ENVIRONMENTAL ASSESSMENT,
FINDING OF NO SIGNIFICANT IMPACT
AND
404 (b) (1) EVALUATION

LOCAL FLOOD PROTECTION PROJECT
SALISBURY, MASSACHUSETTS

Prepared by:

Judith L. Johnson
Biologist

Marcos A. Paiva
Archaeologist

May 2006

U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 01742-2751

Table of Contents

Page Number

Table of Contents (continued)

Page Number

LIST OF FIGURES

LIST OF TABLES

FINDING OF NO SIGNIFICANT IMPACT

The proposed project provides limited flood protection to a residential neighborhood located adjacent to the Blackwater River tidal estuary in Salisbury, Massachusetts. The project site consists of a residential development of about 20 acres that includes approximately 135 homes located on 9th Street, 10th Street, 11th Street, 12th Street, Berry Lane, Lewis Avenue, Florence Avenue, and Carter Street. A floodwall will be constructed for the purpose of alleviating frequent low-level flooding experienced in this residential neighborhood in recent years. The flood barrier will initially provide protection from a 30-35 year flood at the top of protection. This level of protection will gradually decrease to a 5-year flood due to projected increases in sea level during the project's 50-year life. More comprehensive flood protection for the proposed project area is constrained by local topography and the proximate location of the Atlantic Ocean as well as economic and environmental considerations. This study is authorized under the special continuing authority of Section 205 of the 1948 Flood Control Act, as amended. This program is used to assist local communities in identifying flooding problems, and to formulate and construct alternatives for flood damage reduction.

The alternative analysis process involved extensive coordination with federal, state and local agencies over a period of three years to assure the sensitive regulatory, policy and social issues associated with the project were fully evaluated. The alternative analysis included the No Action alternative as well as evaluation of structural measures; floodwall, dike and dike/floodwall combination and nonstructural measures; raise homes with a first floor below elevation 8.0-feet National Geodetic Vertical Datum (NGVD), purchase homes with first floor below elevation 8.0-feet NGVD, and purchase all homes and lots in the study area. In addition, the Corps considered modifying the 1991 Route 286 bridge located in New Hampshire by constricting the bridge span from 70 feet to 35 feet to be comparable to the 1948 span. However, increased tidal conveyance resulting from construction of the 1991 bridge increased the size of the Blackwater River Marsh by approximately ten acres (into the historical range of the salt marsh) along its periphery. Intentionally filling the waterway to restrict tidal conveyance as a flood protection solution would not be supported by the environmental community. Filling the Backwater River to 1948 bridge conditions at the Route 286 bridge and the subsequent loss of salt marsh would also not meet federal Clean Water Act guidelines for the protection of wetlands and was, therefore, eliminated from further evaluation.

The recommended plan to reduce flood damages along the Blackwater River consists of a floodwall having a total length of about 2,765 feet, and two pumping stations. The floodwall is a relatively low structure, having an average height of 2 to 3 feet and a top elevation of 8.0-feet NGVD. The material currently proposed for the floodwall is vinyl sheet piling for its corrosion resistance. A wooden or aluminum cap would be placed on the sheet piling. In addition, soil would be placed against the landward face of the sheet pile wall at most locations to form a slope of 1 vertical on 2 horizontal. This slope, which would be top soiled and seeded with grass, would mitigate visual and other impacts of the wall.

Construction of the proposed floodwall would permanently fill 1,195 acres of salt marsh and restrict tidal flooding to 1,890 square feet of salt marsh for a total salt marsh impact of 3,085 square feet. Impacts were minimized to the maximum extent practicable through the evaluation of alternatives and interagency coordination meetings. To mitigate for wetland losses, a plan involving the creation/restoration of 3,907 square feet of salt marsh was developed to the federal "no net loss" of wetlands guidelines. Sites selected for creation/restoration are degraded or previously filled and hydrologically connected to the Blackwater River Marsh, which maximizes the value of the created wetland. In addition, 5,838 square feet of enhancement will be undertaken in two areas dominated by *Phragmites*, an invasive species with low habitat value.

The Corps Contractor will work from land during the dry portion of the tidal cycle and appropriate erosion control measures will be implemented throughout construction. These measures will assure minimal water quality impact to the estuarine ecosystem.

No significant adverse impacts to the environment are anticipated. My determination of a Finding of No Significant Impact is based on the Environmental Assessment and the following considerations:

a. Water quality impacts will be minimized by employing standard erosion control techniques and scheduling the construction during tidal lows.

b. There will be 3,085 square feet of impacts to coastal wetlands due to floodwall restriction of periodic inundation. These impacts will be mitigated by creation/restoration of 3,907 square feet of salt marsh and the enhancement of 5,838 square feet of salt marsh in two areas dominated by *Phragmites*, an invasive species with low habitat value.

c. There will be no significant long-term adverse impacts on the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans in the Blackwater River estuary.

d. This project will have no impact on any federal or state rare or endangered species.

e. No archaeological or historical resources will be affected by this project.

Based on my review and evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that the Salisbury, Massachusetts Section 205 Local Flood Protection Projects is not a major federal action significantly affecting the quality of the human environment. Therefore, I have determined that this project is exempt from the requirement to prepare an Environmental Impact Statement.

__________________ ____________________________

Date

Curtis L. Thalken
Colonel, Corps of Engineers
District Engineer

ENVIRONMENTAL ASSESSMENT

1.0 INTRODUCTION

1.1 Purpose and Need

The proposed project provides limited flood protection to a residential neighborhood located adjacent to the Blackwater River tidal estuary in Salisbury, Massachusetts (see Location Map, Figure EA-1). It involves the construction of a floodwall for the purpose of alleviating frequent low-level flooding experienced in this residential neighborhood in recent years. The flood barrier is designed to prevent flooding to the 10-year storm event over a 50-year project life. More comprehensive flood protection for the proposed project area is constrained by local topography and the proximate location of the Atlantic Ocean as well as economic and environmental considerations.

The Blackwater River is a coastal river located in Seabrook, New Hampshire and Salisbury, Massachusetts. Tide waters from Hampton Harbor flow up the Blackwater River (south) to the salt marshes in Seabrook and Salisbury. There is a bridge located along Route 286 in Seabrook about two miles upstream from Hampton Harbor which crosses the marshes and river and has historically, through changes in its configuration, altered the hydrology of the Blackwater River tidal estuary (see Project Site Map, Figure EA-2).

Twice the New Hampshire Department of Transportation (DOT) has replaced the Route 286 bridge from its original bridge. The original bridge was constructed in the early 1900's with a clear width of 350 feet at mean tide level, having 35 pile-supported spans. This bridge was replaced in 1948 with a single span bridge in the same location with a bridge opening of 35 feet at mean tide level. The superstructure of the present bridge, constructed in 1991, consists of steel beams and a reinforced concrete slab and abutments with a bridge opening of 70 feet at mean tide level (ACOE, 1995).

A change in width from the 350 feet original bridge opening to the 1948 bridge opening of 35 feet restricted tide heights upstream of the bridge. This tidal restriction was somewhat lessened with the construction of the present bridge in 1991, with a bridge opening of 70 feet, resulting in increased tidal heights upstream of the bridge. The computed change in tide height from the 1948 bridge to the present (1991) bridge near Berry Lane is a few tenths of a foot for a high spring tide event, about 0.5 foot for a one-year event and about 1 foot for a 10-year event (ACOE, 1995). Due to this increase in tidal conveyance, the Blackwater River Marsh has increased in size approximately ten acres (into the historical range of the salt marsh) along its periphery. While there are widely acknowledged benefits to the restoration of salt marsh and estuarine habitat, increased tidal conveyance also affected well-established residential developments. Although flooding along the Blackwater River has occurred to varying degrees over the years, the replacement of the Route 286 bridge in 1991 in New Hampshire exacerbated the problem.

1.2 Project Location

The town of Salisbury is located in northeastern Massachusetts, about 45 miles north of Boston, Massachusetts (see Location Map, Figure EA-1). The project site (see Project Site Map, Figure EA-2) consists of a residential development of about 20 acres that includes approximately 135 homes located on 9th Street, 10th Street, 11th Street, 12th Street, Berry Lane, Lewis Avenue, Florence Avenue, and Carter Street.

1.3 Project Authorization

This study is authorized under the special continuing authority of Section 205 of the 1948 Flood Control Act, as amended. This program is used to assist local communities in identifying flooding problems, and to formulate and construct alternatives for flood damage reduction.

2.0 ALTERNATIVES INCLUDING THE PROPOSED PLAN

The alternative analysis process involved extensive coordination with federal, state and local agencies over a period of three years to assure the sensitive regulatory, policy and social issues associated with the project were fully evaluated. The alternative analysis included the No Action alternative as well as evaluation of structural measures; floodwall, dike and dike/floodwall combination and nonstructural measures; raise homes with a first floor below elevation 8.0-feet National Geodetic Vertical Datum (NGVD), purchase homes with first floor below elevation 8.0-feet NGVD, and purchase all homes and lots in the study area.

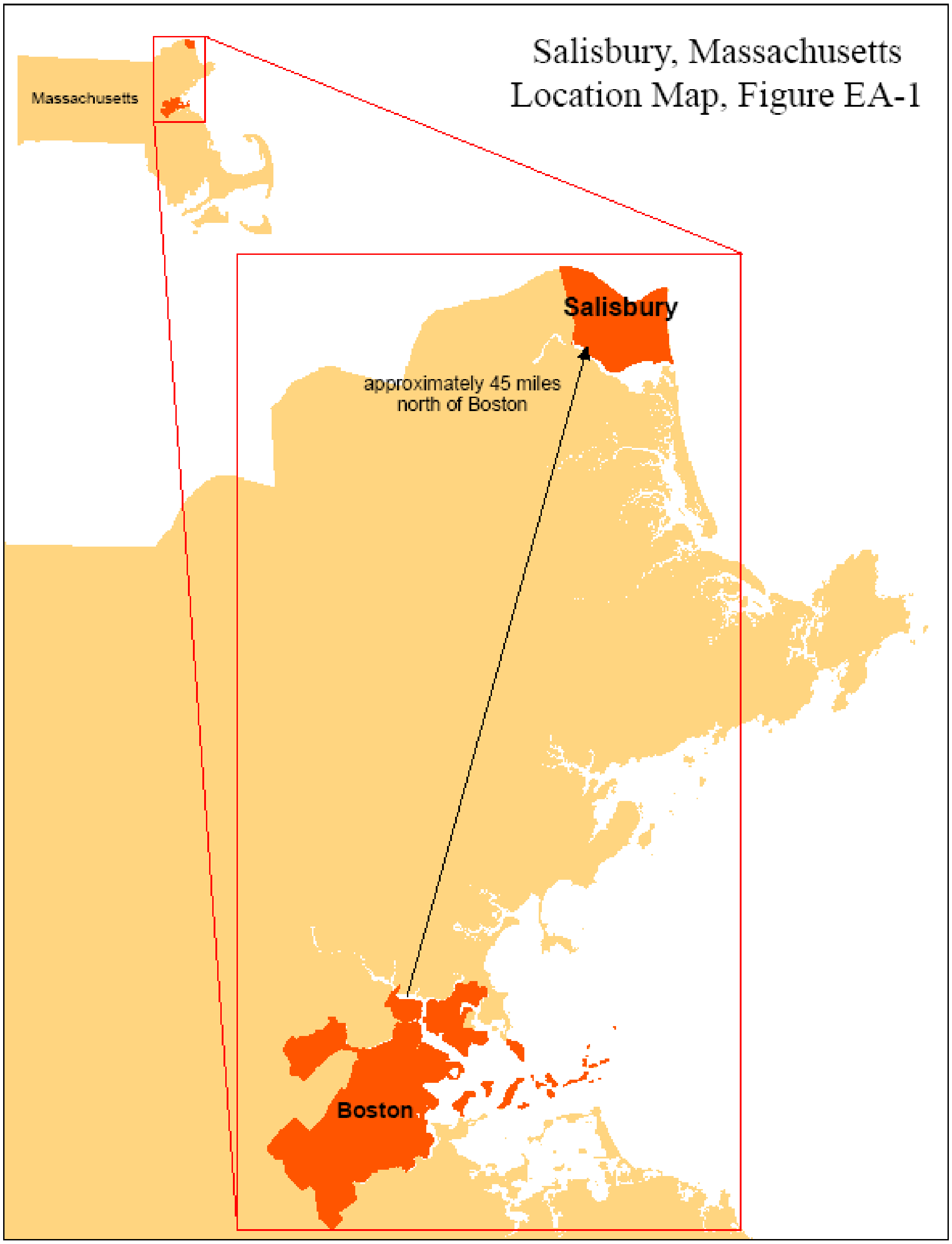
Early in the planning process, the Corps considered constricting the 1991 bridge span from 70 feet to 35 feet, comparable to the 1948 span. However, the political complexities associated with the Federal government and/or the Commonwealth of Massachusetts proposing controversial alterations to highway infrastructure and/or waterways in the state of New Hampshire made this alternative infeasible for all practical purposes. In addition, as the increased tidal conveyance resulting from construction of the 1991 Bridge increased the size of the Blackwater River Marsh by approximately ten acres (into the historical range of the salt marsh) along its periphery, intentionally refilling the waterway to restrict tidal conveyance as a flood protection solution would not be supported by the environmental community. Filling the Backwater River to 1948 bridge conditions at the Route 286 bridge and the subsequent loss of salt marsh would also not meet federal Clean Water Act guidelines for the protection of wetlands and was, therefore, eliminated from further evaluation.

2.1 Proposed Plan – Floodwall to Elevation 8.0 NGVD

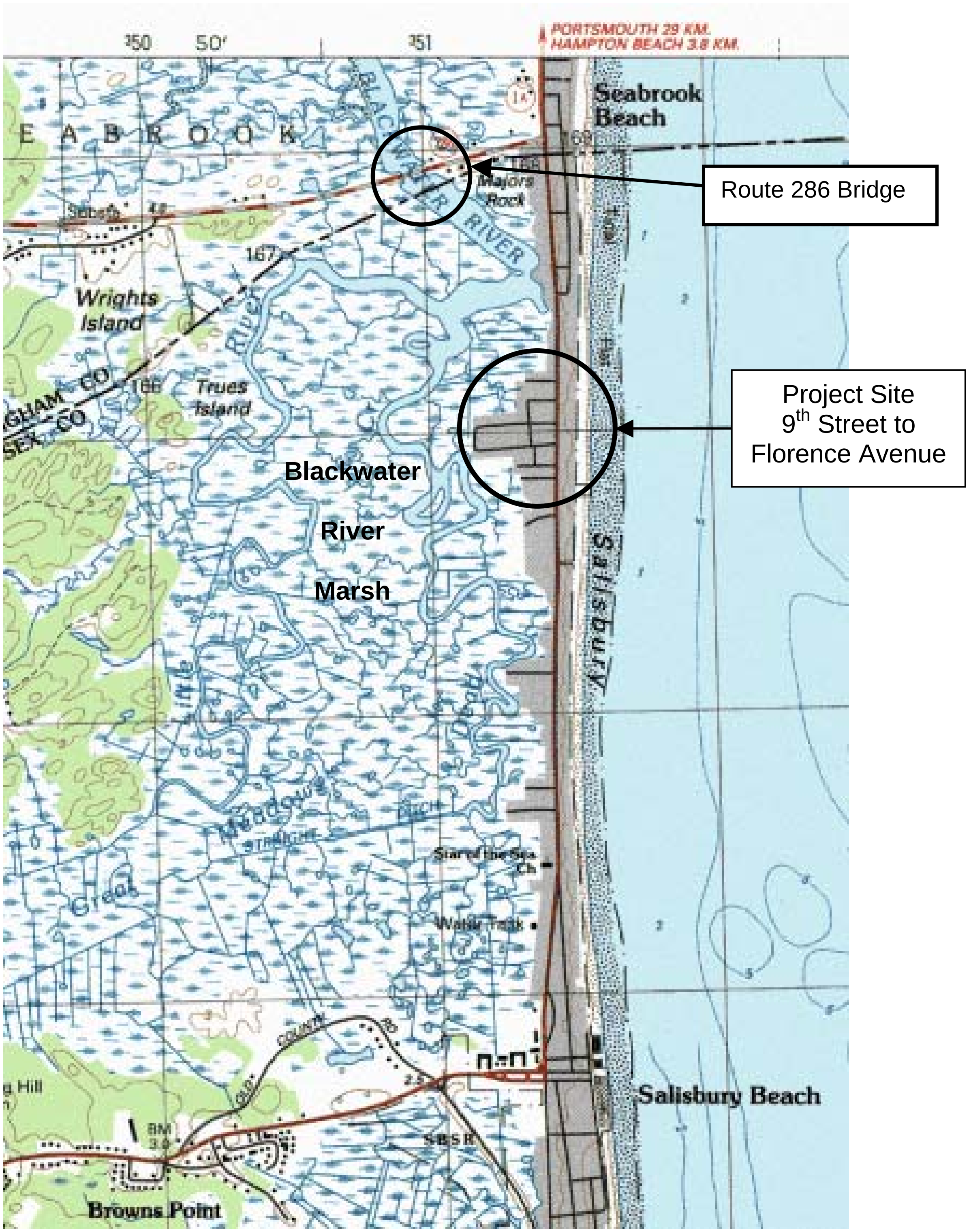
The recommended plan to reduce flood damages along the Blackwater River consists primarily of a two sections of floodwall having a total length of about 2,765 feet, and two pumping stations. The floodwall is a relatively low structure, having an average height of 2 to 3 feet and a top elevation of 8.0-feet NGVD. The material currently proposed for the floodwall is vinyl sheet piling for its corrosion resistance. A wooden or aluminum cap would be placed on the sheet piling. In addition, soil would be placed against the landward face of the sheet pile wall at most locations to form a slope of 1 vertical on 2 horizontal. This slope, which would be top soiled and seeded with grass, would mitigate visual and other impacts of the wall.

