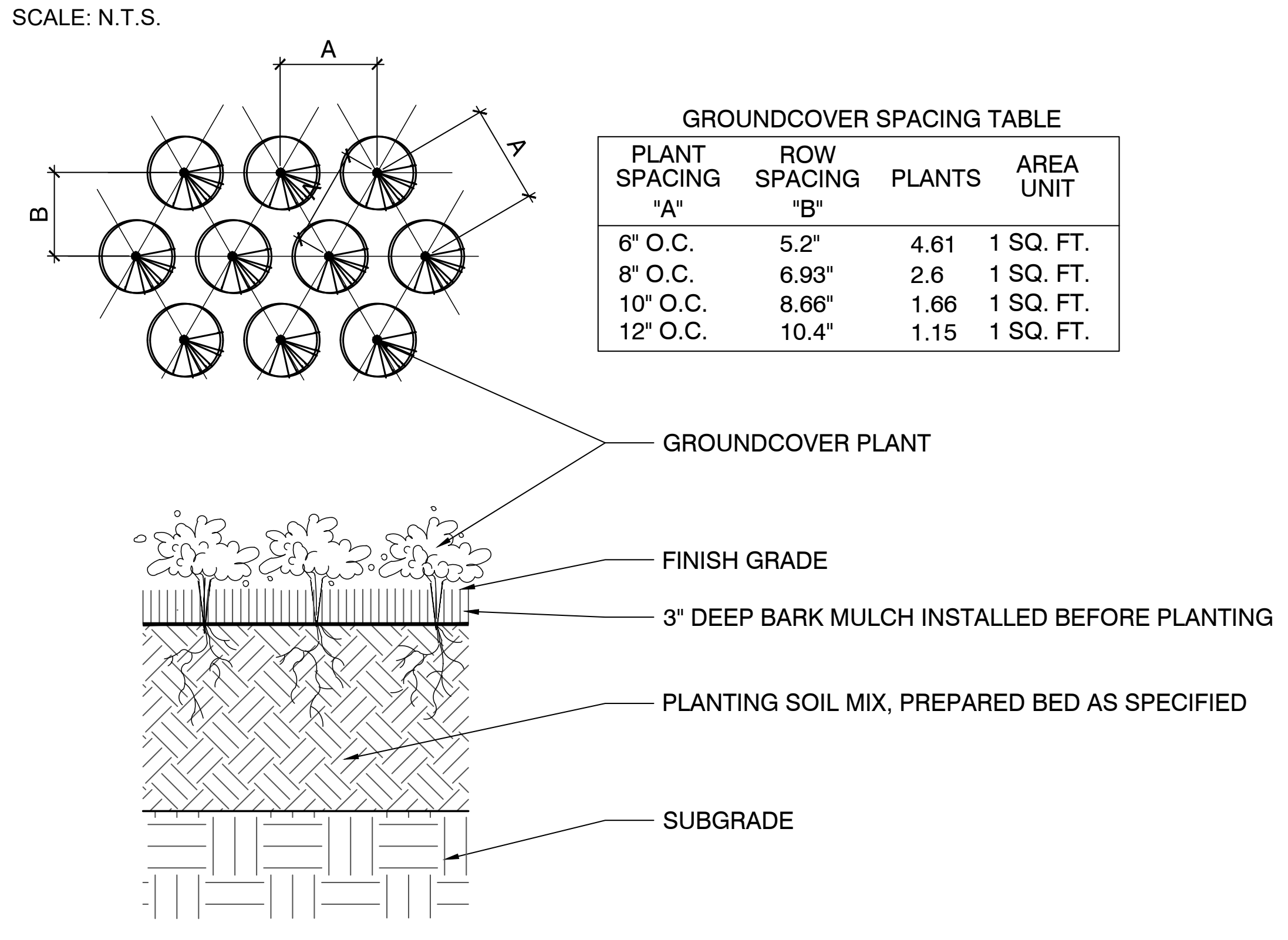


1 LOAM AND SEED

SCALE: N.T.S.



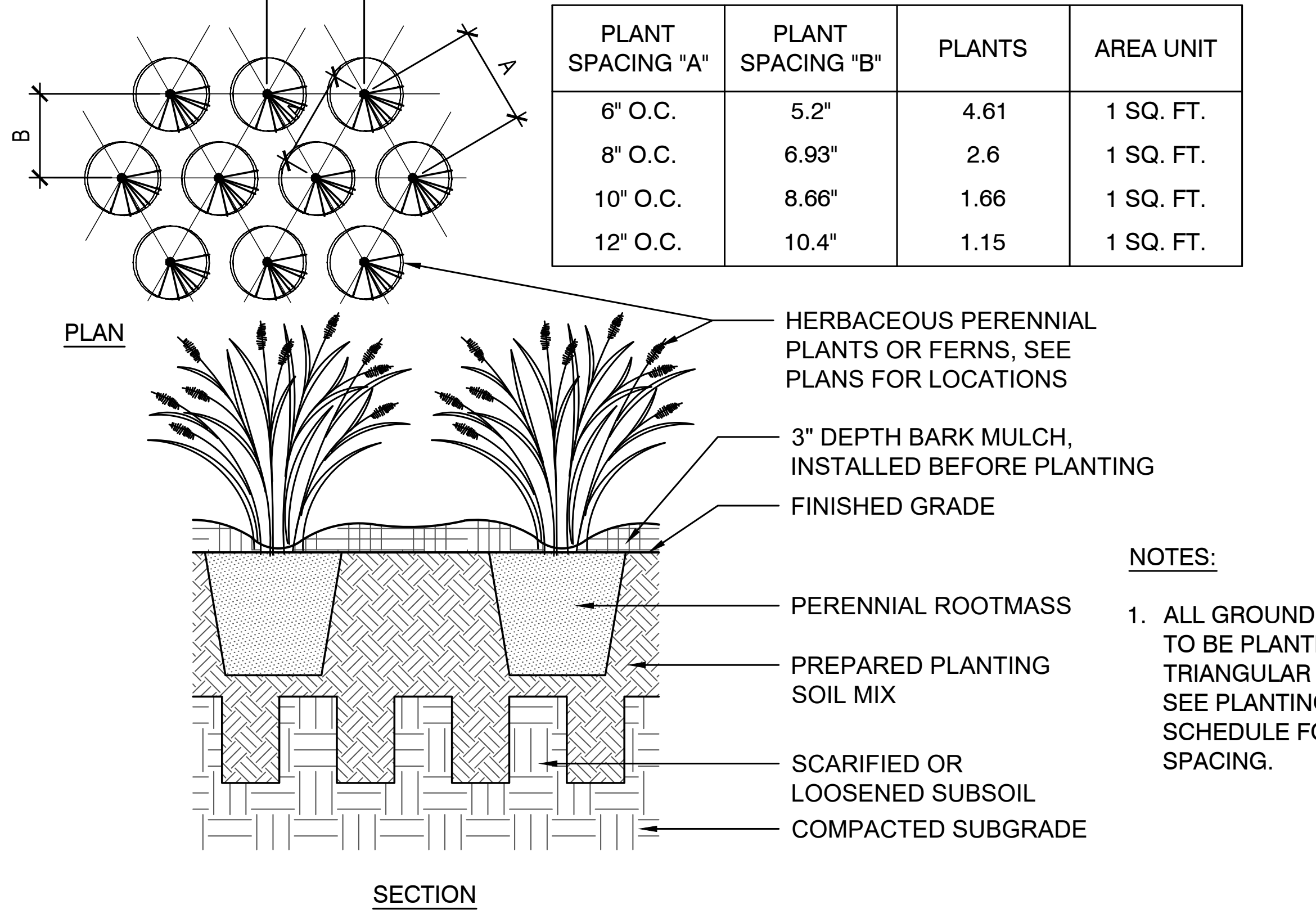
GROUNDCOVER SPACING TABLE

PLANT SPACING "A"	ROW SPACING "B"	PLANTS	AREA UNIT
6" O.C.	5.2"	4.61	1 SQ. FT.
8" O.C.	6.93"	2.6	1 SQ. FT.
10" O.C.	8.66"	1.66	1 SQ. FT.
12" O.C.	10.4"	1.15	1 SQ. FT.

NOTES:
1. ALL GROUNDCOVER TO BE PLANTED IN TRIANGULAR PATTERN. SEE DETAIL PLAN AND GROUNDCOVER SPACING TABLE.
2. JUTE EROSION CONTROL MAT TO BE USED ON ALL SLOPES GREATER THAN 3:1

2 GROUNDCOVER PLANTING

SCALE: N.T.S.



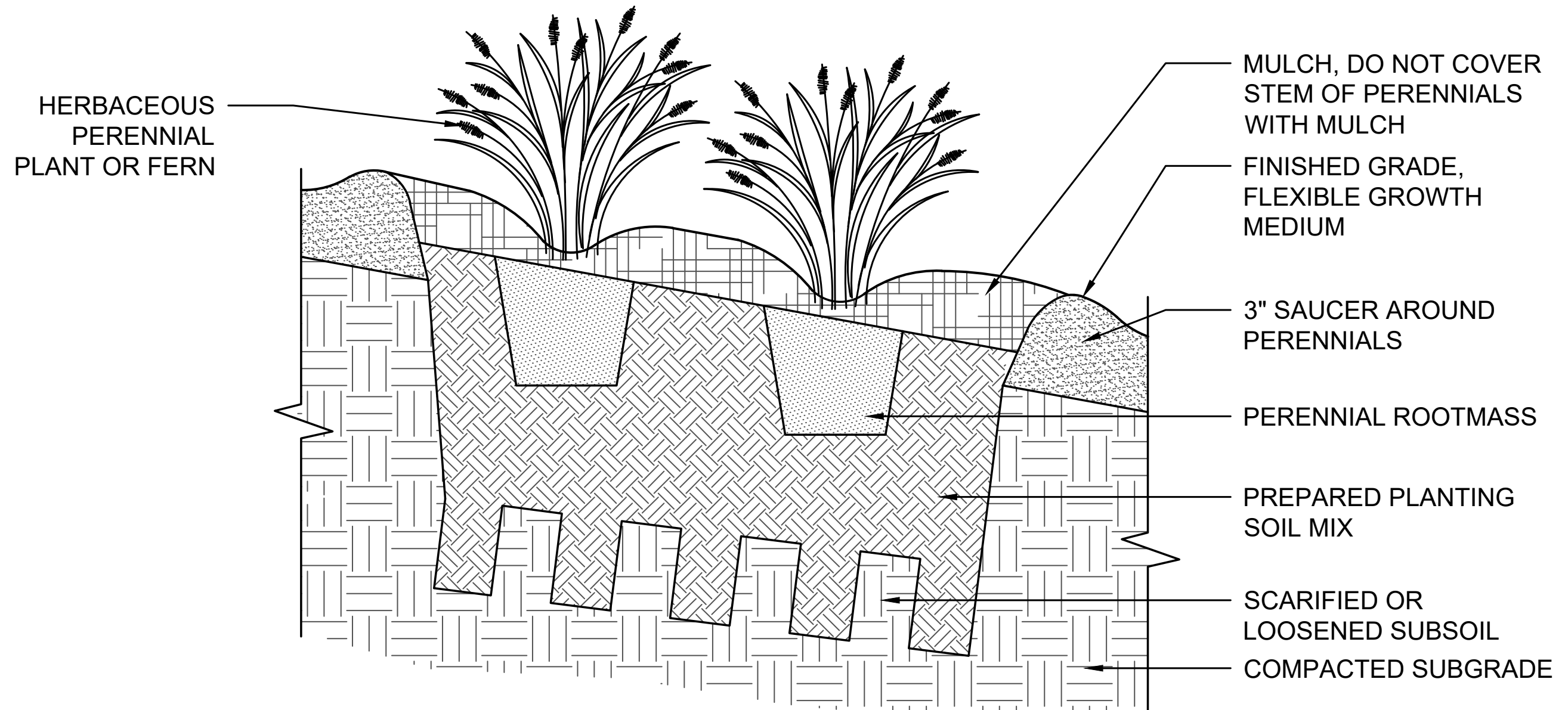
HERBACEOUS PERENNIAL & FERN SPACING TABLE

PLANT SPACING "A"	PLANT SPACING "B"	PLANTS	AREA UNIT
6" O.C.	5.2"	4.61	1 SQ. FT.
8" O.C.	6.93"	2.6	1 SQ. FT.
10" O.C.	8.66"	1.66	1 SQ. FT.
12" O.C.	10.4"	1.15	1 SQ. FT.

NOTES:
1. ALL GROUND COVERS TO BE PLANTED IN TRIANGULAR PATTERN. SEE PLANTING SCHEDULE FOR SPACING.

3 HERBACEOUS PERENNIAL

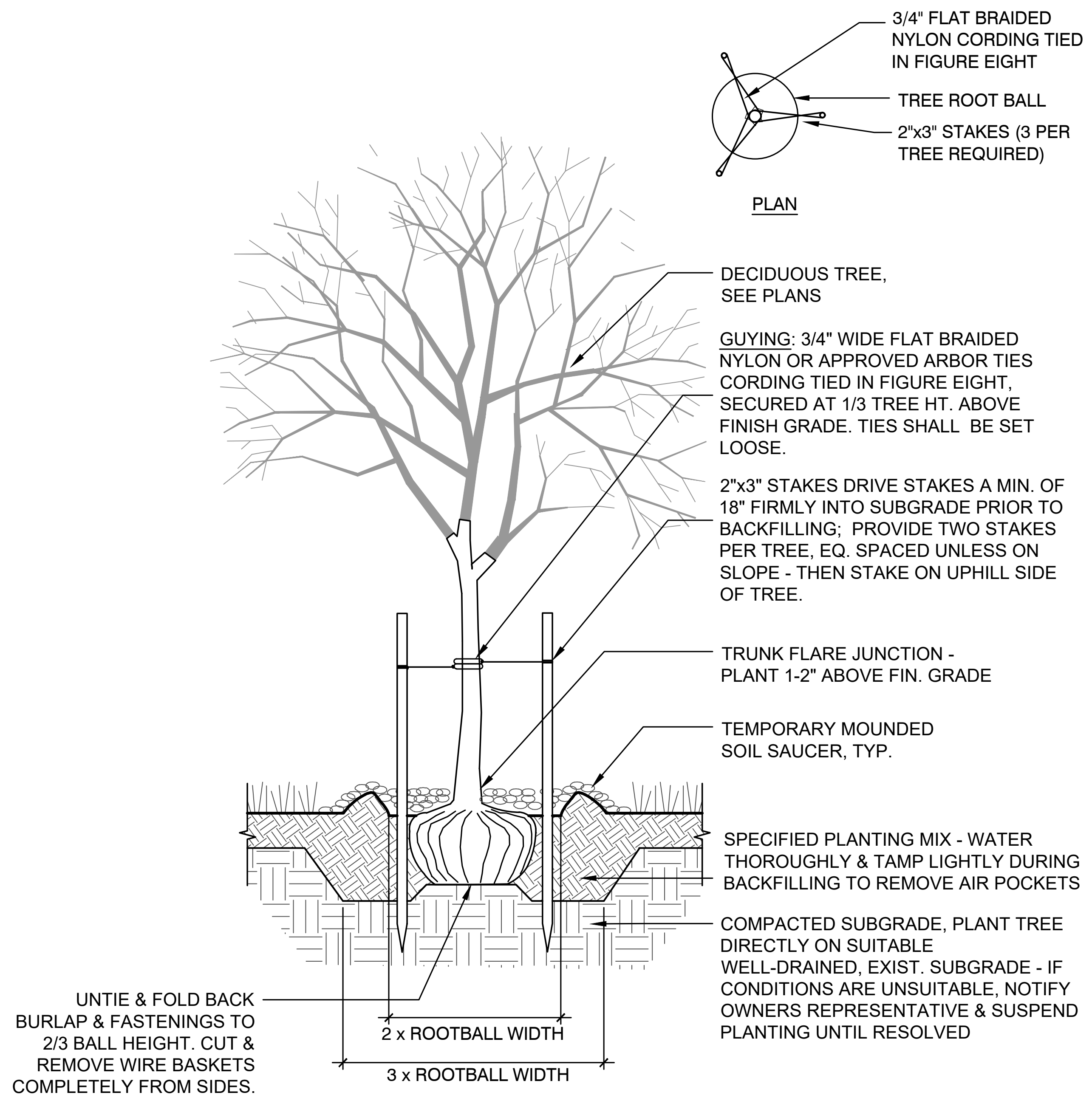
SCALE: N.T.S.



NOTES:
1. SEE GRADING PLAN FOR SLOPE GRADE.
2. ALL MULCH MUST BE DARK IN COLOR. PROVIDE SAMPLE PRIOR TO INSTALLATION TO BE APPROVED BY OWNER'S REPRESENTATIVE.

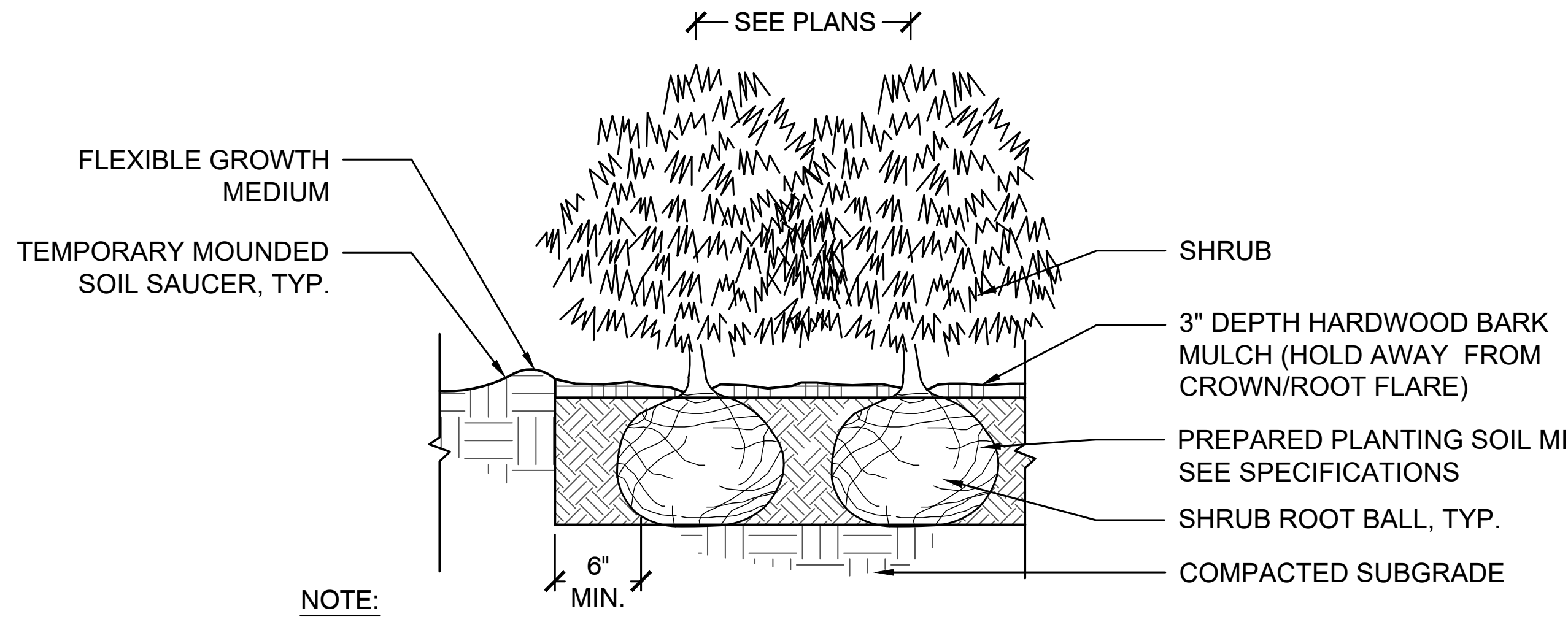
4 HERBACEOUS PERENNIAL ON SLOPE

SCALE: N.T.S.



5 TREE PLANTING AND STAKING - DECIDUOUS

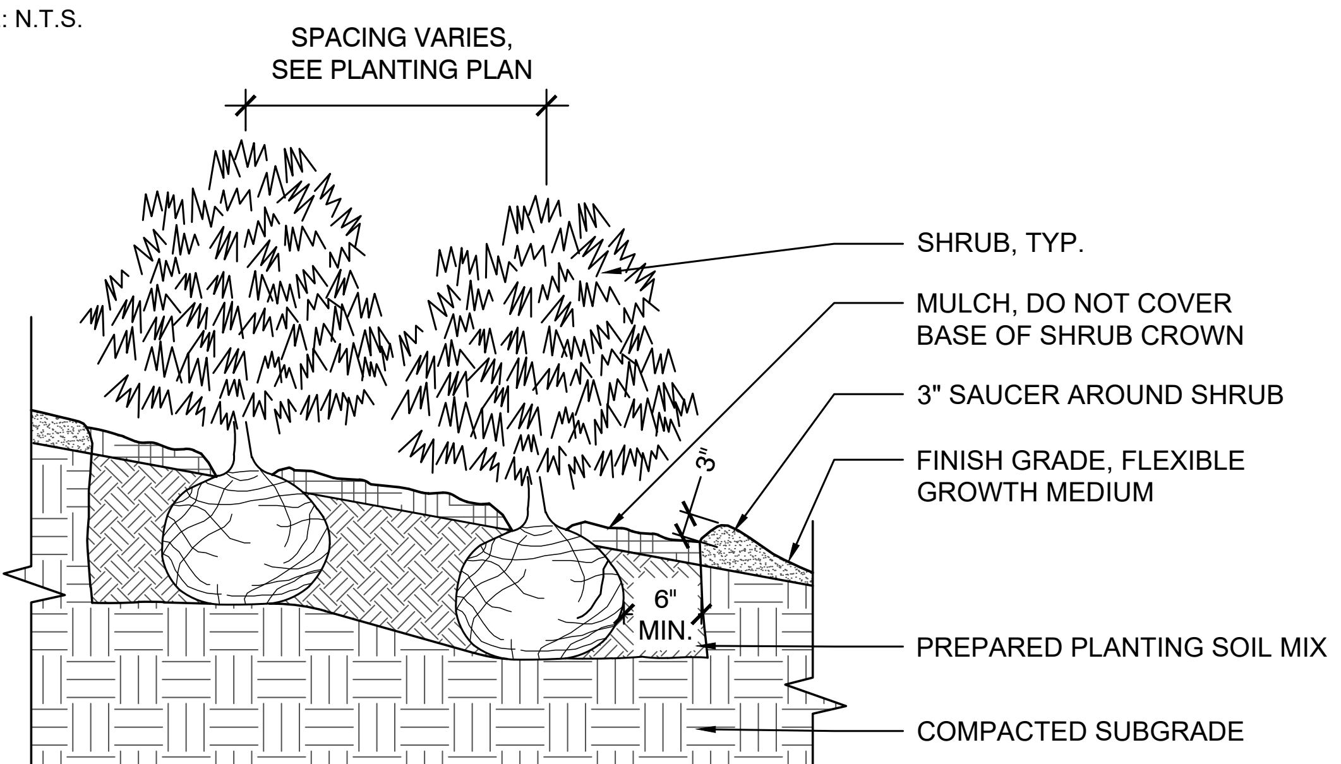
SCALE: N.T.S.



NOTE:
1. ALL MULCH MUST BE DARK IN COLOR. PROVIDE SAMPLE PRIOR TO INSTALLATION TO BE APPROVED BY OWNER'S REPRESENTATIVE.

6 SHRUB PLANTING

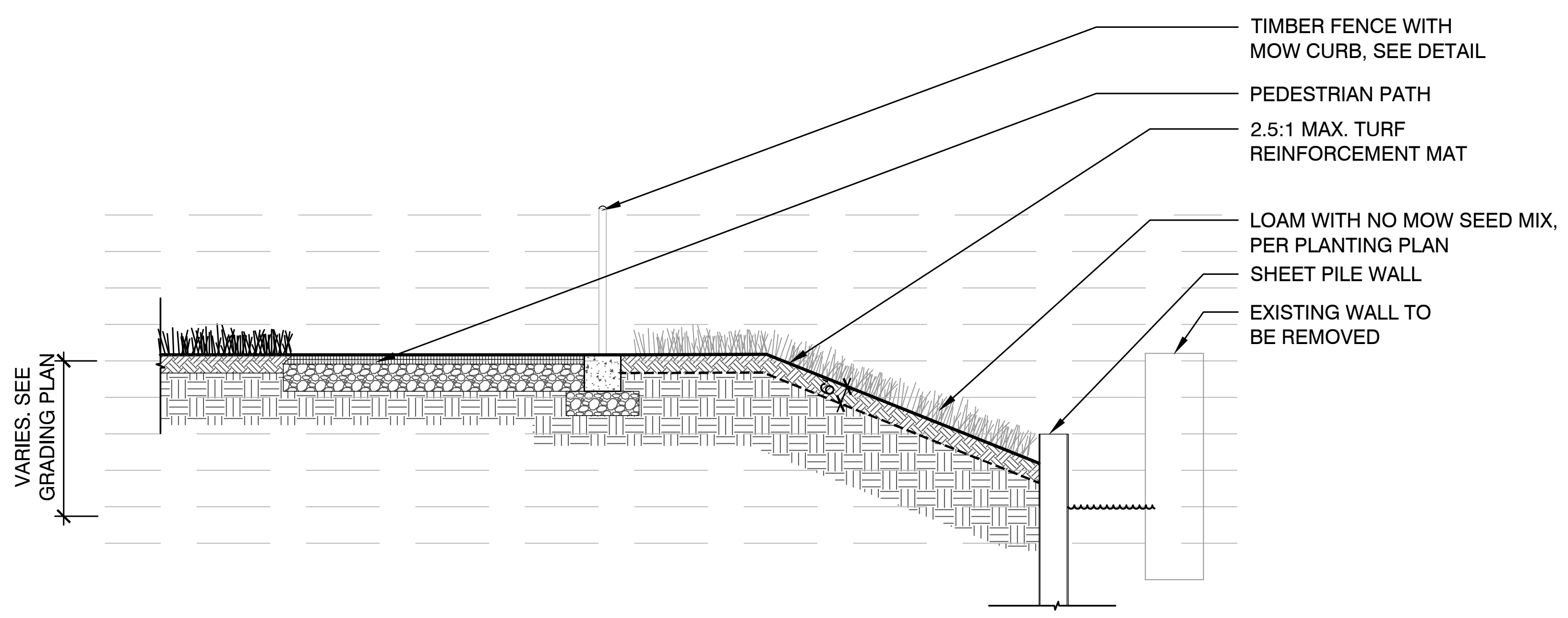
SCALE: N.T.S.



NOTES:
1. SEE GRADING PLAN FOR SLOPE GRADE.
2. ALL MULCH MUST BE DARK IN COLOR. PROVIDE SAMPLE PRIOR TO INSTALLATION TO BE APPROVED BY OWNER'S REPRESENTATIVE.

7 SHRUB PLANTING ON SLOPE

SCALE: N.T.S.



8 SLOPE WITH TURF REINFORCEMENT MAT, LOAM AND EROSION CONTROL

SCALE: N.T.S.

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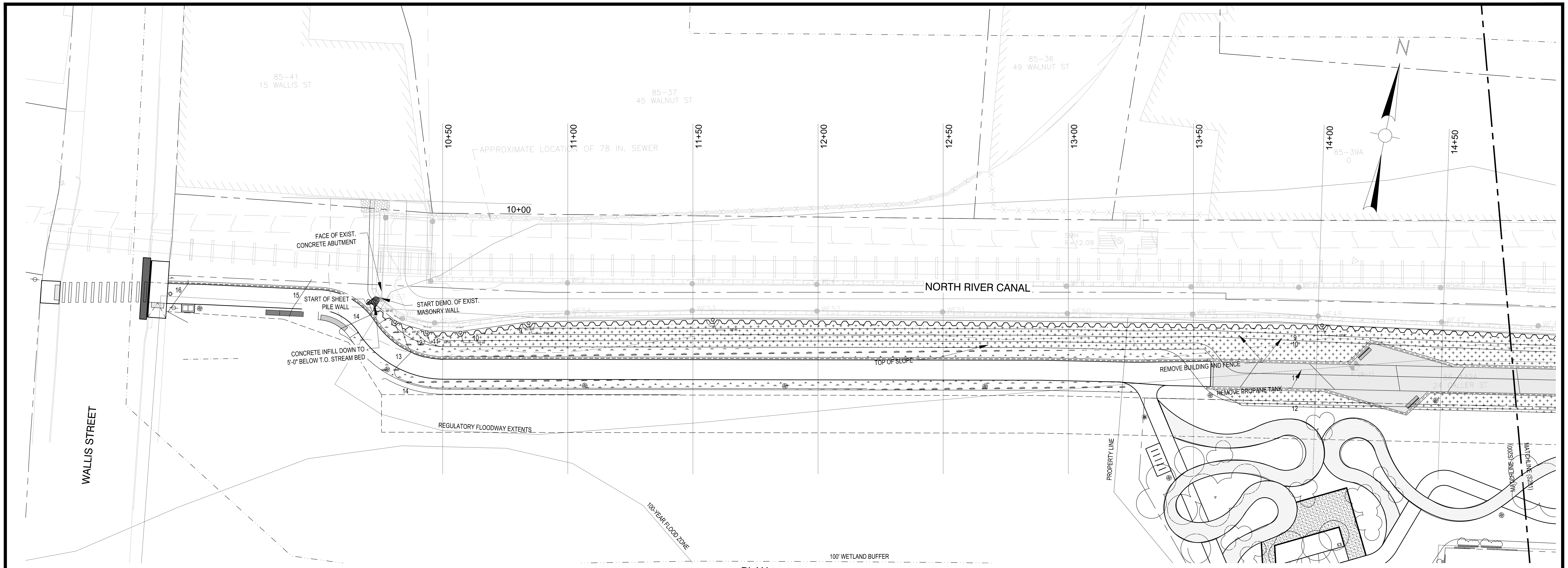
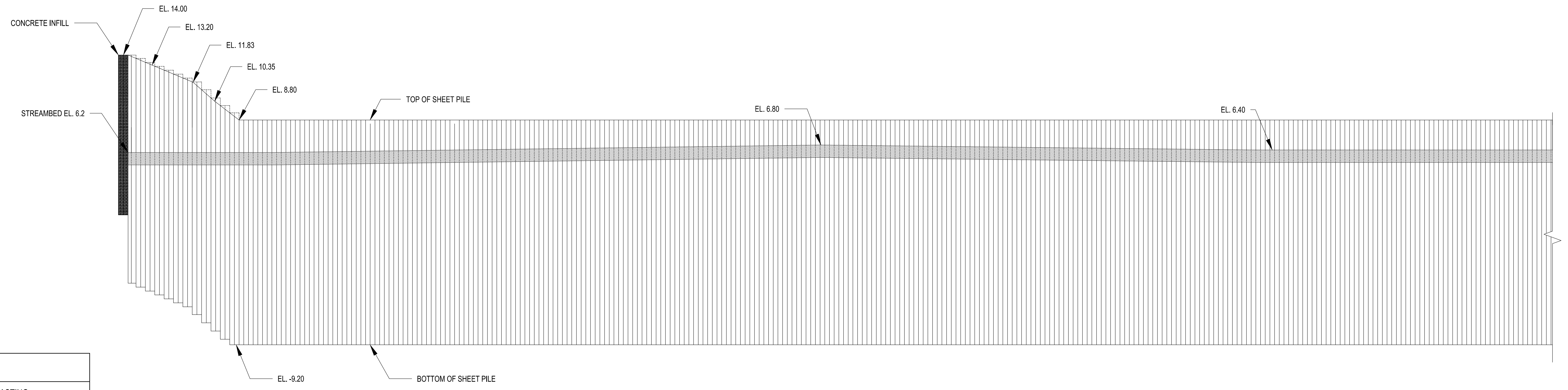
Sheet Number:

L507



PLAN

SCALE: 1" = 20'-0"



ELEVATION - SHEET PILE WALL

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = X'

WORKING POINT TABLE		
WP #	NORTHING	EASTING
1	3120217.9090	-160733.36930
2	3120209.38300	-160722.86670
3	3120205.11650	-160710.25810
4	3120204.84670	-160696.80040
5	3120208.31540	-160669.47910
6	3120208.85690	-160595.88510
7	3120204.00420	-160352.44290

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S200.dwg

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
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HOWLEY STREET
PEABODY, MA. 01960

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Revisions:

No.	Date	Description

Seal:

SCOTT R.
BRUSO
STRUCTURAL
No. 48061

Issued For:

75% PERMITTING SET
- NOT FOR CONSTRUCTION -

Scale: 1" = 20'

Date: APRIL 2021
Drawn By: HLB
Reviewed By: SYC
Approved By: SRB

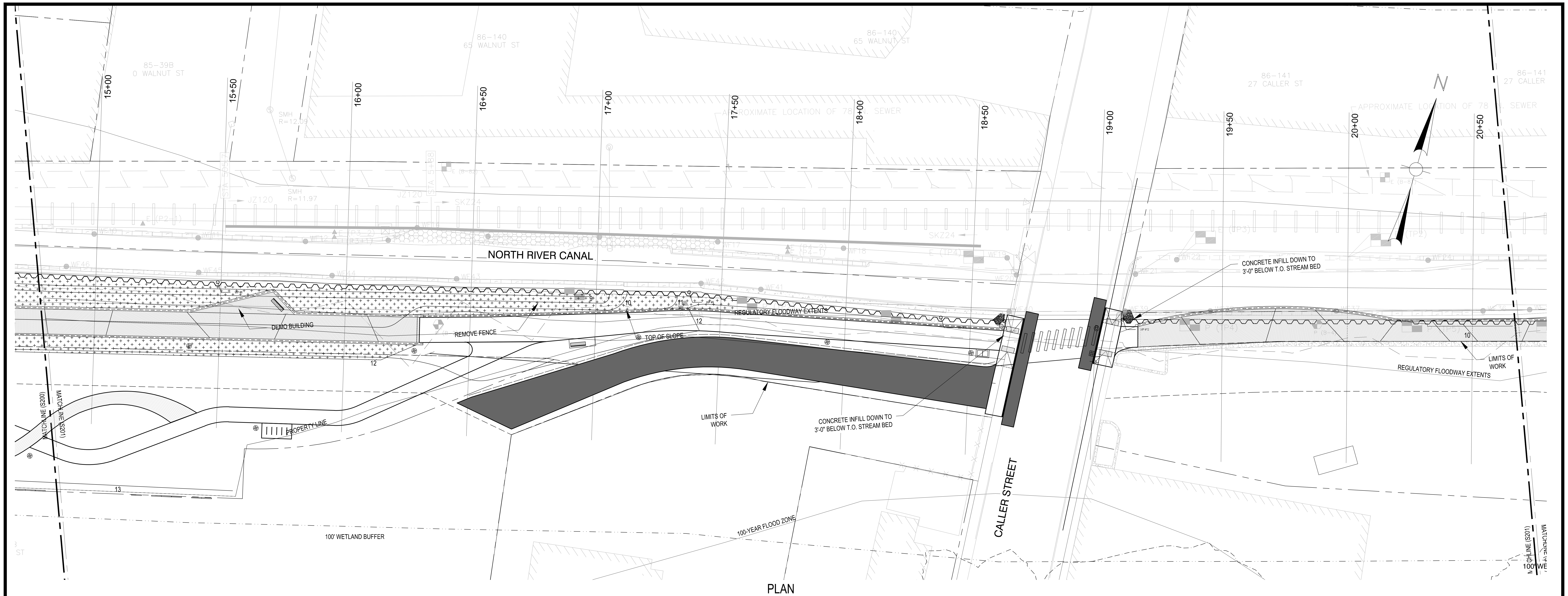
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

PROPOSED LAYOUT PLAN I

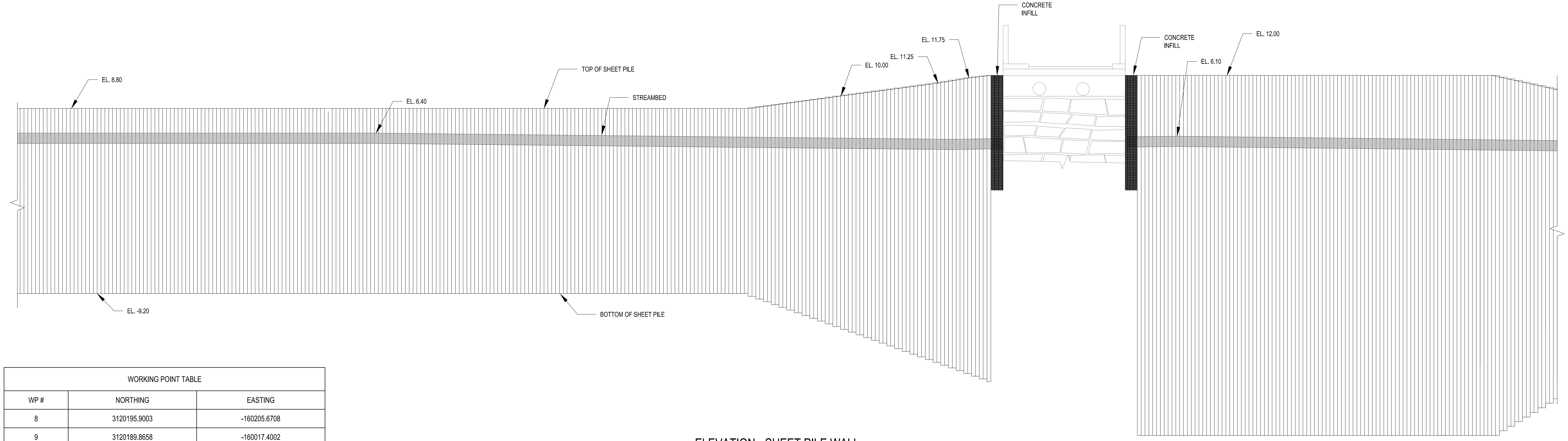
Sheet Number:

S200



PLAN

SCALE: 1" = 20'-0"



ELEVATION - SHEET PILE WALL

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = X'

WORKING POINT TABLE		
WP #	NORTHING	EASTING
8	3120195.9003	-160205.6708
9	3120189.8658	-160017.4002
10	3120178.6442	-159916.9494
11	3120177.0231	-159891.7712
12	3120177.0638	-159844.1990

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S201.dwg

Project:

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SCOTT R. BRUSO
STRUCTURAL
No. 48061

Scott Bruso

Issued For:

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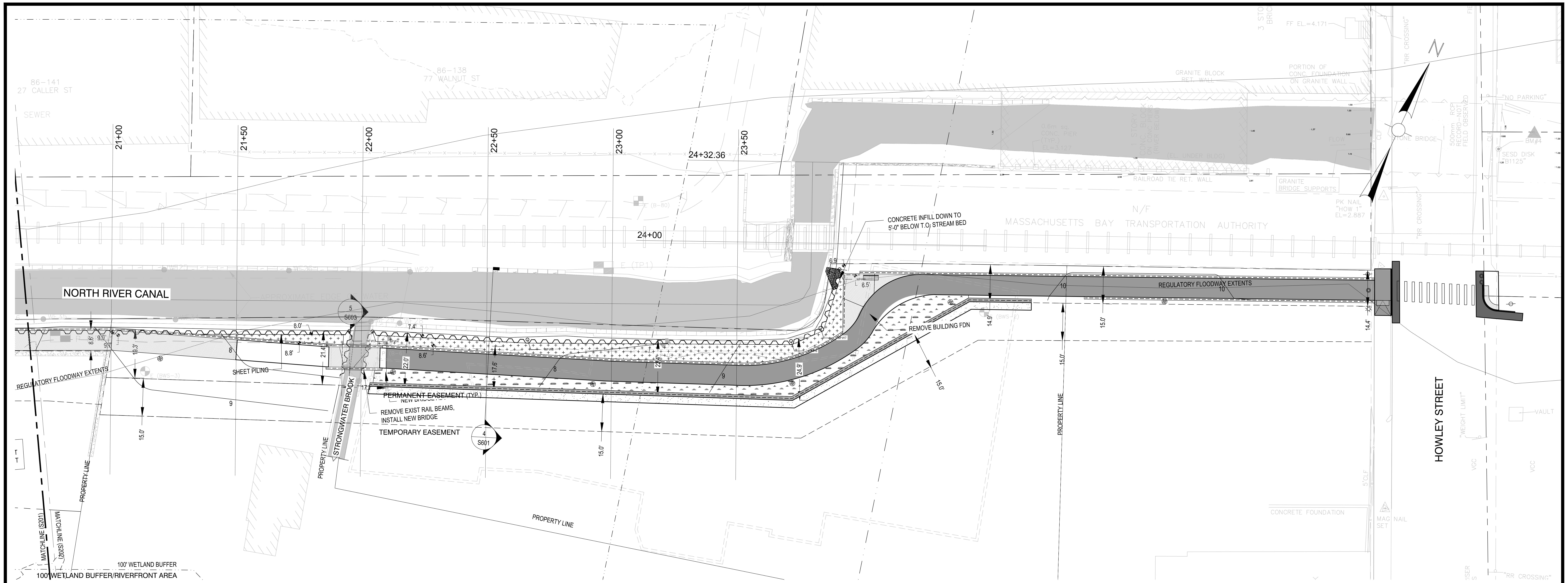
Scale:	1" = 20'
Date:	APRIL 2021
Drawn By:	HLB
Reviewed By:	SYC
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

PROPOSED LAYOUT
PLAN II

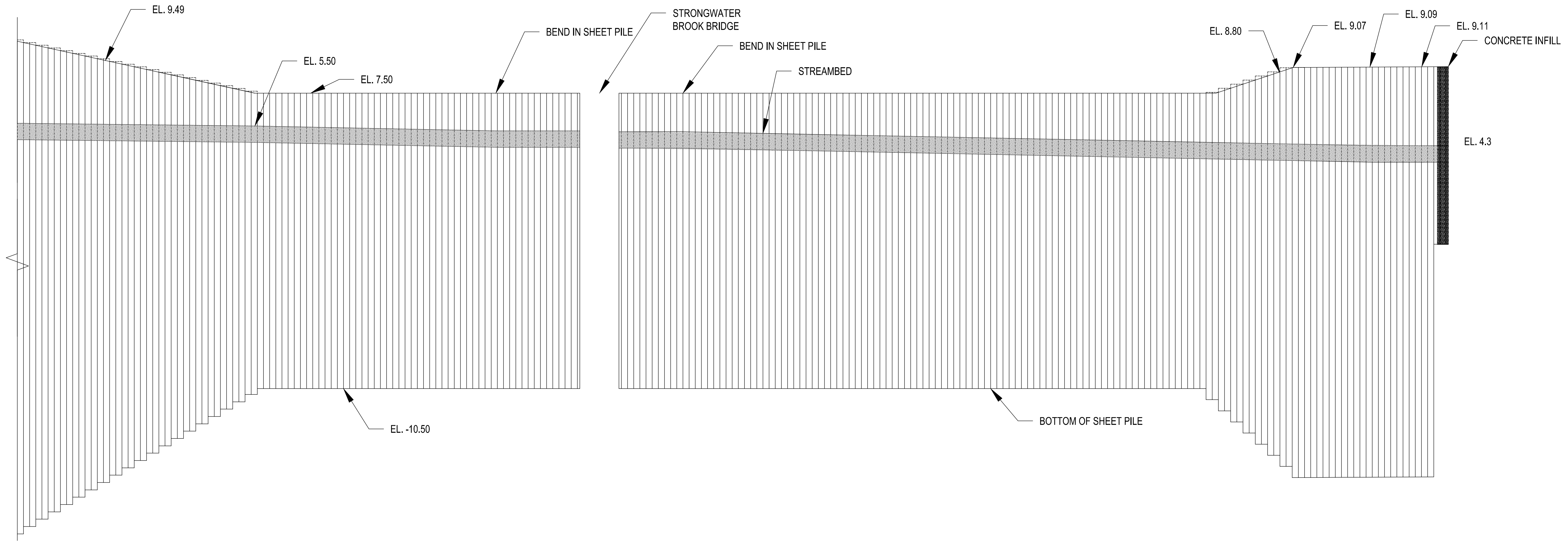
Sheet Number:

S201



PLAN

SCALE: 1" = 20'-0"



ELEVATION - SHEET PILE WALL

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = X'

WORKING POINT TABLE		
WP #	NORTHING	EASTING
13	3120173.1015	-159559.3888
14	3120172.8502	-159550.1588
15	3120168.9470	-159488.2683
16	3120167.2228	-159382.9704
17	3120172.3121	-159371.1687
18	3120195.6586	-159363.2979

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S202.dwg

Project:

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Scale: 1" = 20'

Date: APRIL 2021
Drawn By: HLB
Reviewed By: SYC
Approved By: SRB

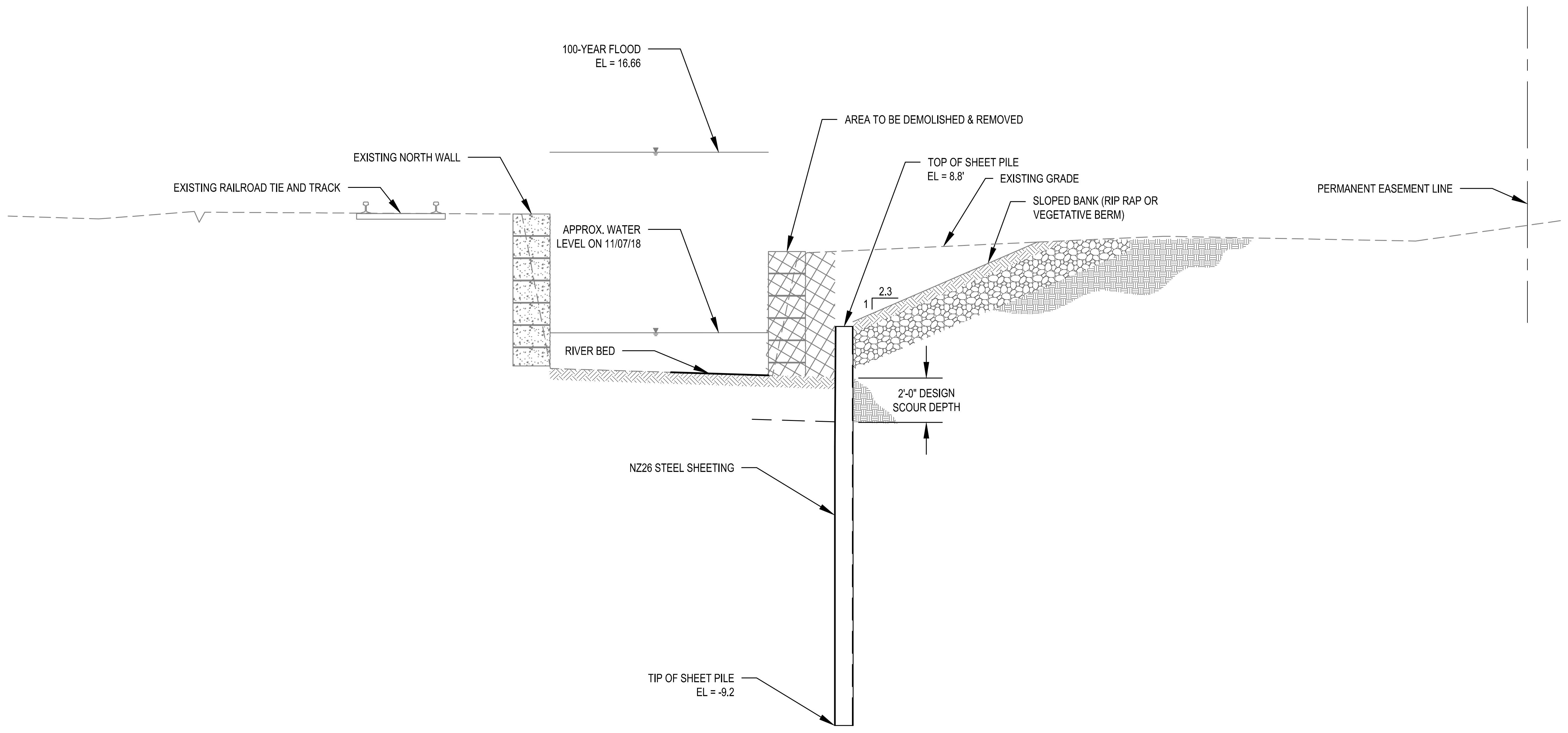
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

PROPOSED LAYOUT PLAN III

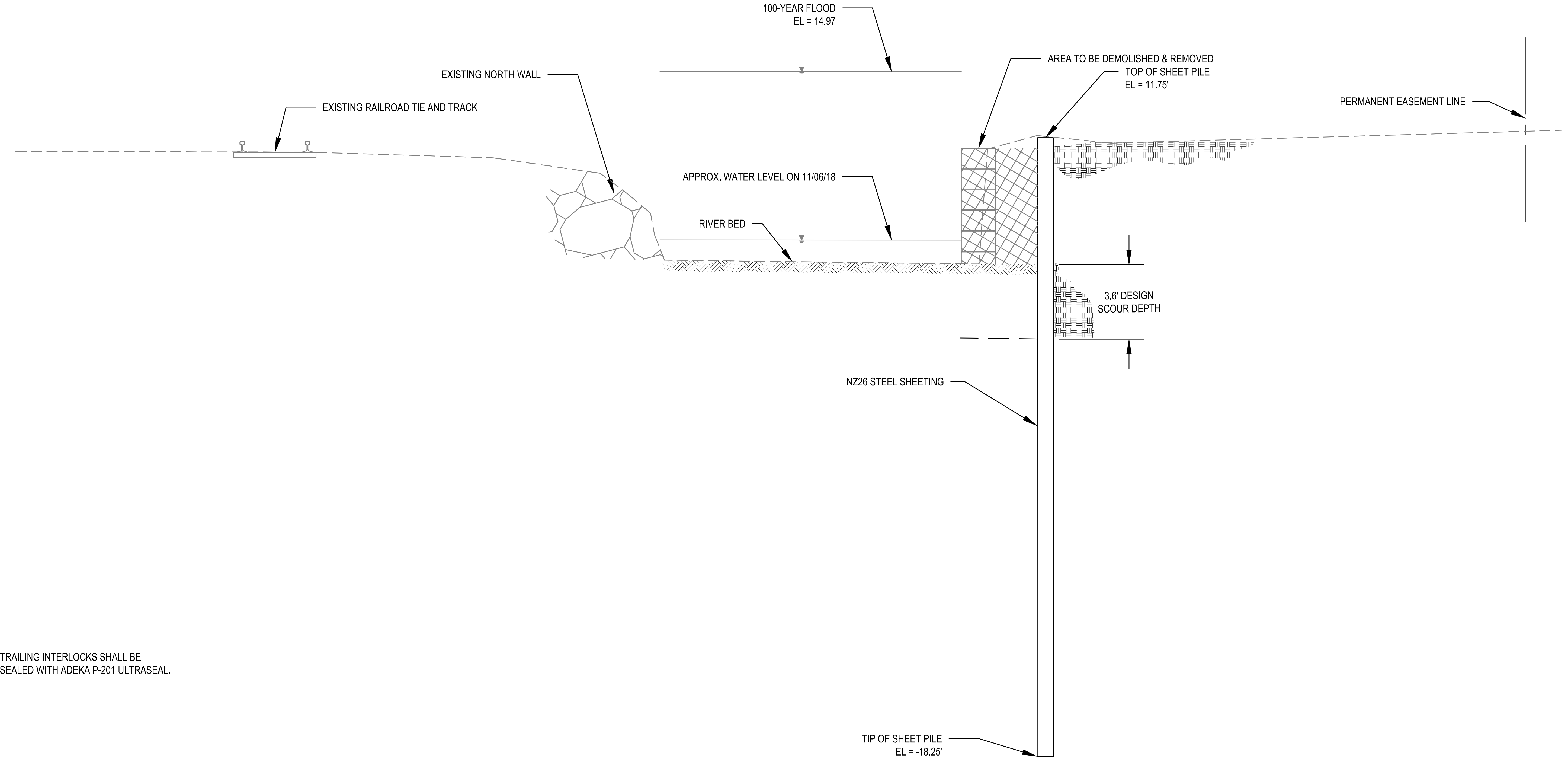
Sheet Number:

S202



① SECTION @ STATION 11+50

SCALE: 1"=4'-0"

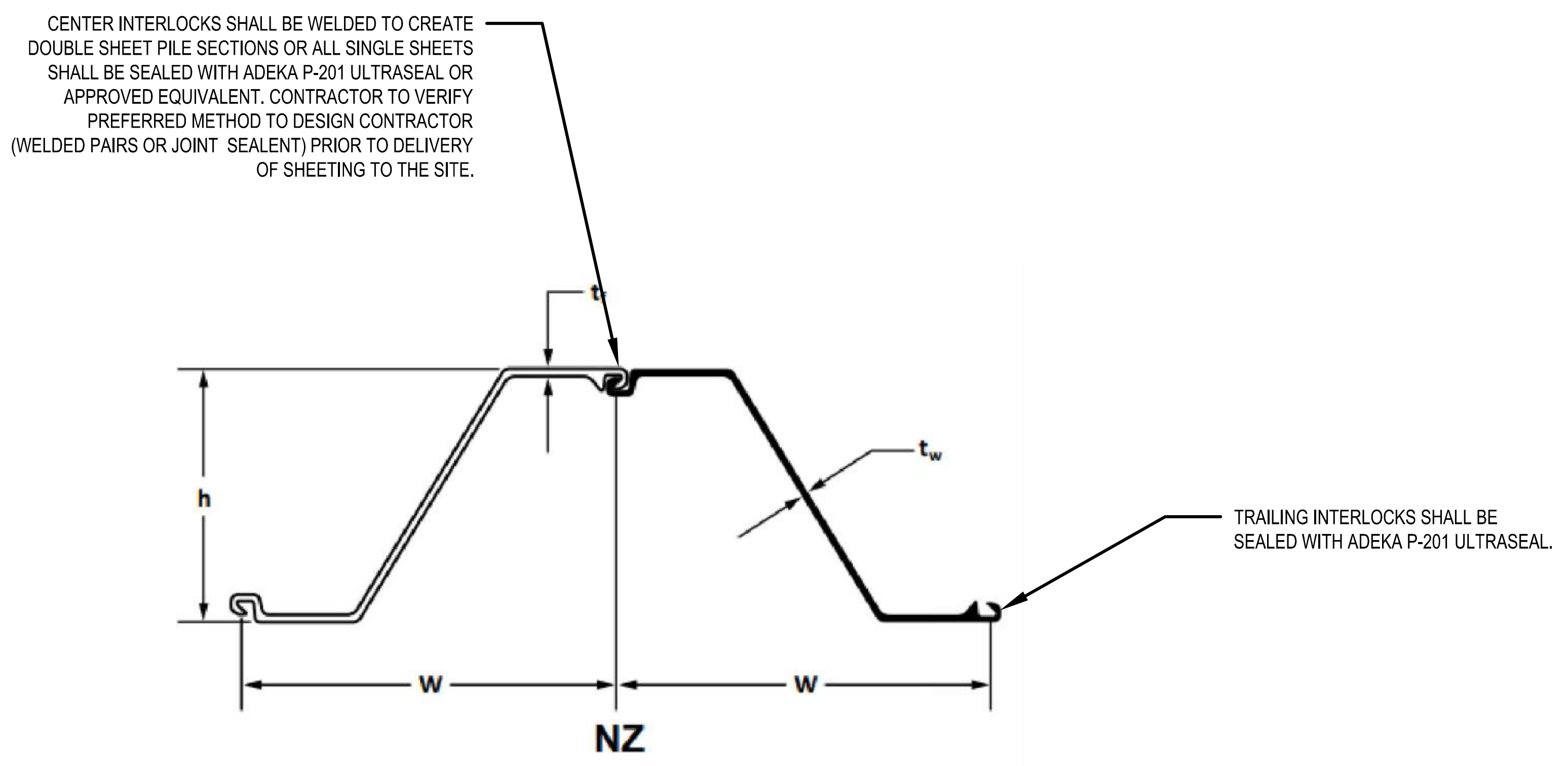


② SECTION @ STATION 18+50

SCALE: 1"=4'-0"

NZ/PZ HOT ROLLED STEEL SHEET PILE

NTS



SECTION	WIDTH (W) (IN)	HEIGHT (H) (IN)	THICKNESS		CROSS SECTIONAL AREA (IN^2/FT)	WEIGHT		SECTION MODULUS		MOMENT OF INERTIA (IN^4/FT)	COATING AREA	
			FLANGE (T_F) (IN)	WEB (T_W) (IN)		PILE (LB/FT)	WALL (LB/FT^2)	ELASTIC (IN^3/FT)	PLASTIC (IN^3/FT)		BOTH SIDES (FT^2/FT) OF SINGLE	WALL SURFACE (FT^2/FT^2)
NZ26	27.56	17.32	0.50	0.50	9.08	71	30.99	48.50	57.01	419.90	6.49	1.41

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S600.dwg

Project:

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Reviewed By: SYC

Approved By: SRB

W&S Project No.: ENG20-0145

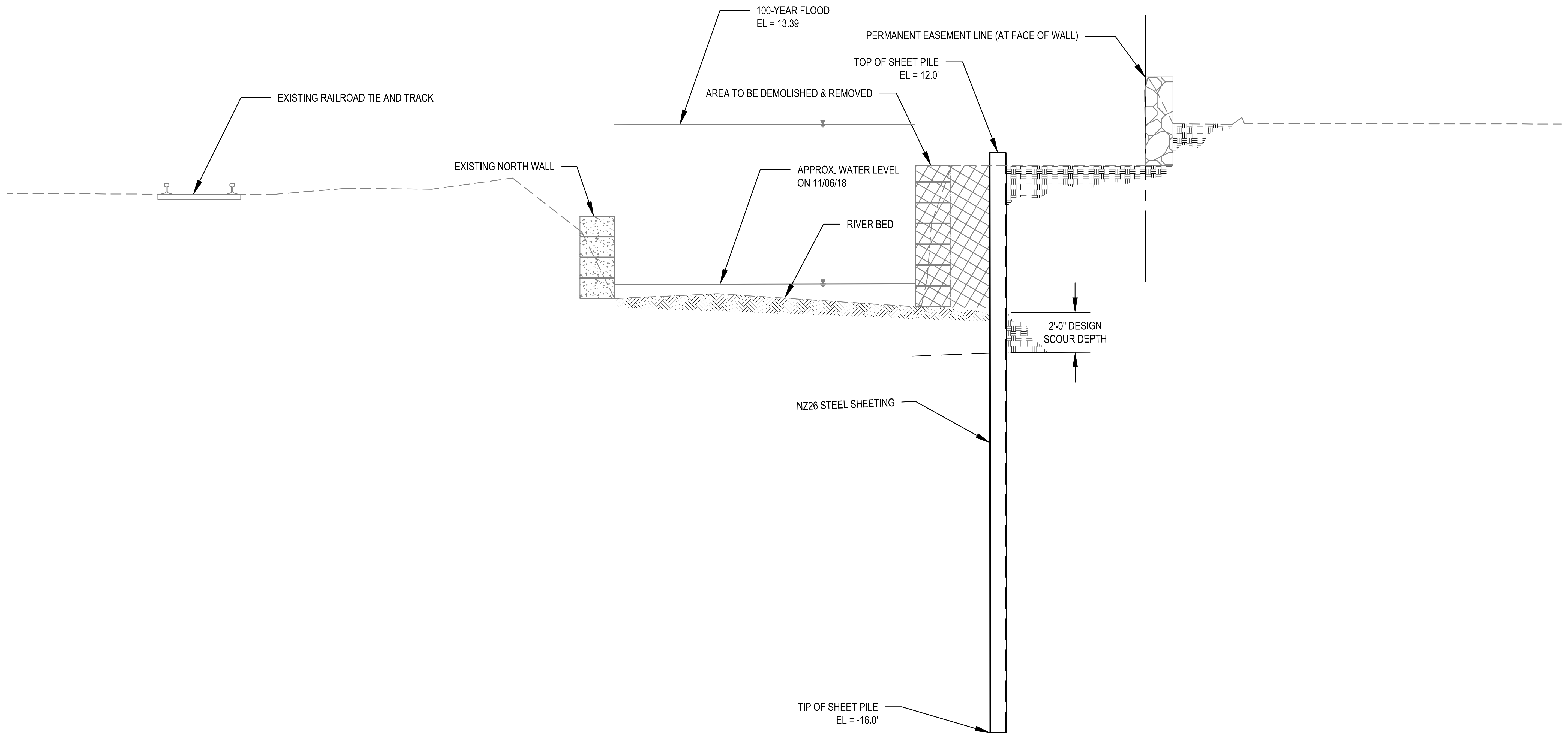
W&S File No.:

Drawing Title:

WALL SECTIONS AND DETAILS I

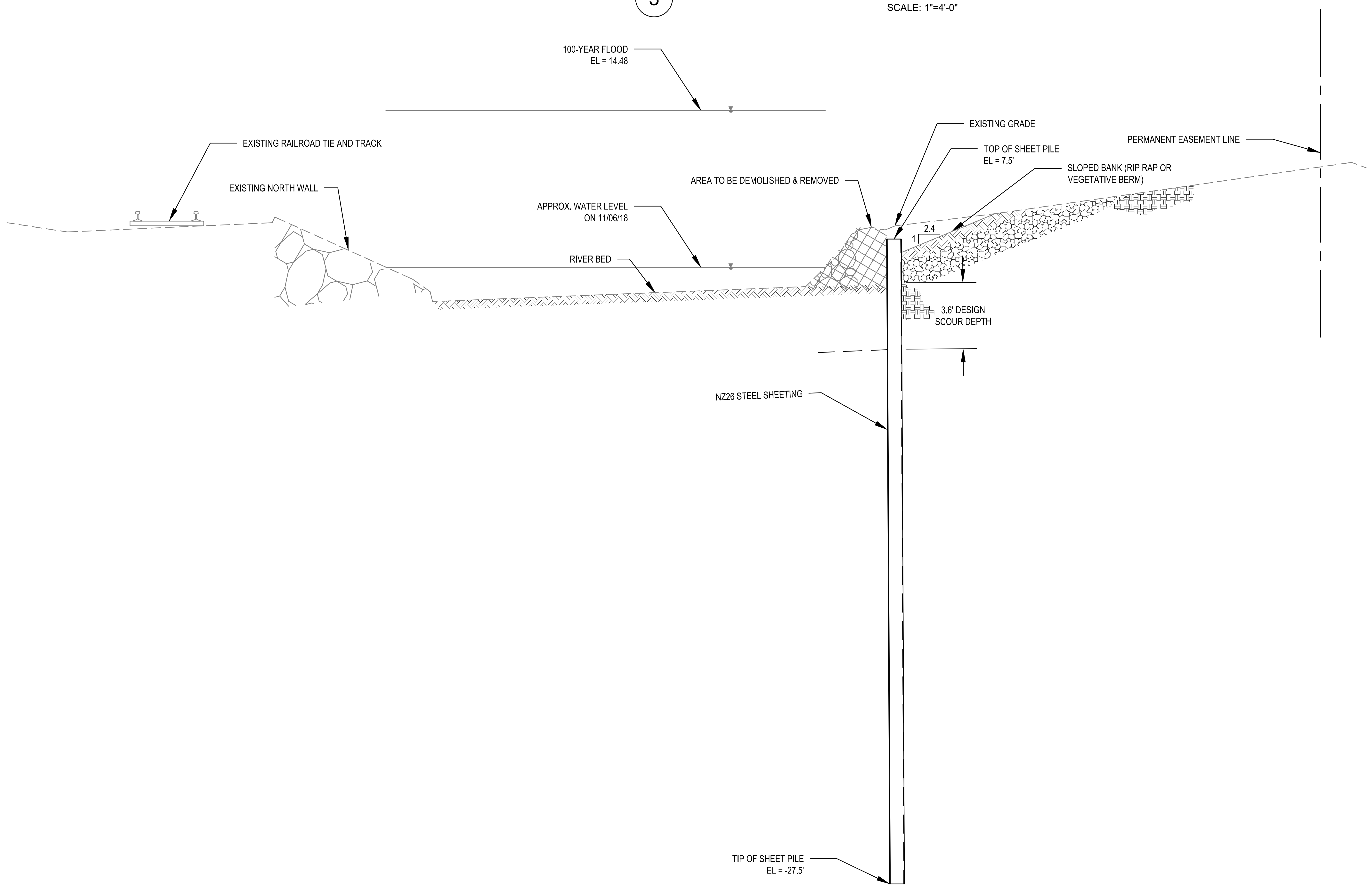
Sheet Number:

S600



3 SECTION @ STATION 19+50

SCALE: 1"=4'-0"



4 SECTION @ STATION 22+50

SCALE: 1"=4'-0"

Project:

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W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

WALL SECTIONS AND
DETAILS II

Sheet Number:

S601

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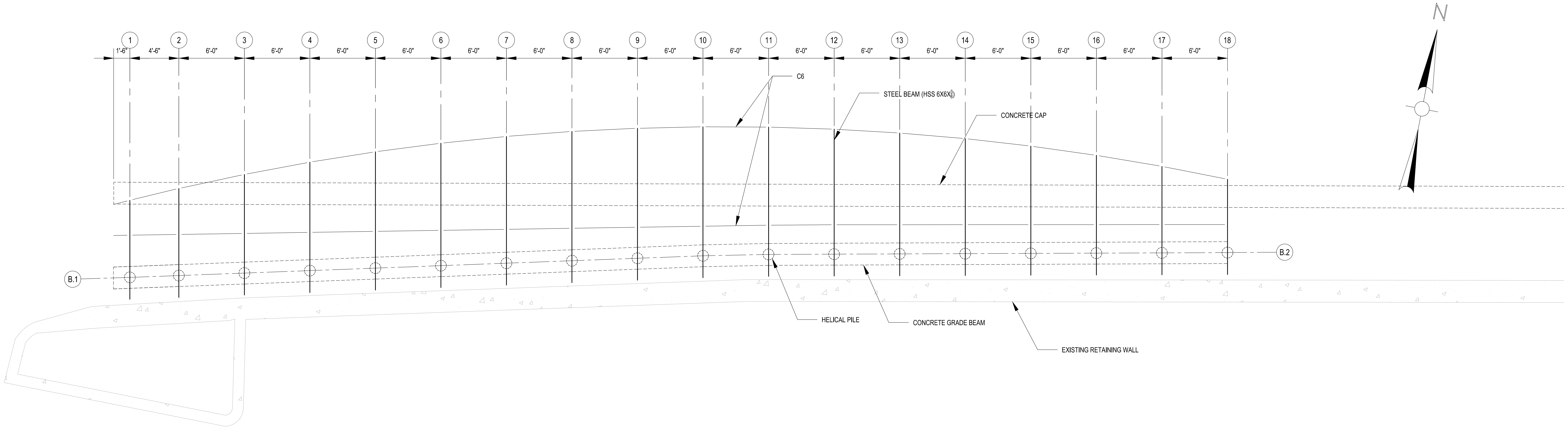
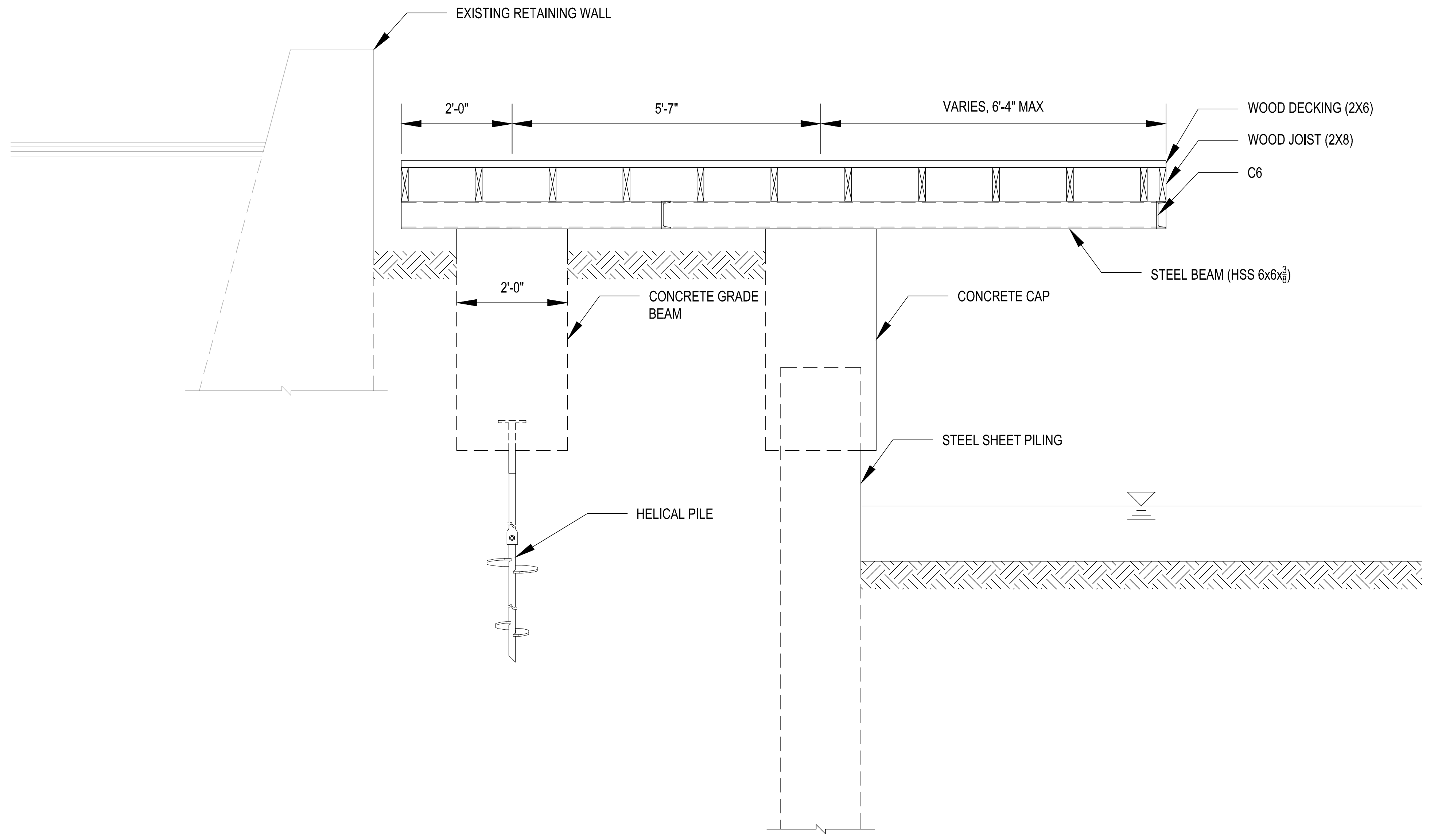
Xref \ \09000 DTR Design Technology Resources\9003 DST Project Sheet Set Manager\Border.dwg



FRAMING PLAN

SCALE: 1" = 5'-0"



ELEVATION VIEW

SCALE: $\frac{1}{2}$" = 1'-0"

Project:

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Scale: 1" = 20'

Date: APRIL 2021

Drawn By: HLB

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Approved By: SRB

W&S Project No.: ENG20-0145

W&S File No.:

Drawing Title:

OVERLOOK FRAMING PLAN, SECTIONS, & DETAILS

Sheet Number:

S602

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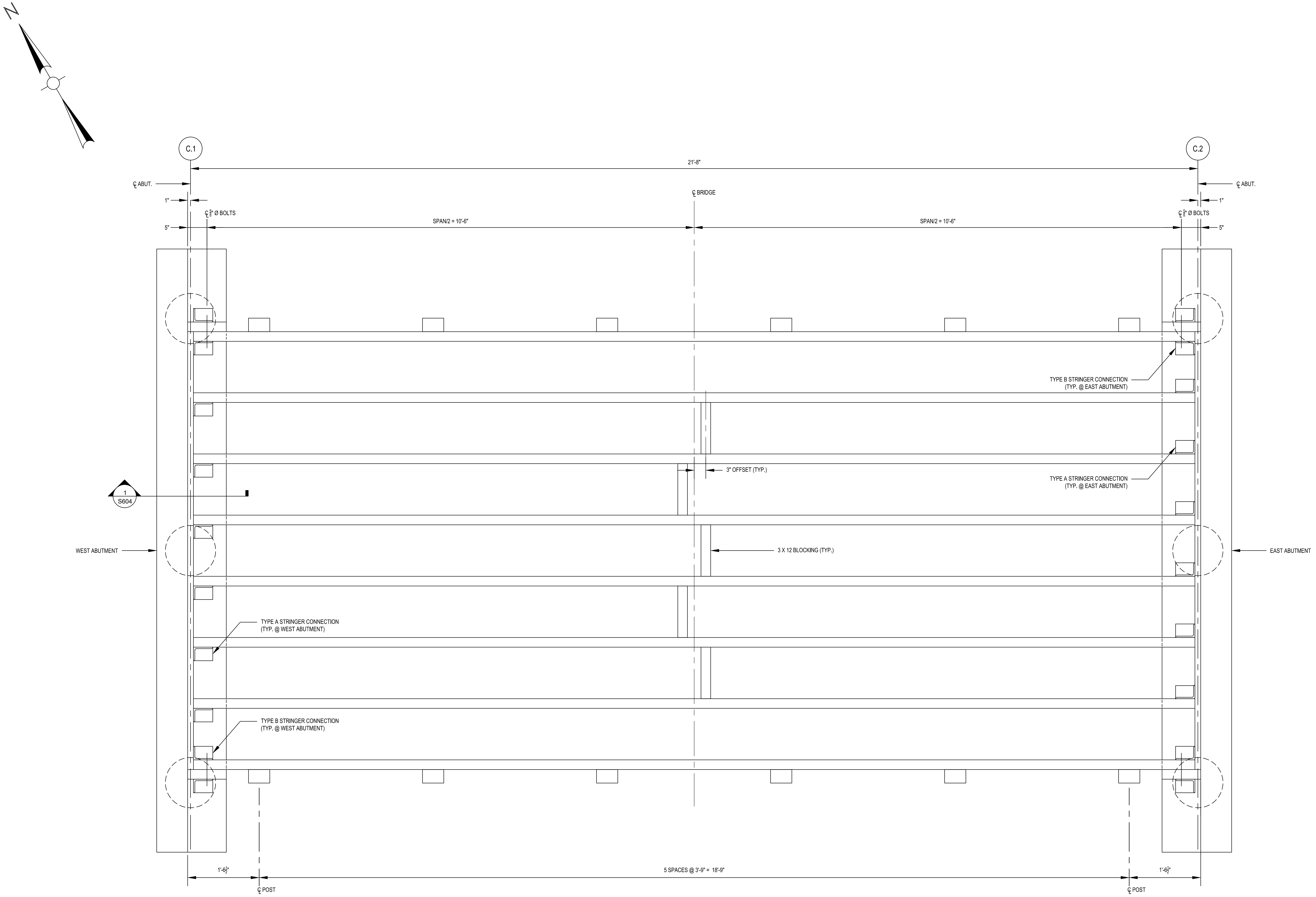

NOTE: RAILING POST ATTACHMENTS ARE
NOT SHOWN FOR CLARITY.

TIMBER BRIDGE FRAMING PLAN
SCALE: 1" = 1'-0"

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S603-S604.dwg

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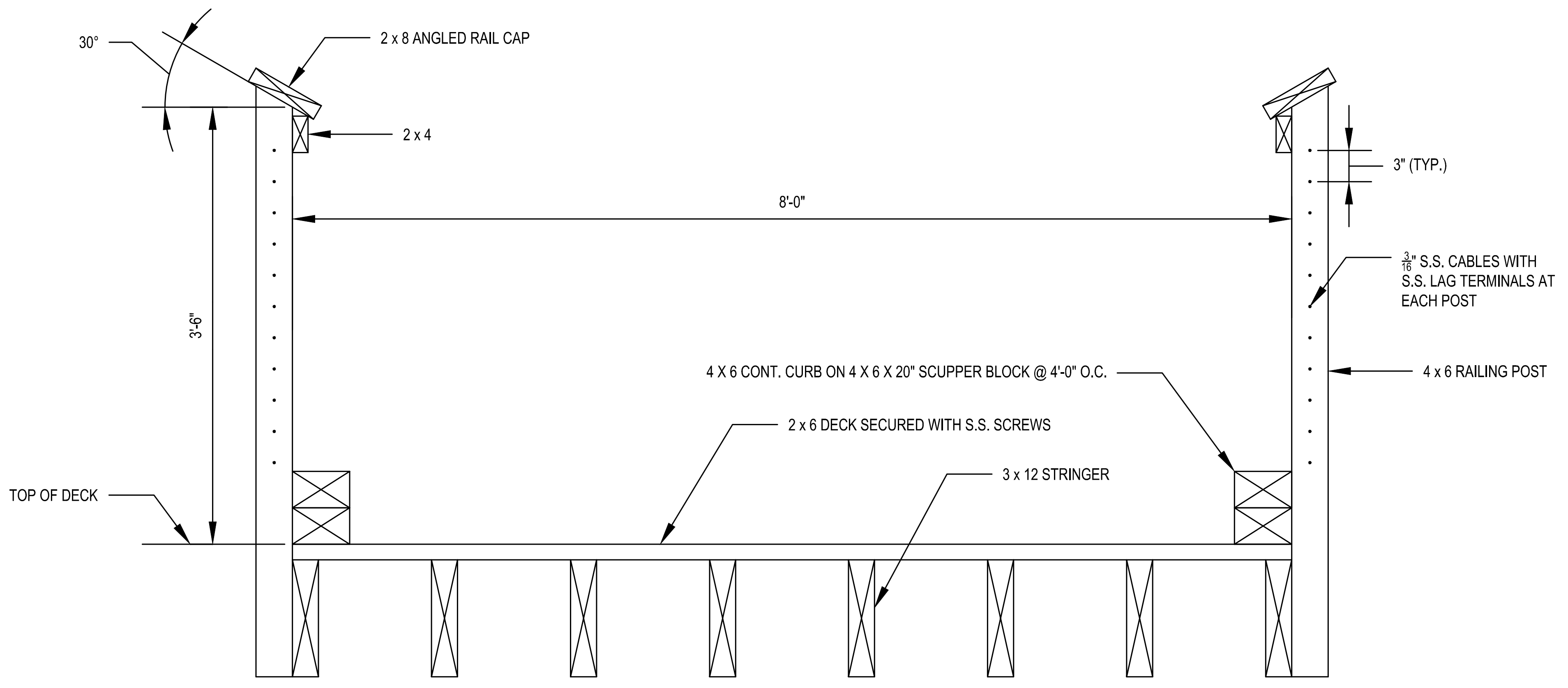
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

TIMBER BRIDGE PLAN & TYP. SECTION

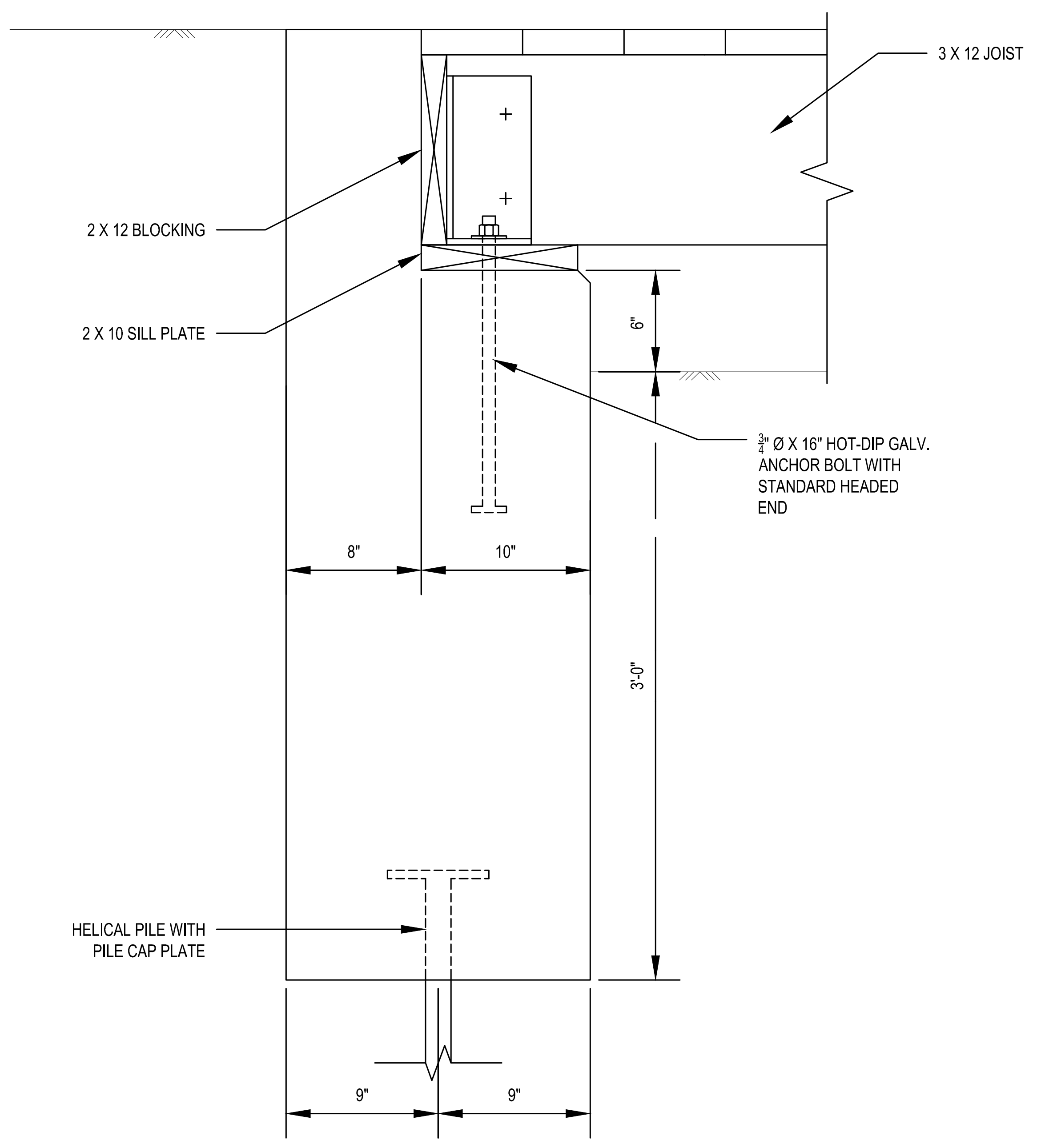
Sheet Number:

S603



TYP. TIMBER BRIDGE SECTION

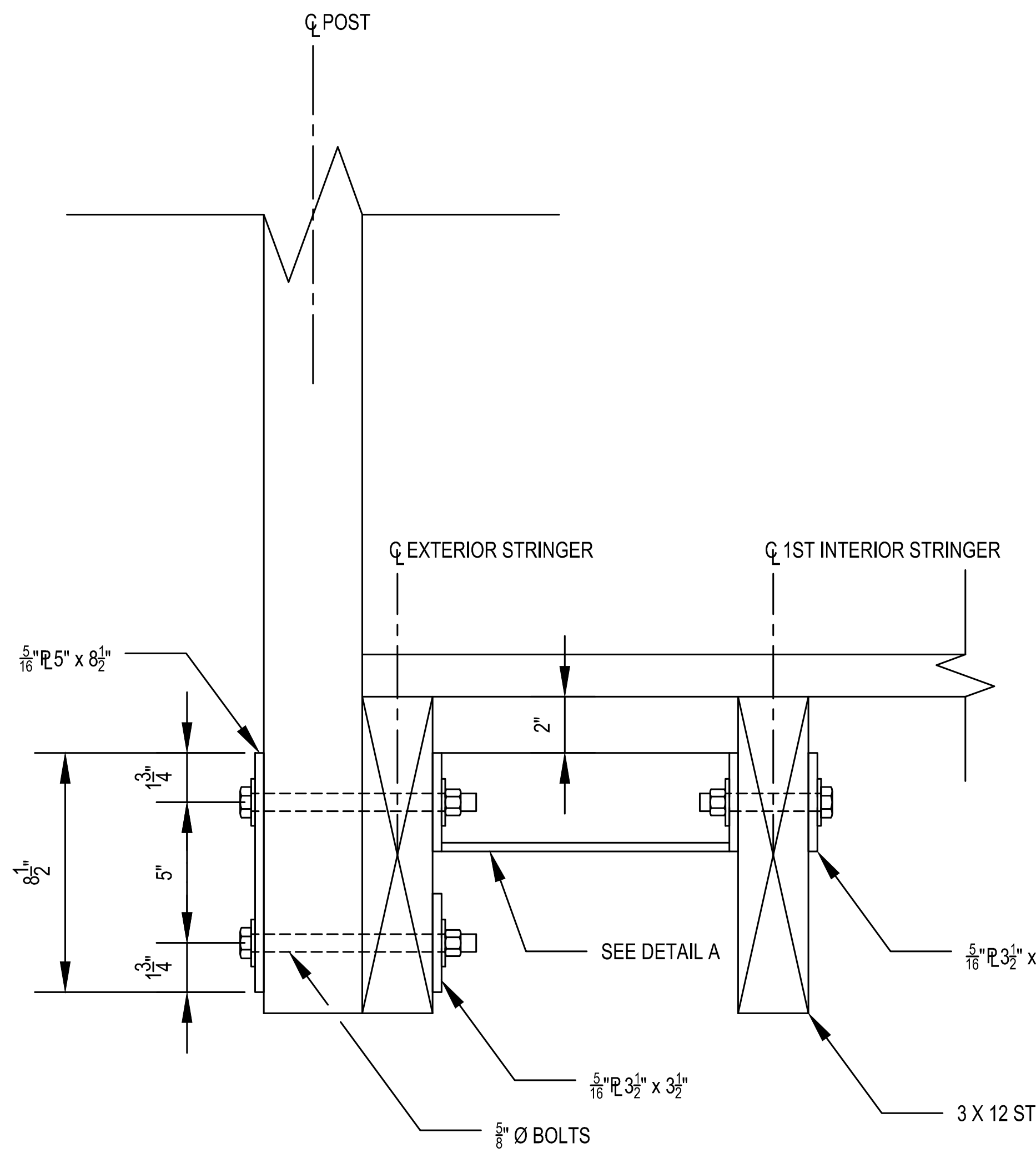
SCALE: 1" = 1'-0"



TYP. ABUTMENT SECTION

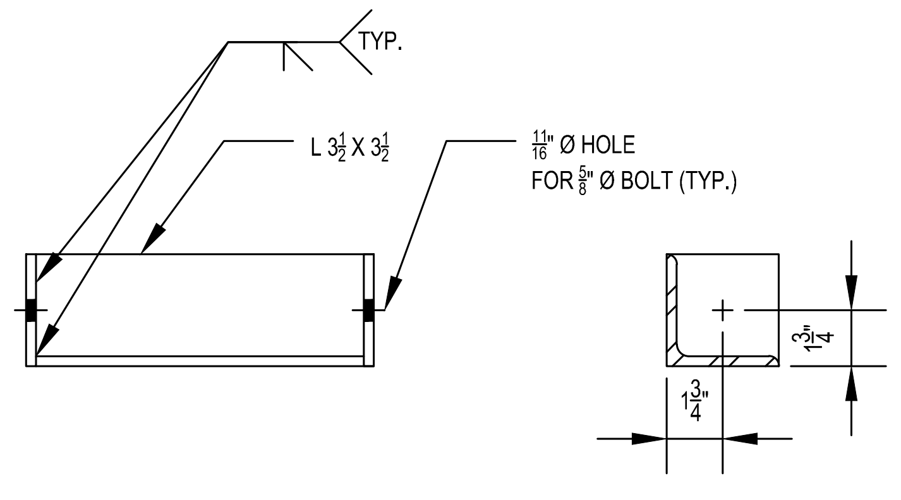
1
S603

SCALE: $1\frac{1}{2}$" = 1'-0"



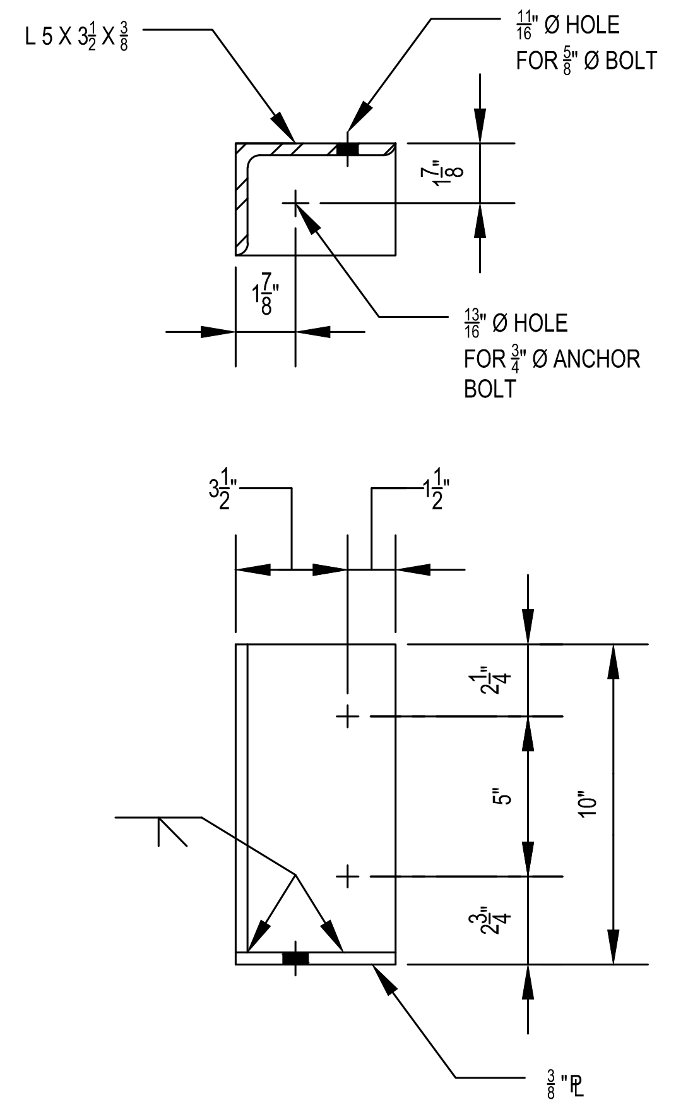
TYP. RAILING POST ATTACHMENT

SCALE: 2" = 1'-0"



DETAIL A

SCALE: 2" = 1'-0"



TYPE A (AS SHOWN)
TOTAL REQ'D = 16

TYPE B (SIMILAR)
TOTAL REQ'D = 4

TYP. STRINGER CONNECTION DETAILS

SCALE: 2" = 1'-0"

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S603-S604.dwg

Project:

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Approved By: SRB

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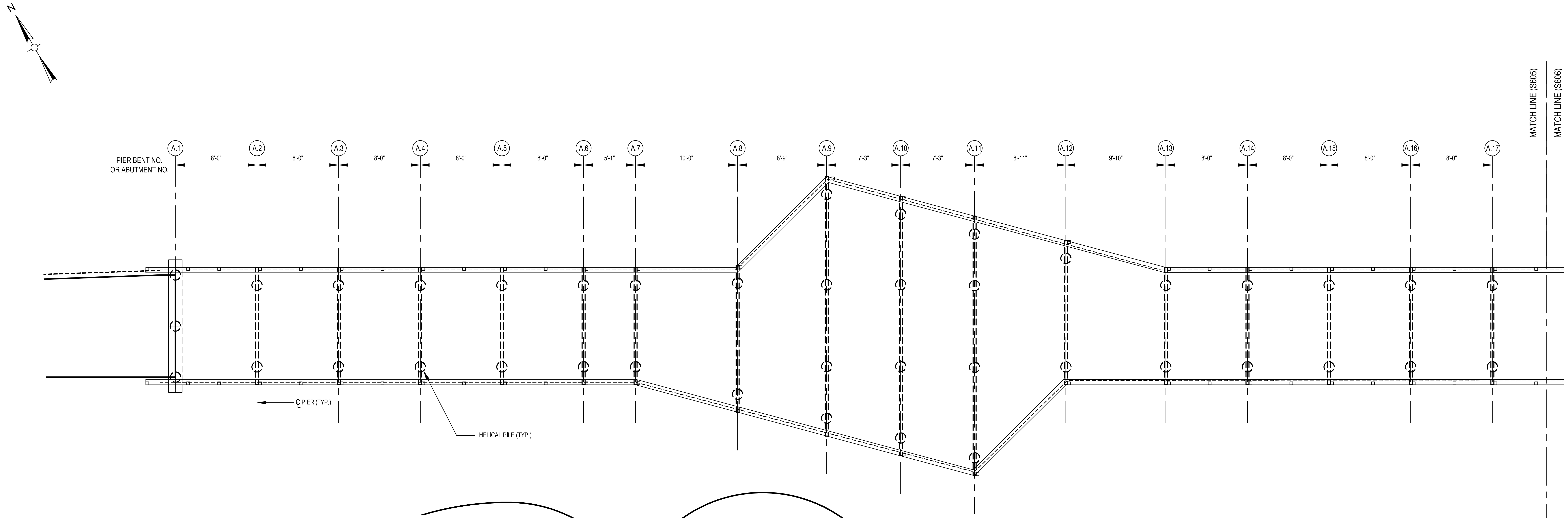
W&S File No.:

Drawing Title:

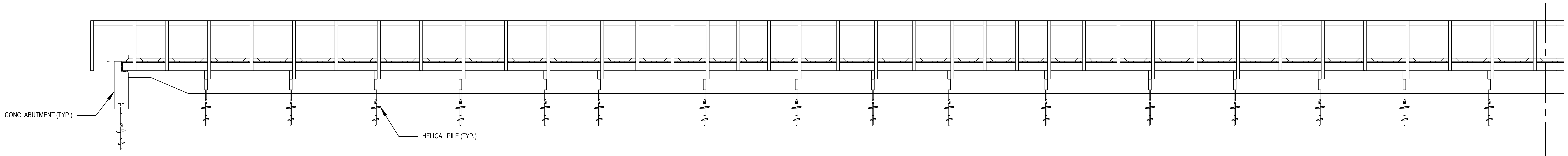
TIMBER BRIDGE DETAILS

Sheet Number:

S604



BOARDWALK PLAN
SCALE: 1" = 5'-0"



BOARDWALK ELEVATION
SCALE: 1" = 5'-0"

MATCH LINE (S605)
MATCH LINE (S606)

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S605-S608.dwg

Project:
PEABODY RIVERWALK
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REGISTERED
PROFESSIONAL ENGINEER
Scott Bruso

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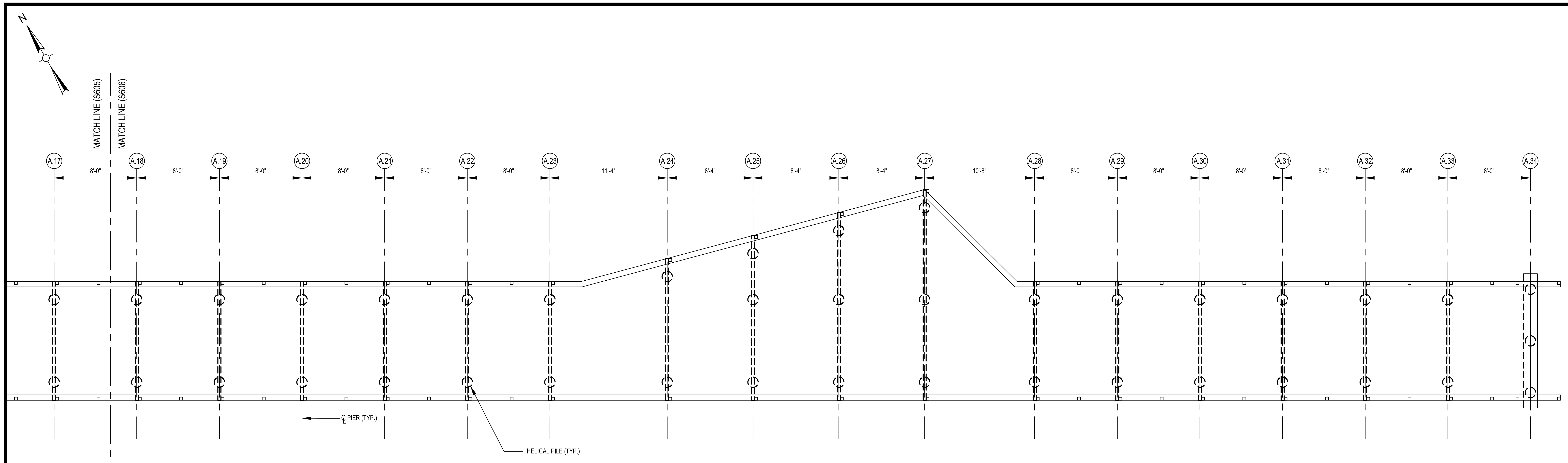
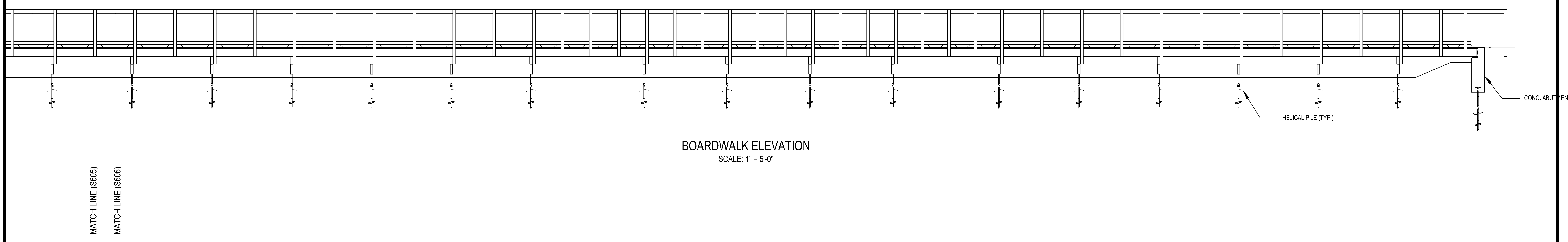
Reviewed By:	SYC
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:
BOARDWALK PLAN & ELEVATION

Sheet Number:
S605



BOARDWALK PLAN
SCALE: 1" = 5'-0"



BOARDWALK ELEVATION
SCALE: 1" = 5'-0"

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Project:

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Approved By: SRB

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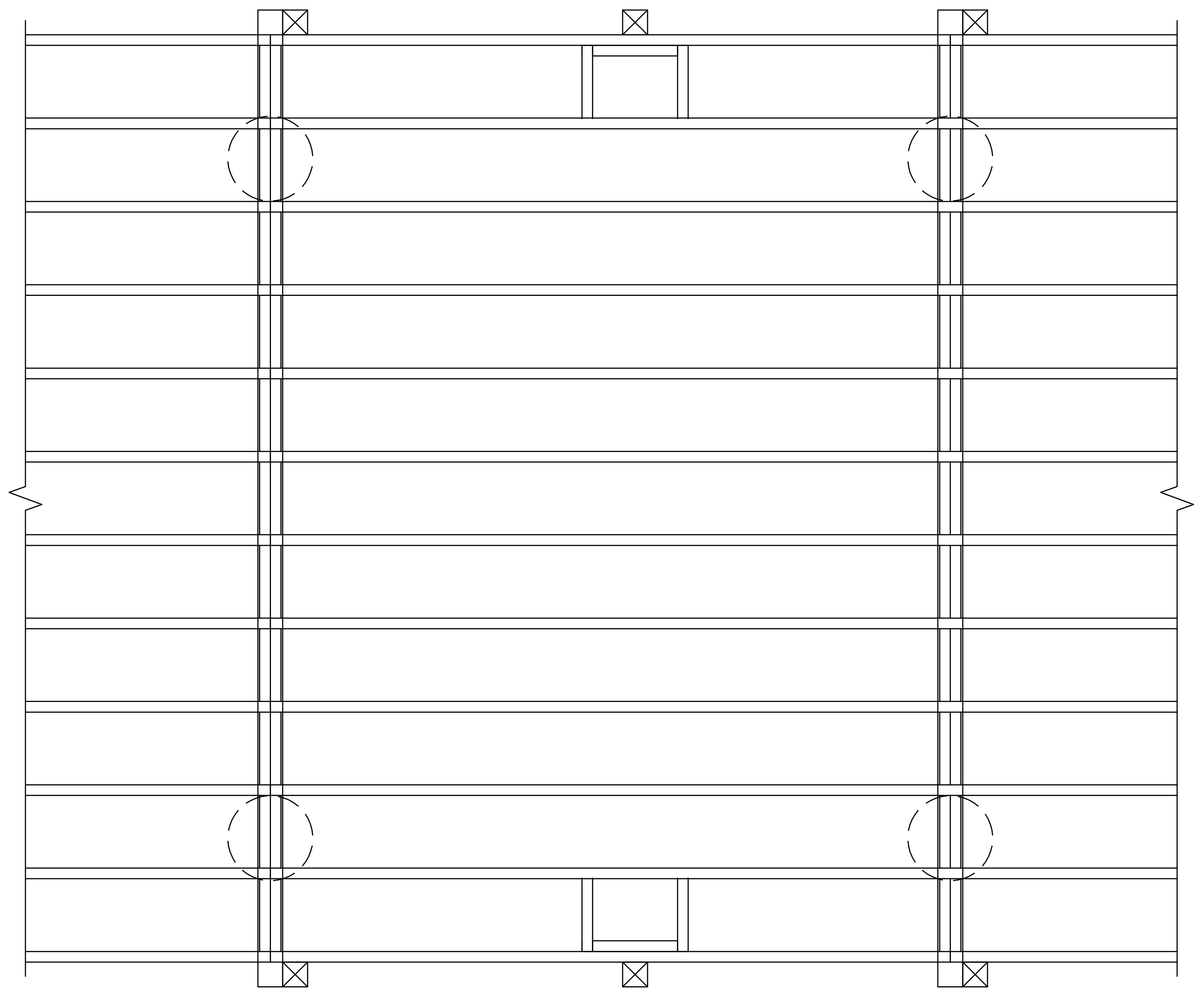
W&S File No.:

Drawing Title:

BOARDWALK PLAN & ELEVATION

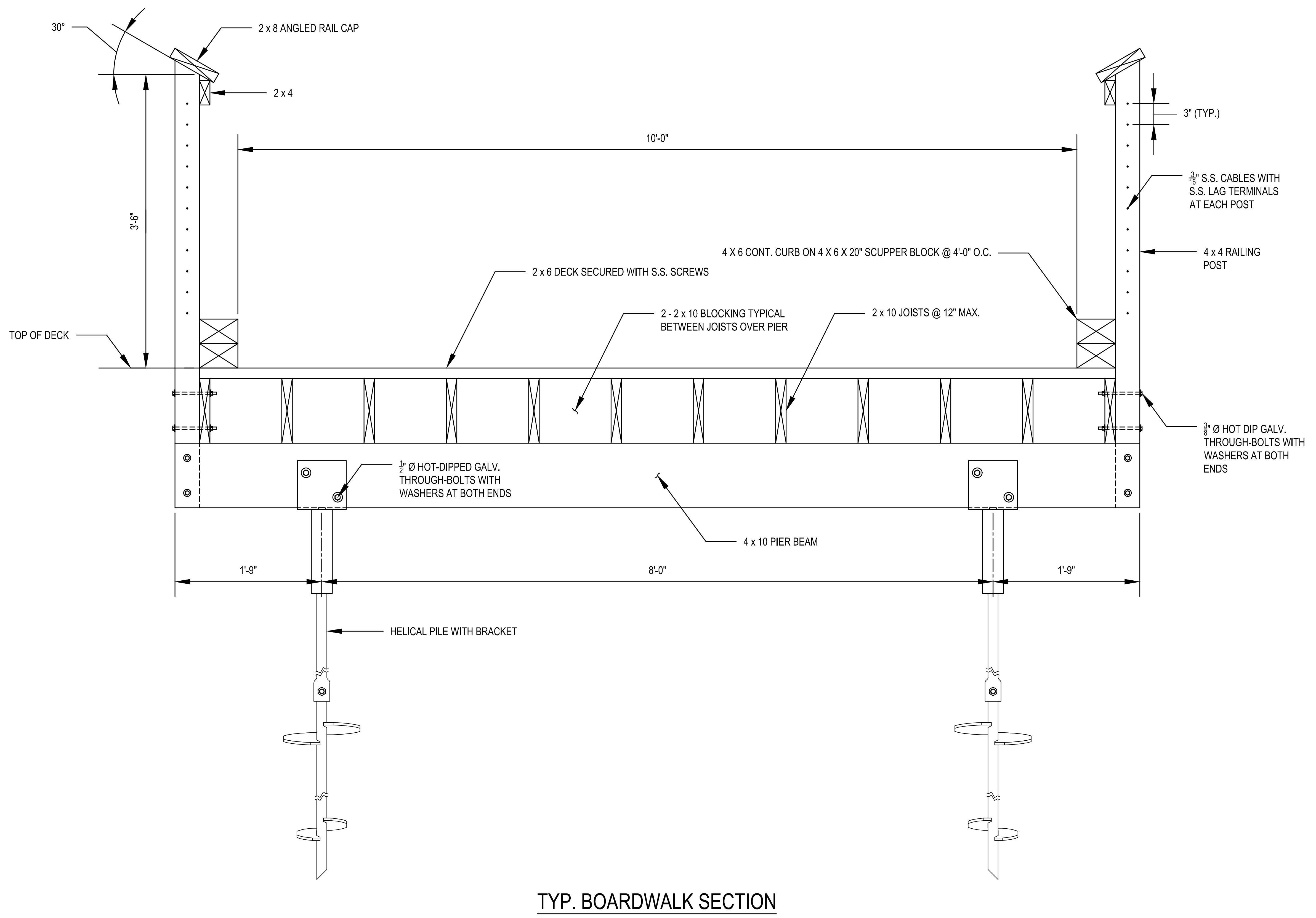
Sheet Number:

S606



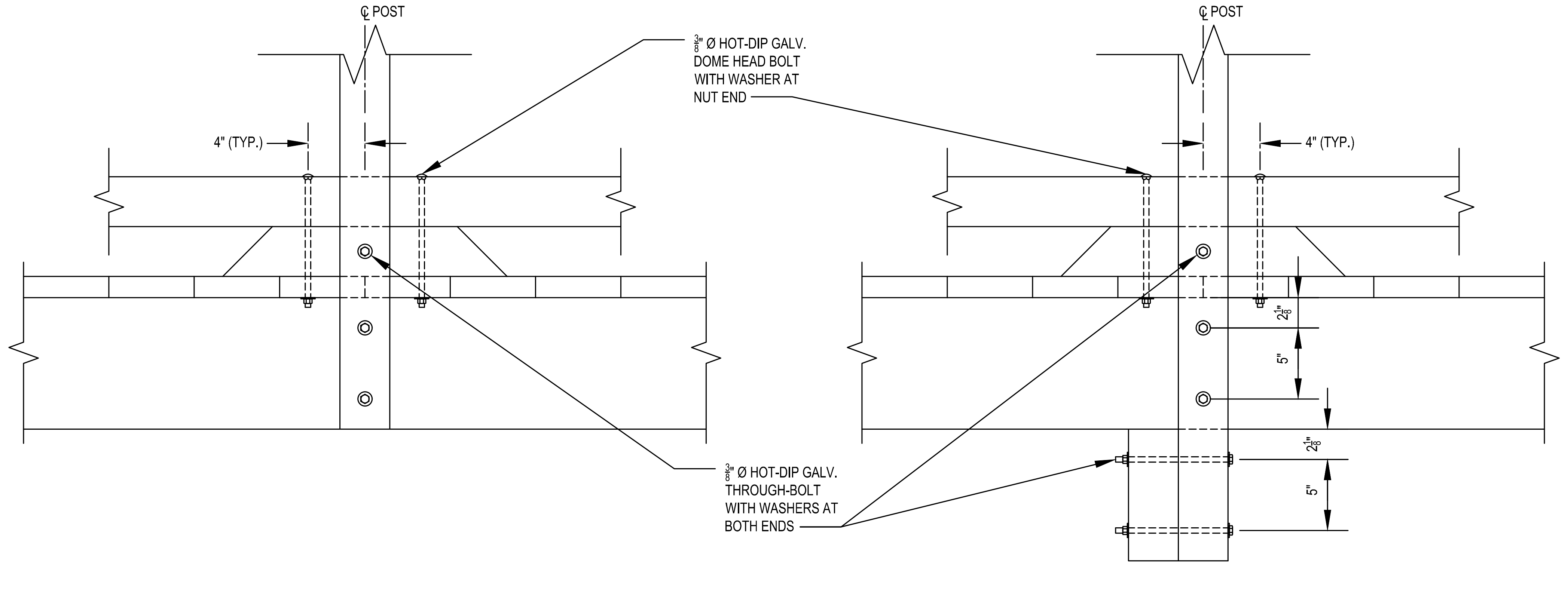
TYP. BOARDWALK FRAMING PLAN

SCALE: $\frac{3}{4}$" = 1'-0"



TYP. BOARDWALK SECTION

SCALE: 1" = 1'-0"



AT INTERMEDIATE RAILING POST

AT PIER BENT

TYP. RAILING POST & CURB ATTACHMENT

SCALE: $1\frac{1}{2}$" = 1'-0"

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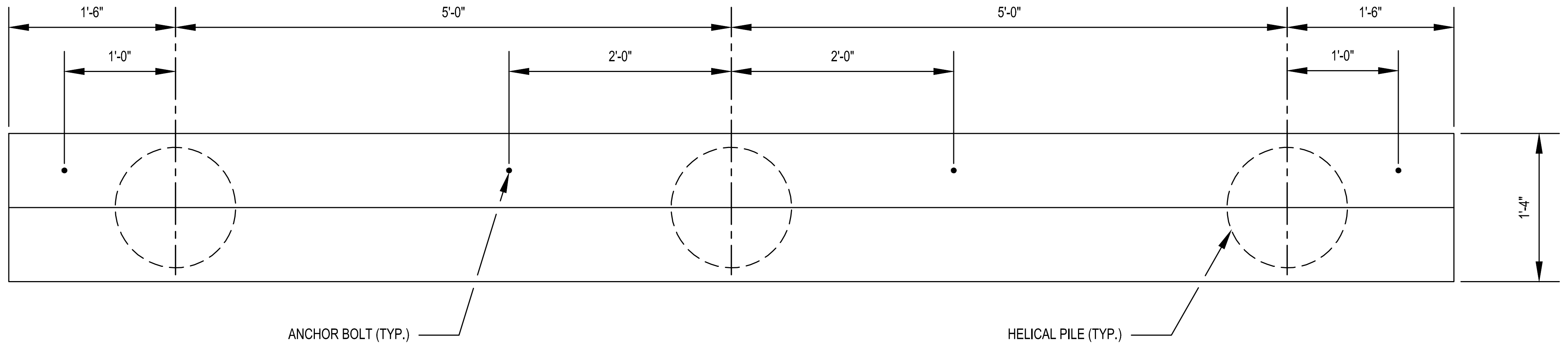
W&S File No.:

Drawing Title:

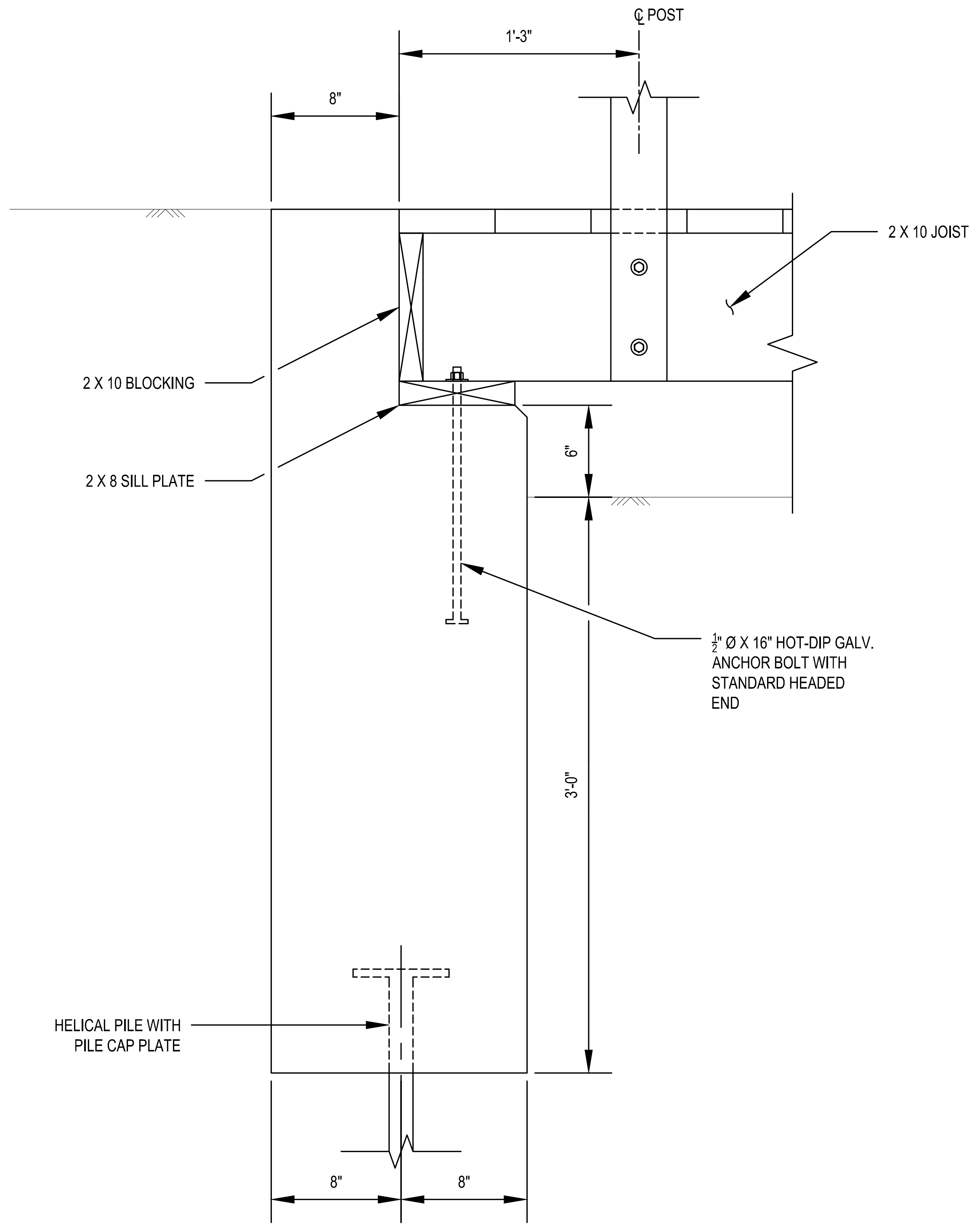
BOARDWALK TYP.
SECTIONS

Sheet Number:

S607



TYP. ABUTMENT PLAN
SCALE: 1" = 1'-0"



TYP. ABUTMENT SECTION
SCALE: 1 1/2"=1'-0"

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Project:

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W&S File No.:	

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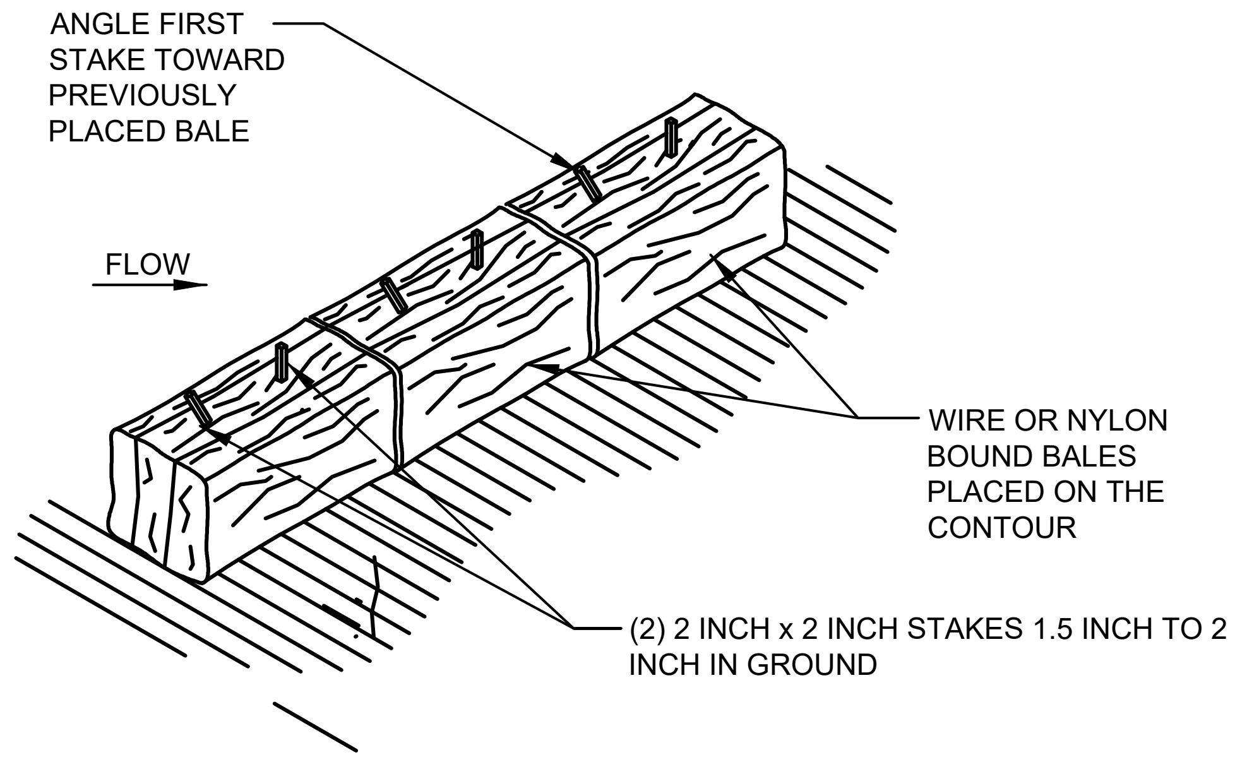
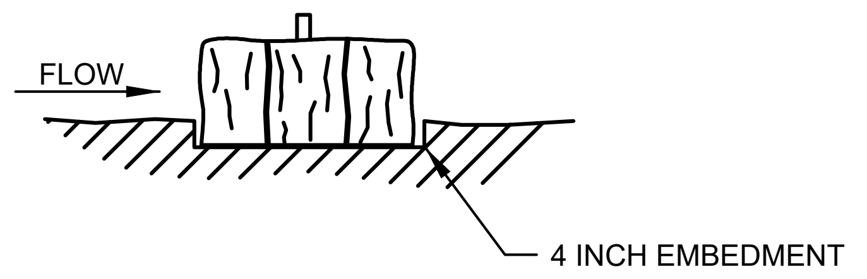
BOARDWALK
ABUTMENT TYP.
SECTIONS

Sheet Number:

S608



ANCHORING DETAIL

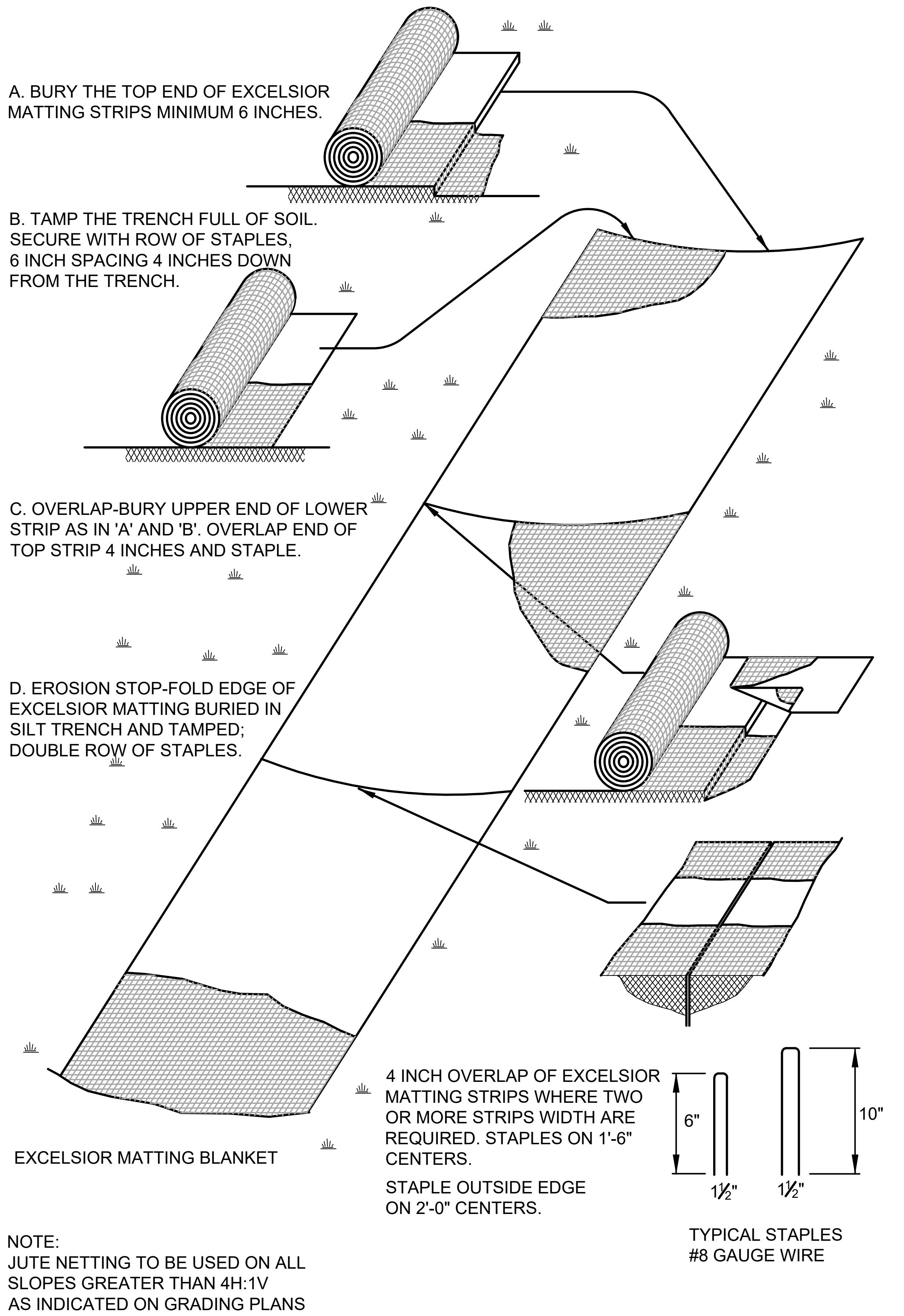


EMBEDDING DETAIL

3 STAKED HALE BALES- EROSION CONTROL

SCALE: N.T.S.

