# Environmental Assessment
# Merrimack River Bank Stabilization
# Chelmsford, Middlesex, MA

## 4028-DR-MA

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FEMA

**U.S. Department of Homeland Security**
**Federal Emergency Management Agency Region I**
**99 High St, Boston, MA 02110**

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## LIST OF ACRONYMS

ACHP – Advisory Council on Historic Preservation

APE – Area of Potential Effect

APHIS – United States Department of Agriculture, Animal, and Plant Health Inspection Services

BAUR - Massachusetts Board of Underwater Archaeological Resources

BGEPA – Bald and Golden Eagle Protection Act

BRP – Bureau of Resource Protection

CERCLA – Comprehensive Environmental Response, Compensation and Liability Act

CFR – Code of Federal Regulations

COC – Community of Concern

dBA – A-Weighted Decibels

DHS – Department of Homeland Security

EA – Environmental Assessment

EFH – Essential Fish Habitat

EJ – Environmental Justice

EO – Executive Order

EPA – Environmental Protection Agency

ESA – Endangered Species Act

FEMA – Federal Emergency Management Agency

FPPA – Farmland Policy Protection Act

HMGP – Hazard Mitigation Grant Program

IPaC – Information for Planning and Consultation

Ldn – Day-Night Average Sound Level

MACRS - Massachusetts Cultural Resource Information System

MADAR – Massachusetts Department of Agricultural Resources

MADCR – Massachusetts Department of Conservation and Recreation

MADEP – Massachusetts Department of Environmental Protection

MADFW – Massachusetts Division of Fisheries and Wildlife

MADOT – Massachusetts Department of Transportation

MASHPO – Massachusetts State Historic Preservation Office

MEMA – Massachusetts Emergency Management Agency

MTBA – Migratory Bird Treaty Act

NHPA – National Historic Preservation Act

NRHP – National Register of Historic Places

NOAA – National Ocean and Atmospheric Administration

NPDES – National Pollution Discharge Elimination System

NRHP – National Register of Historic Places

OSHA – Occupational Safety and Health Administration

PAL – Public Archaeology Laboratory, Inc

RCRA – Resource Conservation and Recovery Act

SHPO – State Historic Preservation Office

SWPPP – Storm Water Pollution Prevention Plan

US – United States

USACE – United States Army Corp of Engineers

USFS – United States Forest Service

USFWS – United States Fish and Wildlife Services

WQC – Water Quality Certification

## 1.0 INTRODUCTION

Tropical Storm Irene caused storm damage from August 27-29, 2011 to several areas across the Commonwealth of Massachusetts. On September 3, 2011, President Obama declared Tropical Storm Irene a major disaster. The declaration authorized the Federal Emergency Management Agency (FEMA) to provide assistance to the state per federal disaster declaration DR-4028–MA and in accordance with Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974 (42 U.S.S. 5172). The Town of Chelmsford (Town) has applied to the FEMA Hazard Mitigation Grant Program (HMGP) for financial assistance to stabilize the bank along the Merrimack River at Wellman Avenue to prevent further erosion as a means to protect a sewer line. The Massachusetts Emergency Management Agency (MEMA) is the grant recipient partner for the proposed action.

This Environmental Assessment (EA) is prepared in accordance with Section 102 of the National Environmental Policy Act (NEPA) of 1969, as amended; and the Regulations for Implementation of the National Environmental Policy Act (40 Code of Federal Regulations [CFR] Parts 1500 to 1508). The purpose of the EA is to analyze the potential environmental impacts of the proposed project and alternatives, including a no action alternative, and to determine whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI). In accordance with above referenced regulations and FEMA Directive 108-1 and FEMA Instruction 108-1-1, FEMA is required, during decision making, to fully evaluate and consider the environmental consequences of major federal actions it funds or undertakes.

## 2.0 PURPOSE AND NEED

FEMA's HMGP fosters the protection of health, safety, and welfare of citizens, assists communities in mitigating damages caused by disasters, and reduces future losses resulting from natural disasters. The purpose of this project is to reduce the risk to the existing gravity sewer line from becoming washed out, exposed, and/or ruptured from bank erosion. The project is needed because the river bank is currently eroded from the natural river flow, storm flooding and runoff, and frost melt. Exposure and rupture of the sewer line would contaminate the Merrimack River with sewage and pose a threat to public health.

## 3.0 PROJECT LOCATION AND BACKGROUND

The site is in, and adjacent to, an 82-acre, 535-unit residential condominium complex located along the southern bank of the Merrimack River in North Chelmsford, Massachusetts (Appendix B, Figure A). Waste water from the complex is collected by an 8 inch gravity sewer line at the back of the residential units between Wellman Avenue and the Merrimack River. The sewer line parallels the river for approximately 4,000 linear feet (Appendix B, Figure B). Sewage in the gravity sewer line flows easterly to a pump station where it is pumped to the Lowell Wastewater treatment facility. (Epsilon 2016a)

The river bank rises about 8 to 12 feet from ordinary high water of the Merrimack River. The project proposal characterizes the river bank as three edge types based on slope condition. (Appendix A, Document A):

- Type A is bank slope that has an approximately 2H:1V (horizontal to vertical) slope and is vegetated. This section is located at the western most reach and is approximately 250 feet long.
- Type B is bank slope that has an approximately 1H:1V slope and is vegetated. This section is approximately 450 feet long.
- Type C is bank slope that has an approximately 1H:1V slope or steeper and is comprised of exposed sandy soil. This section is approximately 3,250 feet long.

The crest of the bank has retreated at an average 15.2 feet since 1985 ranging from 9–20 feet throughout the approximate 4,000 linear foot range (Epsilon 2016a). Erosion is episodic and caused by various factors including flooding, snow and ice melt, ice scouring, or when a tree with a robust root wad topples.

## 4.0 ALTERNATIVES

Several alternative courses of action were evaluated for the Merrimack River Bank Stabilization project. The alternatives were evaluated based upon engineering constraints, environmental impacts and available property. Budgetary constraints were considered but were not the controlling factor.

Guidance provided in NEPA section 102(2)(E) and 40 CFR 1508.9 regarding the NEPA provision of an alternative analysis states that an agency must rigorously explore and objectively evaluate all reasonable alternatives and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their elimination. Additionally, a No Action Alternative must be included. This section discusses the No Action Alternative, also known as the "Future without Federal Project Condition", the feasible Alternatives that would provide for the purpose and need, and the Alternative that was eliminated from full analysis.

### 4.1 Alternative 1: No Action Alternative

The No Action Alternative would not provide federal action to protect the sewer line at the site. The gravity sewer line would continue to be at risk from continued bank erosion. The sewer line could potentially become exposed as natural erosion continues which would risk failure from the water action. If failure were to occur, raw sewage could potentially leak from the system and contaminate the river, nearby residential area and communities down river.

### 4.2 Alternative 2: Proposed Alternative: Bioengineering Bank Stabilization

The Bioengineering Bank Stabilization Alternative would stabilize the bank using a mixture of structural components, such as a stone toe, and natural components such as timber, coir rolls (organic revetment that provides erosion control and facilitates the establishment of vegetation), and living vegetation. There are three stabilization techniques proposed for each edge type described in section 3.0 with sub-designs that vary due to slope conditions. See Appendix A – Document B for the full engineering details of bank stabilization. The general slope designs for each edge type include:

- **Bank Support for Edge Type A:** Work would involve installation of timber toe protection and vegetation management, including removal of tree limbs. The approximate height of this treatment would be 3 - 4 feet. Bank Support is proposed for approximately 250 linear feet.
- **Bank Repair for Edge Type B:** Work would involve installation of stone sill along the toe of the slope to 0.5 feet above ordinary high water and placement of soil behind the sill which would establish a shallow slope. One or more coir rolls would be placed on top of the stone sill to hold the soil in place to establish an approximate ±3H:1V slope. Stabilization would be achieved through seeding, erosion control blankets, and native shrubs. Typical offset from the toe of slope to the centerline of the stone sill would be approximately 7.5 feet and the offset to the outboard limit of the stone sill would be approximately 14 feet. Bank Repair is proposed for approximately 450 linear feet.
- **Bank Reconstruction for Edge Type C:** Work would involve installation of a stone sill along the toe of slope to approximately 0.5 feet above ordinary high water mark and restoration of the entire slope cross-section with the several rows of coir fiber rolls and fabric wrapped soil cells placed in a step-wise manner to establish a 2:1 slope. Revegetation of the soil cells with native trees and shrubs would provide soil stabilization. The offset from the toe of the slope to the centerline of the stone sill would be approximately 7.5 feet and ranges from 1 to 12 feet. The out board offset of the stone sill is approximately 14 feet and ranges from 7.5. To 18.5 feet. Bank Reconstruction is proposed for approximately 3,250 linear feet.

In all edge type zones, trees on the slope and along the top of the slope in imminent danger of toppling would be removed. Installation of a turbidity barrier (a temporary silt curtain or silt fence that traps turbid water to prevent the transport of suspended sediment outside the work area) off the river edge would create a dry work area along the bank. The silt barrier would be installed first and then the remaining work would be done landward from the barrier and would eliminate the need for water egress points and anchoring locations during construction. Work would occur on approximately 3,950 linear feet of inland bank and approximately 145,250 square feet of riverfront area and bordering land. 59,250 square feet of the 145,205 square feet would occur in waters of the US which includes the turbidity shield installation and an approximately 13 foot wide by 2 foot

deep by 3,700 foot long excavation, approximately 3500 cubic yards. Excavated soils would be reused on-site and augmented by off-site material as needed. Staging of equipment and materials would be located on a small open field on the eastern edge of Wellman Ave (Appendix B Figure C). See Appendix A - Document B for location of work types and engineering plans.

### 4.3 Alternative 3: Rock Rip Rap

The Rock Rip Rap Stabilization Alternative includes the installation of rock rip rap along the 3,950 linear feet of bank. The rip rap would be installed along the entire 8 to 12 feet of slope after tree and vegetation removal and proper grading. The rip rap would be anchored using filter-fabric and native vegetation. The level of ground disturbance would be approximately the same is in the Proposed Alternative. This Alternative meets the purpose and need by mitigating against bank erosion which would reduce the threat of sewer exposure. The construction cost for the Rock Rip Rap Stabilization Alternative is less that the Proposed Alternative and would have a similar construction methods including landward work and square footage disturbance.

### 4.4 Alternatives Considered and Dismissed

#### 4.4.1 Sewer Relocation

The Sewer Relocation Alternative involves relocating the sewer line to Wellman Avenue in front of the buildings adjacent to the Merrimack River. This alternative would require constructing approximately 4,250 linear feet of new sewer, replacing approximately 113 sewer services, and modifying the existing pump station to accommodate a deeper sewer invert. This Alternative was dismissed due to the requirements of moving the sewer services from the back of the condominiums to the front. Relocation of sewer services would require two 90 degree bends and would need to be sloped greater than 1% which would increase the likelihood of clogging. Relocation would also increase the pipe length which, coupled with the greater pipe slope, would require the replacement sewer to be deeper than the existing gravity sewer. This would require pump station modifications to accommodate the deeper inlet sewer pipe. Lastly, the cost of the Sewer Relocation Alternative is greater than the Proposed Alternative. Due to the engineering constraints and the increased cost, the Sewer Relocation Alternative was dismissed. Relocation of sewer line to other local collector lines, including under homes and closer to back of the homes would have similar restraints and was also dismissed.

#### 4.4.2 Log Crib Wall

The Log Crib Wall Alternative would install a vertical or sloped log wall with a stone toe foundation. The area would be backfilled with gravel and soil and stabilized with geotextile fabric and native plantings. This alternative would only temporarily meet purpose and need due to timber decay and was therefore dismissed.

### 4.4.3 Site Specific Repairs

The Site Specific Repair alternative would use the same Rock Rip Rap Stabilization discussed in section 4.3 but would be limited to localized erosion spots instead of the entire length of the bank. This alternative would reduce the risk of sewer line exposure at those spots. However, an uneven bank creates eddies and, coupled with higher energy water movement at one or both ends of the repair, would exacerbate the soil bank erosion adjacent to the repaired end. Therefore, this alternative does not meet purpose and need because it would not provide long term protection against sewer line failure.

## 4.5 Summary of Alternatives

Six Alternatives were considered by the Town for implementation at the Merrimack River Bank by Wellman Avenue. Three Alternatives, Sewer Relocation, Log Crib Wall and Site Specific Repairs, were dismissed. The remaining Alternatives are:

1) No Action Alternative
2) Bioengineering Bank Stabilization
3) Rock Rip Rap Installation

The following impact analyses evaluate the potential environmental impacts of the three alternatives. A table summarizing the potential impacts of the three alternatives is provided in Section 10, Summary of Impacts.

# 5.0 AFFECTED ENVIRONMENTAL RESOURCES AND POTENTIAL IMPACTS

This section discusses the potential impacts of the No Action Alternative, the Proposed Alternative, and the Rock Rip Rap Alternative on environmental and cultural resources. The potential cumulative environmental impacts are also discussed in Section 5.11.

When possible, quantitative information is provided to establish potential impacts and the potential impacts are evaluated based on the criteria listed in Table 5.0.1. These impacts listed below will be used for both beneficial and negative impacts.

**Table 5.0.1: Impact Significance and Context Evaluation Criteria for Potential Impacts**

| **Impact Scale** | **Criteria** |
|---|---|
| No Effect | The resource area would not be affected and there would be no impact. |

| **Impact Scale** | **Criteria** |
|---|---|
| Negligible | Changes would either be non-detectable or, if detected, would have effects that would be slight and local. Impacts would be well below regulatory standards, as applicable. |
| Minor | Changes to the resource would be measurable, but the changes would be small and localized. Impacts would be within or below regulatory standards, as applicable. Mitigation measures would reduce any potential adverse effects. |
| Moderate | Changes to the resource would be measurable and have either localized or regional scale impacts. Impacts would be within or below regulatory standards, but historical conditions would be altered on a short-term basis. Mitigation measures would be necessary to reduce any potential adverse effects. |
| Major | Changes to the resource would be readily measurable and would have substantial consequences on regional levels. Impacts would exceed regulatory standards. Mitigation measures to offset the adverse effects would be required to reduce impacts, though long-term changes to the resource would be expected. |

Six environmental resource topics were omitted because they do not apply to the project as covered by this EA.

**Table 5.0.2: Eliminated Resource Topics**

| **Topic** | **Reason** |
|---|---|
| Bedrock | Depth disturbance will occur up to two feet below water line where soil boring showed soil depth to a minimum of 26 feet. Therefore, bedrock will not be impacted since work in all alternatives would not reach that depth. |
| Air Quality | The project site is located in an area that is in attainment for all six National Ambient Air Quality Standards criteria pollutants. The proposed project would also only produce temporary emissions that would be well below *de minimus* standards. |
| Farmland Policy Protection Act | Project site is in in urban development area and is therefore exempt from the Farmland Policy Protection Act. |
| Safe Drinking Water Act | Project site is not located above a sole source aquifer nor would it impact one. |
| Coastal Zone Management Act | Project site is not within, nor does work impact coastal management zones. |
| Coastal Barrier Resources Act | Project site is not within a Coastal Barrier Resource Unit or an Otherwise Protected Area. |

| Topic | Reason |
|---|---|
| EO 12699 Seismic Safety | Project site is not in a seismic active area nor would it impact seismic activity. |
| Wild and Scenic Rivers Act | The Merrimack River is not classified as a Wild and Scenic River nor is there one within or near the project site. |

## 5.1 Soils and Topography

### 5.1.1 Existing Conditions

The soils at the project area are almost entirely classified as Suncook Loamy Sand with a 0 to 3 percent slope. Winooski Very Fine sandy loam could potentially occur within the project area, however, it is located inland from the shore bank (Appendix A, Figure C). The Suncook series soils consists of very deep, excessively drained sandy soils formed in alluvial sediments. They are located on floodplains that are subject to flooding with a high to very high saturated hydraulic conductivity (USDA 2107). In May 2016, 11 soil borings, ranging in depth from 21 to 26 feet, were performed as part of a geotechnical investigation. The soils encountered included 12 to 24 inches of topsoil, narrowly graded sand with fines below the top soil that extended to depths of 15 to 25 feet, and fine to course sand and gravel beneath reaching to the water layer (Epsilon 2016a).

The topography of the area adjacent to the river banks is relatively flat with a slight elevation change (Appendix A, Figure D). The bank has a slope of 1:2 to 1:1 in most locations ranging in 8 to 12 feet in height due to the erosion in the area.

### 5.1.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

Soils would not be disturbed nor would the topography change from construction activities. Erosion would likely continue at the site that could wash away soil and change the topography adjacent to the river bank. Therefore, there would be no short term impact to soils and topography and a long term, negative, minor impact to soils and topography.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

The Proposed Alternative would impact soils through the construction of the bioengineered bank. During construction, installation of the coir rolls and stone sill would require 13 foot wide by 2 foot deep excavation from ordinary high water parallel to the river (Appendix A Document C). The excavation would also have approximately 3,600 cubic yards of dredging which would be reused as fill at the site. Construction would start at the eastern end of the bank and the equipment

would move along the placed fill as it constructs the mattress and stone sill to minimize impact to soils.

The Town is coordinating with MADEP to obtain a Section 401 Water Quality Certificate (WQC) Fill Permit to address the potential use of fill from offsite. If outside fill is required, compliance with all regulations in the 401 WQC Fill Permit and Massachusetts USACE General Permit #7 (USACE 2015). Soils would be stabilized through various techniques stated in section 4.2. A Storm Water Pollution Prevention Plan (SWPPP) developed in accordance with an EPA National Pollution Discharge Elimination System (NPDES) General Construction Permit (See section 5.2 Water Quality for more details on NPDES) would be required since more than 1 acre would be disturbed. Best Management Practices (BMPs) would be a condition of the project and include installation of a turbidity barrier, sedimentation control barriers, installation of erosion control blanket on 4:1 exposed slopes or steeper, seeding and mulching of disturbed areas after construction, and areas with anticipated disturbances would be temporarily stabilized with mulch and tackifier, a compound that increases surface adhesiveness. With the implementation of BMPs and compliance with regulations, impacts on soils would have a minor negative impact during construction and a positive minor impact post construction due to the erosion control from bank stabilization.

Topography would be impacted in a similar way as soils from the Proposed Alternative. During construction, slope fill would be removed and replaced as the coir rolls and stone sill is installed. The work would eventually change the slope from 1:1 in most locations to 2:1 to 3:1 slope and preventing further erosion from the stabilization. Therefore, there would be a minor negative impact on topography during construction and a positive minor impact post construction from modification to the 1:1 slope and the addition of bank stabilization.

**Alternative 3: Rock Rip Rap**

There would be similar impacts to soils and topography from the Rock Rip Rap alternative. Similar dredging and mattress installation would occur but with the installation of rip rap instead of the bioengineered design. Soils would not be as protected from erosion due to the potential loosening of rip rap from conditions that have caused the initial erosion issues. The slope of the topography would be similar to the Proposed Alternative, however, it would not have as much vegetative cover and would not have a uniform look due to the appearance of rip rap. Therefore, the Rock Rip Rap Alternative would have a minor negative impact during construction to both soils and topography and a negligible impact post construction.

## 5.2 Water Quality

Congress enacted the Federal Water Pollution Control Act in 1948 which was later reorganized and expanded in 1972 and became known as the Clean Water Act (CWA) in 1977. The CWA regulates discharge of pollutants into water with sections falling under the jurisdiction of the U.S

Army Corps of Engineers (USACE) and the EPA. Section 404 of the CWA establishes the USACE permit requirements for discharging dredged or fill materials into Waters of the United States and traditional navigable waterways. Massachusetts, through the Department of Environmental Protection (MADEP), administers Section 401 of the CWA with WQC (314 CMR 9.00) for discharge of dredged materials, dredging, and dredged material disposal in waters of the US. USACE regulation of activities within navigable waters is also authorized under the 1899 Rivers and Harbors Act. Under the NPDES, the EPA regulates both point and non-point pollutant sources, including stormwater and stormwater runoff. Activities that disturb one acre of ground or more require a NPDES permit.

### 5.2.1 Existing Conditions

The Merrimack River Watershed (United States Geological Survey watershed designation HUC01070002) encompasses 5010 square miles in New Hampshire and Massachusetts; the fourth largest watershed in New England. The river is formed by the confluence of the Pemigewasset and Winnipesaukee River and flows 115 miles to the Atlantic Ocean near Newburyport, MA (EEA 2001). The MADEP classifies the Merrimack as a Class B (freshwater) water system at the project site, which is suitable as drinking water with adequate treatment. Downriver from the site, starting at Haverhill, the water quality is classified as SB (tidally affected), which means the river is expected to support fish, aquatic life and other wildlife and have primary (swimming) and secondary (boating) uses (MRWC 2009). Water quality issues come from combined sewer overflows up river from the site, various nonpoint sources of pollution, and smaller industrial discharges (EEA 2010). These impacts cause increased levels of bacteria and nutrient levels (primarily phosphorus) within the Lower Merrimack River (EPA 2017a).

Over 600,000 residents in Lowell, Methuen, Andover, Tewksbury and Lawrence in Massachusetts and Nashua in New Hampshire use the Merrimack River as a drinking water source (see Section 5.9).

### 5.2.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

Under the No Action alternative the bank will continue to erode causing silt and debris to wash into the Merrimack River. Erosion could eventually reach the sewer line and cause it to slump and possibly leak. Untreated sewage could enter the Merrimack River further increasing the bacteria and nutrient levels in the water system. Therefore, the No Action Alternative could have a moderate negative impact to water quality from erosion and if the sewer system fails and causes sewage to flow into the river.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

The Proposed Alternative includes dredging of approximately 3,600 cubic yards of soil below ordinary high water, shoreline placement of dredged materials, and the placement of approximately 59,250 sf of fill below ordinary high water line. The Town is required to apply for a WQC under Section 401 of the CWA. In November 2016, they submitted an application for a BRP WW 07 which is a major project certification that results in discharge of dredged material, dredging, or dredged material disposal greater than 100 cubic yards, a BRP WW 10 which is a major project certification for fill and excavation projects in waters of US , and a 401 WQC Fill Permit (Appendix D Correspondence A). The Town has also provided the USACE a Pre-Construction Notification for Massachusetts General Permit No. 7 (Bank and Shoreline Stabilization) in November of 2016 (Appendix D Correspondence B). The applications propose the following mitigation measures to reduce impact to water quality during construction:

- A turbidity barrier in the river around active work areas to contain turbid water and prevent runoff into the Merrimack.
- A "marine mattress" and stone sill to provide a raised work platform on which construction equipment could work to minimize working on river sediments and in the water column.
- Sedimentation control barriers around erodible stockpiled materials
- Erosion control blankets on all exposed slopes of 4:1 or steeper
- Seed and mulch on disturbed areas within a 100-foot buffer zone.
- Temporary stabilization using mulch and tackifier, or erosion control blankets, if additional disturbance is anticipated within 7 to 30 days.

An NPDES permit with a SWPPP may be required since more than one acre would be disturbed. The Town would be required to coordinate with EPA on requirements. The project would reuse dredge material as fill and would not require any additional outside fill. Therefore, the Proposed Alternative would have a negligible impact during construction if all permit requirements, including possible NPDES conditions, are met.

Post construction, the Proposed Alternative would reduce the level of erosion at the bank reducing the amount of sediment that enters the Merrimack River. The bioengineering elements would reduce the level and velocity of stormwater and melt runoff that enters the river as sheet flow over the bank thereby reducing the amount of sediment other contamination carried in surface water runoff conveyed to the river. The sewer line would be protected from possible exposure which would reduce the risk of failure and raw sewage contamination in the river. Any materials used in the construction of the bank would be free of known water contaminants that may violate any CWA permits. As a result, the Proposed Alternative would have a minor positive impact on water quality post construction.

**Alternative 3: Rock Rip Rap**

The Rock Rip Rap Alternative would have similar impacts as the Proposed Alternative both during and post construction. However, the use of rip rap on the bank would reduce the amount of vegetation and require the removal of all trees in the proposed bank stabilization area. The absence of vegetation could possibly increase the level of stormwater and melt runoff into the Merrimack River. Therefore, the Rock Rip Rap Alternative would have negligible impact to water quality because it would reduce the chance of sewer line exposure but would likely increase runoff rates due to vegetation removal.

### 5.3 Wetlands and Floodplain

Wetlands are areas which are inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, or under normal hydrological conditions would support, a prevalence of vegetation or aquatic life typically adapted for those soil conditions. Actions that would impact wetlands would require review under several regulatory programs. Federal Executive Order (EO) 11990 and Section 404 of the CWA (33 USC 1344) are designed to protect wetlands. EO 11990 Wetlands Management requires Federal agencies to avoid funding activities that directly or indirectly support occupancy, modification, or development of wetlands, whenever there are practicable alternatives.

A special flood hazard area is defined as an area subject to inundation from a flood that has a 1 percent chance of being equaled or exceeded in any given year - often referred to as the 100-year flood or base flood. EO 11988, Floodplain Management, requires that a Federal agency avoid direct or indirect support of development within the floodplain whenever there is a practicable alternative. FEMA uses Flood Insurance Rate Maps (FIRM) to identify the special flood hazard areas for the National Flood Insurance Program (NFIP).

FEMA uses an eight-step decision-making process to evaluate potential effects on, and mitigate impacts to, wetlands and floodplains to comply with the requirements of EO 11990 and EO 11988. Federal actions within the 100-year floodplain and/or within a federally recognized wetlands, require the Federal agency to conduct an Eight-Step process (Appendix A, Document D). This process, like NEPA, requires the evaluation of alternatives prior to finding the action. FEMA's regulations on conducting the Eight Step process are documented in 44 CFR Part 9.

#### 5.3.1 Existing Conditions

According to the USFWS National Wetland Inventory, accessed 04/18/2017, the river bank along the project area is adjacent to a riverine wetland (Appendix B, Figure F). The project site is located in the 100 year floodplain as mapped by FIRM panel number 25017C01193E dated 06/04/2010 and a floodway (Appendix B Figure G). Any work within a mapped floodway requires compliance with 44 CFR 60.3(d) through a no-rise certification issued by the local floodplain manager. The

no-rise certification is documentation of a determination that the project will not increase the level of floodwaters upstream or downstream. Since flood records have been kept, flooding on the Merrimack River in Massachusetts has seen an increase in the amount of flood crests since 1996 compared to the previous years (NOAA 2015).

### 5.3.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

Under the No Action Alternative, no work would be done within either the wetland or floodplain. The bank would continue to be susceptible to erosion and the adjacent sewer line could become exposed, slump, and fail due to the erosion. Sewer line failure could contaminate the floodplain and riverine wetlands with raw sewage. Therefore, there would be negligible impact to wetlands and floodplain resources unless sewer line failure occurs. If failure occurs, there would be a moderate negative impact due to erosion runoff and raw sewage contamination.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

Work, including dredging and placing fill, would be conducted within and adjacent to the riverine wetland. The Town is required to apply for and follow all requirements, including implementing all BMPs, within CWA permits (see section 5.2.2 Alternative 2). Post construction, the bank stabilization would reduce erosion rates and runoff from entering the riverine wetland. The project would also mitigate against sewer line failure and reduce the chance of raw sewage contaminating the riverine wetland.

Work would also be conducted within the 100 year floodplain and within a floodway. A joint wetland and floodplain 8-step decision-making process determination was conducted (Appendix A, Document D). The conclusion documented in the 8-step process is that the Proposed Alternative is the best alternative in regards to EO 11988, EO 11990, and 44 CFR part 9. The Town coordinated with the local floodplain administrator and received a no-rise certification on September 12$^{th}$, 2017.

Post construction, the bank stabilization would reduce erosion and runoff and prevent floodplain degradation including potential contamination from sewer line failure. Bioengineering would restore and preserve the natural and beneficial value served by the floodplain through the use of vegetation. The top elevation of the stone sill would match the water level elevation of the river when the flash boards are raised on the downstream Pawtucket Dam and would otherwise make the riverbank more resilient to flooding events (see section 5.11).

Therefore, the Proposed Alternative would have a negligible impact to wetland and floodplain resources during construction when following all permit requirements and implementing BMPs. Post construction, the Proposed Alternative would have a minor positive impact to wetland and

floodplain resources due to increased erosion and runoff control and mitigation against potential sewer line failure.

**Alternative 3: Rock Rip Rap**

The Rock Rip Rap Alternative would have identical impact to wetland and floodplain resources due to similar permitting requirements during construction. Post construction, the Rock Rip Rap Alternative would have similar mitigation against sewer line failure, however it would not restore and preserve the natural and beneficial value served by the floodplain due to the use of rocks as erosion control instead of natural vegetation. It would not reduce runoff into the riverine wetland and floodplain as effectively as the Proposed Alternative due to rip raps inability to absorb run off as effectively as bioengineering (Epsilon 2016a). Therefore, the Rock Rip Rap Alternative would have a negligible impact to wetland and floodplain resource when following all permit requirements and implementing BMPs during construction. Post construction, the Rock Rip Alterative would have a negligible impact to wetlands and floodplains due to the reduced runoff mitigation.

## 5.4 Biological Resources

### 5.4.1 Wildlife and Fish

The project site is within the Southern New England Coastal Plains and Hills ecoregion (MADFW 2008). This ecoregion is currently dominated by a variety of dry to moderately wet oak forests that gradual transition to oak-pine forests along with some elm, ash, and red maple, which is typical of southern New England's forested wetlands (EPA 2009). Within this ecoregion, Massachusetts Division of Fisheries and Wildlife (MADFW) has designated 273,000 acres as habitat critical for Massachusetts species of conservation concern (MADFW 2008). The project site is adjacent to DFW habitat designation Core 3018A which is defined as habitat featuring Wetland, Aquatic, and Natural forested Communities (MADFW 2012). Within Core 3018A there are 16 wildlife and plant species of state conservation concern (Appendix C Table A). Adjacent to the project site to the south east there is MADFW designated open space (Appendix B Figure H). The project site itself is dominated by pine, oak, Maple, and Beech trees with a brush and fern understory.

The Merrimack River is habitat to diurnal fish species including alewife (*Alosa pseudoharengus*), American eel (*Anguilla rostrate*), American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis),* and striped bass (*Morone saxatilis*) during some or all of the species' lifecycle. There is one species of fish protected under the Magnuson Stevens Fisheries Conservation and Management Act, the Atlantic salmon (*Salmo salar*). Efforts to restock the Merrimack, and other rivers, with the Atlantic salmon, through the Atlantic Salmon Restoration Program occurred up until 2013 (NH Fish and Game, 2017). However, there has been no recent occurrence of Atlantic salmon in the vicinity of the project area, but there is still potential for the species to occur. There

is currently no wetland vegetation for fishery habitat along Edge Type C at the project site and is sparse along Edge Type B.

Sturgeon, including both Atlantic and shortnose, also occur in the Merrimack River. However, according to MADFW, both species currently cannot pass the Essex Dam in Lawrence, MA (MADFW 2015a and 2015b). Therefore, sturgeon are not located at the project site, nor impacted from any alternatives, and will not be discussed further.

### 5.4.2 Invasive Species

EO 13112, Invasive Species, requires federal agencies, to the extent practicable, to prevent the introduction of invasive species, provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause. Invasive species prefer disturbed habitats and generally possess high dispersal abilities, enabling them to out-compete native species. Middlesex County currently has 542 species of non-native insects, diseases, plants, and animals (EDD 2017). Middlesex County is within statewide quarantine zones for three invasive species; Emerald Ash Borer, Pine Shoot Beetle, and Euro Gypsy Moth (MANRC 2017).

### 5.4.3 Protected Species

The Endangered Species Act (ESA) of 1973 provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The lead Federal agencies for implementing ESA are the USFWS and the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service. The law requires Federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. The law also prohibits any action that causes a "taking" of any listed species of endangered fish or wildlife. USFWS's Information for Planning and Consultation (IPaC) system, accessed on May 1st 2017, reported one federally threatened species, the Northern Long-eared Bat (*Myotis septentriolnalis)* (Appendix A Document E). The Northern Long-eared Bat is predominately threatened by white nose syndrome, a fungal disease. The species was listed as threatened in 2015 due to reduced population from the syndrome and in 2016, USFWS issued the 4(d) final ruling in managing the species (USFWS 2016). The species could potentially be found underneath tree bark, in cavities, or in crevices of both live trees and snags at the project site during the summer.

The Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668-668c), enacted in 1940, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald and golden eagles, including their parts, nests, or eggs. The law makes it illegal for anyone to possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any eagle, or their parts, feathers, nests, or eggs. "Take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or any attempt to carry out these activities." USFWS's IPaC system reported

the presence of Bald Eagles (*Haliaeetus leucocephalus*) in the area (Appendix A Document E), but MADFW reported, through a correspondence with FEMA, that there are no known nests within 2000 feet of the project site.

The Migratory Bird Treaty Act (MBTA) of 1918 provides a program for the conservation of migratory birds that fly through lands of the United States. The lead Federal agency for implementing the MBTA is the USFWS. Like the BGEPA, the law requires Federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any migratory birds or result in the destruction or adverse modification of designated critical habitat of such species. The law makes it illegal for anyone to "take," possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or their parts, feathers, nests, or eggs. "Take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or any attempt to carry out these activities." USFWS's IPaC system reported 14 migratory birds, not including the Bald Eagle, could potentially occur in the area or be affected by activities in this location (Appendix A Document E).

### 5.4.4 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

The No Action Alternative would not alter current habitat. Bank erosion would continue to be a risk at the site which could cause habitat loss and tree falls. Though tree fall would remove some habitat for certain wildlife species, it would provide additional habitat for others including both wildlife and fish. Sewer line failure could cause river habitat contamination which could impact the health of river fish and plant species and their predators through toxins from sewage. Invasive species, particularly plant species, could get caught or become disturbed during erosion episodes and potentially spread from the disturbance. Tree fall from erosion could potentially remove nesting and perching habitat for Bald Eagles and remove summer habitat for the Northern Long Eared Bat. Tree toppling could remove some stop-over habitat for the 14 migratory bird species that could occur in the area. Therefore, the No Action Alternative could have a minor negative impact to biological resources due to habitat loss from erosion, the potential spread of invasive species, and river habitat contamination due to sewer line failure.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

The Proposed Alternative would temporarily disturb plant and wildlife habitat during construction through noise creation, undergrowth removal, removal of trees in danger of falling, and work in the water from turbidity barrier installation. Due to the disturbance, it is likely that wildlife in the area would be temporarily displaced during construction. BMPs would be used to reduce impacts to wildlife during construction including compliance with EPA and Occupational Safety and Health Administration (OSHA) noise level requirements (see section 5.8) and minimizing runoff and turbidity within the water (see section 5.2). The equipment will traverse the area where the

bank construction would occur to reduce impact to the land and habitat and no egress or anchorage would occur in the Merrimack River. Post construction, the bank would be planted with native vegetation providing habitat for wildlife on land.

There is potential for habitat loss for fish species, including the Atlantic salmon, within the Merrimack River due to the removal of the natural bank and replacement with a berm/sill at the water line. To mitigate potential loss the Town will revegetate from the top of the slope to restore a densely vegetated riparian habitat along the reach of the river on Type C slopes and maintain the sparse vegetation currently there were feasible. Vegetation along Type A and B slopes will maintain the current vegetation and plant extra native vegetation planted where possible. Over time, the vegetation will likely develop and provide shade and overhanging branches for fish. The face of the stone sill will not be chinked with smaller stones and would therefore leave voids between the larger stones and provide refuge for fish and other aquatic organisms. The Massachusetts Division of Marine Fisheries (MADMF) has issued a time of year restriction for diadromous species from March 15th to July 15th where work in water would not be allowed. The Town is currently coordinating with MADMF to install the turbidity barrier outside the time of year restriction and then do the remaining work year round in the bank side of the barrier. The Town would be required to follow all time of year restrictions and any further agreements from MADMF. An Essential Fish Habitat consultation for the Atlantic salmon, including a NOAA-Trust Resource Impact Assessment for diurnal fish, was sent to NOAA on July 25th, 2017 by FEMA and concurrence was received July 25th, 2017. Therefore, there would be a temporary minor negative impact to wildlife and fish resources from construction and, as long as all BMPs and mitigation measures are implemented, there would be a negligible impact post construction.

During construction, there would be a condition that any woody debris produced on site must be disposed of in compliance with all local, state, and federal regulations, polices and guidelines for transportation and disposal of the potentially contaminated debris as identified by the Massachusetts Department of Conservation and Recreation (DCR), the Massachusetts Department of Agricultural Resources (DAR), the United States Department of Agriculture Animal and Plant Health Inspection Services (APHIS), and the United States Forest Service (USFS). For Emerald Ash Borer, debris disposal measures that include the movement or transport of woody materials, in particular, from within a quarantine area, must be completed by a company or agency that has completed compliance training and is certified by the joint eradication program to perform this work. By complying with restrictions imposed by the Emerald Ash Borer Quarantine, Pine Shoot Beetle and Euro Gypsy Moth quarantine restrictions will be adhered to as well. Post construction, plantings would be done with native plants to reduce the chance of non-native and invasive plant species from spreading. Therefore, there would be a negligible impact to the spread of invasive species as long as quarantine zone debris regulations, policies, and guidelines are followed.

Due to the possible presence of the Northern Long-eared Bat and the removal of potential habitable trees, FEMA consulted with USFWS using the Rule 4(d) consultation form on March 27th 2017

(Appendix D Correspondence C) for the Proposed Alternative. FEMA had not received concurrence within thirty days and has therefore, as allowed, assumed concurrence. Construction would be required to follow USFWS's National Bald Eagle Management Guidelines (USFWS 2007) which requires a work buffer of 660 feet from any nest and avoidance of overstory trees within 330 feet of any nest. There are no known nests in or near the project site, however, if a nest is discovered within 660 feet of site, work must stop and the Town would consult with FEMA and USFWS. Migratory birds would be temporarily disturbed during construction but would likely find alternative habitat nearby. Post construction, most trees would remain and native vegetation would be planted providing potential habitat for the Northern Long-eared Bat, Bald Eagle, and migratory birds. Therefore, impacts to protected species would be negligible as long as all conditions and BMPs are followed.

**Alternative 3: Rock Rip Rap**

The Rock Rip Rap Alternative would have similar impacts as the Proposed Alternative with two exceptions. The Rock Rip Rap Alternative would require the removal of all trees within the project foot print to install the rip rap. This would remove habitat for wildlife, including protected species and would create a greater amount of woody debris increasing the chance of invasive species spread. There would be habitat for fish species within the space of the rocks, however, there would be no overhanging vegetation for shade and habitat. The Rock Rip Rap Alternative would also not have the benefit of a bioengineering which would reduce the amount of habit and native plants available post construction. Therefore, the Rock Rip Rap Alternative would have a minor negative impact to biological resources.

### 5.5 Cultural Resources

As a Federal agency, FEMA must consider the potential effects of its funded actions upon cultural resources prior to engaging in any undertaking. There are several laws a federal agency must take into account when working with and identifying cultural resources. For the Chelmsford project, FEMA was required to meet this obligation through the National Historic Preservation Act of 1966, as amended (NHPA). Section 106 of the NHPA, as implemented by 36 CFR Part 800, outlines the required process for Federal Agencies to consider a projects effects to historic properties. The NHPA defines a historic property as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register."

The Massachusetts State Historic Preservation Office (SHPO) maintains a database of cultural resources called the Massachusetts Cultural Resource Information System (MACRIS), which includes both standing structures and objects as well as archaeological sites).

### 5.5.1 Existing Condition

**Historic Properties**

According to the MACRIS database there are 70 buildings or structures that have been assessed for the NRHP within 1-mile of the Area of Potential Effect (APE), including 4 inventoried areas or historic districts: the North Chelmsford Residential District, the Lowell-Dracut-Tyngsboro State Forest, the Eastern Pawtucketville Commercial/Residential District, and Tyng Mansion.

There are also four properties in the Town of Chelmsford listed in the National Register of Historic Places (NRHP), however, none of these properties are within the vicinity of the APE.

Neither the properties listed in MACRIS nor NRHP-listed properties will be affected either directly or indirectly by this undertaking. There are no standing structures within the construction area. The closest property to the APE is the Wellman Avenue apartment/townhouse complex that was originally constructed in the 1980s.

**Archeological Resources**

After reviewing the MACRIS database and other relevant information sources FEMA staff determined that the project area possessed a high potential for archaeological resources and initiated consultation with the (SHPO) as well as the Massachusetts Board of Underwater Archaeological Resources (BUAR). As a result of these consultations, FEMA and its consulting parties determined that an intensive (locational) archaeological field survey would be required (Appendix D). During this process FEMA and the applicant also initiated consultation with federally recognized tribes with an area of interest associated with this undertaking: Mashpee Wampanoag Tribe and the Wampanoag Tribe of Gay Head (Aquinnah) of Massachusetts. The tribes did not raise any specific concerns as part of this early consultation. Public Archaeology Laboratory, Inc. (PAL) was hired to conduct the intensive (locational) archaeological survey and completed the survey during the summer of 2017.