There are two section of floodwall. The first section of floodwall would begin on the northern edge of properties on the north side of 9th Street. From this point it would extend westerly to the edge of the salt marsh, turn southerly along the salt marsh past the end of 9th Street, turn in a somewhat westerly direction past a home on 10th Street, turn southerly past the end of 10th Street, turn westerly along the salt marsh behind homes on 11th Street, and turn southerly along the western side of Berry Lane to its end at a high point near the end of 12th Street. The second section of floodwall would begin behind homes on the south side of 12th Street, extent easterly along these properties, turn southerly following the salt marsh past the ends of Lewis and Florence Avenues, and turn easterly to end a high point behind homes on the south side of Florence Avenue. In most areas, the floodwall would be very close to the edge of the salt marsh. Construction of the proposed floodwall would permanently fill 1,195 acres of salt marsh and restrict tidal flooding to 1,890 square feet of salt marsh for a total of 3,085 square feet of impacts to salt marsh. The loss of 3,085 square feet of salt marsh will be compensated through creation, restoration and enhancement of salt marsh in an area hydrologically connected to the Blackwater River. See Section 5.0 Mitigation for Unavoidable Loss of Wetland for further information on mitigation of impacts to salt marsh.

Pumping stations will be required at two locations along the floodwall to provide for discharge of rainfall and other interior drainage during periods of high water along the Blackwater River. Both pumping stations would be located in underground concrete structures along the alignment of existing storm drains. The largest pump station would be located under Berry Lane at the point where storm drains from 11th and 12th Streets converge and discharge into the Blackwater River. The station would have a pumping capacity of 26 cubic feet per second. The second underground pumping station would be located at the western end of Lewis Avenue along the alignment of the existing storm drains. The capacity of this smaller pumping station would be 5 cubic feet per second. Storm drainage from Florence Avenue would be conveyed to this pump station via a new storm drain connecting the Lewis and Florence Avenue storm drains. An emergency generator, located near the Berry Lane pumping station and connected to the Lewis Avenue pumping station via underground cable, would ensure operation of these pumps under all conditions (see Local Protection Project Map, Figures EA-3 and EA-4). Flap valves would also be located at the gravity outlet of each pump station to prevent water from flowing into the protected area during high water.


Salisbury, Massachusetts
Location Map, Figure EA-1
Massachusetts
Salisbury
approximately 45 miles
north of Boston
Boston

Project Site Map
Figure EA-2



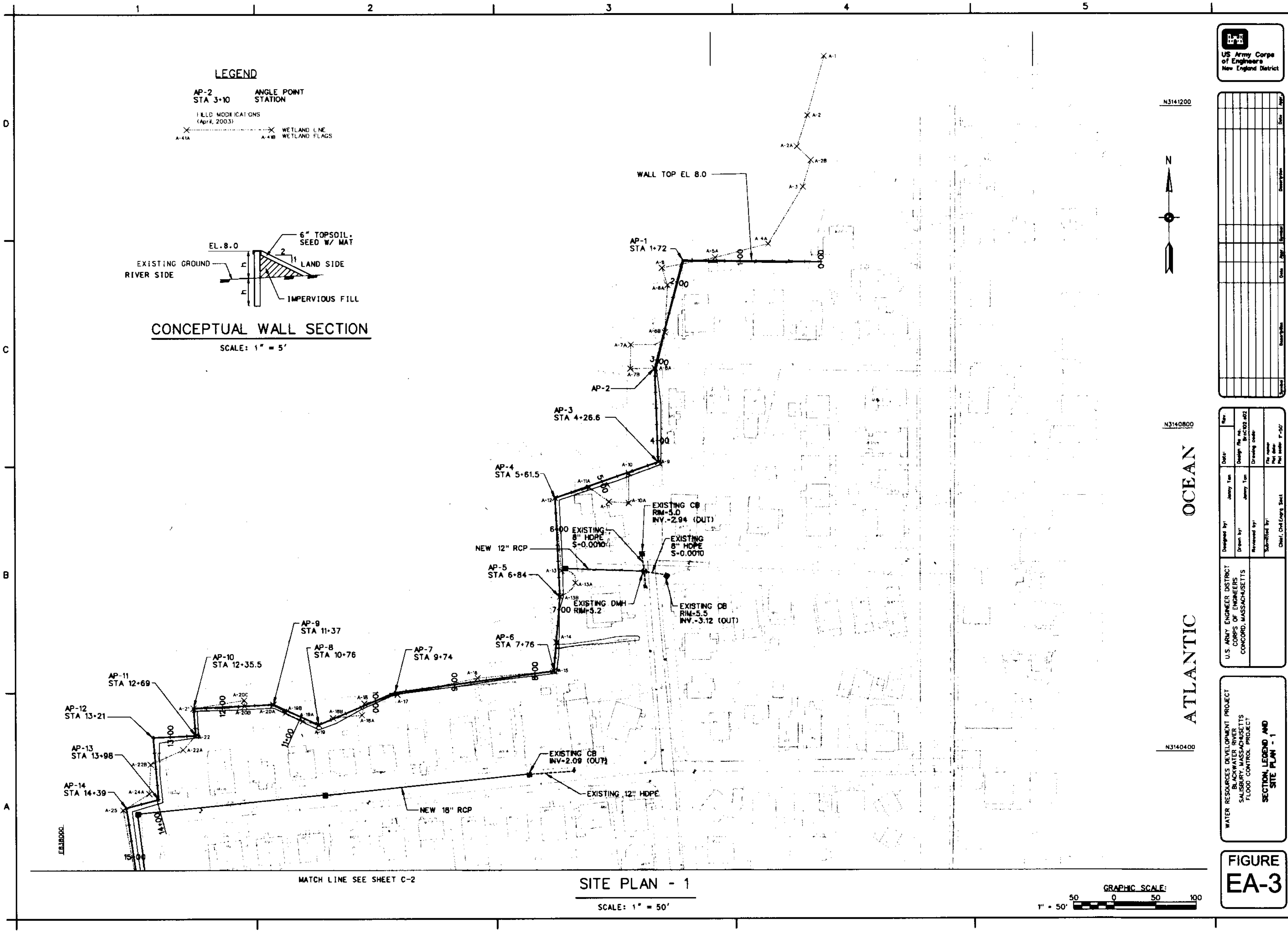
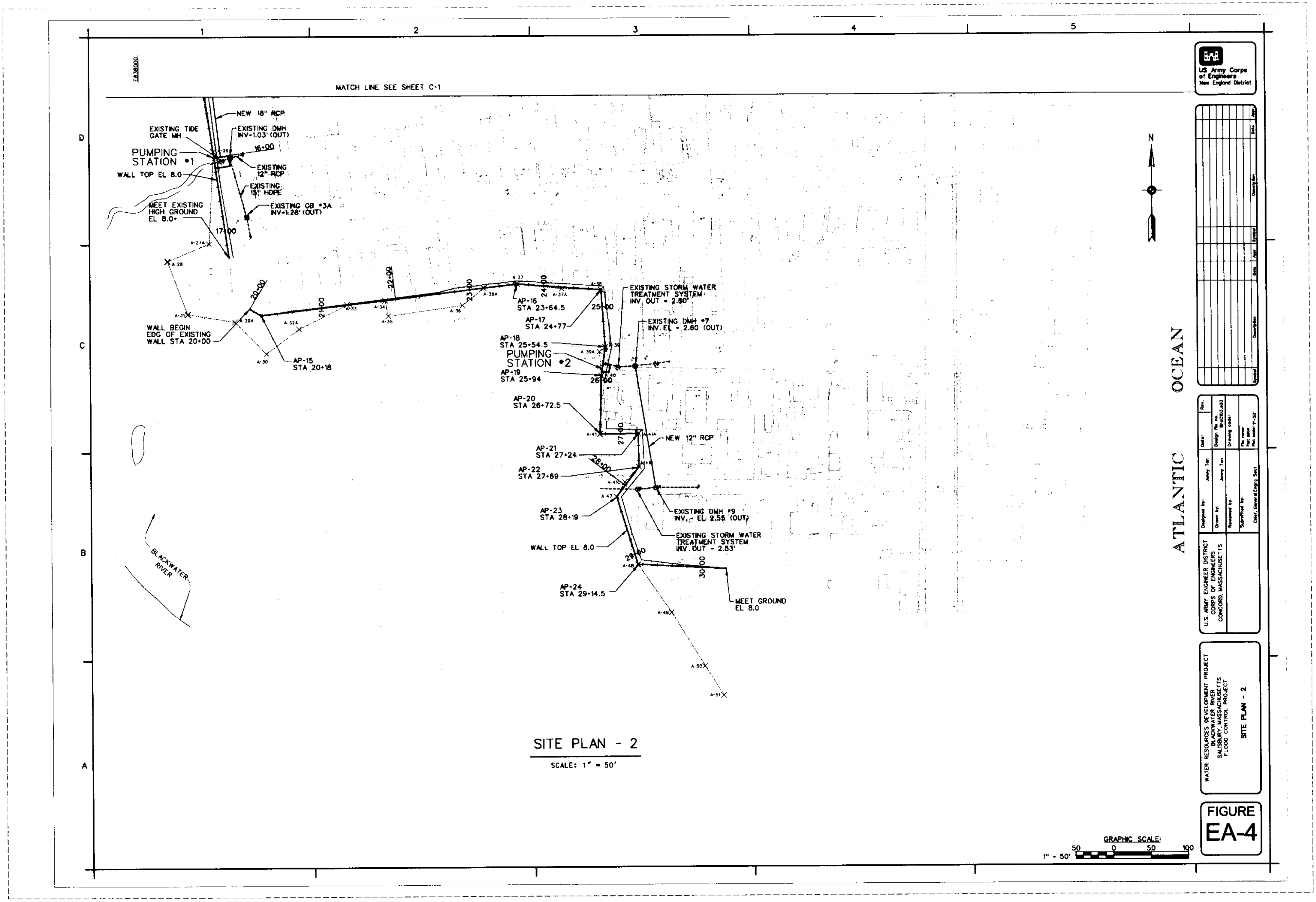

LEGEND
AP-2 STA 3+10 ANGLE POINT STATION
WETLAND LINE
WETLAND FLAGS
EL. 8.0
6" TOPSOIL, SEED W/ MAT
EXISTING GROUND
RIVER SIDE
LAND SIDE
IMPERVIOUS FILL
CONCEPTUAL WALL SECTION
SCALE: 1" = 5'
WALL TOP EL 8.0
AP-1 STA 1+72
AP-2
AP-3 STA 4+26.6
AP-4 STA 5+61.5
AP-5 STA 6+84
AP-6 STA 7+76
AP-7 STA 9+74
AP-8 STA 10+76
AP-9 STA 11+37
AP-10 STA 12+35.5
AP-11 STA 12+69
AP-12 STA 13+21
AP-13 STA 13+98
AP-14 STA 14+39
EXISTING CB RIM=5.0 INV.=2.94 (OUT)
EXISTING 8" HDPE S=0.0010
NEW 12" RCP
EXISTING DMH RIM=5.2
EXISTING CB RIM=5.5 INV.=3.12 (OUT)
EXISTING CB INV=2.09 (OUT)
EXISTING 12" HDPE
NEW 18" RCP
MATCH LINE SEE SHEET C-2
SITE PLAN - 1
SCALE: 1" = 50'
GRAPHIC SCALE:
1" = 50'
N3141200
N3140800
N3140400
ATLANTIC OCEAN
US Army Corps of Engineers New England District
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS
WATER RESOURCES DEVELOPMENT PROJECT
BLACKWATER RIVER
SALISBURY, MASSACHUSETTS
FLOOD CONTROL PROJECT
SECTION, LEGEND AND SITE PLAN - 1

FIGURE EA-3



MATCH LINE SEE SHEET C-1
NEW 18" RCP
EXISTING TIDE GATE MH
EXISTING DMH INV-1.03' (OUT)
16+00
PUMPING STATION #1
WALL TOP EL 8.0
EXISTING 12" RCP
EXISTING 15" HDPE
EXISTING CB #3A INV=1.28' (OUT)
MEET EXISTING HIGH GROUND EL 8.0+
17+00
20+00
21+00
22+00
23+00
24+00
25+00
26+00
27+00
28+00
29+00
30+00
WALL BEGIN EDG OF EXISTING WALL STA 20+00
AP-15 STA 20+18
AP-16 STA 23+64.5
AP-17 STA 24+77
AP-18 STA 25+54.5
PUMPING STATION #2
AP-19 STA 25+94
AP-20 STA 26+72.5
AP-21 STA 27+24
AP-22 STA 27+69
AP-23 STA 28+19
WALL TOP EL 8.0
AP-24 STA 29+14.5
EXISTING STORM WATER TREATMENT SYSTEM INV OUT = 2.50'
EXISTING DMH #7 INV.EL = 2.80 (OUT)
NEW 12" RCP
EXISTING DMH #9 INV. = EL 2.55 (OUT)
EXISTING STORM WATER TREATMENT SYSTEM INV OUT = 2.53'
MEET GROUND EL 8.0
BLACKWATER RIVER
ATLANTIC OCEAN
N
SITE PLAN - 2
SCALE: 1" = 50'
GRAPHIC SCALE:
50 0 50 100
1" = 50'
US Army Corps of Engineers New England District
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS
WATER RESOURCES DEVELOPMENT PROJECT BLACKWATER RIVER SALISBURY, MASSACHUSETTS FLOOD CONTROL PROJECT
SITE PLAN - 2
FIGURE EA-4

2.2 Alternatives

2.2.1 Structural

2.2.1.1 Alternative 1- Dike To Elevation 8.0 feet NGVD – This alternative consists of an earthen dike that would begin at elevation 8.0 behind homes on the north side of 9th Street, follow the periphery of the salt marsh on the west side of the study area, and terminate at elevation 8.0 behind homes on the south side of Florence Avenue. The total length of the dike would be about 2560 feet. The dike would have a top width of 5 feet and have side slopes at 1 vertical on 2.5 horizontal. The dike would be constructed from impervious fill and be finished with 6 inches of topsoil that would be seeded. Rainfall from the area behind the dike would be collected by a drainage system and discharged at 2 pumping stations. These stations would be located at current discharge point on Berry Lane and at the end of Lewis Avenue.

The dike was considered to be a "softer" solution with the sloped seaward edge that simulated more natural conditions allowing the landward migration of storm sediments overtopping the dike, the seaward migration of windblown sediments and landward development of saltmarsh with sea level rise, however, these benefits were determined to be minimal. Sediments that migrate over the dike during a storm event would quickly be removed from residential streets and the eolian transport of sediments would be interrupted to some extent by the numerous residential structures on the landscape. As well, the 1:2.5 dike side slopes, designed with maximum steepness to minimize the dike footprint, also limits the landward migration of saltmarsh over time to a narrow linear area. Of greatest concern, the dike option impacts a total of 25,530 square feet of saltmarsh and freshwater wetlands (see Table 4, Wetland Impacts Associated with Structural Alternatives, for individual categories of impact) due to the side slopes and the 5-foot top width necessary for dike stabilization. The wetland impacts associated with Alternative 1 far exceed the wetland impacts for Alternative 2 and 3 and therefore, Alternative 1 was not considered a viable option.

2.2.1.2 Alternative 2 – Floodwall To Elevation 8.0 feet NGVD (Preferred Alternative) – This plan consists of a vinyl sheet pile floodwall that would follow the same general alignment as Alternative 1. At most locations, the floodwall would be placed immediately landward of the wetland boundary. The plan would include a landward berm with a side slope of 1 vertical on 2 horizontal where there is sufficient space available between the wall and existing structures. The total length of the floodwall would be about 2765 feet. This plan would also include pumping stations on Berry Lane and at the end of Lewis Avenue to discharge interior drainage.

The floodwall was generally considered to be a "hard" structure however, the limited footprint realized a reduction in wetland impacts over the other structural alternative and social and economical considerations further implied Alternative 2 to be the practicable solution. A landward berm was added to the floodwall option to "soften" the structure and realize some of the limited sediment transport benefits of the dike without increasing wetland impacts. Further information concerning the evaluation process which determined Alternative 2 to be the preferred Alternative is explained in Section 2.2.1.3 below.

2.2.1.3 Alternative 3 - Combination Floodwall and Dike To Elevation 8.0 feet NGVD – This alternative is a combination of alternatives 1 and 2 above and would include about 1500 feet of dike and about 1210 feet of floodwall. The alignment of the dike and wall also follows the edge of the salt marsh. Pumping stations on Berry Lane and Lewis Avenue are also included to discharge runoff that would accumulate behind the protective works.

Alternative 3 was revised and reevaluated over a period of time to devise the best alignment utilizing both the floodwall and dike. Generally, the floodwall had a lesser footprint (lesser impacts to wetlands) but the dike was considered a "softer" solution with the seaward-sloped edge simulating more natural shoreline conditions (allowing for some limited sediment transport process benefits). Over several revisions, the floodwall sections were located in areas of limited space and to limit impacts or preserve sections of valuable riparian buffer habitat. This rendered the dike portions of the alignment to limited fragments located primarily in the northern half of the project area. After a public meeting and open dialog with residents in the area, it became apparent that the fragmented dike portions were unacceptable to many property owners, leaving portions of their properties unusable and created an inequity of real estate taking compared to the properties, which had a wall alignment. From an engineering perspective, there is also difficulty inherent with each transition (dike to wall) and a more complicated construction scenario with increased project costs. As well, Alternative 2, the floodwall, had the least impact to wetlands and therefore, was determined to be the preferred plan.