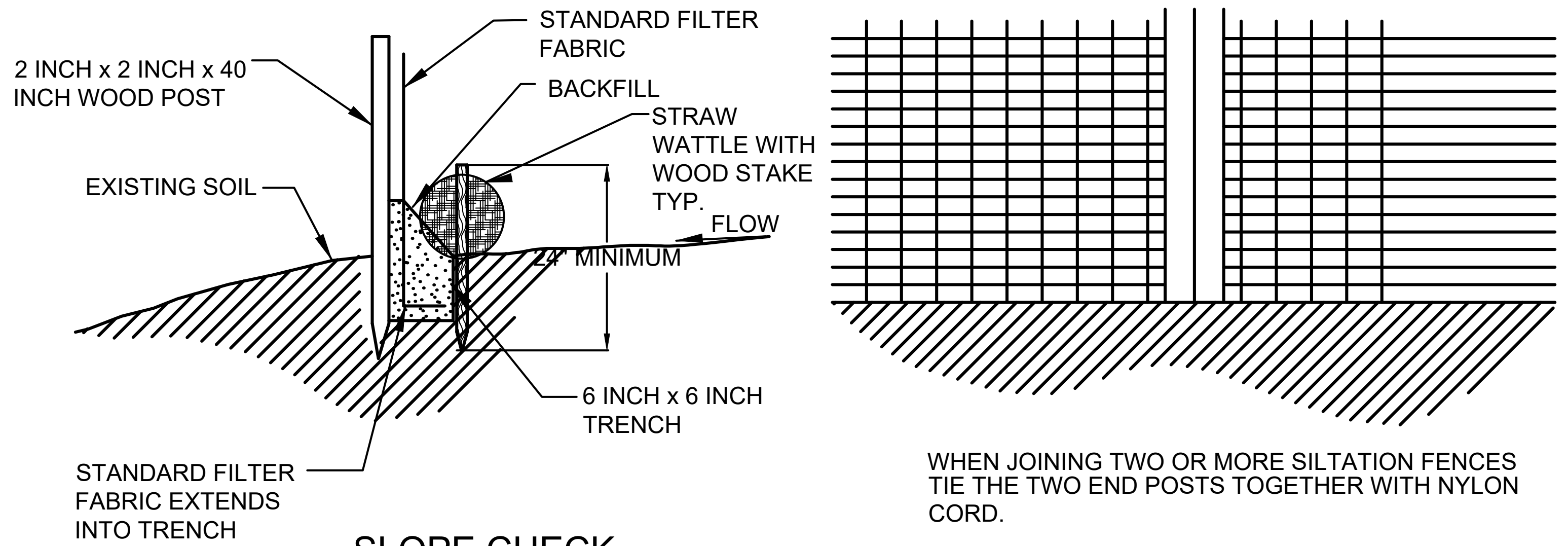
1. EROSION CONTROL MEASURES SHALL BE INCORPORATED IN THE SEQUENCE OF CONSTRUCTION TO PREVENT SEDIMENT LADEN WATER FROM LEAVING THE SITE.
2. AREAS SUBJECT TO EROSION SHALL BE MINIMIZED IN TERMS OF TIME AND AREA.
3. IN GENERAL, WORK REQUIRING EROSION CONTROL INCLUDES EXCAVATIONS, FILLS, DRAINAGE, SWALES AND DITCHES, ROUGH AND FINISH GRADING, AND STOCKPILING OF EARTH.
4. DO NOT DISTURB VEGETATION AND TOPSOIL BEYOND THE PROPOSED LIMIT OF SILT FENCE ACTIVITIES.
5. TEMPORARY SILT CONTROLS SHALL BE PLACED AS SHOWN ON THE PLAN. PERMANENTLY STABILIZE EACH COMPLETED SEGMENT OF CONSTRUCTION.
6. THE CONTRACTOR SHALL REMOVE TEMPORARY SILT CONTROLS AND ALL ACCUMULATED SILT AND DEBRIS AFTER COMPLETION OF CONSTRUCTION OPERATIONS.
7. SILT CONTROLS SHALL BE IN PLACE AT ALL TIMES DURING CONSTRUCTION.
8. THE CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL SILT AND DEBRIS FROM EACH DRAINAGE STRUCTURE UPON COMPLETION OF THE PROJECT.
9. OBJECTS AND/OR AREAS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
10. ALL DISTURBED AREAS SHALL BE RESTORED TO EXISTING GRADE. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE AS NEEDED.
11. SILT CONTROLS SHALL BE REMOVED UPON THE SATISFACTORY COMPLETION OF ALL WORK SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
12. SITE PERIMETER SHALL HAVE STRAW WATTLES INSTALLED AT THE LIMIT OF WORK.



NOTE:
JUTE NETTING TO BE USED ON ALL SLOPES GREATER THAN 4H:1V AS INDICATED ON GRADING PLANS

4 EROSION CONTROL BLANKET

SCALE: N.T.S.



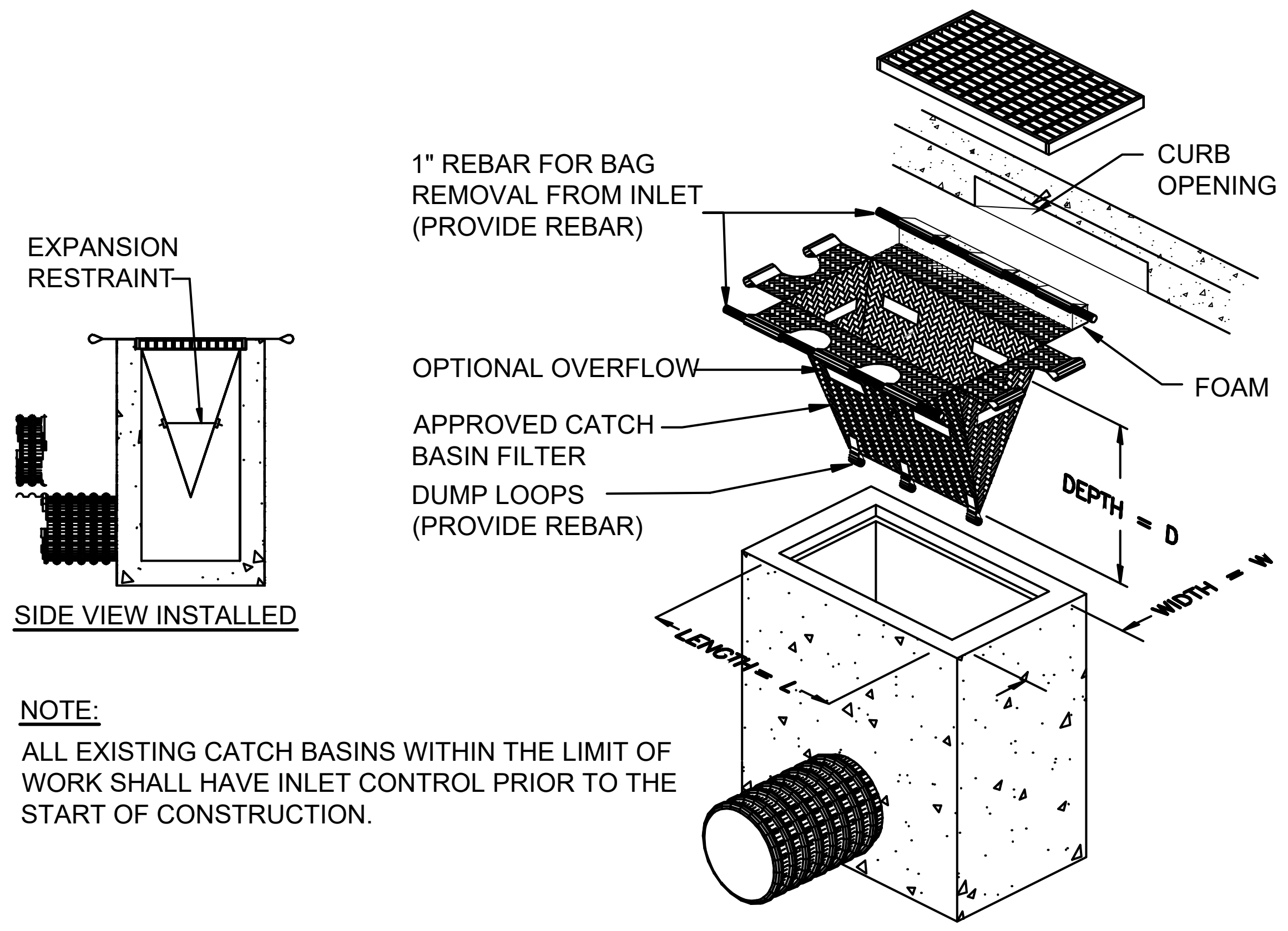
WHEN JOINING TWO OR MORE SILTATION FENCES TIE THE TWO END POSTS TOGETHER WITH NYLON CORD.

SLOPE CHECK

DITCH CHECK

4 SILT FENCE- EROSION CONTROL

SCALE: N.T.S.



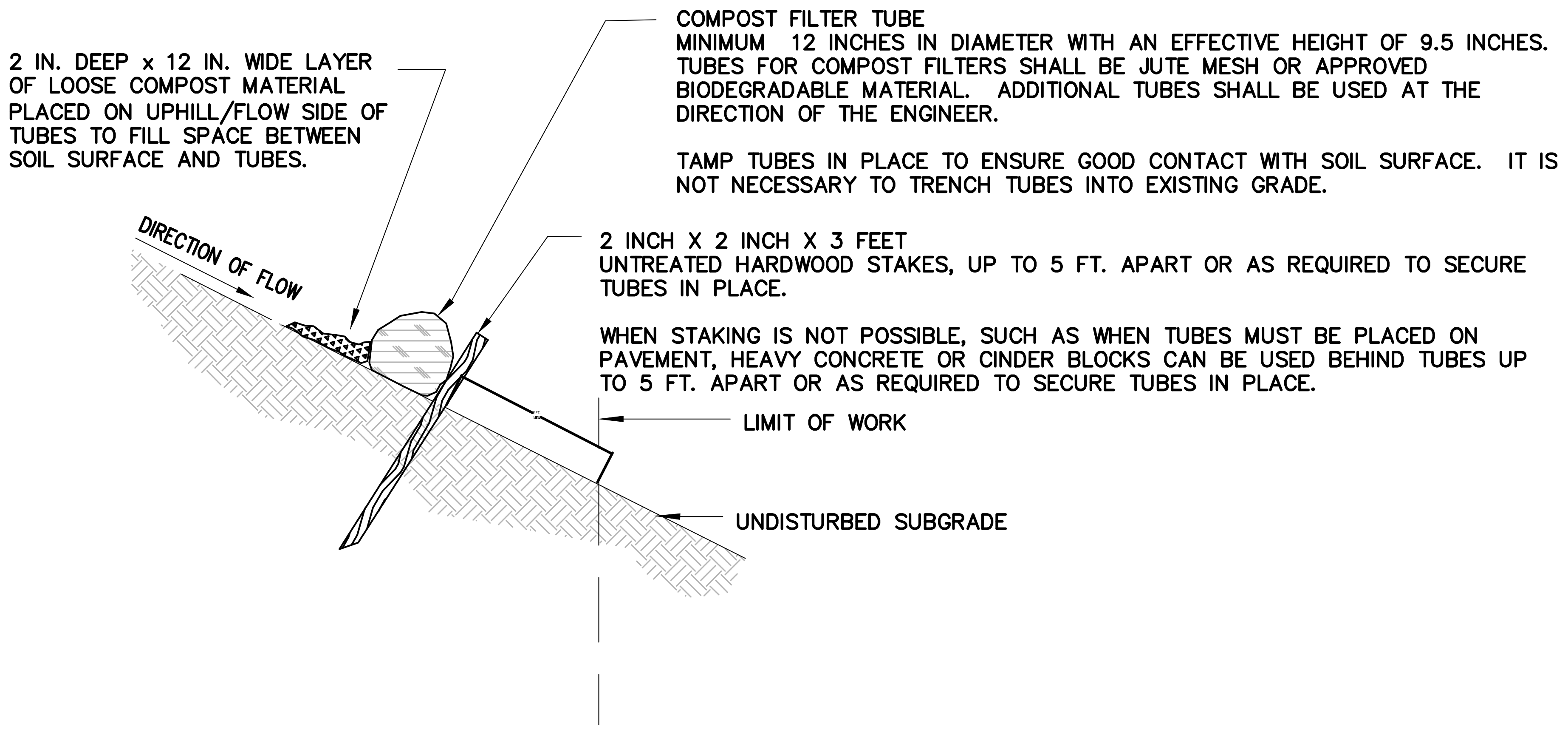
NOTE:
ALL EXISTING CATCH BASINS WITHIN THE LIMIT OF WORK SHALL HAVE INLET CONTROL PRIOR TO THE START OF CONSTRUCTION.

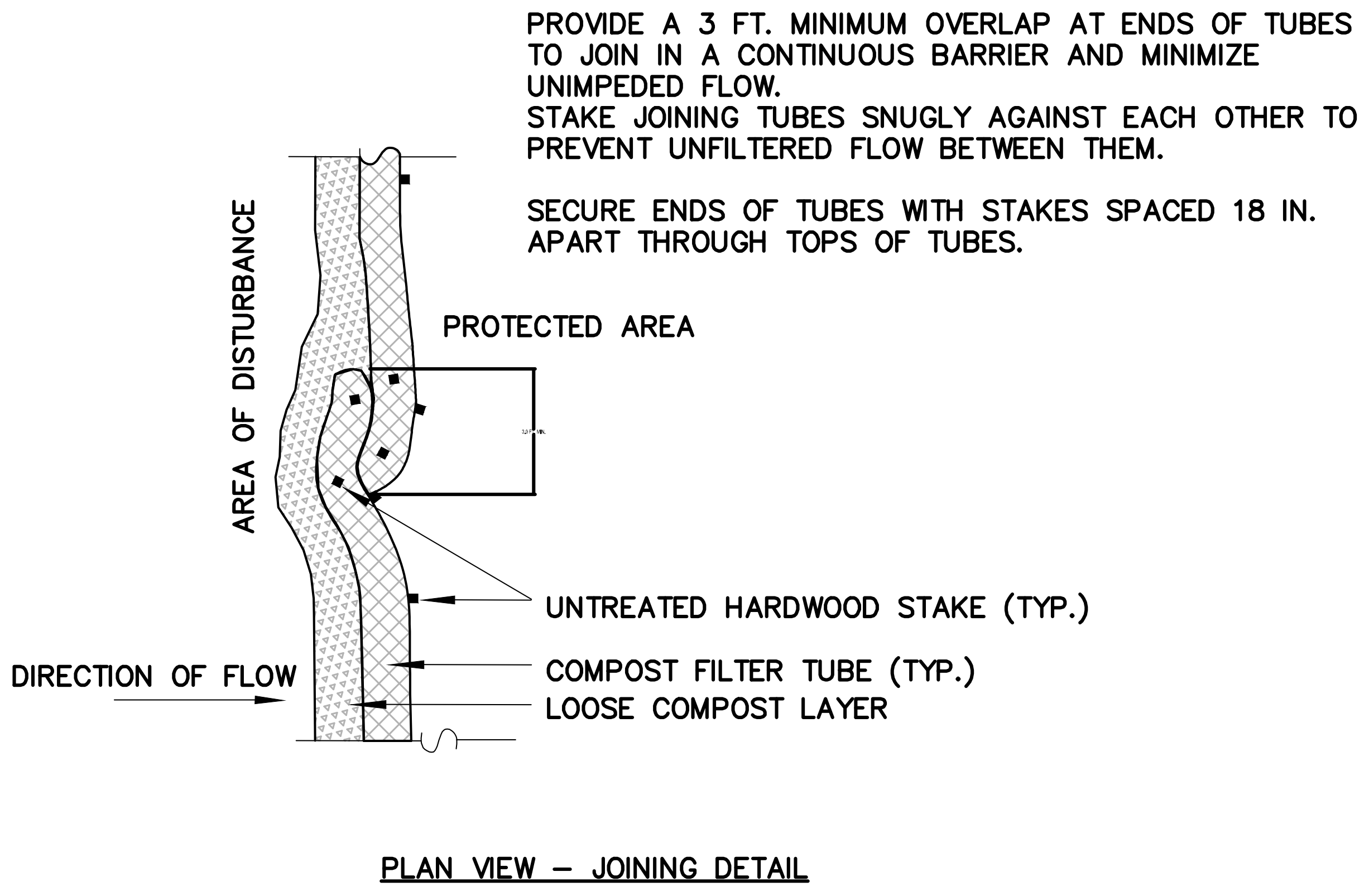
1 INLET SEDIMENT CONTROL

SCALE: N.T.S.

GENERAL NOTES:

1. PROVIDE A MINIMUM TUBE DIAMETER OF 12 INCHES FOR SLOPES UP TO 50 FEET IN LENGTH WITH A SLOPE RATIO OF 3H:1V OR STEEPER. LONGER SLOPES OF 3H:1V MAY REQUIRE LARGER TUBE DIAMETER OR ADDITIONAL COURSING OF FILTER TUBES TO CREATE A FILTER BERM. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SITUATIONS WITH LONGER OR STEEPER SLOPES.
2. INSTALL TUBES ALONG CONTOURS AND PERPENDICULAR TO SHEET OR CONCENTRATED FLOW.
3. DO NOT INSTALL IN PERENNIAL, EPHEMERAL OR INTERMITTENT STREAMS.
4. CONFIGURE TUBES AROUND EXISTING SITE FEATURES TO MINIMIZE SITE DISTURBANCE AND MAXIMIZE CAPTURE AREA OF STORMWATER RUN-OFF.
5. MULCH MATERIAL FOR THE FILTER TUBES SHALL BE WEED-FREE STRAW, WOOD EXCELSIOR, COMPOST, OR WOOD CHIPS, OR COIR. STRAW SHALL BE WEED FREE AND DERIVED FROM THRESHING OF GRAIN CROP.
6. CURVE ENDS UPHILL TO PREVENT DIVERSION OF UNFILTERED RUN-OFF.





PLAN VIEW – JOINING DETAIL

3 SINGLE COMPOST FILTER TUBE DETAIL

SCALE: N.T.S.

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SCOTT R. BRUSO STRUCTURAL No. 48061

Scott Bruso

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Drawing Title:

EROSION AND
SEDIMENT CONTROL
DETAILS

Sheet Number:

C601

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR
AC	ALTERNATING CURRENT
A	AMPERE
AF	AMP FRAME
AT	AMP TRIP
ATC	AUTOMATIC TEMPERATURE CONTROLS
ATS	AUTOMATIC TRANSFER SWITCH
BKR	BREAKER
C	CONDUIT
CKT	CIRCUIT
CB	CIRCUIT BREAKER
EC	ELECTRICAL CONTRACTOR
EMT	ELECTRIC METALLIC TUBING
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EF	EXHAUST FAN
FL	FLOOR
FLA	FULL LOAD AMPERE
GC	GENERAL CONTRACTOR
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
HOA	HAND OFF AUTOMATIC
HP	HORSEPOWER
IG	ISOLATED GROUND
JB	JUNCTION BOX
KVA	KILOVOLT AMPERES
KW	KILOWATT
MCB	MAIN CIRCUIT BREAKER
MLO	MAIN LUGS ONLY
MC	MECHANICAL CONTRACTOR
MTD	MOUNTED
MTG	MOUNTING
NMC	NON-METALLIC CONDUIT
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NA	NOT APPLICABLE
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
PNL	PANELBOARD
PH	PHASE
PVC	POLYVINYL CHLORIDE CONDUIT
RSC	RIGID GALVANIZED STEEL CONDUIT
SF	SUPPLY FAN
SS	SAFETY SWITCH
TEL	TELEPHONE
TRF	TRANSFORMER
V	VOLTS
W	WATTS OR WIRE
WP	WEATHERPROOF
4WSN	4-WIRE SOLID NEUTRAL

RECEPTACLE ABBREVIATIONS

GFI	GROUND FAULT CIRCUIT INTERUPTER, PERSONAL PROTECTION
WP	WEATHERPROOF RECEPTACLE WITH COVERPLATE LISTED FOR WET LOCATION WITH AN ATTACHMENT PLUG INSERTED.

ELECTRICAL LEGEND

RACEWAY AND WIRING

← 1,3 LP1B	HOMERUN TO PANELBOARD, NUMBER OF TICKS INDICATES NUMBER OF #12 AWG CONDUCTORS CONTAINED IN RACEWAY. TWO (2) #12 AWG SHALL NOT BE INDICATED BY TICKS, NUMERALS 1 AND 3 INDICATE CIRCUITS IN PANELBOARD. RACEWAYS LARGER THAN 1/2" AND CONDUCTORS LARGER THAN #12 AWG SHALL BE INDICATED ON THE DRAWINGS. PROVIDE AN INSULATED GREEN GROUND WIRE IN ALL RACEWAYS MINIMUM SIZE TO BE #12AWG.
– – –	UNDERGROUND RACEWAY

LIGHTING FIXTURES

○	PEDESTRIAN LIGHT FIXTURE
⌖	BOLLARD TYPE SITE LIGHTING FIXTURE

RECEPTACLES

(MOUNT 18" AFF TO CENTER LINE UNLESS NOTED OTHERWISE)

GFI ⊖	DUPLEX CONVENIENCE OUTLET RATED 20A, 125V, U-SLOT GROUNDED TYPE MOUNTED 18" ABOVE FINISHED FLOOR TO CENTER LINE. ALL OTHER MOUNTING HEIGHTS SHALL BE AS NOTED ADJACENT TO THE SYMBOL. REFER TO RECEPTACLE ABBREVIATIONS FOR SPECIAL PURPOSE RECEPTACLES. GFI INDICATES GROUND FAULT INTERRUPTING TYPE.

POWER DISTRIBUTION EQUIPMENT

LHH ☐	HAND HOLE PHH = POWER HANDHOLE CHH = COMMUNICATIONS HANDHOLE LHH = LIGHTING HANDHOLE
⏚	GROUND - SYSTEM AND/OR EQUIPMENT
F	FIBER PEDESTAL (50"X42")

SITE

⊖	UTILITY POLE
MH	UTILITY MANHOLE

GENERAL NOTES

1. DRAWINGS ARE DIAGRAMMATIC ONLY. THE EXACT LOCATION, MOUNTING HEIGHTS, SIZE OF EQUIPMENT AND ROUTING OF RACEWAYS SHALL BE COORDINATED AND DETERMINED IN THE FIELD.
2. ALL STRAIGHT FEEDER, BRANCH CIRCUIT AND AUXILIARY SYSTEM CONDUIT RUNS SHALL BE PROVIDED WITH SUFFICIENT PULL BOXES TO LIMIT THE MAXIMUM LENGTH OF ANY SINGLE CABLE PULL TO 150 FEET. EXACT SIZES OF PULL BOXES AND LOCATIONS TO BE DETERMINED IN THE FIELD BY THE ELECTRICAL CONTRACTOR.
3. FURNISH ALL REQUIRED ACCESS PANELS AS REQUIRED TO SUIT FIELD CONDITIONS FOR THE PROPER OPERATION AND MAINTENANCE OF THE ELECTRICAL SYSTEM. THE EXACT SIZES AND PHYSICAL LOCATIONS SHALL BE TO SUIT ACCESSIBILITY AND CONSTRUCTION CONDITIONS. ALL ACCESS PANELS PROVIDED BY THE ELECTRICAL CONTRACTOR SHALL MATCH EXACTLY THE ACCESS PANELS FURNISHED AND INSTALLED BY THE GENERAL CONTRACTOR. THE ACCESS PANELS WILL BE INSTALLED BY THE TRADE CONTRACTOR UNDER THE APPROPRIATE SECTION OF THE SPECIFICATIONS FOR THE SURFACE IN WHICH THE PANELS ARE LOCATED.
4. THE LOCATION AND MOUNTING HEIGHTS OF ALL SITE POWER AND LIGHTING SHOWN ON THE LANDSCAPE DRAWINGS SHALL TAKE PRECEDENCE OVER THE LOCATIONS SHOWN ON THE ELECTRICAL DRAWINGS. THE ELECTRICAL CONTRACTOR SHALL INSTALL ALL SITE POWER AND LIGHTING TO AGREE WITH THE LANDSCAPE DRAWINGS.
5. COMBINED HOMERUNS OF TWO (2) OR THREE (3) CIRCUITS MAY BE UTILIZED. HOWEVER, THE NEUTRAL CONDUCTOR IS TO BE INCREASED TO #10AWG. COMBINED HOMERUNS ARE TO BE LIMITED TO 20A, LIGHTING AND POWER CIRCUITS.
6. WORK SHALL CONFORM TO THE MASSACHUSETTS ELECTRICAL CODE, MASSACHUSETTS BUILDING CODE, NFPA AND REQUIREMENTS OF LOCAL AUTHORITIES HAVING JURISDICTION.
7. THE WORD "CONTRACTOR" AS USED IN THE "ELECTRICAL WORK" SHALL MEAN THE ELECTRICAL SUBCONTRACTOR.
8. CONTRACTOR SHALL PAY FOR ALL PERMITS, INSURANCE AND TESTS, AND SHALL PROVIDE LABOR AND MATERIAL TO COMPLETE THE ELECTRICAL WORK SHOWN.
9. CONTRACTOR(OWNER) SHALL PAY ELECTRIC UTILITY COMPANY BACKCHARGES.
10. CONTRACTOR SHALL PROVIDE ALL REQUIRED COORDINATION WITH THE ELECTRIC UTILITY.
11. THE CONTRACTOR SHALL PROVIDE ALL TEMPORARY LIGHTING AND POWER AND THE GENERAL CONTRACTOR SHALL PAY ALL ENERGY CHARGES.
12. DURING CONSTRUCTION, THE ELECTRICAL CONTRACTOR SHALL KEEP HIS PORTION OF THE WORK NEAT, CLEAN AND ORDERLY.
13. ALL SYSTEMS SHALL BE TESTED FOR SHORT CIRCUIT AND GROUNDS PRIOR TO ENERGIZING AND ANY DEFECTS SHALL BE CORRECTED.
14. COMPLETE SHOP DRAWINGS SHALL BE SUBMITTED FOR ELECTRICAL EQUIPMENT. WHERE SPECIFIED ELECTRICAL EQUIPMENT IS SUBSTITUTED, THE ELECTRICAL CONTRACTOR SHALL SUBMIT COMPLETE SPECIFICATIONS ON THE SUBSTITUTE AS WELL AS THE ITEM ORIGINALLY SPECIFIED.
15. MATERIALS SHALL BE SPECIFICATION GRADE AND UL LISTED.
16. WHERE MATERIAL IS CALLED OUT IN THE LEGEND BY MANUFACTURER, TYPE OR CATALOG NUMBER, SUCH DESIGNATIONS ARE TO ESTABLISH STANDARDS OR DESIRED QUALITY. ACCEPTANCE OR REJECTIONS OF PROPOSED SUBSTITUTIONS SHALL BE SUBJECT TO THE APPROVAL OF THE OWNER.
17. WORK SHALL BE COORDINATED WITH THAT OF OTHER TRADES TO ELIMINATE INTERFERENCES.
18. EXACT LOCATIONS OF MECHANICAL EQUIPMENT, DEVICES, ETC. SHALL BE VERIFIED WITH HEATING, VENTILATION AND AIR CONDITIONING SUBCONTRACTOR PRIOR TO ROUGHING FOR SAME.
19. ELECTRICAL CONTRACTOR SHALL OBTAIN SHOP DRAWINGS/SPECIFICATIONS OF ALL EQUIPMENT FROM THE GENERAL CONTRACTOR PRIOR TO PURCHASING AND INSTALLING ELECTRICAL EQUIPMENT FOR SAME. NOTIFY ENGINEER OF ANY DISCREPANCIES BETWEEN ACTUAL EQUIPMENT INSTALLED AND CONTRACT DOCUMENTS.
20. ELECTRICAL WORK SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF WHICH SYSTEM IS PUT INTO SERVICE.
21. WORK SHALL BE GROUNDED IN ACCORDANCE WITH CODE REQUIREMENTS. COMPLETE EQUIPMENT (INSULATED GREEN WIRE) GROUNDING SYSTEM SHALL BE INSTALLED.
33. BOXES SHALL BE GALVANIZED STEEL AND SHALL BE SIZED TO ACCOMMODATE THE EQUIPMENT OR APPARATUS TO BE INSTALLED. WHERE BOXES OF A STANDARD MAKE ARE NOT AVAILABLE, SPECIAL BOXES SHALL BE MANUFACTURED.
34. PANELBOARDS SHALL BE DEAD FRONT, THERMAL MAGNETIC BOLT-ON CIRCUIT BREAKER TYPE, DESIGNED FOR SURFACE OR FLUSH MOUNTING AS INDICATED ON PLAN, AND HAVING CONNECTIONS TO 120/208 OR 277/480 VOLT, 3 PHASE, 4 WIRE SERVICE. ALL BUS BARS SHALL BE COPPER. CABINETS SHALL BE MADE OF CODE GAUGE GALVANIZED SHEET STEEL, WITH A MINIMUM OF 4 INCH GUTTERS, DOOR IN DOOR CONSTRUCTION, LOCKED DOOR, AND FLUSH HINGES. TYPEWRITTEN INDEX SHALL BE MOUNTED ON DOOR INSIDE TRANSPARENT COVER INDICATING LOAD SERVED. PANELS SHALL INCLUDE SEPARATE EQUIPMENT GROUND BUS.
35. PANELBOARDS, DISCONNECT SWITCHES, AND CONTROLLERS SHALL HAVE NAMEPLATES OF BLACK LAMINATED PLASTIC WITH ENGRAVED WHITE LETTERS, SECURED WITH SELF-TAPPING SCREWS.
36. CONTRACTOR SHALL PHASE BALANCE PANELBOARDS IN THE FIELD. LOAD ON EACH PHASE SHALL BE BALANCED WITHIN 10% OF EACH OTHER.
37. DUPLEX WALL RECEPTACLES SHALL BE 2 POLE, 3 WIRE, GROUNDING TYPE 20 AMPERE, 125 VOLT WITH METAL PLASTER EARS. RECEPTACLES SHALL BE NEMA STANDARD CONFIGURATION 5-20R.
38. FUSES SHALL BE DUAL ELEMENT, TIME DELAY TYPE, AS MANUFACURED BY BUSSMAN, RELIANCE OR APPROVED EQUAL.
39. CONTRACTOR SHALL CHECK EXISTING CONDITIONS TO DETERMINE EXACT EXTENT OF WORK TO BE PERFORMED PRIOR TO BIDDING. DIMENSIONS RELEVANT TO EXISTING WORK SHALL BE VERIFIED IN THE FIELD.
40. IN AREAS NOT AFFECTED BY THIS RENOVATION, THIS SUBCONTRACTOR SHALL MAINTAIN CONTINUITY OF ELECTRIC SERVICE.
41. THE CONTRACTOR SHALL PROVIDE ALL REQUIRED POWER SUPPLIES, APPURTENANCES, FINAL CONNECTIONS, TESTING AND WORK REQUIRED FOR ADDITIONS TO THE EXISTING FIRE ALARM SYSTEM. PAY ALL COSTS ARISING THERE FROM, FOR A COMPLETE AND OPERATIONAL SYSTEM.
42. ELECTRICAL SHUTDOWN SHALL BE AT A TIME AND DATE APPROVED BY THE OWNER.
43. PROVIDE AS-BUILT "CADD" DRAWINGS AT THE COMPLETION OF THE PROJECT.
44. ELECTRICAL CONTRACTOR SHALL LABEL ALL ELECTRICAL DEVICES INCLUDING BUT NOT LIMITED TO RECEPTACLES, DISCONNECT SWITCHES, PANELBOARDS, CONTROL PANELS, JUNCTION BOXES, ETC.
    a. RECEPTACLES - PANEL NAME AND CIRCUIT DESIGNATION
    b. PANELBOARDS - PANEL NAME, VOLTAGE, AMPERAGE, PHASE AS WELL AS PANEL AND CIRCUIT IT IS FED FROM.
    c. CONTROL PANEL - PANEL NAME AND CIRCUIT DESIGNATION
    d. JUNCTION BOXES - PANEL NAME AND CIRCUIT DESIGNATION

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Drawn By: FN
Reviewed By: DNM
Approved By: RFM

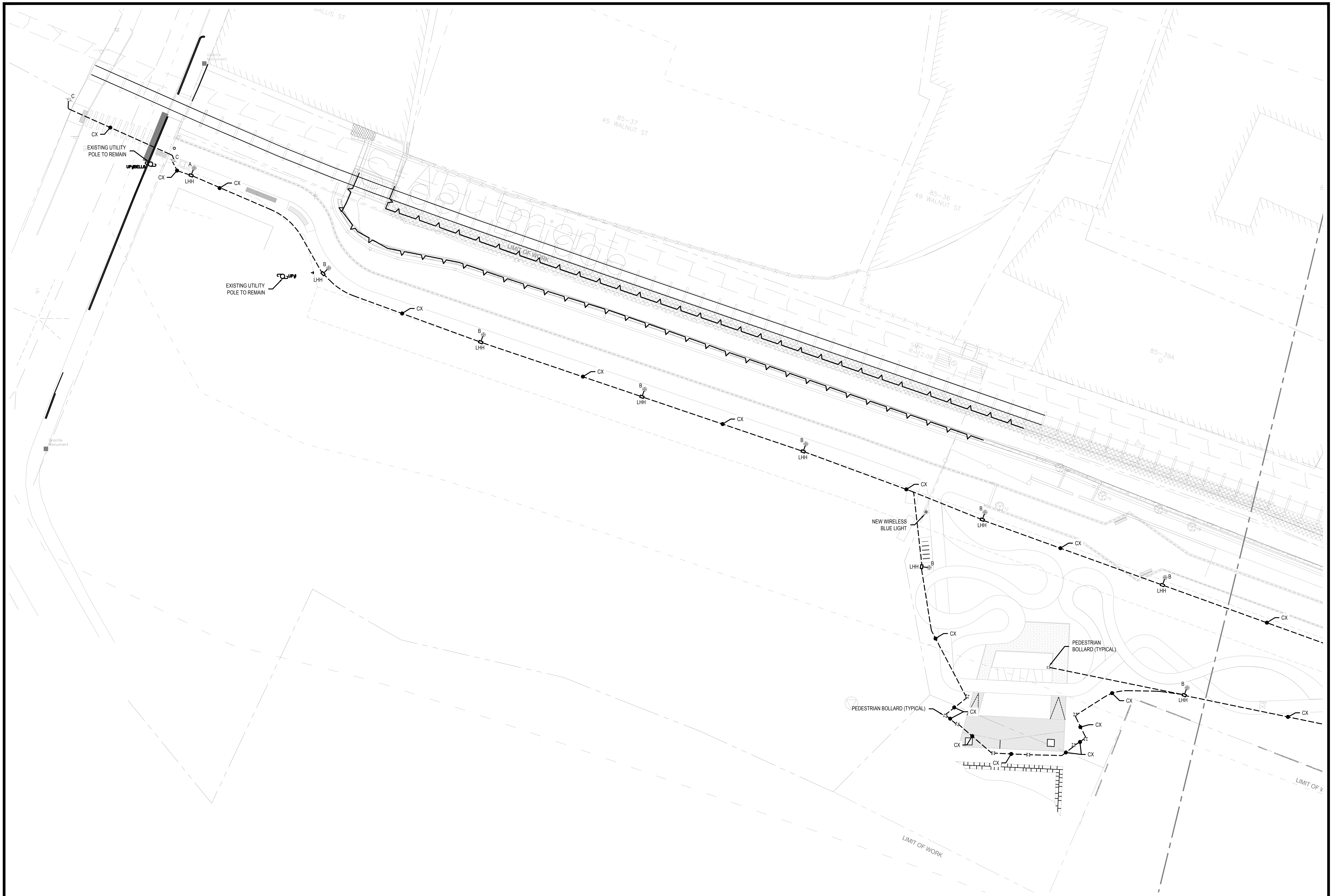
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

ELECTRICAL LEGEND, NOTES AND ABBREVIATIONS

Sheet Number:

E001



ELECTRICAL SITE PLAN A

SCALE: 1" = 20'-0"

NOTE:
REFER TO E001 FOR LEGEND, GENERAL NOTES AND ABBREVIATIONS.

20 10 0 20 40
SCALE: 1"=20'

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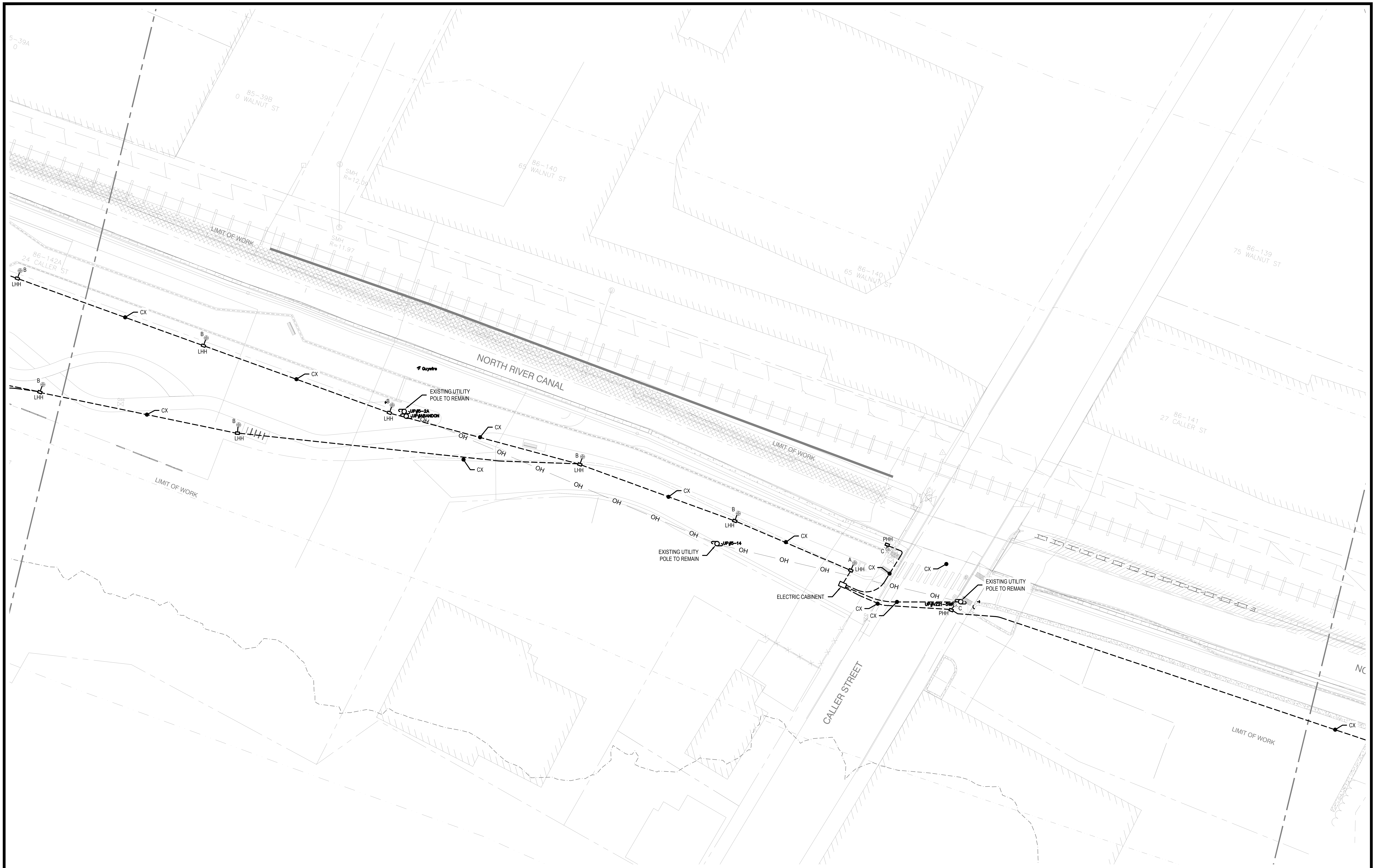
ELECTRICAL
SITE PLAN A

Sheet Number:

E101



ELECTRICAL SITE PLAN B

SCALE: 1" = 20'-0"

NOTE:
REFER TO E001 FOR LEGEND, GENERAL NOTES AND ABBREVIATIONS.

20 10 0 20 40
SCALE: 1"=20'

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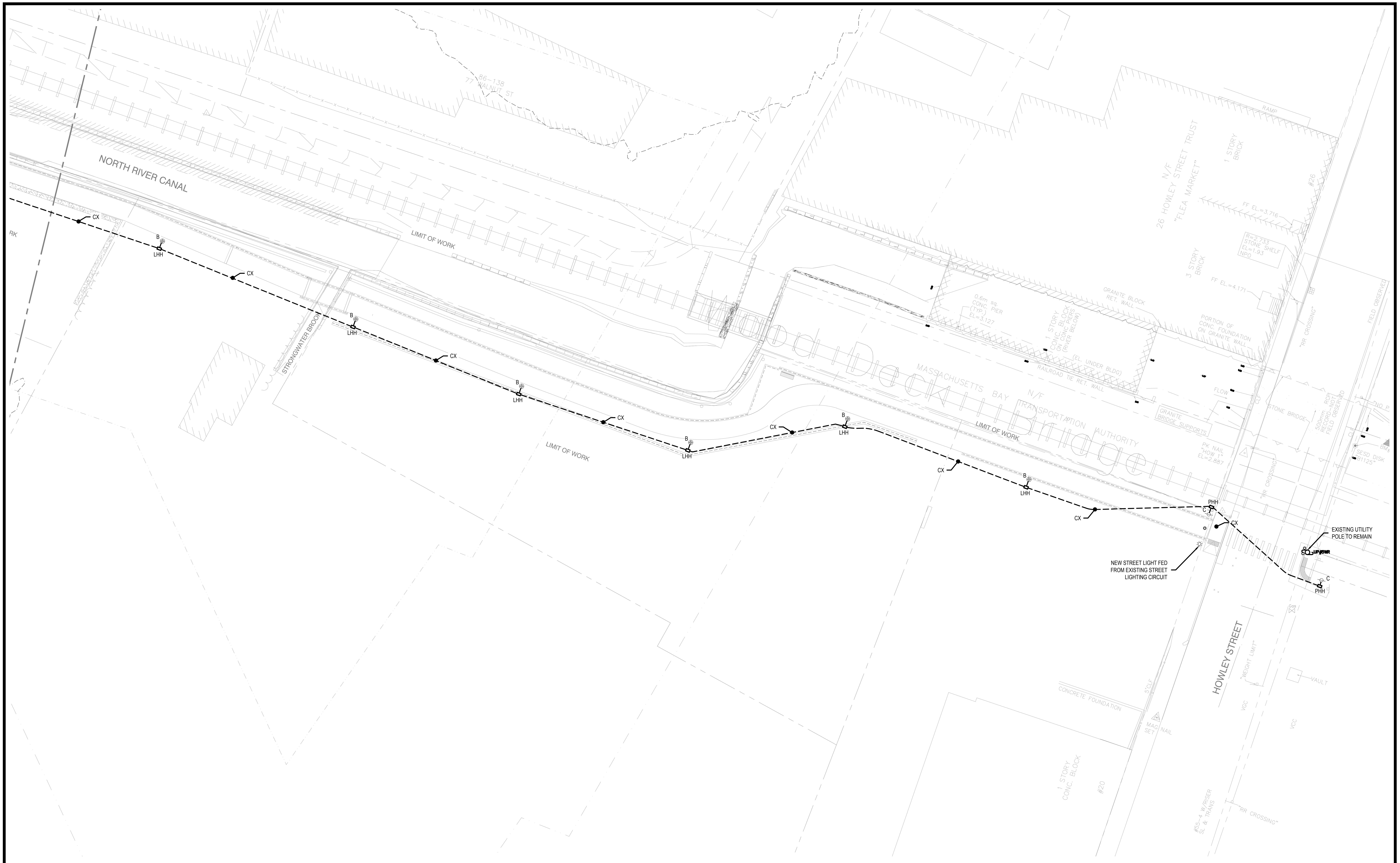
ELECTRICAL
SITE PLAN B

Sheet Number:

E102



NEW STREET LIGHT FED FROM EXISTING STREET LIGHTING CIRCUIT

EXISTING UTILITY POLE TO REMAIN

ELECTRICAL SITE PLAN C

SCALE: 1" = 20'-0"

NOTE:
REFER TO E001 FOR LEGEND, GENERAL NOTES AND ABBREVIATIONS.

20 10 0 20 40
SCALE: 1"=20'

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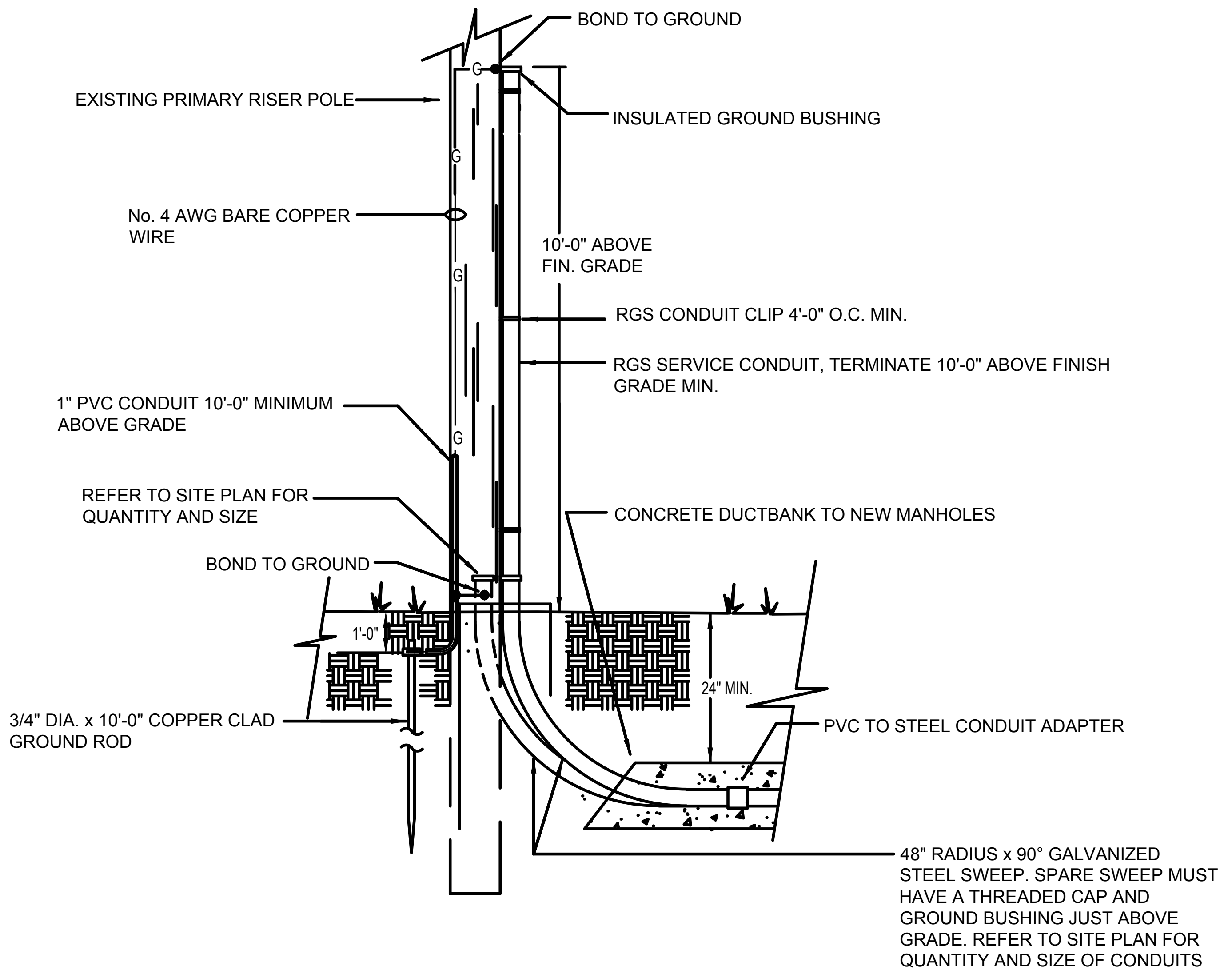
ELECTRICAL
SITE PLAN C

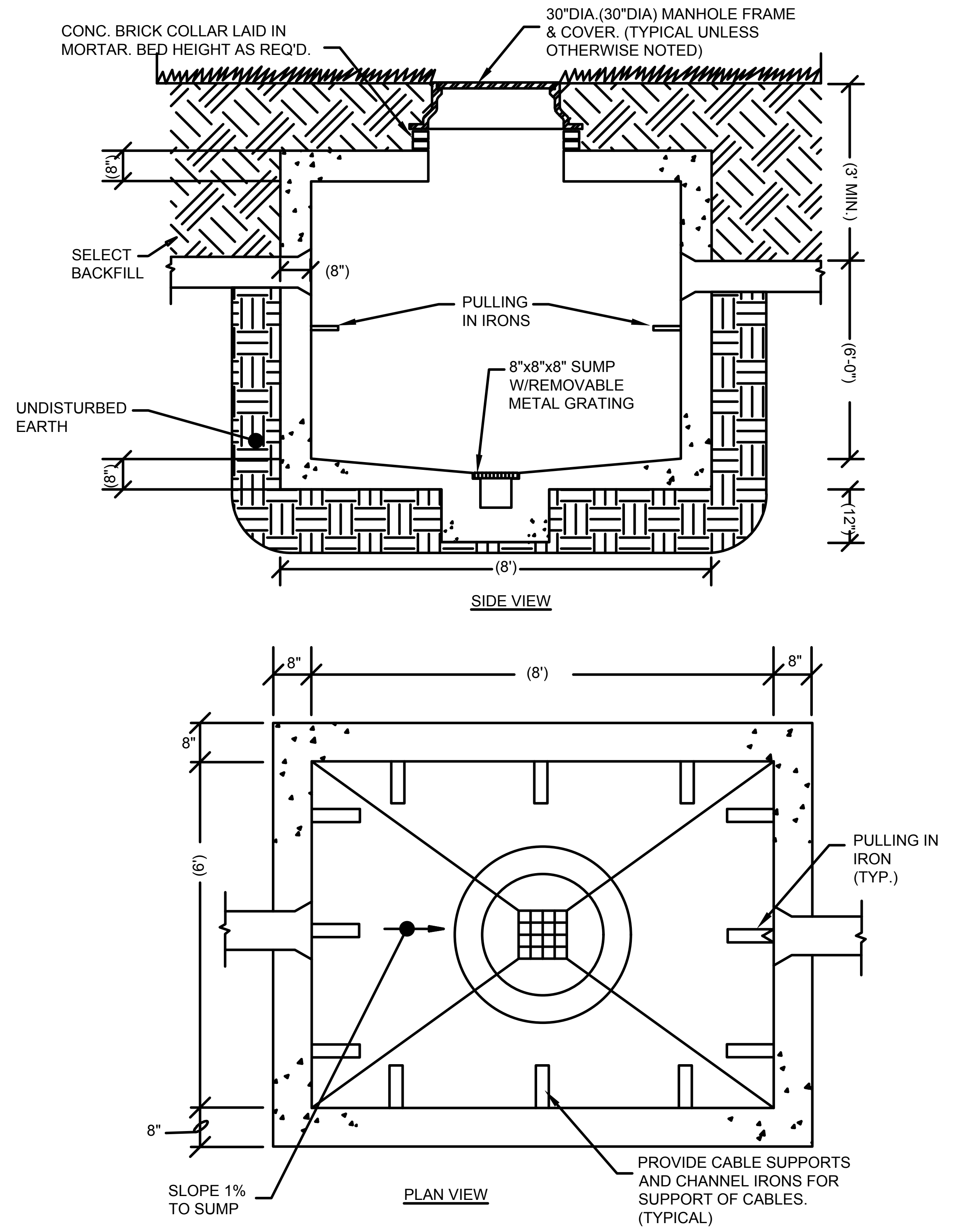
Sheet Number:

E103



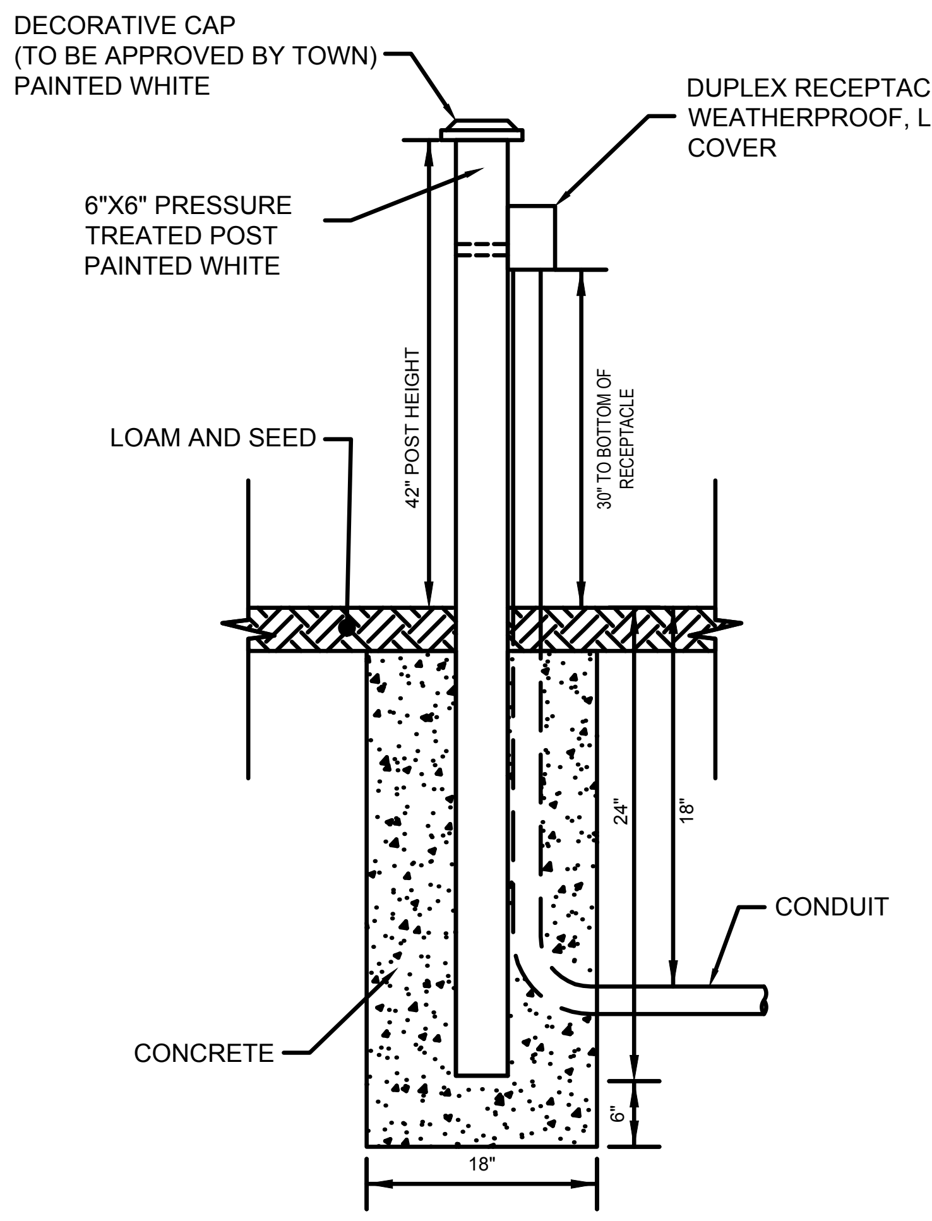
TYPICAL RISER POLE DETAIL

NOT TO SCALE



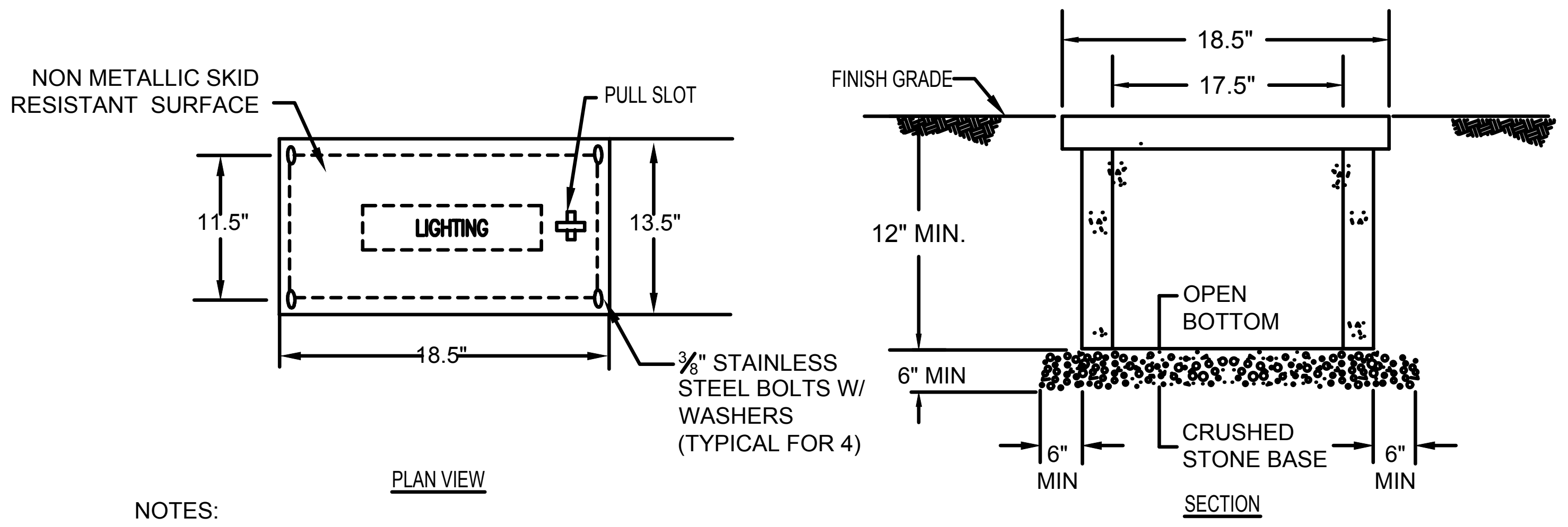
TYPICAL MANHOLE DETAIL

NOT TO SCALE



POST AND RECEPTACLE DETAIL

NOT TO SCALE



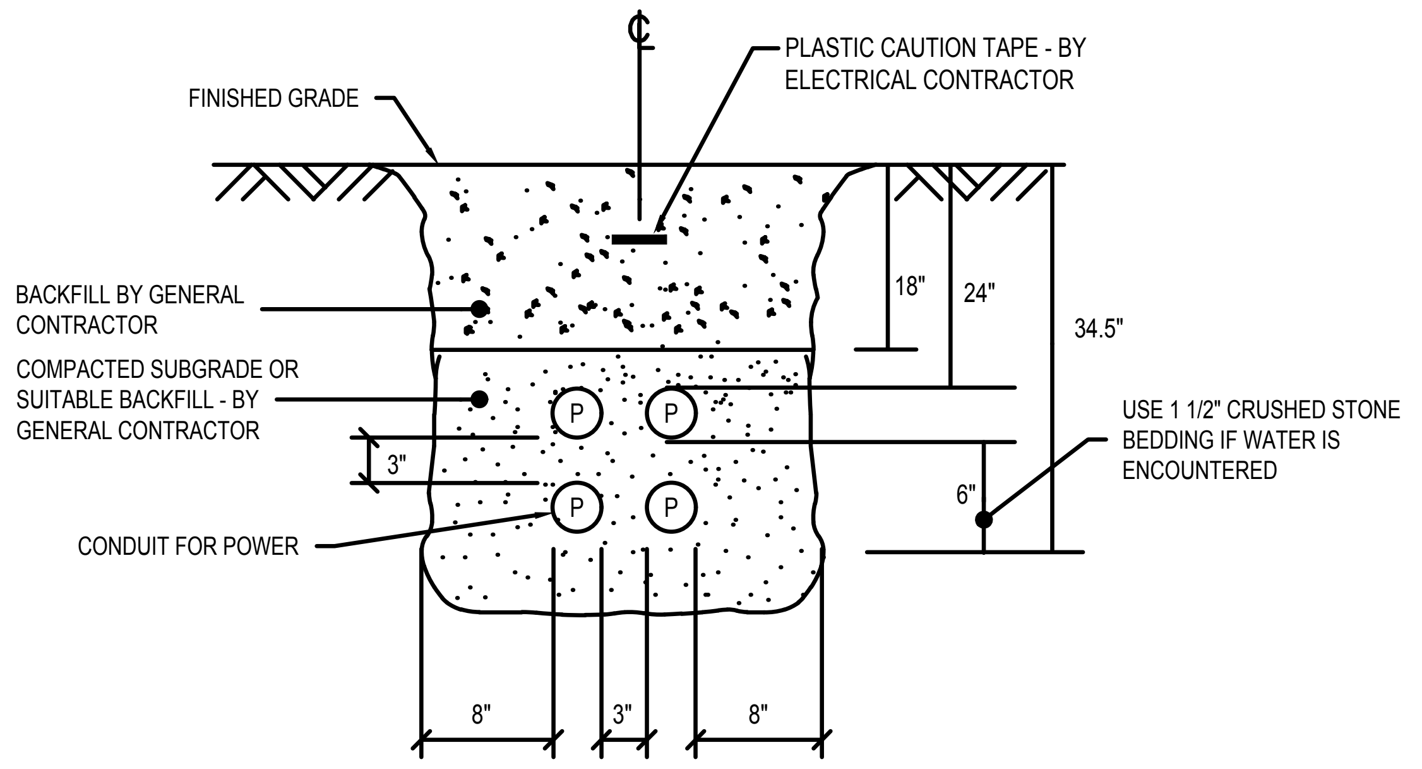
NOTES:

1. THIS HANDHOLE IS INTENDED FOR NON-DELIBERATE VEHICULAR TRAFFIC ONLY.

2. HANDHOLE SHALL BE PREFABRICATED POLYMER CONCRETE AGGREGATE EQUAL TO QUAZITE OR EQUAL PRE CAST CONCRETE CONSTRUCTION.

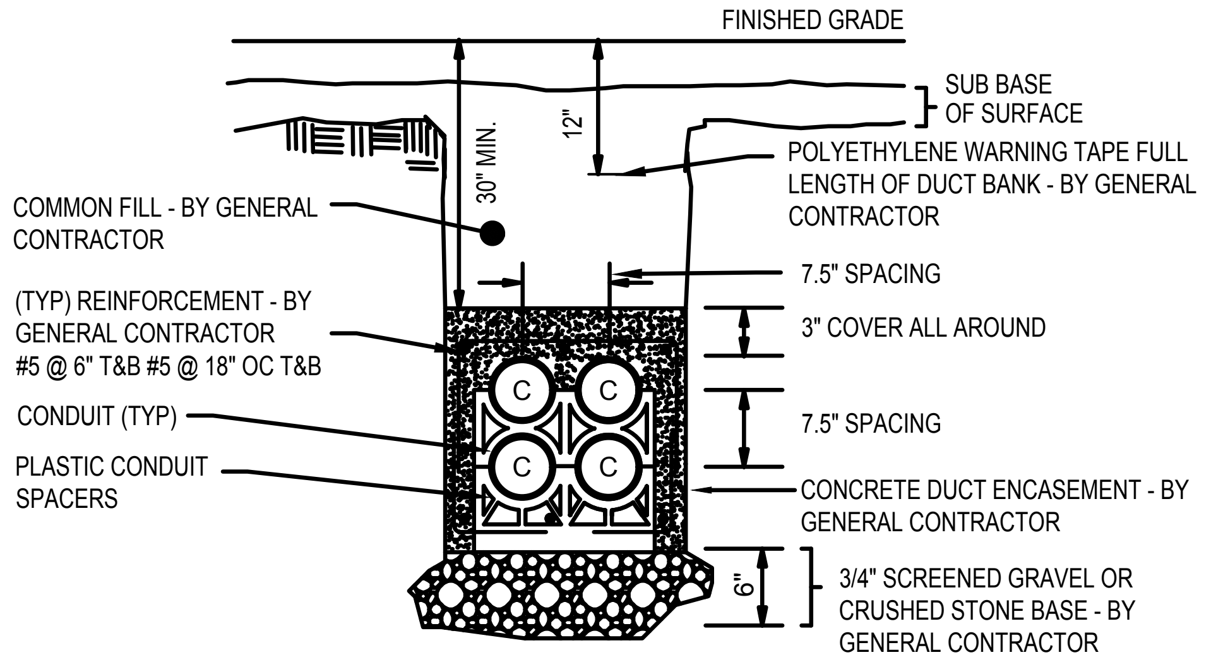
PREFABRICATED HANDHOLE DETAIL (TYPICAL)

NOT TO SCALE



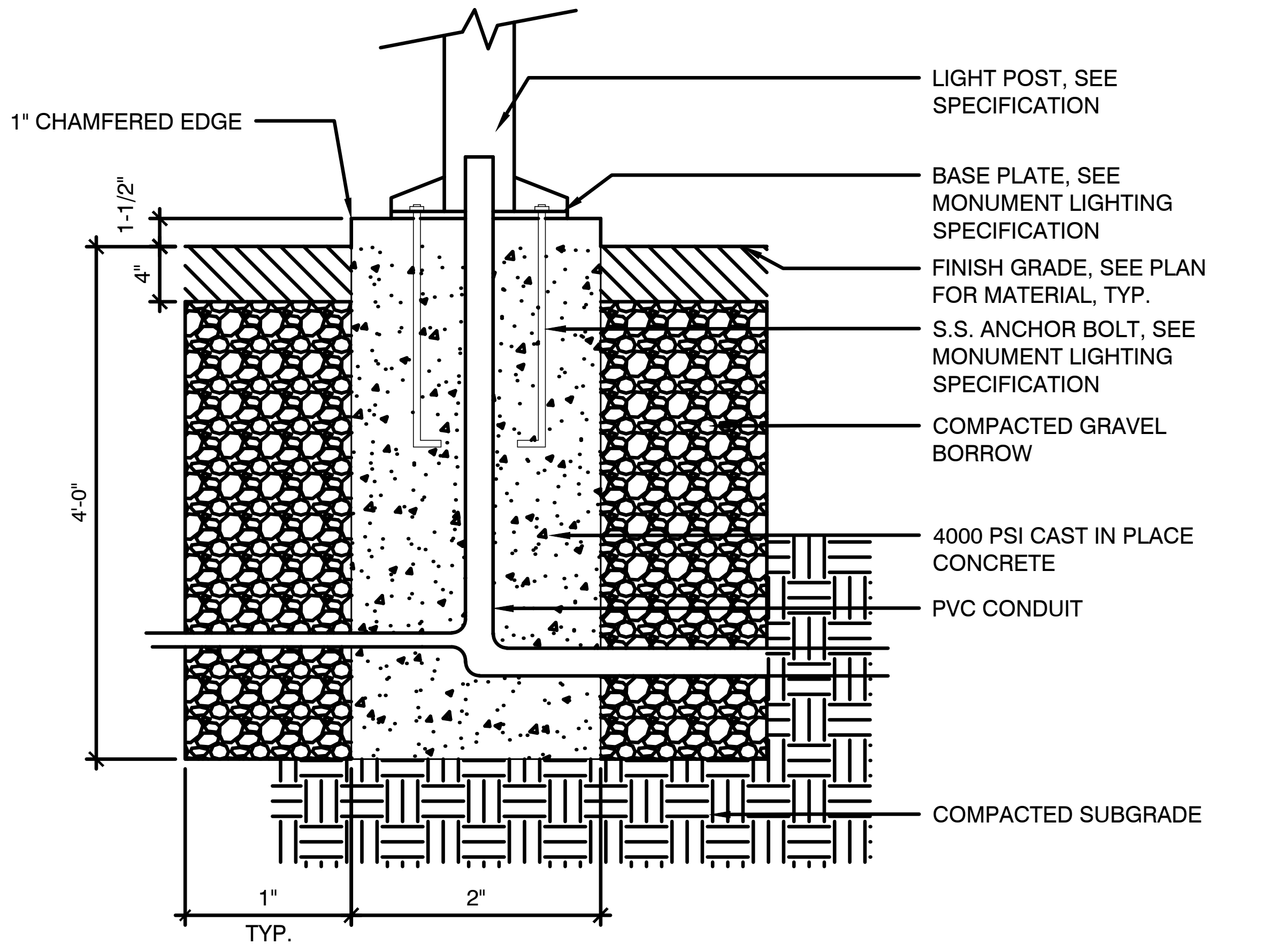
TYPICAL DIRECT BURIED MULTIPLE CONDUIT DETAIL

NOT TO SCALE



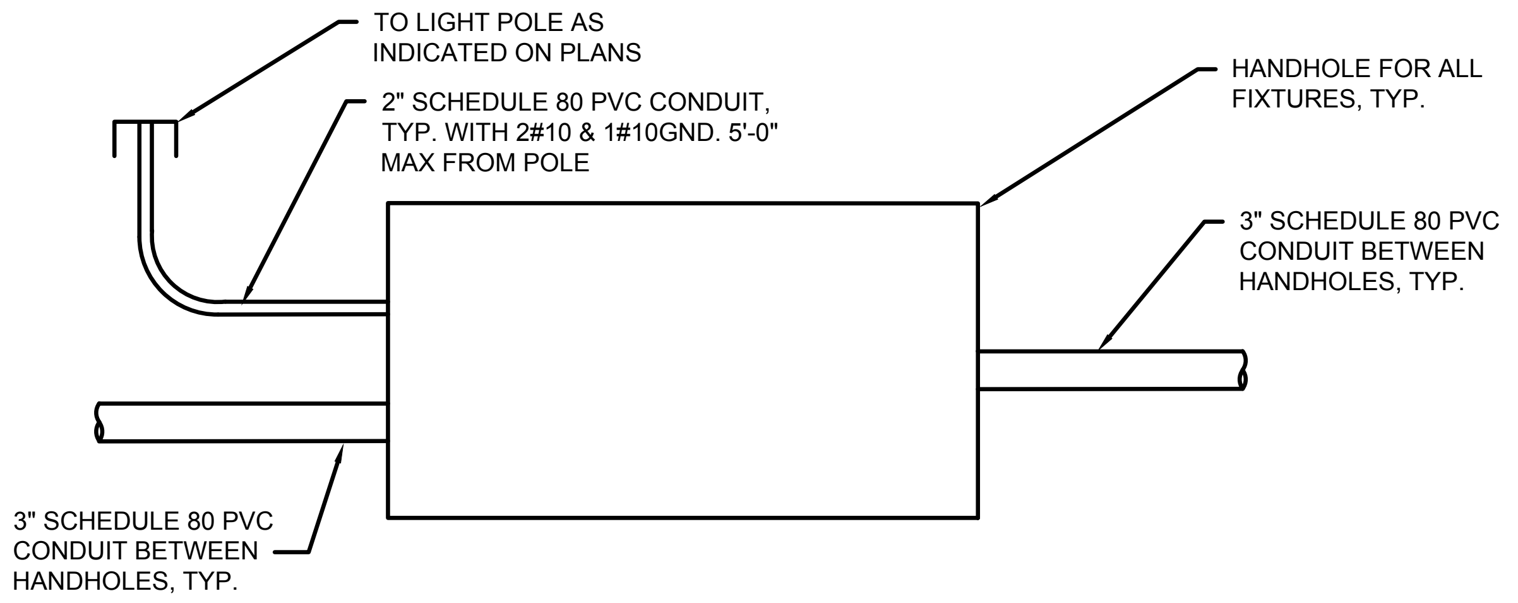
TYPICAL CONCRETE ENCASED DUCTBANK DETAIL

NOT TO SCALE



LIGHT POST FOOTING (TYPICAL)

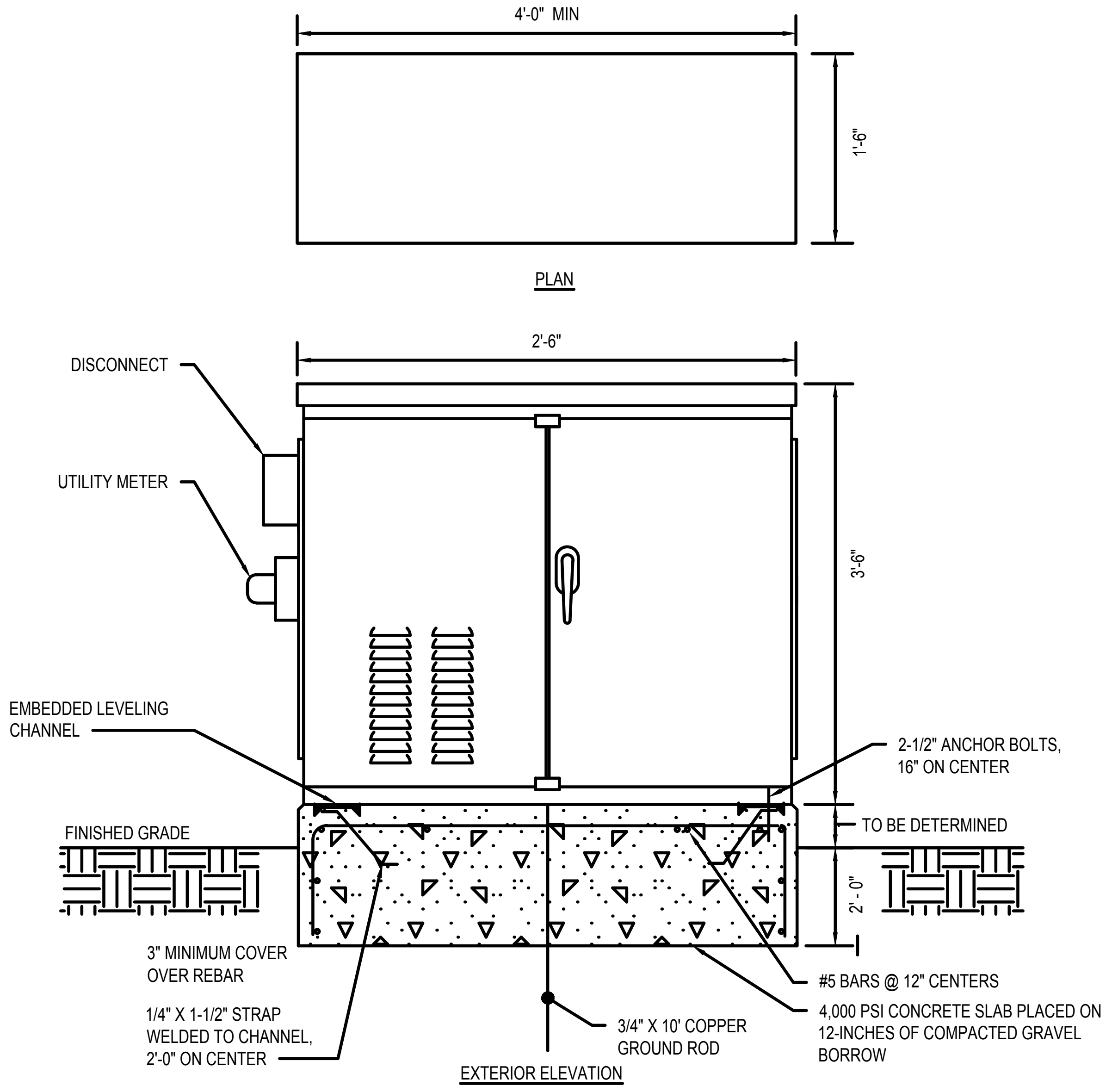
NOT TO SCALE



NOTE: ALL HAND HOLES SHALL BE LOCATED IN THE PAVED PATHWAYS

PEDESTRIAN SITE LIGHTING DISTRIBUTION DETAIL (TYPICAL)

NOT TO SCALE



NOTES:

1. CONTRACTOR SHALL COORDINATE WITH THE EXACT CABINET SIZE WITH ALL MANUFACTURER EQUIPMENT SIZES PRIOR TO SUBMITTING THE CABINET FOR APPROVAL. PROVIDE A SCALED DRAWING SHOWING ALL EQUIPMENT.

PAD MOUNTED 2-DOOR NEMA 3R ELECTRICAL CABINET DETAIL

NOT TO SCALE

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

WESTON & SAMPSON ENGINEERS, INC
85 DEVONSHIRE STREET, 3RD FLOOR
BOSTON, MA 02109
617-412-4480

www.westonandsampson.com

Consultants:

Revisions:

No.	Date	Description

Seal:

Key Plan:

Issued For:

75% DESIGN DEVELOPMENT
- NOT FOR CONSTRUCTION -

Scale: NO SCALE

Date: MARCH 2021
Drawn By: FN
Reviewed By: DNM
Approved By: RFM

W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

ELECTRICAL
DETAILS

Sheet Number:

E501

\\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2019\CAD\Electrical\E501 Riverwalk Electrical Details.dwg

LIGHTING FIXTURE SCHEDULE

TAG	TYPE	MANUFACTURER	CATALOG NUMBER	LAMP		MOUNTING	VOLTAGE	LOAD	REMARKS
				NO.	TYPE				
A	STREET LIGHT	TO BE DETERMINED	TO BE DETERMINED	-	LED	POLE	120	100W	-
B	PEDESTRIAN LED LIGHT FIXTURE	TO BE DETERMINED	TO BE DETERMINED	-	LED	POLE	120	50W	-
C	RAPID FLASHING BEACON	TO BE DETERMINED	TO BE DETERMINED	-	-	POLE	120	-	-

LIGHTING FIXTURE SCHEDULE REQUIREMENTS

1. FURNISH AND INSTALL ALL MATERIALS, ACCESSORIES AND OTHER EQUIPMENT NECESSARY FOR THE COMPLETE AND PROPER INSTALLATION OF ALL LIGHTING FIXTURES INCLUDED IN THIS CONTRACT. PROVIDE ALL NECESSARY ACCESSORIES AS NECESSARY TO PROVIDE A COMPLETE LIGHTING SYSTEM.
2. SPECIFICATIONS AND DRAWINGS ARE INTENDED TO CONVEY THE FEATURES, FUNCTION AND CHARACTER OF THE FIXTURES ONLY, AND DO NOT UNDERTAKE TO SPECIFY EVERY ITEM OR DETAIL NECESSARY. MINOR DETAILS NECESSARY FOR THE PROPER EXECUTION AND COMPLETION OF THE LIGHTING SYSTEM NOT INDICATED ON THE DRAWINGS NOR SPECIFIED SHALL BE PROVIDED AS IF THEY WERE SPECIFIED HERE OR INDICATED ON THE DRAWINGS.
3. EFFECTIVELY PROTECT ALL LIGHTING EQUIPMENT AGAINST DAMAGE FROM THE TIME OF FABRICATION TO FINAL ACCEPTANCE OF THE WORK. INSTALL REFLECTOR CONES, BAFFLES, APERTURE PLATES, LIGHT CONTROLLING ELEMENT AND GENERAL CLEANUP. REPLACE BLEMISHED, DAMAGED OR UNSATISFACTORY FIXTURES AS DIRECTED.
4. AT THE TIME OF FINAL ACCEPTANCE BY THE OWNER, ALL LIGHTING FIXTURES SHALL HAVE BEEN THOROUGHLY CLEANED WITH MATERIALS AND METHODS RECOMMENDED BY THE MANUFACTURERS, ALL BROKEN PARTS SHALL HAVE BEEN REPLACED, AND ALL LAMPS SHALL BE OPERATING.

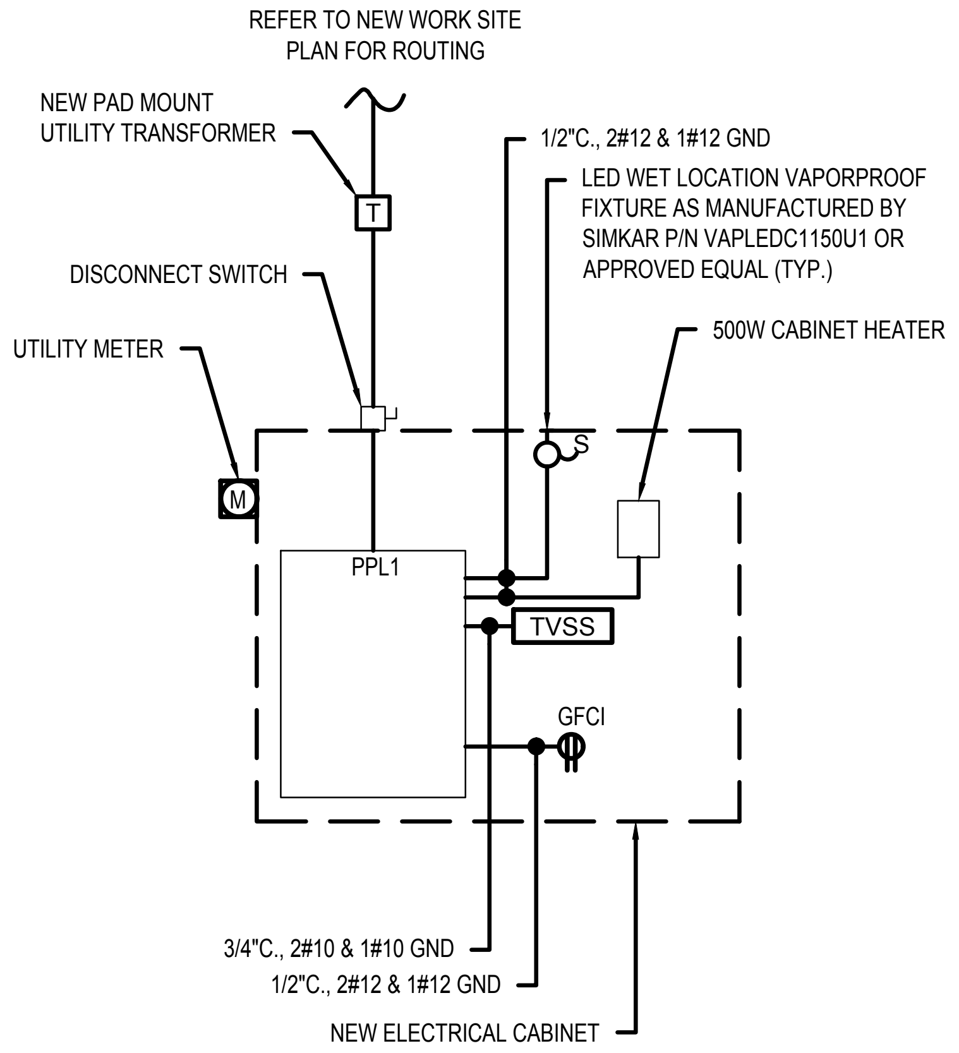
PANELBOARD SCHEDULE

DESIGNATION: PPL1
LOCATION: ELECTRIC CABINET
RATING: 50 AMPS
MAIN: 50 AMP MCB
S.C. RATING: 10,000 A RMS SYSTEM
SERVICE: 120/208V,3Ø,4W
MOUNTING: SURFACE
REMARKS:

CKT. NO.	LOAD DESIGNATION	BREAKER		PHASE			BREAKER		LOAD DESIGNATION	CKT. NO.
		TRIP	POLE	A	B	C	POLE	TRIP		
1	PEDESTRIAN LIGHTING	20		●				20	PEDESTRIAN LIGHTING	2
3	GFI RECEPTACLES	20			●			20	SPARE	4
5	SPARE	20				●		20	SPARE	6
7	SPARE	20		●				20	SPARE	8
9	SPARE	20			●			20	SPARE	10
11	SPACE	-				●		-	SPACE	12
13	SPACE	-		●				-	SPACE	14
15	SPACE	-			●			-	SPACE	16
17	SPACE	-				●		-	SPACE	18
19	SPACE	-		●				-	SPACE	20
21	SPACE	-			●			-	SPACE	22
23	SPACE	-				●		-	SPACE	24
25	SPACE	-		●				-	SPACE	26
27	SPACE	-			●			-	SPACE	28
29	SPACE	-				●		-	SPACE	30
31	SPACE	-		●				-	SPACE	32
33	SPACE	-			●			-	SPACE	34
35	SPACE	-				●		-	SPACE	36
37	SPACE	-		●				-	SPACE	38
39	SPACE	-			●			-	SPACE	40
41	SPACE	-				●		-	SPACE	42

CONDUIT & WIRING SCHEDULE

CONDUIT	FEEDER	FROM	CONTACTOR	TO	FIXTURES	LOAD	CONTACTOR SIZE	REMARKS
C1	2"C., PRIMARY CABLE	UTILITY MANHOLE	-	PAD MOUNTED TRANSFORMER	-	-	-	DIRECT BURIED
C2	2"C., PRIMARY CABLE	PAD MOUNTED TRANSFORMER	-	ELECTRICAL CABINET "A"	-	-	-	DIRECT BURIED
C3	1"C., 2#10&1#10GND	PPL1-1	-	FIXTURE A	7 @ 100W	5.8A	-	DIRECT BURIED
C4	1"C., 2#10&1#10GND	PPL1-3	-	PARK GFI RECEPTACLES	3 @ 180W	4.5A	-	DIRECT BURIED
C5	1 1/2"C., 2#8 & 1#10GND	PPL1-2	-	FIXTURE A	9 @ 100W	7.5A	-	DIRECT BURIED
C6	1 1/2"C., 2#6&1#10GND	PPL2-1	-	FIXTURE A	8 @ 100W	6.6A	-	DIRECT BURIED
C7	1"C., 2#10&1#10GND	PPL2-3	-	FIXTURE A	3 @ 100W	2.5A	-	DIRECT BURIED
C8	1"C., 2#10&1#10GND	PPL2-5	-	PARK GFI RECEPTACLES	3 @ 180W	4.5A	-	DIRECT BURIED
C9	1"C., 2#10&1#10GND	PPL2-2	-	FIXTURE B	5 @ 80W	3.3A	-	DIRECT BURIED
C10	1"C., 2#10&1#10GND	PPL2-4	-	FIXTURE A	7 @ 80W	4.6A	-	DIRECT BURIED
C11	2"C., 2#1/0&1#6GND	PPL2-6	-	FUTURE BRIDGE	N/A	95A	-	DIRECT BURIED
C12	1"C., 2#10&1#10GND	PPL2-7	-	PARK GFI RECEPTACLES	360W	3A	-	DIRECT BURIED



ONE-LINE DIAGRAM

NOT TO SCALE

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

WESTON & SAMPSON ENGINEERS, INC
85 DEVONSHIRE STREET, 3RD FLOOR
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75% DESIGN DEVELOPMENT
- NOT FOR CONSTRUCTION -

Scale: NO SCALE
Date: MARCH 2021
Drawn By: FN
Reviewed By: DNM
Approved By: RFM
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

ELECTRICAL RISER
AND SCHEDULES

Sheet Number:

E601

\\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2019\CAD\Electrical\E601 Riverwalk Electrical Riser and Schedules.dwg

APPENDIX F

Environmental Permitting Materials

Weston & Sampson℠

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

MEMORANDUM

TO:	Sarah DeStefano – Weston & Sampson Engineers, Inc.
FROM:	Timothy Blair – Weston & Sampson Engineers, Inc.
DATE:	February 16, 2021
SUBJECT:	Side Slope Protection Recommendations for Proposed Flood Resilience Improvements to the North River Canal in Peabody, Massachusetts

Introduction

This memorandum summarizes the methodology, results and conclusions of a threshold channel design study completed by Weston & Sampson Engineers, Inc. for proposed flood resilience improvements to the North River Canal in Peabody, Massachusetts. The study area was limited to the south side of the canal along the approximately 1,350-foot-long reach between the railroad crossing adjacent to 15 Wallis Street and the railroad crossing just west of Howley Street. Proposed canal improvements along this reach include replacement of the existing south wall (south canal wall) and incorporation of other resilient design elements aimed to increase stormwater storage, reduce downstream flooding potential, and enhance public access to open space.

The south canal wall will be replaced with permanent interlocking steel sheet piles assembled into a linear wall. The sheet pile wall is expected to have exposed heights ranging from approximately 1.1 feet to 6.5 feet above the canal bottom. The new wall will reduce peak flood elevations, provide a non-erodible flow boundary along a portion of the canal cross-section, and retain the ground upslope above the wall. The canal alignment within the study area is generally straight (flowing from west to east) with the exception of a sharp northerly bend at the railroad crossing. The downstream end of the new wall will terminate in a concrete abutment to be located just south of the railroad crossing. Design development plans for the proposed project currently indicate that the overall planform of the canal will not change considerably. Changes to the cross-sectional geometry of the canal will include modest widening attributed to replacement of the existing south wall with thinner sheet piles and re-grading of the upslope above the new wall.

Considering the proposed canal improvements, the scope and purpose of the study was to provide recommendations for a protective surface treatment for the ground upslope of the (new) south wall based on the design flow conditions.

Scope and Methodology

This study applied threshold channel design techniques to evaluate the need for a protective surface treatment for the ground upslope of the proposed new south canal wall. Threshold channels have essentially erosion resistant flow boundaries (i.e., the channel bottom and sides), which may include vegetated linings, natural soil or rock formations, or hard-armor revetements. In a threshold channel, movement of the channel boundary is minimal or nonexistent for stresses at or below the design flow condition. Therefore, the objective of the threshold channel design procedure is to ensure that the design hydraulic parameters are less than the allowable (limiting) values for the channel boundary. Depth-average channel velocity and boundary shear stress are the hydraulic parameters typically used for threshold channel design.

Weston & Sampson based this study on guidance provided in the NRCS National Engineering Handbook (2007) as well as a 1993 research publication by Stephen T. Maynord titled "U.S. Army Corps of Engineers Riprap Design for Flood Channels." The two methods utilized for the study were those based on allowable velocity and allowable boundary shear (tractive) stress. Hydrologic and hydraulic data utilized for the study included various parameters obtained from a HEC-RAS model and subsequent calculations prepared by Weston & Sampson. At each modeled cross-section, these parameters included hydraulic radius, hydraulic grade line, flow depth, average shear stress, and average velocity. Data sets were provided for a total of ten discrete cross-sections or transects along the canal alignment with respect to five storm events under the present-day baseline climate conditions and five storm events under potential 2070 climate conditions. It is understood that the proposed canal improvements will provide modest reductions in the peak flood elevation within the study area but will not alleviate bank overtopping and associated flood impacts entirely.

Discussion of Results

A modified cross-section of the canal was developed for the study to simplify the variable geometry of the existing and proposed cross-section. The modified cross-section created for the study is a trapezoidal channel with infinitely long 2.3H:1V (23.5-degree) sideslopes and a base width of 18 feet. Since floodwaters are expected to overtop the canal wall and overbank areas during several of the design storm events, use of infinitely long sideslopes is considered a conservative approach. An inclination of 2.3H:1V was selected based on the steepest sideslope currently proposed above the sheet pile wall. The exposed portion of the vertical sheet pile wall was neglected to simplify the cross-section. Soil gradation and plasticity information for the existing and proposed sideslopes was not available at the time of the study. It is noted that the design flow condition for a threshold channel boundary is not necessarily the "worst case" flood. Instead, the design condition is considered to be the combination of concurrent hydrologic/hydraulic factors that produces the largest shear stress along the flow boundary.

Natural Grass Lining – This study considered an earthen sideslope surfaced with grass as the baseline condition for initial evaluation of erosion potential. Since the erosion resistance of unreinforced grass linings is highly dependent on the grass type, established coverage, stem height, and underlying soil conditions supporting the root zone, several variations were considered based on the project site location and other factors including assumed level of maintenance. Grass types considered included several species native to New England, each of which were evaluated under good, fair, and poor coverage conditions. Regardless of the grass type and cover condition, it was assumed that the underlying soil is fine-grained and of sufficient thickness to support the full root zone depth (note, most imported silty or clayey loam products typically used as topsoil are considered fine-grained). The results of this evaluation are summarized in Table 1, below.

Table 1: *Actual versus allowable shear stresses for natural grass lining.*

TRM Vegetation Maturity	Allowable Shear Stress (psf)*	Actual Shear Stress (psf)
Stress on Vegetal Surface	3.33 to 7.50	3.36 to 3.65
Stress on Underlying Soil	0.02 to 0.03	0.19 to 0.49

In general, it was found that the actual shear stresses imposed on the top surface containing the vegetal elements would be susceptible to detachment from the slope face at stress levels low enough to be withstood by the vegetation itself without significant damage. When this occurs, the vegetation is undercut and the weakest vegetation is removed, which may in turn lead to rapid failure or unraveling of the grass lining.

Turf Reinforcement Mat – Non-degradable rolled erosion control products such as turf reinforcement mat (TRM) are often used in areas exposed to erosive forces that will exceed the limits of natural vegetation. TRM is typically buried and/or staked in-placed to add stability to soils and often used to support permanent vegetation on steeper slopes and in higher velocity channels when slope and channel conditions exceed the capabilities of erosion control blankets but are not severe enough to require the use of a hard armoring. Chapter 8 of the NRCS National Engineering Handbook provides permissible velocity and shear stress values for TRM based on cross-sectional averaged values. These permissible values are presented in the table below as a function of the cover vegetation maturity (assumed to be grass).

Table 2: *Permissible velocity and shear stress values for turf reinforcement mat as a function of cover vegetation maturity.*

TRM Vegetation Maturity	Allowable Velocity (ft/s)	Allowable Shear Stress (psf)
Unvegetated TRM	5 to 7	3
Partially Established TRM	7.5 to 15	4 to 6
Fully Vegetated TRM	8 to 21	8

The allowable velocity and shear stress values for the partially established and fully vegetated TRM are greater than the actual imposed values determined for the natural grass lining (non-TRM) condition discussed above. Since both conditions ultimately result in a grass surface, maximum velocities and shear stresses occurring along the channel sideslope protected by TRM would be essentially equal to the natural grass lining condition. TRM would therefore be an adequate slope protection system for the proposed canal improvements.

Hard Armoring – Hard armoring systems such as rock riprap, gabions, and articulated concrete blocks are often used in high velocity or turbulent channels and bendways with increasing hydraulic forces. Rock riprap is the most common hard armoring for sloping surfaces and has the ability to withstand high flow velocity and shear stress if designed appropriately. Based on the expected flow conditions in the canal, angular rock riprap with a maximum particle size of 6 inches would provide adequate erosion protection if placed to a uniform layer thickness equal to at least 1 times the maximum particle size. A commonly available material with pre-determined specifications meeting this minimum criteria is Modified Rockfill (MassDOT Specification M2.02.4), which has a maximum particles size of 8 inches. Use of a riprap slope protection system would also require installation of an underlying bedding and filtration layer designed based on the selected riprap gradation and actual base/subgrade soil conditions.

In general, hard armoring systems can be significantly more expensive to construct than soft armoring systems (such as TRM) and, from an riparian habitat standpoint, should only considered for use if a vegetative approach will not provide adequate protection.

Recommendations

Assuming that a vegetated bank appearance is preferred, it is recommended that the ground upslope of the proposed sheet pile wall be protected by TRM that is fully vegetated with a native grass mixture. TRM provides permanent support for vegetation on slopes and permanent armoring for vegetated channels. TRM also provides protection against wind and raindrop erosion during the weeks between seeding and vegetation emergence. Effectiveness of TRM is dependent upon TRM type, surface preparation, installation practices, and site conditions.

TRM are designed and fabricated to address specific site conditions, such as slope range and length, water velocity, and shear stress, UV exposure, seed type, and post-installation soil fill. As such, it is critical to observe the manufacturer’s requirements when selecting, siting, installing, and maintaining a TRM to achieve optimal performance. For example, TRM installation procedures may include applying the mat over bare seeded ground, or installing the TRM over the bare ground first followed by seed application and a topsoil cover over the TRM. Some applications specify for the seed to be mixed with the fill soil prior to spreading. In cases where a TRM is installed prior to seeding and backfilling with soil, some applications may require the installation of an erosion control blanket to protect the seed and soil within the three-dimensional matrix of the mat during the time between seeding and establishment of dense growth.

Regardless of the order required for mat installation, seeding, and topsoil cover, the need for proper preparation of the bare soil area or channel remains constant and includes the following considerations.

- Plan final surface preparation, seeding, and mat installation during dry periods.
- Assemble mats, anchors, dry topsoil cover, seed, and other needed materials.
- Establish final grade for the ground to be seeded and protected.
- Test soil and adjust pH and fertility according to seed needs.
- Remove all rocks larger than 2 inches and all sticks, limbs, protruding roots, and other debris.
- Ensure all surfaces are smooth and consistent.
- Install seed, TRM, anchors, and top dressing as directed by manufacturer’s instructions.
- Note requirements for using check slots to anchor TRM.

westonandsampson.com

55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

Wetland Delineation Report

April 2021

Peabody, Massachusetts
Project # ENG20-0145

MVP Riverwalk
Peabody, MA

Wetland Delineation Conducted By:
Nathaniel Parker on 4/1/2021

Delineation Report Reviewed By:
Mel Higgins, PWS

TABLE OF CONTENTS

FIGURES

APPENDICES

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1.0 SITE DESCRIPTION

On April 1st, 2021, the presence of wetland resources was investigated near Proctor Brook in Peabody, MA. This investigation area is located in a predominantly urban/industrial area. Please see Figure 1 (Wetlands Field Map) and Figure 2 (USGS Topographic Map) of this report for the investigation area.

Wetland resource areas including a perennial stream were identified and flagged in the field using pink flagging by a Weston & Sampson employee who is trained in the wetland delineation process using the Massachusetts Department of Environmental Protection (MassDEP) and the US Army Corps of Engineers methodology. A further description of these wetland resource areas is presented in the following sections.

2.0 DELINEATION OF WETLAND RESOURCES

2.1 Site Observations

The Weston & Sampson wetland scientist, trained in the ACOE Wetland Delineation Manual and Massachusetts Department of Environmental Protection (MassDEP) Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetland Protection Act guidance document, observed the following protected wetland resources at the site:

- Bank – Perennial Stream

Field data were recorded on US Army Corps of Engineers (ACOE) Wetland Determination Data Forms. See Appendix A for site photographs.

2.2 Bank

Water bodies, including perennial streams, intermittent streams, ponds and lakes, have banks which are protected by the Massachusetts Wetland Protection Act. Bank is a wetland resource area defined by 310 CMR 10.54(2)(a) as "the potion of land surface which normally abuts and confines a water body. It occurs between a waterbody and a vegetated bordering wetland and adjacent floodplain, or, in absence of these, it occurs between a waterbody and an upland." Vegetated banks provide valuable functions such as flood control, stormwater prevention, fisheries protection, and water quality protection. The limit of this resource area is identified by Top of Bank (TOB) which is located at the first observable break in slope or the Mean Annual Flood Level (MAFL), whichever is lower. TOB is easily identified in the field so that indicator was utilized for this wetland delineation.

Perennial Stream Banks

A single perennial stream known as Proctor Brook was identified within the investigation area. The boundary of the perennial stream was identified in the field utilizing Top of Bank (TOB), identified by flag line TOB-A. Proctor Brook is shown as perennial on the current United States Geographical Survey (USGS) map and has a watershed size greater than 0.5 square miles in size according to USGS Stream Stats which classifies the stream as perennial per 310 CMR 10.58 (2)(a)(1)(b-c). The boundary of the perennial stream was identified in the field by the first observable break in slope (TOB). Wetland flags left in the field included:

- TOB-A1 through TOB-A23 (Perennial Stream Bank "A" Series)

Perennial streams are subject to a 200-foot Riverfront Area under the Massachusetts Wetland Protection Act per 301 CMR 10.58(2)(a)(2)(c).

2.3 Other Protected Areas

Weston & Sampson created environmental resources maps (see Figure 4) of the site to determine the presence of other protected areas. The data source of these map layers was the Massachusetts Geographic Information System (MassGIS). These areas included:

- NHESP Priority Habitats of Rare Species
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Certified and Potential Vernal Pools
- Areas of Critical Environmental Concern (ACEC)
- Outstanding Resource Waters (ORW)

Wetland resources identified in the field were also added to these maps. Based on the MassGIS information there are no protected areas other than the Perennial Stream resource area previously identified above.

Based on the information provided by the FIRM map the investigational area is located within a Regulatory Floodway. FEMA defines a Regulatory Floodway as "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height." This Regulatory Floodway is located within Zone AE, which is the 100-year flood zone. As a result, the investigation is located within the 100-year flood zone.

3.0 SUMMARY

On April 1st 2021, the presence of wetland resources was investigated near Proctor Brook in Peabody, MA. A single perennial stream was identified and flagged at the site.

Additional environmental mapping was conducted using MassGIS data layers and FEMA FIRM mapping. This additional mapping indicates that the investigation area falls within the 100-year floodzone.

This Wetlands Delineation Report has been reviewed and approved by a Professional Wetland Scientist PWS.

4.0 REFERENCES

Jackson, Scott. 1995. “Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act.” Massachusetts Department of Environmental Protection.

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.

APPENDIX A

Site Photographs

Path: \\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2019\Task 3 - Permitting\Wetland Delineation\GIS\Maps\wetland flags.mxd **User:** GasparA **Saved:** 4/7/2021 7:53:53 AM **Opened:** 4/7/2021 7:55:22 AM

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

▬	Perennial Stream
☐	Investigation Area
▨	Marsh/Bog
▨	Wooded marsh
▨	Cranberry Bog
▨	Salt Marsh
▭	Open Water
■	Reservoir (with PWSID)
▨	Tidal Flats
▨	Beach/Dune

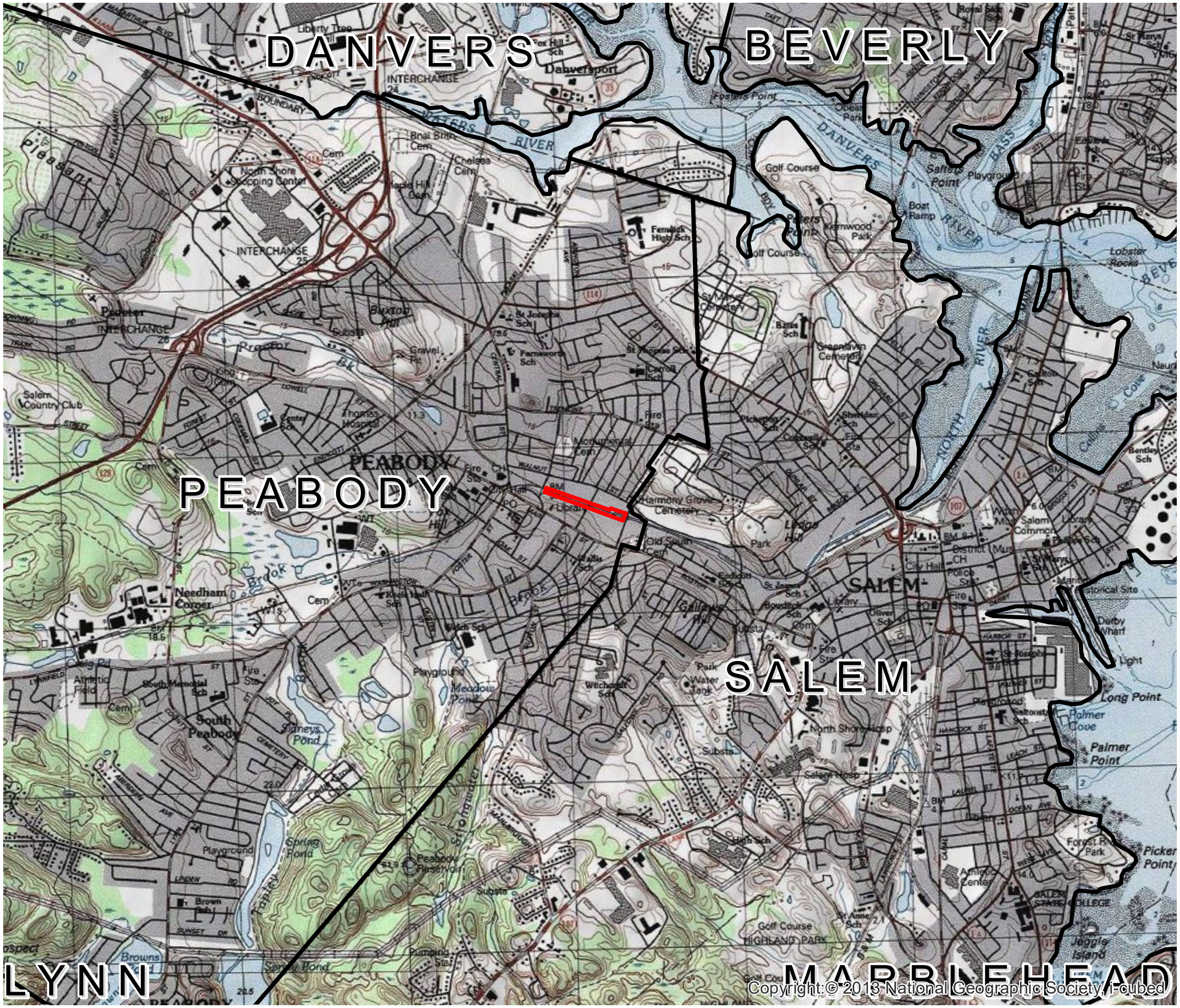
FIGURE 1

MVP Riverwalk
Peabody, MA

Wetland Field Map

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2019\Task 3 - Permitting\Wetland Delineation\GIS\Maps\locus.mxd **User:** GasparA **Saved:** 4/7/2021 7:56:55 AM **Opened:** 4/7/2021 7:58:53 AM



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

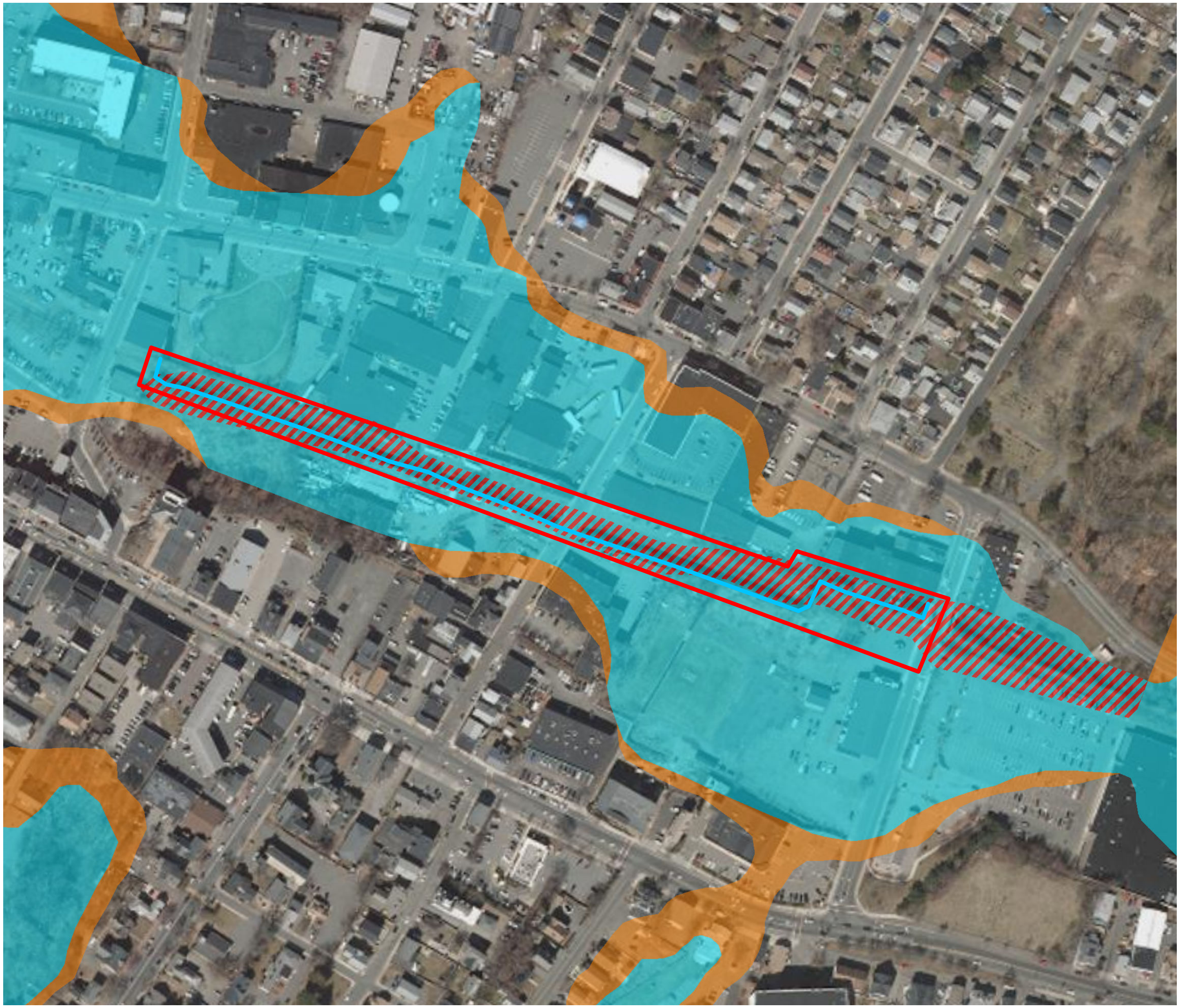
🟥 Investigation Area

FIGURE 2

MVP Riverwalk
Peabody, MA

Locus Map

Weston & Sampson



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- ━ Perennial Stream
- ▭ Investigation Area

FEMA National Flood Hazard Layer

Flood Zone Designations

- 🟩 A: 1% Annual Chance of Flooding, no BFE
- 🟦 AE: 1% Annual Chance of Flooding, with BFE
- ▨ AE: Regulatory Floodway
- 🟦 AH: 1% Annual Chance of 1-3ft Ponding, with BFE
- 🟦 AO: 1% Annual Chance of 1-3ft Sheet Flow Flooding, with Depth
- 🟪 VE: High Risk Coastal Area
- 🟨 D: Possible But Undetermined Hazard
- 🟧 X: 0.2% Annual Chance of Flooding
- ▨ X: Reduced Flood Risk due to Levee
- ▨ Area Not Included
- ▨ Area with no DFIRM - Paper FIRMs in Effect

FIGURE 3

MVP Riverwalk
Peabody, MA

FEMA Map

Weston & Sampson

Path: \\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2019\Task 3 - Permitting\Wetland Delineation\GIS\Maps\Environmental Receptor - MA.mxd **User:** GasparA **Saved:** 3/5/2021 8:18:59 AM **Opened:** 4/7/2021 7:53:08 AM

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- ━ Perennial Stream
- ▭ Investigation Area

ACECs

- ▥ ACECs

NHESP Habitats

- ▨ NHESP Estimated Habitats of Rare Wildlife
- ▨ NHESP Priority Habitats of Rare Species
- ✱ NHESP Certified Vernal Pools
- ✱ NHESP Potential Vernal Pools

Outstanding Resource Waters

- ■ Public Water Supply Contributor
- 🟩 ORW for ACEC
- 🟦 ORW for both Water Supply and Other

FIGURE 4

MVP Riverwalk
Peabody, MA

Environmental
Resource Map

Weston & Sampson

APPENDIX A

Site Photographs

Photo 1: Proctor Brook

westonandsampson.com

55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

Environmental Notification Form

June 2021

PEABODY – MVP RIVERWALK

PREPARED FOR:
CITY OF PEABODY

SUBMITTED TO:
Executive Office of Energy and Environmental Affairs

Weston & Sampson

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

June 25, 2021

Secretary Kathleen Theoharides
Executive Office of Energy and Environmental Affairs
Attention: MEPA Office
100 Cambridge Street, Suite 900
Boston, Massachusetts 02114

Re: **Environmental Notification Form**
Peabody MVP Riverwalk Project

Dear Secretary Theoharides:

On behalf of the City of Peabody, we are pleased to submit the attached Environmental Notification Form (ENF) for review under the provisions of the Massachusetts Environmental Policy Act (MEPA).

The proposed project includes a new Riverwalk approximately 1,600 feet in length that will go through downtown Peabody. The project's scope of work includes replacing the south canal wall with a new wall at a lower elevation with a stabilized slope with a turf reinforcement mat and vegetation. The Riverwalk will consist of an 8-foot wide asphalt path with 4 feet of vegetative buffer on each side where sufficient space permits. There will also be 4 separate sections of boardwalk constructed which will include helical pile footings. Additionally, a porous paver "art walk" will also be constructed as well as a public deck supported by concrete post footings. Plantings will consist of native species and seed mixes. Pedestrian and street lights will be installed as well as rapid flashing beacons at street crossings.

This project is being submitted to MEPA as this project will result in >500 linear feet of bank impact and is also state funded under the Municipal Vulnerability Preparedness grant program

Copies of the ENF have been provided to all required recipients, as listed in the attached Circulation List (Appendix G). Please contact Alexandra Gaspar, of Weston & Sampson, with any questions, or if you request additional copies of the ENF, at 978-532-1900 or by e-mail at gaspara@wseinc.com

Sincerely,

WESTON & SAMPSON ENGINEERS, INC.
Alexandra Gaspar
Environmental Scientist

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs

MEPA Office

100 Cambridge St., Suite 900
Boston, MA 02114
Telephone 617-626-1020

The following should be completed and submitted to a local newspaper:

PUBLIC NOTICE OF ENVIRONMENTAL REVIEW

PROJECT: Peabody MVP Riverwalk

LOCATION: Proctor Brook, Wallis/Howley Street

PROPONENT: City of Peabody

The undersigned is submitting an Environmental Notification Form ("ENF") to the Secretary of Energy & Environmental Affairs on or before
June 25, 2021

This will initiate review of the above project pursuant to the Massachusetts Environmental Policy Act ("MEPA", M.G.L. c. 30, s.s. 61-62I). Copies of the ENF may be obtained from:
Weston & Sampson Engineers: Alexandra Gaspar, gaspara@wseinc.com , 978-532-1900

During the interim Covid-19 response period, electronic copies of the ENF are also being sent to the Conservation Commission and Planning Board of Peabody**.**

The Secretary of Energy & Environmental Affairs will publish notice of the ENF in the Environmental Monitor, will receive public comments on the project for 20 days, and will then decide, within ten days, if an Environmental Impact Report is needed. A site visit and consultation session on the project may also be scheduled. All persons wishing to comment on the project, or to be notified of a site visit or consultation session, should email MEPA@mass.gov. Mail correspondence will continue to be accepted, though responses may be delayed. Mail correspondence should be direct to the Secretary of Energy & Environmental Affairs, 100 Cambridge St., Suite 900, Boston, Massachusetts 02114, Attention: MEPA Office, referencing the above project.

By The City of Peabody

Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs

Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#: ____________________

MEPA Analyst: _____________

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: Peabody Riverwalk		
Street Address: between Wallis and Howley Street		
Municipality: Peabody	Watershed:	
Universal Transverse Mercator Coordinates:	Latitude: 42deg31’30.602”N Longitude:70deg55’18.896”W	
Estimated commencement date: June 2022	Estimated completion date: June 2023	
Project Type: riverwalk	Status of project design: 75 %complete	
Proponent: Brendan Callahan, City of Peabody Asst. Director of Planning		
Street Address: 24 Lowell Street		
Municipality: Peabody	State: MA	Zip Code: 01960
Name of Contact Person: Alexandra Gaspar		
Firm/Agency: Weston & Sampson Engineers	Street Address: 55 Walkers Brook Drive, Suite 100	
Municipality: Reading	State: MA	Zip Code:01867
Phone: 978-532-1900	Fax:	E-mail: gaspara@wseinc.com

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☐Yes ☒No

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8)) ☐Yes ☒No
a Special Review Procedure? (see 301CMR 11.09) ☐Yes ☒No
a Waiver of mandatory EIR? (see 301 CMR 11.11) ☐Yes ☒No
a Phase I Waiver? (see 301 CMR 11.11) ☐Yes ☒No
(Note: Greenhouse Gas Emissions analysis must be included in the Expanded ENF.)

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?
>500 lf of bank impacts
Which State Agency Permits will the project require?

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:
MVP Funding

Summary of Project Size & Environmental Impacts	**Existing**	**Change**	**Total**
LAND			
Total site acreage	2.53		
New acres of land altered		0	
Acres of impervious area	0.32	0.07	0.25
Square feet of new bordering vegetated wetlands alteration		0	
Square feet of new other wetland alteration		1,350 lf bank, 106,465 sf bordering land subject to flooding, 110,305 sf riverfront area	
Acres of new non-water dependent use of tidelands or waterways		0	
STRUCTURES			
Gross square footage	0	0	0
Number of housing units	0	0	0
Maximum height (feet)	0	0	0
TRANSPORTATION			
Vehicle trips per day	0	0	0
Parking spaces	0	0	0
WASTEWATER			
Water Use (Gallons per day)	0	0	0
Water withdrawal (GPD)	0	0	0
Wastewater generation/treatment (GPD)	0	0	0
Length of water mains (miles)	0	0	0
Length of sewer mains (miles)	0	0	0

Has this project been filed with MEPA before?
☐ Yes (EEA #__________) ☒No

Has any project on this site been filed with MEPA before?
☐ Yes (EEA #__________) ☒No

GENERAL PROJECT INFORMATION – all proponents must fill out this section

PROJECT DESCRIPTION:

Describe the existing conditions and land uses on the project site:**The project site is in an urban industrial area of Peabody, between Wallis and Howley Streets, and crosses Caller Street. The south side of the North River Canal along the project limits abuts six (6) privately owned properties, from west to east: 13 Wallis Street, 24 Caller Street, [Caller Street crossing], 21 Caller Street, 18 Howley Street, 166 Main Street (R), and MBTA property**

Describe the proposed project and its programmatic and physical elements: **The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street. (See Appendix A for additional information)**

NOTE: The project description should summarize both the project's direct and indirect impacts (including construction period impacts) in terms of their magnitude, geographic extent, duration and frequency, and reversibility, as applicable. It should also discuss the infrastructure requirements of the project and the capacity of the municipal and/or regional infrastructure to sustain these requirements into the future.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:
See Appendix B for alternatives analysis

NOTE: *The purpose of the alternatives analysis is to consider what effect changing the parameters and/or siting of a project, or components thereof, will have on the environment, keeping in mind that the objective of the MEPA review process is to avoid or minimize damage to the environment to the greatest extent feasible. Examples of alternative projects include alternative site locations, alternative site uses, and alternative site configurations.*

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:
Native vegetation and seeding will be used as part of this project. Debris will be removed as needed.

If the project is proposed to be constructed in phases, please describe each phase:
____

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:

Is the project within or adjacent to an Area of Critical Environmental Concern?
☐Yes (Specify__________________________________)
☒No
if yes, does the ACEC have an approved Resource Management Plan? ___ Yes ___ No;
If yes, describe how the project complies with this plan.
____
Will there be stormwater runoff or discharge to the designated ACEC? ___ Yes ___ No;
If yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.
____

RARE SPECIES:

Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species? (see

http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)
☐Yes (Specify___________________________________) ☒No

HISTORICAL /ARCHAEOLOGICAL RESOURCES:

Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?
☐Yes (Specify___________________________________) ☒No

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☐Yes (Specify___________________________________) ☐No

WATER RESOURCES:

Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site? ___Yes _x__No; if yes, identify the ORW and its location. ____

(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain waters within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site? ___Yes _x__No; if yes, identify the water body and pollutant(s) causing the impairment:_____________________________________.

