Salem Wind Port

Salem, Massachusetts

Expanded Environmental Notification Form

October 17, 2022

submitted to
Executive Office of Energy and Environmental Affairs

submitted by **Crowley Wind Services, Inc.**

prepared by **Fort Point Associates, Inc., a Tetra Tech Company**

in association with
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A TETRA TECH COMPANY

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ENF FORM

Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#: ____________________

MEPA Analyst: ______________

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: Salem Wind Port		
Street Address: 67 Derby Street		
Municipality: Salem	Watershed: Salem Harbor	
Universal Transverse Mercator Coordinates:	Latitude: 42°, 31’, 25” Longitude: -70°, 52’, 38”	
Estimated commencement date: 5/2023	Estimated completion date: 1/2025	
Project Type: Port Development	Status of project design: 30 % complete	
Proponent: Crowley Wind Services, Inc.		
Street Address: 225 Dyer Street		
Municipality: Providence	State: RI	Zip Code: 02903
Name of Contact Person: Richard Jabba		
Firm/Agency: Fort Point Associates, Inc.	Street Address: 31 State Street, 3rd Flr	
Municipality: Boston	State: MA	Zip Code: 02109
Phone: 617-279-4386	Fax:	E-mail: rjabba@fpa-inc.com

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☒Yes ☐No

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8))	☒Yes ☐No
a Rollover EIR? (see 301 CMR 11.06(13))	☐Yes ☒No
a Special Review Procedure? (see 301CMR 11.09)	☐Yes ☒No
a Waiver of mandatory EIR? (see 301 CMR 11.11)	☐Yes ☒No
a Phase I Waiver? (see 301 CMR 11.11)	☐Yes ☒No

(Note: Greenhouse Gas Emissions analysis must be included in the Expanded ENF.)

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?

ENF Thresholds

11.03(1)(b)1.: Direct alteration of 25 or more acres

11.03(3)(b)1.a.: Alteration of a coastal bank

11.03(3)(b)1.e.: New fill or structure in a velocity zone (VE13)

11.03(3)(b)3.: Dredging >10,000 cy

11.03(3)(b)6.: Solid fill structure >1,000 sf, pile-supported structure >2,000 sf

EIR Thresholds
11.03(3)(a)1.b.: alteration of 10 or more acres of any wetlands (Land Under Ocean) other than salt marsh

Which State Agency Permits will the project require? Chapter 91 License, 401 Water Quality Certification, CZM Consistency Review

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:

<u>Financial Assistance:</u> The Proponent anticipates receiving state and federal funding for the Project.

Summary of Project Size & Environmental Impacts	Existing	Change	Total
LAND			
Total site acreage	42.3		
New acres of land altered		0	
Acres of impervious area	4.61	3.77	8.38
Square feet of new bordering vegetated wetlands alteration		0	
Square feet of new other wetland alteration		367,515	
Acres of new non-water dependent use of tidelands or waterways		0	
STRUCTURES			
Gross square footage	12,130	-6,480	5,650
Number of housing units	0	0	0
Maximum height (feet)	15	0	15
TRANSPORTATION			
Vehicle trips per day	0	343	343
Parking spaces	295	-97	198
WASTEWATER			
Water Use (Gallons per day)	0	3,300	3,300
Water withdrawal (GPD)	0	0	0
Wastewater generation/treatment (GPD)	0	3,000	3,000
Length of water mains (miles)	0	0	0
Length of sewer mains (miles)	0	0	0

Has this project been filed with MEPA before?
☐ Yes (EEA #__________) ☒ No

Has any project on this site been filed with MEPA before?
☒ Yes (EEA # 897, 3994, 12685, 14234, 14937) ☐ No

GENERAL PROJECT INFORMATION – all proponents must fill out this section

PROJECT DESCRIPTION:

Describe the existing conditions and land uses on the project site:__________________________

The Project is located in Salem Neck, a peninsula in the northeast corner of the City of Salem. The existing 42.3-acre Project Site is a remediated waterfront property in a Designated Port Area (DPA) of Salem Harbor. The Project Site is bordered by Derby Street to the west, Fort Avenue and the South Essex Sewerage District wastewater treatment plant to the north, and Salem Harbor to the east and south. Most recently, the property was part a larger site that contained a 750-megawatt (MW) coal and oil-fired power plant that encompassed the original 65-acre parcel. The coal plant was demolished in 2014 and a natural gas-fired power plant was constructed in 2017 in the middle of the 65-acre site. The Proponent recently purchased a 42.3-acre portion of the 65-acre site.

The upland portions of the Project Site are mostly flat and vacant, and include two shed structures, remnant foundations, concrete pads and paved areas, and two stockpiles of crushed fill leftover from the power plant demolition project. There are also two small transformer buildings. The property has approximately 6,100 linear feet of waterfront. There is a on 695-foot-long pile-supported pier, a 160-foot-long pile-supported pier, a 150-foot-long wharf with a steel sheet pile wall, an approximately 970-foot-long by 64-foot-wide channel used by the former coal-fired power plant, and approximately 400-foot-long solid-filled jetty pier.

To see a more detailed description of the existing conditions, see Chapter 1, Section 1.2 in the Project Narrative.

Describe the proposed project and its programmatic and physical elements: __________________

NOTE: The project description should summarize both the project's direct and indirect impacts (including construction period impacts) in terms of their magnitude, geographic extent, duration and frequency, and reversibility, as applicable. It should also discuss the infrastructure requirements of the project and the capacity of the municipal and/or regional infrastructure to sustain these requirements into the future.

Crowley Wind Services ("Crowley") is proposing to redevelop the approximately 42.3-acre Project Site at 67 Derby Street adjacent to the existing Salem Harbor Power Development facility. The property will be used to create an offshore wind marshalling terminal. Barges, freighters, and other marine vessels will deliver the large wind turbine components to the marshalling facility and to transfer the partially-assembled components to offshore wind farms. The project is on a fast track in order to support the equipment needs of the offshore wind farms with site work expected to commence in the summer of 2023.

Key components of the project include a reconstructed loadout wharf, a new delivery pier, dredging the existing state turning basin and berths for large ships, and ground improvements to support the heavy components. To redevelop this facility including the pier construction and dredging for future large ship traffic, Crowley is seeking permits from federal, state, and local agencies. See Chapter 1 in the Project Narrative for a detailed project description.

Project impacts are expected mainly from the dredging of the state turning basin and

construction of the pile-supported piers. Specific impacts are detailed in Chapter 3, Wetlands in the Project Narrative.

The project will utilize existing water and sewer utilities. There will be some manageable traffic impacts during construction, but they will be minimal once the facility begins operations, which will be serviced mainly by large vessels transporting large wind components to and from the site. See Chapter 8, Transportation, in the Project Narrative for a detailed description of these uses and impacts.

Describe the on-site project alternatives (and alternative off-site locations, if applicable), considered by the proponent, including at least one feasible alternative that is allowed under current zoning, and the reasons(s) that they were not selected as the preferred alternative:

NOTE*: The purpose of the alternatives analysis is to consider what effect changing the parameters and/or siting of a project, or components thereof, will have on the environment, keeping in mind that the objective of the MEPA review process is to avoid or minimize damage to the environment to the greatest extent feasible. Examples of alternative projects include alternative site locations, alternative site uses, and alternative site configurations.*

The Proponent considered two alternatives in addition to the Project, which is the Preferred Alternative: 1) No Build, 2) Maximum Build, and 3) Preferred (the Project). For a description of these alternatives, see attached Chapter 1, Section 1.4, in the Project Narrative.

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:

Mitigation measures for the preferred alternative are focused on construction period mitigation, transportation plans, stormwater infrastructure, climate change adaptation, dredging mitigation, and community benefits and services. Construction period impacts will be mitigated with a variety of tools including erosion control measures, noise control measures, and transportation plans to optimally schedule and route truck deliveries. Transportation impacts as a result of the Project will be mitigated through the use of a transportation demand management plan, a construction management plan, and optimizing access and egress routes. The impacts of the Project on stormwater will be mitigated by installing new stormwater infrastructure, which includes but is not limited to vegetated swales, landscaping, and a new outfall. This system will also comply with the Massachusetts Department of Environmental Protection's Stormwater Management Standards. The Site will mitigate the future effects of sea level rise by being raised an additional 2 feet. Dredging will be mitigated by observing time of year restrictions and use of turbidity curtains as required by the Division of Marine Fisheries, and mechanical removal of dredged material. The impacts of the preferred alternative on the community, including the Environmental Justice populations, will be mitigated by providing community services and benefits, including development of offshore wind workforce development program for the community and the establishment of a community benefits agreement between Salem and the Proponent.

See attached Chapter 9, Mitigation in the Project Narrative for a detailed description of each mitigation measure.

If the project is proposed to be constructed in phases, please describe each phase:

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:
Is the project within or adjacent to an Area of Critical Environmental Concern?
☐Yes (Specify___________________________________)
☒No
if yes, does the ACEC have an approved Resource Management Plan? ___ Yes ___ No;
If yes, describe how the project complies with this plan.
____
Will there be stormwater runoff or discharge to the designated ACEC? ___ Yes ___ No;
If yes, describe and assess the potential impacts of such stormwater runoff/discharge to the designated ACEC.
____

RARE SPECIES:
Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species? (see http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)
☐Yes (Specify___________________________________) ☒No

HISTORICAL /ARCHAEOLOGICAL RESOURCES:
Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?
☐Yes (Specify___________________________________) ☒No
If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☐Yes (Specify___________________________________) ☒No

WATER RESOURCES:
Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site? ___Yes _X_No;
if yes, identify the ORW and its location. ____

(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain waters within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site? _X__Yes ___No; if yes, identify the water body and pollutant(s) causing the impairment:____ **Salem Harbor, impaired by Enterococcus and Fecal Coliform.** _________________________________.

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? ___Yes _ X __No

STORMWATER MANAGEMENT:

Generally describe the project's stormwater impacts and measures that the project will take to comply with the standards found in MassDEP's Stormwater Management Regulations:____ **The Project will construct a new stormwater drainage system within the site that collects stormwater runoff via deep sump catch basins, landscaped features, area drains, and trench drains. Stormwater treatment of Total Suspended Solids will be provided via deep-sump catch basins, landscaped features, and water quality structures, both existing and proposed. Stormwater will then be conveyed via piped drainage to either two proposed outfalls in Salem Harbor or an existing outfall in the former discharge channel. The new system will comply with MassDEP Stormwater Management Standards. See Chapter 5, Infrastructure in the Project Narrative for a detailed description of the existing and proposed stormwater system.**
____

MASSACHUSETTS CONTINGENCY PLAN:
Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes _X__ No ___ ; if yes, please describe the current status of the site (including Release Tracking Number (RTN), cleanup phase, and Response Action Outcome classification):______ **All RTNs prior to 2016 have achieved RAOs/Permanent Solutions (see Table 1 in Attachment J, Release Tracking Inventory and Plan). Since 2016, 2 RTNs:**

3-3346 – no release just a threat of oil filled transmission cable. Permanent solution
3-35907 – mineral oil release with no PCBs. Connected to other RTNs for the same issue, just a new location. ____________

Is there an Activity and Use Limitation (AUL) on any portion of the project site? Yes _X__ No ___;
if yes, describe which portion of the site and how the project will be consistent with the AUL: __ **AUL is shown on Attached Figure 1, MCP Release Tracking Number Locations in Attachment J. Maintain clean soil cover for compliance with AUL**. _______________.

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN?
Yes ___ No _X__ ; if yes, please describe:____________________________________

SOLID AND HAZARDOUS WASTE:

If the project will generate solid waste during demolition or construction, describe alternatives considered for re-use, recycling, and disposal of, e.g., asphalt, brick, concrete, gypsum, metal, wood:_ **The Proponent will take an active role in the reprocessing and recycling of construction waste. The disposal contract will include specific requirements that will ensure that construction procedures allow for the necessary segregation, reprocessing, reuse, and recycling of materials when possible. For those materials that cannot be recycled, solid waste will be transported in covered trucks to an approved solid waste facility, per MassDEP Regulations for Solid Waste Facilities, 310 CMR 16.00 .**__________________

(NOTE: Asphalt pavement, brick, concrete and metal are banned from disposal at Massachusetts landfills and waste combustion facilities and wood is banned from disposal at Massachusetts landfills. See 310 CMR 19.017 for the complete list of banned materials.)

Will your project disturb asbestos containing materials? Yes ___ No _X__ ;
if yes, please consult state asbestos requirements at http://mass.gov/MassDEP/air/asbhom01.htm

Describe anti-idling and other measures to limit emissions from construction equipment: __ **The importance of limited idling will be discussed with bidders during contracting, Signs will be posted as a reminder during construction. The Proponent expect their contractors to have a strict no-idling policy and to use post-2007 diesel vehicles retrofit to the US EPA's standards.** _______________

DESIGNATED WILD AND SCENIC RIVER:

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes ___ No _X__ ;
if yes, specify name of river and designation:

If yes, does the project have the potential to impact any of the "outstandingly remarkable" resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River?
Yes ___ No ___ ; if yes, specify name of river and designation: _____________;
if yes, will the project will result in any impacts to any of the designated "outstandingly remarkable" resources of the Wild and Scenic River or the stated purposes of a Scenic River.
Yes ___ No ___ ;
if yes,describe the potential impacts to one or more of the "outstandingly remarkable" resources or stated purposes and mitigation measures proposed.

ATTACHMENTS:

1. List of all attachments to this document.
2. U.S.G.S. map (good quality color copy, 8-½ x 11 inches or larger, at a scale of 1:24,000) indicating the project location and boundaries.
3.. Plan, at an appropriate scale, of existing conditions on the project site and its immediate environs, showing all known structures, roadways and parking lots, railroad rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.
4 Plan, at an appropriate scale, depicting environmental constraints on or adjacent to the project site such as Priority and/or Estimated Habitat of state-listed rare species, Areas of Critical Environmental Concern, Chapter 91 jurisdictional areas, Article 97 lands, wetland resource area delineations, water supply protection areas, and historic resources and/or districts.
5. Plan, at an appropriate scale, of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).
6. List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).
7. List of municipal and federal permits and reviews required by the project, as applicable.
8. Printout of output report from RMAT Climate Resilience Design Standards Tool, available here.
9. Printout from the EEA EJ Maps Viewer showing the project location relative to Environmental Justice (EJ) Populations located in whole or in part within a 1-mile and 5-mile radius of the project site.

LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1) _X__ Yes ___ No; if yes, specify each threshold:

11.03(1)(b)1.: Direct alternation of 25 or more acres

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	__0.28__	__-0.15__	__ 0.13 __
Internal roadways	__0.00 __	__ 0.00 __	__ 0.00 __
Parking and other paved areas	__2.57 __	__ 0.00 __	__ 2.57 __
Other altered areas	_37.86 ___	__ 0.15 __	_ 38.01 __
Undeveloped areas	__1.58 ___	__ 0.00 ___	__ 1.58___
Total: Project Site Acreage	_42.30 __	__ 0.00____	_ 42.30___

B. Has any part of the project site been in active agricultural use in the last five years? ___ Yes _X__ No; if yes, how many acres of land in agricultural use (with prime state or locally important agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use? ___ Yes _X__ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a forest management plan approved by the Department of Conservation and Recreation:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes _ X __ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___ Yes_ X __ No; if yes, does the project involve the release or modification of such restriction? ___ Yes ___ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes _ X __ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No _ X __; if yes, describe:

III. Consistency

A. Identify the current municipal comprehensive land use plan
Title:__Imagine Salem (in progress)____ Date_2017____________

B. Describe the project's consistency with that plan with regard to:
1) economic development: ____**The Project will redevelop a large vacant industrial parcel along Salem Harbor into a terminal for the assembly and transport of Components for offshore wind turbine construction. The construction and early operation of this facility will provide opportunity for employment at the local level at the Project Site, aligning with the City of Salem's goal of expanded job creation for local residents.**

2) adequacy of infrastructure: ___**The Project will utilize the existing capacity of the City's water and wastewater infrastructure servicing the Project Site. Stormwater management will improve water quality through structural treatment of stormwater runoff before discharging into the Salem Harbor. Additionally, the Project's laydown areas will be raised higher than flood elevations, which aligns with the City's goal for climate resiliency.**

3) open space impacts: ___**The Project will maintain the existing green space along Derby Street and Fort Avenue at the northern limits of the property. It will also maintain pedestrian access between the Salem Wharf and the cruise ship terminal along the adjacent property, coalescing with the City's goal to create and maintain accessible amenities for all residents.** _

4) compatibility with adjacent land uses: ___**The Project aims to facilitate expanded use of the Designated Port Area with active wind turbine assembly and transport. This Project will also maintain the existing vehicular access from Derby Street and Fort Avenue and vegetated buffer for the surrounding residential neighborhood. Additionally, the Project will be compatible with the adjacent South Essex Sewerage District facilities.**

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)
RPA: Metropolitan Area Planning Council (MAPC)

Title:_MetroCommon 2050 ____________________ Date_(September 2021)________

D. Describe the project's consistency with that plan with regard to:

1) economic development: ___**The goals of the Project align well with the region's goals of striving toward a net-zero carbon output, economic security, and economic prosperity. The site will be used as an assembly area for construction of offshore wind turbines for renewable energy generation. The site operator will employ workers with benefits to provide job stability throughout the Project. Additionally, the Project will revitalize a vacant industrial site as an active construction area, close to downtown Salem and Salem Harbor**.

2) adequacy of infrastructure: ___**The Project will avoid impacts to the current infrastructure along Derby Street and Fort Avenue to safely protect vehicular roadways, pedestrian walkways, and existing utility infrastructure. It also will maintain pedestrian access to the Salem Wharf and cruise ship terminal for water transportation. Existing utility infrastructure will be maintained and repurposed as necessary but resilient infrastructure will also be implemented on-site where necessary, specifically through stormwater treatment measures and shoreline reinforcement.**

3) open space impacts: ___**The Project will aim to protect existing open spaces along Derby Street, Fort Avenue, and the community path within the site for public use consistent with the MetroCommon 2050 goals aimed toward healthy environments and safe neighborhoods.**

RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? ___ Yes _ X __ No; if yes, specify, in quantitative terms:

(NOTE: If you are uncertain, it is recommended that you consult with the Natural Heritage and Endangered Species Program (NHESP) prior to submitting the ENF.)

B. Does the project require any state permits related to **rare species or habitat**? __ Yes _X_ No

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes _ X __ No.

D. If you answered "No" to all questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? ___Yes ___No; if yes, have you received a determination as to whether the project will result in the "take" of a rare species? ___ Yes ___ No; if yes, attach the letter of determination to this submission.

2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate rare species impacts

3. Which rare species are known to occur within the Priority or Estimated Habitat?

4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? ___ Yes ___ No

4. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? _ X __ Yes ___ No; if yes, specify, in quantitative terms:

Approximately 3,431 linear feet of coastal bank will be altered. Approximately 0.41 acres of fill will be in a velocity zone. Approximately 18.80 acres of Land Under Ocean will be altered due to dredging and pile installation. Approximately 80,190 CY of material will be dredged from the state turning basin. There will be construction and reconstruction of approximately 132,029 SF of pile-supported structures.

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? _ X __ Yes ___ No; if yes, specify which permit:
401 Water Quality Certification, local Order of Conditions, Chapter 91 License and Dredge Permit, CZM Consistency Review

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? _ X _ Yes __ No; if yes, has a Notice of Intent been filed? __ Yes _X_ No; if yes, list the date and MassDEP file number: ______; if yes, has a local Order of Conditions been issued? ___ Yes ___ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes _ X __ No.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site: **See Chapter 3, Wetlands in the Project Narrative for a description of wetland resources and temporary and permanent impacts.**

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Coastal Wetlands	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Land Under the Ocean	818,720 SF	Permanent
Designated Port Areas	818,720 SF	Permanent
Coastal Beaches	0	0
Coastal Dunes	0	0
Barrier Beaches	0	0
Coastal Banks	3,341 LF	Permanent
Rocky Intertidal Shores	0	0
Salt Marshes	0	0
Land Under Salt Ponds	0	0
Land Containing Shellfish	0	0
Fish Runs	0	0
Land Subject to Coastal Storm Flowage	160,420 SF	Permanent
Inland Wetlands		
Bank (lf)	0	0
Bordering Vegetated Wetlands	0	0
Isolated Vegetated Wetlands	0	0
Land under Water	0	0
Isolated Land Subject to Flooding	0	0
Borderi ng Land Subject to Flooding	0	0
Riverfront Area	0	0

D. Is any part of the project:

1. proposed as a **limited project**? ___ Yes _ X __ No; if yes, what is the area (in sf)?___
2. the construction or alteration of a **dam**? ___ Yes _ X __ No; if yes, describe:
3. fill or structure in a **velocity zone** or **regulatory floodway**? _ X __ Yes ___ No
4. dredging or disposal of dredged material? _ X _ Yes ___ No; if yes, describe the volume of dredged material and the proposed disposal site: 80,190 CY, Offshore Disposal
5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**? ___ Yes _ X __ No
6. subject to a wetlands restriction order? ___ Yes _ X _ No; if yes, identify the area (in sf):
7. located in buffer zones? _ X __Yes ___No; if yes, how much (in sf) _ 411,200 ___

E. Will the project:

1. be subject to a local wetlands ordinance or bylaw? _ X __ Yes ___ No
2. alter any federally-protected wetlands not regulated under state law? ___ Yes _ X __ No; if

yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? _ X_ Yes __ No; if yes, is there a current Chapter 91 License or Permit affecting the project site? _ X __ Yes ___ No; if yes, list the date and license or permit number and provide a copy of the historic map used to determine extent of filled tidelands: **See Chapter 2 of the Project Narrative for a detailed description of the license history and copies of plans used to determine the extent of filled tidelands.**

B. Does the project require a new or modified license or permit under M.G.L.c.91? _ X_ Yes __ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current _0__ Change _0__ Total _0__

If yes, how many square feet of solid fill or pile-supported structures (in sf)? **Approximately 132,029 sf of new pile-supported piers will be constructed.**

C. For non-water-dependent use projects, indicate the following:

Area of filled tidelands on the site:______________________

Area of filled tidelands covered by buildings:____________

For portions of site on filled tidelands, list ground floor uses and area of each use: _______________

Does the project include new non-water-dependent uses located over flowed tidelands? Yes ___ No ___

Height of building on filled tidelands_________________

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands? ___ Yes _X_ No; if yes, describe the project's impact on the public's right to access, use and enjoy jurisdictional tidelands and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations? ___Yes _X_ No; if yes, describe the project's impact on groundwater levels and describe measures the project will implement to avoid, minimize or mitigate any adverse impact:

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR? ___ Yes _X__ No;

(NOTE: If yes, then the project will be subject to Public Benefit Review and Determination.)