2.2.2 Nonstructural

2.2.2.1 Raise All Homes With A First Floor Elevation Below 8.0 – This alternative consists of raising the 33 homes within the study area that have a first floor elevation less than elevation 8.0. The home would be taken off its existing foundation and the foundation would be replaced or modified so that when the home was lowered, the first floor elevation would be above potential flood heights (elevation 10.0). All utility connections, primarily water and sewer lines, would be extended, and new exterior stairways would be constructed. Although this plan had a favorable cost to benefit ratio, the plan was not acceptable to the Town for two primary reasons: (1) roadway flooding would continue to hinder and/or prevent evacuation and delivery of emergency services; and (2) flood damages would only be reduced for a small percentage of properties in the study area.

2.2.2.2 Purchase All Homes With A First Floor Elevation Below 8.0 – This plan involves purchasing the 33 homes with a first floor elevation below 8.0. After purchase, the homes and other improvements would be demolished and/or removed from the lot. This would create about 5 acres of open space in the project area. As the costs associated with this plan would exceed its benefits, this plan was eliminated as a potential flood damage reduction alternative. In addition, the community did not support this Alternative as roadway flooding would continue to impact the evacuation and delivery of emergency services to remaining homes.

2.2.2.3 Purchase All Homes and Lots in Study Area – This alternative includes purchasing all 133 properties in the project area. This consists of 125 developed lots (with homes) and 8 undeveloped lots. Following purchase, all homes and other improvements, including roads and utilities, would be removed and the area restored. This would create about 20 acres of open space. This alternative was eliminated from further consideration as the costs associated with purchasing all private property in the area would far exceed the flood damage reduction benefits of this alternative.

2.2.3 No Action – The No Action Alternative is required to be evaluated as prescribed by National Environmental Policy Act (NEPA) and the Council on Environmental Quality (CEQ). The No Action Alternative serves as a baseline against which the proposed action and alternatives can be evaluated as well a being a viable alternative. Evaluation of the No Action Alternative involves assessing the environmental effects that would result if the proposed action did not take place. Under the No Action Alternative, no improvements or modifications would be made in the study area to reduce flood losses and frequent flooding of this area would continue to be a problem. Under current conditions, a 10-year flood event would cause an estimated $1,138,200 in damages to 135 residential structures. Twenty of these homes would have first floor flooding. In addition to damage to structures, extensive roadway flooding would continue to occur throughout the study area. This flooding causes serious safety problems as it impacts evacuation of residents, and the delivery of emergency medical, fire protection and other services. For these reasons, the No Action Alternative was not supported by the town of Salisbury or residents of the study area.

3.0 AFFECTED ENVIRONMENT

3.1 Water Resources

The Blackwater River is a coastal river located in Seabrook, New Hampshire and Salisbury, Massachusetts. The headwaters of the Blackwater River begin in west Salisbury and flow easterly approximately 3 miles before turning northerly about 2 miles before the Route 286 bridge. From the bridge, the river runs northerly about 2 miles until it discharges into Hampton Harbor. The drainage area at the mouth of the Blackwater River is about 8.9 square miles with about one third of the area having a ground surface less than 5 feet NGVD.

Pursuant to 314 Code of Massachusetts Regulations (CMR) 4.06 the Blackwater River is located in the North Shore Coastal Drainage Area (Map 93). The freshwater headwater of the Blackwater River, Smallpox Brook, is designated as a Class B waterway. As such, Smallpox Brook is designated for uses of protection and propagation of fish, other aquatic life and wildlife; and for primary (i.e. swimming) and secondary contact recreation (i.e. boating). The Massachusetts Department of Environmental Protection (DEP) has not assigned a water quality classification to the Blackwater River. In accordance with 314 CMR 4.06, unlisted coastal and marine waters are designated as Class SA, High Quality Waters.

Water quality information specific to the Blackwater River is not available, however limited water quality monitoring is conducted in the Hampton Harbor area as part of the on-going environmental monitoring of Seabrook Station. Estuarine waters of Hampton Harbor generally meet the Massachusetts Class A water quality standards (North Atlantic Energy Service Corporation, 2000) however, 0.61 square miles of shell fishing beds are restricted in the Hampton Harbor area as designated by the New Hampshire Department of Environmental Services (DES). Restrictions on shell fishing are due to bacterial levels that exceed state and federal standards for shellfish consumption. Possible sources of bacteria include bird and wildlife feces, illegal waste discharge from boats, storm water runoff, and/or combined sewage overflows (CSOs). The beds are open during extended periods of dry weather and are closed for five days when it rains significantly (DES, 2000). Therefore, based on the water quality conditions in Hampton Harbor, the Blackwater River more closely correlates with Class SB standards, which included waters, approved for restricted shell fishing.

3.2 Upland Environment

The Town of Salisbury assessor's office dates construction of the homes on 10th Street, 11th Street to the 1960's (ACOE, 1995). Real estate in this area was undoubtedly valued for its view of the salt marsh and close proximity to the ocean and resort community. The majority of development also occurred after construction of the 1948 bridge, when the area appeared more suitable for development due to reduced tidal flows. Coincidentally, the value of wetlands and barrier beaches was not fully recognized and therefore, development was not subject to the regulatory protections currently in effect today. Project area real estate continues to be valued for its close proximity to coastal beaches and acceptability distance-wise to Boston commuters. The Town of Salisbury recently installed town sewers in the project area, beneficial to water resources but also increases desirability of real estate by eliminating constraints involved with the placement of residential septic systems.

When the present bridge was built in 1991, tidal flow increased to the Blackwater River marsh due to the larger bridge opening. The change in bridge opening had the effect of restoring hydrology to the approximately 10 acres of salt marsh as evidenced through mortality of upland vegetation and establishment of high marsh vegetation along the marsh periphery. Although there are widely acknowledged benefits to the restoration of salt marsh and estuarine habitat, the increased flushing also had the effect of flooding an established residential community. Although flooding in the Blackwater River has occurred to varying degrees over the years, the replacement of the Route 286 Bridge in 1991 in New Hampshire exacerbated the problem in the project area. The computed change in tide height from the previous conditions (1948 bridge) to the present conditions (1991) near Berry Lane is a few tenths of a foot for a high spring tide event, about 0.5 feet of a 1-year event and about 1 foot for a 10-year event (ACOE, 1995).

It is worth noting that other factors may be contributing to increased flooding in the project area. Sea level rise is a phenomenon related to a gradual warming of the earth's atmosphere which may promote expansion of near surface ocean water and increase the rate of glacier melting, thereby hastening the rate at which ocean levels appear to be rising (see Section 3.4.2 <u>Sea Level Rise</u> for a more in-depth discussion of this phenomenon). In addition, under natural conditions of salt marsh development, the compaction of underlying peat is compensated through the accumulation of organic material and sediment to keep in step with sea level rise. Land that was developed that was historically a saltmarsh may "sink" slightly due to the compression and drying of underlying peat layers and lack of accumulating sediment and detritus. Although no surveys were undertaken to this effect, the "sinking" of land in the proposed project area may also have contributed to the increased flooding in the area. Despite the increase in flooding, this residential development continues to undergo dramatic renovations and redevelopment due to high real estate demand for the desirable view and location.

The project site is a densely populated residential area bordered by tidal marsh on three sides. Upland vegetation, characteristic of residential land use, includes a variety of ornamental planting and mowed lawn areas. Landscape plantings include some large red pine (*Pinus resinosa*) and scots pine (*P. sylvestris*) in the Berry Lane area with maple (*Acer sp.*), ash (*Fraxinus sp.*), arborvitae (*Thuja occidentalis*), willow (*Salix sp.*) and rose (*Rosa sp.*) scattered throughout. The majority of the development expands to the wetland boundary with the exception of three small riparian areas; in the northern most part of the project, south of the western end of 12th Street and the southern most portion of the project area. The naturally occurring species observed in these areas included gray birch (*Betula populifolia*), black cherry (*Prunus serotina*), trembling aspen (*Populus tremuloides*), red cedar (*Juniperus virginiana*), bayberry (*Myrica pensylvanica*), blueberry (*Vaccinium sp.*), red chokeberry (*Pyrus arbutifolia*) and an especially noteworthy specimen of serviceberry (*Amelanchier sp.*) in the riparian area near 12th Street. There are also several areas of upland, located at the ends of east-west oriented streets, that were created through snow removal operations as snow and mixed debris is pushed into the marsh by plows.

3.3 Wetland Environment

On November 12, 1998, ENSR, under contract to the Army Corps of Engineers, New England District, conducted a wetland delineation of the project area. This wetlands delineation was performed in accordance with the 1987 Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory, 1987) and the Army Corps of Engineers, New England Division 1992 Performance Standards and Supplemental Definitions for use with the 1987 Corps Manual. Wetlands at the site were classified according to Classification of Wetland and Deepwater Habitats of the United States (Cowardin et. al., 1979). Transects were conducted at regular intervals along the wetland boundary and vegetation, soils, and hydrologic information was recorded. The northern boundary of the site delineation included a location approximately 400 feet north of 9th Street, while the southern terminus of the delineation effort was established approximately 300 feet south of Florence Avenue.

In general, the densely populated residential properties in the project area delineate uplands from jurisdictional wetlands at this site. The tidally influenced Blackwater River bisects a large 3.4 square mile marsh classified as Estuarine Intertidal Emergent Wetlands (E2EM), the Blackwater Marshes. The Blackwater River flows north past the project area, over the Massachusetts border into New Hampshire where it discharges into Hampton Harbor and eventually the Atlantic Ocean.

Salt marshes are divided into two general types based on the frequency of tidal flooding: low marsh and high marsh. Low marsh or regularly flooded salt marsh extends to roughly the level of mean high water and is therefore flooded twice a day in New England. High marsh extends from the inland limit of low marsh to the level of the highest lunar tides (Lefor, 1987). The low marsh vegetation in New England is typically dominated by salt marsh cordgrass (*Spartina alterniflora*) while the high marsh is typically dominated by salt hay grass (*Spartina patens*). Salt marshes typically support a number of other species, most notably spike grass (*Distichlis spicata*), which often make up a large portion of the high marsh. The Blackwater marshes shows a varied profile which shows gradation from open water to upland which is broken up by mosquito ditches, pannes, pools and upland mounds.

The Blackwater Marsh, nearly a mile across at the project site, is characterized by a vegetative prevalence of salt hay grass, salt marsh cordgrass and spike grass. Other commonly observed species in the wetland and along the wetland/upland interface include seaside goldenrod (*Solidago sempervirens*), common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*) and common glasswort (*Salicornia europaea*). High marsh salt hay grass is established in a few backyards due to the increase in tidal flushing. In addition, the dumping of yard waste in the marsh was observed in a few areas. Soil borings in the wetland revealed the presence of a thick organic horizon overlying sandy loams with a distinct sulfidic odor. Borings in the upland during the wetland delineation were limited due to the residential community but generally yielded profiles consisting of thin organic surface horizons underlain by medium sands, which are likely a combination of fill and historic dunes.

The wetland delineation was verified at an on-site meeting July 12, 1999 with natural resource agencies with interest or jurisdiction in the project; all suggested alterations were incorporated into the project plans. The wetland delineation was reflagged in the spring of 2003 and changes to the line incorporated into the plans and were coordinated with the local sponsor and cooperating agencies.

3.4 Coastal Resources

3.4.1 <u>Barrier Beach</u> The project area is a barrier beach, defined by the Massachusetts Code of Regulations (310 CMR 10.29(2)) as "a low-lying strip of land generally consisting of coastal beaches and coastal dunes extending roughly parallel to the trend of the coast. It is separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system." Barrier beaches provide storm damage protection to the mainland as well as marine fisheries and wildlife habitat protection. As such, projects involving alterations to barrier beach environment are subject to stringent regulatory protection under federal and state laws.

The development of a tidal marsh is dependent on post-glacial submergence of land or the concurrent rise in sea level or both. The formation of a salt marsh begins with the deposition and accumulation of sediments in embayments protected from the direct force of the sea. The origin of the sediments may be marine, through tidal action; silts and sands carried from adjacent uplands by streams or rivers, or the overland transport by wind or storm surges. Strong winds from the northeast, which usually occur during storms accompanied by large waves, shift the beach profile and carry sediment overland to the back barrier marshes. These large sediment loads contribute to sediment accumulation in the marsh and fuel the natural progression and expansion of the marsh. Sediment deposition is a gradual and continuous process, which eventually supports the substrate and nutrient needs of plants. Plant growth raises the level of the marsh, accumulating living and dead organic material to keep in step with sea level rise and the sinking of the marsh as the underlying peat compresses under the weight of new growth. The salt marsh aggrades as the sea level rises and floods into upland areas inundating freshwater plants. As the plants succumb to the effects of flooding by salt water, they are gradually replaced by high marsh vegetation as the marsh gradually expands.

Recognizing the importance of the barrier beach system, a comprehensive alternative analysis was undertaken to determine the most practicable alternative to meet the project objectives. The placement of structures in the barrier beach system disrupts the sediment transport process and may alter the dynamic nature of the barrier beach system making it less stable and less capable of preventing stormwater damage. Disruption of coastal processes and impacts to wetlands (fill and isolation from tidal flushing) were considered in the selection of the preferred plan.

3.4.2 Sea Level Rise In recent years, there has been much discussion regarding a potential increased rate of future sea level rise. This phenomenon is related to a gradual warming of the earth's atmosphere associated with increased emission of carbon dioxide and other gases on earth. The warmed atmosphere may promote expansion of near surface ocean water and increase the rate of glacier melting, thereby hastening the rate at which ocean levels appear to be rising. The United States Environmental Protection Agency (EPA) published a report in 1995 entitled "The Probability of Sea Level Rise" (EPA 1995). This report predicts slightly lower estimates of sea level rise than previous reports because of lower temperature projections. The lower projections are based on assumed lower concentrations of carbon dioxide, inclusion of the cooling effects of sulfates and stratospheric ozone depletion, and less of an increase on global temperature from greenhouse gases. Based on the predictions presented by the EPA, there is an anticipated sea level rise of 0.8 feet over the next 50 years (the estimated project life). Table 1 shows existing and future water surface elevations at Hampton Harbor.

Results indicate that for future conditions, the 5 and 10-year events, Hampton Harbor will have tidal elevations above 8.5 feet NGVD. Above 8.5 feet NGVD, overflow of Route 286 will occur on the west side of the bridge. UNET modeling was run to determine the effects of flooding in the Blackwater Marsh interior for existing conditions and future conditions (with sea level rise). During the 5 and 10-year events including sea level rise, approximately 150 feet and 350 feet, respectively, of Route 286 will be overtopped. The overtopping rate over Route 286 was added into the UNET model to determine flooding elevations in the project area (see Table 2 Sea Level Water Surface Elevations in the Project Area Existing and Future (50-year) with Sea Level Rise (ft., NGVD)).

The top elevation of the proposed floodwall is 8.0 feet NGVD. For the 10-year event, the floodwall would be overtopped at Bayberry Lane in the future condition as surface water elevation was calculated to be 8.2 feet NGVD. Flood protection in the project area is limited to frequent low-level flood protection, a floodwall height of 8.0 feet NGVD, because the Atlantic Ocean would flood North End Boulevard during serious flood events by overtopping the coastal dune in this area, and flood protection beyond 8.0 feet NGVD would require large-scale structural solutions as North End Boulevard is only a few tenths of a foot higher than elevation 8.0. These large-scale structural solutions would not be cost effective or environmentally acceptable by regulatory agencies in this barrier beach environment.

Table 1

Existing and Future (50-year) Water Surface Levels at Hampton Harbor

Event	Existing Condition Water Elevation (ft, NGVD)	Future Condition (50 year) Water Elevation (ft, NGVD)
10-Year	8.5	9.3
5-Year	8.1	8.9
2-Year	7.6	8.4
1-Year	6.9	7.7

Table 2

Sea Level Water Surface Elevations in the Project Area Existing and Future (50-year) with Sea Level Rise (ft., NGVD)

Event	Bayberry Lane Existing/Future	Liberty Street Existing/Future	16th&17th Streets Existing/Future	Beach Road Existing/Future
10-year	7.3 / 8.2	6.7 / 7.4	6.0 / 6.6	5.6 / 6.1
5-year	7.0 / 7.9	6.4 / 7.1	5.9 / 6.4	5.4 / 5.9
2-year	6.7 / 7.3	6.1 / 6.6	5.5 / 6.0	5.1 / 5.6
1-year	6.1 / 6.7	5.6 / 6.1	5.2 / 5.5	4.5 / 4.9

3.4.3 Shoreline Views and Aesthetics

The unobstructed view of the Blackwater River Marsh is a valuable aesthetic attribute to real estate property in the proposed project area. The considerable development pressure in the area has resulted in increased property values and generated on-going redevelopment and renovation projects. The placement of man-made structures along the marsh periphery is a potential obstruction to the viewshed and therefore, careful considered was given to the selection of materials and design of the proposed floodwall. Design features to reduce the obtrusiveness of this structure included capping with aluminum or pressure treated lumber for a "finished" appearance and the placement of a berm on its landward side, where space allows, which can be planted with shrubs and herbaceous vegetation.

3.5 Fish and Wildlife

3.5.1 Fisheries There is a minimal amount of information specific to the Blackwater River concerning fisheries resources. However, the project area is in the general vicinity of Seabrook Station in Seabrook and Hampton, New Hampshire. Environmental monitoring studies have been conducted to determine affects of the operation of Seabrook Station, which became operational in 1990, on aquatic biota in the near field coastal waters (North Atlantic Energy Service Corporation, 2000). The Station is located on Browns River, a tributary to Hampton Harbor which has similar environmental features to the Blackwater River, also a tributary to Hampton Harbor, and therefore, the data collected concerning fisheries resources would likely be comparable.