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? ___Yes _x__No

STORMWATER MANAGEMENT:

Generally describe the project's stormwater impacts and measures that the project will take to comply with the standards found in MassDEP's Stormwater Management Regulations:
Please see Appendix I for the stormwater discussion related to this project.

MASSACHUSETTS CONTINGENCY PLAN:

Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):_no

Is there an Activity and Use Limitation (AUL) on any portion of the project site? Yes _X__ No ___; if yes, describe which portion of the site and how the project will be consistent with the AUL: ______________________.

The Project alignment passes through the Disposal Site Boundary of six Release Tracking Numbers (RTNs), five of which are subject to Activity and Use Limitations (AULs):

- 3-0577 (18 Howley Street, 166 Main Street, and 21 Caller Street; multiple AULs)
- 3-4322 (166R Main Street; AUL)
- 3-14440 (166R Main Street)
- 3-17492 (20 Howley Street; AUL)
- 3-18180 (24 Caller Street; AUL)

A review of the publicly available documents submitted to MassDEP under the above RTNs and the results of a due diligence assessment program conducted by Weston & Sampson in 2017 indicate soil within the Project alignment is impacted with metals (arsenic, chromium, and lead) and polycyclic aromatic hydrocarbons (PAHs) throughout.

In accordance with the Rules for Groundwater Recharge, as provided in the Massachusetts Stormwater Handbook, Volume 1, Chapter 1, Standard 3 (pages 7-8), the City, at this time, is not proposing infiltration and recharge throughout the Project alignment due to the presence of contaminated soils and shallow groundwater.

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN?
Yes __X_ No ___ ; if yes, please describe:____________________________________

Weston & Sampson recently completed a subsurface investigation at 24 Caller Street (RTN 3-18180), which is the largest City-owned parcel in the Project alignment and the proposed location of a passive recreation park. The results of the subsurface investigation indicate the presence of metals, PAHs, volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), and petroleum impacts in the form of light non-aqueous-phase liquid (LNAPL) on the 24 Caller Street parcel. Although remediation is planned as part of redevelopment at 24 Caller Street, it is likely that regulatory closure at the Site will include a revised AUL and some level of contaminated soil will remain in place. Groundwater elevation surveys conducted 24 Caller Street during recent subsurface investigations show that groundwater is present at depths ranging from approximately 2.5 to 3.5 feet below the ground surface.

SOLID AND HAZARDOUS WASTE:

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood:________________________

(NOTE: Asphalt pavement, brick, concrete and metal are banned from disposal at Massachusetts landfills and waste combustion facilities and wood is banned from disposal at Massachusetts landfills. See 310 CMR 19.017 for the complete list of banned materials.)

Will your project disturb asbestos containing materials? Yes ___ No _x__ ;
if yes, please consult state asbestos requirements at http://mass.gov/MassDEP/air/asbhom01.htm

Describe anti-idling and other measures to limit emissions from construction equipment: __________________

DESIGNATED WILD AND SCENIC RIVER:

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes ___ No x___ ;
if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the “outstandingly remarkable” resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River?
Yes ___ No ___ ; if yes, specify name of river and designation: ______________;
if yes, will the project will result in any impacts to any of the designated “outstandingly remarkable” resources of the Wild and Scenic River or the stated purposes of a Scenic River.
Yes ___ No ___ ;
if yes,describe the potential impacts to one or more of the “outstandingly remarkable” resources or stated purposes and mitigation measures proposed.

ATTACHMENTS:

1. List of all attachments to this document.
2. U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries.
3.. Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.
4 Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts.
5. Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).
6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).
7. List of municipal and federal permits and reviews required by the project, as applicable.

LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1)
___ Yes __x_ No; if yes, specify each threshold:

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	__0______	___0_____	___0_____
Internal roadways	_3290sf_	__715sf__	_2875 sf_
Parking and other paved areas	__0_____	__0______	__0______
Other altered areas	__0______	___0_____	___0_____
Undeveloped areas	__0______	__0______	___0_____
Total: Project Site Acreage	__2.53ac_	___0_____	_2.53ac__

B. Has any part of the project site been in active agricultural use in the last five years?
___ Yes __x_ No; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use?
___ Yes _x__ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes _x__ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___ Yes_x__ No; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes _x__ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No __x_; if yes, describe:

III. Consistency

A. Identify the current municipal comprehensive land use plan
Title:___________________________ Date___________________

B. Describe the project's consistency with that plan with regard to:
1) economic development ______________________
2) adequacy of infrastructure _____________________
3) open space impacts ____________________________
4) compatibility with adjacent land uses_______________

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)
RPA: ____________________

Title:___________________________ Date___________________

D. Describe the project's consistency with that plan with regard to:
   1) economic development _________________________
   2) adequacy of infrastructure ________________________
   3) open space impacts _____________________________

RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ___ Yes _x__ No; if yes, specify, in quantitative terms:

(NOTE: If you are uncertain, it is recommended that you consult with the Natural Heritage and Endangered Species Program (NHESP) prior to submitting the ENF.)

B. Does the project require any state permits related to **rare species or habitat**? ___ Yes x___ No

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes __x_ No.

D. If you answered "No" to <u>all</u> questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? ___Yes ___No; if yes, have you received a determination as to whether the project will result in the “take” of a rare species? ___ Yes ___ No; if yes, attach the letter of determination to this submission.

2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts

3. Which rare species are known to occur within the Priority or Estimated Habitat?

4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? ___ Yes ___ No

4. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? _x__ Yes ___ No; if yes, specify, in quantitative terms:

Bank: 1,350 lf
Riverfront: 110,305 sf

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? _x__ Yes ___ No; if yes, specify which permit: **Notice of Intent**

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? __x_ Yes ___ No; if yes, has a Notice of Intent been filed? ___ Yes _x__ No; if yes, list the date and MassDEP file number: ______; if yes, has a local Order of Conditions been issued? ___ Yes ___ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes _x__ No.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site: Improved bank stability and flood storage (See Appendix A)

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Coastal Wetlands	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Land Under the Ocean	0	0
Designated Port Areas	0	0
Coastal Beaches	0	0
Coastal Dunes	0	0
Barrier Beaches	0	0
Coastal Banks	0	0
Rocky Intertidal Shores	0	0
Salt Marshes	0	0
Land Under Salt Ponds	0	0
Land Containing Shellfish	0	0
Fish Runs	0	0
Land Subject to Coastal Storm Flowage	0	0
Inland Wetlands		
Bank (lf)	1350	temporary
Bordering Vegetated Wetlands	0	0
Isolated Vegetated Wetlands	0	0
Land under Water	0	0
Isolated Land Subject to Flooding	0	0
Bordering Land Subject to Flooding	106,465	permanent
Riverfront Area	110,305	permanent

D. Is any part of the project:

1. proposed as a **limited project**? ___ Yes __x_ No; if yes, what is the area (in sf)?____
2. the construction or alteration of a **dam**? ___ Yes __x_ No; if yes, describe:

3. fill or structure in a **velocity zone** or **regulatory floodway**? ___ Yes _x__ No
4. dredging or disposal of dredged material? ___ Yes _x__ No; if yes, describe the volume of dredged material and the proposed disposal site:
5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**? ___ Yes _x__ No
6. subject to a wetlands restriction order? ___ Yes _x__ No; if yes, identify the area (in sf):
7. located in buffer zones? _x__Yes ___No; if yes, how much (in sf) **110,305sf of riverfront**

E. Will the project:
1. be subject to a local wetlands ordinance or bylaw? __x_ Yes ___ No
2. alter any federally-protected wetlands not regulated under state law? ___ Yes _x__ No; if yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? ___ Yes _x__ No; if yes, is there a current Chapter91 License or Permit affecting the project site? ___ Yes ___ No; if yes, list the date and license or permit number and provide a copy of the historic map used to determine extent of filled tidelands:

B. Does the project require a new or modified license or permit under M.G.L.c.91? ___ Yes _x__ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current ___ Change ___ Total ___
If yes, how many square feet of solid fill or pile-supported structures (in sf)?

C. For non-water-dependent use projects, indicate the following:
Area of filled tidelands on the site:_________0____________
Area of filled tidelands covered by buildings:__0__________
For portions of site on filled tidelands, list ground floor uses and area of each use:
____
Does the project include new non-water-dependent uses located over flowed tidelands?
Yes ___ No _x__
Height of building on filled tidelands________________

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands? ___ Yes _x__ No; if yes, describe the project's impact on the public's right to access, use and enjoy jurisdictional tidelands and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations? ___Yes _x__ No; if yes, describe the project's impact on groundwater levels and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR? ___ Yes _x__ No;
(NOTE: If yes, then the project will be subject to Public Benefit Review and Determination.)

G. Does the project include dredging? ___ Yes _x__ No; if yes, answer the following questions:

What type of dredging? Improvement ___ Maintenance ___ Both ____

What is the proposed dredge volume, in cubic yards (cys) _________

What is the proposed dredge footprint ____length (ft) ___width (ft)____depth (ft);

Will dredging impact the following resource areas?

Intertidal Yes__ No__; if yes, ___ sq ft

Outstanding Resource Waters Yes__ No__; if yes, ___ sq ft

Other resource area (i.e. shellfish beds, eel grass beds) Yes__ No__; if yes __ sq ft

If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?

If no to any of the above, what information or documentation was used to support this determination?

Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis.

Sediment Characterization

Existing gradation analysis results? __Yes ___No: if yes, provide results.

Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6? ___Yes ____No; if yes, provide results.

Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? If yes, check the appropriate option.

Beach Nourishment ___
Unconfined Ocean Disposal ___
Confined Disposal:
    Confined Aquatic Disposal (CAD) ___
    Confined Disposal Facility (CDF) ___
Landfill Reuse in accordance with COMM-97-001 ___
Shoreline Placement ___
Upland Material Reuse____
In-State landfill disposal____
Out-of-state landfill disposal ____

(NOTE: This information is required for a 401 Water Quality Certification.)

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? ___ Yes _x__ No; if yes, describe these effects and the projects consistency with the policies of the Office of Coastal Zone Management:

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes _x__ No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

WATER SUPPLY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes __x_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ___ Yes _x__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Municipal or regional water supply	________	________	________
Withdrawal from groundwater	________	________	________
Withdrawal from surface water	________	________	________
Interbasin transfer	________	________	________

(NOTE: Interbasin Transfer approval will be required if the basin and community where the proposed water supply source is located is different from the basin and community where the wastewater from the source will be discharged.)

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. ______________

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? ______Will the project require an increase in that withdrawal? ___Yes ___No; if yes, then how much of an increase (gpd)? ____________________

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___No. If yes, describe existing and proposed water supply facilities at the project site:

	Permitted Flow	Existing Avg Daily Flow	Project Flow	Total
Capacity of water supply well(s) (gpd)	_______	________	________	________
Capacity of water treatment plant (gpd)	_______	________	________	________

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve:

1. new water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes ___ No
2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking

water supply for purpose of forest harvesting activities? ___ Yes ___ No

III. Consistency

Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes __x_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _x__ No; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

	Existing	Change	Total
Discharge of sanitary wastewater	________	________	________
Discharge of industrial wastewater	________	________	________
TOTAL	________	________	________

	Existing	Change	Total
Discharge to groundwater	________	________	________
Discharge to outstanding resource water	________	________	________
Discharge to surface water	________	________	________
Discharge to municipal or regional wastewater facility	________	________	________
TOTAL	________	________	________

B. Is the existing collection system at or near its capacity? ___ Yes ___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

C. Is the existing wastewater disposal facility at or near its permitted capacity? ___ Yes___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No; if yes, describe as follows:

	Permitted	Existing Avg Daily Flow	Project Flow	Total
Wastewater treatment plant capacity (in gallons per day)	_______	________	________	________

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?

(NOTE: Interbasin Transfer approval may be needed if the basin and community where wastewater will be discharged is different from the basin and community where the source of water supply is located.)

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (tons per day):

	Existing	Change	Total
Storage	________	________	________
Treatment	________	________	________
Processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

III. Consistency

A. Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:

TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? ___ Yes _x__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **state-controlled roadways**? ___ Yes _x__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

	Existing	Change	Total
Number of parking spaces	_______	________	_______
Number of vehicle trips per day	________	________	________
ITE Land Use Code(s):	________	________	________

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. ___________________	________	________	________
2. ____________________	________	________	________
3. ____________________	________	________	________

C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

C. Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes ____ No; if yes, describe if and how will the project will participate in the TMA:

D. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities? ____ Yes ____ No; if yes, generally describe:

E. If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

III. Consistency

Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? ___ Yes __x_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? ___ Yes _x__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? ____________
2. Cutting of living public shade trees (number)? ____________
3. Elimination of stone wall (in linear feet)? ____________

III. Consistency -- Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))?
___ Yes _x__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ___ Yes _x__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)			
Length of fuel line (in miles)			
Length of transmission lines (in miles)			
Capacity of transmission lines (in kilovolts)			

B. If the project involves construction or expansion of an electric generating facility, what are:

1. the facility's current and proposed fuel source(s)?
2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes ___No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency

Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes __x_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes __x_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

	Existing	Change	Total
Particulate matter	________	________	________
Carbon monoxide	________	________	________
Sulfur dioxide	________	________	________
Volatile organic compounds	________	________	________
Oxides of nitrogen	________	________	________
Lead	________	________	________
Any hazardous air pollutant	________	________	________
Carbon dioxide	________	________	________

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes _x__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? ___ Yes _x__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Treatment, processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Recycling	________	________	________
Treatment	________	________	________
Disposal	________	________	________

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos?
___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency

Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Have you consulted with the Massachusetts Historical Commission? ___ Yes _x__ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes ____ No; if yes, attach correspondencex

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _x__ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes ___ No; if yes, please describe:

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _x__ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

D. If you answered "No" to all parts of both questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts

Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources:

III. Consistency

Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name)___Peabody/Lynnfield Weekly News ______(Date)__6/25/2021_______

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

05/17/21	Brendan Callahan		
Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing ENF (if different from above)

Brendan Callahan	Alexandra Gaspar
Name (print or type)	Name (print or type)
City of Peabody	Weston & Sampson Engineers
Firm/Agency	Firm/Agency
24 Lowell Street	55 Walkers Brook Drive, Suite 100
Street	Street
Peabody/MA/01960	Reading, MA 01867
Municipality/State/Zip	Municipality/State/Zip
978-538-5780	978-532-1900
Phone	Phone

APPENDIX A

PROJECT DESCRIPTION

Project Description

Background

In 2018, the City of Peabody (the City) was awarded a Municipal Vulnerability Preparedness (MVP) Action Grant by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA). The MVP grant will allow the City to explore options for improving the flood resiliency of Peabody Square and was awarded based on a comprehensive project proposal to specifically target a stretch of the North River Canal that will improve flood resilience, address site contamination from historic use as a tannery district and evaluate a park resource and Riverwalk that would enhance public access and vitality of the area.

Site Description

The project site is in an urban industrial area of Peabody, between Wallis and Howley Streets, and crosses Caller Street. The south side of the North River Canal along the project limits abuts seven (7) privately owned properties, from west to east: 13 Wallis Street, 24 Caller Street [Caller Street crossing], 21 Caller Street, 18 Howley Street, 20 Howley Street, 166 Main Street (R), and MBTA property.

The south canal wall along the length of the project limits consists of multiple sections including earthen embankment (or possible buried wall), a stacked timber railroad tie structure behind an earth embankment, reinforced concrete, granite blocks, or stone or stone rubble sections. Wall heights range from about 4 to 6 feet above the canal bottom. The wall's condition varies over its length, ranging from good, in need of minor or no repairs, to poor, requiring full or partial reconstruction.

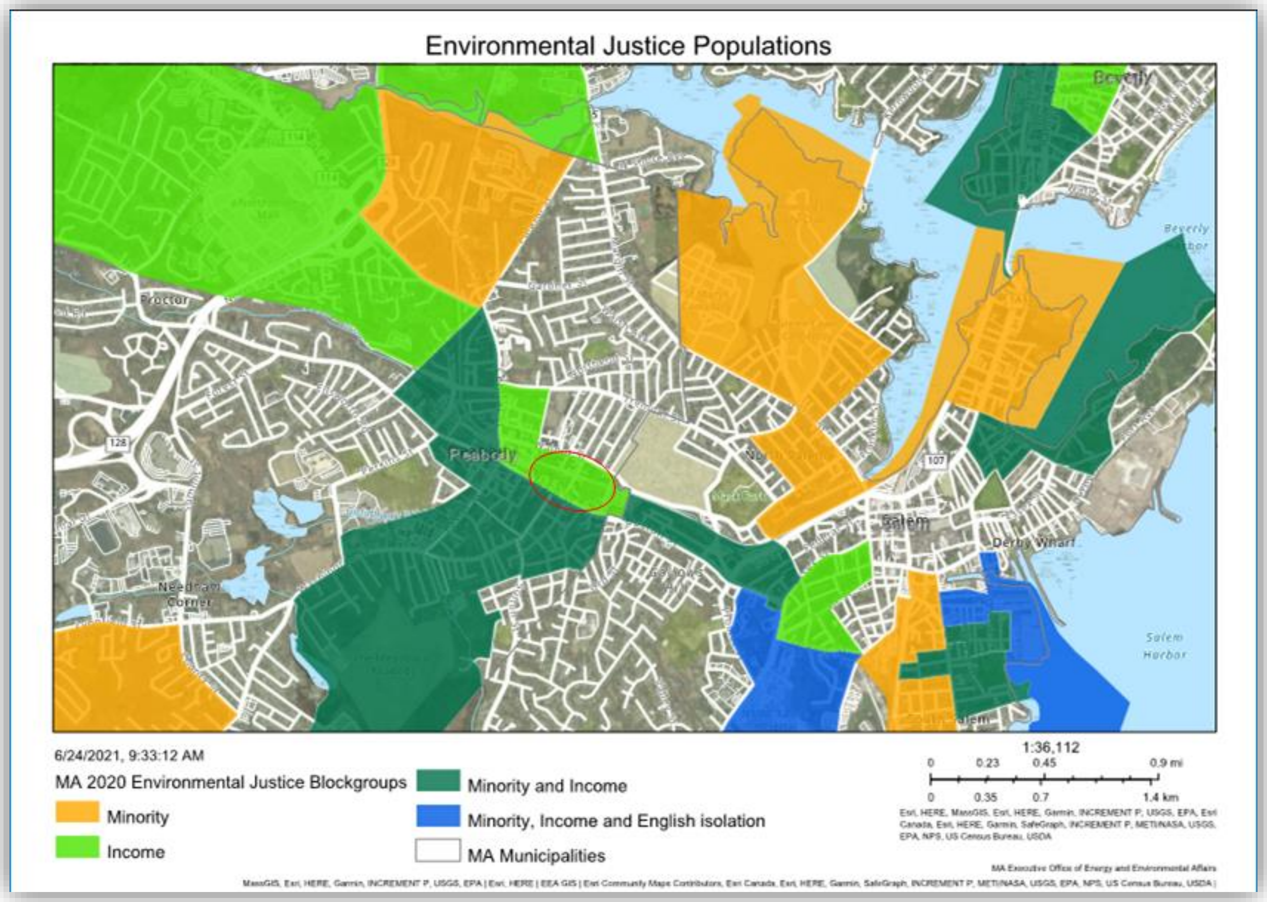
Scope of Work

The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street. Part of the project's scope of work includes replacing the south canal wall with a new wall at a lower elevation with a stabilized slope with a turf reinforcement mat and vegetation. The new wall will consist of driven steel sheet pilings located approximately 2 feet inland from the existing canal wall. The sheet piling wall will be craned into place and driven to specific depths. The Riverwalk will consist of an 8-foot wide asphalt path with 4 feet of vegetative buffer on each side where sufficient space permits. There will also be 4 separate sections of boardwalk constructed which will include helical pile footings. Additionally, a porous paver "art walk" will also be constructed as well as a public deck supported by concrete post footings. Plantings will consist of native species and seed mixes. Pedestrian and streetlights will be installed as well as rapid flashing beacons at street crossings.

Environmental Justice Populations

Per Section 60 of Chapter 8 of the Acts of 2021: An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy (the "Climate Roadmap Act") (adding new Section 62J to M.G.L. c. 30), the Secretary of the Executive Office of Energy and Environmental Affairs (EEA) is directed to provide opportunities for meaningful public involvement by environmental justice (EJ) populations during the MEPA review process.

Environmental Justice populations within a mile of the project area include Minority, Income, Minority and Income, and Minority, Income, and English Isolation (see below Figure).



It is anticipated that this project will have a positive impact on these environmental justice populations. The proposed Riverwalk will be a space that will be open and accessible to all to enjoy this valuable community resource.

Environmental Considerations

Resources that will be impacted by this project include Bordering Land Subject to Flooding, Bank, and Riverfront Area. Please see below for the General Performance Standards for each resource and how this project will approach them.

Bordering Land Subject to Flooding - General Performance Standards

1. **Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project within Bordering Land Subject to Flooding.**
   See below cut and fill table that accounts for the change in flood storage as a result of this project.

Contour El. (ft)	Fill (cuft)	Compensatory Storage (cuft)	Fill (CY)	Storage (CY)

11-12	197±	1620±	7±	60±
12-13	1418±	3356±	53±	124±
13-14	898±	911±	33±	34±

2. **Work within Bordering Land Subject to Flooding, including that work required to provide the above-specified compensatory storage, shall not restrict flows so as to cause an increase in flood stage or velocity.**

3. **Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions …**

This proposed project is not within any of the habitat areas identified by the Mass Wildlife's Natural Heritage & Endangered Species Program (NHESP) on MassGIS data layers including NHESP Estimated Habitats of Rare Wildlife, NHESP Priority Habitats of Rare Species, NHESP Certified Vernal Pools, and NHESP Potential Vernal Pools. Environmental resources map outlining these areas are attached in this package.

Bank – General Performance Standards

Where the presumption set forth in 310 CMR 10.54(3) is not overcome, any proposed work on a Bank shall not impair the following:

1. **the physical stability of the Bank;**

As mentioned in the Scope of Work, this project will enhance the slopes stability. Turf reinforcement mat and vegetation will be added to accomplish this.

2. **the water carrying capacity of the existing channel within the Bank;**

The new canal wall will be set back which will increase the width of the river along the length of the project. Proper resource protection will be utilized to ensure this process does not have any severe impact to nearby resource areas. Resource protection will include compost filter tubes on land and siltation curtain in the river to minimize sediment migration into the river during construction activities. The new, gentler bank slope will enhance slope stability . In addition, the new bank will be stabilized with turf reinforcement mat and vegetation

3. **ground water and surface water quality;**

There will be no impacts to ground water and surface water quality.

4. **the capacity of the Bank to provide breeding habitat, escape cover and food for fisheries;**

This project will not impact negatively impact the capacity of the Bank to provide breeding habitat, escape cover, and food for fisheries. As we are increasing the width of the river, there may be more habitat available to fisheries. In addition, the existing bank currently exists of stone wall, so it is not providing much habitat in its current state.

5. the capacity of the Bank to provide important wildlife habitat functions. A project or projects on a single lot, for which Notice(s) of Intent is filed on or after November 1,1987, that (cumulatively) alter(s) up to 10% or 50 feet (whichever is less) of the length of the bank found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. In the case of a bank of a river or an intermittent stream, the impact shall be measured on each side of the stream or river. Additional alterations beyond the above threshold may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60.

This project will not negatively impact the capacity of the bank to provide wildlife habitat functions. The bank is already made up of degraded area (stone wall). This project will improve the quality of the bank, and the ability of the bank to provide wildlife habitat functions.

Riverfront Area – General Performance Standards

The area where work will occur (Wallis/Howley Street area) is considered already altered area. As such, since the limit of work is fully within the riverfront area, work at this site is considered re-development work in riverfront area. Each standard for work in riverfront for redevelopment projects area (per 310 CMR 10.58 (5)) are provided below, followed by an explanation on how the project meets each standard.

(a) At a minimum, proposed work shall result in an improvement over existing conditions of the capacity of the riverfront area to protect the interests identified in M.G.L. c. 131 § 40.

Because work will involve improving bank stability and adding native plantings to the area, this project will result in an improvement over existing conditions of the capacity of the riverfront area to protect the interests identified in M.G.L. c. 131 § 40.

(b) Stormwater management is provided according to standards established by the Department.

Per Appendix G of the Notice of Intent, this project will adhere to the stormwater standards established by the Department.

(c) Within 200 foot riverfront areas, proposed work shall not be located closer to the river than existing conditions or 100 feet, whichever is less, or not closer than existing conditions within 25 foot riverfront areas, except in accordance with 310 CMR 10.58(5)(f) or (g).

The work will all be within already altered area (roadway, buildings, parking lot, manicured lawn, train tracks).

(d) Proposed work, including expansion of existing structures, shall be located outside the riverfront area or toward the riverfront area boundary and away from the river, except in accordance with 310 CMR 10.58(5)(f) or (g).

Work will not be outside the riverfront area or toward the riverfront area boundary, however the work will be in accordance with 310 CMR 10.58(5)(f) as much of the work is within a degraded riverfront area (train tracks, urban industrial area, neither of which provide optimal riverfront area habitat).

(e) The area of proposed work shall not exceed the amount of degraded area, provided that the proposed work may alter up to 10% if the degraded area is less than 10% of the riverfront area, except in accordance with 310 CMR 10.58(5)(f) or (g).

The area of proposed work within the riverfront area is 110,305 sf. Total riverfront area on the parcel is 612,400 sf. Thus, 18 percent of the site's riverfront area will be altered. The work will be in accordance with 310 CMR 10.58(5)(f) as much of the work is within a degraded riverfront area.

(f) When an applicant proposes restoration on-site of degraded riverfront area, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), and (e) at a ratio in square feet of at least 1:1 of restored area to area of alteration not conforming to the criteria. Areas immediately along the river shall be selected for restoration. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Restoration shall include:

1. removal of all debris, but retaining any trees or other mature vegetation;

2. grading to a topography which reduces runoff and increases infiltration;

3. coverage by topsoil at a depth consistent with natural conditions at the site; and

4. seeding and planting with an erosion control seed mixture, followed by plantings of

herbaceous and woody species appropriate to the site;

Restoration efforts will include removal of all debris, and the addition of native species and seed mixes to serve as a vegetative buffer.

(g) When an applicant proposes mitigation either on-site or in the riverfront area within the same general area of the river basin, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), or (e) at a ratio in square feet of at least 2:1 of mitigation area to area of alteration not conforming to the criteria or an equivalent level of environmental protection where square footage is not a relevant measure. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Mitigation may include off-site restoration of riverfront areas, conservation restrictions under M.G.L. c. 184, §§ 31 through 33 to preserve undisturbed riverfront areas that could be otherwise altered under 310 CMR 10.00, the purchase of development rights within the riverfront area, the restoration of bordering vegetated wetland, projects to remedy an existing adverse impact on the interests identified in M.G.L. c. 131, § 40 for which the applicant is not legally responsible, or similar activities undertaken voluntarily by the applicant which will support a determination by the issuing authority of no significant adverse impact. Preference shall be given to potential mitigation projects, if any, identified in a River Basin Plan approved by the Secretary of the Executive Office of Energy and Environmental Affairs.

Not applicable.

APPENDIX B

ALTERNATIVES ANALYSIS

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EXECUTIVE SUMMARY

In 2018, the City of Peabody (the City) was awarded a Municipal Vulnerability Preparedness (MVP) Action Grant by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA). The MVP grant will allow the City to explore options for improving the flood resiliency of Peabody Square and was awarded based on a comprehensive project proposal to specifically target a stretch of the North River Canal that will improve flood resilience, address site contamination from historic use as a tannery district and evaluate a park resource and Riverwalk that would enhance public access and vitality of the area.

The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street. The existing wall on the south side of the canal over the length of the proposed Riverwalk varies drastically in condition from good to poor. In 2017, Weston & Sampson determined that prior to the construction of the Riverwalk, the south canal wall would need to be repaired / replaced in order to support the construction of the proposed Riverwalk.

Weston & Sampson, on behalf of the City, has performed subsurface explorations immediately behind the Canal wall to obtain back of existing wall information, including wall type, dimensions, and subsurface conditions. Using that information, Weston & Sampson was able to perform preliminary geotechnical and structural analyses to evaluate repair/replacement design alternatives for the wall. Additional grant activities also included limited environmental sampling activities to better understand potential regulatory obligations under the Massachusetts Contingency Plan (MCP), 310 CMR 40.0000.

Weston & Sampson has developed five (5) design repair/replacement alternatives for the south canal wall to support the construction of a Riverwalk and improve flood resilience along the North River Canal. Wall alternatives include options for replacing the current wall with a new wall, as well as green options like providing protection with an earthen berm. Preliminary engineering cost estimates for each alternative have been provided. Weston & Sampson then conducted a preliminary analysis to evaluate the five (5) wall alternatives based on factors such as resiliency, anticipated durability, environmental impact, permitting, schedule, and costs. This was used to rank and prioritize alternatives for the wall.

Based upon the findings and comparative evaluations presented in this report, Alternative C – Sheet Pile Option 2 with Sloped Bank ranked as the highest scoring alternative. This alternative would provide the most additional flood storage with relatively low total cost and minimal maintenance when compared to other alternatives. In addition, Alternative C – Sheet Pile Option 2 with Sloped Bank requires a reasonable easement width from private property owners, would allow for the design of an adjacent Riverwalk, does not require any material to be dredged from the canal and had the highest total permitting favorability.

However, while this alternative works from a conceptual engineering and permitting evaluation perspective, Alternative C – Option 2 may not be feasible along the entire length of the wall due to existing structures and grade and may require a limited length of one of the other wall alternatives to be considered. The feasibility in such areas will need to be further evaluated during the preliminary design process and may depend on other factors such as property easements or acquisition potential.

Other well-scoring alternatives were: Alternative C - Sheet Pile Wall - Option 1; Alternative B - Vegetative Berm - Option 1; and Alternative A - Rip Rap - Option 1. The highest-ranking wall option, Alternative C - Sheet Pile Wall - Option 2 with Sloped Bank, combines all the favorable qualities of Alternatives A and B with the favorable qualities of Alternative C - Sheet Pile - Option 1 and provides the highest percentage of potential parcel protection for all six flood-climate change projection scenarios.

1.0 INTRODUCTION

The City of Peabody suffers from recurring flooding which is expected to worsen from climate change, including sea level rise and increased precipitation frequency and intensity. In 2018, the City of Peabody (the City) was awarded a Municipal Vulnerability Preparedness (MVP) Action Grant by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA). The MVP grant will allow the City to explore options for improving the flood resiliency of Peabody Square and was awarded based on a comprehensive project proposal to specifically target a stretch of the North River Canal that will improve flood resilience, address site contamination from historic use as a tannery district and evaluate a park resource and proposed Riverwalk that would enhance public access and vitality of the area. The North River Canal is a straightened and walled reach of the North River connecting Peabody Square to the tidal reach of the North River near the Salem-Peabody municipal boundary. The North River drainage basin discharges into Salem Sound

The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal (i.e. Proctor Brook) in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street. The south side of the canal abuts six (6) privately owned properties (from west to east: 13 Wallis Street, 24 Caller Street, [Caller Street crossing], 21 Caller Street, 18 Howley Street, 166R Main Street, and Massachusetts Bay Transit Authority (MBTA) property]. The existing wall on the south side of the canal over the length of the proposed Riverwalk varies drastically in condition from good to poor. In 2017, Weston & Sampson determined that prior to the construction of the Riverwalk, the south canal wall would need to be repaired / replaced in order to support the construction of the proposed Riverwalk.

This report presents the results of Weston & Sampson's geotechnical and structural feasibility studies that were conducted in the target area along the North River Canal as part of MVP Grant activities. The purpose of this engineering evaluation was to preliminarily explore subsurface conditions and assess geotechnical, environmental, structural, and regulatory permitting considerations for for repair/replacement alternatives for the North River Canal south wall to support the proposed Riverwalk.

The recommendations presented in this report are based on Weston & Sampson's understanding of the proposed project as described herein, subsurface conditions encountered at discrete exploration locations, and the provisions of the Limitations, provided in Section 11, of this report. Additional investigations, testing, and recommendations will be necessary for final design.

1.1 Project Understanding

The project site is in an urban industrial area of Peabody, between Wallis and Howley Streets, and crosses Caller Street, as shown in ***Figure 1 – Site Locus***. The south side of the North River Canal along the project limits abuts six (6) privately owned properties, from west to east: 13 Wallis Street, 24 Caller Street, [Caller Street crossing], 21 Caller Street, 18 Howley Street, 166 Main Street (R), and MBTA property. Refer to ***Figure 1*** and ***Figure 2 – Site Plan*** for the property limits, and ***Table 1 – Summary of Existing Conditions*** for a summary of existing conditions within the project area. Construction of the park and Riverwalk will require property acquisition or easements on these private properties.

The south canal wall along the length of the project limits consists of multiple sections including earthen embankment (or possible buried wall), a stacked timber railroad tie structure behind an earth embankment, reinforced concrete, granite blocks, or stone or stone rubble sections. Wall heights range from about 4 to 6 feet above the canal bottom. The wall's condition varies over its length, ranging from good, in need of minor or no repairs, to poor, requiring full or partial reconstruction. Refer to Weston & Sampson's report titled "Riverwalk along North River Corridor – South Wall Evaluation," dated June 2, 2017, in ***Appendix A*** for detailed description of the existing wall types and conditions along the project alignment.

The North River Canal has a history of flooding. The overall goal of the MVP grant project is to evaluate and incorporate resilient design measures to provide flood protection during storm events, which may include floodwater storage, increased canal wall height, and/or widening of the canal.

Proposed site development plans, including site grading, canal wall alignment and proposed elevations, were not developed at the time of this report.

2.0 DESCRIPTION OF EXISTING SITE CONDITIONS

2.1 Existing Wall Structure

In May and June of 2017, Weston & Sampson documented the existing conditions of the south wall in a report titled “Riverwalk along North River Corridor – South Wall Evaluation,” dated June 2, 2017. In the report, Weston & Sampson recommended repair or replacement to sections of the wall for support of new loads associated with the proposed Riverwalk. The visual inspection performed on the south wall of the North River Corridor revealed that the wall’s condition varies drastically over its length. Conditions range from “good,” which need minor or no repairs, to “poor,” which require full or partial reconstruction. Causes of deterioration include waterflow, overgrown vegetation (roots), and changes in the surrounding land conditions due to lack of maintenance. Materials used in construction of the wall vary along the wall’s length and include earth embankment or buried wall, a timber tie structure behind earth embankment, reinforced concrete, granite blocks, and stone or stone rubble.

2.2 Existing Subsurface Conditions

2.2.1 Geologic Setting

Based on information available from the Massachusetts Office of Geographic Information (MassGIS), surficial geology conditions at the site are mapped as fine glaciomarine deposits overlying thin till and bedrock at depths less than 50 feet. Bedrock in the area of the site is mapped as the Peabody Granite formation. The nearest mapped bedrock outcrops are located approximately a quarter mile from the site, north of the North River Canal.

2.2.2 Subsurface Explorations

A total of ten (10) borings and five (5) test pits were completed in the past during previous subsurface explorations in the area. The following studies provide subsurface data relevant to our geotechnical assessment. The explorations are described below.

2002 Explorations by Geotechnical Services, Inc:
Six (6) borings, herein referred to as B-1(GSI) through B-6(GSI), were completed at the 13 Wallis Street property between October 31 and November 4, 2002 for a multi-family housing development proposed at the time. Boring depths ranged from 17 to 40 feet. The borings were performed by New Hampshire Boring, Inc. (now New England Boring Contractors) of Derry, New Hampshire, and logged by Geotechnical Services, Inc. (GSI) of Goffstown, New Hampshire. Approximate boring locations are shown in ***Figure 2***, and the boring logs prepared by GSI are included ***in Appendix B – Previous Subsurface Explorations – Boring Logs.***

2007 Explorations by Weston & Sampson:
Weston & Sampson explored subsurface conditions in the project area by advancing four (4) borings (WS-1 through WS-4) between March 21 and 23, 2007 during a previous phase of the North River Canal project. The borings were advanced to depths up to 41 feet below grade at the approximate locations shown on ***Figure 2***. Geologic Earth Explorations, Inc of Norfolk, MA performed the borings using drive and wash drilling methods. Boring logs from the 2007 explorations are included in ***Appendix B***.

The 2007 explorations also included five (5) test pits (TP-1 through TP-5) to observe the back of the canal wall. Test pits TP-1 through TP-4 were located at the north wall of the canal, outside of the current project area. TP-5 was located within the project area at 13 Wallis Street, at the approximate location shown on ***Figure 2*** (labelled TP-5(2007) on the figure). Photographs showing the conditions observed in the test pit are included in ***Appendix B***.

2.3 Existing Soil Contamination

There is known or suspected soil contamination along the proposed Riverwalk area that will need to be addressed as part of proposed wall repair activities and construction of the Riverwalk. Most of the area was formerly a tannery and it has known and potential environmental impacts. Weston & Sampson, on behalf of the City, conducted limited subsurface environmental assessments at several of the properties within the proposed Riverwalk area in 2017. Copies of the reports are provided in Appendix C - 2017 Limited Subsurface Investigations – Proposed Riverwalk Area. Additional information regarding known, existing current environmental conditions and recommendations to comply with the requirements of the Massachusetts Contingency Plan (MCP) are provided in Section 4.0 – Environmental Considerations and Recommendations.

2.4 Existing Flood Issues

The City of Peabody has suffered from recurring flooding events since the 1950's, with the most significant flooding occurring downtown in Peabody Square. Significant floods occurred in 1954, 1968, 1979, 1987, 1996 and 2006. In the past, flooding was largely attributed to post-WWII development and decreased discharge capacity of watercourses in downtown Peabody. However, flooding events have become more frequent with climate change. As noted in the 2008 Preliminary Design of Flood Mitigation Facilities for Peabody Square Area Report, developed for the City, Peabody experienced flooding in October 1996, June 1998, March 2001, April 2004, and May 2006. Three of these events were declared Federal Disasters and caused significant impacts to public safety and public health, substantial property damage, and widespread economic losses. Major transportation arterials that connect to I-95 and MA Routes 128 and 114 as well as commercial rail service were closed for several days. The May 2006 event alone caused the following significant impacts:

- The City's main fire station and police department were isolated by floodwaters for several days. FEMA estimated the cost of this impact at $1.4 million.
- Emergency responses during the flooding cost the City approximately $360,000.
- FEMA estimated the loss of associated with road closures, delays, and detours cost $4.2 million.
- FEMA insurance claims were paid to home and business owners to a total of more than $4.6 million.

The City also experienced significant flooding in March 2010, October 2011 and December 2014 from short duration and intense rain events.

Flooding in the project area is largely due to high flows in the North River Canal caused by precipitation in the upgradient watersheds of Procter Brook and the North River (Metcalf & Eddy-AECOM, 2008). Precipitation events are projected to be more extreme due to climate change, which would exacerbate riverine flooding in the project area. Currently tidal influences at Mean Higher High Water (MHHW) extend approximately 230 feet upstream of Howley Street (Metcalf & Eddy-AECOM, 2008). Sea level rise is expected to extend tidal influences further upstream into the project area.

The flood events negatively impact area businesses and make it difficult for Fire and Police Department staff to respond to emergencies.

3.0 SUBSURFACE INVESTIGATION ACTIVITIES

Weston & Sampson explored subsurface conditions in the project area by overseeing the advancement of six (6) borings (B-1 through B-6) and six (6) test pits (TP-1 through TP-6) between November 5 and 9, 2018. The borings extended to depths of up to 22 feet below grade. The test pit excavations were terminated due to groundwater seepage at depths ranging from 5.6 to 6.8 feet. The approximate exploration locations are shown on Figure 2.

New England Boring Contractors (NEBC) of Derry, New Hampshire advanced the borings using an ATV or truck-mounted drill rig and drive and wash drilling methods. Standard penetration tests (SPTs) were conducted at 2-foot to 5-foot intervals using a standard 24-inch long by 1-3/8-inch inside diameter (2-inch outside diameter) split spoon sampler driven by blows from a 140-pound safety hammer falling 30 inches. Following completion of drilling, the borings were backfilled with soil cuttings.

NEBC excavated the test pits along the back of the existing canal wall using a Kubota U17 excavator with a toothed bucket. The test pits were backfilled with the excavated soil upon completion.

Weston & Sampson geotechnical engineering staff monitored drilling and test pit activities in the field and prepared logs for each boring. A Weston & Sampson structural engineer was also onsite to observe the structural characteristics of the back of the canal wall during test pit activities. Weston & Sampson environmental staff was on site to collect the representative soil samples for disposal characterization data to support the potential excavation and off-site disposal of soil associated with future repairs to the canal wall and construction of the Riverwalk. Boring and test pit logs from the 2018 explorations are included in Appendix D.

A description of the subsurface conditions based on the 2002 borings by GSI and the 2007 and 2018 borings by Weston & Sampson is provided below. Refer to Table 2 – Summary of Subsurface Conditions for a summary of the explorations. The conditions of the existing canal wall observed in the test pits are also summarized in Table 2.

3.1 Subsurface Conditions

Subsurface conditions encountered in the explorations generally consisted of FILL overlying native SAND and SILT to the depths explored. ORGANIC SOILS were observed below the fill in six of the sixteen borings. The major soil groups encountered are described below, in general order of their occurrence with depth. Descriptions of the soils encountered are also included in the attached exploration logs. Variations may occur and should be expected outside of the exploration locations.

Fill: Very loose to very dense FILL (or probable fill) was encountered below surface materials (i.e. topsoil, bare earth, asphalt concrete pavement, or concrete) in all explorations except WS-3. The fill extended to depths ranging from about 4 to 15 feet, and generally consisted of fine to coarse sand with varying amounts of silt, gravel, organic matter, and debris including brick, glass, wood, asphalt, metal, and weathered mortar. Cobbles and boulders up to 28 inches in diameter were observed within the fill in test pits TP-2, TP-3, TP-5, and TP-6. Each of the test pits terminated within the fill.

Native soils: Loose to medium dense or very soft to medium stiff ORGANIC SOILS was encountered below the fill in borings B-1, B-3 through B-6, and WS-2. The organic soils extended to depths ranging from about 8 to 14 feet below existing grade.
Native SAND was encountered below the surface materials, fill, or organic soils in all borings. The sand was fine to coarse-grained or fine-grained, and contained varying amounts of silt and gravel. The sand

was generally described as medium dense to dense, except in borings advanced at 13 Wallis Street, where most of the sand samples were described as loose to medium dense. Roller bit grinding was noted within the sand in some borings, which may be indicative of the presence of cobbles and/or boulders. Medium stiff to hard SILT was encountered below or interlayered with the sand in borings WS-2, WS-3, WS-4, B-3, and B-5. Each of the borings terminated within the sand or silt.

Refusal: Borings B-1(GSI) and B-4(GSI) encountered auger refusal at depths of 40 feet and 32 feet, respectively. Rock coring was not performed, and therefore refusal could have been on cobbles, boulders, and bedrock.

3.2 Groundwater

Logs for borings B-1(GSI) through B-6(GSI) report groundwater depths ranging from 8 feet to 10.5 feet at the completion of drilling. Groundwater depths were not measured in borings WS-1 through WS-4 or B-1 through B-6 due to the drilling method (drive and wash) which introduces water into the borehole during drilling. Groundwater seepage was observed at depths ranging from about 4.6 to 6.7 feet below grade in TP-1 through TP-6. Groundwater levels are expected to be influenced by the water level in the North River Canal and may fluctuate due to local and regional factors including, but not limited to, precipitation events, seasonal changes, and periods of wet or dry weather.

3.3 Geotechnical Laboratory Testing

Select soil samples from the 2018 explorations were submitted to GeoTesting Express of Acton, Massachusetts for grain size analysis to confirm field classification and estimate engineering properties. Geotechnical Laboratory analytical results are included on the boring logs and in a copy is provided in Appendix E.

3.4 Conditions of Existing Canal Wall

Overall site conditions remained relatively unchanged from the 2017 structural evaluation report that was completed by Weston & Sampson and provided in ***Appendix A***, other than an increase in overgrown vegetation. It was also noted that the north wall was at a lower elevation than the south wall for about half the wall length.

The six (6) exploratory test pits described above (TP-1 through TP-6) were excavated in order to determine the condition of the wall behind the canal, and to determine if any footings or foundations belong to the wall. Three (3) test pits (TP-1 through TP-3) were completed on the 24 Caller Street property, and the remaining three (3) test pits (TP-4 through TP-6) were completed on the 21 Caller Street Property. Locations of test pits can be found in ***Figure 2***

At the originally proposed location of TP-1, the wall was in poor condition and a communal decision was made between engineers and the excavator operator to move about 12 feet eastward to a location of more stable wall, so as not to collapse the wall into the river during excavation. Test pit TP-1 revealed a rock wall consisting of large boulders about 34 inches in thickness. The canal-side face of the wall segment showed grout between each boulder. However, no grouted surfaces were found at the back of the wall. No visible footings or foundation were discovered after 6 feet of excavation. The top of wall was 3 feet 4 inches above the river bed, with 4 inches of water above the river bed.

At test pit TP-2, a concrete wall exists in good condition. At the test pit location, the wall thickness changes from 21 inches to 17 inches at a 90-degree bend. No structural foundation was discovered after 5 feet of excavation, however large rocks of similar size as at test pit TP-1 were encountered in test pit TP-2 at the base of the wall and visible from the canal-side face of the wall. The top of wall was 6 feet 8 inches above the river bed with 1 foot 8-inches of water above the river bed.

Test pit TP-3 was excavated at a concrete wall segment in good shape and 21 inches thick. No footing was encountered after roughly six feet of excavation. The top of wall was 6 feet 4 inches to the river bed, with 1 foot 1-inch of water above the river bed.

The wall at test pit TP-4 was a stone wall with mortar on the front face and the excavated rear face. The wall was 16 inches thick. No visible footing was found after 6 feet of excavation. A hard and irregular shaped surface was encountered by probing with a metal rod about a foot below the test pit. The top of wall was 6 feet 4 inches above the river bed with 4 inches of water above the river bed.

The wall at test pit TP-5 consisted of roughly 20-inch thick stacked rocks. No visible grout or mortar was encountered on either side of the wall. No footing was encountered after 6 feet of excavation. The top of wall was 6 feet above the river bed with 2 feet of water above the river bed.

No wall was encountered during excavation at test pit TP-6. Small rocks were visible along the sloped shore line, with larger rocks at and just above the water level.

3.5 Disposal Characterization Sampling and Analysis

To support the potential excavation and off-site disposal of soil associated with future repairs to the canal wall and construction of the Riverwalk, Weston & Sampson collected one (1) composite soil sample (TP-5) from 5 to 6 feet below ground surface (bgs) from the test pit advanced on the 21 Caller Street property on November 6, 2018. The owners of 166R Main Street and 24 Caller Street would not allow Weston & Sampson to collect samples for environmental analyses.

The sample from the 21 Caller Street property was submitted for disposal characterization parameters pursuant to the Massachusetts Department of Environmental Protection (DEP) Policy #COMM-97-001, *Reuse and Disposal of Contaminated Soil at Massachusetts Landfill*, including: total petroleum hydrocarbons (TPH); Resource Recovery Act (RCRA) 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver); semi-volatile organic compounds (SVOCs); polychlorinated biphenyls (PCBs); pH; ignitability; specific conductivity; and reactivity. The sample was later analyzed for speciated chromium and Toxicity Characteristic Leaching Procedure (TCLP) metals analysis. A grab soil sample was submitted for laboratory analysis for volatile organic compounds (VOCs) from the test pit.

The results of the disposal characterization analyses are presented in ***Table 3***. The results were compared to the COMM-97-001 requirements for reuse at Massachusetts lined and unlined landfills. As shown in ***Table 3***, soil analytical results indicate concentrations do not exceed the RCS-1 thresholds or the COMM-97-001 Disposal/Reuse levels for In-State Lined and Unlined Landfills and were consistent with the analytical results for the soils collected in the 0-5 ft bgs interval in 2017. However, based on the history of the Site and the contaminant concentrations detected, surplus soils generated at 21 Caller Street as part of the Riverwalk project will likely be required to be managed and disposed of appropriately in accordance with the Massachusetts Contingency Plan (MCP).

A copy of the laboratory analytical report is included as ***Appendix F.***

4.0 ENVIRONMENTAL CONSIDERATINOS AND RECOMMENDATIONS

The City is considering property acquisition or easements on private property as part of the repair / replacement options for the southern canal wall and construction of the Riverwalk. As the City is aware, there is known or suspected soil contamination along the proposed area of these activities that will need to be addressed. Most of the area was formerly a tannery and it has known or potential environmental impacts, including several previously identified Disposal Sites as defined by the MCP; 310 CMR 40.0000.

In 2017, in support of the City of Peabody's desire to construct the Riverwalk along the North River Corridor, limited subsurface investigations were performed as part of a multi-parcel limited environmental assessment on the 21 and 24 Caller Street, 18 and 20 Howley Street, and 13 Wallis Street properties. Each assessment evaluated the top 5 feet of soils in an approximate 10-foot wide strip of land abutting the south side of the North River in Peabody, Massachusetts. Copies of the 2017 Limited Subsurface Investigation Reports are included as Appendix C. Analysis of soil samples identified concentrations of metals (i.e. antimony, arsenic, barium, trivalent chromium, unspeciated chromium (hexavalent), lead, and zinc) and polycyclic aromatic hydrocarbons (PAHs) (i.e. benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene and phenanthrene) above the applicable MCP RCS-1 thresholds and Method 1 S-1/GW-2 and S-1/GW-3 standards. Therefore, excess soils generated during construction activities associated with the construction of the wall will be required to be managed and disposed of appropriately in accordance with the MCP.

A summary of the estimated soil transportation and disposal cost estimates associated with each property evaluated as part of the wall alternative analysis is provided in Table 4 – Soil Transportation and Disposal Cost Estimate Summary. These cost estimates do not include any soils that may need to be removed from the properties associated with the future construction of the proposed Riverwalk, etc., as the preliminary design of the Riverwalk has not been completed at this time.

4.1 MCP Regulatory Considerations

4.1.1 13 Wallis Street

The property located at 13 Wallis Street is not listed as Disposal Site by MassDEP; however, it has a long, industrial history primarily in tannery operations. Currently, a US Post Office occupies the northwestern corner of the property and the remainder of the property is used to store miscellaneous construction equipment.

A subsurface investigation conducted in 2009 indicated the presence of fill material containing arsenic, chromium, and lead at concentrations in excess of the MassDEP Reportable Concentrations (RCs) for S-1 soil (RCS-1) at a depth of 0-5 feet below ground surface. Several additional metals and PCBs were detected at concentrations below the applicable MassDEP RCS-1 thresholds in shallow soil. PAHs were detected below the RCS-1 thresholds in deeper soil (5-10 feet below ground surface); however, PAHs were not analyzed in the 0-5 foot depth interval. Data collected during the 2009 sampling event is insufficient in that only two (2) boring locations were investigated, and no shallow soil was analyzed for PAHs. The concentrations of arsenic, chromium, and lead detected during the 2009 subsurface investigation above the RCS-1 thresholds were not reported to the MassDEP by the property owner.

The contaminant concentrations reported during Weston & Sampson's limited subsurface investigation in 2017 indicated that:

- A reportable condition exists at the Site due to the presence of arsenic, chromium, lead, and PAHs at concentrations above the RCS-1;
- The City is not currently obligated to report the RCS-1 exceedances to MassDEP, however, If the City takes ownership of the Site, the City will be responsible for reporting the release to MassDEP within 120 days of the property transfer;
- In general, contaminants in the 0-2 feet bgs depth interval tend to be similar to the concentrations of contaminants in soils in the 2-5 ft bgs depth interval;
- Excavation will require soil management under the MCP;
- The contaminated media (soil) will require disposal at an appropriate facility and documentation by a Licensed Site Professional (LSP); and
- The soil did not fail the leachability test and does not require disposal at a RCRA facility.

Prior to the start of construction at the Site, the detected release of PAHs, lead, and arsenic (detected during a previous investigation) will require reporting to the MassDEP, and construction will require management under a Release Abatement Measure (RAM). During construction of the preferred wall alternative selected by the City, soils will likely be excavated and will be required to be disposed of at a licensed facility.

Based upon currently available information, soils from 13 Wallis Street meet the disposal requirements for in-state unlined and lined landfills. However, Weston & Sampson has assumed that because each wall repair option at 13 Wallis Street generates less than 500 cubic yards of soils, all soils will be managed similarly across all properties as the cost difference among in-state and out of state non-hazardous disposal facilities does not exceed the cost to manage the soils separately. Out-of-state (non-hazardous) soil transportation and disposal currently costs approximately $65 / ton.

Potential MCP regulatory obligations to the City associated with the repair / replacement of the southern canal wall along the corridor at the 13 Wallis Street Property may include the following:

- MCP compliance costs for soil disturbance / construction activities ~ $40,000
    - Release Abatement Measure Plan (RAM) Plan, including Health and Safety Plan (HASP & Soil Management Plan (SMP)
    - RAM Status Report
    - Method 3 Risk Assessment for Riverwalk Area
    - Permanent Solutions Statement PSS (assumes no AUL based on existing data)
    - RAM Completion Report
    - Soil Management & Bills of Lading (BOLs)
- Construction Administration, Coordination & Oversight ~ $5,000 - $10,000

Estimated TOTAL = ~ $45,000 - $50,000 (not including release notification to MassDEP, soil transportation and disposal, wall repair design plans, regulatory permitting, bids and specifications or construction costs).

4.1.2 24 Caller Street

The property located at 24 Caller Street has a documented history of environmental releases and is regulated under the MCP. In 2000, 24 Caller Street [Release Tracking Number (RTN) 3-18180] was closed under the MCP with an Activity and Use Limitation (AUL) [i.e., an A-3 Response Action Outcome (RAO) and AUL].

The AUL is located on the northwestern portion of the parcel and is approximately 15,000 square feet of the 42,776-square feet total parcel area. The AUL restricts any activity including, but not limited to excavation, which is likely to disturb contaminated soil located at 1 to 8 feet below grade. Residential use and any other use at which a child's presence is likely [i.e., an educational facility/school (with the exception of adult education), a daycare/nursery, a recreational facility (such as a park or athletic fields, etc.)] is also prohibited. The portion of the 24 Caller Street parcel that the City is interested in redeveloping into the Riverwalk is also within the AUL area.

No files are available on-line from MassDEP for RTN 3-18180. A copy of the RAO Statement for the 24 Caller Street property (RTN 3-18180), dated August 4, 2000, was provided by the City. The RAO report is incomplete and did not include relevant data tables, appendices and/or referenced historical reports. A file review was therefore completed at the MassDEP for RTN 3-18180 on December 8, 2016. Contaminants of concern include metals (lead / chromium / cadmium / arsenic), PAHs and VOCs, and to a lesser extent polychlorinated biphenyls (PCBs). In addition, the site file for RTN 3-18180 indicated that a historic 'landfill' was identified in the northeast portion of parcel.

Given that the property has continued to operate as a barrel reconditioner in the approximately 19 years since regulatory closure and the data gaps from the previous RAO, a Limited Subsurface Site Investigation was conducted by Weston & Sampson on behalf of the City to evaluate the quality of the surficial and near surficial soils. The investigation was confined to the area of the proposed Riverwalk only.

In summary, the data that was generated during the 2017 limited subsurface investigation completed by Weston & Sampson is generally consistent with the limited findings presented in the RAO report for RTN 3-18180. Based on the data collected, no new reportable conditions under the MCP were encountered. Because the Site is fenced with limited access, no Imminent Hazard (IH) condition was discovered. However, the concentrations indicate that:

- In general, contaminants in the 0-2 feet bgs depth interval tend to be greater than the concentrations of contaminants in soils in the 2-5 ft bgs depth interval;
- Excavation will require soil management under the MCP;
- The contaminated media (soil) will require disposal at an appropriate facility and documentation by a LSP; and
- The soil did not fail the leachability test and does not require disposal at a RCRA or hazardous waste disposal facility.

Future Site use for the property as a passive recreational facility will have a different exposure scenario than current site conditions, therefore a Method 3 Risk Characterization for the property will be needed to evaluate risks under the new conditions and with new (i.e., post-construction) exposure point concentrations. Specifically, recreational use (such as a park or athletic fields) and/or any other use at which a child's presence is likely, are currently prohibited at the Site, in accordance with the AUL.

In addition, any activity including, but not limited to, excavation which is likely to disturb contaminated soil located at 1 to 8 feet bgs associated with underground utility and/or construction work, without prior development and implementation of a Soil Management Plan (SMP) and a Health and Safety Plan (HASP) is also prohibited. The contaminated soil located at 1 to 8 feet below surface grade must remain at depth and may not be relocated, unless such activity is first evaluated by a Licensed Site Professional (LSP) who renders an Opinion which states that such activity poses no greater risk of harm to health, safety, public welfare, or the environment and ensures that a condition of No Significant Risk is maintained.

In summary, to repair the wall located at 24 Caller Street and construct the Riverwalk, soils will likely be excavated, and will need to be properly managed and disposed of at a licensed facility. Based upon currently available information, soils from 24 Caller Street must be disposed of at an out of state non-hazardous disposal facilities. Out-of-state (non-hazardous) soil transportation and disposal costs are currently estimated at approximately $65 / ton.

Following removal of impacted materials, soil sampling will be required to evaluate remaining conditions and associated risk under the MCP. A new risk characterization will be required for the property. A geotextile membrane barrier may also be required to separate impacted fill as part of the risk management strategy. A revised Activity and Use Limitation (AUL) will likely also be required to document and manage site risks.

Potential regulatory obligations to the City associated with the repair / replacement of the southern canal wall along the corridor at the 24 Caller Street Property may include the following:

- MCP compliance costs for soil disturbance / construction activities ~ $55,000
    - RAM Plan, including HASP & SMP
    - RAM Status Report
    - Additional sampling to support new risk characterization
    - Method 3 Risk Assessment
    - Revised PSS and AUL (and associated land survey)
    - RAM Completion Report
    - Soil Management & Bills of Lading (BOLs)
- Construction Administration, Coordination & Oversight ~ $5,000 - $10,000

Estimated TOTAL = ~ $60,000 - $65,000 (not including soil transportation and disposal, wall repair design plans, regulatory permitting, bids and specifications or construction costs).

As the City is interested in purchasing the entire 24 Caller Street parcel, a comprehensive Phase I/II Environmental Site Assessment (ESA) is recommended prior to the City taking title to the property in order to: 1) address data gaps; 2) to support the proposed reuse and evaluate exposure risks under non-industrial/commercial use; 3) to provide liability protection to the City; and 4) to evaluate regulatory obligations and costs to proceed with redevelopment of the property as a passive recreational facility. As detailed above, the RAO report for RTN 3-18180 was incomplete and did not include copies of relevant data / tables, appendices and/or referenced previous reports. Based upon our review, several data gaps exist at the property based upon the lack of information provided in the RAO report as well as the lack of any recent data relevant to the existing conditions at parcel based upon the barrel reclamation operations that have continued to be conducted at property since 2000.

4.1.3 21 Caller Street

The 21 Caller Street property has a documented history of releases to the environment and is regulated under the MCP. 21 Caller Street [Release Tracking Number (RTN) 3-0577] is closed with a Permanent Solution Statement with Conditions that includes an AUL, which restricts any activity or uses that involve the excavation, removal and/or disturbance of soils greater than 3 feet below grade. Additionally, the AUL prohibits the use of the property The AUL is applicable to the entire parcel but there has been limited assessment in the area of interest to the City along the canal.

Contaminants of concern are metals (i.e., cadmium, chromium and lead); however limited concentrations of Polycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs) and/or Extractable Petroleum Hydrocarbons (EPHs) which have historically been detected at the property. Historical fill containing ash, cinders, brick, buffing dust, and/or leather scraps was also historically observed at approximately 1-8 feet below ground surface (bgs) across the property.

The data collected in 2017 was generally consistent with the findings in the PSS report filed for the Site under RTN 3-0577:

- In general, contaminant concentrations are similar in the 0-1 and 2-5 feet depth intervals, with the exception of 2-5 feet bgs soils at SP-3, which contains elevated concentrations of arsenic and lead;
- Excavation will require soil management under the MCP; and
- Surplus soil will require disposal at an appropriate facility and documentation by a Licensed Site Professional (LSP).

The Method 3 Risk Characterization presented in the PSS for the Site includes exposure scenarios consistent with the City's planned future for the Riverwalk. Specifically, "use of the [Site] without limitation to pedestrian and/or vehicle traffic" is permitted under the AUL. Furthermore, given that the 2017 and newly collected data is consistent with the previous data and findings of the PSS, an updated Method 3 Risk Characterization for the proposed Riverwalk (i.e. easement) area will not likely be necessary. However, activities inconsistent with the AUL including "excavation, removal, and/or disturbance of subsurface soil greater than three (3) feet below ground surface" are likely to occur during wall repair and redevelopment and will require a Release Abatement Measure (RAM) Plan to be filed with MassDEP, along with a Soil Management Plan (SMP) and Health and Safety Plan (HASP). A new risk characterization will not likely be required for the Riverwalk area and redevelopment is unlikely to require a separate AUL or PSS.

In summary, in order to implement a wall repair alternative, soils will likely be excavated and require disposal at an appropriate facility. Based upon currently available disposal characterization data collected from the proposed Riverwalk area of the property in 2017 and 2018, soils concentrations were less than RCS-1 and Comm-97 criteria for in-state unlined and lined landfills. However, Weston & Sampson has assumed that because each wall repair option at 21 Caller Street generates significantly less than 500 cubic yards of soils, all soils will be managed similarly across all properties as the cost difference among in-state and out of state non-hazardous disposal facilities does not exceed the cost to manage the soils separately. Out-of-state (non-hazardous) soil transportation and disposal currently costs approximately $65 / ton.

Potential regulatory obligations to the City associated with the repair / replacement of the southern canal wall along the corridor at the 21 Caller Street Property may include the following:

- MCP compliance costs for soil disturbance / construction activities ~ $30,000
  - Release Abatement Measure Plan (RAM) Plan, including HASP & SMP
  - RAM Status Report
  - RAM Completion Report
  - Soil Management & Bills of Lading (BOLs)
- Construction Administration, Coordination & Oversight ~ $5,000 - $10,000

Estimated TOTAL = ~ $35,000 - $40,000 (not including soil transportation and disposal, wall repair design plans, regulatory permitting, bids and specifications or construction costs).

4.1.4 18 Howley Street

The property located at 18 Howley Street has a documented history of environmental releases and is regulated under the MCP. 18 Howley Street, identified by MassDEP as RTN 3-0577, was closed under the MCP in 2013 with a B-2 Response Action Outcome (RAO) and Activity and Use Limitation (AUL) [i.e., a Permanent Solution Statement with Conditions].

The AUL restricts the use of the property as a residence, school, daycare, nursery recreational area (e.g., park or athletic field) and/or any other use in which a child's presence (other than incidental). The AUL also restricts the use of the property for growing produce for human consumption as well as any long-term (greater than 1 month) activity at the property that is likely to result in the excavation, relocation and/or removal of soils, unless such activity is first evaluated by an LSP. The AUL is applicable to the entire parcel, and therefore includes the Site.

The primary contaminants of concern are metals (i.e., arsenic, chromium and lead), PAHs, extractable petroleum hydrocarbons (EPHs), dioxins, and polychlorinated biphenyls (PCBs). Historical fill containing ash and/or coal has also been observed. Contamination appears to be limited to the top 8 feet of soil across the property.

The data collected by Weston & Sampson during the limited subsurface investigations in 2017 is generally consistent with the limited findings in the RAO report for RTN 3-0577. Based on the data collected, no new reportable conditions under the MCP were encountered. Concentrations indicate that:

- In general, contaminants in the 0-1 feet bgs depth interval tend to be greater than the concentrations of contaminants in soils in the 2-5 ft bgs depth interval;
- Excavation will require soil management under the MCP;
- The contaminated media (soil) will require disposal at an appropriate facility and documentation by an LSP; and
- The soil did not fail the leachability test and does not require disposal at a RCRA (hazardous waste) facility.

Future Site use for the Riverwalk trail will have a different exposure scenario than current site conditions; therefore, a Method 3 Risk Characterization for the proposed Riverwalk (i.e. easement) area will need to evaluate risks under the new conditions and with new (i.e., post-construction) exposure point concentrations. Specifically, recreational use (such as a park or athletic fields) and/or any other use at which a child's presence is likely, are currently prohibited at the Site, in accordance with the AUL. Likewise, any long-term (greater than 1 month) activity at the property that is likely to result in the excavation, relocation and/or removal of soils, unless such activity is first evaluated by an LSP.

In summary, during construction of the preferred wall alternative, soils will likely be excavated and disposed of at a licensed facility. Based upon currently available information, soils from 18 Howley Street must be disposed of at an out of state non-hazardous disposal facilities. Out-of-state (non-hazardous) soil transportation and disposal costs are currently estimated at approximately $65 / ton.

Following removal of impacted fill, soil sampling will be required to evaluate remaining conditions and associated risk. A new risk characterization will be required for the Riverwalk area. A geotextile membrane barrier may also be required to separate impacted fill as part of the risk management strategy. A separate AUL may also be required to document and manage site risks along the Riverwalk corridor area.

Potential regulatory obligations to the City associated with the repair / replacement of the southern canal wall along the corridor at the18 Howley Street Property may include the following:

- MCP compliance costs for soil disturbance / construction activities ~ $55,000
    - Release Abatement Measure Plan (RAM) Plan, including HASP & SMP
    - RAM Status Report
    - Additional sampling to support new risk characterization
    - Method 3 Risk Assessment for Riverwalk Area
    - Revised PSS and AUL for Riverwalk Area (and associated land survey)
    - RAM Completion Report
    - Soil Management & Bills of Lading (BOLs)
- Construction Administration, Coordination & Oversight ~ $5,000 - $10,000

Estimated TOTAL = ~ $60,000 - $65,000 (not including soil transportation and disposal, wall repair design plans, regulatory permitting, bids and specifications or construction costs).

4.1.5 166R Main Street

The property located at 166R Main Street has a documented history of environmental releases and is regulated under the MCP. 166R Main Street, identified by MassDEP as RTN 3-1444 and RTN 3-4322.

RTN 3-4322 was closed under the MCP in 1997 with a A-2 RAO [i.e., a Permanent Solution Statement].

RTN 3-1444 was closed under the MCP in 2007 with an A-3 RAO and AUL [i.e. a Permanent Solution Statement with Conditions]. The AUL restricts the use of the property for single family residential use or for growing of produce for human consumption. The AUL also restricts activity at the property that is likely to cause physical or chemical deterioration, breakage, or damage to the pavement or building foundations, unless such activity is first evaluated by an LSP. The AUL is applicable to the entire parcel. The primary contaminants of concern at the 166R Main Street property are metals (i.e., arsenic, chromium and lead), PAHs, EPH, and VHP. Historical fill has also been observed in the top 8 to 10 feet of soil.

The property owner did not provide the City access to allow Weston & Sampson to collect samples for disposal characterization from the area of the proposed wall improvement activities and proposed Riverwalk. Therefore, for cost-estimation purposes, based upon the limited historical data available for the property and the data collected to date from the adjacent properties in the area, it has been assumed that soils generated during construction of the preferred wall alternative at 166R Main Street will be required to be disposed of at an out of state non-hazardous disposal facilities. Out-of-state (non-hazardous) soil transportation and disposal costs are currently estimated at approximately $65 / ton.

Future use for the Riverwalk trail will have a different exposure scenario than current site conditions; therefore, a Method 3 Risk Characterization for the proposed Riverwalk (i.e. easement) area will need to evaluate risks under the new conditions and with new (i.e., post-construction) exposure point concentrations.

A geotextile membrane barrier may also be required to separate impacted fill as part of the risk management strategy. A separate AUL may also be required to document and manage site risks along the Riverwalk corridor area.

Potential regulatory obligations to the City associated with the repair / replacement of the southern canal wall along the corridor at the 166R Main Street Property may include the following:

- MCP compliance costs for soil disturbance / construction activities ~ $55,000
    - Release Abatement Measure Plan (RAM) Plan, including HASP & SMP
    - RAM Status Report
    - Additional sampling to support new risk characterization
    - Method 3 Risk Assessment for Riverwalk Area
    - Revised PSS and AUL for Riverwalk Area (and associated land survey)
    - RAM Completion Report
    - Soil Management & Bills of Lading (BOLs)
- Construction Administration, Coordination & Oversight ~ $5,000 - $10,000

Estimated TOTAL = ~ $60,000 - $65,000 (not including soil transportation and disposal, wall repair design plans, regulatory permitting, bids and specifications or construction costs).

4.2 MCP Environmental Regulatory Summary and Recommendations

The properties that will be impacted as part of the repair / replacement alternatives for the south wall of the North River Canal are known or suspected to be contaminated. Construction activities will require management of soils in accordance with the MCP and under a RAM Plan. Excess soils will be required to be disposed of at a licensed disposal facility. Given the approximate quantities to be generated at each individual property locations for the repairs of the wall, Weston & Sampson has assumed that all soils will be managed similarly across all properties as the cost difference among in-state and out of state non-hazardous disposal facilities does not exceed the cost to manage the soils separately.

Additional MCP regulatory compliance requirements may also include: RAM Status Reports, additional sampling to support new risk characterization for Riverwalk area, Method 3 Risk Assessments for Riverwalk Area; Revised PSSs and AULs for Riverwalk Area (and associated land surveys); RAM Completion Reports, Soil Management & Bills of Lading (BOLs); and Construction Administration, Coordination & Oversight. In total, MCP regulatory compliance requirements are currently estimated at approximately $260,000 - $285,000. Cost do not include out-of-state (non-hazardous) transportation and disposal cost for soils that need to be removed as part of the repairs to the wall, as these costs have been included in the wall alternative cost estimates provided in ***Appendix I.***

5.0 GEOTECHNICAL DESIGN AND CONSTRUCTION RECOMMENDATIONS

The following sections provide preliminary geotechnical design considerations and recommendations for site design, and for evaluation and selection of preferred wall replacement alternative(s). Weston & Sampson should be contacted to provide specific geotechnical design and construction recommendations during final design. Additional information on the use of these geotechnical recommendations is provided in the document titled "Important Information about this Geotechnical Engineering Report" by Geoprofessional Business Association (GBA), Inc., included as Appendix G.

5.1 Existing Fill and Organics

Undocumented fill and organic soils were encountered to depths of up to 15 feet below grade, with organic soil thicknesses ranging from 1.5 to 8 ft. at locations explored. These materials are not suitable for support of structures due to the risk of differential settlement from variable rates of compression/decomposition of these materials. Fill and organics should be removed from within the "zone-of-influence" (ZOI) beneath new foundations and other rigid structures sensitive to settlement. The ZOI is defined by planes extending horizontally away from the bottom edge of the structure a distance of two feet, then down and away at a 1H:1V (horizontal:vertical) slope to the intersection with suitable native soils. The resulting excavation should be backfilled with compacted Structural Fill.

Placement of new fill above existing site grades will result in settlement due to compression of underlying existing fill and organic soils. The amount of settlement will vary with the load increase and the thickness and composition of existing fill and organics. Over-excavation and replacement of the unsuitable materials, the use of lightweight fill materials, or design for settlement should be considered if grade changes are proposed.

5.2 Retaining Walls

Concrete cantilever walls or stone masonry walls can be supported on a minimum 12-inch thick bedding layer of compacted Structural Fill overlying native, inorganic sand and/or silt following removal of existing fill and organic soils. The retaining wall bedding layer should extend at least 18 inches horizontally past the edges of the wall foundation or bottom blocks. Foundations should extend at least 4 feet below the nearest ground surface exposed to freezing.

Retaining wall foundations bearing on subgrades prepared as described herein can be designed using an allowable bearing pressure of 2000 psf for foundations constructed on loose sands such as at 13 Wallis Street, and 4000 psf for foundations constructed on medium dense (or denser) sand or medium stiff (or stiffer) silt or structural fill.

5.2.1 Lateral Pressures

Design lateral pressures should consider appropriate loading conditions including earth pressures, hydrostatic, wind, seismic, and surcharge loads such as sloped backfill, structures and adjacent traffic as appropriate. The design lateral pressures should be calculated by adding unbalanced earth and water pressures, and surcharge pressures from structures near the proposed wall.

Lateral earth pressures for design of new retaining walls may be computed using the preliminary soil parameters provided in the table below:

Preliminary Soil Design Parameters for Retaining Walls

Parameter	Values for			
	Existing Fill	Organics	Native Sand and Silt	Compacted Backfill
Angle of Internal Friction, ϕ	28°	26°	30°	34°
Total Unit Weight, γ (pounds per cubic foot)	125	115	125	130
Buoyant Unit Weight, γ' (pounds per cubic foot)	62.6	52.6	62.6	67.6

Groundwater level at the site should be assumed at ground surface. In addition, we recommend a minimum 150 psf lateral surcharge pressure be assumed over the full height of the wall, intended to account for vertical areal surcharge pressures at the top of the wall up to 300 psf. Additional lateral pressures equal to 0.5 times the additional surcharge pressures should be added to sections of wall where surcharge pressures exceed 300 psf.

Resistance to lateral loads should be calculated using a base friction coefficient of 0.35. For resistance to lateral loading we recommend a minimum factor of safety of 1.5 when using sliding friction alone. A larger magnitude of movement is required to engage passive resistance than sliding friction. Therefore, a minimum factor of safety of 2.0 is recommended when using passive pressure in addition to friction to resist lateral loads. Passive earth pressures should be ignored for a depth of 4 feet below bottom of canal.

Footings, floor slabs, and other improvements located above and behind retaining walls (including footings for upper walls in tiered retaining wall configurations) and within a zone defined by a plane extending upward at 1H:1V from the back of the bottom of the wall will increase lateral pressures on the wall. We should be consulted if footings or surcharges are located within this zone. The global slope stability of the proposed retaining walls will have to be confirmed once design progresses.

5.2.2 Seismic Considerations

Seismic site class is determined in accordance with the International Building Code (IBC) as adapted by the Massachusetts State Building Code using a weighted average of SPT blow counts in the upper 100 feet of soil at a site. Based on the soil types and consistencies encountered in the boring (to the depths explored), we recommend that new canal walls be designed using parameters presented in the table below:

Seismic Design Parameters

Design Parameter	Recommended Value
Site Class	E
S_s	0.240 g
S_1	0.073 g
F_a [IBC Table 1613.5.3(1)]	2.5
F_v [IBC Table 1613.5.3(2)]	3.5

Loose, potentially liquefiable native sands were encountered in borings WS-1, B-1(GSI) through B-3(GSI), B-5(GSI) and B-6(GSI) at 13 Wallis Street. Soil liquefaction describes a phenomenon in which saturated granular soils lose their strength during earthquake conditions, causing sinkholes, or deformation and/or settlement of structures they support. Liquefaction potential depends on the soil density, fines content, groundwater depth, and the magnitude of ground movements during seismic events. Additional borings and lab testing should be conducted in this area during final design to further evaluate the potential for liquefaction. Mitigation measures such as over-excavation and replacement may be necessary to address potential liquefaction.

5.3 Construction Considerations

Existing structures, pavements, curbing, vegetation, topsoil, tree roots greater than 1-inch in diameter, and surface debris should be removed from within the limits of construction during initial site preparation. The existing fill contains debris, cobbles, and boulders which may interfere with installation of driven wall elements. Pre-trenching may be required to remove these obstructions if a driven wall type is selected (such as soldier pile or sheet pile wall). Any existing utilities within the proposed development areas should be identified and properly removed, re-routed, or evaluated and approved to remain.

Excavations to remove and replace the existing canal walls will extend up to about 10 feet, or deeper where unsuitable soils are present at proposed structure bearing depths. Temporary excavation support will be required where excavations cannot feasibly be open cut, such as locations adjacent to structures and utilities, and where groundwater seepage is present. Groundwater is expected to be approximately equal with the water level in the canal and dewatering of excavations should be anticipated during construction.

Weston & Sampson should be contacted to evaluate exposed subgrades prior to placement of overlying materials and foundation construction.

5.3.1 Fill Materials and Placement

The existing fill at the site contains variable amounts of fines, organics, and debris. The existing fill is not suitable for use as Structural Fill (i.e., support of structures or other settlement sensitive features) but may be suitable for use as backfill in non-structural or landscape areas, provided it can be moisture conditioned and compacted to at least 92 percent maximum dry density as determined by ASTM D1557 (modified proctor).

Structural Fill beneath foundations and other settlement sensitive improvements (or where on-site materials are not available or suitable for re-use) should consist of well graded imported sand and gravel with less than approximately 10 percent fines (such as MassDOT M1.03.0- type B Gravel Borrow or M2.01.7 Dense-graded Crushed Stone). Structural fill should have a maximum particle size of 3 inches and be compacted to at least 95 percent of maximum dry density as determined by ASTM D1557.

Crushed stone shall be wrapped in filter fabric, consisting of a woven geosynthetic with an AOS of #70 to #100 sieve, and a minimum puncture resistance of at least 120 pounds (such as Mirafi FW700 or equivalent).

6.0 WALL ALTERNATIVE ANALYSIS

Five wall alternatives are being considered for the repair of the south wall of the North River Canal from Wallis Street to Howley Street. The alternative wall types being considered are:

- Alternative A – Rip Rap Slope
- Alternative B – Vegetative Berm Above Rip Rap Slope
- Alternative C – Sheet Pile Wall
- Alternative D – Cantilever Concrete Retaining Wall
- Alternative E – Stone Masonry Wall

Regardless of the alternative chosen, grades along the river may need to be raised or lowered in order to achieve ADA compliance for the Riverwalk. A new bridge structure will likely be required over Strongwater Brook. The existing Caller Street Bridge creates a design constraint for all alternatives considered. Each alternative has taken into account the need to accommodate the existing river width opening at the Caller Street Bridge. Each alternative will require the handling of contaminated/potentially-contaminated soils to some extent. Easements or property acquisition will be required for each alternative to accommodate the Riverwalk, with some alternatives requiring more property than others. Multiple storm drains exist in the area of the proposed new wall alternatives; these drains will need to be accommodated and accounted for later in the design process. Typical cross sections of each alternative can be seen in ***Appendix H***.

Since the north wall is at a lower height elevation than the current south wall for about half of the river length being considered, raising the south wall height would create more flooding on the north side of the river. If additional flood storage is desired, each alternative can be adjusted to allow for river widening in addition to repairing the south wall. All design alternatives propose the new south wall height be constructed to match the existing south wall height.

Each alternative was analyzed for its resilience, durability, environmental impacts, constructability, construction schedule, and cost. The recommended alternative was decided by comparing these five aspects of each design alternative. The engineer’s cost estimate for each alternative can be found in ***Appendix I.***

The resiliency of each wall alternative was evaluated based on the six design flood-climate change projection scenarios presented in Weston & Sampson’s report entitled, *MVP Action Grant: Peabody North River Canal Resilient Wall, Riverwalk and Park – Resilience Evaluation (Resilience Evaluation)*, dated February 2019, and the estimate of the potential benefit in terms of volume of storage and the number of parcels that may be removed from the floodplain without increasing downstream flooding impacts. Fifty-eight parcels or portions of parcels were identified in the study area. The maximum percent of parcels protected for all wall alternatives and the six scenarios ranged from 11% to 60% of the total number of parcels in the study area. A copy of the Resilience Evaluation is provided in Appendix J.

6.1 Alternative A – Rip Rap Slope

Alternative A consists of placed rip rap on a slope of 1 vertical to 1.5 horizontal. The rip rap will be placed in a 3-foot thick layer, with diameters ranging from 8 to 24-inches, underlain with a 1-foot layer of bedding stone placed on top of geotextile fabric for permanent erosion control. The rip rap will extend 5-feet into the river bed and 3.5-feet below the river bed to maintain continuity with the slope. This alternative requires the removal of the existing south wall along the entire length in consideration.

Two options are considered for the location of the bottom of the rip rap slope. Option 1 is to set the bottom of the slope at the location of the existing wall which will provide some additional flood storage. Option 2 is to set the bottom of the slope into the river providing no additional flood storage but maintaining the storage the current river width provides.

6.1.1 *Resilience*

- Option 1 would provide 18 cu. ft./ft. additional flood storage capacity; Option 2 would match current flood storage capacity.
- The surface roughness of the rip rap would decrease flood flow speed.
- Allows flexibility to vary slope along river length to allow more flood storage at key locations.
- In the future, both options can accommodate the future flood elevations by constructing a berm on top of the would-be existing slope, however the north wall height will also need to be increased to not cause increased flooding on the north side. The Riverwalk pathway would need to be located away from the top of slope to allow room for this potential future berm to be constructed. Additional easement area or land acquisition would be required.
- Neither option requires compensatory storage for regulatory purposes since they both provide a greater than or equal amount of flood storage as existing conditions allow. If more flood storage is desired by the City then the land at 24 Caller Street can potentially be regraded to provide additional flood storage space.

6.1.2 *Durability*

- This alternative requires inspections to be performed after flood events and a minimum level of maintenance such as replacing any dislodged rocks after a flood event and managing vegetation to prevent overgrowth.
- With proper maintenance and routine inspection, a rip rap slope should provide a minimum life span of 50 years.

6.1.3 *Environmental Impact*

- Requires excavation of contaminated soils to form the rip rap slope.
- Requires dredging of the streambed to construct the toe of the rip rap slope.
- Stones in the existing channel wall can be incorporated into the riprap slope.

6.1.4 *Constructability & Construction Schedule*

- This alternative is easy to construct and does not require any special equipment or methods.
- Water control will be necessary to construct the rip rap slope.
- Requires excavation of abandoned rail road east of Strongwater Brook.
- Requires demolition of the abandoned building foundation east of Strongwater Brook.
- Estimated construction duration is 5 months.

6.1.5 *Right-of-Way*

- This alternative will require a maximum permanent easement that is approximately 25 feet wide from the face of the existing wall.
- A 15-foot-wide temporary easement for construction will be required as well.

6.2 Alternative B – Vegetative Berm Above Rip Rap Slope

Alternative B is similar to Alternative A except the rip rap slope for this alternative will stop at approximately 3.5-feet above the river bed with the vegetative berm extending to the top of the slope. The slope of the vegetative berm would be 1 vertical to 3 horizontal. This alternative requires the removal of the existing south wall along the entire length in consideration.

Alternative B, like Alternative A, has the same two options for the location of the bottom of slope.

6.2.1 *Resilience*

- Option 1 would provide 20 cu. ft./ft. additional flood storage capacity; Option 2 would match current flood storage capacity.
- The surface roughness of the rip rap and vegetative slope would decrease flood flow speed.
- Allows flexibility to vary slope along river length to allow more flood storage at key locations.
- In the future, both options can accommodate the future flood elevations by constructing a berm on top of the would-be existing slope, however the north wall height will also need to be increased to not cause increased flooding on the north side. The Riverwalk pathway would need to be located away from the top of slope to allow room for this potential future berm to be constructed. Additional easement area or land acquisition would be required.
- Neither option requires compensatory storage for regulatory purposes since they both provide a greater than or equal amount of flood storage as existing conditions allow. If more flood storage is desired by City, then the land at 24 Caller Street can potentially be regraded to provide additional flood storage space.

6.2.2 *Durability*

- This alternative requires inspections to be performed after flood events and a minimum level of maintenance such as replacing any dislodged rocks after a flood event and managing vegetation to prevent overgrowth.
- With proper maintenance and routine inspection, a rip rap and vegetative slope should provide a minimum life span of 50 years.

6.2.3 *Environmental Impact*

- Requires excavation of contaminated soils to form the rip rap slope.
- Requires dredging of the streambed to construct the toe of the rip rap slope.
- Stones in the existing channel wall can be incorporated into the riprap slope.

6.2.4 *Constructability & Construction Schedule*

- This alternative is easy to construct and does not require any special equipment or methods.
- Water control will be necessary to construct the rip rap and vegetative slope.
- Requires excavation of abandoned rail road east of Strongwater Brook.
- Requires demolition of the abandoned building foundation east of Strongwater Brook.
- Estimated construction duration is 5 months, which does not include growing season of the vegetation.

6.2.5 *Right-of-Way*

- This alternative will require a maximum permanent easement that is approximately 28 feet wide from the face of the existing wall.
- A 15-foot-wide temporary easement for construction will be required as well.

6.3 Alternative C – Sheet Pile Wall

Alternative C Option 1 consists of a sheet pile wall installed behind the existing wall to an approximate depth of 20 feet below the top of slope. The existing wall structure would be removed after the sheet piles are installed, providing a small increase in flood storage. A concrete cap would be constructed along the top of the sheet pile wall for a more aesthetic look and to cover the jagged top of the sheet piling. An available option for this alternative is architectural cladding, such as a stone veneer matching the aesthetics of the existing wall.

Alternative C Option 2 consists of a sheet pile wall installed behind the existing wall. The sheet pile would extend 2-feet above the canal bed, and 13-feet below ground. A sloped bank, of either rip rap or vegetative berm, would then extend from the top of the sheet pile to the top of bank. A rip rap slope would require more excavation of soils than the vegetative berm option but would be more stable during flood events. The vegetative berm would require less excavation than a rip rap slope but would be less stable during and after flood events. Both the rip rap slope and vegetative berm options would provide additional flood storage.

6.3.1 Resilience

- Option 1 would increase flood storage by adding approximately 8.5 cu.ft./ft. of additional flood storage due to the removal of the existing stone masonry wall which increases the cross section of the channel.
- Option 2 would provide an additional 20-25 cu.ft./ft. additional flood storage due to the rip rap slope or vegetative berm.
- Height of wall can be increased in the future; however, the north wall height will also need to be increased to not cause increased flooding on the north side. Requires design and special detailing of the wall to accommodate future height addition (cost included in engineer's cost estimate).
- This option does not require compensatory storage for regulatory purposes since it provides greater storage capacity than currently available. If more flood storage is desired by City, then the land at 24 Caller Street can potentially be regraded to provide additional flood storage space.

6.3.2 Durability

- Steel sheet piling requires very minimal maintenance, such as monitoring for deviation from design alignment and corrosion. The concrete coping would need to be checked for minor cracks and spalls at multiple times during its design life.
- Steel sheet piling can provide a minimum design life of 75 years.
- Rip rap requires inspections to be performed after flood events and a minimum level of maintenance such as replacing any dislodged rocks after a flood event. The vegetative berm would be less stable than the rip rap during and after flood events. The vegetative berm would also require scheduled maintenance of vegetation to prevent overgrowth.
- With proper maintenance and routine inspection, a rip rap slope should provide a minimum life span of 50 years.

6.3.3 Environmental Impact

- Sheet pile installation will create more noise than the other alternatives. This may be able to be mitigated based on the installation methods needed.
- Option 1 requires the least amount of contaminated soil removal of all Alternatives considered.
- Option 2 requires no dredging of the stream bed.

6.3.4 *Constructability & Construction Schedule*

- This alternative will require specialized equipment for the installation of the sheet piling.
- Water control will be necessary for the removal of the existing stone masonry wall.
- Requires excavation of abandoned rail road east of Strongwater Brook.
- Minimizes the demolition of the abandoned building foundation east of Strongwater Brook for Option 1.
- Estimated construction duration is 4-5 months

6.3.5 *Right-of-Way*

- This alternative will require permanent easement that is approximately 15 feet wide from the face of the existing wall for Option 1 and up to 30 feet wide for Option 2.
- A 15-foot-wide temporary easement for construction will be required as well.

6.4 Alternative D – Cantilever Concrete Retaining Wall

Alternative D consists of removing the existing stone masonry wall and constructing a concrete cantilever retaining wall in the same location. The concrete retaining wall will have a footing constructed approximately 4 feet below the stream bed. The stem of the concrete wall will be approximately 14 inches wide at the top and about 30 inches wide at the base. A concrete form liner may be used to provide texture or the look of a stone veneer if desired.

6.4.1 *Resilience*

- This alternative would not provide any increase in flood storage.
- Height of wall can be increased in the future; however, the north wall height will also need to be increased to not cause increased flooding on the north side. Requires design and special detailing of the wall to accommodate future height addition (cost included in engineer's cost estimate).
- This option does not require compensatory storage for regulatory purposes since it provides equal storage capacity as currently available. If more flood storage is desired by City, then the land at 24 Caller Street can potentially be regraded to provide additional flood storage space.

6.4.2 *Durability*

- Requires minimal maintenance including minor spall or crack repairs; repairs will need to be completed multiple times during its design life.
- A concrete retaining wall, with proper maintenance, can provide a minimum design life of 75 years.

6.4.3 *Environmental Impact*

- Requires excavation of contaminated soils.
- Requires dredging of the streambed to construct the footing.
- Requires over-excavation of organic soils to prevent settlement.

6.4.4 *Constructability & Construction Schedule*

- This alternative does not require any specialized equipment or methods.
- Water control will be necessary for the removal of the existing stone masonry wall and construction of the new wall.
- Sheet piling should be permanently installed at the toe of the footing in areas of deep organic soils, such as at 24 Caller St and 166R Main St.

- Requires excavation of abandoned rail road east of Strongwater Brook.
- Requires demolition of the abandoned building foundation east of Strongwater Brook.
- Estimated construction duration is 6-8 months.

6.4.5 Right-of-Way

- This alternative will require permanent easement that is approximately 15 feet wide from the face of the existing wall.
- A 15-foot-wide temporary easement for construction will be required as well.

6.5 Alternative E – Stone Masonry Wall

Alternative E consists of removing the existing stone masonry wall and constructing a new stone masonry wall on a concrete footing in the same location. The stem of the wall will be approximately 20 inches wide at the top and 4 feet at the base. The concrete footing would be constructed approximately 4 feet below the stream bed. This alternative would provide no additional flood storage space.

6.5.1 Resilience

- This alternative would not provide any increase in flood storage.
- Height of wall can be increased in the future; however, the north wall height will also need to be increased to not cause increased flooding on the north side. Requires design and special detailing of the wall to accommodate future height addition (cost included in engineer's cost estimate).
- This option does not require compensatory storage for regulatory purposes since it provides greater storage capacity than currently available. If more flood storage is desired by the City then the land at 24 Caller Street can potentially be regraded to provide additional flood storage space.

6.5.2 Durability

- The stone masonry retaining wall requires a moderate amount of maintenance such as repointing of masonry. The majority of maintenance will be required above the waterline; however, some areas may require maintenance and repair below the water level. Maintenance done below water level will require sandbags to divert water away from location of repairs.
- A stone masonry retaining wall, with proper maintenance, can provide a minimum design life of 50 years.

6.5.3 Environmental Impact

- Requires excavation of contaminated soils.
- Requires dredging of the streambed to construct the footing.
- Requires over-excavation of organic soils to prevent settlement.

6.5.4 Constructability & Construction Schedule

- This alternative does not require any specialized equipment or methods.
- Water control will be necessary for the removal of the existing stone masonry wall and construction of the new wall.
- Sheet piling should be permanently installed at the toe of the footing in areas of deep organic soils, such as at 24 Caller St and 166R Main St.
- Requires excavation of abandoned rail road east of Strongwater Brook.
- Requires demolition of the abandoned building foundation east of Strongwater Brook.
- Estimated construction duration is 7-9 months.

6.5.5 Right-of-Way

- This alternative will require permanent easement that is approximately 15 feet wide from the face of the existing wall.
- A 15-foot-wide temporary easement for construction will be required as well.

7.0 REFERENCES INCREMENTAL APPROACH

Climate change projections indicate that, by 2100, mean sea level rise in Boston Harbor since 2000 is unlikely to exceed (83% probability) 4.0 feet although it could be as high as 10.2 feet (NECSC). Boston Harbor has seen a sea level rise of more than 11 inches between 1921 and 2018. Since the North River Canal is tidally influenced closer to Salem, it is possible the canal will experience an even higher likelihood of extreme flooding as the canal shoulder of the North River will likely become tidal. Since work is only being done to the south wall, a significant decrease in current riverine flooding is difficult without also working on the north wall. There are options and steps that can be taken to assure that the south wall of the North River Canal can be altered to accommodate larger flood events or to match future work done of the north wall.

Not all alternative options will be able to accommodate an added wall height in the future. The rip rap slope, vegetative berm and sheet pile walls could be altered to accommodate an increase wall height but may require additional land usage to do so. The stone masonry wall and concrete cantilever wall could be designed to accommodate future wall height increase. For it to be possible to increase the wall height in the future, the walls will need to be designed to have additional capacity than current conditions require.

Raising the South wall height in the future would only provide additional flood storage if the North wall height were also increased. If the South wall were to be raised in the future without raising the North wall as well, it would only increase flooding on the North side of the canal.

Additional investigations would still be required in the future to ensure the wall has available capacity and no deterioration or damage has occurred that would reduce the capacity of the walls.

8.0 PERMITTING STRATEGY

8.1 Introduction

Weston & Sampson has developed five (5) design repair / replacement alternatives, Alternative A through Alternative E. Alternatives A, B, and C each included two separate options (options 1 & 2) for the south canal wall in order to support the construction of a Riverwalk and improve the flood resilience along the North River Canal. Wall alternatives include options for repairing the wall in place to protect against future flooding as well as other options that provide additional flood storage. Weston & Sampson then conducted a preliminary analysis and evaluated the permitting strategy for each of the proposed five (5) wall alternatives.

The permitting evaluation which follows in this chapter, first reviews each alternative for the amount of impact to resource areas, the required environmental permits associated with those impacts, permitting timelines, and finally permitting costs. In addition, an evaluation of the different wall options and associated permitting was also conducted based on the anticipated ease or feasibility of implementation with regulatory agencies, and other additional studies or requirements, and their associated costs, that may be required as part of for each wall alternative.

The five (5) wall alternatives that are being considered for the repair of the south wall of the North River Canal are:

- Alternative A – Rip Rap Slope
  - Option 1, build out from Toe of existing wall
  - Option 2, build out from inside of existing wall
- Alternative B – Vegetative Berm Over Rip Rap Slope
  - Option 1, build out from Toe of existing wall
  - Option 2, build out from inside of existing wall
- Alternative C – Sheet Pile Wall
  - Option 1, Sheet Pile with Concrete Cap
  - Option 2, Sheet Pile with Sloped Bank (rip-rap or vegetated berm)
- Alternative D – Cantilever Concrete Retaining Wall
- Alternative E – Stone Masonry Wall

Currently, it is infeasible to modify the north wall of the river, so these alternatives are only relative to the south wall. Furthermore, since the north wall is at a lower elevation than the current south wall for about half of the river length, there would be no point to raise the wall height to accommodate future flood levels, as it would just force the flood water to the north. In order to obtain additional flood storage from these repairs the river would need to be widened.

There is known or suspected soil contamination along the proposed Riverwalk area that will also need to be addressed, as each alternative will require the handling of soils to some extent. The permitting strategy detailed in this chapter report does not include any MCP permitting associated with the contamination found. Easements or property acquisition will be required for each alternative to accommodate the Riverwalk, with some alternatives requiring more property than others.

A description of the typical permits and requirements that might be required for each alternative can be seen in **Appendix K. Appendix L** provides a summary table of estimated regulatory impacts and likely permits required for each of the five options, while **Appendix M** provides a permit approval schedule for each alternative.

Information presented in the permitting matrix in Section 8.3 - Permitting Summary and Recommendations, is described in greater detail, below.

8.2 Environmental Permitting Strategy

8.2.1 Alternative A – Rip Rap Slope

A rip rap slope would require the removal of the existing south wall along the entire length in consideration. The rip rap would be placed with a slope of 1 vertical to 1.5 horizontal; the stone can be locally sourced or reused from the current south wall. The rip rap will extend 5-feet into the river bed and 3.5-feet below the river bed to maintain continuity with the slope. Two options are presented for the location of the slope.

- Option 1 will begin the 1:1.5 slope where the current wall exists, providing additional flood storage along the slope.
- Option 2 will begin the 1:1.5 slope roughly 3.5-feet north of the south wall (in the river) providing no additional flood storage but maintaining the storage the current river width provides.

8.2.1.1 Regulatory Impacts

Environmental resources that will be impacted with both Rip Rap Slope options include the following (all calculations are estimates based on current conceptual designs):

- Bank of perennial stream
  - For both rip rap options, an estimated 1,335 linear feet (lf) will be impacted due to the removal of the existing wall.
- Land under water associated with a perennial stream
  - Option 1 will result in Land Under Water (LUW) impacts of 6,700 sf and dredging of 24,800 cubic feet (cf) of material.
  - Option 2 will result in LUW impacts of 12,300 sf, 43,500 cf of dredge, and unknown amount of fill.
- 100-year flood zone
  - Option 1 would increase flood storage by adding approximately 24,000 CF of additional flood storage due to the removal of the existing stone masonry wall Option 2 will match existing storage volume
- Riverfront area
  - Option 1 will impact 26,000 sf
  - Option 2 will impact 21,000 sf

8.2.1.2 Potential Permits

Potential permits required for both the rip rap slope alternatives include the following:

- MA Wetlands Protection Act Notice of Intent
- MassDEP 401 Water Quality Certification
- MassDEP Chapter 91 submission
- MEPA Environmental Notification Form
- US Army Corps of Engineers Individual Permit

A description of these permits and typical required documents has been included in ***Appendix K***.

8.2.1.3 Permit Costs

Permit costs can vary depending on resource area impacts, project complexity, and reviewer comments. The typical range of costs per likely required permit is provided below.

Permit Costs for Rip Rap Slope Options 1 or 2

Permit	Minimum Cost	Maximum Cost
MassDEP Wetlands NOI	5,000	10,000
MassDEP 401 WQC	5,000	10,000
MassDEP Ch 91	5,000	10,000
MEPA ENF	5,000	10,000
ACOE IP	5,000	10,000
TOTAL	25,000	50,000

Option 2 would most likely incur an additional $10,000 -15,000 for additional studies related to mitigation/compensation design.

8.2.1.4 Permit Approval Schedule

To efficiently gain permit approvals, it is recommended that the ENF be submitted first. The ENF is forwarded to those reviewers who would have jurisdiction or an interest in the project. Comments from these reviewers are forwarded to the MEPA reviewer, who compiles the comments and forwards them on to the project proponent.

It is helpful to get these comments first and incorporate these comments into the remaining permit submissions to minimize the amount of back and forth with reviewers. Once submitted, the review time for the ENF is approximately 60 days. After incorporating the ENF comments into the remaining permits, all remaining permits can be submitted simultaneously. The ACOE IP can take up to 135 days before gaining approval. The joint 401 WQC / Chapter 91 submission can take from approximately 150 – 400 days for review, depending on if MassDEP determines there are administrative or technical deficiencies with the submission and requests additional information. Finally, assuming the NOI review requires two (2) public meetings, the review process can take approximately 45 days.

In all, the environmental permit review process could take between **seven (7) and fifteen (15) months.**

8.2.1.5 Alternative Favorability

When evaluating both options from a favorability standpoint, Option 1 presents a much more favorable approach from a wetland’s perspective. Not only does it increase flood storage volume in the region, but it also requires no filling to LUW. Any fill within the river will be hard to permit through the various agencies, including DEP and ACOE. It will also require mitigation to replace lost wetland resource areas.

8.2.2 Alternative B – Vegetative Berm Over Rip Rap Slope

The vegetative berm option would be a combination of rip rap slope and vegetative berm. The rip rap would have the same stone size and slope as Alternative A but would stop approximately 3.5-feet above the river bed with the vegetative berm extending to the top of the slope. The slope of the vegetative berm would be 1 vertical to 3 horizontal. As with the rip rap slope, two options are presented for the location of the slope.

- Option 1 is to begin the rip rap slope where the existing wall is located and provide additional flood storage in the sloped area.
- Option 2 is to begin the rip rap slope roughly 3.75-feet north of the south wall (in the river) which would provide no additional flood storage but would maintain the currently available flood storage.

8.2.2.1 Regulatory Impacts

Environmental resources that will be impacted with both vegetative berm options include the following (all calculations are estimates based on current conceptual designs):

- Bank of perennial stream
  - For both options, an estimated 1,335 linear feet (lf) of bank will be impacted
- Land under water
  - Option1 will result in LUW impacts of 6,000 sf and dredging of 21,400 cubic feet (cf)
  - Option 2 will result in LUW impacts of 10,600 sf, 41,400 cf of dredge, and unknown amount of fill
- 100-year flood zone
  - Option 1 would increase flood storage by adding approximately 26,000 CF of additional flood storage due to the removal of the existing stone masonry wall
  - Option 2 will have negligible impact to the flood zone
- Riverfront area
  - Option 1 will impact 28,500 sf
  - Option 2 will impact 21,800 sf

8.2.2.2 Potential Permits

Potential permits required for both vegetative berm alternatives include the following:

- MA Wetlands Protection Act Notice of Intent
- MassDEP 401 Water Quality Certification
- MassDEP Chapter 91 submission
- MEPA Environmental Notification Form
- US Army Corps of Engineers Individual Permit

A description of these permits and typical required documents has been included in Appendix J.

8.2.2.3 Permit Costs

Permit costs can vary depending on resource area impacts, project complexity, and reviewer comments. The typical range of costs per likely required permit is provided on the following page.

Permit Costs for Vegetative Berm Option

Permit	Minimum Cost	Maximum Cost
MassDEP Wetlands NOI	5,000	10,000
MassDEP 401 WQC	5,000	10,000
MassDEP Ch 91	5,000	10,000
MEPA ENF	5,000	10,000
ACOE IP	5,000	10,000
TOTAL	25,000	50,000

Option 2 would most likely incur an additional $10,000 -15,000 for additional studies related to mitigation/compensation design.

8.2.2.4 Permit Approval Schedule

Much like Alternative A the approach of Alternative B would be similar with a review through the MEPA ENF process followed by a simultaneous review by the other agencies. In all, the environmental permit review process could take between seven (7) and fifteen (15) months.

8.2.2.5 Alternative Favorability

Similar to Alternative A, Alternative B, Option 1 presents a much more favorable approach from a wetland's perspective. Not only does it increase flood storage volume in the region, but it also requires no filling to LUW. Any fill within the river will be hard to permit through the various agencies, including DEP and ACOE. It will also require mitigation to replace lost wetland resource areas.

The vegetative berm approach also has the added benefit of providing habitat to the stream. In many agencies minds this presents a greener solution than the rip rap slope does and could potentially be seen as the desired and preferred alternative from a regulatory perspective.

8.2.3 Alternative C – Sheet Pile Wall

A sheet pile wall would require the removal of the existing wall structure. The existing wall structure would be removed after the sheet piles were installed just behind the existing wall. The height of the sheet pile walls can vary along the length of the canal or maintain a constant height. By removing the existing wall after installation of the sheet piles, a small increase in the canal flood storage will be achieved.

- Option 1 consists of a sheet pile wall installed behind the existing wall to an approximate depth of 20 feet below the top of slope. The existing wall structure would be removed after the sheet piles are installed, providing a small increase in flood storage. A concrete cap would be constructed along the top of the sheet pile wall for a more aesthetic look and to cover the jagged top of the sheet piling. An available option for this alternative is architectural cladding, such as a stone veneer matching the aesthetics of the existing wall.

- Option 2 consists of a sheet pile wall installed behind the existing wall. The sheet pile would extend 2-feet above the canal bed, and 13-feet below ground. A rip rap or vegetative slope, much like Alternatives A and B, would then extend from the top of the sheet pile to the top of bank.

8.2.3.1 Regulatory Impacts

Environmental resources that will be impacted with this option include the following (all calculations are estimates based on current conceptual designs):

- Bank of perennial stream
    - An estimated 1,335 linear feet (lf) of bank will be impacted
- Land under water
    - Temporary LUW impacts associated with demolition of south wall
- 100-year flood zone
    - Option 1 would increase flood storage by adding approximately 10,700 CF of additional flood storage due to the removal of the existing stone masonry wall
    - Option 2 would provide approximately 37,000 CF of flood storage due to the removal of wall and addition of a rip rap slope. If the slope were constructed as a vegetative berm, the additional flood storage would be increased to 44,000 CF.
- Riverfront area
    - Option 1 will impact 17,200 sf
    - Option 2 will impact 20,000 sf

8.2.3.2 Potential Permits

Potential permits required for the sheet pile wall alternative include the following:

- MA Wetlands Protection Act Notice of Intent
- MEPA Environmental Notification Form
- US Army Corps of Engineers Individual Permit
- MassDEP 401 Water Quality Certification

A description of these permits and typical required documents has been included in Appendix K.

8.2.3.3 Permit Costs

Permit costs can vary depending on resource area impacts, project complexity, and reviewer comments. The typical range of costs per likely required permit is provided, below.

Permit Costs for Sheet Pile Option

Permit	Minimum Cost	Maximum Cost
MassDEP Wetlands NOI	5,000	10,000
MEPA ENF	5,000	10,000
ACOE IP	5,000	10,000
401 WQC	5,000	10,000
Add'l Cost Analysis	5,000	10,000
TOTAL	25,000	50,000

An additional cost analysis may be needed to prove this Alternative is the preferred Alternative. We estimate that additional cost to be $5,000 -10,000 as explained in Section 8.3.

8.2.3.4 Permit Approval Schedule

Much like Alternative A and B, the approach of Alternative C would be similar with a review through the MEPA ENF process followed by a simultaneous review by the other agencies. The only permit that most likely will not be necessary is the Chapter 91 permit, as there will be no jurisdictional work within the waterway. Although this is only 1 permit fewer then the first alternatives, the CH91 permit has a lengthy review timeframe and by avoiding it, the project could cut the permitting approval process in half. In all, the environmental permit review process could take up to seven (7) months.

8.2.3.5 Alternative Favorability

Although this Alternative C - Option 1 is a suitable alternative for repair of the existing south wall, it provides no extra environmental benefit from a regulatory standpoint, with the exception of a marginal flood storage benefit.

Because the current wall is a vertical wall, it would be permittable as a replacement of the existing conditions. However, with other more favorable alternatives present, the City would have to show how other options would be less practicable based on at least the following considerations:

- Costs and whether such costs are reasonable or prohibitive to the owner;
- Existing technology; and
- Logistics considering the overall project purposes

Alternative C- Option 2 presents a more favorable approach than Alternative C - Option 1 from a regulatory perspective as it provides additional flood storage. If combined with the greener solution of a vegetated berm, then it could even provide some habitat benefit, as well.

8.2.4 Alternative D – Cantilever Concrete Retaining Wall

A cantilever concrete retaining wall would replace the existing south wall. Excavation would be required for the placement of the footing. The stem of the concrete wall will be approximately 14 inches wide at the top and about 30 inches wide at the base. A concrete form liner may be used to provide texture or the look of a stone veneer if desired.

8.2.4.1 Regulatory Impacts

Environmental resources that will be impacted with this option include the following (all calculations are estimates based on current conceptual designs):

- Bank of perennial stream
  - An estimated 1,335 linear feet (lf) of bank will be impacted
- Land under water
  - Temporary LUW impacts associated with demolition of south wall
- 100-year flood zone
  - Marginal increase in flood storage from removal of wall
- Riverfront area
  - Will impact 14,800 sf

8.2.4.2 Potential Permits

Potential permits required for the cantilever retaining wall alternative include the following:

- MA Wetlands Protection Act Notice of Intent

- MEPA Environmental Notification Form
- US Army Corps of Engineers Individual Permit
- 401 Water Quality Certification

A description of these permits and typical required documents has been included in Appendix J.

8.2.4.3 Permit Costs

Permit costs can vary depending on resource area impacts, project complexity, and reviewer comments. The typical range of costs per likely required permit is provided on the following page.

Permit Costs for Cantilever Retaining Wall Option

Permit	Minimum Cost	Maximum Cost
MassDEP Wetlands NOI	5,000	10,000
MEPA ENF	5,000	10,000
ACOE IP	5,000	10,000
401 WQC	5,000	10,000
Add'l Cost Analysis	5,000	10,000
TOTAL	25,000	50,000

An additional cost analysis may be needed to prove this Alternative is the preferred Alternative. We estimate that additional cost to be $5,000 -10,000 as explained in Section 8.3.

8.2.4.4 Permit Approval Schedule

Alternative D would replicate the schedule of Alternative C, with a review through the MEPA ENF process followed by a simultaneous review by the other agencies. Again, no CH 91 permit review would be necessary and therefore permitting review timelines would be reduced.

In all, the environmental permit review process could take up to seven (7) months.

8.2.4.5 Alternative Favorability

Similar to Alternative C, this alternative is a suitable alternative for repair of the existing south wall, however it provides no extra environmental benefit from a regulatory standpoint. It only provides a marginal flood storage benefit and no habitat benefit to the resource area.

Because the current wall is a vertical wall, it would be permittable as a replacement of the existing conditions. However, with other more favorable alternatives present, the City would have to show how other options would be less practicable based on at least the following considerations:

- Costs and whether such costs are reasonable or prohibitive to the owner;
- Existing technology; and
- Logistics considering the overall project purposes

To make this alternative more favorable the wall could be pushed back farther south, and the river widened to allow for increased flood storage.

8.2.5 *Alternative E – Stone Masonry Wall*

The stone masonry wall would replace the existing stone masonry wall with a new concrete footing in the same location. The stem of the wall will be approximately 20 inches wide at the top and 4 feet at the base. The concrete footing would be constructed approximately 4 feet below the stream bed. This alternative would provide no additional flood storage space.

8.2.5.1 *Regulatory Impacts*

Environmental resources that will be impacted with this option include the following (all calculations are estimates based on current conceptual designs):

- Bank of perennial stream
    - An estimated 1,335 linear feet (lf) of bank will be impacted
- Land under water
    - Temporary LUW impacts associated with demolition of south wall
- 100-year flood zone
    - Marginal increase in flood storage from removal of wall
- Riverfront area
    - Will impact 15,900 sf

8.2.5.2 *Potential Permits*

Potential permits required for the stone masonry wall alternative include the following:

- MA Wetlands Protection Act Notice of Intent
- MEPA Environmental Notification Form
- US Army Corps of Engineers Individual Permit
- 401 Water Quality Certification

A description of these permits and typical required documents has been included in Appendix K.

8.2.5.3 *Permit Costs*

Permit costs can vary depending on resource area impacts, project complexity, and reviewer comments. The typical range of costs per likely required permit is provided below

Permit Costs for Stone Masonry Wall Option

Permit	Minimum Cost	Maximum Cost
MassDEP Wetlands NOI	5,000	10,000
MEPA ENF	5,000	10,000
ACOE IP	5,000	10,000
401 WQC	5,000	10,000
Add'l Cost Analysis	5,000	10,000
TOTAL	25,000	50,000

An additional cost analysis may be needed to prove this Alternative is the preferred Alternative. We estimate that additional cost to be $5,000 -10,000 as explained in Section 8.3.

8.2.5.4 Permit Approval Schedule

Alternative E would replicate the schedule of Alternative C and D, with a review through the MEPA ENF process followed by a simultaneous review by the other agencies. Again, no CH 91 permit review would be necessary and therefore permitting review timelines would be reduced.

In all, the environmental permit review process could take up to seven (7) months

8.2.5.5 Alternative Favorability

Similar to both Alternatives C and D, this alternative is a suitable alternative for repair of the existing south wall, however it provides no extra environmental benefit from a regulatory standpoint. It only provides a marginal flood storage benefit and no habitat benefit to the resource area.

Because the current wall is a vertical wall, it would be permittable as a replacement of the existing conditions. However, with other more favorable alternatives present, the City would have to show how other options would be less practicable based on at least the following considerations:

- Costs and whether such costs are reasonable or prohibitive to the owner;
- Existing technology; and
- Logistics considering the overall project purposes

To make this alternative more favorable the wall could be pushed back farther south, and the river widened to allow for increased flood storage.

8.3 Permitting Summary and Recommendations

Weston & Sampson has produced five (5) design alternatives (three with sub options for a total of eight total alternatives) for repair / replacement options for the south wall along the North River Canal in order to support the proposed construction of a Riverwalk and to improve the flood resilience along the North River Canal. Each of these designs has been evaluated for five (5) different variables, including impacts to protected environmental resources, required permits, permit costs, permit approval schedule and regulatory favorability. For each alternative, each variable was given a value, with lower values indicating lesser preferred alternative results. A summary table showing each alternative with five different variable results are provided in ***Appendix K***.

In general, the more complicated the wall repair, the greater the number of environmental resources and impact areas, which results in a greater number of environmental permits being required along with increased costs and schedule duration. As a result of this analysis, it should be noted that the alternatives fall into one of two groups, those that require permanent work within land under water (Alternative A and B), and those that do not require permanent work within land under water (Alternative C, D and E). For those alternatives that impact land under water, an additional permit (MassDEP Chapter 91) will be required and result in additional project costs and permitting approval duration.

In general, the only difference between these two groups of alternatives from a permit cost and schedule context is approximately $5k-$10k in costs and 7-8 months in review. However, when providing additional overall project cost analysis study, the cost of C, D and E are comparable to Option 1 in both Alternatives A and B. Furthermore Option 2 in Alternatives A and B add even more costs associated with further design required for mitigation of lost resource areas. Therefore, Option 1 in Alternative A and B, Alternative C, Alternative D, and Alternated E all have roughly the same costs when factoring in the Permit costs and Additional Overall Cost Analysis. The additional studies required as part of Option

2 for Alternative A and B would make those choices more expensive. See table below:

Potential Permitting Costs

	Alt A, Opt. 1	Alt A, Opt. 2	Alt. B, Opt. 1	Alt. B, Opt. 2	Alt. C, Opt. 1	Alt. C. Opt. 2	Alt. D	Alt. E
Costs ($)	$25,000 - $50,000	$35,000 - $65,000	$25,000 - $50,000	$35,000 - $65,000	$25,000 - $50,000	$25,000 - $50,000	$25,000 - $50,000	$25,000 - $50,000

Given the relatively small difference in cost and timing of the permits required for each alternative, Weston & Sampson evaluated the anticipated favorability of each alternative from a regulatory perspective. Each permitting agency will be evaluating the potential impacts of resource areas that will be impacted by the proposed alternative; most notably bank and land under water. Although any repair alternative work will be performed within the flood plain, the intent of the overall project will be to increase flood storage and not fill the flood plain, which will also be looked at favorably by the regulatory agencies. Additionally, work will also be completed in the riverfront area, however the portion of the riverfront area that will be impacted is previously developed and any project of this magnitude that has a goal of cleaning up the riverfront is anticipated to be looked at favorably by the permitting agency reviewer.

The following is an excerpt of the performance standards for bank and land under water in the wetland's protection act:

"General Performance Standards (Land Under Water).

(a) Where the presumption set forth in 310 CMR 10.56(3) is not overcome, any proposed work within Land under Water Bodies and Waterways shall not impair the following:

1. *The water carrying capacity within the defined channel, which is provided by said land in conjunction with the banks;*
2. *Ground and surface water quality;*
3. *The capacity of said land to provide breeding habitat, escape cover and food for fisheries; and*
4. *The capacity of said land to provide important wildlife habitat functions. A project or projects on a single lot, for which Notice(s) of intent is filed on or after November 1, 1987, that (cumulatively) alter(s) up to 10% or 5,000 square feet (whichever is less) of land in this resource area found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. Additional alterations beyond the above threshold may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures established under 310 CMR 10.60."*

"General Performance Standard (BANK).

(a) Where the presumption set forth in 310 CMR 10.54(3) is not overcome, any proposed work on a Bank shall not impair the following:

1. *the physical stability of the Bank;*
2. *the water carrying capacity of the existing channel within the Bank;*
3. *groundwater and surface water quality;*
4. *the capacity of the Bank to provide breeding habitat, escape cover and food for fisheries;*
5. *the capacity of the Bank to provide important wildlife habitat functions. A project or projects on a single lot, for which Notice(s) of Intent is filed on or after November 1, 1987, that (cumulatively) alter(s) up to 10% or 50 feet (whichever is less) of the length of the bank found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. Additional alterations beyond the above threshold may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60."*

Although they are listed as two (2) different resource areas, the performance standards for both are very similar. Essentially LUW and Bank need to provide the following:

- Stability,
- Water carrying capacity,
- Ground water and surface water quality,
- Habitat for fisheries, and
- Capacity of land to provide other wildlife habitat functions

Although these are just performance standards under the Massachusetts Wetlands Protection Act, and both resource areas are also protected under the Army Corp Section 404 and Mass DEP Section 401 of the Clean Water Act, as well as Mass DEP Chapter 91 regulations, the intent of the protection remains the same throughout.

So, when evaluating each alternative, we must review them to these standards to see if they Meet (M), Improve (I) or Diminish (D) each standard.

Alternative Evaluation against Performance Standards

	Stability	Water Carrying	Water Quality	Habitat for Fisheries	Wildlife Habitat	**Total**
Alternative A Option 1	Improve	Improve	Improve	Improve	Meet	**4 I, 1 M**
Alternative A Option 2	Improve	Diminish	Diminish	Diminish	Meet	**1 I, 1 M, 3 D**
Alternative B Option 1	Improve	Improve	Improve	Improve	Improve	**5 I**
Alternative B Option 2	Improve	Diminish	Diminish	Diminish	Improve	**2 I, 3 D**
Alternative C Option 1	Improve	Improve	Meet	Meet	Meet	**2 I, 3 M**
Alternative C Option 2	Improve	Improve	Meet	Meet	Improve (if veg berm)	**3 I, 2 M**
Alternative D	Improve	Meet	Meet	Meet	Meet	**1 I, 4 M**
Alternative E	Improve	Meet	Meet	Meet	Meet	**1 I, 4 M**

As can be seen above, Option 2 for both Alternative A and B would diminish the quality of the resource areas impacted by the project. Based on the location of the wall in both scenarios, fill would need to be placed within the existing land under water. This would diminish the river's existing ability to carry water, treat the water and provide fish habitat. Because these alternatives would result in a diminished resource area, the agencies would more than likely require some type of mitigation to replicate the lost function of the resource area lost. This would require additional studies (hydraulic, water quality, habitat evaluations, etc.) and design of replication/restoration areas in order to determine exactly what functions were being lost and how to best replicate them on the same stretch of river.

Alternatives D, and E would meet the standards, but would provide no benefit or improvement, except for stabilizing the wall. Alternatives C - Option 1 rates slightly higher as it would improve on 1 standard by increasing water carrying capacity. Because the river is currently confined between two vertical walls throughout this stretch, an argument could be made that all three alternatives should be allowable, as the work will not diminish what currently exists. Agencies would most likely require additional information to determine why these three alternatives were preferred over others that may provide more benefit to the site. Additional information could include an overall project cost analysis of each alternative and additional information on property rights along the river. For instance, acquisition of private land in order to complete Alternative B may be cost prohibitive and not preferred over another alternative that had a smaller footprint and required less acquisition of land. The proponent would be required to prove that the selected alternative, although possibly not the most environmentally preferred, was selected for other preferential reasons.

Alternative B - Option 1, Alternative A - Option 2, and Alternative C - Option 2provide the most favorable alternatives when compared to the standards. Because these options include the expansion of the width of the river, the creation of Land Under Water and the gradual sloping of the bank, all three options would improve upon various criteria within the standards.

Although not called out specifically in the performance standards there are still other environmental considerations that will factor into overall favorability. Special consideration should also be given to alternatives that provide other benefits, such as the creation of flood storage volume. When rating each alternative based on their potential long-term impact to increasing storage along the river, Alternative B - Option 1, Alternative A - Option 1 and Alternative C - Option 2 rate out the most favorable, in that order.

In summary, the evaluated alternatives ranked accordingly highest to lowest based on regulatory favorability:

- Alternative B - Option 1 (provides 5 improvements and provides flood storage)
- Alternative A -Option 1 (provides 4 improvements and provides flood storage)
- Alternative C - Option 2 (provides 3 improvement and provides flood storage)
- Alternative C - Option 1 (provides 2 improvement and meets others)
- Alternative D (provides 1 improvement, additional study required to show why selected)
- Alternative E (provides 1 improvement, additional study required to show why selected)
- Alternative B - Option 2 (will diminish resource area, additional studies for impact and replication)
- Alternative A - Option 2 (will diminish resource area, additional studies for impact and replication)

Utilizing the five standards and flood plain considerations mentioned above, we have included a Permitting Strategy Matrix on the following page for the project. Although the matrix rates out four alternatives relatively close, careful consideration should be taken to which variables are more important to the client.