G. Does the project include dredging? _ X __ Yes ___ No; if yes, answer the following questions:

What type of dredging? Improvement ___ Maintenance ___ Both __ X __

What is the proposed dredge volume, in cubic yards (cys) _ 80,190 ______

What is the proposed dredge footprint _1,305_length (ft) _ 1,500_width (ft)_ 2_depth (ft);

Will dredging impact the following resource areas?

Intertidal Yes_ _ No_ X _; if yes, ___ sq ft

Outstanding Resource Waters Yes__ No_ X _; if yes, ___ sq ft

Other resource area (i.e. shellfish beds, eel grass beds) Yes__ No_ X_; if yes __ sq ft

If yes to any of the above, have you evaluated appropriate and practicable steps to: 1) avoidance; 2) if avoidance is not possible, minimization; 3) if either avoidance or minimize is not possible, mitigation?

If no to any of the above, what information or documentation was used to support this determination? **The site was recently surveyed above and below the water to determine wetland resource areas. Based on the topographic and bathymetric plans, and state-mapped resources areas, none of the proposed dredge area is located within intertidal areas, eelgrass beds, shellfish beds, other identified living resource areas.**

Provide a comprehensive analysis of practicable alternatives for improvement dredging in accordance with 314 CMR 9.07(1)(b). Physical and chemical data of the sediment shall be included in the comprehensive analysis. **See Chapter 4, Dredging in the Project Narrative.**

Sediment Characterization

Existing gradation analysis results? _ X _Yes ___No: if yes, provide results. **See Chapter 4, Dredging in the Project Narrative for a description of past sampling results.**

Existing chemical results for parameters listed in 314 CMR 9.07(2)(b)6? ___Yes __X__No; if yes, provide results. **See Chapter 4, Dredging in the Project Narrative for a description of past sampling results.**

Do you have sufficient information to evaluate feasibility of the following management options for dredged sediment? **Yes, see the description in Chapter 4, Dredging of the Project Narrative for a description of past sampling results.** If yes, check the appropriate option.

Beach Nourishment ___
Unconfined Ocean Disposal _ X __
Confined Disposal:
Confined Aquatic Disposal (CAD) ___
Confined Disposal Facility (CDF) ___
Landfill Reuse in accordance with COMM-97-001 ___
Shoreline Placement ___
Upland Material Reuse____
In-State landfill disposal____
Out-of-state landfill disposal ____
(NOTE: This information is required for a 401 Water Quality Certification.)

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? _ X __ Yes ___ No; if yes, describe these effects and the projects consistency with the policies of the Office of Coastal Zone Management: **See Chapter 2, Tidelands in the Project Narrative.**

B. Is the project located within an area subject to a Municipal Harbor Plan? _ X _ Yes __ No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan: 2008 Salem Municipal Harbor Plan. **The project is consistent with the 2008 Salem MHP, which encourages water-dependent industrial uses at the Site that is in the Salem Designated Port Area. See Chapter 2, Tidelands in the Project Narrative for a detailed review of this type of use.**

<u>WATER SUPPLY SECTION</u>

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes _ X __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **water supply**? ___ Yes _ X __ No; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons per day (gpd), the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Municipal or regional water supply	________	________	________
Withdrawal from groundwater	________	________	________
Withdrawal from surface water	________	________	________
Interbasin transfer	________	________	________

(NOTE: Interbasin Transfer approval will be required if the basin and community where the proposed water supply source is located is different from the basin and community where the wastewater from the source will be discharged.)

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source, has a pumping test been conducted? ___ Yes ___ No; if yes, attach a map of the drilling sites and a summary of the alternatives considered and the results. ______________

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons per day)? ______Will the project require an increase in that withdrawal? ___Yes ___No; if yes, then how much of an increase (gpd)? ____________________

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___No. If yes, describe existing and proposed water supply facilities at the project site:

	Permitted Flow	Existing Avg Daily Flow	Project Flow	Total
Capacity of water supply well(s) (gpd)	_______	________	________	________
Capacity of water treatment plant (gpd)	_______	________	________	________

F. If the project involves a new interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve:

1. new water service by the Massachusetts Water Resources Authority or other agency of the Commonwealth to a municipality or water district? ___ Yes ___ No
2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes ___ No

III. Consistency

Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes _ X __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _ X __ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe the volume (in gallons per day) and type of disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00 for septic systems or 314 CMR 7.00 for sewer systems):

	Existing	Change	Total
Discharge of sanitary wastewater	________	________	________
Discharge of industrial wastewater	________	________	________
TOTAL	________	________	________

	Existing	Change	Total
Discharge to groundwater	________	________	________
Discharge to outstanding resource water	________	________	________
Discharge to surface water	________	________	________
Discharge to municipal or regional wastewater facility	________	________	________
TOTAL	________	________	________

B. Is the existing collection system at or near its capacity? ___ Yes ___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

C. Is the existing wastewater disposal facility at or near its permitted capacity? ___ Yes___ No; if yes, then describe the measures to be undertaken to accommodate the project's wastewater flows:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No; if yes, describe as follows:

	Permitted	Existing Avg Daily Flow	Project Flow	Total
Wastewater treatment plant capacity (in gallons per day)	_______	________	________	________

E. If the project requires an interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or new?

(NOTE: Interbasin Transfer approval may be needed if the basin and community where wastewater will be discharged is different from the basin and community where the source of water supply is

located.)

F. Does the project involve new sewer service by the Massachusetts Water Resources Authority (MWRA) or other Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there an existing facility, or is a new facility proposed at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, wastewater reuse (gray water) or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (tons per day):

	Existing	Change	Total
Storage	________	________	________
Treatment	________	________	________
Processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

H. Describe the water conservation measures to be undertaken by the project, and other wastewater mitigation, such as infiltration and inflow removal.

III. Consistency

A. Describe measures that the proponent will take to comply with applicable state, regional, and local plans and policies related to wastewater management:

B. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EEA number for the plan and whether the project site is within a sewer service area recommended or approved in that plan:

TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? ___ Yes _ X __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **state-controlled roadways**? __ Yes _ X__ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

	Existing	Change	Total
Number of parking spaces	________	________	________
Number of vehicle trips per day	________	________	________
ITE Land Use Code(s):	________	________	________

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1. ____________________	________	________	________
2. ____________________	________	________	________
3. ____________________	________	________	________

C. If applicable, describe proposed mitigation measures on state-controlled roadways that the project proponent will implement:

D. How will the project implement and/or promote the use of transit, pedestrian and bicycle facilities and services to provide access to and from the project site?

C. Is there a Transportation Management Association (TMA) that provides transportation demand management (TDM) services in the area of the project site? ____ Yes ____ No; if yes, describe if and how will the project will participate in the TMA:

D. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation facilities? ____ Yes ____ No; if yes, generally describe:

E. If the project will penetrate approach airspace of a nearby airport, has the proponent filed a Massachusetts Aeronautics Commission Airspace Review Form (780 CMR 111.7) and a Notice of Proposed Construction or Alteration with the Federal Aviation Administration (FAA) (CFR Title 14 Part 77.13, forms 7460-1 and 7460-2)?

III. Consistency

Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? ___ Yes _ X __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? ___ Yes _ X __ No; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the **Energy Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities in the immediate vicinity of the project site:

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? ____________
2. Cutting of living public shade trees (number)? ____________
3. Elimination of stone wall (in linear feet)? ____________

III. Consistency -- Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))? ___ Yes _ X __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **energy**? ___ Yes _ X __ No; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)	________	________	________
Length of fuel line (in miles)	________	________	________
Length of transmission lines (in miles)	________	________	________
Capacity of transmission lines (in kilovolts)	________	________	________

B. If the project involves construction or expansion of an electric generating facility, what are:

1. the facility's current and proposed fuel source(s)?
2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___Yes ___No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency

Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes _ X __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **air quality**? ___ Yes _ X __ No; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)? ___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

Existing	Change	Total

Particulate matter	________	________	________
Carbon monoxide	________	________	________
Sulfur dioxide	________	________	________
Volatile organic compounds	________	________	________
Oxides of nitrogen	________	________	________
Lead	________	________	________
Any hazardous air pollutant	________	________	________
Carbon dioxide	________	________	________

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes _ X __ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? __Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Treatment, processing	________	________	________
Combustion	________	________	________
Disposal	________	________	________

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

	Existing	Change	Total
Storage	________	________	________
Recycling	________	________	________
Treatment	________	________	________
Disposal	________	________	________

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos?
___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency
Describe measures that the proponent will take to comply with the State Solid Waste Master Plan:

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts
A. Have you consulted with the Massachusetts Historical Commission? ___ Yes _ X __ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes __ X __ No; if yes, attach correspondence

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? _X__ Yes ___ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes _X__ No; if yes, please describe:

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _ X__ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

D. If you answered "No" to <u>all parts of both</u> questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to <u>any part of either</u> question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts
Describe and assess the project's impacts, direct and indirect, on listed or inventoried historical and archaeological resources: **A small portion (approx. 975 sf in size) of the Derby Street Historic District encroaches into the Site at a location that used to have an historic building. That structure was demolished by prior owners and the site no longer contains historic resources. See Chapter 6 in the Project Narrative for a description of the historic resources.**

III. Consistency
Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources: **The Project includes a large open space buffer along the Project-side of Derby Street and Fort Avenue providing a visual and physical buffer to the Derby Street Historic District**.

CLIMATE CHANGE ADAPTATION AND RESILIENCY SECTION

This section of the Environmental Notification Form (ENF) solicits information and disclosures related to climate change adaptation and resiliency, in accordance with the MEPA Interim Protocol on Climate Change Adaptation and Resiliency (the "MEPA Interim Protocol"), effective October 1, 2021. The Interim Protocol builds on the analysis and recommendations of the 2018 Massachusetts Integrated State Hazard Mitigation and Climate Adaptation Plan (SHMCAP), and incorporates the efforts of the Resilient Massachusetts Action Team (RMAT), the inter-agency steering committee responsible for implementation, monitoring, and maintenance of the SHMCAP, including the "Climate Resilience Design Standards and Guidelines" project. The RMAT team recently released the RMAT Climate Resilience Design Standards Tool, which is available here.

The MEPA Interim Protocol is intended to gather project-level data in a standardized manner that will both inform the MEPA review process and assist the RMAT team in evaluating the accuracy and effectiveness of the RMAT Climate Resilience Design Standards Tool. Once this testing process is completed, the MEPA Office anticipates developing a formal Climate Change Adaptation and Resiliency Policy through a public stakeholder process. Questions about the RMAT Climate Resilience Design Standards Tool can be directed to rmat@mass.gov.

All Proponents must complete the following section, referencing as appropriate the results of the output report generated by the RMAT Climate Resilience Design Standards Tool and attached to the ENF. In completing this section, Proponents are encouraged, but not required at this time, to utilize the recommended design standards and associated Tier 1/2/3 methodologies outlined in the RMAT Climate Resilience Design Standards Tool to analyze the project design. However, Proponents are requested to respond to a respond to a user feedback survey on the RMAT website or to provide feedback to rmat@mass.gov, which will be used by the RMAT team to further refine the tool. Proponents are also encouraged to consult general guidance and best practices as described in the RMAT Climate Resilience Design Guidelines.

Climate Change Adaptation and Resiliency Strategies

I. Has the project taken measures to adapt to climate change for all of the climate parameters analyzed in the RMAT Climate Resilience Design Standards Tool (sea level rise/storm surge, extreme precipitation (urban or riverine flooding), extreme heat)? _X_Yes __ No

Note: Climate adaptation and resiliency strategies include actions that seek to reduce vulnerability to anticipated climate risks and improve resiliency for future climate conditions. Examples of climate adaptation and resiliency strategies include flood barriers, increased stormwater infiltration, living shorelines, elevated infrastructure, increased tree canopy, etc. Projects should address any planning priorities identified by the affected municipality through the Municipal Vulnerability Preparedness (MVP) program or other planning efforts, and should consider a flexible adaptive pathways approach, an adaptation best practice that encourages design strategies that adapt over time to respond to changing climate conditions. General guidance and best practices for designing for climate risk are described in the RMAT Climate Resilience Design Guidelines.

A. If no, explain why.

B. If yes, describe the measures the project will take, including identifying the planning horizon and climate data used in designing project components. If applicable, specify the return period and design storm used (e.g., 100-year, 24-hour storm).

The Project will be designed to mitigate the effects of storm surge, extreme precipitation, and extreme heat for the next 50 years. The Project will elevate the site to accommodate future sea level rise and will design marine structures to withstand 100-year storm conditions. The marine structures have a design life of 50 years at which point major rehabilitation or replacement will likely be required. This lifetime is based on the physical condition of the marine structures and upholding its original function, with the assumption that the structures are inspected and maintained. The design team has modeled proposed stormwater infrastructure to accommodate stormwater for the site's design life.

C. Is the project contributing to regional adaptation strategies? _X_ Yes __ No; If yes, describe.

Yes, this Project has been planned in accordance with Imagine Salem, at the local level, and MetroBoston 2050, for regional planning. The goals of both the local and regional planning goals of improving economic development, resilient infrastructure, and open space preservation efforts are addressed with this Project development. See Land Section, Section III for further description.

II. Has the Proponent considered alternative locations for the project in light of climate change risks? _X_ Yes ___ No

A. If no, explain why.

B. If yes, describe alternatives considered.

The Proponent considered alternative locations in addition to the Project Site, which is the Preferred Alternative. However, the nature of the Project is such that it must be located on a deep water channel and would be exposed to rising sea levels at any location. For a description of these alternatives, see Chapter 1, Section 1.4 in the Project Narrative.

III. Is the project located in Land Subject to Coastal Storm Flowage (LSCSF) or Bordering Land Subject to Flooding (BLSF) as defined in the Wetlands Protection Act? __X__Yes ____No

If yes, describe how/whether proposed changes to the site's topography (including the addition of fill) will result in changes to floodwater flow paths and/or velocities that could impact adjacent properties or the functioning of the floodplain. General guidance on providing this analysis can be found in the CZM/MassDEP Coastal Wetlands Manual, available here.

Changes to the site topography are principally above the existing floodplain and therefore would have little effect on existing flood pathways. Only a small area along the existing shoreline within the floodplain will be elevated with dense graded aggregate (DGA), and this change will have no offsite impacts on flooding. The addition of DGA within the site will result in the intervention of flood pathways closer to the shoreline, limiting the impacts to adjacent properties and the property itself. The elevation of the site laydown areas will help reduce the potential for flooding of offsite areas such as along Derby Street due to future sea level rise. The Project Site will be sloped gradually up from the shoreline, mitigating any potential adverse effects to neighboring properties via changes to existing floodwater flow patterns. The construction of wharf structures and additional fill along the shoreline will also restrict flood waters from travelling into the site.

ENVIRONMENTAL JUSTICE SECTION

I. Identifying Characteristics of EJ Populations

A. If an Environmental Justice (EJ) population has been identified as located in whole or in part within 5 miles of the project site, describe the characteristics of each EJ populations as identified in the EJ Maps Viewer (i.e., the census block group identification number and EJ characteristics of "Minority," "Minority and Income," etc.). Provide a breakdown of those EJ populations within 1 mile of the project site, and those within 5 miles of the site.

Within a 5-mile radius of the Project Site, there are 81 Census block group that trigger five EJ criteria. These criteria include Minority; Income; Income and Minority; Minority and English Isolation; and Minority, Income, and English Isolation (see Figure 7-2, Environmental Justice Populations, 5-Miles). Within a 1-mile radius there are twelve Census block group that trigger four EJ criteria. These criteria include Minority; Income; Income and Minority; and Minority, Income, and English Isolation (see Figure 7-1, Environmental Justice Populations, 1-Mile and Table 7-1). Since the Proposed Project does not meet or exceed air quality review thresholds under 301 CMR 11.03(8)(a)-(b) or generate 150 or more new average daily trips of diesel vehicle traffic over a duration of 1 year or more, only the EJ Populations within 1 mile of the Project Site will be included in the evaluation of potential project-related impacts.

B. Identify all languages identified in the "Languages Spoken in Massachusetts" tab of the EJ Maps Viewer as spoken by 5 percent or more of the EJ population who also identify as not speaking English "very well." The languages should be identified for each census tract located in whole or in part within 1 mile and 5 miles of the project site, regardless of whether such census tract contains any designated EJ populations.

Three languages are spoken within the 5-mile radius of the Project Site. Languages include: Spanish or Spanish Creole, French Creole, and Portuguese or Portuguese Creole. There is one language spoken within the 1-mile radius of the Project Site, which is Spanish or Spanish Creole.

C. If the list of languages identified under Section I.B. has been modified with approval of the EEA EJ Director, provide a list of approved languages that the project will use to provide public involvement opportunities during the course of MEPA review. If the list has been expanded by the Proponent (without input from the EEA EJ Director), provide a list of the additional languages that will be used to provide public involvement opportunities during the course of MEPA review as required by Part II of the MEPA Public Involvement Protocol for Environmental Justice Populations ("MEPA EJ Public Involvement Protocol"). If the project is exempt from Part II of the protocol, please specify.

II. Potential Effects on EJ Populations

A. If an EJ population has been identified using the EJ Maps Viewer within 1 mile of the project site, describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

There may be potential temporary air quality impacts during the construction of the terminal and its components. These impacts may include dust from demolition and site excavation and emissions from construction equipment, increased vehicular

traffic to and from the Project Site, and building, road, and harbor construction and renovation. The Proponent will follow local construction regulations and best practices to minimize these air quality impacts in the surrounding community.

The development of the Project Site will turn a large, vacant, and underutilized portion of Salem's industrial waterfront into a productive and viable marine terminal that will replace dilapidated structures with a new and modern facility. The Project will improve the existing wharf infrastructure and raise the existing Project Site an additional 2 feet above the floodplain so that flooding and sea level rise concerns are addressed. The new stormwater drainage system will improve the water quality and habitat of Salem Harbor, which is enjoyed by all those the recreate on and along this valuable community resource. This project is also expected to create approximately 100 jobs during the 2-year construction period and approximately 200 full-time jobs when the facility is in operation.

For a more detailed description of the Project's impacts on EJ Populations, see Chapter 7, Section 7.4 in the Project Narrative.

B. If an EJ population has been identified using the EJ Maps Viewer within 5 miles of the project site, will the project: (i) meet or exceed MEPA review thresholds under 301 CMR 11.03(8)(a)-(b) __ Yes _X_ No; or (ii) generate150 or more new average daily trips (adt) of diesel vehicle traffic, excluding public transit trips, over a duration of 1 year or more. ___ Yes __X_ No

C. If you answered "Yes" to either question in Section II.B., describe the likely effects of the project (both adverse and beneficial) on the identified EJ population(s).

III. Public Involvement Activities

A. Provide a description of activities conducted prior to filing to promote public involvement by EJ populations, in accordance with Part II of the MEPA EJ Public Involvement Protocol. In particular:

1. If advance notification was provided under Part II.A., attach a copy of the Environmental Justice Screening Form and provide list of CBOs/tribes contacted (with dates). Copies of email correspondence can be attached in lieu of a separate list.

   Please see Chapter 7, Environmental Justice, Section 7.2.3 Public Involvement Activities and Attachment F, EJ Screening Form Advanced Notification.

2. State how CBOs and tribes were informed of ways to request a community meeting, and if any meeting was requested. If public meetings were held, describe any issues of concern that were raised at such meetings, and any steps taken (including modifications to the project design) to address such concerns.

   In the EJ Screening Form, recipients were informed of the ways to contact the project team in order to request a meeting about the project. Several public meetings were also held prior to the filing of the EENF.

   See Chapter 7, Table 7-2, Community Outreach Efforts in the Project Narrative to see a breakdown of the meetings that have been held by the Proponent within the community to date.