PAL identified two archaeological sites during its survey: a historic period foundation associated with a defunct utility system, and what PAL designated the "Wellman Avenue Site" which dates to the pre-contact period. PAL recommended, based on the findings of the survey that Wellman Avenue Site be considered eligible for the NRHP.

FEMA reviewed the Technical Report completed by PAL, determined that it concurred with PAL's findings and the recommendations, and re-initiated consultation with the SHPO, BUAR, and Tribes. FEMA initially reached out to both the Mashpee Wampanoag Tribe and the Wampanoag Tribe of Gay Head (Aquinnah) of Massachusetts by phone and email in October and followed the this initial outreach with an official consultation letter in November 2017. FEMA determined that the project as designed would not directly affect any NRHP eligible resources,

including the Wellman Avenue Site, but determined that project conditions would be necessary to ensure that no inadvertent damage to historic properties occurred. As such, in a letter dated November 13, 2017, FEMA recommended project conditions including the avoidance of the Wellman Avenue Site and Archaeological Monitoring during all work in the vicinity. SHPO and the BUAR concurred with these recommendations, the tribes did not provide FEMA with an official response.

### 5.5.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

Potential impacts to standing structures would be at the Wellman Village/Williamsburg I and II neighborhood, to which the sewer line serves. The development was built in 1984 with expansion in 1991, and is not potentially historic and therefore no impact to historic structures would occur.

The Wellman Avenue Site could be susceptible to erosion and damage and/or total loss if bank degradation continues. The No Action alternative could have a moderate negative impact to archaeological and cultural resources associated with bank erosion.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

No impact to historic structures is expected as a result of the proposed construction work and post construction due to the fact that there are no historic structures in or near the APE.

Provided that all conditions developed during the NHPA consultation are followed there should be no effect to the Wellman Avenue Site or any other historic property or cultural resources during construction. Therefore, construction would have a negligible impact on cultural resources. However, following construction the site would be protected from damage or loss associated with bank erosion. As such, following construction there would be a minor positive impact to cultural resources.

**Alternative 3: Rock Rip Rap**

Impacts to Alternative 3 would be the same to the Proposed Alternative due to similar work and ground disturbance activities. All conditions associated with Alternative 2 would also apply to work completed under Alternative 3.

## 5.6 Socioeconomic Resources – Environmental Justice

### 5.6.1 Existing Conditions

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires agencies to identify and address disproportionately high and adverse

human health or environmental effects its activities may have on minority or low income populations. In Massachusetts, a community is recognized as an Environmental Justice (EJ) community by the following (MADEP 2017):

- Block group whose annual median household income is equal to or less than 65 percent of the statewide median ($62,072 in 2010); or
- 25% or more of the residents identifying as minority; or
- 25% or more of households having no one over the age of 14 who speaks English only or very well - Limited English Proficiency (LEP)

In order to provide context for this report a demographic analysis was undertaken of the project area, which is completely in Census Tract 3173.02 – Block Group 3. According to the 2010 Decennial Census (Appendix C Table B) there is a population of 1,487 people within the project site census tract. Of that population 80 percent are white, 2 percent are Black, 14 percent are Asian, and 1 percent other. The American Community Survey (Appendix C Table C) shows the median family income within Census Tract 3173.02 estimated at $104,556 between 2010 and 2015. The Massachusetts Environmental Justice Mapper (Appendix B Figure I) shows that Census Tract 3173.02 – Block Group 3 is not a LEP population. Therefore there are no EJ communities within or adjacent to the project site.

Down river from the project site there are communities designated as minority, minority and low income, and all three (minority, income, and LEP) (Appendix B Figure I). Therefore, there are EJ communities that could be impacted by the alternatives through runoff and other materials flowing down river.

### 5.6.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

There would be no disproportionate impact to EJ communities from any construction work due to no undertaking, however, erosion could continue at the site causing soils and debris to flow down river. Under the No Action Alternative, the sewer line could potentially fail and cause raw sewage to flow down the Merrimack River towards the EJ communities bordering the river. This could potentially contaminate the river water that those communities may use, for recreational or other purposes, exposing them to pathogens and other health hazards that could be in raw sewage. Therefore, there could be a negative moderate impact to EJ communities, in the event of sewer line failure and a negligible impact from erosion.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

Construction would cause a temporary impact to land use by residents in Census Tract 3173.02 – Block Group 2 (see section 5.7) and would not impact any down river communities as long as

proper BMPs are used (see section 5.2). Since Census Tract 3173.02 – Block Group 2 is not an EJ community, there would be no construction impacts to EJ resources. Post construction, the bioengineered bank would reduce erosion rates and runoff from the project site. The project would reduce the chance of sewer line failure preventing raw sewage contamination from flowing down river towards EJ communities. Therefore, there would be a minor positive impact to EJ communities and no disproportionate impact, from reduced erosion and runoff from site and mitigation against sewage contamination.

**Alternative 3: Rock Rip Rap**

The Rock Rip Rap Alternative would have similar impacts as the Proposed Alternative with the exception of reduced runoff mitigation due to the hard rock stabilization not absorbing runoff as well as the bioengineered surface. Therefore, there would be a minor positive impact to EJ communities though there would be more potential runoff from the site than in the Proposed Alternative.

## 5.7 Land Use

### 5.7.1 Existing Conditions

The project site is located within two zoning districts within the Town of Chelmsford (Appendix B Figure J). The majority of the project is located within an 82 acre property that contains a 535-unit condominium complex zoned as "Residential Multifamily". The eastern end of the project site is zoned as "Public District", which are lands owned or leased by federal, state, or municipal district. This zone is used as natural space and fields for the adjacent Lighthouse School. (Chelmsford 1998).

The Merrimack River, along the project site banks, is used primarily for recreational purposes including fishing and paddle boating. Residents of the condominium complex typically access the river at various ad hoc locations along the bank within the Residential Multifamily zone. Other members of the public typically access the river in the area zoned as Public District. There are no official access points to the river; access points have been created by the local population.

### 5.7.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

Under the No Action alternative, the bank would continue to erode and ad hoc river access points would continue to be modified as deemed necessary by recreational users. If riverbank erosion led to sewer line failure, sewage could contaminate river access points and prevent recreational use over a short period of time. Therefore, there would be a minor negative impact to land use from continued erosion and possible contamination.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

During construction, the Proposed Alternative would reduce access to the river bank and, a turbidity shield in the river along the length of the project site would effectively prevent access into, or from, the river. Post construction, access points would be built into the bank to allow continued access to the Merrimack River in the form of paths. The project would also mitigate against sewer line failure which would also help to maintain safe recreational use of the river. Therefore, there would be a temporary minor negative impact to land use and a long term minor positive impact.

**Alternative 3: Rock Rip Rap**

The Rock Rip Rap Alternative would have similar impacts as the Proposed Alternative. Therefore, the Rock Rip Rap Alternative would have a minor negative impact during construction and negligible impact post construction to land use with reduced river access.

## 5.8 Noise

### 5.8.1 Existing Conditions

The project site is located within a residential area with public space and a small commercial district adjacent (See Section 5.7). The largest noise generator in the area is traffic along route 3A, which typically peaks at 70 to 80 weighted decibels (dBA) and average sound level (Ldn) of 45 dBA (2003 FHA). The town of Chelmsford requires that all sound-amplifying equipment, including construction equipment, is not be audible for a distance excess of 300 feet and not to be operated with 100 yards of hospitals, nursing homes, public housing for elderly, schools, and churches without prior approval from the Police Chief (1973 Chelmsford).

### 5.8.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

There would be no construction activity, and therefore no noise generation from equipment from the No Action Alternative. Noise levels could increase from emergency repair vehicles if sewer line fails but would remain under EPA and OSHA limits. Therefore there would be no impact to noise levels unless sewer line fails, then a short term minor negative impact would occur from emergency repair noises.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

The Proposed Alternative would create increased short term noise levels from construction activities. All construction activity would follow EPA, OSHA, and local town ordinances to minimize sound exposure and ensure noise levels would not cause impairment and permanent

damage. Post construction, noise levels would return to pre-construction levels and reduce the possibility of emergency repair noise. Therefore, the Proposed Alternative would have a minor temporary impact to noise levels and no impact long term.

**Alternative 3: Rock Rip Rap**

The Rock Rip Rap Alternative would have the same impact as the Proposed Alternative due to the similar level of construction work and post work mitigation.

## 5.9 Infrastructure, Health, and Safety

### 5.9.1 Existing Conditions

The project site is located within a residential area (see Section 5.7) with Wellman Ave as the main means of egress and ingress at route 3A (Appendix B – Figure A). The last traffic count by the Massachusetts Department of Transportation (MADOT) at the Wellman Ave intersection at Route 3A counted 3,467 vehicles in one day. The last monthly traffic count on Wellman Ave had a count of 13,665 vehicles.

The Town of Chelmsford, along with many municipalities on the river, draws water from gravel-packed wells (CDW 2017). Sewer collection service, including the at-risk sewer line in the project area, is provided by the town of Chelmsford Sewer Division. Sewage is treated at the Lowell Wastewater Facility (Section 3.0). Electricity is provided by National Grid or Constellation Energy through the Chelmsford Choice Program using a combination of underground and above ground lines (Chelmsford 2015). Natural gas is provided by National Grid through underground lines.

The Wellman Ave residential area is within the Chelmsford Police Department coverage area. The Chelmsford Fire Department provides emergency services and fire protection. Lowell General Hospital is the primary emergency health care facility for the Wellman Ave residential area.

### 5.9.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

Under the No Action Alternative, construction activity would not occur and would not cause any interruption to traffic patterns, utilities, and emergency services. Sewer failure could be a potential health risk to the Wellman Ave residential area and communities down river. Emergency crews would likely be needed to repair the failed sewer line using emergency services and adding a small increase in traffic load on Wellman Ave. Some Wellman Ave residents would be without sewer utilities until the line is repaired. Therefore, there would be no impact to infrastructure, health, and safety resources unless the sewer line fails. If the sewer line fails there would be a moderate negative temporary impact to infrastructure, health, and safety resources.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

During construction there would be a slight increase in traffic from construction vehicles and workers leaving and entering the project site. It is unlikely that utilities would be shut down during construction work. Since the project is within a residential neighborhood, emergency service personal presence would likely not be required, though police presence may be required per local ordinance. Post construction, there would be no increase in traffic since project would not encourage growth (see section 5.3). The Proposed Alternative would reduce the risk of sewer failure and therefore reduce the need for utility outage and emergency work. Therefore, there would be a minor positive impact to infrastructure, health, and safety resources during and post construction.

**Alternative 3: Rock Rip Rap**

The Rock Rip Rap Alternative would have similar impacts the infrastructure, health, and safety resources and will therefore have a negligible impact during and post construction.

## 5.10 Hazardous Materials

Hazardous materials and wastes are regulated under a variety of federal and state laws, including 40 CFR Part 260, the Resource Conservation and Recovery Act (RCRA) of 1976 (42 USC 6901 et seq.), Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 USC 9601 et seq.), Solid Waste Act, the Toxic Substances Control Act, and the Clean Air Act of 1970 (42 USC 7401 et seq.). OSHA standards under the Occupational Safety and Health Act seek to minimize adverse impacts on worker health and safety (U.S. Department of Labor no date). Evaluations of hazardous substances and wastes must consider whether any hazardous material would be generated by the proposed activity and/or already exists at or in the general vicinity of the site (40 CFR 312.10). If hazardous materials are discovered, they must be handled by properly permitted entities. Solid waste management is regulated under Massachusetts 310 CMR 19.000 by MADEP.

### 5.10.1 Existing Conditions

Soil boring samples were testing for volatile and semi volatile organics, petroleum hydrocarbons, metals, inorganic, and miscellaneous contamination (Epsilon 2016). None of the samples returned significant levels of hazardous and toxic waste. A search of the EPA Enviromapper (EPA 2017d) showed no superfund sites located within half a mile of project site. There is one registered RCRA waste producer located adjacent to project site (Courier North Chelmsford) and forty others within half a mile (Appendix C Table D). Domestic sewage is not regulated under RCRA (Fed Center 2017) but it is regulated as a pollutant under the CWA (see section 5.2), therefore it will no longer be discussed in this section. There is dumped waste within the bank that has been exposed by erosion, including metal and machinery waste.

### 5.10.2 Potential Impacts and Proposed Mitigation

**Alternative 1: No Action**

Under the No Action alternative, no construction work would be conducted and therefore no hazardous materials would be introduced to the site. There is potential for non-point hazardous waste to enter the Merrimack River due to the continued erosion (see section 5.2). There is also the potential for buried waste to come loose from the continued erosion as well. If hazardous materials are within the buried waste it could potentially contaminate the Merrimack. Therefore, the no action alternative could have a minor negative impact from hazardous waste.

**Alternative 2: Proposed Alternative, Bioengineering Bank Stabilization**

During construction of the Proposed Alternative any solid and hazardous waste produced or removed, including dumped waste, from site would be managed by MADEP permitted haulers and facilities. If dumped waste cannot be removed, burial must be done in accordance to 310 CMR 30. The discovery of Hazardous waste is not expected at the site, however, if any is found, work is to stop and FEMA and MADEP are to be notified to ensure proper management of materials. Construction equipment and any hazardous materials will comply with all EPA and OSHA regulations, including BMPs (see section 5.2), to ensure contamination does not occur. Construction activities are not expected to interfere with regulated RCRA materials producers adjacent or within the vicinity of the project site. None of the permanent materials used in the construction of the bank would contain hazardous materials. Post construction, the bioengineered bank would reduce non-point source pollution, including potential non-point hazardous waste, from entering the Merrimack River (see section 5.2). Therefore, there would be a negligible impact from hazardous waste both during and post constructions as long as all BMPs are followed.

**Alternative 3: Rock Rip Rap**

The impact from the Rock Rip Rap Alternative would be similar to the Proposed Alternative with the exception of reduced runoff control. Therefore there would be a negligible impact from hazardous waste both during and post construction as long as all BMPs are followed.

## 5.11 Cumulative Impacts

In accordance with NEPA, this EA considers the overall cumulative impact of the Proposed Alternative and other actions that are related in terms of time or proximity. According to the Council of Environmental Quality (CEQ) regulations, cumulative impacts represent the "impact on the environment which results from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what federal agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from

individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7).

Cumulative impacts are those impacts "… which result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions…" (40 CFR 1508.7). In the context of evaluating the scope of a proposed action, direct, indirect and cumulative impacts must be considered.

In addition to NEPA, other statutes require federal agencies to consider cumulative impacts. These include the Clean Water Act section 404 (b) (1) guidelines; the regulations implementing the conformity provisions of the Clean Air Act; the regulations implementing Section 106 of the NHPA; and the regulations implementing section 7 of the ESA.

The Town of Chelmsford is currently under taking several public works projects before, during, and after the Merrimack River Bank Stabilization project. These include construction of a new DPW facility and Salt Shed, New Fire Station, and upgrades to schools including South Row, Parker, McCarthy and the High School (Chelmsford 2017). The proposed alternatives would have no impact any of these projects, nor would they have any impact to any alternatives due to locations and project types. Since projects would not impact each other there would be no cumulative impacts to environmental and cultural resources.

There is one federally funded project down river from the project site, at the Pawtucket dam, that may cause cumulative impacts to environmental and cultural resources. Boott Hydropower Inc is replacing an existing 5 foot high wooden flash board system on the Pawtucket Dam with an identical height Pneumatic crest gate system. As compared to the wooden flashboard system and the interim modification, the proposed pneumatic crest gate system would maintain more stable water level elevations at 92.2 feet North American Vertical Datum 1988 during normal operations and 93.2 feet North American Vertical Datum 1988 during high flow conditions (FERC 2011). It is predicted that the water level would normalize up river and could impact the project alternatives due to the change in water elevation. The Proposed Alternative has been designed with the expectation that the water level would be normalized as estimated by Boott Hydropower Inc (Appendix A Document A). Therefore, there would be negligible impact to the Merrimack River Bank Stabilization project from the Pawtucket Dam project. Since the water levels will be normalized at the bank, the resources analyzed in this EA would not have any extra impacts due to the cumulative impacts between of these projects. There are no other projects that could directly or indirectly impact the Merrimack River Bank Stabilization project and environmental resources.

## 6.0 PERMITS AND PROJECT CONDITIONS

The Town is responsible for obtaining all applicable Federal, State, and local permits and other authorizations for project implementation prior to construction and adherence to all permit conditions. Any substantive change to the approved scope of work will require re-evaluations by FEMA for compliance with NEPA and other laws and EOs. The Town must also adhere to the following conditions during project implementations and consider the below conservation recommendations. Failure to comply with grant conditions may jeopardize Federal funds:

1. The Town shall coordinate with the USEPA on the requirement for an NPDES permit and Storm Water Pollution Prevention Plan
2. Adhere to all conditions within the USACE Individual Permit to be issued for the Project.
3. Adhere to all conditions within MADEP permits and certifications, e.g. CWA section 401 Water Quality Certification, BRP WW 07, BRP WW 10
4. The Town shall follow all time of year restrictions and other conditions from MADMF and NOAA regarding diadromous species and Atlantic salmon.
5. Woody debris produced on site must be disposed of in compliance with all local, state, and federal regulations, polices and guidelines for transportation and disposal of the potentially contaminated debris as identified by the MADCR, MADAR, APHIS, and USFS.
6. All conditions within the USFWS National Bald Eagle Management Guidelines shall be followed. If a Bald Eagle's nest is discovered within 660 feet of project site, work must stop and consultation with FEMA and USFWS will occur.
7. To reduce disturbance of archaeological resources the Town would implement the following BMPs. Avoid these locations using equipment access along the top of the embankment at the six designated access points, keep equipment and material storage at designated area, and no tree removal that could impact the Wellman Ave Sites. Archaeological monitoring and perimeter flagging would also be required.
8. In the event of the discovery of archaeological deposits (e.g. Indian pottery, stone tools, old house foundations, and old bottles) the Sub-recipient and their contractor shall immediately stop all work in the vicinity of the discovery and take reasonable measures to avoid or minimize harm to the finds. The Sub-recipient and their contractor shall secure all archaeological discoveries and restrict access to discovery sites. The Sub-recipient and their contractor shall immediately report the archaeological discovery to the Massachusetts Emergency Management Agency (Sarah White, 508-820-2053) and the FEMA Regional Environmental Officer (David E. Robbins, 978-914-0378). FEMA will determine the next steps.
9. In the event of the discovery of human remains, the Sub-recipient and their contractor shall immediately stop all work in the vicinity of the discovery and take reasonable measures to avoid or minimize harm to the finds. The Sub-recipient and their contractor shall secure all human remains discoveries and restrict access to discovery sites. The Sub-recipient and

their contractor shall follow the provisions of applicable state laws, including Massachusetts General Laws Chapter 38, section 6 (Discovery of skeletal remains likely to be Native American); Chapter 9, sections 26A (State archaeologist; duties; reservation of lands from sale; cooperation of governmental agencies) & 27C (Projects; notice; adverse effect; review); and Chapter 7, section 38A (Skeletal remains; preservation; excavation; analysis), or any amendments or supplanting laws and regulations. Violation of state law will jeopardize FEMA funding for this project. The applicant will inform the Office of the Chief Medical Examiner (617-267-6767), the State Archaeologist (Brona Simon, 617-727-8470), Massachusetts Emergency Management Agency (Sarah White, 508-820-2053) and the FEMA Regional Environmental Officer (David E. Robbins, 978-914-0378). FEMA will consult with the SHPO and Tribes, if remains are of tribal origin. Work in sensitive areas may not resume until consultation is completed and appropriate measures have been taken to ensure that the project is in compliance with the National Historic Preservation Act.

10. Any solid and hazardous waste produced or removed, including dumped waste, from site would be managed by MADEP permitted haulers and facilities. If dumped waste cannot be removed, burial must be done in accordance to 310 CMR 30.

## 7.0 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

An Environmental Notification Form was submitted by the Town to the Massachusetts Executive Office of Energy and Environmental Affairs in accordance to the Massachusetts Environmental Policy Act on August 31st 2016. The Town also submitted an application package for water quality certification under Section 401 of the CWA to MADEP on November 16th, 2016. They also submitted a pre-construction notification in accordance with Massachusetts General Permit number 7 – Bank Stabilization to the USACE on November 22nd 2016. A 20 day Public Notice for the section 401 water quality certification was posted on September 15th, 2016 and on April 25th 2017 for the pre-construction notification. Public Meetings were held at the project site on September 12, 2016 conducted by the MEPA office as part of the ENF review process; and at the Chelmsford Town Hall on December 6th and 20th 2016 conducted by the Chelmsford Conservation Commission as part of the Wetlands Protection Act and Chelmsford Wetland Protection By-Law review process.

This EA will be made available for agency and public review and comment for a period of 15 days. The public information process will include a public notice with information about the proposed action in the Lowell Sun. The EA will also be made available for download at http://www.townofchelmsford.us/174/Public-Works.

A hard copy of the EA will be available for review at the following location(s):

Chelmsford Town Hall
50 Billerica Road
Chelmsford, MA 01824

FEMA will send notifications of the EA to the following agencies:

Massachusetts Emergency Management Agency
400 Worcester Road
Framingham, MA 01702

United States Army Corp of Engineers
696 Virginia Road
Concord, Massachusetts 01742-2751

United States Fish and Wildlife Service
70 Commercial Street, Suite 300
Concord, New Hampshire 03301

United States Environmental Protection Agency
5 Post Office Square
Suite 100

Boston, MA 02109-3912

Interested parties may request an electronic copy of the EA by emailing FEMA at Fema-r1ehppubliccomments@fema.dhs.gov. This EA reflects the evaluation and assessment of the federal government, the decision maker for the federal action; however, FEMA will take into consideration any substantive comments received during the public review period to inform the final decision regarding grant approval and project implementation. The public is invited to submit written comments by emailing Fema-r1ehppubliccomments@fema.dhs.gov or via mail to:

FEMA Region I EHP
99 High St, Floor 6
Boston, MA 02110
Attn: Merrimack River Bank Stabilization EA Comments.

If no substantive comments are received from the public and/or agency reviewers, the EA will be adopted as final, and FEMA will issue a FONSI. If FEMA receives substantive comments, it will evaluate and address comments as part of the FONSI documentation or in a final EA.

## 8.0 CONCLUSION

FEMA, through NEPA, has found that the Proposed Alternative to construct a bioengineered bank along the Merrimack River would not significantly impact the human environment. The EA evaluated resources that could potentially be significantly impacted. The evaluation resulted in identification of no unmitigated significant impacts associated with resources of soils and topography, water quality, wetlands and floodplains, biological resources, cultural resources, socioeconomic resources, land use and planning, noise, infrastructure, health and safety, and hazardous materials. Obtaining and implementing permit requirements and with appropriate BMPs and mitigation measures would avoid or minimize any impacts associated with the alternatives considered in this EA to below the level of a significant impact. The Town and local community would benefit from the bioengineered bank for erosion reduction and sewer line protection. If no substantive comments are received, or significant impact identified during the public comment period, it is recommended issuing a FONSI for the Proposed Alternative.

## 9.0 LIST OF PREPARERS

FEMA Region 1, 99 High St, Boston, MA 02210
Brandon Webb, Environmental Specialist
Marcus Tate, Historic Preservation Specialist
Mary Shanks, Historic Preservation Specialist
Kathryn Emmitt, Historic Preservation Specialist
David E. Robbins, Regional Environmental Officer

## 10.0 SUMMARY OF IMPACTS

| Section | Area of Evaluation | Alternative 1: No Action | Alternative 2: Proposed Action: Bioengineering Bank Stabilization | Alternative 3: Rock Rip Rap |
|---|---|---|---|---|
| **5.1** | **Soils and Topography**<br>Agency: USDA | Minor negative impact to soils and topography from continued erosion. | There would be short term minor negative impact during construction that would be mitigated through BMPs that include using temporary stabilization with mulch and trackifer, turbidity barrier, sedimentation control barriers, erosion control blanket, marine mattress, and seeding and mulching of disturbed areas. Post construction, there would be a minor positive impact due to improved erosion control. | Rock Rip Rap installation would have similar impacts as the Proposed Action during construction. Post construction there would be a negligible positive impact due to reduced erosion protection from loose rip rap and topography would not have a uniform look. |
| **5.2** | **Water Quality**<br>Agencies: USACE, EPA, and MADEP | Moderate negative impacts could occur due to erosion and sewer line failure causing sewage to flow in the river. | During construction there would be negligible impact to water quality if all BMPs listed in section 5.1 are followed. After construction, there would be a minor positive impact due to reduced erosion, sewer line protection, and reduced stormwater runoff velocity. | Impacts would be similar to the Proposed Action during construction. Post construction there would be a negligible impact to water quality due to increased removal of vegetation increasing potential stormwater and melt runoff. |

| Section | Area of Evaluation | Alternative 1: No Action | Alternative 2: Proposed Action: Bioengineering Bank Stabilization | Alternative 3: Rock Rip Rap |
|---|---|---|---|---|
| **5.3** | **Wetlands and Floodplain**<br>Agencies: USACE, EPA, and FEMA | Moderate negative impacts would occur due to sewer line failure contaminating wetland and floodplain resources | There would be a negligible impact to wetland and floodplain resources during construction when BMPs and any floodplain and floodway manager requirements are followed. Post construction there would be a minor positive impact to wetland and floodplains due to increased erosion and runoff control and mitigation against potential sewer line failure. | The Rock Rip Rap alternative would have similar impacts during construction as Proposed Action. Post construction, the project would have a negligible impact to wetland and floodplain resources due to reduced ability to control erosion and runoff from Proposed Action but will still reduce compared to the No Action. |
| **5.4** | **Biological Resources**<br>Agencies: USFWS, NOAA, MADEP, MADCR, and MADFW | Minor negative impacts due to potential habitat loss from erosion, the potential spread of invasive species, and river habitat contamination due to possible sewer line failure. | There would be a temporary minor negative impact to fish and wildlife due to temporary displacement of habitat. Long term, there would negligible impact to fish and wildlife as long as all BMPs and mitigation measures are implemented.<br>There would be a negligible impact to the spread of invasive species as long as quarantine zone debris regulations, policies, and guidelines are followed.<br>Impacts to protected species would be negligible due to the remaining trees and native vegetation plantings. | There would be similar impacts as the Proposed Action with the exception of the removal of all trees would reduce habitat for fish, wildlife, and protected species. Therefore, there would be a minor negative impact to biological resources. |

| Section | Area of Evaluation | Alternative 1: No Action | Alternative 2: Proposed Action: Bioengineering Bank Stabilization | Alternative 3: Rock Rip Rap |
|---|---|---|---|---|
| **5.5** | **Cultural Resources**<br>Agencies: MHC | There could be a moderate negative impact to archeological resources from erosion. | Following the conditions imposed in Section 5.5.2, there would be a negligible impact to archaeological resources during construction and a positive minor impact post construction in the form of erosion control as long as all BMPs are used. | Impacts to Alternative 3 would be the same to the Proposed Alternative due to similar work and ground disturbance activities. |
| **5.6** | **Socioeconomic – Environmental Justice**<br>Agencies: EPA | There would be moderate negative impact to EJ communities from erosion. In the event of a sewer line failure there could be a negative minor impact from raw sewage exposure. | There would be a minor positive impact to EJ communities and no disproportionate impact, from reduced erosion and runoff from site and mitigation against sewage contamination. | The impacts to EJ communities would be similar to Proposed Action and have a minor positive impact, though there would be more potential for runoff due to rip rap. |
| **5.7** | **Land Use and Planning** | There would be a minor negative impact from continued erosion and possible contamination reducing access to recreation use and limit residential zoning capabilities. | Land use would have a negative temporary impact from construction disruptions and a minor positive impact long term due to bank stability and sewer line protection | The Rock Rip Rap Alternative would be similar to the Proposed Alternative with the exception of a limited water access due to the rip rap. |
| **5.8** | **Noise**<br>Agencies: EPA and OSHA | There would be no impact to noise levels unless sewer line fails, then a short term minor negative impact would occur from emergency repair noises. | There would be a temporary negative impact from construction noise and no impact long term. | Alternative 3 would have similar impacts at Proposed Action. |

| Section | Area of Evaluation | Alternative 1: No Action | Alternative 2: Proposed Action: Bioengineering Bank Stabilization | Alternative 3: Rock Rip Rap |
|---|---|---|---|---|
| **5.9** | **Infrastructure, Health, and Safety**<br>Agencies: MADOT | There would be a moderate negative temporary impact from sewer line failure that would cause health issues in the Merrimack and may require emergency response | The Proposed Alternative would reduce the risk of sewer failure and therefore reduce the need for utility outage and emergency work. Therefore, there would be a negligible impact to infrastructure, health, and safety resources during and post construction. | Alternative 3 would have similar impacts at Proposed Action. |
| **5.10** | **Hazardous Materials**<br>Agencies: EPA, OSHA, and MADEP | If hazardous materials are within the buried waste it could potentially contaminate the Merrimack. Therefore, the no action alternative could have a minor negative impact from hazardous waste. | There would be a negligible impact from hazardous waste both during and post constructions as long as all BMPs are followed and all laws and regulations are followed for any potential hazardous waste management. | Alternative 3 would have similar impacts at Proposed Action with the exception of reduced runoff control. |

## 11.0 REFERENCES

**Chelmsford, Town of (Chelmsford)**

1973 "Town of Chelmsford, MA Code: Chapter 100: Noise" http://ecode360.com/8273932

1998 "Town of Chelmsford, MA Code: Chapter 195: Zoning" http://ecode360.com/29363180

2015 "Chelmsford Choice to Deliver Electricity Price Stability and Savings for Residents and Businesses" http://www.townofchelmsford.us/AgendaCenter/ViewFile/Item/666?fileID=1295

2017 "Chelmsford Current Projects" http://www.townofchelmsford.us/196/Current-Projects

**Chelmsford Water District (CWD)**

2017 "Chelmsford Water District"
http://www.chelmsfordwater.com/Pages/ChelmsfordWater_Quality/drinking

**Early Detection and Distribution Mapping System (EDD)**

2017 "Invasive Species by County Database"
https://www.eddmaps.org/tools/recordsbysubject.cfm

**Epsilon Associates, Inc. (Epsilon)**

2016a "Merrimack River Bank Stabilization at Wellman Avenue, Chelmsford" Submitted to Massachusetts Office of Energy and Environmental Affairs August 31, 2016.

2016b "Major Dredging Project Certification" Submitted to Massachusetts Department of Environmental Protection November 16, 2016.

**Fed Center**

2017 "Hazardous Waste Identification Flowchart"
https://www.fedcenter.gov/assistance/facilitytour/hazardous/whatis/flowchart/

**Federal Energy Regulatory Commission**

2011 "Final Environmental Assessment for a Non-Capacity Related Amendment to License"
http://www.lowellheritagepartnership.org/Websites/lowellheritagepartnership/files/Content/2021282/FERC%20Final%20EA%2020111219-3034(26724507).pdf

**Massachusetts Department of Environmental Protection (MADEP)**

2017 "MassDEP Environmental Justice"
http://www.mass.gov/eea/agencies/massdep/service/justice/

**Massachusetts Department of Transportation (MADOT)**

2017 "Traffic Volume Counts"
https://www.massdot.state.ma.us/highway/TrafficVolumeCounts.aspx

**Massachusetts Executive Office of Energy and Environmental Affairs (EEA)**

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2010 "Merrimack River Watershed 2004 Water Quality Assessment Report"
http://www.mass.gov/eea/docs/dep/water/resources/71wqar09/84wqar09.pdf

**Massachusetts Division of Fisheries and Wildlife (MADFW)**

2008 "Priority and Estimated Habitat by Natural Heritage and Endangered Species" http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm

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2015b "Shortnose Sturgeon" http://www.mass.gov/eea/docs/dfg/nhesp/species-and-conservation/nhfacts/acipenser-brevirostrum.pdf

**Massachusetts Natural Resources Collaborations (MANRC)**

2017 "Introduced Pests Outreach Project" https://massnrc.org/pests/index.htm

**Merrimack River Watershed Council, Inc. (MRWC)**

2009 "Merrimack River Monitoring Program 2009 Annual Report" http://www.merrimack.org/oldsite/publications/documents/MRWC2009WaterQualityReport.pdf

**National Ocean and Atmospheric Administration (NOAA)**

2015 "Advanced Hydrologic Prediction Service" http://water.weather.gov/ahps2/glance.php?wfo=box&gage=lawm3&riverid=204381

**New Hampshire Fish and Game (NH Fish and Game)**

2017 "Atlantic Salmon" http://www.wildlife.state.nh.us/fishing/profiles/atlantic-salmon.html

**Pan Am Railways (Pan Am)**

2017 "About Pan Am Railways" http://www.panamrailways.com/index.php?main_page=panam_railways

**United States Army Corp of Engineers (USACE)**

2015 "Errata sheet for the General Permits for Massachusetts" http://www.nae.usace.army.mil/Portals/74/docs/regulatory/StateGeneralPermits/MAGPs9March2015.pdf

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2017a "Urban Waters - Lower Merrimack River" https://www.epa.gov/lowermerrimackriver

2017a "Sole Source Aquifer Mapper" https://www.epa.gov/dwssa

2017c "EPA EJscreen" https://ejscreen.epa.gov/mapper/

2017d "EPA Enviromapper" https://www.epa.gov/emefdata/em4ef.home

**United States Federal Highway Administration (FHA)**

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1983, "Bedrock Geologic Map of Massachusetts" https://ngmdb.usgs.gov/Prodesc/proddesc_16357.htm

# Environmental Assessment - Appendices
# Merrimack River Bank Stabilization
# Chelmsford, Middlesex, MA

## 4028-DR-MA

**January 2018**

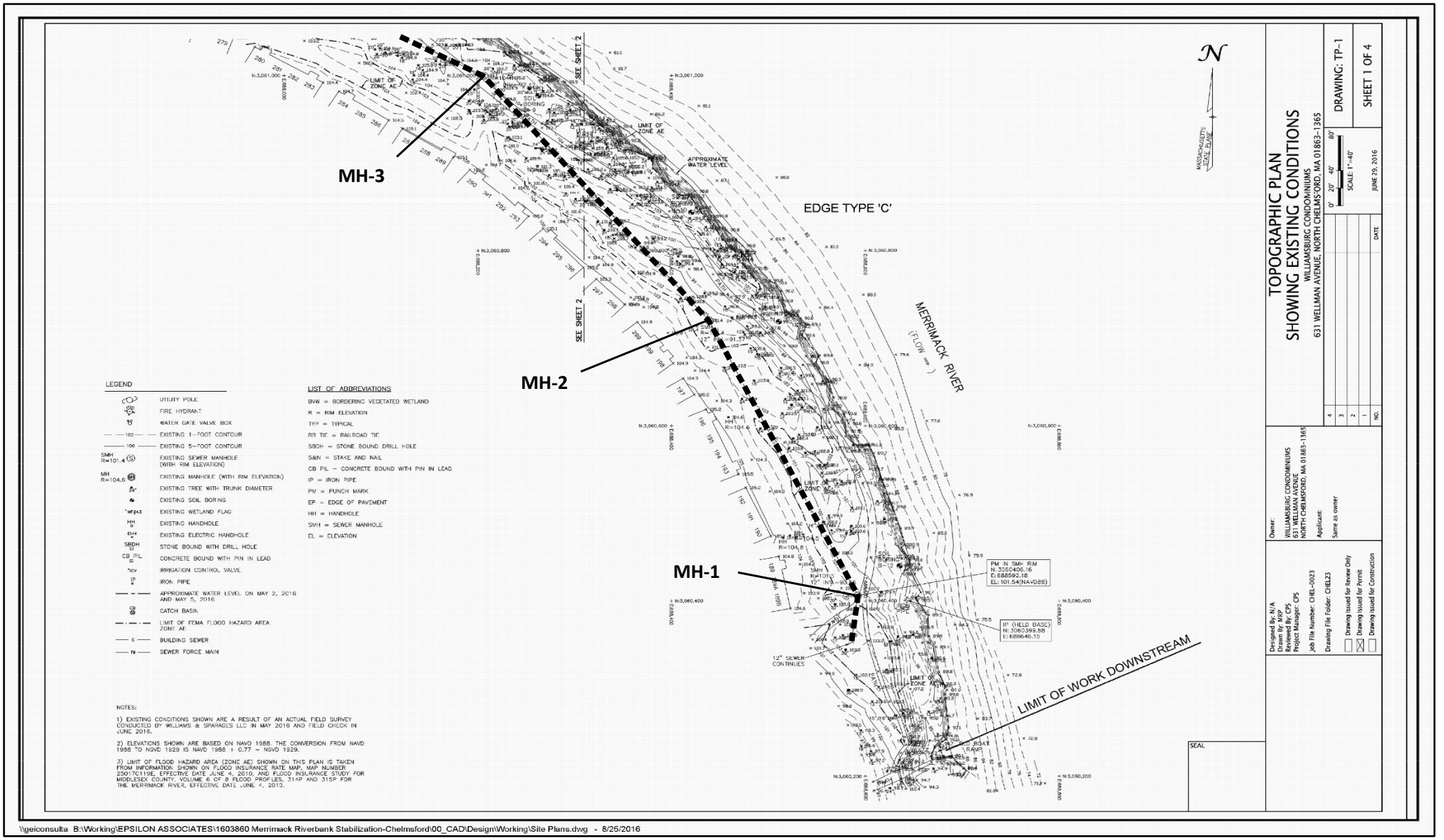
FEMA

**U.S. Department of Homeland Security**
**Federal Emergency Management Agency Region I**
**99 High St, 6th Floor, Boston, MA 02110**