Given the relatively small difference in cost and timing of the permits (when compared to the general wall repair costs, etc.) these factors are less likely to impact the City's decisions as to which alternative to choose. More important factors, such as favorability or the likelihood and ease of which approvals can be obtained from the agencies might be the governing factor. This would be evident in the favorability ranking of each alternative. Please see the Permitting Strategy Matrix Summary provided on the following page:

Permitting Strategy Matrix Summary

	A.1 - Rip Rap Slope	A.2 - Rip Rap Slope	B.1 - Vegetative Berm	B.2 - Vegetative Berm	C.1 - Sheet Pile Wall	C.2- Sheet Pile Wall w/ Sloped Bank	D - Cantilever Concrete Retaining Wall	E - Stone Masonry Wall
Impacts (1-7)	3	1	4	2	5	5	7	6
Permits (1-7)	5	1	5	1	6	6	6	6
Costs (1-7)	3	1	3	1	3	3	3	3
Favorability (1-8)	7	1	8	2	3	6	3	3
Schedule (1-7)	3	1	3	1	4	4	4	4
Total Average	4.2	1.0	4.6	1.4	4.2	4.8	4.6	4.4

lower number = less preferred alternative
higher number = more preferred alternative

9.0 COMPREHENSIVE COMPARATIVE MATRIX

The following is a comprehensive comparative matrix to assist the City when comparing each of the repair design alternatives outlined in this report. Please note that this is not a final construction cost estimate. The preliminary cost estimates provided for each conceptual alternative only include major items associated with each wall design and are to be used for comparative purposes only. These preliminary cost estimates are not representative of the final construction costs as they do not include minor items that will be required for the implementation of each alternatives such as site preparation work, clearing and grubbing, erosion controls, etc.

Please refer to the assumptions presented in ***Appendix I – Wall Alternative Cost Estimates***. Please note that the cost estimates assume that only impacted soils associated with wall repair activities are removed from the site and are transported and disposed of at a licensed, out-of-state non-hazardous disposal/recycling facility. This does not include any soils that may need to be removed from the site associated with the future construction of the proposed Riverwalk, etc., as the preliminary design of the Riverwalk has not been completed at this time.

	Resiliency & Flood Storage	Durability & Maintenance	Estimated Excavation	Construction & Easements	Permitting & Regulatory Favorability	Preliminary Cost Estimate *
Alt A - Rip Rap Option 1	- Approx. 18 cu.ft./ft additional flood storage - Future height increase possible - Max. % of parcels protected ranges from 30%-55%	- Minimum design service life 50 years - Low maintenance (i.e. replace dislodged riprap after storm events)	- Requires excavating ~3000 CY of contaminated soils	- Requires 25-ft permanent easement from edge of river - Additional 15-ft temporary easement for construction - Approx. 5-month construction	-4th in Total Permitting Favorability (tie) - 2nd in Regulatory Favorability - 4 Improved Resources	$2,607,000 – $9,926,000
Alt A - Rip Rap Option 2	- Approx. 1 cu. ft./ft. additional flood storage - Future height increase possible - Max. % of parcels protected ranges from 11%-17%	- Minimum design service life 50 years - Low maintenance (i.e. replace dislodged riprap after storm events)	- Requires excavating ~1500 CY of contaminated soils	- Requires 21-ft permanent easement from edge of river - Additional 15-ft temporary easement for construction - Approx. 5-month construction	- Lowest scoring (8th) alternative in Total Permitting Favorability - Lowest (8th) Regulatory Favorability -Diminishes Resources & Need for additional studies	$2,615,000 - $8,459,000
Alt B - Vegetative Berm Option 1	- Approx. 20 cu.ft./ft. additional flood storage - Future height increase possible - Max. % of parcels protected ranges from 31%-60%	- Minimum design service life 50 years - Low to Moderate maintenance required (i.e. maintain vegetation, replace rip rap and/or soils, etc. after storm events)	- Requires excavating ~3000 CY of contaminated soils	- Requires 28-foot permanent easement from edge of river - Additional 15-foot temporary easement for construction - Approx. 5-9-month construction (depends on growing season)	- 2rd in Total Permitting Favorability (tie) - Highest (1st) Regulatory Favorability -5 Improved Resources	$2,479,000 - $9,712,000

Alt B - Vegetative Berm Option 2	- Approx. 1 cu.ft./ft. additional flood storage - Future height increase possible - Max. % of parcels protected ranges from 11%-17%	- Minimum design service life 50 years - Low to Moderate maintenance required (i.e. maintain vegetation, replace rip rap and/or soils, etc. after storm events)	- Requires excavating ~1400 CY of contaminated soils	- Requires 25-foot permanent easement from edge of river - Additional 15-foot temporary easement for construction - Approx. 5-9-month construction (depends on growing season)	- 5th in Total Permitting Favorability - 7th (second to last) in Regulatory Favorability - Diminishes Resources & Need for additional studies	$2,421,000 - $8,103,000
Alt C – Sheet Pile Wall Option 1	- Approx. 8.5 cu.ft./ft. additional flood storage - Future height increase possible - Max. % of parcels protected ranges from 20%-45%	- Minimum design service life 75 years - Low maintenance required (i.e. monitor sheet piles for corrosion, crack and spall repairs of concrete cap)	- Requires excavating ~400 CY of contaminated soils	- Requires 13-foot permanent easement from edge of river -Additional 15-foot temporary easement for construction - Specialized construction methods - Approx. 4-5-month construction	- 4th in Total Permitting Favorability (tie) - 4th in Regulatory Favorability - Limited Improvements & Need for additional studies	$2,678,000 - $3,422,000
Alt C – Sheet Pile Wall Option 2 w/ Sloped Bank	- Approx. 20-25 cu.ft./ft. additional flood storage - Future height increase possible - Max. % of parcels protected ranges from 31%-60%	- Minimum design service life 50 years - Low to Moderate maintenance required (i.e. monitor sheet piles for corrosion; replace dislodged rip rap after storm events; maintain vegetative berm which is less stable than rip rap during and after storm events and may require minor repair)	- Requires excavating: ~2600 CY of contaminated soils for Rip Rap option ~1500 CY of contaminated soils for Earthen Berm	- Requires 28-foot permanent easement from edge of river - Additional 15-foot temporary easement for construction - Approx. 5-month construction	- Highest (1st) in Total Permitting Favorability - 3rd in Regulatory Favorability -3 Improved Resources but Meet all others	$2,332,000 - $5,060,000 (w/ Earthen Berm) $2,726,000 - $7,214,000 (w/ Rip Rap)

Alt D - Concrete Cantilever Retaining Wall	- No increased river flood storage - Future height increase possible - No % of parcels protected	- Minimum design service life 75 years - Moderate maintenance required (i.e. crack and spall repairs)	- Requires excavating ~1900 CY of contaminated soils	- Requires 13-foot permanent easement from edge of river - Additional 15-foot temporary easement for construction - Requires removal of organic soils to prevent settlement - Approx. 6-8-month construction	- 2nd in Total Permitting Favorability (tie) - 5th in Regulatory Favorability - limited Improvement & need for additional studies	$4,832,000 - $9,834,000
Alt E - Stone Masonry Wall	- No additional river flood storage - Future height increase possible - No % of parcels protected	- Minimum design service life 50 years - Moderate maintenance required (i.e. repointing of mortar, replace dislodged stones)	- Requires excavating ~2100 CY of contaminated soils	- Requires 13-foot permanent easement from edge of river - Additional 15-foot temporary easement for construction - Requires removal of organic soils to prevent settlement - Approx. 7-9-month construction - Requires removal of organic soils to prevent settlement	- 3rd in Total Permitting Favorability - 6th in Regulatory Favorability - limited Improvement & need for additional studies	$4,328,000 - $9,702,000

* Upper cost range assumes all impacted soil/sediment subject to federal/EPA land ban disposal restrictions

10.0 CONCLUSIONS

The comparative matrix in the previous section was used to determine the highest-ranking wall alternative option for this project. Factors with the most importance during this decision were: cost, quantity of impacted soils requiring excavation and off-site disposal, volume of dredged material, favorability by regulatory agencies in obtaining permits, feasibility of providing additional flood storage, and the ease of adding a Riverwalk behind the wall.

In general, the least expensive alternatives were: 1) Alternatives C – Sheet Pile options; 2) Alternatives B – Vegetative Berm options; and Alternatives A- Rip Rap options. The alternatives which require the least estimated amount of material to be dredged from the canal are: 1) Alternatives C – Sheet Pile options; 2) Alternative D - Cantilever Wall; and 3) Alternative E - Stone Masonry wall. Adding a Riverwalk behind the sheet pile wall option 1, concrete cantilever wall or stone masonry wall may prove difficult at certain locations where a cantilever walkway would become necessary. At those difficult locations, the two rip rap options, the two vegetative berm options, and sheet pile option 2 would allow for the use of piers to avoid a cantilever walkway and thus likely reduce costs.

Therefore, Alternative C – Sheet Pile Wall Option 2 with Sloped Bank is the highest scoring alternative. However, Alternative C- Option 2 may not be feasible along the entire length due to existing structures and grade, such as the parking lot at 21 Caller Street, and may require a limited length of one of the other wall alternatives to be considered. As an example, the Sheet Pile Wall Option 1 could be used for a short distance along the bank until a larger portion of land is available behind the wall to return to the Sheet Pile Wall Option 2. The feasibility in areas such as 21 Caller Street will need to be further evaluated during the preliminary design and may depend on other factors such as property easements or acquisition potential.

Other well-scoring options during the comparison evaluation were: Alternative C - Sheet Pile Wall - Option 1; Alternative B - Vegetative Berm - Option 1; and Alternative A - Rip Rap - Option 1. The highest-ranking wall option, Alternative C - Sheet Pile Wall - Option 2 with Sloped Bank, combines all the favorable qualities of Alternatives A and B with the favorable qualities of Sheet Pile Option 1 and provides the highest percentage of potential parcel protection for all six flood-climate change projection scenarios.

While Alternative C - Sheet Pile Wall options generally cost about the same as Alternative B - Vegetative Berm Option 1, the sheet pile walls' low maintenance, ease of construction and long lifespan make it a good option and this alternative also does not require any material to be dredged from the canal. Alternative A - Rip Rap Option 1 was ranked closely behind Alternative B because of its similar characteristics to the Vegetative Berm Option 1 but ranked slightly lower due to its greater construction costs and lower total permitting favorability. The estimated cost of Alternative C – Sheet Pile Wall – Option 2 is slightly lower than these other well-scoring options due to the limited excavation and channel dredging required. Alternatives A – Option 1, B – Option 1 and C – Option 2 require roughly the same easement widths.

11.0 REFERENCES

This report has prepared the report for the use by the City of Peabody and the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA), and the design and construction teams for this project and this site only. The information herein could be used for bidding or estimating purposes but should not be construed as a warranty of subsurface conditions. We have made observations only at the aforementioned locations and only to the stated depths. These observations do not reflect soil types, strata thicknesses, or water levels that may exist between observations. Weston & Sampson should be retained during final design to complete additional geotechnical analyses as necessary and review final design and specifications to ensure that our recommendations are suitably followed.

The findings provided by Weston & Sampson in this report are based solely on the information reported in this document. Future subsurface investigations, sampling, and/or other information that was not available to Weston & Sampson at the time of the study, may result in a modification of the findings stated in this report.

Should additional information become available concerning this project site or neighboring properties, which could directly impact the Site in the future, that information should be made available to Weston & Sampson for review so that, if necessary, conclusions presented in this report may be modified.

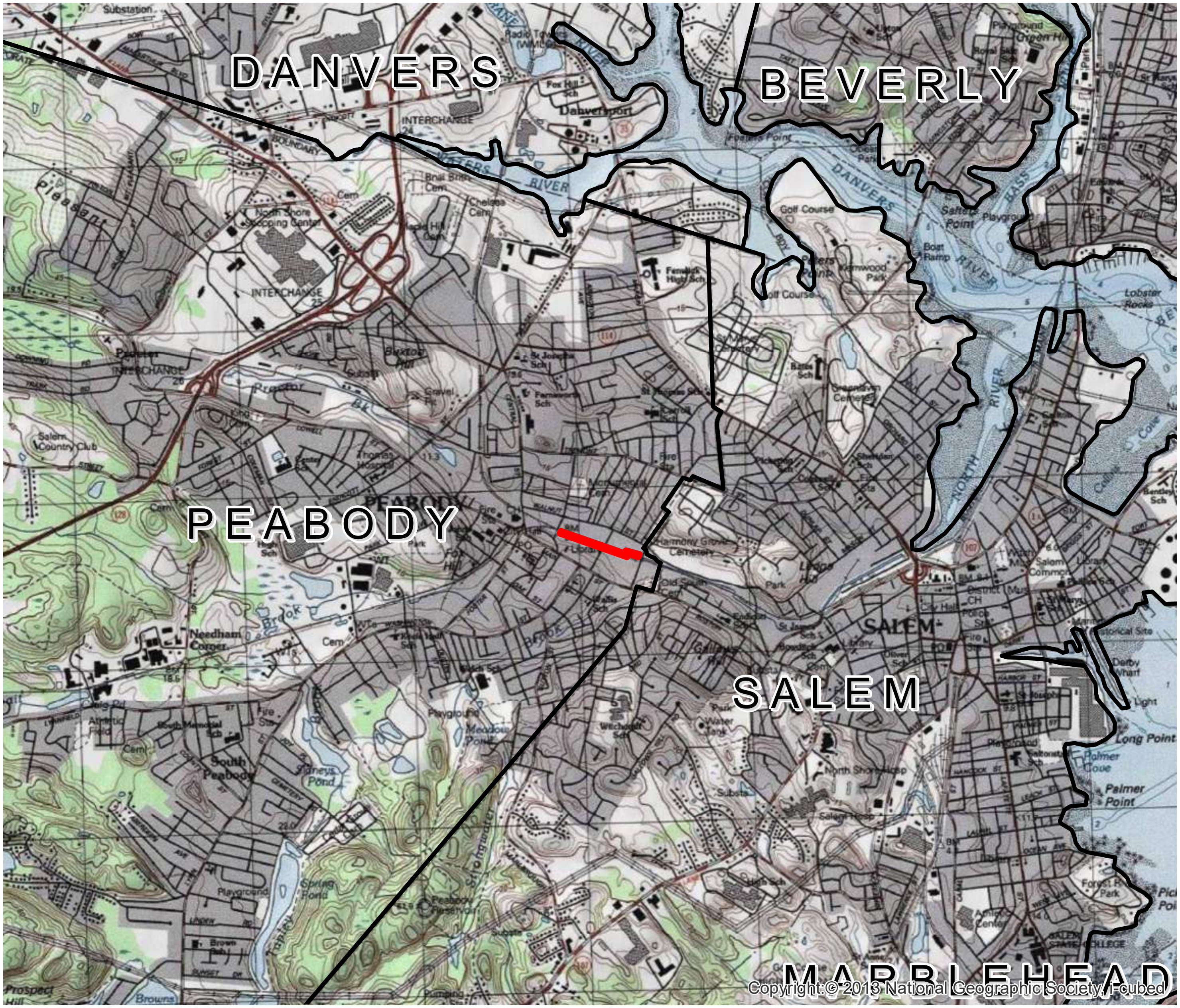
The preceding recommendations should be considered preliminary, as actual soil conditions may vary. In order for our recommendations to be final, Weston & Sampson should be retained to observe actual subsurface conditions encountered during construction. Our observations will allow us to interpret actual conditions and adapt our recommendations if needed.

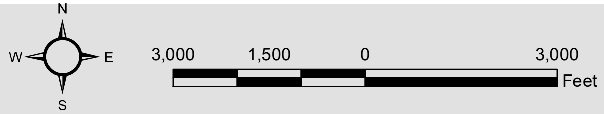
The conclusions of this report are based on project site conditions observed by Weston & Sampson personnel at the time of the study, information provided by the City of Peabody, and samples collected and analyzed on the dates shown or stated in this report. Any modification of the report without written verification or adaptation by Weston & Sampson, as appropriate for the specific purpose intended, will be at the City and MassEEA’s sole risk and without liability or legal exposure to Weston & Sampson or to Weston & Sampson’s consultants. Within the limitations of scope, schedule and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty, expressed or implied, is given.

APPENDIX C

MAPS

Path: \\wse03.local\WSE\Depts\Water\Water Resources Group\GIS - Constraints Mapping\Peabody\MVP Riverwalk\Locus.mxd **User:** GasparA **Saved:** 2/21/2021 5:38:51 PM **Opened:** 3/3/2021 12:26:46 PM





Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

🟥 Work Area

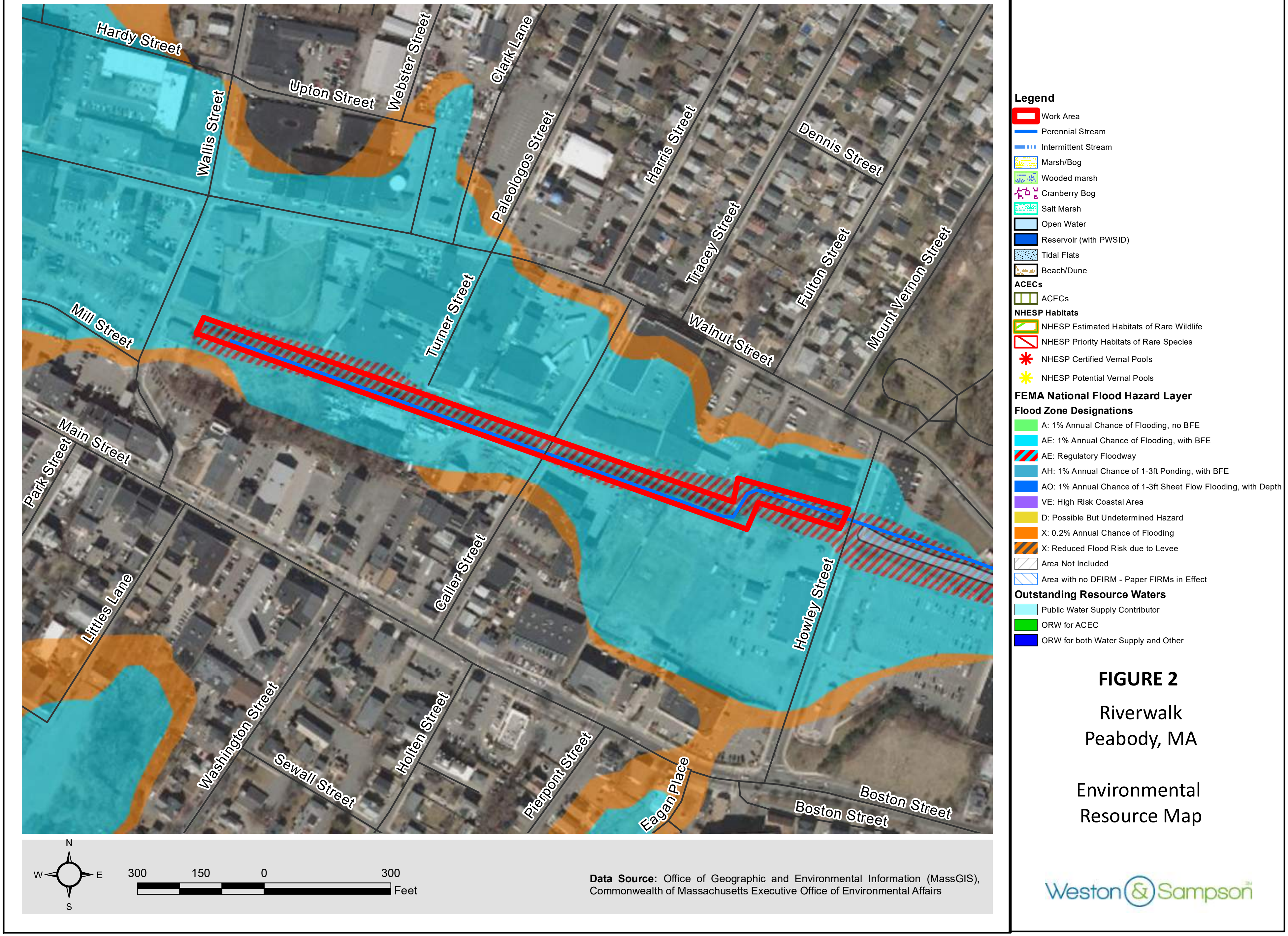
FIGURE 1

Riverwalk
Peabody, MA

Locus Map

Weston & Sampson

Path: \\wse03.local\WSE\Depts\Water\Water Resources Group\GIS - Constraints Mapping\Peabody\MVP Riverwalk\Environmental Receptor - MA.mxd **User:** GasparA **Saved:** 12/10/2020 2:11:39 PM **Opened:** 2/21/2021 5:34:33 PM



Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

FIGURE 2

Riverwalk
Peabody, MA

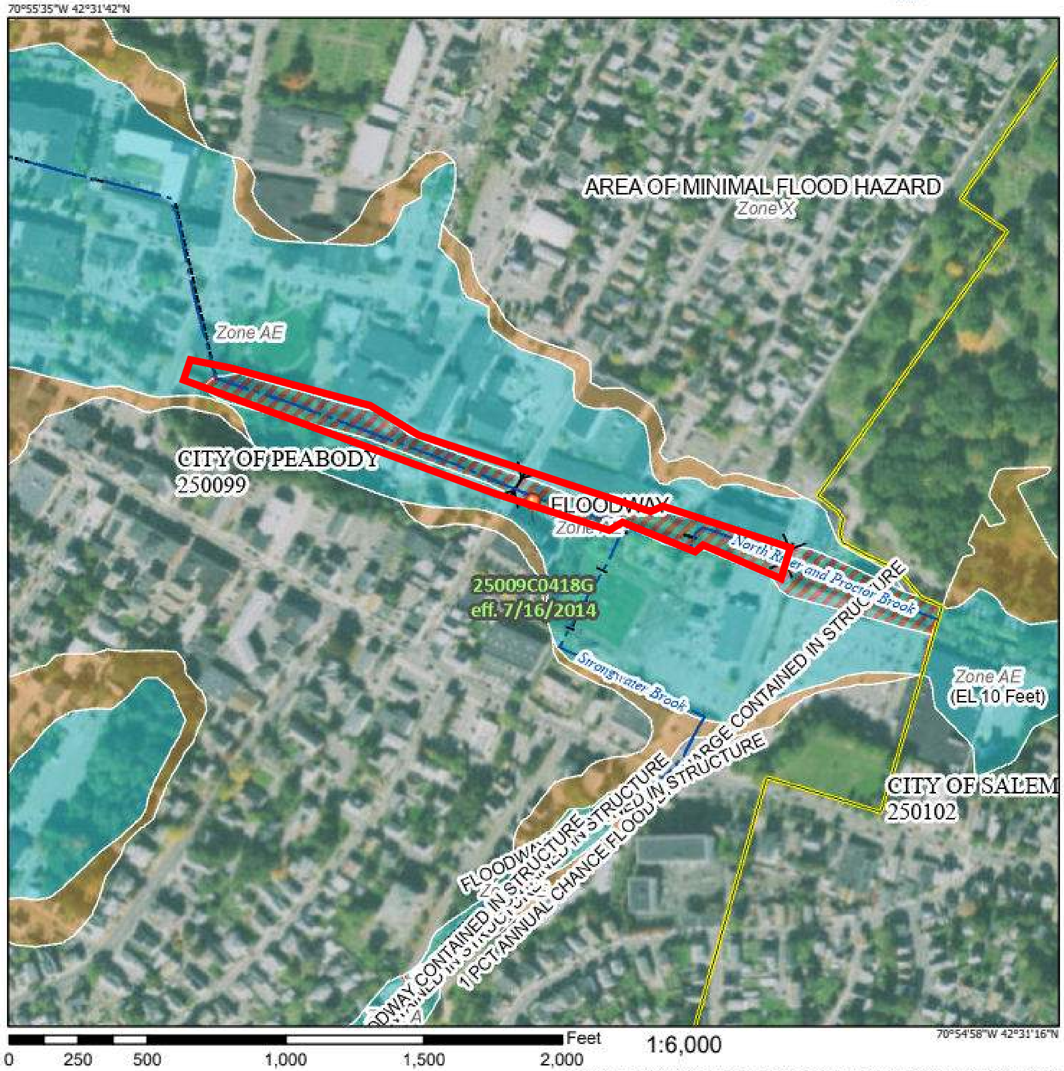
Environmental
Resource Map

Weston & Sampson

Path: \\wse03.local\WSE\Depts\Water\Water Resources Group\GIS - Constraints Mapping\Peabody\MVP Riverwalk\FEMA Template.mxd **User:** GasparA **Saved:** 12/16/2019 9:55:05 AM **Opened:** 3/3/2021 12:33:20 PM

National Flood Hazard Layer FIRMette

FEMA



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	■	Without Base Flood Elevation (BFE) *Zone A, V, A99*
		With BFE or Depth *Zone AE, AO, AH, VE, AR*
	▨	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	■	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	▨	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	▨	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	▨	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard *Zone X*
	☐	Effective LOMRs
	■	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	— — — —	Channel, Culvert, or Storm Sewer
	I I I I I I I	Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2	Cross Sections with 1% Annual Chance
	17.5	Water Surface Elevation
	– – – –	Coastal Transect
	~~ 513 ~~~	Base Flood Elevation Line (BFE)
	═	Limit of Study
	═	Jurisdiction Boundary
	–·– –·–	Coastal Transect Baseline
	– —	Profile Baseline
	—	Hydrographic Feature
MAP PANELS	☐	Digital Data Available
	☐	No Digital Data Available
	☒	Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/3/2021 at 12:31 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

FIGURE 3

Riverwalk
Peabody, MA

FEMA Map

Weston & Sampson

APPENDIX D

SPECS

SECTION 01562

DUST CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION:

This section of the specification covers the control of dust via water, complete.

PART 2 - PRODUCTS

2.01 WATER:

A. Water shall not be brackish and shall be free from oil, acid, and injurious alkali or vegetable matter.

PART 3 - EXECUTION

3.01 APPLICATION:

A. Water may be sprinkler applied with equipment including a tank with gauge-equipped pressure pump and a nozzle-equipped spray bar.

B. Water shall be dispersed through the nozzle under a minimum pressure of 20 pounds per square inch, gauge pressure.

END OF SECTION

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SECTION 01570

ENVIRONMENTAL PROTECTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. The work covered by this section of the specifications consists of furnishing all labor, materials, tools and equipment and performing all work required for the prevention of environmental pollution during and as a result of construction operations under this contract.

B. The requirements set forth in this section of the specifications apply to construction in and adjacent to wetlands, unless otherwise specifically stated.

C. All work under this Contract shall be in accordance with the Conservation Commissions' Orders of Conditions as well as any conditional requirements applied

D. Prior to commencement of work, the Contractor shall meet with representatives of the Engineer to develop mutual understandings relative to compliance of the environmental protection program.

1.02 SUBMITTALS:

A. The Contractor shall submit for approval six sets of details and literature fully describing environmental protection methods to be employed in carrying out construction activities within 100 feet of wetlands or across areas designated as wetlands.

PART 2 - PRODUCTS

2.01 CATCH BASIN PROTECTION:

A. To trap sediment and to prevent sediment from clogging drainage systems, catch basin protection in the form of a siltation sack (Siltsack as manufactured by ACF Environmental, Inc. or approved equal) shall be provided as approved by the Engineer.

2.02 COMPOST FILTER TUBES:

A. Silt socks shall be a tubular filter sock of mesh fabric. The fabric will have openings of between 1/8” to ¼” diameter. The mesh material will either photo degrade within one year or be made of nylon with a life expectancy of 24 months. The sock shall be filled with a mix of composted leaf mulch, bark mulch and wood chips that have been composted for at least one year. The sock will have a minimum diameter of 12-inches.

2.03 EROSION CONTROL BLANKET:

A. The erosion control blanket shall be completely biodegradable and constructed from spun jute yarns. The standard roll shall be 4' wide by 225' long and shall last approximately 6-9 months. The jute matting shall meet the following specifications.

a.	Mesh Size	11mm x 18mm
b.	Water Absorption	>450% of Fabric Weight
c.	Thickness	0.25 inch
d.	Recommended Shear Stress	0.45 lbs./ft^2
e.	Recommended Flow	6 fps
f.	Recommended Slope	3:1
g.	Coverage	100yd^2/roll
h.	Roll Weight	92 lbs

B. Erosion control blanket shall be Jute Matting, manufactured by GEI Works, PO Box 780928, Sebastian, FL 32978, 772-646-0597, www.geiworks.com

2.04 SILT CURTAIN:

A. The silt curtain shall be a Type-1-Silt-Barrier consisting of 18-ounce vinyl fabric skirt with a 6-inch marine quality floatation device. The skirt shall be ballasted to hang vertical in the water column by a minimum 3/16-inch galvanized chain. The silt curtain shall extend into the water as shown on the drawings. If necessary, join adjacent ends of the silt curtain by connecting the reinforcing grommets and shackling ballast lines.

PART 3- EXECUTION

3.01 NOTIFICATION AND STOPPAGE OF WORK:

A. The Engineer will notify the Contractor in writing of any non-compliance with the provisions of the Order of Conditions. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails to act promptly, the Owner may order stoppage of all or part of the work through the Engineer until satisfactory corrective action has been taken. No claim for an extension of time or for excess costs or damage incurred by the Contractor as a result of time lost due to any stop work orders shall be made unless it was later determined that the Contractor was in compliance.

3.02 AREA OF CONSTRUCTION ACTIVITY:

A. Insofar as possible, the Contractor shall confine his construction activities to those areas defined by the plans and specifications. All land resources within the project boundaries and outside the limits of permanent work performed under this contract shall be preserved in their present condition or be restored to a condition after completion of construction at least equal to that which existed prior to work under this contract.

3.03 PROTECTION OF WATER RESOURCES:

A. The Contractor shall not pollute streams, lakes or reservoirs with fuels, oils, bitumens, calcium chloride, acids or other harmful materials. It is the Contractor's responsibility to comply with all applicable Federal, State, County and Municipal laws regarding pollution of rivers and streams.

B. Special measures should be taken to insure against spillage of any pollutants into public waters.

3.04 CONSTRUCTION IN AREAS DESIGNATED AS WETLANDS ON THE DRAWINGS:

A. Insofar as possible, the Contractor shall make every effort to minimize disturbance within areas designated as wetlands or within 100-feet of wetland resource areas.

B. The Contractor shall perform his work in such a way that these areas are left in the condition existing prior to construction.

C. The elevations of areas designated as wetlands shall not be unduly disturbed by the Contractor's operations.

3.05 PROTECTING AND MINIMIZING EXPOSED AREAS:

A. The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, temporary vegetation, mulching or other protective measures shall be provided as specified.

B. The Contractor shall take account of the conditions of the soil where temporary cover crop will be used to insure that materials used for temporary vegetation are adaptive to the sediment control. Materials to be used for temporary vegetation shall be approved by the Engineer.

3.06 LOCATION OF STORAGE AREAS:

A. The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site or areas to be cleared as a part of this project, and shall require written approval of the Engineer. Plans showing storage facilities for equipment and materials shall be submitted for approval of the Engineer.

B. No excavated materials or materials used in backfill operations shall be deposited within a minimum distance of one hundred (100) feet of any watercourse or any drainage facility. Adequate measures for erosion and sediment control such as the placement of baled straw or line of straw wattles or compost filter tubes around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

C. There shall be no storage of equipment or materials in areas designated as wetlands.

D. The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

3.07 PROTECTION OF LANDSCAPE:

A. The Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without written authority from the Owner. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorages unless specifically authorized by the Engineer. Excavating machinery and cranes shall be of suitable type and be operated with care to prevent injury to trees which are not to be removed, particularly overhanging branches and limbs. The Contractor shall, in any event, be responsible for any damage resulting from such use.

B. Branches, limbs, and roots shall not be cut except by permission of the Engineer. All cutting shall be smoothly and neatly done without splitting or crushing. When there is unavoidable injury to branches, limbs and trunks of trees, the injured portions shall be neatly trimmed and covered with an application of grafting wax or tree healing paint as directed.

C. Where, in the opinion of the Engineer, trees may possibly be defaced, bruised, injured, or otherwise damaged by the Contractor's equipment or by his blasting or other operations, the Engineer may require the Contractor to adequately protect such trees by placing boards, planks, poles or fencing around them. Any trees or landscape feature scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the expense of the Contractor. The Engineer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of under the provisions of Section 02230, CLEARING AND GRUBBING.

D. Cultivated hedges, shrubs, and plants which could be injured by the Contractor's operations shall be protected by suitable means or shall be dug up, balled and temporarily replanted and maintained. After construction operations have been substantially completed, they shall be replanted in their original positions and cared for until growth is re-established. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of a kind and quality at least equal to that existing at the start of the work.

3.08 CLEARING AND GRUBBING:

A. The Contractor shall clear and grub only on the Owner's land or the Owner's easements, and only the area required for construction operations, as approved by the Engineer. Removal of mature trees (4 inches or greater DBH) will not be allowed on temporary easements.

B. The Contractor shall not remove trees in the Owner's temporary easements without permission of the Engineer.

3.09 DISCHARGE OF DEWATERING OPERATIONS:

A. Under no circumstances shall the Contractor discharge water to the areas designated as wetlands. When constructing in a wetlands area, the Contractor shall discharge water from dewatering operations directly to the nearest drainage system, stream, or waterway after filtering by an approved method.

B. The pumped water shall be filtered through filter fabric and baled straw, a vegetative filter strip or a vegetated channel to trap sediment occurring as a result of the construction operations. The vegetated channel shall be constructed such that the discharge flow rate shall not exceed a velocity of more than 1 foot per second. Accumulated sediment shall be cleared from the channel periodically.

3.10 DUST CONTROL:

A. During the progress of the work, the Contractor shall conduct his operations and maintain the area of his activities, including sweeping and sprinkling of streets as necessary, to minimize creation and dispersion of dust. If the Engineer decides it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed. Calcium chloride shall be as specified under Section 01562, DUST CONTROL.

B. Calcium Chloride shall not be used for dust control within a drainage basin or in the vicinity of any source of potable water.

3.15 CATCH BASIN PROTECTION:

A. Catch basin protection shall be used for every catch basin, shown on the plans or as required by the Engineer, to trap sediment and prevent it from clogging drainage systems and entering wetlands. Siltation sacks shall be securely installed under the catch basin grate. Care shall be taken to keep the siltation sacks from breaking apart or clogging. All deposited sediment shall be removed periodically and at times prior to predicted precipitation to allow free drainage flow. Prior to working in areas where catch basins are to be protected, each catch basin sump shall be cleaned of all debris and protected. The Contractor shall properly dispose of all debris at no additional cost to the Owner.

3.16 COMPOST FILTER TUBES:

A. The filter tubes will be staked in the ground using wooden stakes driven at 4-foot intervals. The wooden stakes will be placed at a minimum depth of 24-inches into the ground.

3.17 EROSION CONTROL BLANKET:

A. Mating rolls should be stored in their original, unopened packaging. The designated storage area should be level, dry, well-drained, stable, and should protect the product from precipitation, chemicals, standing water, excessive heat, ultraviolet radiation, vandalism, and animals.

B. It is recommended that weed affected areas are sprayed with herbicide prior to mat installation. Excavate and trim slope to smooth profile, removing obstructions such as tree stumps or rubble and filling in any voids. Excavate anchor trenches along the top edge of the slope. Top soil is required to successfully grow grass and plants. Evenly spread top soil across the surface to required depth. All pre-seeding of the soil to be carried out prior to laying mat.

C. Dig a trench at the top of the slope, minimum depth of six (6) inches. Pin the end of the roll into the bottom of the trench. Back-fill the trench and roll the matting down the slope with a minimum overlap of four (4) inches.

D. See contract drawings for additional detail.

3.18 SILT CURTAIN:

A. The silt curtain shall be a Type-1-Silt-Barrier consisting of 18-ounce vinyl fabric skirt with a 6-inch marine quality floatation device. The skirt shall be ballasted to hang vertical in the water column by a minimum 3/16-inch galvanized chain. The silt curtain shall extend into the water as shown on the drawings. If necessary, join adjacent ends of the silt curtain by connecting the reinforcing grommets and shackling ballast lines.

END OF SECTION

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SECTION 01740

CLEANING UP

PART 1 - GENERAL

1.01 DESCRIPTION:

The Contractor must employ at all times during the progress of its work adequate cleanup measures and safety precautions to prevent injuries to persons or damage to property. The Contractor shall immediately, upon request by the Engineer provide adequate material, equipment and labor to cleanup and make safe any and all areas deemed necessary by the Engineer.

PART 2 - PRODUCTS

Not applicable

PART 3 - EXECUTION

3.01 DAILY CLEANUP:

A. The Contractor shall clean up, at least daily, all refuse, rubbish, scrap and surplus material, debris and unneeded construction equipment resulting from the construction operations and sweep the area. The site of the work and the adjacent areas affected thereby shall at all times present a neat, orderly and workmanlike appearance.

B. Upon written notification by the Engineer, the Contractor shall within 24 hours clean up those areas, which in the Engineer's opinion are in violation of this section and the above referenced sections of the specifications.

C. If in the opinion of the Engineer, the referenced areas are not satisfactorily cleaned up, all other work on the project shall stop until the cleanup is satisfactory.

3.02 MATERIAL OR DEBRIS IN DRAINAGE FACILITIES:

A. Where material or debris has washed or flowed into or has been placed in existing watercourses, ditches, gutters, drains, pipes, structures, such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, pipes, structures, and work shall, upon completion of the work, be left in a clean and neat condition.

3.03 REMOVAL OF TEMPORARY BUILDINGS, STRUCTURES AND EQUIPMENT:

A. On or before completion of the work, the Contractor shall, unless otherwise specifically required or permitted in writing, tear down and remove all temporary buildings and structures it built; shall remove all temporary works, tools and machinery or other construction equipment it furnished; shall remove all rubbish from any grounds which it has occupied; shall remove erosion controls; and shall leave the roads and all parts of the property and adjacent property affected by its operations in a neat and satisfactory condition.

3.04 RESTORATION OF DAMAGED PROPERTY:

A. The Contractor shall restore or replace, when and as required, any property damaged by its work, equipment or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end the Contractor shall do as required all necessary highway or driveway, walk and landscaping work. Materials, equipment, and methods for such restoration shall be as approved by the Engineer.

3.05 FINAL CLEANUP:

A. Before acceptance by the Owner, the Contractor shall perform a final cleanup to bring the construction site to its original or specified condition. This cleanup shall include removing all trash and debris off of the premises. Before acceptance, the Engineer shall approve the condition of the site.

END OF SECTION

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APPENDIX E

WETLANDS MEMO

westonandsampson.com

55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

Wetland Delineation Report

April 2021

Peabody, Massachusetts
Project # ENG20-0145

MVP Riverwalk
Peabody, MA

Wetland Delineation Conducted By:
Nathaniel Parker on 4/1/2021

Delineation Report Reviewed By:
Mel Higgins, PWS

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FIGURES

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1.0 SITE DESCRIPTION

On April 1st, 2021, the presence of wetland resources was investigated near Proctor Brook in Peabody, MA. This investigation area is located in a predominantly urban/industrial area. Please see Figure 1 (Wetlands Field Map) and Figure 2 (USGS Topographic Map) of this report for the investigation area.

Wetland resource areas including a perennial stream were identified and flagged in the field using pink flagging by a Weston & Sampson employee who is trained in the wetland delineation process using the Massachusetts Department of Environmental Protection (MassDEP) and the US Army Corps of Engineers methodology. A further description of these wetland resource areas is presented in the following sections.

2.0 DELINEATION OF WETLAND RESOURCES

2.1 Site Observations

The Weston & Sampson wetland scientist, trained in the ACOE Wetland Delineation Manual and Massachusetts Department of Environmental Protection (MassDEP) Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetland Protection Act guidance document, observed the following protected wetland resources at the site:

- Bank – Perennial Stream

Field data were recorded on US Army Corps of Engineers (ACOE) Wetland Determination Data Forms. See Appendix A for site photographs.

2.2 Bank

Water bodies, including perennial streams, intermittent streams, ponds and lakes, have banks which are protected by the Massachusetts Wetland Protection Act. Bank is a wetland resource area defined by 310 CMR 10.54(2)(a) as "the potion of land surface which normally abuts and confines a water body. It occurs between a waterbody and a vegetated bordering wetland and adjacent floodplain, or, in absence of these, it occurs between a waterbody and an upland." Vegetated banks provide valuable functions such as flood control, stormwater prevention, fisheries protection, and water quality protection. The limit of this resource area is identified by Top of Bank (TOB) which is located at the first observable break in slope or the Mean Annual Flood Level (MAFL), whichever is lower. TOB is easily identified in the field so that indicator was utilized for this wetland delineation.

Perennial Stream Banks

A single perennial stream known as Proctor Brook was identified within the investigation area. The boundary of the perennial stream was identified in the field utilizing Top of Bank (TOB), identified by flag line TOB-A. Proctor Brook is shown as perennial on the current United States Geographical Survey (USGS) map and has a watershed size greater than 0.5 square miles in size according to USGS Stream Stats which classifies the stream as perennial per 310 CMR 10.58 (2)(a)(1)(b-c). The boundary of the perennial stream was identified in the field by the first observable break in slope (TOB). Wetland flags left in the field included:

- TOB-A1 through TOB-A23 (Perennial Stream Bank "A" Series)

Perennial streams are subject to a 200-foot Riverfront Area under the Massachusetts Wetland Protection Act per 301 CMR 10.58(2)(a)(2)(c).

2.3 Other Protected Areas

Weston & Sampson created environmental resources maps (see Figure 4) of the site to determine the presence of other protected areas. The data source of these map layers was the Massachusetts Geographic Information System (MassGIS). These areas included:

- NHESP Priority Habitats of Rare Species
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Certified and Potential Vernal Pools
- Areas of Critical Environmental Concern (ACEC)
- Outstanding Resource Waters (ORW)

Wetland resources identified in the field were also added to these maps. Based on the MassGIS information there are no protected areas other than the Perennial Stream resource area previously identified above.

Based on the information provided by the FIRM map the investigational area is located within a Regulatory Floodway. FEMA defines a Regulatory Floodway as "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height." This Regulatory Floodway is located within Zone AE, which is the 100-year flood zone. As a result, the investigation is located within the 100-year flood zone.

3.0 SUMMARY

On April 1st 2021, the presence of wetland resources was investigated near Proctor Brook in Peabody, MA. A single perennial stream was identified and flagged at the site.

Additional environmental mapping was conducted using MassGIS data layers and FEMA FIRM mapping. This additional mapping indicates that the investigation area falls within the 100-year floodzone.

This Wetlands Delineation Report has been reviewed and approved by a Professional Wetland Scientist PWS.

4.0 REFERENCES

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Path: \\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2019\Task 3 - Permitting\Wetland Delineation\GIS\Maps\wetland flags.mxd **User:** GasparA **Saved:** 4/7/2021 7:53:53 AM **Opened:** 4/7/2021 7:55:22 AM

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- ━ Perennial Stream
- ▭ Investigation Area
- ▨ Marsh/Bog
- ▨ Wooded marsh
- ▨ Cranberry Bog
- ▨ Salt Marsh
- ▭ Open Water
- ■ Reservoir (with PWSID)
- ▨ Tidal Flats
- ▨ Beach/Dune

FIGURE 1

MVP Riverwalk
Peabody, MA

Wetland Field Map

Weston & Sampson

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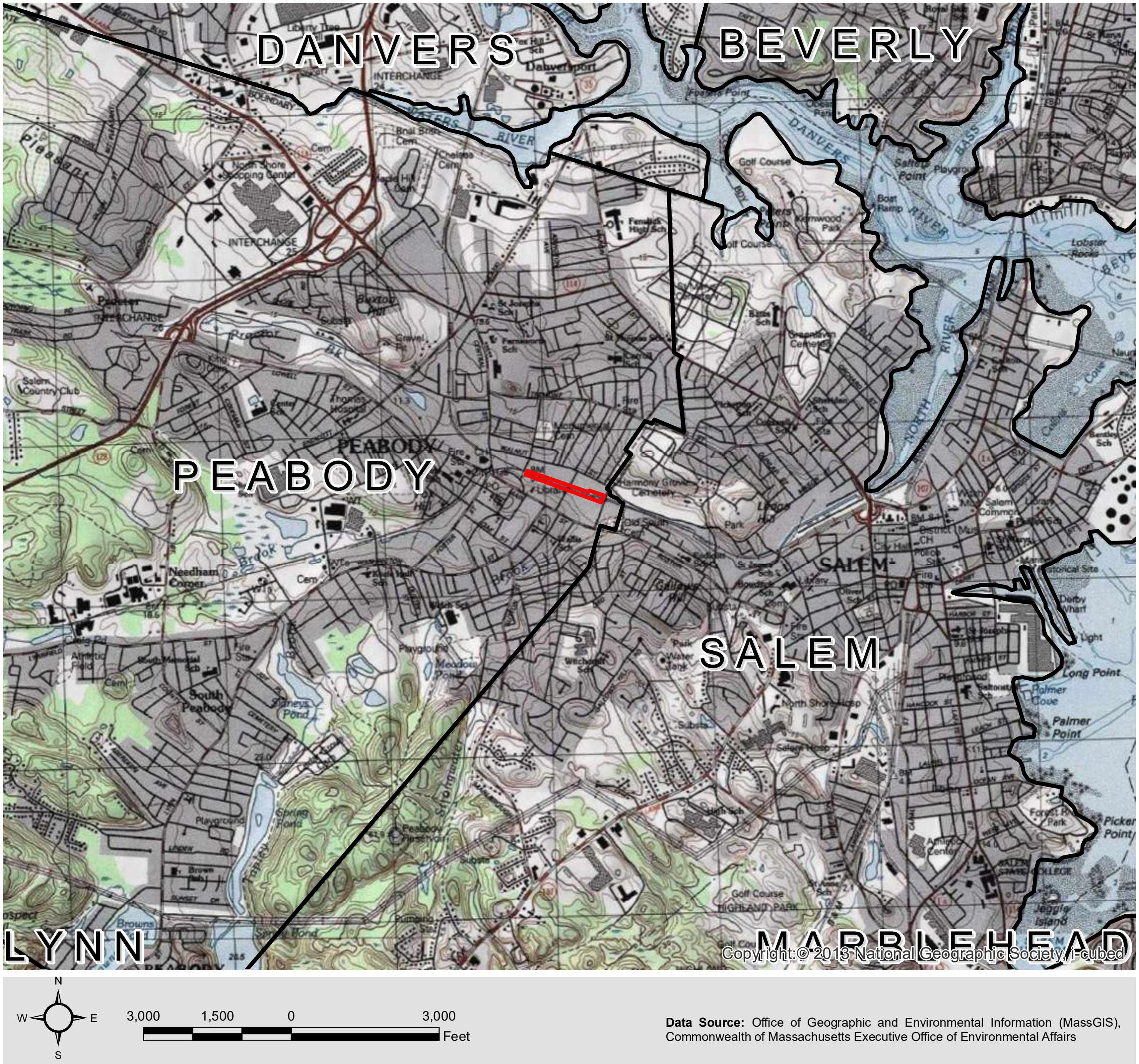

Copyright:© 2013 National Geographic Society, i-cubed

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

▭ Investigation Area

FIGURE 2

MVP Riverwalk
Peabody, MA

Locus Map

Weston & Sampson

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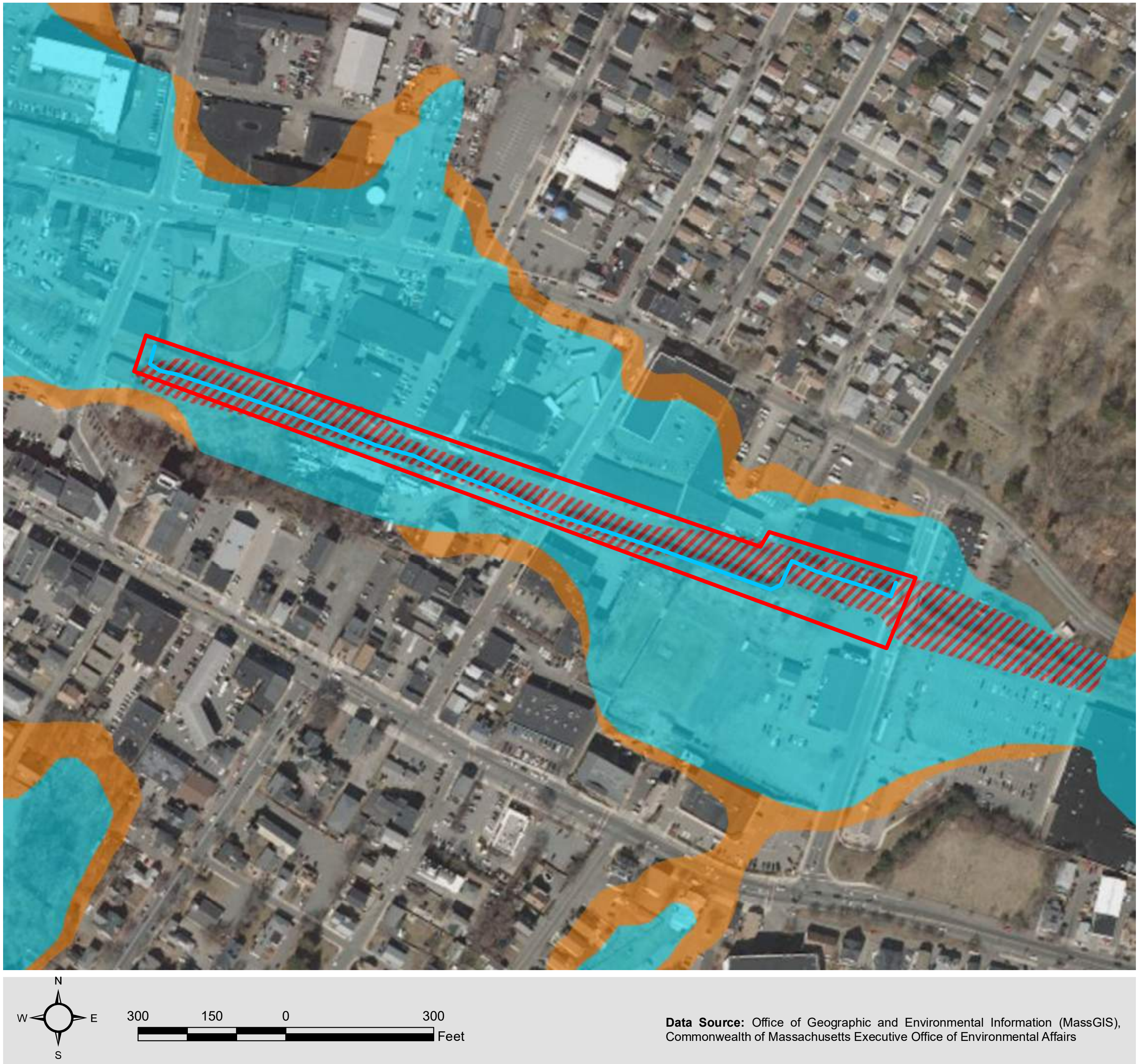

Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

- Perennial Stream
- 🟥 Investigation Area

FEMA National Flood Hazard Layer

Flood Zone Designations

- 🟩 A: 1% Annual Chance of Flooding, no BFE
- 🟦 AE: 1% Annual Chance of Flooding, with BFE
- ▨ AE: Regulatory Floodway
- 🟦 AH: 1% Annual Chance of 1-3ft Ponding, with BFE
- 🟦 AO: 1% Annual Chance of 1-3ft Sheet Flow Flooding, with Depth
- 🟪 VE: High Risk Coastal Area
- 🟨 D: Possible But Undetermined Hazard
- 🟧 X: 0.2% Annual Chance of Flooding
- ▨ X: Reduced Flood Risk due to Levee
- ▨ Area Not Included
- ▨ Area with no DFIRM - Paper FIRMs in Effect

FIGURE 3

MVP Riverwalk
Peabody, MA

FEMA Map

Weston & Sampson

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Data Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Legend

━ Perennial Stream

🟥 Investigation Area

ACECs

▥ ACECs

NHESP Habitats

▨ NHESP Estimated Habitats of Rare Wildlife

▨ NHESP Priority Habitats of Rare Species

✱ NHESP Certified Vernal Pools

✱ NHESP Potential Vernal Pools

Outstanding Resource Waters

🟦 Public Water Supply Contributor

🟩 ORW for ACEC

🟦 ORW for both Water Supply and Other

FIGURE 4

MVP Riverwalk
Peabody, MA

Environmental
Resource Map

Weston & Sampson

APPENDIX A

Site Photographs

Photo 1: Proctor Brook

APPENDIX F

PHOTOS

Riverwalk
Peabody, MA

Riverwalk
Peabody, MA

APPENDIX G

MEPA TRIGGERS

MEPA THRESHOLDS DISCUSSION

WETLANDS, WATERWAYS AND TIDELANDS

This project will trigger one of the thresholds put forth in 301 CMR 11.03 (3)(b). The exceeded thresholds include:

- Over 500 linear feet of bank impacts

This project involves creating a new canal wall at a lower elevation than the existing. Because of this, project will result in approximately 1,350 linear feet of bank impact.

Site Description

The project site is in an urban industrial area of Peabody, between Wallis and Howley Streets, and crosses Caller Street. The south side of the North River Canal along the project limits abuts six (6) privately owned properties, from west to east: 13 Wallis Street, 24 Caller Street, [Caller Street crossing], 21 Caller Street, 18 Howley Street, 166 Main Street (R), and MBTA property.

The south canal wall along the length of the project limits consists of multiple sections including earthen embankment (or possible buried wall), a stacked timber railroad tie structure behind an earth embankment, reinforced concrete, granite blocks, or stone or stone rubble sections. Wall heights range from about 4 to 6 feet above the canal bottom. The wall's condition varies over its length, ranging from good, in need of minor or no repairs, to poor, requiring full or partial reconstruction.

Scope of Work

The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street. Part of the project's scope of work includes replacing the south canal wall with a new wall at a lower elevation with a stabilized slope with a turf reinforcement mat and vegetation. The new wall will consist of driven steel sheet pilings located approximately 2 feet inland from the existing canal wall. The sheet piling wall will be craned into place and driven to specific depths. The Riverwalk will consist of an 8-foot wide asphalt path with 4 feet of vegetative buffer on each side where sufficient space permits. There will also be 4 separate sections of boardwalk constructed which will include helical pile footings. Additionally, a porous paver "art walk" will also be constructed as well a public deck supported by concrete post footings. Plantings will consist of native species and seed mixes. Pedestrian and street lights will be installed as well as rapid flashing beacons at street crossings.

See attached project description (Appendix A) for more detail.

LAND ALTERATION

The proposed project will not directly alter 25 or more acres of land, create five or more acres of impervious area, or exceed any of the other thresholds put forth in 301 CMR 11.03 (1)(b). As such, there are no MEPA triggers concerning Land Alteration.

RARE SPECIES

The proposed project is not located within any significant rare species habitat and therefore will not alter or take an endangered or threatened species of special concern as noted as a thresholds put forth in 301 CMR 11.03 (2)(b). As such, there are no MEPA triggers concerning Rare Species.

WATER

This project will not trigger any of the thresholds put forth in 301 CMR 11.03 (4)(b)

WASTEWATER

The proposed project will not expand upon any wastewater treatment facilities, infrastructure associated with wastewater facilities or trigger any other thresholds as noted as a in 301 CMR 11.03 (5)(b). As such, there are no MEPA triggers concerning Wastewater.

TRANSPORTATION

The proposed project will not construct or alter any roadways or trigger any other thresholds as noted as a in 301 CMR 11.03 (6)(b). As such, there are no MEPA triggers concerning Transportation.

ENERGY

The proposed project will not include the construction or expansion of an electric generation facility or a fuel pipeline as noted as a in 301 CMR 11.03 (7)(a). As such, there are no MEPA triggers concerning Energy.

AIR

The proposed project will not construct or modify a major stationary source with federal potential emissions as noted as a in 301 CMR 11.03 (8)(a). As such, there are no MEPA triggers concerning Air.

SOLID AND HAZARDOUS WASTE

The proposed project will not build or expand in capacity for combustion or disposal of any quantity of solid waste as noted as a in 301 CMR 11.03 (9)(b). As such, there are no MEPA triggers concerning Solid and Hazardous Waste.

HISTORICAL AND ARCHAEOLOGICAL RESOURCES

The proposed project will not include any alteration of any historic structures or archaeological sites as noted as a in 301 CMR 11.03 (10)(b). As such, there are no MEPA triggers concerning Historical and Archaeological Resources.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN

The proposed project will not be conducted in any areas of environmental concern (ACEC) as noted as a in 301 CMR 11.03 (11)(b). As such, there are no MEPA triggers concerning ACECs.

REGULATIONS

The proposed project will not reduce any standards for environmental protection, reduce opportunities for public participation in permitting or other review processes, or reduce public access to information generated or provided in accordance with the regulations whose primary purpose is to protect against damage to the environment as noted as a in 301 CMR 11.03 (12)(b). As such, there are no MEPA triggers concerning Regulations.

APPENDIX H

DISTRIBUTION LIST

Peabody MVP Riverwalk

ENF - Distribution List

Secretary of EEA
Executive Office of Energy and Environmental Affairs (EEA)
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

DEP/Northeast Regional Office
Attn: MEPA Coordinator
205B Lowell Street
Wilmington, MA 01887

DEP Boston Office
Commissioner's Office
One Winter Street
Boston, MA 02108

MA Department of Transportation
Public/Private Development Unit
10 Park Plaza
Boston, MA 02116

Massachusetts DOT District Office
District #4
Attn: MEPA Coordinator
519 Appleton Street
Arlington, MA 02476

Massachusetts Historical Commission
The MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Metropolitan Area Planning Council
60 Temple Place
Boston, MA 02111

City of Peabody
City Council
City Hall
24 Lowell Street
Peabody, MA 01960

City of Peabody
Planning Board
City Hall
24 Lowell Street
Peabody, MA 01960

City of Peabody
Conservation Commission
City Hall
24 Lowell Street
Peabody, MA 01960

City of Peabody
Board of Health
City Hall
24 Lowell Street
Peabody, MA 01960

APPENDIX I

STORMWATER REPORT

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

---

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

JAMES I. PEARSON
CIVIL
No. 50675

04/12/2021

4/12/2021
Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): ____________________

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☐ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☐ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

---

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☐ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- ☐ The BMP is sized (and calculations provided) based on:
  - ☐ The ½" or 1" Water Quality Volume or
  - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☒ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☒ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☐ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

  ☐ Name of the stormwater management system owners;

  ☐ Party responsible for operation and maintenance;

  ☐ Schedule for implementation of routine and non-routine maintenance tasks;

  ☐ Plan showing the location of all stormwater BMPs maintenance access areas;

  ☐ Description and delineation of public safety features;

  ☐ Estimated operation and maintenance budget; and

  ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

  ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;

  ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Stormwater Report
To Be Submitted with the Notice of Intent

Applicant/Project Name: City of Peabody

Project Address: Wallis/Howley Street, Peabody

Application Prepared by:
Firm: Weston & Sampson, Inc.
Registered PE James Pearson, P.E.

Below is an explanation concerning Standards 1-10 as they apply to the City of Peabody MVP Riverwalk Project:

General:

In 2018, the City of Peabody (the City) was awarded a Municipal Vulnerability Preparedness (MVP) Action Grant by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA). The MVP grant will allow the City to explore options for improving the flood resiliency of Peabody Square and was awarded based on a comprehensive project proposal to specifically target a stretch of the North River Canal that will improve flood resilience, address site contamination from historic use as a tannery district and evaluate a park resource and Riverwalk that would enhance public access and vitality of the area.

The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street. Part of the project's scope of work includes replacing the south canal wall with a new wall at a lower elevation with a stabilized slope with a turf reinforcement mat and vegetation.

Standard 1: No New Untreated Discharges

The proposed project will create no new untreated discharges. A 6,000 square foot existing building at 24 Caller Street was removed recently prior to the start of this project and is being replaced with vegetated park space. The only proposed impervious area as part of this project will be a bike and pedestrian path. A vegetated buffer will be provided between the pathway and the River. The path is not expected to generate any significant pollutant load, and the vegetative buffer will be adequate for whatever incidental treatment may be required.

Standard 2: Peak Rate Attenuation

There will be a net increase in impervious area. When factoring in the building removal, the net increase is 3,000 square feet, all consisting of pathway. Due to the proximity of the pathway to the river, lack of land space and high groundwater elevations, the installation of stormwater detention BMPs is not feasible. A vegetated buffer is being provided between the pathway and the river which will slow runoff to the maximum extent practicable.

To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction. These measures are described in the erosion and sediment control plans for the project.

Standard 3: Recharge

As noted in the Standard 2 explanation, there will be a net increase in impervious area at the site. Existing soil conditions preclude the installation of recharge BMPs. Geotechnical explorations performed in November 2018 showed static groundwater elevations at depths of 2-5 feet below ground surface. Seasonal high groundwater elevations are expected to be higher, to within a few inches of the ground surface. All observed water surface elevations occur within a layer of urban fill of varying quality that would likewise render it unsuitable for siting a recharge BMP.

Standard 4: Water Quality

Due to the site limitations described above, coupled with the negligible pollutant load expected from a pathway, water quality treatment has been addressed only to the maximum extent practicable. Water quality treatment for runoff from the pathway will be accomplished by means of sheet flow from the pathway through a vegetated strip between the pathway and the river.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)

Not Applicable. There are no LUHPPLs in the work area.

Standard 6: Critical Areas

There will be no new discharge to critical areas.

Standard 7: Redevelopments and Other Projects Subject to the Standards Only to the Maximum Extent Practicable

This is a redevelopment and limited project

Standard 8: Construction Period Pollution Prevention and Erosion and Sediment Control

A detailed Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included. To ensure that the work incorporates the performance standards recommended in the DEP's Stormwater Management Policy, necessary erosion and sedimentation control measures will be utilized during construction. These measures will include compost filter tubes, silt fencing and a stabilized construction entrance, as depicted on the site plans.

Standard 9: Operation and Maintenance Plan

An operations and maintenance plan is not needed since there will not be any new stormwater management systems put in place in the project work area.

Standard 10: Prohibition of Illicit Discharges

By the nature of the proposed work, there will be no illicit discharges. There will be no opportunity for illicit discharges into the system.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including any relevant soil evaluations, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

JAMES I.
PEARSON
CIVIL
No. 50675

04/12/2021

4/12/2021

Signature and Date

Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan

SECTION 1: Introduction

In 2018, the City of Peabody (the City) was awarded a Municipal Vulnerability Preparedness (MVP) Action Grant by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA). The MVP grant will allow the City to explore options for improving the flood resiliency of Peabody Square and was awarded based on a comprehensive project proposal to specifically target a stretch of the North River Canal that will improve flood resilience, address site contamination from historic use as a tannery district and evaluate a park resource and Riverwalk that would enhance public access and vitality of the area.

The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street. Part of the project's scope of work includes replacing the south canal wall with a new wall at a lower elevation with a stabilized slope with a turf reinforcement mat and vegetation.

As part of this project, this "Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan" has been created to ensure that no further disturbance to the wetland resource is created during the project.

SECTION 2: Construction Period Pollution Prevention Measures

Best Management Practices (BMPs) will be utilized as Construction Period Pollution Prevention Measures to reduce potential pollutants and prevent any off-site discharge. The objectives of the BMPs for construction activity are to minimize the disturbed areas, stabilize any disturbed areas, control the site perimeter and retain sediment. Both erosion and sedimentation controls and non-stormwater best management measures will be used to minimize site disturbance and ensure compliance with the performance standards of the WPA and Stormwater Standards. Measures will be taken to minimize the area disturbed by construction activities to reduce the potential for soil erosion and stormwater pollution problems. In addition, good housekeeping measures will be followed for the day-to-day operation of the construction site under the control of the contractor to minimize the impact of construction. This section describes the control practices that will be in place during construction activities. Recommended control practices will comply with the standards set in the MA DEP Stormwater Policy Handbook.

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

In order to minimize disturbed areas, work will be completed within well-defined work limits. These work limits are shown on the construction plans. The Contractor shall not disturb native vegetation in the undisturbed wetland area without prior approval from the Engineer. The Contractor will be responsible to make sure that all of their workers and any subcontractors know the proper work limits and do not extend their work into the undisturbed areas. The protective measures are described in more detail in the following sections.

2.2 Control Stormwater Flowing onto and through the project

Construction areas adjacent to wetland resources will be lined with appropriate sediment and erosion control measures. Both the silt curtain and compost filter tubes will be inspected daily for sediment build-up and accumulated silt will be removed as needed.

2.3 Stabilize Soils

The Contractor shall limit the area of land which is exposed and free from vegetation during construction. In areas where the period of exposure will be greater than two (2) months, mulching, the use of erosion control mats, or other protective measures shall be provided as specified.

The Contractor shall take account of the conditions of the soil where erosion control seeding will take place to insure that materials used for re-vegetation are adaptive to the sediment control.

2.4 Proper Storage and Cover of Any Stockpiles

The location of the Contractor's storage areas for equipment and/or materials shall require written approval of the Engineer.

Adequate measures for erosion and sediment control such as the placement of compost filter tubes around the downstream perimeter of stockpiles shall be employed to protect any downstream areas from siltation.

There shall be no storage of equipment or materials in areas designated as wetlands.

The Engineer may designate a particular area or areas where the Contractor may store materials used in his operations.

2.5 Perimeter Controls and Sediment Barriers

Erosion control lines as described in Section 5 will be utilized to ensure that sedimentation does not occur outside the perimeter of the work area.

2.6 Storm Drain Inlet Protection

Storm drain inlet protection will be used when necessary.

2.7 Retain Sediment On-Site

The Contractor will be responsible to monitor erosion control measures. Whenever necessary the Contractor will clear sediment from the compost filter tube and silt curtain that have been silted up during construction. Daily monitoring should be conducted using the attached Monitoring Form. The following good housekeeping practices will be followed on-site during the construction project:

2.8 Material Handling and Waste Management

Materials stored on-site will be stored in a neat, orderly manner in appropriate containers. Materials will be kept in their original containers with the original manufacturer’s label. Substances will not be mixed with one another unless recommended by the manufacturer.

Waste materials will be collected and stored in a securely lidded metal container from a licensed management company. The waste and any construction debris from the site will be hauled off-site daily and disposed of properly. The contractor will be responsible for waste removal. Manufacturer's recommendations for proper use and disposal will be followed for materials. Sanitary waste will be collected from the portable units a minimum of once a week, by a licensed sanitary waste management contractor.

2.9 Designated Washout Areas

The Contractor shall use washout facilities at their own facilities, unless otherwise directed by the Engineer.

2.10 Proper Equipment/Vehicle Fueling and Maintenance Practices

On-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage. To ensure that leaks on stored equipment do not contaminate the site, oil-absorbing mats will be placed under oil-containing equipment during storage. Regular fueling and service of the equipment may be performed using approved methods and with care taken to minimize chance of spills. Repair of equipment or machinery within the 100' water resources area shall not be allowed without the prior approval of the Engineer. Any petroleum products will be stored in tightly sealed containers that are clearly labeled with spill control pads/socks placed under/around their perimeters.

2.11 Equipment/Vehicle Washing

The Contractor will be responsible to ensure that no equipment is washed on-site.

SECTION 3: Spill Prevention and Control Plan

The Contractor will be responsible for preventing spills in accordance with the project specifications and applicable federal, state and local regulations. The Contractor will identify a properly trained site employee, involved with the day-to-day site operations to be the spill prevention and cleanup coordinator. The name(s) of the responsible spill personnel will be posted on-site. Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator.

3.1 Spill Control Equipment

Spill control/containment equipment will be kept in the Work Area. Materials and equipment necessary for spill cleanup will be kept either in the Work Area or in an otherwise accessible on-site location. Equipment and materials will include, but not be limited to, absorbent booms/mats, brooms, dust pans, mops, rags, gloves, goggles, sand, plastic and metal containers specifically for this purpose. It is the responsibility of the Contractor to ensure the inventory will be readily accessible and maintained.

3.2 Notification

Workers will be directed to inform the on-site supervisor of a spill event. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures. Primary notification of a spill should be made to the local Fire Department and Police Departments. Secondary Notification will be to the certified cleanup contractor if deemed necessary by Fire and/or Police personnel. The third level of notification (within 1 hour) is to the DEP or municipality's Licensed Site Professional (LSP). The specific cleanup contractor to be used will be identified by the Contractor prior to commencement of construction activities.

3.3 Spill Containment and Clean-Up Measures

Spills will be contained with granular sorbent material, sand, sorbent pads, booms or all of the above to prevent spreading. Certified cleanup contractors should complete spill cleanup. The material manufacturer's recommended methods for spill cleanup will be clearly posted and on-site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

3.4 Hazardous Materials Spill Report

The Contractor will report and record any spill. The spill report will present a description of the release, including the quantity and type of material, date of the spill, circumstances leading to the release, location of spill, response actions and personnel, documentation of notifications and corrective measures implemented to prevent reoccurrence.

This document does not relieve the Contractor of the Federal reporting requirements of 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302 and the State requirements specified under the Massachusetts Contingency Plan (M.C.P) relating to spills or other releases of oils or hazardous substances. Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117 or 40 CFR Part 302, occurs during a twenty-four (24) hour period, the Contractor is required to comply with the response requirements of the above mentioned regulations. Spills of oil or hazardous material in excess of the reportable quantity will be reported to the National Response Center (NRC).

SECTION 4: Contact Information/Responsible Parties

Owner/Operator:
City of Peabody
Brendan Callahan
24 Lowell Street
Peabody MA 01960
978-538-5780
Brendan.callahan@peabody-ma.gov

Engineer:
James Pearson, PE
Weston & Sampson Engineers, Inc.
55 Walkers Brook Dr, Suite 100
Reading, MA 01867
978-532-1900 ex. 2346

Site Inspector:
TBD

Contractor:
TBD

SECTION 5: Erosion and Sedimentation Control

Erosion and Sedimentation Control Drawings can be found in the attached project plans. In addition a technical specification (***Section 01570 Environmental Protection***) has been included as part of Appendix D, which details all Erosion and Sedimentation controls.

SECTION 6: Site Development Plan

The Site Development Plan is included in the attached plans.

SECTION 7: Operation and Maintenance of Erosion Control

The erosion control measures will be installed as detailed in the technical specification ***01570 Environmental Protection***. If there is a failure to the controls the Contractor, under the supervision of the Engineer, will be required to stop work until the failure is repaired.

Periodically throughout the work, whenever the Engineer deems it necessary, the sediment that has been deposited against the controls will be removed to ensure that the controls are working properly.

SECTION 8: Inspection Schedule

During construction, the erosion and sedimentation controls will be inspected daily. Once the Contractor is selected, an onsite inspector will be selected to work closely with the Engineer to ensure that erosion and sedimentation controls are in place and working properly. An Inspection Form is included.

Inspection Form

Inspected By: ______________________________ Date: __________Time:________

YES	NO	DOES NOT APPLY	ITEM
			Do any erosion/siltation control measures require repair or clean out to maintain adequate function?
			Is there any evidence that sediment is leaving the site and entering the wetlands?
			Are any temporary soil stockpiles or construction materials located in non-approved areas?
			Are on-site construction traffic routes, parking, and storage of equipment and supplies located in areas not specifically designed for them?

Specific location, current weather conditions, and action to be taken:

____

____

____

____

____

Other Comments:

____

____

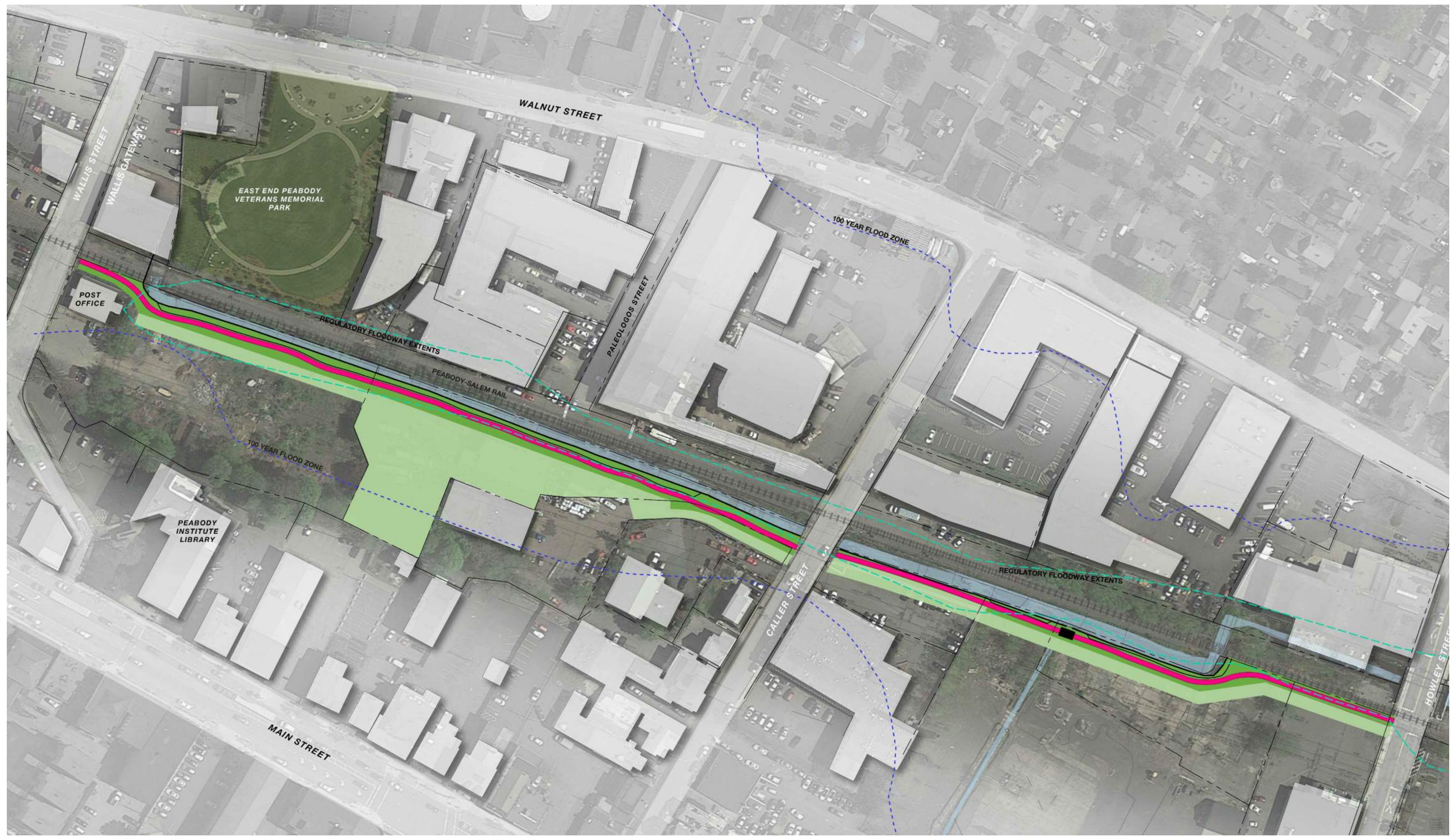
Pending the actions noted above I certify that the site is in compliance with the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan.

Signature: _____________________________ Date: __________________________

PEABODY RIVERWALK

RIVERWALK PARK

WALLIS STREET - CALLER STREET - HOWLEY STREET,
PEABODY, MA 01960



75% PERMITTING SET
-NOT FOR CONSTRUCTION-

APRIL 2021

SHEET INDEX

	COVER SHEET
L001	SITE INDEX PLAN
L100 - L102	EXISTING CONDITIONS PLAN
L110 - L112	SITE DEMOLITION AND PREPARATION PLAN
L120 - L122	MATERIALS PLAN
L130 - L132	LAYOUT PLAN
L140 - L142	GRADING AND DRAINAGE PLAN
L150 - L152	PLANTING PLAN
L500 - L504	CONSTRUCTION DETAILS
S200-S202	PROPOSED LAYOUT PLAN I - III
S600-S601	WALL SECTIONS AND DETAILS I - II
S602	OVERLOOK FRAMING PLAN, SECTIONS, & DETAILS
S603	TIMBER BRIDGE PLAN & TYP. SECTION
S604	TIMBER BRIDGE DETAILS
S605-S606	BOARDWALK PLAN & ELEVATION
S607	BOARDWALK TYP. SECTIONS
S608	BOARDWALK ABUTMENT TYP. SECTIONS
C601	EROSION AND SEDIMENT CONTROL DETAILS
E001	ELECTRICAL LEGEND, NOTES AND ABBREVIATIONS
E101 - E103	ELECTRICAL SITE PLAN A - C
E501	ELECTRICAL DETAILS
E601	ELECTRICAL RISER AND SCHEDULES

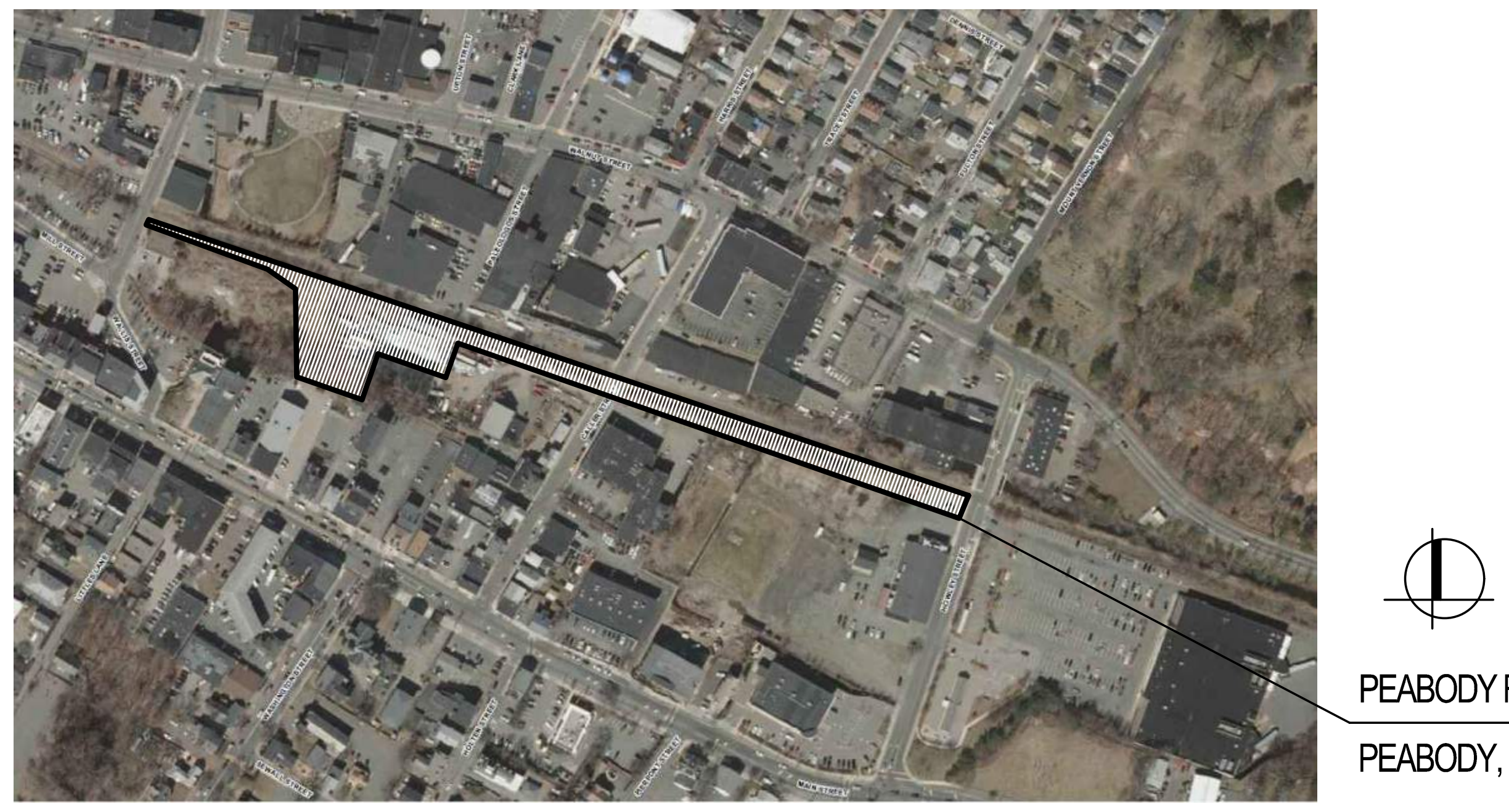
Prepared By

Weston & Sampson℠ design studio

Weston & Sampson Engineers, inc.
85 Devonshire St., 3rd Floor,
Boston, MA 02109
(617) 412-4480
www.westonandsampson.com

MASSACHUSETTS
CHERILYN F. PUJANS
NO. 1220
REGISTERED LANDSCAPE ARCHITECT

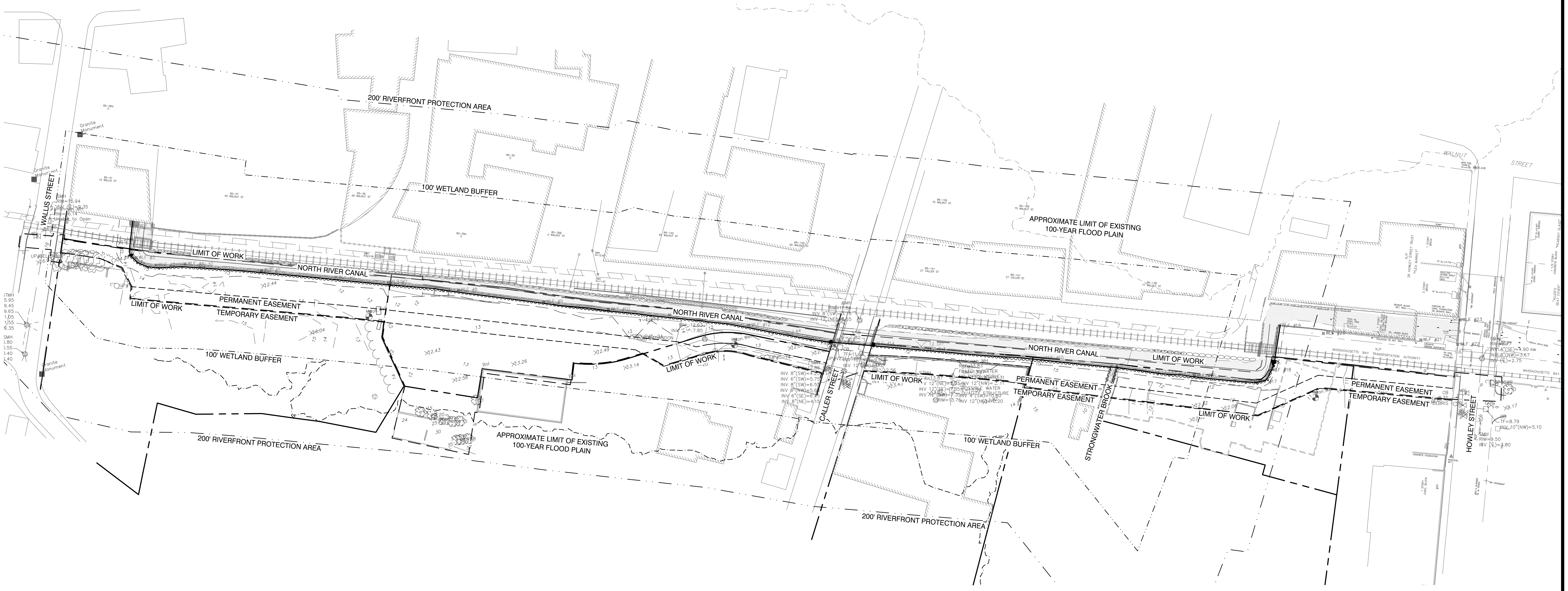
Locus Map

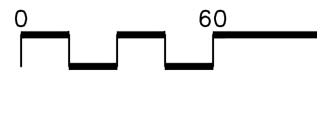


PEABODY RIVERWALK VICINITY MAP
PEABODY, MA 01960

LEGEND

——— — — ———	PROPERTY LINE
— — — — —	LIMIT OF WORK
━ ━ ━ ━ ━	EASEMENTS
—·—·—·—	100-FT WETLAND BUFFER
— · · — · · —	200-FT RIVERFRONT PROTECTION AREA
- · - · - · -	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN





Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

WESTON & SAMPSON ENGINEERS, INC
85 DEVONSHIRE STREET, 3RD FLOOR
BOSTON, MA 02109
617-412-4480

www.westonandsampson.com

Consultants:

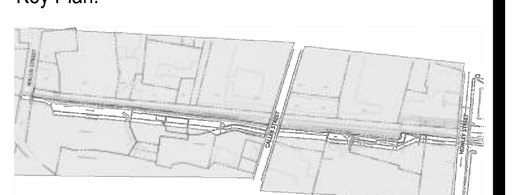
Revisions:

No.	Date	Description

Seal:

CHERILYN F. ALIANO
NO. 1220

Key Plan:



Issued For:

75% PERMITTING SET
- NOT FOR CONSTRUCTION -

Date: APRIL 2021
Drawn By: FD, TY, SG
Reviewed By: CC
Approved By: CFR

W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

SITE INDEX PLAN

Sheet Number:

L001

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\L001 INDEX PLAN.dwg

LEGEND

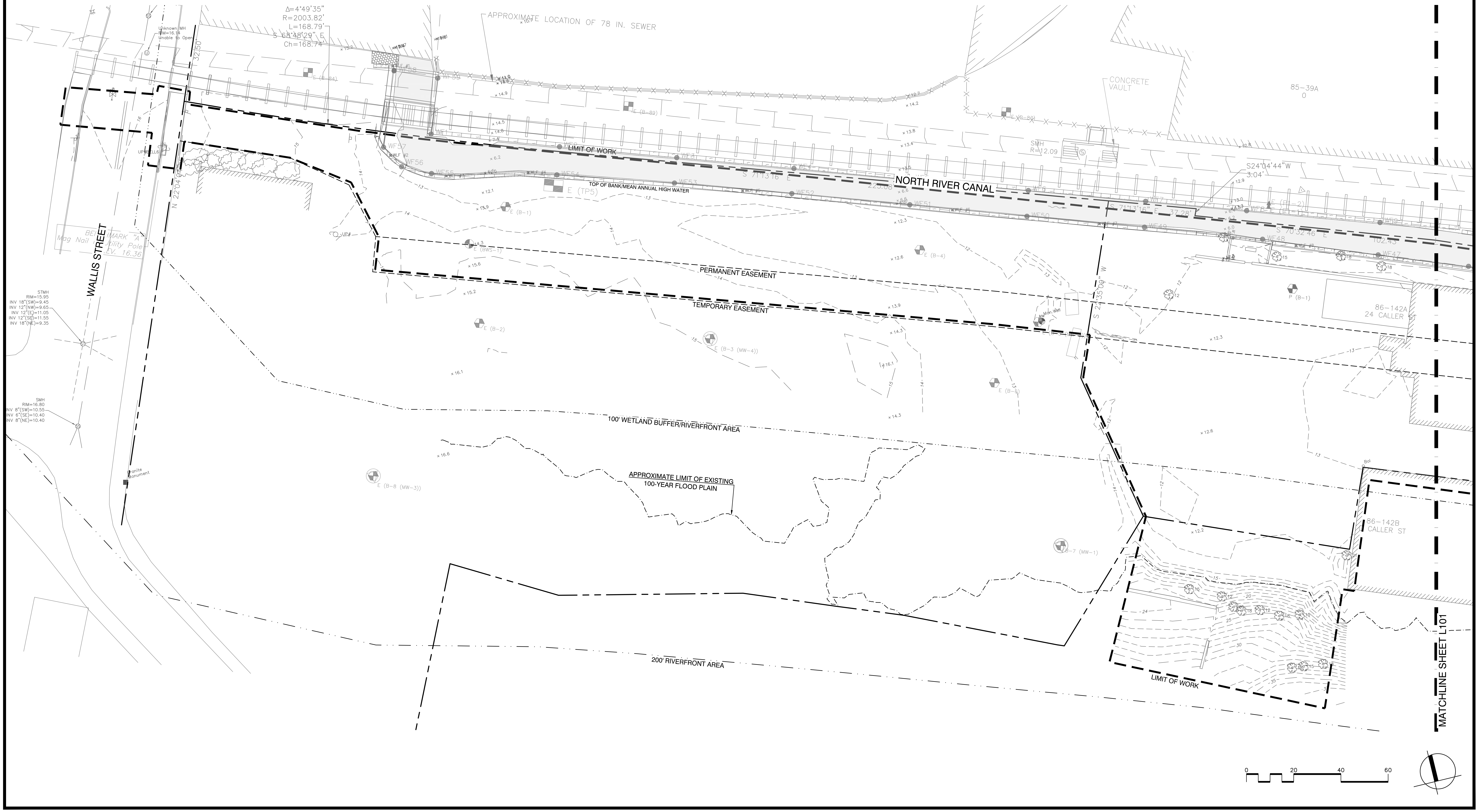
- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 200' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE

- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB/BUSH
- SIGN
- UTILITY POLE
- LIGHT POLE
- HYDRANT
- WATER SHUTOFF
- GAS VALVE
- WATER VALVE

- MONUMENT
- IRON PIN / IRON ROD
- HANDICAP SPACE
- SANITARY MANHOLE (SMH)
- STORM MANHOLE (STMH)
- CATCHBASIN (CB)
- METAL POST/BOLLARD (BOL)
- ELECTRIC MANHOLE (MHE)
- UNKNOWN MANHOLE
- TELEPHONE MANHOLE (MHT)

GENERAL NOTES

1. BEARINGS REFER TO THE MASSACHUSETTS NAD 83 STATE PLANE COORDINATE SYSTEM (MAINLAND ZONE).
2. ELEVATIONS REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988.
3. REFERENCE IS MADE TO THE FOLLOWING MAPS:
   - A. "LAND OF ANNABLE BROS. PEABODY", BY GUY W. RICKER, DATED SEPT. 1902, RECORDED IN BOOK 1683, PLAN 438 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - B. "LAND OF MORRILL LEATHER CO. PEABODY MASS.", BY GUY W. RICKER, DATED DEC. 1902, RECORDED AS MAP 1669 - 600.
   - C. "STATION MAP - LANDS BOSTON AND MAINE R.R. STATION 45+0 TO STATION 95+0", DATED JUNE 30, 1914, REVISED TO DEC. 1, 1975, RECORDED IN PLAN BOOK 141, PLAN 20 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - D. "PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, DATED OCT. 27, 1914, LAND COURT PLAN 5137A.
   - E. "PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, , DATED AUGUST 1916, RECORDED IN PLAN BOOK 30, PLAN 39 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - F. PLAN OF LAND IN PEABODY", BY THOMAS A. APPLETON, DATED OCT. 1918, LAND COURT PLAN 6997A.
   - G. "PLAN OF LAND - PEABODY, MASS. BELONGING TO THE MORRILL LEATHER CO.", BY SHAY & SHAY, SCALE , DATED FEB. 14, 1930, RECORDED AS PLAN 110 OF 1930 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - H. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER, DATED SEPTEMBER 1952, LAND COURT PLAN 6997C.
   - I. "PLAN OF LAND IN PEABODY PROPERTY OF HOWLEY REALTY TRUST OF PEABODY", BY OSBORN PALMER, INC., DATED FEB, 26, 1965, RECORDED IN PLAN BOOK 104, PLAN 12 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - J. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER INC, , DATED MAY 26, 1966, LAND COURT PLAN 5137B.
   - K. "SUBDIVISION PLAN OF LAND IN PEABODY", BY OSBORN PALMER INC, DATED FEBRUARY 5, 1967, LAND COURT PLAN 5137C.
   - L. "EASEMENT PLAN PEABODY-SALEM INTERCEPTING SEWER FROM SALEM-PEABODY LINE TO PEABODY SQUARE PEABODY, MASS.", BY RAYMOND C. PRESSEY, INC., DATED APRIL 15, 1971, REVISED JUNE 15, 1971, RECORDED IN PLAN BOOK 121 PLAN 64 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - M. "PLAN OF LAND IN PEABODY PREPARED FOR E.H. PORTER CONSTRUCTION COMPANY", BY ESSEX SURVEY SERVICE, INC., DATED NOV. 28, 1975, RECORDED IN PLAN BOOK 136, PLAN 37 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - N. "PLAN OF LAND IN PEABODY PREPARED FOR BOB-KAT TANNING CO., INC.", BY ESSEX SURVEY SERVICE INC., DATED APRIL 27, 1976, RECORDED IN PLAN BOOK 144, PLAN 52 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - O. "COUNTY OF ESSEX, MASSACHUSETTS PLAN OF A PORTION OF WALLIS STREET FROM MAIN STREET TO WALNUT STREET IN THE CITY OF PEABODY AS RELOCATED" DATED MARCH 5, 1985, REVISED DEC. 4, 1990, COUNTY RECORD NUMBER 3204.
   - P. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., SCALE , DATED JULY 14, 1986, REVISED NOVEMBER 7, 1989, RECORDED IN PLAN BOOK 260, PLAN 46 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - Q. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASS. PREPARED FOR EASTERN LAND SURVEY ASSOCIATES, INC., DATED APRIL 2, 2001, RECORDED IN PLAN BOOK 350, PLAN 53 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - R. "EASEMENT PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., , DATED OCTOBER 18, 2004, RECORDED IN PLAN BOOK 386, PLAN 11 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - S. "SUBDIVISION PLAN OF LAND LOCATED IN PEABODY, MASSACHUSETTS", BY EASTERN LAND SURVEY ASSOCIATES, INC., DATED AUGUST 22, 2008, RECORDED IN PLAN BOOK 416, PLAN 7 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - T. "PLAN OF LAND LOCATED IN PEABODY, MASS.", BY EASTERN LAND SURVEY ASSOCIATES, INC., , DATED MAY 17, 2010, RECORDED IN PLAN BOOK 424, PLAN 17 OF THE ESSEX SOUTH REGISTRY OF DEEDS.
   - U. "PLAN OF LAND LOCATED IN PEABODY, MASSACHUSETTS (ESSEX COUNTY) PREPARED FOR MASSACHUSETTS BAY TRANSPORTATION AUTHORITY - CITY OF PEABODY", BY MERIDIAN ASSOCIATES, DATED MARCH 30, 2012, RECORDED IN PLAN BOOK 433, PLAN 91 OF THE ESSEX SOUTH REGISTRY OF DEEDS.



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Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

Weston & Sampson

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CHERILYN F.
NO. 1220

Key Plan:

Issued For:

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Date: APRIL 2021
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Reviewed By: CC
Approved By: CFR

W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

EXISTING
CONDITIONS PLAN

Sheet Number:

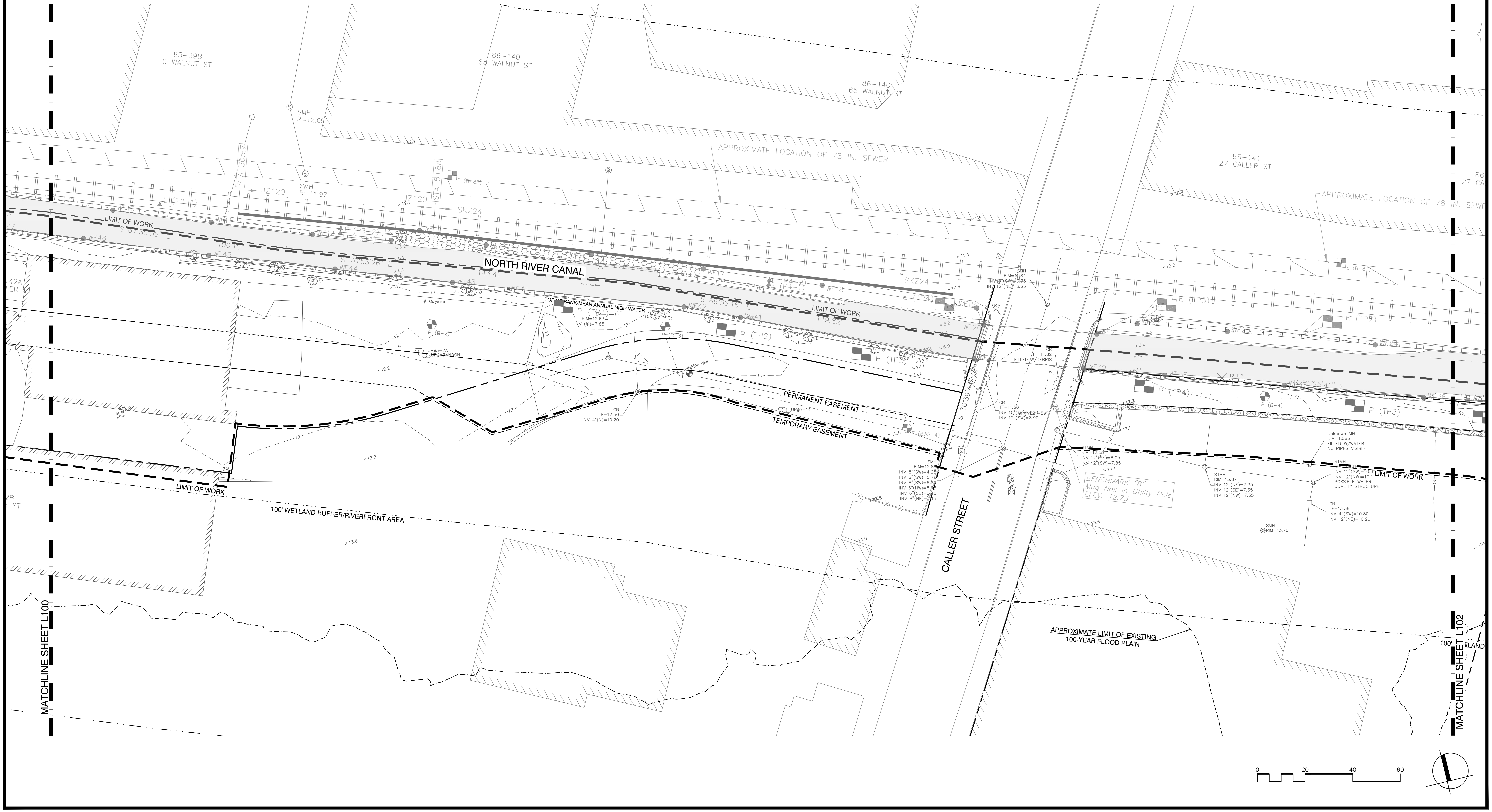
L100

LEGEND

PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
200' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
MAJOR CONTOUR LINE
MINOR CONTOUR LINE

DECIDUOUS TREE
CONIFEROUS TREE
SHRUB/BUSH
SIGN
UTILITY POLE
LIGHT POLE
HYDRANT
WATER SHUTOFF
GAS VALVE
WATER VALVE

MONUMENT
IRON PIN / IRON ROD
HANDICAP SPACE
SANITARY MANHOLE (SMH)
STORM MANHOLE (STMH)
CATCHBASIN (CB)
METAL POST/BOLLARD (BOL)
ELECTRIC MANHOLE (MHE)
UNKNOWN MANHOLE
TELEPHONE MANHOLE (MHT)



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Project:

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CHERILYN F. ANANIS
NO. 1220

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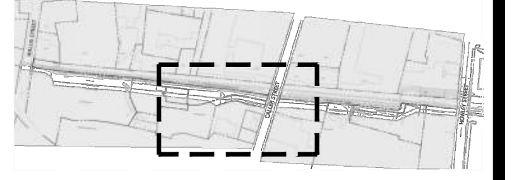

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EXISTING
CONDITIONS PLAN

Sheet Number:

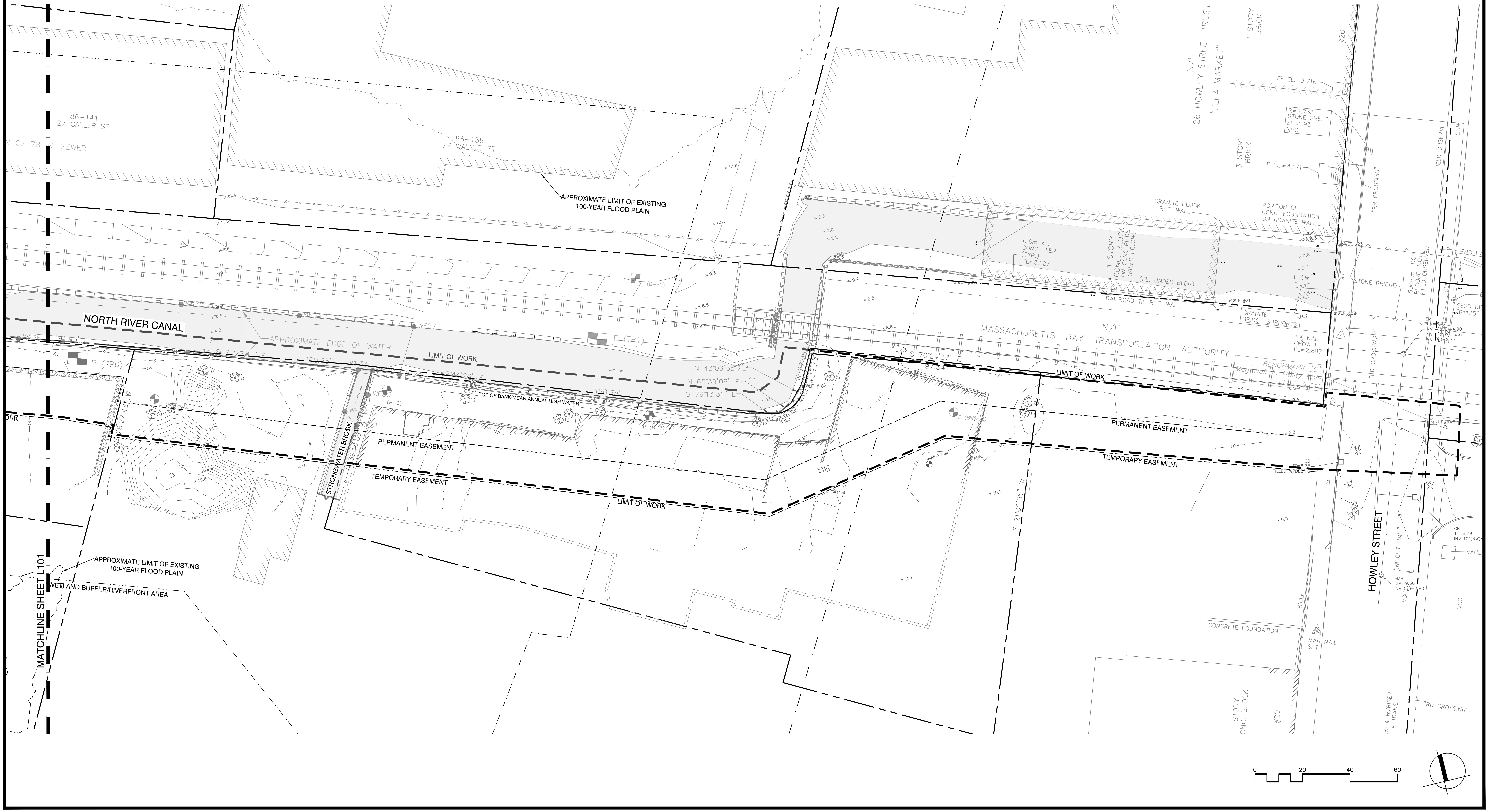
L101

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 200' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- MAJOR CONTOUR LINE
- MINOR CONTOUR LINE

- DECIDUOUS TREE
- CONIFEROUS TREE
- SHRUB/BUSH
- SIGN
- UTILITY POLE
- LIGHT POLE
- HYDRANT
- WATER SHUTOFF
- GAS VALVE
- WATER VALVE

- MONUMENT
- IRON PIN / IRON ROD
- HANDICAP SPACE
- SANITARY MANHOLE (SMH)
- STORM MANHOLE (STMH)
- CATCHBASIN (CB)
- METAL POST/BOLLARD (BOL)
- ELECTRIC MANHOLE (MHE)
- UNKNOWN MANHOLE
- TELEPHONE MANHOLE (MHT)



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Drawing Title:

EXISTING CONDITIONS PLAN

Sheet Number:

L102

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- COMPOST SOCKS

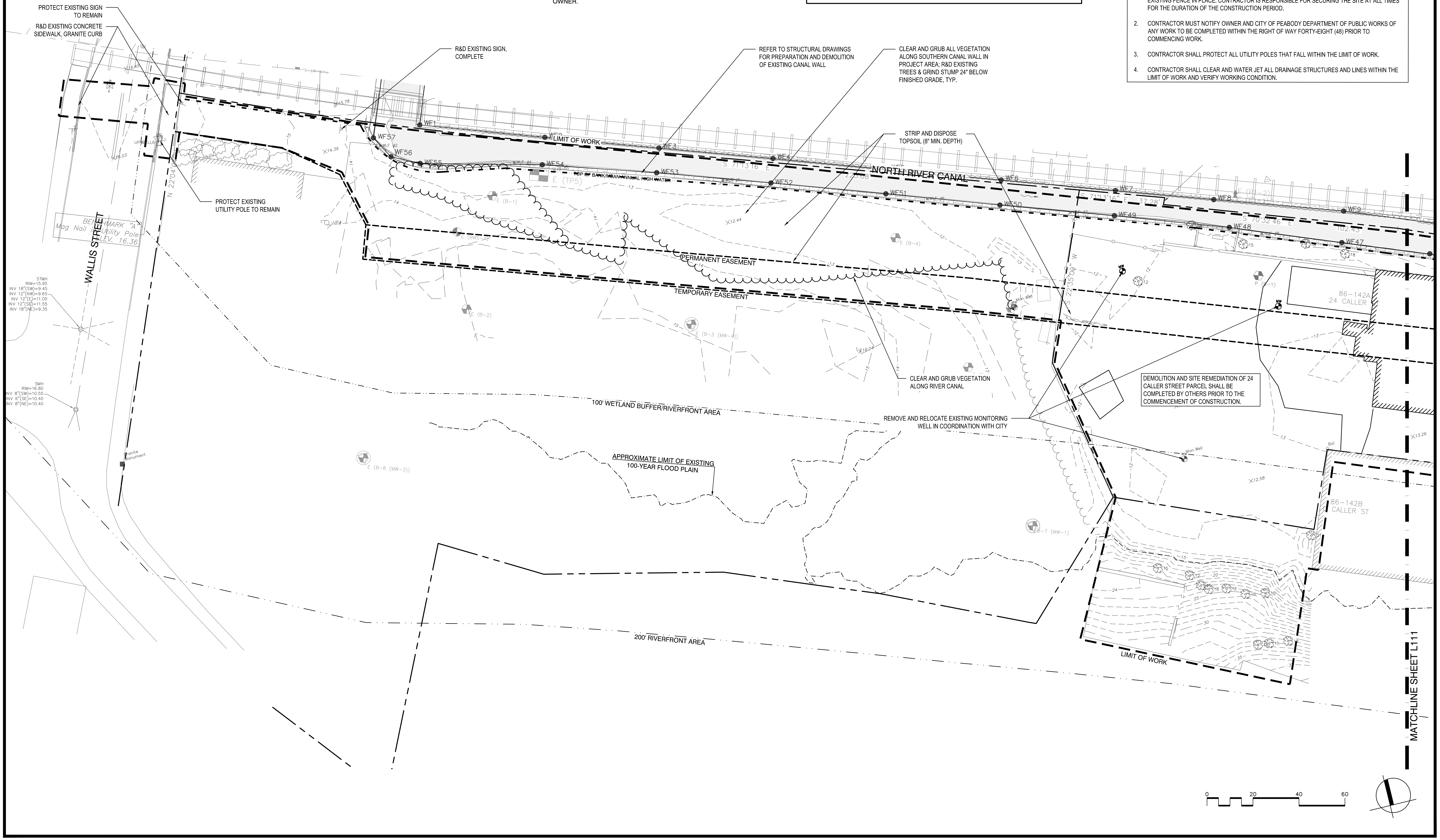
TYP.	TYPICAL
EX.	EXISTING
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
R&S	REMOVE AND STORE

DEMOLITION & SITE PREPARATION NOTES

1. THE CONTRACTOR SHALL INCLUDE IN THE BID THE COST OF REMOVING ANY EXISTING SITE FEATURES NECESSARY TO ACCOMPLISH THE CONSTRUCTION OF THE PROPOSED SITE IMPROVEMENTS. THE CONTRACTOR SHALL ALSO INCLUDE IN THE BID THE COST NECESSARY TO RESTORE SUCH ITEMS IF THEY ARE DISTURBED YET SCHEDULED TO REMAIN AS PART OF THE FINAL SITE IMPROVEMENTS. REFER TO PLANS TO DETERMINE EXCAVATION AND DEMOLITION REQUIRED TO RECEIVE PROPOSED SITE IMPROVEMENTS AND TO DETERMINE THE LOCATION OF PROPOSED SITE IMPROVEMENTS.
2. THE OWNER RESERVES THE RIGHT TO REVIEW ALL MATERIALS DESIGNATED FOR REMOVAL AND TO RETAIN OWNERSHIP OF SUCH MATERIALS. IF THE OWNER RETAINS ANY MATERIAL THE CONTRACTOR SHALL MAKE ARRANGEMENTS WITH THE OWNER TO HAVE THOSE MATERIALS DELIVERED TO FRANKLIN PARK YARD AT NO ADDITIONAL EXPENSE TO THE OWNER.
3. UNLESS SPECIFICALLY NOTED TO BE SAVED OR REUSED, ALL SITE FEATURES CALLED FOR REMOVAL SHALL BE TRANSPORTED FROM THE SITE AND DISPOSED OF IN A LAWFUL MANNER AT AN ACCEPTABLE DISPOSAL SITE AT NO COST TO THE OWNER.
4. ALL EXISTING SITE FEATURES TO REMAIN SHALL BE PROTECTED THROUGHOUT THE CONSTRUCTION PERIOD. ANY FEATURES DAMAGED DURING CONSTRUCTION OPERATIONS SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE OWNER AND OWNER'S REPRESENTATIVE AT NO ADDITIONAL COST TO THE OWNER.
5. DURING EARTHWORK OPERATIONS, CONTRACTOR SHALL TAKE CARE TO NOT DISTURB EXISTING MATERIALS TO REMAIN, OUTSIDE THE LIMITS OF EXCAVATION AND BACKFILL AND SHALL TAKE WHATEVER MEASURES NECESSARY, AT THE CONTRACTOR'S EXPENSE, TO PREVENT ANY EXCAVATED MATERIAL FROM COLLAPSING. ALL BACKFILL MATERIALS SHALL BE PLACED AND COMPACTED AS SPECIFIED TO THE SUBGRADE REQUIRED FOR THE INSTALLATION OF THE REMAINDER OF THE CONTRACT WORK.
6. ALL ITEMS CALLED FOR REMOVAL (COMPLETE) SHALL BE REMOVED TO FULL DEPTH INCLUDING ALL FOOTINGS, FOUNDATIONS, AND OTHER APPURTENANCES, EXCEPT AS SPECIFICALLY NOTED OTHERWISE.
7. CONTRACTOR SHALL INSTALL TREE PROTECTION BARRIER AT DRIPLINE AFTER CLEARING UNDERBRUSH AND TAKE DUE CARE TO PREVENT INJURY TO TREES DURING CLEARING OPERATIONS. TREES TO REMAIN SHALL BE PRUNED.
8. THE STORAGE OF MATERIALS AND EQUIPMENT WILL BE PERMITTED AT LOCATIONS DESIGNATED BY OWNER OR OWNER'S REPRESENTATIVE. PROTECTION OF STORED MATERIALS AND EQUIPMENT SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. THERE SHALL BE NO STORAGE OF MATERIALS OR PARKING OF CONSTRUCTION VEHICLES WITHIN DRIPLINE OF TREES.
9. **DEMOLITION AND SITE REMEDIATION OF 24 CALLER STREET SHALL BE COMPLETED BY OTHERS PRIOR TO THE COMMENCEMENT OF CONSTRUCTION**
10. **ALL SEDIMENT AND EROSION CONTROL DEVICES SHALL BE PUT INTO PLACE PRIOR TO BEGINNING ANY CONSTRUCTION OR DEMOLITION.**
11. **THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONTINUAL MAINTENANCE OF ALL EROSION CONTROL DEVICES THROUGHOUT THE DURATION OF THE PROJECT.**
12. **CONTRACTOR SHALL MEET ALL THE COMMONWEALTH OF MASSACHUSETTS D.E.P. AND THE CITY OF PEABODY'S WETLAND ORDINANCE REGULATIONS FOR SEDIMENT AND EROSION CONTROL.**
13. **THE CONTRACTOR SHALL PROVIDE DUST CONTROL FOR CONSTRUCTION OPERATIONS AS APPROVED BY OWNER.**
14. **ALL POINTS OF CONSTRUCTION EGRESS OR INGRESS SHALL BE MAINTAINED TO PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC / PRIVATE ROADS.**

NOTES:

1. CONTRACTOR SHALL PROVIDE 6'-HT CONSTRUCTION FENCE PLACED AT LIMIT OF WORK OR USE EXISTING FENCE IN PLACE. CONTRACTOR IS RESPONSIBLE FOR SECURING THE SITE AT ALL TIMES FOR THE DURATION OF THE CONSTRUCTION PERIOD.
2. CONTRACTOR MUST NOTIFY OWNER AND CITY OF PEABODY DEPARTMENT OF PUBLIC WORKS OF ANY WORK TO BE COMPLETED WITHIN THE RIGHT OF WAY FORTY-EIGHT (48) PRIOR TO COMMENCING WORK.
3. CONTRACTOR SHALL PROTECT ALL UTILITY POLES THAT FALL WITHIN THE LIMIT OF WORK.
4. CONTRACTOR SHALL CLEAR AND WATER JET ALL DRAINAGE STRUCTURES AND LINES WITHIN THE LIMIT OF WORK AND VERIFY WORKING CONDITION.



Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
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Drawing Title:

SITE DEMOLITION
AND PREPARATION
PLAN

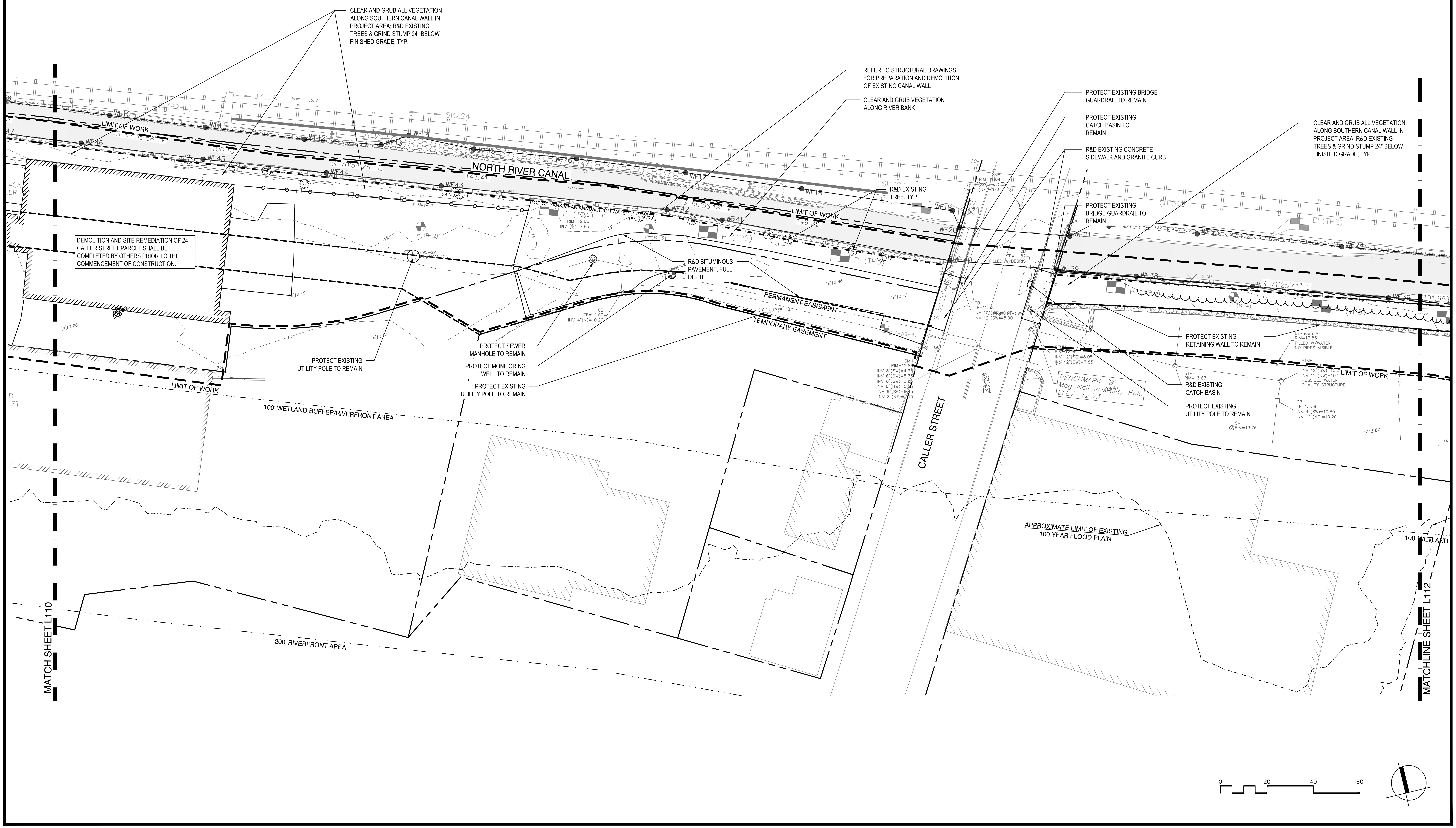
Sheet Number:

L110

LEGEND

PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
100' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
COMPOST SOCKS

TYP.	TYPICAL
EX.	EXISTING
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
R&S	REMOVE AND STORE



Project:

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Drawing Title:

SITE DEMOLITION AND PREPARATION PLAN

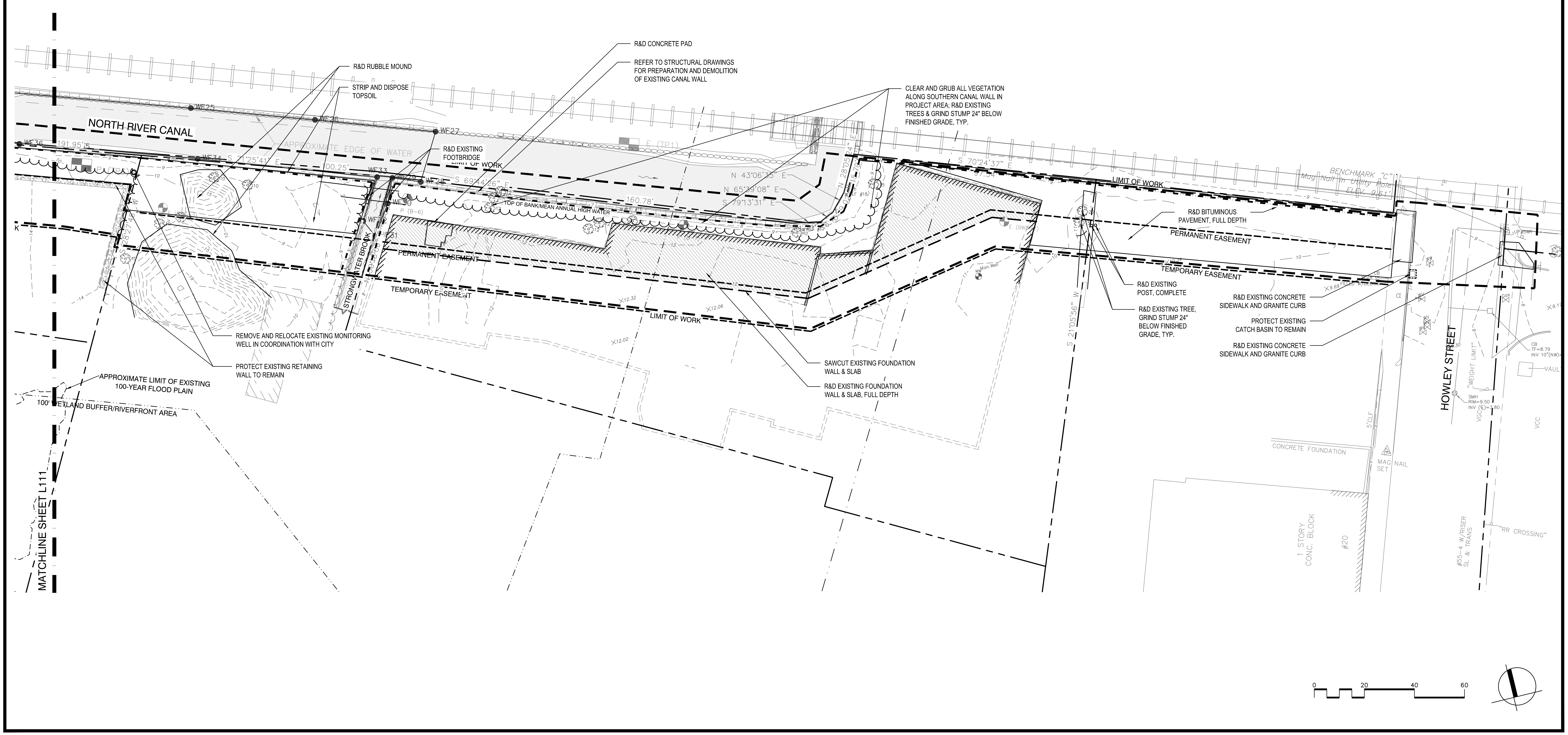
Sheet Number:

L111

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- COMPOST SOCKS
- INLET SEDIMENT CONTROL
- CLEAR AND GRUB VEGETATION ALONG RIVER CANAL

TYP.	TYPICAL
EX.	EXISTING
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
R&S	REMOVE AND STORE



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Project:

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SITE DEMOLITION AND PREPARATION PLAN

Sheet Number:

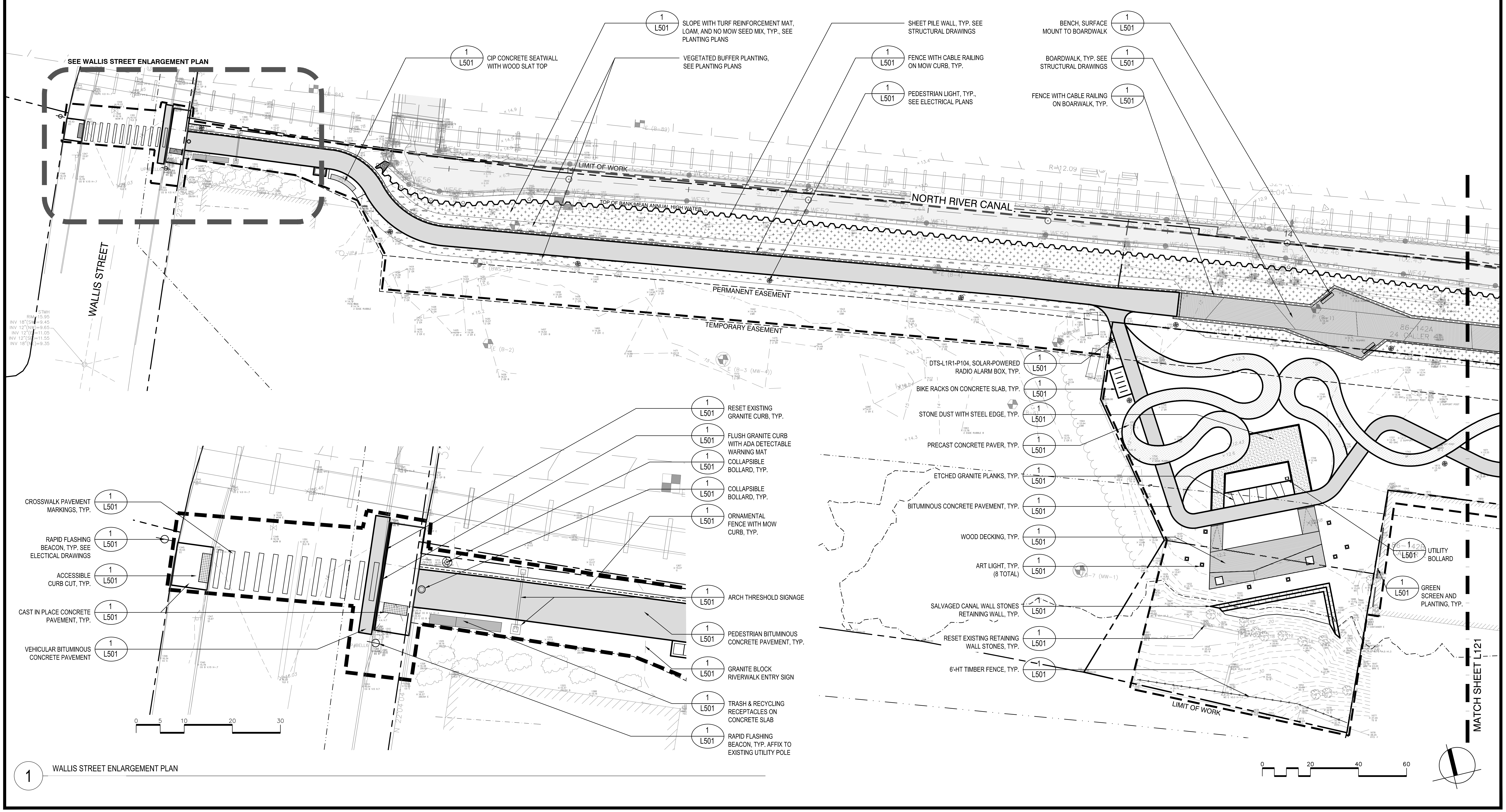
L112

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 200' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- SHEET PILE WALL
- FENCE WITH CABLE RAILING ON BOARWALK
- FENCE WITH CABLE RAILING ON MOW CURB
- PEDESTRIAN BITUMINOUS CONCRETE PAVEMENT
- VEHICULAR BITUMINOUS CONCRETE PAVEMENT
- BOARDWALK
- SLOPE WITH TURF REINFORCEMENT MAT, LOAM, AND NO MOW SEED MIX
- VEGETATED BUFFER PLANTING
- CIP CONCRETE PAVEMENT
- EXPANSION JOINT (EJ)
- SCORE JOINT (SJ)
- BENCH WITH BACK
- ☼ STREET LIGHT
- ◎ PEDESTRIAN LIGHT
- RAPID FLASHING BEACON
- ✷ EMERGENCY CALL BOX
- ○ COLLAPSIBLE BOLLARD
- TRASH AND RECYCLE RECEPTACLES ON CONCRETE SLAB
- Ⓓ DRAIN MANHOLE
- ⊞ CATCH BASIN

MATERIALS NOTES

1. REFER TO EXISTING CONDITIONS PLAN FOR SURVEY INFORMATION.
2. REFER TO PLANTING PLAN FOR PLANT TYPES AND LOCATIONS.
3. ALL PROPOSED PAVEMENTS SHALL MEET THE LIEN AND GRADE OF EXISTING ADJACENT PAVEMENT SURFACES AND SHALL BE TREATED WITH RS-1 TACK COAT AND INFRARED LIGHT AT ALL POINTS OF CONNECTION AND ALL SAWCUT EDGES WHERE PROPOSED PAVEMENT METS EXISTING PAVEMENT.
4. THE DEPTH OF LOAM TOP SOIL FOR ALL RESTORED LAWN AREAS SHALL BE 6" MINIMUM. ALL DISTURBED AREAS SHALL BE RESTORED WITH LOAM AND SEED UNLESS OTHERWISE NOTED.
5. ALL LIGHTING CONTROLS TO BE COORDINATED WITH THE CITY OF PEABODY.