3. If the project is exempt from Part II of the protocol, please specify.

   N/A

B. Provide below (or attach) a distribution list (if different from the list in Section III.A. above) of CBOs and tribes, or other individuals or entities the Proponent intends to maintain for the notice of the MEPA Site Visit and circulation of other materials and notices during the course of MEPA review.

   Please see Chapter 7, Environmental Justice, Section 7.2.3 Public Involvement Activities and Table 7.2: Community Outreach Efforts in the Project Narrative.

C. Describe (or submit as a separate document) the Proponent's plan to maintain the same level of community engagement throughout the MEPA review process, as conducted prior to filing.

   The Proponent has set up a Project website to post updates and provide contact information. Project materials can be found at: Salem Offshore Wind Terminal (salemoffshorewind.com). Meetings will also be held during the MEPA process with the public and interested community-based organizations.

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name)_____ Salem News _______________________(Date)__ October 20, 2022 _____

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing ENF (if different from above)
10/17/22			

Jared Kemp	Richard Jabba
Name (print or type)	Name (print or type)
Crowley Wind Services	Fort Point Associates, Inc.
Firm/Agency	Firm/Agency
225 Dyer Street	31 State Street, 3rd Flr
Street	Street
Providence, RI 02903	Boston, MA 02109
Municipality/State/Zip	Municipality/State/Zip
(562) 743-1535	(617) 279-4386
Phone	Phone

PROJECT NARRATIVE

Chapter 1

PROJECT SUMMARY

CHAPTER 1: PROJECT SUMMARY

1.1 INTRODUCTION

This Expanded Environmental Notification Form (EENF) is submitted on behalf of Crowley Wind Services, Inc. (the "Proponent" or "Crowley"). Crowley is responsible for project management, shipping services, engineering, and logistics for emerging utility-scale offshore wind (OSW) projects in the United States. Crowley specializes in Jones Act-compliant vessels for delivering wind turbine generator (WTG) components and other essential materials to project sites, as well as providing onshore support for WTG construction, supply chain expertise, and other services.

Crowley entered into an agreement with the City of Salem in September 2022 to establish a public-private partnership in order to develop Salem Harbor as the Commonwealth's second purpose-built OSW construction staging port. The partnership is backed by agreements with two OSW developers. The completed facility will be used to support the installation of approximately two gigawatts (GW) of OSW power in the waters south of Cape Cod. There is a potential to utilize the property afterward for work on another existing OSW lease area south of Cape Cod.

Crowley recently purchased 42.3 acres of property at 67 Derby Street, Salem (the "Project Site"), which is located next to the 22.7-acre property of the Salem Harbor Power Station, formerly known as Footprint Power Salem Harbor (see Figure 1-1, Locus Map). The Project Site will be used to create an OSW marshalling terminal where turbine components will be partially assembled and deployed to OSW farms (the "Project"). Freighters, barges, and other marine vessels will be used to deliver the components to the marshalling facility and to transfer the partially-assembled turbines to OSW project locations for full assembly and installation.

This Project will be a key component in achieving the Commonwealth's goals for transitioning to renewable energy as well as the City of Salem's goals for economic development and tourism. This Project will bring important economic and social benefits to the City through job opportunities and workforce development programs in a Commonwealth gateway city containing several environmental justice communities. This new facility will provide excellent deep-water access without any height or width restrictions, which are major requirements for an OSW marshalling facility not found in many ports along the east coast. These attributes make Salem one of the only facilities that can support the assembly of future floating OSW turbines, which will be necessary as the industry expands into the Gulf of Maine. In a report commissioned and published by the Massachusetts Clean Energy Center

(MassCEC) in 2022[1], analysis of the floating wind installation process and review of available waterfront and port properties indicated that there are very few port facilities capable of supporting floating OSW turbine assembly in the northeast – and that the Port of Salem is, in fact, the only port in northern Massachusetts/New England that can support these activities, with relatively limited redevelopment requirements, in time to support potential Gulf of Maine projects in the latter 2020s and beyond.

The Project will provide the infrastructure needed for vessel access, berthing, and laydown area to support the marshalling and assembly of wind turbine components that will help meet the goals of the City of Salem and the Commonwealth. The Project will also serve double duty by continuing to support cruise ship visitations to the Port of Salem, which will support the City's tourism, increase public access to the historic waterfront, and bring additional economic benefits.

1.2 PROJECT SITE - EXISTING CONDITIONS

The Project is located in Salem Neck, a peninsula in the northeast corner of the City of Salem (see Figure 1-2, Aerial View of Project Site). The existing site is a remediated waterfront property in the Salem Harbor Designated Port Area (DPA) (see Figure 1-3, Salem Harbor Designated Port Area). The 42.3-acre Project Site is bordered by Derby Street to the west, Fort Avenue and the South Essex Sewerage District wastewater treatment plant to the north, and Salem Harbor to the east and south, including the Salem Wharf facility bordering the southern edge of the Project Site. There is a buffer of trees and other vegetation within the Project Site along Derby Street and Fort Avenue (see Figure 1-4, Existing Conditions Photograph Key, and Figures 1-5 through 1-8, Existing Conditions Photographs. Directly across Salem Harbor from the northeastern side of the Project Site is Winter Island where the Salem Harbormaster's office is located. The area across Derby Street from the Project Site on the southern and southwestern sides is the Derby Street Historic District and is mostly residential with some notable historical sites, including the House of the Seven Gables and Nathaniel Hawthorne's Birthplace. Park areas including David Beattie Park and Irzyk Park are in proximity to the western edge of the Project Site. The Bentley Academy Innovation School and Salem Community Child Care are located on the northern side of Salem Neck. There is a residential area on the other side of Fort Avenue near the north and northwestern edges of the Project Site.

The site development history dates to the 1790s and includes several industrial development and land reclamation projects that have resulted in the current site configuration. Up until recently, the property was the site of a 750-megawatt (MW) coal and oil-fired power plant that encompassed the original 65-acre parcel. The coal plant was demolished in 2014 and a site environmental remediation effort was undertaken. A natural gas-fired power plant was constructed in the middle of the 65-acre site and began operating in 2017. Salem Harbor

[1]MassCEC, Massachusetts Offshore Wind, Ports and Infrastructure Assessment: North Shore, April 2022

Power Development LP currently controls the power plant site. The Project Site surrounds the power plant on all sides except for the side facing Derby Street.

The upland portions of the Project Site are mostly flat and vacant industrial land, and include two dilapidated shed structures, remnant foundations, concrete pads and paved areas, and two stockpiles of crushed rock fill leftover from the power plant demolition project (see Figure 1-6). There are also two small transformer buildings: one found along the water in the southern side of the site, and one found in the rear of the property in the western corner of the Project Site. The existing Project Site is approximately 11% impervious.

The property contains approximately 6,100 linear feet of waterfront composed of sloped rip rap banks and steel sheet pile walls along Salem Harbor (see Figures 1-7 and 1-8). Structures along the shoreline include a 695-foot-long pile-supported wharf with a concrete apron formerly used to offload bulk coal and oil, and an approximately 970-foot-long by 64-foot-wide channel that widens to 150 feet at the opening used by the former power plant to discharge cooling water into Salem Harbor (see Figure 1-7). The channel is bounded by the upland property to the northwest and a filled jetty pier with sloped riprap on all sides to the southeast. The jetty pier is approximately 1,380 feet long and varies in width from 40 feet to 100 feet. A 60-foot-long by 6-foot-wide pile-supported timber fishing pier is located along the southern side of the jetty pier. The State Turning Basin (the "Basin") is approximately 18 acres and -32 feet in depth (mean lower low water, MLLW). The Basin extends 500 feet out into Salem Harbor and meets the federal navigation channel, which also has a -32-foot depth (MLLW) and extends seaward from Salem Harbor around Winter Island to the north.

1.3 PROJECT DESCRIPTION

The main objective of the Project is to create an OSW marshalling terminal to facilitate the receiving, storage, assembly, and shipment of WTGs and their components. This terminal is designed to support various OSW projects that are currently being developed, , as well as future projects. The terminal will be focused on vessel accommodation, WTG assembly, and storage of turbine components. Freighters, barges, and other vessels will be used to deliver the OSW components to the marshalling facility. The WTG components will then be assembled on large transfer vessels and transported to OSW projects. To support these efforts, renovations and improvements are proposed for the upland, shoreline, and watersheet areas of the Project Site. These additions and improvements collectively describe the proposed work (see Figure 1-9, Project Site Plan and Figure 1-10, Project Site Rendering).

Upland Improvements

Two laydown yards totaling 32.5 acres on the south and north areas of the Project Site will be developed to store towers, nacelles, and blades for WTG construction. A 3.0-acre transition yard will connect the two laydown yards and will be used for transporting equipment and terminal circulation. To make these upland areas suitable for the storage and transportation of WTG components, ground improvements and dense graded aggregate will be needed. A small portion of the site in the northwest corner will be maintained for parking up to approximately 195 vehicles and for a small, triple-wide, office trailer. There will be a small 3,000 square foot (SF) storage shed located in the northern section of north laydown area (B) and a single-wide office trailer near the loadout wharf. The overall site will have utilities and systems added including electricity, lighting, and water/fire and stormwater controls. The planned Project Site will be 21% impervious.

Pier and Shoreline Improvements

The wharfs and adjacent bulkheads will support heavy lift operations and the mooring of Wind Turbine Installation Vessels (WTIVs), feeder barges, ocean going tugs, freighters, and other support vessels. The existing 685-foot long, pile-supported wharf will be reconstructed to support the loading of the WTG components. A heavy lift platform adjacent to the wharf and bulkhead will be constructed for pre-assembly, staging, and loadout of turbines onto vessels. A new 660-foot-long pile-supported delivery pier to receive incoming turbine components and support Heavy Transport Vessels (HTVs) will be constructed along the existing jetty pier.

Dredging and Dredge Material Disposal

Approximately 80,170 cubic yards (CY) of maintenance and improvement dredging to elevation -32 feet (MLLW) with a 2-foot overdredge within an approximately 21.3-acre area will occur in the Basin and along the loadout wharf and delivery pier. The dredge material will be tested and analyzed prior to dredging and is expected to be approved for disposal at the Massachusetts Bay Disposal Site (MBDS). To accommodate the large vessels with full loads needed for the Project throughout the tidal cycle, the existing berth along the 685-foot wharf will be dredged to -36 feet (MLLW) with a 2-foot overdredge.

1.4 ALTERNATIVES ANALYSIS

Crowley evaluated three scenarios for the Project Site: (1) No Build, (2) Maximum Build, and (3) Preferred (the "Project") alternatives, which are summarized below. Table 1-1 provides a comparison of the alternatives and their impacts.

1.4.1 NO BUILD ALTERNATIVE

Under the No Build Alternative, the Project Site would remain in its existing condition. This Alternative would not include any improvement to the physical condition of the piers and wharves or to the environmental conditions of the Project Site; and the physical connections to the water would remain in a dilapidated condition and not useable for berthing large vessels.

The Salem Harbor would remain in its current condition, with the existing harbor being underutilized and not utilized to its full potential as a Designated Port Area. The Project Site would remain approximately 11% impervious, covered by a two buildings and concrete pads. The existing stormwater management system would remain as it currently exists today, with no improvement for treatment before being discharged into Salem Harbor or mitigation of the existing erosion issues. The existing site would remain at risk to storm damage from coastal storm flooding, which is expected to worsen due to estimated future sea level rise. Under these existing conditions, the Project Site would not generate any local job opportunities and would not be able to accommodate cruise ship calls..

In summary, a No Build Alternative would maintain existing conditions at the Project Site and would not yield site improvements or community benefits to the local area and to the City of Salem. Stormwater discharges would not be improved, resilience measures would not be implemented, OSW farm construction would be delayed or deferred, and employment opportunities would be lost.

1.4.2 PREFERRED ALTERNATIVE

The Preferred Alternative (the "Project") will meet the Commonwealth's goals to support OSW development along the Massachusetts coast in a timely manner and the City's goals for economic and tourism development. This Project has three main components: (1) upland work, (2) pier construction, and (3) dredging. Improvements include a reconstructed 685-foot-long pile-supported delivery pier, a new 660-foot-long pile-supported loadout wharf, approximately 80,170 CY of maintenance and improvement dredging in the Basin and along the piers, and reinforcing existing onshore infrastructure to support the storage and assembly of wind turbine components. An approximately 32.5-acre portion of the site will be used to store the components (Laydown Areas A and B). The upland area of the site will include a 3,000 SF storage shed for storing equipment and two office trailers to support workers and manage the site. There will also be several acres for moving the components around the site, and parking. The wharfs and adjacent bulkheads will support heavy lift operations and the mooring of WTIVs, feeder barges, ocean going tugs, freighters, and other support vessels. Dredging at the Project Site will also allow the City to resume cruise ship operations, which will bring additional tourism revenue to the area and increase public access to the historic waterfront.

In the Preferred Alternative, stormwater runoff quality would be improved, on-site and off-site resilience to rising sea levels would be enhanced through increasing site elevations, up to 200 jobs would be created during the construction phase and also up to 200 jobs during the operations phase and construction of OSW farms providing renewable energy would be supported. At the same time, there would be one-time impacts to the marine environment from dredging and pier construction, which would be mitigated through various measures. Modest amounts of traffic would be generated during the construction and operational phases of the Project affecting local streets.

1.4.3 MAXIMUM BUILD ALTERNATIVE

The Maximum Build Alternative is the same as the Preferred Alternative with the addition of an expanded dredged area and a longer loadout wharf and berth to accommodate larger ships and more efficient turning movements. The cove at the south end of the existing wharf would be filled, and the loadout wharf and laydown space would be expanded over this filled area to support transfer of both cruise ship passenger and wind turbine components between the cruise ships and WTIVs at berth. The former cooling water discharge channel would be filled to increase the laydown space and maneuverability of the vehicles that transport the wind turbine components between the two laydown areas and the delivery pier and loadout wharf.

Expanded Dredge Area

The north and south sides of the existing Basin would be dredged to allow larger cruise ships and improve maneuverability of these and other vessels. Approximately 107,370 cy of dredge material would be removed from an approximately 107,000 SF area on the north side of the Basin and 210,000 SF area on the south side of the Basin. These two areas would be dredged to -32 feet (MLLW) using a mechanical dredge that places the material into bottom-opening scows. Based on the previous test results of sampling locations near these two areas, the dredged material from the expanded area is expected to be clean and would be disposed of at the MBDS.

Expanded Laydown Area and Pier Expansion

The former discharge channel and the cove on the south side of the Project Site would be filled with approximately 41,390 CY of fill. The waterside of each of these filled areas would be contained by a combination of stone riprap and steel sheet piling. The main loadout wharf would be extended approximately 200 linear feet (LF) and would include an additional 44,000 SF of laydown and loadout areas to support the transfer of heavy wind turbine components. Each of these areas would have ground improvements and would be covered with dense graded aggregate.

The Maximum Build Alternative would have the same impacts and near-term benefits as the Preferred Alternative plus additional environmental impacts from project components. As compared to the Preferred Alternative, the Maximum Build Alternative would provide greater opportunities for larger ships, due to the expanded Basin and greater area for laydown space with the filling of the discharge channel and cove area in the southeast portion of the site. At the same time, there would be one-time mitigated impacts to the marine environment from the additional dredging and some permanent loss of benthic habitat with the filling of the discharge channel and "cove" areas. Stormwater and traffic impacts would be similar to the Preferred Alternative. Job creation would be similar to the Preferred Alternative.

The Maximum Build Alternative has operational benefits over the Preferred Alternative; however, it is not feasible at this time due to the higher cost as well as the timeline and uncertainty of regulatory approvals. The Maximum Build Alternative could not be constructed within the timeline and budget necessary to accommodate the needs of the Initial Leaseholder. In the future, the City, through its Port Authority, will work closely with Crowley to understand whether elements of the Maximum Build Alternative will be needed to allow the Project Site to continue to best serve the OSW industry, particular as floating OSW projects begin construction in the Gulf of Maine.

1.4.4 SUMMARY

The following Table 1-1 summarizes the project components and impacts to the environment in each of the alternatives.

Table 1-1, Project Alternatives

Item	No Build Alternative	Preferred Alternative	Maximum Build Alternative
Project Site (acres)	42.3	42.3	42.3
Impervious area (acres)	4.61	8.38	9.38
Buildings (Gross square Footage, GSF)	12,100	5,650	5,650
Pier/Wharf Length (LF)	905	1,345	1,545
Wetlands Impacts (SF – temporary)	0	0	0
Wetlands Impacts (SF – permanent)		929,350	1,257,100
Dredging Area (SF)	0	929,350	1,257,100
Dredge Volume (CY)	0	80,190	187,560
In-Water Fill Area (SF)	0	14,450	122,290
Traffic (ADT)	0	343	343

1.5 PUBLIC AND COMMUNITY BENEFITS

The Project's benefits include, but are not limited to:

- Improvement in channels, wharves, and port facilities to support existing and future maritime uses in Salem Harbor and the recommendations of the Salem Municipal Harbor Plan (MHP);

- Improvement in stormwater management to improve and protect water quality in Salem Harbor;

- Investment in a new and promising industry for the City of Salem with workforce development and training in the OSW industry, including partnerships with high schools like Salem High School, local colleges, nonprofits, and academies to provide Global Wind Offshore Training (GWO) and other training programs;

- Creation of up to 200 FTE jobs during construction of the Project and up to 200 jobs during the terminal's operation phase;

- Establishment of a community benefits agreement between the Proponent and the City of Salem to preserve the City's long-term interests, including identifying local supply chain opportunities, workforce development, increasing public access to the waterfront by supporting cruise ships visits, and developing partnerships with residents and community organizations; and

- Investment in renewable energy to further the Commonwealth of Massachusetts' clean energy and climate goals in order to address climate change impacts and pollution from traditional fossil fuel energy sources: and

- Enables the Commonwealth to remain at the forefront of the OSW industry and to take full advantage of the nation's rapidly growing OSW industry on the East Coast, especially as the industry matures and new technologies, such as floating OSW, become more common.

1.6 SUSTAINABILITY

Crowley is committed to designing and constructing the Project in an environmentally sustainable manner and one that dramatically improves our renewable energy mix by supporting the construction of OSW farms. The Project is located on filled tidelands and on a peninsula. Given the Project Site's location and its proposed use for transferring large wind turbine components and placing them in the large laydown areas, the best flood mitigation measure that can be taken in the site design is raising the site grade. Further, this will help, in combination with other district scale measures, to mitigate flood impacts in the surrounding neighborhoods. The Project Site is also adaptable since there is only one building that will not contain critical equipment and can be easily moved if needed. The Project Site can continue to adapt to rising sea levels by adding additional fill in the upland areas and moving the open warehouse structure to areas with less flood risk.

The following mitigation measures will be pursued to reduce the environmental impacts associated with the Project. The site design and resiliency measures include:

1.6.1 SITE DESIGN AND RESILIENCY

- Incorporation of state-recommended Resilient Massachusetts Action Team (RMAT) design criteria in the design of flood resilience measures to account for future sea level rise, setting Design Flood Elevation (DFE) more than two feet above the current 100-year base flood elevation (BFE) of El. 10 NAVD88;

- Utilizing efficient design and construction practices to minimize Project Site area to the maximum extent practicable and avoid unnecessary impacts to coastal resource areas and buffer zone areas along Salem Harbor; and
- Raising the existing grade and reinforcing existing waterfront infrastructure to address future sea level rise and flooding to improve resiliency.

1.6.2 STORMWATER

- Inspection and maintenance of existing storm drainage systems that outlet into the Salem Harbor;
- Proposed stormwater utilities will include stormwater treatment devices such as deep sump catch basins and proprietary water quality structures to remove Total Suspended Solids and accommodate overflow stormwater collection; and
- Install and/or repair of backflow prevention devices on existing storm drain outlets into the Salem Harbor to prevent saltwater intrusion and storm surge into drainage systems that can erode utility infrastructure and disturb collected sediments within catch basin sump collection systems.

1.6.3 TRANSPORTATION

- A Travel Demand Management Program will include several measures to make the Project more resilient such as preferential parking for low-emission vehicles and for vanpools and carpools, vehicle charging stations, and no idling signage.
- The provision of bicycles facilities will encourage workers to utilize alternative modes of transportation and reduce auto emissions, including working with the City to explore a nearby Bluebike station.

1.7 ENVIRONMENTAL JUSTICE POPULATIONS

The Project is in proximity to neighborhoods defined as Environmental Justice (EJ) Populations based on the Massachusetts EEA 2020 EJ Map Viewer, which is derived from 2020 Census Block Groups. Within a 5-mile radius of the Project Site, there are 81 Census block group that trigger five EJ criteria. These criteria are Minority; Income; Income and Minority; Minority and English Isolation; and Minority, Income, and English Isolation. Within a 1-mile radius there are twelve Census block group that trigger four EJ criteria. These criteria are Minority; Income; Income and Minority; and Minority, Income, and English Isolation. The Project Site however is not in an EJ area.

The Project is in a historically industrial area along the Salem Harbor Waterfront in a DPA. The area presently contains a major natural gas-fired power plant, which will continue operating under this Project, and the Project Site is bordered by a municipal wastewater treatment plant to the north. Residential neighborhoods are in proximity to the Project Site on the west side of Derby Street, and the property of Bentley Academy Innovation School borders Fort Avenue, located northwest of the Project Site.