Sampling of estuarine fishes was conducted at three stations within the estuary of Hampton-Seabrook Harbor. The most common fish species found included Atlantic silversides (*Menidia menidia*), mummichog (*Fundulus heteroclitus*) and striped killifish (*Fundulus majalis*) which are small schooling fish that are ecologically important as consumers of zooplankton and prey for many of the larger, commercially important fish species. Winter flounder (*Pseudopleuronectes americanus*), a valuable commercial species, and ninespine stickleback (*Pungitius pungitius*), a common component of the estuarine fishery community, were also found. The winter flounder is a shallow water bottom species inhabiting soft, muddy to moderately hard bottoms. Spawning occurs in shallow water over a sand or mud bottom in late winter or early spring. Fertilized eggs are adhesive and settle to the bottom singly or in clumps. Larvae drift in surface water for a period of time, metamorphosing to flat-fish form in about 2.5 to 3.5 months (Scott et al.1988). Winter flounder abundance in the Gulf of Maine has been reduced substantially due to overfishing (NOAA 1998 in North Atlantic Energy Service Corporation 2000). Soft-shell clams (*Mya arenaria*) would also likely be found in intertidal flats the vicinity of Hampton Harbor Shellfish beds in the vicinity of the project area are officially classified by the Massachusetts Division of Marine Fisheries as prohibited for shell fishing due to fecal coliform contamination. The waters offshore of Salisbury Beach are also classified as prohibited (North Coastal Watershed Alliance 2000).

In addition, the New Hampshire Department of Environmental Services periodically conducts surface water monitoring to assess water quality function the rivers, lakes and coastal areas in New Hampshire. Surface water has many functional uses, such as aquatic life, fish consumption, drinking water, primary and secondary contact recreation and aesthetics. Through an analysis of biological, habitat, physical, chemical and toxicity data, a determination of support is calculated for each functional use category. Designated areas are assessed as "support," "partial support" or "non support" which represent increasingly impaired conditions for a specific functional use. Based on this assessment, the use of fish consumption is defined as being partially supporting in New Hampshire estuaries because of the bluefish advisory issued in 1989 due to Polychlorinated Biphenyls (PCBs) in fish tissue, which affects all tidal waters (DES 2000).

3.5.2 Wildlife Wildlife habitat within the study area lies within close proximity to Main Street (Route 1A) in Salisbury, which results in a high, level of human and domestic disturbance. Some mice and voles may use the residential lawns and landscaping vegetation in summer and survive periodic flooding on the highest ground. No unique or significant wildlife species are known to utilize the project site.

Salt marshes have many beneficial functions and values including wildlife and fisheries habitat, shoreline anchoring and aesthetic quality. Salt marshes are an important source of food for invertebrates such as worms, snails, clams and crabs, which feed on living and decaying salt marsh vegetation. The invertebrates in turn become a source of food for animals higher in the food web such as fish and mammals, and birds. Smaller fish become food for larger fish, including commercial species. The mammals associated with marsh habitat feed in tropic levels lower in the food web. Salt marshes also provide valuable habitat for nesting birds.

Waterfowl species using the Blackwater River tidal estuary near the project site are mallard, American black duck, northern pintail, common merganser, green-winged teal and blue-winged teal. Waterfowl stage on the Blackwater River during spring and fall migration but the river freezes during the winter and therefore, few waterfowl are present during the winter season. Other species common to the project area primarily for feeding include osprey, killdeer, and greater yellowlegs, American robin, red-winged blackbird, goldfinch, chipping sparrow, and brown-headed cowbird. Permanent residents include the rock dove, European starling and house sparrow.

3.6 Rare and Protected Species and Outstanding Natural Communities

The only Federally listed or proposed, threatened or endangered species under the jurisdiction of the U.S. Fish and Wildlife Service known to occur in the project area is the endangered piping plover (*Charadrius melodus*). Piping plovers are known to nest on both Salisbury Beach (at/near the Salisbury Beach State Reservation) and at Seabrook immediately south of the State line (USFWS, 1999). Piping plovers require sandy coastal beaches that are relatively flat and free of vegetation. They prefer the dry, light-colored sand found along the outer coastal shores. The often build their nests in the narrow area of land between the high tide line and the foot of the coastal dunes. Plovers feed in the intertidal zone along the beach.

The Massachusetts Natural Heritage and Endangered Species Program (NHESP), in a letter dated 1 February 1999, identify the western-most portion of the proposed project area as intersecting the Estimated Habitat for 8 endangered, threatened or special concern species as listed in Table 3. (This list of 8 species includes the Federally threatened piping plover previously mentioned.) A description of the life history requirements of these species is provided following Table 3.

The majestic bald eagle, our national bird, is found over most of North America, from Alaska and Canada to Northern Mexico. In Massachusetts, the bald eagle utilizes the Quabbin Reservoir, a portion of the Connecticut River and the Assawompsett Pond system in Lakeville as nesting and wintering habitat. They also overwinter in distinct areas throughout Massachusetts including the Merrimack River, Cape Cod and the islands of Martha's Vineyard and Nantucket.

Table 3

Estimated Habitat #WH2
Natural Heritage and Endangered Species Program (NHESP 2001)

SPECIES	TAXON	STATUS*
Bald Eagle (*Haliaeetus leucocephalus*)	Bird	Endangered
Piping Plover (*Charadrius melodus*)	Bird	Threatened
Common Tern (*Sterna hirundo*)	Bird	Special Concern
Spotted Turtle (*Clemmys guttata*)	Reptile	Special Concern
Atlantic Sturgeon (*Acipenser oxyrhynchus*)	Fish	Endangered
Shortnose Sturgeon (*Acipenser brevirostrum*)	Fish	Endangered
Saline Sedge (*Carex recta*)	Plant	Endangered
Silverling (*Paronychia argyrocoma*)	Plant	Endangered

* E = Endangered: any species of plant or animal in danger of extinction throughout all or a significant portion of its range and species of plants or animals in danger of extirpation as documented by biological research and inventory.

T = Threatened: any species of plant or animal likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and any species declining or rare as determined by biological research and inventory and likely to become endangered in the foreseeable future.

SC = Special Concern: any species of plant or animal which has been documented by biological research and inventory to have suffered a decline that could threaten the species if allowed to continue unchecked or that occurs in such small numbers or with such a restricted distribution or specialized habitat requirements that it could easily become threatened within Massachusetts.

Adult bald eagles have distinctive coloration, with a white head and tail, brown body, pale yellow eyes and bright yellow beak and feet. Immature plumage changes from the uniformly dark coloration through varying phases until they reach the characteristic adult plumage around the age of 5 years. It is the largest raptor in the state of Massachusetts attaining a wingspan of approximately 7 feet. They utilize coastal areas, estuaries and large inland water systems where fish and other food sources are abundant and forest stands allow for perching and night roosting (NHESP 1995).

The shortnose sturgeon, a small sturgeon rarely exceeding three feet in length, is endemic to the rivers and estuaries of the eastern United States and Canada from New Brunswick south to Florida. The Populations are small, isolated and sporadic with the exception of the St. John's River in New Brunswick, which may consist of up to 100,000 individuals. Three populations of shortnose sturgeon exist in Massachusetts; in the Merrimack River, in the Connecticut River below Holyoke Dam and a landlocked population in the Connecticut River between Turners Falls Dam and Holyoke Dam and in the Connecticut River.

Shortnose sturgeon utilize a variety of habitats throughout their life history including estuaries and the open ocean during the winter months; migrating to freshwater in the spring to spawn. Shortnose sturgeon spawning runs occur every year starting in the early May however, individual sturgeon spawn only once every two to three years. Female shortnose sturgeon lay eggs in turbulent, fast flowing water on gravel, rock or rubble substrate. The newly hatched larvae are initially nourished by yolk sacs and hide under rocks or in burrows in the substrate until further development. Sturgeon are bottom feeders with young sturgeon eating insects and crustaceans while adults eat a variety of foods including small mollusks (NHESP 1991).

The Atlantic sturgeon is a large anadromous fish sometimes exceeding 13 feet in length. These fish spend most of their adult life in the ocean, except during spawning when they enter rivers and migrate upstream to just above the salt front (the border between salt and fresh water) where they move upstream and downstream with the tide (NHESP 1991). Females lay eggs, which attach to rocks, plants or other objects and the larvae hatch within a week, initially nourished by yolk sacs. Young sturgeons are bottom feeders, remaining in their river habitat until emigrating to the ocean between the ages of 2 to 6 years. Females migrate back to the ocean soon after spawning while males may remain in rivers until September or October before they migrated to the ocean (NHESP 1991).

The Common Tern resembles a small gull but has a long forked tail, black cap and pointed bill. They nest in colonies on sandy or rocky islands, sand dunes and, less frequently, in salt marshes on sand spits. The Spotted Turtle is found in marshy meadows, bogs, small ponds, and other forested and nonforested freshwater wetland habitats including vernal pools. Vascular plants identified on the list include the Silvering, a low-growing perennial which generally grows in open areas of granitic rock slopes in the mid to upper mountain elevations, and the Saline Sedge. Little information is available on the ecological characteristics of the Saline Sedge, a rare plant of tidal salt marshes and coastal shores. Populations of the Saline Sedge in Massachusetts and Maine (where the Saline Sedge is also listed as endangered) are located in the southern portion of its range, although the plant is globally widespread and abundant (MDC 1999). In Essex County, Massachusetts, the Saline Sedge was last observed in 1985 (www.state.ma.us/dfwele/dfw/nhesp.esse.htm).

3.7 Essential Fish Habitat

The 1996 amendments to the Magnunson-Stevens Fishery Conservation Management Act strengthen the ability of the National Marine Fisheries Service and the New England Fishery Management Council to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat", and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The project area is included within the Essential Fish Habitat (EFH) Designation within the 10' x 10' square coordinates 43^{0} 00.0'North, 70^{0} 40.0'West, 42^{0} 50.0'North and 70^{0} 50.0West. This area includes "from east of Salisbury, MA. north up to Rye, NH., including waters affecting Smithtown, NH., Hampton and Hampton Beach, NH. Other features affected include: Lockes Neck, Jenness Beach, Rye Ledge, Rye Beach, Fox Hill Pt., Little Boars Head Pt., Rye Ledge, North Beach, Great Boars Head, Hampton Harbor, Hampton Shoal Ledge, Seabrook Beach, Round Rock, Breaking Rocks, Salisbury Beach, and Cushing, MA. Also, the waters within this square affect east of Seabrook, NH and the Seabrook Nuclear Power Station near Seabrook Beach."(NMFS, 1999).

The 10 x10' square coordinate which encompasses the project area is designated as EFH for several marine species for various life stages including Atlantic cod, *Gadus morhua* (eggs, larvae, juveniles and adults); haddock, *Melanogrammus aeglefinus* (juveniles); pollock, *Pollachius virens* (juveniles); whiting, *Merluccius bilinearis* (eggs, larvae, juveniles and adults); red hake, *Urophycis chuss* (eggs, larvae, juveniles and adults); redfish, *Sebastes fasciatus* (larvae, juveniles and adults); winter flounder, *Pseudopleuronectes americanus* (eggs, larvae, juveniles and adults); yellowtail flounder, *P. ferruginea* (juveniles and adults); windowpane flounder, *Scopthalmus aquosus* (juveniles and adults); American plaice, *Hippoglossoides platessoides* (juveniles and adults); ocean pout, *Macrozoarces americanus* (eggs, larvae, juveniles and adults); Atlantic halibut, *Hippoglossus hippoglossus* (eggs, larvae, juveniles and adults); Atlantic sea scallop, *Placopecten magellanicus* (eggs, larvae, juveniles and adults); Atlantic sea herring, *Clupea harengus* (juveniles and adults); monkfish, *Lophius* americanus (eggs, larvae, juveniles and adults); long finned squid, *Loligo pealei* (juveniles and adults); short finned squid, *Illex illecebrosus* (juveniles and adults); Atlantic butterfish, *Peprilus triacanthus* (eggs, larvae, juveniles and adults); Atlantic mackerel, *Scomber scombrus* (eggs, larvae, juveniles and adults); summer flounder, *Paralicthys dentatus* (adults); scup, *Stenotomus chrysops* (juveniles and adults); surf clam, *Spisula solidissima* (juveniles and adults); and bluefin tuna, *Thunnus thynnus* (adults) (NMFS, 1999).

The EFH concerns of the project area include the waters, salt marsh and mudflats of the near project area, which are necessary to fish for spawning, breeding, feeding, or growth to maturity. Intertidal flats with salt marsh fringes are extremely valuable habitat for marine fish and shellfish for many reasons. Salt marshes export organic matter (detritus) which enriches coastal waters and serves as a microbial food source in estuarine and near shore marine ecosystems. Salt marshes also harbor several species of minnows such as mummichogs and Atlantic silversides, which are food sources to larger fish and serve as nurseries/refuges for young fish and important commercial species such as winter flounder. Intertidal mudflats typically support diverse biotic assemblages of shellfish and marine invertebrates, which also serve as a food resource for a variety of migratory finfish. Habitat requirements for each of the listed species is as follows:

Atlantic cod (*Gadus morhua*)

EFH is designated within the project area for all life stages of Atlantic cod (*Gadus morhua*). The eggs and larvae are found in pelagic waters, but the eggs are near the surface waters where as the larvae are found deeper, 98.4 to 229.7 feet (30-70 m). The juveniles and adults are found on bottom habitats with a substrate of rocks, pebbles, or gravel, but the adults have a greater depth range. This project is expected to have minimal effects on Atlantic cod as Blackwater River estuary and associated salt marsh is shallower than the preferred habitat of Atlantic cod and the adults are motile and can swim away from most disturbances.

Haddock (*Melanogrammus aeglefinus*)

EFH is designated within the project area for juveniles of haddock (*Melanogrammus aeglefinus*). Juveniles are found on bottom habitats with a substrate of pebble gravel at depths of 114.8 to 328 feet (35-100 m). No impacts are anticipated on juvenile haddock as a result of the proposed project because the juveniles tend to be found in deeper waters.

Pollock (*Pollachius virens*)

EFH is designated within the project area for juveniles of Pollock (*Pollachius virens*). The juveniles have been reported over a wide variety of substrates, including sand, mud, or rocky bottom, and vegetation. Most commonly juveniles are found at depths of 82 to 246 feet (25-75 m) although they can be found from the surface to 410 feet deep (125 m). This project is expected to have minimal effects on juvenile pollock since they are commonly found at depths deeper than that found in the project area.

Whiting (*Merluccius bilinearis*)

EFH is designated within the project area for all life stages of whiting (*Merluccius* bilinearis). The eggs are pelagic and drift with the prevailing currents. Most eggs are found between 164 and 492 feet (50-150 m) depth with abundance peaks from June through September in temperatures below 20° C. The larvae are also pelagic and most are found at depths of 164 to 426.5 feet (50-130 m) with abundance peaks from July through September. Juvenile whiting are found on bottom habitats of all substrate types with water temperatures below 21° C and depths between 65.6 and 885.9 feet (20-270 m). Adult whiting are found on bottom habitats of all substrate types with water temperatures below 22° C and depths between 98.4 to 1,066.3 feet (30-325 m). This species is broadly distributed in the northwest Atlantic from the Gulf of Maine to Cape Hatteras. All the life stages are more common at greater depths than found at the project site and therefore, no impact on whiting is anticipated as a result of the proposed project.

Red Hake (*Urophycis chuss*)

EFH is designated within the project area for all life stages of red hake (*Urophycis chuss*). The eggs are found in surface waters with temperatures below 10° C and most often observed during the months from May - November, with peaks in June and July. Larvae are found in surface waters with temperatures below 19° C, water depths less than 656.2 feet (200 m). Red hake larvae are most often observed from May through December, with peaks in September - October. The juveniles are found on bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops. The water temperatures are below 16° C, depths less than 328.1 ft (100 m), and a salinity range from 31 to 33 parts per thousand (ppt). Adults are found associated bottom habitats in depressions with a substrate of sand and mud (but generally not in open sandy bottoms), with water temperatures below 12° C, depths from 32.8 to 426.5 feet (10-130 m), and salinities of 33 to 34 ppt. This species is broadly distributed in north and mid-Atlantic waters from the Gulf of Maine to Cape Hatteras. It is unlikely that this species would be found in the project area and therefore, no impacts are anticipated to red hake as a result of the proposed project.

Redfish (*Sebastes fasciatus*)

EFH is designated within the project area for larvae, juveniles and adults of redfish (*Sebastes fasciatus*). The larvae are found in pelagic waters at depths between 164 and 885.8 feet (50-270 m). Juveniles are found on bottom habitats with a substrate of silt, mud or hard bottom, water temperatures below 13° C, and depths from 82 to 1312.3 feet (25-400 m). Adults are found on bottom habitats with a substrate of silt, mud or hard bottom, water temperatures below 13° C, a salinity range from 31 – 34 ppt and depths from 164 to 1,148.3 feet (50-350 m). Spawning adults are most often observed during the months from April through August. It is unlikely that this species would be found in the shallow estuary water of the Blackwater River and therefore, no impacts are anticipated to redfish as a result of the proposed project.

Winter flounder (*Pseudopleuronectes americanus*)

EFH is designated within the project area for all life stages of winter flounder (*Pseudopleuronectes americanus*). Winter flounder are a demersal species, common on muddy sand with patches of eelgrass, sand, clay, and even gravel/cobble from the shoreline out to deeper waters. Winter flounder are rarely seen in waters deeper than 36 meters. Their movements are generally localized, undertaking small scale migrations into estuaries, embayments and saltwater ponds in the winter to spawn, and moving into deeper water in summer. Juveniles tend to stay in inshore areas for 2 or more years, but will move to avoid temperature extremes. Spawning occurs over bottom habitats with substrates of sand, muddy sand, mud, or gravel. Spawning in inshore areas occurs in water depths less than 6 meters, while spawning offshore can occur in waters as deep as 80 meters. Adult winter flounder are most often observed spawning from February through June. Winter flounder eggs sink and stick together in clusters on the bottom. Newly hatched larvae remain near the bottom and are generally found at depths less than 37 meters. The larvae are unlike other flatfishes in that even though they are pelagic, they are not completely at the mercy of tides or currents. Winter flounder larvae will alternatively swim upward in the water column and then sink to lie on the bottom as opposed to remaining constantly adrift at the surface.