# Table of Contents

# Appendices A: Documents

# Document A – Current Site Conditions Plans


MH-3
MH-2
MH-1
EDGE TYPE 'C'
MERRIMACK RIVER
(FLOW →)
LIMIT OF WORK DOWNSTREAM
SEE SHEET 2
SEE SHEET 2
LIMIT OF ZONE AE
APPROXIMATE WATER LEVEL
PM IN SMH RIM
N: 3060406.16
E: 688592.18
EL: 101.54(NAVD88)
IP (HELD BASE)
N: 3060399.88
E: 688646.15
12" SEWER CONTINUES
BOAT RAMP
LEGEND
UTILITY POLE
FIRE HYDRANT
WATER GATE VALVE BOX
EXISTING 1-FOOT CONTOUR
EXISTING 5-FOOT CONTOUR
EXISTING SEWER MANHOLE (WITH RIM ELEVATION)
EXISTING MANHOLE (WITH RIM ELEVATION)
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SEWER FORCE MAIN
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BVW = BORDERING VEGETATED WETLAND
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EP = EDGE OF PAVEMENT
HH = HANDHOLE
SMH = SEWER MANHOLE
EL = ELEVATION
NOTES:
1) EXISTING CONDITIONS SHOWN ARE A RESULT OF AN ACTUAL FIELD SURVEY CONDUCTED BY WILLIAMS & SPARAGES LLC IN MAY 2016 AND FIELD CHECK IN JUNE 2016.
2) ELEVATIONS SHOWN ARE BASED ON NAVD 1988. THE CONVERSION FROM NAVD 1988 TO NGVD 1929 IS NAVD 1988 + 0.77 = NGVD 1929.
3) LIMIT OF FLOOD HAZARD AREA (ZONE AE) SHOWN ON THIS PLAN IS TAKEN FROM INFORMATION SHOWN ON FLOOD INSURANCE RATE MAP, MAP NUMBER 25017C0119E, EFFECTIVE DATE JUNE 4, 2010, AND FLOOD INSURANCE STUDY FOR MIDDLESEX COUNTY, VOLUME 6 OF 8 FLOOD PROFILES, 31AP AND 31SP FOR THE MERRIMACK RIVER, EFFECTIVE DATE JUNE 4, 2010.
MASSACHUSETTS STATE PLANE
TOPOGRAPHIC PLAN
SHOWING EXISTING CONDITIONS
WILLIAMSBURG CONDOMINIUMS
631 WELLMAN AVENUE, NORTH CHELMSFORD, MA 01863-1365
DRAWING: TP-1
SHEET 1 OF 4
SCALE 1"=40'
JUNE 29, 2016
Owner: WILLIAMSBURG CONDOMINIUMS 631 WELLMAN AVENUE NORTH CHELMSFORD, MA 01863-1365
Applicant: Same as owner
Designed By: N/A
Drawn By: MBB
Reviewed By: CPS
Project Manager: CPS
Job File Number: CHEL-0023
Drawing File Folder: CHEL23
Drawing Issued for Review Only
Drawing Issued for Permit
Drawing Issued for Construction
SEAL
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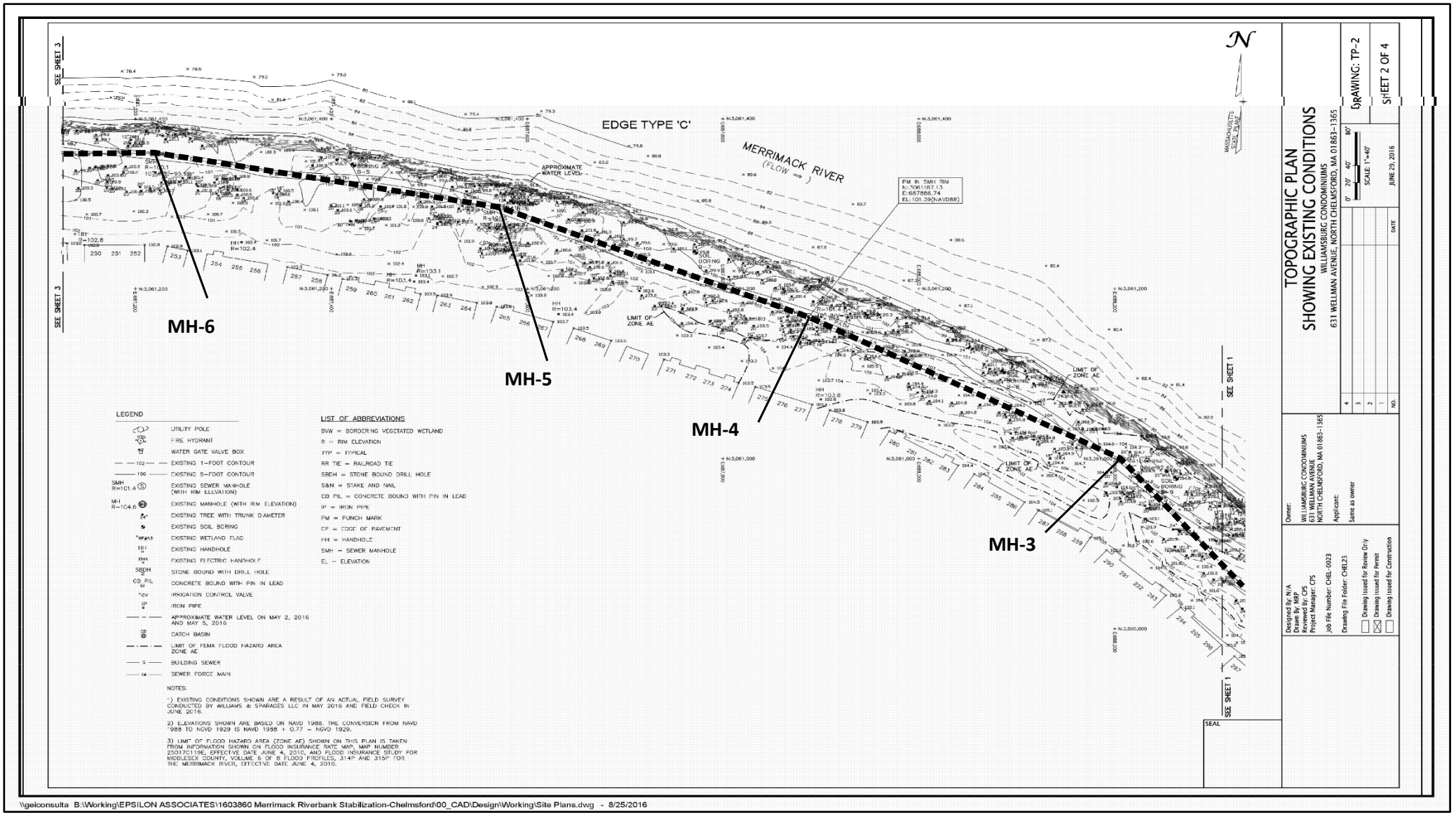
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NORTH CHELMSFORD, MA 01863-1365
Applicant:
Same as owner
Designed By: N/A
Drawn By: MKP
Reviewed By: CPS
Project Manager: CPS
Job File Number: CHEL-0023
Drawing File Folder: CHEL23
Drawing Issued for Review Only
Drawing Issued for Permit
Drawing Issued for Construction
SEAL
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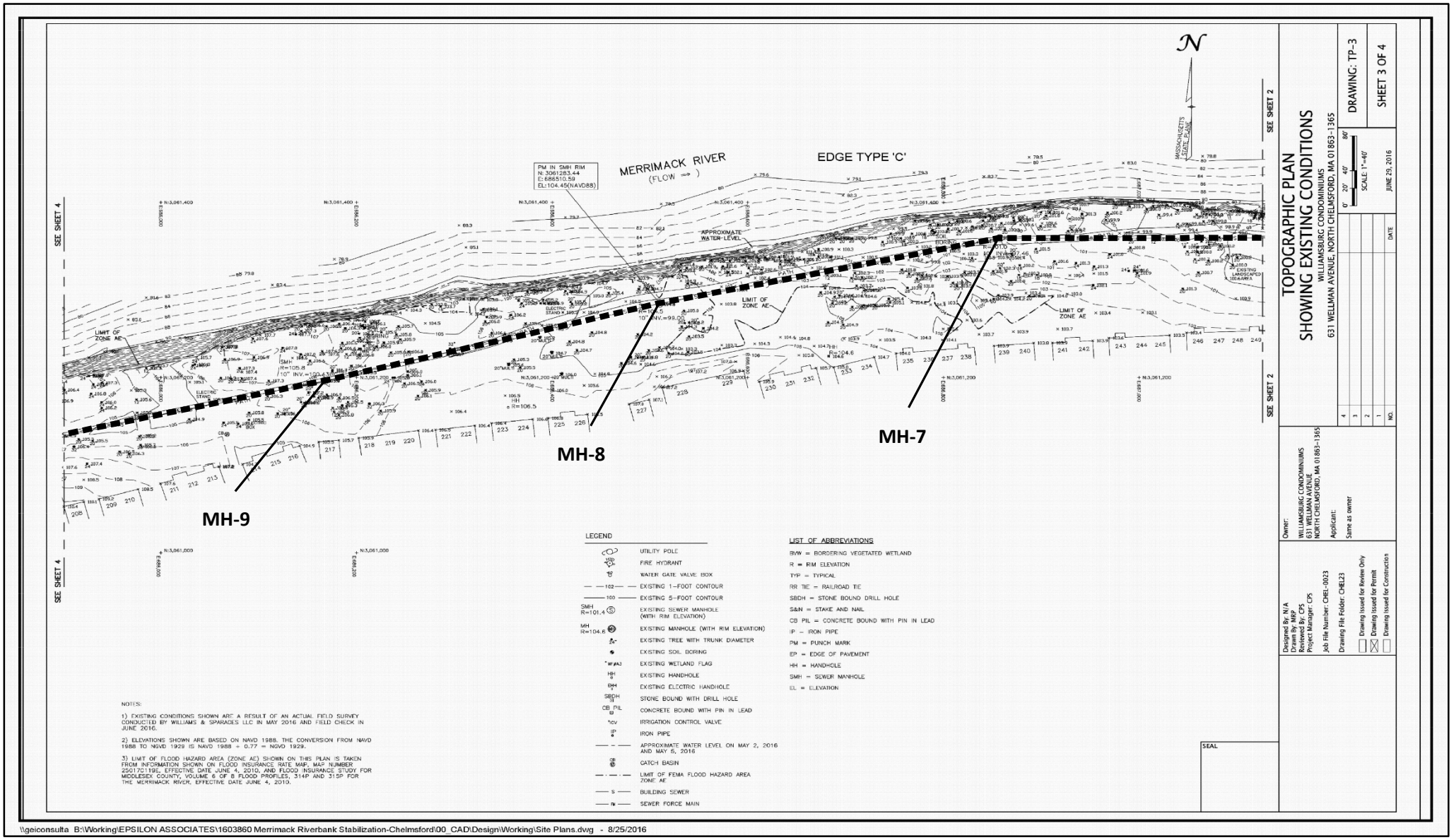


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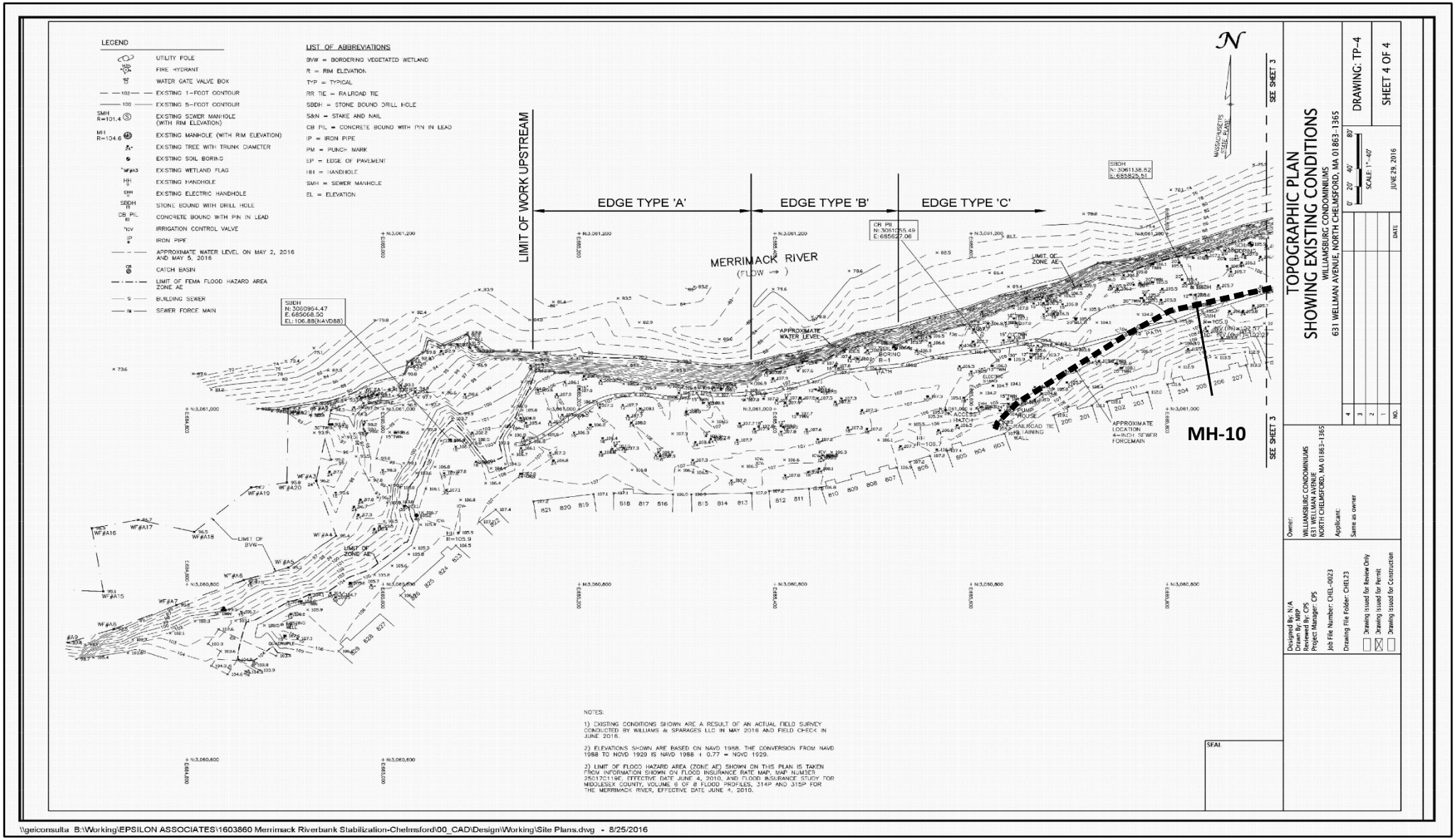
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PM = PUNCH MARK
EP = EDGE OF PAVEMENT
HH = HANDHOLE
SMH = SEWER MANHOLE
EL = ELEVATION
LIMIT OF WORK UPSTREAM
EDGE TYPE 'A'
EDGE TYPE 'B'
EDGE TYPE 'C'
MERRIMACK RIVER
(FLOW →)
SEE SHEET 3
SEE SHEET 3
N
MH-10
APPROXIMATE LOCATION 4-INCH SEWER FORCEMAIN
APPROXIMATE WATER LEVEL
LIMIT OF BVW
LIMIT OF ZONE AE
TOPOGRAPHIC PLAN
SHOWING EXISTING CONDITIONS
WILLIAMSBURG CONDOMINIUMS
631 WELLMAN AVENUE, NORTH CHELMSFORD, MA 01863-1365
DRAWING: TP-4
SHEET 4 OF 4
JUNE 29, 2016
SCALE 1"=40'
Owner:
WILLIAMSBURG CONDOMINIUMS
631 WELLMAN AVENUE
NORTH CHELMSFORD, MA 01863-1365
Applicant:
Same as owner
Designed By: N/A
Drawn By: MRP
Reviewed By: CPS
Project Manager: CPS
Job File Number: CHEL-0023
Drawing File Folder: CHEL23
Drawing issued for Review Only
Drawing issued for Permit
Drawing issued for Construction
NOTES:
1) EXISTING CONDITIONS SHOWN ARE A RESULT OF AN ACTUAL FIELD SURVEY CONDUCTED BY WILLIAMS & SPARAGES LLC IN MAY 2016 AND FIELD CHECK IN JUNE 2016.
2) ELEVATIONS SHOWN ARE BASED ON NAVD 1988. THE CONVERSION FROM NAVD 1988 TO NGVD 1929 IS NAVD 1988 + 0.77 = NGVD 1929.
3) LIMIT OF FLOOD HAZARD AREA (ZONE AE) SHOWN ON THIS PLAN IS TAKEN FROM INFORMATION SHOWN ON FLOOD INSURANCE RATE MAP, MAP NUMBER 25017C119E, EFFECTIVE DATE JUNE 4, 2010, AND FLOOD INSURANCE STUDY FOR MIDDLESEX COUNTY, VOLUME 6 OF 8 FLOOD PROFILES, 314P AND 315P FOR THE MERRIMACK RIVER, EFFECTIVE DATE JUNE 4, 2010.
SFAL
\\geiconsulta B:\Working\EPSILON ASSOCIATES\1603860 Merrimack Riverbank Stabilization-Chelmsford\00_CAD\Design\Working\Site Plans.dwg - 8/25/2016

# Document B – Edge Type Plans


DRAFT

**NOTES:**

1. BORINGS LOCATED USING EXISTING SURVEY DATA FROM DRAWING SP-1 "TOPOGRAPHIC PLAN SHOWING EXISTING CONDITIONS" DATED JUNE 20, 2016 PROVIDED BY WILLIAMS & SPARAGES, LLC.

**LEGEND:**

B-9 GEI BORING LOCATION

0 125' 250' 500'

SCALE: 1" = 250'

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

SITE OVERVIEW

Project 1603860 | November 2016 | Sheet 6 of 39

MERRIMACK RIVER

EDGE TYPE 'A'

EDGE TYPE 'B'

EDGE TYPE 'C'

LIMIT OF WORK UPSTREAM

ACCESS NO. 6

TIMBER TOE

SED-WEST

A 14

APPROXIMATE LOCATION OF SEDIMENT FENCE

LIMIT OF STONE SILL

TOP OF STONE SILL

B 15

ORDINARY LOW WATER

ORDINARY HIGH WATER

C 16

0+00

EP: 0+00.19
N: 3061034.18
E: 685143.80

0+50

1+00

1+50

2+00

2+50

3+00

3+50

4+00

4+50

5+00

5+50

APPROXIMATE TOP OF SLOPE

PROJECT BASELINE

PI: 2+21.26
N: 3061009.19
E: 685363.46

PI: 3+45.63
N: 3061043.66
E: 685482.95

EXISTING WALKING PATH

EXISTING CONDOMINIUMS (TYP.)

SOIL BORING B-1

CB PIL
N: 3061055.49
E: 685627.06

N:3,061,200

E:685,400

E:685,600

N:3,061,000

E:685,200

ELECTRIC STAND

ACCESS HATCH

PUMP HOUSE

EHH

HH

R=106.7

MATCH LINE - SHEET 8

821 820 819 818 817 816 815 814 813 812 811 810 809 808 807 806 805 804 803 200

DRAFT

***NOTES:***

1. EXISTING SURVEY DATA FROM DRAWING SP-1 "TOPOGRAPHIC PLAN SHOWING EXISTING CONDITIONS" DATED JUNE 20, 2016 PROVIDED BY WILLIAMS & SPARAGES, LLC.

***LEGEND:***

B-9 GEI BORING LOCATION

SED GEI SEDIMENT SAMPLE LOCATION

0 40 80

SCALE: 1" = 40'

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

SITE PLAN
(1 OF 7)

Project 1603860

November 2016

Sheet 7 of 39

\\geiconsulta B:\Working\EPSILON ASSOCIATES\1603860 Merrimack Riverbank Stabilization-Chelmsford\00_CAD\Design\Working\Site Plans (11X17).dwg - 11/22/2016

MERRIMACK RIVER

EDGE TYPE 'C' | EDGE TYPE 'B' | EDGE TYPE 'C'

D 17 | E 18 | F 19

ACCESS NO. 5

ORDINARY LOW WATER

ORDINARY HIGH WATER

TOP OF STONE SILL

LIMIT OF STONE SILL

APPROXIMATE LOCATION OF SEDIMENT FENCE

B-11

B-10

6+00 | 6+50 | 7+00 | 7+50 | 8+00 | 8+50 | 9+00 | 9+50 | 10+00 | 10+50 | 11+00 | 11+50

PI: 6+75.52
N: 3061151.84
E: 685794.60

PROJECT BASELINE

PI: 9+82.96
N: 3061225.21
E: 686093.16

APPROXIMATE TOP OF SLOPE

PI: 11+27.98
N: 3061260.81
E: 686233.74

SOIL BORING B-2

SOIL BORING B-3

SBDH

SMH R=105.9 4" INV.(IN)=102.57 10" INV.(OUT)=102.27

SMH R=105.8 10" INV.=100.43

EXISTING WALKING PATH

EXISTING CONDOMINIUMS (TYP.)

ELECTRIC STAND

ELECTRIC BOX

CB

APPROXIMATE LOCATION 4-INCH SEWER FORCEMAIN

202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221

N:3,061,200

N:3,061,000

E:685,800

E:686,000

MATCH LINE - SHEET 7

MATCH LINE - SHEET 9

DRAFT

***NOTES:***

1. EXISTING SURVEY DATA FROM DRAWING SP-1 "TOPOGRAPHIC PLAN SHOWING EXISTING CONDITIONS" DATED JUNE 20, 2016 PROVIDED BY WILLIAMS & SPARAGES, LLC.

***LEGEND:***

B-9 GEI BORING LOCATION

SED GEI SEDIMENT SAMPLE LOCATION

0 40 80

SCALE: 1" = 40'

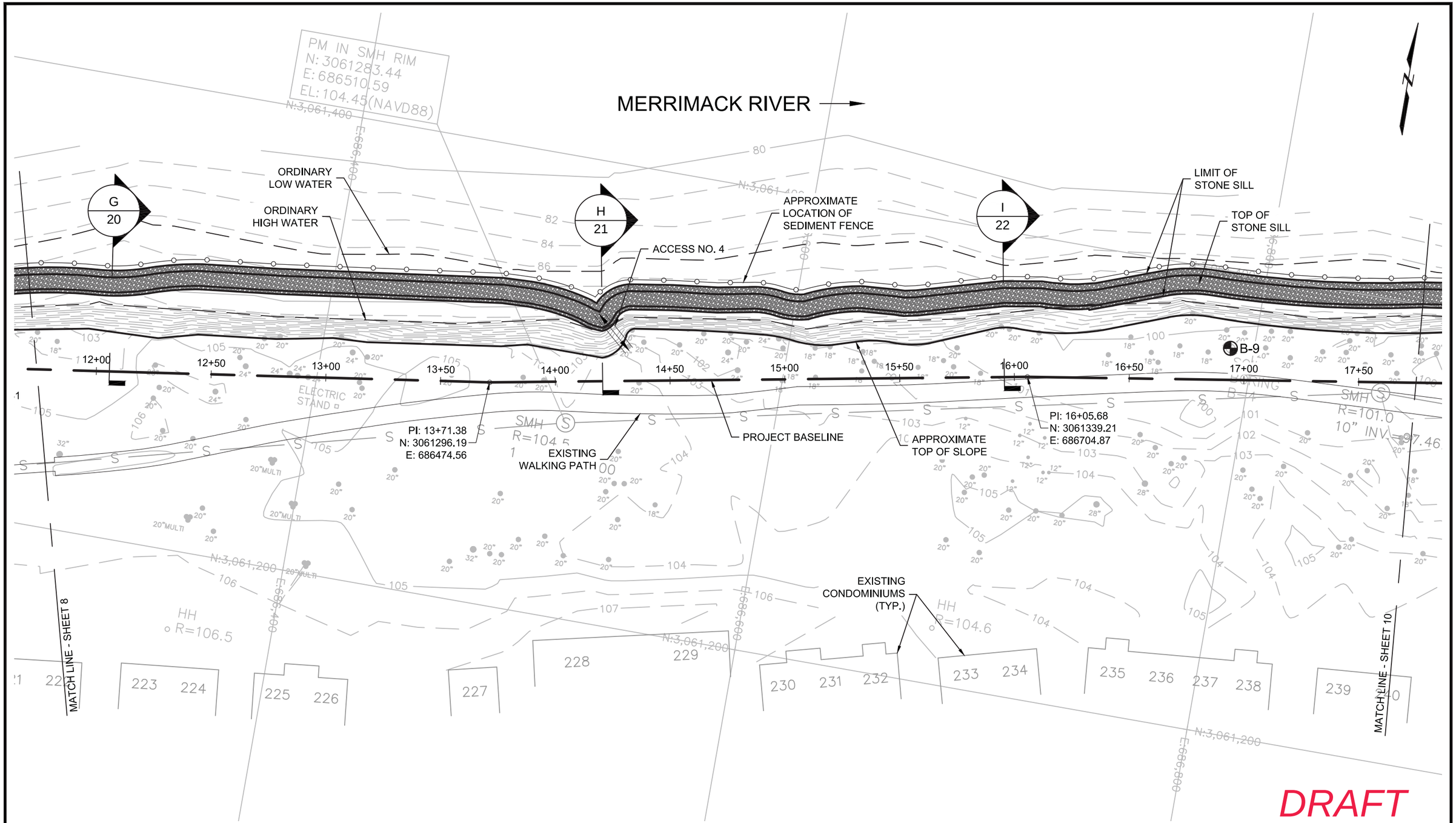
Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

SITE PLAN
(2 OF 7)

Project 1603860 | November 2016 | Sheet 8 of 39




***NOTES:***

1. EXISTING SURVEY DATA FROM DRAWING SP-1 "TOPOGRAPHIC PLAN SHOWING EXISTING CONDITIONS" DATED JUNE 20, 2016 PROVIDED BY WILLIAMS & SPARAGES, LLC.

***LEGEND:***

B-9 GEI BORING LOCATION

SED GEI SEDIMENT SAMPLE LOCATION

0 40 80

SCALE: 1" = 40'

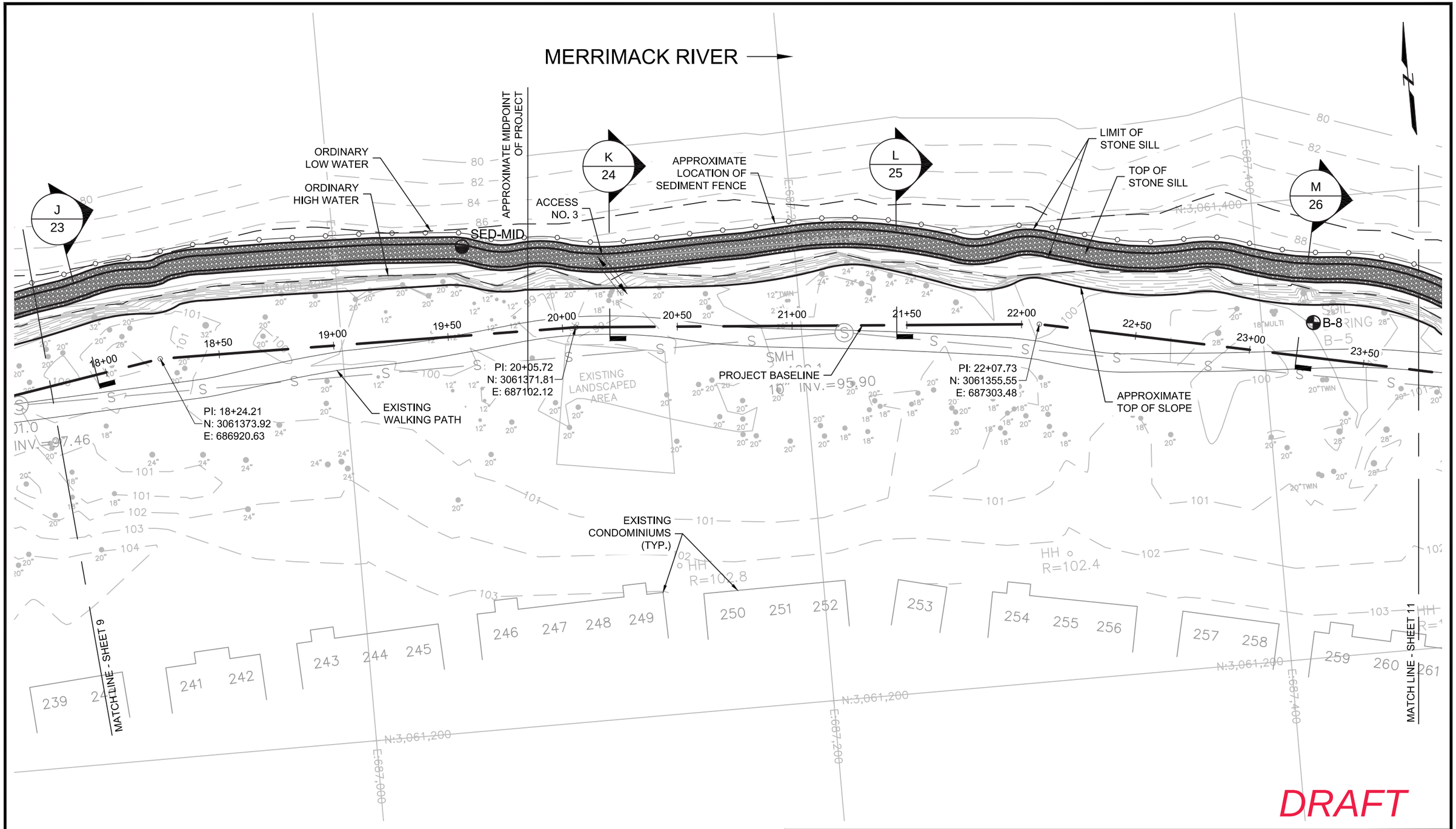
Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

SITE PLAN
(3 OF 7)

Project 1603860 | November 2016 | Sheet 9 of 39




DRAFT

***NOTES:***

1. EXISTING SURVEY DATA FROM DRAWING SP-1 "TOPOGRAPHIC PLAN SHOWING EXISTING CONDITIONS" DATED JUNE 20, 2016 PROVIDED BY WILLIAMS & SPARAGES, LLC.

***LEGEND:***

B-9 GEI BORING LOCATION

SED GEI SEDIMENT SAMPLE LOCATION

0 40 80

SCALE: 1" = 40'

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

SITE PLAN
(4 OF 7)

Project 1603860 | November 2016 | Sheet 10 of 39

MERRIMACK RIVER

PM IN SMH RIM
N: 3061283.44
E: 686510.59
EL: 104.45(NAVD88)

ORDINARY LOW WATER

ORDINARY HIGH WATER

LIMIT OF STONE SILL

TOP OF STONE SILL

APPROXIMATE LOCATION OF SEDIMENT FENCE

N 27

O 28

P 29

Q 30

ACCESS NO. 2

B-7

B-6

24+00

24+50

25+00

25+50

26+00

26+50

27+00

27+50

28+00

28+50

29+00

29+50

PI: 23+90.99
N: 3061317.63
E: 687482.77

SMH
R=101.5
10" INV=94.57

EXISTING WALKING PATH

PI: 26+05.88
N: 3061263.03
E: 687690.61

APPROXIMATE TOP OF SLOPE

PI: 28+11.68
N: 3061187.86
E: 687882.19

SMH
R=101.7
10" INV=95.12

PROJECT BASELINE

PI:
N: 30
E: 6

EXISTING CONDOMINIUMS (TYP.)

HH R=103.1

HH R=103.4

HH R=103.8

MATCH LINE - SHEET 10

MATCH LINE - SHEET 12

259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281

N:3,061,400 E:687,800

N:3,061,200 E:687,600

N:3,061,200 E:688,000

DRAFT

***NOTES:***

1. EXISTING SURVEY DATA FROM DRAWING SP-1 "TOPOGRAPHIC PLAN SHOWING EXISTING CONDITIONS" DATED JUNE 20, 2016 PROVIDED BY WILLIAMS & SPARAGES, LLC.

***LEGEND:***

B-9 GEI BORING LOCATION

SED GEI SEDIMENT SAMPLE LOCATION

0 40 80

SCALE: 1" = 40'

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

SITE PLAN
(5 OF 7)

Project 1603860

November 2016 Sheet 11 of 39

MERRIMACK RIVER

ORDINARY LOW WATER

ORDINARY HIGH WATER

LIMIT OF STONE SILL

TOP OF STONE SILL

APPROXIMATE LOCATION OF SEDIMENT FENCE

R 31

S 32

T 33

U 34

B-5

B-4

B-3

PROJECT BASELINE

29+50 30+00 30+50 31+00 31+50 32+00 32+50 33+00 33+50 34+00 34+50 35+00 35+50

PI: 30+05.34
N: 3061114.79
E: 688061.54

PI: 32+59.75
N: 3060971.71
E: 688271.90

PI: 34+05.62
N: 3060872.58
E: 688378.91

EXISTING WALKING PATH

APPROXIMATE TOP OF SLOPE

EXISTING CONDOMINIUMS (TYP.)

MATCH LINE - SHEET 11

MATCH LINE - SHEET 13

279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299

N:3,061,200 E:688,200

N:3,061,000 E:688,400

N:3,061,000 E:688,000

N:3,060,800

DRAFT

***NOTES:***

1. EXISTING SURVEY DATA FROM DRAWING SP-1 "TOPOGRAPHIC PLAN SHOWING EXISTING CONDITIONS" DATED JUNE 20, 2016 PROVIDED BY WILLIAMS & SPARAGES, LLC.

***LEGEND:***

B-9 GEI BORING LOCATION

SED GEI SEDIMENT SAMPLE LOCATION

0 40 80

SCALE: 1" = 40'

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

SITE PLAN
(6 OF 7)

Project 1603860

November 2016 Sheet 12 of 39

MERRIMACK RIVER

ORDINARY LOW WATER

ORDINARY HIGH WATER

LIMIT OF STONE SILL

TOP OF STONE SILL

V 35

W 36

X 37

APPROXIMATE LOCATION OF SEDIMENT FENCE

B-2

B-1

SED-EAST

35+50

36+00

36+50

37+00

37+50

38+00

38+50

39+00

39+50

PI: 35+56.23
N: 3060751.86
E: 688468.97

PROJECT BASELINE

APPROXIMATE TOP OF SLOPE

PI: 37+01.97
N: 3060626.80
E: 688543.80

PI: 38+13.69
N: 3060527.02
E: 688594.05

EXISTING WALKING PATH

ACCESS NO. 1

BP: 39+50.00
N: 3060394.97
E: 688627.85

LIMIT OF WORK DOWNSTREAM 5' SOUTH OF IRON PIPE

PM IN SMH RIM
N: 3060406.16
E: 688592.18
EL: 101.54(NAVD88)

IP (HELD BASE)
N: 3060399.88
E: 688646.15

SMH
R=101.4
12" INV.=91.

SMH
R=101.5
12" INV.=90.46

SMH
R=104.6

SMH
R=104.5

SMH
R=104.8

EXISTING CONDOMINIUMS (TYP.)

MATCH LINE - SHEET 12

12" SEWER CONTINUES

OLD BOAT RAMP

N:3,060,600
E:688,600

N:3,060,400
E:688,400

N:3,060,200
E:688,600

299 199 198 197 196 195 194 193 192 191 190 189 189A 189B

DRAFT

**NOTES:**

1. EXISTING SURVEY DATA FROM DRAWING SP-1 "TOPOGRAPHIC PLAN SHOWING EXISTING CONDITIONS" DATED JUNE 20, 2016 PROVIDED BY WILLIAMS & SPARAGES, LLC.

**LEGEND:**

B-9 GEI BORING LOCATION

SED GEI SEDIMENT SAMPLE LOCATION

0 40 80

SCALE: 1" = 40'

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

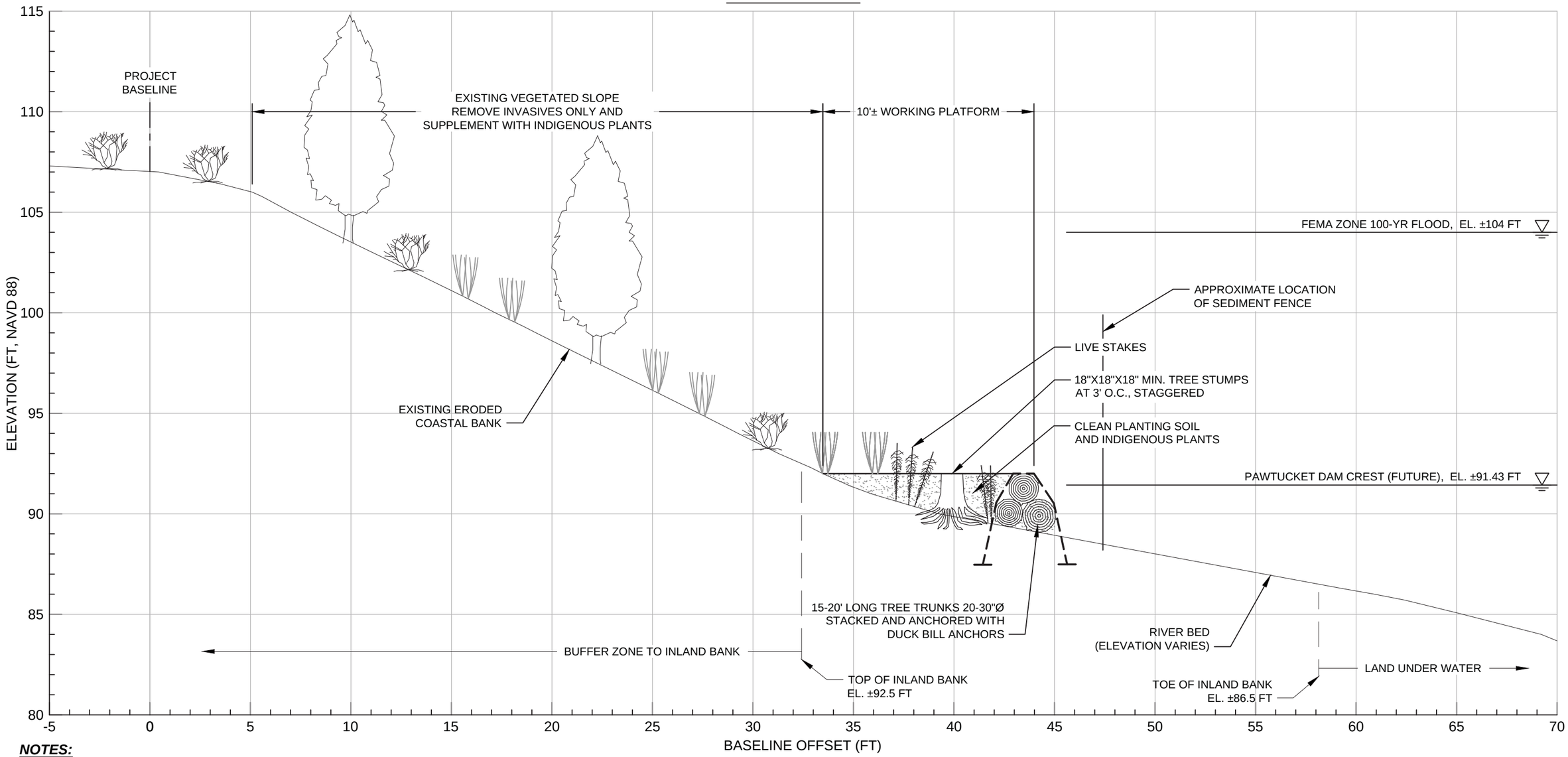
Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

SITE PLAN
(7 OF 7)

Project 1603860 November 2016 Sheet 13 of 39

# STA. 1+22




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
4. HARVESTED TREE TRUNKS SHALL BE BUNDLED AND PLACED ADJACENT TO THE RIP RAP BERM/SILL TO EXTEND THE WORKING PLATFORM. TREE TRUNKS ARE FOR TEMPORARY USE DURING CONSTRUCTION AND SHALL BE REMOVED AND REPLACED WITH SAND FILL.
5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

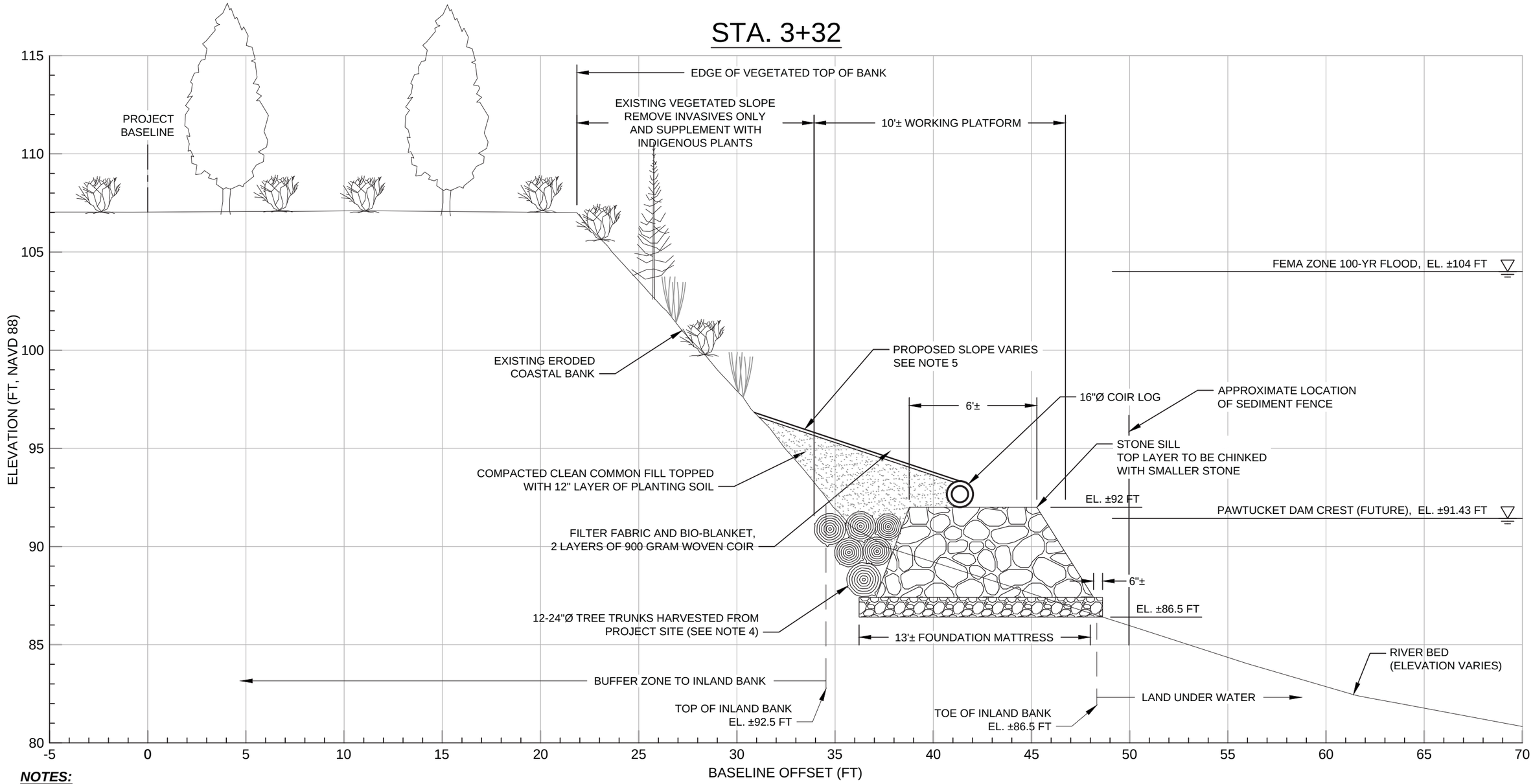
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Chelmsford River Bank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'A'<br>MINIMAL DISTURBANCE<br>SECTION A |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 14 of 39 |