The Project is anticipated to provide several economic and environmental benefits to both EJ and Non-EJ populations. Environmental benefits of the Project include improving the existing wharf and harbor in Salem Harbor, implementing a new stormwater management system to protect water quality in Salem Harbor, and raising and reinforcing existing infrastructure at the Project Site to address future sea level rise and flooding. Economic benefits to the community include job opportunities with a new and exciting industry in OSW, collaboration with colleges, nonprofits, and academies to provide workforce training and development in the OSW industry, and the creation of a community benefits agreement with the Proponent and the City of Salem in order to engage residents and community organizations in the Project while also preserving the community's long-term interests. On a broader scale, the Project will help the Commonwealth meet its clean energy goals and will further the integration of renewable energy into the United States' energy grid. These efforts will help reduce pollution from fossil fuels and slow the progression of climate change-related impacts, two important concerns for communities, and especially for traditionally marginalized communities and EJ populations.

1.8 COMMUNITY AND AGENCY OUTREACH

The Proponent has been engaging in outreach efforts alongside the City throughout the local community since the announcement of the Project and is working with Regina Villa Associates, Inc., a Boston-based public outreach, communications, and marketing firm, on these outreach efforts. The Proponent has met with local and state government agencies, neighborhood associations, and community groups to discuss the Project and has received positive feedback on the Project since it was announced. Meetings held since May 2022 are described in Table 7-2, Environmental Justice Population, Community, and Agency Outreach. A select number of meetings have provided Spanish translation services in order to increase accessibility and further EJ principles.

Prior to the Proponent's involvement in the Project Site, the City had initiated a community-wide discussion around the potential reuse potential of the property through an update to the Salem MHP and DPA Master Plan. The City hosted dozens of public forums and one-on-one meetings with stakeholders, and leveraged online tools including an interactive map and surveys which provided additional opportunities for feedback on the future use of the DPA. These online tools were hosted on the Project website, shared via mail blast, and discussed during public meetings. The "Priorities for the Footprint Property Survey" received approximately 650 responses and identified local priorities for the reuse of the approximately

42 acres of privately owned land around the new power plant. The interactive mapping tool, which received 698 visits and 127 comments, asked users to help craft the future of the waterfront by using the icons to make note of something they like, an idea or suggestion, and comments. The map covered the entire planning area, including the DPA. The results of these online engagement tools were discussed with Harbor Planning Committee (HPC) members and the public.

On February 24, 2020, an MHP update meeting was held with the City of Salem and various consultants to discuss the progress made on the design and future use of the Project Site as part of the Salem MHP, and to review the results of the online survey efforts. Responses show that residents are most supportive of OSW and are excited to introduce this industry to the community. OSW/renewable energy was the most supported marine industrial use among respondents. Public access was the most important priority among respondents for the site, and public access has been maintained in the design of the Project Site. See Attachment C, Salem MHP Update Presentation, which is the presentation from the February 2020 MHP meeting and contains the results of the community survey.

1.9 REQUEST FOR A SINGLE ENVIRONMENTAL IMPACT REPORT

This EENF is being submitted to the Executive Office of Energy and Environmental Affairs (EEA) to initiate review of the Project under the Massachusetts Environmental Policy Act (MEPA). Crowley is submitting an EENF in advance of submitting a Single Environmental Impact Report (SEIR), rather than a Draft Environmental Impact Report (DEIR) and Final Environmental Impact Report (FEIR). The EENF includes an expanded analysis of dredging work, including an alternatives analysis, and a description of anticipated wetland impacts and proposed mitigation. Furthermore, the Project is within a mile of identified EJ Populations, and the EENF contains an expanded analysis of environmental impacts, including on EJ Populations. The Project is on a fast-track schedule to meet the Commonwealth's OSW targets, , so an SEIR is requested in order to accelerate the permitting process to allow Project construction to begin in early summer 2023.

Pursuant to the Chapter 91 regulations at 310 CMR 9.11 (2)(b)(4), Crowley is requesting coordinated review under MEPA and 310 CMR 9.00 by specifying in the EENF the intent to pursue a joint MEPA/Chapter 91 filing. The SEIR submitted under 301 CMR 11.07(3) will include information to meet the application requirements of 310 CMR 9.11(3)(a) through (c)2. for pre-application review by the Massachusetts Department of Environmental Protection (MassDEP).

1.10 SUMMARY OF REQUIRED PERMITS AND APPROVALS

Table 1-2 lists the anticipated approvals needed for this Project.

Table 1-2, Anticipated Project Approvals

Agency	Approval
Local	
Salem Conservation Commission	• Wetlands Protection Act Form 5 – Order of Conditions
Salem Planning Board	• Planned Unit Development Special Permit • Flood Hazard Overlay District Special Permit • Stormwater Management Special Permit
City Engineer	• Drainage Alteration Permit
Salem Historical Commission	• Waiver of Demolition Delay Ordinance (any structures over 50 years old)
City Council	• Inflammables Permit (storage of fuel onsite), rezoning of R2 parcels and discontinuance of public way (India Street)
State	
Executive Office of Energy and Environmental Affairs	• MEPA Certificate on EENF • MEPA Certificate on Single Environmental Impact Report
Massachusetts Department of Environmental Protection	• Chapter 91 License • 401 Water Quality Certification
Massachusetts Office of Coastal Zone Management	• Coastal Zone Management Federal Consistency Review
Massachusetts Historical Commission	• No Adverse Effects on Historic Properties (Section 106 and State Chapter 254)
Federal	
U.S. Army Corps of Engineers	• Finding of No Significant Impact under the National Environmental Policy Act (NEPA) General Permit (U.S. Army Corps of Engineers [USACE] Individual Section 10, 103 and 404)
Federal Aviation Administration	• Determination of No Hazard to Air Navigation for Permanent or Temporary Structures
U.S. Environmental Protection Agency (EPA)	• EPA National Pollutant Discharge Elimination System (NPDES) Construction General Permit • EPA NPDES Multi-sector General Permit (MSGP) Stormwater General Permit

1.11 PROJECT TEAM

Table 1-3 below contains contact information for the Project Team of the Salem Wind Port Project.

Table 1-3, Project Team

Team Member	Contact Information
Proponent	Crowley Wind Services, Inc. 225 Dyer Street Providence, RI 02903 Contact: Jared Kemp, Project Manager Jared.Kemp@crowley.com (562) 743-1535
Planning and Permitting	Fort Point Associates, Inc. A Tetra Tech Company 31 State Street, 3rd Floor Boston, MA 02109 Contact: Richard Jabba, AICP rjabba@fpa-inc.com (617) 279-4386
Transportation	MDM Transportation Consultants, Inc. 28 Lord Road, Suite 280 Marlborough, MA 01752 Contact: Daniel Dumais, P.E. ddumais@mdmtrans.com (508) 303-0370,
Local Zoning	Correnti & Darling LLP 70 Washington Street, Suite 316 Salem, MA 01970 Contact: Joseph C. Correnti, Esquire jcorrenti@CDLawyers.com (978) 744-0212

Team Member	Contact Information
Local Environmental Permitting	Susan St. Pierre Consulting Services Salem, MA 01970 Contact: Susan St. Pierre, AICP sst.pierre@comcast.net (781) 439-2461
Design and Engineering	AECOM Technical Services, Inc. 605 3rd Avenue, 2nd Floor New York, NY 10004 Contact: David Simpson david.a.simpson@aecom.com
Site Investigation and Environmental Loads	GZA GeoEnvironmental, Inc. 188 Valley Street, Suite 300 Providence, RI 02909 Contact: James J. Marsland, P.E. Senior Project Manager James.marsland@gza.com (401) 427-2743
Dredge Planning and Maintenance	Anchor QEA, LLC 300 East Lombard Street, Suite 1510 Baltimore, MD 21202 Contact: Karin Olsen PG, AICP (443) 465-9783 kolsen@anchorqea.com
Community Outreach and Stakeholder Engagement	Regina Villa Associates 51 Franklin Street, Suite 400 Boston, MA 02110 Contact: Jason Silva Community Engagement Director jsilva@reginavilla.com (617) 357-5772

Salem, Massachusetts

Figure 1-1
Locus Map
Source: U.S. Geological Survey, 2022

Figure 1-2
Aerial View of Project Site
Source: Nearmap, 2022

Salem, Massachusetts

Figure 1-3
Salem Harbor Designated Port Area
Source: CZM, 2011; Nearmap, 2022

Figure 1-4
Existing Conditions Photographs Key
Source: Fort Point Associates, Inc., 2022; Nearmap, 2022

Photo 1: View looking northeast down Fort Avenue outside the Salem Harbor Power Development facility

Photo 2: View looking northeast down Derby Street near the intersection with India Street

Figure 1-5
Existing Conditions Photographs
Source: Fort Point Associates, Inc., 2022

Photo 3: View looking northeast from the southeastern edge of the Salem Harbor Power Development facility

Photo 4: View looking northeast towards the northeastern corner of the Project Site

Figure 1-6
Existing Conditions Photographs
Source: Fort Point Associates, Inc., 2022

Photo 5: View looking southwest towards the western side of the Salem Harbor Power Development facility

Photo 6: View looking south down the former discharge channel

Figure 1-7
Existing Conditions Photographs
Source: Fort Point Associates, Inc., 2022

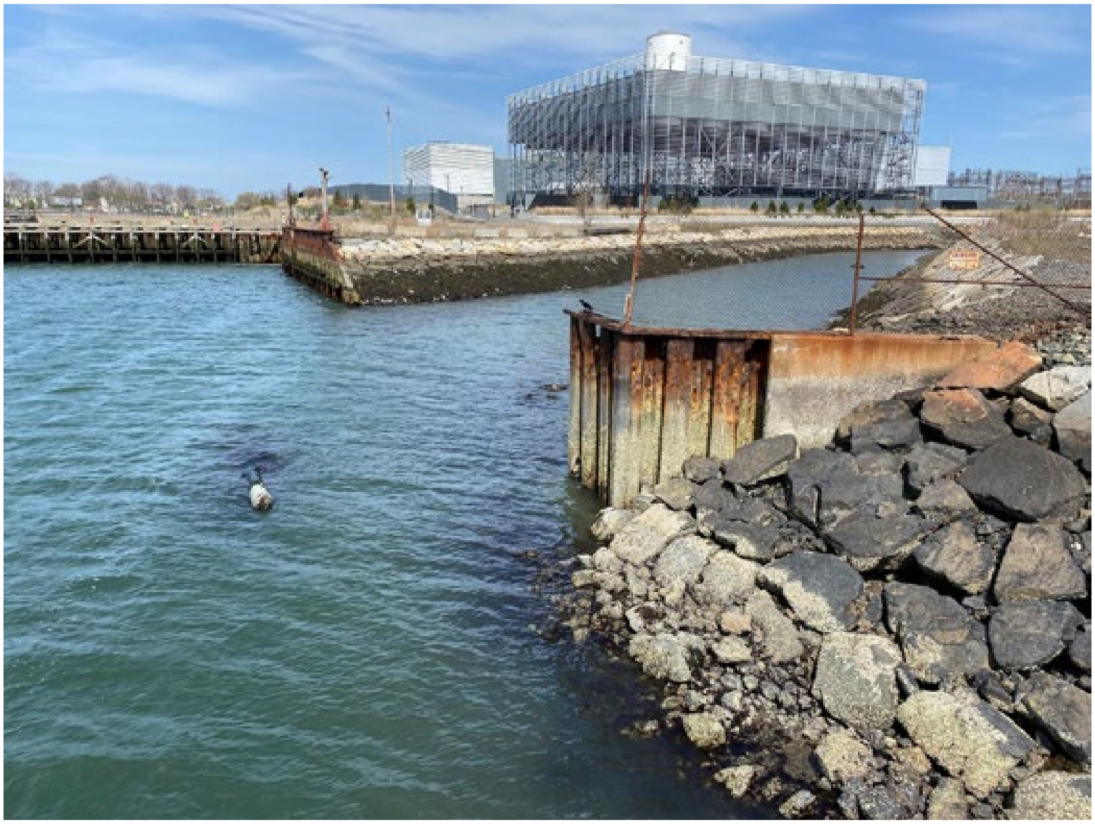


Photo 7: View looking west towards the existing wharf and bulkhead from the east jetty

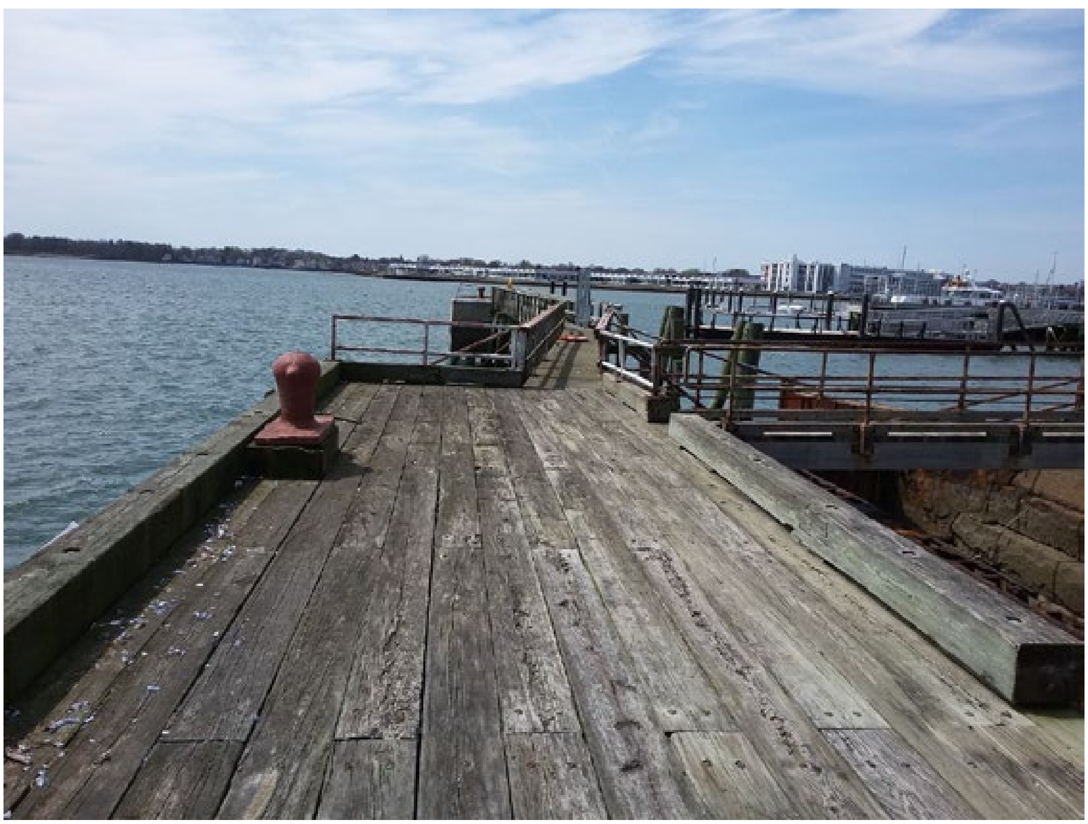


Photo 8: View looking southwest from the southern end of the wharf

Figure 1-8
Existing Conditions Photographs
Source: Fort Point Associates, Inc., 2022

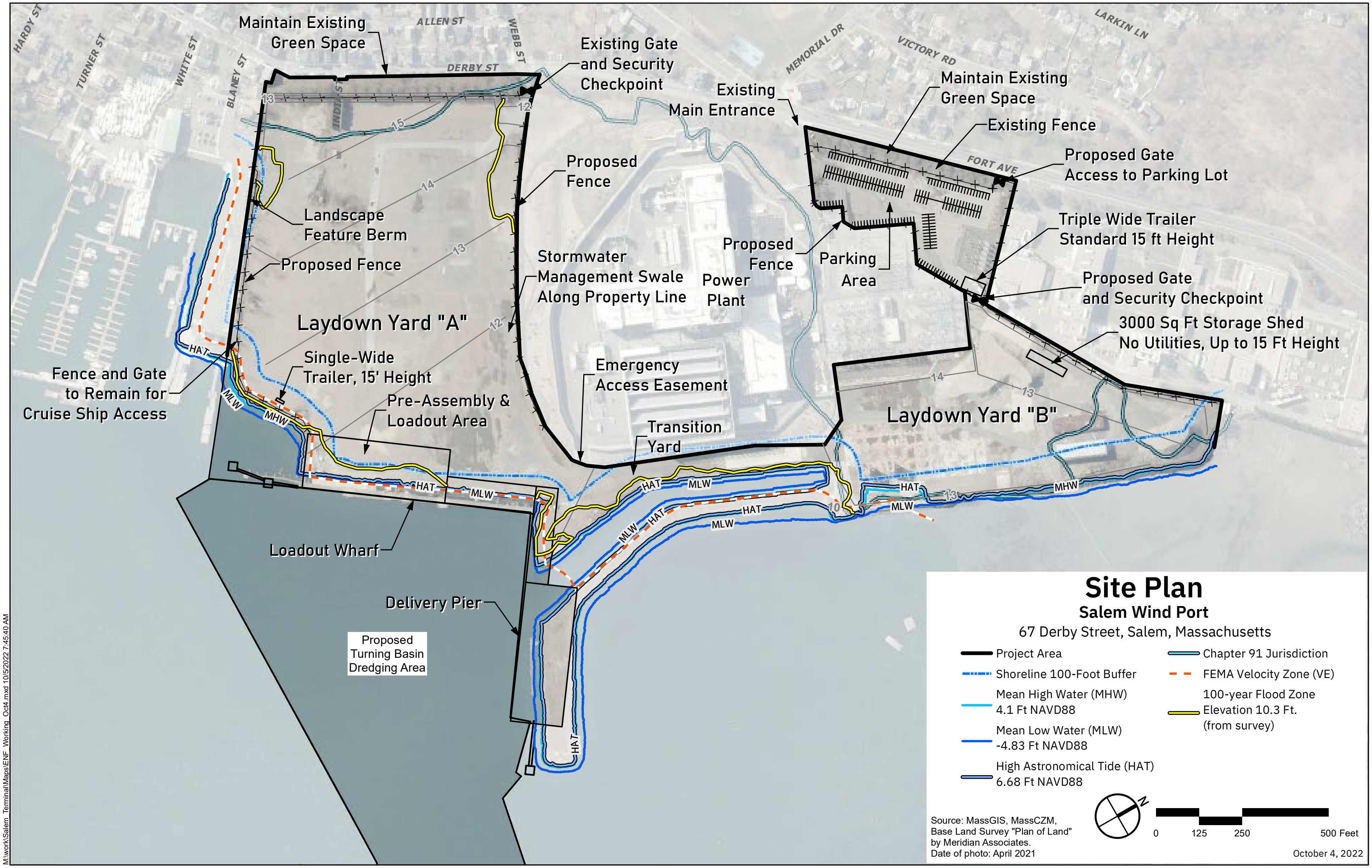


Figure 1-9
Project Site Plan
Source: AECOM, 2022

Figure 1-10
Project Site Rendering
Source: AECOM, 2022

Chapter 2

TIDELANDS

CHAPTER 2: TIDELANDS

2.1 INTRODUCTION

Crowley proposes to construct a marshalling terminal to support the assembly of OSW terminal components at the proposed terminal, 67 Derby Street, Salem, located along Salem Harbor. The approximately 42.3-acre Project Site is currently comprised of mostly flat, vacant land with several long wharves, two pile-supported piers, and a mix of sheet pile and rock riprap coastal engineered structures. The entire Project Site is located within the Salem Harbor DPA and has a history of water-dependent industrial uses over the past 100 years, mainly the transfer of coal and energy generation.

The Project will provide substantial investment in the Site's infrastructure that will create a major wind farm marshalling terminal as well as reestablish Salem as a cruise port. The existing conditions of this site's infrastructure vary from poor to critical condition: the wharf is not safe for berthing large vessels, and the berthing and use of the approximately 18-acre state turning basin (the "Basin") is limited due to shoaling. To improve the Site for use as a wind turbine marshalling terminal, the Project will construct a pile-supported loadout wharf and a pile-supported jetty delivery pier, add fill and stabilize the existing ground to support the storage and movement of heavy wind turbine components including blades, nacelles, and towers, and add utilities, including stormwater drainage and outfalls, which are all considered water-dependent industrial uses within this DPA. Several small buildings, which are accessory uses in the DPA, will also be constructed. The Project will also be requesting a permit to dredge portions of the Basin located adjacent to the Project Site. The following sections describe Chapter 91 jurisdiction and the Project's compliance with the regulations.