Winter flounder utilizing the Blackwater River tidal estuary project area would be limited to the bottom habitats with a substrate of sand, muddy sand, mud, or gravel and the shallow seawater areas of the Blackwater River. There would be no direct physical impacts to any of the life stages of winter flounder as a result of the project as no work will occur in the river proper. All work will occur along the periphery of the marsh and although construction activities will involve the filling of salt marsh, which provides valuable nutrients and detritus to the estuary, the amount of fill is small in comparison to the size of the estuary and loss of wetland will be mitigation on a 1:1 ratio on-site. As well, sediment erosion control practices will be implemented throughout construction to avoid water quality problems and sedimentation.

Yellowtail flounder (*Pleuronectes ferruginea*)

EFH is designated within the project area for juveniles and adults of yellowtail flounder (*Pleuronectes ferruginea*). Both juveniles and adults are found on bottom habitats with a substrate of sand or sand and mud in depths from 20 to 50 meters and would be limited to the bottom habitats in the seawater areas of the Blackwater River. No impacts are expected to occur to the yellowtail flounder.

Windowpane flounder (*Scopthalmus aquosus*)

EFH is designated within the project area for juveniles and adults of windowpane flounder (*Scopthalmus aquosus*). Juveniles and adults prefer bottom habitats of mud or fine-grained sand. Windowpane flounder are most often observed spawning during the months February – December with a peak in May in the middle Atlantic. Although EFH for the windowpane is within the project area, this species would be limited to the deeper water of the Blackwater River. As well, this species is broadly distributed in north and mid-Atlantic waters from the Gulf of Maine to Cape Hatteras. As was the case with the winter flounder and yellowtail flounder, the windowpane flounder adults and juveniles would be associated with the deeper water of the Blackwater River and would not be impacted by the proposed construction of a floodwall along the marsh periphery.

American plaice (*Hippoglossoides platessoides*)

EFH is designated within the project area for juveniles and adults of American plaice (*Hippoglossoides platessoides*). These life stages of American plaice are generally found in waters with depths of over 30 meters. Juveniles and adults prefer bottom habitats with fine-grained sediments or a substrate of sand or gravel. This project is expected to have minimal effects on EFH for American plaice as construction activities associated with the proposed project will occur in areas shallower than their preferred habitat.

Ocean pout (*Macrozoatces americanus*)

EFH is designated within the project area for all life stages of ocean pout (*Macrozoarces americanus*). This species is a nearshore species that inhabits hard bottom substrates with salinities greater than 30 ppt. Ocean pout egg development takes two to three months during late fall and winter. The larvae are most often observed from late fall through spring. The soft bottom substrate of this project should limit any potential impact to the eggs and larvae. It is unlikely that ocean pout will be found in the shallow, estuarine waters of the project area and therefore, no impacts are anticipated as a result of the proposed project.

Atlantic halibut (*Hippoglossus hippoglossus*)

EFH is designated within the project area for all life stages of Atlantic halibut (*Hippoglossus hippoglossus*). The eggs are bathypelagic, floating not at the surface, but suspended in the water column at depths ranging from 177.2 to 656.2 feet (54-200 m). Atlantic halibut eggs are observed between late fall and early spring, with peaks in November and December. The larvae are pelagic floating within 50 m of the surface. Juveniles and adults are found on bottom habitats with a substrate of sand, gravel, or clay. The juveniles are found in depths from 65.6 to 196.9 feet (20-60 m), where as the adults are found at depths of 328.1 to 2,296.6 feet (100-700 m). The Blackwater River estuary is too shallow to have any effect on Atlantic halibut and therefore, no impacts on all life stages of Atlantic halibut are anticipated as a result of this project.

Atlantic sea scallop (*Placopecten megellanicus*)

EFH is designated with the project area for all life stages of Atlantic sea scallop (*Placopecten megellanicus*). Spawning occurs from May through October, with peaks in September and October, therefore this is when the eggs are present on the sea floor. The larvae are pelagic and are found in salinities between 16.9 ppt to 30 ppt until they become spat and settle on bottom habitats with a substrate of gravelly sand, shell fragments, and pebbles, or on various red algae, hydroids, amphipod tubes and bryozoans. Juveniles and adults are found on bottom habitats with a substrate of cobble, shells and silt in water depths from 59 to 360.9 feet (18-110 m). The project area does not meet the habitat requirements for this species and therefore, no impacts on all stages of Atlantic sea scallop are anticipated as a result of this project.

Atlantic sea herring (*Clupea harengus*)

EFH is designated within the project area for juveniles and adults of Atlantic sea herring (*Clupea harengus*). The juveniles and adults tend to prefer depths that are deeper than those found in the project area and therefore, no impacts are expected to occur to Atlantic sea herring juveniles and adults.

Monkfish (*Lophius americanus*)

EFH is designated within the project area for all stages of monkfish (*Lophius* americanus). The eggs are found in surface waters within a mucus veil and are most often observed during the months from March to September in water depths from 49 to 3,281 feet (15-1000 m). The larvae are pelagic, most found at depths of 98.4 to 295.3 feet (30-90m). The juveniles and adults are found on bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud, depths from 82 to 656 feet (25-200 m), and a salinity range from 29.9 to 36.7 ppt. The monkfish is primarily pelagic and therefore, no impacts are anticipated as a result of the proposed project.

Long finned squid *(Loligo pealei)* and short finned squid *(Illex illecebrosus)*

EFH is designated within the project area for juveniles and adults of long finned (*Logio pealei*) and short finned (*Illex illecebrosus*) squid. EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina where the highest catches are found. The squid are pelagic and highly mobile and therefore, no impact on squid or squid habitat is anticipated as a result of the project.

Atlantic butterfish (*Peprilus triacanthus*)

EFH is designated within the project area for all stages of Atlantic butterfish (*Peprilus triacanthus*). Butterfish eggs and larvae are pelagic and occur at salinities that range from estuarine to full strength seawater. They have been collected to about 1200 (366 m) deep in shelf waters. Juvenile and adult butterfish are pelagic, form loose schools, often near the surface. This species is broadly distributed in north and mid-Atlantic waters from the Gulf of Maine to Cape Hatteras. This species is primarily pelagic and therefore, no impact on all life stages of Atlantic butterfish is anticipated as a result of this project.

Atlantic mackerel (*Scomber scombrus*)

EFH is designated within the project area for adult Atlantic mackerel (*Scomber scombrus*). Atlantic mackerel is a pelagic schooling species distributed in the northwest Atlantic from the Gulf of St. Lawrence to Cape Lookout, North Carolina. Adult mackerel are generally found in deeper waters and therefore, would not be impacted by the proposed project.

Summer flounder *(Paralichthys dentatus)*

EFH is designated with the project area for adult summer flounder (*Paralicthys dentatus*). Adult summer flounder migrate into shallow coastal and estuarine waters during warmer months and move offshore during colder months. Although summer flounder may occur in the Blackwater River within the estuary, no construction activities will in the river as a result of the project. Furthermore, adults should be able to avoid any disturbance because of their mobility and therefore no impacts are anticipated to summer flounder as a result of the project.

Scup *(Stenotomus chrysops)*

EFH is designated in the project area for juvenile and adult stages of Scup (*Stenotomus chrysops*). Scup occur in estuarine systems during the spring and summer months in the mixing and seawater salinity zones. Juveniles can be found in eelgrass beds however adult and juveniles are sufficiently mobile to be able to avoid disturbance. Generally, wintering adults (November through April) are usually offshore, south of New York to North Carolina, in waters above 45 ^{o}F and therefore, no impacts to Scup EFH are anticipated as a result of this project.

Surf clam (*Spisula solidissima*)

EFH is designated in the project area for juvenile and adult Surf clam (*Spisula solidissima*). Surf clams are distributed in western North Atlantic continental shelf waters from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina in sandy habitats. Surf clam would not be found in the project area and therefore, no impacts area anticipated as a result of this project.

Atlantic bluefin tuna (*Thunnus thynnus*)

EFH is designated in the project area for adult bluefin tuna (*Thunnus thynnus*). Bluefin tuna is a highly migratory species found in pelagic waters of at least 25 meters in depth. The few that enter coastal waters are highly motile and can swim away from any disturbances. Therefore, no more than minimal impacts to highly migratory species are anticipated as a result of this project.

3.8 Historic and Archaeological Resources

Salisbury was inhabited by members of the Pawtucket group (often called Pennacook) who inhabited the coast from the north side of Massachusetts Bay in the Saugus area to York Village, Maine. Locally, this group is commonly referred to as the Pentuckets. Most 17th Century colonists considered the Pawtucket and Massachusetts Indians to be closely related yet separate entities. The Native American population in the Salisbury area may have numbered in the vicinity of 100 individuals during the Contact Period (1500-1620 AD). Following a period of European epidemics and warfare in the 17th Century, fewer than 25 individuals likely remained in the Salisbury area (Massachusetts Historical Commission (MHC) 1997).

Salisbury was originally part of Merrimac Plantation authorized in 1638 and settled shortly thereafter. It was originally named Colchester and later was changed to Salisbury. The township of Salisbury was originally comprised of the Massachusetts towns of Salisbury, Amesbury, and Merrimac as well as the New Hampshire towns of South Hampton, part of Kingston, Plainstown, Newton, Seabrook, and Hampstead. In 1655, Salisbury west of the Powwow River was renamed Salisbury New Town (later Amesbury and Merrimac) and included Merrimac. In 1679, Salisbury's size was reduced to include only the land east of the Powwow River and south of the New Hampshire border. This was further reduced in 1886 when land was annexed by Amesbury, leaving Salisbury with land east of the village of Rocky Hill and north of the Merrimack (MHC 1997).

According to the Massachusetts Historical Commission (MHC) survey report (MHC 1997), Salisbury is a suburban coastal town characterized by the historic beach resort village and three-mile long commercial/residential strip on the shore. The historic town center (west of the project area) was the focal point of the community and exhibits development from the Federal through the Late Modern Periods before the beach area became the dominant village. Historic farms and agricultural operations are evident away from the town center and beach areas but their surrounding landscapes are disappearing under residential subdivisions.

Surviving historic landscapes, groups of buildings, and isolated historic fabric are evident in the town in several areas. Ring's Island on the Merrimack River in the southern part of town retains the highest amount of surviving buildings with the least amount of intrusive elements. The town center exhibits elements of significant historic fabric and isolated examples of building types and styles survive dispersed throughout the community (MHC 1997).

The current project area is located within and behind the side streets off North End Boulevard along the beach area. (North End Boulevard is the main thoroughfare bisecting Salisbury Beach to the east and the commercial/residential community to the west along the tidal flats of the Blackwater River.) Houses subject to flooding extend from the Boulevard area to the wetlands surrounding the River. Sand bags have been placed at the end of some streets in this area bordering the river. There is evidence of fill and historic dunes from soil borings in upland areas adjacent to the marshes.

3.9 Air Quality

Ambient air quality is protected by Federal and state regulations. The U.S. Environmental Protection Agency (EPA) has developed National Ambient Air Quality Standards (NAAQS) for certain air pollutants, with the NAAQS setting concentration limits that determine the attainment status for each criteria pollutant. The six criteria air pollutants are ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead.

The entire State of Massachusetts, including Essex County, is designated as a non-attainment area for ozone. Effective June 15, 2004, all of Eastern Massachusetts were designated by the EPA as moderate non-attainment areas for the 8-hour ozone standard, including Salisbury, Essex County where the project is located (U.S. Environmental Protection Agency, 2005).

4.0 ENVIRONMENTAL EFFECTS

4.1 Water Resources

The floodwall will be installed in the upland and high marsh area by a pile driver in the dry with minimal disturbance of soils. Flooding occurs approximately once monthly during extreme high tides or during storm events. Proper erosion control measures would be implemented throughout construction to assure minimal impacts to water resources. The landward berm will be constructed once the floodwall is complete and seeded to stabilize soils. Homeowners will be permitted to landscape the berm with shrubs, which will buffer the marsh and benefit wildlife to some degree.

4.2 Upland Environment

Construction of the floodwall would not significantly impact existing upland vegetation, which is composed mainly of lawns and ornamental shrubs and trees. However, an upland area at the end of 9th Street was evidently caused by winter plowing activities as debris and snow were pushed into the wetland. This area will be restored to salt marsh as part of the project mitigation plan and the proposed floodwall will protect wetland areas from becoming filled again in the future by street plowing. In addition, there are 1,890 square feet of salt marsh wetland landward of the floodwall, which will gradually transition to upland when isolated from tidal flows.

A berm will be constructed on the landward side of the floodwall, which will be available to the homeowner for planting shrubs and herbaceous vegetation. This berm will provide aesthetic benefits and will supplement (to a small degree) a wildlife buffer along the perimeter of the marsh. In addition, wind driven sands will follow the berm contours, blowing over the floodwall and be deposited into the marsh. As previously described, this process of sediment transport and marsh aggregation is important in keeping step with sea-level rise and compaction of underlying peat. (For more information on the function of the landward berm, see Section 4.4 Coastal Processes.)

4.3 Wetland Environment

Construction of the proposed floodwall would permanently fill 1,195 square feet of salt marsh and restrict tidal flooding to 1,890 square feet of salt marsh for a total salt marsh impact of 3,085 square feet. Table 4 describes the wetland impacts for each of the three structural alternatives. Pursuant to the requirements of the federal Section 404 Clean Water Act permit program and the federal "no net loss of wetlands" policy, a mitigation plan was developed to compensate for losses to wetlands. The Clean Water Act guidelines require that wetland impacts first be avoided, then minimized and then mitigation should be used to compensate for unavoidable losses and the alternative analysis must demonstrate that wetland impacts for a specific project are avoided to the maximum extent practicable. A mitigation plan involving a combination of salt marsh creation, restoration and enhancement was developed to compensate the loss of salt marsh on a 1:1 ratio (see Section 5.0 Mitigation for Unavoidable Loss of Wetlands for more information).

4.4 Coastal Resources

4.4.1 Barrier Beach The interaction of wind, waves, tides and currents plays a significant role in the development of barrier beaches and their back barrier marshes. Strong winds from the northeast which usually occur during storms accompanied by large waves shift the beach profile and carry sediment overland to the back barrier marshes. These large sediment loads contribute to sediment accumulation in the marsh and fuel the natural progression and expansion of the marsh. The project area however, is not a pristine, naturally functioning barrier beach system in the less than catastrophic storm event. Housing development and the public works activities associated with maintenance of this hazard-prone residential development disrupts the natural sediment transport process. Buildings impede wind driven sediment transport and sediments accumulated in streets are removed by street sweepers. The proposed flood control structures can disrupt sediment transport and hinder the upland migration of the marsh.

Table 4

Wetland Impacts Associated with Structural Alternatives
Salisbury Section 205 Project, Salisbury, Massachusetts

	SALTMARSH(sq.ft.)			FRESHWATER (sq.ft.)		
Alternative	**Fill***	**Affected+**	**Temporary^**	**Fill***	**Temporary^**	**Total**
Alternative 1 Construct a Dike To Elevation 8.0	19,610	2,020	3,810	85	5	25,530
Alternative 2 Construct a Wall To Elevation 8.0	1,195	1,890	0	0	0	3,085
Alternative 3 Construct a Wall/Dike To Elevation 8.0	4,845	1,600	1,450	85	5	7,985

*Area directly affected by the footprint (fill) of the flood control structure.
+Area isolated from tidal inundation landward of the flood control structure.
^Area temporarily impacted by excavation of buried toe of the dike.

The dike (Alternative 1) provided the least impediment to sediment transport, marsh aggradation (increase in height) and marsh expansion, however, the amount of wetland impacts increased significantly with the dike only alternative due to the spatial footprint of the dike and construction related disturbances. The floodwall (Alternative 2) provided flood protection however, the vertical structure impeded coastal geologic sediment transport process. To realize some benefits to the sediment transport process, a sloped berm was added to the landward side of the wall. This allows for storm and wind driven sediments to flow over the wall into the marsh to complete the overland flow of sediment to the back-barrier marsh. With this feature, the marsh will continue to accumulate sediment (aggrade) keeping pace with sea level rise however, no additional acreages will be realized in the project area because the marsh rises up along a vertical structure. Although the floodwall prevents marsh expansion into upland areas in the project area, conversely, it will also eliminate the future need for placement of sandbags by landowners to protect property or deter landowner fill activities to expand property. Although the floodwall may not preclude all marsh encroachment in the future, it will clearly demarcate the salt marsh boundary making enforcement actions easier to prevent or pursue, as illegal fill activities will be obvious.

Similarly, the dike alternative would provide only a small amount of marsh expansion with sea-level rise due to the slope of the dike (steepened to minimize wetland impacts). A combination floodwall/dike (Alternative 3) was also evaluated however, engineering, infrastructure, environmental and public acceptability constraints deemed the floodwall alterative to be the preferred. The evaluation of alternatives and final selection was coordinated with agencies with interest and jurisdiction in the project through meetings and written correspondence. The final selection of the preferred alternative was discussed and agreed upon by federal, state and local agencies at a meeting held on 1 April 2003. It should be noted again, this project provides limited flood protection and higher intensity storms and sea level rise will inevitably contribute to future stormwater damage in this hazard prone coastal area.

4.4.2 Sea Level Rise Sea level rise was considered in determining the life of the project. Based on the predictions presented by the EPA (EPA 1995), there is an anticipated sea level rise of 0.8 feet over the next 50 years. Modeling results indicate that for future conditions (50 years) for the 5 and 10-year storm events, Hampton Harbor will have tidal elevations above 8.5 feet NGVD. In the 10-year storm event, the floodwall, at elevation 8.0 feet NGVD, would be overtopped as surface water elevation was calculated to be 8.2 feet NGVD. Flood protection in the project area is limited to frequent low-level flooding because North End Boulevard is only a few tenth of a foot higher than elevation 8.0. Flood protection beyond the elevation of the floodwall, 8.0 feet NGVD, would require large-scale structural solutions not cost effective or environmentally acceptable in the barrier beach environment.