# STA. 3+32




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
4. HARVESTED TREE TRUNKS SHALL BE BUNDLED AND PLACED ADJACENT TO THE RIP RAP BERM/SILL TO EXTEND THE WORKING PLATFORM. TREE TRUNKS ARE FOR TEMPORARY USE DURING CONSTRUCTION AND SHALL BE REMOVED AND REPLACED WITH SAND FILL.
5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

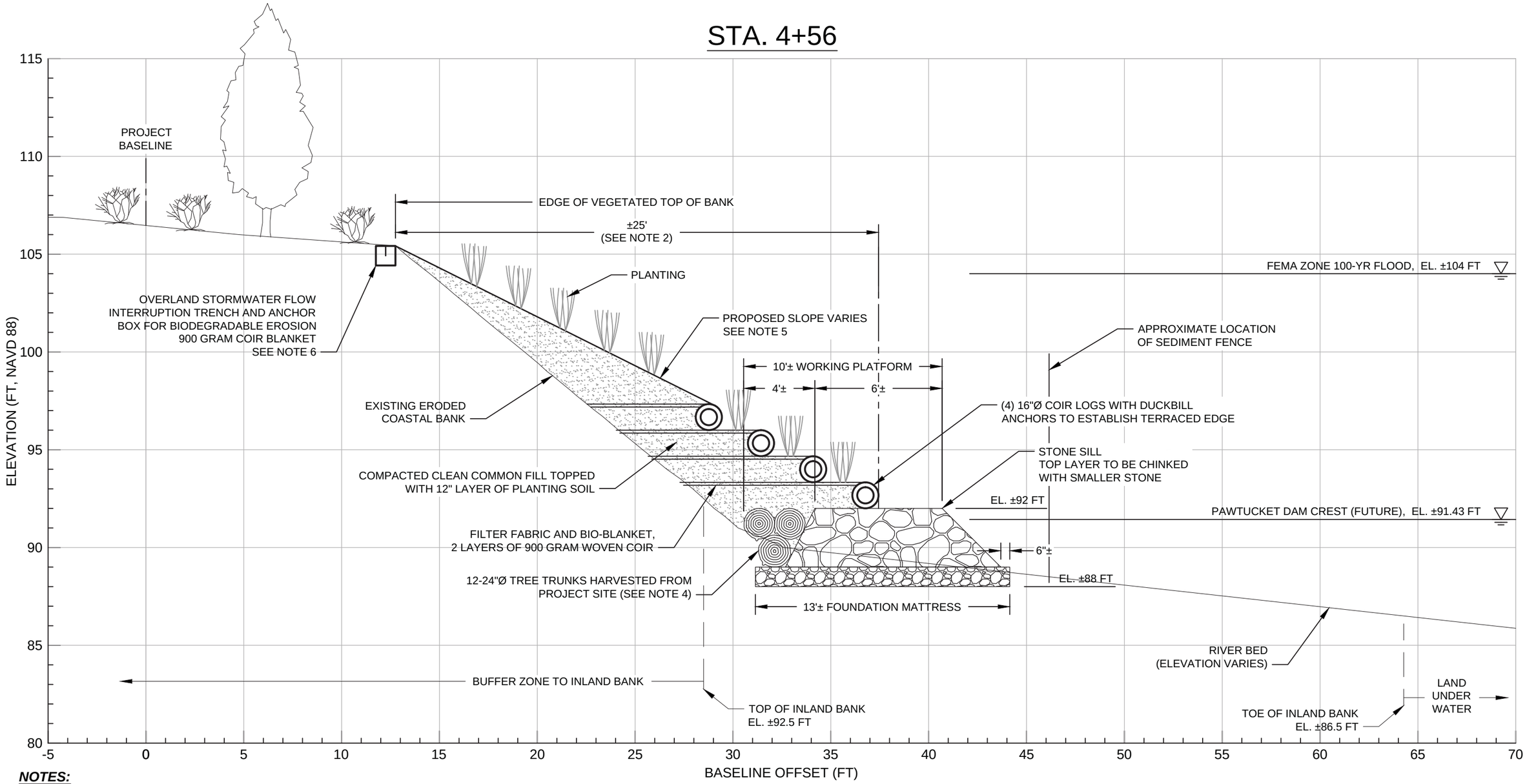
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Chelmsford River Bank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'B'<br>MODERATE DISTURBANCE<br>SECTION B |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 15 of 39 |

# STA. 4+56




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
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5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'B'
MODERATE DISTURBANCE
SECTION C

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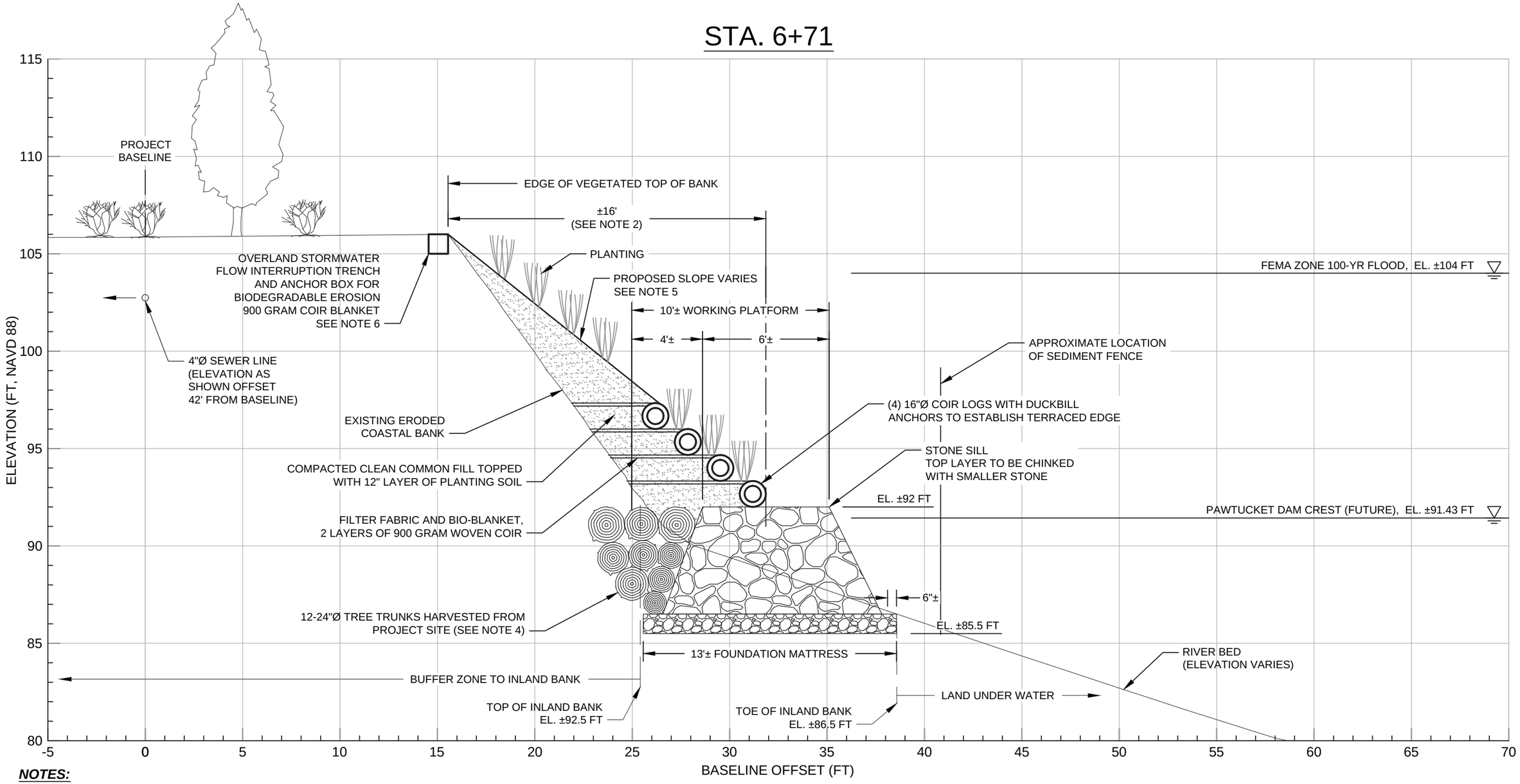
# STA. 6+71




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
4. HARVESTED TREE TRUNKS SHALL BE BUNDLED AND PLACED ADJACENT TO THE RIP RAP BERM/SILL TO EXTEND THE WORKING PLATFORM. TREE TRUNKS ARE FOR TEMPORARY USE DURING CONSTRUCTION AND SHALL BE REMOVED AND REPLACED WITH SAND FILL.
5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION D

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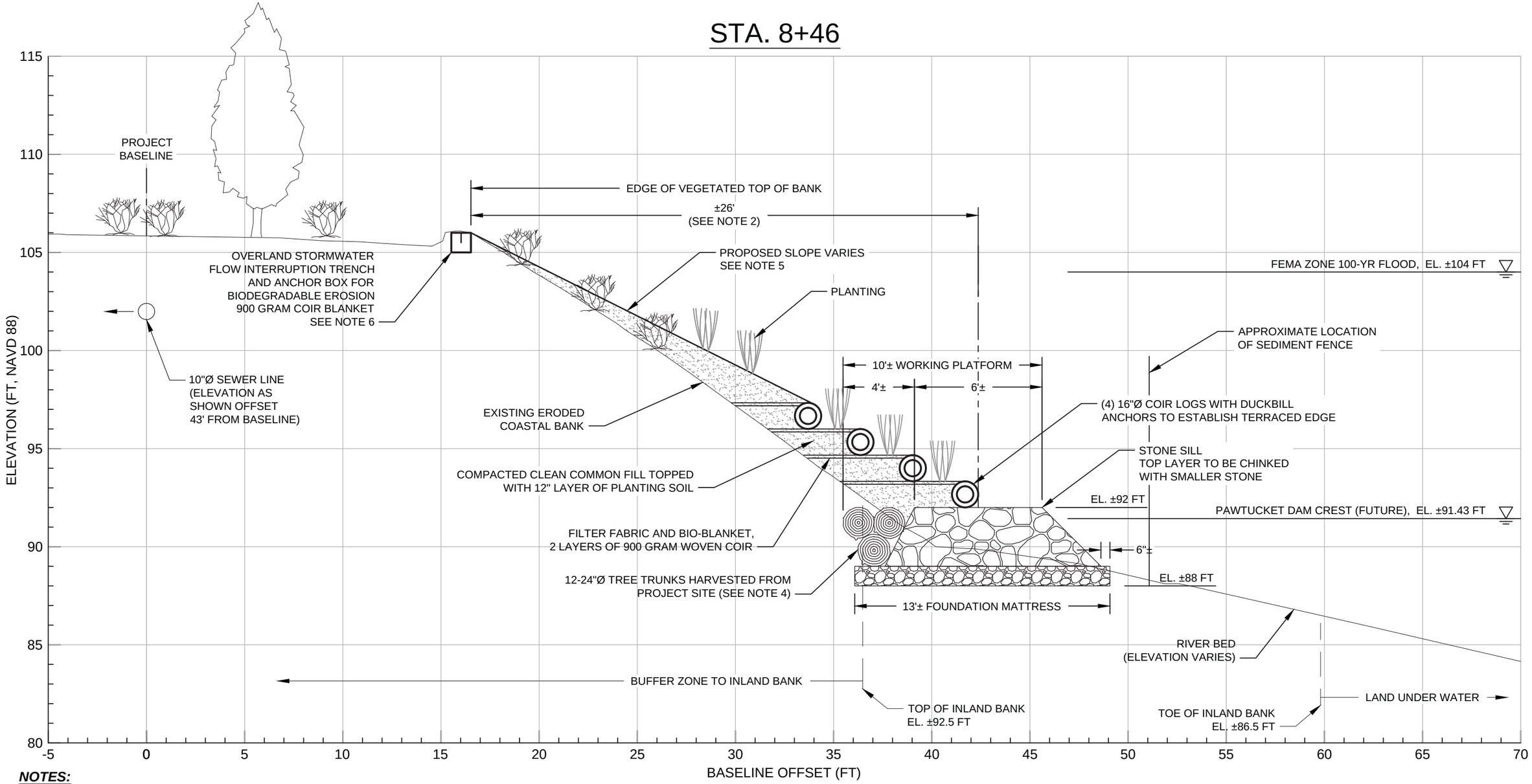
# STA. 8+46




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
4. HARVESTED TREE TRUNKS SHALL BE BUNDLED AND PLACED ADJACENT TO THE RIP RAP BERM/SILL TO EXTEND THE WORKING PLATFORM. TREE TRUNKS ARE FOR TEMPORARY USE DURING CONSTRUCTION AND SHALL BE REMOVED AND REPLACED WITH SAND FILL.
5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'B'
MODERATE DISTURBANCE
SECTION E

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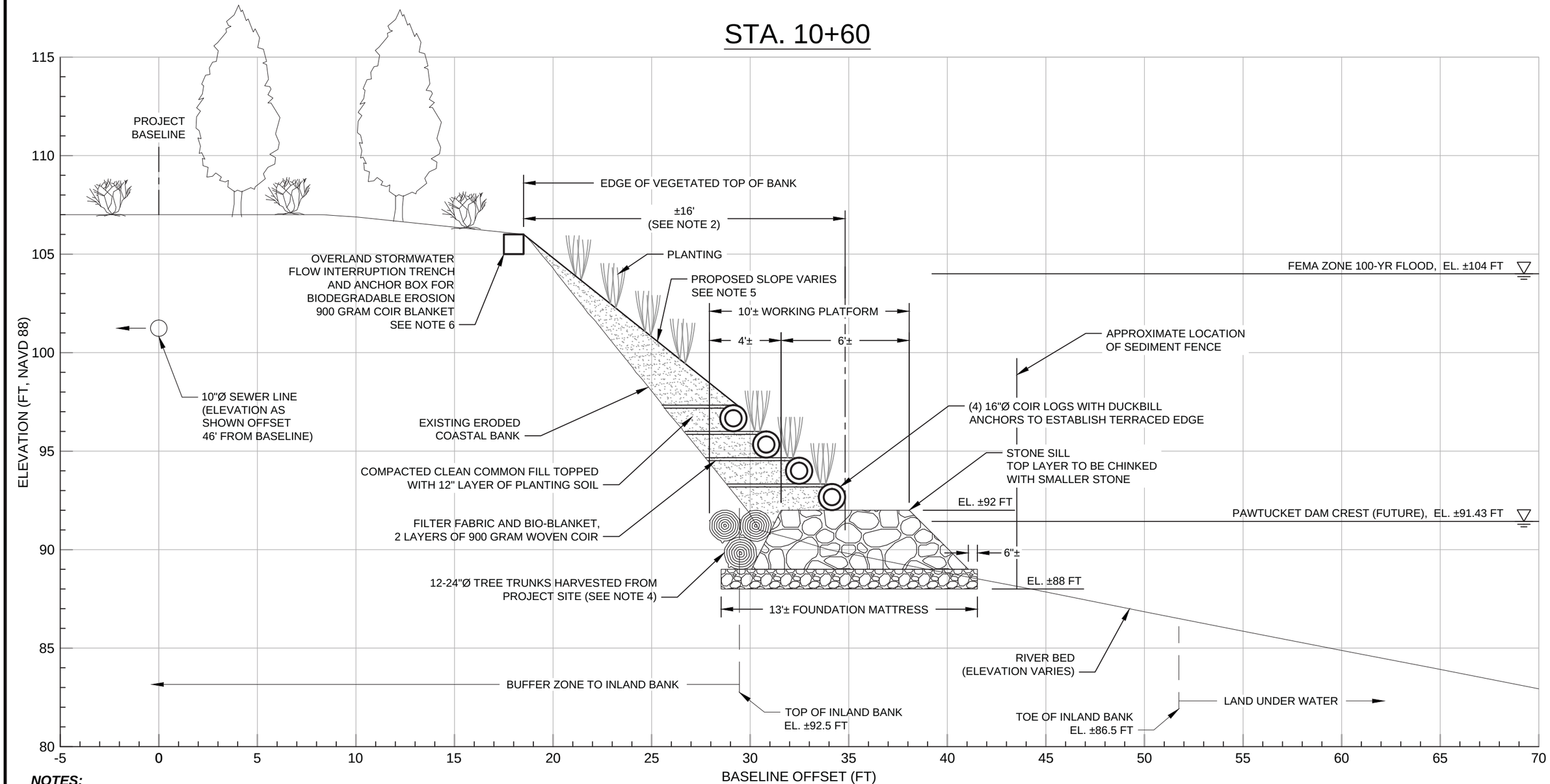
# STA. 10+60




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
4. HARVESTED TREE TRUNKS SHALL BE BUNDLED AND PLACED ADJACENT TO THE RIP RAP BERM/SILL TO EXTEND THE WORKING PLATFORM. TREE TRUNKS ARE FOR TEMPORARY USE DURING CONSTRUCTION AND SHALL BE REMOVED AND REPLACED WITH SAND FILL.
5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

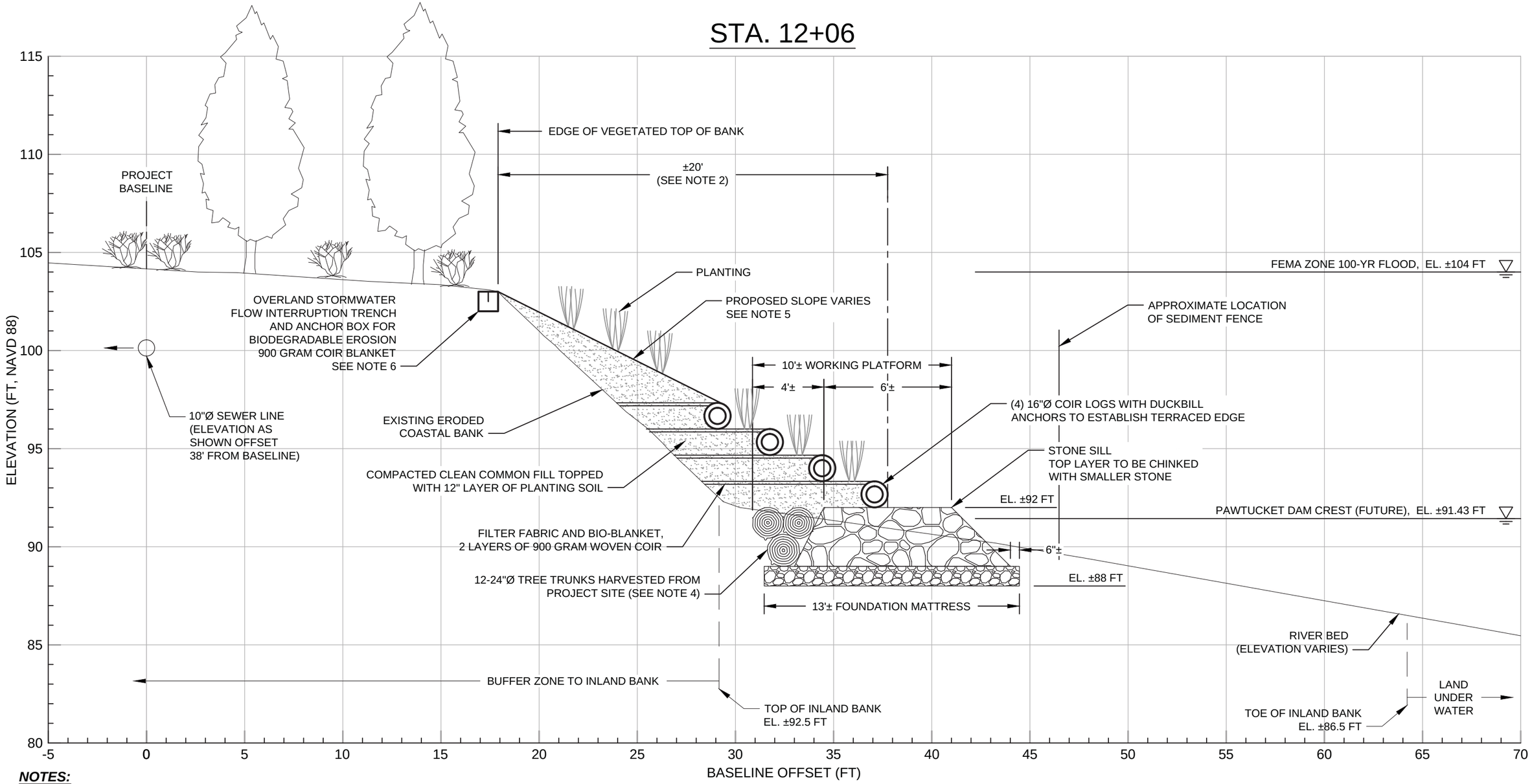
Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION F

Project 1603860 | November 2016 | Sheet 19 of 39

# STA. 12+06




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

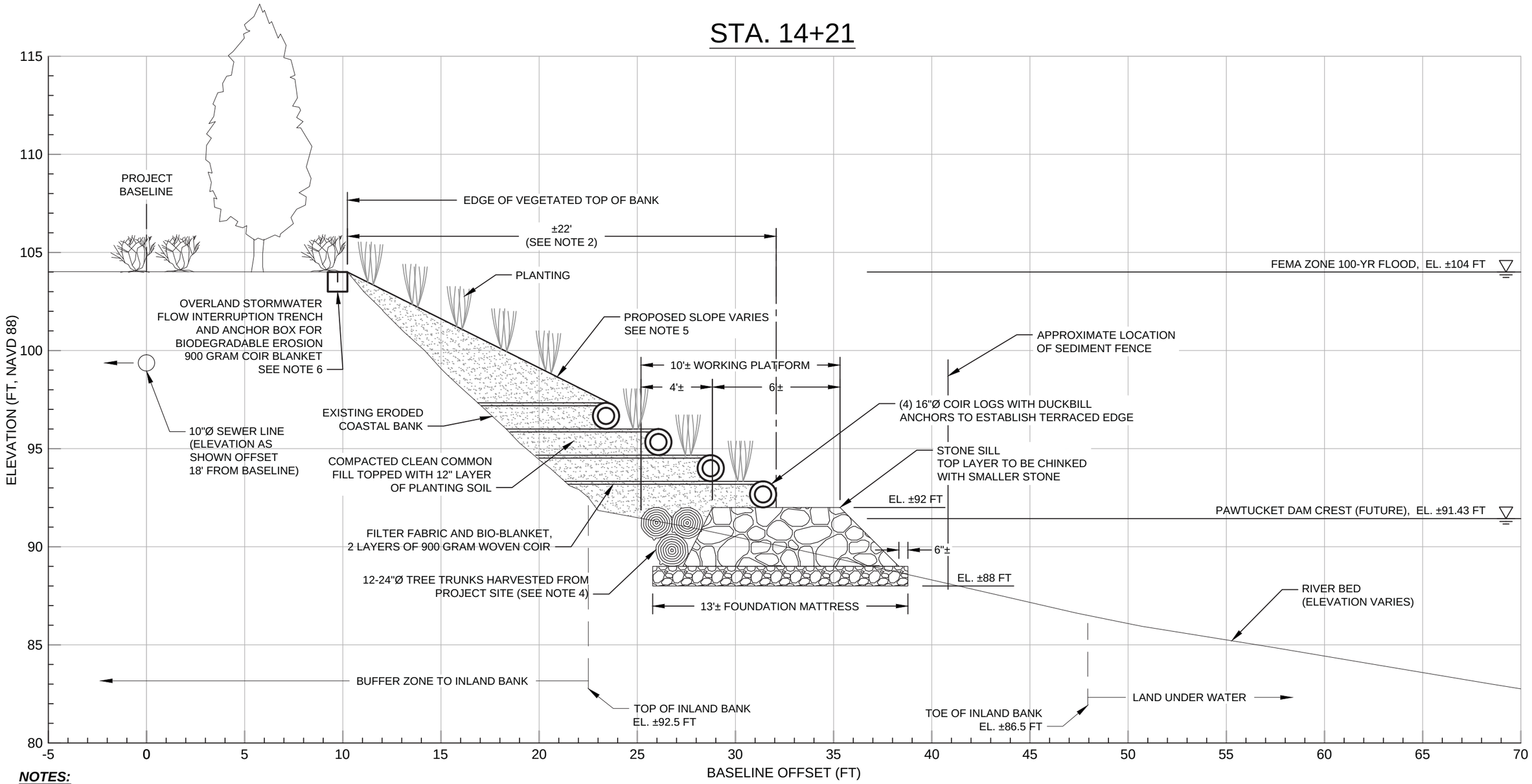
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION G |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 20 of 39 |

# STA. 14+21




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION H

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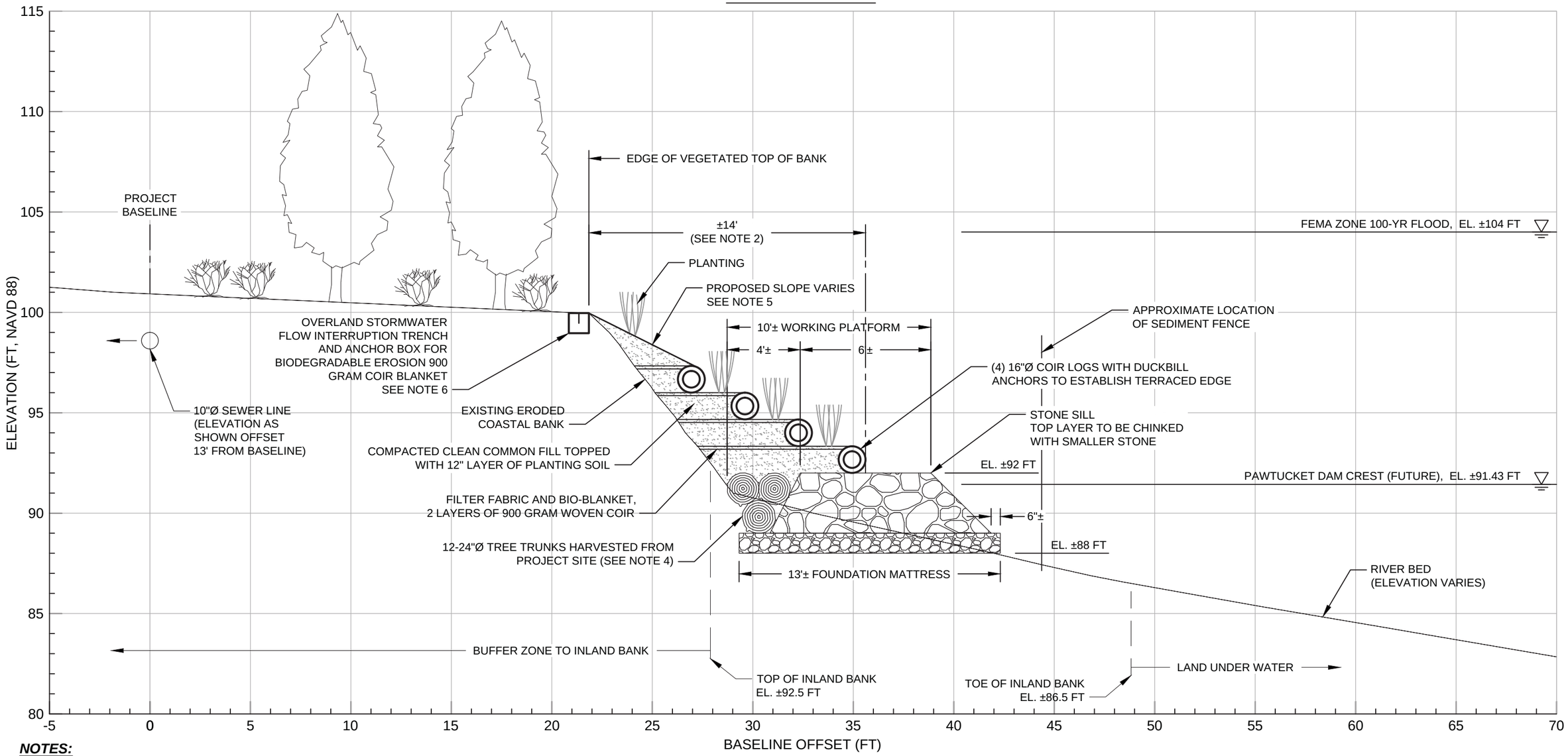
# STA. 15+96




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

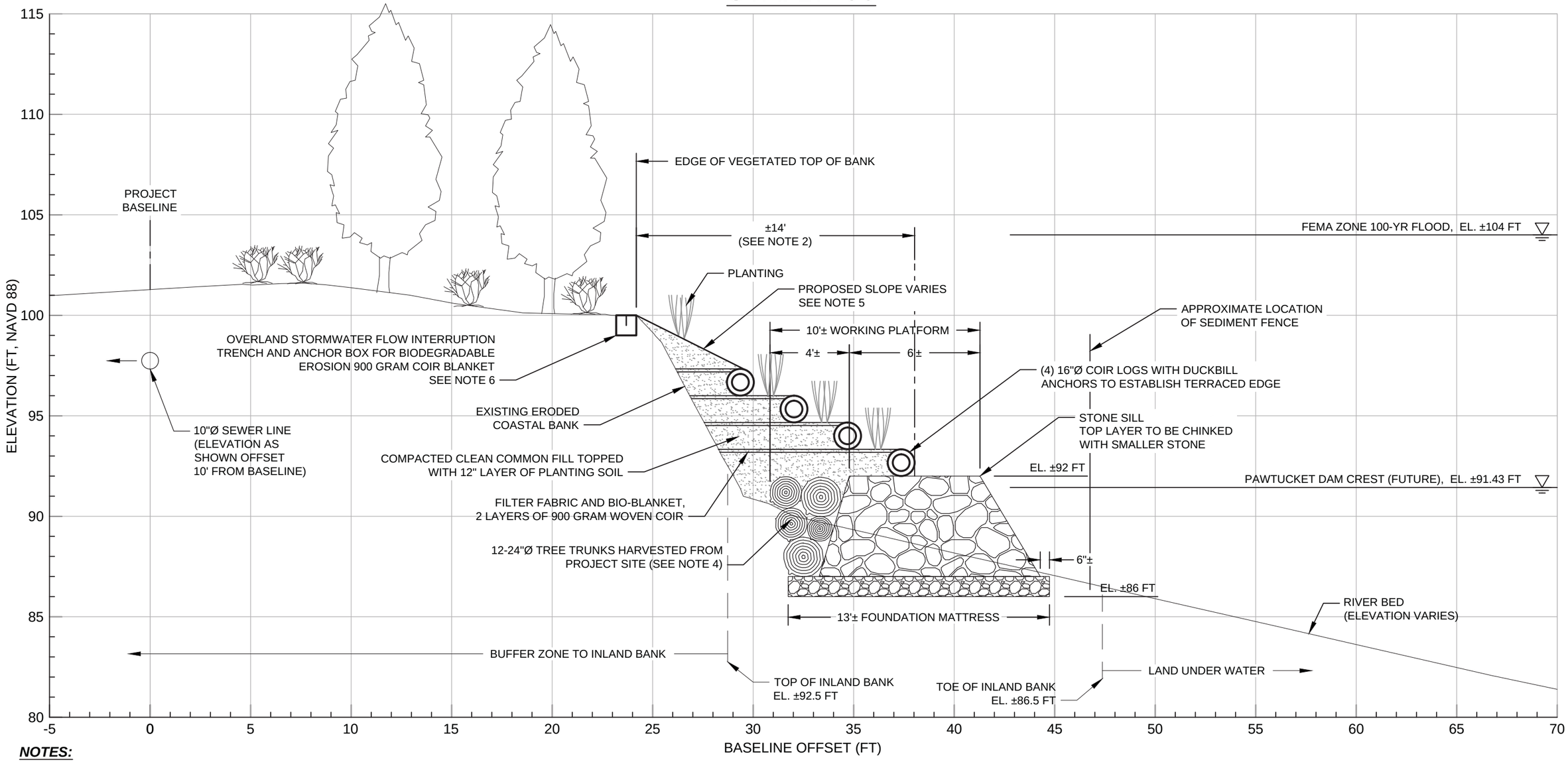
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION I |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 22 of 39 |

# STA. 17+96




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION J

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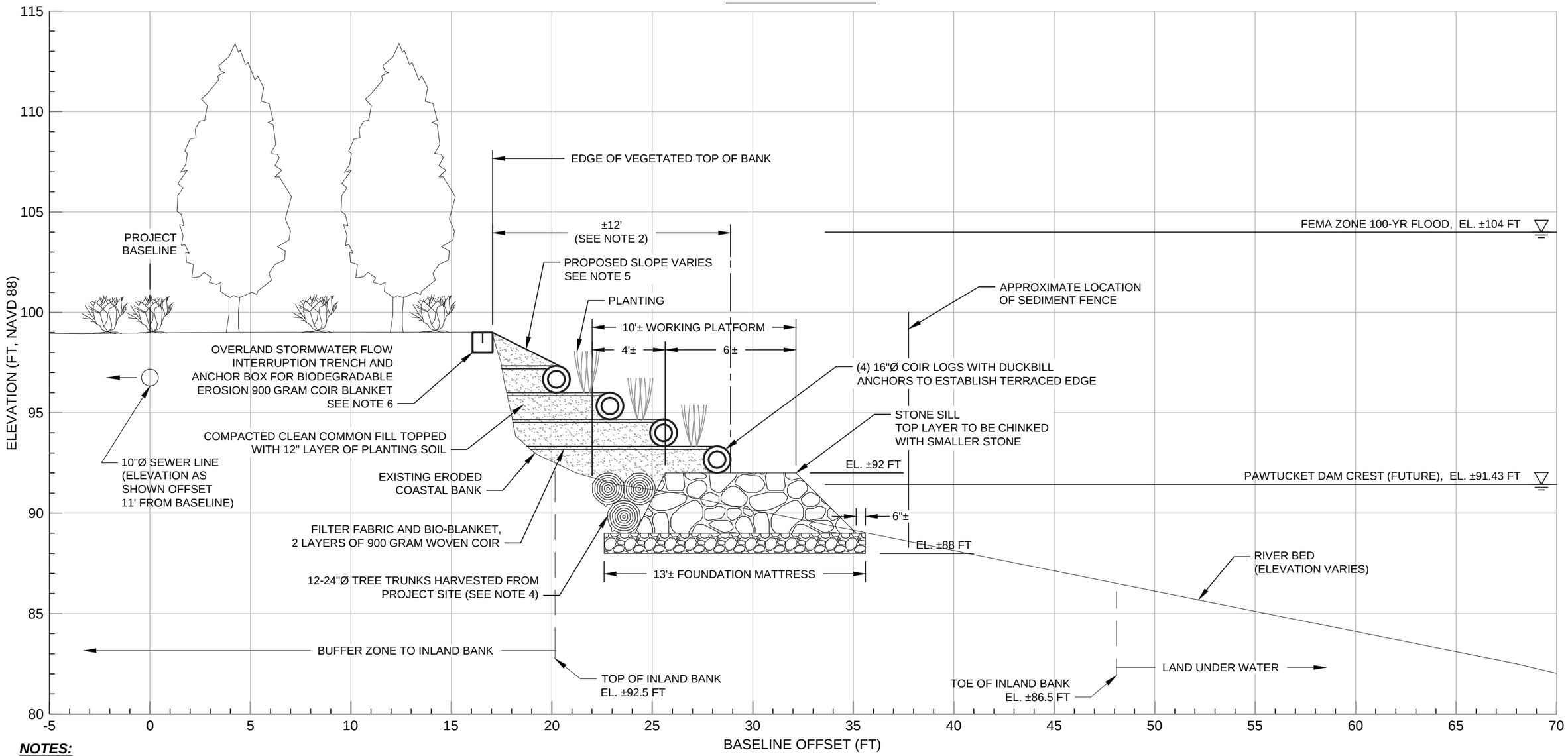
# STA. 20+21




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

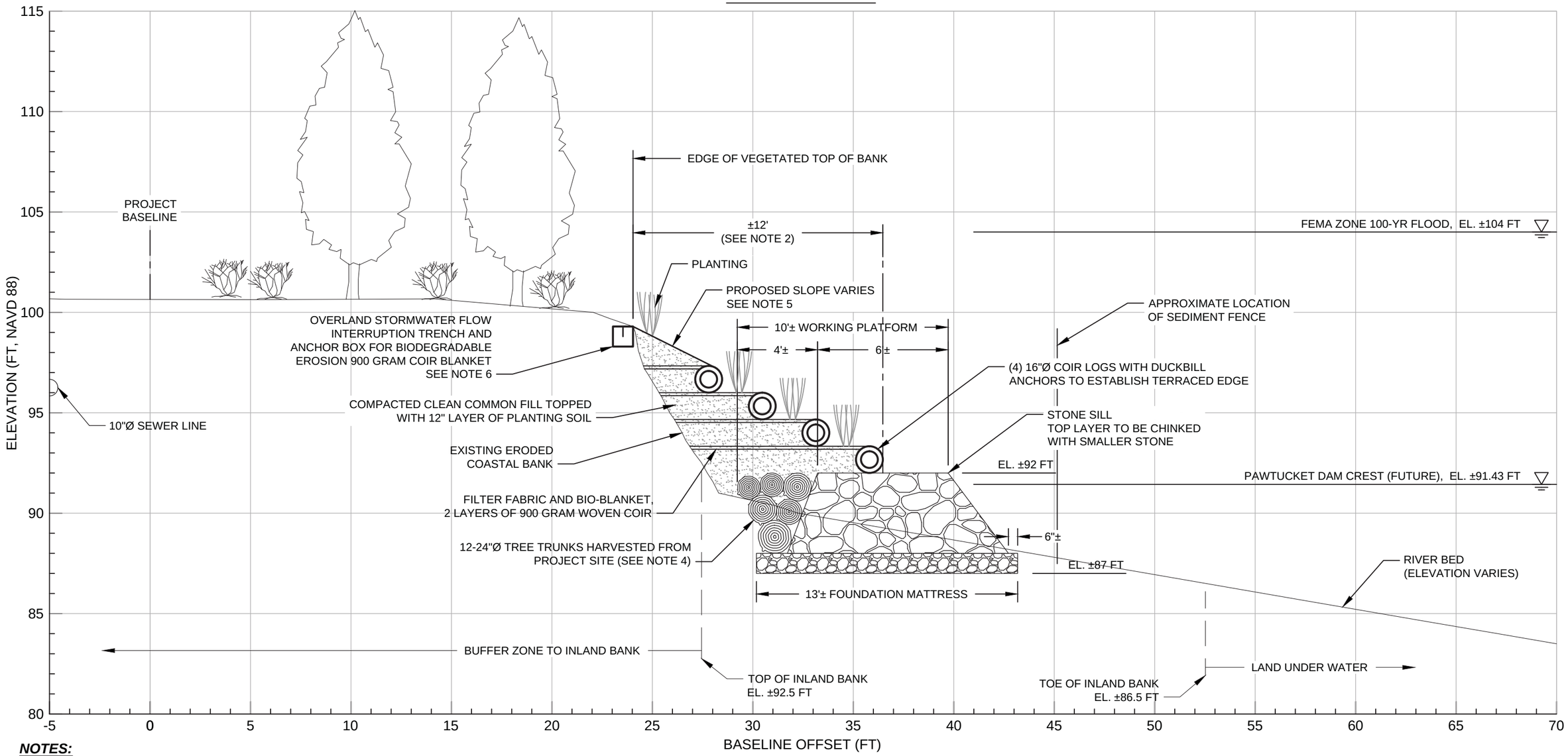
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION K |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 24 of 39 |