1 WALLIS STREET ENLARGEMENT PLAN

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
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W&S File No.:

Drawing Title:

MATERIALS PLAN

Sheet Number:

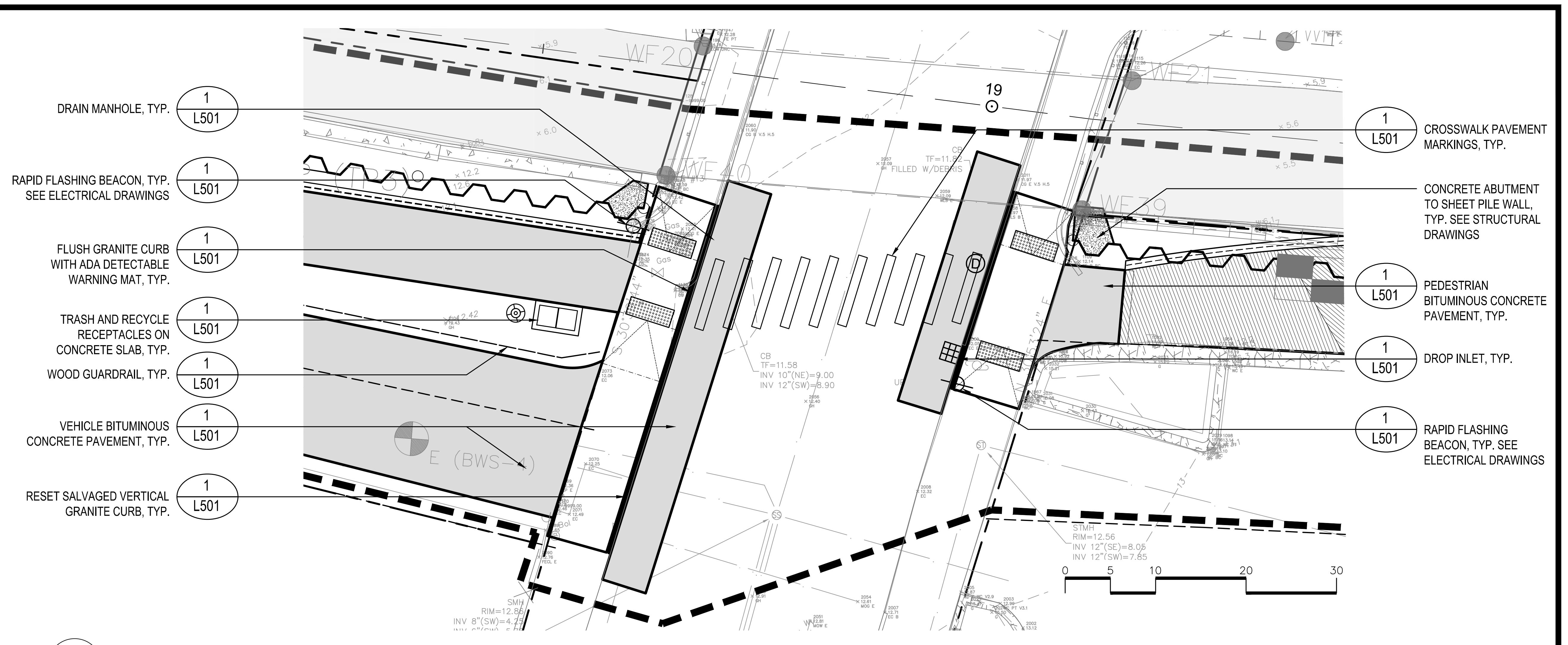
L120

LEGEND

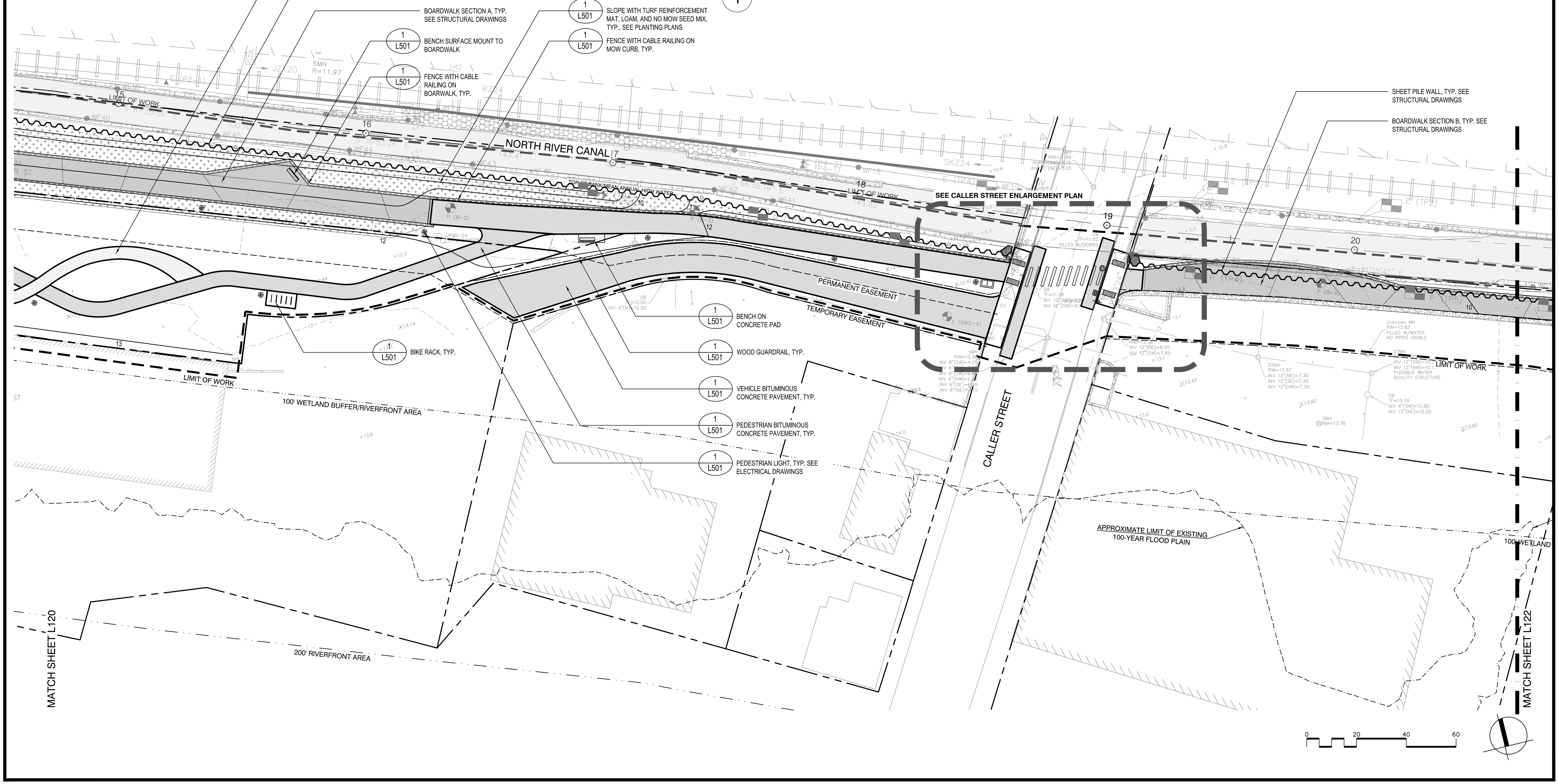
PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
200' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
SHEET PILE WALL
FENCE WITH CABLE RAILING ON BOARWALK
FENCE WITH CABLE RAILING ON MOW CURB
PEDESTRIAN BITUMINOUS CONCRETE PAVEMENT

VEHICULAR BITUMINOUS CONCRETE PAVEMENT
BOARDWALK
SLOPE WITH TURF REINFORCEMENT MAT, LOAM, AND NO MOW SEED MIX
VEGETATED BUFFER PLANTING
CIP CONCRETE PAVEMENT
EXPANSION JOINT (EJ)
SCORE JOINT (SJ)
BENCH WITH BACK

☼ STREET LIGHT
◎ PEDESTRIAN LIGHT
-o- RAPID FLASHING BEACON
✷ EMERGENCY CALL BOX
○ COLLAPSIBLE BOLLARD
◫ TRASH AND RECYCLE RECEPTACLES ON CONCRETE SLAB
Ⓓ DRAIN MANHOLE
⊞ CATCH BASIN



1 CALLER STREET ENLARGEMENT PLAN



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MATERIALS PLAN

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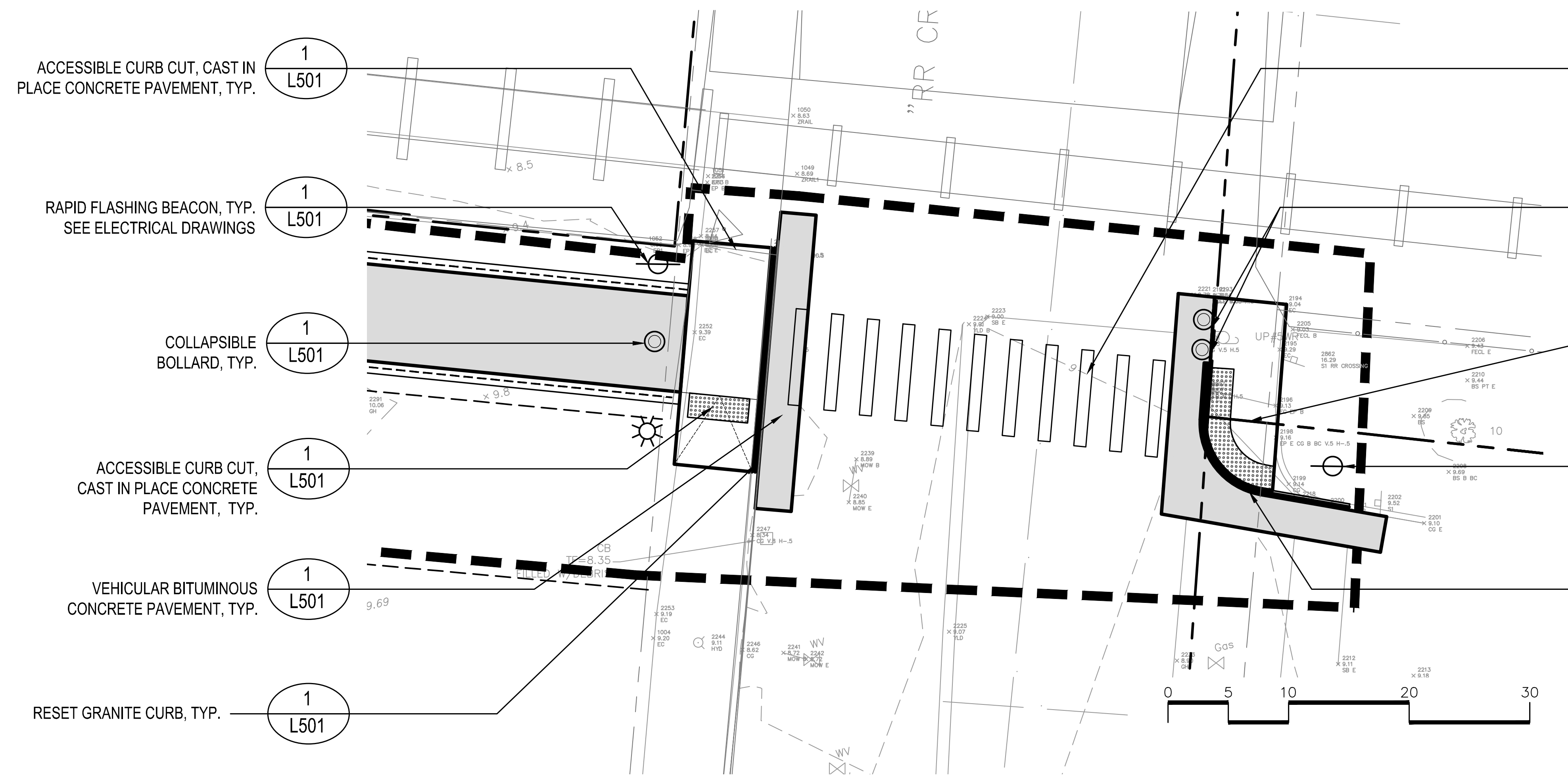
L121

LEGEND

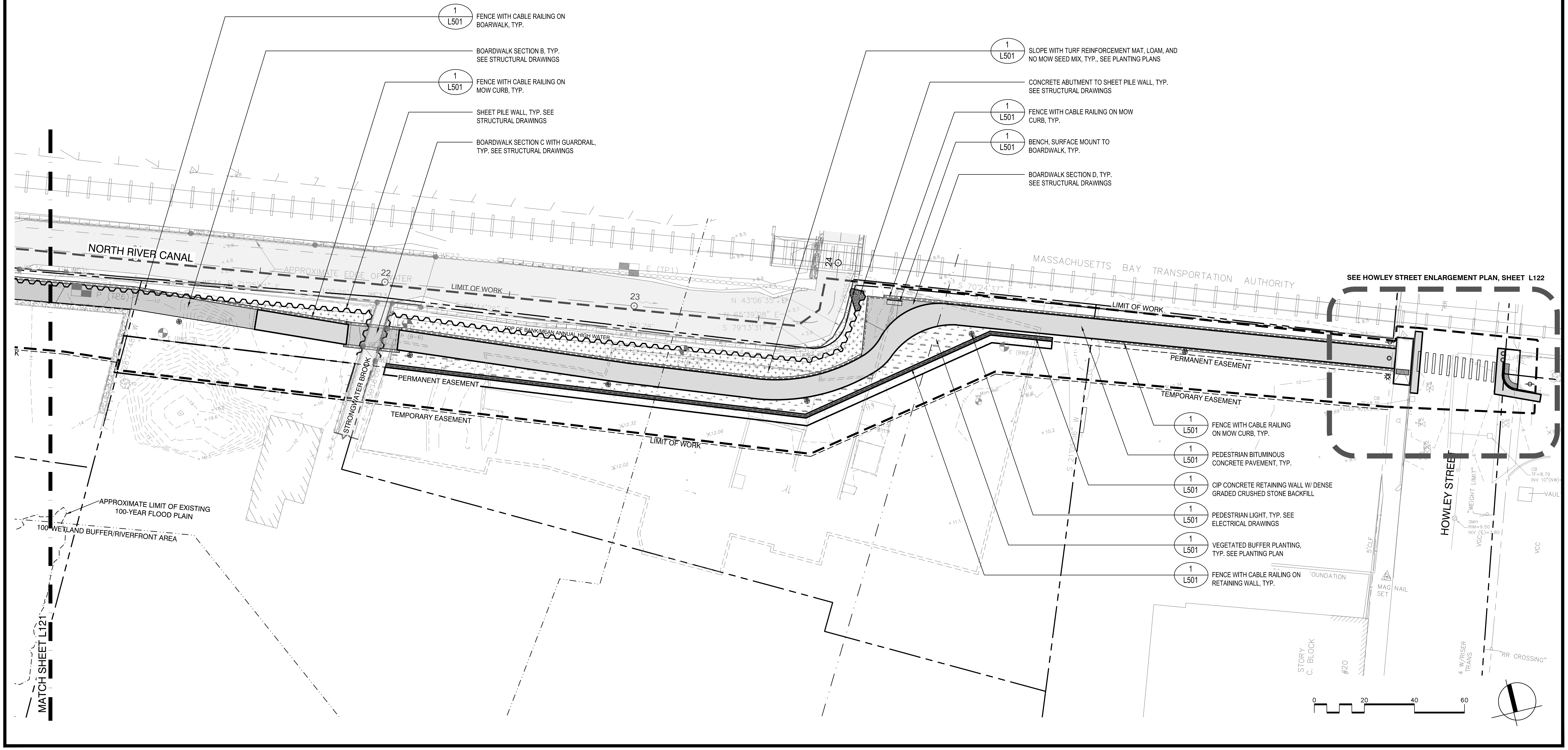
PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
200' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
SHEET PILE WALL
FENCE WITH CABLE RAILING ON BOARWALK
FENCE WITH CABLE RAILING ON MOW CURB
PEDESTRIAN BITUMINOUS CONCRETE PAVEMENT

VEHICULAR BITUMINOUS CONCRETE PAVEMENT
BOARDWALK
SLOPE WITH TURF REINFORCEMENT MAT, LOAM, AND NO MOW SEED MIX
VEGETATED BUFFER PLANTING
CIP CONCRETE PAVEMENT
EXPANSION JOINT (EJ)
SCORE JOINT (SJ)
BENCH WITH BACK

STREET LIGHT
PEDESTRIAN LIGHT
RAPID FLASHING BEACON
EMERGENCY CALL BOX
COLLAPSIBLE BOLLARD
TRASH AND RECYCLE RECEPTACLES ON CONCRETE SLAB
DRAIN MANHOLE
CATCH BASIN



1 HOWLEY STREET ENLARGEMENT PLAN



P:\MA\Peabody MA\MVP Action Grant 2019\CAD\L120 - L122 MATERIALS.dwg

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

WESTON & SAMPSON ENGINEERS, INC
85 DEVONSHIRE STREET, 3RD FLOOR
BOSTON, MA 02109
617-412-4480

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Seal:

NO. 1220

Key Plan:

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Date: APRIL 2021
Drawn By: FD, TY, SG
Reviewed By: CC
Approved By: CFR

W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

MATERIALS PLAN

Sheet Number:

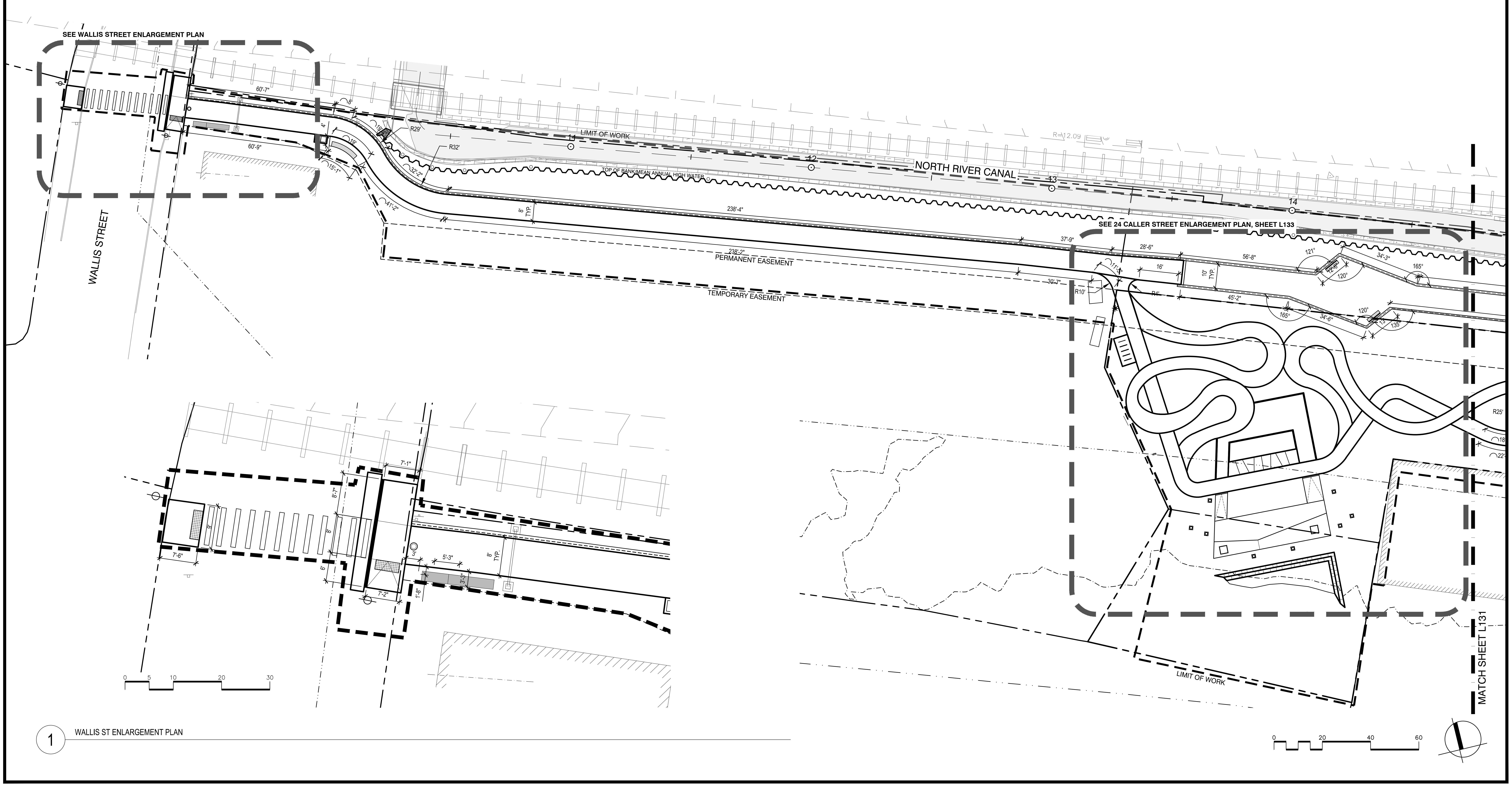
L122

LEGEND

━ ‒ ‒ ━	PROPERTY LINE
▬ ▬ ▬ ▬	LIMIT OF WORK
‒ ‒ ‒ ‒	EASEMENTS
—··—··—	100' WETLAND BUFFER
— · · — · · —	100' RIVERFRONT PROTECTION AREA
—·—·—·—	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
—·—·—·—	CENTER LINE
X'-X"	TYP. DIMENSION
⌒X'-X"	TYP. ARC DIMENSION
RX'	TYP. RADIUS
X°	TYP. ANGLE DIMENSION

LAYOUT NOTES

1. COORDINATE ALL LAYOUT ACTIVITIES WITH THE SCOPE OF WORK CALLED FOR BY DEMOLITION, GRADING, AND UTILITIES OPERATIONS ENCOMPASSED BY THIS CONTRACT. SET, PROTECT, AND REPLACE REFERENCE STAKES AS NECESSARY OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
2. ALL LINES AND GRADING WORK AS PER DRAWINGS AND SPECIFICATIONS SHALL BE LAID OUT BY A MASSACHUSETTS REGISTERED CIVIL ENGINEER OR LICENSED SURVEYOR ENGAGED BY THE GENERAL CONTRACTOR.
3. ALL LAYOUT LINES, OFFSETS, OR REFERENCES TO LOCATING OBJECTS ARE EITHER PARALLEL OR PERPENDICULAR UNLESS OTHERWISE DESIGNATED WITH ANGLE OFFSETS NOTED.
4. ALL PROPOSED SITE FEATURES SHALL BE LAID OUT AND STAKED FOR REVIEW AND APPROVAL BY THE OWNER'S REPRESENTATIVE PRIOR TO COMMENCEMENT OF INSTALLATION. ANY REQUIRED ADJUSTMENTS TO THE LAYOUT SHALL BE UNDERTAKEN AS DIRECTED AT NO ADDITIONAL COST TO THE OWNER.
5. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND GRADES ON THE GROUND AND REPORT ANY DISCREPANCIES IMMEDIATELY TO THE OWNER AND OWNER'S REPRESENTATIVE.
6. LAYOUT AND DIMENSIONS PROVIDED FOR BIDDING PURPOSED ONLY. CONTRACTOR SHALL COORDINATE WITH OWNER'S REPRESENTATIVE FOR FINAL LAYOUT AND DIMENSION PLAN.



1 WALLIS ST ENLARGEMENT PLAN

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

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W&S File No.:	

Drawing Title:

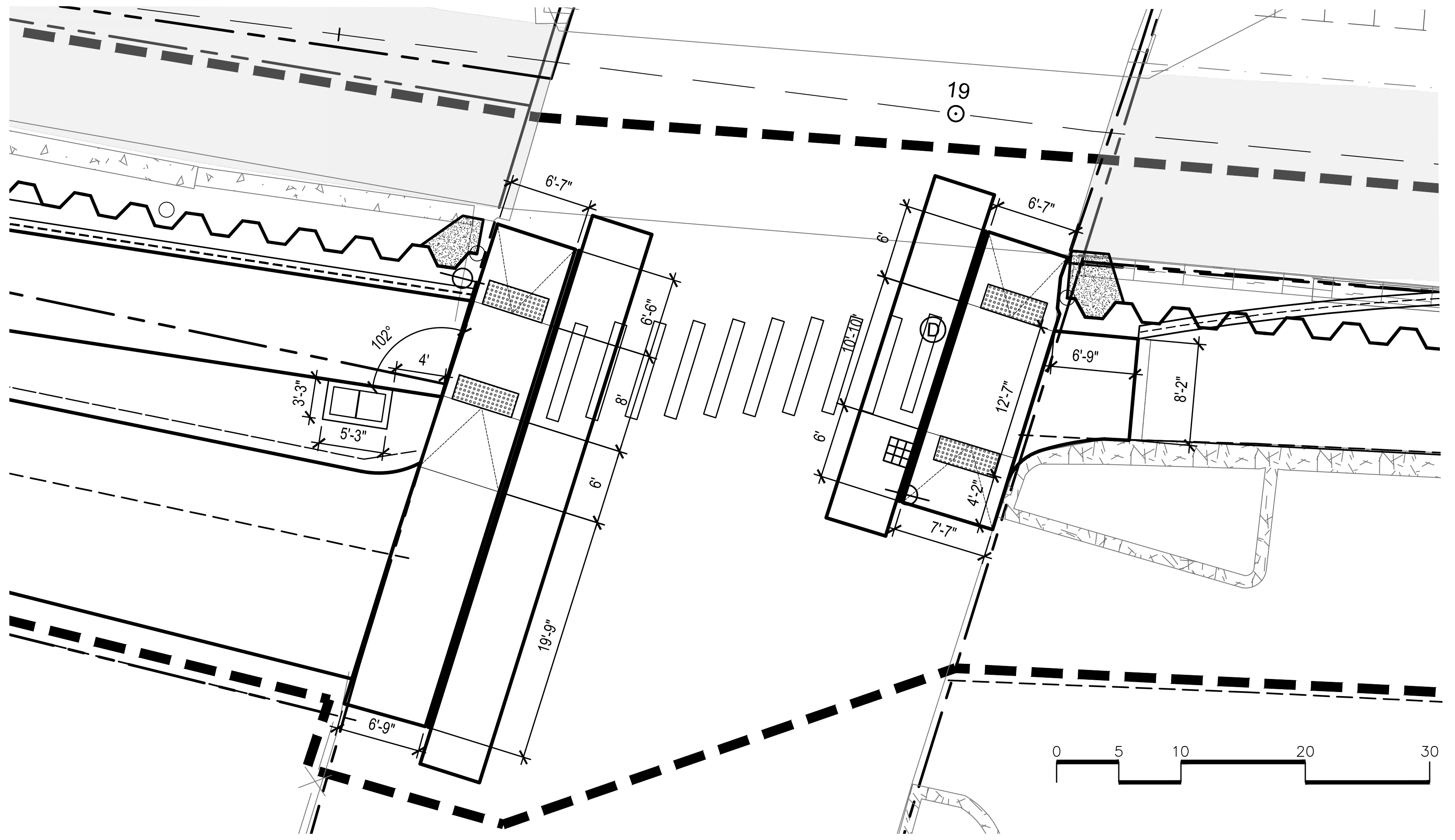
LAYOUT PLAN

Sheet Number:

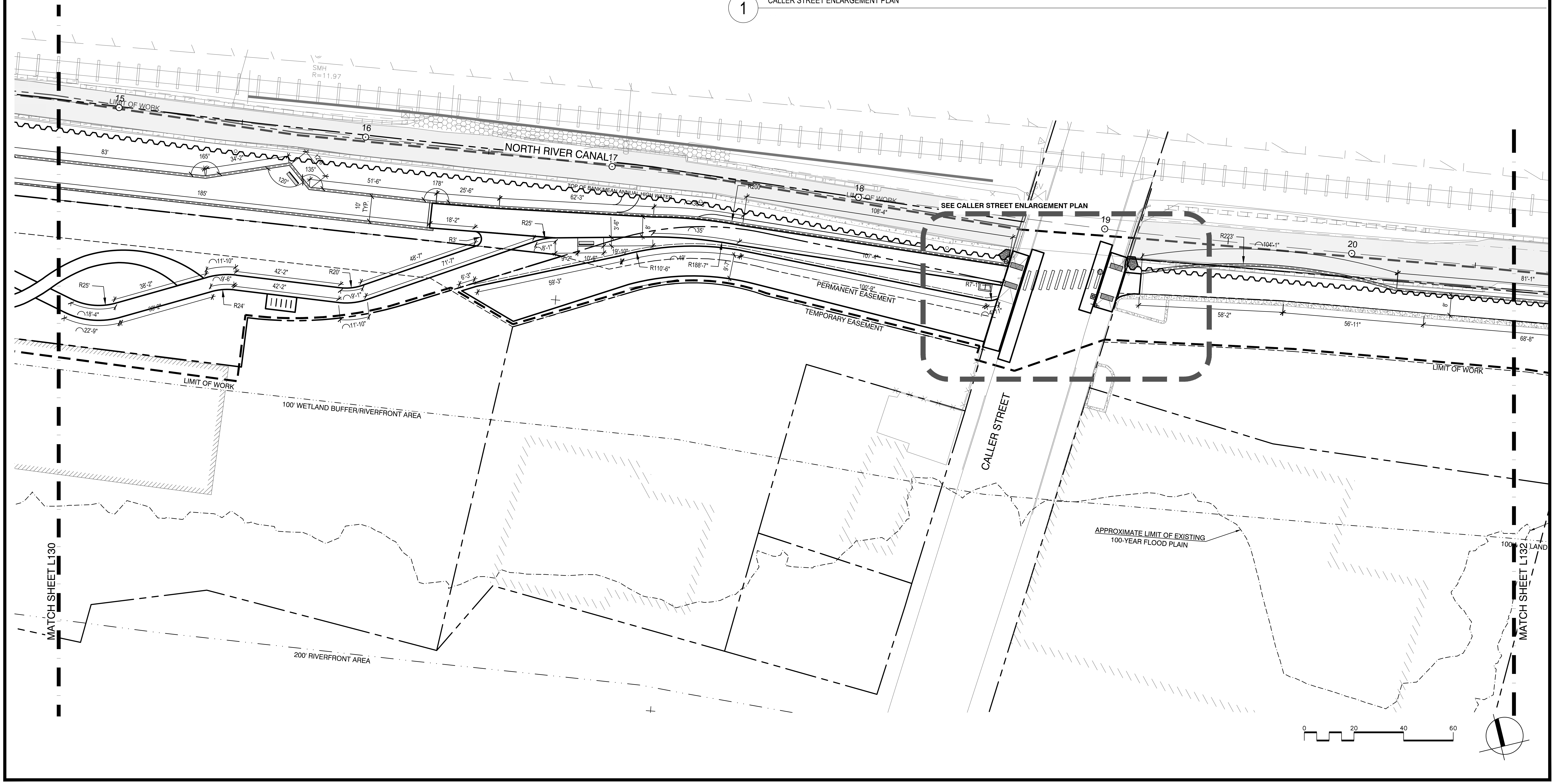
L130

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- CENTER LINE
- X'-X" TYP. DIMENSION
- X'-X" TYP. ARC DIMENSION
- RX' TYP. RADIUS
- X° TYP. ANGLE DIMENSION



1 CALLER STREET ENLARGEMENT PLAN



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Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
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HOWLEY STREET
PEABODY, MA. 01960

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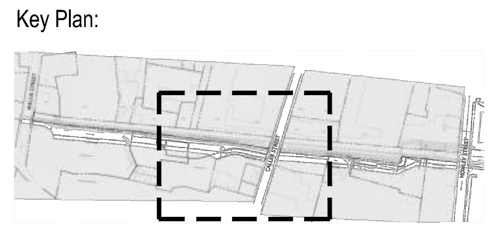
No.	Date	Description

Seal:

CHERILYN F. RUANE
NO. 1220

Key Plan:



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Drawing Title:

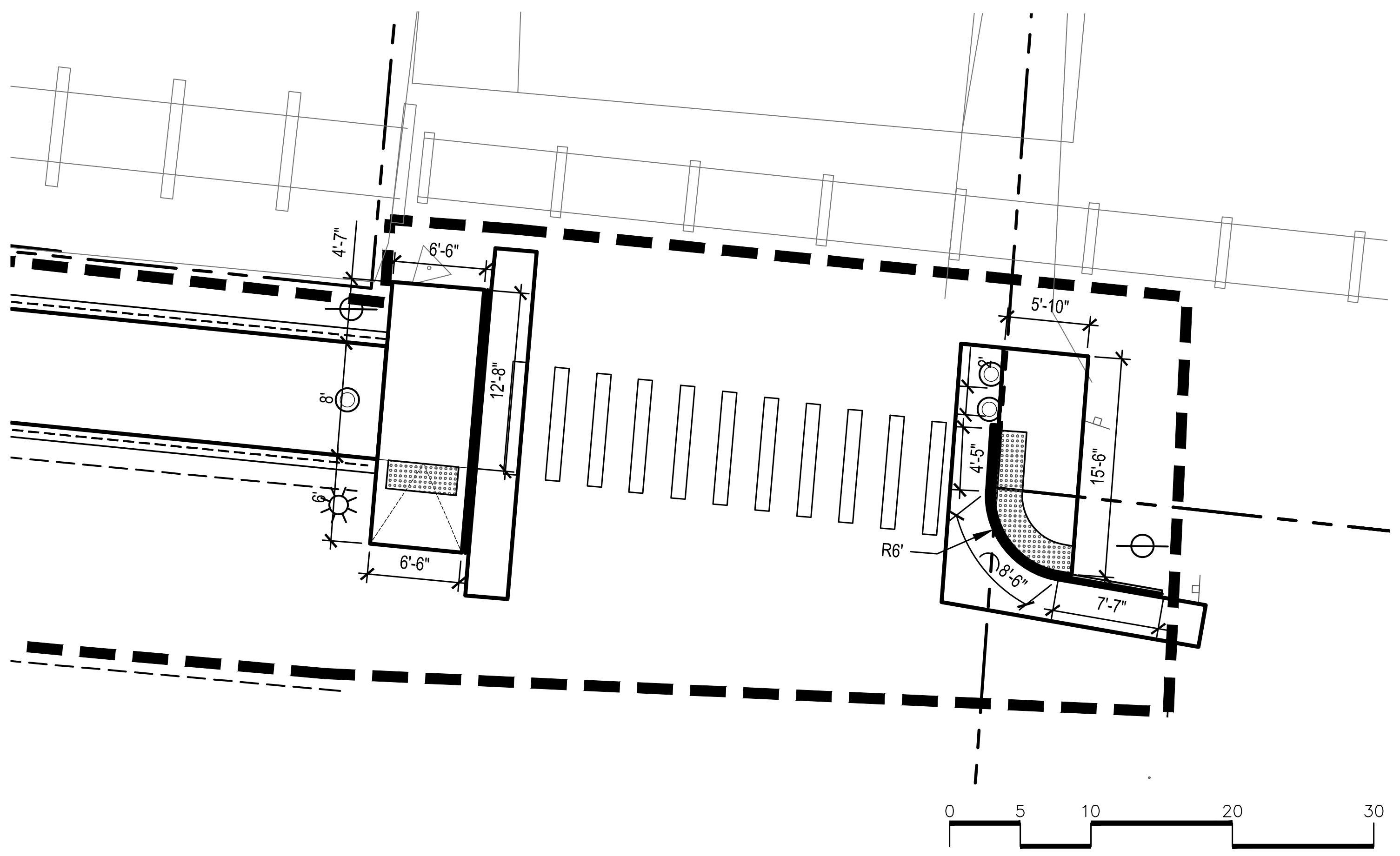
LAYOUT PLAN

Sheet Number:

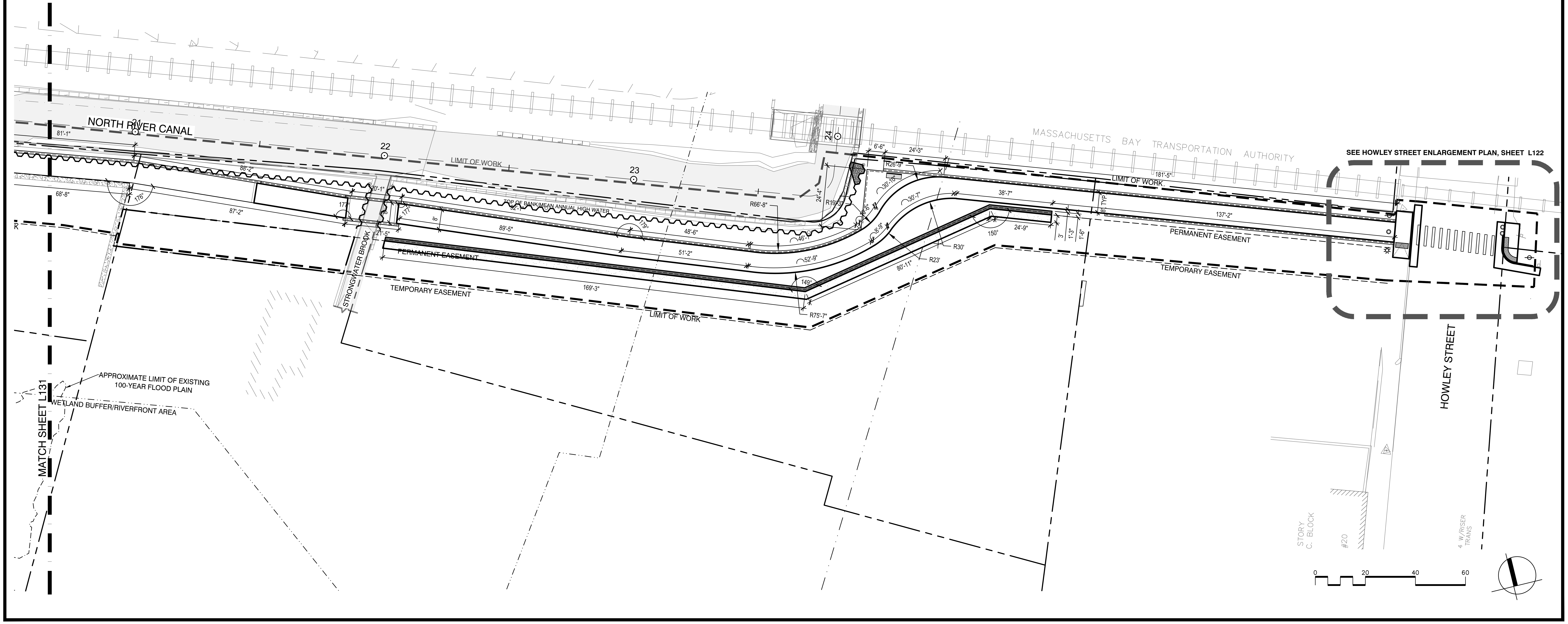
L131

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- CENTER LINE
- X'-X" TYP. DIMENSION
- X'-X" TYP. ARC DIMENSION
- RX' TYP. RADIUS
- X° TYP. ANGLE DIMENSION



1 HOWLEY STREET ENLARGEMENT PLAN



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Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
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PEABODY, MA. 01960

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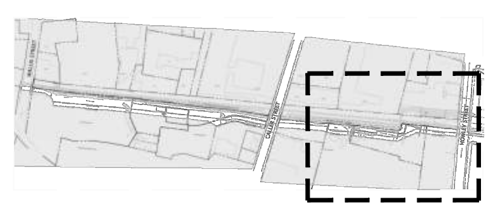

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LAYOUT PLAN

Sheet Number:

L132

LEGEND

PROPERTY LINE

LIMIT OF WORK

EASEMENTS

100' WETLAND BUFFER

100' RIVERFRONT PROTECTION AREA

APPROXIMATE LIMIT OF EXISTING
100-YEAR FLOOD PLAIN

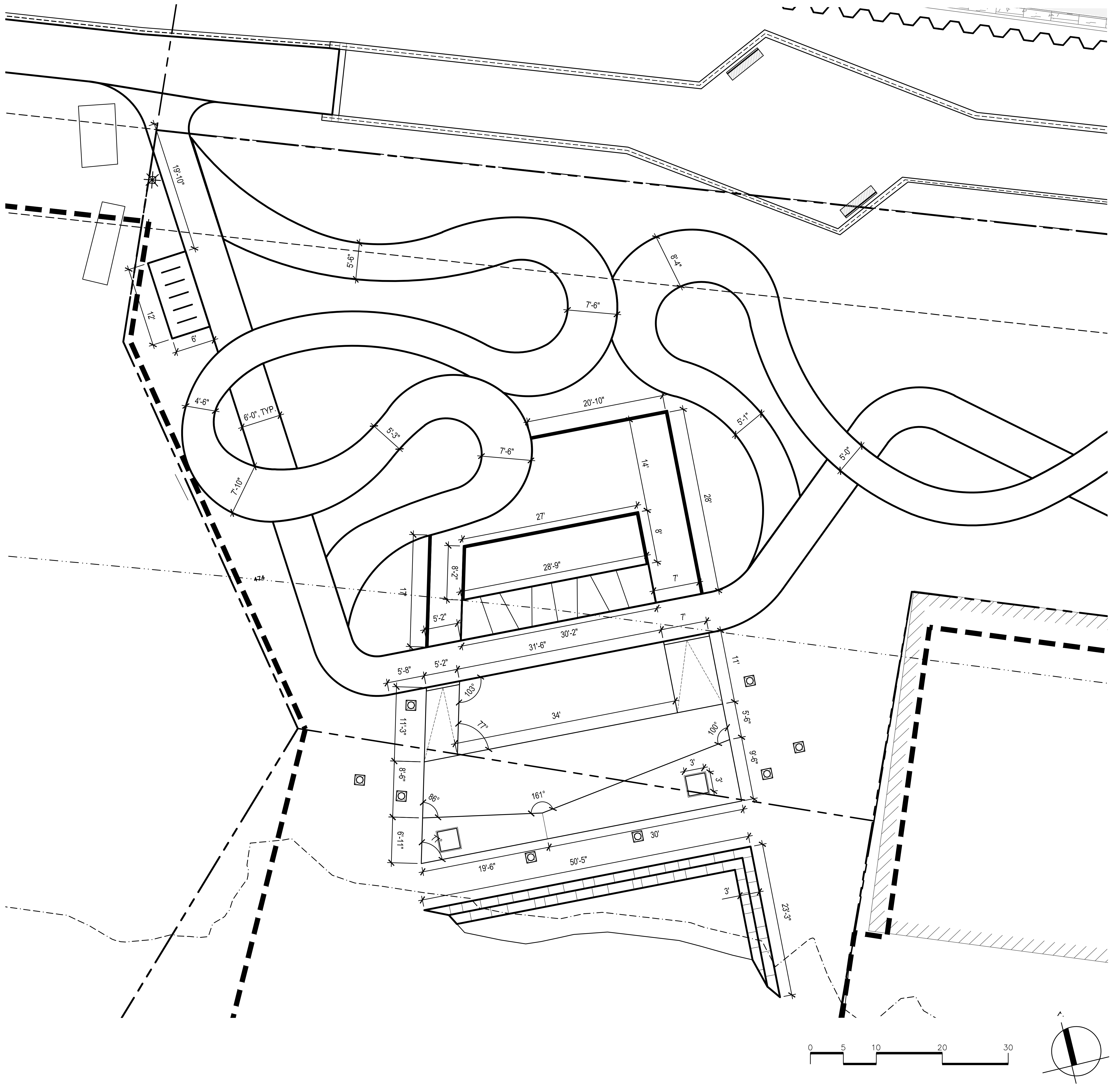
CENTER LINE

X'-X" TYP. DIMENSION

⌒X'-X" TYP. ARC DIMENSION

RX' TYP. RADIUS

X° TYP. ANGLE DIMENSION



1 24 CALLER STREET ENLARGEMENT PLAN

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

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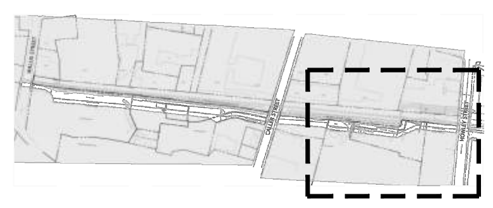
CHERILYN F. RUANE
NO. 1220

Key Plan:



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Drawing Title:

LAYOUT PLAN

Sheet Number:

L133

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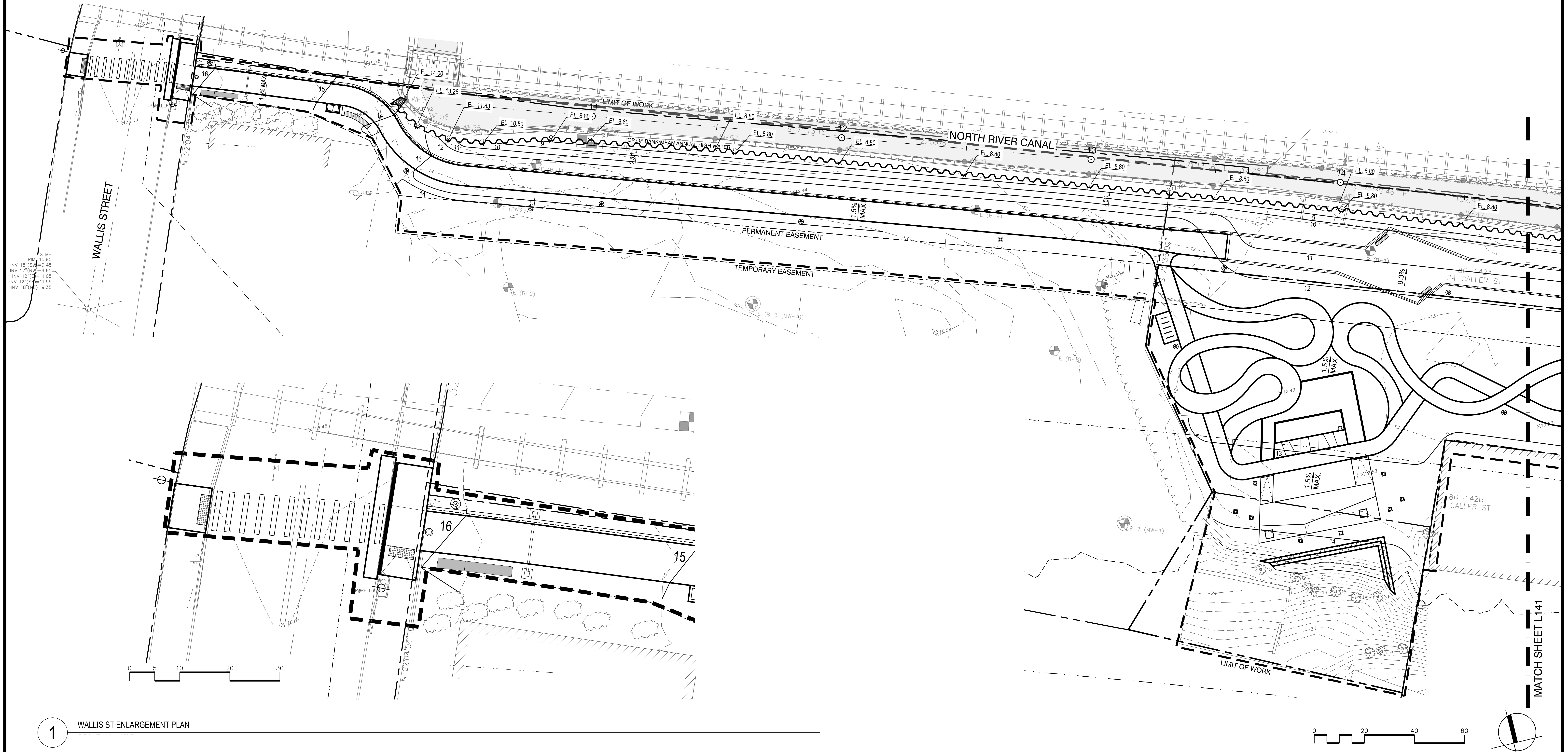
LEGEND

	PROPERTY LINE	14 15	PROPOSED CONTOURS
	LIMIT OF WORK	1.5%	PROPOSED SLOPE
	EASEMENTS	8.25	PROPOSED SPOT ELEVATION
	100' WETLAND BUFFER		
	200' RIVERFRONT PROTECTION AREA	HDPE PERF. DRAIN PIPE	HDPE PERFORATED DRAIN PIPE, DIAMETER VARIES
	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN		GRADE BREAK
⊞ Ⓓ	EXISTING DRAINAGE STRUCTURE. SEE UTILITIES PLAN	HP	HIGH POINT
		LP	LOW POINT
		TW	TOP OF WALL
		BW	BOTTOM OF WALL
12	EXISTING CONTOURS	EL	ELEVATION
95.10	EXISTING SPOT ELEVATION		

GRADING & DRAINAGE NOTES

1. ALL WORK RELATING TO INSTALLATION, RENOVATION OR MODIFICATION OF WATER, UTILITY STORMWATER DRAINAGE AND/OR SEPTIC UTILITIES SHALL BE PERFORMED IN ACCORDANCE WITH THE STANDARDS OF THE CITY, AND STATE OF MASSACHUSETTS.
2. THE CONTRACTOR SHALL VERIFY ALL GRADES ON THE GROUND AND REPORT ANY DISCREPANCIES IMMEDIATELY TO THE OWNER'S REPRESENTATIVE.
3. ALL GRADING IS TO BE SMOOTH AND CONTINUOUS WHERE PROPOSED SURFACE MEETS EXISTING SURFACE, BLEND THE TWO PAVEMENTS AND ELIMINATE ROUGH SPOTS AND ABRUPT GRADE CHANGES AND MEET LINE AND GRADE OF EXISTING CONDITIONS WITH NEW IMPROVEMENTS.
4. CONTRACTOR SHALL ENSURE ALL AREAS ARE PROPERLY PITCHED TO DRAIN, WITH NO SURFACE WATER PONDING OR PUDDLING.
5. ALL NEW WALKWAYS MUST CONFORM TO CURRENT AMERICANS WITH DISABILITIES ACT (ADA), AND MASSACHUSETTS ARCHITECTURAL ACCESS BOARD (MAAB) REGULATIONS: WALKWAYS SHALL MAINTAIN A CROSS PITCH OF NOT MORE THAN ONE AND A HALF (1.5%) PERCENT AND THE RUNNING SLOPE (PARALLEL TO THE DIRECTION OF TRAVEL) BETWEEN 1% MIN. AND 4.5% MAX. ANY DISCREPANCIES NOT ALLOWING THIS TO OCCUR SHALL BE REPORTED TO THE OWNER'S REPRESENTATIVE PRIOR TO CONTINUING WORK.
6. ALL UTILITY GRATES, COVERS OR OTHER SURFACE ELEMENTS INTENDED TO BE EXPOSED AT GRADE SHALL BE FLUSH WITH THE ADJACENT FINISHED GRADE AND ADJUSTED TO PROVIDE A SMOOTH TRANSITION AT ALL EDGES.
7. THE CONTRACTOR SHALL CONFIRM AND/OR SET SUBGRADE ELEVATIONS TO ALLOW FOR POSITIVE DRAINAGE AND PROVIDE EROSION CONTROL DEVICES, STRUCTURES, MATERIALS AND CONSTRUCTION METHODS TO DIRECT SILT MIGRATION AWAY FROM DRAINAGE AND OTHER UTILITY SYSTEMS, PUBLIC/PRIVATE STREETS AND WORK AREAS. CLEAN BASINS REGULARLY AND AT THE END OF THE PROJECT.
8. EXCAVATION REQUIRED WITHIN PROXIMITY OF KNOWN EXISTING UTILITY LINES SHALL BE DONE BY HAND. CONTRACTOR SHALL REPAIR ANY DAMAGE TO EXISTING UTILITY LINES OR STRUCTURES INCURRED DURING CONSTRUCTION OPERATIONS AT NO COST TO THE OWNER.
9. WHERE NEW EARTHWORK MEETS EXISTING EARTHWORK, CONTRACTOR SHALL BLEND NEW EARTHWORK SMOOTHLY INTO EXISTING, PROVIDING VERTICAL CURVES OR ROUNDS AT ALL TOP AND BOTTOM OF SLOPES.
10. WHERE A SPECIFIC LIMIT OF WORK LINE IS NOT OBVIOUS OR IMPLIED, BLEND GRADES TO EXISTING CONDITIONS WITHIN 5 FEET OF PROPOSED CONTOURS.
11. RESTORE ALL DISTURBED AREAS AND LIMITS OF ALL REMOVALS TO LOAM AND SEED UNLESS OTHERWISE NOTED.
12. SEE EARTHWORK SECTION OF SPECIFICATIONS FOR EXCAVATION AND FILLING PROCEDURES.



1 WALLIS ST ENLARGEMENT PLAN

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

WESTON & SAMPSON ENGINEERS, INC
85 DEVONSHIRE STREET, 3RD FLOOR
BOSTON, MA 02109
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Consultants:

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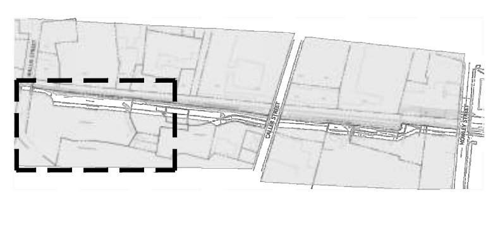
No.	Date	Description

Seal:

MASSACHUSETTS
CHERILYN F. ALIANO
NO. 1220
REGISTERED LANDSCAPE ARCHITECT

Key Plan:



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Approved By:	CFR
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

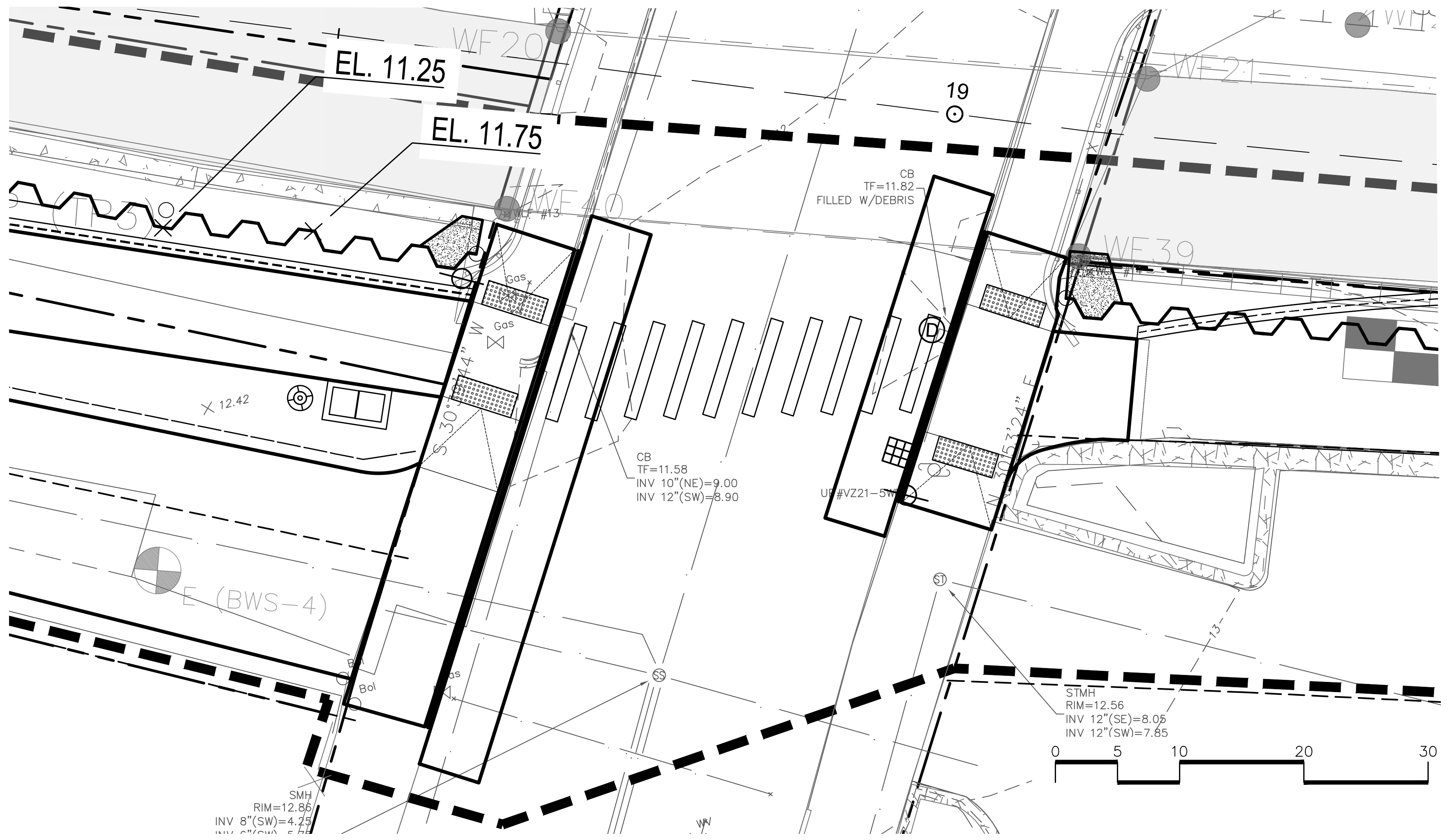
GRADING AND
DRAINAGE PLAN

Sheet Number:

L140

LEGEND

— – – —	PROPERTY LINE	14 / 15	PROPOSED CONTOURS
▬ ▬ ▬	LIMIT OF WORK	1.5% →	PROPOSED SLOPE
– – – –	EASEMENTS	×—8.25	PROPOSED SPOT ELEVATION
— · · — · · —	100' WETLAND BUFFER	HDPE PERF. DRAIN PIPE	HDPE PERFORATED DRAIN PIPE, DIAMETER VARIES
—— · · ——	200' RIVERFRONT PROTECTION AREA		
— – · — – · —	APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN	– – – – –	GRADE BREAK
⊞ Ⓓ	EXISTING DRAINAGE STRUCTURE. SEE UTILITIES PLAN	HP	HIGH POINT
		LP	LOW POINT
		TW	TOP OF WALL
		BW	BOTTOM OF WALL
		EL	ELEVATION
12	EXISTING CONTOURS		
95.10 +	EXISTING SPOT ELEVATION		



1 CALLER STREET ENLARGEMENT PLAN

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

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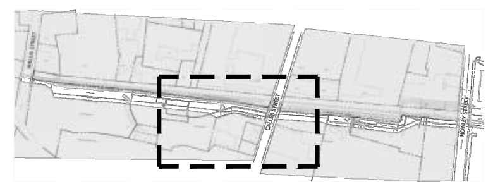

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W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

GRADING AND DRAINAGE PLAN

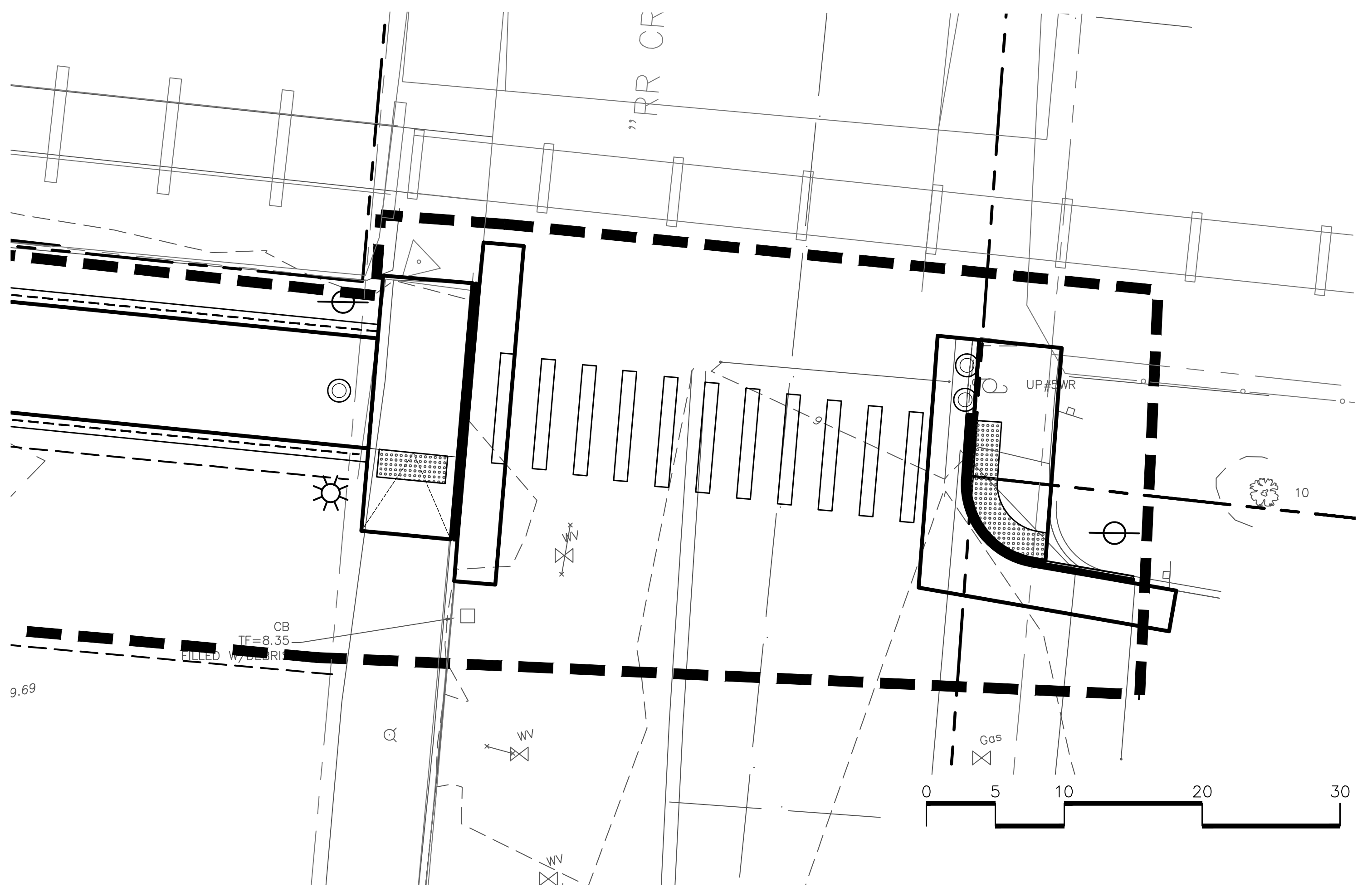
Sheet Number:

L141

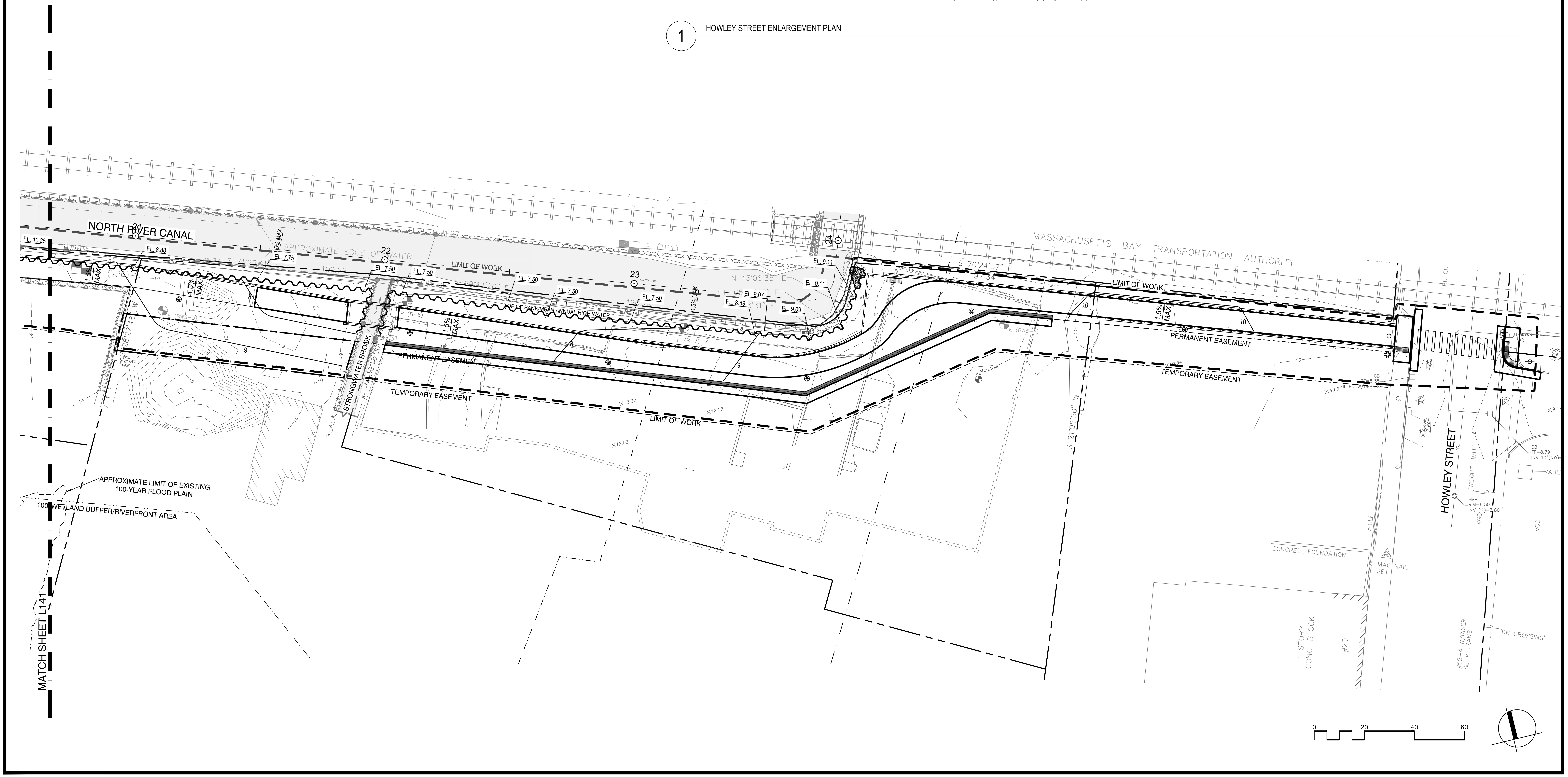
LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 200' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- EXISTING DRAINAGE STRUCTURE. SEE UTILITIES PLAN
- 12 — EXISTING CONTOURS
- 95.10 — EXISTING SPOT ELEVATION
- 14, 15 — PROPOSED CONTOURS
- 1.5% — PROPOSED SLOPE
- 8.25 — PROPOSED SPOT ELEVATION
- HDPE PERF. DRAIN PIPE — HDPE PERFORATED DRAIN PIPE, DIAMETER VARIES
- GRADE BREAK

HP	HIGH POINT
LP	LOW POINT
TW	TOP OF WALL
BW	BOTTOM OF WALL
EL	ELEVATION



1 HOWLEY STREET ENLARGEMENT PLAN



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Project:

PEABODY RIVERWALK
RIVERWALK PARK

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HOWLEY STREET
PEABODY, MA. 01960

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GRADING AND
DRAINAGE PLANS

Sheet Number:

L142

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- SHEET PILE WALL
- ▨ NO-MOW SEED MIX
- PROPOSED TREES
- PROPOSED SHRUBS

PLANT SCHEDULE L150

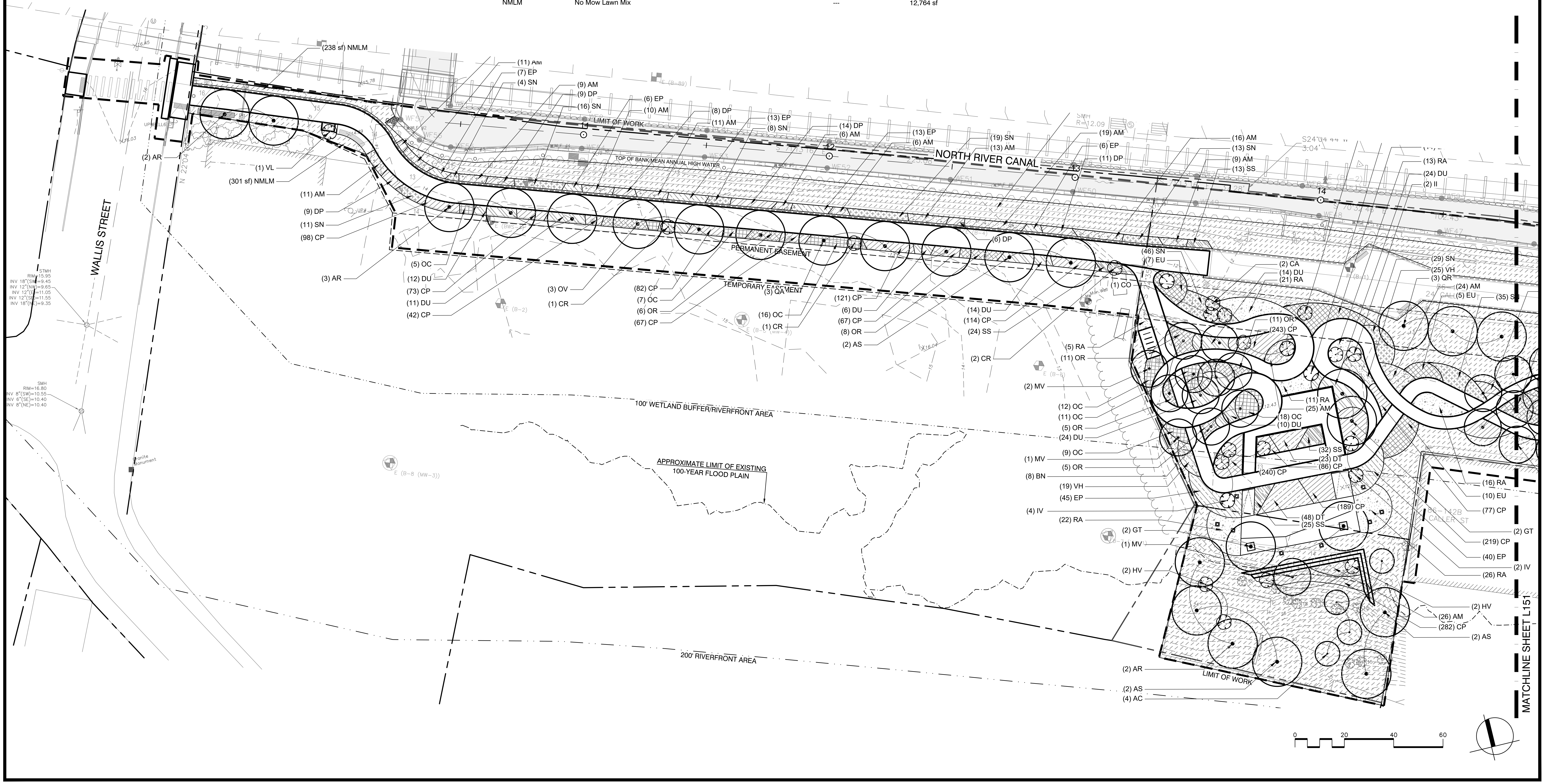
TREES	BOTANICAL NAME	COMMON NAME	SIZE	QTY
AR	Acer rubrum	Red Maple	3" Cal.	7
AS	Acer saccharum	Sugar Maple	---	6
AC	Amelanchier canadensis `Autumn Brilliance`	Autumn Brilliance Serviceberry	3" Cal.	4
BN	Betula nigra "Dura-Heat"	River Birch "Dura-Heat"	3" Cal.	8
BP	Betula papyrifera	Paper Birch	3" Cal.	2
GT	Gleditsia triacanthos	Honey Locust	---	4
MV	Magnolia virginiana	Sweet Bay	3" Cal.	4
OV	Ostrya virginiana	American Hophornbeam	3" Cal.	3
QA	Quercus alba	White Oak	3" Cal.	3
QR	Quercus rubra	Red Oak	---	3

SHRUBS	BOTANICAL NAME	COMMON NAME	SIZE	QTY
CO	Cephalanthus occidentalis	Buttonbush	#2 Pot	1
CA	Clethra alnifolia	Summersweet	#3 Pot	2
CR	Cornus racemosa	Gray Dogwood	#3 Pot	4
HV	Hamamelis virginiana	Common Witch Hazel	#3 Pot	4
IV	Ilex verticillata "Winter Red"	Winterberry "Winter Red"	#3 Pot	6
II	Itea virginica	Virginia Sweetspire	#2 Pot	5
VL	Viburnum lentago	Nannyberry	#3 Pot	2

SHRUB AREAS	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
RA	Rhus aromatica "Gro-Low"	Fragrant Sumac "Gro-Low"	#3 Pot	36" o.c.	114

GROUND COVERS	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
AM	Achillea millefolium	Common Yarrow	1 gal.	24" o.c.	196
CP	Carex pensylvanica		---	10" o.c.	2,207
DP	Dalea purpurea		---	24" o.c.	61
DU	Dennstaedtia punctilobula	Hay-scented Fern	---	30" o.c.	124
DT	Deschampsia cespitosa	Tufted Hair Grass	---	24" o.c.	71
EP	Echinacea purpurea	Coneflower	---	24" o.c.	130
EU	Eutrochium purpureum		---	48" o.c.	36
OC	Osmunda cinnamomea		---	30" o.c.	82
OR	Osmunda regalis		---	36" o.c.	55
SS	Schizachyrium scoparium	Little Bluestem	---	18" o.c.	94
SN	Solidago nemoralis		---	24" o.c.	181
VH	Verbena hastata	Blue Vervain	---	24" o.c.	44

SEEDING	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	QTY
NMLM	No Mow Lawn Mix		---		12,764 sf



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RIVERWALK PARK

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Consultants:

Revisions:

No.	Date	Description

Seal:

NO. 1220

Key Plan:

Issued For:

75% PERMITTING SET
- NOT FOR CONSTRUCTION -

Date:	APRIL 2021
Drawn By:	SG
Reviewed By:	CC
Approved By:	
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

PLANTING PLAN

Sheet Number:

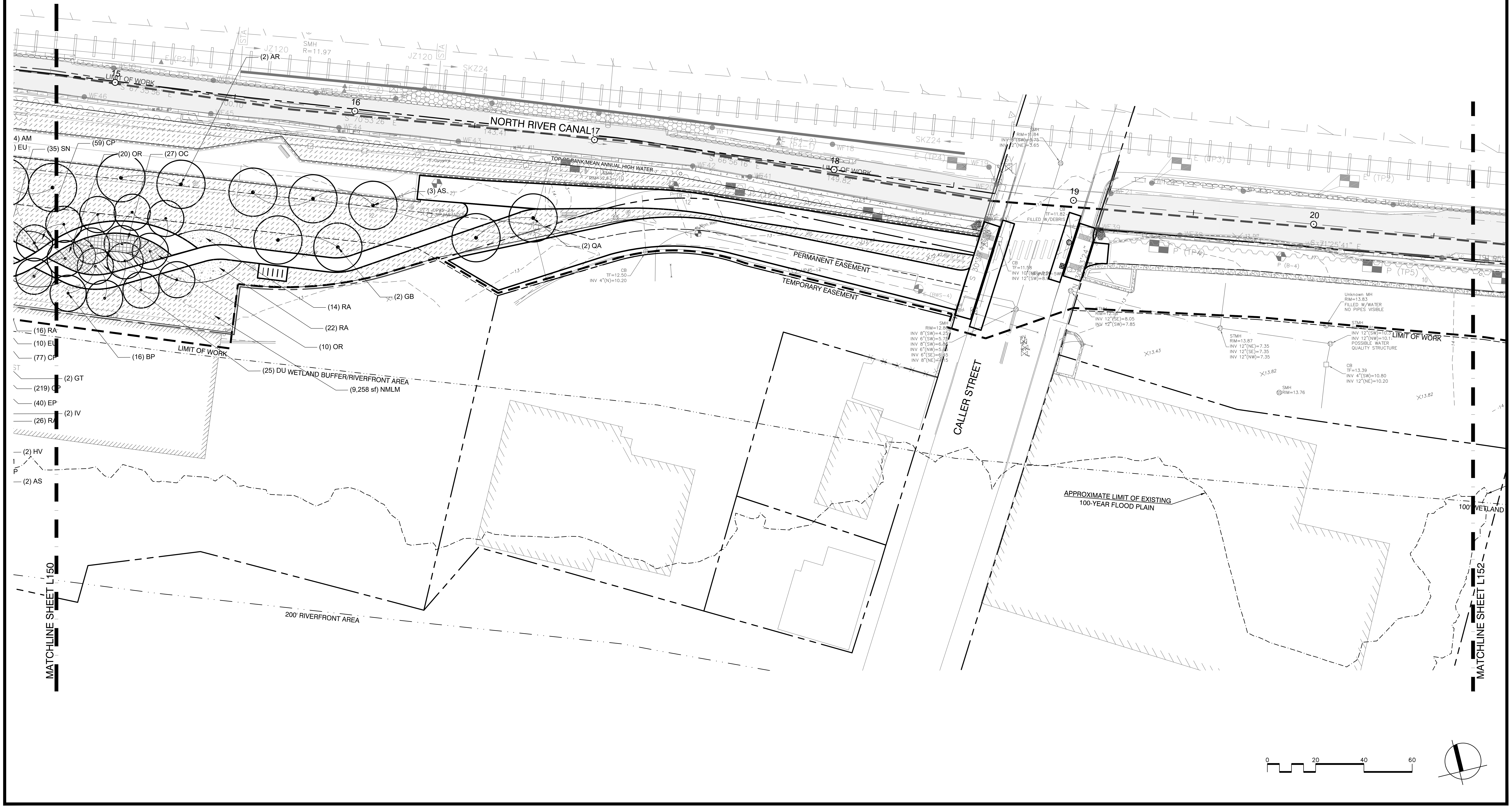
L150

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- EASEMENTS
- 100' WETLAND BUFFER
- 100' RIVERFRONT PROTECTION AREA
- APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
- SHEET PILE WALL
- ▨ NO-MOW SEED MIX
- PROPOSED TREES
- PROPOSED SHRUBS

PLANT SCHEDULE L151

TREES	BOTANICAL NAME	COMMON NAME	SIZE		QTY
AR	Acer rubrum	Red Maple	3" Cal.		2
AS	Acer saccharum	Sugar Maple	---		3
BP	Betula papyrifera	Paper Birch	3" Cal.		14
GB	Ginkgo biloba	Maidenhair Tree	3" Cal.		2
QA	Quercus alba	White Oak	3" Cal.		2
SHRUB AREAS	**BOTANICAL NAME**	**COMMON NAME**	**SIZE**	**SPACING**	**QTY**
RA	Rhus aromatica "Gro-Low"	Fragrant Sumac "Gro-Low"	#3 Pot	36" o.c.	36
GROUND COVERS	**BOTANICAL NAME**	**COMMON NAME**	**SIZE**	**SPACING**	**QTY**
DU	Dennstaedtia punctilobula	Hay-scented Fern	---	30" o.c.	25
OC	Osmunda cinnamomea		---	30" o.c.	27
OR	Osmunda regalis		---	36" o.c.	30
SEEDING	**BOTANICAL NAME**	**COMMON NAME**	**SIZE**	**SPACING**	**QTY**
NMLM	No Mow Lawn Mix		---		8,777 sf



Project:

PEABODY RIVERWALK
RIVERWALK PARK

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PEABODY, MA, 01960

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PLANTING PLAN

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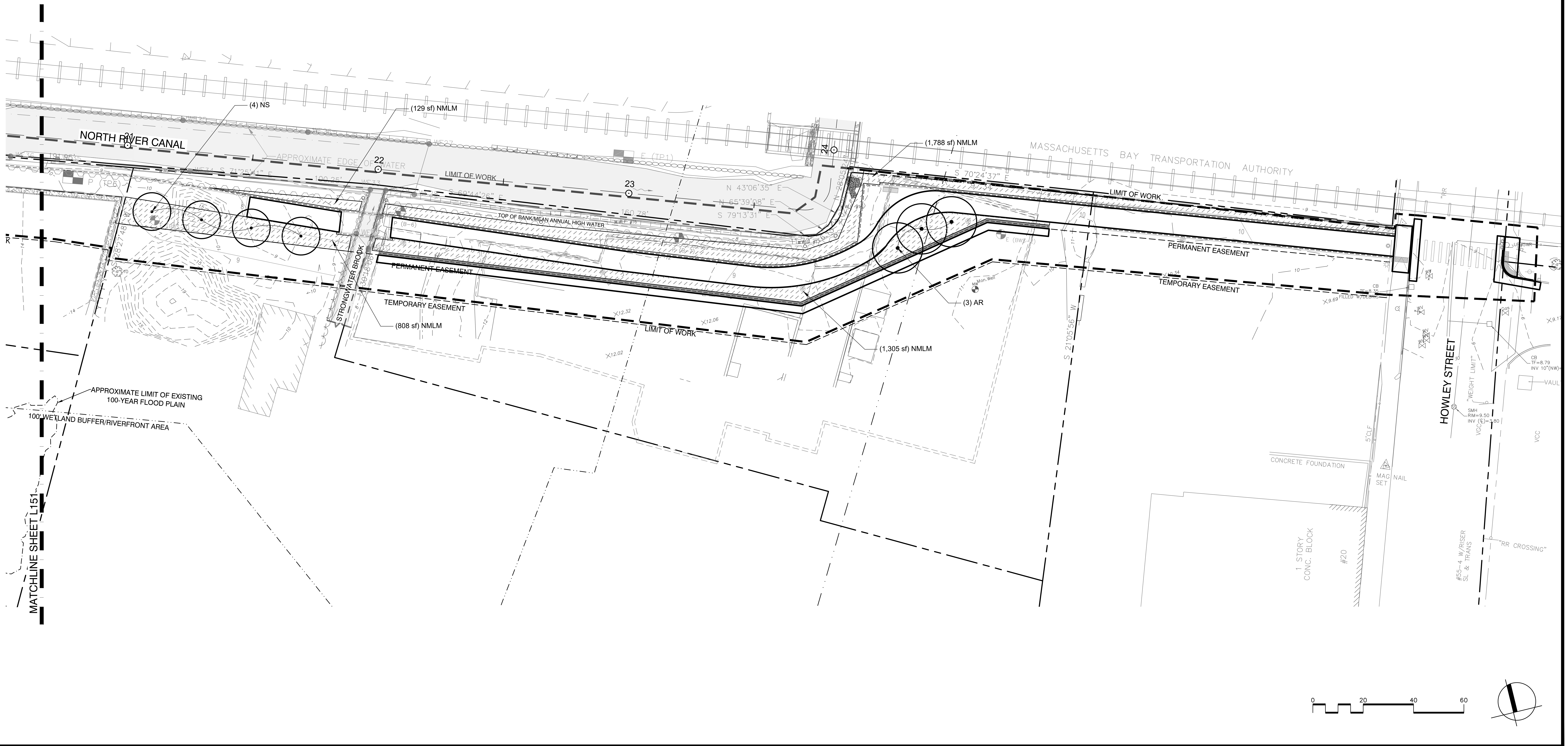
L151

LEGEND

PROPERTY LINE
LIMIT OF WORK
EASEMENTS
100' WETLAND BUFFER
100' RIVERFRONT PROTECTION AREA
APPROXIMATE LIMIT OF EXISTING 100-YEAR FLOOD PLAIN
SHEET PILE WALL
▨ NO-MOW SEED MIX
PROPOSED TREES
PROPOSED SHRUBS

PLANT SCHEDULE L152

TREES	BOTANICAL NAME	COMMON NAME	SIZE		QTY
AR	Acer rubrum	Red Maple	3" Cal.		3
NS	Nyssa sylvatica	Sour Gum	3" Cal.		4
SEEDING	**BOTANICAL NAME**	**COMMON NAME**	**SIZE**	**SPACING**	**QTY**
NMLM	No Mow Lawn Mix		---		4,031 sf



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CHERILYN F. RUANE
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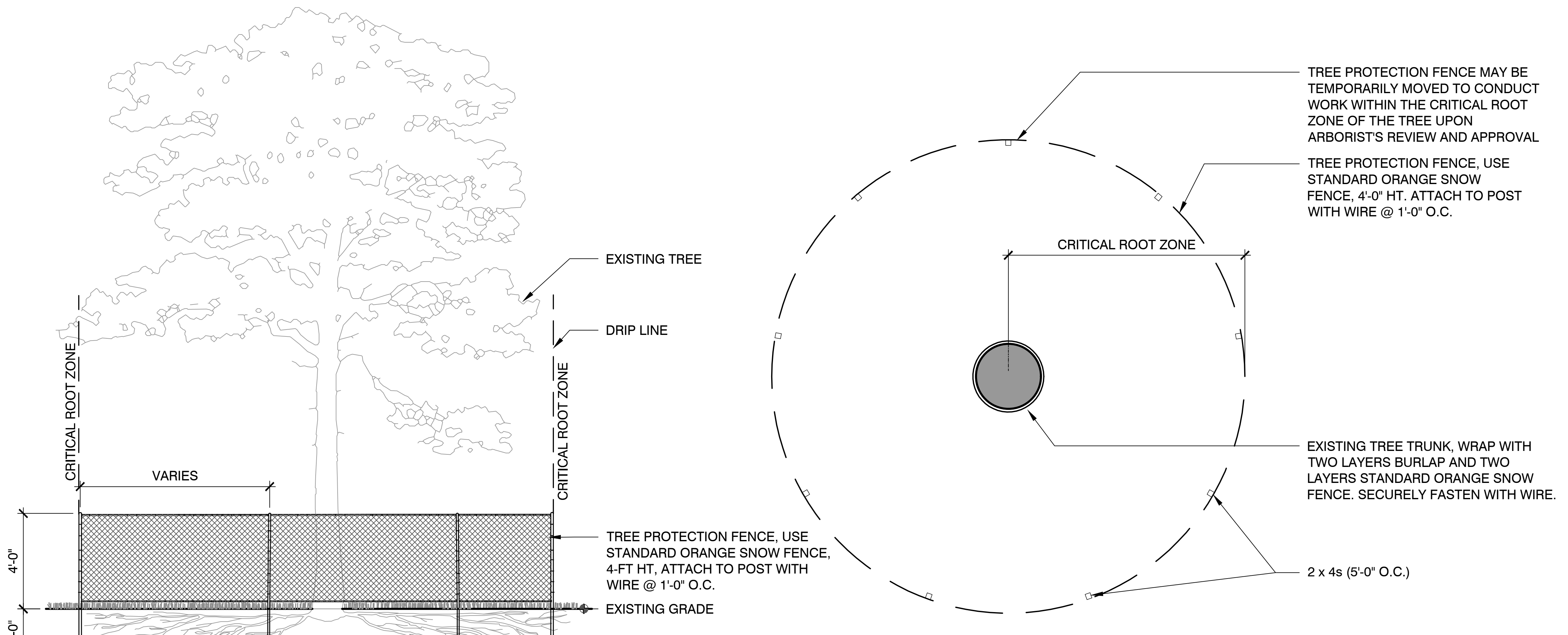
PLANTING PLAN

Sheet Number:

L152

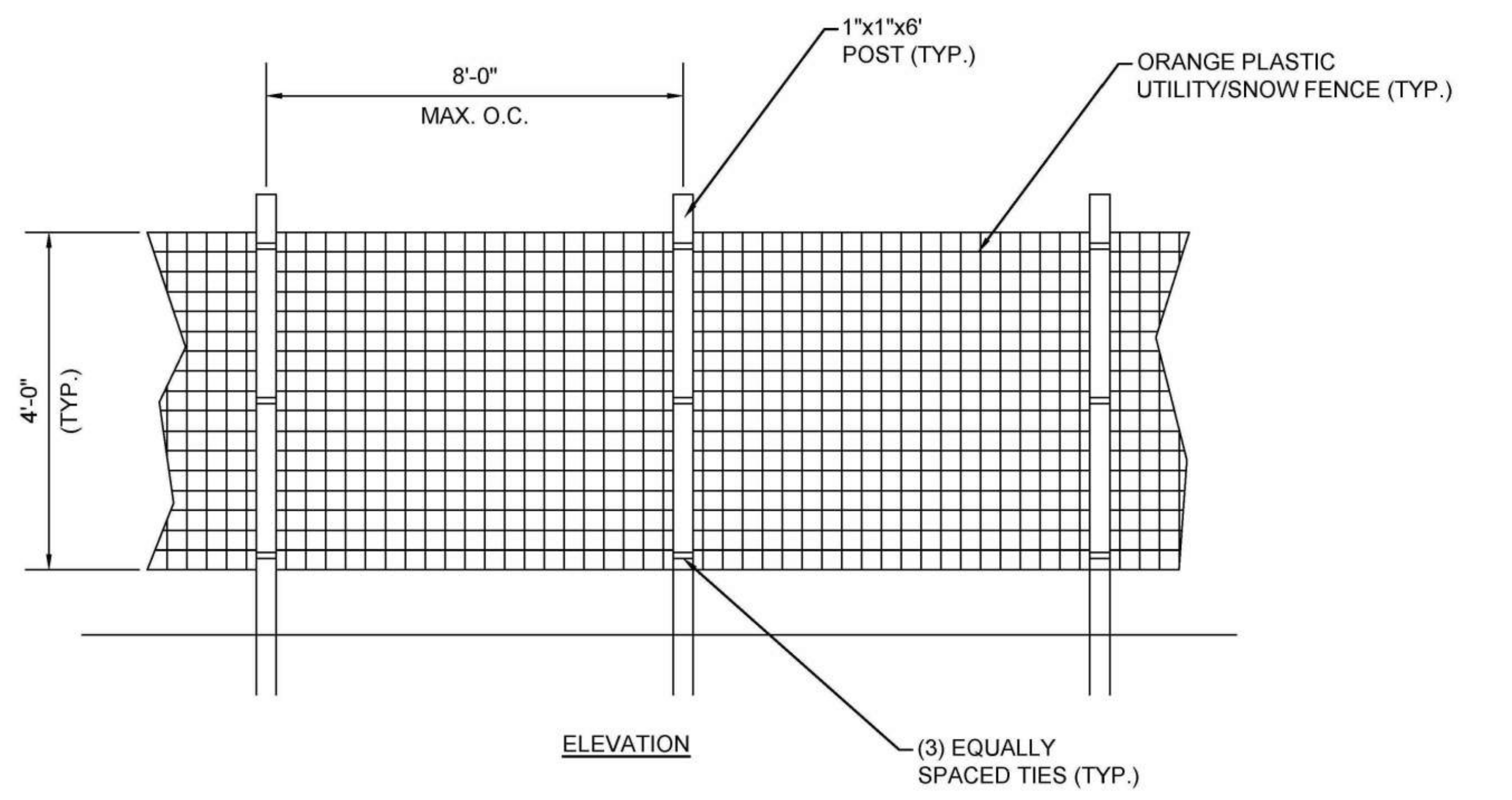


NOTES:

1. WHERE SPACE IS AVAILABLE, TREE PROTECTION FENCE TO BE PLACED A MINIMUM OF 10'-0" FROM BASE OF TREE. ADD AN ADDITIONAL 1'-0" FOR EACH ADDITIONAL DBH INCH FOR TREES GREATER THAN 10" DBH (DIA. AT BREAST HT.).
2. ALL WORK DONE WITHIN TREE PROTECTION FENCE IS TO BE DONE BY HAND AND WITH LIGHT EQUIPMENT.
3. ROOTS EXPOSED DURING EXCAVATION SHALL BE NEATLY CUT AND COVERED WITH SOIL IMMEDIATELY.
4. FOR TREES THAT OCCUR IN GROUPS, PROVIDE TREE PROTECTION FENCE AROUND ENTIRE AREA.
5. MAINTAIN FENCE PROTECTION IN SOUND CONDITION UNTIL CONSTRUCTION COMPLETION.
6. A CERTIFIED ARBORIST SHALL DELINEATE LIMIT OF TREE PROTECTION FENCE AS IT RELATES TO THE LIMITS OF THE CRITICAL ROOT ZONE.
7. CRITICAL ROOT ZONE TO BE PROTECTED. ALL WORK NECESSARY WITHIN THE CRITICAL ROOT ZONE SHALL BE PERFORMED BY HAND.

1 TREE PROTECTION

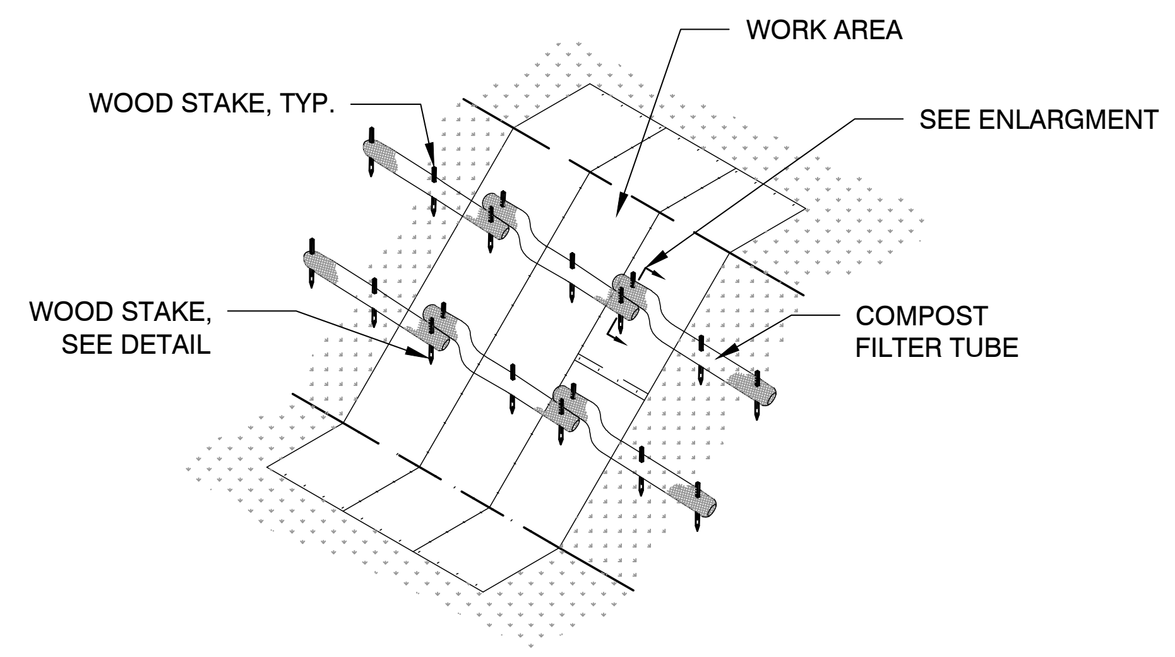
SCALE: N.T.S.



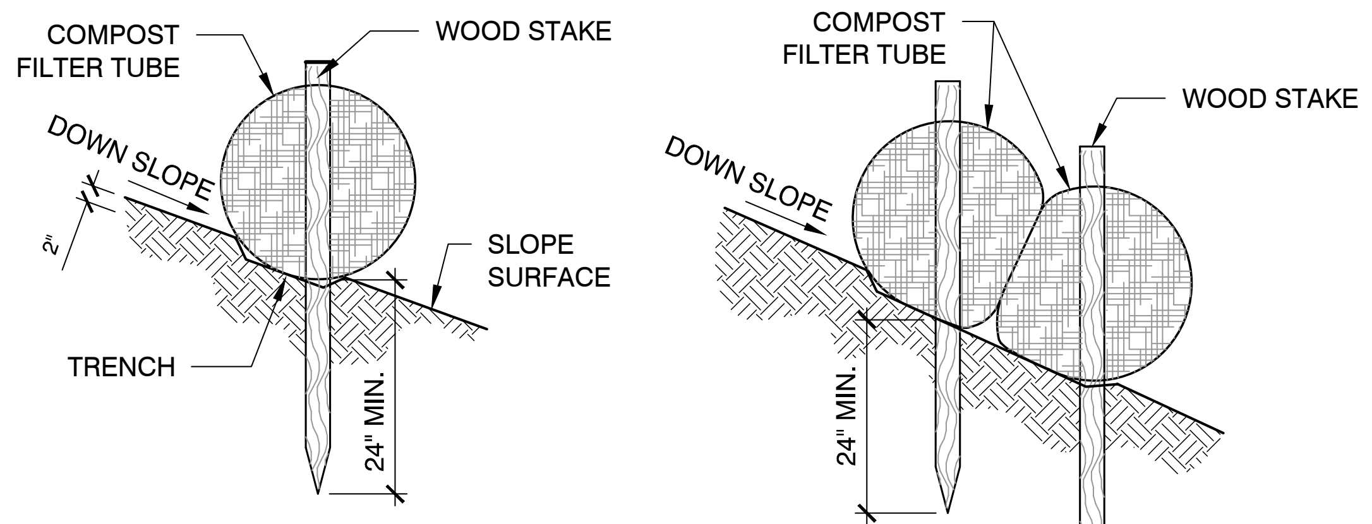
ELEVATION

2 TEMPORARY CONSTRUCTION FENCE

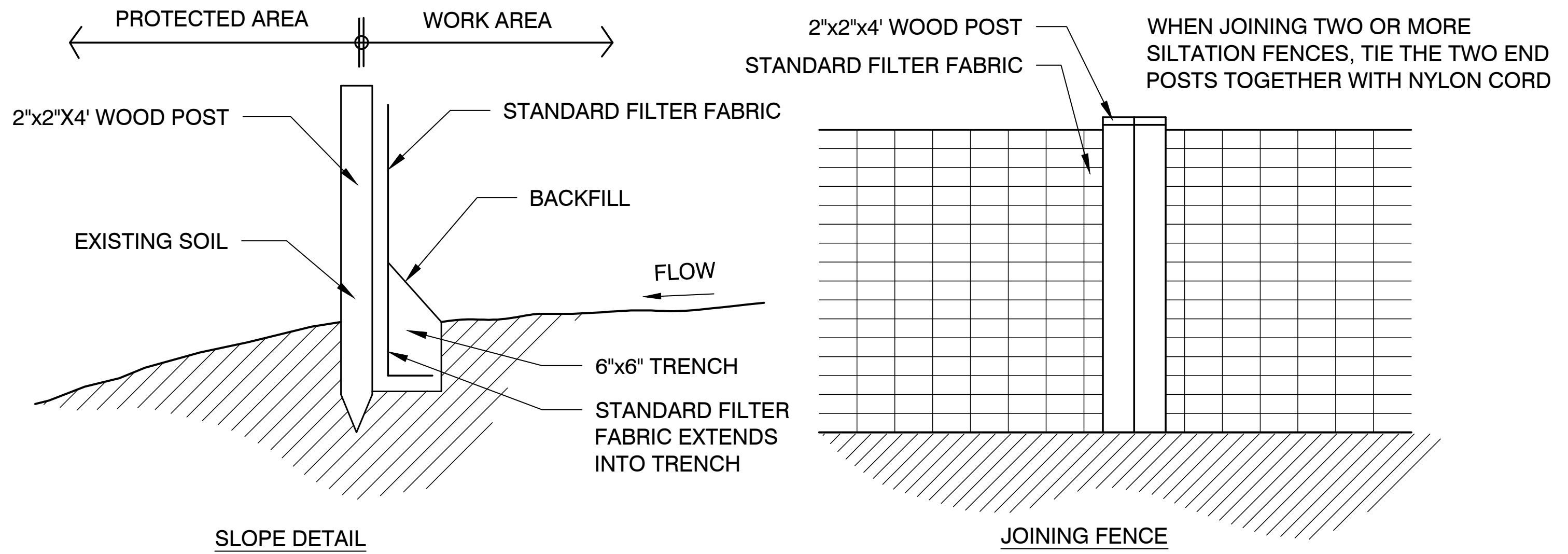
SCALE: N.T.S.



COMPOST FILTER TUBE LAYOUT ON SLOPE



COMPOST FILTER TUBE STAKING DETAILS

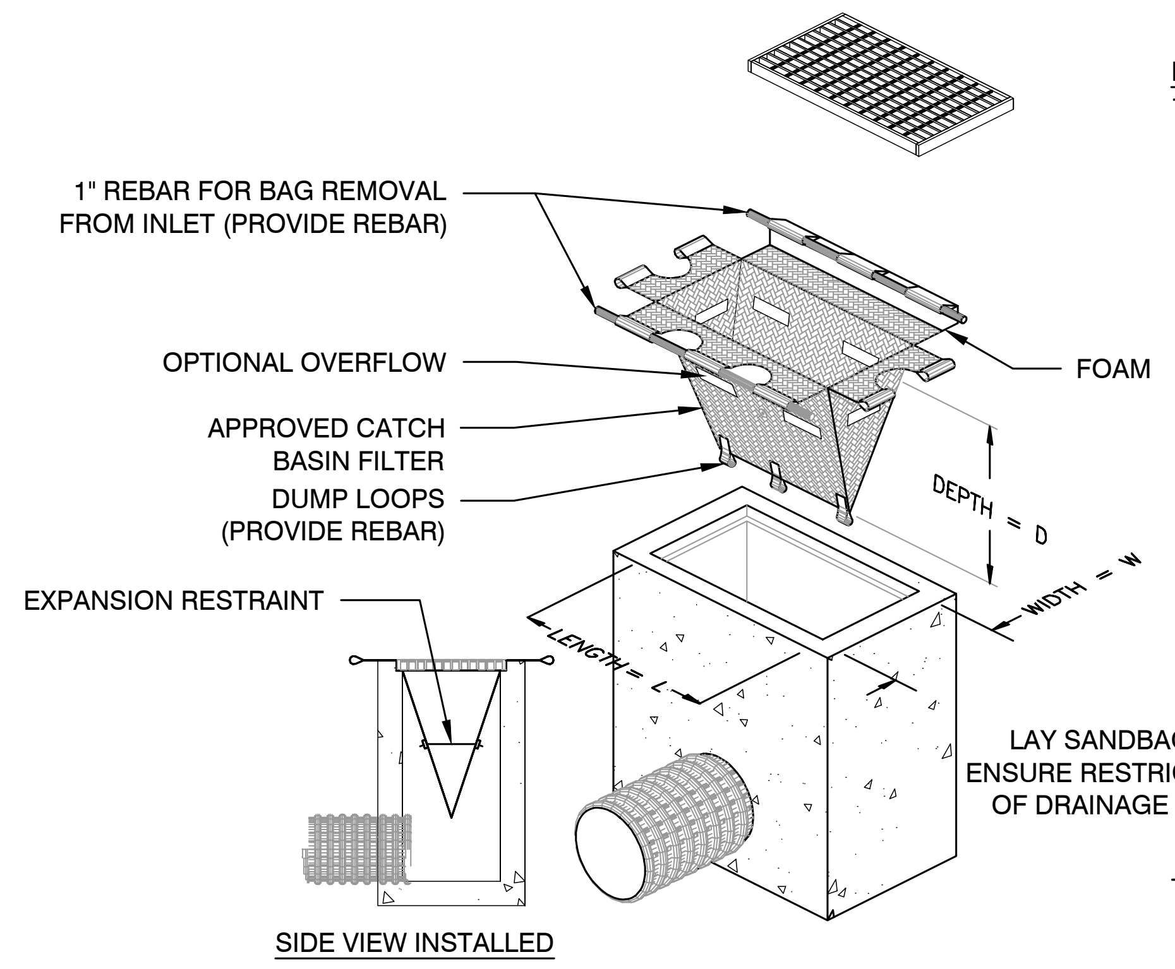


SLOPE DETAIL

JOINING FENCE

3 EROSION CONTROL - COMPOST FILTER TUBE

SCALE: N.T.S.

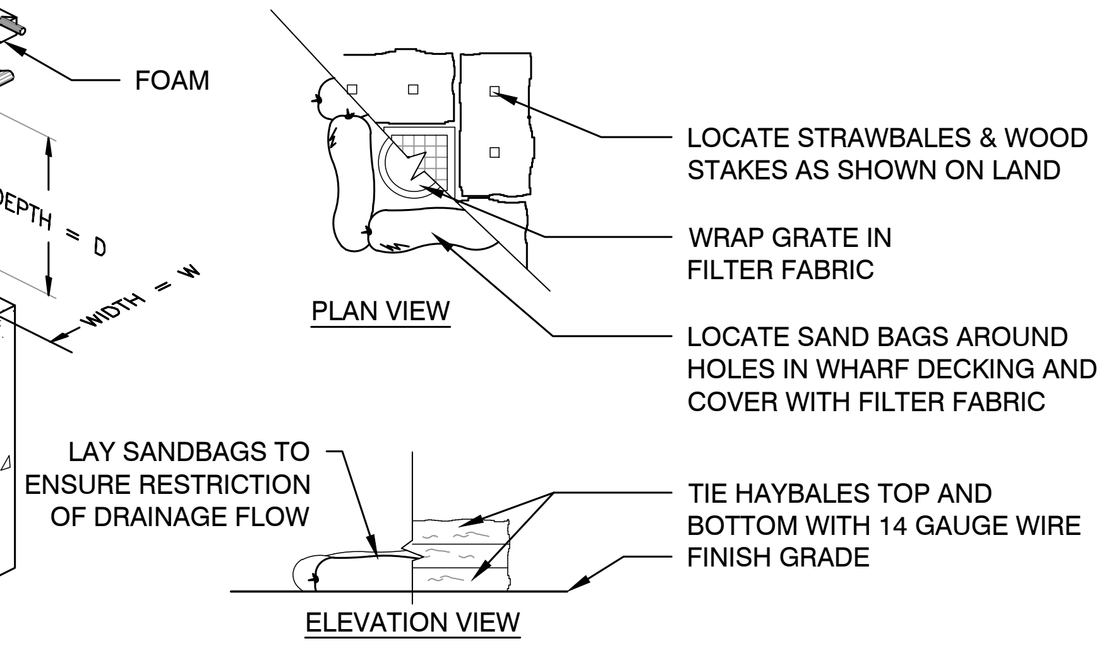


SIDE VIEW INSTALLED

INSTALLATION IN PAVED AREAS

NOTES:

1. HAYBALE/SANDBAG PROTECTION OR CATCH BASIN FILTER FOR PAVED AREAS SHALL BE PROVIDED FOR ALL DRAINAGE STRUCTURES WITHIN THE LIMIT OF WORK AND ANY STRUCTURES OUTSIDE THE PROJECT TERMINII THAT ARE AFFECTED BY CONSTRUCTION.



PLAN VIEW

ELEVATION VIEW

INSTALLATION IN GRASS AREAS

4 INLET SEDIMENT CONTROL

SCALE: N.T.S.

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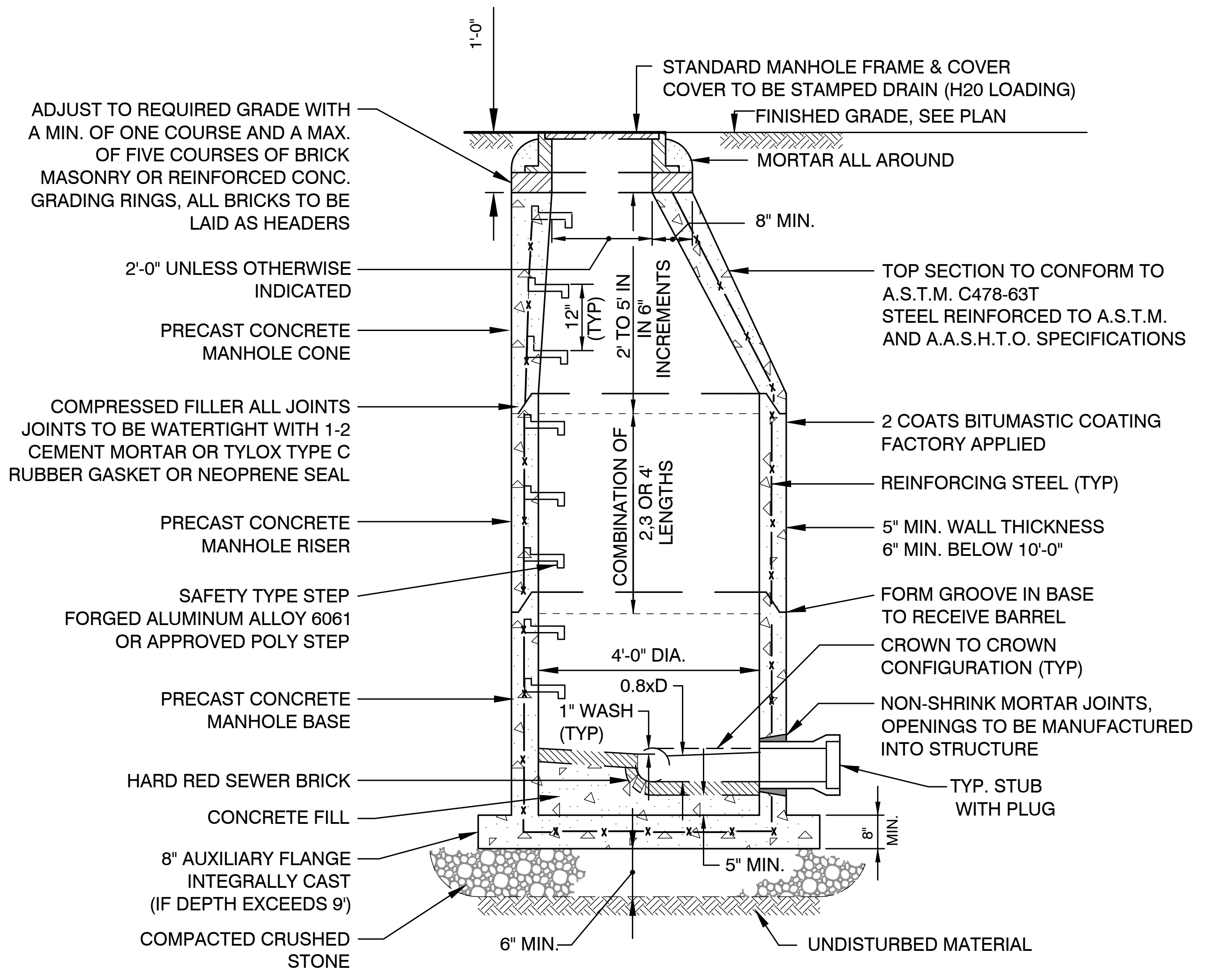
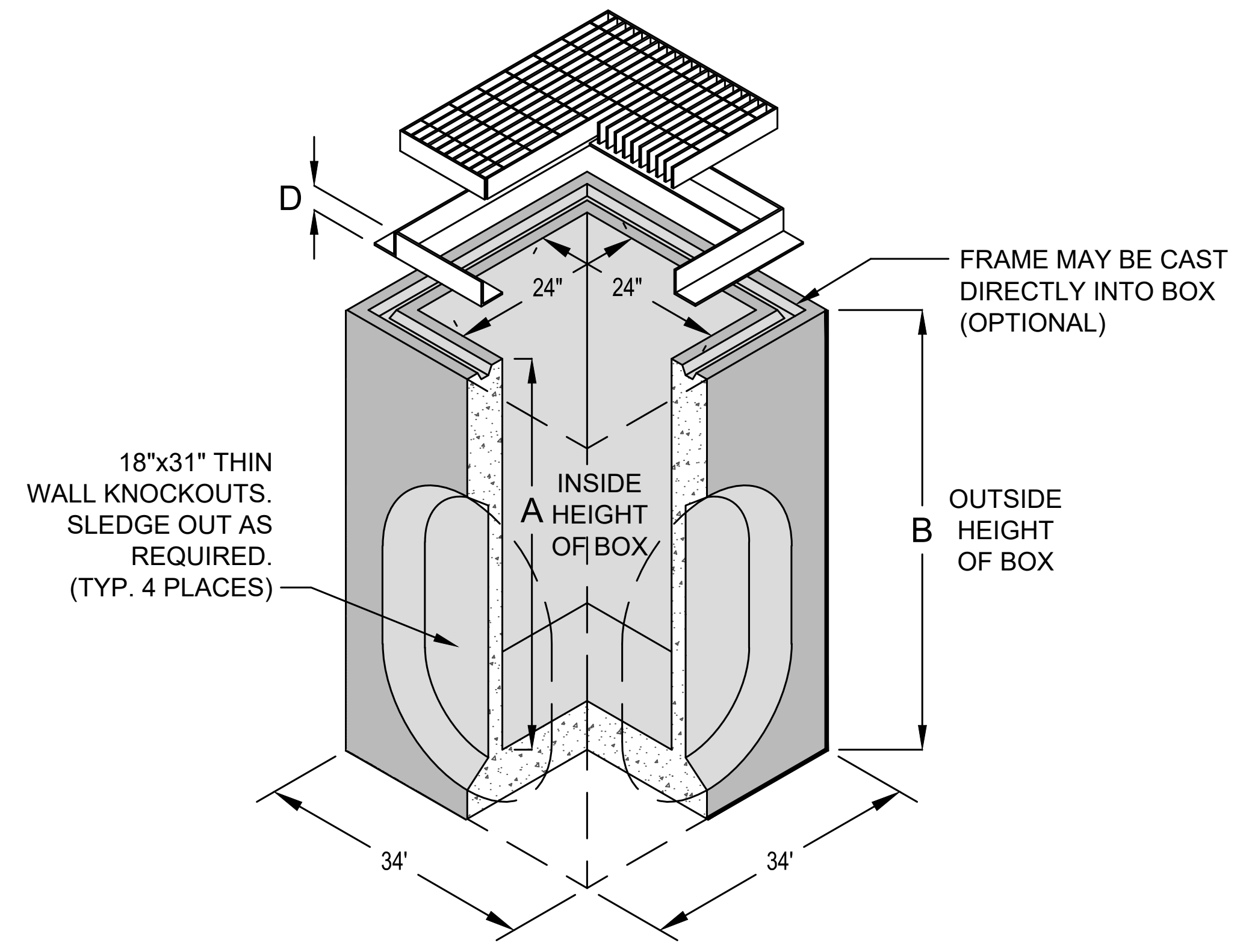


1 DRAIN MANHOLE

SCALE: N.T.S.