4.4.3 Shoreline Views and Aesthetics The landward berm will be seeded with a conservation grass mixture to stabilize soils. Landowners will be permitted to landscape the berm with shrubs for aesthetic purposes. Shrub vegetation will also provide a narrow buffer from human disturbance, an added benefit to wildlife using the marsh.

4.5 Fish and Wildlife

4.5.1 Fisheries The proposed project will not affect fish likely to be found in the Blackwater River Marsh estuary such as Atlantic silversides, mummichog, striped killifish, winter flounder and ninespine stickleback. The proposed project involves driving floodwall sections in upland and high marsh areas and the placement of a berm on the landward side of the floodwall. Construction will occur in the dry with minimal soil disturbance to minimize water quality impacts. The high marsh area impacted by the proposed project is flooded approximately once monthly during extreme high tides or during storm events and therefore, would not harbor small fish typically found in tidal pools such as the mummichog and striped killifish. To survive above the low tide range, these fish must choose pools that are flooded by almost every high tide in the low marsh area. Regular tidal flooding prevents major changes in salinity that would occur with rain or evaporation. Soft-shell clams would not be affected considering there will be no impacts to intertidal flats. Also, larger fish species that are confined to the river channel, such as the winter flounder, will not be impacted by the proposed project.

Although fish would not be found close to the floodwall, salt marshes provide other benefits to fisheries resources. Salt marshes export organic matter (detritus) which enriches coastal waters and serves as a microbial food source in estuarine and near shore marine ecosystems. The loss of 3,085 square feet of salt marsh will be compensated through creation, restoration and enhancement of salt marsh in an area hydrologically connected to the Blackwater River. See Section 5.0 Mitigation for Unavoidable Loss of Wetland for further information on mitigation of impacts to salt marsh.

4.5.2 Wildlife No impacts to wildlife are expected to occur as a result of the proposed project. Habitat within the study area lies within close proximity to Main Street (Route 1A) in Salisbury, which results in a high level of human and domestic disturbance. No unique or significant wildlife species are known to utilize the project site. Although the marsh is home to many species of invertebrates, mammals and birds, there is minimal wildlife habitat for marsh-dependent species in the immediate project area due to its residential setting. Some birds and small mammals may be temporarily displaced during construction due to noise human disturbance however, this is not expected to be significant. Once construction activities are completed, the area will be available to displaced animals including the landward berm which may provide a narrow buffer to the marsh.

4.6 Rare and Protected Species and Outstanding Natural Communities

Federally listed endangered piping plovers are known to nest on both Salisbury Beach (at/near the Salisbury Beach State Reservation) and at Seabrook immediately south of the State line (USFWS, 1999). Piping plovers nest and feed along sandy coastal beaches that are relatively flat and free of vegetation. Although the piping plover are known to be in the vicinity of the project area, it is unlikely that they would utilize the proposed project area due to the high level of human disturbance and the lack of preferred habitat in the project area. Therefore, there will be no impact to this species as a result of the proposed project. The U.S. Fish and Wildlife Service concurred with this finding at a meeting held on June 9, 1999 and again in an electronic mail dated 14 August 2001 from Philip Morrison and therefore, no further consultation was required.

Based on a review of the life history requirements of the 8 protected species identified by the NHESP as having intersecting Estimated Habitat within the proposed project area, it is unlikely that any of those species would be found in the proposed project area. The species identified require habitat features lacking at the project site such as freshwater wetlands, sandy or rocky islands or granitic rock slopes.

4.7 Essential Fish Habitat

The project area is included within an area designated as EFH for marine species for various life stages including as listed in the Affected Environment section of this EA, Section 3.7. The majority of the designated species of concern would not utilize the high marsh area to satisfy their life history requirements. Although a few species, such at the winter flounder, would use the Blackwater River, moving with the ebb and flow of the tides, they would be confined to the river channel. The essential fish habitat concerns for the project area are primarily the waters, salt marsh, mudflats and benthic resources of the near project area, which are necessary to fish for spawning, breeding, feeding, or growth to maturity.

There will be 3,085 square feet of salt marsh impacted by the proposed project located along the periphery of the Blackwater River estuary. These high marsh areas are flooded approximately once monthly at extreme tides and during storm events. Due to the close proximity to a residential development, some areas of the affected high marsh are located in residential yards. Other areas of the affected high marsh are degraded by existing structures, yard waste, debris and trash laden tidal rack or are dominated by *Phragmites*, a non-native invasive species. Aside from the nutrient and detritus contributions to the estuary, these areas are not essential habitats for fish spawning, breeding, or feeding of designated EFH species of concern. However, salt marsh is a valuable habitat for a wide range of habitat functions and therefore, a mitigation plan involving the replacement and enhancement of salt marsh is included as a project component. The plan involves mitigation of salt marsh on a 1:1 ratio within the proposed project vicinity which will provide commensurate salt marsh habitat benefits to the estuarine community in the near shore estuarine ecosystem in the project vicinity.

Other construction related impacts to essential fish habitat include temporary turbidity, and smothering of benthic species and demersal eggs by uncontrolled sedimentation. To minimize water quality impacts, the Corps contractor will work from land and in the dry. Floodwall section will be driven into the substrate using a pile driver, which will minimize soil disturbance. These measures will assure minimal water quality impacts to near shore sensitive fish and benthic resources and assure no impacts to species of concern or essential fish habitat will be realized. Estuarine dependent fish species are fairly tolerant of elevated suspended sediments levels and the impact to fisheries resources will be minimized through the use of erosion control measures. Typically, most EFH species in the adult phase are found in deeper waters of the Blackwater River or ocean waters, beyond the area of immediate disturbance (saltmarsh).

Direct impacts to fish species of concern and essential fish habitat in the project area were avoided or minimized to the maximum extent practicable through the planning and design process. The incorporation of sediment control measures and mitigation of impacts to high marsh habitat should protect the interests of the Magnuson-Stevens Fisheries Conservation Act for EFH in the project area**.**

4.8 Historic and Archaeological Resources

There are no known historic or archaeological resources within the project area. A review of the archaeological site files at the Massachusetts Historical Commission indicated that several sites are recorded to the south and southwest of the study area near the mouth of the Merrimack River and also near the Ram Island Wildlife Sanctuary. Two sites just offshore of the Salisbury Beach State Reservation are presumed shipwrecks; one is the Jennie M. Carter, a late 19th Century 3-masted schooner sunk in 1894 and the other is unknown. These resources will not be impacted by the proposed flood control project.

Cultural resource impacts are not expected within the study area. The construction of a system of flood walls and dikes at the end of streets in the area from 9th Street in the north to Florence Street to the south will help to alleviate flooding from the Blackwater River. Residential properties within most of the area of concern date from the 1960's according to town assessor's reports. Construction of walls/dikes will occur within upland locations characterized by densely settled residential development and surrounded by tidal salt marsh on three sides. The Blackwater Marshes are characterized by a vegetative prevalence of salt hay grass, salt marsh cordgrass and spike grass. Soil borings indicated a thick organic deposit overlaying sandy loam with a sulfidic odor. Upland borings reveal a thin organic layer covering fill and historic sand dunes. The wall/dike combination will impact the current viewshed of the Blackwater Marshes and the River from the residences; however, design features will be incorporated to reduce the obtrusiveness of this structure to include capping with pressure treated lumber for a "finished" appearance.

Therefore, the proposed flood control measures will have no impact upon any structure of site of historic, architectural, or archaeological significance as defined by the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR 800. The Massachusetts State Historic Preservation Officer, in a letter dated September 23, 2005, has concurred with this determination.

4.9 Air Quality

U.S. Army Corps of Engineers guidance on air quality compliance is summarized in Appendix C of the Corps Planning Guidance Notebook (ER1105-2-100, Appendix C, Section C-7, pg. C-47). Section 176 (c) of the Clean Air Act (CAA) requires that Federal agencies assure that their activities are in conformance with Federally-approved CAA state implementation plans for geographic areas designated as non-attainment and maintenance areas under the CAA. The EPA General Conformity Rule to implement Section 176 (c) is found at 40 CFR Part 93.

Clean Air Act compliance, specifically with EPA's General Conformity Rule, requires that all Federal agencies, including Department of the Army, to review new actions and decide whether the actions would worsen an existing NAAQS violation, cause a new NAAQS violation, delay the SIP attainment schedule of the NAAQS, or otherwise contradict the State's SIP.

The Commonwealth of Massachusetts is authorized by the EPA to administer its own air emissions permit program, which is shaped by its State Implementation Plan (SIP). The SIP sets the basic strategies for implementation, maintenance, and enforcement of the National Ambient Air Quality Standards (NAAQS). The SIP is the federally enforceable plan that identifies how that state will attain and/or maintain the primary and secondary National Ambient Air Quality Standards (NAAQS) established by the EPA (U.S. Environmental Protection Agency, 2005). In Massachusetts, Federal actions must conform to the Massachusetts state implementation plan or Federal implementation plan. The Corps must evaluate and determine if the proposed action (construction and operation) will generate air pollution emissions that aggravate a non-attainment problem or jeopardize the maintenance status of the area for ozone. When the total direct and indirect emissions caused by the operation of the Federal action/facility are less than threshold levels established in the rule (40 C.F.R. § 93.153), a Record of Non-applicability (RONA) is prepared and signed by the facility environmental coordinator.

4.9.1 Construction and Operation

Construction would occur over a total period of 6 to 8 months. Construction activity at the proposed project site would require backhoes, a crane, bulldozer, dump trucks, highway trucks, pick-up trucks, front-end loaders, and other construction equipment such as dewatering pumps and small loaders.

During construction, equipment operating in Salisbury would emit pollutants including nitrogen oxides that can lead to the formation of ozone. Construction of the floodwall and pumping stations would involve vehicles transporting impervious fill and topsoil (dump trucks), floodwall sections (highway trucks), and other construction equipment to and from the site. These vehicles will be in compliance with the state's vehicle emission program.

Equipment operating on the construction site (non-road construction equipment) will emit pollutants that contribute to increased levels of criteria pollutants such as carbon monoxide, nitrogen oxides, and ozone. The emissions for construction vehicles and related equipment will have an insignificant impact to local air quality.

Construction of the proposed project could cause a temporary reduction in local ambient air quality because of fugitive dust and emissions generated by construction equipment. The extent of dust generated would depend on the level of construction activity and dryness. Proper dust suppression techniques would be employed to avoid creating a nuisance for nearby residents during dry and windy weather.

In order to minimize air quality effects during construction, all construction operations would comply with applicable provisions of the Commonwealth of Massachusetts air quality control regulations pertaining to dust, odors, construction, noise, and motor vehicle emissions. No direct or indirect increases or other changes in local or regional air quality are likely to occur with the construction and operation of the proposed project.

4.9.2 General Conformity

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions "conform with" (i.e., do not undermine) the approved SIP for their geographic area. Federal agencies make this demonstration by performing a conformity review. The conformity review is the process used to evaluate and document project-related air pollutant emissions, local air quality impacts and the potential need for emission mitigation (Polyak, K and Webber, L. 2002). A conformity review must be performed when a Federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more NAAQS. Non-attainment areas are geographic regions where the air quality fails to meet the NAAQS.

The project is located in Essex County, Salisbury Massachusetts. Essex County is considered to be non-attainment for ozone, receiving a "moderate" classification under the new 8-hour ozone air quality classification. The General Conformity thresholds for ozone in a moderate non-attainment area have an emission rate threshold of 50 tons per year (tons/year) of VOC (volatile organic compounds) and 100 tons/year of NO_x (nitrogen oxides) (U.S. Army Environmental Center, 2002) (40 CFR 51.853, 7-1-03).

To conduct a general conformity review and emission inventory for the proposed floodwall project, a list of construction equipment was identified using the project construction cost estimate. The first column of the emissions calculations table provides a summary equipment list (see General Conformity – Record of Non-Applicability at the end of this Environmental Assessment). The New England District prepared calculations of the worst-case project specific emissions of NOx and VOCs to determine whether project emissions would be under the General Conformity Trigger Levels. Because of the small scale of the project, several simplifying assumptions were applied in performing the calculations to prepare a worst-case analysis. The actual emissions would most likely be much lower, but in no case above the calculated values. For instance, the load factor is the average percentage of rated horsepower used during a source's operational profile. To simplify the calculations, we used a worst-case estimate of 1.0, or 100 percent, for all equipment. We used 10 hours per day as worst-case hours of operation for most equipment. We used the total construction duration minus non-work days (i.e. weekends and holidays) to estimate days of operation, rather than the specific days of operation for each piece of equipment. Based on these calculations, the worst-case NOx emissions were 27.93 tons and the worst-case VOC emissions were 4.01 tons. In both cases, the total construction emissions were below the General Conformity Trigger Levels. These calculations are presented in the Record of Non Applicability for Clean Air Act Conformity (RONA) at the end of this Environmental Assessment.

Detailed calculations (i.e. not worst case) for several projects of similar scale in the Corps of Engineers, Philadelphia District (small navigation, emergency streambank stabilization, and ecosystem restoration projects in New Jersey, and a road maintenance project in Delaware) had calculated emissions well below the 100 tons per year threshold. Table 5 summarizes the emissions estimates for these 4 projects. Detailed calculations for the Salisbury Local Flood Protection project would be likely to have values closer to this range.

Table 5
Estimated Project Emissions for Ozone at 4 Corps of Engineers Projects located in Severe Non-Attainment Areas

Project	Location	Type	Maximum Pollutant (tons) NOx	VOCs
Wills Hole Thorofare	New Jersey	Small Navigation-Dredging	9.80	0.25
Barnegat Bay Dredged Hole #6	New Jersey	Ecosystem Restoration	19.90	0.36
Manasquan River at Bergerville Rd	New Jersey	Streambank Stabilization	0.69	0.10
Summit Bridge Road Maintenance	Delaware	Road Maintenance	5.01	0.71
		Combined totals:	35.40	1.42
		Multiple of 2 combined totals (tons):	70.80	2.84

The total estimated direct and indirect emissions that would result from the construction of the flood protection project in Salisbury are below the General Conformity trigger levels of 100 tons per year of NOx and 50 tons per year of VOCs. General Conformity under the Clean Air Act, Section 176 has been evaluated for the project according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project because the total direct and indirect emissions from the project are below the conformity threshold values established at 40 CFR 93.153 (b) for ozone (NOx and VOCs) in a moderate attainment area.

The determination of whether or not a project is regionally significant is if its emissions exceed 10% of the state's total emissions budget for the criteria pollutants (40 CFR 93.153 (i)). Table IV – 1 of the 2002 Eastern Massachusetts Supplement to the July 1998 Ozone Attainment State Implementation Plan Submittal (MADEP, 2002), lists the total emissions inventories for emissions sources in the state for various years, and predicts estimated inventories for 2007. These inventories are calculated as tons per summer day (tpsd) and show that for mobile sources alone, total values of 243.328 tpsd of NOx and 117.118 tpsd of VOCs are predicted for 2007. As noted, the emissions for the Salisbury Local Flood Protection Project are estimated to be 27.93 and 4.01 tons for both NOx and VOCs respectively. These values show that *in less than one day*, mobile sources alone within the area of Eastern Massachusetts would exceed the yearly estimated emissions for both NOx and VOCs for the proposed Salisbury Local Flood Protection Project. Therefore the estimated emissions for the proposed project are below 10% of the total emissions inventory for the Commonwealth of Massachusetts. The Army activity does not reach the threshold levels established by the EPA rule, and is not regionally significant, and therefore the conformity rule is inapplicable here. A Record of Non-Applicability and the supporting emissions calculations for the Salisbury Local Flood Protection Project are provided at the end of this Environmental Assessment.

5.0 MITIGATION FOR UNAVOIDABLE LOSS OF WETLANDS

Pursuant to the requirements of the federal Section 404 Clean Water Act permit program and the federal "no net loss of wetlands" policy, a mitigation plan was developed to compensate for unavoidable loss of wetlands. The alternative analysis process involved extensive coordination with federal, state and local agencies over a period of three years to assure the sensitive regulatory, policy and social issues associated with the project were fully evaluated. A mitigation plan involving a combination of salt marsh creation, restoration and enhancement was developed to compensate the loss of salt marsh on a 1:1 ratio. The mitigation plan provided 3,907 square feet of salt marsh through a combination of creation (areas excavated from upland) and restoration (the area at the end of 9^{th} Street caused by snow plow operations) of salt marsh. The selected creation and restoration sites are located along the alignment of the floodwall providing on-site, in-kind mitigation preferable to the regulatory community. As well, sites selected for creation and restoration are degraded or previously filled and hydrologically connected to the Blackwater River Marsh, which maximizes the value of the created/restored wetland. In addition, 5,838 square feet of enhancement will be undertaken in two areas dominated by *Phragmites,* an invasive species with low habitat value. See Figure EA-5 and EA-6, Mitigation Sites for depictions of the selected mitigation sites and acreage of each site. On the

Figure EA-5 and EA-6, two salt marsh creation areas are shown in red, one salt marsh restoration area is shown in blue and two salt marsh enhancement areas are shown in blue.