# STA. 21+46




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION L

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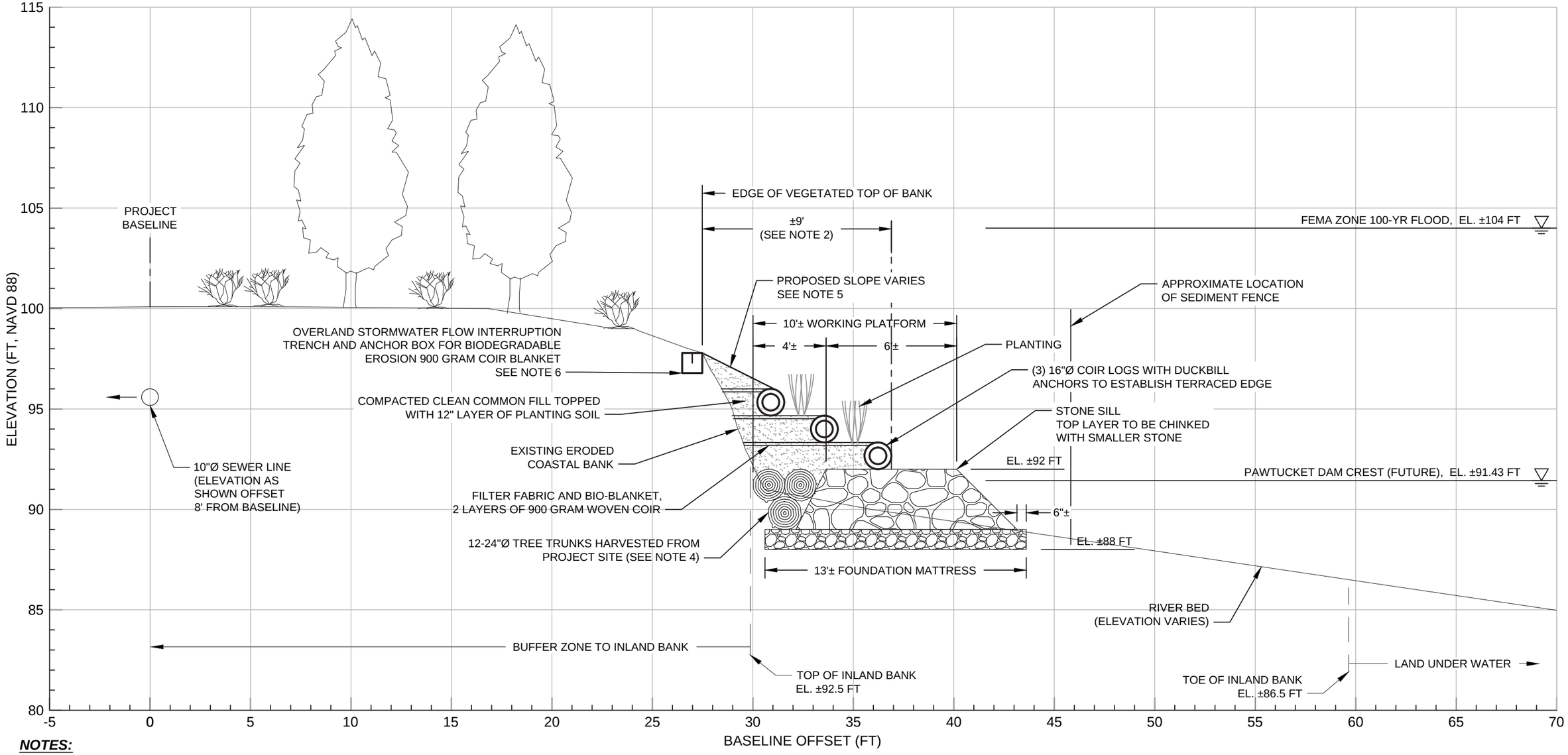
# STA. 23+21




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION M

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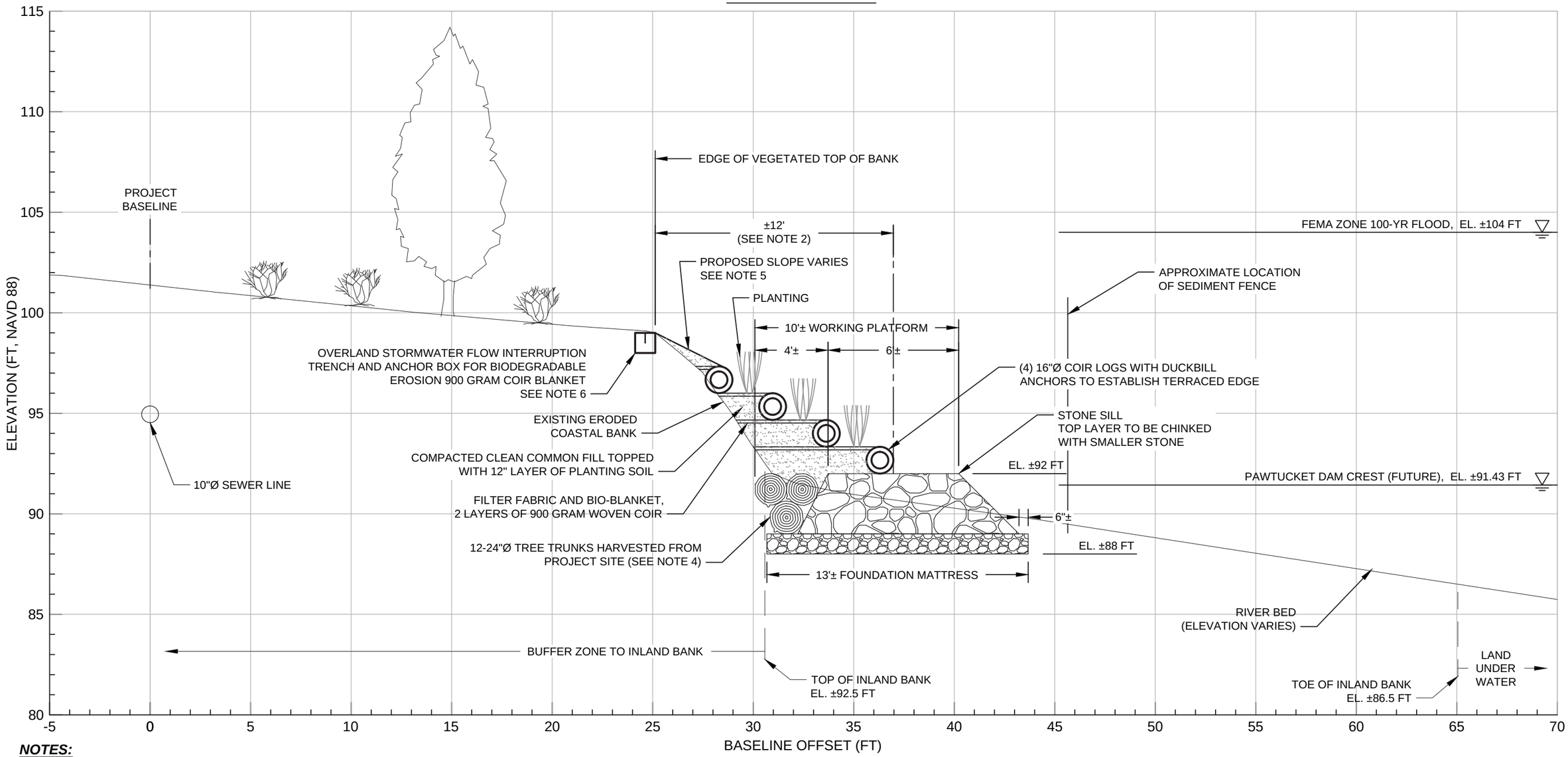
# STA. 24+65




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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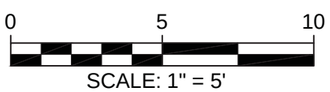
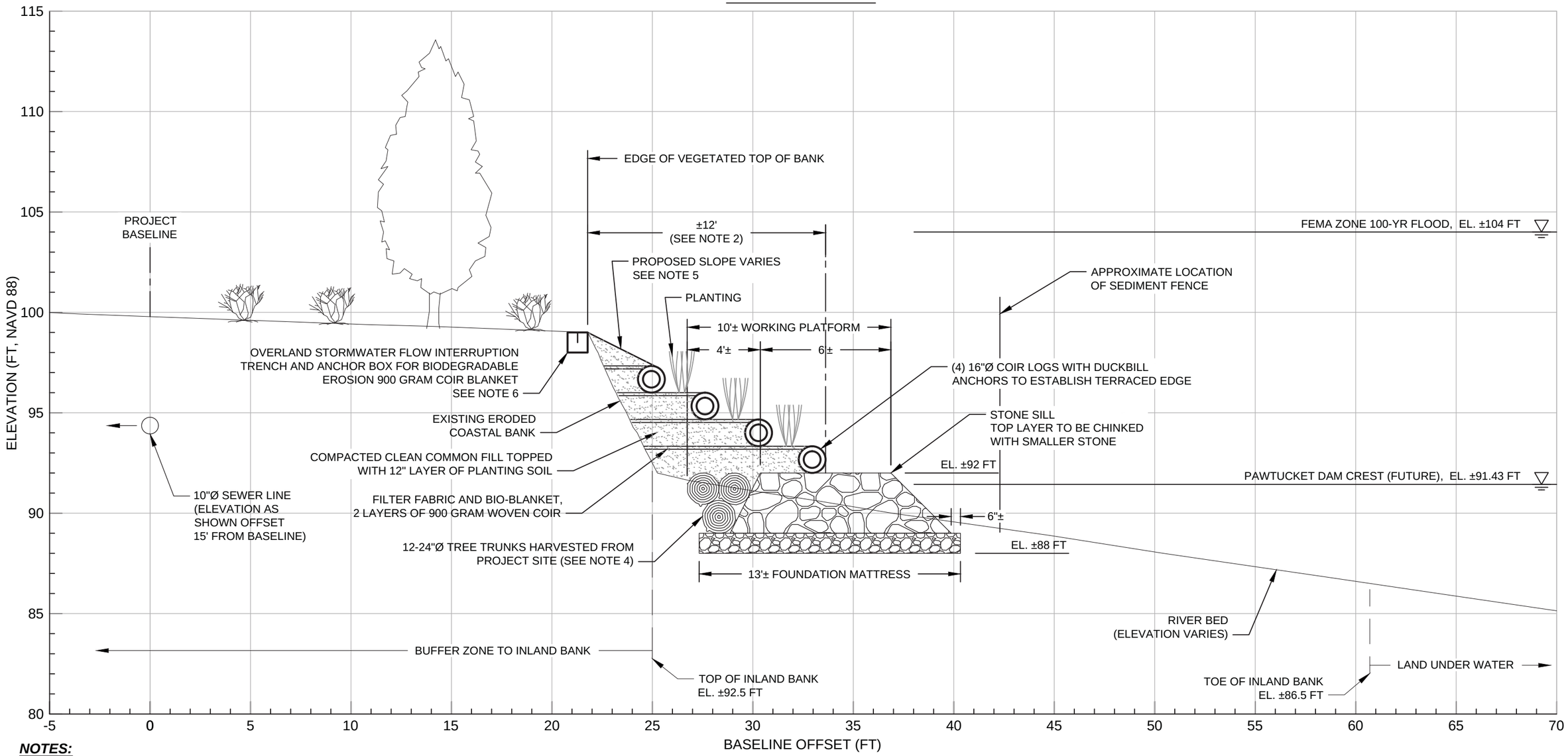
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.




DRAFT

| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION N |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 27 of 39 |

# STA. 26+20




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

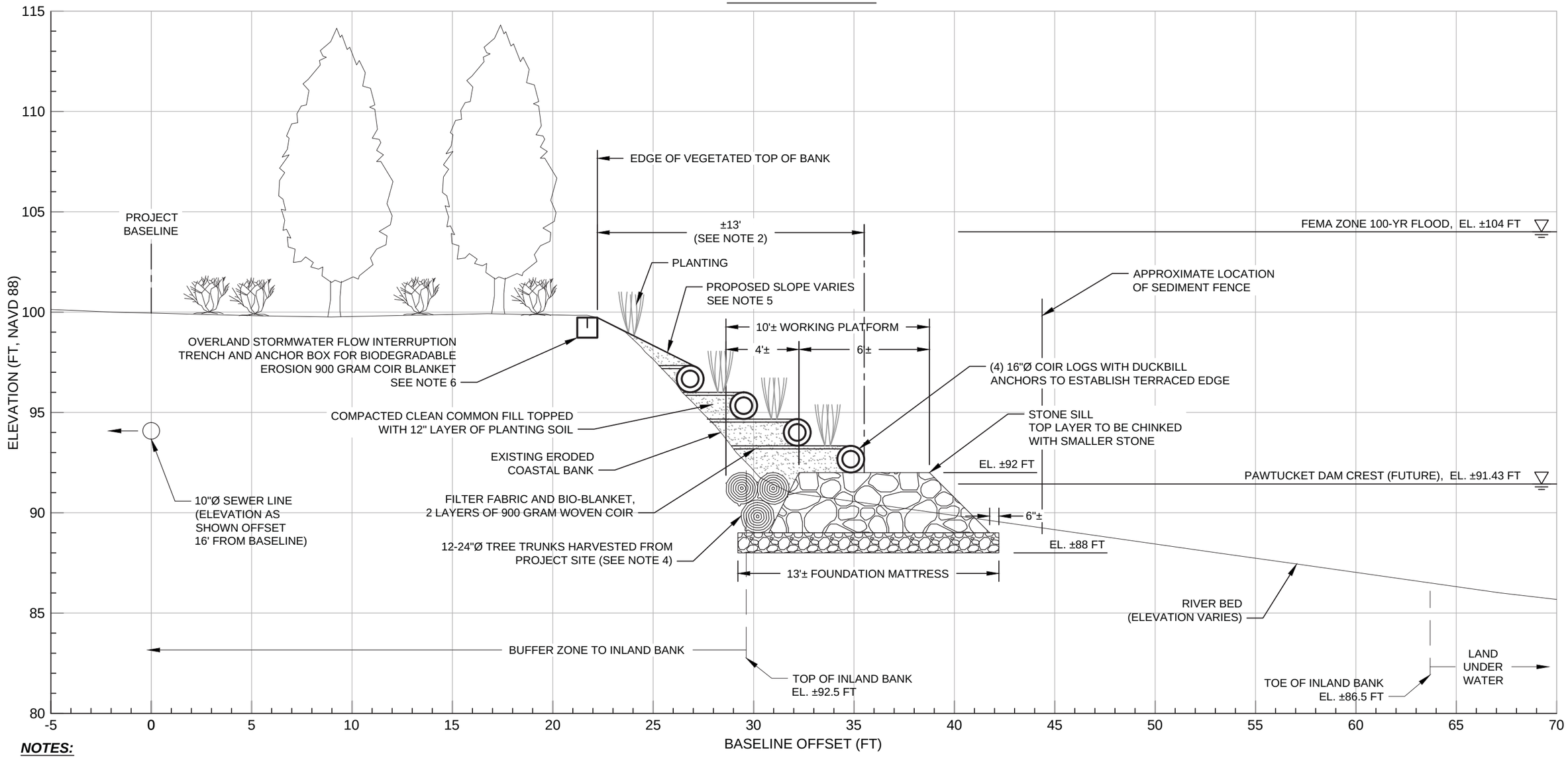
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION O |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 28 of 39 |

# STA. 26+96




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION P

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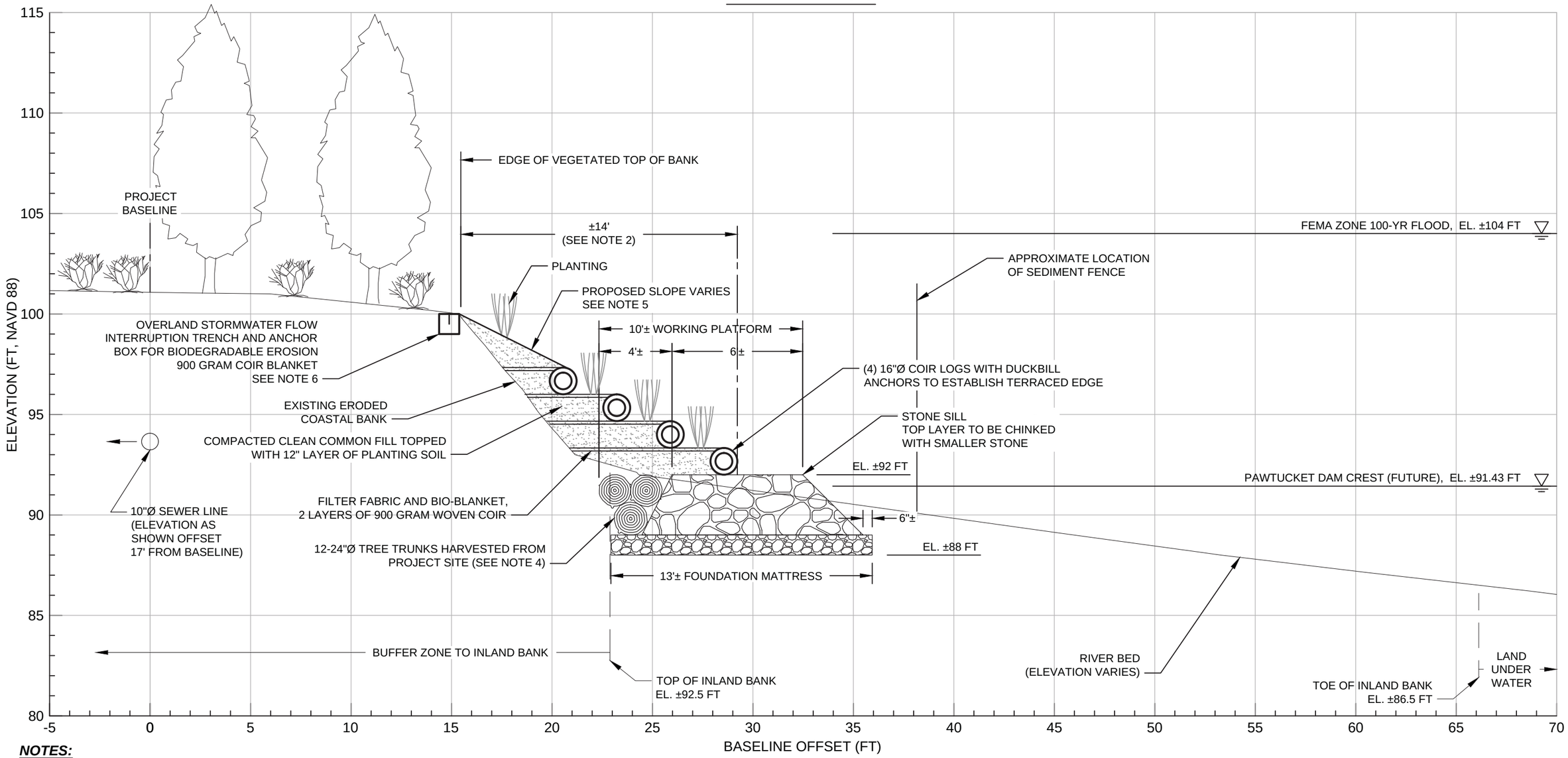
# STA. 27+96




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION Q

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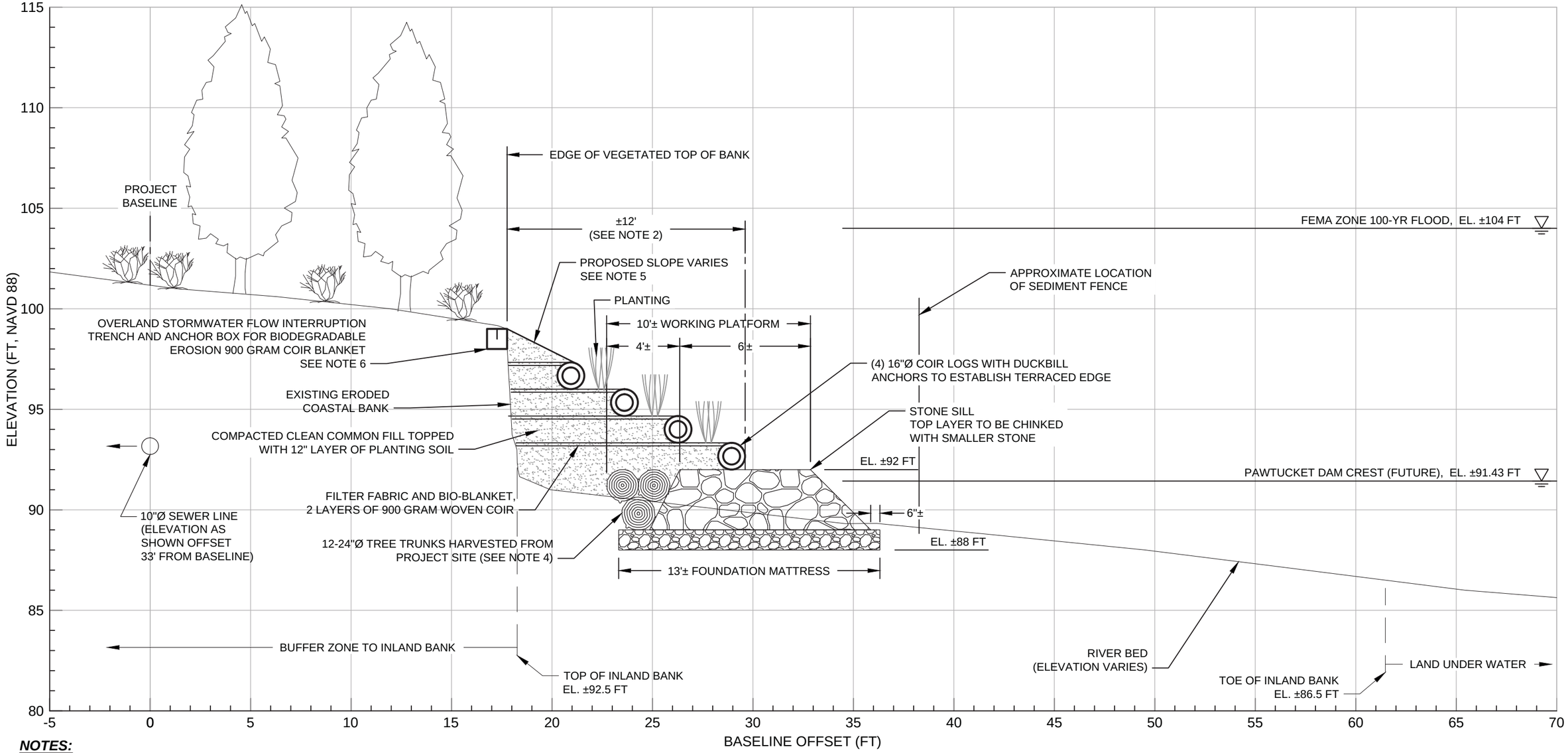
# STA. 30+21




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

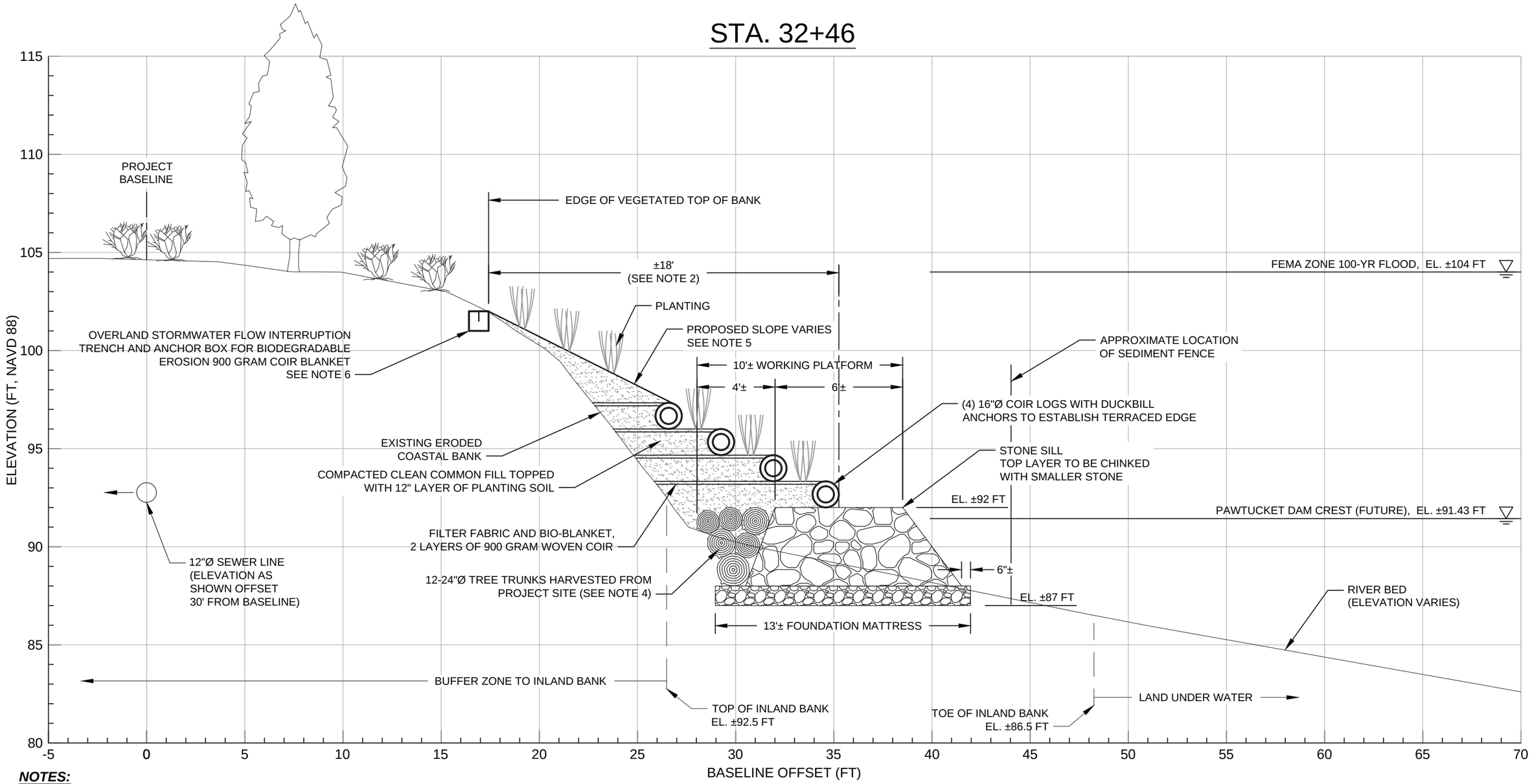
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION R |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 31 of 39 |

# STA. 32+46




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
4. HARVESTED TREE TRUNKS SHALL BE BUNDLED AND PLACED ADJACENT TO THE RIP RAP BERM/SILL TO EXTEND THE WORKING PLATFORM. TREE TRUNKS ARE FOR TEMPORARY USE DURING CONSTRUCTION AND SHALL BE REMOVED AND REPLACED WITH SAND FILL.
5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

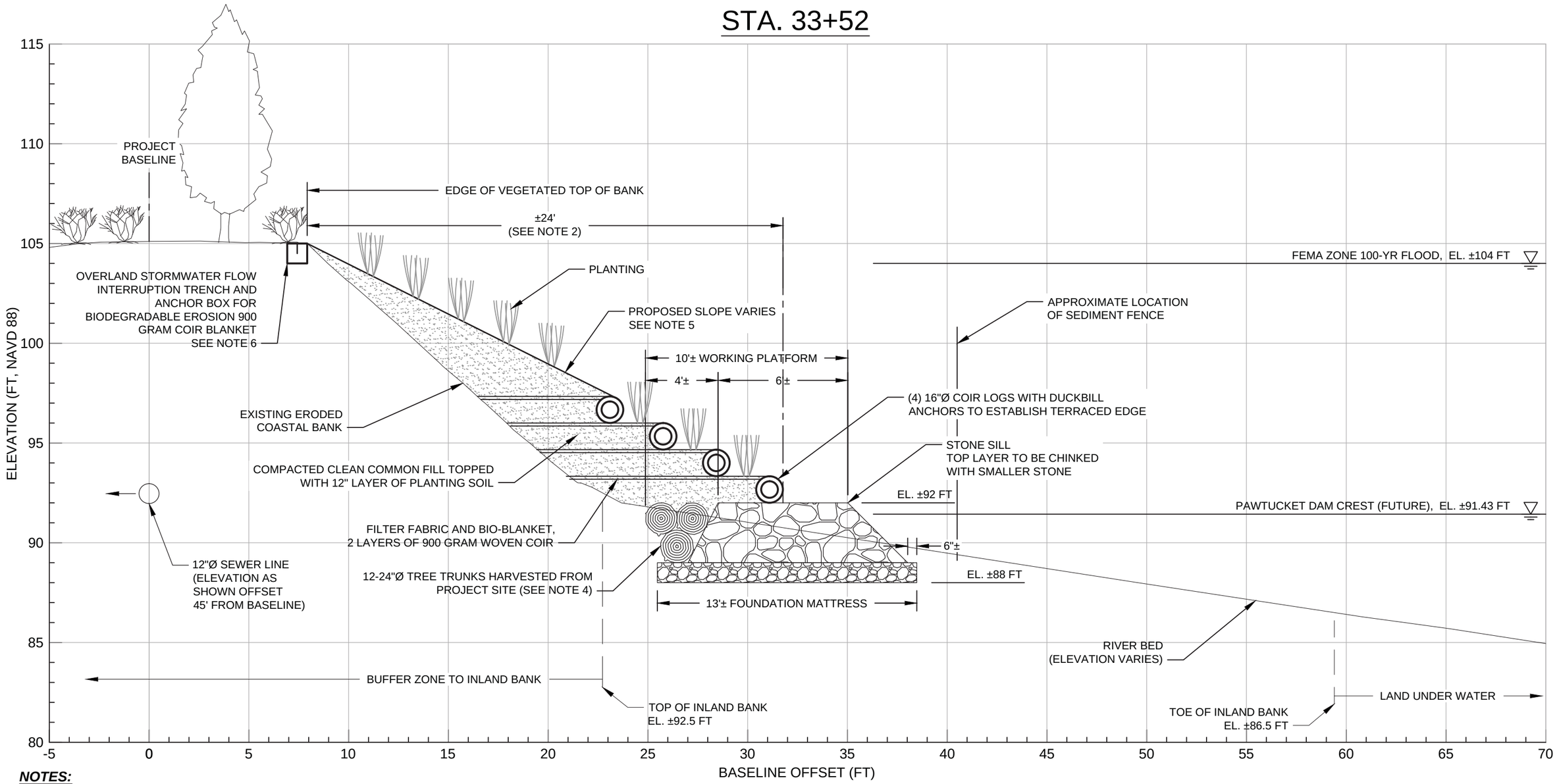
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION S |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 32 of 39 |

# STA. 33+52




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
4. HARVESTED TREE TRUNKS SHALL BE BUNDLED AND PLACED ADJACENT TO THE RIP RAP BERM/SILL TO EXTEND THE WORKING PLATFORM. TREE TRUNKS ARE FOR TEMPORARY USE DURING CONSTRUCTION AND SHALL BE REMOVED AND REPLACED WITH SAND FILL.
5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

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| | | |
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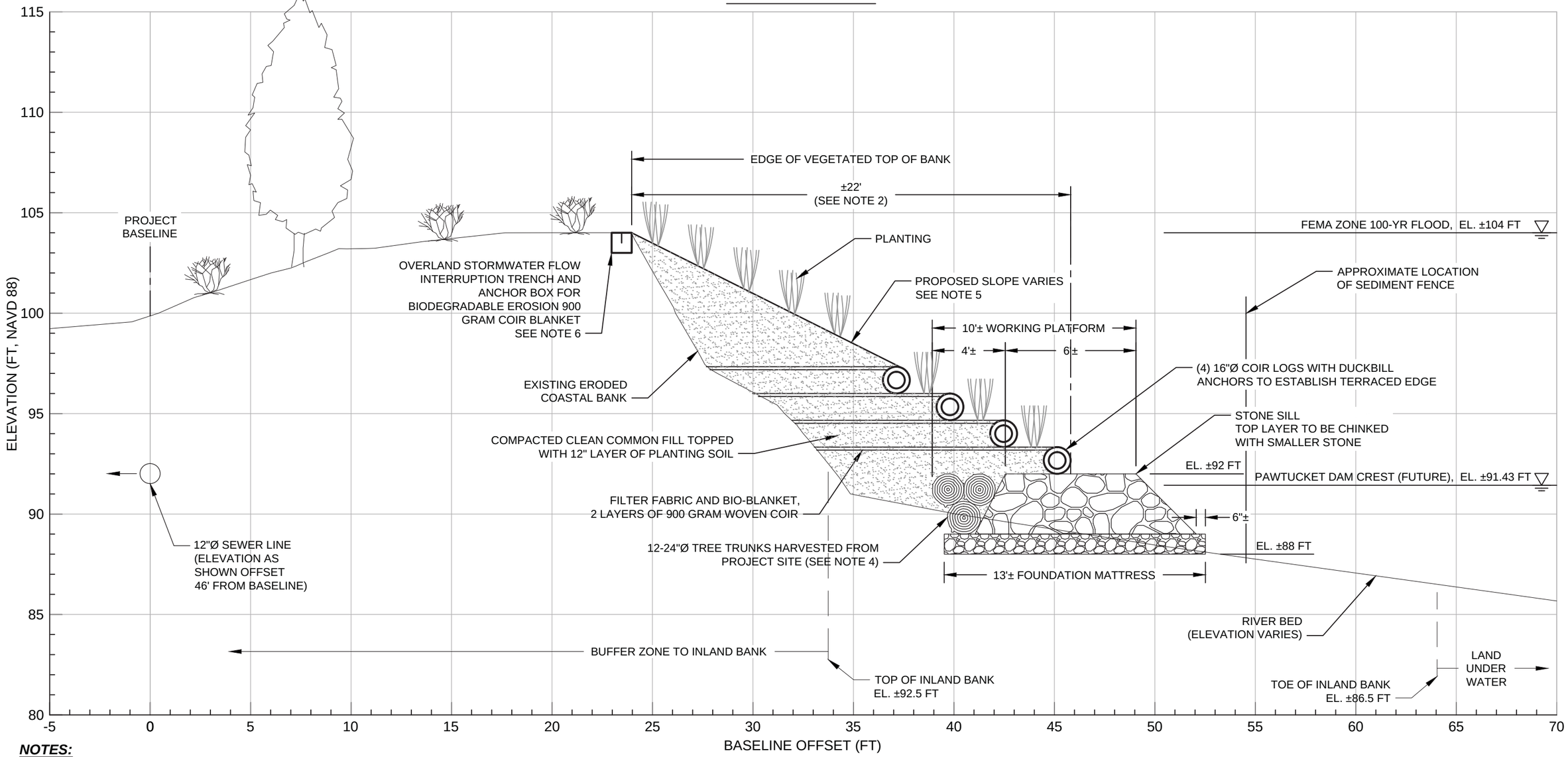
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION T |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 33 of 39 |

# STA. 35+10




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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5. PROPOSED RIVER EDGE STABILIZATION WILL VARY IN SLOPE FROM A MAXIMUM OF 3H:1V TO A MINIMUM OF 1.5H:1V. THIS ACTION WILL PREVENT EXCESSIVE ENCROACHMENT INTO THE RIVER AND WILL MAINTAIN A REASONABLE ALIGNMENT.
6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

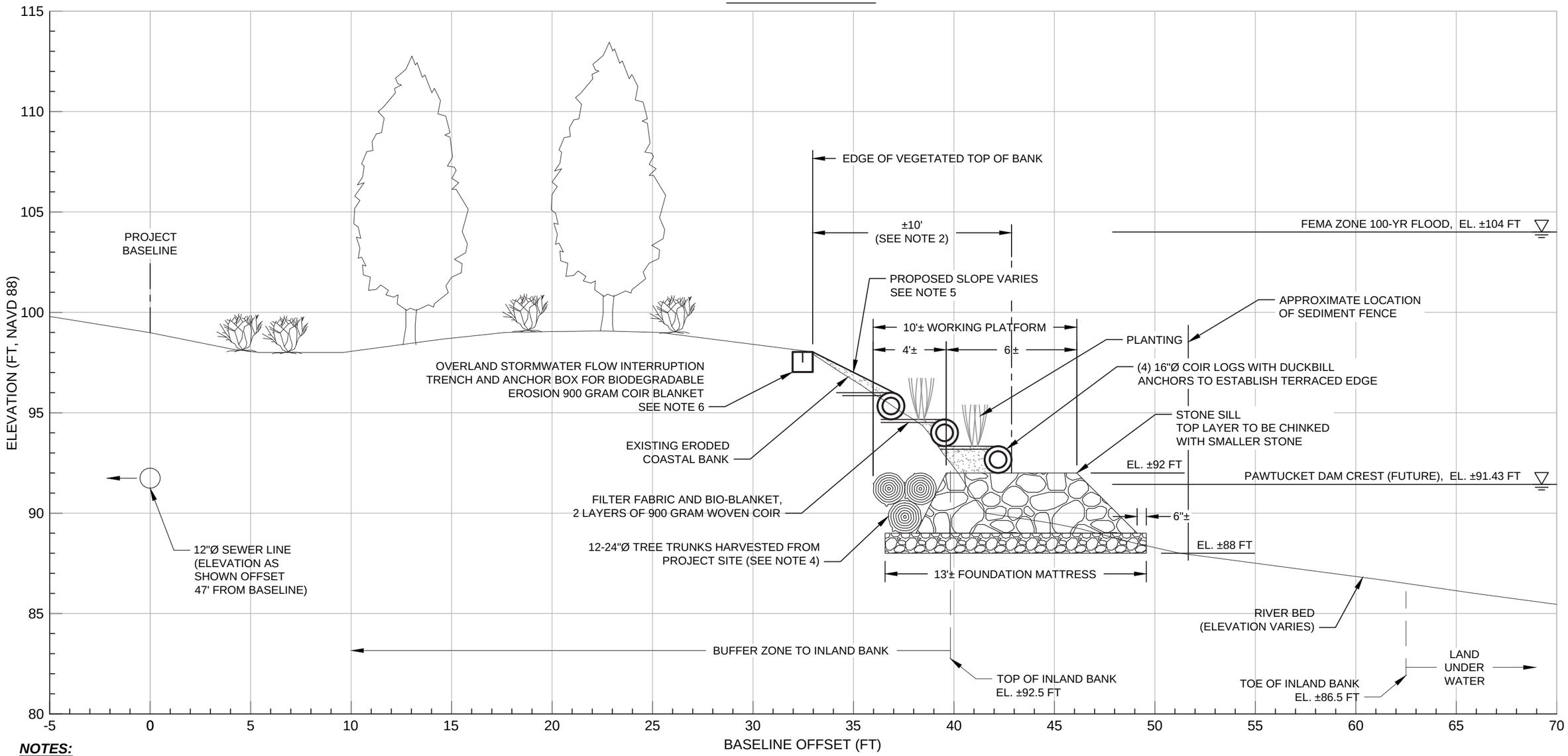
0 5 10

SCALE: 1" = 5'

DRAFT

| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION U |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 34 of 39 |

# STA. 36+21




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

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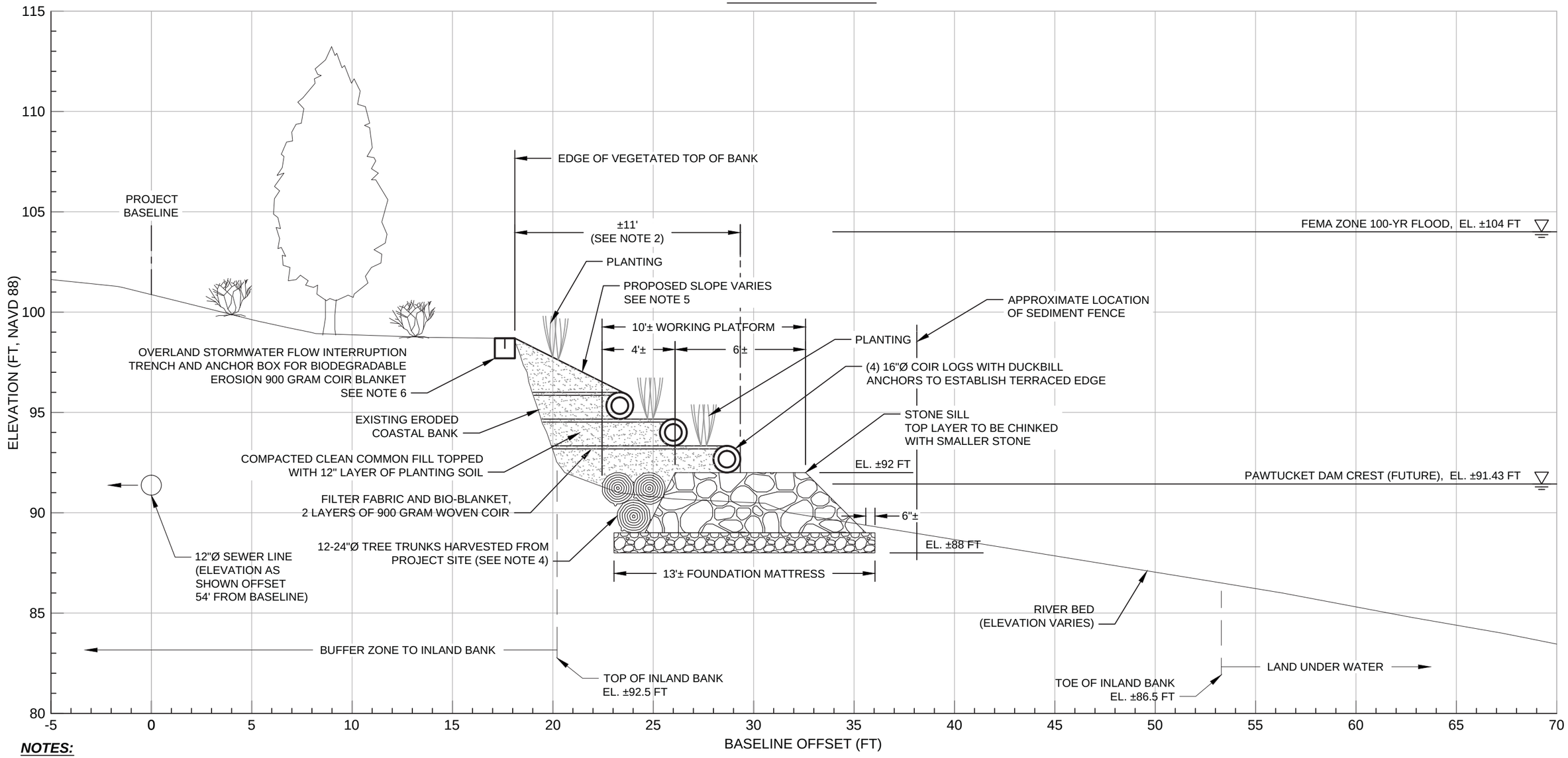
| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | EDGE TYPE 'C'<br>MAJOR DISTURBANCE<br>SECTION V |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 35 of 39 |