2.2 CHAPTER 91 JURISDICTION

The Project Site consists of filled (formerly flowed) tidelands and flowed tidelands on private and Commonwealth tidelands (see Figure 2-1, Chapter 91 Jurisdiction). Approximately 17.4 acres are filled private tidelands, 8.7 acres are filled Commonwealth tidelands, 21.9 acres are flowed tidelands, and 16.2 acres of Project Site not subject to Chapter 91 jurisdiction. The Chapter 91 presumptive jurisdiction line is based on MassGIS data and the high-water mark from three historic survey plans that were georeferenced on MassGIS data. The historic high-water mark reflects the most landward high-water marks of the Perley map, 1700; the U.S. Coast Survey, 1850 (T-303); and the U.S. Coast and Geodetic Survey, 1902 (T-2603) (see Figure 2-2, Historic Chapter 91 Jurisdiction (1700); Figure 2-3, Historic Chapter 91 Jurisdiction (1850); and Figure 2-4, Historic Chapter 91 Jurisdiction (1902). The historic low water mark (HLWM) was determined from the U.S. Coast Survey, 1854 (H-254) plan that was georeferenced by the Massachusetts Coastal Zone Management (MCZM) Program. The HLWM runs along the shoreline in the northern part of the Project Site and traverses approximately halfway through the southern portion of the Site (see Figure 2-5, Historic Chapter 91 Jurisdiction (1854). The discharge channel and the State turning basin, which will be dredged, is considered to be Commonwealth tidelands since it is located seaward of the mean low water line. The mean high water (MHW) is 4.10′ (NAVD88) and the mean low water (MLW) is -5.16′.

2.2.1 HISTORIC LICENSES

State authorizations for fill and structures within Chapter 91 jurisdiction were researched using a database from DEP, files at Fort Point Associates, and the on-line web sites at the South Essex Registry of Deeds. Authorizations were found for the existing structures including pile-supported piers and deck, filling, dredging, and stormwater structures. Authorizations for structures and fill were issued between 1809 and 2013. See Table 2-1, Chapter 91 Authorizations within the Project Site, and Table 2-2, Legislative Authorizations within the Project Site. These approvals authorized the property owner to maintain, repair, dredge, construct walls, foundations, and piers, and fill in and over the tidelands at the Project Site and in the waters of Salem Harbor.

Table 2-1, Chapter 91 Authorizations within the Project Site

License No.	Date Issued	Authorization
168	6/28/1873	To construct a wharf partly on piles and partly on solid in Salem Harbor
186	10/31/1873	To construct a wharf partly on piles and partly on solid in Salem Harbor
392	1/7/1924	To construct and maintain a seawall and pile wharf and to dredge and make fill solid
436	6/5/1924	To build a pile and bulkhead and fill solid back the same, and to construct pile dolphins and walks connecting the same. Reinforce existing wall of Phillips Wharf, runways, and dolphins
924	4/24/1886	To construct a pile and timber wharf in and over tide waters of Salem Harbor
1065	5/2/1888	Extension and widening of portion of Philadelphia & Reading Coal & Iron Company Pier in and over tidewaters of Salem Harbor
1069	9/3/1929	To build and maintain extensions to an existing seawall and to a loading platform, to drive piles to build and maintain dolphins, to fill solid and dredge
1089	11/12/1929	Build walkways and two 10- pile dolphins
1239	3/13/1890	To widen and extend Phillips Wharf on piles in and over tide waters of Salem Harbor

License No.	Date Issued	Authorization
1288	5/3/ 1931	To make repairs and additions to existing dolphins and to place and maintain a float held in position by piles
1507	7/11/1933	To replace damaged piles, to drive additional piles, to remove a pile dolphin and the connection platform, and to place ten feet of riprap in four locations
1570	3/30/1934	To install two 5-pile dolphins
1852	10/31/1895	To fill solid portions of "Pennsylvania Pier" in Salem Harbor at Phillips Wharf
2042	2/7/1939	To add piles to existing 16 pile turning dolphin – total 24 piles
2068	4/17/1939	Construct and maintain a 20-pile turning dolphin and remove existing dolphin
2769	5/28/1945	To place additional piles in dolphins # 1 and # 12 and to reconstruct and place additional piles in mooring dolphin # 14
3098	10/26/1948	To construct and maintain a screen well and pump house and an adjoining building, and to build and maintain a dike and fill solid; dredge intake channel
3298	1/16/1951	To construct and maintain a bulkhead and to reconstruct and alter a wharf and turning dolphin. Maintain existing sheet piling solid fill
3458	06/18/1952	To install a buried ground connection and cable in Salem Harbor
3581	5/10/1911	To fill a portion of flats (coal pocket) with solid fill in Salem Harbor
3624	4/12/1954	To maintain a screen well and pump house and an adjoining building, a dike and solid fill and a discharge weir to provide for discharge water, also an intake channel as dredged
3834	4/2/1956	To construct and maintain a screen well and pump house for units Nos. 3 and 4 and build a temporary cofferdam
3835	4/2/1956	To fill solid a portion of Cat Cove and construct dike
3849	5/7/1956	To construct and maintain a dike and fill solid in Salem Harbor
4090	6/23/1958	To construct and maintain a turning dolphin, fender dolphin and walkway to maintain existing sheet piling, mooring dolphin and two walkways
5589	10/1/1969	To construct and maintain a temporary cofferdam, screen well and pump house for unit 4, relocate a portion of an existing discharge channel with riprap

License No.	Date Issued	Authorization
		slopes, place stone revetment, construct a sheet steel bulkhead, and dredge and fill Salem Harbor
321	5/20/1977	To maintain as built: fisherman's wharf; walkways; oil boom; foam barriers; retaining wall; and maintain minor changes to structures authorized under License No. 5589
324	5/20/1977	To reconstruct and stabilize an existing dock structure by installing four fender dolphins, new oil unloading platform, new sheet pile bulkhead, walkways and extend existing oil boom in Salem Harbor
10066	1/10/2005	To install and maintain emission control equipment and maintain existing structures on filled tidelands
WD13-3886-N	11/1/2013	Variance to allow gas-fired power generating station as a non-water-dependent use in a DPA

Source: DEP Waterways, 2022.

Table 2-2, Legislative Authorizations within the Project Site

Legislature	Authorization
Chapter 16 Acts of 1809	Incorporate Salem India Wharf Corporation
Chapter 111 Acts of 1847	An act to authorize Stephen C. Phillips to extend a wharf or Wharves
Chapter 169 Acts of 1861	An Act to Incorporate Phillips Wharf Corporation of Salem
Chapter 194 Acts of 1872	An Act to authorize the Eastern Railroad company to build a wharf in Salem
Chapter 209 Acts of 1872	An Act in addition to an act to incorporate the Phillips Wharf Corporation

2.3 COMPLIANCE WITH CHAPTER 91 REGULATIONS

This section describes the Project's compliance with the following applicable standards of the Chapter 91 Regulations (see Figure 2-6, Chapter 91 Compliance).

2.3.1 APPLICABLE CHAPTER 91 STANDARDS

310 Code of Massachusetts Regulations (CMR) 9.11(3)(c)2 – Statement Regarding Proper Public Purpose, Public Rights, MCZM Consistency, and Conformity to MHP

As described below, under 310 CMR 9.31(2), the Project serves a proper public purpose because it is a water-dependent use project. The Project is not detrimental to the rights, access, or use of the tidelands by the public. The Project conforms with the Salem MHP pursuant to 310 CMR 9.34(2), and is consistent with the policies of the MCZM Program pursuant to 310 CMR 9.45 as described below.

310 CMR 9.12 – Water-Dependent Use

Under the provisions of 310 CMR 9.12, a project is considered a water-dependent industrial use (WDIU) if it meets the use standards under 310 CMR 9.12(2)(b). WDIUs include marine terminals and related facilities for the transfer between ship and shore and the storage of bulk materials or other goods transported in waterborne commerce; and facilities associated with commercial passenger vessel operations.

The Project complies with these standards by created a marshalling terminal for the transfer of OSW turbine components and for commercial passenger vessels (cruise ships) to berth and transfer passengers.

310 CMR 9.31(2) – Proper Public Purpose

The standards at 310 CMR 9.31(2)(a) state that no license shall be issued by the Department for any project on tidelands unless the project serves a proper public purpose which provides greater benefit than detriment to the rights of the public in said lands in accordance with the provisions of this standard. Pursuant to the standard at 310 CMR 9.31(2)(a), the project is presumed to provide a proper public purpose if it is a water-dependent use project. Therefore, the Project meets this standard because it is a water-dependent use project.

310 CMR 9.32 - Categorical Restrictions on Fill and Structures

The project is eligible for a license if it is restricted to fill and structures which accommodate specific uses depending on its location within and outside of a DPA. The entire Project Site is within the DPA (see Figure 2-1). As described below, the Project complies with the applicable standards pursuant to 310 CMR 9.32(1)(b) regarding fill and structures within the DPA.

In compliance with 310 CMR 9.32(1)(b)1., buildings for accessory uses, including two offices and a warehouse, will be located near the berths and in the parking lot. In compliance with 310 CMR 9.32(1)(b)1.a., fill will stabilize the shoreline along and underneath the proposed pile-supported piers. In compliance with 310 CMR 9.32(1)(b)1.c., parking within the DPA will be limited to persons employed by or doing business with the WDIU over flowed tidelands.

310 CMR 9.33(1) - Environmental Protection Standards

The Project will comply with applicable environmental regulatory programs of the Commonwealth, including the Massachusetts Wetlands Protection Act (WPA) and MassDEP Stormwater Management Standards. The Applicant will submit a Notice of Intent (NOI) to the Salem Conservation Commission. Along with the Chapter 91 License/Permit application, the Proponent will submit a 401 Water Quality Certification application to MassDEP. A Federal Consistency Review will be filed with the Massachusetts Office of Coastal Zone Management (MCZM). The Massachusetts Historical Commission and Bureau of Underwater Archaeological Resources will also be notified about this Project as part of this EENF.

310 CMR 9.34 – Conformance with Municipal Zoning and Harbor Plans

The Site is located on private and Commonwealth filled and flowed tidelands and therefore the Project must conform to the standards of 310 CMR 9.34(1) regarding compliance with applicable zoning ordinances. The Project will comply with the Salem zoning ordinance after approval of a height variance. The Chapter 91 Form G Municipal Zoning Certificate that states the Project is not in violation of the local zoning ordinances and bylaws will be submitted to the Salem Planning Department along with the Application and sent to MassDEP upon approval.

The Project Site is located within the planning area of the 2008 Salem MHP and therefore the Project is subject to the standards for complying with a municipal harbor plan. The 2008 Salem MHP recommended maintaining the current levels of water - dependent industrial uses, which at the time, included the power plant and use of its berths for coal deliveries. The 2008 Salem MHP also contemplated changes in the marine industry and infrastructure needed to support future energy production. The Project is consistent with these recommendations as it will be support offshore energy needs as well as substantially improve the Site's infrastructure for WDIUs. All the proposed uses are consistent with the standards for WDIUs and DPAs. The proposed offices and shed structures are integral to the port operations and are considered Accessory Uses in accordance with 310 CMR 9.12(3)(a). All these uses are also consistent with the 2008 Plan.

The City of Salem is currently in the process of updating the 2008 Salem MHP and DPA Master Plan (the "2022 MHP"). While the timeline for submission and approval of the 2022 MHP is still being determined, the City has confirmed that the Project is consistent with the recommendations of the 2022 MHP. Specifically, the 2022 MHP, which will also serve as an update to the City's DPA Master Plan, identifies OSW as a preferred use for the Project Site.

310 CMR 9.35 – Standards to Preserve Water-Related Public Rights

The Project conforms to the Standards to Preserve Water-Related Public Rights at 310 CMR 9.35. In accordance with this standard, the project must preserve any rights held by the Commonwealth in trust for the public to use tidelands along with any public rights for access that are associated with such use. To comply with this general standard, the Project meets the applicable standards for access to waterways and tidelands set forth in 310 CMR 9.35(2) through (4) as described below.

Pursuant to 310 CMR 9.35(2), the Project does not interfere with public rights of navigation. The Project improves navigation by providing new berthing areas and facilities and by making the Basin deeper and allowing larger ships to access the site.

The Project will not extend beyond the length required to achieve safe berthing, generate water-borne traffic that would substantially interfere with other existing or future water-borne traffic, adversely affect the depth or width of an existing channel, or impair in any other substantial manner the ability of the public to pass freely upon the waterways and to engage in transport or loading/unloading activities. The loading wharf and delivery jetty improvements will not interfere with the public rights of navigation and will improve navigation access. The berths are the minimum size necessary to safely accommodate the proposed uses. There is currently little waterborne traffic, and the provision of these new facilities will increase vessel traffic to the port through the existing established deep draft navigation channels without interfering with smaller vessel traffic. The proposed dredging, which is for a water-dependent industrial use, will not significantly interfere with navigation by recreation vessels.

Pursuant to 310 CMR 9.35(3)(a), the Project does not interfere with public rights to access the flowed tidelands within the site for the purposes of fishing, fowling, and navigation, and does not pose an obstacle to the public's ability to pursue such activities. Flowed tidelands will still be accessible to the public, except when and where vessels are berthed for marine industrial use.

Pursuant to 310 CMR 9.35(3)(b)2.b., the industrial water-dependent use Project is located on Commonwealth tidelands and shall provide public passage thereon by such means as are consistent with the need to avoid undue interference with the water dependent use in question. There will be limited public access to the waterfront for cruise ship access. To ensure the safety of the public and those working within the port's facility, and to comply with regulations promulgated by the Department of Homeland Security, public access to the industrial use portions of the Project will not be allowed.

In compliance with 310 CMR 9.35, the public access portion of the Project will be managed with appropriate signage, access to open space, and a management plan with reasonable rules and regulations.

310 CMR 9.36 – Standards to Protect Water-Dependent Uses

The Project conforms to the Standards to Protect Water-Dependent Uses of 310 CMR 9.36. In accordance with 310 CMR 9.36, a project must preserve the availability and suitability of tidelands that are in use for water-dependent purposes, or which are reserved primarily as a location for maritime industry or other specific types of water-dependent uses. The Project meets the applicable specific provisions of these standards as described below.

In compliance with 310 CMR 9.36(1), the Project will be preserving the availability for water-dependent uses by improving access to and use of the Project Site for water-dependent industrial uses with new berths, wharf, pier, and laydown space. The proposed OSW marshalling facility use is consistent with the requirements of the 2008 Salem MHP as described in the section above.

In compliance with 310 CMR 9.36(2), the Project will not limit existing or future water-dependent uses on the project site or access to abutting littoral or riparian property owner's right to approach their properties. Landside access will be provided through existing roads and access ways off Derby Street and Fort Avenue. The proposed loading wharf on the south side of the property site will be more than 25 feet from the abutting property line and will not interfere with the riparian rights of the abutter.

In compliance with 310 CMR 9.36(3), the Project will not significantly disrupt any water-dependent use in operation within proximate vicinity of the Project Site. Construction and use of the berthing facilities will not affect any offsite water dependent uses.

In compliance with 310 CMR 9.36(4), the Project will not displace any water-dependent uses in operation that have occurred on the site for the previous five years. There have not been any vessel uses at the Project Site for the past five years.

In compliance with 310 CMR 9.36(5), all fill and structures will be for water-dependent industrial uses.

310 CMR 9.37 - Engineering and Construction Standard

The Project will comply with the standards of 310 CMR 9.37. In compliance with 310 CMR 9.37(1), all structures and fill will be certified by a Registered Professional Engineer and will comply with all applicable safety regulations. The Project will not restrict the ability to dredge any channels. In compliance with 310 CMR 9.37(3), the proposed wharf reconstruction and underlying seawalls will be compatible with existing seawalls and revetments in terms of its design, size, function, and materials. A minor amount of new fill will need to be permitted in accordance with the standards at 310 CMR 9.32.

310 CMR 9.40 – Standards for Dredging and Dredged Material

The Project will comply with the standards at 310 CMR 9.40. This section of the Chapter 91 regulations requires dredging projects to meet specific requirements for resource protection, operational requirements for dredging and dredged materials disposal, and notification of dredging and disposal activities.

Dredging activities will be timed to minimize impacts on the and land under ocean resource areas. Approximately 80,190 cubic yards of dredge material will be removed from the Basin. Based on previous sampling and dredging activities, the dredged material is expected to test clean and will be disposed of at the MBDS.

The Project will comply with specific applicable provisions of Chapter 91 regulations, 310 CMR 9.40, as follows:

- The Project includes dredging of the state turning basin, which is in the Salem DPA, to a depth greater than 20 feet;
- The dredge area has been designed to reasonably accommodate the navigational requirements of the Project and provide adequate water circulation;
- The dredged area is connected to and is dredged to the same depth as the adjacent federal channel and shall not exceed that which is reasonably necessary to accommodate the safe navigation of project vessels. To ensure safe berthing and clearance of the WDTVs at all tide ranges at the loadout wharf, the adjacent berth will be dredged deeper than the Basin;
- Dredging will occur within the limits and side slopes of the existing state turning basin;
- Dredging operations will utilize a mechanical dredge due to the expected silt and clay material, and the use of a bottom-opening scow to transport and dispose of the fine grain material at the MBDS; and
- The Applicant will submit appropriate notices about the ocean disposal, ensure transport vessels are appropriately loaded, and the material is deposited within the confines of the MBDS.

2.4 CONSISTENCY WITH COASTAL ZONE MANAGEMENT POLICIES

The Project is consistent with the applicable MCZM Program Polices as described below.

2.4.1 WATER QUALITY

Water Quality Policy #2

Ensure the implementation of nonpoint source pollution controls to promote the attainment of water quality standards and protect designated uses and other interests.

The Project will improve the Site's stormwater drainage system that currently allows stormwater to sheet flow without treatment into the receiving waters by providing new storm drains and treatment structures, which will meet the State's stormwater management standards.

The Project will implement BMPs during construction to ensure that erosion and sedimentation are minimized. As appropriate, erosion and sedimentation controls, such as coir logs, siltation fences, and turbidity curtains, will also be used during construction.

2.4.2 HABITAT

Habitat Policy #1

Protect coastal, estuarine, and marine habitats—including salt marshes, shellfish beds, submerged aquatic vegetation, dunes, beaches, barrier beaches, banks, salt ponds, eelgrass beds, tidal flats, rocky shores, bays, sounds, and other ocean habitats—and coastal freshwater streams, ponds, and wetlands to preserve critical wildlife habitat and other important functions and services including nutrient and sediment attenuation, wave and storm damage protection, and landform movement and processes.

The Project includes structures that will affect coastal bank and land under ocean resource areas in Salem Harbor. Best management practices (BMP) will be implemented during construction of both the landside and waterside structures to minimize any potential impacts to the resources of Salem Harbor. To the extent practicable, the dredging operations will minimize turbidity and impacts to nearby habitats with the use of appropriate BMPs, such as turbidity curtains, and time-of-year (TOY) restrictions. Pier construction will utilize BMPs such as slow-start pile driving and TOY restrictions to minimize impacts to finfish. Furthermore, the existing site, which does not treat any of the stormwater runoff will have a new stormwater drainage system that will improve the water quality and habitats of the downgradient wetland resources.

2.4.3 COASTAL HAZARDS

Coastal Hazard Policy #1

Preserve, protect, restore, and enhance the beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as dunes, beaches, barrier beaches, coastal banks, land subject to coastal storm flowage, salt marshes, and land under the ocean.

Coastal Hazard Policy #2

Ensure that construction in water bodies and contiguous land areas will minimize interference with water circulation and sediment transport. Flood or erosion control projects must demonstrate no significant adverse effects on the project site or adjacent or downcoast areas.

The Project has been designed to minimize interference with water circulation and sediment transport. The proposed delivery pier on the north side of the Basin will be pile-supported to allow water to circulate under and through the pier instead of constructed a solid-fill pier. The main loadout pier on the west side of the Basin will be reconstructed in the same footprint of the existing pier, pile supported, and not extend any further seaward to minimize impacts to the water circulation. Dredging within the existing dredge footprint of the state turning basin will not significantly impact the coastal bank or adjacent or downcoast areas. Dredging land under ocean, which is deeper than 32 feet below mean low water, will not impact the functions of storm damage prevention or flood control.

2.4.4 PUBLIC ACCESS

Public Access Policy #1

Ensure that development (both water-dependent or nonwater-dependent) of coastal sites subject to state waterways regulation will promote general public enjoyment of the water's edge, to an extent commensurate with the Commonwealth's interests in flowed and filled tidelands under the Public Trust Doctrine.

This industrial water-dependent use project with this DPA will improve navigational access to and use of the proposed industrial use for supporting the development of OSW developments. The Project will also improve access and berthing for large passenger cruise ships and will provide a connecting way for passengers to access and egress the cruise ships, which will support increased public access to this historic harbor. Due to public safety and security concerns, general pedestrian access will not be provided on the Project Site.

2.4.5 GROWTH MANAGEMENT

Growth Management Principle #3

Encourage the revitalization and enhancement of existing development centers in the coastal zone through technical assistance and financial support for residential, commercial, and industrial development.

The Project, which may be funded, in part, with public funds, will support industrial development that will help revitalize a water-dependent industrial use, and the local and regional economy with jobs and associated terminal support businesses, especially those in the marine trades and vessel-related industries in the region.

2.4.6 PORTS AND HARBORS

Ports and Harbors Policy #1

Ensure that dredging and disposal of dredged material minimize adverse effects on water quality, physical processes, marine productivity, and public health and take full advantage of opportunities for beneficial reuse.

Dredging for the Project will be conducted in accordance with local, state, and federal regulations to ensure that it minimizes impacts to the environmental resources as well as the public's health. Previously tested dredge material from this state turning basin was determined to be suitable for disposal at the MBDS. It is expected that the material to be dredge will also be suitable for disposal at the MBDS, in compliance with state and federal regulations. Dredging operations will be conducted to minimize impacts to the water quality and fish and benthic habitat, including observation of the TOY restriction period and BMPs.