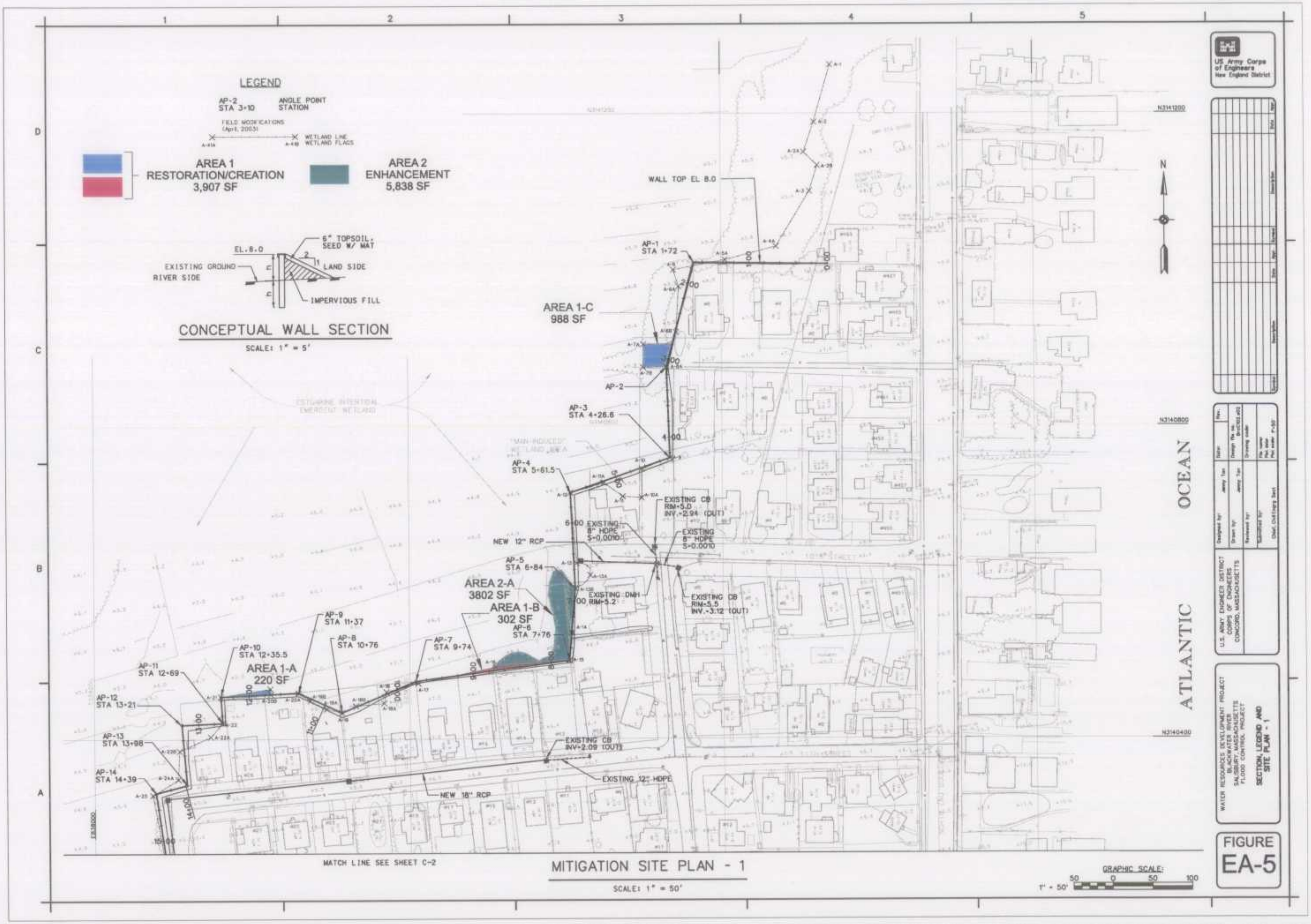
Salt marsh creation, restoration and enhancement will be accomplished on a site-specific basis. The creation and restoration areas will be excavated to the elevation subscribed by adjacent healthy salt marsh or underlying natural strata as determined during Plans and Specifications (Areas 1-A, 1-B, 1-C, and 1-D). The areas dominated by *Phragmites* (Areas 2-A and 2-B) will be excavated to a depth to include the *Phragmites* root structure and then backfilled with appropriate soils. Care will be taken to dispose of *Phragmites* contaminated soils in a suitable area to prevent reinfestation. All mitigation sites will be planted with salt marsh cordgrass, *Spartina alterniflora*. An herbaceous coastal grass seed mixture will be broadcast on the landward berm and in other disturbed areas as necessary.

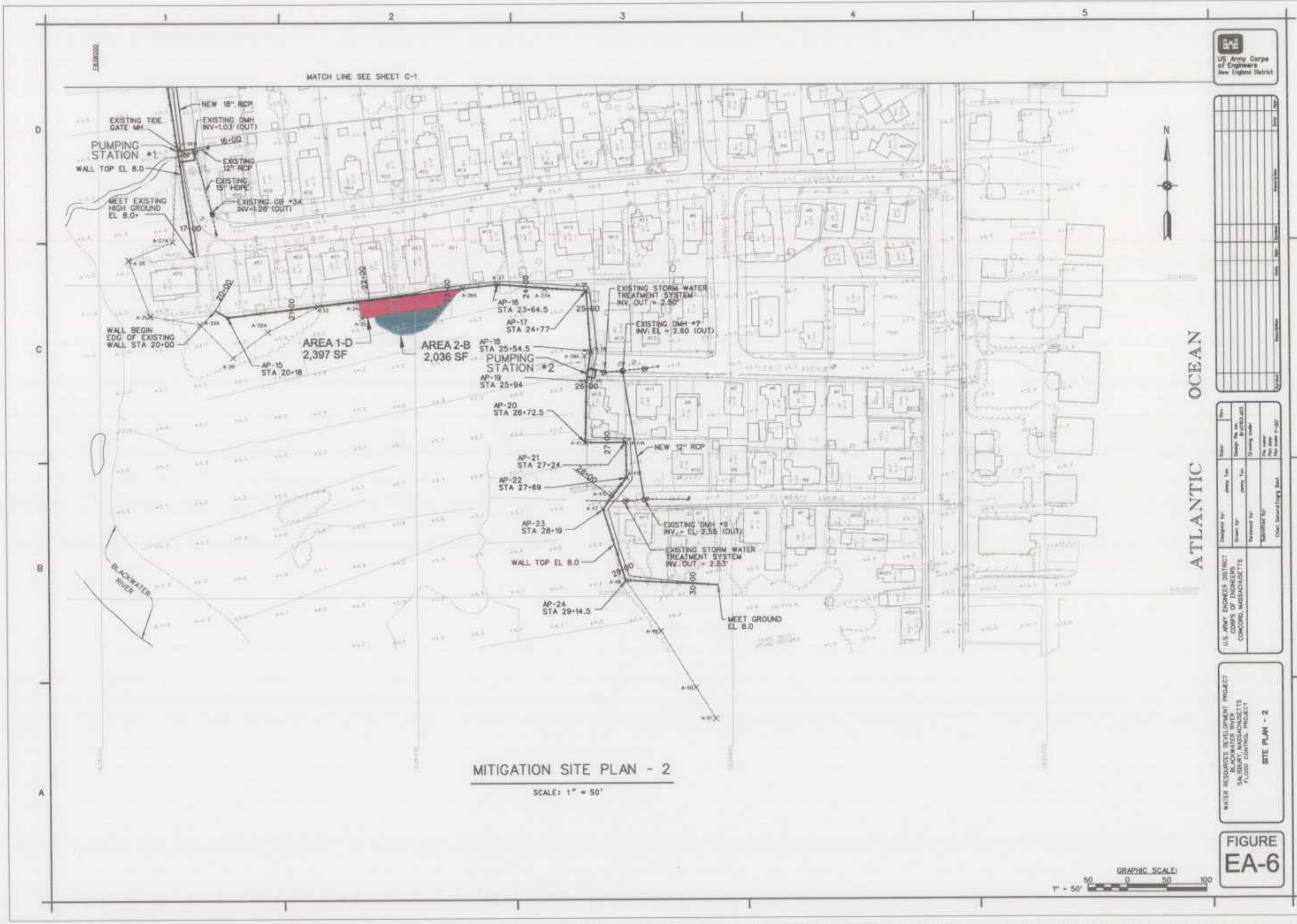
6.0 COMPLIANCE ISSUES

6.1 Environmental Justice

Executive Order 12898 directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of an agency's programs, policies, and activities on minority populations and low-income populations. The proposed project provides limited flood protection to a circa 1960’s residential neighborhood. It involves the construction of a floodwall for the purpose of alleviating frequent low-level flooding experienced in this residential neighborhood in recent years. The flood barrier is designed to prevent flooding to the 10-year storm event over a 50-year project life.

The proposed project is not expected to pose impacts upon any minority or low-income neighborhoods adjacent to or in the vicinity of the project pursuant to Executive Order No. 12898. The proposed project location was defined by a persistent flooding problem. Although flooding in the Blackwater River estuary has occurred to varying degrees over the years however, the replacement of the Route 286 Bridge in 1991 in New Hampshire exacerbated the problem in the project area. The computed change in tide height from the previous conditions (1948 bridge) to the present conditions (1991) near Berry Lane is a few tenths of a foot for a high spring tide event, about 0.5 feet of a 1-year event and about 1 foot for a 10-year event (ACOE, 1995). Therefore, no disproportionately high and adverse impacts specific to any minority or low-income neighborhood would occur as a result of the proposed project.


LEGEND
AP-2 STA 3+10 ANGLE POINT STATION
FIELD MODIFICATIONS (April, 2003)
WETLAND LINE WETLAND FLAGS
AREA 1
RESTORATION/CREATION
3,907 SF
AREA 2
ENHANCEMENT
5,838 SF
EL. 8.0
6" TOPSOIL, SEED W/ MAT
EXISTING GROUND
RIVER SIDE
LAND SIDE
IMPERVIOUS FILL
CONCEPTUAL WALL SECTION
SCALE: 1" = 5'
WALL TOP EL 8.0
AP-1
STA 1+72
AREA 1-C
988 SF
AP-2
AP-3
STA 4+26.6
AP-4
STA 5+61.5
EXISTING CB
RIM=5.0
INV.=2.94 (OUT)
EXISTING 8" HDPE S=0.0010
NEW 12" RCP
AP-5
STA 6+84
AREA 2-A
3802 SF
AREA 1-B
302 SF
AP-6
STA 7+76
EXISTING DMH
RIM=5.2
EXISTING CB
RIM=5.5
INV.=3.12 (OUT)
AP-9
STA 11+37
AP-8
STA 10+76
AP-7
STA 9+74
AP-10
STA 12+35.5
AREA 1-A
220 SF
AP-11
STA 12+69
AP-12
STA 13+21
AP-13
STA 13+98
AP-14
STA 14+39
EXISTING CB
INV=2.09 (OUT)
EXISTING 12" HDPE
NEW 18" RCP
MATCH LINE SEE SHEET C-2
MITIGATION SITE PLAN - 1
SCALE: 1" = 50'
GRAPHIC SCALE
1" = 50'
ATLANTIC OCEAN
US Army Corps of Engineers New England District
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
CONCORD, MASSACHUSETTS
WATER RESOURCES DEVELOPMENT PROJECT
BLACKWATER RIVER
SALISBURY, MASSACHUSETTS
FLOOD CONTROL PROJECT
SECTION, LEGEND AND SITE PLAN - 1
FIGURE
EA-5


MATCH LINE SEE SHEET C-1
NEW 18" RCP
EXISTING TIDE GATE MH
EXISTING DMH INV=1.03' (OUT)
PUMPING STATION #1
WALL TOP EL 8.0
EXISTING 12" RCP
EXISTING 15" HDPE
MEET EXISTING HIGH GROUND EL 8.0±
EXISTING CB #3A INV=1.28' (OUT)
WALL BEGIN EDG OF EXISTING WALL STA 20+00
AP-15 STA 20+18
AREA 1-D 2,397 SF
AREA 2-B 2,036 SF
AP-16 STA 23+64.5
AP-17 STA 24+77
EXISTING STORM WATER TREATMENT SYSTEM INV. OUT = 2.50'
EXISTING DMH #7 INV. EL = 2.60 (OUT)
AP-18 STA 25+54.5
PUMPING STATION #2
AP-19 STA 25+94
AP-20 STA 26+72.5
NEW 12" RCP
AP-21 STA 27+24
AP-22 STA 27+69
AP-23 STA 28+19
EXISTING DMH #9 INV. EL 2.55 (OUT)
EXISTING STORM WATER TREATMENT SYSTEM INV. OUT = 2.53'
WALL TOP EL 8.0
AP-24 STA 29+14.5
MEET GROUND EL 8.0
BLACKWATER RIVER
ATLANTIC OCEAN
N
MITIGATION SITE PLAN - 2
SCALE: 1" = 50'
GRAPHIC SCALE
1" = 50'
US Army Corps of Engineers New England District
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS CONCORD, MASSACHUSETTS
WATER RESOURCES DEVELOPMENT PROJECT BLACKWATER RIVER SALISBURY, MASSACHUSETTS FLOOD CONTROL PROJECT
SITE PLAN - 2
FIGURE EA-6

6.2 Protection of Children

Executive Order 13045 requires federal agencies to examine proposed actions to determine whether they will have disproportionately high human health or safety risks on children. During the construction phase of the proposed project, heavy construction equipment and vehicles will be transported to the site. However, the actual site will be fenced off to prevent unauthorized personnel from entering the work area (including children). In addition, there will be a temporary increase in truck traffic transporting materials to and from the site. These trucks will be limited to public roadways and the existing project access road and increased traffic will be of short duration and temporary. The closest school is approximately 4 miles by road and therefore, no disturbance will occur to children attending school as a result of the project. Therefore, the proposed project is not expected to cause any disproportionate direct, or indirect or cumulative environmental health or safety risks to children.

6.3 Cumulative Impacts

The Council on Environmental Quality (CEQ) definition of cumulative impacts as found in 40 Code of Federal Regulation (CFR) section 1508.7 is as follows: "Cumulative Impact is the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or nonfederal) or persons undertakes such other acts." This project provides low-level flood protection to a circa 1960’s residential neighborhood. The majority of development also occurred after construction of the 1948 bridge, when the area appeared more suitable for development due to reduced tidal flows. Although flooding along the Blackwater River has occurred to varying degrees over the years however, the replacement of the Route 286 Bridge in 1991 in New Hampshire exacerbated the problem in the project area.

The construction of a floodwall will prevent frequent low-level flooding in the project area residential development and therefore, prevent salt marsh expansion into the project area. The purchase or taking of residential properties to allow the natural advancement of salt marsh habitat was not an economically or socially feasible solution. Although developmental pressure is high in this coastal community, strict federal and state environmental regulations should prevent future large-scale development at the expense of salt marsh habitat. As well, the change in bridge opening in 1991, which exacerbated flooding in the project area, had the effect of restoring hydrology to approximately 10 acres of salt marsh. Therefore, there is a net gain in acres of salt marsh habitat with the floodwall solution versus early proposals to close the bridge opening to 1948 conditions. There will be 3,085 square feet of salt marsh impacts with construction of the floodwall, however, this impact will be mitigated on a 1:1 ratio for no net loss of salt marsh. No negative cumulative impacts are anticipated to occur as a result of the proposed project.

6.4 Impacts on Prime or Unique Agricultural Lands

The soils in the project area consist of a rolling udipsamments bordered by Ipswich and Westwood mucky peats as mapped by the U.S. Department of Agriculture (USDA, 1977).

Rolling udipsamments are deep, gently sloping to very steep, excessively drained to moderately well drained soils on sand dunes adjacent to coastal beaches and tidal marshes. Ipswich and Westwood mucky peats are deep, nearly level, very poorly drained organic soils subject to daily tidal inundation. These soils are not listed as prime, state or locally important soils and therefore, no impacts on farmland soils will occur as a result of the project.

7.0 COORDINATION

A coordinated site inspection was conducted on 15 December 1999 with federal, state and local agencies with interest or jurisdiction in the proposed project. Additional meetings were held on several occasions to coordinate project plan formulation and consider agency comments and concerns. On **Blank Date**, a Public Notice of the proposed project was released to additionally inform federal, state and local agencies and the interested public. No comments were received during the Public Notice 30-day comment period. Coordination letters were mailed to the following agencies (see Appendix A for letters sent, letters of response and a copy of the Public Notice):

Federal

U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
U.S. National Marine Fisheries Service
Tribal Historic Preservation Officer

State

Massachusetts Executive Office of Environmental Affairs
- Massachusetts Coastal Zone Management
- Massachusetts Environmental Policy Act Unit

Massachusetts Department of Environmental Protection
- Operations and Programs - Northeast Regional Office
- Bureau of Resource Protection - Wetlands and Waterways Program

Massachusetts Department of Environmental Management
- Division of Resource Conservation
  - Bureau of Engineering - Office of Waterways
  - Bureau of Resource Protection - Office of Water Resources

Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement
- Division of Fisheries and Wildlife
  - Fisheries
  - Wildlife
  - Natural Heritage & Endangered Species Program
- Division of Marine Fisheries

Massachusetts State Historic Preservation Officer

<u>Local</u>

Town of Salisbury
Deoartment of Public Works
Town Manager
Town Planner

8.0 REFERENCES CITED

Army Corps of Engineers (ACOE), New England Division. 1995. Effect of Route 286 Bridge on Flooding of the Blackwater River – Salisbury, Massachusetts. July 1995

Army Corps of Engineers (ACOE), New England District. 1998. Wetland Delineation Report for the Blackwater River Marshes Site in Salisbury, Massachusetts. Prepared for the Army Corp of Engineers by ENSR. Contract DACW33-96-D-0004. December 1998.

Cowardin, Lewis M.,Virginia Carter, Francis C. Golet and Edward T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Performed for the U.S. Department of the Interior, Fish and Wildlife Service. FWS/OBS 79/31.

Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual", Technical Report Y-87-1, US Army Corps of Engineer Waterways Experiment Station, Vicksburg, Miss.

Environmental Protection Agency (EPA). 1995. The Probability of Sea Level Rise. U.S. EPA, EPA 230-R-95-008 (1995).

Environmental Protection Agency (EPA), 2005. EPA Green Book. Website accessed 5/31/2005. http://www.epa.gov/oar/oaqps/greenbk/gnca.html#1123

Lefor, M.W., W.C. Kennard and D.L. Civco. 1987. Relationship of salt marsh plant distributions to tidal levels in Connecticut. Environmental Management 11:1:61-68.