# STA. 37+65




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION W

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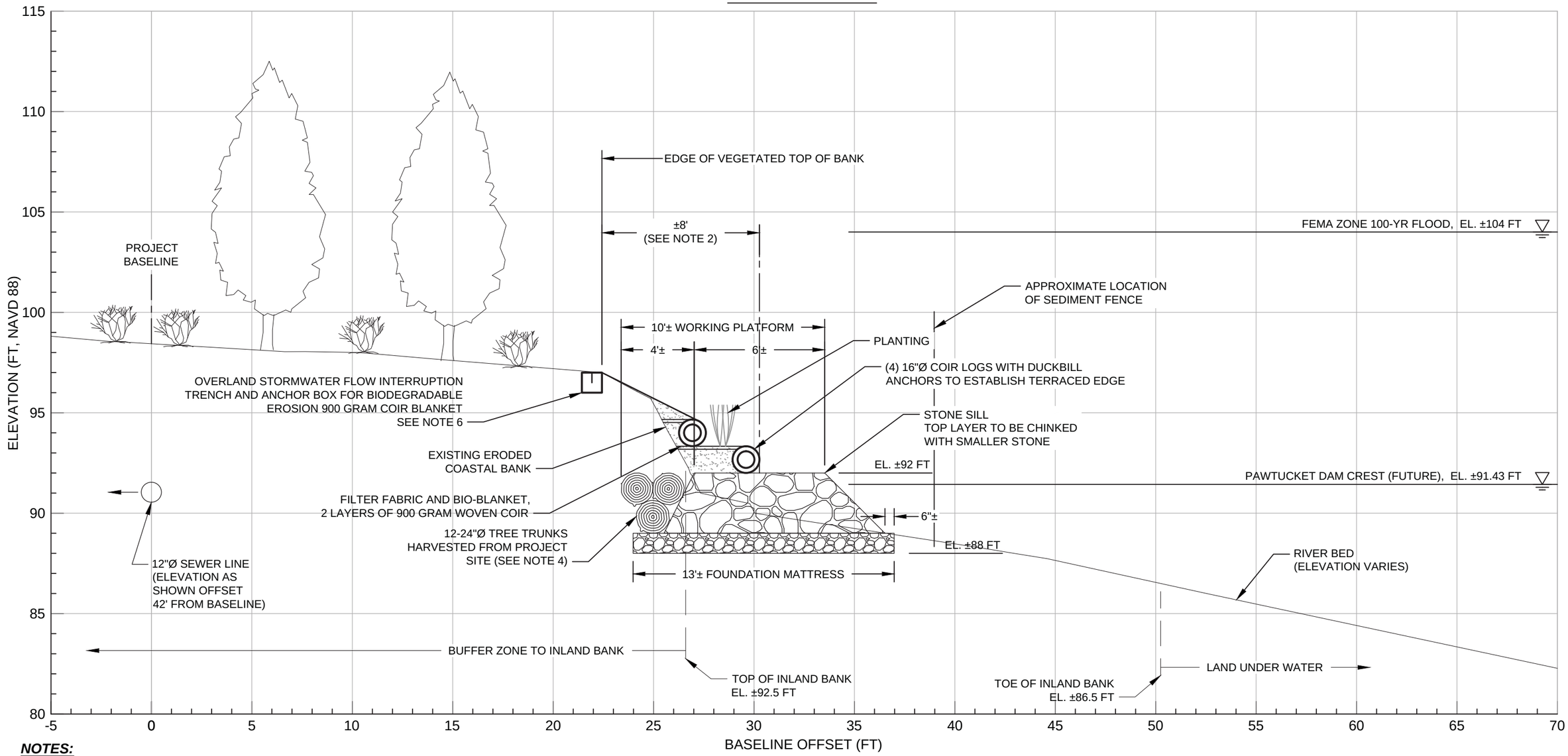
# STA. 38+96




***NOTES:***

1. ALL WORK TO BE DONE FROM THE RIVER BY UTILIZING THE WORKING PLATFORM AS A BASE.
2. MAINTAIN AN APPROXIMATELY 20' DISTANCE FROM THE TOP OF THE EXISTING ERODED COASTAL BANK TO THE CENTER OF THE RIP RAP BERM TO MINIMIZE TREE REMOVAL AND ACHIEVE A 2H:1V PREFERRED SLOPE.
3. ELEVATIONS SHOWN ARE SUBJECT TO CHANGE BASED ON EXISTING FIELD CONDITIONS OBSERVED DURING CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY GEI AND EPSILON OF SIGNIFICANT DISCREPANCIES IN EXPECTED CONDITIONS PRIOR TO CONTINUING WORK.
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6. OVERLAND STORMWATER TRENCH LOCATION TO BE DETERMINED IN THE FIELD. ESTIMATED LENGTH OF 2,000' REQUIRED.

0 5 10

SCALE: 1" = 5'

DRAFT

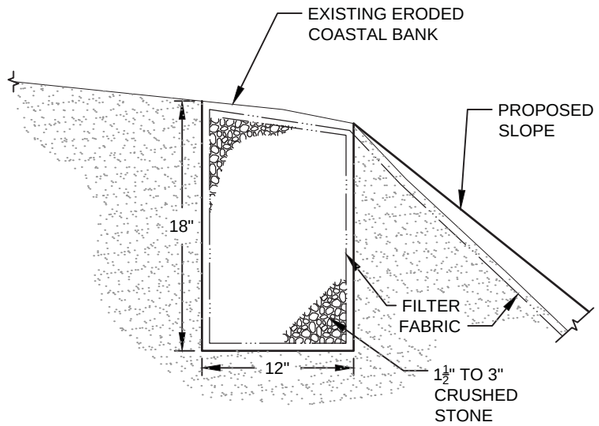
Merrimack Riverbank Stabilization
Wellman Avenue
North Chelmsford, Massachusetts

Town of Chelmsford
Chelmsford, Massachusetts

GEI Consultants

EDGE TYPE 'C'
MAJOR DISTURBANCE
SECTION X

Project 1603860 | November 2016 | Sheet 37 of 39

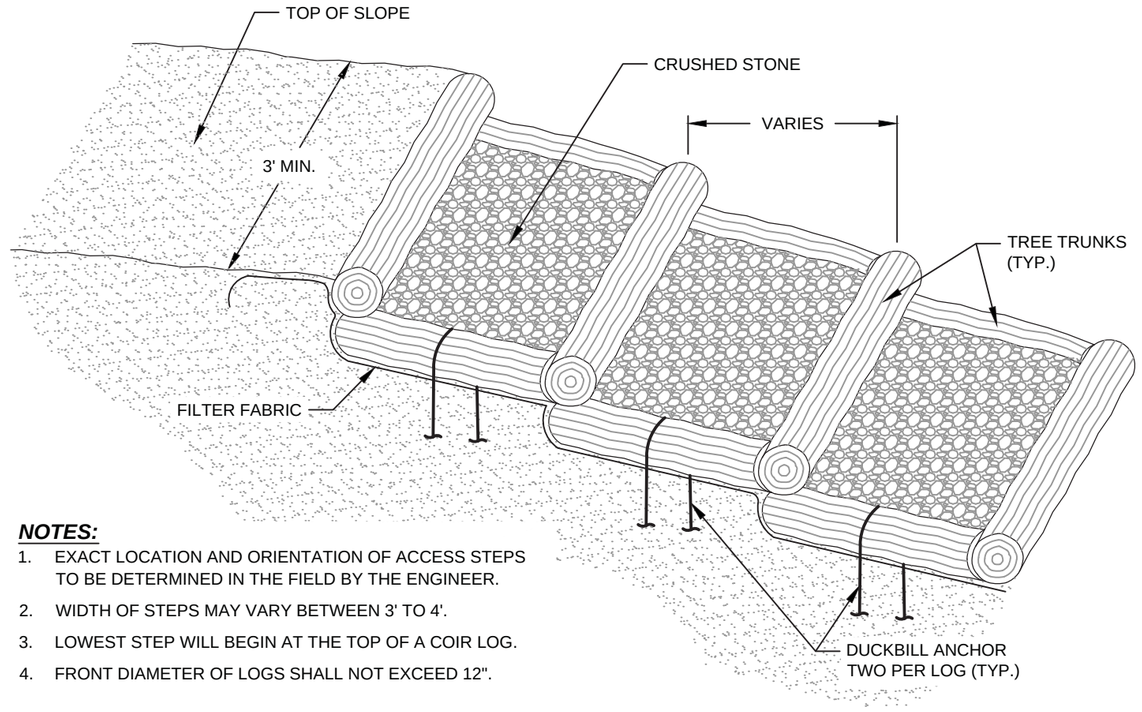



***NOTES:***

1. STORMWATER INTERRUPTION TRENCH SHALL BE INSTALLED ALONG THE TOP OF THE SLOPE TO PREVENT OVERLAND FLOW. LOCATION WILL BE DETERMINED AT THE SITE TO MINIMZE IMPACT ON EXISTING TREE ROOTS.

## STORMWATER FLOW TRENCH

SCALE: 1" = 1'




***NOTES:***

1. EXACT LOCATION AND ORIENTATION OF ACCESS STEPS TO BE DETERMINED IN THE FIELD BY THE ENGINEER.
2. WIDTH OF STEPS MAY VARY BETWEEN 3' TO 4'.
3. LOWEST STEP WILL BEGIN AT THE TOP OF A COIR LOG.
4. FRONT DIAMETER OF LOGS SHALL NOT EXCEED 12".

## TYPICAL ACCESS STAIRS

SCALE: 1" = 2'

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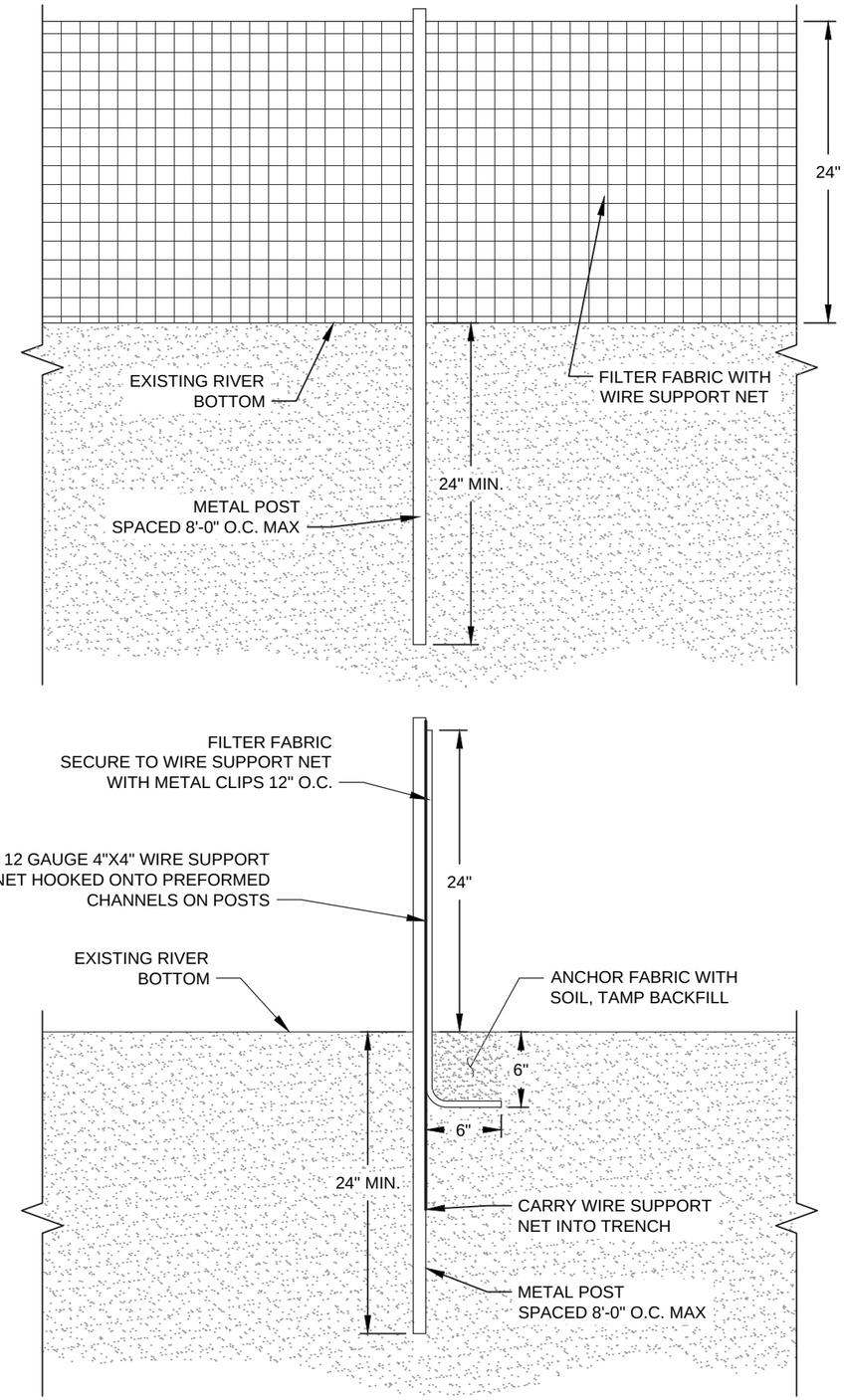
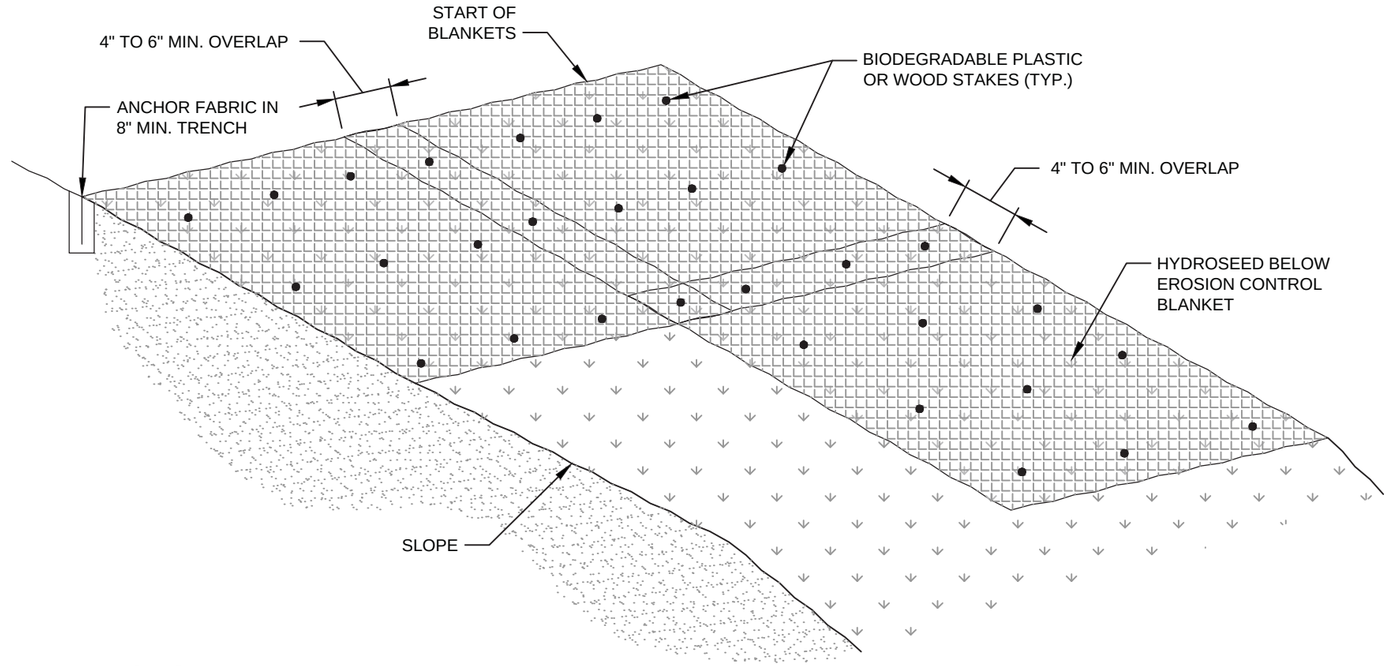
| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | CONSTRUCTION DETAILS<br>(1 OF 2) |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 38 of 39 |




## SEDIMENT FENCE

SCALE: 1" = 1'




***NOTES:***

1. PLACE AND PREPARE TOPSOIL AND HYDROSEED.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING FABRIC IN 8" MIN. TRENCH, BACKFILLING, AND COMPACTING.
3. UNROLL EROSION CONTROL BLANKETS DOWN OR HORIZONTALLY ACROSS THE SLOPE FOR GRASS-LINED SWALE INSTALLATION. UNROLL BLANKETS IN DIRECTION OF WATER FLOW. OVERLAP ALL ADJACENT BLANKETS END OVER END (SHINGLE STYLE). MINIMIZE DISTURBANCE OF HYDROSEED DURING FIBER ROLL INSTALLATION. REPLACE DAMAGED AREAS WITH HAND BROADCAST SEED.
4. SECURELY FASTEN EROSION CONTROL BLANKETS TO THE 6" TOPSOIL LAYER AND SUBGRADE USING BIODEGRADABLE PLASTIC OR WOOD STAKES. STAKES SHALL BE OF SUFFICIENT LENGTH TO SECURE TO THE SUBGRADE. STAKE SPACING AND PATTERN SHALL BE AS RECOMMENDED BY THE MANUFACTURER. STAKE SPACING AND PATTERN SHOWN HEREIN IS FOR ILLUSTRATION PURPOSES ONLY.

## EROSION CONTROL BLANKET

SCALE: 1" = 2'

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| | | |
|---|---|---|
| Merrimack Riverbank Stabilization<br>Wellman Avenue<br>North Chelmsford, Massachusetts | GEI Consultants | CONSTRUCTION DETAILS<br>(2 OF 2) |
| Town of Chelmsford<br>Chelmsford, Massachusetts | Project 1603860 | November 2016 Sheet 39 of 39 |

# Document C – Floodplain and Wetland 8-Step

# EXECUTIVE ORDER 11988 Floodplain Management and 11990 Wetlands Protection

## TITLE: Merrimack River Bank Stabilization

DESCRIPTION OF PROJECT: The proposed SOW includes bioengineering bank stabilization that would stabilize the bank using a mixture of structural components such as a stone toe and natural components such as timber, coir rolls, and living vegetation. There are three stabilization techniques proposed for each edge type which include:

- Bank Support for Edge Type A: Work involves installation of timber toe protection and vegetation management, including up-limbing of trees, on the slope. The approximate width of this treatment is 10 feet. Bank Support is proposed for approximately 250linear feet.
- Bank Repair for Edge Type B: Work involves installation of stone sill along the toe of slope to one foot above ordinary high water, and placing soil behind the sill which would establish a shallow slope. One or more coir log would be placed on top of the stone sill to hold the soil in place to establish a +3:1 slope. Stabilization will be done using seed sowing, erosion control blankets, and native shrubs. Typical offset from the toe of slope to the centerline of the stone sill is approximately 7.5 feet and the offset to the outboard limit of the stone sill is approximately 14 feet. Bank Repair is proposed for approximately 450 lf
- Bank Reconstruction for Edge Type C: Work involves installation of a stone sill along the toe of slope to approximately 0.5 feet above ordinary high water mark and restoring the entire slope cross-section with the installation of several rows of coir fiber rolls and fabric wrapped soils cells in a step-wise manner to establish a 2:1 slope. Revegetation of the soils cells with native trees and shrubs would provide soil stabilization. The offset form the toe of the slope to centerline of stone sill is approximately 7.5 feet and rangers from 1 to 12 feet. The out board offset of the stone sill is approximately 14 feet and ranges from 75. To 18.5 feet. Bank Reconstruction is propose for approximately 3,250 linear feet.

In all edge type zones, trees on the slope and along the top of the slope that are deemed in imminent danger of toppling would be removed. Work will be done landward and therefore, will not have water egress points and anchoring locations. Work would occur in approximately 3,950 linear feet of inland bank and approximately 145,250 square feet of riverfront area and bordering land. 59,250 square feet of the 145,205 square feet will occur in waters of the US with an approximately 13 foot wide by 2 foot deep by 3,700 foot long excavation. Reusing of excavated soils would occur and therefore, no off site fill will be brought in. Project is located between the Merrimack River and Wellman Ave in Chelmsford, MA (42.647644, -71.392505 to 42.645174, -71.379039).

**STEP 1 Determine whether the proposed action is located in the 100-year floodplain (500-year floodplain for critical actions)**

**YES** the project is located in the 100 Year floodplain as mapped by FIRM Panel No.

25017C01193E date: 06/04/2010. This project is located within the AE Zone (100-year) and Floodway AE zone.

**Wetland.** The proposed action is located in a wetland mapped by USFW Dated 04/18/2017.

**STEP 2 Notify the public at the earliest possible time of the intent to carry out an action in a floodplain and involve the affected and interested public in the decision-making process.**

The public notice was provided by FEMA of Public Assistance projects by cumulative public notice after the major disaster declaration.

**STEP 3 Identify and evaluate practicable alternatives to locating the proposed action in a floodplain (including alternatives sites, actions and the "no action" option). If a practicable alternative exists outside the floodplain FEMA must locate the action at the alternative site.**

**Alternative Options**

1. **No Action Alternative –**If no action is taken, the bank of the Merrimack River would continue to erode potentially exposing the adjacent sewer line to the river. This could cause the line to fail and contaminate the river with untreated sewage.
2. **Proposed Alternative –** The proposed alternative of bioengineering bank stabilization would mitigate against erosion and sewer line exposure. This would mitigate against potential sewage contamination in the river.
3. **Alternative within the floodplain** – The proposed alternative of rock rip rap installation would mitigate against erosion and sewer line exposure. This would mitigate against potential sewage contamination in the river.
4. **Alternative outside the floodplain** – It would be costly and unfeasible to relocate the sewer line outside the floodplain. The line would not function for the community that requires it due to the distance from the floodplain.

**STEP 4 Identify the potential direct and indirect impacts associated with the occupancy or modification of floodplains and the potential direct and indirect support of floodplain development that could result from the proposed action. 44CFR Part 9.10**

**Alternative Options**

1. **No Action Alternative** – If no action is taken, the bank would continue to erode potentially exposing the adjacent sewer line to the river. This could cause the line to fail and contaminate the river with untreated sewage.
2. **Proposed Alternative** – Would reduce the rate of erosion at the bank protecting the sewer line from exposure.
3. **Alternative within the floodplain** – Would reduce the rate of erosion at the bank protecting the sewer line from exposure.
4. **Alternative outside the floodplain** – N/A

**STEP 5 Minimize the potential adverse impacts and support to or within floodplains to be identified under Step 4, restore and preserve the natural and beneficial values served by floodplains.**

**Alternative Options**

1. **No Action Alternative** – If no action is taken the bank could erode up to the sewer line exposing to the river water and cause potential contamination.
2. **Proposed Alternative** –By using bioengineering techniques the bank work would reduce erosion rates while keeping the floodplain in a natural state
3. **Alternative within the floodplain** – By using rock rip rap the bank work would reduce erosion rates but would not keep the floodplain in a natural state.
4. **Alternative outside the floodplain** – N/A

**STEP 6 Reevaluate the proposed action to determine first, if it is still practicable in light of its exposure to flood hazards or impacts on wetlands, the extent to which it will aggravate the hazards to others, and its potential to disrupt floodplain and wetland resources and second, if alternatives preliminarily rejected at Step 3 are practicable in light of the information gained in Steps 4 and 5. FEMA shall not act in a floodplain unless it is the only practicable location.**

**Alternative Options**

1. **No Action Alternative –** This choice would continue to leave the area vulnerable to sewer line exposure and failure.
2. **Proposed Alternative –** This is the best alternative to mitigate against erosion and sewer line exposure while keeping the floodplain in a natural state.
3. **Alternative within the floodplain** – Though this alternative would mitigate against erosion and sewer line exposure the floodplain would be altered from a natural to a built up state.
4. **Alternative outside the floodplain** – N/A

**STEP 7 Prepare and provide the public with a finding and public explanation of any final decision that the floodplain is the only practicable alternative.**

A public notice will be provided by FEMA by cumulative public notice after the close of the major disaster declaration.

**STEP 8 Review the implementation and post - implementation phases of the proposed action to ensure that the requirements stated in Section 9.11 are fully implemented.**

It has been determined by FEMA that the Proposed Alternative is the most practicable Alternative available.

**CONDITIONS TO BE PLACED ON ACTION:** Applicant must coordinate with the local

floodplain administrator and must obtain any required approval prior to initiating work. All coordination pertaining to these activities and applicant compliance with any conditions should be documented and copies forwarded to the state and FEMA for inclusion in the permanent project files.

1. Applicant is working in a floodway and must apply for a no-rise certification and follow all requirements per 44 CFR 60.3(d).
2. If deviations from the proposed scope of work (including conditions) result in design changes, the need for additional ground disturbance, additional removal of vegetation, or result in any other unanticipated changes to the physical environment, the Grantee must contact FEMA, and a re-evaluation under NEPA and other applicable environmental laws will be conducted by FEMA.

# Document D – USFW IpaC Report

**IPaC** Information for Planning and Consultation **U.S. Fish & Wildlife Servi**

# IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as trust resources) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

## Location

Middlesex County, Massachusetts


## Local office

New England Ecological Services Field Office

(603) 223-2541

(603) 223-0104

70 Commercial Street, Suite 300
Concord, NH 03301-5094

http://www.fws.gov/newengland

# Endangered species

**This resource list is for informational purposes only and does not constitute an analysis of project level impacts.**

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] are managed by the Endangered Species Program of the U.S. Fish and Wildlife Service.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC

also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

# Mammals

| NAME | STATUS |
|---|---|
| Northern Long-eared Bat Myotis septentrionalis<br>No critical habitat has been designated for this species.<br>https://ecos.fws.gov/ecp/species/9045 | Threatened |

# Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

# Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-

species/
birds-of-conservation-concern.php

- Conservation measures for birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location. It is not a list of every bird species you may find in this location, nor a guarantee that all of the bird species on this list will be found on or near this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

| NAME | SEASON(S) |
|---|---|
| American Bittern Botaurus lentiginosus https://ecos.fws.gov/ecp/species/6582 | Breeding |
| American Oystercatcher Haematopus palliatus https://ecos.fws.gov/ecp/species/8935 | Breeding |
| Bald Eagle Haliaeetus leucocephalus https://ecos.fws.gov/ecp/species/1626 | Year-round |
| Black-billed Cuckoo Coccyzus erythropthalmus https://ecos.fws.gov/ecp/species/9399 | Breeding |
| Blue-winged Warbler Vermivora pinus | Breeding |
| Canada Warbler Wilsonia canadensis | Breeding |
| Least Bittern Ixobrychus exilis https://ecos.fws.gov/ecp/species/6175 | Breeding |
| Olive-sided Flycatcher Contopus cooperi https://ecos.fws.gov/ecp/species/3914 | Breeding |

| | |
|---|---|
| Peregrine Falcon Falco peregrinus https://ecos.fws.gov/ecp/species/8831 | Breeding |
| Pied-billed Grebe Podilymbus podiceps | Breeding |
| Prairie Warbler Dendroica discolor | Breeding |
| Purple Sandpiper Calidris maritima | Wintering |
| Short-eared Owl Asio flammeus https://ecos.fws.gov/ecp/species/9295 | Wintering |
| Willow Flycatcher Empidonax traillii https://ecos.fws.gov/ecp/species/3482 | Breeding |
| Wood Thrush Hylocichla mustelina | Breeding |

**What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?**

**Landbirds:**

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

**Atlantic Seabirds:**

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAANCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the Northeast Ocean Data Portal. The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAANCCOS models: the models were developed as part of the NOAANCCOS project: Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf. The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the Northeast Ocean Data Portal, which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

**Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?**

**Landbirds:**

The Avian Knowledge Network (AKN) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest,survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the Migratory Bird Programs AKN Histogram Tools webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North, Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

**Atlantic Seabirds:**

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAANCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

# Facilities

# Wildlife refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

# Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

# Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location overlaps the following wetlands:

RIVERINE

R2UBH

A full description for each wetland code can be found at the National Wetlands Inventory website: https://ecos.fws.gov/ipac/wetlands/decoder

**Data limitations**

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the

image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

### Data exclusions

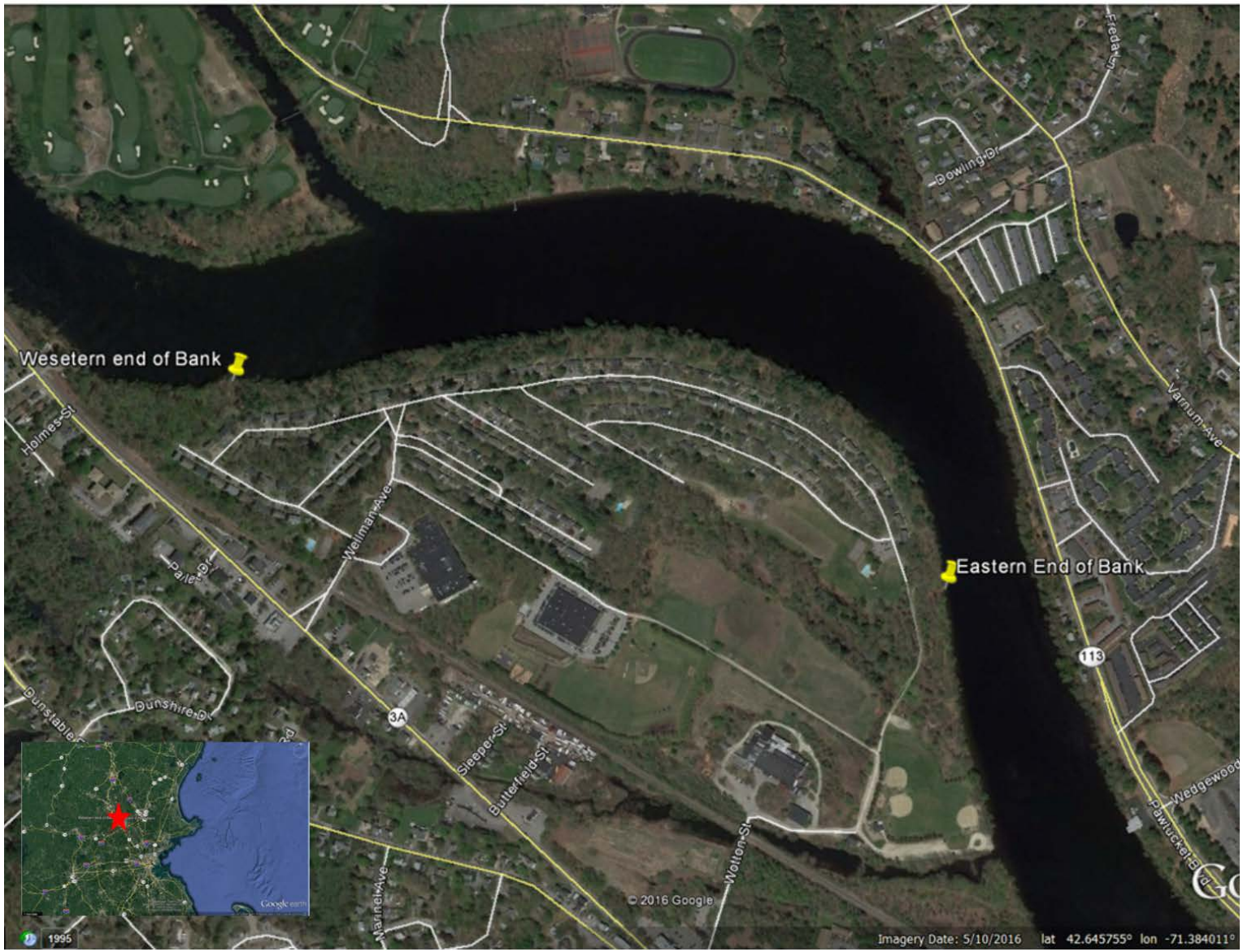
Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

### Data precautions

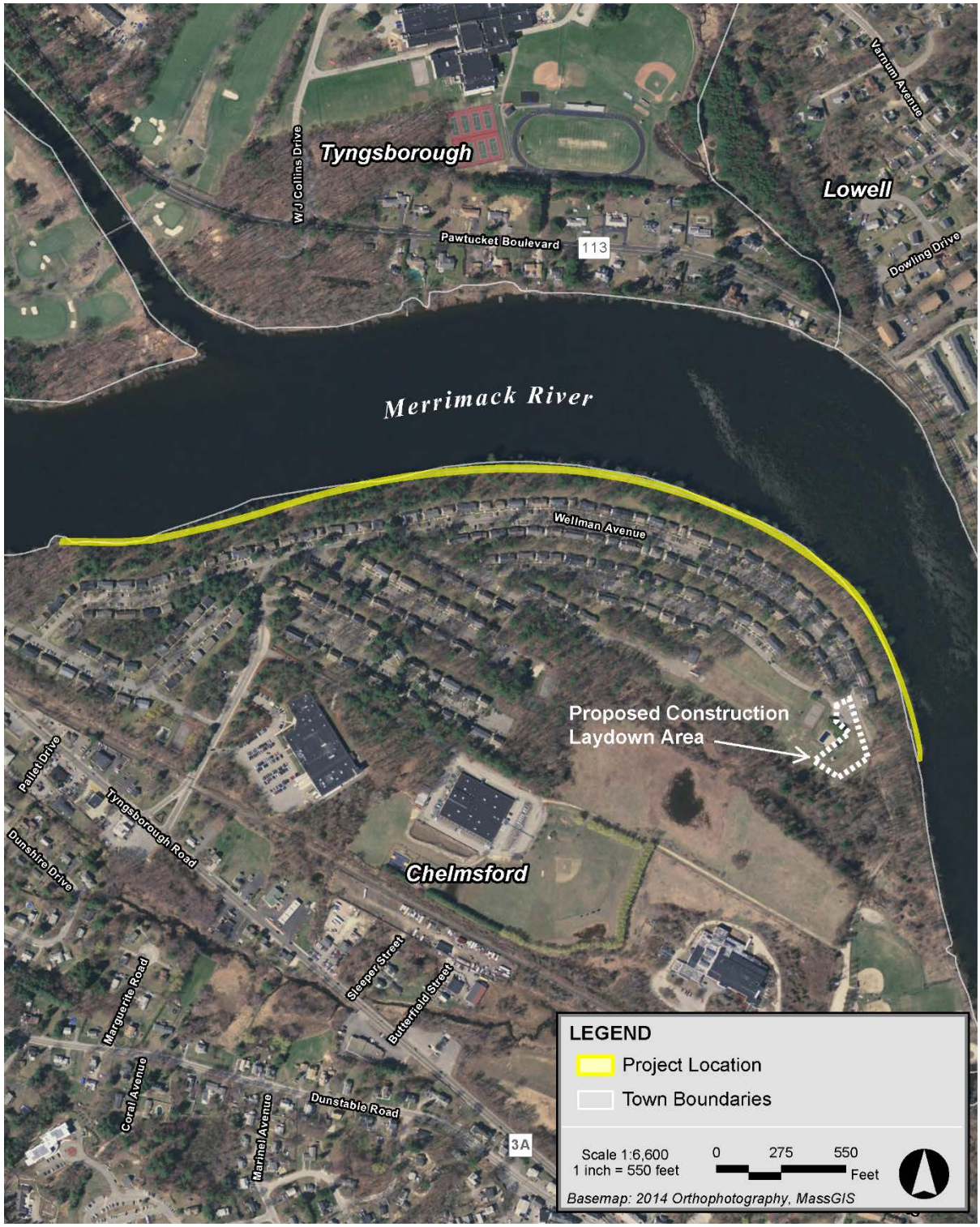
Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

# Appendices B: Figures

# Figure A – Site Location Map



# Figure B – Staging Area Map




**Merrimack River Bank Stabilization Project** **Chelmsford, Massachusetts**

Epsilon ASSOCIATES INC.