Ports and Harbors Policy #4

For development on tidelands and other coastal waterways, preserve and enhance the immediate waterfront for vessel-related activities that require sufficient space and suitable facilities along the water's edge for operational purposes.

This project requires the use of industrial vessels along the shoreline and structures to support their use and transfer of large OSW turbine components. The Project enhances wharves and piers to support transfer of these components. The berths and state turning basin will also be dredged to improve navigation and access for these vessels.

Ports and Harbors Policy #5

Encourage, through technical and financial assistance, expansion of water dependent uses in Designated Port Areas and developed harbors, re-development of urban waterfronts, and expansion of physical and visual access.

The Project is expected to be supported by several federal, state, and local funding sources and technical assistance, which will protect existing and future water-dependent industrial uses within the Salem DPA. The Project will redevelop an industrial waterfront as a water-dependent industrial use that will support the City of Salem's port and economic development and tourism goals. This urban waterfront, which has supported the City's growth over the past 100 years, will continue with new modern and resilient infrastructure that is designed to last for the next 50 years.

Figure 2-1
Chapter 91 Jurisdiction
Source: MassDEP, 2011; Nearmap, 2022

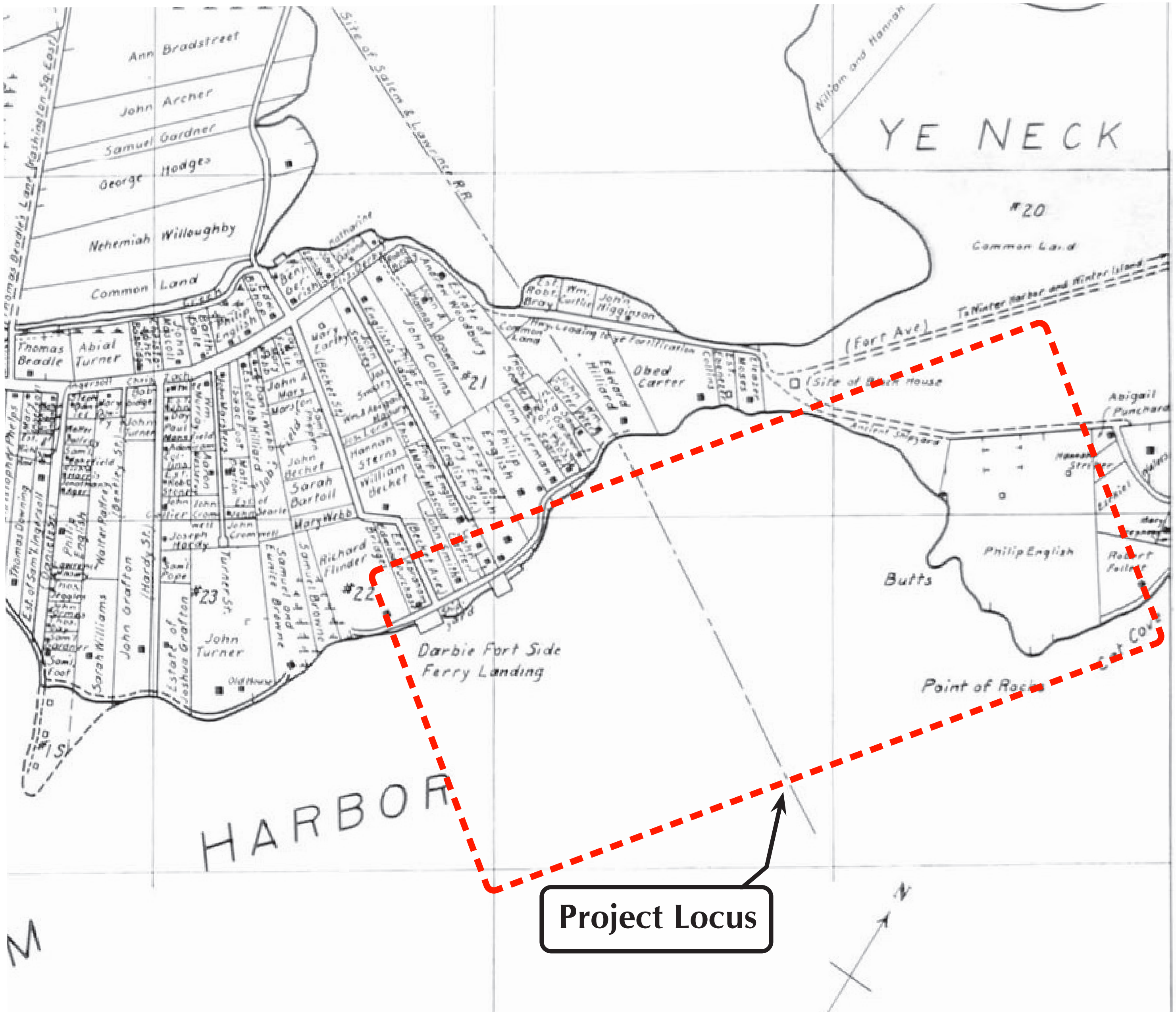


Figure 2-2
Historic Chapter 91 Jurisdiction (1700)
Source: Perley, 1700

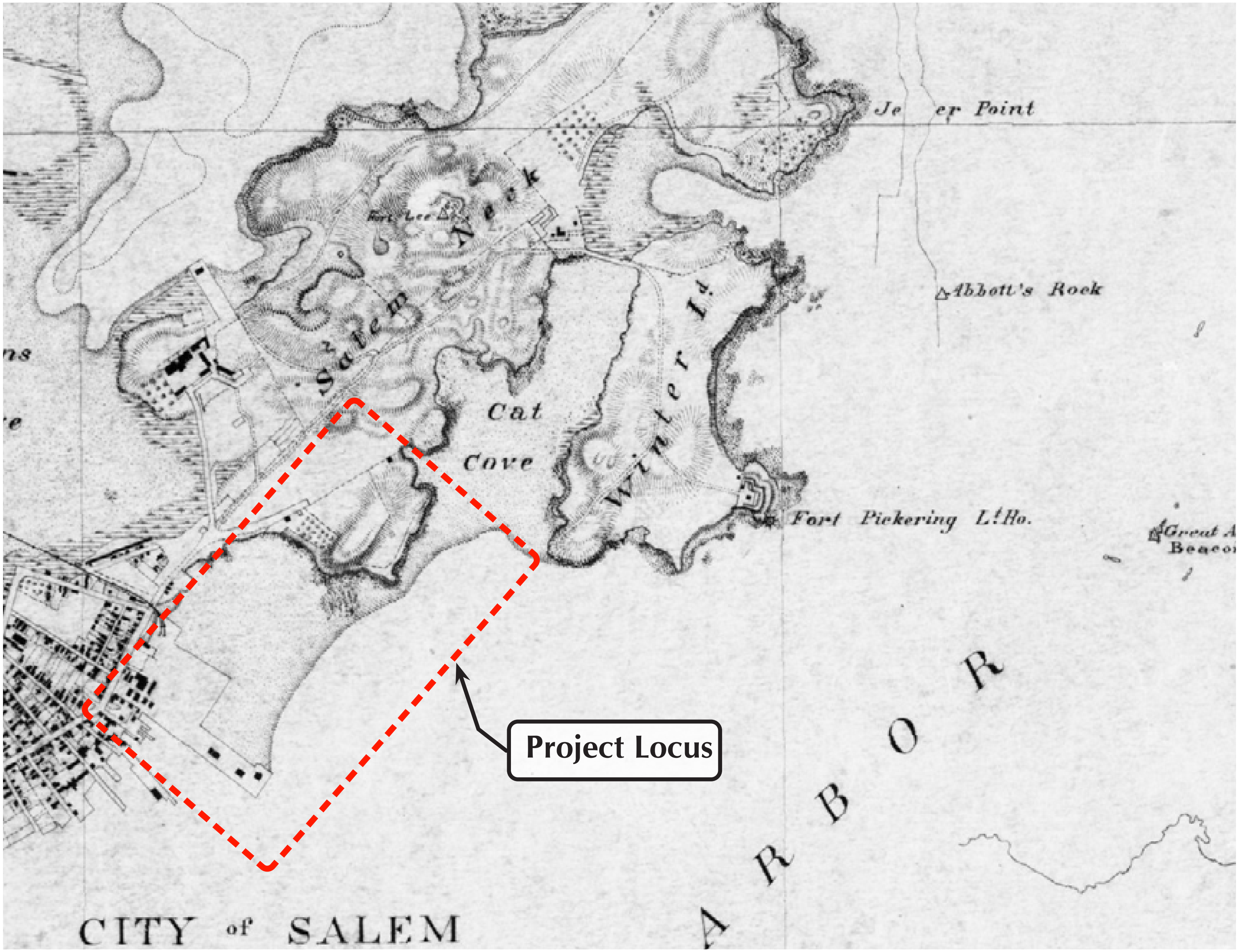


Figure 2-3
Historic Chapter 91 Jurisdiction (1850)
Source: U.S. Coast Survey, 1850

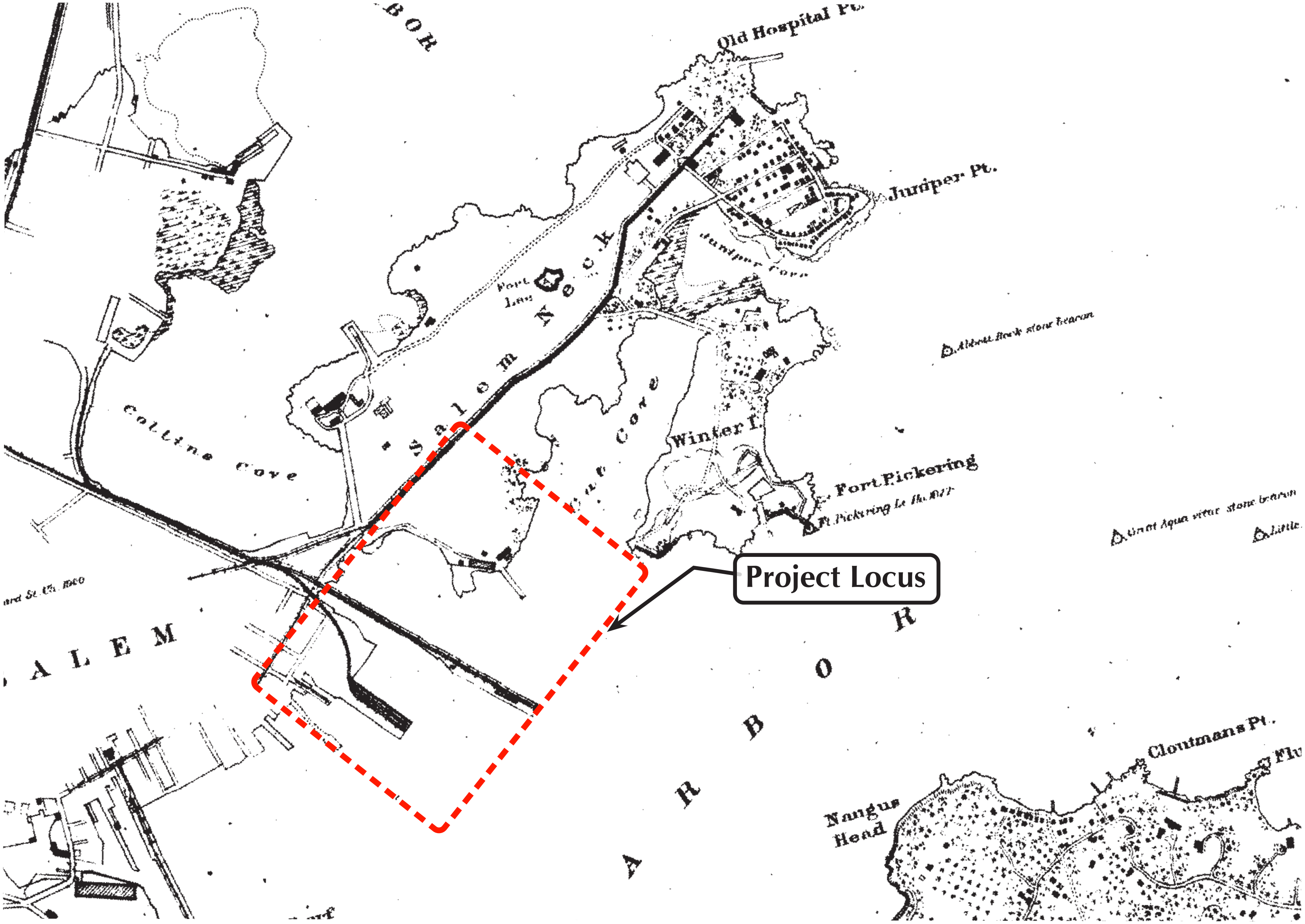


Figure 2-4
Historic Chapter 91 Jurisdiction (1902)
Source: U.S. Coast and Geodetic Survey, 1902

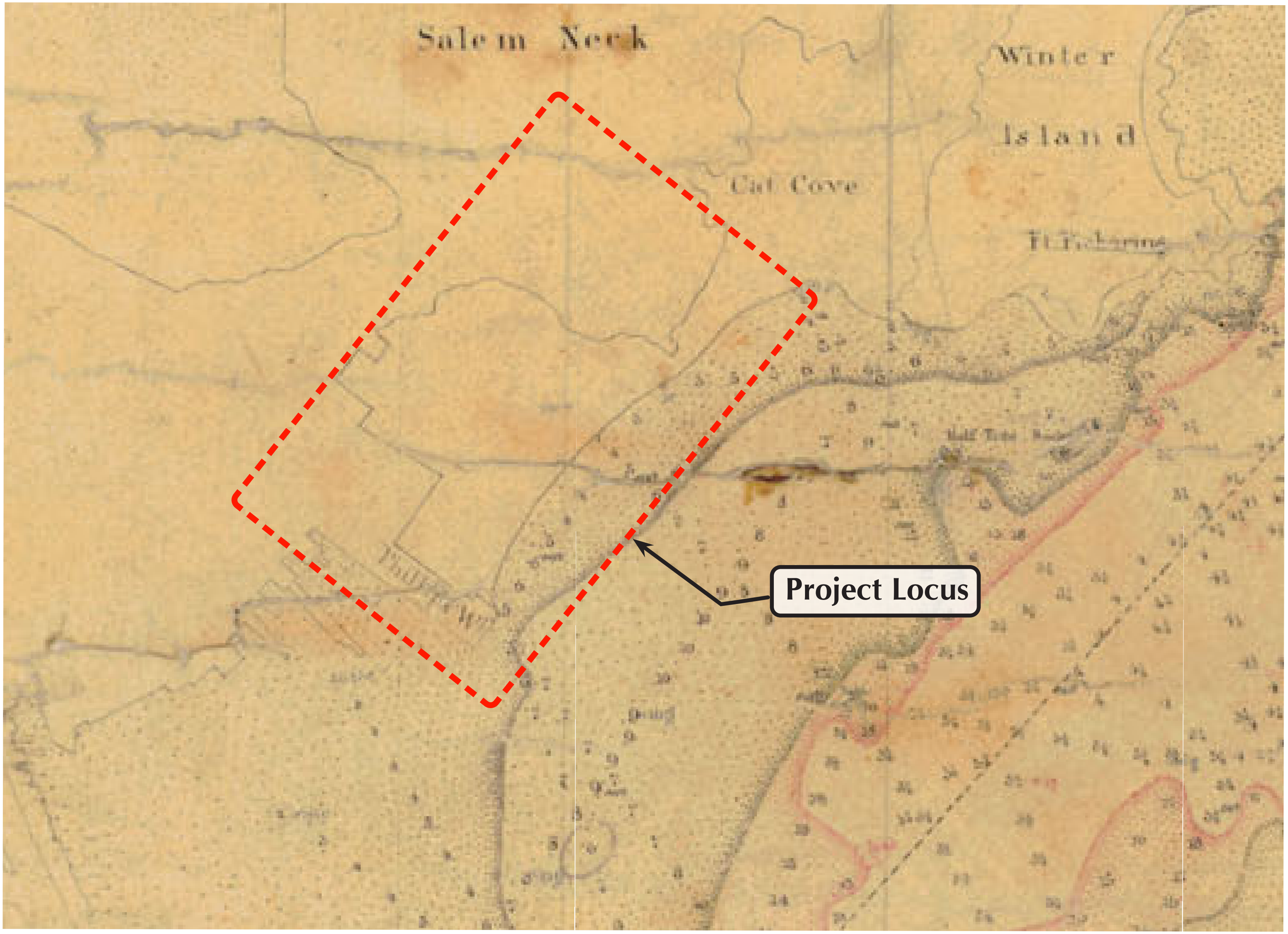


Figure 2-5
Historic Chapter 91 Jurisdiction (1854)
Source: U.S. Coast Survey, 1854

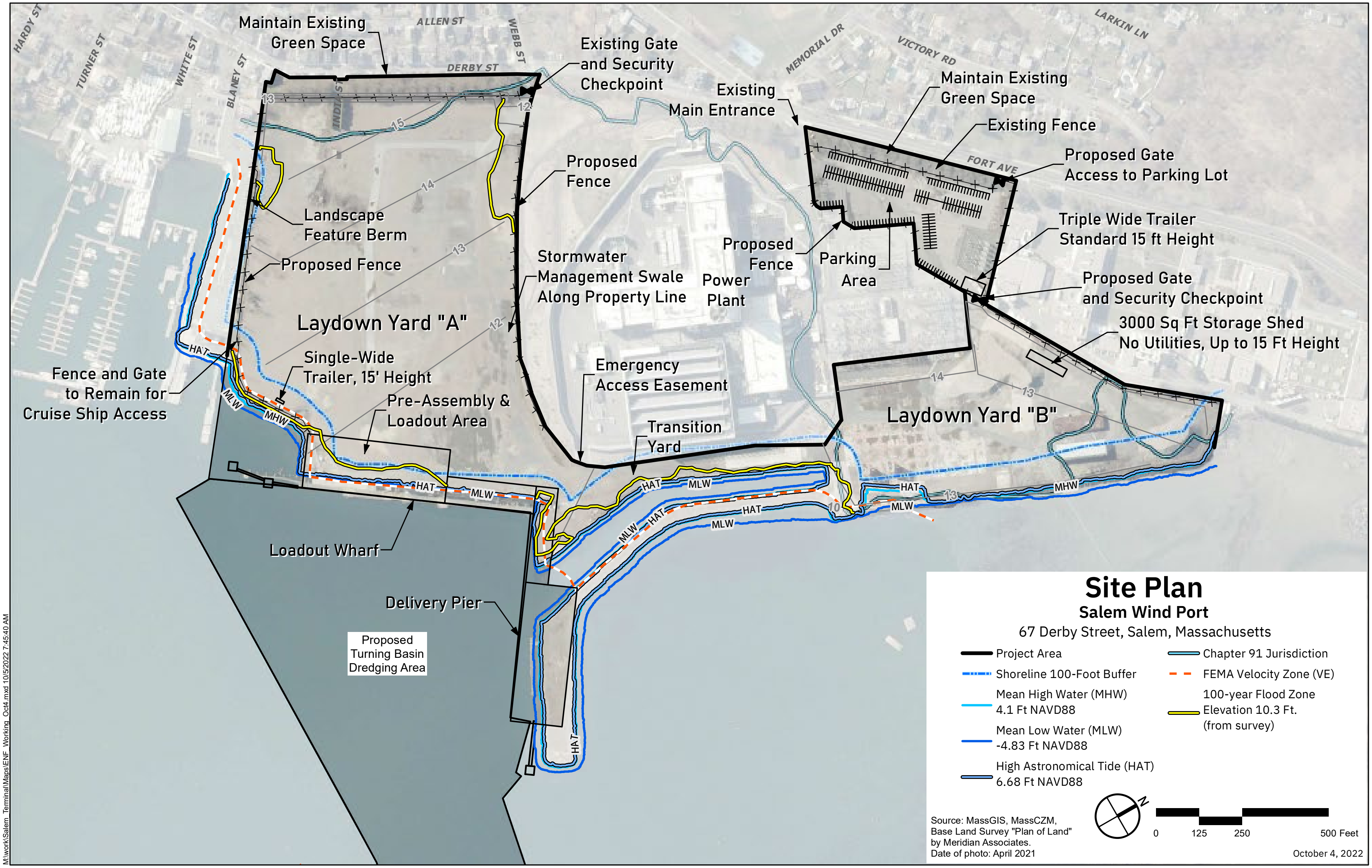


Figure 2-6
Chapter 91 Compliance
Source: AECOM, 2022

Chapter 3

WETLANDS

CHAPTER 3: WETLANDS

3.1 INTRODUCTION

The Project Site is located on the shoreline in the northwest corner of Salem Harbor**.** The work at the Project Site is regulated under the WPA, the wetlands protection regulations at 310 CMR 10.00, and local bylaws and programs. This chapter describes the wetland resources at the Site, potential impacts, and compliance with the performance standards.