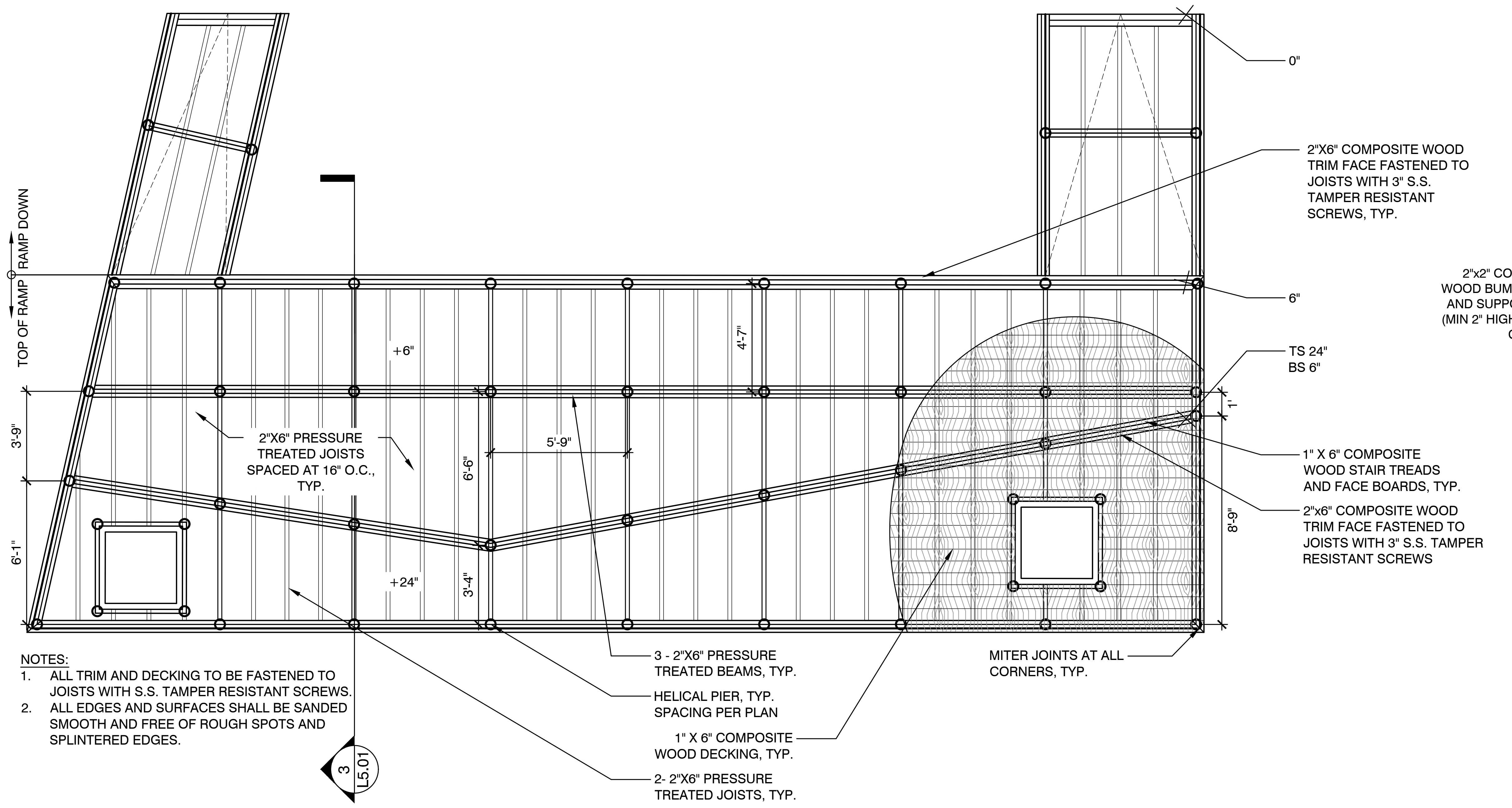
DROP INLET			
MODEL NO.	A	B	* WEIGHT
DI242436	36"	42"	1900 LBS.

* BOX ONLY

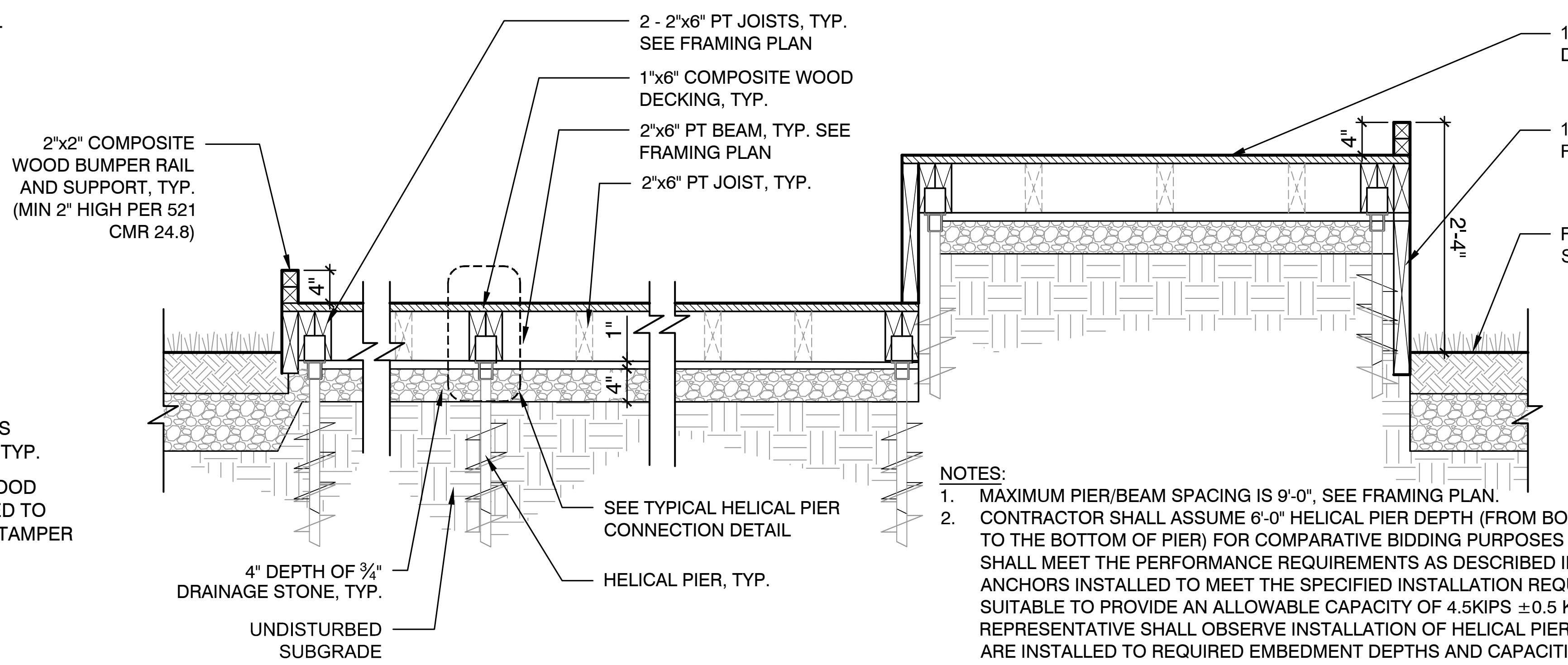
FRAME AND GRATE			
MODEL NO.	RATING	D	WEIGHT
SG2424-DIT	TRAFFIC	3"	120 LBS.

2 DROP INLET

SCALE: N.T.S.

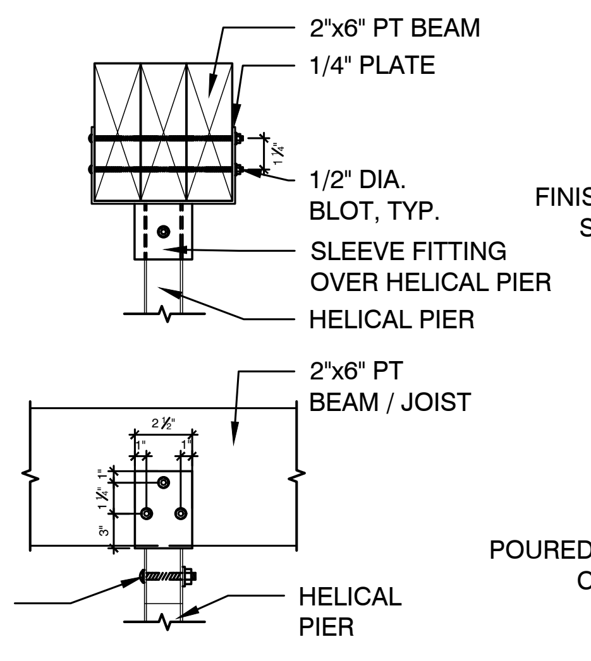


NOTES:
1. ALL TRIM AND DECKING TO BE FASTENED TO JOISTS WITH S.S. TAMPER RESISTANT SCREWS.
2. ALL EDGES AND SURFACES SHALL BE SANDED SMOOTH AND FREE OF ROUGH SPOTS AND SPLINTERED EDGES.

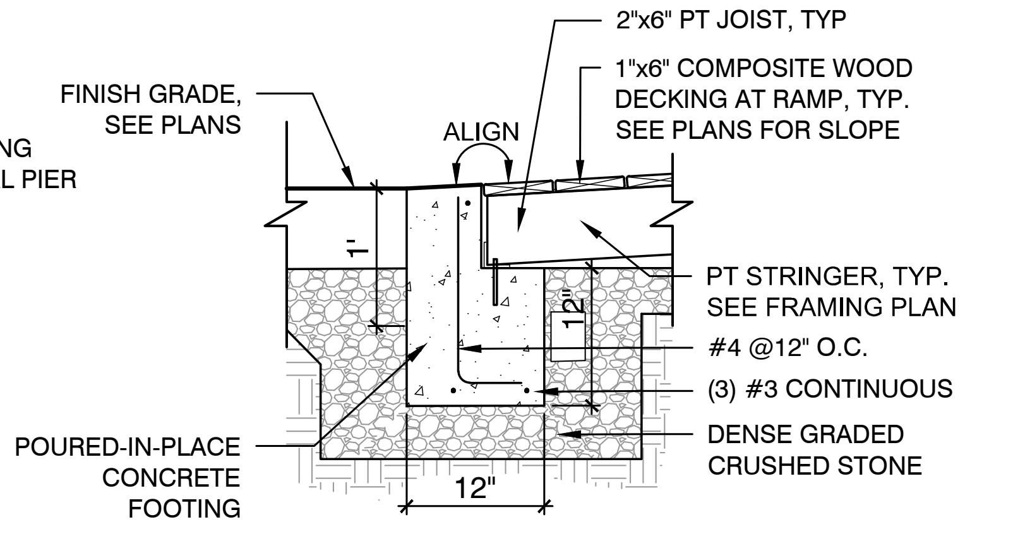


NOTES:
1. MAXIMUM PIER/BEAM SPACING IS 9'-0", SEE FRAMING PLAN.
2. CONTRACTOR SHALL ASSUME 6'-0" HELICAL PIER DEPTH (FROM BOTTOM OF TIMBER BEAM TO THE BOTTOM OF PIER) FOR COMPARATIVE BIDDING PURPOSES ONLY. FINAL DEPTHS SHALL MEET THE PERFORMANCE REQUIREMENTS AS DESCRIBED IN THE SPECIFICATIONS. ANCHORS INSTALLED TO MEET THE SPECIFIED INSTALLATION REQUIREMENTS ARE SUITABLE TO PROVIDE AN ALLOWABLE CAPACITY OF 4.5KIPS ±0.5 KIPS. THE OWNER'S REPRESENTATIVE SHALL OBSERVE INSTALLATION OF HELICAL PIERS TO CONFIRM THE PIERS ARE INSTALLED TO REQUIRED EMBEDMENT DEPTHS AND CAPACITIES.
3. ALL TRIM AND DECKING TO BE FASTENED TO JOISTS WITH S.S. TAMPER RESISTANT SCREWS.
4. CONTRACTOR SHALL PROVIDE 2" EDGE CURB AT ALL VERTICAL REVEALS ALONG LENGTH OF RAMP.

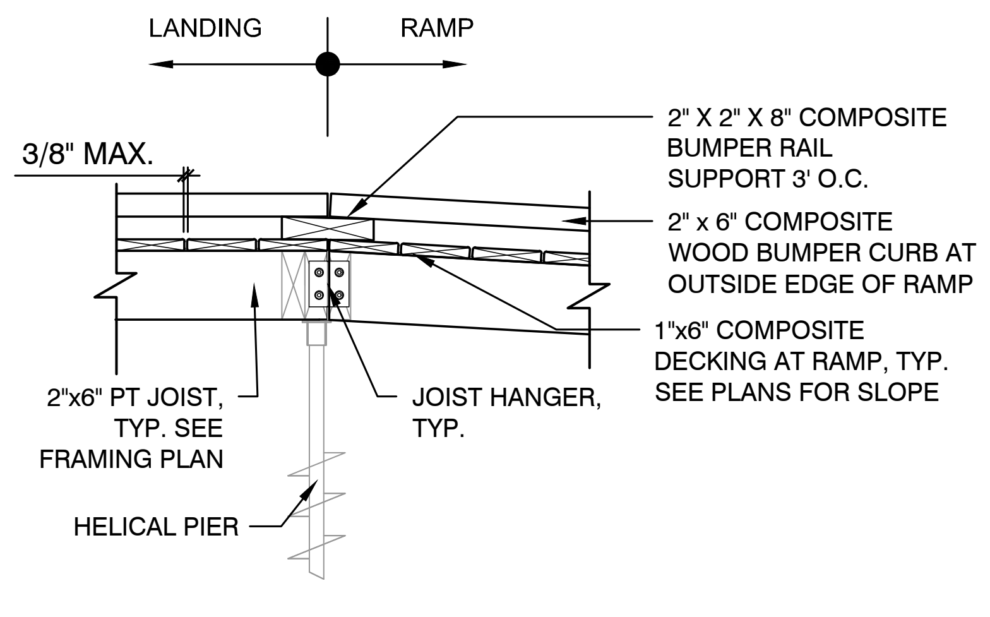
DECK SECTION



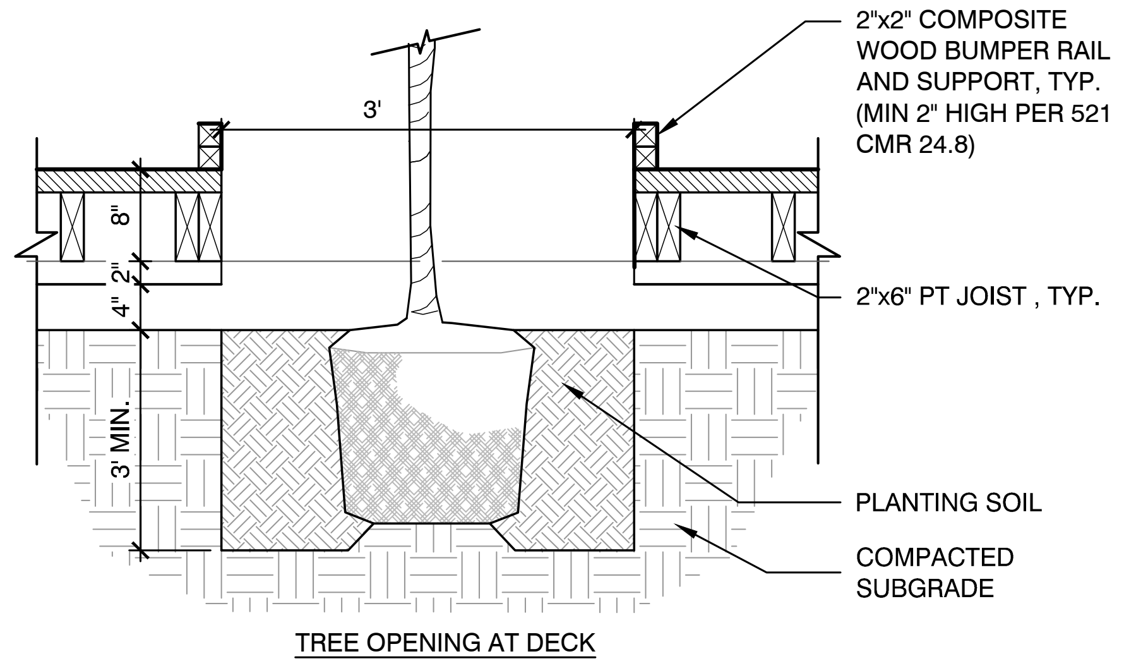
PILE CONNECTION



BOTTOM OF RAMP



TOP OF RAMP



TREE OPENING AT DECK

3 WOOD DECKING

SCALE: N.T.S.

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DETAILS

Sheet Number:

L501

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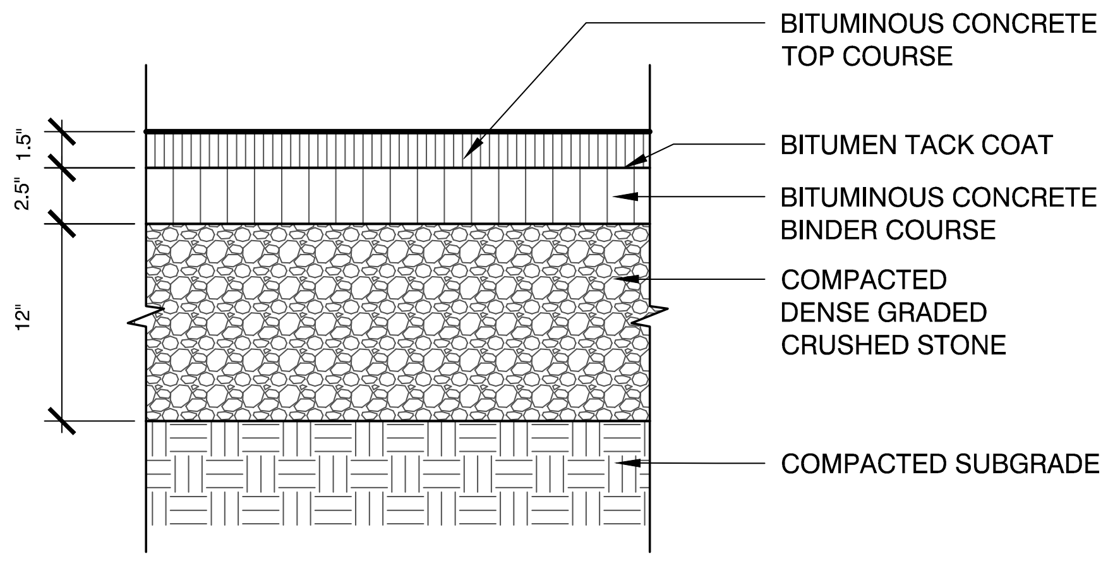
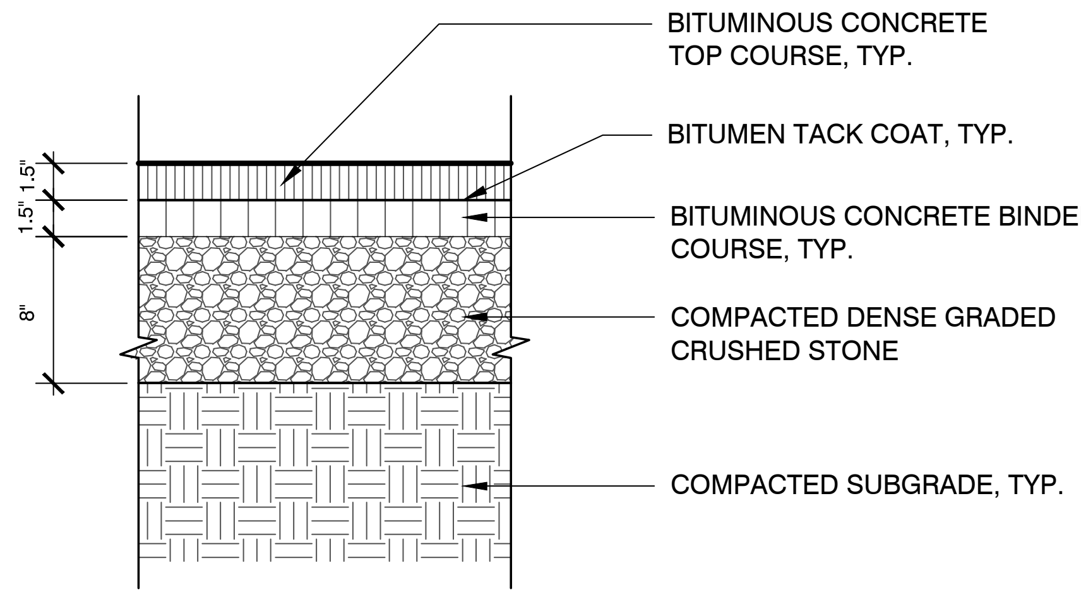


NOTES:
1. CONTRACTOR TO PROVIDE SMOOTH TRANSITION WHERE NEW PAVEMENT ABUTS EXISTING PAVEMENT, TYP.

1 VEHICULAR BITUMINOUS CONCRETE PAVEMENT

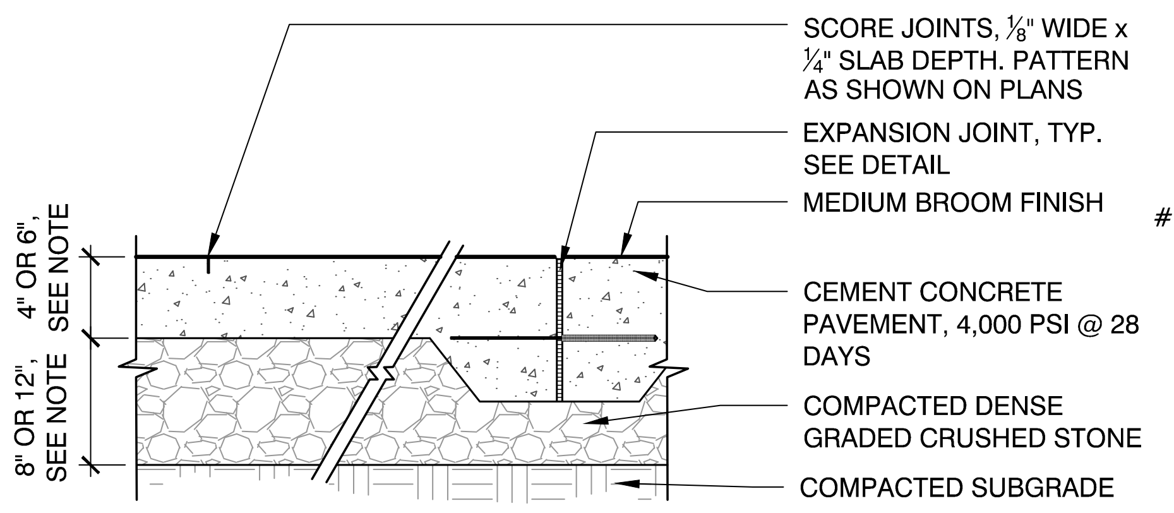
SCALE: N.T.S.



NOTE:.
1. CONTRACTOR TO PROVIDE SMOOTH TRANSITION WHERE NEW PAVEMENT ABUTS EXISTING PAVEMENT, TYP.

2 PEDESTRIAN BITUMINOUS CONCRETE PAVEMENT

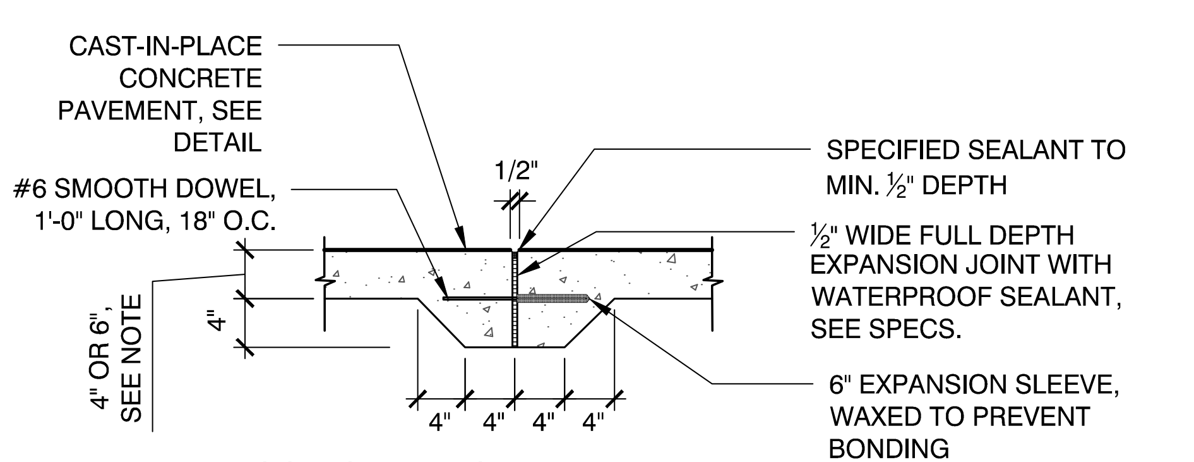
SCALE: N.T.S.



CAST-IN-PLACE CONCRETE PAVEMENT

CAST-IN-PLACE CONCRETE NOTES:

1. PEDESTRIAN CAST-IN-PLACE CONCRETE PAVEMENT TO BE 4" THICK, WITH 8" COMPACTED DENSE CRUSHED STONE.
2. VEHICULAR CAST-IN-PLACE CONCRETE PAVEMENT TO BE 6" THICK, WITH 12" COMPACTED DENSE GRADED CRUSHED STONE.



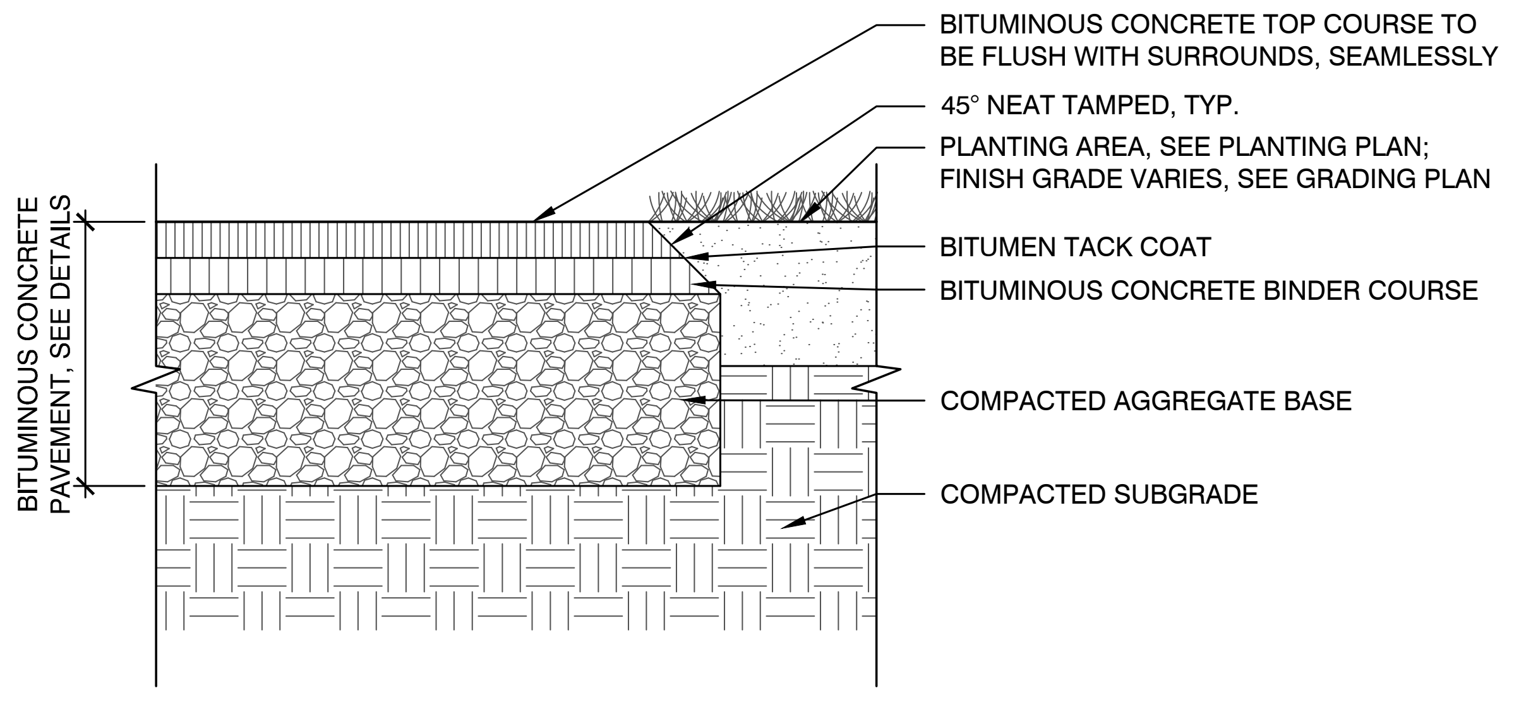
EXPANSION JOINT, TYPICAL

EXPANSION JOINT INSTALLATION NOTES:

1. DOWEL IS TYPICAL AT ALL EXPANSION JOINTS (18" O.C.) WITHIN CONCRETE PAVING AND BETWEEN NEW CONCRETE PAVING AND EXISTING CONCRETE PAVING TO REMAIN.
2. DELETE EXPANSION SLEEVE AND DOWEL WHERE JOINT ABUTS WALL, CURBS, OR OTHER VERTICAL SURFACES, UNLESS OTHERWISE NOTED.
3. EXPANSION JOINTS MAX. 25'-0" O.C. UNLESS SHOWN OTHERWISE.
4. ALL SCORE JOINTS SHALL BE TOOLED.

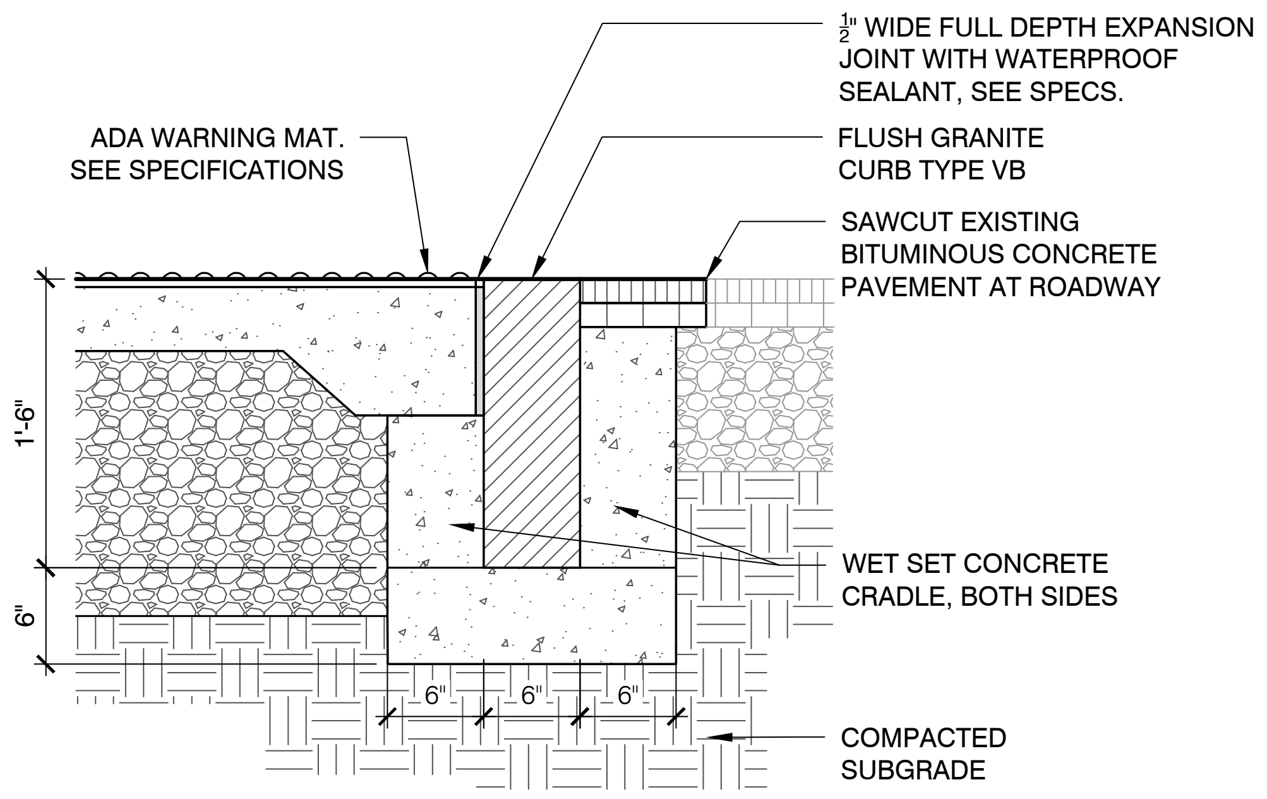
3 CIP CONCRETE PAVEMENT

SCALE: N.T.S.



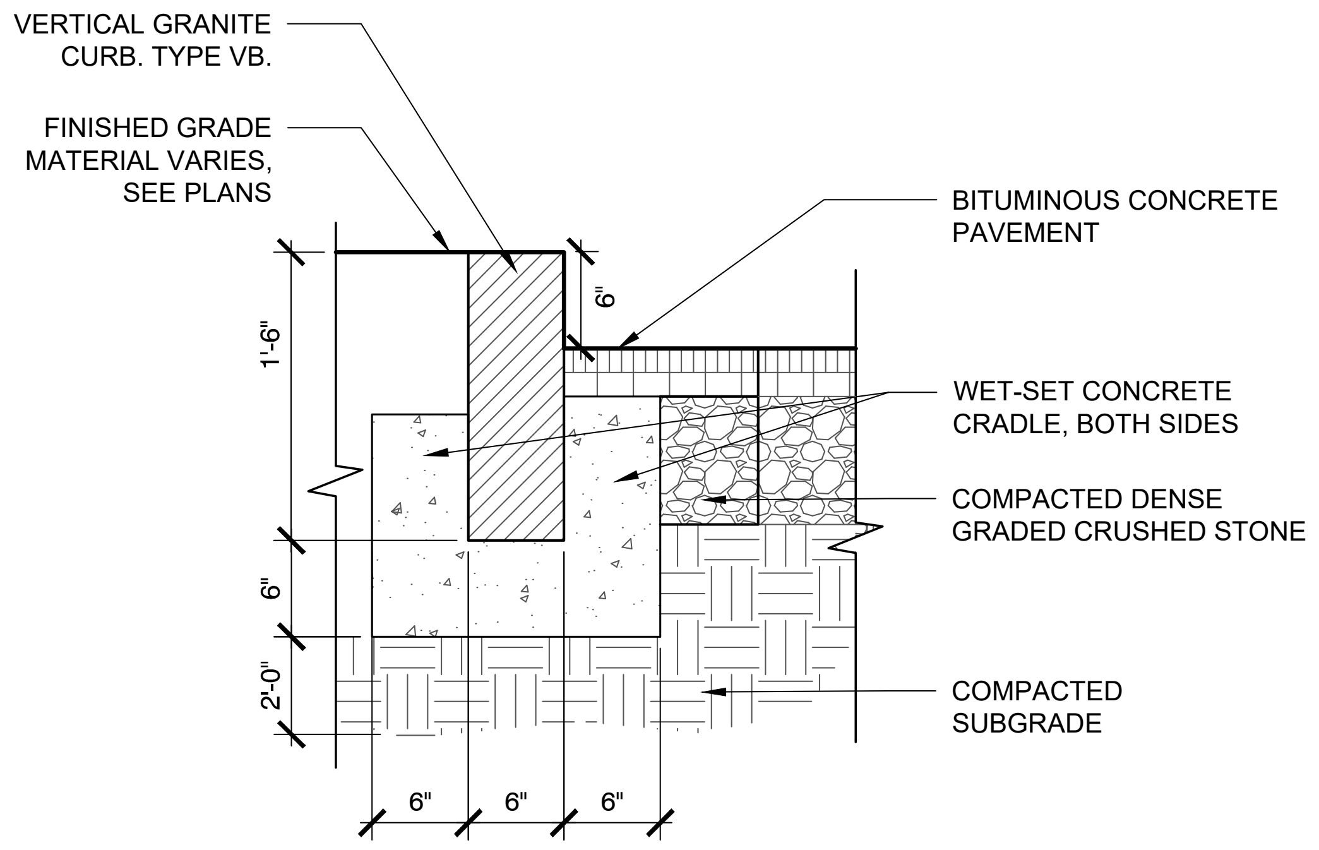
4 BITUMINOUS CONCRETE AT PLANTING

SCALE: N.T.S.



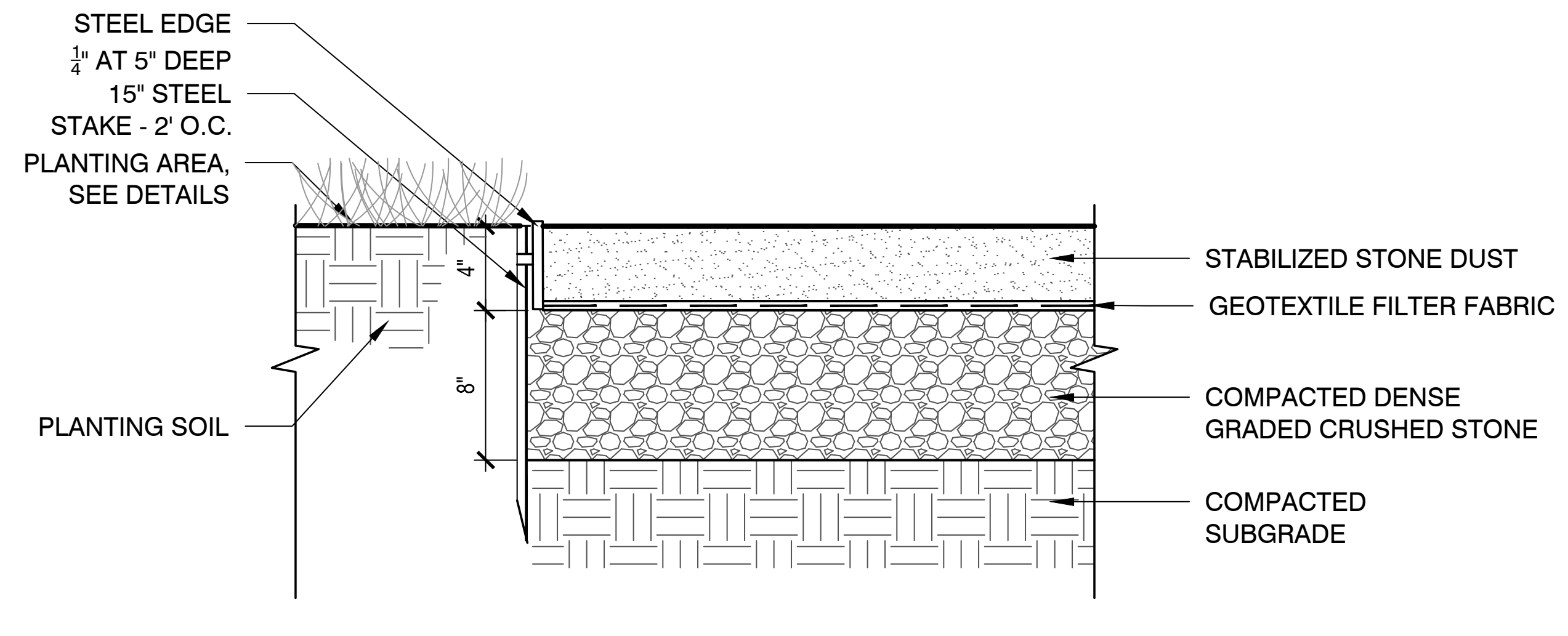
5 FLUSH GRANITE CURB WITH ADA DETECTABLE WARNING MAT

SCALE: N.T.S.



6 VERTICAL GRANITE CURB

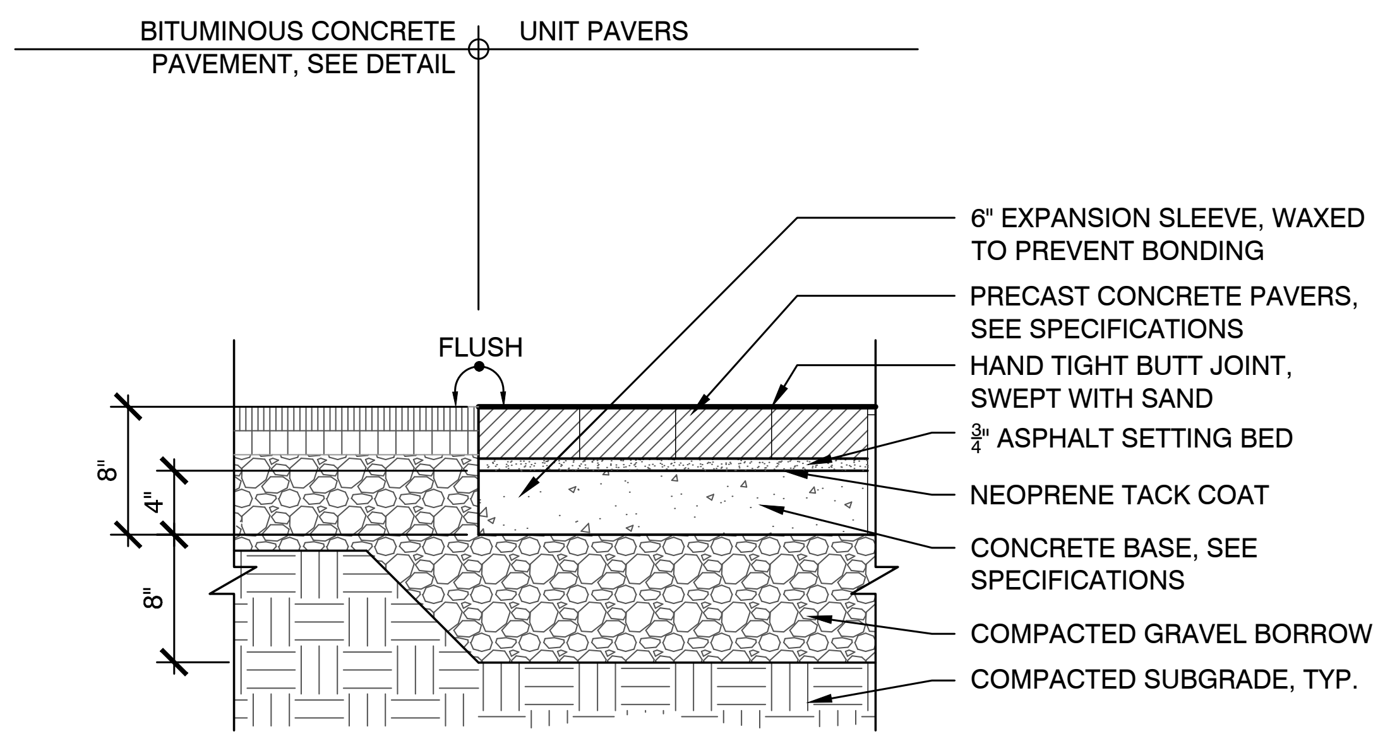
SCALE: N.T.S.



STONE DUST AT PLANTING AREA

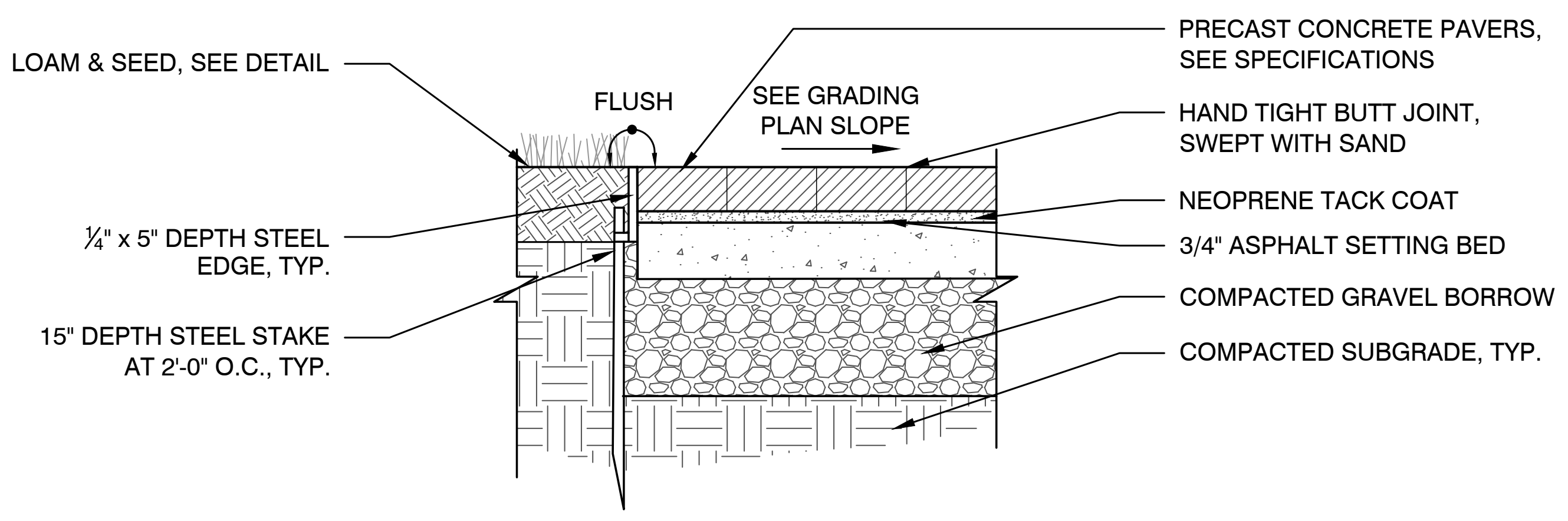
7 STONE DUST PAVING WITH STEEL EDGE

SCALE: N.T.S.



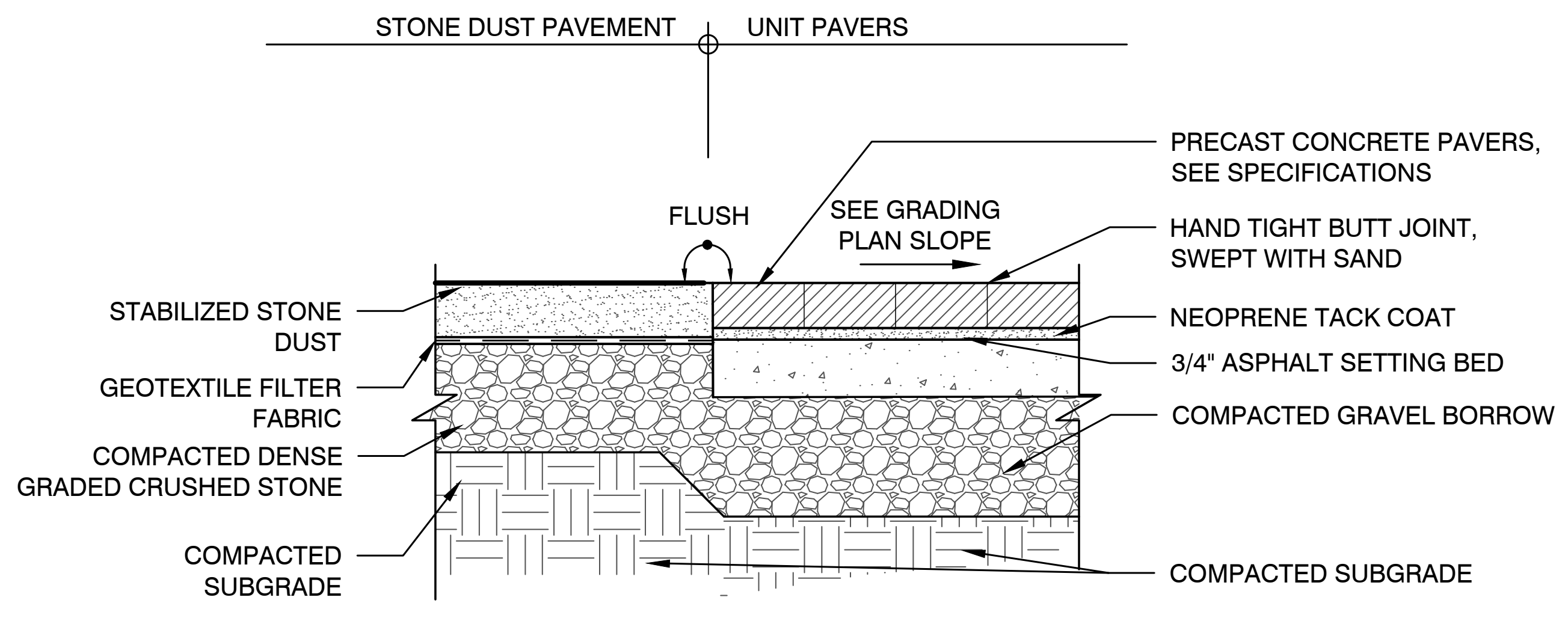
8 UNIT PAVERS AT BITUMINOUS CONCRETE PAVEMENT

SCALE: N.T.S.



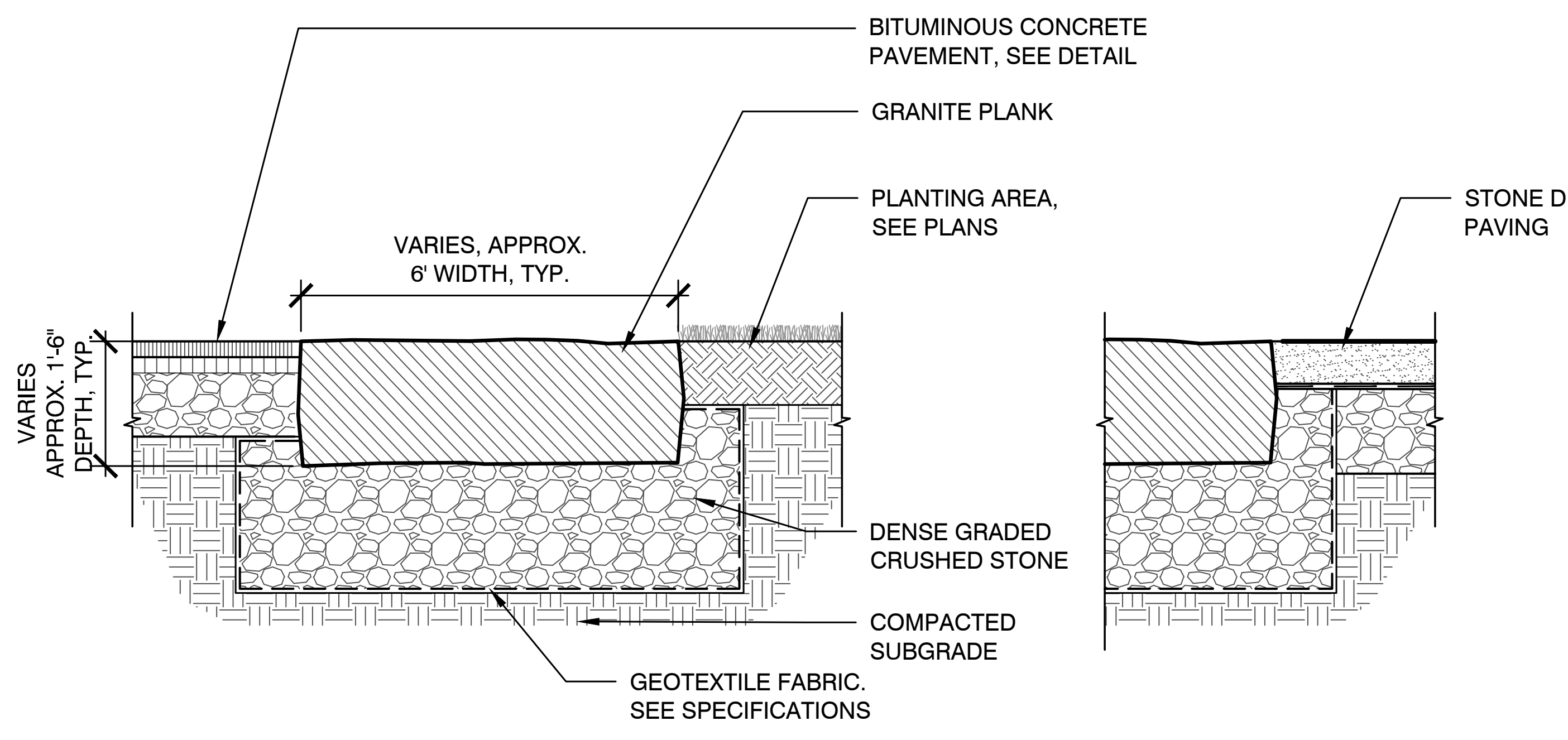
9 UNIT PAVERS AT PLANTING AREA

SCALE: N.T.S.



10 UNIT PAVERS AT STONE DUST

SCALE: N.T.S.



11 ENGRAVED GRANITE PLANKS

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Sheet Number:

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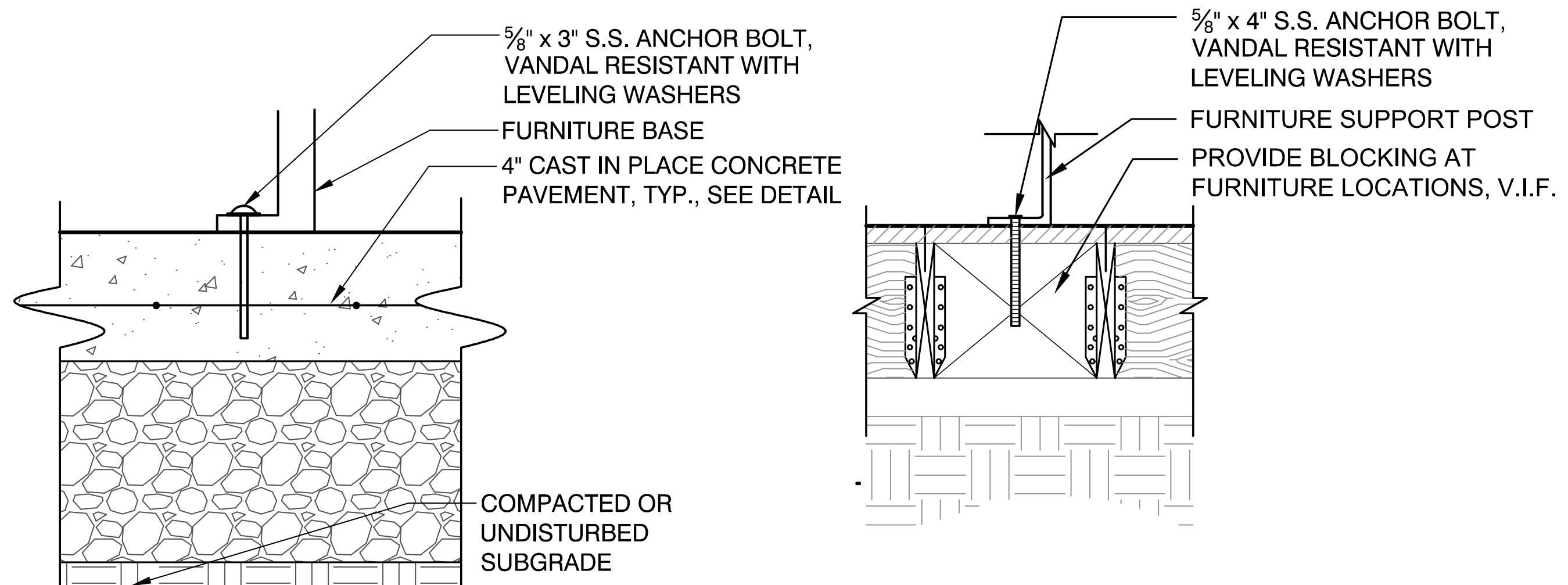


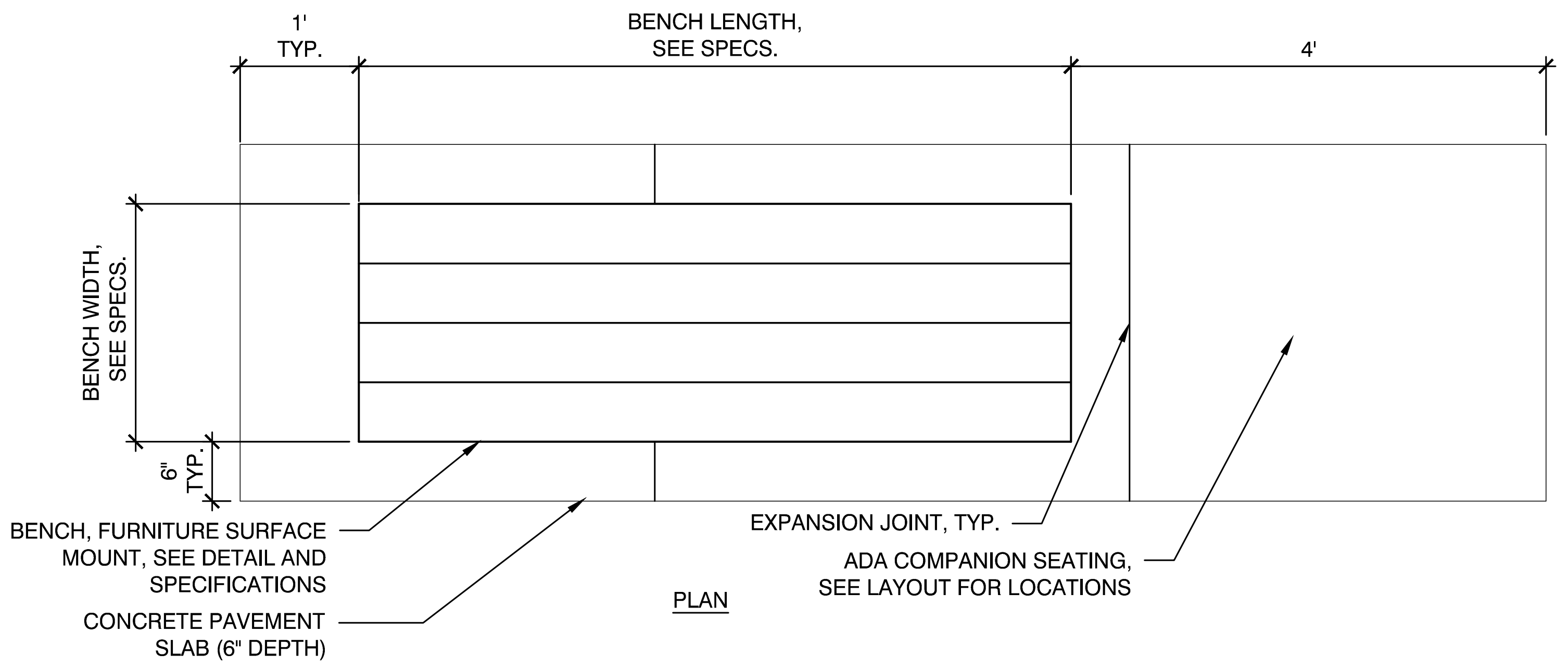
NOTES:
1. ALL SITE FURNISHINGS SHALL BE SURFACE MOUNTED PER MANUFACTURER'S RECOMMENDATIONS.

NOTE:
1. ALL SITE FURNISHINGS SHALL BE SURFACE MOUNTED PER MANUFACTURER'S RECOMMENDATIONS.

SURFACE MOUNT TO DECKING

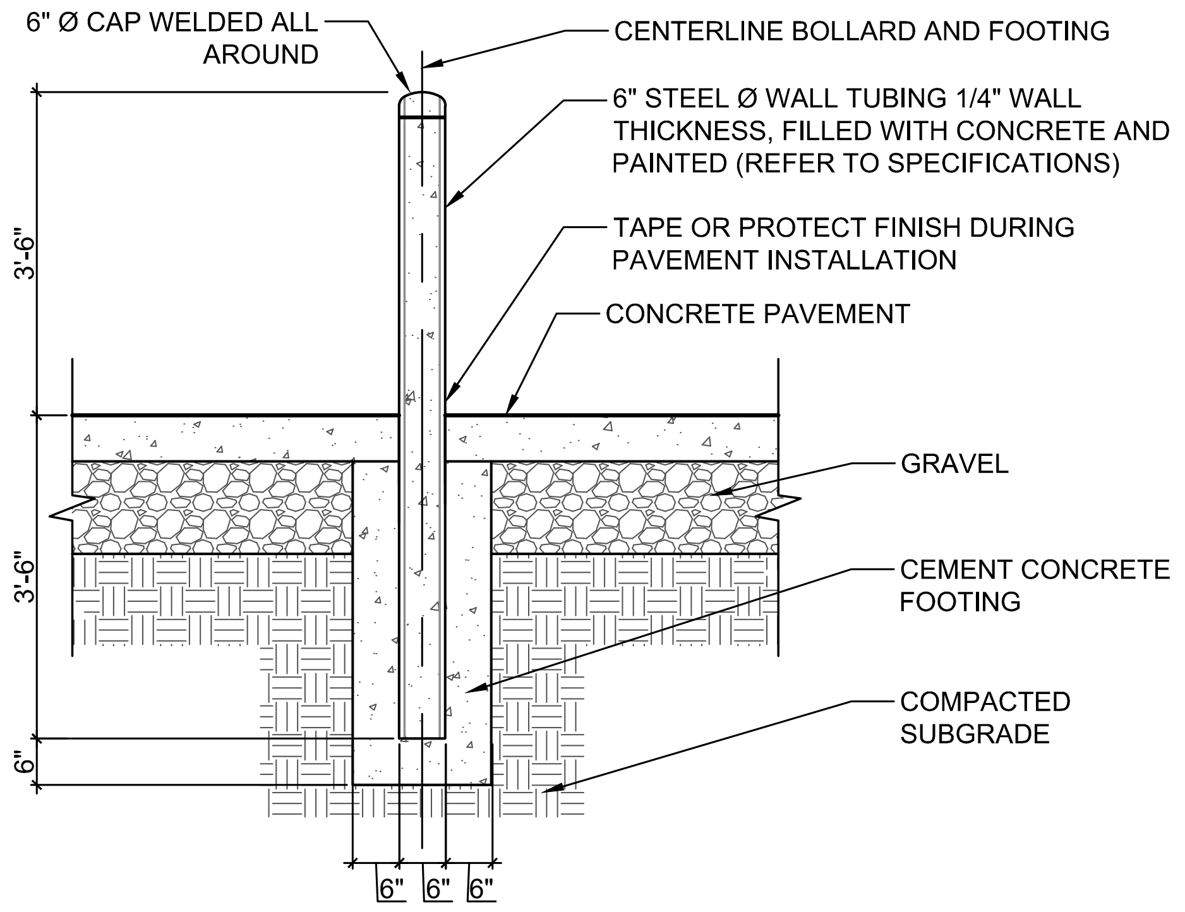
1 FURNITURE SURFACE MOUNT

SCALE: N.T.S.



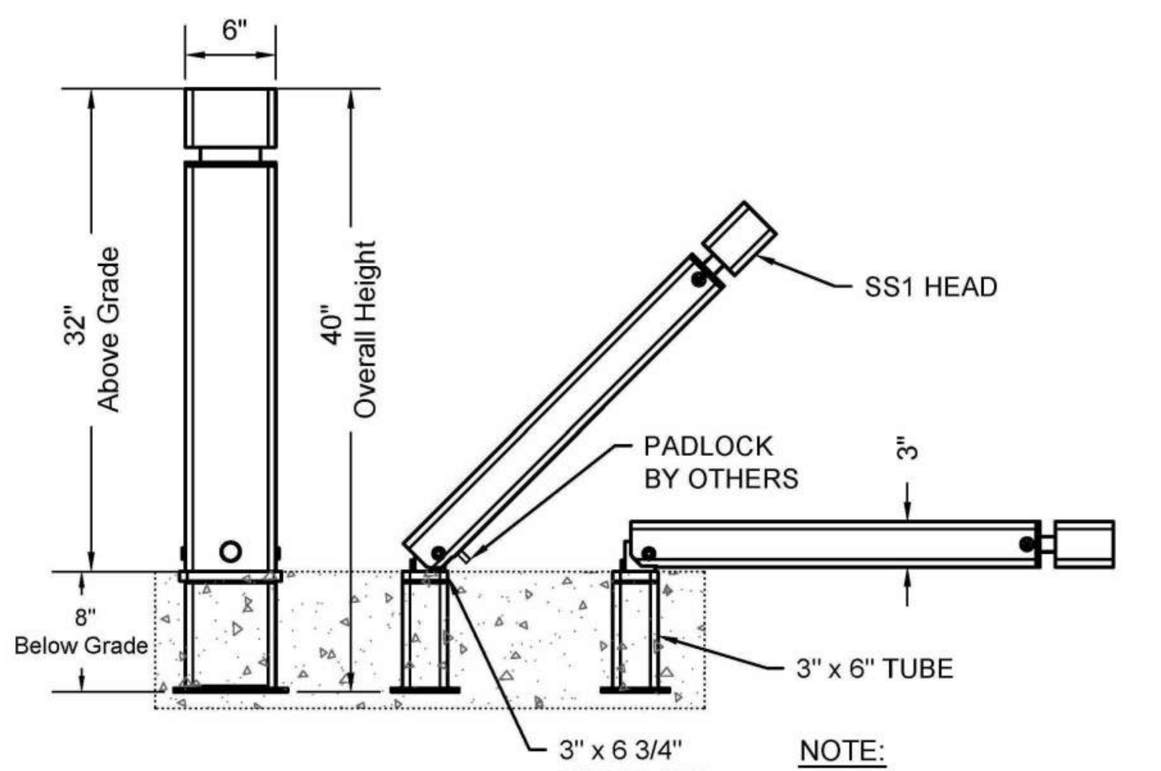
2 BENCH ON CONCRETE PAD

SCALE: N.T.S.



3 VEHICLE BOLLARD

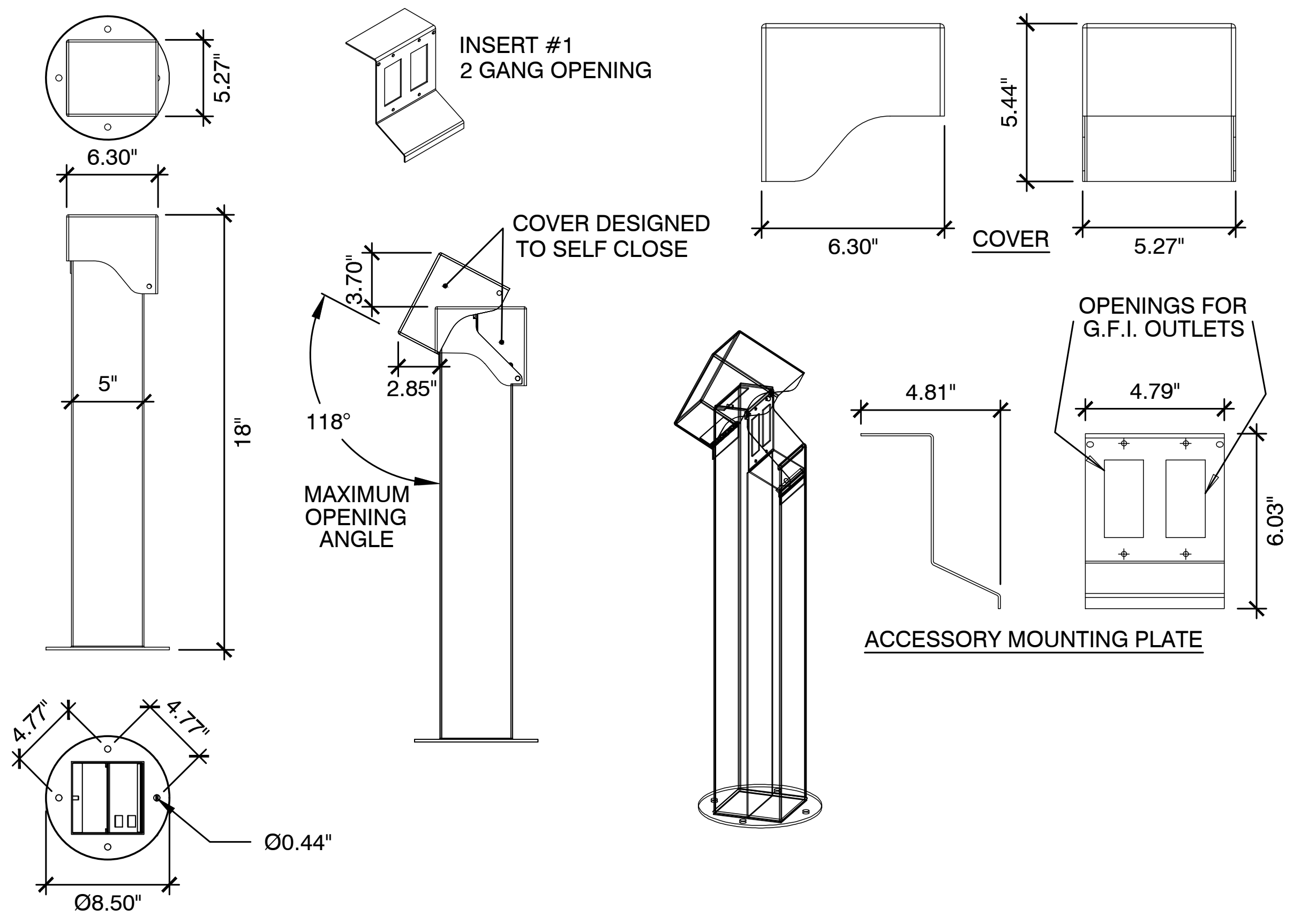
SCALE: N.T.S.



NOTE:
ALL PIPES SHALL BE PAINTED MOSS GREEN.

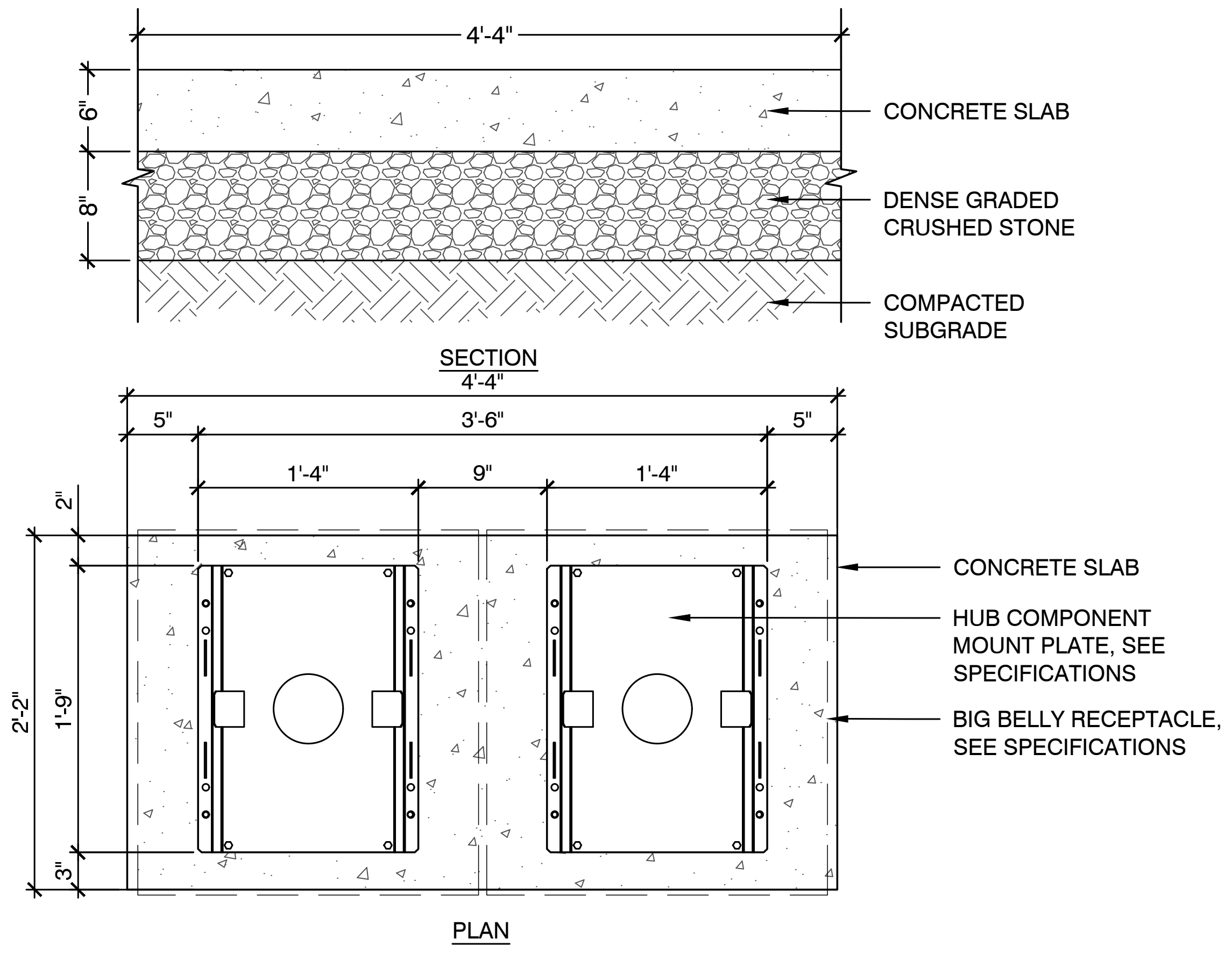
4 COLLAPSIBLE BOLLARD

SCALE: N.T.S.



5 UTILITY BOLLARD

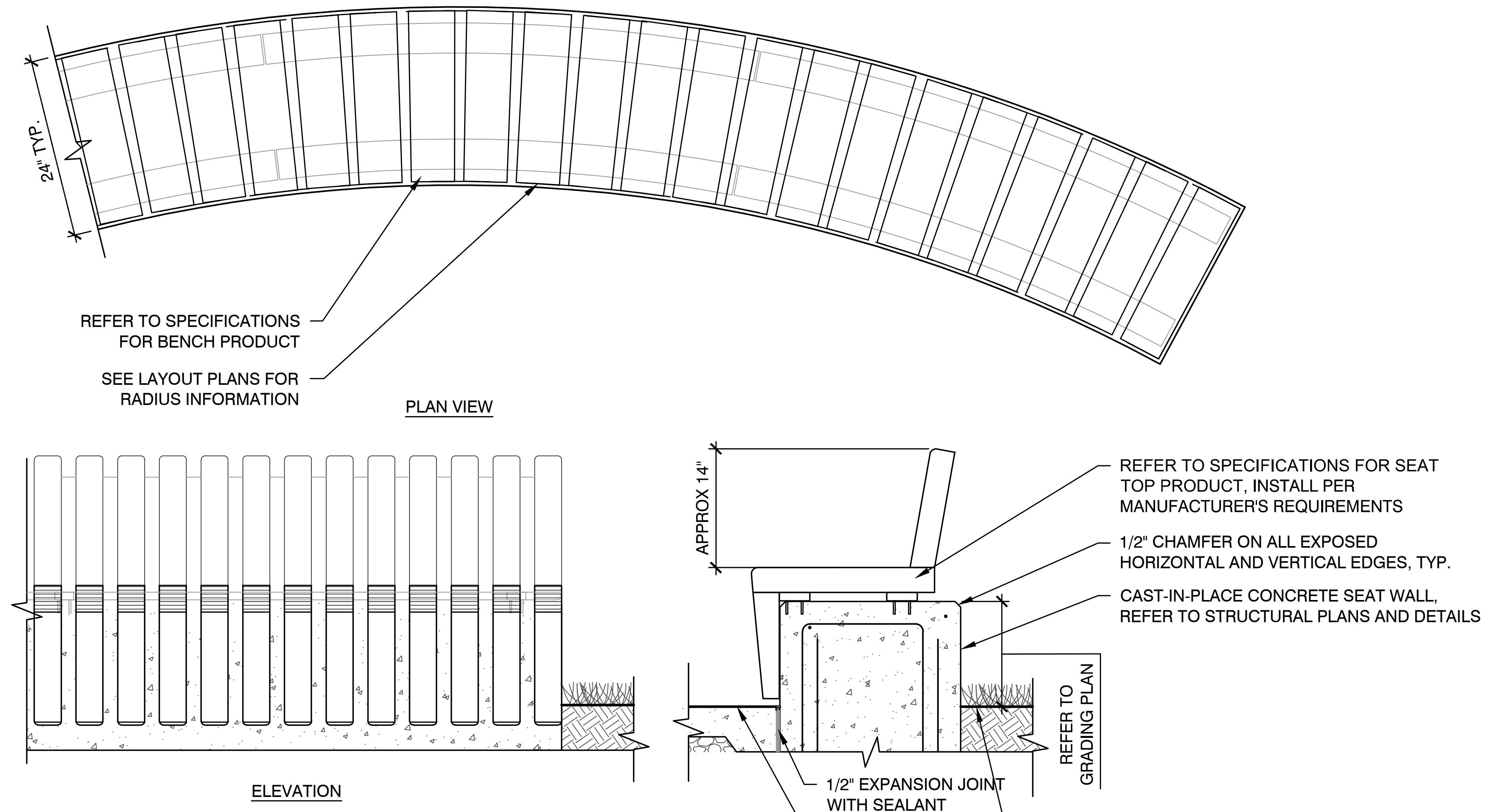
SCALE: N.T.S.



NOTE:
1. INSTALL PER MANUFACTURER INSTRUCTIONS.

6 TRASH AND RECYCLE RECEPTACLES ON CONCRETE SLAB

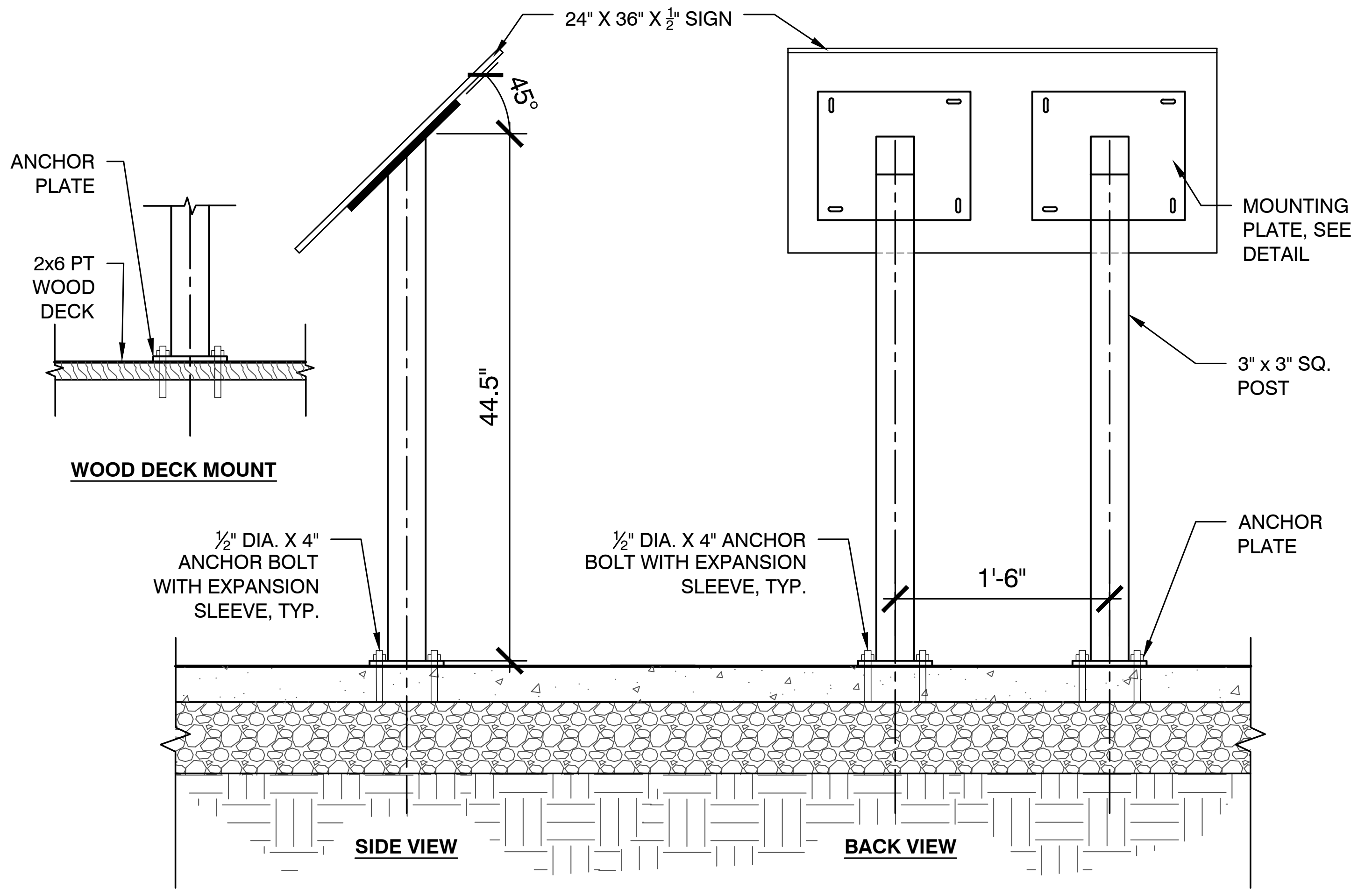
SCALE: N.T.S.



NOTES:
1. PROVIDE 1" EXPANSION JOINTS SPACED @ 10FT MAX. ALONG LENGTH OF SEAT WALL. REFER TO STRUCTURAL PLANS AND DETAILS.
2. ALL VISIBLE SURFACES OF CONCRETE WALLS SHALL BE SMOOTH RUBBED FINISH. REMOVE AND OR FILL ALL BUGHOLES, FORM TIES AND OTHER IMPERFECTIONS ON ALL VISIBLE SURFACES.
3. BENCH TOP RUNS PERPENDICULAR TO FACE OF WALL. BENCH PRODUCTS MUST BE INSTALLED PER MANUFACTURER REQUIREMENTS, USING STAINLESS STEEL TAMPER PROOF BOLTS.

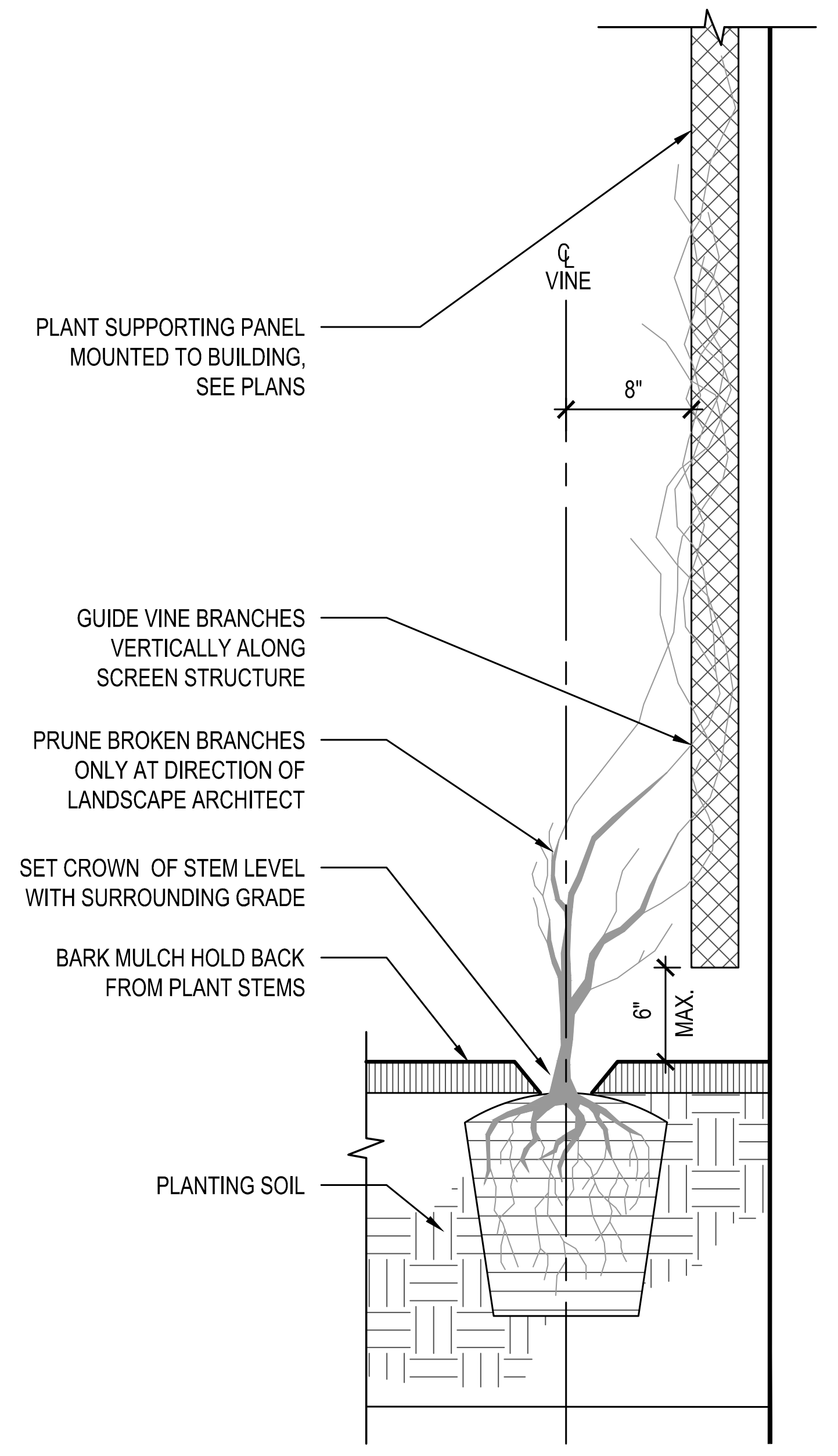
7 CIP CONCRETE SEATWALL WITH WOOD SLAT TOP

SCALE: N.T.S.



8 INTERPRETIVE SIGNAGE - DOUBLE POST

SCALE: N.T.S.



9 GREEN SCREEN PLANTING AT FACE OF BUILDING

SCALE: N.T.S.

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No.	Date	Description

Seal:

NO. 1220

Key Plan:

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Approved By:	CFR
W&S Project No.:	ENG20-0145
W&S File No.:	

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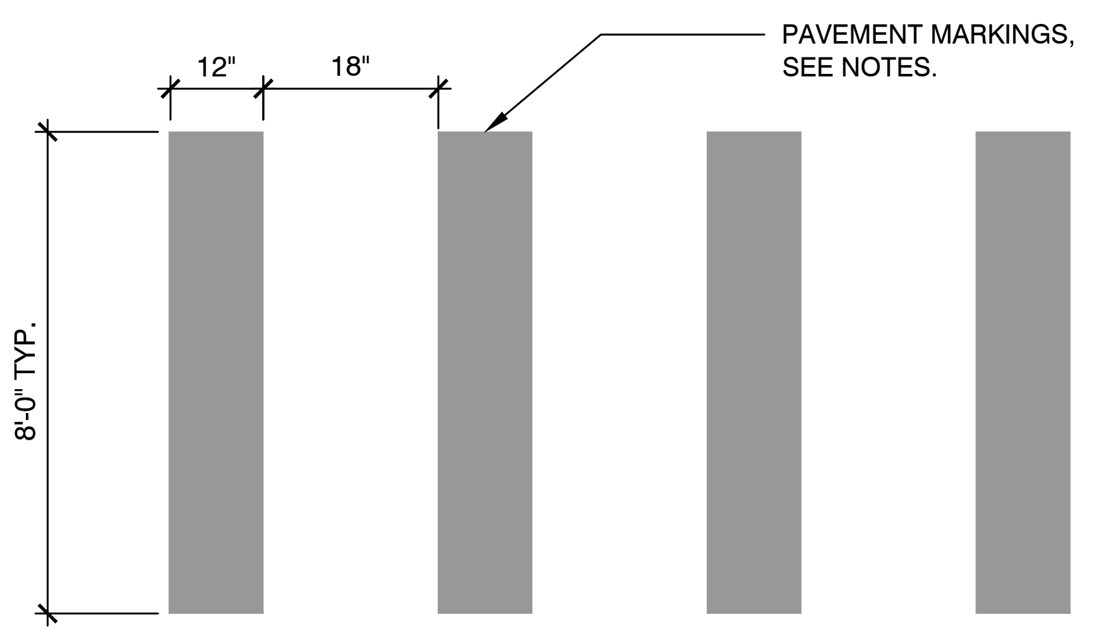
Sheet Number:

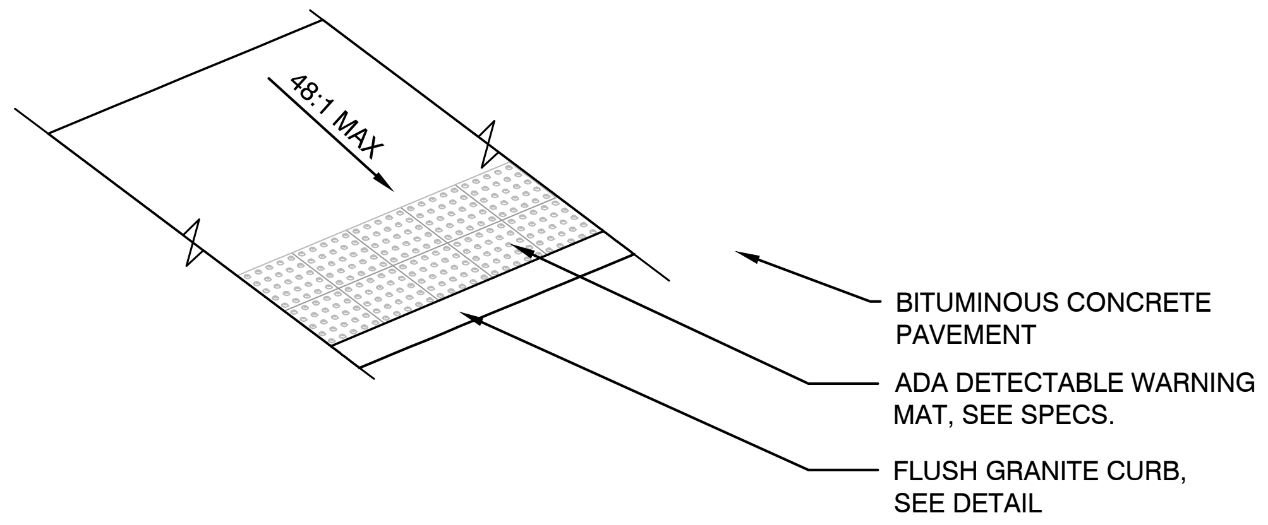
L503



NOTES:
1. PROVIDE PAVEMENT MARKINGS WHERE SHOWN ON PLANS IN ACCORDANCE WITH THIS DETAIL.
2. PAVEMENT MARKINGS SHALL BE WHITE, REFLECTORIZED TRAFFIC PAINT CONFORMING TO FEDERAL SPECIFICATION TTP-1952B TRAFFIC PAINT, TYPE I OR II.

1 CROSSWALK PAVEMENT MARKINGS

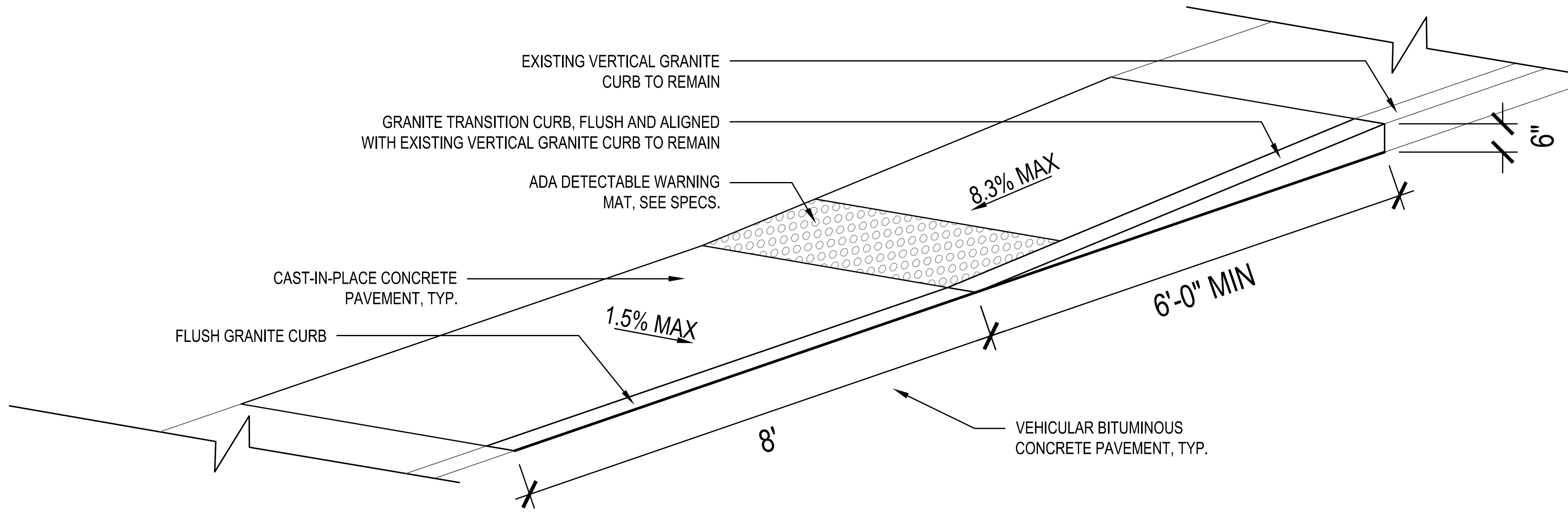
SCALE: N.T.S.



AXON VIEW
N.T.S.

2 ADA ACCESSIBLE CURB CUT AT WALLIS STREET - WEST

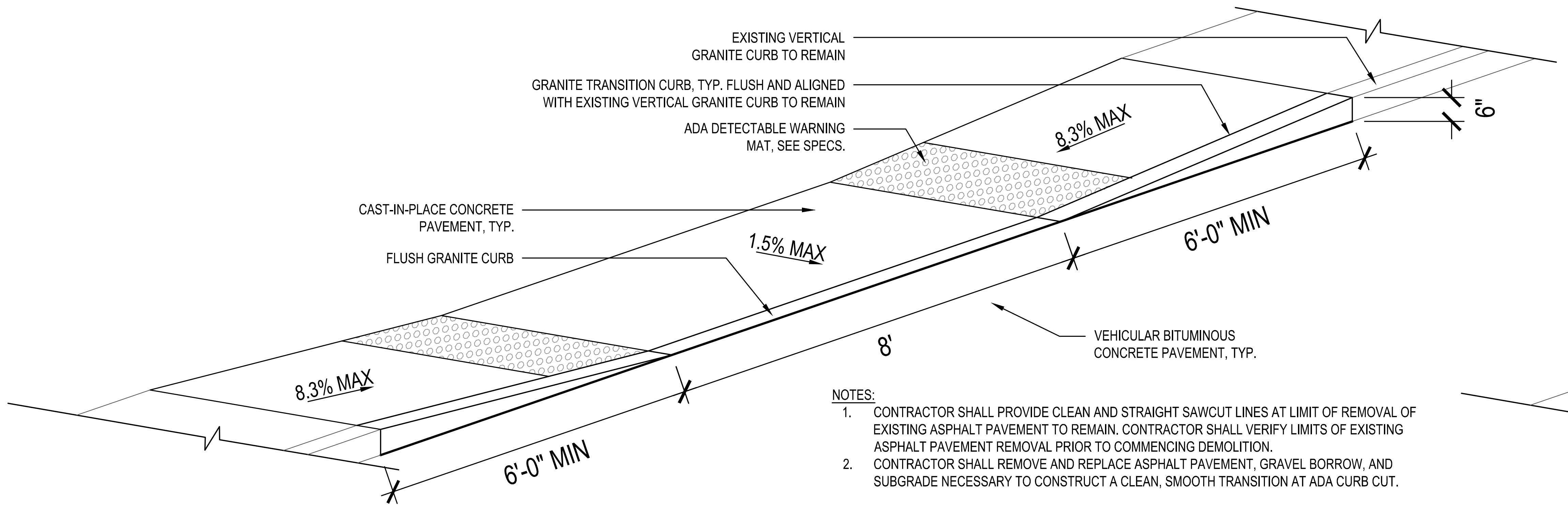
SCALE: N.T.S.



NOTES:
1. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING ASPHALT PAVEMENT TO REMAIN. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
2. CONTRACTOR SHALL REMOVE AND REPLACE ASPHALT PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

3 ADA ACCESSIBLE CURB CUT AT WALLIS STREET - EAST

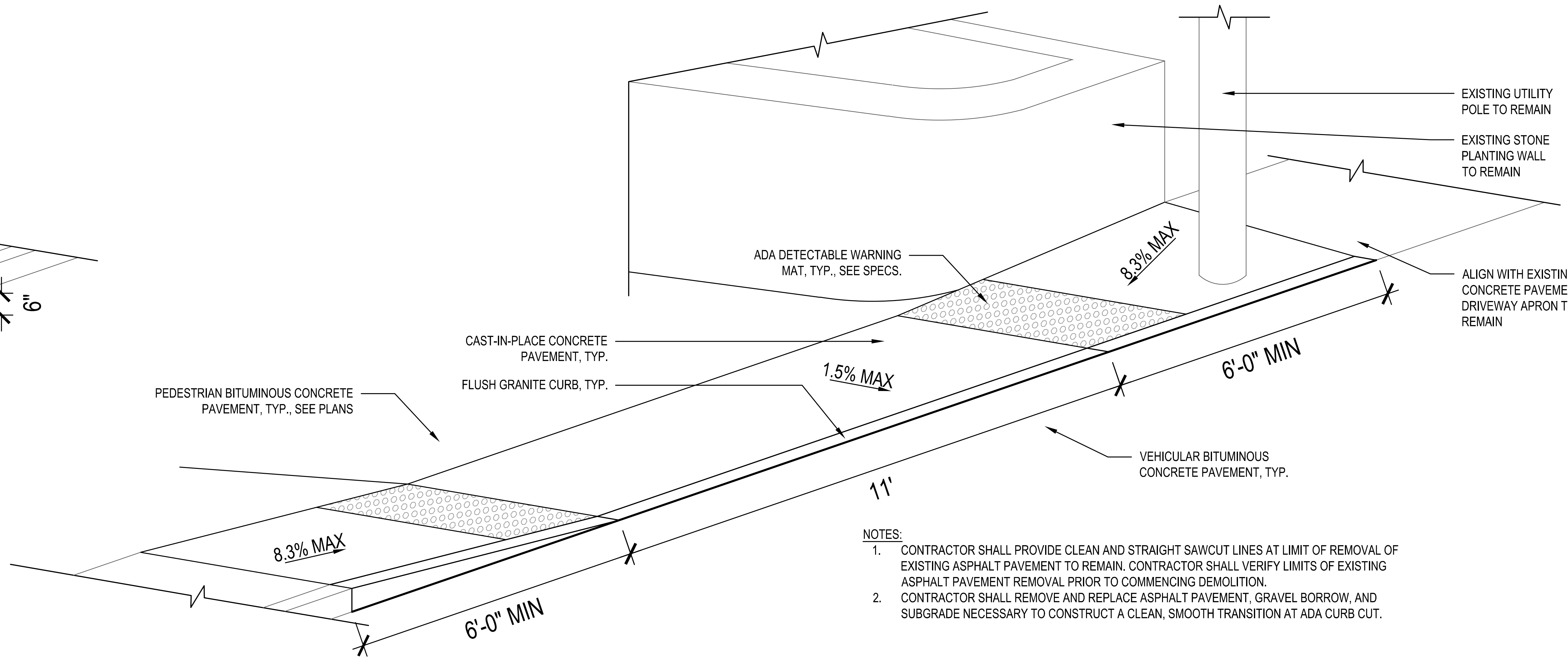
SCALE: N.T.S.



NOTES:
1. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING ASPHALT PAVEMENT TO REMAIN. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
2. CONTRACTOR SHALL REMOVE AND REPLACE ASPHALT PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

4 ADA ACCESSIBLE CURB CUT AT CALLER STREET - WEST

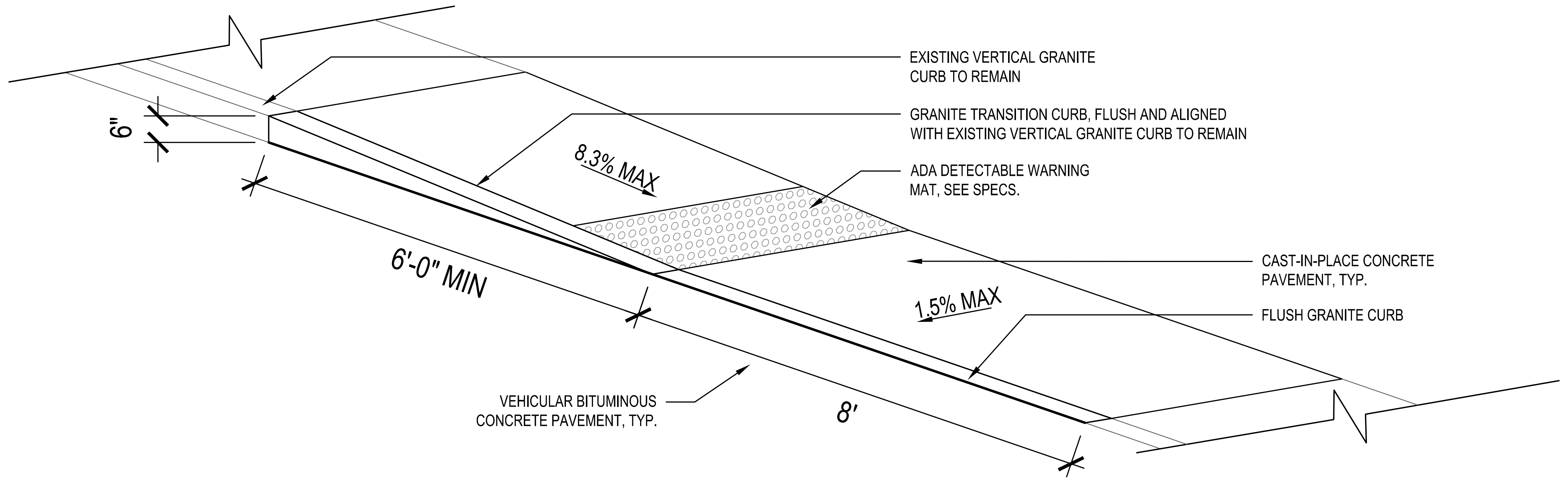
SCALE: N.T.S.



NOTES:
1. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING ASPHALT PAVEMENT TO REMAIN. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
2. CONTRACTOR SHALL REMOVE AND REPLACE ASPHALT PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

5 ADA ACCESSIBLE CURB CUT AT CALLER STREET - EAST

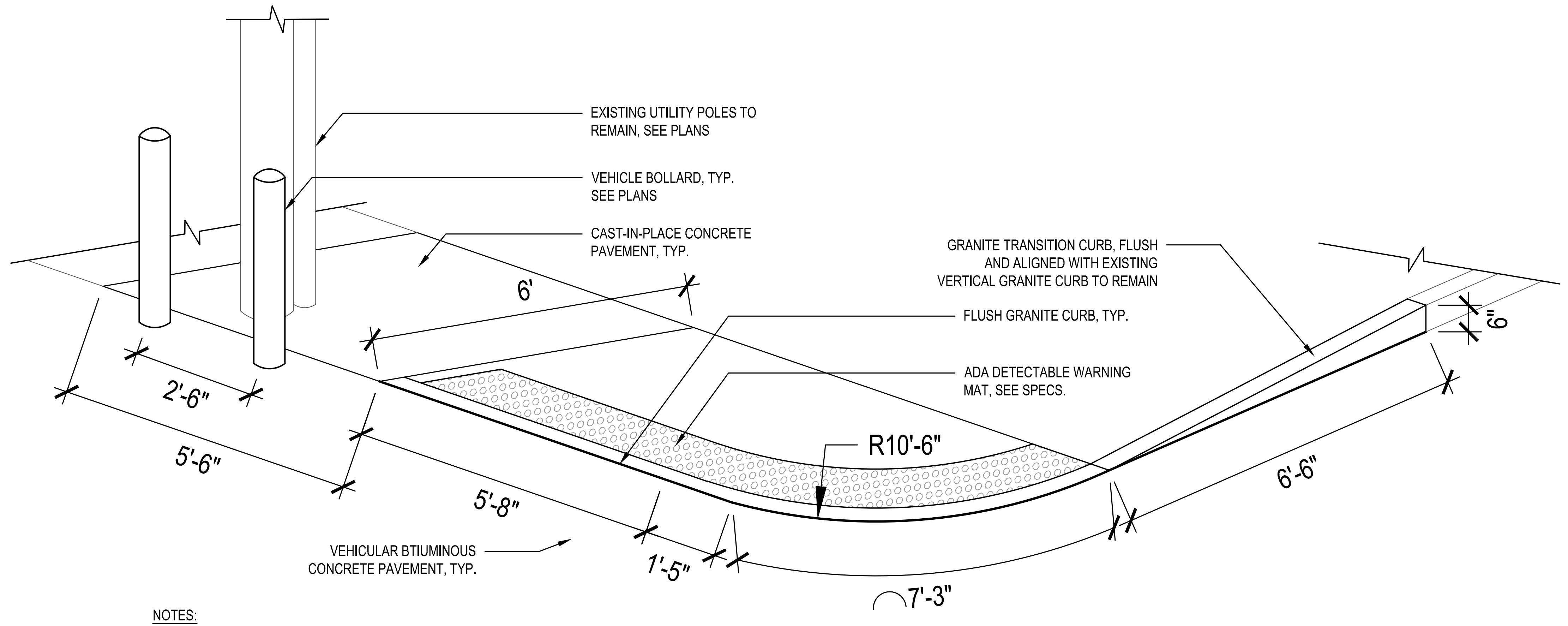
SCALE: N.T.S.



NOTES:
1. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING ASPHALT PAVEMENT TO REMAIN. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
2. CONTRACTOR SHALL REMOVE AND REPLACE ASPHALT PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

6 ADA ACCESSIBLE CURB CUT AT HOWLEY STREET - WEST

SCALE: N.T.S.



NOTES:
1. ALL CROSS SLOPES SHALL NOT EXCEED 1.50%
2. CONTRACTOR SHALL PROVIDE CLEAN AND STRAIGHT SAWCUT LINES AT LIMIT OF REMOVAL OF EXISTING BITUMINOUS CONCRETE PAVEMENT TO REMAIN AT ROADWAY. CONTRACTOR SHALL VERIFY LIMITS OF EXISTING ASPHALT PAVEMENT REMOVAL PRIOR TO COMMENCING DEMOLITION.
3. CONTRACTOR SHALL REMOVE AND REPLACE BITUMINOUS CONCRETE PAVEMENT, GRAVEL BORROW, AND SUBGRADE NECESSARY TO CONSTRUCT A CLEAN, SMOOTH TRANSITION AT ADA CURB CUT.

7 ADA ACCESSIBLE CURB CUT AT HOWLEY STREET - EAST

SCALE: N.T.S.

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NO. 1220

Key Plan:

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W&S File No.:

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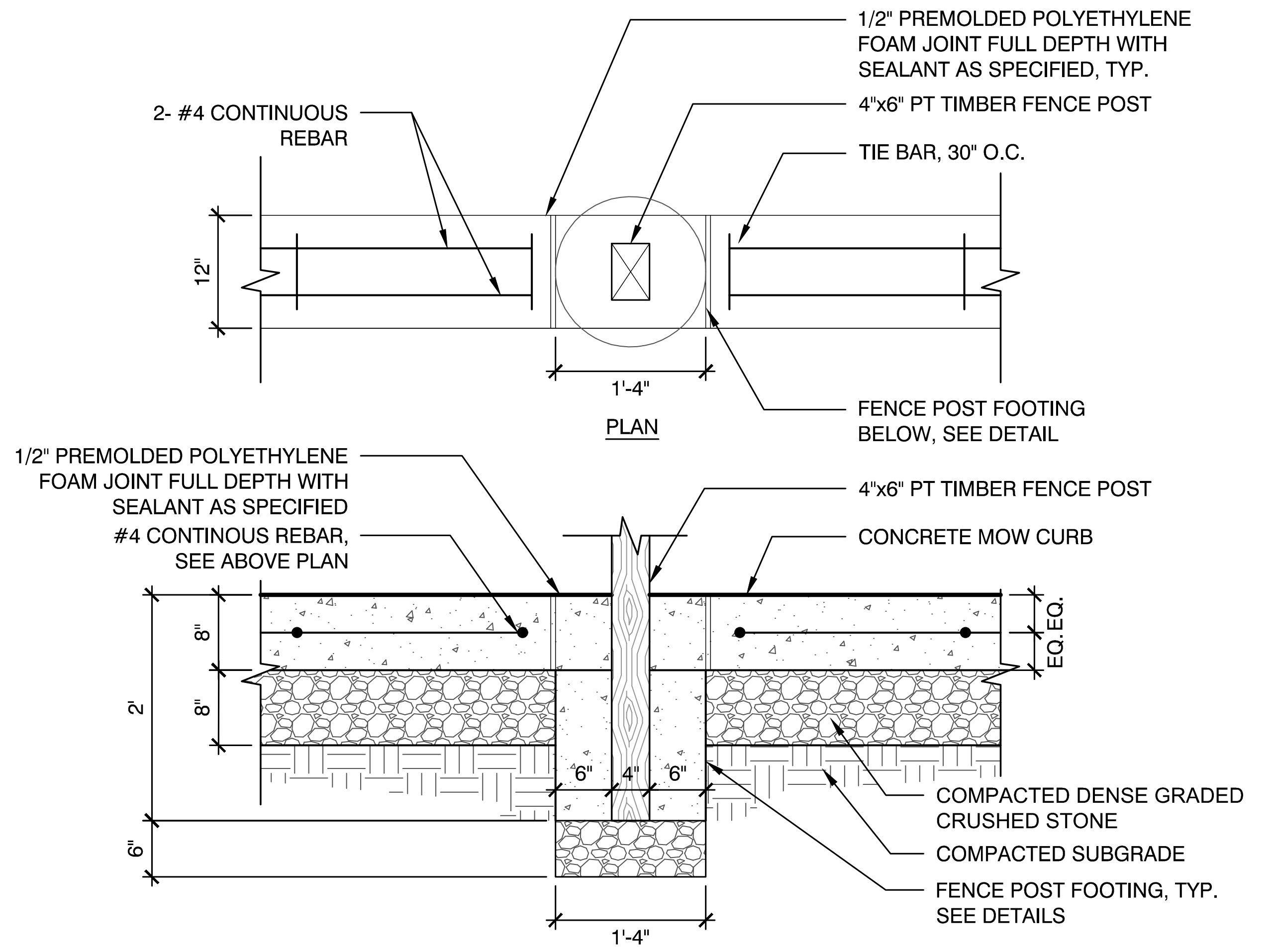
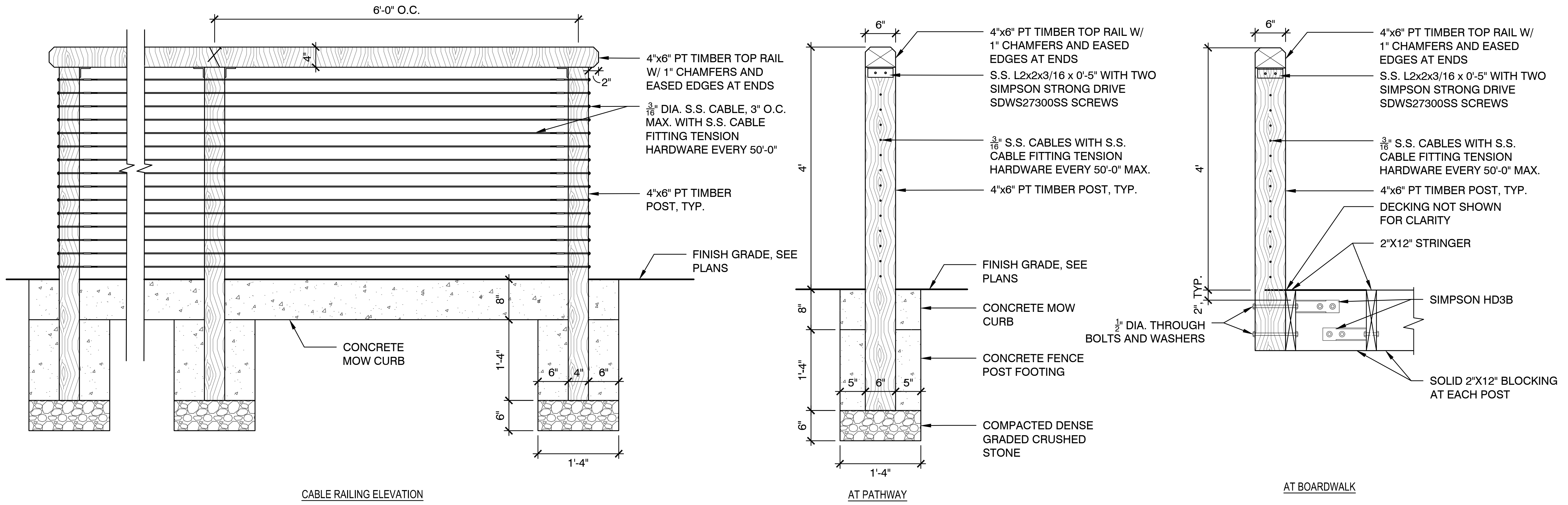


NOTES:
1. MOW CURB CORNERS ADJACENT TO WALLS AND CURBS SHALL BE SQUARE TO ENSURE SMOOTH INTERFACE BETWEEN MATERIALS.
2. MOW CURB CORNERS ADJACENT TO PLANTING BED OR LAWN AREAS SHALL HAVE 1/2" CHAMFER.
3. CONTRACTOR SHALL PROVIDE $\frac{1}{2}$" PRE-MOLDED POLYETHYLENE FOAM EXPANSION JOINT, FULL DEPTH WITH SEALANT AS SPECIFIED AT FENCE POSTS UNLESS OTHERWISE NOTED.
4. SEE CRITICAL ROOT ZONE NOTE ON SITE DEMOLITION AND PREPARATION PLAN.

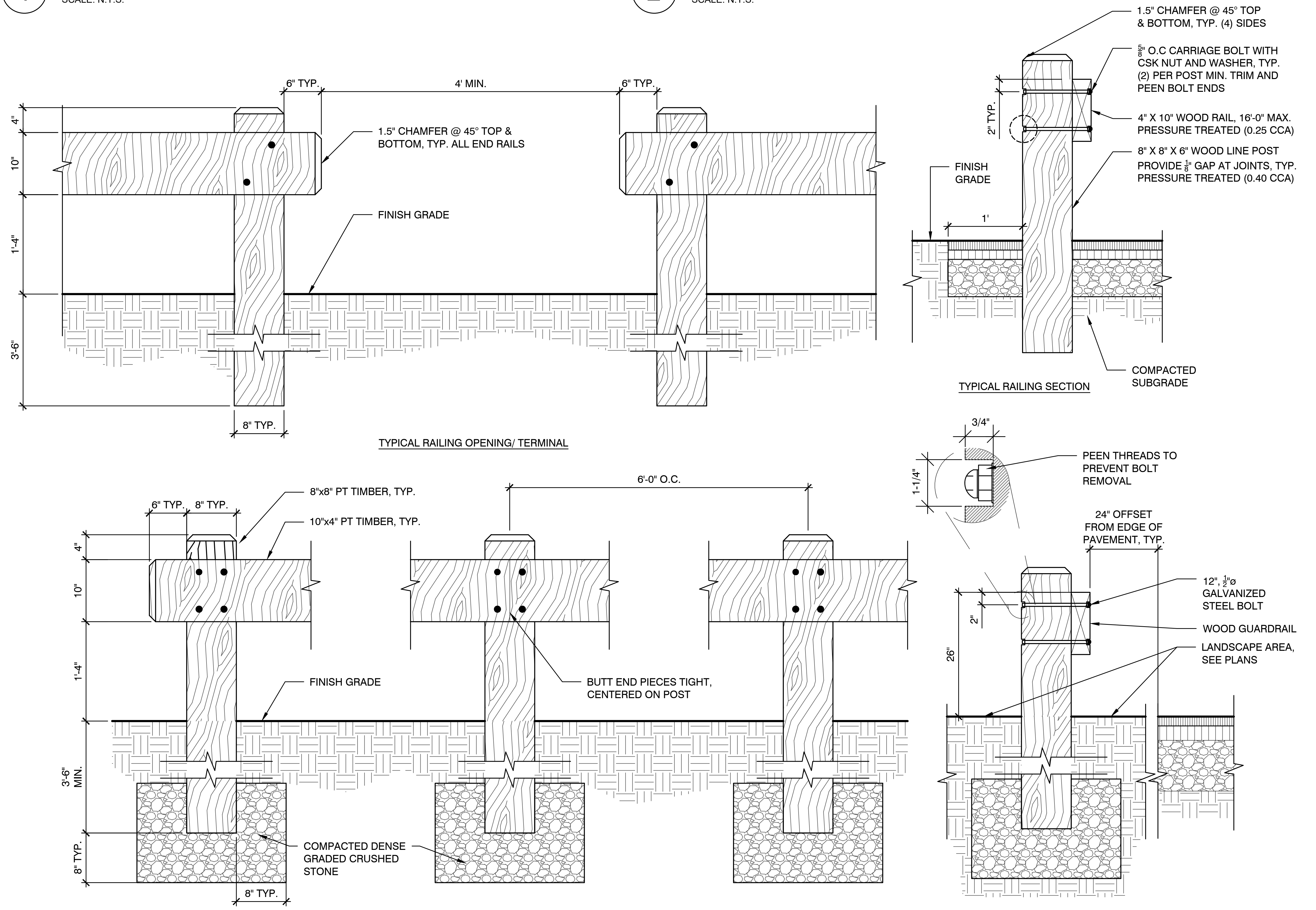
1 MOW CURB AT FENCE

SCALE: N.T.S.



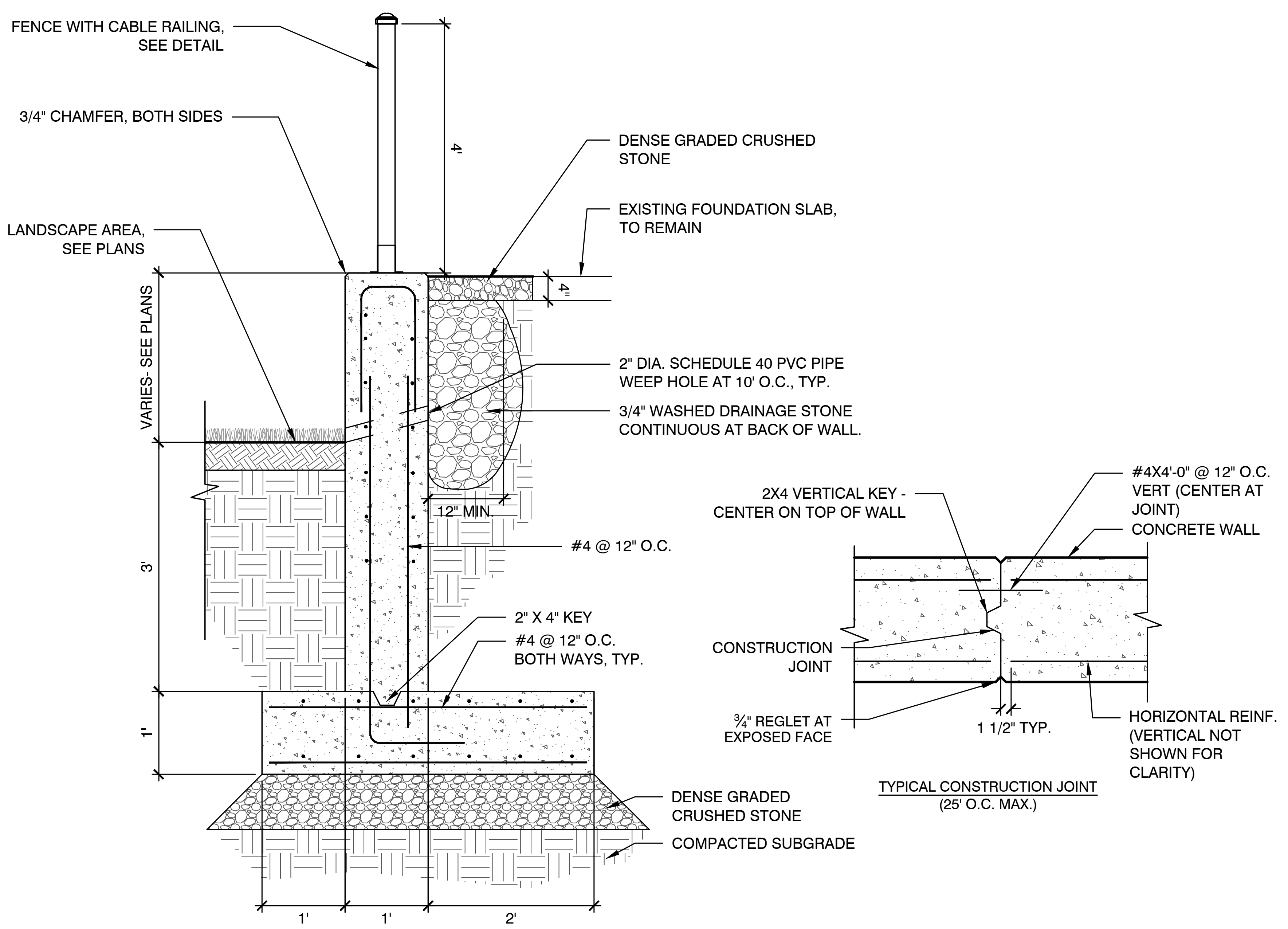
2 FENCE WITH CABLE RAILING

SCALE: N.T.S.