Maine Department of Conservation (MDC) Natural Areas Division. 1999. Rare Plant Fact Sheet PMCYPO3F00. *Carex recta* Boott – Salt-marsh Sedge.

Massachusetts Department of Environmental Protection (DEP), Division of Water Pollution Control. 1997. 314 Code of Massachusetts Regulations (CMR) 4.00 Surface Water Quality Standards Regulations. 30 May 1997.

Massachusetts Historical Commission (MHC). 1997. Reconnaissance Survey Report, Town of Salisbury. (Original 1985, updated 1997). MHC, Boston, Massachusetts.

Massachusetts Natural Heritage and Endangered Species Program (NHESP). 1991. Massachusetts Endangered Wildlife - Shortnose Sturgeon (*Acipenser brevirostrum*).

Massachusetts Natural Heritage and Endangered Species Program (NHESP). 1991. Massachusetts Endangered Wildlife - Atlantic Sturgeon (*Acipenser oxyrhynchus*).

Massachusetts Natural Heritage and Endangered Species Program (NHESP). 1995. Massachusetts Endangered Species – Bald Eagle (*Haliaeetus leucocephalus (Linnaeus*).

Massachusetts Natural Heritage and Endangered Species Program (NHESP). 1999. Correspondence dated 1 February 1999.

Massachusetts Department of Environmental Protection, Division of Air Quality (MA DEP). 2002. http://www.mass.gov/dep/bwp/daqc/daqcpubs.htm#sip

New Hampshire Department of Environmental Services (DES). 2000. 2000 Section 305(b) Water Quality Report. NHDES-WD-00-4. New Hampshire Department of Environmental Services, 6 Hazen Drive, Concord, New Hampshire 03301

North Atlantic Energy Service Corporation. 2000. Seabrook Station 1999 Environmental Monitoring in the Hampton-Seabrook Area. A Characterization of Environmental Conditions During the Operation of Seabrook Station. North Atlantic Energy Service Corporation, P.O. Box 300, Seabrook Station, Seabrook, New Hampshire 03874. December 2000.

North Coastal Watershed Alliance. 2000. Water Quality Assessment: Gloucester Harbor, The North River, Salem/Peabody, The Sagus River, Smallpox Brook, Salisbury. North Coastal Watershed Alliance: Salem Sound, Inc., Sagus River Watershed Counsel, Massachusetts Audubon Society, North Shore.

National Oceanographic and Atmospheric Administration (NOAA) 1998. Status of the Fishery Resources off the Northeastern United States for 1998. National Marine Fisheries Service, Northeast Fisheries Science Center. NOAA Technical Memorandum NMFS-NE115.

Polyak, K and Webber, L. 2002. Technical Guide for Compliance with the General Conformity Rule. U.S. Army Center for Health Promotion and Preventative Medicine, Directorate of Environmental Health Engineering, Air Quality Surveillance Program.

Scott, W.B., and M.G. Scott. 1988. Atlantic Fishes of Canada. Can. Bull. Fish. Aquat. Sci. 219: 731p.

U.S. Department of Agriculture, Soil Conservation Service (USDA). 1977. Soil Survey of Essex County, Massachusetts, Northern Part.

U.S. Fish and Wildlife Service (USFWS). 1999. Letter for the U.S. Fish and Wildlife Service dated January 26, 1999 in response to requirements under the Endangered Species Act.

9.0 COMPLIANCE WITH FEDERAL ENVIRONMENTAL STATUTES, EXECUTIVE ORDERS AND EXECUTIVE MEMORANDA

Federal Statutes

1. Archaeological Resources Protection Act of 1979, as amended, 16 USC 470 et seq.

Compliance: Not applicable; no permit from the Federal land manager to excavate or remove archaeological resources located on public or Indian lands is required.

2. Preservation of Historic and Archeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: Mitigation of impacts to historic and archaeological resources, if required, will be addressed through further coordination and consultation with the Massachusetts State Historic Preservation Officer and the Advisory Council on Historic Preservation. A Memorandum of Agreement concerning the mitigation will be prepared which shall constitute compliance with this statute.

3. American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.

Compliance: Must ensure access by native Americans to sacred sites, possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

4. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: Public notice of the availability of this report to the Environmental Protection Agency is required for compliance pursuant to Sections 176c and 309 of the Clean Air Act.

5. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Compliance: A Section 404(b)(1) Evaluation and Compliance Review will been incorporated into the project report. An application shall be filed for State Water Quality Certification pursuant to Section 401 of the Clean Water Act.

6. Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq.

Compliance: A CZM consistency determination shall be provided to the State for review and concurrence that the proposed project is consistent with the approved State CZM program.

7. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the U.S. Fish and Wildlife Service (FWS) and/or National Marine Fisheries Service (NMFS) will determine formal consultation requirements pursuant to Section 7 of the Endangered Species Act.

8. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: Applicable only if report is being submitted to Congress.

9. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Public notice of availability to the project report to the National Park Service (NPS) and Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

10. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination with the FWS, NMFS, and State fish and wildlife agencies signifies compliance with the Fish and Wildlife Coordination Act.

11. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Public notice of the availability of this report to the National Park Service (NPS) and the Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

12. Marine Protection, Research, and Sanctuaries Act of 1971, as amended, 33 U.S.C. 1401 et seq.

Compliance: Applicable if the project does involves the transportation or disposal of dredged material in ocean waters pursuant to Sections 102 and 103 of the Act, respectively.

13. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: Coordination with the Massachusetts State Historic Preservation Officer has been completed by letter dated September 23, 2005, signifying compliance with Section 106 of this Act.

14. Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3000-3013, 18 U.S.C. 1170

Compliance: Regulations implementing NAGPRA will be followed if discovery of human remains and/or funerary items occur during implementation of this project.

15. National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.

Compliance: Preparation of an Environmental Assessment signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact is issued.

16. Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: No requirements for projects or programs authorized by Congress.

17. Watershed Protection and Flood Prevention Act as amended, 16 U.S.C 1001 et seq.

Compliance: Floodplain impacts must be considered in project planning.

18. Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.

Compliance: Not applicable; the project does not impact a designated Wild and Scenic River.

19. Magnuson-Stevens Act, as amended, 16 U.S.C. 1801 et seq.

Compliance: Coordination with the National Marine Fisheries Service and preparation of an Essential Fish Habitat (EFH) Assessment signifies compliance with the EFH provisions of the Magnuson-Stevens Act.

Executive Orders

1. Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971

Compliance: Coordination with the Massachusetts Historic Preservation Officer signifies compliance.

2. Executive Order 11988, Floodplain Management, 24 May 1977 amended by Executive Order 12148, 20 July 1979.

Compliance: Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2).

3. Executive Order 11990, Protection of Wetlands, 24 May 1977.
Compliance: Public notice of the availability if this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

4. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: Not applicable to projects located within the United States.

5. Executive Order 12898, Environmental Justice, 11 February 1994.

Compliance: Not applicable if the project is not expected to have a significant impact on minority or low-income population, or any other population in the United States.

6. Executive 13007, Accommodation of Sacred Sites, 24 May 1996

Compliance: Not applicable unless on Federal lands, then agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites.

7. Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. 21 April, 1997.

Compliance: The project would not create a disproportionate environmental health or safety risk for children.

8. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.

Compliance: Consultation with Indian Tribal Governments, where applicable, and consistent with executive memoranda, DoD Indian policy, and USACE Tribal Policy Principles signifies compliance.

Executive Memorandum

Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: Not applicable. The project does not involve impacts to prime, state or local soils as per section of 6.4 Impacts on Prime or Unique Agricultural Lands of the Environmental Assessment.

White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.

Compliance: Consultation with Federally Recognized Indian Tribes, where appropriate, signifies compliance.

CLEAN WATER ACT SECTION 404 (b)(1) EVALUATION

NEW ENGLAND DISTRICT
U.S. ARMY CORPS OF ENGINEERS, CONCORD, MA
CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

PROJECT: Salisbury Section 205 Local Flood Protection Project

PROJECT MANAGER: Richard Heidebrecht EXT. 78513

FORM COMPLETED BY: Judith Johnson EXT. 78138

PROJECT DESCRIPTION: The proposed project provides limited flood protection to a residential neighborhood located adjacent to the Blackwater River tidal estuary in Salisbury, Massachusetts. It involves the construction of a floodwall for the purpose of alleviating frequent low-level flooding experienced in this residential neighborhood in recent years. The flood barrier is designed to prevent flooding to the 10-year storm event over a 50-year project life. More comprehensive flood protection for the proposed project area is constrained by local topography and the proximate location of the Atlantic Ocean as well as economic and environmental considerations.

CLEAN WATER ACT
Evaluation of Section 404(b)(1) Guidelines

1. Review of Compliance (Section 230.10(a)-(d)).

a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose;

__X__YES ___ NO

b. The activity does not appear to:
1) violate applicable state water quality standards or effluent standards prohibited under Section 307of the CWA;
2) jeopardize the existence of Federally listed threatened and endangered species or their critical habitat; and
3) violate requirements of any Federally designated marine sanctuary,

__X__YES ____ NO

c. The activity will not cause or contribute to significant degradation of waters of the

U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values;

__X__YES ____ NO

d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.

__X__YES ____ NO

2. <u>Technical Evaluation Factors (Subparts C-F).</u>

	N/A	Not Significant	Significant*
a. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C).			
1) Substrate.		X	
2) Suspended particulates/turbidity.		X	
3) Water.		X	
4) Current patterns and water circulation		X	
5) Normal water fluctuations.		X	
6) Salinity gradients.		X	
b. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D).			
1) Threatened and endangered species.	X		
2) Fish, crustaceans, mollusks and other aquatic organisms in the food web.		X	
3) Other wildlife.		X	
c. Potential Impacts on Special Aquatic Sites (Subpart E).			
1) Sanctuaries and refuges.	X		
2) Wetlands.		X	
3) Mud flats.		X	
4) Vegetated shallows.		X	
5) Coral reefs.	X		
6) Riffle and pool complexes.	X		

d. Potential Effects on Human Use Characteristics (Subpart F).

1) Municipal and private water supplies.	X		
2) Recreational and Commercial fisheries.		X	
3) Water-related recreation.		X	
4) Aesthetics.		X	
5) Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves.	X		

3. Evaluation and Testing (Subpart G).

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Only those appropriate are checked.)

1) Physical characteristics.. X
2) Hydrography in relation to known or anticipated sources of contaminants.. ___
3) Results from previous testing of the material or similar material in the vicinity of the project.................................... ___
4) Known, significant sources of persistent pesticides from land runoff or percolation... ___
5) Spill records for petroleum products or designated hazardous substances (Section 311 of CWA).. ___
6) Public records of significant introduction of contaminants from industries, municipalities, or other sources.. ___
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities................. ___
8) Other sources (specify).. ___

List appropriate references. See 2005 Environmental Assessment for the Salisbury, Massachusetts Section 205 Local Flood Protection Project

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to require constraints. The material meets the testing exclusion criteria.

4. Disposal Site Delineation (Section 230.11(f)).

a. The following factors, as appropriate, have been considered in evaluating the disposal site.

1) Depth of water at disposal site.. __X__
2) Current velocity, direction, and variability at disposal site............... __X__
3) Degree of turbulence... _____
4) Water column stratification... _____
5) Discharge vessel speed and direction.. _____
6) Rate of discharge.. _____
7) Dredged material characteristics (constituents, amount, and type of material, settling velocities).. __X__
8) Number of discharges per unit of time... _____
9) Other factors affecting rates and patterns of mixing (specify)............ _____

List appropriate references. See 2005 Environmental Assessment for the Salisbury, Massachusetts Section 205 Local Flood Protection Project

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or mixing zone are acceptable.

__X__YES ____ NO

5. Actions To Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.

__X__YES ____ NO

6. Factual Determination (Section 230.11).

A review of appropriate information as identified in items 2 - 5 above indicates that there is minimal potential for short or long term environmental effects of the proposed discharge as related to:

a. Physical substrate (review sections 2a, 3, 4, and 5 above). _X_YES ____ NO

b. Water circulation, fluctuation and salinity (review sections 2a, 3, 4, and 5). _X_YES ____ NO

c. Suspended particulates/turbidity

(review sections 2a, 3, 4, and 5). _X_ YES ____ NO

d. Contaminant availability
(review sections 2a, 3, and 4). _X_ YES ____ NO

e. Aquatic ecosystem structure, function
and organisms(review sections 2b and
c, 3, and 5). _X_ YES ____ NO

f. Proposed disposal site
(review sections 2, 4, and 5).
c, 3, and 5). _X_ YES ____ NO

g. Cumulative effects on the aquatic
ecosystem. _X_ YES ____ NO

h. Secondary effects on the aquatic
ecosystem. _X_ YES ____ NO

7. Findings of Compliance.

The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines.

_______________________ _________________________________

Date

Curtis L. Thalken
Colonel, Corps of Engineers
District Engineer

GENERAL CONFORMITY - RECORD OF NON-APPLICABILITY

Project/Action Name:	**Salisbury Local Flood Protection Project, Salisbury, Massachusetts**
Project/Action Point of Contact:	*Joseph MacKay, Chief, Environmental Resources Section* *phone: 978-318-8142*

General Conformity under the Clean Air Act, Section 176 has been evaluated for the project described above according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project/action because:

Total direct and indirect emission from this project/action are estimated at less than 100 tons for Ozone, and are below the conformity threshold value established at 40 CFR 93.153(b) of 100 tons/year of Ozone;

AND

The project/action is not considered regionally significant under 40 CFR 93.153(i).

Supporting documentation and emissions estimates are:

(X) ATTACHED
(X) APPEAR IN THE NEPA DOCUMENTATION (Section 6.8)
( ) OTHER

SIGNED____
Joseph MacKay, Chief, Environmental Resources Section

General Conformity Review and Emission Inventory for the Salisbury Local Flood Protection Project
(Worst Case Analysis)

	Project Emission Sources and Estimated Power						NOx Emission Estimates		VOC Emission Estimates	
Equipment/Engine Category	# of engines	hp	LF	hrs/day	days of operation	hp-hr	NOx EF (g/hp-hr)	NOx Emissions (tons)	VOC EF (g/hp-hr)	VOC Emissions (tons)
TRK, HWY, 21,000 GVW, 4X2, 2 Axle	1	175	1.00	10	167	292,250	9.200	2.96	1.300	0.42
TRK, Rear Dump Body, 12 cy	1	325	1.00	10	167	542,750	9.200	5.50	1.300	0.78
Loader, WH, 3.25 CY Bkt.	1	137	1.00	10	167	228,790	9.200	2.32	1.300	0.33
Loader, Backhoe, WH 1.25CY FE Bkt	1	85	1.00	10	167	141,950	9.200	1.44	1.300	0.20
Dewatering Pump 6" Diesel	2	25	1.00	24	167	200,400	9.200	2.03	1.300	0.29
Crane, Hyd, TRK MTD 25T/80' Boom	1	152	1.00	10	167	253,840	9.200	2.57	1.300	0.36
Drill Rig, Horiz. Boring	1	200	1.00	10	167	334,000	9.200	3.39	1.300	0.48
TRK, HWY 8,800GVW 4x4 3/4T-PKUP	1	137	1.00	10	167	228,790	9.200	2.32	1.300	0.33
Loader, mini (Bobcat)	1	25	1.00	10	167	41,750	9.200	0.42	1.300	0.06
Dozer, Crawler, D-6	1	145	1.00	10	167	242,150	9.200	2.46	1.300	0.35
Hyd Exc BH, Crawler, 1.25CY Bkt	1	143	1.00	10	167	238,810	9.200	2.42	1.300	0.34
							NOx Total	**27.84**	**VOC Total**	**3.93**

Total emissions including employee travel (see next sheet)	**NOx Total**	**27.93**	**VOC Total**	**4.01**

Horsepower Hours
hp-hr = # of engines*hp*LF*hrs/day*days of operation

Load Factors
Load Factor (LF) represents the average percentage of rated horsepower used during a source's operational profile. For this worst case estimate, LF is held at 1 for all equipment. Typical is 0.4 to 0.6

Days of Operation
8 -month construction duration, 30 days per month operation

Emission Factors
NOx Emissions Factor (EF) for Off-Road Construction Equipment is 9.20 g/hp-hr
VOC Emissions Factor (EF) for Off-Road Construction Equipment is 1.30 g/hp-hr

Emissions (g) = Power Demand (hp-hr) * Emission Factor (g/hp-hr)

Emissions (tons) = Emissions (g) * (1 ton/907200 g)

Pollutant Emissions from Employee Vehicles

Assumptions:		
	Average trip distance (1 way) is	25 miles.
	Average NOx vehicle emission factor is	0.96 g/mile.
	Average VOC vehicle emission factor is	0.84 g/mile.
	Work crew comprised of	10 people.
	Every member of the work crew drives their own vehicle.	
	Project construction period :	8 months.
	Project construction occurs 5 days per week.	
	There are 10 holidays in a calendar year.	

Actual work days = construction duration (days) - weekend days off - holidays off.

Construction Duration	Weekend days off	Holidays
240	69	4

Actual work days = 167

NOx Calculation: 10 workers * 2 trips/work day * 167 work days * 25 miles/trip * 0.96 g of NOx/mile

Total NOx resulting from employee vehicles = 0.09 tons.

VOC Calculation: 10 workers * 2 trips/work day * 167 work days * 25 miles/trip * 0.84 g of VOC/mile

Total VOCs resulting from employee vehicles = 0.08 tons.

Pollutant emissions associated with employee vehicles derived from data found in: Marine and Land-Based Mobile Source Emission Estimates for 50-Foot Deepening Project. January 2002. Prepared for The Port Authority of New York and New Jersey by Killam Associates and Starcrest Consulting Group, LLC.