3.2 WETLAND RESOURCES

There are eight wetland resource areas on and near the Project Site. These areas include Land Subject to Coastal Storm Flowage (LSCSF), Coastal Bank, Coastal Beaches, Rocky Intertidal Shore, Designated Port Areas (DPAs), Land Under the Ocean, Land Subject to Tidal Action, and Land Containing Shellfish. In addition, the City of Salem Wetlands Protection and Conservation Regulations protect wetland resource areas and land within 100 feet of LSCSF. The Project Site also includes a regulated 100-foot Buffer Zone, which, while not a resource area, is protected under the WPA and the Bylaw. The MHW and MLW are located at Elevation (El.) 4.10 (NAVD88) and El. -4.83 (NAVD88), respectively. The boundaries of these resource areas are described below. See Figure 3-1, Wetlands Resources and Figure 3-2, Project Site Wetlands.

3.2.1 LAND SUBJECT TO COASTAL STORM FLOWAGE

LSCSF is "land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record, or storm of record, whichever is greater" (310 CMR 10.04). There are two Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) that cover the Project Site and are based on Map Nos. 25009C0419G and 25009C0438G, both effective July 16, 2014. The FEMA 100-year Flood Zone is at El. 10 based on the FIRM (see Figure 3-3, FEMA 100-Year Flood Zone).

These flood maps were based on site elevations prior to the demolition of the coal fired power plant and construction of the new gas-fired power plant, which occurred in 2017 and resulted in an increased elevation of most of the Project Site. The 100-year flood zone is based on the Flood Insurance Study (No. 250009CV001C) at El. 10.3, which was plotted on the existing conditions survey. As a result, the 100-year flood zone runs mainly along the water side of the Project Site (see Figure 3-2). The LSCSF extends along the entire waterfront including the jetty pier.

3.2.2 COASTAL BANK

Coastal Bank is defined at 310 CMR 10.30(2) as "the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action or other wetland."

Coastal Bank extends around nearly the entire eastern and southern landward edges of the Project Site but excludes the area of the wharf and seawall at the mouth of the discharge channel and portions of the northeastern section of the harbor within the "Cat Cove" of Salem Harbor and north of the discharge channel.

100-Foot Buffer Zone to Coastal Bank

Per 310 CMR 10.30(6), the Buffer Zone of the Coastal Bank extends 100 feet inland from the Top of Bank.

3.2.3 COASTAL BEACHES

Coastal Beaches are defined in 310 CMR 10.27(2) as "unconsolidated sediment subject to wave, tidal and coastal storm action which forms the gently sloping shore of a body of salt water and includes tidal flats. Coastal beaches extend from the mean low water line landward to the dune line, coastal bank line or the seaward edge of existing human-made structures, when these structures replace one of the above lines, whichever is closest to the ocean."

Coastal Beach is found at the northeast corner of the Project Site, as well as on the bank of the harbor in Cat Cove, located north of the discharge channel.

3.2.4 ROCKY INTERTIDAL SHORES

Rocky Intertidal Shores are defined in 310 CMR 10.31(2) as "naturally occurring rocky areas, such as bedrock or boulder-strewn areas between the mean high water line and the mean low water line."

This resource area is located within the Coastal Beaches resource area at the northeast corner of the Project Site and is outside of the scope of work.

3.2.5 LAND CONTAINING SHELLFISH

Land Containing Shellfish is defined in 310 CMR 10.34(2) as "land under the ocean, tidal flats, rocky intertidal shores, salt marshes and land under salt ponds when any such land contains shellfish." The shellfish included under this regulation are Bay scallops (*Argopecten irradians*), blue mussels (*Mytilus edulis*), ocean quahogs (*Arctica islandica*) Oysters (*Crassostrea virginica*), quahogs (*Mercenaria merceneria*), razor clams (*Ensis directus*), sea clams (*Spisula solidissima*), sea scallops (*Placopecten magellanicus*), and soft-shell clams (*Mya arenaria*).

This resource area is located near the southwest corner of the Project Site near the Salem Wharf, as well as on the northeast side of the Project Site (see Figure 1-9, Project Site Plan). These two areas are outside of the limit of work and are not expected to be impacted by the Project.

3.2.6 LAND SUBJECT TO TIDAL ACTION

Land Subject to Tidal Action is defined in 310 CMR 10.04 as land which is subject to periodic rise and fall of a coastal water body, and this includes spring tides.

Land Subject to Tidal Action is found along nearly the entirety of the eastern and southern edges of the Project Site. This resource is located on the southern edge between the existing wharf and the Salem Wharf facility, within the two sides of the discharge channel, around the existing jetty pier next to the discharge channel, and on the northeastern edge of the Project Site.

3.2.7 LAND UNDER OCEAN IN DESIGNATED PORT AREAS

The Project Site is nearly entirely encompassed by the Salem Harbor DPA and overlaps with other resource areas, including Land Under Ocean, LSCSF, Land Containing Shellfish, Land Subject to Tidal Action, and Coastal Bank.

3.2.8 BUFFER ZONES

A Buffer Zone is associated with wetland resources present on the Project Site, including Coastal Bank as defined above in section 3.2.2. Land within 100 feet landward of a Coastal Bank is defined under the WPA regulations as Buffer Zone.

Local 100-foot Buffer Zone

In addition to the above listed resource areas, the City of Salem Wetlands Protection and Conservation Regulations regulate a 100-foot Buffer Zone which protects land extending 100 feet horizontally outward from the boundary of all the resource areas subject to protection under the Salem Wetlands Ordinance except for Riverfront Area, Land Under Waters, Land Containing Shellfish, Fish Runs, Land Subject to Tidal Action, and DPAs. Within the Buffer Zone, the ordinance establishes a 25-foot no disturb and a 50-foot mitigation zone. The Buffer Zone itself is not a resource area. The Project Site is located within the Salem DPA and therefore, the regulations for the local 100-foot Buffer Zone do not apply.

3.3 WETLAND IMPACTS, COMPLIANCE, AND MITIGATION

3.3.1 IMPACTS

Impacts to the wetland resources from the Project are associated with dredging activities in the turning basin, construction of a new pier and wharf, and upland soil improvements on the upland area of the Project Site. Approximately 23 acres of resource area, consisting of the LSCSF, Coastal Bank, Land Subject to Tidal Action, DPA and Land Under the Ocean will be impacted by the Project. The Project has been designed to avoid and minimize impacts to the resource areas wherever possible.

Temporary and permanent impacts, including improvements, to the Project Site's wetland resources are described below in Table 3-1. As shown on Figure 3-1, Wetlands Resources and Figure 3-2, Project Site Wetlands, many of the wetland resources overlap and are partially or wholly within the limits of LSCSF.

Table 3-1, Wetland Resource Area Impacts

Resource Area	Project Work	Temporary Impacts	Permanent Impacts
Land Subject to Coastal Storm Flowage	Improvements to soil structure to accommodate heavy loads, removal of jetty pier and improvements to existing wharf	0 SF	160,420 SF
Coastal Bank	Removal of portions of existing jetty pier, drainage installation, and stabilization of bank under loading wharf	0 LF	1,210 LF
100-Foot Buffer Zone	Removal of existing jetty pier, shoreline improvements, landward improvements to ground structure to accommodate heavy loads	0 SF	441,240 SF
Coastal Beaches	None	0 SF	0 SF

Resource Area	Project Work	Temporary Impacts	Permanent Impacts
Rocky Intertidal Shores	None	0 SF	0 SF
Land Under the Ocean	New and maintenance dredging, pile driving to support new pier and wharf	0 SF	818,720 SF
Land Containing Shellfish	None	0 SF	0 SF
Land Subject to Tidal Action	Removing old wharf, jetty pier, construction of new pier and wharf, drainage installation	0 SF	9,060 SF
Land Under Ocean in DPA	New and maintenance dredging, pile driving to support new pier and wharf	0 SF	818,720 SF

3.3.2 COMPLIANCE WITH WETLAND PROTECTION ACT PERFORMANCE STANDARDS

This section describes the compliance of each of the Project activities in WPA jurisdiction with the applicable regulatory performance standards for the respective resource areas.

The planned work occurs within LSCSF, Land Under Ocean, Coastal Bank, Coastal Beaches, Land Under Ocean in DPA, and the 100-Foot Buffer to Coastal Bank and portions of the 100-foot Buffer Zone established by local regulations. The following details of resource area compliance are presented from the furthest landside resource area (LSCSF) to the resource areas furthest seaward (Land Under Ocean).

No areas of the Project Site are identified as Priority Natural Habitat or Estimated Habitat of Rare Wildlife by the Natural Heritage and Endangered Species Program, as identified by procedures established under 310 CMR 10.37 (Natural Heritage Areas, 14th Edition, 2017).

Land Subject to Coastal Storm Flowage

There are no regulatory performance standards for LSCSF under 310 CMR 10.00. The Project Site will be elevated to approximately 2 feet above the base flood elevation (BFE), which will help to reduce flooding and storm damage on the Project Site from coastal storms. The overall amount of LSCSF will be reduced after the Project Site is regraded and raised.

Coastal Bank

There will be some impacts to Coastal Bank with the reconstruction of the wharf, pier, and transition yard. Table 3-2 below describes how the Project will comply with performance standards for Coastal Bank as presented in 310 CMR 10.30.

Table 3-2, Compliance with Performance Standards for Coastal Bank (310 CMR 10.30)

COASTAL BANK PERFORMANCE STANDARD	COMPLIANCE WITH PERFORMANCE STANDARD
310 CMR 10.30(6): Any project on such a coastal bank or within 100 feet landward of the top of such coastal bank shall have no adverse effects on the stability of the coastal bank.	The Project will not have any adverse effects to the stability of the Coastal Bank. Work done on and around the Coastal Bank will include drainage installation and construction of the jetty pier in order to accommodate the wind turbine equipment that will be stored landward and the vessels that will be docking at and near the Coastal Bank. Work on the loading pier will improve the existing stability of the existing coastal bank.
310 CMR 10.30(7): Bulkheads, revetments, seawalls, groins or other coastal engineering structures may be permitted on such a coastal bank except when such bank is significant to storm damage prevention or flood control because it supplies sediment to Coastal Beaches, coastal dunes, and barrier beaches.	Portions of the Coastal Bank are to be reinforced steel sheet pile wall, and proposed work on the Coastal Bank will include bulkheads and seawalls. The existing Coastal Bank does not supply sediment to Coastal Beaches, coastal dunes, or barrier beaches.
310 CMR 10.30 (8): Notwithstanding the provisions of 310 CMR 10.30(3) through (7), no project may be permitted with which will have an adverse effect on specified habitat sites of rare vertebrate of invertebrate species, as identified by procedures established under 310 CMR 10.37.	There are no specified habitat sites of rare vertebrate or invertebrate species on the Project Site.

Coastal Beaches

There are expected to be no impacts to Coastal Beaches as a result of the Project. Table 3-3 below shows how the Project complies with the performance standards for Coastal Beaches as described in 310 CMR 10.27.

Table 3-3, Compliance with Performance Standards for Coastal Beaches (310 CMR 10.27)

COASTAL BEACHES PERFORMANCE STANDARD	COMPLIANCE WITH PERFORMANCE STANDARD
310 CMR 10.27(3): Any project on a coastal beach, except any project permitted under 310 CMR 10.30(3)(a), shall not have an adverse effect by increasing erosion, decreasing the volume or changing the form of any such coastal beach or an adjacent or downdrift coastal beach.	The Project will not have any impacts on Coastal Beaches within the Project Site.
310 CMR 10.27(4): Any groin, jetty, solid pier, or other such solid fill structure which will interfere with littoral drift, in addition to complying with 310 CMR 10.27(3), shall be constructed as follows: (a) It shall be the minimum length and height demonstrated to be necessary to maintain beach form and volume. In evaluating necessity, coastal engineering, physical oceanographic and/or coastal geologic information shall be considered. (b) Immediately after construction any groin shall be filled to entrapment capacity in height and length with sediment of grain size compatible with that of the adjacent beach. (c) Jetties trapping littoral drift material shall contain a sand by-pass system to transfer sediments to the downdrift side of the inlet or shall be periodically redredged to provide beach nourishment to ensure that downdrift or adjacent beaches are not starved of sediments.	There are no solid fill structures proposed with the Project within Coastal Beaches.
310 CMR 10.27(5): (5) Notwithstanding 310 CMR 10.27(3), beach nourishment with clean sediment of a grain size	There is no beach nourishment proposed within the Project in the Coastal Beaches.

COASTAL BEACHES PERFORMANCE STANDARD	COMPLIANCE WITH PERFORMANCE STANDARD
compatible with that on the existing beach may be permitted.	
310 CMR 10.27(6): In addition to complying with the requirements of 310 CMR 10.27(3) and (4), a project on a tidal flat shall if water-dependent be designed and constructed, using best available measures, so as to minimize adverse effects, and if non-water-dependent, have no adverse effects, on marine fisheries and wildlife habitat caused by: (a) alterations in water circulation; (b) alterations in the distribution of sediment grain size; and (c) changes in water quality, including, but not limited to, other than natural fluctuations in the levels of dissolved oxygen, temperature or turbidity, or the addition of pollutants.	There are no tidal flats on the Project Site, so there will be no impacts to tidal flats as a result of the Project.
310 CMR 10.27(7): Notwithstanding the provisions of 310 CMR 10.27(3) through (6), no project may be permitted which will have any adverse effect on specified habitat sites or rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.37.	There are no specified habitat sites of rare vertebrate or invertebrate species on the Project Site.

Land Subject to Tidal Action

There are no regulatory performance standards for Land Subject to Tidal Action under 310 CMR 10.00. There may be permanent impacts to Land Subject to Tidal Action from the installation of an outfall along the channel. See Section 1.6.1, Site Design and Resiliency, for more information about the Project Site's adaptability to potential tidal action impacts and resiliency measures.

Land Under the Ocean

There will be both temporary and permanent impacts to the Land Under the Ocean resource area as a result of dredging activities and the construction of a new pier and wharf, and these are the same impacts to the DPA. Table 3-4 details how the Project will comply with the performance standards for Land Under the Ocean, as described in 310 CMR 10.25.

Table 3-4, Compliance with Performance Standards for Land Under the Ocean (310 CMR 10.25)

LAND UNDER THE OCEAN PERFORMANCE STANDARD	COMPLIANCE WITH PERFORMANCE STANDARD
310 CMR 10.25(3): Improvement dredging for navigational purposes affecting land under the ocean shall be designed and carried out using the best available measures so as to minimize adverse effects on such interests caused by changes in: (a) bottom topography which will result in increased flooding or erosion caused by an increase in the height or velocity of waves impacting the shore; (b) sediment transport processes which will increase flood or erosion hazards by affecting the natural replenishment of beaches; (c) water circulation which will result in an adverse change in flushing rate, temperature, or turbidity levels; or (d) marine productivity which will result from the suspension or transport of pollutants, the smothering of bottom organisms, the accumulation of pollutants by organisms, or the destruction of marine fisheries habitat or wildlife habitat.	Improvement dredging of the Land Under the Ocean will be conducted with BMPs in order to prevent adverse effects. These efforts include the use of turbidity curtains to control erosion and sedimentation, following time of year restrictions as designated by the MADMF to protect fisheries and marine wildlife, and slow start pile driving practices in order to minimize impacts to marine fisheries and habitats within the Land Under the Ocean resource area.
310 CMR 10.25(4): Maintenance dredging for navigational purposes affecting land under the ocean shall be designed and carried out using the best available measures so as to minimize adverse effects on such interests caused by changes in marine productivity which will result from the suspension or transport of pollutants, increases in turbidity, the smothering of bottom organisms, the accumulation of pollutants by organisms, or the destruction of marine fisheries habitat or wildlife habitat.	Maintenance dredging of the Land Under the Ocean will be conducted with BMPs in order to prevent adverse effects. These efforts include the use of turbidity curtains to control erosion and sedimentation, following time of year restrictions and slow start pile driving requirements as designated by the MADMF to protect fisheries and marine wildlife.
310 CMR 10.25(5): Projects not included in 310 CMR 10.25(3) or (4) which affect nearshore areas of land under the ocean shall not cause	The Project is subject to the regulations for work in DPAs pursuant to 310 CMR 10.25.

LAND UNDER THE OCEAN PERFORMANCE STANDARD	COMPLIANCE WITH PERFORMANCE STANDARD
adverse effects by altering the bottom topography so as to increase storm damage or erosion of coastal beaches, coastal banks, coastal dunes, or salt marshes.	
310 CMR 10.25(6): (6) Projects not included in 310 CMR 10.25(3) which affect land under the ocean shall if water-dependent be designed and constructed, using best available measures, so as to minimize adverse effects, and if non-water-dependent, have no adverse effects, on marine fisheries habitat or wildlife habitat caused by: (a) alterations in water circulation; (b) destruction of eelgrass (Zostera marina) or widgeon grass (Rupia maritina) beds; (c) alterations in the distribution of sediment grain size; (d) changes in water quality, including, but not limited to, other than natural fluctuations in the level of dissolved oxygen, temperature or turbidity, or the addition of pollutants; or (e) alterations of shallow submerged lands with high densities of polychaetes, mollusks or macrophytic algae.	The Project is subject to the regulations for work in DPAs pursuant to 310 CMR 10.25.
310 CMR 10.25(7): Notwithstanding the provisions of 310 CMR 10.25(3) through (6), no project may be permitted which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.37.	There are no specified habitat sites of rare vertebrate or invertebrate species on the Project Site.

Land Under Ocean in Designated Port Area

There will be both temporary and permanent impacts to the Land Under the Ocean in a DPA resource area as a result of dredging activities and the construction of a new pier and wharf, and these are similar to the impacts discussed in the Land Under the

Ocean section. Table 3-5 below details how the Project will comply with the performance standards for DPAs set forth in 310 CMR 10.26.

Table 3-5, Compliance with Performance Standards for Designated Port Areas (310 CMR 10.26)

LAND UNDER THE OCEAN PERFORMANCE STANDARD	COMPLIANCE WITH PERFORMANCE STANDARD
310 CMR 10.26(3): Projects shall be designed and constructed, using best practical measures, so as to minimize adverse effects on marine fisheries caused by changes in: (a) water circulation; (b) water quality, including, but not limited to, other than natural fluctuations in the level of dissolved oxygen, temperature or turbidity, or the addition of pollutants.	Activities in the DPA on the Project Site will follow BMPs and a construction management plan in order to minimize the impact of construction-related activities on water circulation and water quality, including the level of dissolved oxygen, temperature, turbidity, and the addition of pollutants. These practices may include, but are not limited to, erosion control measures such as turbidity curtains, following time of year restrictions, slow start pile driving, establishing trucking routes to minimize congestion, and wetting down areas to control dust and exhaust.
310 CMR 10.26(4): Projects shall be designed and constructed, using the best practical measures, so as to minimize adverse effects on storm damage prevention or flood control caused by changes in such land's ability to provide support for adjacent coastal banks or adjacent coastal engineering structures.	The Project is designed to improve the existing shoreline and wharf infrastructure to support the Project's goals while also minimizing flooding and storm damage on the Project Site. The Project Site is on a peninsula in a flood zone, so controlling flooding and future sea level rise on the Project Site is a challenge. However, the design will not be impacting the ability of the land on the Project Site to provide support for adjacent coastal banks or coastal engineering structures and should improve the strength of the existing shoreline and landward infrastructure.

WPA Buffer Zone to Coastal Bank

Work within the WPA Buffer Zone to Coastal Bank (which at the Project Site overlaps Land Subject to Coastal Storm Flowage) includes site grading, pier construction, and stormwater management. While no performance standards are associated with the Buffer Zone, the WPA recognizes the role the Buffer Zone plays in protecting the interests of the WPA. The Project will utilize all necessary BMPs to ensure that activities in the Buffer Zone do not impact overlapping or adjacent resource areas during the construction period or long term. In addition, those portions of the Buffer Zone work that occur within areas of Land Subject to Coastal Storm Flowage are specifically designed to improve waterfront conditions.