**Exhibit 1**
*Aerial Locus Map*

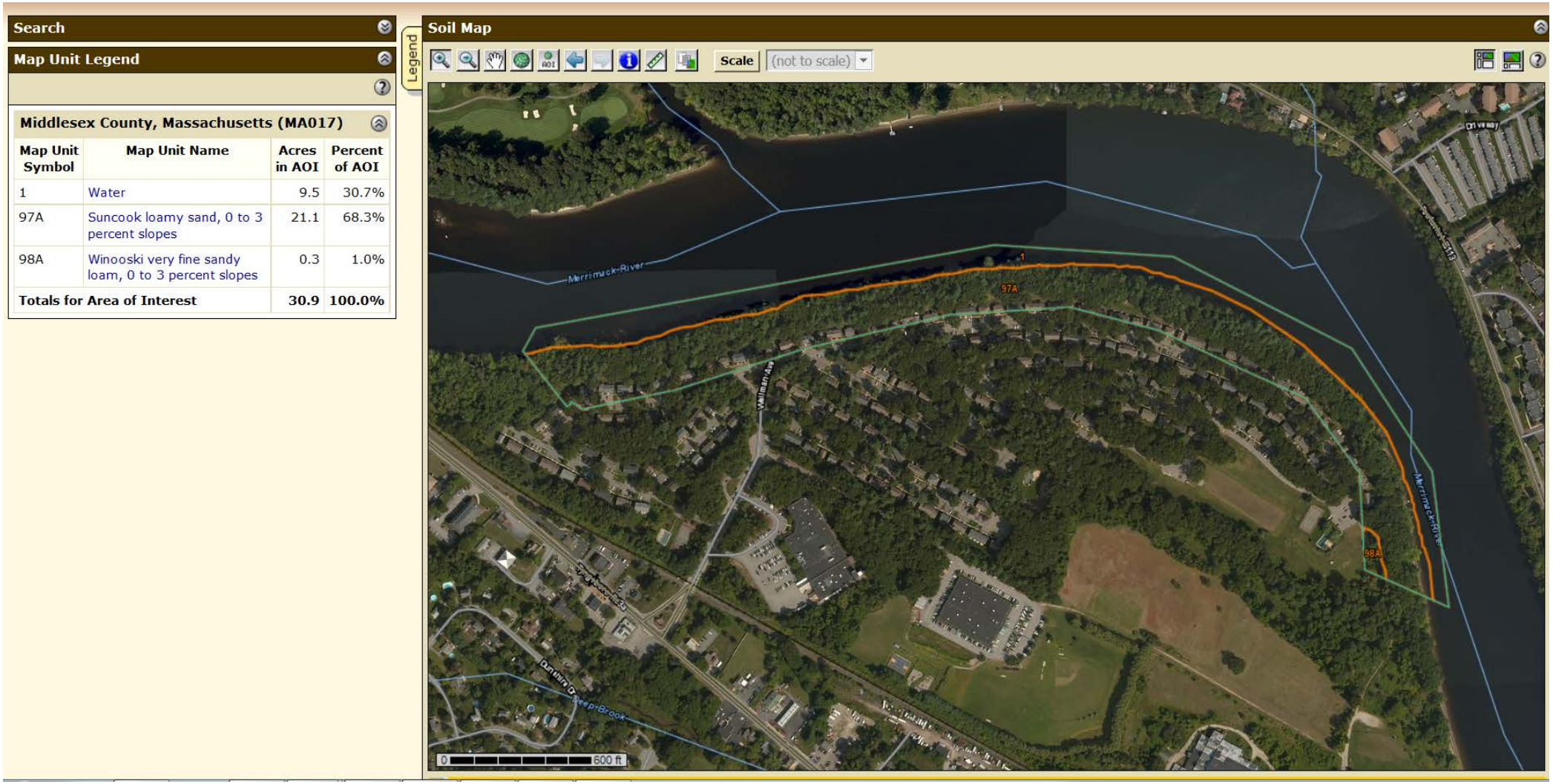
# Figure C – Soil Map

Search

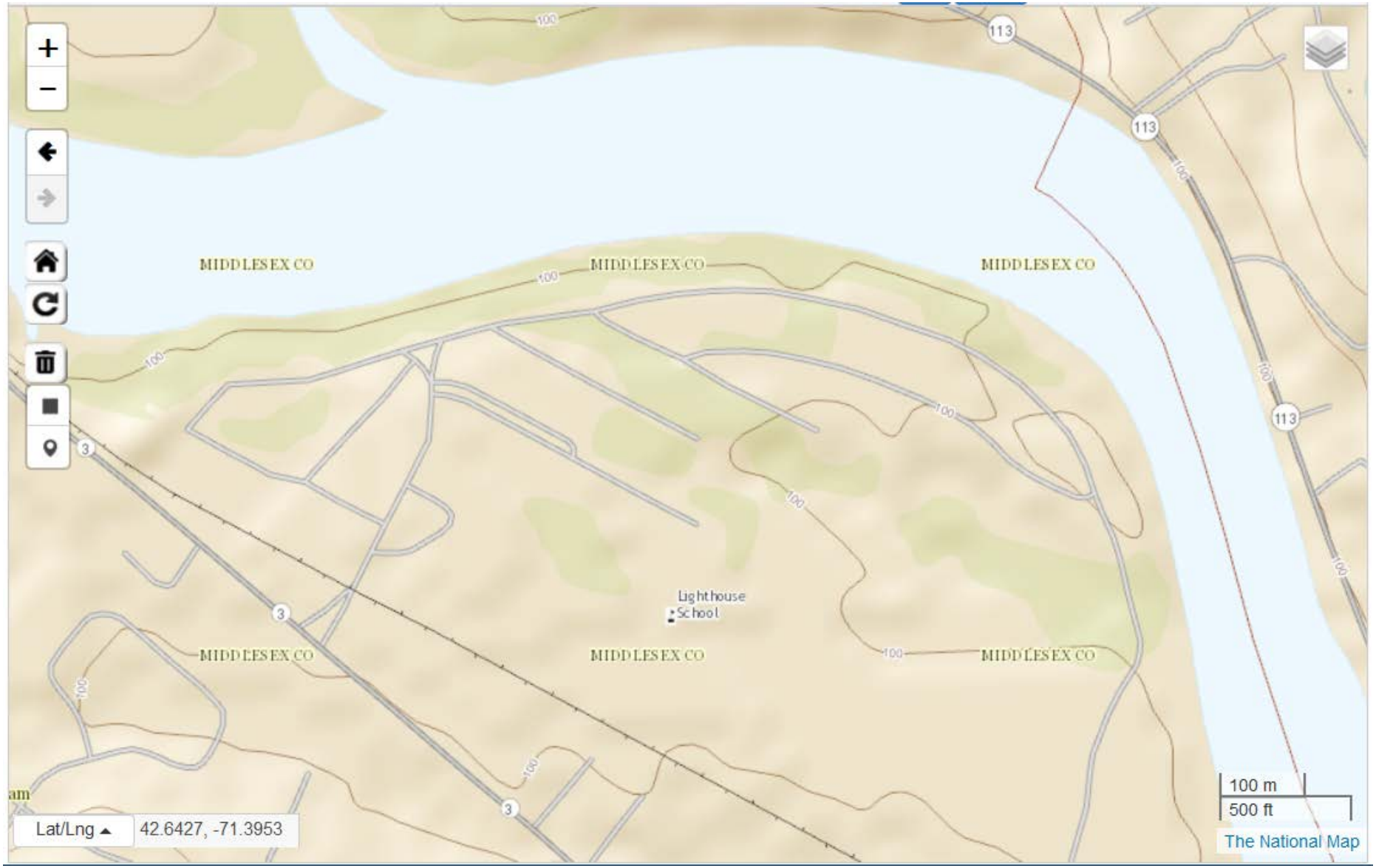
Map Unit Legend

Middlesex County, Massachusetts (MA017)

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 1 | Water | 9.5 | 30.7% |
| 97A | Suncook loamy sand, 0 to 3 percent slopes | 21.1 | 68.3% |
| 98A | Winooski very fine sandy loam, 0 to 3 percent slopes | 0.3 | 1.0% |
| **Totals for Area of Interest** | | **30.9** | **100.0%** |

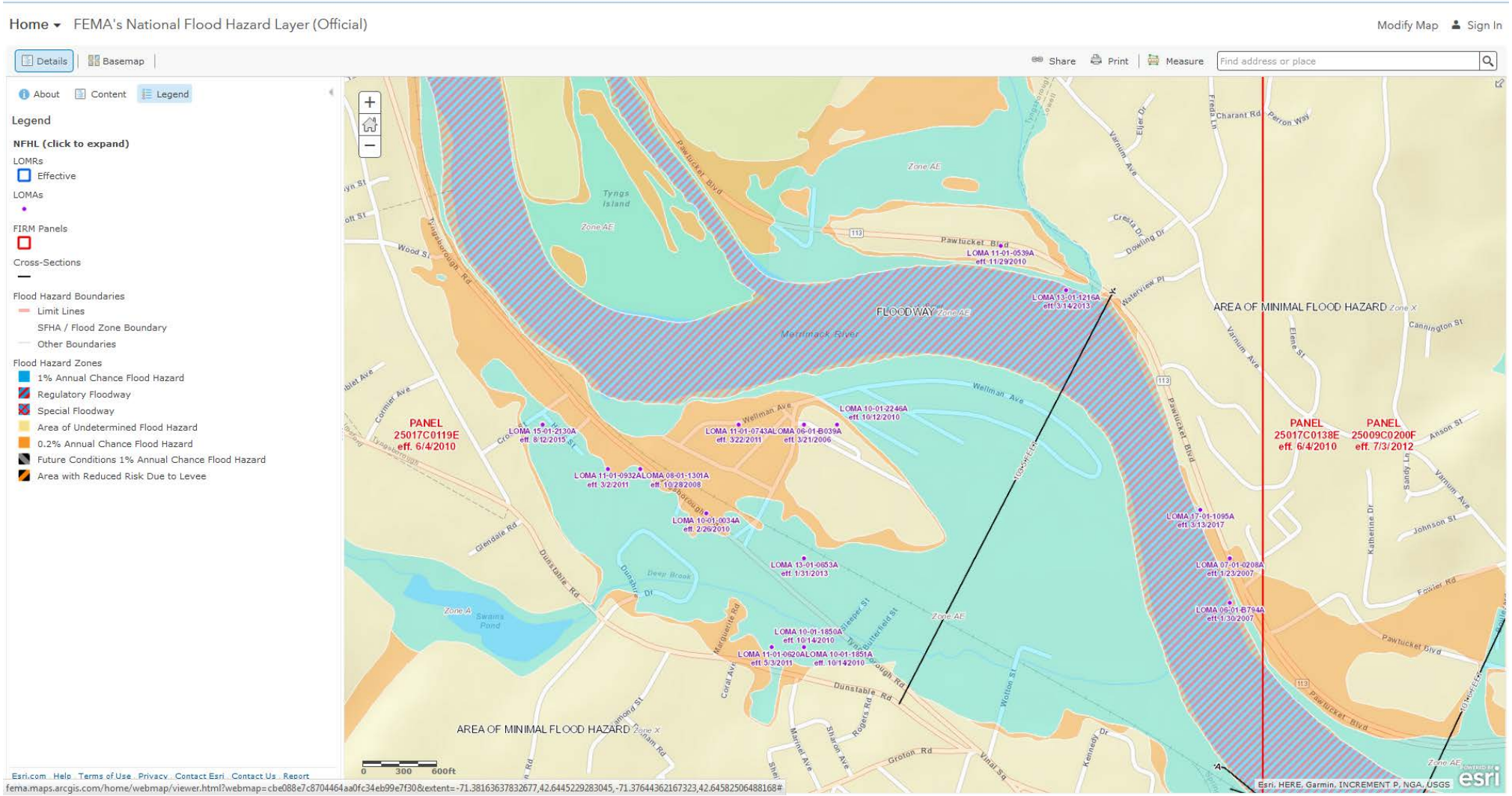


# Figure D – Topographic Map

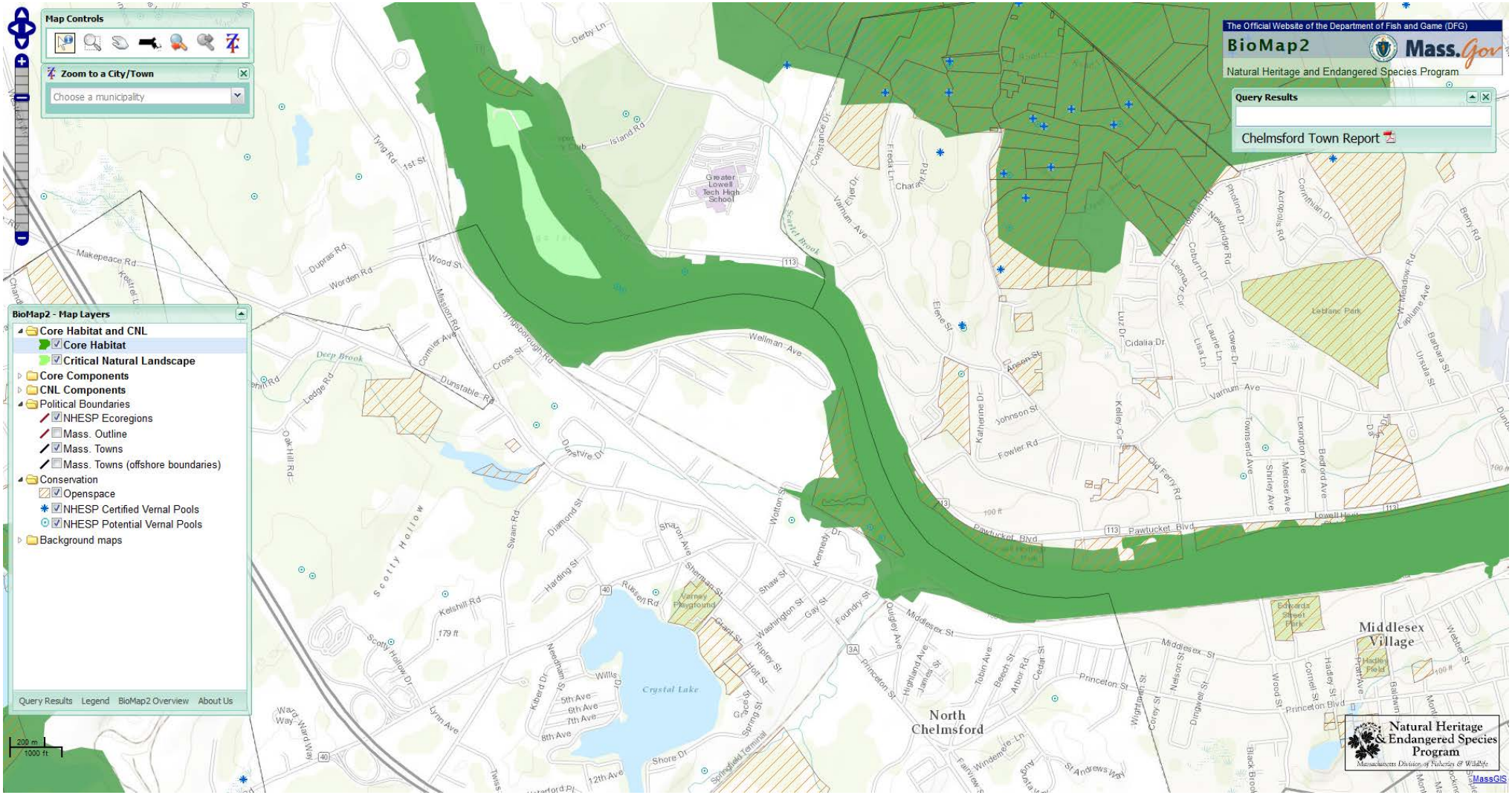


# Figure E – Wetland Map

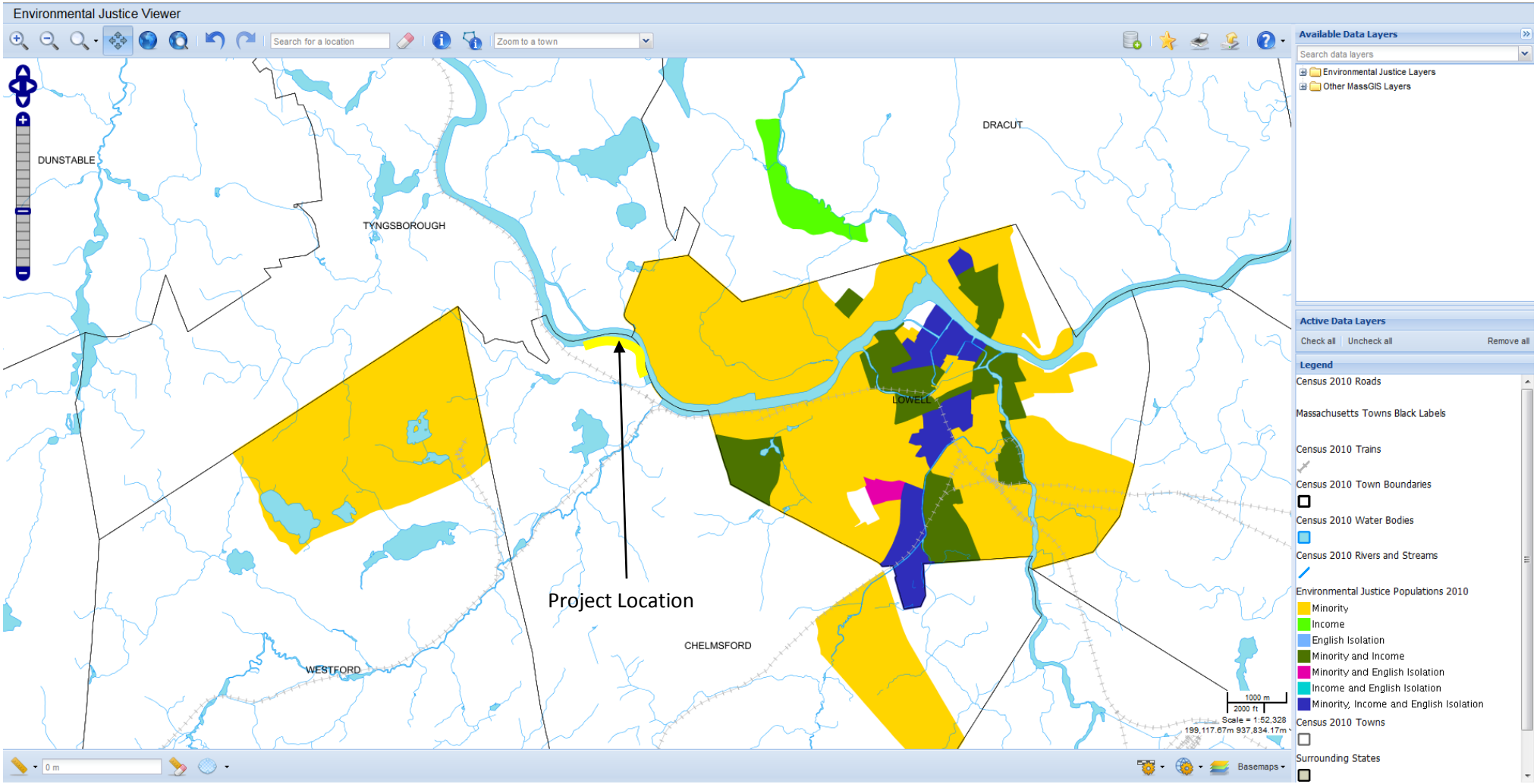
# Figure F – Flood Map



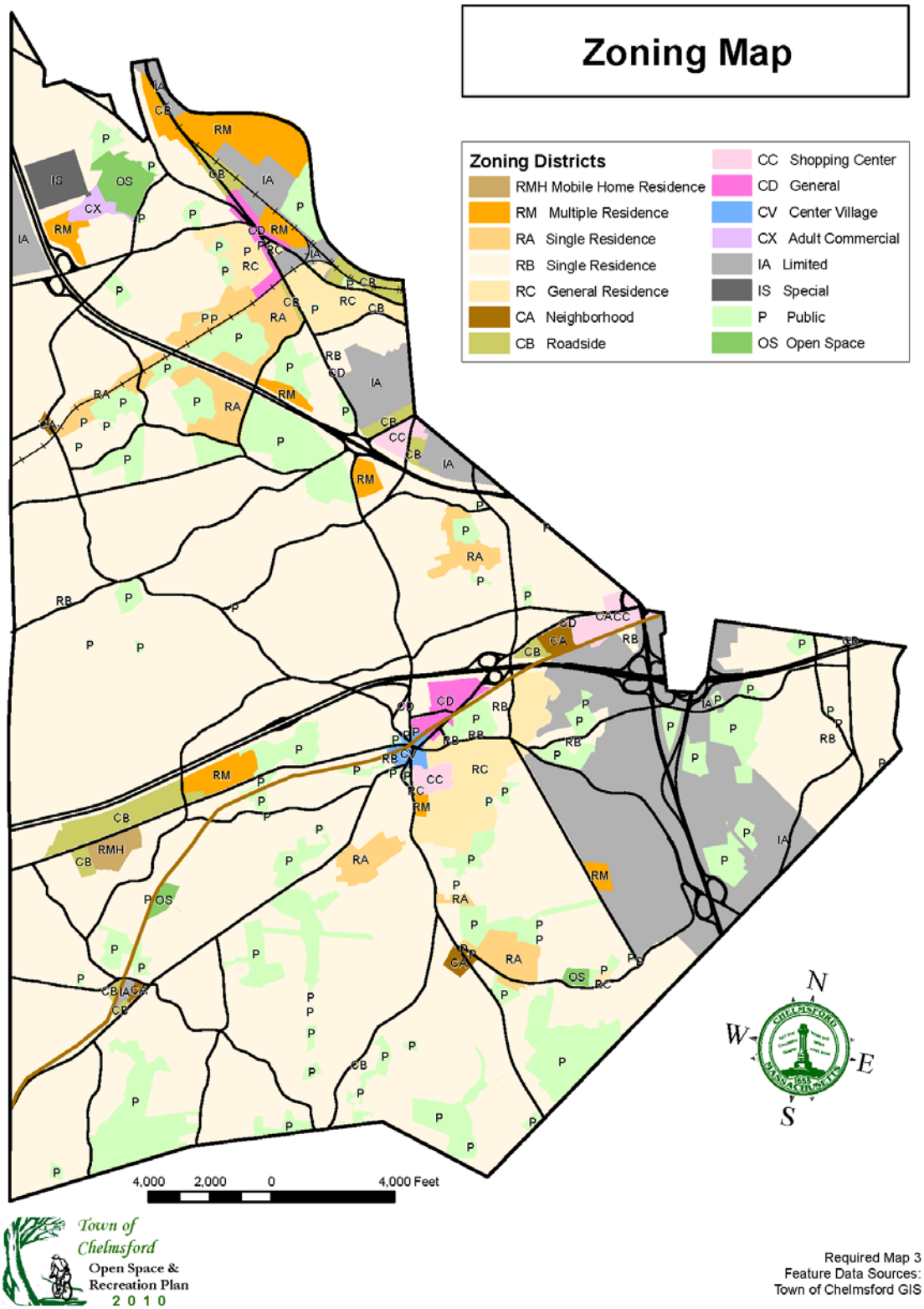
# Figure G – BioMap 2 Habitat Map



# Figure H – Massachusetts Environmental Justice Communities Locations



# Figure I – Chelmsford Zoning Map



# Appendices C: Tables

# Table A – Species of Conservation Concern

| Species | Scientific Name | MA Species of Conservation Concern |
|---|---|---|
| **American Waterwort** | *Elatine Americana* | E |
| **Eaton's Begger-ticks** | *Bidens eatonii* | E |
| **Englemann's Umbrella-sedge** | *Cyperus engelmannii* | T |
| **Estuary Arrowhead** | *Sagittaria montevidensis ssp. spongiosa* | E |
| **Parker's Pipework** | *Eriocaulon parkeri* | E |
| **Seabeach Dock** | *Rumex pallidus* | T |
| **Vasey's Pondweed** | *Potamogeton vaseyi* | E |
| **New England Siltsnail** | *Floridobia winkleyi* | SC |
| **Arrow Clubtail** | *Stylurus spiniceps* | Non-listed SWAP |
| **Cobra Clubtail** | *Gomphus vastus* | SC |
| **Coppery Emerald** | *Somatochlora georgiana* | E |
| **Riverine Clubtail** | *Stylurus amnicola* | E |
| **Umber Shadowdragon** | *Neurocorduliea obsolete* | SC |
| **Atlantic Sturgeon** | *Acipenser oxyrinchus* | E |
| **Shortnoese Sturgeon** | *Acipenser brevirostrum* | E |
| **Bald Eagle** | *Haliaeetus leucocephalus* | T |

E = Endangered

T = Threatened

SC = Special Concern

http://maps.massgis.state.ma.us/dfg/biomap/pdf/town_core/Chelmsford.pdf

# Table B – Census 2010 Minority Population

# EJSCREEN Census 2010 Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-mile radius
Description:

| Summary | | |
|---|---|---|
| Population | | 1,487 |
| Population Density (per sq. mile) | | 3,581 |
| Minority Population | | 311 |
| % Minority | | 21% |
| Households | | 683 |
| Housing Units | | 712 |
| Land Area (sq. miles) | | 0.42 |
| % Land Area | | 78% |
| Water Area (sq. miles) | | 0.11 |
| % Water Area | | 22% |

| Population by Race | | |
|---|---|---|
| Total | 1,487 | ------- |
| Population Reporting One Race | 1,447 | 97% |
| White | 1,195 | 80% |
| Black | 25 | 2% |
| American Indian | 0 | 0% |
| Asian | 210 | 14% |
| Pacific Islander | 0 | 0% |
| Some Other Race | 17 | 1% |
| Population Reporting Two or More Races | 40 | 3% |
| Total Hispanic Population | 33 | 2% |
| Total Non-Hispanic Population | 1,454 | 98% |
| White Alone | 1,176 | 79% |
| Black Alone | 25 | 2% |
| American Indian Alone | 0 | 0% |
| Non-Hispanic Asian Alone | 210 | 14% |
| Pacific Islander Alone | 0 | 0% |
| Other Race Alone | 6 | 0% |
| Two or More Races Alone | 37 | 2% |

| Population by Sex | | |
|---|---|---|
| Male | 669 | 45% |
| Female | 818 | 55% |

| Population by Age | | |
|---|---|---|
| Age 0-4 | 127 | 9% |
| Age 0-17 | 321 | 22% |
| Age 18+ | 1,166 | 78% |
| Age 65+ | 124 | 8% |

| Households by Tenure | | |
|---|---|---|
| Total | 683 | |
| Owner Occupied | 571 | 84% |
| Renter Occupied | 112 | 16% |

**Data Note:** First Row of data is number of people, Second Row is percentage of people compared to whole population.
**Source:** U.S. Census Bureau, Census 2010 Summary File 1.

# Table C – Economic Characteristics

DP03

# SELECTED ECONOMIC CHARACTERISTICS

## 2010-2014 American Community Survey 5-Year Estimates

Supporting documentation on code lists, subject definitions, data accuracy, and statistical testing can be found on the American Community Survey website in the Data and Documentation section.

Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.

Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

| Subject | Census Tract 3173.02, Middlesex County, Massachusetts | | | |
|---|---|---|---|---|
| | Estimate | Margin of Error | Percent | Percent Margin of Error |
| EMPLOYMENT STATUS | | | | |
| Population 16 years and over | 4,521 | +/-236 | 4,521 | (X) |
| In labor force | 3,412 | +/-252 | 75.5% | +/-3.9 |
| Civilian labor force | 3,390 | +/-249 | 75.0% | +/-3.9 |
| Employed | 3,197 | +/-279 | 70.7% | +/-4.6 |
| Unemployed | 193 | +/-120 | 4.3% | +/-2.7 |
| Armed Forces | 22 | +/-36 | 0.5% | +/-0.8 |
| Not in labor force | 1,109 | +/-183 | 24.5% | +/-3.9 |
| | | | | |
| Civilian labor force | 3,390 | +/-249 | 3,390 | (X) |
| Percent Unemployed | (X) | (X) | 5.7% | +/-3.6 |
| | | | | |
| Females 16 years and over | 2,489 | +/-198 | 2,489 | (X) |
| In labor force | 1,691 | +/-165 | 67.9% | +/-5.1 |
| Civilian labor force | 1,691 | +/-165 | 67.9% | +/-5.1 |
| Employed | 1,578 | +/-186 | 63.4% | +/-6.3 |
| | | | | |
| Own children under 6 years | 360 | +/-162 | 360 | (X) |
| All parents in family in labor force | 196 | +/-105 | 54.4% | +/-24.8 |
| | | | | |
| Own children 6 to 17 years | 738 | +/-155 | 738 | (X) |
| All parents in family in labor force | 666 | +/-166 | 90.2% | +/-9.0 |
| | | | | |
| COMMUTING TO WORK | | | | |
| Workers 16 years and over | 3,185 | +/-283 | 3,185 | (X) |
| Car, truck, or van -- drove alone | 2,721 | +/-311 | 85.4% | +/-5.2 |
| Car, truck, or van -- carpooled | 217 | +/-128 | 6.8% | +/-3.9 |
| Public transportation (excluding taxicab) | 40 | +/-39 | 1.3% | +/-1.2 |
| Walked | 0 | +/-17 | 0.0% | +/-1.1 |
| Other means | 0 | +/-17 | 0.0% | +/-1.1 |
| Worked at home | 207 | +/-93 | 6.5% | +/-3.1 |
| | | | | |
| Mean travel time to work (minutes) | 29.9 | +/-2.5 | (X) | (X) |
| | | | | |

| Subject | Census Tract 3173.02, Middlesex County, Massachusetts | | | |
|---|---|---|---|---|
| | Estimate | Margin of Error | Percent | Percent Margin of Error |
| OCCUPATION | | | | |
| Civilian employed population 16 years and over | 3,197 | +/-279 | 3,197 | (X) |
| Management, business, science, and arts occupations | 1,686 | +/-254 | 52.7% | +/-6.9 |
| Service occupations | 483 | +/-145 | 15.1% | +/-4.3 |
| Sales and office occupations | 754 | +/-183 | 23.6% | +/-5.4 |
| Natural resources, construction, and maintenance occupations | 231 | +/-94 | 7.2% | +/-2.8 |
| Production, transportation, and material moving occupations | 43 | +/-43 | 1.3% | +/-1.3 |
| | | | | |
| INDUSTRY | | | | |
| Civilian employed population 16 years and over | 3,197 | +/-279 | 3,197 | (X) |
| Agriculture, forestry, fishing and hunting, and mining | 0 | +/-17 | 0.0% | +/-1.1 |
| Construction | 151 | +/-92 | 4.7% | +/-2.9 |
| Manufacturing | 326 | +/-109 | 10.2% | +/-3.5 |
| Wholesale trade | 75 | +/-62 | 2.3% | +/-1.9 |
| Retail trade | 389 | +/-133 | 12.2% | +/-3.8 |
| Transportation and warehousing, and utilities | 33 | +/-38 | 1.0% | +/-1.2 |
| Information | 84 | +/-79 | 2.6% | +/-2.5 |
| Finance and insurance, and real estate and rental and leasing | 189 | +/-87 | 5.9% | +/-2.9 |
| Professional, scientific, and management, and administrative and waste management services | 670 | +/-169 | 21.0% | +/-5.1 |
| Educational services, and health care and social assistance | 722 | +/-176 | 22.6% | +/-4.8 |
| Arts, entertainment, and recreation, and accommodation and food services | 247 | +/-112 | 7.7% | +/-3.4 |
| Other services, except public administration | 212 | +/-125 | 6.6% | +/-3.8 |
| Public administration | 99 | +/-73 | 3.1% | +/-2.3 |
| | | | | |
| CLASS OF WORKER | | | | |
| Civilian employed population 16 years and over | 3,197 | +/-279 | 3,197 | (X) |
| Private wage and salary workers | 2,720 | +/-260 | 85.1% | +/-4.6 |
| Government workers | 363 | +/-138 | 11.4% | +/-4.1 |
| Self-employed in own not incorporated business workers | 114 | +/-69 | 3.6% | +/-2.1 |
| Unpaid family workers | 0 | +/-17 | 0.0% | +/-1.1 |
| | | | | |
| INCOME AND BENEFITS (IN 2014 INFLATION-ADJUSTED DOLLARS) | | | | |
| Total households | 2,567 | +/-96 | 2,567 | (X) |
| Less than $10,000 | 88 | +/-81 | 3.4% | +/-3.2 |
| $10,000 to $14,999 | 217 | +/-128 | 8.5% | +/-5.0 |
| $15,000 to $24,999 | 197 | +/-99 | 7.7% | +/-3.9 |
| $25,000 to $34,999 | 149 | +/-87 | 5.8% | +/-3.4 |
| $35,000 to $49,999 | 357 | +/-140 | 13.9% | +/-5.4 |
| $50,000 to $74,999 | 348 | +/-114 | 13.6% | +/-4.4 |
| $75,000 to $99,999 | 247 | +/-109 | 9.6% | +/-4.2 |
| $100,000 to $149,999 | 456 | +/-134 | 17.8% | +/-5.2 |
| $150,000 to $199,999 | 353 | +/-127 | 13.8% | +/-5.0 |
| $200,000 or more | 155 | +/-84 | 6.0% | +/-3.3 |
| Median household income (dollars) | 69,440 | +/-16,179 | (X) | (X) |
| Mean household income (dollars) | 89,925 | +/-9,350 | (X) | (X) |
| | | | | |
| With earnings | 2,023 | +/-156 | 78.8% | +/-5.7 |
| Mean earnings (dollars) | 102,423 | +/-11,407 | (X) | (X) |
| With Social Security | 690 | +/-146 | 26.9% | +/-5.6 |
| Mean Social Security income (dollars) | 16,204 | +/-1,784 | (X) | (X) |
| With retirement income | 446 | +/-143 | 17.4% | +/-5.4 |
| Mean retirement income (dollars) | 16,176 | +/-4,260 | (X) | (X) |
| | | | | |
| With Supplemental Security Income | 64 | +/-53 | 2.5% | +/-2.0 |

| Subject | Census Tract 3173.02, Middlesex County, Massachusetts | | | |
|---|---|---|---|---|
| | Estimate | Margin of Error | Percent | Percent Margin of Error |
| Mean Supplemental Security Income (dollars) | 10,463 | +/-2,831 | (X) | (X) |
| With cash public assistance income | 26 | +/-32 | 1.0% | +/-1.2 |
| Mean cash public assistance income (dollars) | 1,762 | +/-1,972 | (X) | (X) |
| With Food Stamp/SNAP benefits in the past 12 months | 106 | +/-85 | 4.1% | +/-3.3 |
| | | | | |
| Families | 1,491 | +/-161 | 1,491 | (X) |
| Less than $10,000 | 0 | +/-17 | 0.0% | +/-2.3 |
| $10,000 to $14,999 | 0 | +/-17 | 0.0% | +/-2.3 |
| $15,000 to $24,999 | 27 | +/-29 | 1.8% | +/-2.0 |
| $25,000 to $34,999 | 76 | +/-68 | 5.1% | +/-4.5 |
| $35,000 to $49,999 | 109 | +/-65 | 7.3% | +/-4.4 |
| $50,000 to $74,999 | 260 | +/-97 | 17.4% | +/-6.2 |
| $75,000 to $99,999 | 232 | +/-109 | 15.6% | +/-6.9 |
| $100,000 to $149,999 | 337 | +/-121 | 22.6% | +/-8.1 |
| $150,000 to $199,999 | 295 | +/-125 | 19.8% | +/-7.5 |
| $200,000 or more | 155 | +/-84 | 10.4% | +/-5.9 |
| Median family income (dollars) | 104,556 | +/-21,722 | (X) | (X) |
| Mean family income (dollars) | 120,978 | +/-13,382 | (X) | (X) |
| | | | | |
| Per capita income (dollars) | 42,606 | +/-3,381 | (X) | (X) |
| | | | | |
| Nonfamily households | 1,076 | +/-189 | 1,076 | (X) |
| Median nonfamily income (dollars) | 33,750 | +/-13,149 | (X) | (X) |
| Mean nonfamily income (dollars) | 46,894 | +/-9,188 | (X) | (X) |
| | | | | |
| Median earnings for workers (dollars) | 50,074 | +/-5,400 | (X) | (X) |
| Median earnings for male full-time, year-round workers (dollars) | 80,248 | +/-9,249 | (X) | (X) |
| Median earnings for female full-time, year-round workers (dollars) | 52,750 | +/-7,928 | (X) | (X) |
| | | | | |
| HEALTH INSURANCE COVERAGE | | | | |
| Civilian noninstitutionalized population | 5,443 | +/-295 | 5,443 | (X) |
| With health insurance coverage | 5,385 | +/-294 | 98.9% | +/-1.0 |
| With private health insurance | 4,919 | +/-363 | 90.4% | +/-3.5 |
| With public coverage | 1,210 | +/-181 | 22.2% | +/-3.8 |
| No health insurance coverage | 58 | +/-56 | 1.1% | +/-1.0 |
| | | | | |
| Civilian noninstitutionalized population under 18 years | 1,098 | +/-182 | 1,098 | (X) |
| No health insurance coverage | 0 | +/-17 | 0.0% | +/-3.1 |
| | | | | |
| Civilian noninstitutionalized population 18 to 64 years | 3,422 | +/-230 | 3,422 | (X) |
| In labor force: | 3,085 | +/-220 | 3,085 | (X) |
| Employed: | 2,917 | +/-259 | 2,917 | (X) |
| With health insurance coverage | 2,859 | +/-256 | 98.0% | +/-1.9 |
| With private health insurance | 2,774 | +/-259 | 95.1% | +/-3.5 |
| With public coverage | 102 | +/-93 | 3.5% | +/-3.1 |
| No health insurance coverage | 58 | +/-56 | 2.0% | +/-1.9 |
| Unemployed: | 168 | +/-116 | 168 | (X) |
| With health insurance coverage | 168 | +/-116 | 100.0% | +/-18.7 |
| With private health insurance | 126 | +/-101 | 75.0% | +/-35.9 |
| With public coverage | 42 | +/-66 | 25.0% | +/-35.9 |
| No health insurance coverage | 0 | +/-17 | 0.0% | +/-18.7 |
| Not in labor force: | 337 | +/-95 | 337 | (X) |
| With health insurance coverage | 337 | +/-95 | 100.0% | +/-9.9 |
| With private health insurance | 220 | +/-84 | 65.3% | +/-17.9 |
| With public coverage | 130 | +/-68 | 38.6% | +/-16.7 |
| No health insurance coverage | 0 | +/-17 | 0.0% | +/-9.9 |

| Subject | Census Tract 3173.02, Middlesex County, Massachusetts | | | |
|---|---|---|---|---|
| | Estimate | Margin of Error | Percent | Percent Margin of Error |
| | | | | |
| PERCENTAGE OF FAMILIES AND PEOPLE WHOSE INCOME IN THE PAST 12 MONTHS IS BELOW THE POVERTY LEVEL | | | | |
| All families | (X) | (X) | 0.0% | +/-2.3 |
| With related children under 18 years | (X) | (X) | 0.0% | +/-5.5 |
| With related children under 5 years only | (X) | (X) | 0.0% | +/-29.9 |
| Married couple families | (X) | (X) | 0.0% | +/-2.9 |
| With related children under 18 years | (X) | (X) | 0.0% | +/-6.9 |
| With related children under 5 years only | (X) | (X) | 0.0% | +/-34.0 |
| Families with female householder, no husband present | (X) | (X) | 0.0% | +/-14.7 |
| With related children under 18 years | (X) | (X) | 0.0% | +/-34.0 |
| With related children under 5 years only | (X) | (X) | - | ** |
| | | | | |
| All people | (X) | (X) | 3.6% | +/-2.6 |
| Under 18 years | (X) | (X) | 0.0% | +/-3.1 |
| Related children under 18 years | (X) | (X) | 0.0% | +/-3.1 |
| Related children under 5 years | (X) | (X) | 0.0% | +/-12.4 |
| Related children 5 to 17 years | (X) | (X) | 0.0% | +/-4.1 |
| 18 years and over | (X) | (X) | 4.5% | +/-3.2 |
| 18 to 64 years | (X) | (X) | 3.5% | +/-2.7 |
| 65 years and over | (X) | (X) | 8.0% | +/-10.2 |
| People in families | (X) | (X) | 0.0% | +/-0.8 |
| Unrelated individuals 15 years and over | (X) | (X) | 15.3% | +/-10.3 |

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see Accuracy of the Data). The effect of nonsampling error is not represented in these tables.

Workers include members of the Armed Forces and civilians who were at work last week.

Occupation codes are 4-digit codes and are based on Standard Occupational Classification 2010.

Industry codes are 4-digit codes and are based on the North American Industry Classification System (NAICS). The Census industry codes for 2013 and later years are based on the 2012 revision of the NAICS. To allow for the creation of 2010-2014 tables, industry data in the multiyear files (2010-2014) were recoded to 2013 Census industry codes. We recommend using caution when comparing data coded using 2013 Census industry codes with data coded using Census industry codes prior to 2013. For more information on the Census industry code changes, please visit our website at http://www.census.gov/people/io/methodology/.

Logical coverage edits applying a rules-based assignment of Medicaid, Medicare and military health coverage were added as of 2009 -- please see http://www.census.gov/hhes/www/hlthins/publications/coverage_edits_final.pdf for more details. The corresponding 2008 data table in American FactFinder does not incorporate these edits and is therefore not comparable to this table in 2009, 2010, 2011, or 2012. Select geographies of 2008 data comparable to the 2009, 2010, 2011, and 2012 tables are accessible at http://www.census.gov/hhes/www/hlthins/data/acs/2008/re-run.html.

The health insurance coverage category names were modified in 2010. See ACS Health Insurance Definitions for a list of the insurance type definitions.

While the 2010-2014 American Community Survey (ACS) data generally reflect the February 2013 Office of Management and Budget (OMB) definitions of metropolitan and micropolitan statistical areas; in certain instances the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB definitions due to differences in the effective dates of the geographic entities.

Estimates of urban and rural population, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2010 data. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

Source: U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates

Explanation of Symbols:

1. An '**' entry in the margin of error column indicates that either no sample observations or too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.
2. An '-' entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution.
3. An '-' following a median estimate means the median falls in the lowest interval of an open-ended distribution.
4. An '+' following a median estimate means the median falls in the upper interval of an open-ended distribution.
5. An '***' entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
6. An '*****' entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
7. An 'N' entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
8. An '(X)' means that the estimate is not applicable or not available.