3 WOOD GUARDRAIL

SCALE: N.T.S.



4 CIP CONCRETE RETAINING WALL WITH DENSE GRADED CRUSHED STONE BACKFILL

SCALE: N.T.S.

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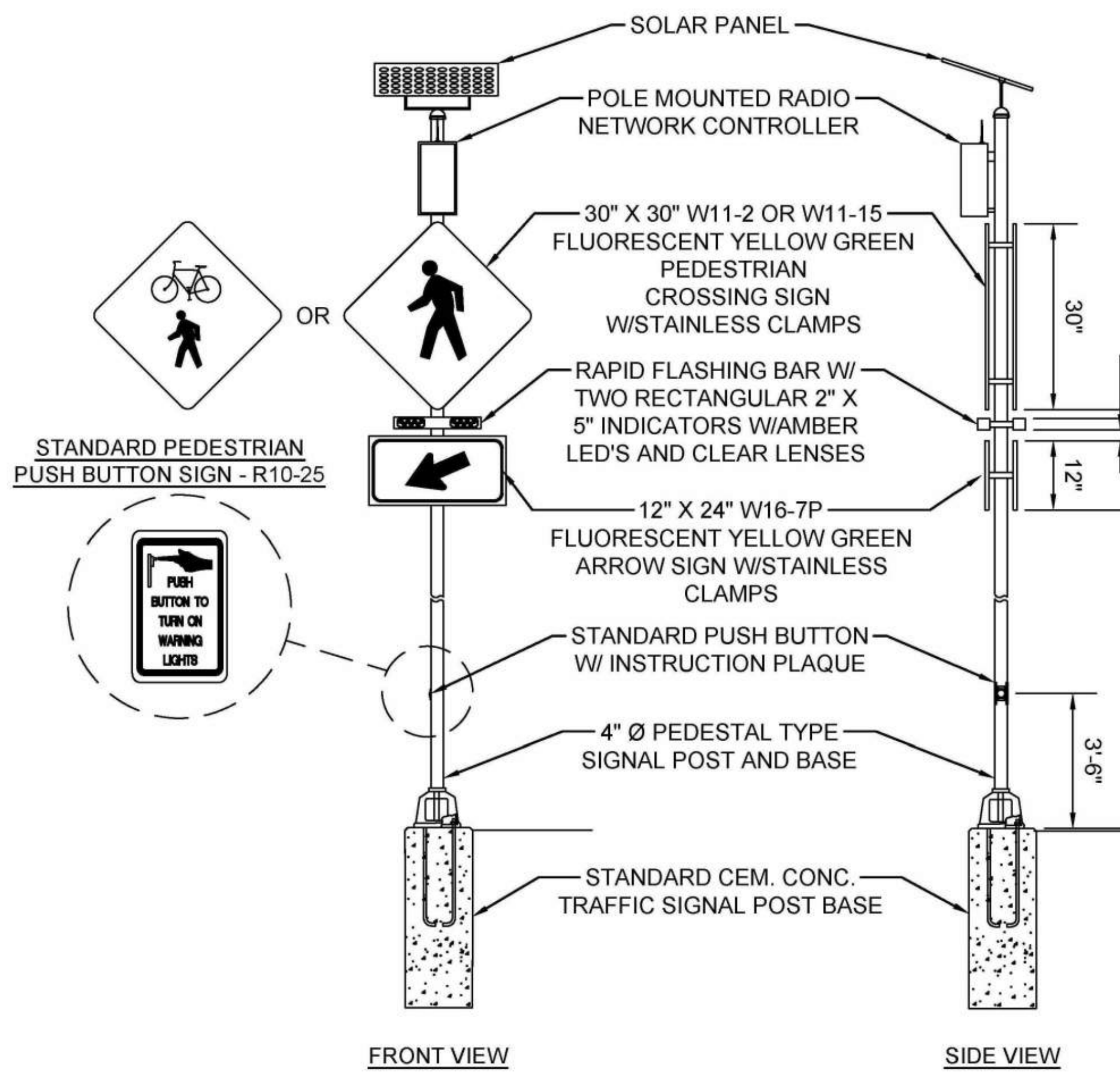


RRFB NOTES:

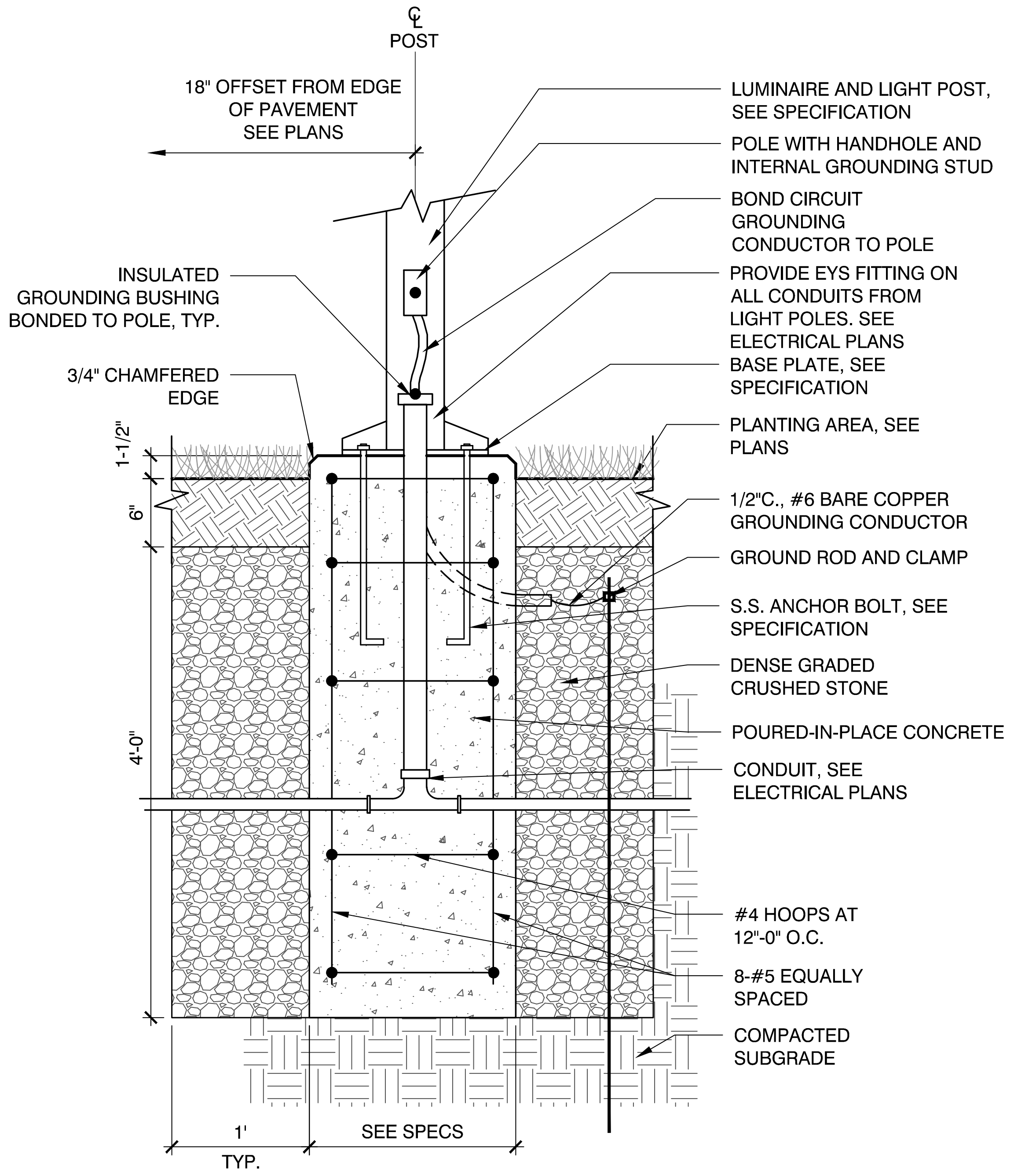
1. RECTANGULAR RAPID FLASHING BEACON (RRFB) SHALL BE SUPPLIED FROM A MANUFACTURER LISTED ON THE MASSDOT APPROVED EQUIPMENT LIST.
2. EACH LOCATION SHALL HAVE TWO (2) RRFB INSTALLED (ONE ON EACH SIDE OF THE CROSSWALK).
3. LOCATIONS 1 AND 3 WILL USE SIGN W11-15 AND LOCATION 2 WILL USE SIGN W11-2.
4. R10-25 SIGNS SHALL BE INSTALLED ABOVE ALL PEDESTRIAN PUSH BUTTONS.
5. OPERABLE CONTROLS ON RRFB SHALL BE LOCATED PER ADA STANDARDS 305-309
6. WARNING SIGNS AND INSTRUCTIONAL SIGNS ARE PAID SEPARATELY UNDER ITEM 832.

RRFB CLEARANCE TIME

APPROACH	LENGTH (ft)	CLEARANCE (s)
LOCATION 1	40	14
LOCATION 2	36	12
LOCATION 3	34	12

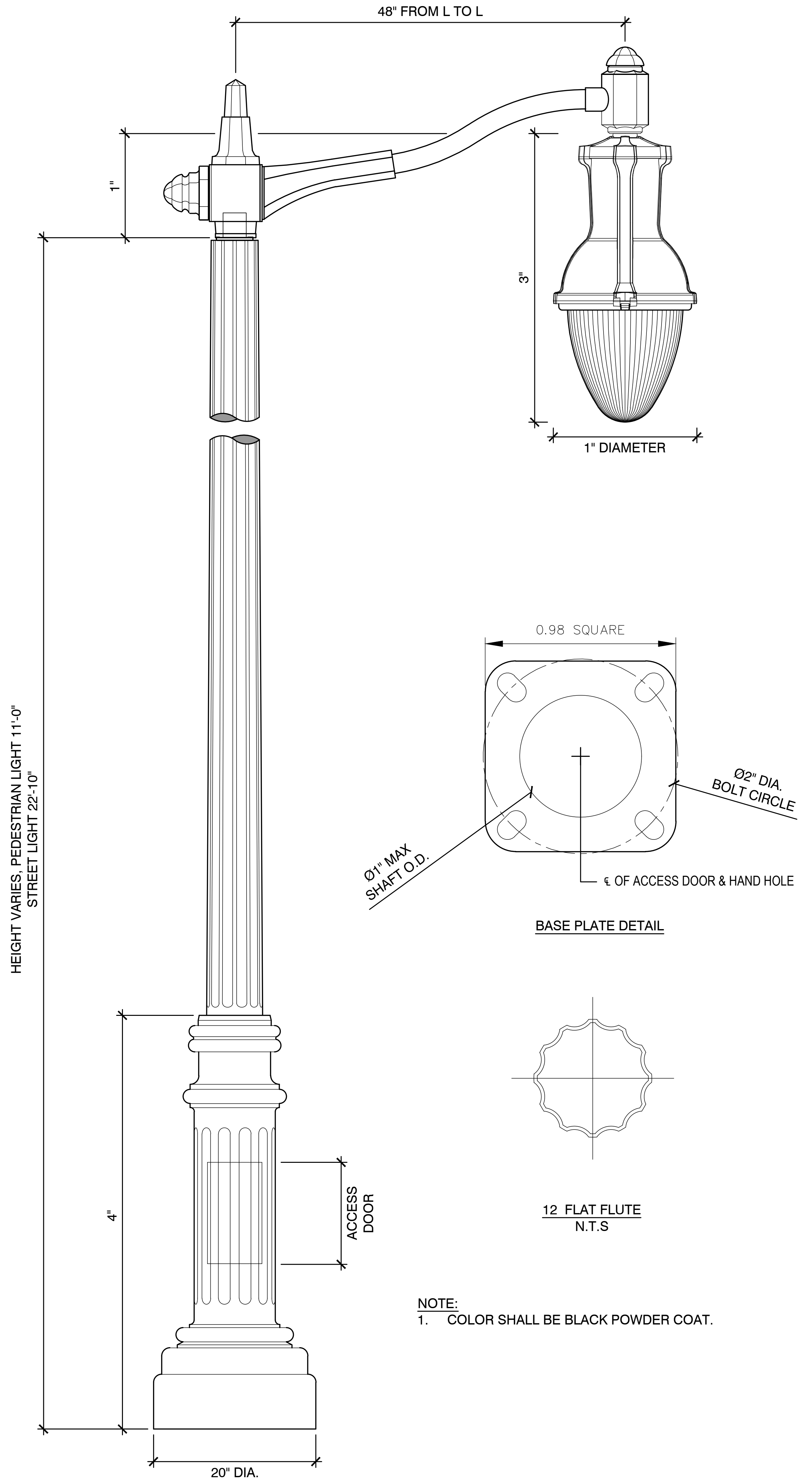
1 RAPID FLASHING BEACON

SCALE: N.T.S.



2 LIGHT POST FOOTING

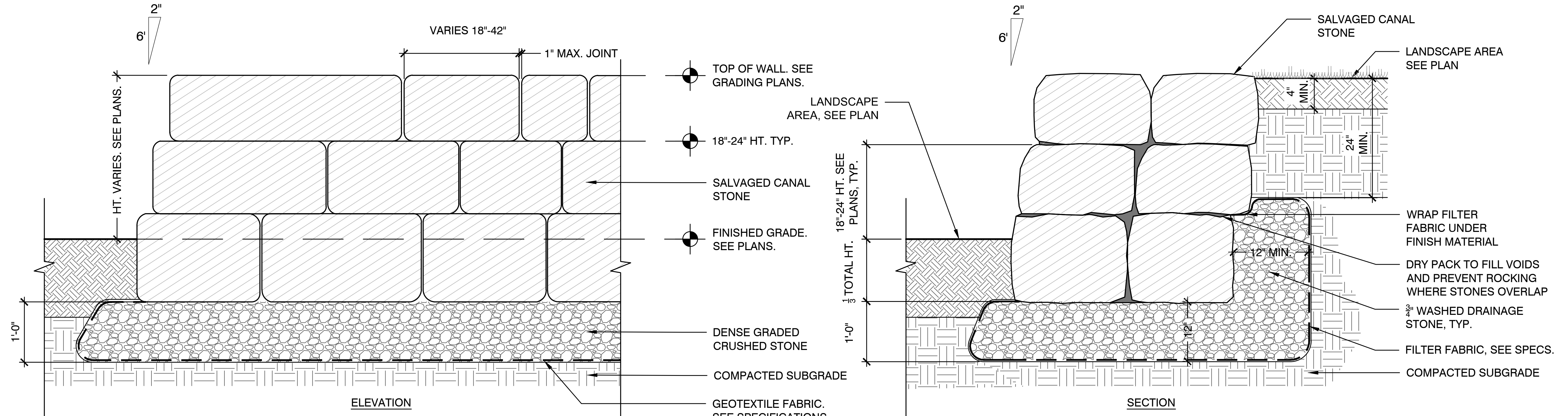
SCALE: N.T.S.



NOTE:
1. COLOR SHALL BE BLACK POWDER COAT.

3 PEDESTRIAN AND STREET LIGHT

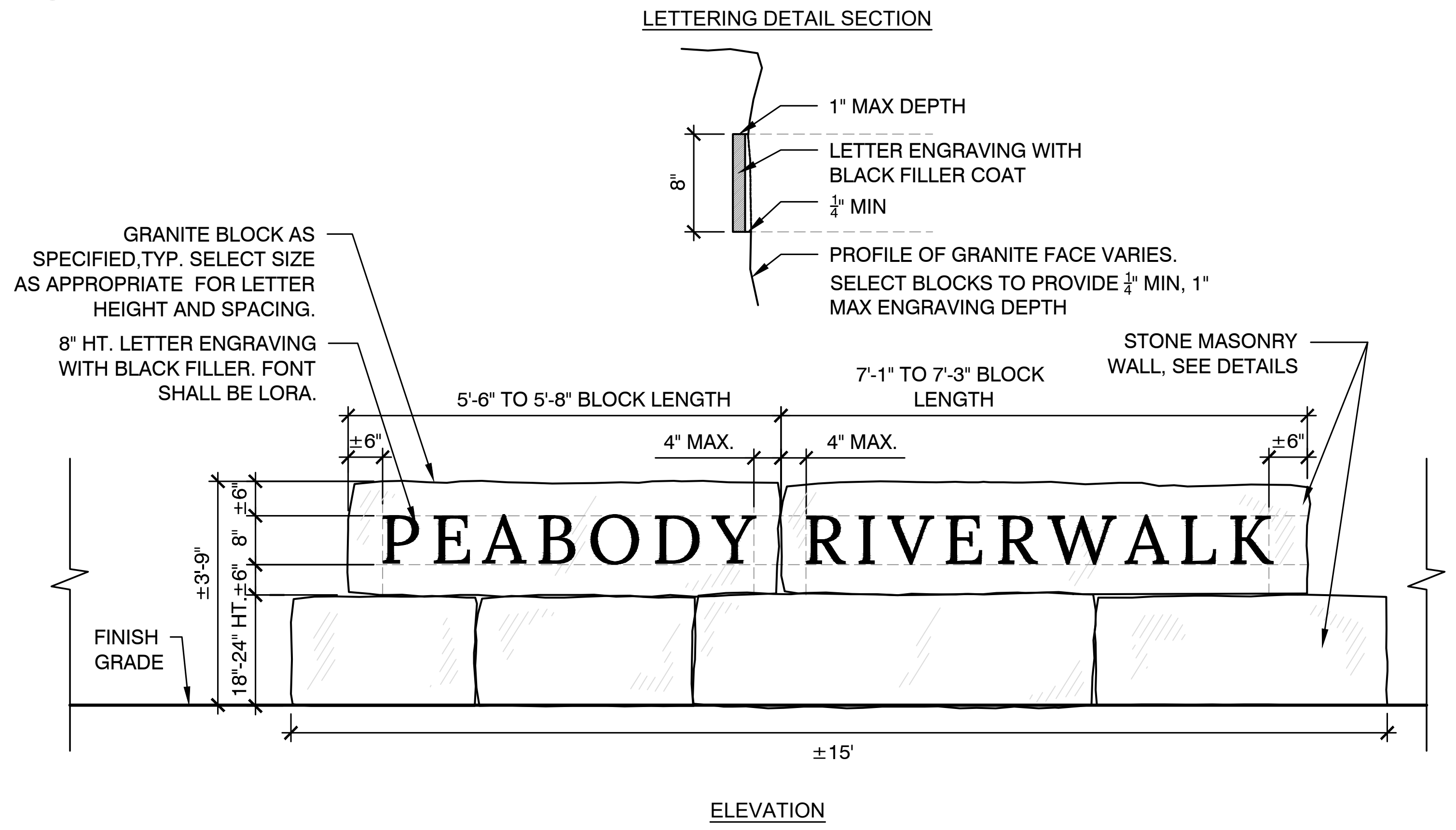
SCALE: N.T.S.



NOTES:
1. BLOCK SELECTION SHALL BE BY OWNER'S REPRESENTATIVE.
2. FINAL LOCATION AND LAYOUT SHALL BE BY OWNER'S REPRESENTATIVE IN FIELD. CONTRACTOR SHALL ASSUME PLACEMENT OF EACH BLOCK A MINIMUM OF 3 TIMES.
3. CONTRACTOR SHALL PROVIDE 6' x 2" BATTER FOR EACH ROW OF STONE.
4. JOINT BETWEEN BOULDER AND ADJACENT MATERIAL SHALL NOT EXCEED ½". STRIPPED TOP SHALL BE FILLED WITH POLYMERIC SAND.
5. CONTRACTOR SHALL FILL VOIDS BETWEEN STONES USING TRAP ROCK. TRAP ROCK SHALL BE SECURELY PLACED TO PREVENT REMOVAL.

4 SALVAGED CANAL STONE RETAINING WALL

SCALE: N.T.S.



5 GRANITE BLOCK RIVERWALK ENTRY SIGN

SCALE: N.T.S.

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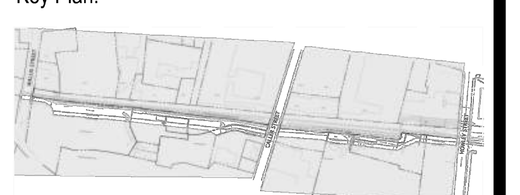

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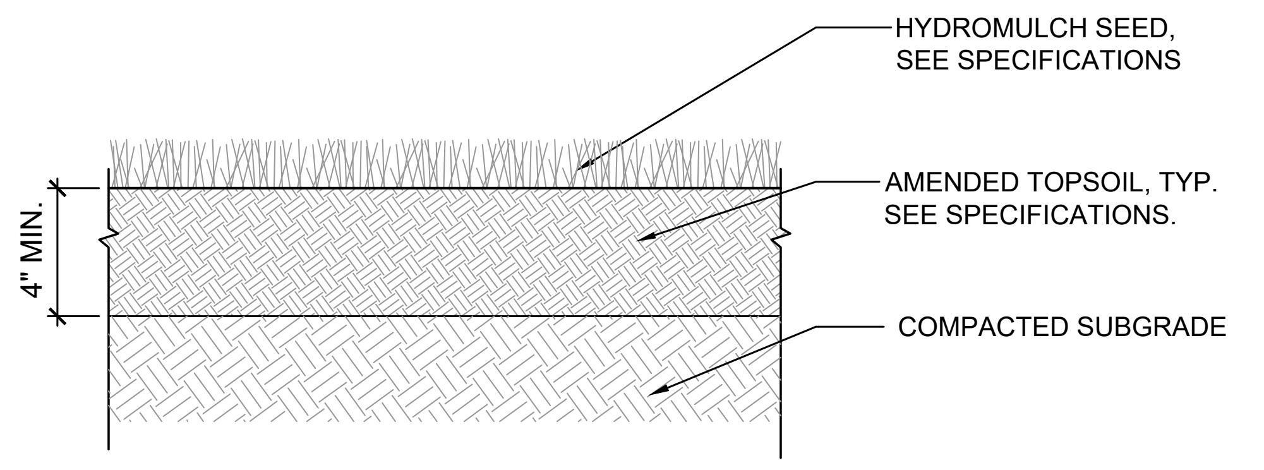
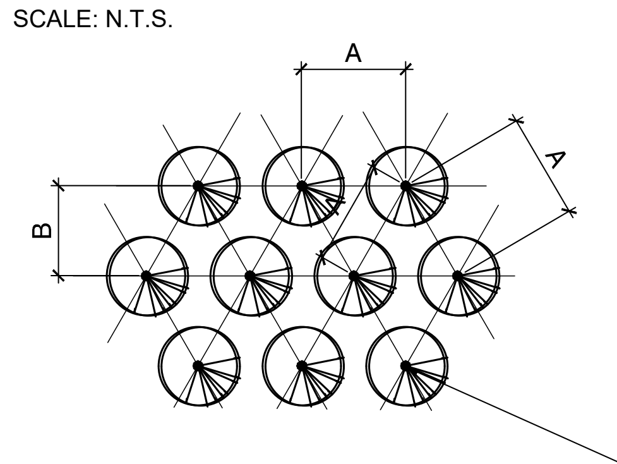


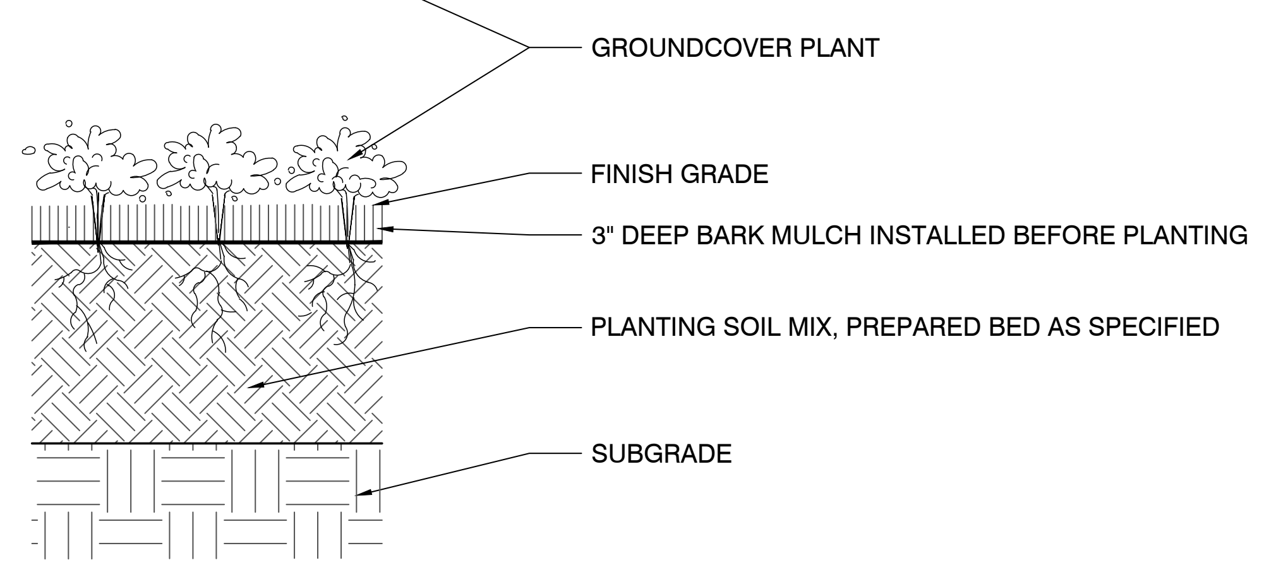
1 LOAM AND SEED

SCALE: N.T.S.



GROUNDCOVER SPACING TABLE

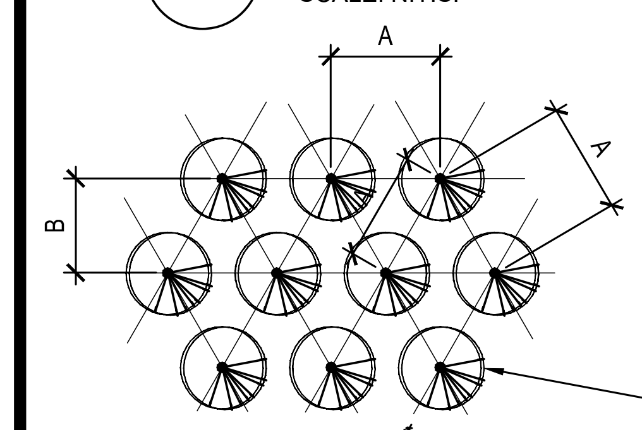
PLANT SPACING "A"	ROW SPACING "B"	PLANTS	AREA UNIT
6" O.C.	5.2"	4.61	1 SQ. FT.
8" O.C.	6.93"	2.6	1 SQ. FT.
10" O.C.	8.66"	1.66	1 SQ. FT.
12" O.C.	10.4"	1.15	1 SQ. FT.



NOTES:
1. ALL GROUNDCOVER TO BE PLANTED IN TRIANGULAR PATTERN. SEE DETAIL PLAN AND GROUNDCOVER SPACING TABLE.
2. JUTE EROSION CONTROL MAT TO BE USED ON ALL SLOPES GREATER THAN 3:1

2 GROUNDCOVER PLANTING

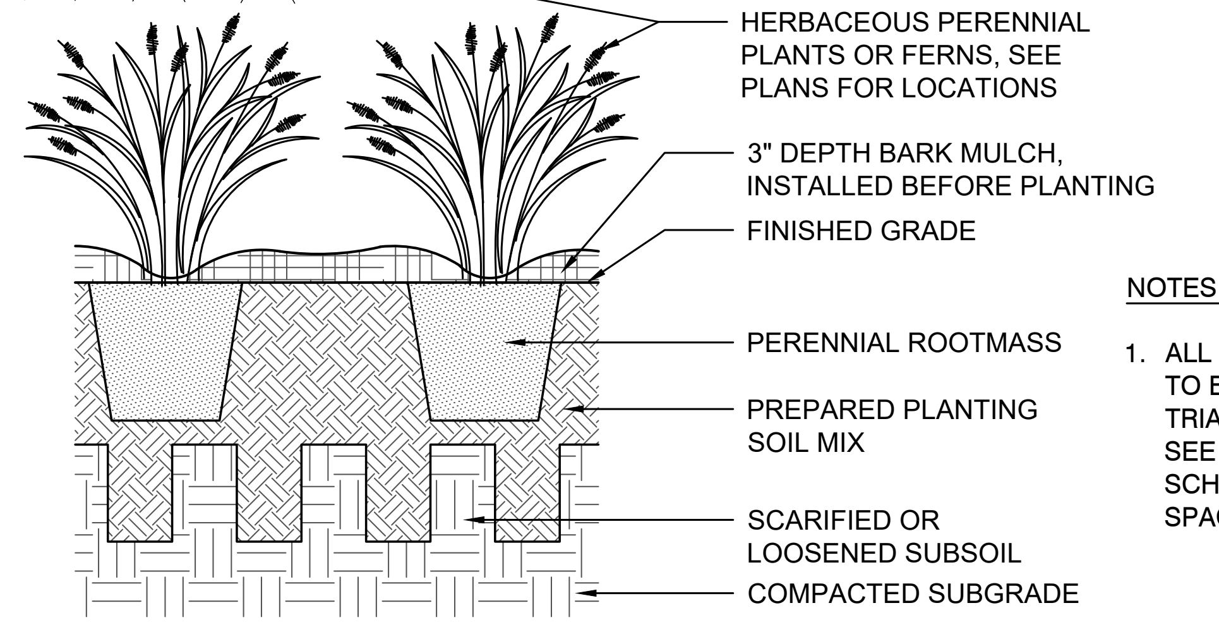
SCALE: N.T.S.



PLAN

HERBACEOUS PERENNIAL & FERN SPACING TABLE

PLANT SPACING "A"	PLANT SPACING "B"	PLANTS	AREA UNIT
6" O.C.	5.2"	4.61	1 SQ. FT.
8" O.C.	6.93"	2.6	1 SQ. FT.
10" O.C.	8.66"	1.66	1 SQ. FT.
12" O.C.	10.4"	1.15	1 SQ. FT.

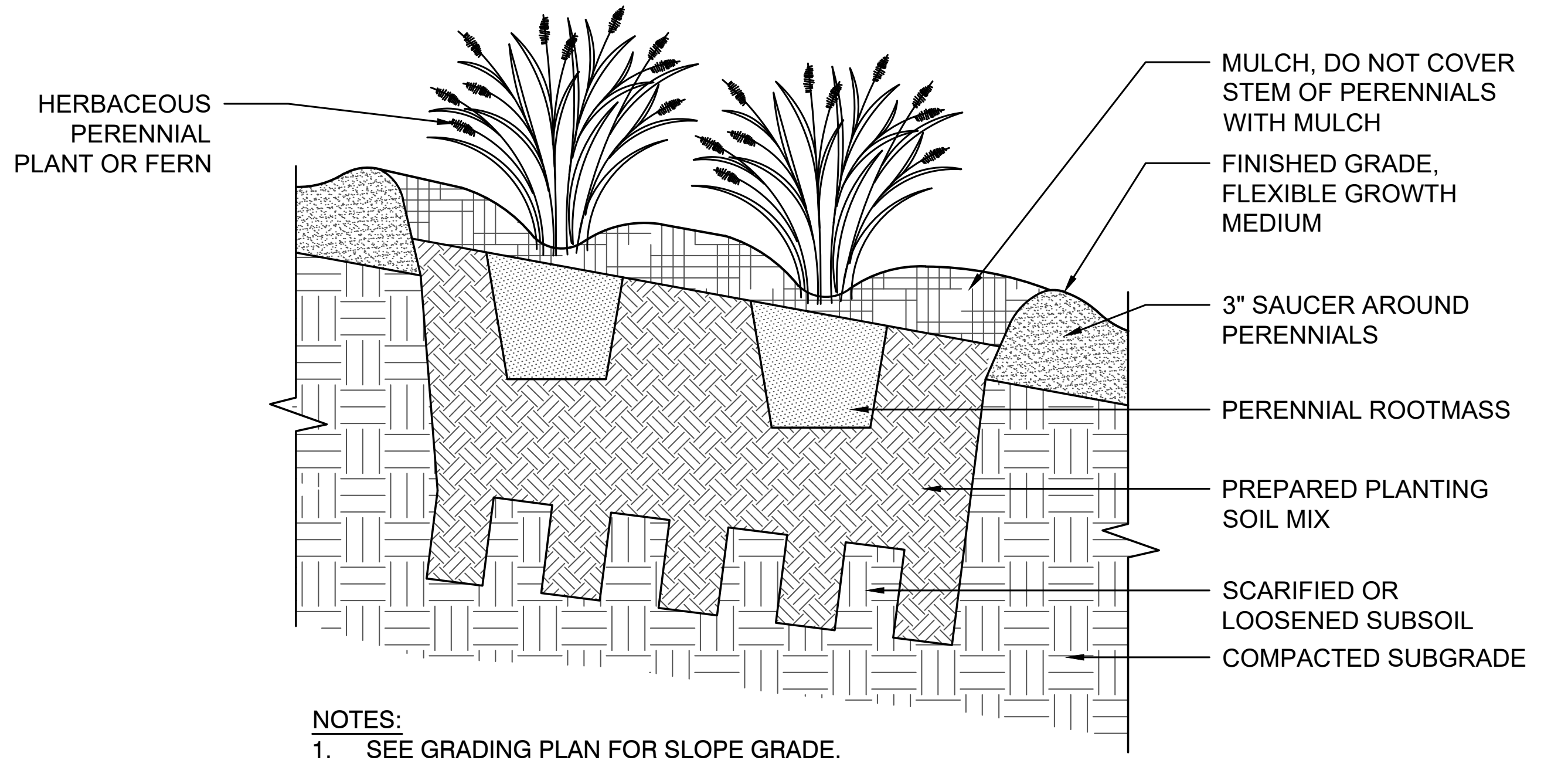


NOTES:
1. ALL GROUND COVERS TO BE PLANTED IN TRIANGULAR PATTERN. SEE PLANTING SCHEDULE FOR SPACING.

SECTION

3 HERBACEOUS PERENNIAL

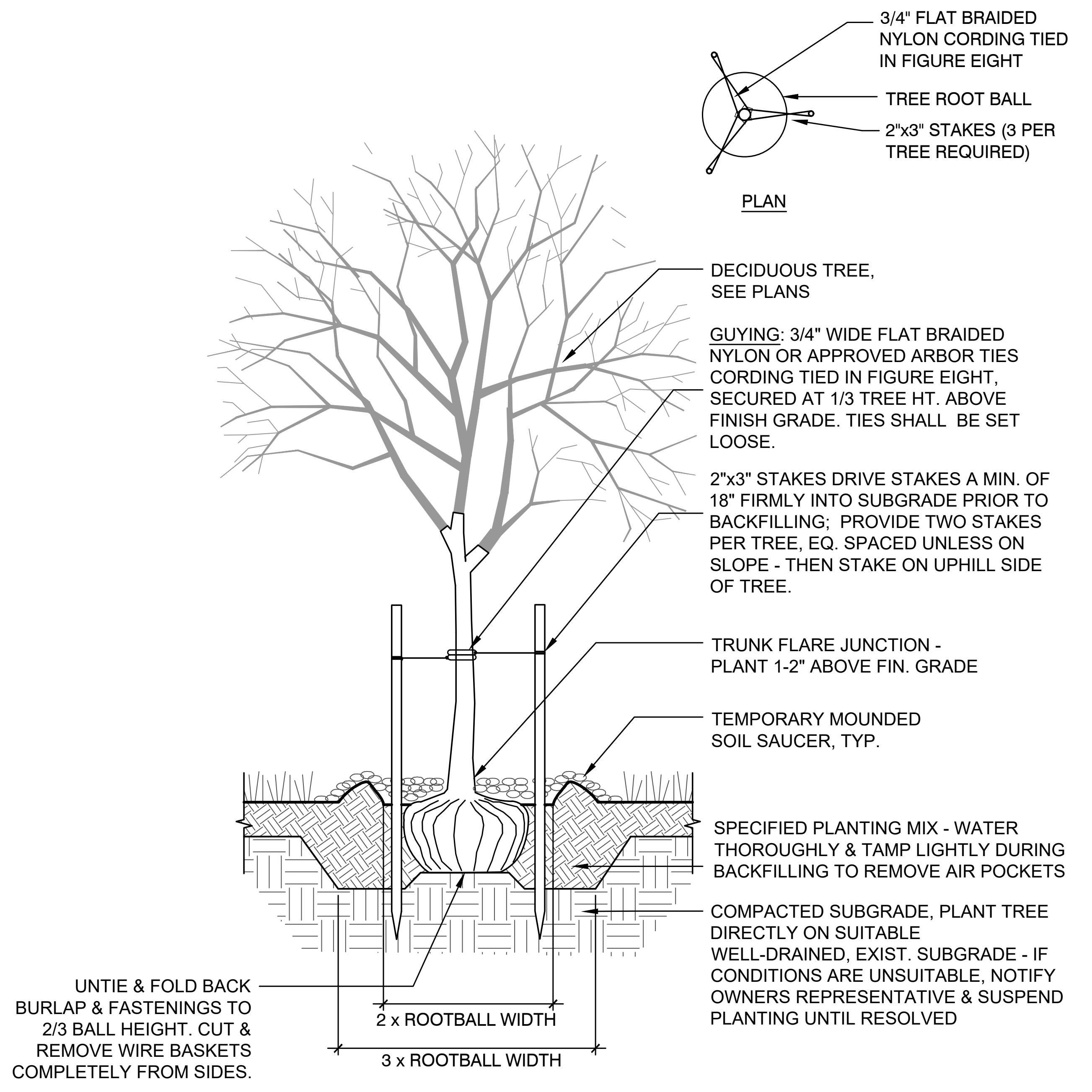
SCALE: N.T.S.



NOTES:
1. SEE GRADING PLAN FOR SLOPE GRADE.
2. ALL MULCH MUST BE DARK IN COLOR. PROVIDE SAMPLE PRIOR TO INSTALLATION TO BE APPROVED BY OWNER'S REPRESENTATIVE.

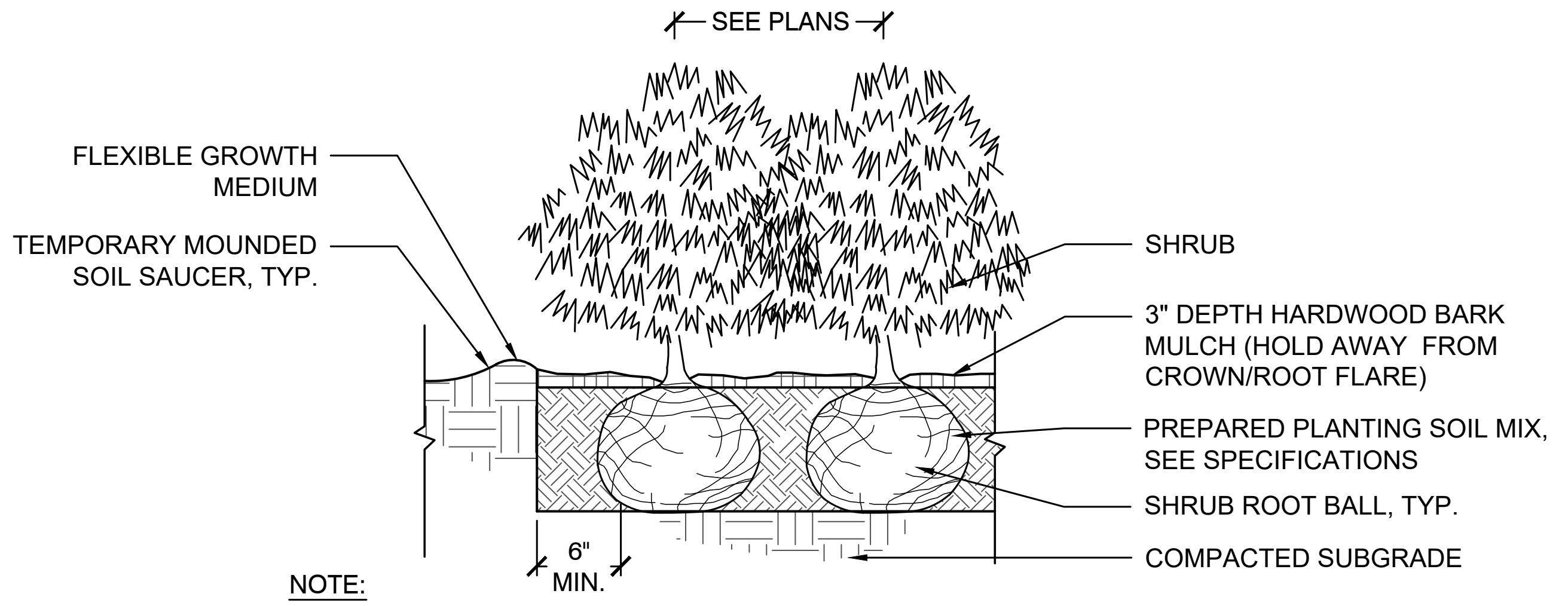
4 HERBACEOUS PERENNIAL ON SLOPE

SCALE: N.T.S.



5 TREE PLANTING AND STAKING - DECIDUOUS

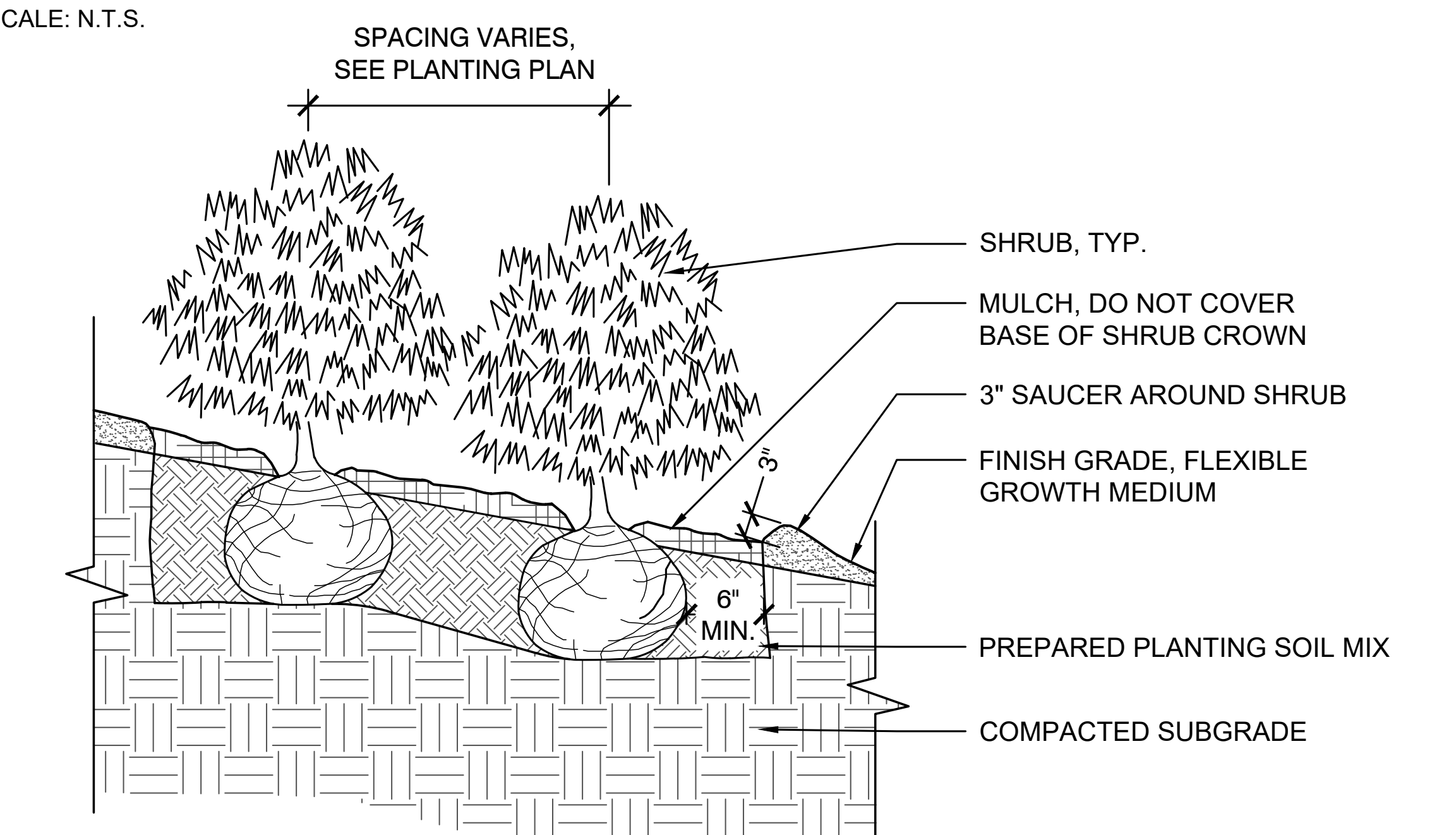
SCALE: N.T.S.



NOTE:
1. ALL MULCH MUST BE DARK IN COLOR. PROVIDE SAMPLE PRIOR TO INSTALLATION TO BE APPROVED BY OWNER'S REPRESENTATIVE.

6 SHRUB PLANTING

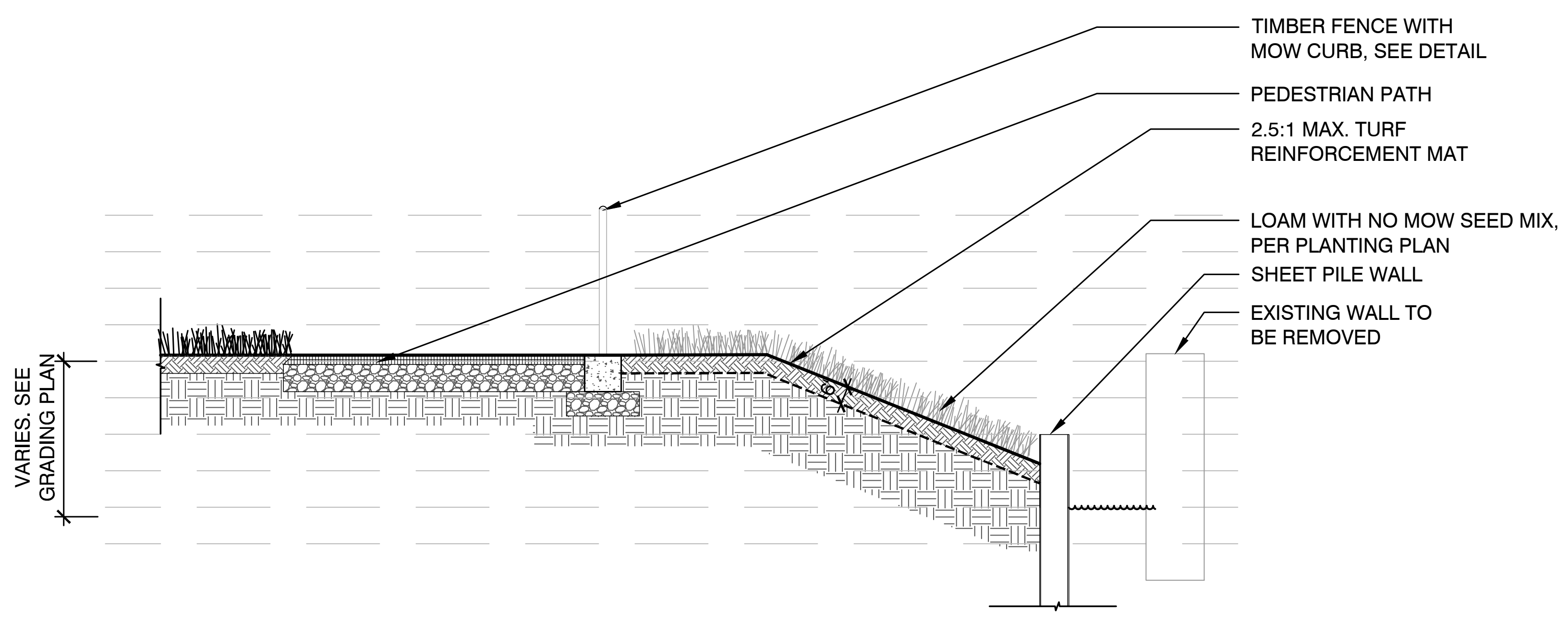
SCALE: N.T.S.



NOTES:
1. SEE GRADING PLAN FOR SLOPE GRADE.
2. ALL MULCH MUST BE DARK IN COLOR. PROVIDE SAMPLE PRIOR TO INSTALLATION TO BE APPROVED BY OWNER'S REPRESENTATIVE.

7 SHRUB PLANTING ON SLOPE

SCALE: N.T.S.



8 SLOPE WITH TURF REINFORCEMENT MAT, LOAM AND EROSION CONTROL

SCALE: N.T.S.

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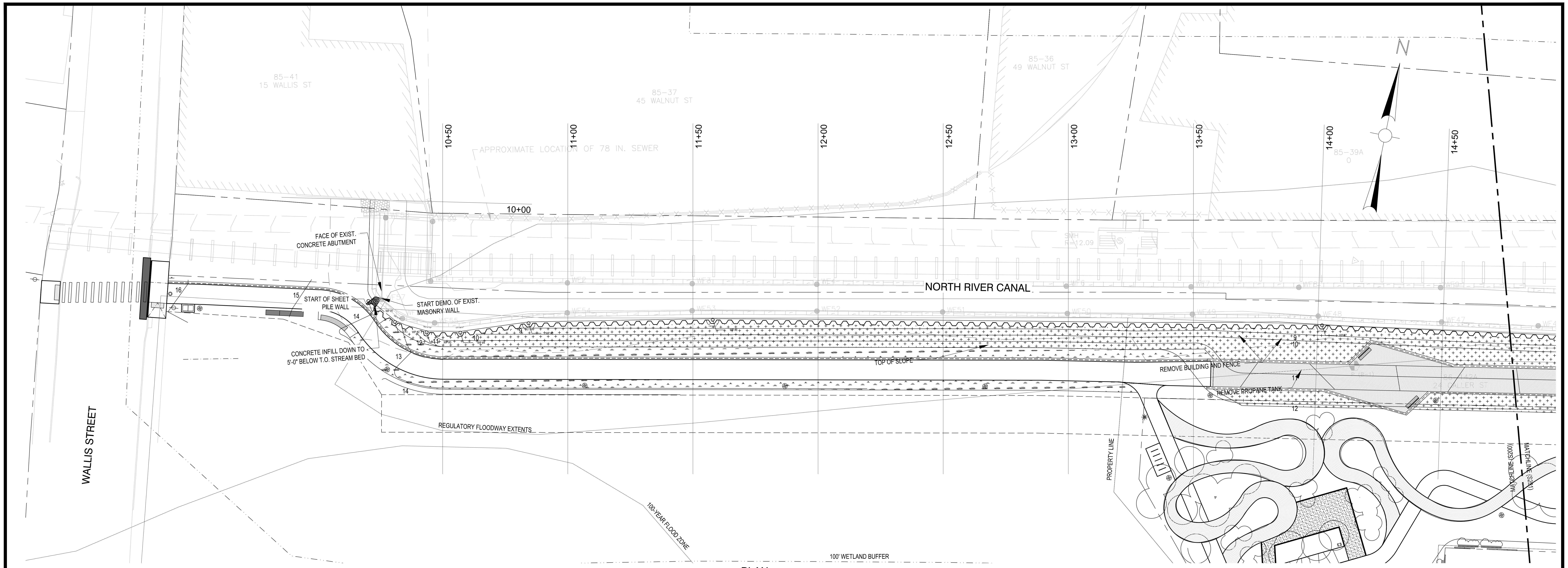
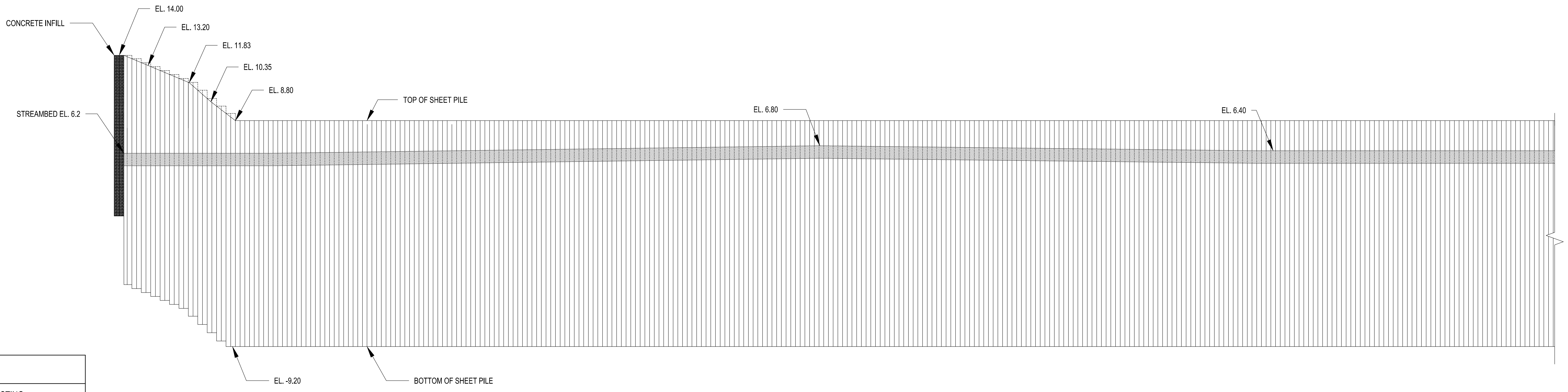


PLAN



ELEVATION - SHEET PILE WALL

WORKING POINT TABLE		
WP #	NORTHING	EASTING
1	3120217.9090	-160733.36930
2	3120209.38300	-160722.86670
3	3120205.11650	-160710.25810
4	3120204.84670	-160696.80040
5	3120208.31540	-160669.47910
6	3120208.85690	-160595.88510
7	3120204.00420	-160352.44290

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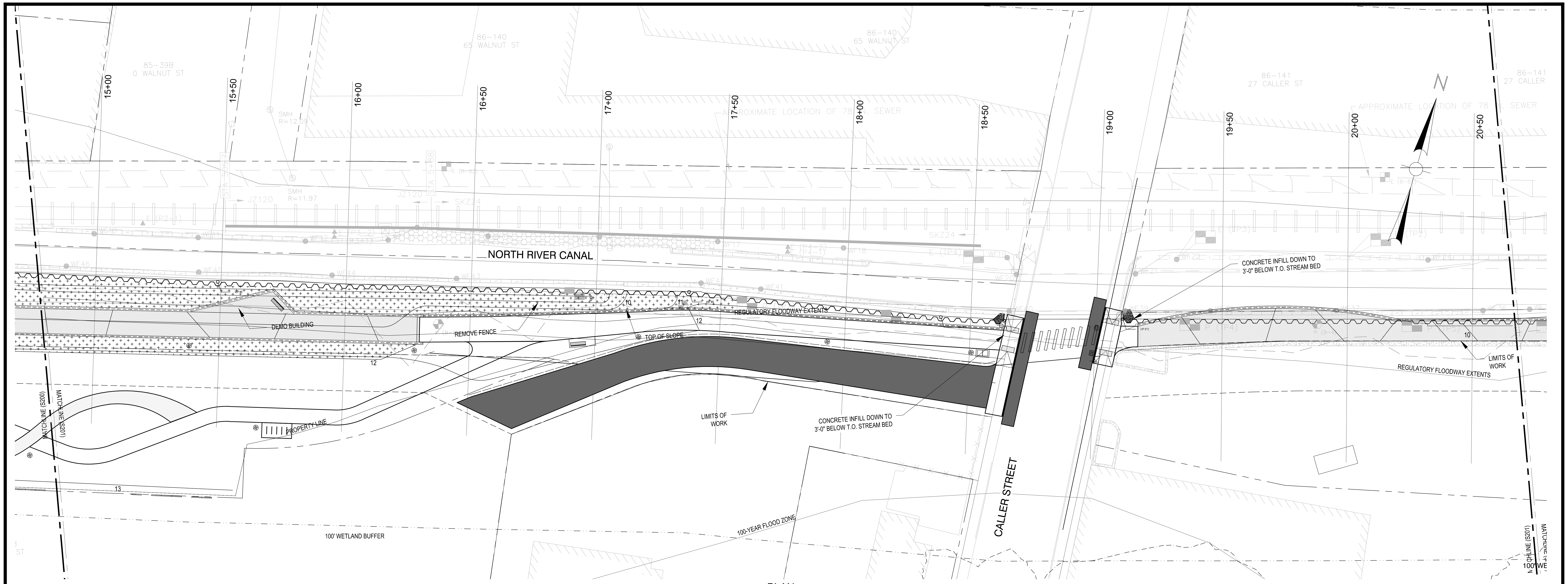
W&S File No.:

Drawing Title:

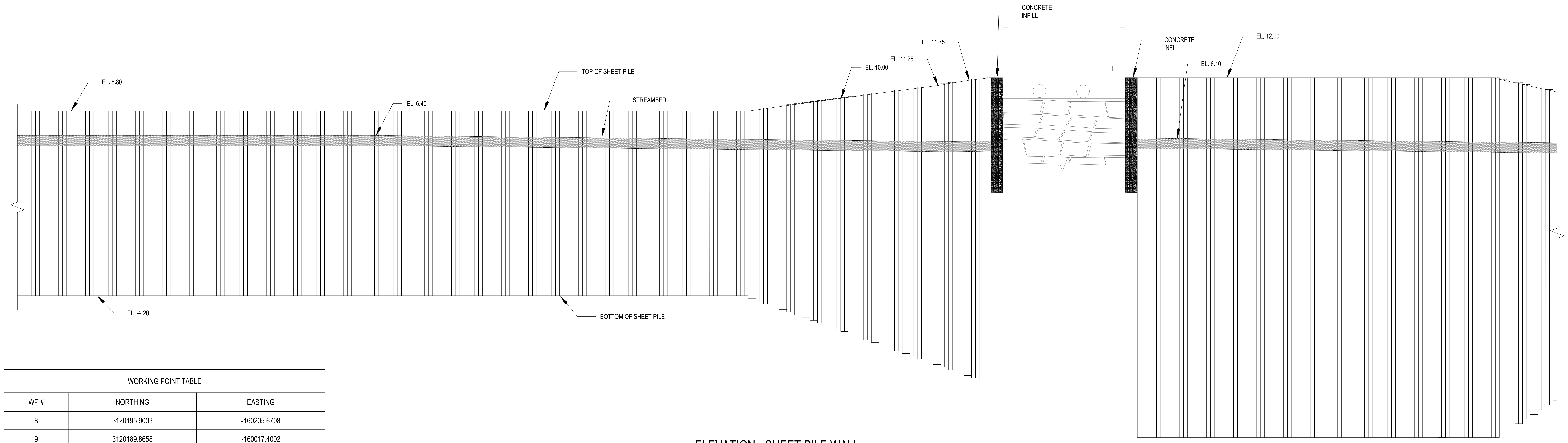
PROPOSED LAYOUT
PLAN I

Sheet Number:

S200



PLAN



ELEVATION - SHEET PILE WALL

WORKING POINT TABLE		
WP #	NORTHING	EASTING
8	3120195.9003	-160205.6708
9	3120189.8658	-160017.4002
10	3120178.6442	-159916.9494
11	3120177.0231	-159891.7712
12	3120177.0638	-159844.1990

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

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Consultants:

Revisions:

No.	Date	Description

Seal:

SCOTT R.
BRUSO
STRUCTURAL
No. 48061

Scott Bruso

Issued For:

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- NOT FOR CONSTRUCTION -

Date: APRIL 2021
Drawn By: HLB
Reviewed By: SYC
Approved By: SRB

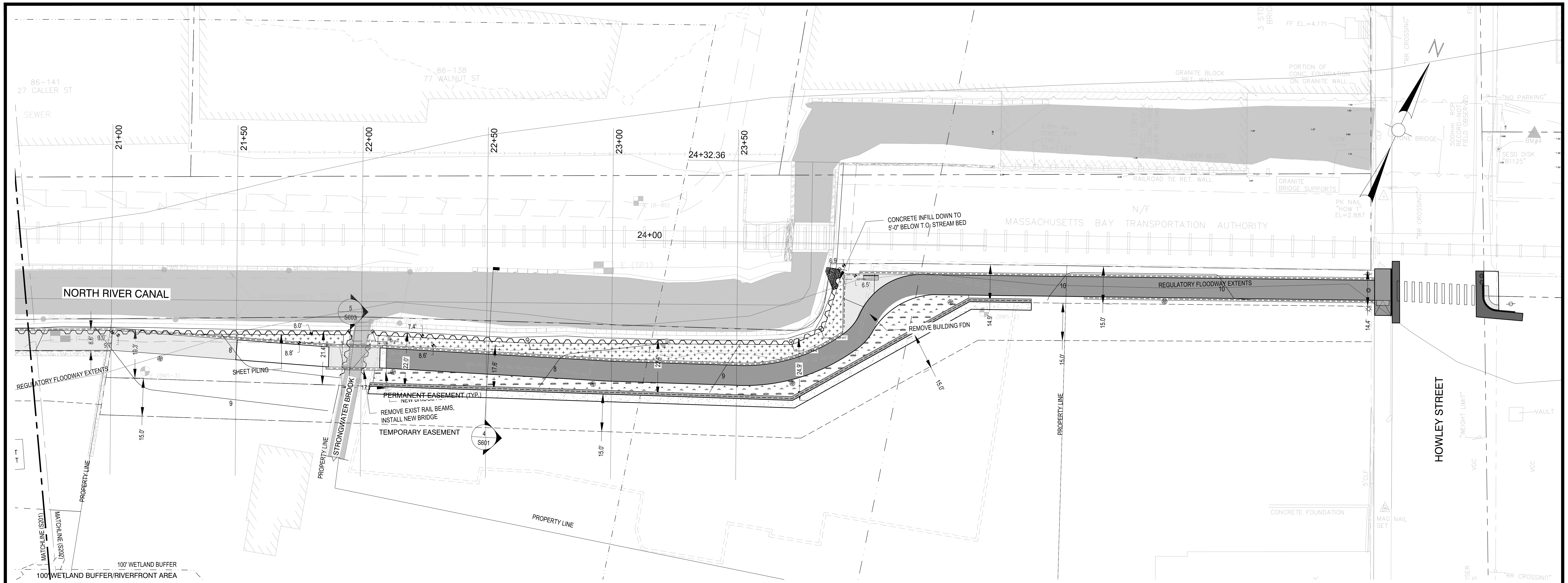
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

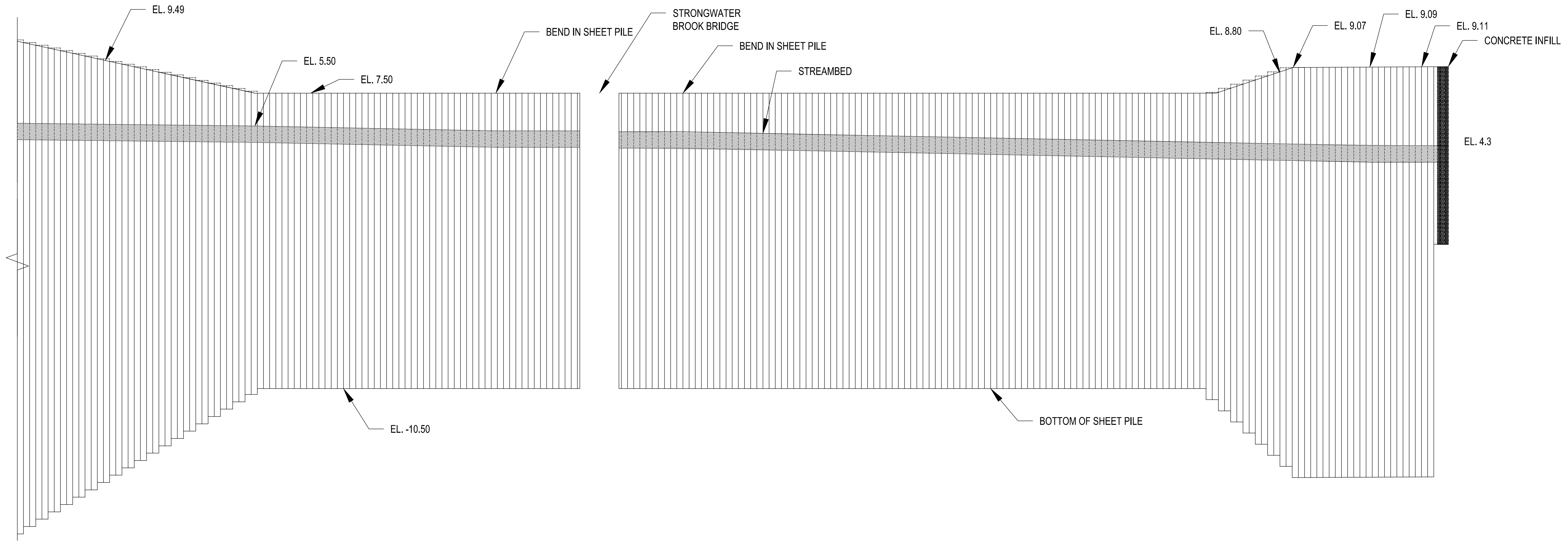
PROPOSED LAYOUT
PLAN II

Sheet Number:

S201



PLAN



ELEVATION - SHEET PILE WALL

WORKING POINT TABLE		
WP #	NORTHING	EASTING
13	3120173.1015	-159559.3888
14	3120172.8502	-159550.1588
15	3120168.9470	-159488.2683
16	3120167.2228	-159382.9704
17	3120172.3121	-159371.1687
18	3120195.6586	-159363.2979

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S202.dwg

Project:

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Reviewed By: SYC
Approved By: SRB

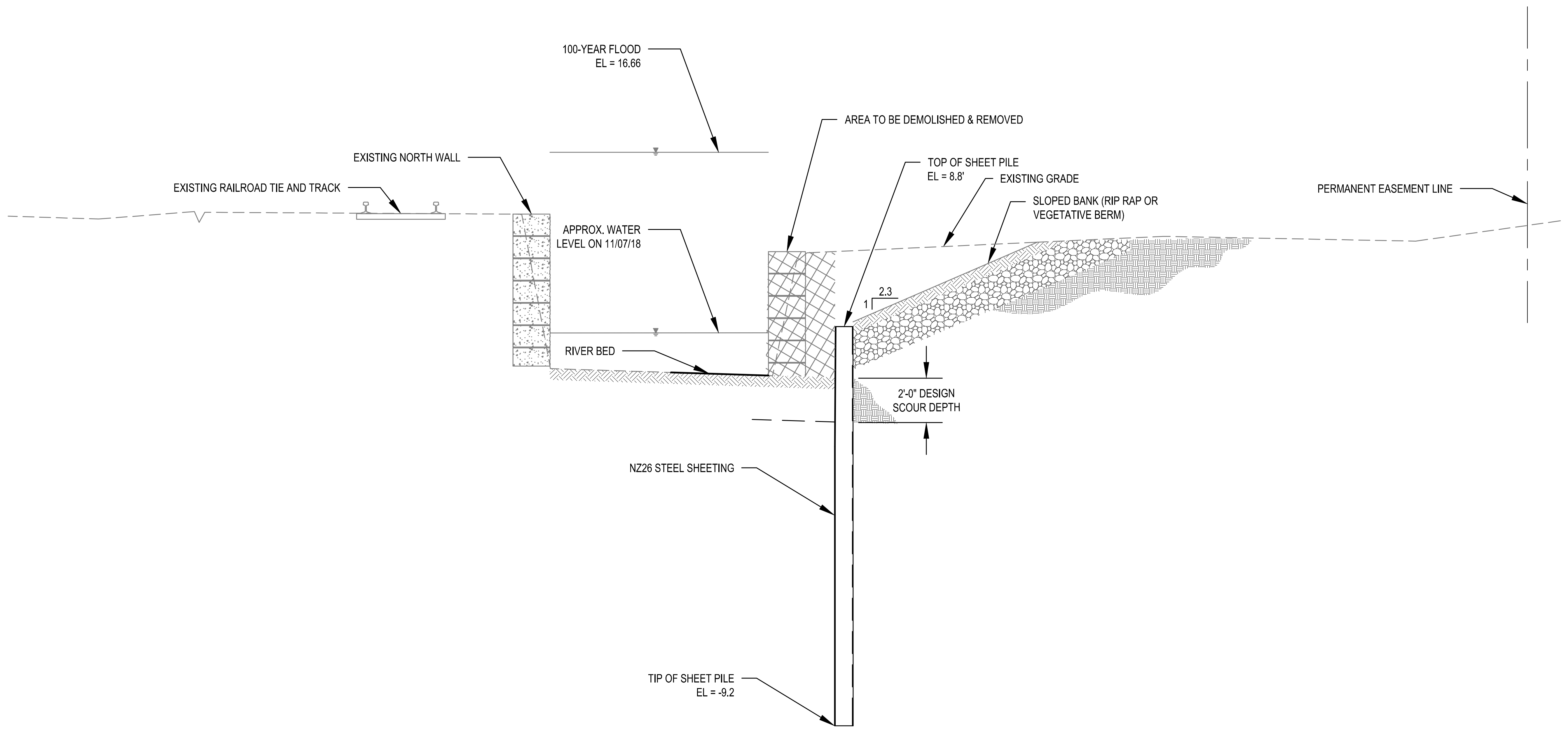
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

PROPOSED LAYOUT
PLAN III

Sheet Number:

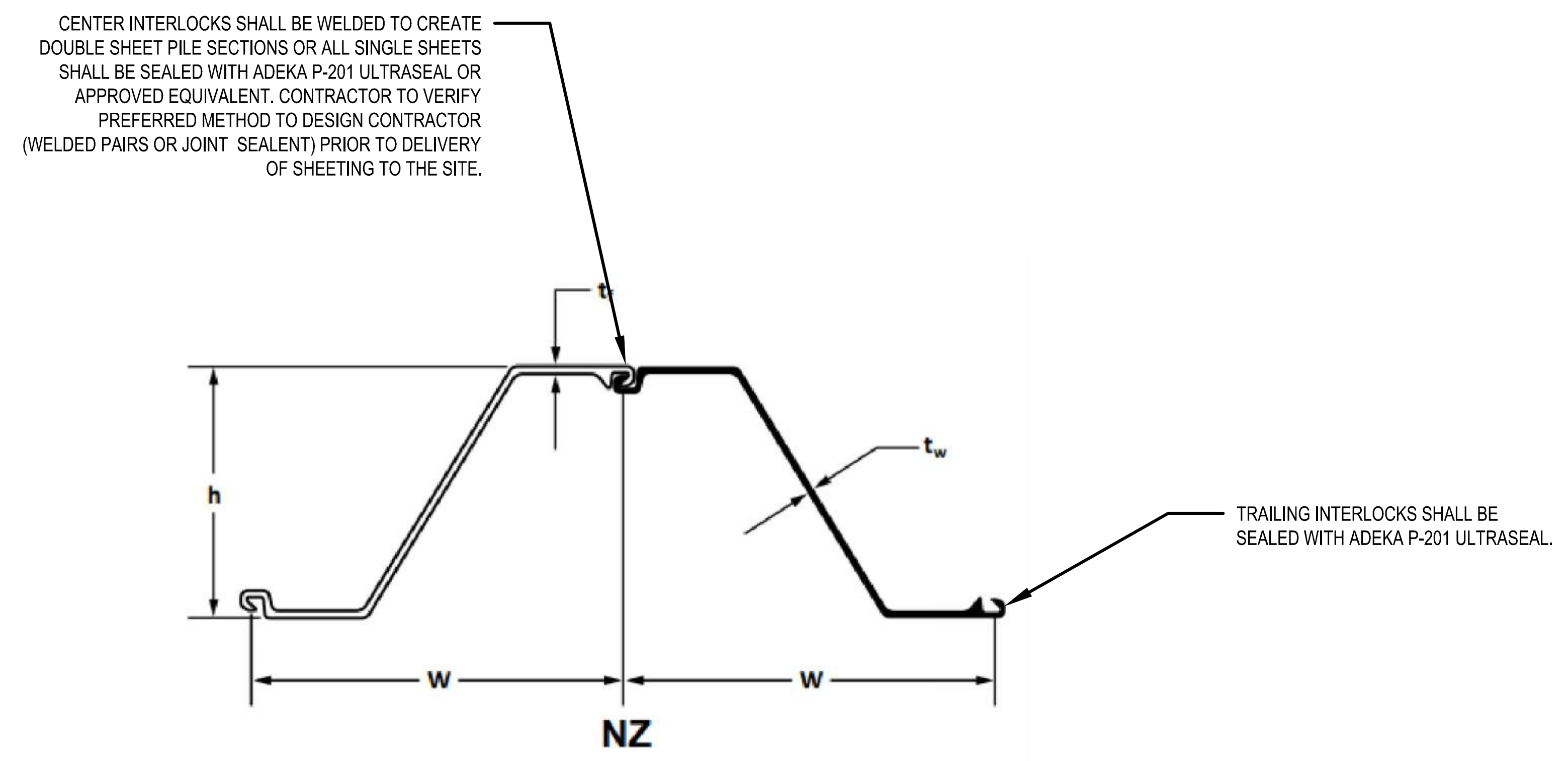
S202



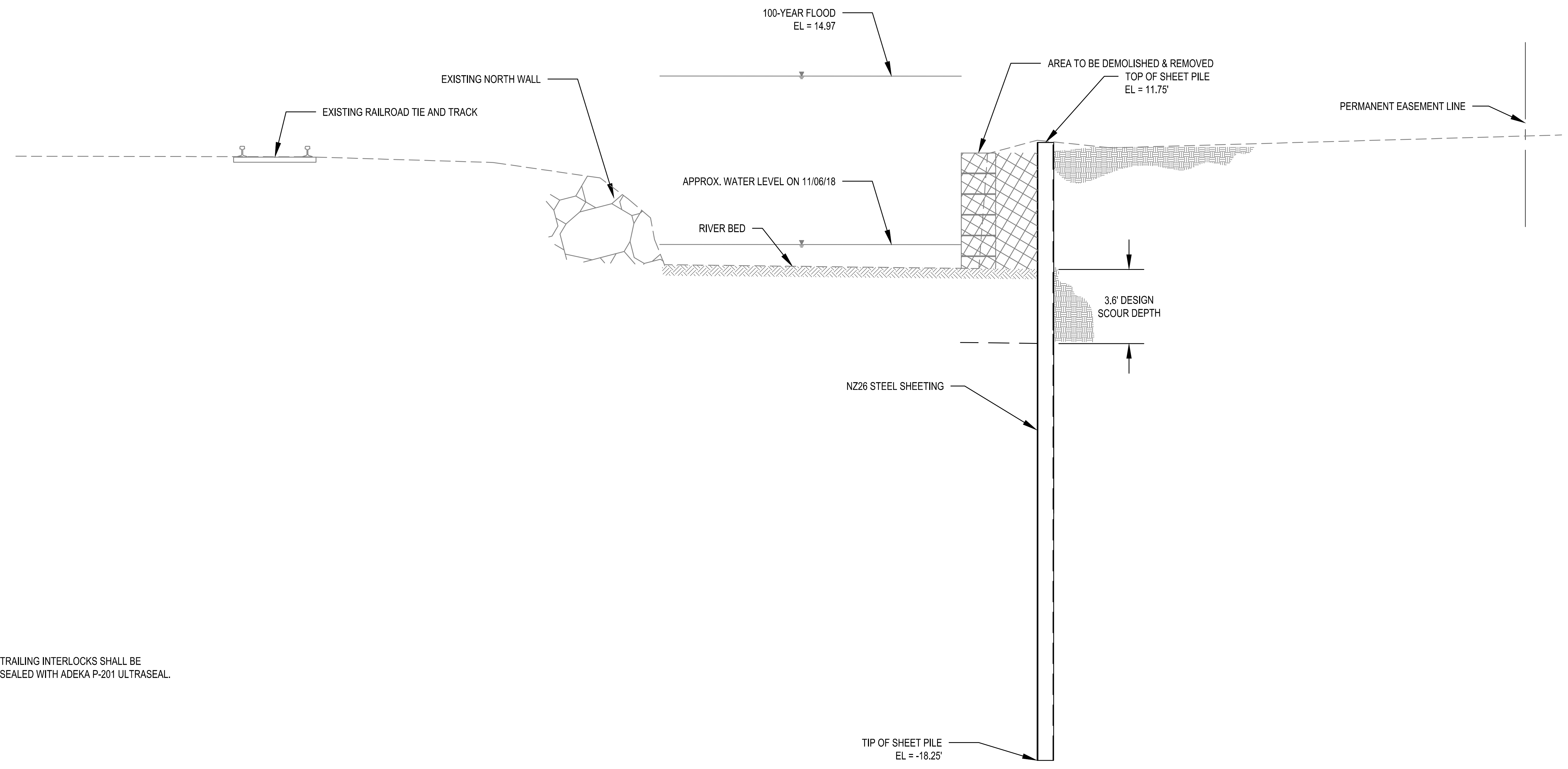
1 SECTION @ STATION 11+50

NZ/PZ HOT ROLLED STEEL SHEET PILE

NTS



SECTION	WIDTH (W) (IN)	HEIGHT (H) (IN)	THICKNESS		CROSS SECTIONAL AREA (IN^2/FT)	WEIGHT		SECTION MODULUS		MOMENT OF INERTIA (IN^4/FT)	COATING AREA	
			FLANGE (T_F) (IN)	WEB (T_W) (IN)		PILE (LB/FT)	WALL (LB/FT^2)	ELASTIC (IN^3/FT)	PLASTIC (IN^3/FT)		BOTH SIDES (FT^2/FT) OF SINGLE	WALL SURFACE (FT^2/FT^2)
NZ26	27.56	17.32	0.50	0.50	9.08	71	30.99	48.50	57.01	419.90	6.49	1.41



2 SECTION @ STATION 18+50

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S600.dwg

Project:

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Approved By: SRB

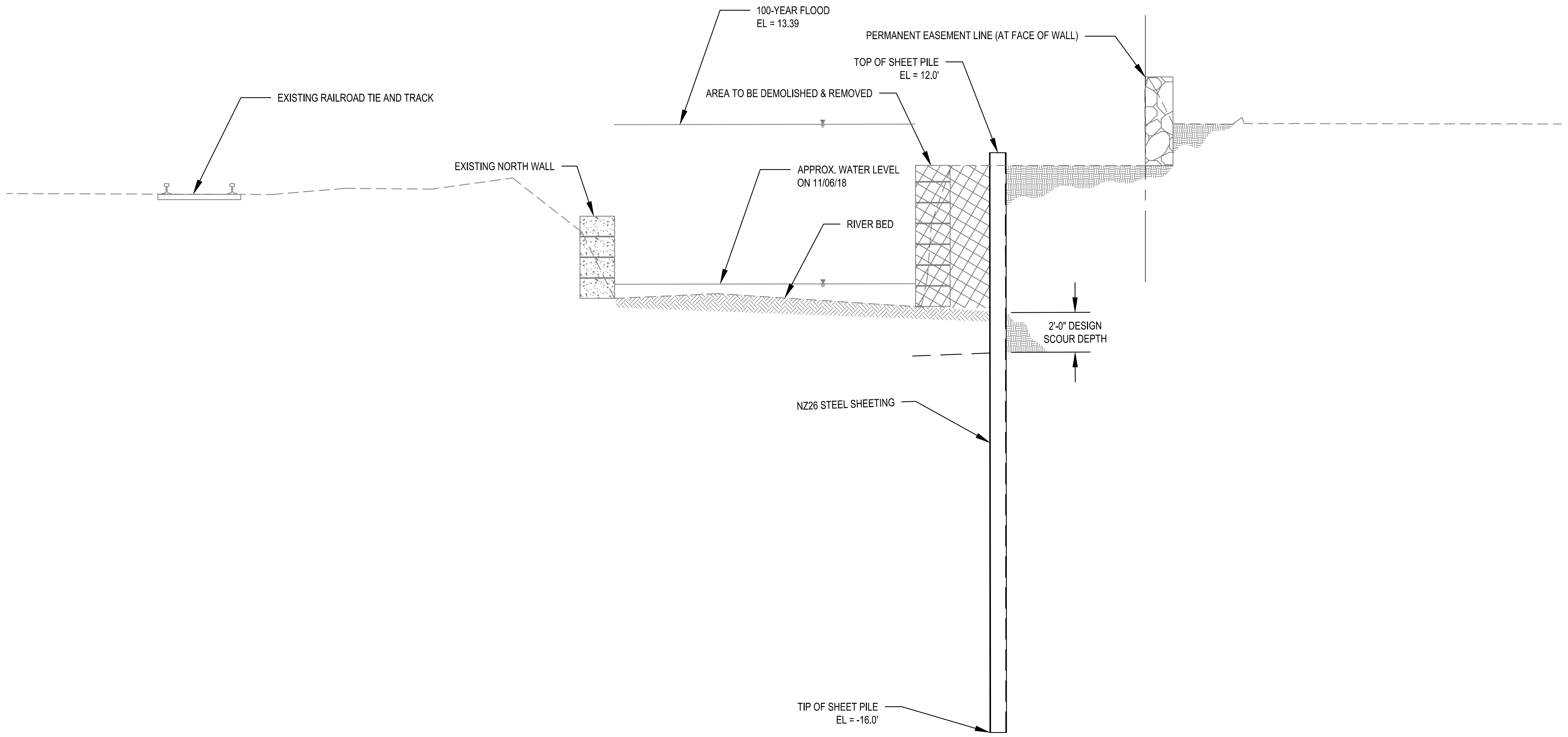
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

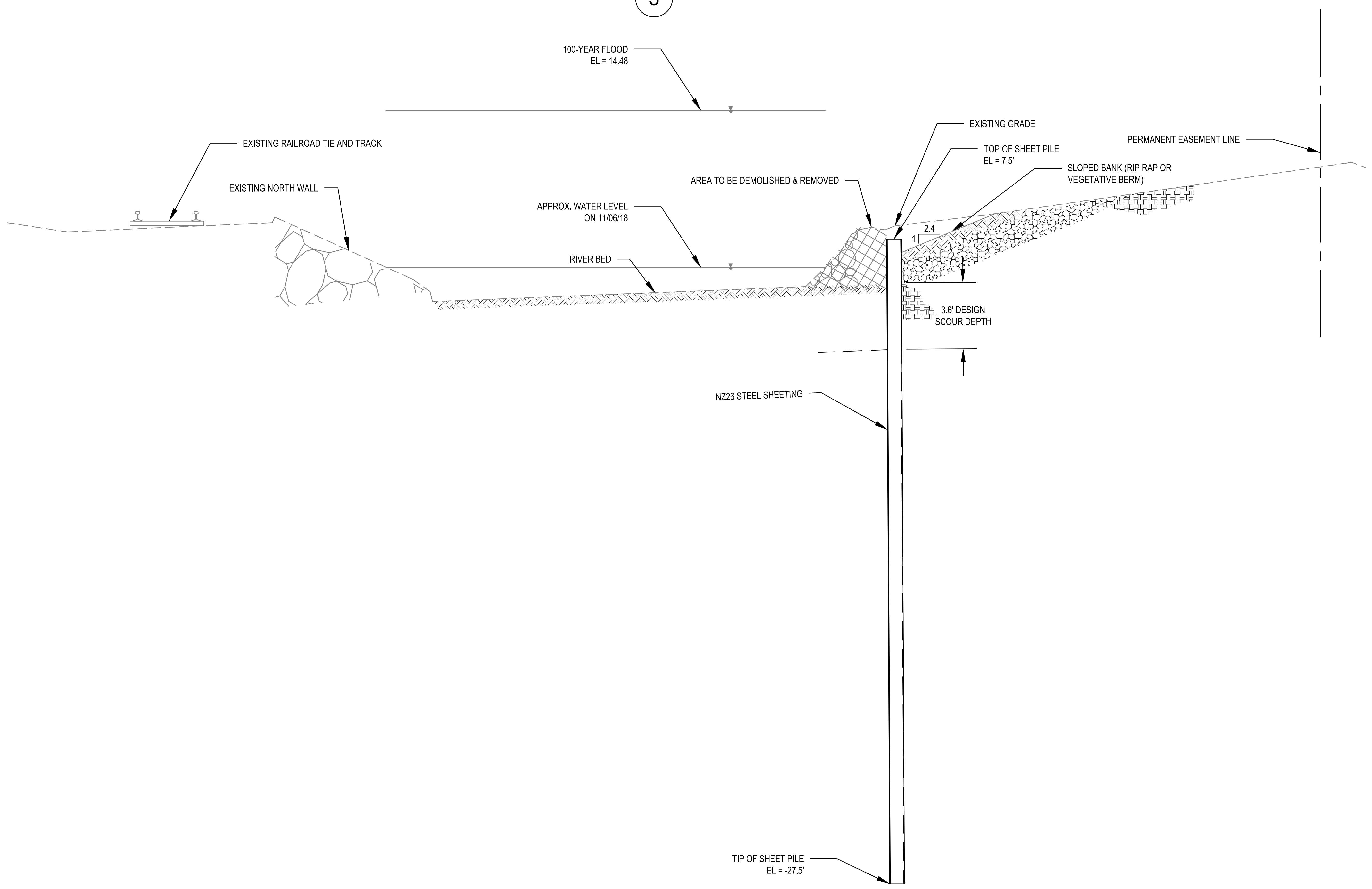
WALL SECTIONS AND
DETAILS I

Sheet Number:

S600



3 SECTION @ STATION 19+50



4 SECTION @ STATION 22+50

Project:

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W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

WALL SECTIONS AND DETAILS II

Sheet Number:

S601

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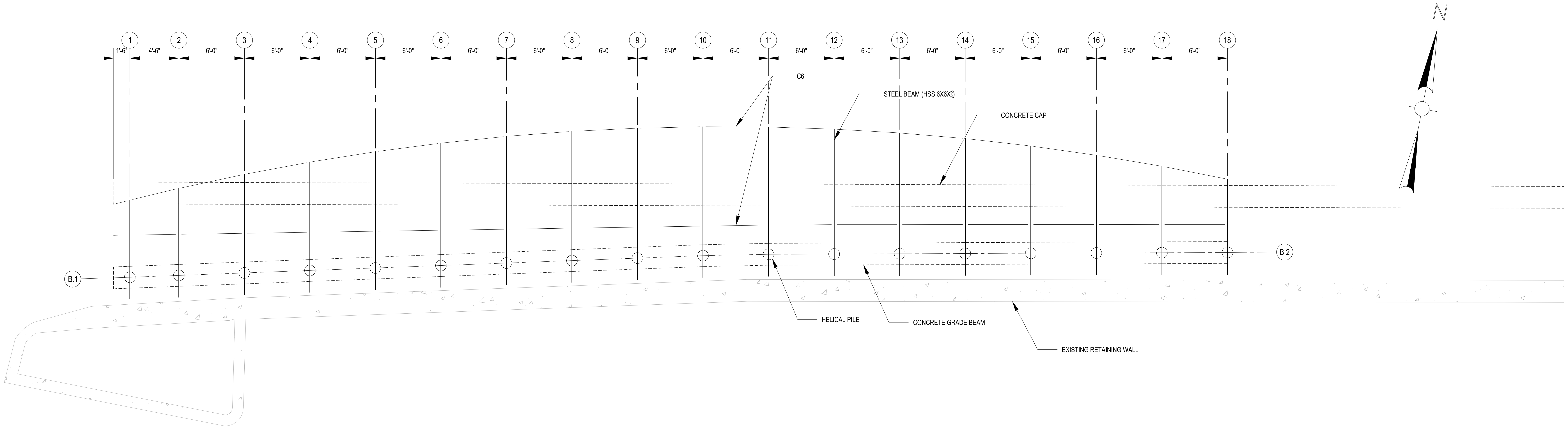
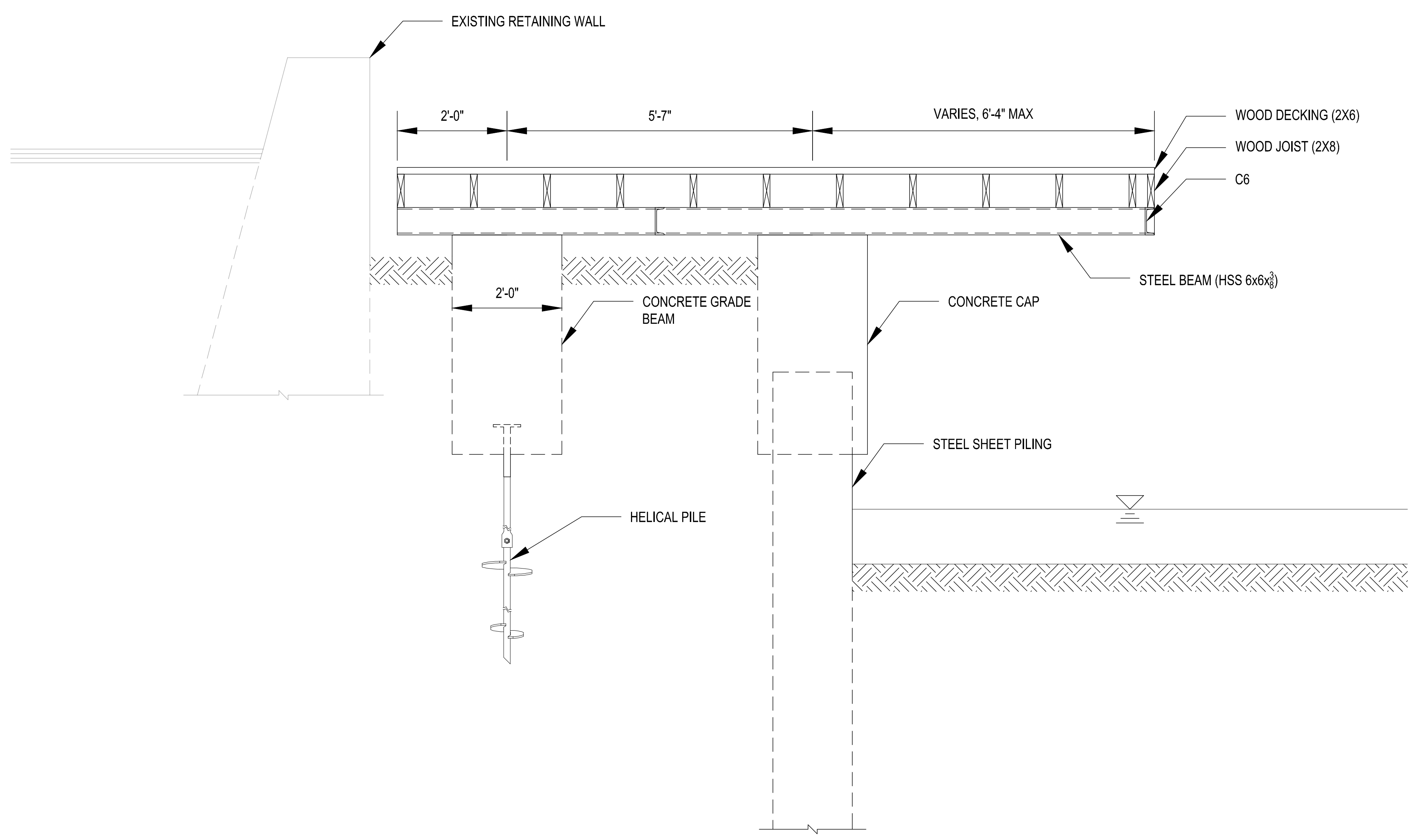
Xref ..\..\09000 DTR Design Technology Resources\9003 DST Project Sheet Set Manager\Border.dwg



FRAMING PLAN



ELEVATION VIEW

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S602.dwg

Project:

PEABODY RIVERWALK
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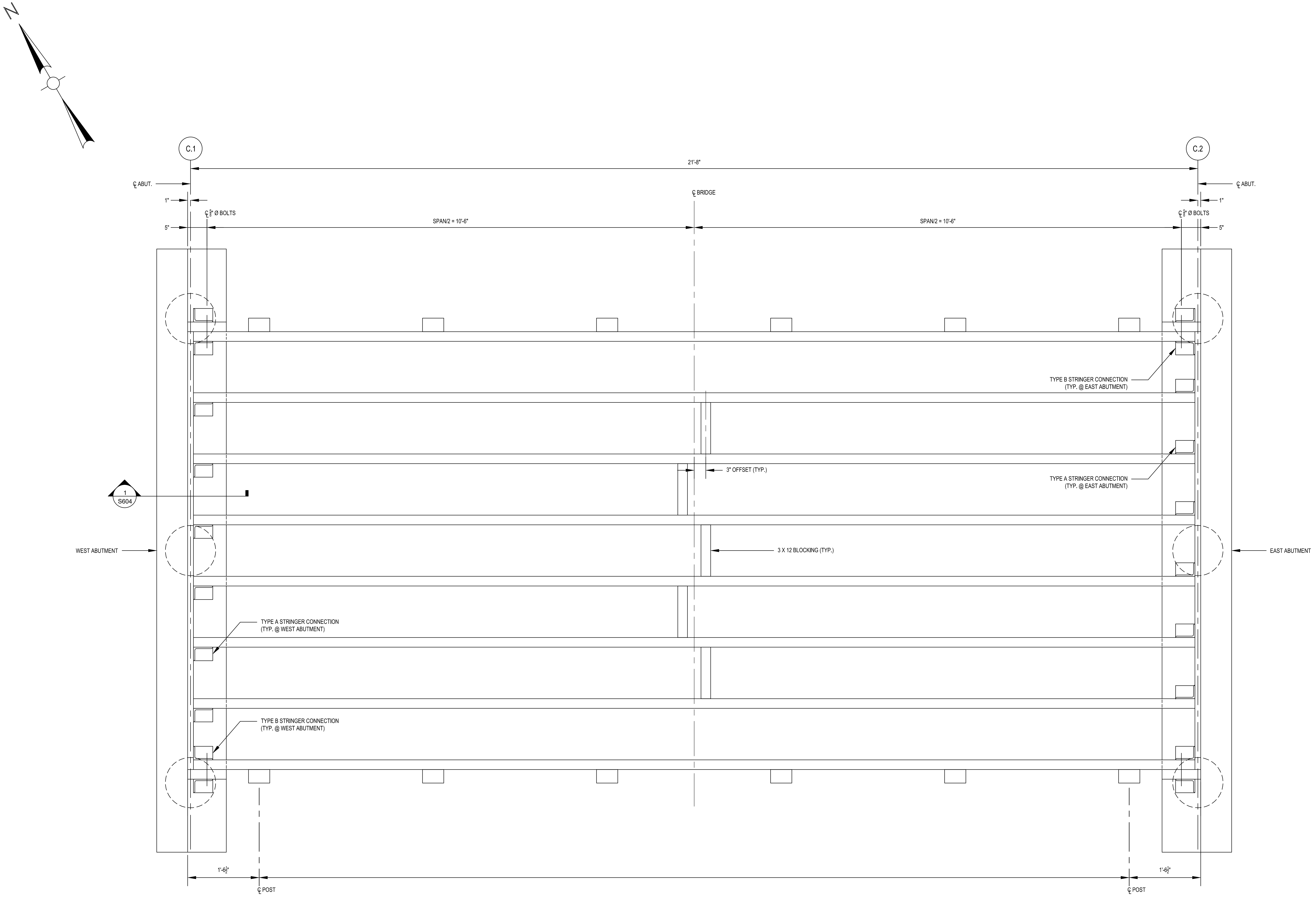
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

OVERLOOK FRAMING
PLAN, SECTIONS, &
DETAILS

Sheet Number:

S602



NOTE: RAILING POST ATTACHMENTS ARE
NOT SHOWN FOR CLARITY.

TIMBER BRIDGE FRAMING PLAN

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S603-S604.dwg

Project:

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Reviewed By: SYC
Approved By: SRB

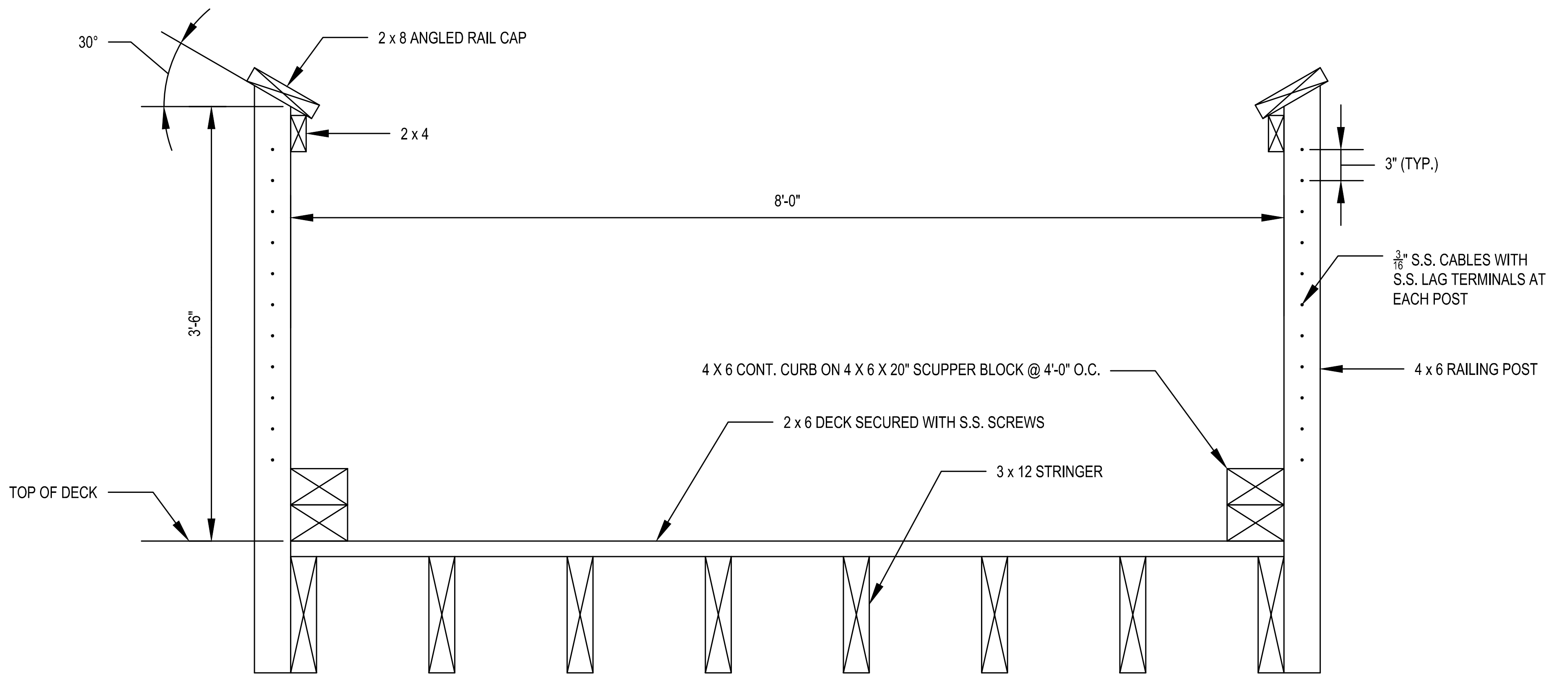
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

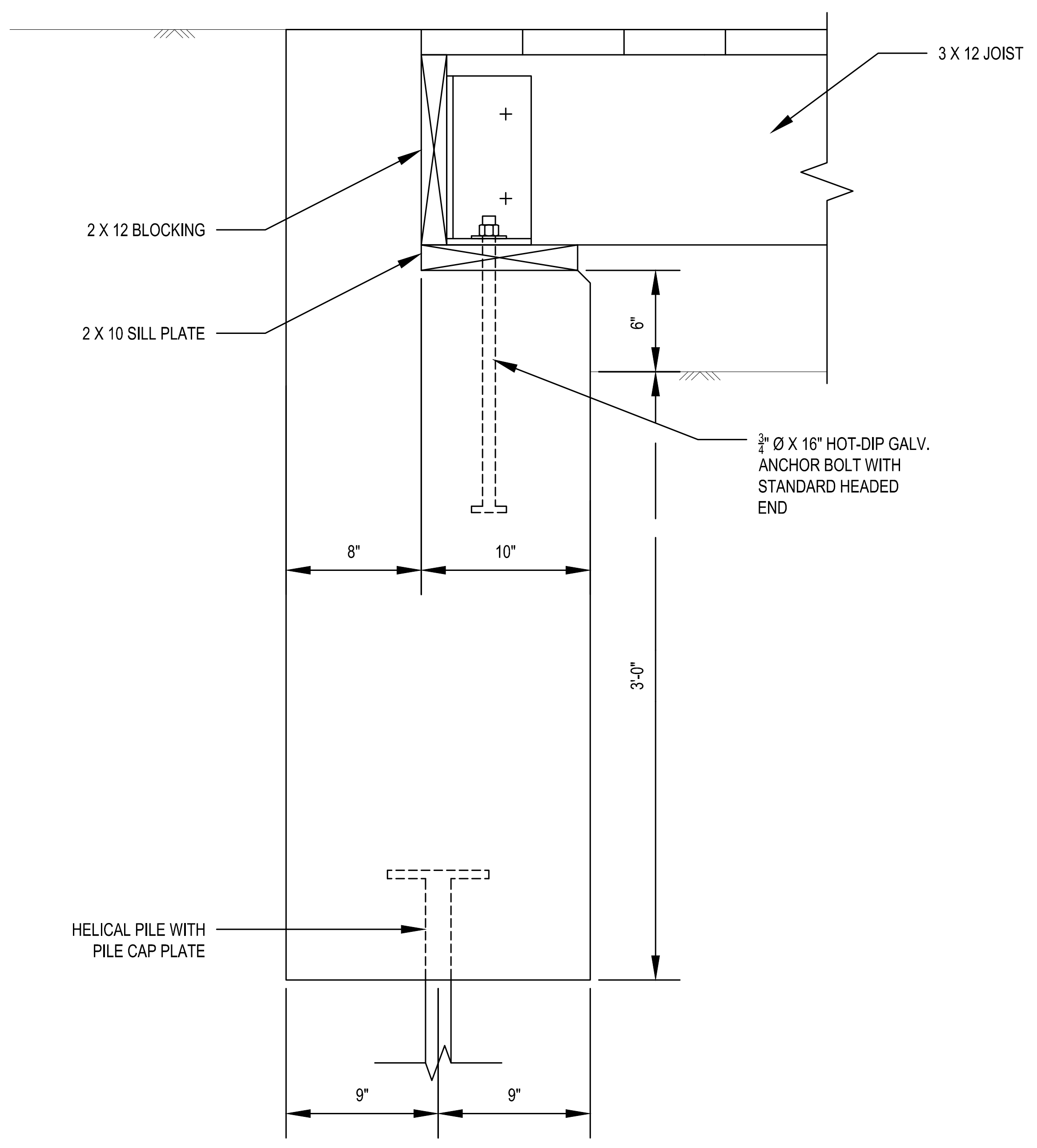
TIMBER BRIDGE PLAN
& TYP. SECTION

Sheet Number:

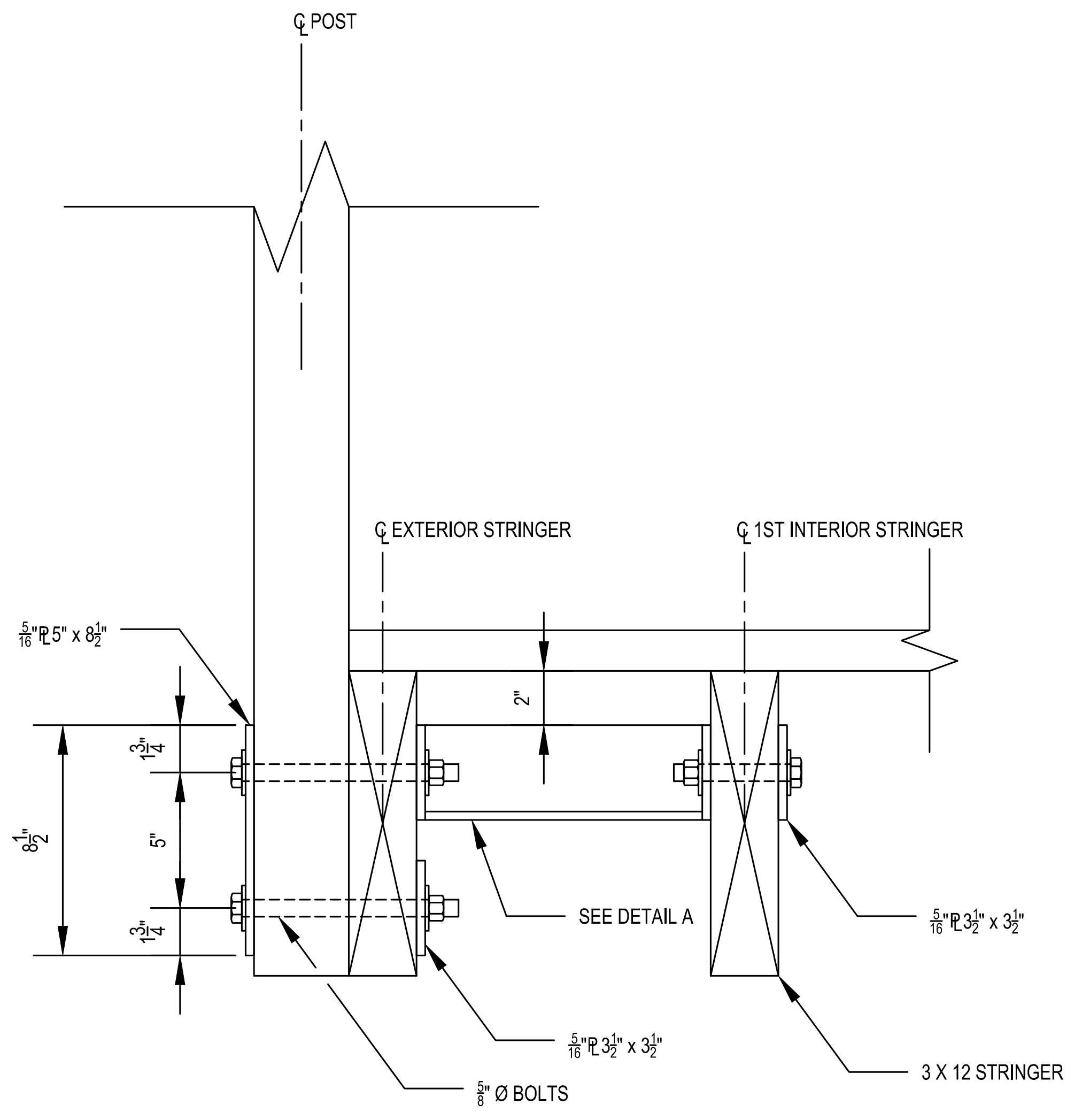
S603

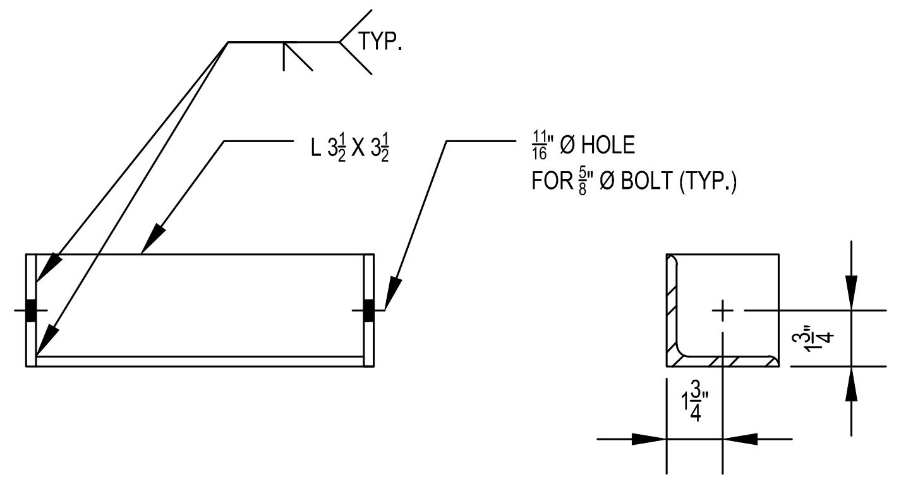


TYP. TIMBER BRIDGE SECTION



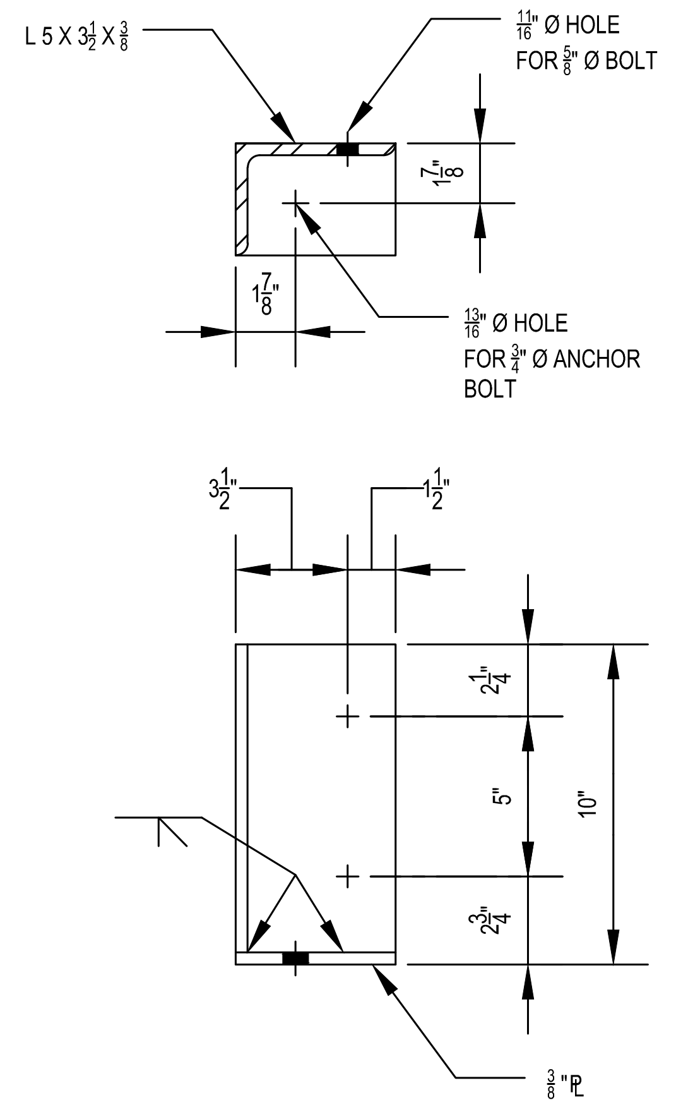
TYP. ABUTMENT SECTION ① S603





DETAIL A

TYP. RAILING POST ATTACHMENT



TYPE A (AS SHOWN)
TOTAL REQ'D = 16

TYPE B (SIMILAR)
TOTAL REQ'D = 4

TYP. STRINGER CONNECTION DETAILS

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S603-S604.dwg

Project:
PEABODY RIVERWALK
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Revisions:

No.	Date	Description

Seal:
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No. 48061

Issued For:
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- NOT FOR CONSTRUCTION -

Date:	APRIL 2021
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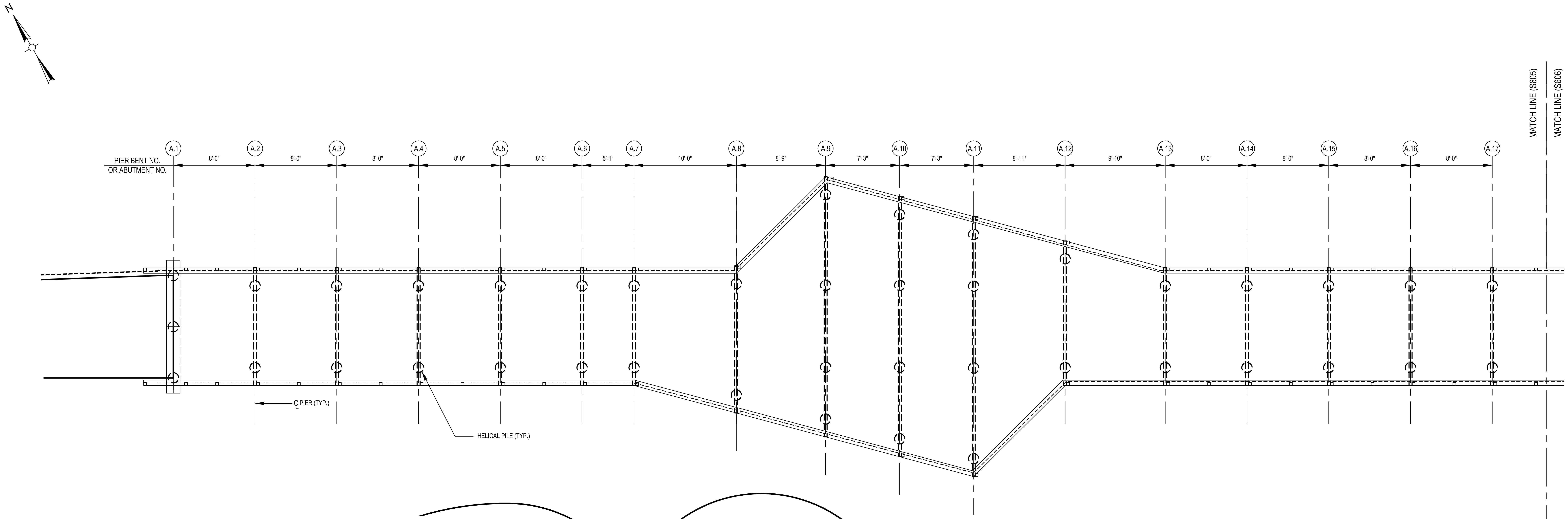
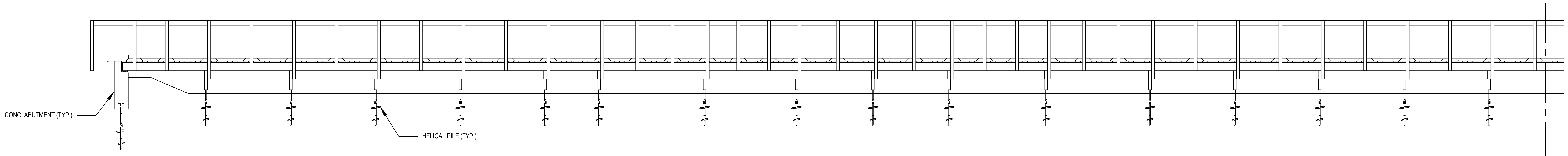
Reviewed By:	SYC
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:
TIMBER BRIDGE
DETAILS

Sheet Number:
S604



BOARDWALK PLAN



BOARDWALK ELEVATION

MATCH LINE (S605)

MATCH LINE (S606)

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S605-S608.dwg

Project:

PEABODY RIVERWALK
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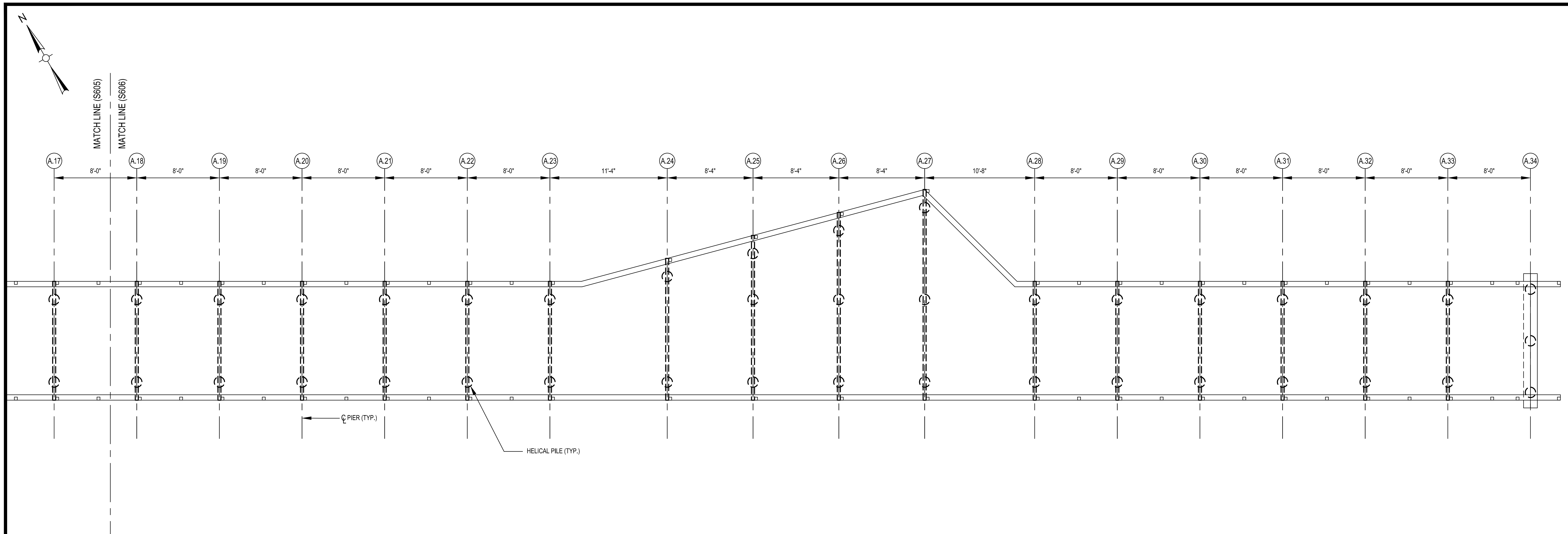
Reviewed By:	SYC
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:

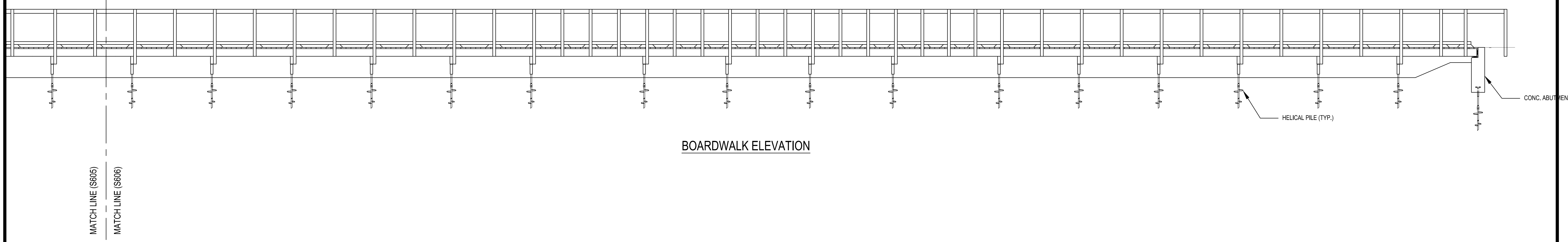
BOARDWALK PLAN & ELEVATION

Sheet Number:

S605



BOARDWALK PLAN



BOARDWALK ELEVATION

P:\MA\Peabody MA\MVP Action Grant 2019\CAD\Structural\Sheet Set\S605-S608.dwg

Project:
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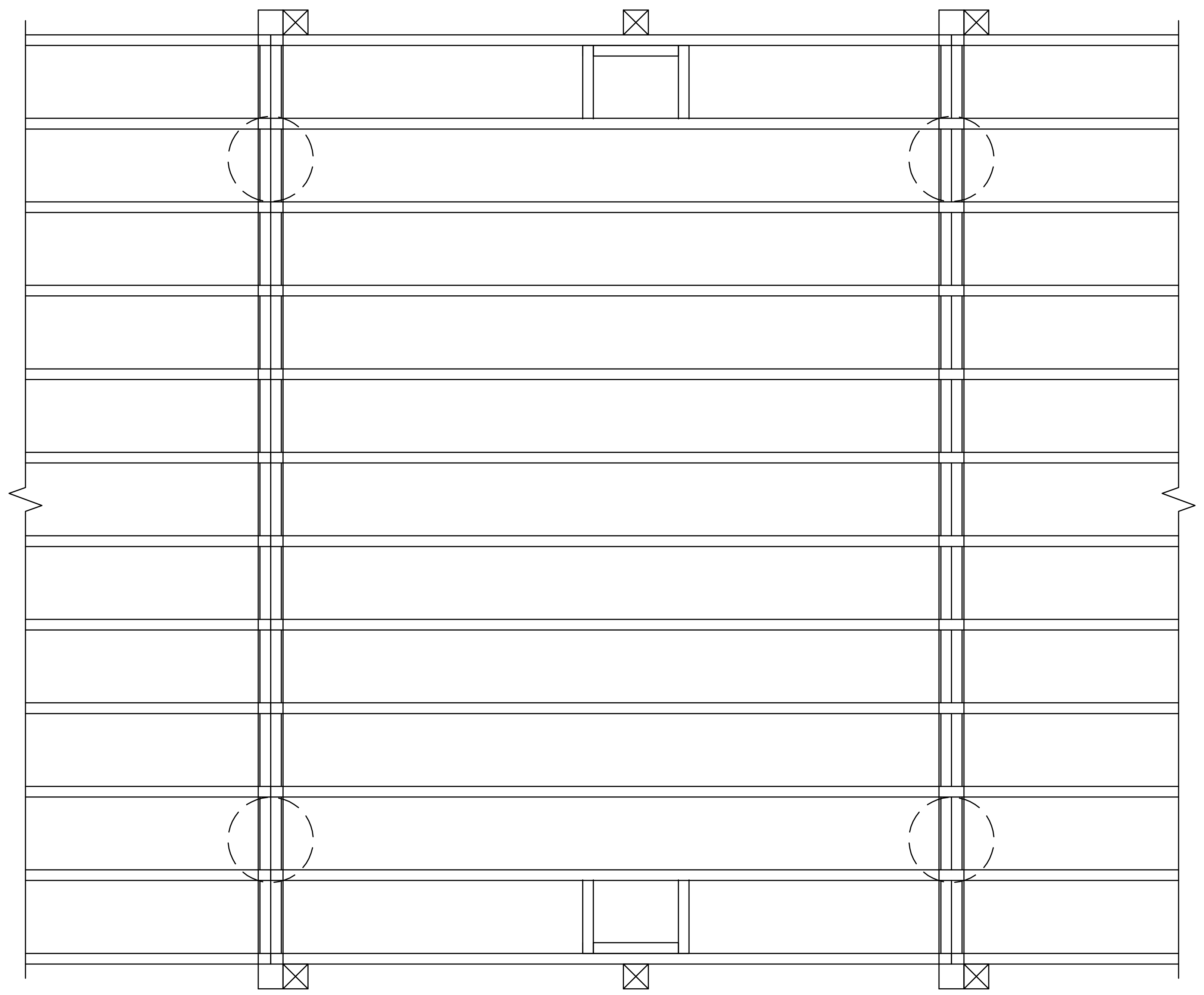
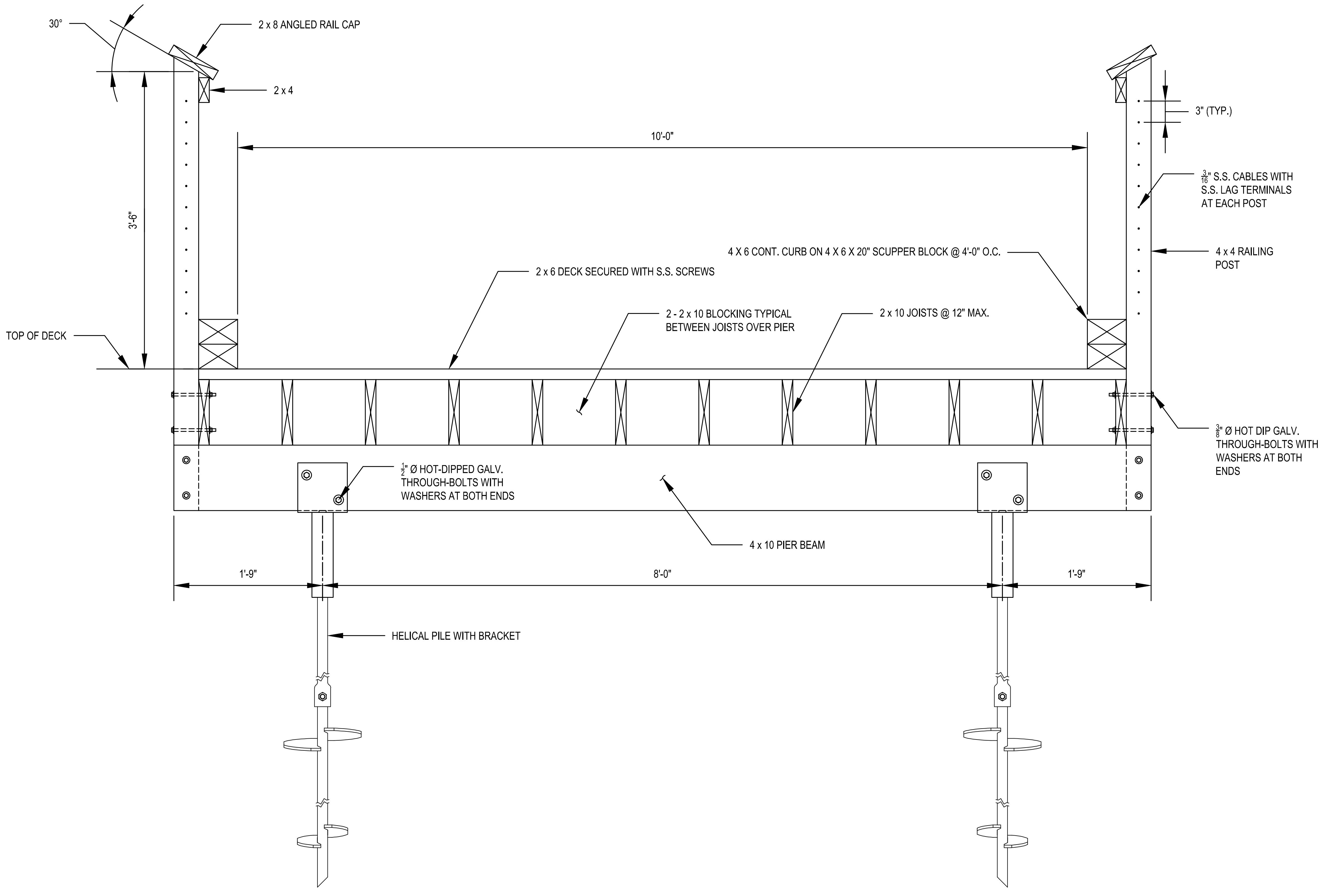
Approved By:	SRB
W&S Project No.:	ENG20-0145
W&S File No.:	

Drawing Title:
BOARDWALK PLAN & ELEVATION

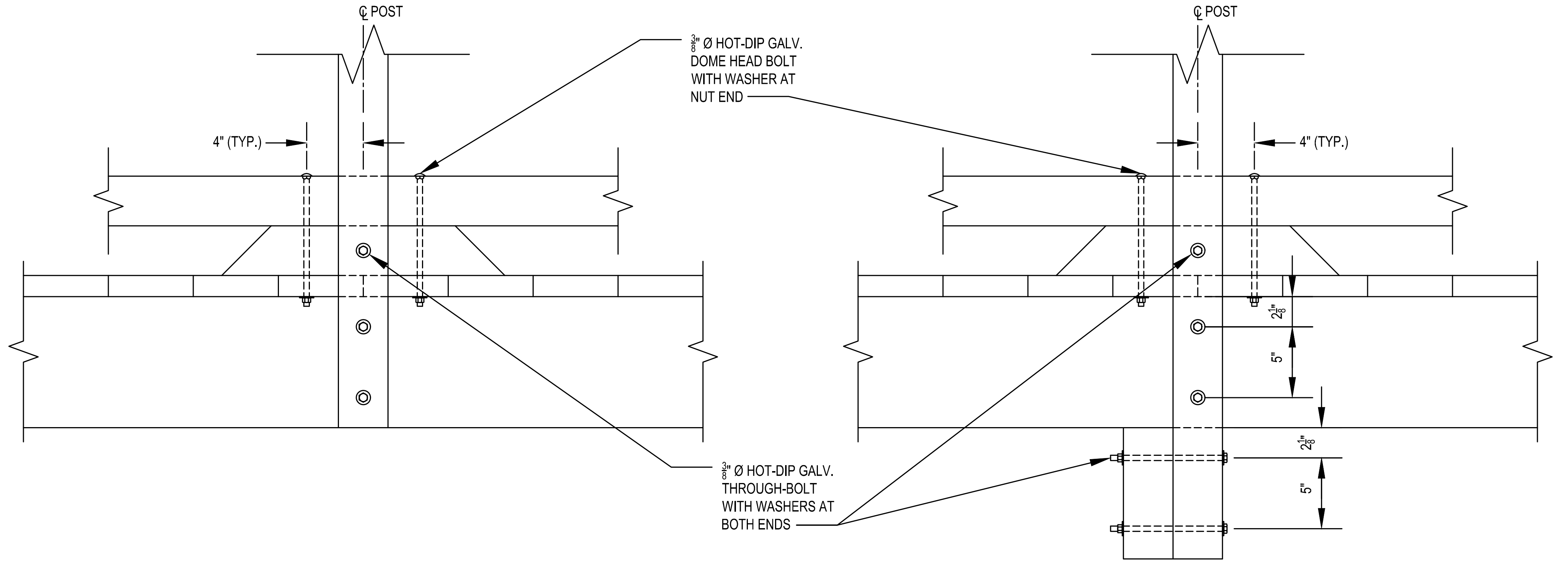
Sheet Number:
S606



TYP. BOARDWALK FRAMING PLAN



TYP. BOARDWALK SECTION



AT INTERMEDIATE RAILING POST

AT PIER BENT

TYP. RAILING POST & CURB ATTACHMENT

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Reviewed By: SYC
Approved By: SRB

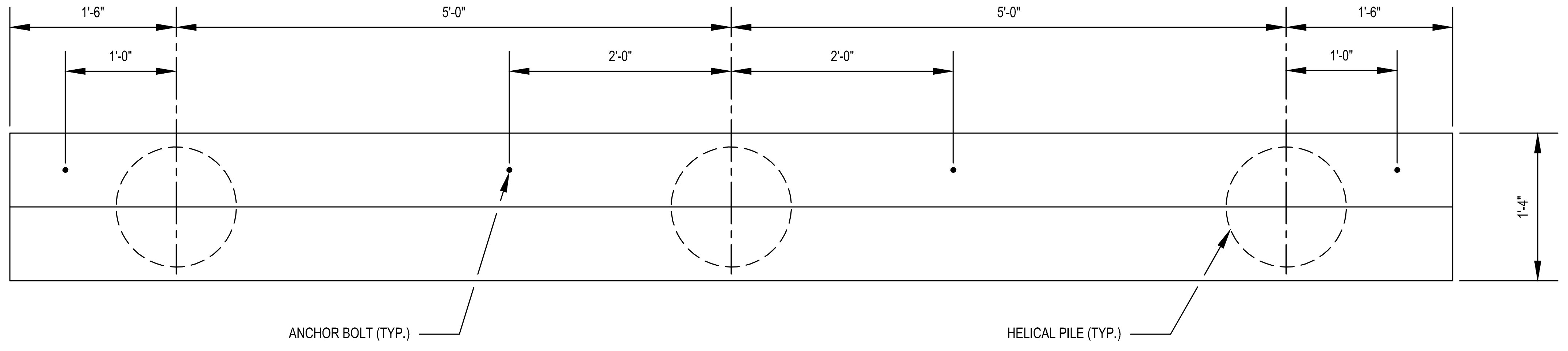
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

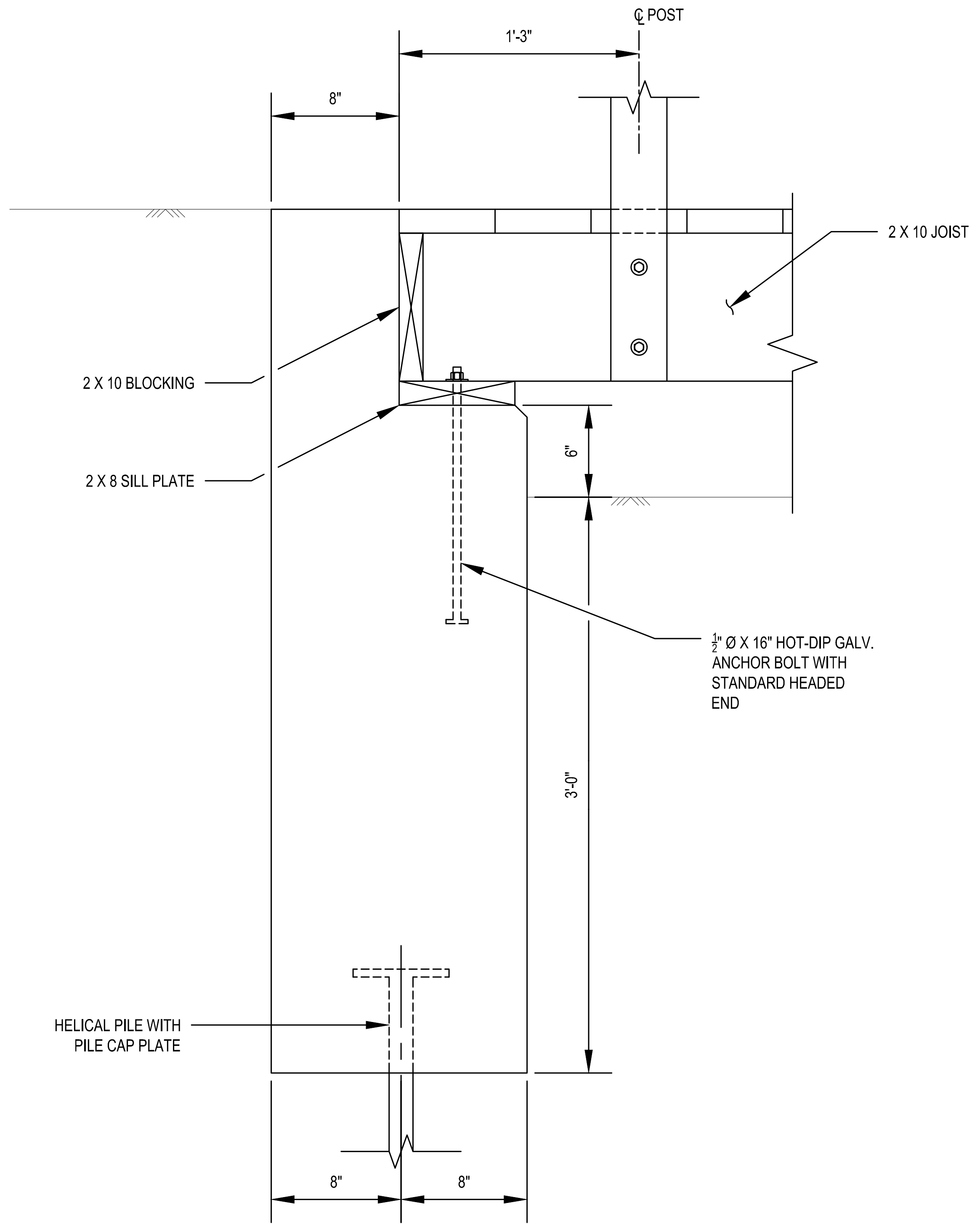
BOARDWALK TYP. SECTIONS

Sheet Number:

S607



TYP. ABUTMENT PLAN



TYP. ABUTMENT SECTION

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Project:

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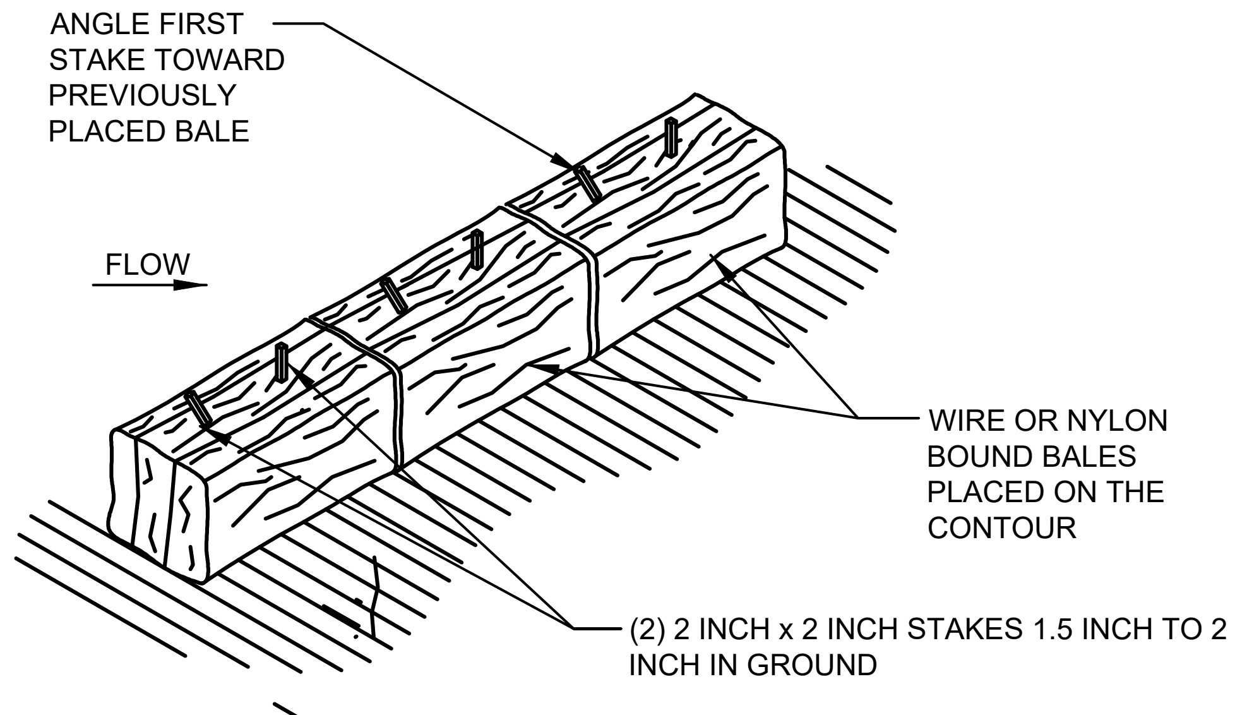
W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

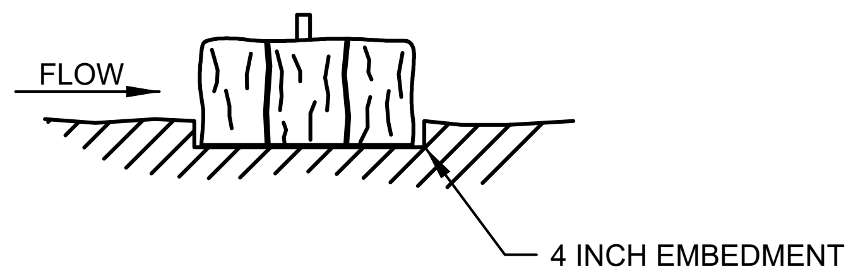
BOARDWALK
ABUTMENT TYP.
SECTIONS

Sheet Number:

S608



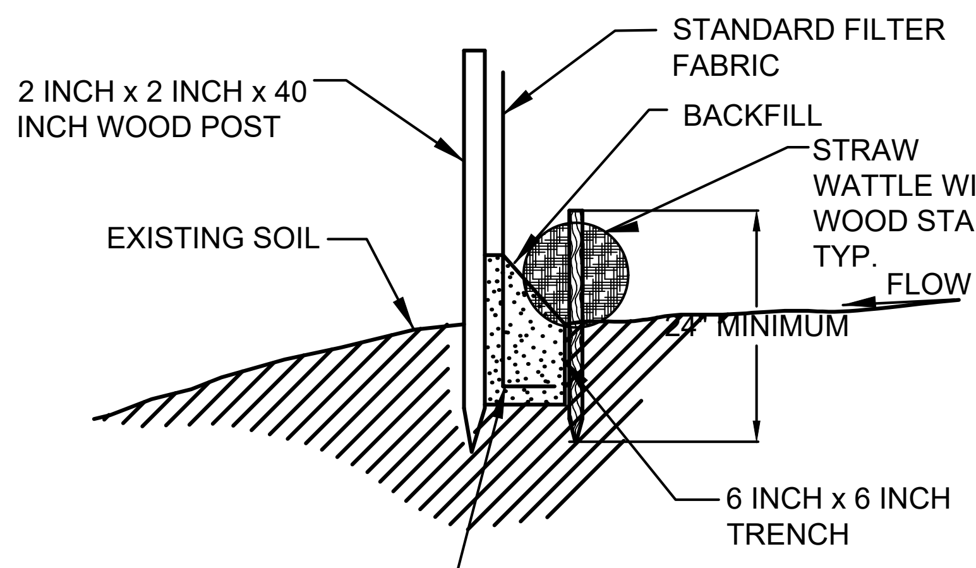
ANCHORING DETAIL



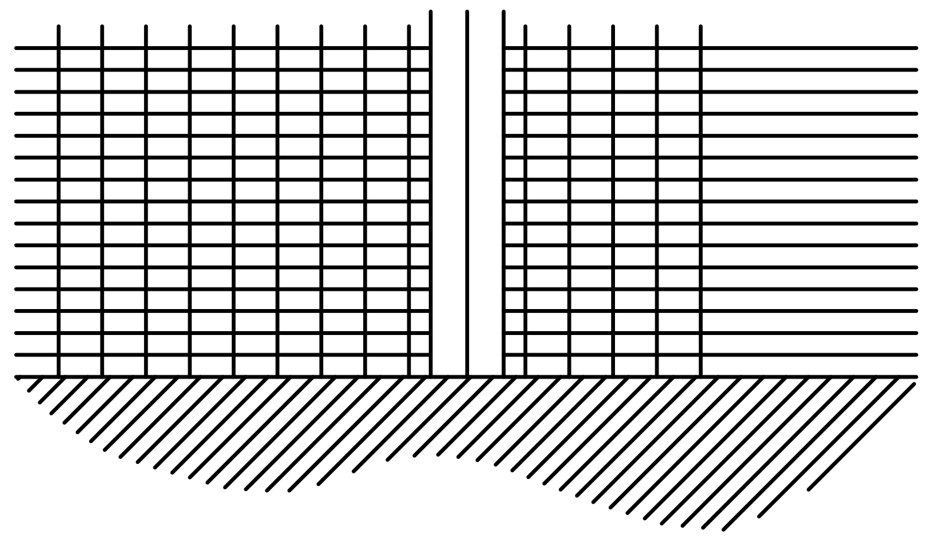
EMBEDDING DETAIL

3 STAKED HALE BALES- EROSION CONTROL

SCALE: N.T.S.



SLOPE CHECK



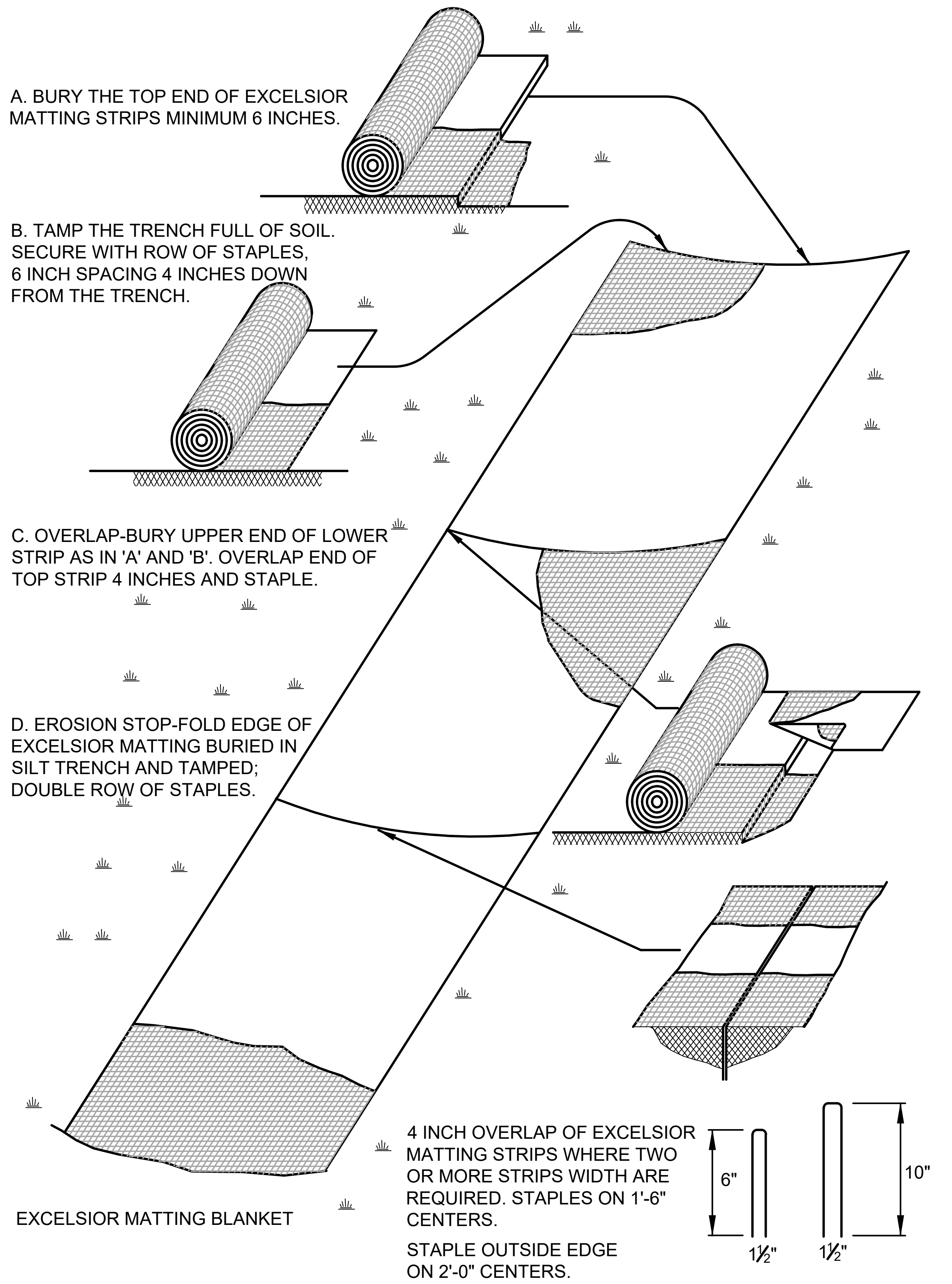
WHEN JOINING TWO OR MORE SILTATION FENCES TIE THE TWO END POSTS TOGETHER WITH NYLON CORD.

DITCH CHECK

4 SILT FENCE- EROSION CONTROL

SCALE: N.T.S.

1. EROSION CONTROL MEASURES SHALL BE INCORPORATED IN THE SEQUENCE OF CONSTRUCTION TO PREVENT SEDIMENT LADEN WATER FROM LEAVING THE SITE.
2. AREAS SUBJECT TO EROSION SHALL BE MINIMIZED IN TERMS OF TIME AND AREA.
3. IN GENERAL, WORK REQUIRING EROSION CONTROL INCLUDES EXCAVATIONS, FILLS, DRAINAGE, SWALES AND DITCHES, ROUGH AND FINISH GRADING, AND STOCKPILING OF EARTH.
4. DO NOT DISTURB VEGETATION AND TOPSOIL BEYOND THE PROPOSED LIMIT OF SILT FENCE ACTIVITIES.
5. TEMPORARY SILT CONTROLS SHALL BE PLACED AS SHOWN ON THE PLAN. PERMANENTLY STABILIZE EACH COMPLETED SEGMENT OF CONSTRUCTION.
6. THE CONTRACTOR SHALL REMOVE TEMPORARY SILT CONTROLS AND ALL ACCUMULATED SILT AND DEBRIS AFTER COMPLETION OF CONSTRUCTION OPERATIONS.
7. SILT CONTROLS SHALL BE IN PLACE AT ALL TIMES DURING CONSTRUCTION.
8. THE CONTRACTOR SHALL REMOVE AND LEGALLY DISPOSE OF ALL SILT AND DEBRIS FROM EACH DRAINAGE STRUCTURE UPON COMPLETION OF THE PROJECT.
9. OBJECTS AND/OR AREAS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
10. ALL DISTURBED AREAS SHALL BE RESTORED TO EXISTING GRADE. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE AS NEEDED.
11. SILT CONTROLS SHALL BE REMOVED UPON THE SATISFACTORY COMPLETION OF ALL WORK SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
12. SITE PERIMETER SHALL HAVE STRAW WATTLES INSTALLED AT THE LIMIT OF WORK.



A. BURY THE TOP END OF EXCELSIOR MATTING STRIPS MINIMUM 6 INCHES.

B. TAMP THE TRENCH FULL OF SOIL. SECURE WITH ROW OF STAPLES, 6 INCH SPACING 4 INCHES DOWN FROM THE TRENCH.

C. OVERLAP-BURY UPPER END OF LOWER STRIP AS IN 'A' AND 'B'. OVERLAP END OF TOP STRIP 4 INCHES AND STAPLE.

D. EROSION STOP-FOLD EDGE OF EXCELSIOR MATTING BURIED IN SILT TRENCH AND TAMPED; DOUBLE ROW OF STAPLES.

EXCELSIOR MATTING BLANKET

4 INCH OVERLAP OF EXCELSIOR MATTING STRIPS WHERE TWO OR MORE STRIPS WIDTH ARE REQUIRED. STAPLES ON 1'-6" CENTERS.

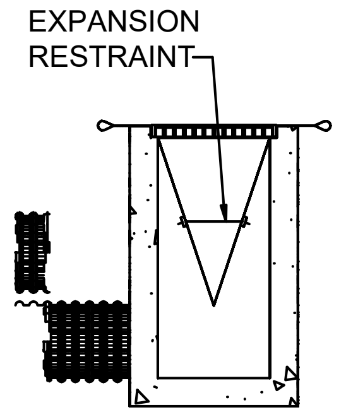
STAPLE OUTSIDE EDGE ON 2'-0" CENTERS.

TYPICAL STAPLES
#8 GAUGE WIRE

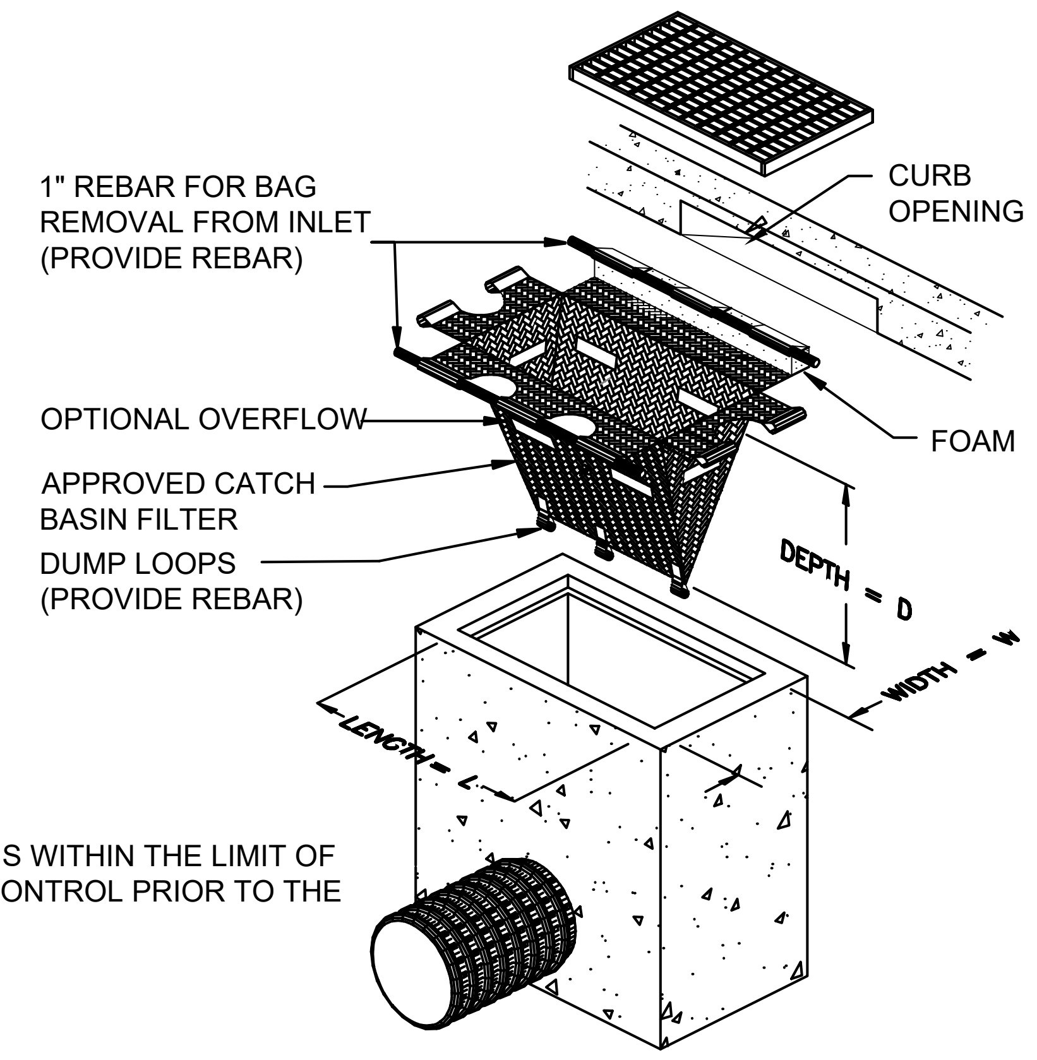
NOTE:
JUTE NETTING TO BE USED ON ALL SLOPES GREATER THAN 4H:1V AS INDICATED ON GRADING PLANS

4 EROSION CONTROL BLANKET

SCALE: N.T.S.



SIDE VIEW INSTALLED



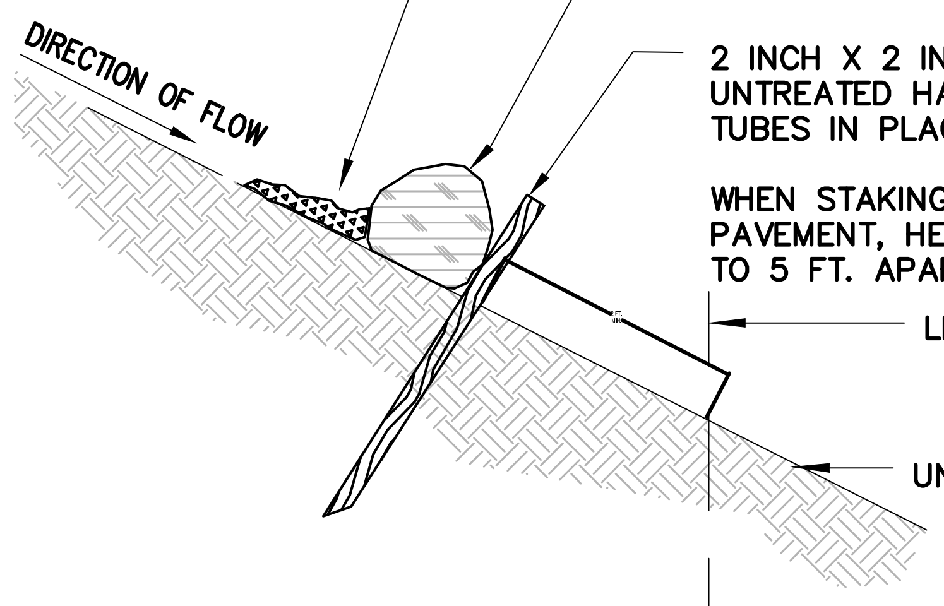
NOTE:
ALL EXISTING CATCH BASINS WITHIN THE LIMIT OF WORK SHALL HAVE INLET CONTROL PRIOR TO THE START OF CONSTRUCTION.

1 INLET SEDIMENT CONTROL

SCALE: N.T.S.

GENERAL NOTES:

1. PROVIDE A MINIMUM TUBE DIAMETER OF 12 INCHES FOR SLOPES UP TO 50 FEET IN LENGTH WITH A SLOPE RATIO OF 3H:1V OR STEEPER. LONGER SLOPES OF 3H:1V MAY REQUIRE LARGER TUBE DIAMETER OR ADDITIONAL COURSING OF FILTER TUBES TO CREATE A FILTER BERM. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SITUATIONS WITH LONGER OR STEEPER SLOPES.
2. INSTALL TUBES ALONG CONTOURS AND PERPENDICULAR TO SHEET OR CONCENTRATED FLOW.
3. DO NOT INSTALL IN PERENNIAL, EPHEMERAL OR INTERMITTENT STREAMS.
4. CONFIGURE TUBES AROUND EXISTING SITE FEATURES TO MINIMIZE SITE DISTURBANCE AND MAXIMIZE CAPTURE AREA OF STORMWATER RUN-OFF.
5. MULCH MATERIAL FOR THE FILTER TUBES SHALL BE WEED-FREE STRAW, WOOD EXCELSIOR, COMPOST, OR WOOD CHIPS, OR COIR. STRAW SHALL BE WEED FREE AND DERIVED FROM THRESHING OF GRAIN CROP.
6. CURVE ENDS UPHILL TO PREVENT DIVERSION OF UNFILTERED RUN-OFF.



2 IN. DEEP x 12 IN. WIDE LAYER OF LOOSE COMPOST MATERIAL PLACED ON UPHILL/FLOW SIDE OF TUBES TO FILL SPACE BETWEEN SOIL SURFACE AND TUBES.

COMPOST FILTER TUBE
MINIMUM 12 INCHES IN DIAMETER WITH AN EFFECTIVE HEIGHT OF 9.5 INCHES. TUBES FOR COMPOST FILTERS SHALL BE JUTE MESH OR APPROVED BIODEGRADABLE MATERIAL. ADDITIONAL TUBES SHALL BE USED AT THE DIRECTION OF THE ENGINEER.

TAMP TUBES IN PLACE TO ENSURE GOOD CONTACT WITH SOIL SURFACE. IT IS NOT NECESSARY TO TRENCH TUBES INTO EXISTING GRADE.

2 INCH X 2 INCH X 3 FEET
UNTREATED HARDWOOD STAKES, UP TO 5 FT. APART OR AS REQUIRED TO SECURE TUBES IN PLACE.

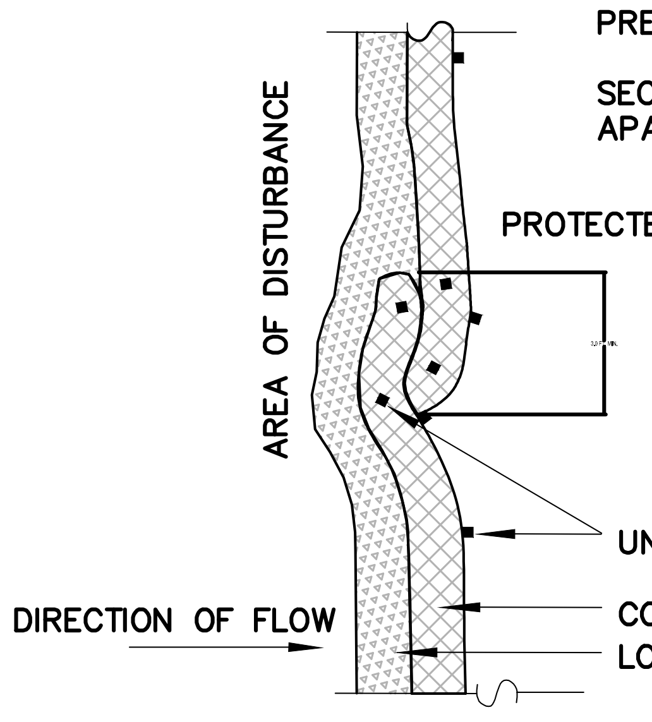
WHEN STAKING IS NOT POSSIBLE, SUCH AS WHEN TUBES MUST BE PLACED ON PAVEMENT, HEAVY CONCRETE OR CINDER BLOCKS CAN BE USED BEHIND TUBES UP TO 5 FT. APART OR AS REQUIRED TO SECURE TUBES IN PLACE.

LIMIT OF WORK

UNDISTURBED SUBGRADE

PROVIDE A 3 FT. MINIMUM OVERLAP AT ENDS OF TUBES TO JOIN IN A CONTINUOUS BARRIER AND MINIMIZE UNIMPEDED FLOW.
STAKE JOINING TUBES SNUGLY AGAINST EACH OTHER TO PREVENT UNFILTERED FLOW BETWEEN THEM.

SECURE ENDS OF TUBES WITH STAKES SPACED 18 IN. APART THROUGH TOPS OF TUBES.



PLAN VIEW – JOINING DETAIL

3 SINGLE COMPOST FILTER TUBE DETAIL

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SCOTT R. BRUSO
STRUCTURAL
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Drawing Title:
EROSION AND
SEDIMENT CONTROL
DETAILS

Sheet Number:
C601

ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR
AC	ALTERNATING CURRENT
A	AMPERE
AF	AMP FRAME
AT	AMP TRIP
ATC	AUTOMATIC TEMPERATURE CONTROLS
ATS	AUTOMATIC TRANSFER SWITCH
BKR	BREAKER
C	CONDUIT
CKT	CIRCUIT
CB	CIRCUIT BREAKER
EC	ELECTRICAL CONTRACTOR
EMT	ELECTRIC METALLIC TUBING
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WATER HEATER
EF	EXHAUST FAN
FL	FLOOR
FLA	FULL LOAD AMPERE
GC	GENERAL CONTRACTOR
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
HOA	HAND OFF AUTOMATIC
HP	HORSEPOWER
IG	ISOLATED GROUND
JB	JUNCTION BOX
KVA	KILOVOLT AMPERES
KW	KILOWATT
MCB	MAIN CIRCUIT BREAKER
MLO	MAIN LUGS ONLY
MC	MECHANICAL CONTRACTOR
MTD	MOUNTED
MTG	MOUNTING
NMC	NON-METALLIC CONDUIT
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NA	NOT APPLICABLE
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
PNL	PANELBOARD
PH	PHASE
PVC	POLYVINYL CHLORIDE CONDUIT
RSC	RIGID GALVANIZED STEEL CONDUIT
SF	SUPPLY FAN
SS	SAFETY SWITCH
TEL	TELEPHONE
TRF	TRANSFORMER
V	VOLTS
W	WATTS OR WIRE
WP	WEATHERPROOF
4WSN	4-WIRE SOLID NEUTRAL

RECEPTACLE ABBREVIATIONS

GFI	GROUND FAULT CIRCUIT INTERUPTER, PERSONAL PROTECTION
WP	WEATHERPROOF RECEPTACLE WITH COVERPLATE LISTED FOR WET LOCATION WITH AN ATTACHMENT PLUG INSERTED.

ELECTRICAL LEGEND

RACEWAY AND WIRING

←⫽⫽ 1,3 LP1B	HOMERUN TO PANELBOARD, NUMBER OF TICKS INDICATES NUMBER OF #12 AWG CONDUCTORS CONTAINED IN RACEWAY. TWO (2) #12 AWG SHALL NOT BE INDICATED BY TICKS, NUMERALS 1 AND 3 INDICATE CIRCUITS IN PANELBOARD. RACEWAYS LARGER THAN 1/2" AND CONDUCTORS LARGER THAN #12 AWG SHALL BE INDICATED ON THE DRAWINGS. PROVIDE AN INSULATED GREEN GROUND WIRE IN ALL RACEWAYS MINIMUM SIZE TO BE #12AWG.
– – –	UNDERGROUND RACEWAY

LIGHTING FIXTURES

○	PEDESTRIAN LIGHT FIXTURE
⌖	BOLLARD TYPE SITE LIGHTING FIXTURE

RECEPTACLES

(MOUNT 18" AFF TO CENTER LINE UNLESS NOTED OTHERWISE)

GFI ⊜	DUPLEX CONVENIENCE OUTLET RATED 20A, 125V, U-SLOT GROUNDED TYPE MOUNTED 18" ABOVE FINISHED FLOOR TO CENTER LINE. ALL OTHER MOUNTING HEIGHTS SHALL BE AS NOTED ADJACENT TO THE SYMBOL. REFER TO RECEPTACLE ABBREVIATIONS FOR SPECIAL PURPOSE RECEPTACLES. GFI INDICATES GROUND FAULT INTERRUPTING TYPE.

POWER DISTRIBUTION EQUIPMENT

LHH □	HAND HOLE PHH = POWER HANDHOLE CHH = COMMUNICATIONS HANDHOLE LHH = LIGHTING HANDHOLE
⏚	GROUND - SYSTEM AND/OR EQUIPMENT
F	FIBER PEDESTAL (50"X42")

SITE

○	UTILITY POLE
MH	UTILITY MANHOLE

GENERAL NOTES

1. DRAWINGS ARE DIAGRAMMATIC ONLY. THE EXACT LOCATION, MOUNTING HEIGHTS, SIZE OF EQUIPMENT AND ROUTING OF RACEWAYS SHALL BE COORDINATED AND DETERMINED IN THE FIELD.
2. ALL STRAIGHT FEEDER, BRANCH CIRCUIT AND AUXILIARY SYSTEM CONDUIT RUNS SHALL BE PROVIDED WITH SUFFICIENT PULL BOXES TO LIMIT THE MAXIMUM LENGTH OF ANY SINGLE CABLE PULL TO 150 FEET. EXACT SIZES OF PULL BOXES AND LOCATIONS TO BE DETERMINED IN THE FIELD BY THE ELECTRICAL CONTRACTOR.
3. FURNISH ALL REQUIRED ACCESS PANELS AS REQUIRED TO SUIT FIELD CONDITIONS FOR THE PROPER OPERATION AND MAINTENANCE OF THE ELECTRICAL SYSTEM. THE EXACT SIZES AND PHYSICAL LOCATIONS SHALL BE TO SUIT ACCESSIBILITY AND CONSTRUCTION CONDITIONS. ALL ACCESS PANELS PROVIDED BY THE ELECTRICAL CONTRACTOR SHALL MATCH EXACTLY THE ACCESS PANELS FURNISHED AND INSTALLED BY THE GENERAL CONTRACTOR. THE ACCESS PANELS WILL BE INSTALLED BY THE TRADE CONTRACTOR UNDER THE APPROPRIATE SECTION OF THE SPECIFICATIONS FOR THE SURFACE IN WHICH THE PANELS ARE LOCATED.
4. THE LOCATION AND MOUNTING HEIGHTS OF ALL SITE POWER AND LIGHTING SHOWN ON THE LANDSCAPE DRAWINGS SHALL TAKE PRECEDENCE OVER THE LOCATIONS SHOWN ON THE ELECTRICAL DRAWINGS. THE ELECTRICAL CONTRACTOR SHALL INSTALL ALL SITE POWER AND LIGHTING TO AGREE WITH THE LANDSCAPE DRAWINGS.
5. COMBINED HOMERUNS OF TWO (2) OR THREE (3) CIRCUITS MAY BE UTILIZED. HOWEVER, THE NEUTRAL CONDUCTOR IS TO BE INCREASED TO #10AWG. COMBINED HOMERUNS ARE TO BE LIMITED TO 20A, LIGHTING AND POWER CIRCUITS.
6. WORK SHALL CONFORM TO THE MASSACHUSETTS ELECTRICAL CODE, MASSACHUSETTS BUILDING CODE, NFPA AND REQUIREMENTS OF LOCAL AUTHORITIES HAVING JURISDICTION.
7. THE WORD "CONTRACTOR" AS USED IN THE "ELECTRICAL WORK" SHALL MEAN THE ELECTRICAL SUBCONTRACTOR.
8. CONTRACTOR SHALL PAY FOR ALL PERMITS, INSURANCE AND TESTS, AND SHALL PROVIDE LABOR AND MATERIAL TO COMPLETE THE ELECTRICAL WORK SHOWN.
9. CONTRACTOR(OWNER) SHALL PAY ELECTRIC UTILITY COMPANY BACKCHARGES.
10. CONTRACTOR SHALL PROVIDE ALL REQUIRED COORDINATION WITH THE ELECTRIC UTILITY.
11. THE CONTRACTOR SHALL PROVIDE ALL TEMPORARY LIGHTING AND POWER AND THE GENERAL CONTRACTOR SHALL PAY ALL ENERGY CHARGES.
12. DURING CONSTRUCTION, THE ELECTRICAL CONTRACTOR SHALL KEEP HIS PORTION OF THE WORK NEAT, CLEAN AND ORDERLY.
13. ALL SYSTEMS SHALL BE TESTED FOR SHORT CIRCUIT AND GROUNDS PRIOR TO ENERGIZING AND ANY DEFECTS SHALL BE CORRECTED.
14. COMPLETE SHOP DRAWINGS SHALL BE SUBMITTED FOR ELECTRICAL EQUIPMENT. WHERE SPECIFIED ELECTRICAL EQUIPMENT IS SUBSTITUTED, THE ELECTRICAL CONTRACTOR SHALL SUBMIT COMPLETE SPECIFICATIONS ON THE SUBSTITUTE AS WELL AS THE ITEM ORIGINALLY SPECIFIED.
15. MATERIALS SHALL BE SPECIFICATION GRADE AND UL LISTED.
16. WHERE MATERIAL IS CALLED OUT IN THE LEGEND BY MANUFACTURER, TYPE OR CATALOG NUMBER, SUCH DESIGNATIONS ARE TO ESTABLISH STANDARDS OR DESIRED QUALITY. ACCEPTANCE OR REJECTIONS OF PROPOSED SUBSTITUTIONS SHALL BE SUBJECT TO THE APPROVAL OF THE OWNER.
17. WORK SHALL BE COORDINATED WITH THAT OF OTHER TRADES TO ELIMINATE INTERFERENCES.
18. EXACT LOCATIONS OF MECHANICAL EQUIPMENT, DEVICES, ETC. SHALL BE VERIFIED WITH HEATING, VENTILATION AND AIR CONDITIONING SUBCONTRACTOR PRIOR TO ROUGHING FOR SAME.
19. ELECTRICAL CONTRACTOR SHALL OBTAIN SHOP DRAWINGS/SPECIFICATIONS OF ALL EQUIPMENT FROM THE GENERAL CONTRACTOR PRIOR TO PURCHASING AND INSTALLING ELECTRICAL EQUIPMENT FOR SAME. NOTIFY ENGINEER OF ANY DISCREPANCIES BETWEEN ACTUAL EQUIPMENT INSTALLED AND CONTRACT DOCUMENTS.
20. ELECTRICAL WORK SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR FROM DATE OF WHICH SYSTEM IS PUT INTO SERVICE.
21. WORK SHALL BE GROUNDED IN ACCORDANCE WITH CODE REQUIREMENTS. COMPLETE EQUIPMENT (INSULATED GREEN WIRE) GROUNDING SYSTEM SHALL BE INSTALLED.
33. BOXES SHALL BE GALVANIZED STEEL AND SHALL BE SIZED TO ACCOMMODATE THE EQUIPMENT OR APPARATUS TO BE INSTALLED. WHERE BOXES OF A STANDARD MAKE ARE NOT AVAILABLE, SPECIAL BOXES SHALL BE MANUFACTURED.
34. PANELBOARDS SHALL BE DEAD FRONT, THERMAL MAGNETIC BOLT-ON CIRCUIT BREAKER TYPE, DESIGNED FOR SURFACE OR FLUSH MOUNTING AS INDICATED ON PLAN, AND HAVING CONNECTIONS TO 120/208 OR 277/480 VOLT, 3 PHASE, 4 WIRE SERVICE. ALL BUS BARS SHALL BE COPPER. CABINETS SHALL BE MADE OF CODE GAUGE GALVANIZED SHEET STEEL, WITH A MINIMUM OF 4 INCH GUTTERS, DOOR IN DOOR CONSTRUCTION, LOCKED DOOR, AND FLUSH HINGES. TYPEWRITTEN INDEX SHALL BE MOUNTED ON DOOR INSIDE TRANSPARENT COVER INDICATING LOAD SERVED. PANELS SHALL INCLUDE SEPARATE EQUIPMENT GROUND BUS.
35. PANELBOARDS, DISCONNECT SWITCHES, AND CONTROLLERS SHALL HAVE NAMEPLATES OF BLACK LAMINATED PLASTIC WITH ENGRAVED WHITE LETTERS, SECURED WITH SELF-TAPPING SCREWS.
36. CONTRACTOR SHALL PHASE BALANCE PANELBOARDS IN THE FIELD. LOAD ON EACH PHASE SHALL BE BALANCED WITHIN 10% OF EACH OTHER.
37. DUPLEX WALL RECEPTACLES SHALL BE 2 POLE, 3 WIRE, GROUNDING TYPE 20 AMPERE, 125 VOLT WITH METAL PLASTER EARS. RECEPTACLES SHALL BE NEMA STANDARD CONFIGURATION 5-20R.
38. FUSES SHALL BE DUAL ELEMENT, TIME DELAY TYPE, AS MANUFACURED BY BUSSMAN, RELIANCE OR APPROVED EQUAL.
39. CONTRACTOR SHALL CHECK EXISTING CONDITIONS TO DETERMINE EXACT EXTENT OF WORK TO BE PERFORMED PRIOR TO BIDDING. DIMENSIONS RELEVANT TO EXISTING WORK SHALL BE VERIFIED IN THE FIELD.
40. IN AREAS NOT AFFECTED BY THIS RENOVATION, THIS SUBCONTRACTOR SHALL MAINTAIN CONTINUITY OF ELECTRIC SERVICE.
41. THE CONTRACTOR SHALL PROVIDE ALL REQUIRED POWER SUPPLIES, APPURTENANCES, FINAL CONNECTIONS, TESTING AND WORK REQUIRED FOR ADDITIONS TO THE EXISTING FIRE ALARM SYSTEM. PAY ALL COSTS ARISING THERE FROM, FOR A COMPLETE AND OPERATIONAL SYSTEM.
42. ELECTRICAL SHUTDOWN SHALL BE AT A TIME AND DATE APPROVED BY THE OWNER.
43. PROVIDE AS-BUILT "CADD" DRAWINGS AT THE COMPLETION OF THE PROJECT.
44. ELECTRICAL CONTRACTOR SHALL LABEL ALL ELECTRICAL DEVICES INCLUDING BUT NOT LIMITED TO RECEPTACLES, DISCONNECT SWITCHES, PANELBOARDS, CONTROL PANELS, JUNCTION BOXES, ETC.
    a. RECEPTACLES - PANEL NAME AND CIRCUIT DESIGNATION
    b. PANELBOARDS - PANEL NAME, VOLTAGE, AMPERAGE, PHASE AS WELL AS PANEL AND CIRCUIT IT IS FED FROM.
    c. CONTROL PANEL - PANEL NAME AND CIRCUIT DESIGNATION
    d. JUNCTION BOXES - PANEL NAME AND CIRCUIT DESIGNATION

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ELECTRICAL LEGEND, NOTES AND ABBREVIATIONS

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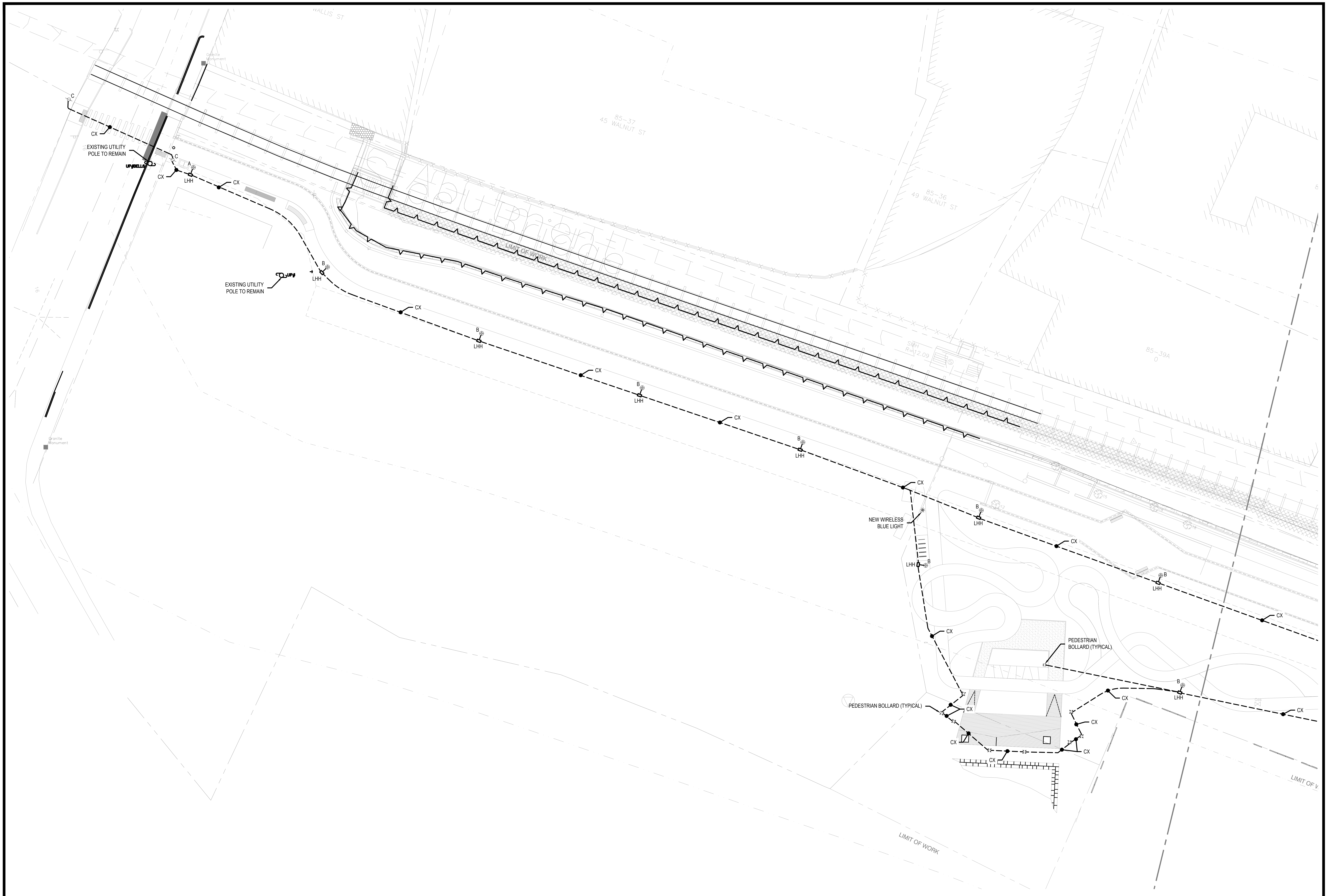
E001



ELECTRICAL SITE PLAN A

NOTE:
REFER TO E001 FOR LEGEND, GENERAL NOTES AND ABBREVIATIONS.

20 10 0 20 40

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ELECTRICAL
SITE PLAN A

Sheet Number:

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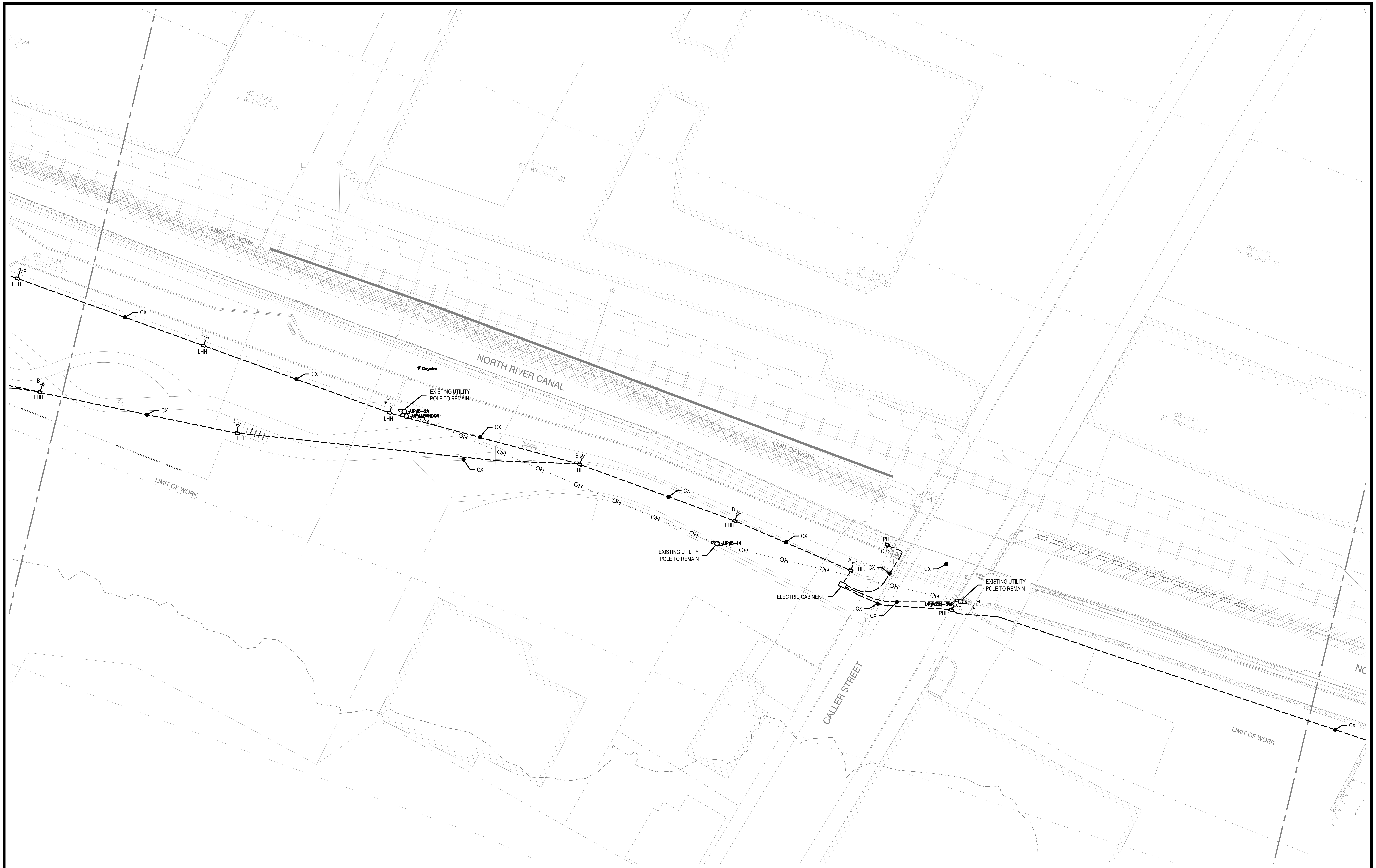

ELECTRICAL SITE PLAN B

NOTE:
REFER TO E001 FOR LEGEND, GENERAL NOTES AND ABBREVIATIONS.

20 10 0 20 40

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ELECTRICAL
SITE PLAN B

Sheet Number:

E102

ELECTRICAL SITE PLAN C

NOTE:
REFER TO E001 FOR LEGEND, GENERAL NOTES AND ABBREVIATIONS.

Project:

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RIVERWALK PARK

SOUTH DANVERS 1855 • TOWN OF PEABODY 1868 • CITY OF PEABODY 1916

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ELECTRICAL
SITE PLAN C

Sheet Number:

E103

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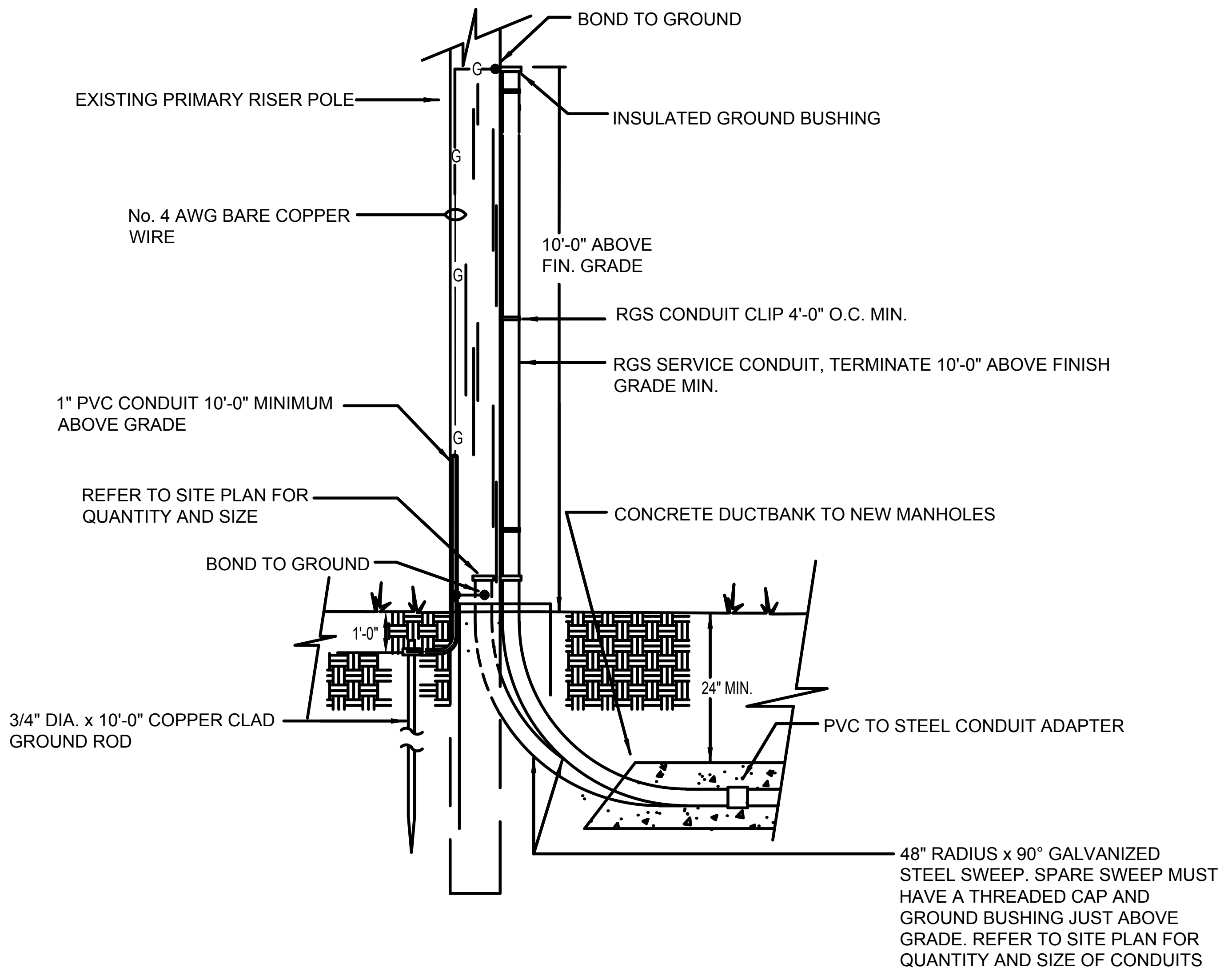
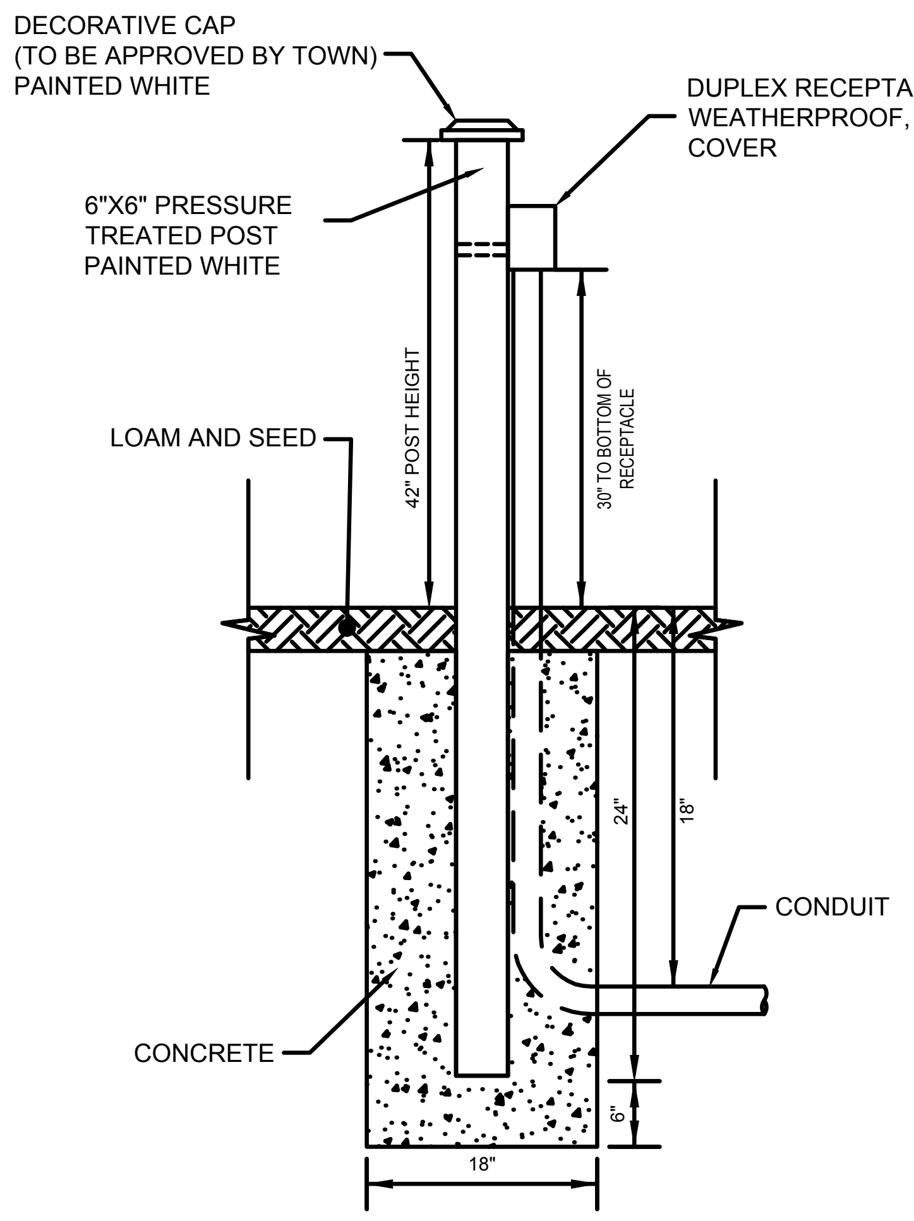


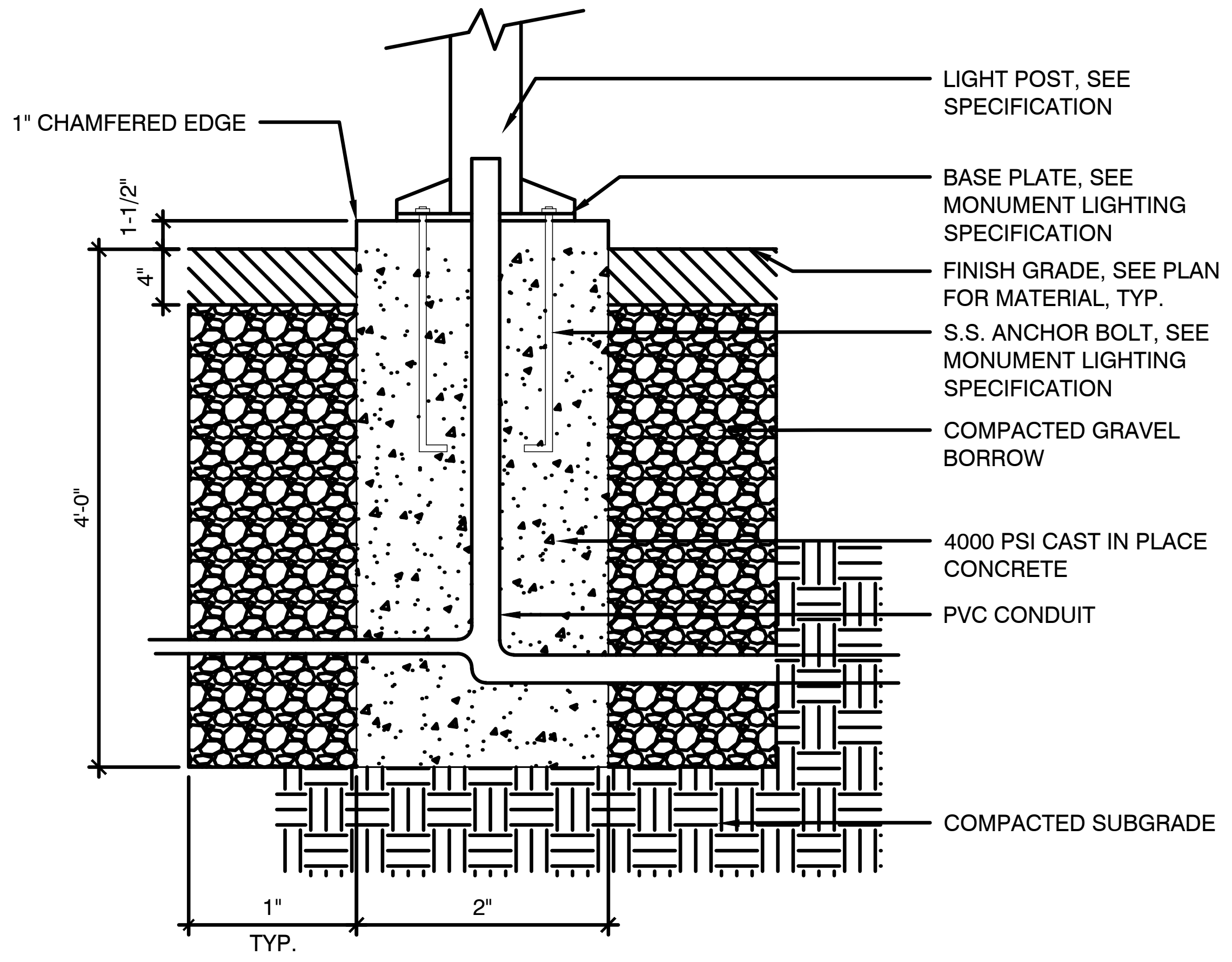
TYPICAL RISER POLE DETAIL

NOT TO SCALE



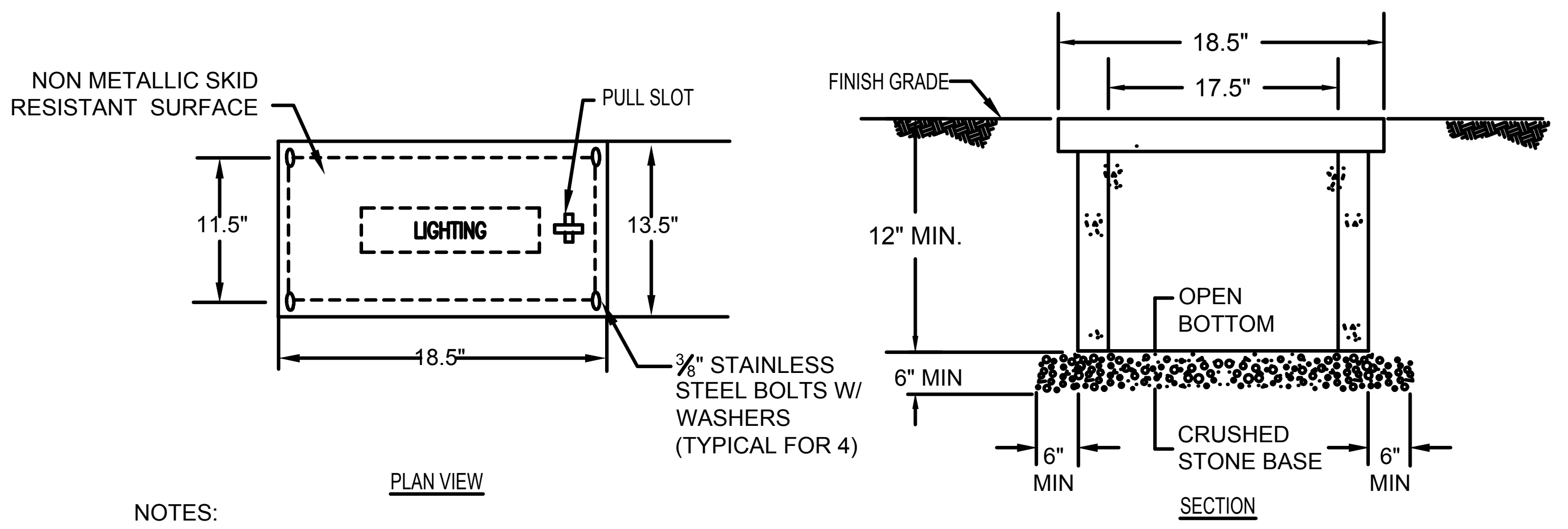
POST AND RECEPTACLE DETAIL

NOT TO SCALE



LIGHT POST FOOTING (TYPICAL)

NOT TO SCALE



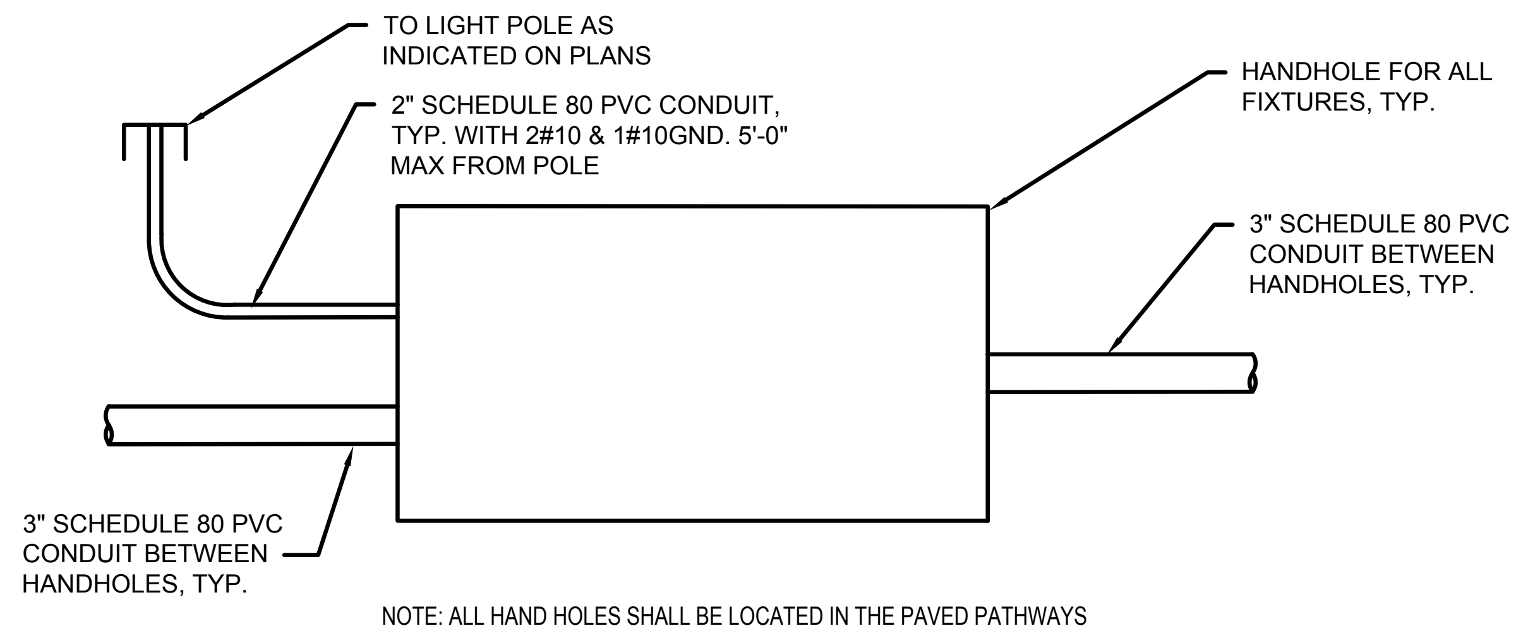
NOTES:

1. THIS HANDHOLE IS INTENDED FOR NON-DELIBERATE VEHICULAR TRAFFIC ONLY.

2. HANDHOLE SHALL BE PREFABRICATED POLYMER CONCRETE AGGREGATE EQUAL TO QUAZITE OR EQUAL PRE CAST CONCRETE CONSTRUCTION.

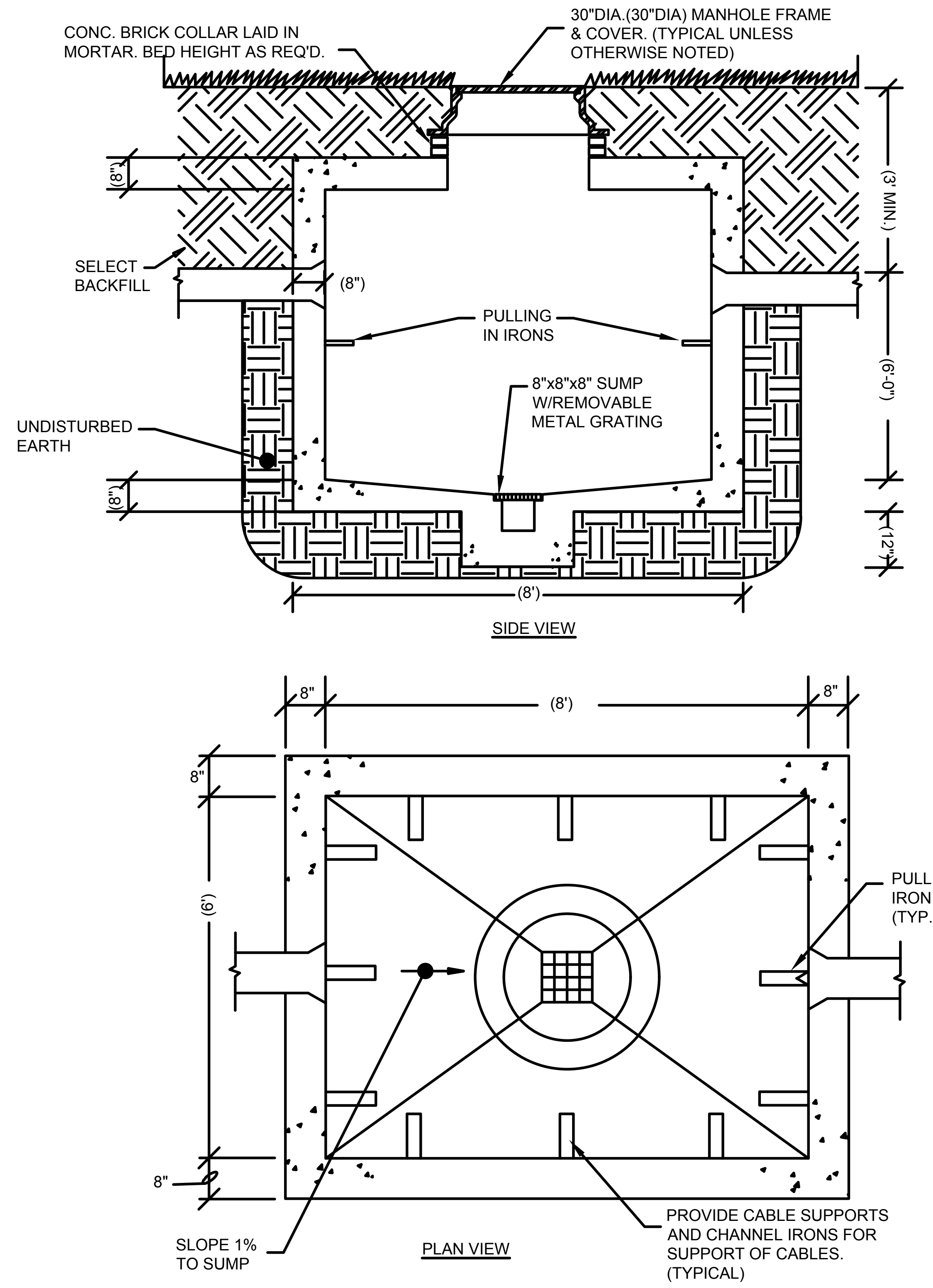
PREFABRICATED HANDHOLE DETAIL (TYPICAL)

NOT TO SCALE



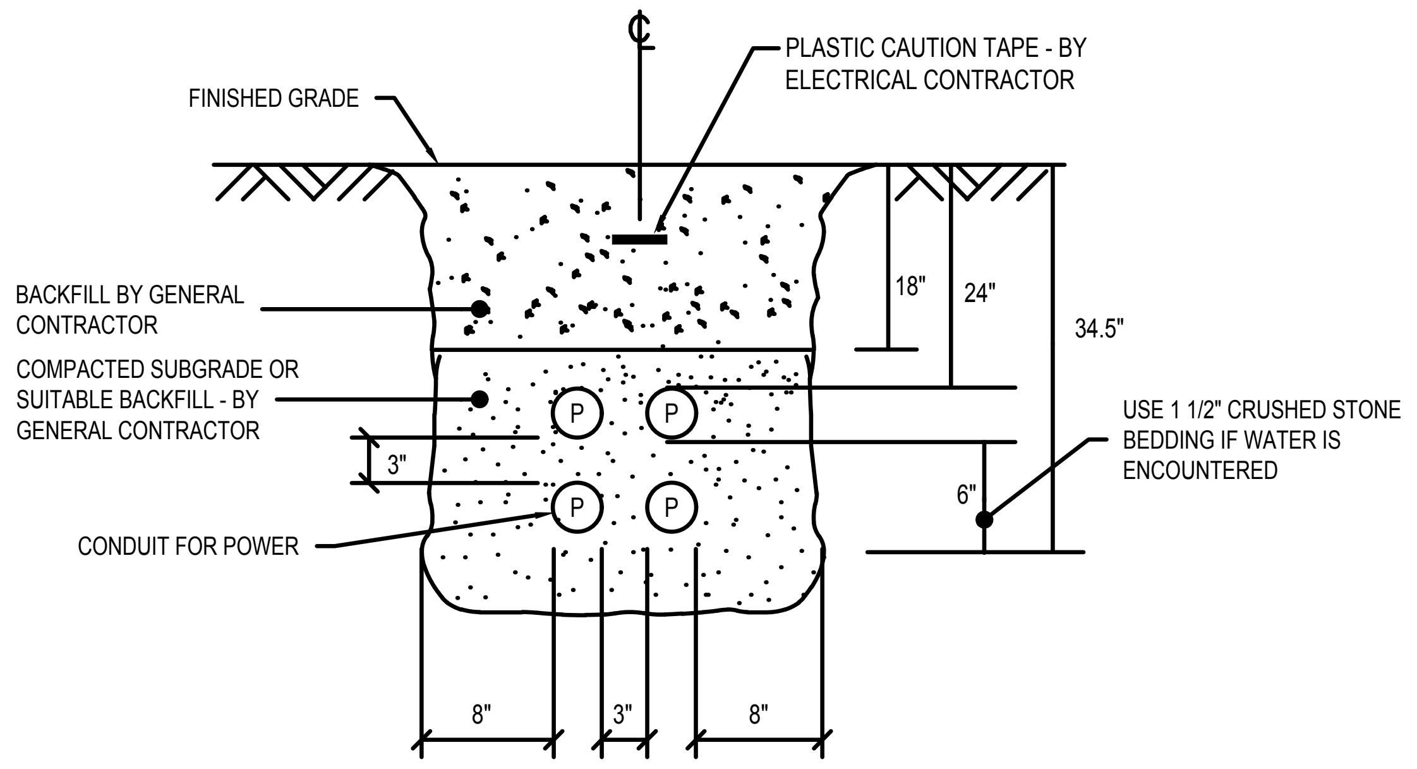
PEDESTRIAN SITE LIGHTING DISTRIBUTION DETAIL (TYPICAL)

NOT TO SCALE



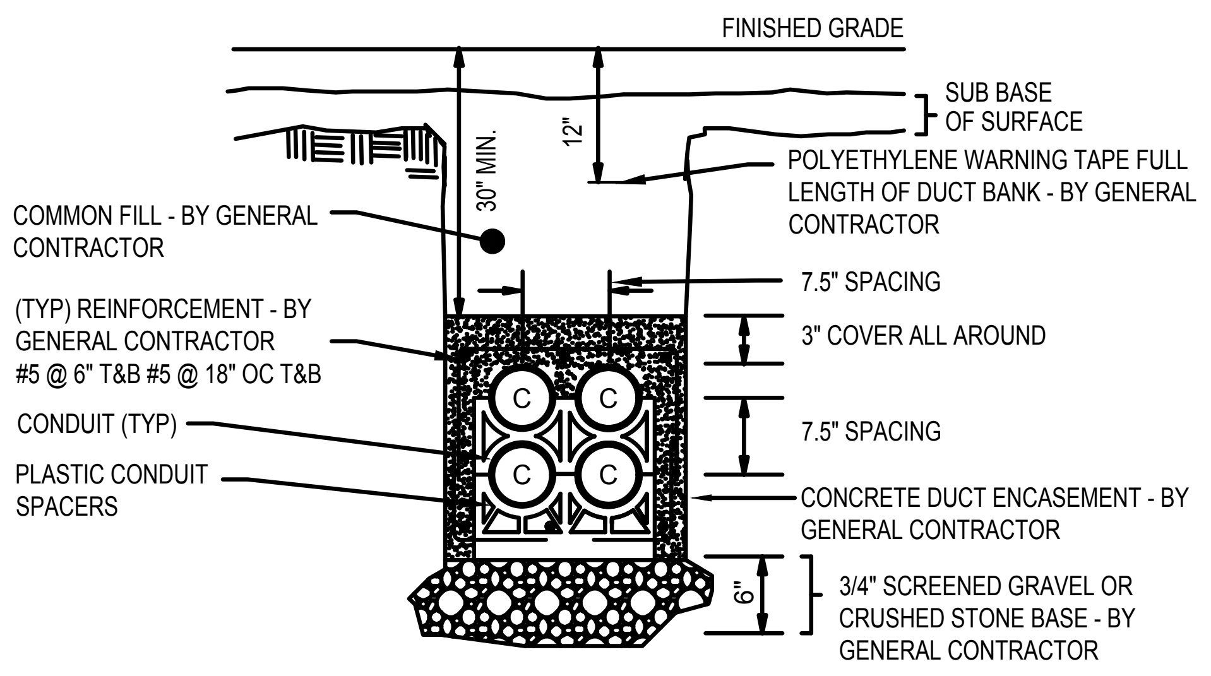
TYPICAL MANHOLE DETAIL

NOT TO SCALE



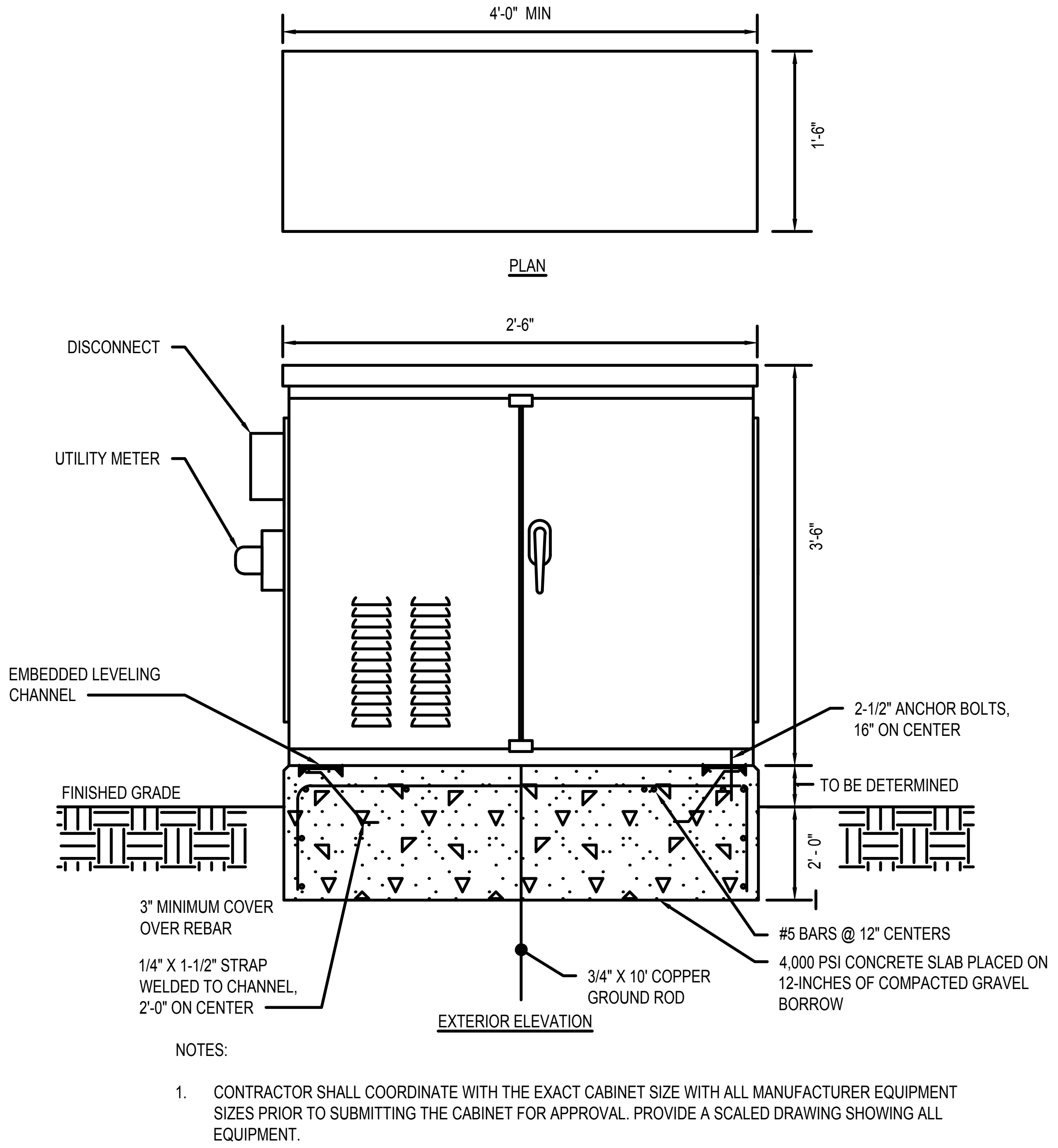
TYPICAL DIRECT BURIED MULTIPLE CONDUIT DETAIL

NOT TO SCALE



TYPICAL CONCRETE ENCASED DUCTBANK DETAIL

NOT TO SCALE



NOTES:

1. CONTRACTOR SHALL COORDINATE WITH THE EXACT CABINET SIZE WITH ALL MANUFACTURER EQUIPMENT SIZES PRIOR TO SUBMITTING THE CABINET FOR APPROVAL. PROVIDE A SCALED DRAWING SHOWING ALL EQUIPMENT.

PAD MOUNTED 2-DOOR NEMA 3R ELECTRICAL CABINET DETAIL

NOT TO SCALE

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ELECTRICAL DETAILS

Sheet Number:

E501

LIGHTING FIXTURE SCHEDULE

TAG	TYPE	MANUFACTURER	CATALOG NUMBER	LAMP		MOUNTING	VOLTAGE	LOAD	REMARKS
				NO.	TYPE				
A	STREET LIGHT	TO BE DETERMINED	TO BE DETERMINED	-	LED	POLE	120	100W	-
B	PEDESTRIAN LED LIGHT FIXTURE	TO BE DETERMINED	TO BE DETERMINED	-	LED	POLE	120	50W	-
C	RAPID FLASHING BEACON	TO BE DETERMINED	TO BE DETERMINED	-	-	POLE	120	-	-

LIGHTING FIXTURE SCHEDULE REQUIREMENTS

1. FURNISH AND INSTALL ALL MATERIALS, ACCESSORIES AND OTHER EQUIPMENT NECESSARY FOR THE COMPLETE AND PROPER INSTALLATION OF ALL LIGHTING FIXTURES INCLUDED IN THIS CONTRACT. PROVIDE ALL NECESSARY ACCESSORIES AS NECESSARY TO PROVIDE A COMPLETE LIGHTING SYSTEM.
2. SPECIFICATIONS AND DRAWINGS ARE INTENDED TO CONVEY THE FEATURES, FUNCTION AND CHARACTER OF THE FIXTURES ONLY, AND DO NOT UNDERTAKE TO SPECIFY EVERY ITEM OR DETAIL NECESSARY. MINOR DETAILS NECESSARY FOR THE PROPER EXECUTION AND COMPLETION OF THE LIGHTING SYSTEM NOT INDICATED ON THE DRAWINGS NOR SPECIFIED SHALL BE PROVIDED AS IF THEY WERE SPECIFIED HERE OR INDICATED ON THE DRAWINGS.
3. EFFECTIVELY PROTECT ALL LIGHTING EQUIPMENT AGAINST DAMAGE FROM THE TIME OF FABRICATION TO FINAL ACCEPTANCE OF THE WORK. INSTALL REFLECTOR CONES, BAFFLES, APERTURE PLATES, LIGHT CONTROLLING ELEMENT AND GENERAL CLEANUP. REPLACE BLEMISHED, DAMAGED OR UNSATISFACTORY FIXTURES AS DIRECTED.
4. AT THE TIME OF FINAL ACCEPTANCE BY THE OWNER, ALL LIGHTING FIXTURES SHALL HAVE BEEN THOROUGHLY CLEANED WITH MATERIALS AND METHODS RECOMMENDED BY THE MANUFACTURERS, ALL BROKEN PARTS SHALL HAVE BEEN REPLACED, AND ALL LAMPS SHALL BE OPERATING.

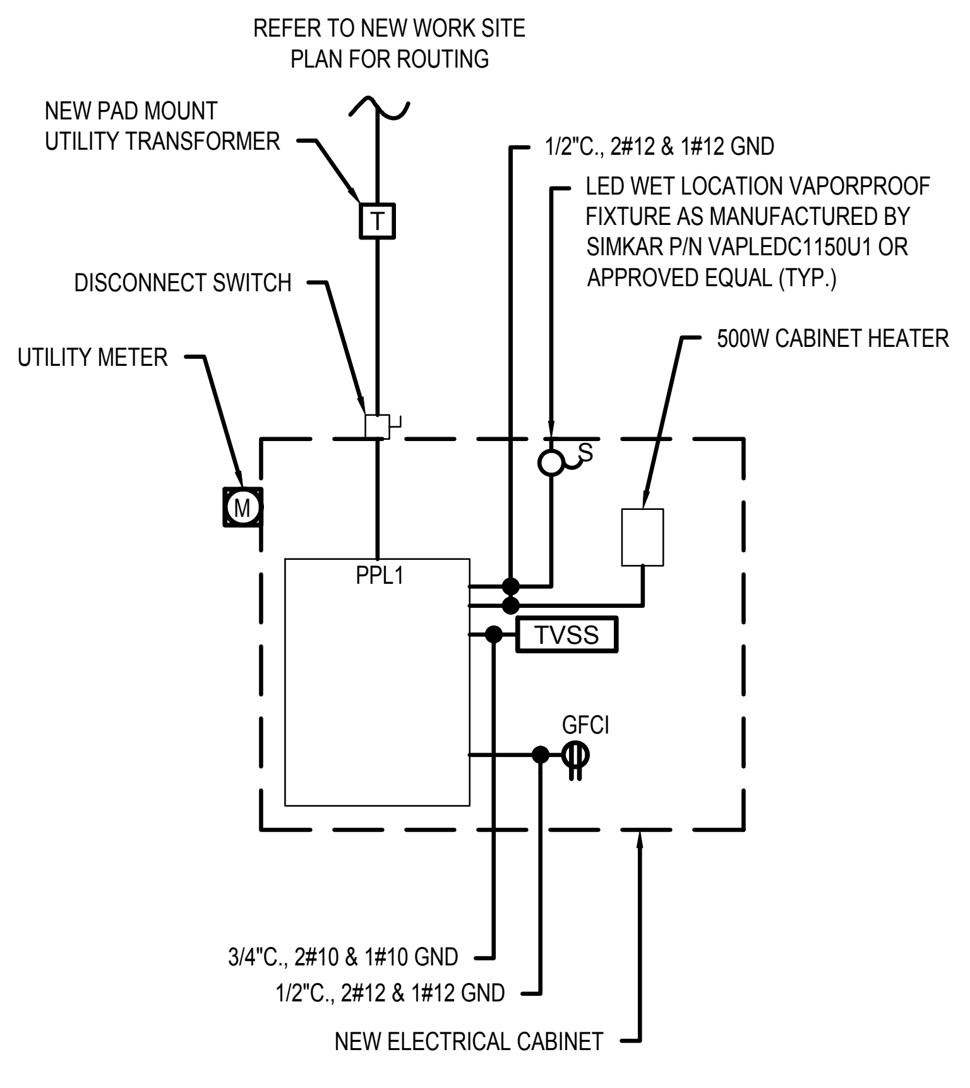
PANELBOARD SCHEDULE

DESIGNATION: PPL1
LOCATION: ELECTRIC CABINET
RATING: 50 AMPS
MAIN: 50 AMP MCB
S.C. RATING: 10,000 A RMS SYSTEM
SERVICE: 120/208V,3Ø,4W
MOUNTING: SURFACE
REMARKS:

CKT. NO.	LOAD DESIGNATION	BREAKER		PHASE			BREAKER		LOAD DESIGNATION	CKT. NO.
		TRIP	POLE	A	B	C	POLE	TRIP		
1	PEDESTRIAN LIGHTING	20		●				20	PEDESTRIAN LIGHTING	2
3	GFI RECEPTACLES	20			●			20	SPARE	4
5	SPARE	20				●		20	SPARE	6
7	SPARE	20		●				20	SPARE	8
9	SPARE	20			●			20	SPARE	10
11	SPACE	-				●		-	SPACE	12
13	SPACE	-		●				-	SPACE	14
15	SPACE	-			●			-	SPACE	16
17	SPACE	-				●		-	SPACE	18
19	SPACE	-		●				-	SPACE	20
21	SPACE	-			●			-	SPACE	22
23	SPACE	-				●		-	SPACE	24
25	SPACE	-		●				-	SPACE	26
27	SPACE	-			●			-	SPACE	28
29	SPACE	-				●		-	SPACE	30
31	SPACE	-		●				-	SPACE	32
33	SPACE	-			●			-	SPACE	34
35	SPACE	-				●		-	SPACE	36
37	SPACE	-		●				-	SPACE	38
39	SPACE	-			●			-	SPACE	40
41	SPACE	-				●		-	SPACE	42

CONDUIT & WIRING SCHEDULE

CONDUIT	FEEDER	FROM	CONTACTOR	TO	FIXTURES	LOAD	CONTACTOR SIZE	REMARKS
C1	2"C., PRIMARY CABLE	UTILITY MANHOLE	-	PAD MOUNTED TRANSFORMER	-	-	-	DIRECT BURIED
C2	2"C., PRIMARY CABLE	PAD MOUNTED TRANSFORMER	-	ELECTRICAL CABINET "A"	-	-	-	DIRECT BURIED
C3	1"C., 2#10&1#10GND	PPL1-1	-	FIXTURE A	7 @ 100W	5.8A	-	DIRECT BURIED
C4	1"C., 2#10&1#10GND	PPL1-3	-	PARK GFI RECEPTACLES	3 @ 180W	4.5A	-	DIRECT BURIED
C5	1 1/2"C., 2#8 & 1#10GND	PPL1-2	-	FIXTURE A	9 @ 100W	7.5A	-	DIRECT BURIED
C6	1 1/2"C., 2#6&1#10GND	PPL2-1	-	FIXTURE A	8 @ 100W	6.6A	-	DIRECT BURIED
C7	1"C., 2#10&1#10GND	PPL2-3	-	FIXTURE A	3 @ 100W	2.5A	-	DIRECT BURIED
C8	1"C., 2#10&1#10GND	PPL2-5	-	PARK GFI RECEPTACLES	3 @ 180W	4.5A	-	DIRECT BURIED
C9	1"C., 2#10&1#10GND	PPL2-2	-	FIXTURE B	5 @ 80W	3.3A	-	DIRECT BURIED
C10	1"C., 2#10&1#10GND	PPL2-4	-	FIXTURE A	7 @ 80W	4.6A	-	DIRECT BURIED
C11	2"C., 2#1/0&1#6GND	PPL2-6	-	FUTURE BRIDGE	N/A	95A	-	DIRECT BURIED
C12	1"C., 2#10&1#10GND	PPL2-7	-	PARK GFI RECEPTACLES	360W	3A	-	DIRECT BURIED



ONE-LINE DIAGRAM

NOT TO SCALE

Project:

PEABODY RIVERWALK
RIVERWALK PARK

WALLIS STREET -
CALLER STREET -
HOWLEY STREET
PEABODY, MA. 01960

WESTON & SAMPSON ENGINEERS, INC
85 DEVONSHIRE STREET, 3RD FLOOR
BOSTON, MA 02109
617-412-4480

www.westonandsampson.com

Consultants:

Revisions:

No.	Date	Description

Seal:

Key Plan:

Issued For:

75% DESIGN DEVELOPMENT
- NOT FOR CONSTRUCTION -

Scale: NO SCALE
Date: MARCH 2021
Drawn By: FN
Reviewed By: DNM
Approved By: RFM

W&S Project No.: ENG20-0145
W&S File No.:

Drawing Title:

ELECTRICAL RISER AND SCHEDULES

Sheet Number:

E601

\\wse03.local\WSE\Projects\MA\Peabody MA\MVP Action Grant 2019\CAD\Electrical\E601 Riverwalk Electrical Riser and Schedules.dwg

westonandsampson.com

55 Walkers Brook Drive, Suite 100
Reading, MA 01867
tel: 978.532.1900

ACOE Pre-Construction Notification

July 2021

PEABODY MVP RIVERWALK

PREPARED FOR:
CITY OF PEABODY

SUBMITTED TO:
US ARMY CORPS OF ENGINEERS –
REGULATORY DIVISION

US Army Corps
of Engineers®
New England District

VIII: SHPO/THPO Notification Form

In accordance with General Condition 6, proponents must ensure and document that all potential historic properties within the permit area have been identified. For PCN activities, proponents must notify the SHPO and applicable THPO(s) and provide proof as specified in Section IX, Part B(2) and submit a copy of any other documentation with the PCN. This form may be used for self-verification or PCN activities. It is recommended that you complete all fields (write "none" or "see attached form" if applicable), attach any Corps or State waterway agency application form, and attach plans and a copy of the USGS quadrangle map section that clearly marks the project location.

The SHPOs and THPOs will contact the Corps if there is any potential for an effect on a historic property and the Corps will begin consultation. Applicants need to coordinate with the Corps before conducting any onsite archaeological work (reconnaissance, surveys, recovery, etc.) as the Corps will use 33 CFR 325 Appendix C, including its "permit area" definition, to determine its scope of analysis for the consideration of historic properties. This is to ensure that work is done in a cost-effective manner, in accordance with Corps requirements and to avoid effects to historic properties before the consultation requirements of Section 106 of the NHPA have been satisfied.

Permittee: Brendan Callahan
Address, City, State & Zip: 24 Lowell Street Peabody, MA 01960
Phone(s) and Email: 978-538-5780 brendan.callahan@peabody-ma.gov

Project Name: Peabody MVP Riverwalk Project
Project Location (provide detailed description if necessary): between Wallis and Howley Street
Address, City, State & Zip: between Wallis and Howley Street, Peabody MA 01960
Latitude/Longitude Coordinates (if address doesn't exist): 42deg31'30.602"N 70deg55'18.896"W
Waterway Name: Proctor Brook
Project Purpose: to improve the Citys overall flood resiliency while providing a usable space for pedestrians
Work Description: Construction of a 1,600 lf riverwalk along the canal
(See Appendix A for additional information)

To the best of your knowledge, are any historic or archaeological properties known to exist within the project's area of potential impact? If so, specify. no

Signature of person submitting this form: Date: 6/24/2021

Name: Alexandra Gaspar
Address: 55 Walkers Brook Drive, Suite 100
City/Town/Zip: Peabody, MA 01960
Telephone: 978-532-1900

Weston & Sampson

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

July XX, 2021

U.S. Army Corps of Engineers
Regulatory Division
696 Virginia Road
Concord, Massachusetts 01742-2751

Re: **Pre-Construction Notification (PCN) Submittal**
MVP Riverwalk Project
Peabody, MA

To Whom it May Concern:

On behalf of the City of Peabody, Weston & Sampson Engineers, Inc. is hereby enclosing one (1) copy of the application for the Army Corp of Engineers Pre-Construction Notification (PCN) General Permit for a Riverwalk project occurring in downtown Peabody. This is being submitted for review because of impacts greater than 500 linear feet to bank.

As part of the filing, we have attached the following:

Appendix A:	Additional Project Information
Appendix B:	Alternatives Analysis
Appendix C:	Project Maps
Appendix D:	Project Specifications
Appendix E:	Wetlands Delineation Memo
Appendix F:	Photographs
Appendix G:	Distribution List
Appendix H:	Abutters List

If you have any questions regarding this submittal, please contact me at (978) 532-1900.

Sincerely,

WESTON & SAMPSON ENGINEERS, INC.
Alexandra Gaspar
Environmental Scientist

Print Form | Save As

U.S. Army Corps of Engineers (USACE)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT

33 CFR 325. The proponent agency is CECW-CO-R.

Form Approved -
OMB No. 0710-0003
Expires: 02-28-2022

The public reporting burden for this collection of information, OMB Control Number 0710-0003, is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at . Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR APPLICATION TO THE ABOVE EMAIL.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website:

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME
First - Brendan Middle - Last - Callahan
Company - City of Peabody
E-mail Address - brendan.callahan@peabody-ma.gov

8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First - Alexandra Middle - Last - Gaspar
Company - Weston & Sampson Engineers, Inc.
E-mail Address - gaspara@wseinc.com

6. APPLICANT'S ADDRESS:
Address- 24 Lowell Street
City - Peabody State - MA Zip - 01960 Country - USA

9. AGENT'S ADDRESS:
Address- 55 Walkers Brook Drive, Suite 100
City - Reading State - MA Zip - 01867 Country - USA

7. APPLICANT'S PHONE NOs. w/AREA CODE
a. Residence
b. Business 978-538-5780
c. Fax

10. AGENTS PHONE NOs. w/AREA CODE
a. Residence
b. Business 978-532-1900
c. Fax

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Weston & Sampson Engineers to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

Brendan Callahan 05/17/2021
SIGNATURE OF APPLICANT DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)
Peabody MVP Riverwalk

13. NAME OF WATERBODY, IF KNOWN (if applicable)
Proctor Brook (North River Canal)

14. PROJECT STREET ADDRESS (if applicable)
Address between Wallis and Howley Street
City - Peabody State- MA Zip- 01960

15. LOCATION OF PROJECT
Latitude: ºN 42deg31'30.602" Longitude: ºW 70deg55'18.896"

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)
State Tax Parcel ID multiple Municipality Peabody
Section - Township - Range -

Print Form Save As

17. DIRECTIONS TO THE SITE

Take exit 37A toward Peabody
Take exit 25A toward Salem/MA-114 E/Lowell St/W Peabody.
Keep left to take the ramp toward Salem State College/Peabody Essex Museum.
Turn slight right onto Andover St/MA-114.
Turn left onto Tremont St
Turn right onto Wallis St

18. Nature of Activity (Description of project, include all features)

Construction of approximately 1600 lf of riverwalk along Proctor Brook/North River Canal (See Appendix A for additional information)

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

To increase the flood resiliency within the City of Peabody while providing a usable space for pedestrians

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

no discharge as part of this project

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
0	0	0

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres
or
Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

Print Form Save As

24. Is Any Portion of the Work Already Complete? ○ Yes ● No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address- See Appendix G for abutters list

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
MassDEP	Notice of Intent		submitted concurren		
MEPA	ENF		submitted concurren		

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

Brendan Callahan — 05/17/2021

SIGNATURE OF APPLICANT — DATE

6/2/2021

SIGNATURE OF AGENT — DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

APPENDIX A

PROJECT DESCRIPTION

Project Description

Background

In 2018, the City of Peabody (the City) was awarded a Municipal Vulnerability Preparedness (MVP) Action Grant by the Massachusetts Executive Office of Energy & Environmental Affairs (MassEEA). The MVP grant will allow the City to explore options for improving the flood resiliency of Peabody Square and was awarded based on a comprehensive project proposal to specifically target a stretch of the North River Canal that will improve flood resilience, address site contamination from historic use as a tannery district and evaluate a park resource and Riverwalk that would enhance public access and vitality of the area.

Site Description

The project site is in an urban industrial area of Peabody, between Wallis and Howley Streets, and crosses Caller Street. The south side of the North River Canal along the project limits abuts seven (7) privately owned properties, from west to east: 13 Wallis Street, 24 Caller Street [Caller Street crossing], 21 Caller Street, 18 Howley Street, 166 Main Street (R), and MBTA property.

The south canal wall along the length of the project limits consists of multiple sections including earthen embankment (or possible buried wall), a stacked timber railroad tie structure behind an earth embankment, reinforced concrete, granite blocks, or stone or stone rubble sections. Wall heights range from about 4 to 6 feet above the canal bottom. The wall’s condition varies over its length, ranging from good, in need of minor or no repairs, to poor, requiring full or partial reconstruction.

Scope of Work

The proposed Riverwalk will be approximately 1,600 feet in length, following along the canal in the urban industrial section of downtown Peabody from approximately Wallis Street to Howley Street. Part of the project’s scope of work includes replacing the south canal wall with a new wall at a lower elevation with a stabilized slope with a turf reinforcement mat and vegetation. The new wall will consist of driven steel sheet pilings located approximately 2 feet inland from the existing canal wall. The sheet piling wall will be craned into place and driven to specific depths. The Riverwalk will consist of an 8-foot wide asphalt path with 4 feet of vegetative buffer on each side where sufficient space permits. There will also be 4 separate sections of boardwalk constructed which will include helical pile footings. Additionally, a porous paver “art walk” will also be constructed as well a public deck supported by concrete post footings. Plantings will consist of native species and seed mixes. Pedestrian and street lights will be installed as well as rapid flashing beacons at street crossings.

Environmental Considerations – Notice of Intent

Resources that will be impacted by this project include Bordering Land Subject to Flooding, Bank, and Riverfront Area. Please see below for the General Performance Standards for each resource and how this project will approach them.

Bordering Land Subject to Flooding - General Performance Standards

1. **Compensatory storage shall be provided for all flood storage volume that will be lost as the result of a proposed project within Bordering Land Subject to Flooding.**

See below cut and fill table that accounts for the change in flood storage as a result of this project.

Contour El. (ft)	Fill (cuft)	Compensatory Storage (cuft)	Fill (CY)	Storage (CY)
11-12	197±	1620±	7±	60±
12-13	1418±	3356±	53±	124±
13-14	898±	911±	33±	34±

2. Work within Bordering Land Subject to Flooding, including that work required to provide the above-specified compensatory storage, shall not restrict flows so as to cause an increase in flood stage or velocity.

3. Work in those portions of bordering land subject to flooding found to be significant to the protection of wildlife habitat shall not impair its capacity to provide important wildlife habitat functions …

This proposed project is not within any of the habitat areas identified by the Mass Wildlife's Natural Heritage & Endangered Species Program (NHESP) on MassGIS data layers including NHESP Estimated Habitats of Rare Wildlife, NHESP Priority Habitats of Rare Species, NHESP Certified Vernal Pools, and NHESP Potential Vernal Pools. Environmental resources map outlining these areas are attached in this package.

<u>Bank – General Performance Standards</u>

Where the presumption set forth in 310 CMR 10.54(3) is not overcome, any proposed work on a Bank shall not impair the following:

1. the physical stability of the Bank;

As mentioned in the Scope of Work, this project will enhance the slopes stability. Turf reinforcement mat and vegetation will be added to accomplish this.

2. the water carrying capacity of the existing channel within the Bank;

The new canal wall will be set back which will increase the width of the river along the length of the project. Proper resource protection will be utilized to ensure this process does not have any severe impact to nearby resource areas.

3. ground water and surface water quality;

There will be no impacts to ground water and surface water quality.

4. the capacity of the Bank to provide breeding habitat, escape cover and food for fisheries;

This project will not impact negatively impact the capacity of the Bank to provide breeding habitat, escape cover, and food for fisheries. As we are increasing the width of the river, there may be more habitat available to fisheries. In addition, the existing bank currently exists of stone wall, so it is not providing much habitat in its current state.

5. the capacity of the Bank to provide important wildlife habitat functions. A project or projects on a single lot, for which Notice(s) of Intent is filed on or after November 1,1987, that (cumulatively) alter(s) up to 10% or 50 feet (whichever is less) of the length of the bank found to be significant to the protection of wildlife habitat, shall not be deemed to impair its capacity to provide important wildlife habitat functions. In the case of a bank of a river or an intermittent stream, the impact shall be measured on each side of the stream or river. Additional alterations beyond the above threshold may be permitted if they will have no adverse effects on wildlife habitat, as determined by procedures contained in 310 CMR 10.60.

This project will not negatively impact the capacity of the bank to provide wildlife habitat functions. The bank is already made up of degraded area (stone wall). This project will improve the quality of the bank, and the ability of the bank to provide wildlife habitat functions.

Riverfront Area – General Performance Standards

The area where work will occur (Wallis/Howley Street area) is considered already altered area. As such, since the limit of work is fully within the riverfront area, work at this site is considered re-development work in riverfront area. Each standard for work in riverfront for redevelopment projects area (per 310 CMR 10.58 (5)) are provided below, followed by an explanation on how the project meets each standard.

(a) At a minimum, proposed work shall result in an improvement over existing conditions of the capacity of the riverfront area to protect the interests identified in M.G.L. c. 131 § 40.

Because work will involve improving bank stability and adding native plantings to the area, this project will result in an improvement over existing conditions of the capacity of the riverfront area to protect the interests identified in M.G.L. c. 131 § 40.

(b) Stormwater management is provided according to standards established by the Department.

Per Appendix G of the Notice of Intent, this project will adhere to the stormwater standards established by the Department.

(c) Within 200 foot riverfront areas, proposed work shall not be located closer to the river than existing conditions or 100 feet, whichever is less, or not closer than existing conditions within 25 foot riverfront areas, except in accordance with 310 CMR 10.58(5)(f) or (g).

The work will all be within already altered area (roadway, buildings, parking lot, manicured lawn, train tracks).

(d) Proposed work, including expansion of existing structures, shall be located outside the riverfront area or toward the riverfront area boundary and away from the river, except in accordance with 310 CMR 10.58(5)(f) or (g).

Work will not be outside the riverfront area or toward the riverfront area boundary, however the work will be in accordance with 310 CMR 10.58(5)(f) as much of the work is within a degraded riverfront area (train tracks, urban industrial area, neither of which provide optimal riverfront area habitat).

(e) The area of proposed work shall not exceed the amount of degraded area, provided that the proposed work may alter up to 10% if the degraded area is less than 10% of the riverfront area, except in accordance with 310 CMR 10.58(5)(f) or (g).

The area of proposed work within the riverfront area is 110,305 sf. Total riverfront area on the parcel is 612,400 sf. Thus, 18 percent of the site's riverfront area will be altered. The work will be in accordance with 310 CMR 10.58(5)(f) as much of the work is within a degraded riverfront area.

(f) When an applicant proposes restoration on-site of degraded riverfront area, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), and (e) at a ratio in square feet of at least 1:1 of restored area to area of alteration not conforming to the criteria. Areas immediately along the river shall be selected for restoration. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Restoration shall include:

1. removal of all debris, but retaining any trees or other mature vegetation;

2. grading to a topography which reduces runoff and increases infiltration;

3. coverage by topsoil at a depth consistent with natural conditions at the site; and

4. seeding and planting with an erosion control seed mixture, followed by plantings of

herbaceous and woody species appropriate to the site;

Restoration efforts will include removal of all debris, and the addition of native species and seed mixes to serve as a vegetative buffer.

(g) When an applicant proposes mitigation either on-site or in the riverfront area within the same general area of the river basin, alteration may be allowed notwithstanding the criteria of 310 CMR 10.58(5)(c), (d), or (e) at a ratio in square feet of at least 2:1 of mitigation area to area of alteration not conforming to the criteria or an equivalent level of environmental protection where square footage is not a relevant measure. Alteration not conforming to the criteria shall begin at the riverfront area boundary. Mitigation may include off-site restoration of riverfront areas, conservation restrictions under M.G.L. c. 184, §§ 31 through 33 to preserve undisturbed riverfront areas that could be otherwise altered under 310 CMR 10.00, the purchase of development rights within the riverfront area, the restoration of bordering vegetated wetland, projects to remedy an existing adverse impact on the interests identified in M.G.L. c. 131, § 40 for which the applicant is not legally responsible, or similar activities undertaken voluntarily by the applicant which will support a determination by the issuing authority of no significant adverse impact. Preference shall be given to potential mitigation projects, if any, identified in a River Basin Plan approved by the Secretary of the Executive Office of Energy and Environmental Affairs.

Not applicable.

Environmental Considerations – Army Corps

Army Corps of Engineers (ACOE) has jurisdiction over work in “Waters of the United States” and “Navigable Waters of the United States” based on Section 404 of the Clean Water Act and Sections 9 and 10 of the Rivers and Harbors Act of 1899 respectively. Activities are authorized under 23 separate General Permits (GP) which are broken down by type of activity. This project involves creating a new canal wall at a lower elevation than the existing. Because of this, project will result in approximately 1,350 linear feet of bank impact. The only work occurring within the river is the installation of the silt curtain for sediment and erosion control protection.

APPENDIX B

ALTERNATIVES ANALYSIS