# Table D – RCRA Sites

| Name | EPA REG ID | Address | City | Lat | Long |
|---|---|---|---|---|---|
| **Additive Tech Corp** | 110003446209 | 210 TYNGSBORO RD | CHELMSFORD | 42.65132 | -71.4003 |
| **Alantic Testing & Assembling** | 110006796100 | 21 QUIGLEY AVENUE | CHELMSFORD | 42.63701 | -71.37666 |
| **Alpine Cleaners** | 110003426846 | 1691 MIDDLESEX ST | LOWELL | 42.635575 | -71.35203 |
| **Alternative Final Finishes Inc** | 110024346947 | 166 MIDDLESEX ST | CHELMSFORD | 42.63568 | -71.36664 |
| **Atlantic Auto Body, Carstar** | 110003439422 | 1516 MIDDLESEX ST | LOWELL | 42.63721 | -71.34636 |
| **Blanchette Jack** | 110003473731 | 77 TYNGSBORO RD | CHELMSFORD | 42.643137 | -71.38917 |
| **Chelmsford Auto Electric** | 110003433632 | 110 MIDDLESEX ST | CHELMSFORD | 42.63599 | -71.37342 |
| **Circuit Service Co** | 110003438021 | 1995 MIDDLESEX ST | LOWELL | 42.6356 | -71.36317 |
| **Cobham Defense Electronics Systems** | 110040446390 | 1001 PAWTUCKET BLVD. | LOWELL | 42.64233 | -71.37159 |
| **Courier North Chelmsford** | 110008406377 | 15 WELLMAN AVE | CHELMSFORD | 42.647163 | -71.38934 |
| **Cp Auto Body Inc** | 110003461496 | 1599 MIDDLESEX STREET | LOWELL | 42.63622 | -71.34909 |
| **Cvs Pharmacy 1056** | 110003500140 | 1815 MIDDLESEX ST | LOWELL | 42.6348 | -71.35641 |
| **Dana Wallboard Supply Inc** | 110003444960 | 112 MIDDLESEX ST | CHELMSFORD | 42.63595 | -71.37312 |
| **Duffys Auto Co** | 110006816669 | 50 TYNGSBORO ROAD | CHELMSFORD | 42.642135 | -71.387585 |
| **E R Ls Auto Body** | 110003444327 | 25 VINAL SQ | CHELMSFORD | 42.63943 | -71.38337 |
| **Greater Lowell Reg Voc Tech Hs** | 110008406091 | 250 PAWTUCKET BLVD | TYNGSBOROUGH | 42.65116 | -71.38484 |
| **Gs&P Co** | 110006501883 | 160 MIDDLESEX ST | CHELMSFORD | 42.63571 | -71.36684 |
| **Howes Engineering Co Inc** | 110003494665 | 55 MIDDLESEX STREET | NORTH CHELMSFORD | 42.63776 | -71.37774 |
| **Jiffy Lube Service Center #364** | 110003474972 | 1713 MIDDLESEX ST | LOWELL | 42.635369 | -71.35276 |
| **Lowrey Auto Service** | 110003442748 | 170 TYNGSBORO RD | CHELMSFORD | 42.64834 | -71.39699 |
| **Marinel Transportation** | 110008404583 | WARD WAY | CHELMSFORD | 42.63123 | -71.40839 |
| **Metrigraphics Llc** | 110066864021 | 1001 PAWTUCKET BLVD | LOWELL | 42.64233 | -71.37159 |
| **Microwave Printed Circuitry** | 110000795408 | 81 OLD FERRY RD | LOWELL | 42.64108 | -71.36088 |
| **Mill City Auto Body** | 110008416295 | 51 OAKHILL RD | WESTFORD | 42.643162 | -71.40942 |
| **Murphy Bob Nissan** | 110003433062 | 1625 MIDDLESEX ST | LOWELL | 42.63606 | -71.34983 |

| Name | EPA REG ID | Address | City | Lat | Long |
|---|---|---|---|---|---|
| **New England Tele** | 110003414831 | 30 GROTN RD | CHELMSFORD | 42.6396 | -71.38591 |
| **Oneil Graphics** | 110003423714 | 1 BRIDGEVIEW CIR | TYNGSBOROUGH | 42.65871 | -71.4041 |
| **Palmers Automotive Service** | 110003438824 | 1500 MIDDLESEX ST | LOWELL | 42.63745 | -71.34569 |
| **Rite Aid Pharmacy 10119** | 110003498457 | 25 WOOD ST | LOWELL | 42.633941 | -71.35557 |
| **Silvas Garage** | 110006504808 | 164 MIDDLESEX ST | CHELMSFORD | 42.63566 | -71.36655 |
| **Specialty Materials** | 110041592755 | 1449 MIDDLESEX STREET | LOWELL | 42.63782 | -71.34468 |
| **Speedee Oil Change & Tune Up** | 110009593332 | 1485 MIDDLESEX ST | LOWELL | 42.63768 | -71.34506 |
| **Stony Brook Auto Body** | 110025384769 | 112 TYNGSBORO ROAD | CHELMSFORD | 42.6449 | -71.39192 |
| **Styletek Inc** | 110002018735 | 1857 MIDDLESEX STREET | LOWELL | 42.63486 | -71.35765 |
| **Trilap Co Inc** | 110003447770 | 100 WOTTON ST | CHELMSFORD | 42.641957 | -71.382446 |
| **Tyngsboro Auto Works** | 110003483294 | 33 MIDDLESEX RD | TYNGSBOROUGH | 42.65636 | -71.4025 |
| **University Of Massachusetts Lowell West** | 110024290701 | 255 PRINCETON ST | CHELMSFORD | 42.63422 | -71.36612 |
| **W C S Corporation** | 110003489608 | 1485 MIDDLESEX ST | LOWELL | 42.63768 | -71.34506 |
| **Walgreen Drug Store 11726** | 110058242717 | 1765 MIDDLESEX ST | LOWELL | 42.634875 | -71.354784 |
| **Wang Labs Inc** | 110002086331 | 1001 PAWTUCKET BLVD | LOWELL | 42.64233 | -71.37159 |
| **William Branden Company** | 110001959186 | 51 MIDDLESEX STREET | CHELMSFORD | 42.63812 | -71.37911 |

https://www.epa.gov/emefdata/em4ef.home

# Appendices D: Correspondences

# Correspondence A – BRP WW 07 and 10 Water Quality Certification Application Cover Letter

Epsilon
ASSOCIATES INC.

Projects:\4469 Chelmsford Bank Stabilization\401 WQC

November 15, 2016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Ms. Heidi Davis
MassDEP Northeast Regional Office
205B Lowell Street
Wilmington, Massachusetts 01887

Mr. Ken Chin
MassDEP 401 Dredging Program
1 Winter Street
Boston, MA 02108

**Subject: BRP WW 07 and BRP WW 10 Water Quality Certification Applications, Merrimack River Bank Stabilization at Wellman Avenue, Chelmsford, MA**

Dear Ms. Davis and Mr. Chin:

On behalf of the Town of Chelmsford ("Applicant" or "Town"), Epsilon Associates Inc. ("Epsilon") is pleased to submit this application package for the above referenced Project to the Massachusetts Department of Environmental Protection ("MassDEP") for a Water Quality Certification under Section 401 of the Clean Water Act. These applications were prepared in accordance with the Federal Water Pollution Control Act (33 U.S.C. 1341 et seq., §. 401); Massachusetts Clean Water Act, (M.G.L. c. 21, § 26-53); and 401 Water Quality Certification Regulations (314 CMR 9.00). This project completed MEPA review (EEA No. 15572) and the Secretary determined no further MEPA review was required.

Epsilon has included one full copy of the BRP WW 10 application to the Northeast Regional Office ("NERO") and one full copy of the BRP WW 07 application to the 401 Dredging Program Office in Boston. Please note, copies of both applications are also being sent to the Chelmsford Conservation Commission and to the Chelmsford Board of Health. The Applicant submitted a joint Wetlands Protection Act / Mass. Endangered Species Act filing to the Chelmsford Conservation Commission and NHESP on October 27, 2016, with a hard copy mailed to MassDEP NERO. The Applicant is preparing a MassDEP Chapter 91 License application and an application the Army Corps of Engineers. Both of which are anticipated to be submitted in within the next two weeks.

As explained in the enclosed application package, the Project is needed to stabilize approximately 3,950 linear feet of the Merrimack River bank adjacent to Wellman Avenue. This reach of the riverbank is experiencing significant erosion, and the purpose of this project is to protect the existing sanitary sewer located adjacent to the bank from future exposure and rupture. The Applicant is acting proactively to protect the sewer from future damage. Avoiding a sewer break protects the public health of residents served by the sewer and avoids potential environmental damage caused by a raw sewage discharge to the Merrimack River.

Work requiring Water Quality Certification includes stabilization of the river bank, specifically installation of a foundation mattress overlaid with a stone sill, and back fill riverward, or below, the ordinary high water of the Merrimack River. This activity will occur within approximately 59,250 square feet ("s.f.") of waters of the U.S. in the Commonwealth. To create a level surface and to install the mattress and stone sill, an approximately 13 foot wide by 2 foot deep by 3,700 foot long excavation (dredging) is needed below ordinary high water, corresponding to approximately 3,600 cubic yards of dredging. Laboratory testing shows this sediment meets S-1 standards and therefore can, and will, be re-used on-site as part of the bank stabilization project. No in-water of off-site disposal of dredge material is proposed.

If you have any questions regarding the BRP WW 07 or BRP WW 10 applications, please do not hesitate to contact me at (978) 897-7100 or via e-mail at ddunk@epsilonassociates.com.

Sincerely,
EPSILON ASSOCIATES, INC.

Dwight R. Dunk, LPD, PWS, BCES
Principal

cc: S. Janhle, Town of Chelmsford DPW
S. Barbera, Harvard Management Solutions, Inc.
V. Hagopian, GEI Consultants

# Correspondence B - NAE-2016-1969 Merrimack River Bank Stabilization Application Cover Letter

Epsilon
ASSOCIATES INC.

Projects:\4469\404 Army Corps Permit\

November 22, 2016

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Ms. Barbara Newman, Branch Chief
United States Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742

**Subject: NAE-2016-1969 Merrimack River Bank Stabilization, Chelmsford, MA Application of Permit Coverage as Massachusetts General Permit #7 – Bank Stabilization**

Dear Ms. Newman:

On behalf of the Town of Chelmsford ("Applicant"), Epsilon Associates Inc. ("Epsilon") submits this application for a U.S. Army Corps of Engineers Permit pursuant to the Massachusetts General Permits ("G.P."), specifically seeking coverage as a Pre-Construction Notification in accordance with G.P. No. 7 – Bank Stabilization. Enclosed is a completed ENG Form 4345, abutters list, notification to the Tribal Historic Preservation Officers ("THPOs") and proof of previous consultation with the State Historic Preservation Officer ("SHPO"), and a copy of the Massachusetts Water Quality Certification ("WQC") Application package. Although this project involves work on over 500 linear feet of bank, we respectfully request review as a Pre-Construction Notification ("PCN"); because it is our opinion the project results in no more than "minimal adverse effects." Please see the attached WQC Application Package for the alternatives analysis, mitigation measures and other project information, which we believe supports this determination.

The Applicant and area residents worked together to seek funds from the Federal Emergency Management Agency ("FEMA") and the Massachusetts Emergency Management Agency ("MEMA") to design, permit and construct the proposed Project. The FEMA Grant Application was submitted in April 2012, and the FEMA/MEMA Hazard Mitigation Grant (HMGP 4028-09) between FEMA and Chelmsford was signed in December 2015.

The basic project purpose is to stabilize this approximately 3,950 linear foot reach of the Merrimack River bank which is experiencing significant erosion. The goal is to protect the existing sanitary sewer, located adjacent to the top of the bank, from future exposure and rupture. The Proponent is acting proactively to protect the sewer from future damage. Avoiding a sewer break protects the public health of residents served by the sewer and avoids potential environmental damage caused by a raw sewage discharge to the Merrimack River.

Work requiring a U.S. Army Corps Permit includes stabilization of the river bank, specifically installation of a foundation mattress overlaid with a stone sill, and back fill landward of the sill to reconstruct and stabilize this reach of the Merrimack River bank. This activity will occur within approximately 59,250 square feet of waters of the U.S. To create a level surface and to install the mattress and stone sill, an approximately 13 foot wide by 2 foot deep by 3,700 foot long excavation (dredging) is needed below ordinary high water, corresponding to approximately 3,600 cubic yards of dredging. Laboratory testing shows this sediment meets Massachusetts Department of Environmental Protection ("MassDEP") S-1 standards and therefore can, and will, be re-used on-site as part of the bank stabilization project. No in-water or off-site disposal of dredge material is proposed; and no work below ordinary low water is proposed.

The Project team met with local and state agencies in July 2016 to review Project data and to discuss the initial conceptual bank stabilization plans. Based on that pre-application meeting, and additional comments received through the Mass. Environmental Policy Act ("MEPA") review process, the design was revised to address comments from the MassDEP and other commenters. The proposed Project presented in this application incorporates comments by MassDEP, is consistent with the conceptual design submitted to FEMA in the grant application, and seeks to minimize environmental impacts while concomitantly providing long-term bank stabilization.

Please note, FEMA recently determined they need to prepare an Environmental Assessment ("EA") pursuant to FEMA National Environmental Policy Act implementation regulations. In compliance with Section 106 of the National Historic Preservation Act we expect that FEMA will consult with the SHPO and applicable THPOs as a component of the EA. However, for this PCN review we have notified the applicable THPOs, see copies of notification forms, and provide copies of prior correspondence with the SHPO received during the MEPA review

process for your review. We expect that FEMA will initiate additional consultation with the SHPO and THPOs in support of the EA.

We look forward to working with you on this important project. Please contact me at (978) 897-7100 or via e-mail at ddunk@epsilonassociates.com to schedule a site visit or with any other questions or comments on this Project.

Sincerely,
EPSILON ASSOCIATES, INC.

Dwight R. Dunk, LPD, PWS, BCES
Principal

cc: S. Janhle, Town of Chelmsford
S. Barbera, Harvard Management Solutions, Inc.

Encl.
Attachment 1 – ENG 4345 Form
Attachment 2 – Abutters List
Attachment 3 – Agency Correspondence (SHPO, THPO, NHESP)
Attachment 4 - WQC Application Package (bound separately)

# Correspondence C – USFW Northern Long-eared Bat Rule 4(d) Notification Form

# Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form

Federal agencies should use this form for the optional streamlined consultation framework for the northern long-eared bat (NLEB). This framework allows federal agencies to rely upon the U.S. Fish and Wildlife Service's (USFWS) January 5, 2016, intra-Service Programmatic Biological Opinion (BO) on the final 4(d) rule for the NLEB for section 7(a)(2) compliance by: (1) notifying the USFWS that an action agency will use the streamlined framework; (2) describing the project with sufficient detail to support the required determination; and (3) enabling the USFWS to track effects and determine if reinitiation of consultation is required per 50 CFR 402.16.

This form is not necessary if an agency determines that a proposed action will have no effect to the NLEB or if the USFWS has concurred in writing with an agency's determination that a proposed action may affect, but is not likely to adversely affect the NLEB (i.e., the standard informal consultation process). Actions that may cause prohibited incidental take require separate formal consultation. Providing this information does not address section 7(a)(2) compliance for any other listed species.

| **Information to Determine 4(d) Rule Compliance:** | **YES** | **NO** |
|---|---|---|
| 1. Does the project occur wholly outside of the WNS Zone[1]? | ☐ | ☒ |
| 2. Have you contacted the appropriate agency[2] to determine if your project is near known hibernacula or maternity roost trees? | ☒ | ☐ |
| 3. Could the project disturb hibernating NLEBs in a known hibernaculum? | ☐ | ☒ |
| 4. Could the project alter the entrance or interior environment of a known hibernaculum? | ☐ | ☒ |
| 5. Does the project remove any trees within 0.25 miles of a known hibernaculum at any time of year? | ☐ | ☒ |
| 6. Would the project cut or destroy known occupied maternity roost trees, or any other trees within a 150-foot radius from the maternity roost tree from June 1 through July 31. | ☐ | ☒ |

You are eligible to use this form if you have answered yes to question #1 **or** yes to question #2 **and** no to questions 3, 4, 5 and 6. The remainder of the form will be used by the USFWS to track our assumptions in the BO.

**Agency and Applicant**[3]**:** Grant Management: FEMA Region 1, Brandon.webb@fema.dhs.gov, 917-753-2821 for Town of North Chelmsford

**Project Name**: Merrimack River Bank Stabilization

**Project Location**: North Chelmsford, MA. Starting point: 42.647644°, -71.392505° Ending Point: 42.645174°, -71.379039°

**Basic Project Description**:
Bioengineering Bank Stabilization would stabilize the bank using a mixture of structural components such as a stone toe and natural components such as timber, coir rolls, and living vegetation. There are three stabilization techniques proposed:

- Bank Support for Edge Type A: Work involves installation of timber toe protection and vegetation management on the slope.

[1] http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf
[2] See http://www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html
[3] If applicable - only needed for federal actions with applicants (e.g., for a permit, etc.) who are party to the consultation.

- Bank Repair for Edge Type B: Work involves installation of stone sill along the toe of slope, and placing soil behind the sill which would establish a shallow slope. One coir log would be placed on top of the stone sill to hold the soil in place. Any placed and bare soils on the slope would be vegetated with native plants for stabilization.
- Bank Reconstruction for Edge Type C: Work involves installation of a stone sill along the toe of slope and restoring the entire slope cross-section with several rows of coir fiber rolls which would be installed in a step-wise manner. The slope would then be re-vegetated using native plants.

In all edge type zones, trees on the slope and along the top of the slope that are deemed in imminent danger of toppling would be removed. For the Bank Reconstruction, the offset from the toe of slope to the outboard limit of the stone sill/marine mattress would range from 7.5 to 18.5 feet with an average of 14 feet. The Bank Repair and Bank Support work would offset between 10 to 14 feet. Work would occur in approximately 4,250 linear feet of inland bank, 145,250 square feet of riverfront area and bordering land, and 41,500 square feet of land under water sandy soil for stone sill installation.

| **General Project Information** | **YES** | **NO** |
|---|---|---|
| Does the project occur within 0.25 miles of a known hibernaculum? | ☐ | ☒ |
| Does the project occur within 150 feet of a known maternity roost tree? | ☐ | ☒ |
| Does the project include forest conversion? (if yes, report acreage below) | ☐ | ☒ |
| Estimated total acres of forest conversion | | |
| If known, estimated acres of forest conversion from April 1 to October 31 | | |
| If known, estimated acres of forest conversion from June 1 to July 31 | | |
| Does the project include timber harvest? (if yes, report acreage below) | ☐ | ☒ |
| Estimated total acres of timber harvest | | |
| If known, estimated acres of timber harvest from April 1 to October 31 | | |
| If known, estimated acres of timber harvest from June 1 to July 31 | | |
| Does the project include prescribed fire? (if yes, report acreage below) | ☐ | ☒ |
| Estimated total acres of prescribed fire | | |
| If known, estimated acres of prescribed fire from April 1 to October 31 | | |
| If known, estimated acres of prescribed fire from June 1 to July 31 | | |
| Does the project install new wind turbines? (if yes, report capacity in MW below) | ☐ | ☒ |
| Estimated wind capacity (MW) | | |

Agency Determination:

By signing this form, the action agency determines that this project may affect the NLEB, but that any resulting incidental take of the NLEB is not prohibited by the final 4(d) rule.

If the USFWS does not respond within 30 days from submittal of this form, the action agency may presume that its determination is informed by the best available information and that its project responsibilities under 7(a)(2) with respect to the NLEB are fulfilled through the USFWS January 5, 2016, Programmatic BO. The action agency will update this determination annually for multi-year activities.

The action agency understands that the USFWS presumes that all activities are implemented as described herein. The action agency will promptly report any departures from the described activities to the appropriate USFWS Field Office. The action agency will provide the appropriate USFWS Field Office with the results of any surveys conducted for the NLEB. Involved parties will promptly notify the appropriate USFWS Field Office upon finding a dead, injured, or sick NLEB.

Signature: _____ Date Submitted: 3/27/2017

Attached:

- Site Location
- Engineering Plans

# Correspondence D – NOAA NMFS Consultation and Concurrence.

# NOAA FISHERIES
# GREATER ATLANTIC REGIONAL FISHERIES OFFICE
## Essential Fish Habitat (EFH) Consultation Guidance
## EFH ASSESSMENT WORKSHEET

**Introduction:**

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) mandates that federal agencies conduct an essential fish habitat (EFH) consultation with NOAA Fisheries regarding any of their actions authorized, funded, or undertaken that may adversely affect EFH. An adverse effect means any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

This worksheet has been designed to assist in determining whether a consultation is necessary and in preparing EFH assessments. This worksheet should be used as your EFH assessment or as a guideline for the development of your EFH assessment. At a minimum, all the information required to complete this worksheet should be included in your EFH assessment. If the answers in the worksheet do not fully evaluate the adverse effects to EFH, we may request additional information in order to complete the consultation.

An expanded EFH assessment may be required for more complex projects in order to fully characterize the effects of the project and the avoidance and minimization of impacts to EFH. While the EFH worksheet may be used for larger projects, the format may not be sufficient to incorporate the extent of detail required, and a separate EFH assessment may be developed. However, regardless of format, the analysis outlined in this worksheet should be included for an expanded EFH assessment, along with additional information that may be necessary. This additional information includes:

- the results of on-site inspections to evaluate the habitat and site-specific effects
- the views of recognized experts on the habitat or the species that may be affected
- a review of pertinent literature and related information
- an analysis of alternatives to the action that could avoid or minimize the adverse effects on EFH.

**Your analysis of adverse effects to EFH under the MSA should focus on impacts to the habitat for all life stages of species with designated EFH, rather than individual responses of fish species. Fish habitat includes the substrate and benthic resources (e.g., submerged aquatic vegetation, shellfish beds, salt marsh wetlands), as well as the water column and prey species.**

Consultation with us may also be necessary if a proposed action results in adverse impacts to other NOAA-trust resources. Part 6 of the worksheet is designed to help assess the effects of the action on other NOAA-trust resources. This helps maintain efficiency in our interagency coordination process. In addition, further consultation may be required if a proposed action impacts marine mammals or threatened and endangered species for which we are responsible. Staff from our Greater Atlantic Regional Fisheries Office, Protected Resources Division should be contacted regarding potential impacts to marine mammals or threatened and endangered species.

**Instructions for Use:**

Federal agencies must submit an EFH assessment to NOAA Fisheries as part of the EFH consultation. Your EFH assessment must include:

1) A description of the proposed action.
2) An analysis of the potential adverse effects of the action on EFH, and the managed species.
3) The federal agency's conclusions regarding the effects of the action on EFH.
4) Proposed mitigation if applicable.

In order for this worksheet to be considered as your EFH assessment, you must answer the questions in this worksheet fully and with as much detail as available. Give brief explanations for each answer.

Federal action agencies or the non-federal designated lead agency should submit the completed worksheet to NOAA Fisheries Greater Atlantic Regional Fisheries Office, Habitat Conservation Division (HCD) with the public notice or project application. Include project plans showing existing and proposed conditions, all waters of the U.S. on the project site, with mean low water (MLW), mean high water (MHW), high tide line (HTL), and water depths clearly marked and sensitive habitats mapped, including special aquatic sites (submerged aquatic vegetation, saltmarsh, mudflats, riffles and pools, coral reefs, and sanctuaries and refuges), hard bottom habitat areas and shellfish beds, as well as any available site photographs.

For most consultations, NOAA Fisheries has 30 days to provide EFH conservation recommendations once we receive a complete EFH assessment. Submitting all necessary information at once minimizes delays in review and keeps review timelines consistent. Delays in providing a complete EFH assessment can result in our consultation review period extending beyond the public comment period for a particular project.

The information contained on the HCD website will assist you in completing this worksheet. The HCD website contains information regarding: the EFH consultation process; Guide to EFH Designations which provides a geographic species list; Guide to EFH Species Descriptions which provides the legal description of EFH as well as important ecological information for each species and life stage; and other EFH reference documents including examples of EFH assessments and EFH consultations.

Our website also includes a link to the NOAA EFH Mapper .
We would note that the EFH Mapper is currently being updated and revised. Should you use the EFH Mapper to identify federally managed species with designated EFH in your project area, we recommend checking this list against the Guide to Essential Fish Habitat Designations in the Northeast to ensure a complete and accurate list is provided.

# EFH ASSESSMENT WORKSHEET FOR FEDERAL AGENCIES (modified 3/2016)

**PROJECT NAME:** HMGP DR 4028 - Merrimack River Bank Stabilization

**DATE:** 07/25/2017

**PROJECT NO.:** 7-R

**LOCATION (Water body, county, physical address):**

Merrimack River Adjacent to Wellman Ave, North Chelmsford, MA 42.645174°,-71.379039° to 42.647644°,-71.392505°

**PREPARER:** Brandon Webb, Environmental Specialist, FEMA

**Step 1: Use the Habitat Conservation Division EFH webpage's Guide to Essential Fish Habitat Designations in the Northeastern United States to generate the list of designated EFH for federally-managed species for the geographic area of interest. Use the species list as part of the initial screening process to determine if EFH for those species occurs in the vicinity of the proposed action. The list can be included as an attachment to the worksheet. Make a preliminary determination on the need to conduct an EFH consultation.**

## 1. INITIAL CONSIDERATIONS

| EFH Designations | Yes | No |
|---|---|---|
| **Is the action located in or adjacent to EFH designated for eggs?**<br>**List the species:** | ☐ | ☒ |
| **Is the action located in or adjacent to EFH designated for larvae?**<br>**List the species:** | ☐ | ☒ |
| **Is the action located in or adjacent to EFH designated for juveniles?**<br>**List the species:**<br>Atlantic Salmon | ☒ | ☐ |

| | | |
|---|---|---|
| **Is the action located in or adjacent to EFH designated for adults or spawning adults? List the species:**<br>Atlantic Salmon | ☒ | ☐ |

**If you answered 'no' to all questions above, then an EFH consultation is not required - go to Section 5.**

**If you answered 'yes' to any of the above questions, proceed to Section 2 and complete the remainder of the worksheet.**

**<u>Step 2</u>: In order to assess impacts, it is critical to know the habitat characteristics of the site before the activity is undertaken. Use existing information, to the extent possible, in answering these questions. Identify the sources of the information provided and provide as much description as available. These should not be yes or no answers. Please note that there may be circumstances in which new information must be collected to appropriately characterize the site and assess impacts. Project plans that show the location and extent of sensitive habitats, as well as water depths, the HTL, MHW and MLW should be provided.**

## 2. SITE CHARACTERISTICS

| Site Characteristics | Description |
|---|---|
| **Is the site intertidal, sub-tidal, or water column?** | Water Column |
| **What are the sediment characteristics?** | Unconsolidated Bottom |
| **Is there submerged aquatic vegetation (SAV) at or adjacent to project site? If so describe the SAV species and spatial extent.** | No |
| **Are there wetlands present on or adjacent to the site? If so, describe the spatial extent and vegetation types.** | Yes, Riverine wetlands, Merrimack River. Vegetative types along edge include trees, shrubs, and persistent emergents. No vegetation within riverine wetland. |

| | |
|---|---|
| **Is there shellfish present at or adjacent to the project site? If so, please describe the spatial extent and species present.** | No |
| **Are there mudflats present at or adjacent to the project site? If so please describe the spatial extent.** | No |
| **Is there rocky or cobble bottom habitat present at or adjacent to the project site? If so, please describe the spatial extent.** | No |
| **Is Habitat Area of Particular Concern (HAPC) designated at or near the site? If so for which species, what type habitat type, size, characteristics?** | No |
| **What is the typical salinity, depth and water temperature regime/range?** | Freshwater unaffected by tides, 29-1°C (per EPA water monitoring station accessed 5/31/2017) |
| **What is the normal frequency of site disturbance, both natural and man-made?** | Water flow, rainfall, and snow melt runoff and flooding occurs seasonally and area used for recreational use including kayaking and low impact water activities. |
| **What is the area of proposed impact (work footprint & far afield)?** | Work would occur in approximately 3,950 linear feet of inland bank and approximately 145,250 square feet of riverfront area and bordering land with 59,250 square feet of area located in land under water. |

**Step 3: This section is used to describe the anticipated impacts from the proposed action on the physical/chemical/biological environment at the project site and areas adjacent to the site that may be affected.**

## 3. DESCRIPTION OF IMPACTS

| Impacts | Y | N | Description |
|---|---|---|---|
| **Nature and duration of activity(s). Clearly describe the activities proposed and the duration of any disturbances.** | | | The SOW of the project is for the construction of a bioengineered bank. The work involves installation of a stone sill along the toe of slope to approximately 0.5 feet above ordinary high water mark and restoring the entire slope cross-section with the installation of several rows of coir fiber rolls and fabric wrapped soil cells in a step-wise manner to establish a 2:1 slope. Re-vegetation of the soils cells with native trees and shrubs would provide soil stabilization. The offset form the toe of the slope to centerline of stone sill is approximately 7.5 feet and rangers from 1 to 12 feet. The out board offset of the stone sill is approximately 14 feet and ranges from 75. To 18.5 feet. Installation of a turbidity shield along the bank would occur first and then the remaining work will be done landward from shield and therefore, will not have water egress points and anchoring locations during construction. Work would occur in approximately 3,950 linear feet of inland bank and approximately 145,250 square feet of riverfront area and bordering land. 59,250 square feet of the 145,205 square feet will occur in waters of the US which includes the turbidity shield installation and an approximately 13 foot wide by 2 foot deep by 3,700 foot long excavation. Reusing of excavated soils would occur and therefore, no off site fill will be brought in. Work is expected to begin in November with all work in the dry after installation of turbidity shield. |
| **Will the benthic community be disturbed? If no, why not? If yes, describe in detail how the benthos will be impacted.** | X | | Dredging will impact 3,600 cubic yard of below ordinary high water will occur. A turbidity barrier will be installed around active work area and dredging would occur landward of shield with no equipment in water. |
| **Will SAV be impacted? If no, why not? If yes, describe in detail how the SAV will be impacted. Consider both direct and indirect impacts. Provide details of any SAV survey conducted at the site.** | | X | No SAV in reach |
| **Will salt marsh habitat be impacted? If no, why not? If yes, describe in detail how wetlands will be impacted. What is the aerial extent of the impacts? Are the effects temporary or permanent?** | | X | Project site is in riverine fresh water. |

| | | | |
|---|---|---|---|
| **Will mudflat habitat be impacted? If no, why not? If yes, describe in detail how mudflats will be impacted. What is the aerial extent of the impacts? Are the effects temporary or permanent?** | ☐ | ☒ | Project site is not in tidal waters. |
| **Will shellfish habitat be impacted? If so, provide in detail how the shellfish habitat will be impacted. What is the aerial extent of the impact? Provide details of any shellfish survey conducted at the site.** | ☐ | ☒ | |
| **Will hard bottom (rocky, cobble, gravel) habitat be impacted at the site? If so, provide in detail how the hard bottom will be impacted. What is the aerial extent of the impact?** | ☐ | ☒ | |
| **Will sediments be altered and/or sedimentation rates change? If no, why not? If yes, describe how.** | ☒ | ☐ | Dredging will impact 3,600 cubic yard of fill below ordinary high water and will impact sediments temporarily. The bank stabilization will prevent further erosion post construction. |
| **Will turbidity increase? If no, why not? If yes, describe the causes, the extent of the effects, and the duration.** | ☒ | ☐ | Minimally. Subrecipient will employ a turbidity barrier around project site and comply with permit restrictions limiting turbidity. |

| | | | |
|---|---|---|---|
| **Will water depth change? What are the current and proposed depths?** | ☐ | ☒ | |
| **Will contaminants be released into sediments or water column? If yes, describe the nature of the contaminants and the extent of the effects.** | ☐ | ☒ | |
| **Will tidal flow, currents, or wave patterns be altered? If no, why not? If yes, describe in detail how.** | ☒ | ☐ | Minimally, turbidity barrier will cause a slight change in current patterns in River during construction. Project is not anticipated to change river flow post construction. |
| **Will water quality be altered? If no, why not? If yes, describe in detail how. If the effects are temporary, describe the duration of the impact.** | ☐ | ☒ | Bank stabilization will not introduce factors that could impact salinity or temperature regime. Tree removal will include only hangers and will not impact temperature. |
| **Will ambient noise levels change? If no, why not? If yes, describe in detail how. If the effects are temporary, describe the duration and degree of impact.** | ☐ | ☒ | Minimally, construction equipment will temporarily increase noise levels but they will not permanently increase the ambient noise levels. |
| **Does the action have the potential to impact prey species of federally managed fish with EFH designations?** | ☒ | ☐ | Though there are species that are considered prey for Atlantic Salmon there wouldn't be any permanent impacts to these species. Subrecipient is applying to MASS DEP for an exception for the Time of Year restriction. They plan on installing the turbidity barrier outside the time of year restriction and then work would be done in dry year round if exception is approved. Since barrier would prevent any work in water during spawning season, there would still be no impact to prey species. |

**Step 4: This section is used to evaluate the consequences of the proposed action on the functions and values of EFH as well as the vulnerability of the EFH species and their life stages. Identify which species (from the list generated in Step 1) will be adversely impacted from the action. Assessment of EFH impacts should be based upon the site characteristics identified in Step 2 and the nature of the impacts described within Step 3. The Guide to EFH Descriptions webpage should be used during this assessment to determine the ecological parameters/preferences associated with each species listed and the potential impact to those parameters.**

## 4. EFH ASSESSMENT

| Functions and Values | Y | N | Describe habitat type, species and life stages to be adversely impacted |
|---|---|---|---|
| **Will functions and values of EFH be impacted for:** | | | |
| **Spawning**<br>**If yes, describe in detail how, and for which species. Describe how adverse effects will be avoided and minimized.** | ☐ | ☒ | |
| **Nursery**<br>**If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.** | ☐ | ☒ | |
| **Forage**<br>**If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.** | ☒ | ☐ | Temporary impacts to forage habitat because of turbidity barrier. No other impacts anticipated because Atlantic salmon are not present in this river. |
| **Shelter**<br>**If yes, describe in detail how and for which species. Describe how adverse effects will be avoided and minimized.** | ☒ | ☐ | Temporary impacts to shelter habitat because of turbidity barrier. Herring, which salmon smolts shelter with along their migration out to the ocean may be impacted from work (see section 6). However, no impacts are anticipated because Atlantic salmon are not present in this river. |

| | | | |
|---|---|---|---|
| **Will impacts be temporary or permanent? Please indicate in description box and describe the duration of the impacts.** | | | Temporary during construction period. |
| **Will compensatory mitigation be used? If no, why not? Describe plans for mitigation and how this will offset impacts to EFH. Include a conceptual compensatory mitigation plan, if applicable.** | ☐ | ☒ | Buying and managing wetlands to offset impacts would not occur as wetlands impacts would be minimal. |

**<u>Step 5</u>: This section provides the federal agency's determination on the degree of impact to EFH from the proposed action. The EFH determination also dictates the type of EFH consultation that will be required with NOAA Fisheries**.

**Please note: if information provided in the worksheet is insufficient to allow NOAA Fisheries to complete the EFH consultation additional information will be requested.**

## 5. DETERMINATION OF IMPACT

| Federal Agency's EFH Determination | | |
|---|---|---|
| **Overall degree of adverse effects on EFH (not including compensatory mitigation) will be:**<br><br>**(check the appropriate statement)** | ☐ | **There is no adverse effect on EFH or no EFH is designated at the project site.**<br><br>**EFH Consultation is not required.** |
| | ☒ | **The adverse effect on EFH is not substantial. This means that the adverse effects are either no more than minimal, temporary, or that they can be alleviated with minor project modifications or conservation recommendations.**<br><br>**This is a request for an abbreviated EFH consultation.** |
| | ☐ | **The adverse effect on EFH is substantial.**<br><br>**This is a request for an expanded EFH consultation.** |

**Step 6: Consultation with NOAA Fisheries may also be required if the proposed action results in adverse impacts to other NOAA-trust resources, such as anadromous fish, shellfish, crustaceans, or their habitats as part of the Fish and Wildlife Coordination Act Some examples of other NOAA-trust resources are listed below. Inquiries regarding potential impacts to marine mammals or threatened/endangered species should be directed to NOAA Fisheries' Protected Resources Division.**

## 6. OTHER NOAA-TRUST RESOURCES IMPACT ASSESSMENT

| Species known to occur at site (list others that may apply) | Describe habitat impact type (i.e., physical, chemical, or biological disruption of spawning and/or egg development habitat, juvenile nursery and/or adult feeding or migration habitat). Please note, impacts to federally listed species of fish, sea turtles, and marine mammals must be coordinated with the GARFO Protected Resources Division. |
|---|---|
| **alewife** | Species may spawn near project, however, work would not be conducted between April and Mid October which is outside spawning season. Subrecipient is applying to MASS DEP for an exception for the Time of Year restriction. They plan on installing the turbidity barrier outside the time of year restriction and then work would be done in dry year round if exception is approved. Since barrier would prevent any work in water during spawning season, there would still be no impact to alewife. |
| **American eel** | Species may be present in project area as juveniles and adults and could be impacted by project due to potential removal of natural shelters. Project would mitigate impact through design of soft and hard bank features that may include outcrops, utilizing bioengineering at the toe, and minimization of encroachment into river. |
| **American shad** | Species may spawn near project, however, work would not be conducted between April and Mid October which is outside spawning season. Subrecipient is applying to MASS DEP for an exception for the Time of Year restriction. They plan on installing the turbidity barrier outside the time of year restriction and then work would be done in dry year round if exception is approved. Since barrier would prevent any work in water during spawning season, there would still be no impact to to Shad. |
| **Atlantic menhaden** | |
| **blue crab** | |
| **blue mussel** | |
| **blueback herring** | Species may spawn near project, however, project site is not optimal since they spawn in deep river waters with hard substrates. Though site is not optimal for blueback herring spawning, work in water would still not be conducted between April and Mid October which is outside spawning season. Subrecipient is applying to MASS DEP for an exception for the Time of Year restriction. They plan on installing the turbidity barrier outside the time of year restriction and then work would be done in dry year round if exception is approved. Since barrier would prevent any work in water during spawning season, there would still be no impact to blueback herring. |

| | |
|---|---|
| **Eastern oyster** | |
| **horseshoe crab** | |
| **quahog** | |
| **soft-shell clams** | |
| **striped bass** | Species may spawn near project, however, work would not be conducted between April and Mid October which is outside spawning season. Subrecipient is applying to MASS DEP for an exception for the Time of Year restriction. They plan on installing the turbidity barrier outside the time of year restriction and then work would be done in dry year round if exception is approved. Since barrier would prevent any work in water during spawning season, there would still be no impact to striped bass. |
| **other species:** | |
| | |

**Useful Links**

National Wetland Inventory Maps

EPA's National Estuaries Program

Northeast Regional Ocean Council (NROC) Data

Mid-Atlantic Regional Council on the Ocean (MARCO) Data

**Resources by State:**

**Maine**
Eelgrass maps

Maine Office of GIS Data Catalog

Casco Bay Estuary Partnership

Maine GIS Stream Habitat Viewer

**New Hampshire**
New Hampshire's Statewide GIS Clearinghouse, NH GRANIT

New Hampshire Coastal Viewer

**Massachusetts**
Eelgrass maps

MADMF Recommended Time of Year Restrictions Document

Massachusetts Bays National Estuary Program

Buzzards Bay National Estuary Program

Massachusetts Division of Marine Fisheries

Massachusetts Office of Coastal Zone Management

**Rhode Island**
Eelgrass maps

Narraganset Bay Estuary Program

Rhode Island Division of Marine Fisheries

Rhode Island Coastal Resources Management Council

**Connecticut**

Eelgrass Maps

Long Island Sound Study

CT GIS Resources

CT DEEP Office of Long Island Sound Programs and Fisheries

CT Bureau of Aquaculture Shellfish

Maps CT River Watershed Council

**New York**

Eelgrass report

Peconic Estuary Program

NY/NJ Harbor Estuary

**New Jersey**

Submerged Aquatic Vegetation mapping

Barnegat Bay Partnership

**Delaware**

Partnership for the Delaware Estuary

Center for Delaware Inland Bays

**Maryland**

Submerged Aquatic Vegetation mapping

MERLIN

Maryland Coastal Bays Program

**Virginia**

Submerged Aquatic Vegetation mapping

**From:** [redacted]
[redacted]
[redacted]
**Subject:** Re: DR-4028-MA Merrimack River Bioengineered Bank Stabilization EFH abbreviated assessment
**Date:** Tuesday, July 25, 2017 2:49:06 PM

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Brandon,

Based upon the information in the EFH assessment, we have determined that the proposed project would have minimal adverse effect on EFH for Atlantic salmon. In addition, the project area will have minimal effects on other NOAA-trust resources, including those covered under the Fish and Wildlife Coordination Act. Therefore, we have no EFH conservation recommendations to provide to you for this action pursuant to Section 305(b)(4)(A) of the Magnuson-Stevens Act.

Thanks,

Mike

On Tue, Jul 25, 2017 at 2:30 PM, [redacted] wrote:

> Mike,
>
> Please find attached FEMA's EHF assessment worksheet for the Chelmsford, MA bank stabilization project on the Merrimack River. This is a request for an abbreviated EFH consultation and please let me know if you require more information. Thank you.
>
> Brandon M Webb
>
> Environmental Specialist
>
> Mitigation FEMA Region 1
>
> 99 High St Boston, MA 02110
>
> [redacted]
>
> [redacted]

--
Michael R. Johnson
U.S. Department of Commerce
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
(formerly, Northeast Regional Office)

Habitat Conservation Division
55 Great Republic Drive
Gloucester, MA 01930
[redacted]
http://www.greateratlantic.fisheries.noaa.gov/

| | |
|---|---|
| Web | www.nmfs.noaa.gov |
| Facebook | www.facebook.com/usnoaafisheriesgov |
| Twitter | www.twitter.com/noaafisheries |
| YouTube | www.youtube.com/usnoaafisheriesgov |