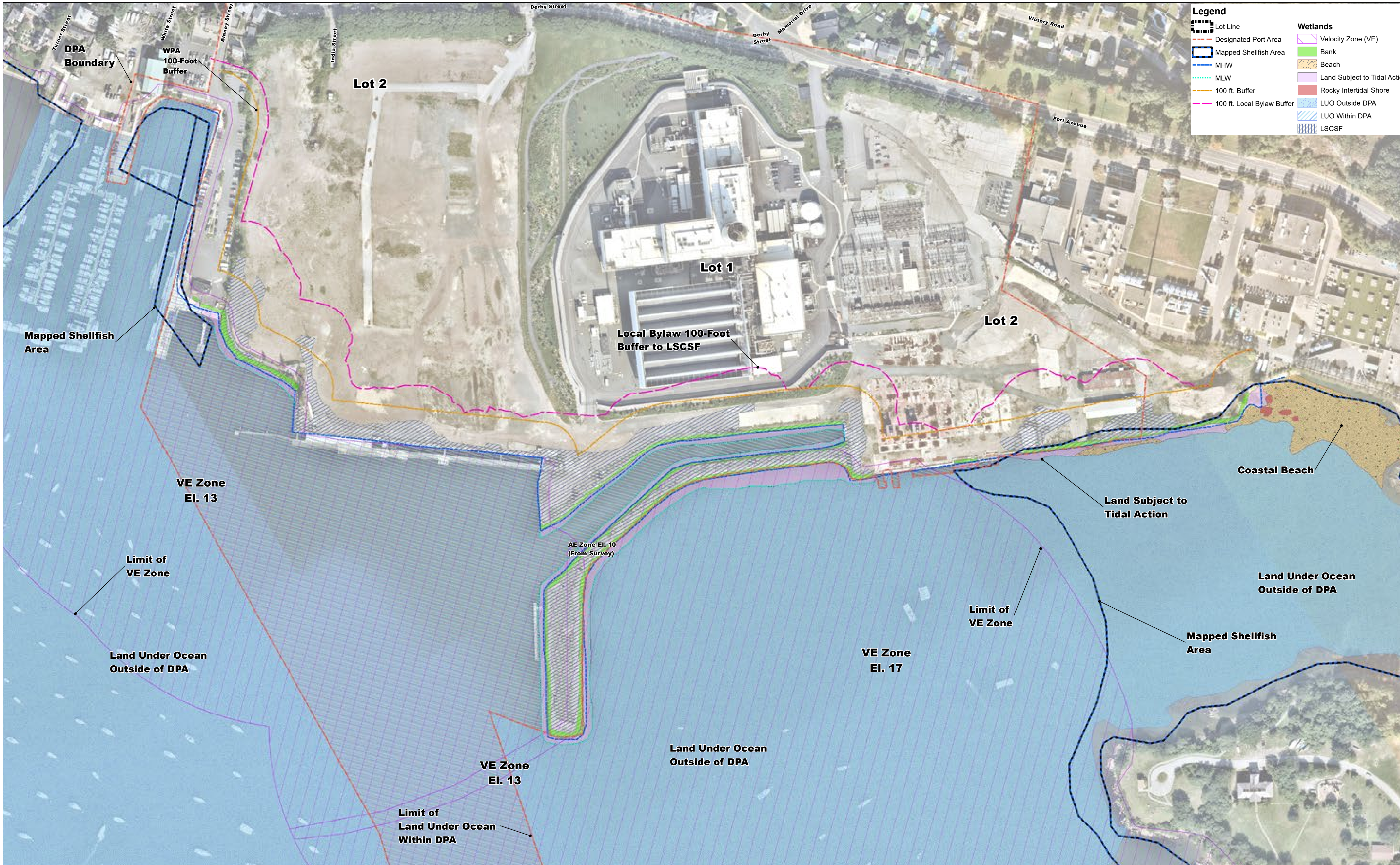
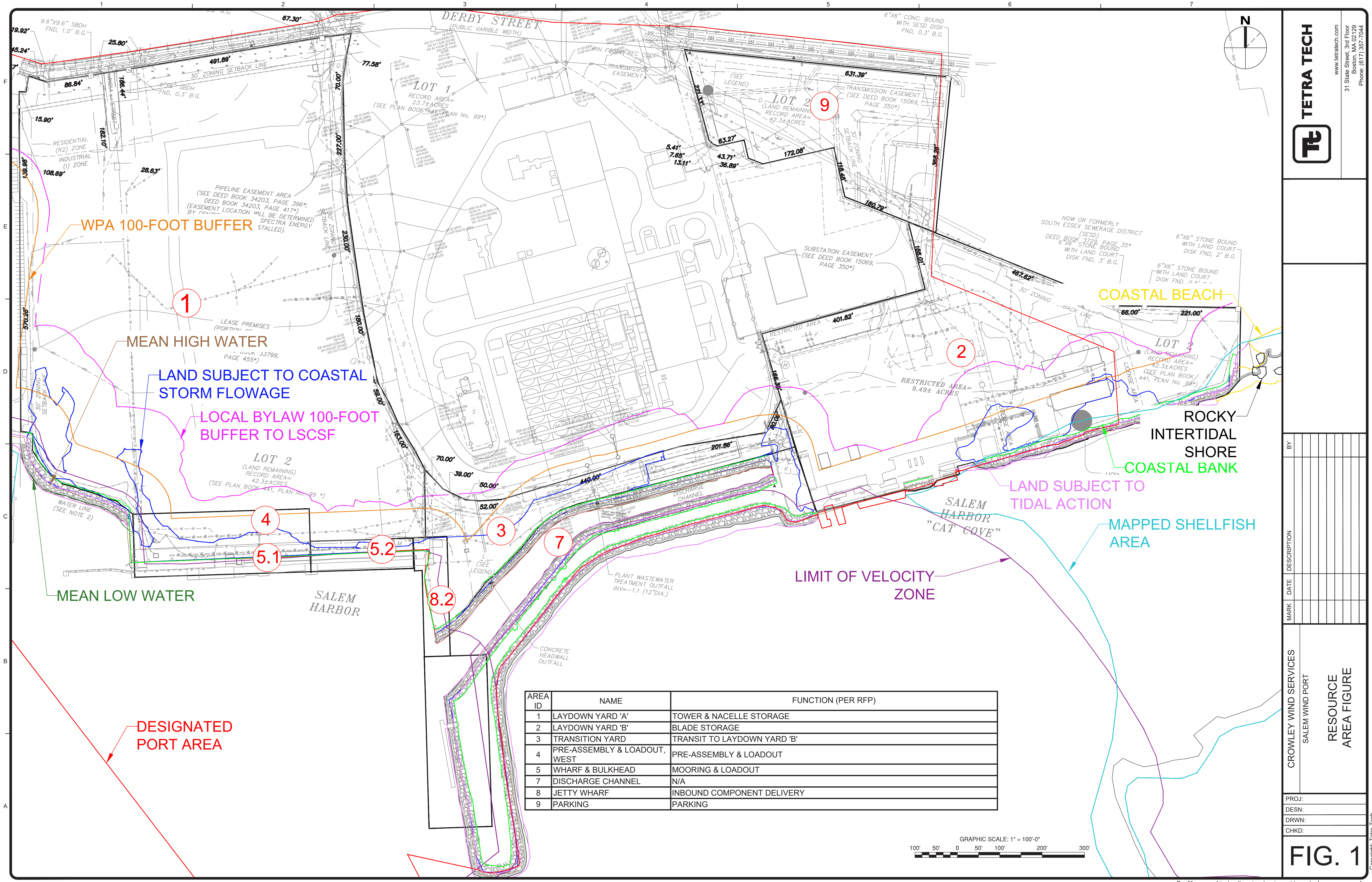


Figure 3-1
Wetlands Resources
Source: Tetra Tech, 2022



AREA ID	NAME	FUNCTION (PER RFP)
1	LAYDOWN YARD 'A'	TOWER & NACELLE STORAGE
2	LAYDOWN YARD 'B'	BLADE STORAGE
3	TRANSITION YARD	TRANSIT TO LAYDOWN YARD 'B'
4	PRE-ASSEMBLY & LOADOUT, WEST	PRE-ASSEMBLY & LOADOUT
5	WHARF & BULKHEAD	MOORING & LOADOUT
7	DISCHARGE CHANNEL	N/A
8	JETTY WHARF	INBOUND COMPONENT DELIVERY
9	PARKING	PARKING

Figure 3-2
Project Site Wetlands
Source: Tetra Tech, 2022

Figure 3-3
FEMA 100-Year Flood Zone
Source: Federeal Emergency Management Agency, 2014

Chapter 4

DREDGING AND DISPOSAL

CHAPTER 4: DREDGING AND DISPOSAL

4.1 INTRODUCTION

Dredging will be conducted at the Basin and adjacent berths to accommodate the vessels that will utilize the reconstructed loadout wharf and new delivery pier. To achieve the objectives and full operational capabilities of the marshalling terminal, certain areas within the Basin and adjacent to the reconstructed loadout wharf and new delivery pier need to be dredged. This dredging is required to accommodate the many different vessels that will be entering, exiting, and docking around the Project Site, including WTIVs, HTVs, barges, and tugs.

The Basin has been dredged repeatedly since the site was used to deliver bulk coal in the 1920s and once since the Salem Harbor DPA was established in 1978. Past dredging in this area is described in further detail in Section 4.2 below. The proposed Project dredging will be a combination of maintenance dredging in previously dredged areas and a relatively small amount of new dredging along the berths. Dredge material sampling has occurred at this location as part of previous dredging activities. Additional samples will be collected, and dredge material will be tested before dredging commences at the Project Site in compliance with state and federal regulations.

The adjacent Federal Navigation Project (the main entrance channel to Salem Harbor) has also been dredged several times since it was created in 1905. The USACE is currently planning to dredge the Federal Navigation Channel within the next two years, which will help support navigational access to the port.

4.2 HISTORY OF DREDGING

As part of the development of Salem Harbor for industrial and maritime uses, the area in and around the Project Site has been dredged regularly over the past 100 years. The first documented dredging occurred at Salem Harbor in 1924, with dredging occurring in the berthing area and approach channel to achieve a maximum depth of -26 feet (License No. 392). In 1927, License No. 1100 was issued to permit the dredging of 3,000 cy of material at the head of the Salem Terminal Corporation Dock. Two years later, License No. 1069 was issued to allow dredging to create a 25-foot-deep channel to connect to an existing berthing area. In 1935, License No. 2694 was approved to allow 5,000 cy of material at the dock at the head of the wharf to be dredged. License No. 3747 was issued five years later to allow the re-dredging of 20,000 cy of material from the berthing area and approach channel.

The Project Site was purchased for the creation of the Salem Harbor Generating Station in 1947, and one year later, License No. 3098 was issued to allow dredging to a depth of elevation -16 feet in front of the intake screens as part of the operation of the power station.

In 1951, License No. 4976 was issued for the dredging of 130,000 cy of material in the approach channel and berthing area, changing the depth in the approach channel and berthing area to -25 feet and -30 feet, respectively. License No. 3624 was issued to re-dredge the area in front of the intake structure in 1954, and two years later, License No. 5299 was issued to permit dredging in the intake channel. License No. 5419 was issued in 1958 to re-dredge the berthing area and approach channel to the same depths as dredged in 1951. In 1969, License No. 5589 was issued to allow dredging in the area in front of the intake screens to an elevation of -20 feet. The New England Power Company was issued two permits, one from the Massachusetts Division of Waterways (Permit No. 5906) and one from the USACE (Permit No. MA-SALE-73-50), in 1973 to conduct maintenance dredging to an elevation of -32 feet at the Basin, including the areas of the navigation channel and berthing area. In 2002, USGen New England, Inc., Salem Harbor Station, received approval with License No. 9383 to dredge 42,199 cy in the Basin, which includes the berthing area and approach channel, to return this area to an elevation of -32 feet. The most recent dredging occurred in 2006-2007. This effort resulted in the dredging of 339,039 cy of material.

4.3 PROJECT DREDGING

The Project's maintenance and improvement dredging will remove approximately 80,190 cy of material (see Table 4-1, Dredge Areas). Maintenance dredging occurs in areas that have been dredged at least once as part of the function and operation of the Project Site, as previously described in Section 4.2. New Project dredging is planned to occur in an area of the harbor not previously dredged.

Table 4-1, Dredge Areas

Part	Volume (CY)	Area (Acres)*
Dredge Areas	80,190	21.3

* Includes side slopes

Dredging will occur within the Basin (see Figure 4-1, Dredging Plan). The proposed berth areas will be dredged to -32 feet with a 2-foot overdredge to accommodate WTIVs and HTVs in the wharf area. A berth pocket next to the proposed main wharf and jetty wharf will be dredged to -34 feet with a 2-foot overdredge. To maintain the design water depth at the berth, the proposed scour protection pocket dredging area is in front of the proposed wharf and will be dredged to -36 feet with a 2-foot overdredge 10 feet outboard from the wharf walls. This is slightly deeper than the rest of the maintenance dredging to protect the underlying seabed by allowing scour protection measures along the wharf to be constructed thereby maintaining the stability of the steel sheet pile bulkhead and Coastal Bank. The remaining areas within the Basin will be dredged to -32 feet with a 2-foot overdredge, returning the Basin to the elevation of the last maintenance dredging that occurred in 2002 and making it consistent with the authorized depth of the federal channel.

Dredging will comply with TOY) restrictions associated with the protection of marine habitats and fish. The Proponent will work with the MADMF to determine the TOY period and mitigation measures needed to dredge. Based on previous dredging approvals in this area of Salem Harbor, the TOY restriction is for winter flounder spawning is from February 15 to June 30 and for shellfishing, it extends to September 30.

4.4 DREDGING SAMPLING PLAN

A Draft Sampling Analysis Plan (SAP) was submitted to the MassDEP and the USACE in August 2022 for review and approval. Although MassDEP comments on the SAP, they rely on the USACE Suitability Determination since they and the USEPA manage the disposal of material at the MBDS in accordance with Section 103 of the Clean Water Act.

Prior to dredging, dredge samples will be taken to assess the environmental conditions of the sediment. The total dredge area described in the SAP has been split into four dredging units (DUs). These DUs address the sampling areas for the Project and the potential new expanded dredge areas located beyond the existing Basin that are part of the Maximum Build Alternative. See Figure 1-3, Phase 1 Sampling Plan, and Figure 1-4, Phase 2 Sampling Plan in Attachment D, Sampling and Analysis Plan and Quality Assurance Project Plan to see the DUs and sampling areas. To see more detailed information about the SAP, analysis procedure, and quality control processes, also see Attachment D.

4.5 MATERIAL CHARACTERIZATION

An analysis of sediments is needed to determine the location, number, and types of samples to be taken at the proposed dredge areas. Prior sampling results from the Basin in 2002 and adjacent area on the south side near Salem Wharf in 2009 have resulted in approval of the dredge material to be disposed of at MBDS, which is located approximately 15 nautical miles southeast of the Project Site. The proposed sampling locations are representative of the prior dredged areas and are expected to have similar results.

4.6 CONSTRUCTION METHOD AND SEQUENCE OF ACTIVITIES

The basic construction method and sequence is set forth below. Prospective contractors bidding on the dredge and shoreline work may have their own method and sequence of activities based on their experience and evaluation of the Site and proposed plans. Additional details on means and methods can be provided when a contractor is selected. Dredging operations will be coordinated with the appropriation agencies including the Salem Port Authority, the USACE, and the US Coast Guard.

A turbidity curtain will be deployed and secured around the area to be dredged in advance of any work in accordance with requirements by the Massachusetts Department of Marine

Fisheries (MADMF). Depending on the location of work, the turbidity curtain will be stayed by spud piles or by tie-offs to nearby land fixtures.

Sediment will be dredged using an excavator or crane equipped with an environmental clam shell bucket. The dredged material will be transferred into a hopper barge or scow in preparation for transport to MBDS.

4.7 DREDGING DISPOSAL

Dredge sampling and subsequent analysis of the physical and chemical properties of the samples will show whether the material meets the conditions for ocean placement under the Marine Protection, Research, and Sanctuaries Act (MPRSA) Section 103. Dredge sampling was conducted prior to the last maintenance dredging in 2002, as described previously in Section 4.2. Samples taken in that time met the limiting permissible concentration (LPC) for ocean placement as designated under MPSRA Section 103, and all of the dredged material was placed at MBDS. Because dredged material taken from this location in the past qualified for ocean placement, dredged material taken from the Project Site is proposed to be suitable for placement at MBDS. Should the sampling results not allow for offshore disposal, the SAP (see Attachment D) does include sufficient analysis of constituents to allow a determination of upland disposal in accordance with MassDEP requirements for dredge sampling and could include on or off-site processing and treatment before being disposed of at an upland landfill, placement somewhere on-site, and potential beneficial reuse on site or off site.

A dredging inspector shall accompany the vessel towing the dredge material while in transit and during disposal operations and will provide documentation to MassDEP about these activities. A report of appropriate information such as dredge material volume and points of origin and destination shall be submitted to MassDEP.

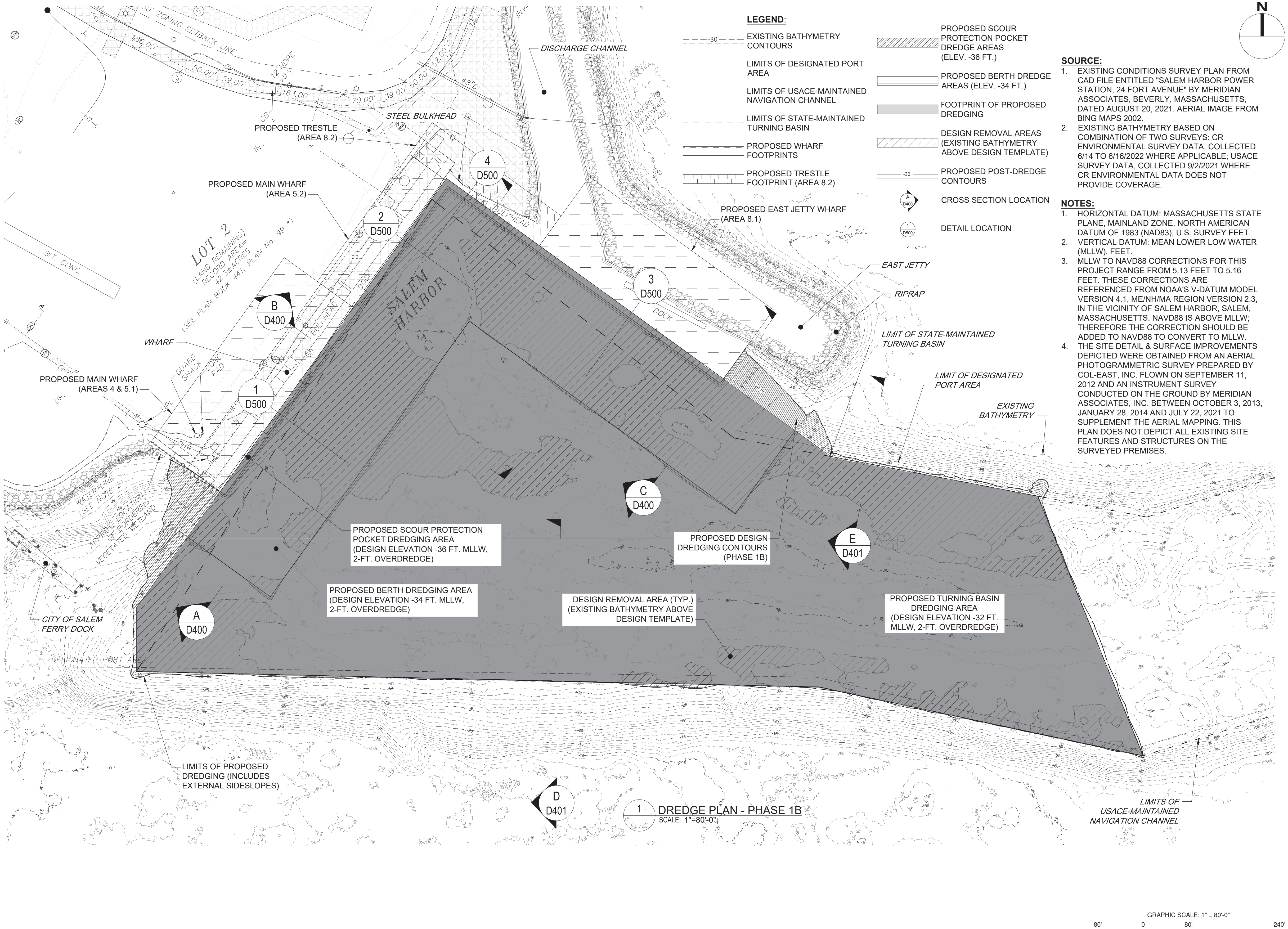


Figure 4-1
Dredging Plan
Source: AECOM, 2022

Chapter 5

INFRASTRUCTURE

CHAPTER 5: INFRASTRUCTURE

5.1 INTRODUCTION

The Project Site will be serviced with municipal utilities including sanitary sewer served by South Essex Sewerage District and municipal water supplied by the water filtration plant located in Beverly. This chapter addresses the Project's compliance with the MassDEP Stormwater Management Standards, existing and proposed water usage and sewer flows, and electric connections.

5.2 STORMWATER

5.2.1 EXISTING STORMWATER SYSTEM

Stormwater from the southern portion of the Project Site flows overland to an existing swale within the Salem Harbor Power Development Site. At locations within the swale, area drains collect stormwater. Stormwater is then conveyed by a 30-inch pipe to water quality structures. Finally, stormwater discharges at 48-inch outfall at the existing discharge channel shared by the evaporative discharge from the adjacent Salem Harbor Power Development property. There is currently no structural stormwater infrastructure along the northern portion of the Project Site or wharf structures.

Five years ago, work was performed on the site subject to an Order of Conditions. An additional stormwater system was installed with a 48-inch outfall. The subject site flows overland to area drains, water quality structure, and 48-inch outfall to Salem Harbor. Figure 5-1, Stormwater Plan shows the stormwater infrastructure at the existing site as well as the proposed infrastructure.

5.2.2 PROPOSED STORMWATER SYSTEM

The existing stormwater flow patterns found on the site will be maintained. The proposed new systems will include swales, landscape features, stormwater piping, tide gate manhole, and stormwater manholes and inlets. Laydown Area A will be pitched at 0.5% to drain the site towards a vegetative swale and series of deep sump catch basins along the property line abutting the Salem Harbor Power Development Site. Stormwater will then be conveyed via proposed and existing piping towards an existing outfall along the discharge channel. Additionally, a vegetative feature is proposed with a catch basin along the southern property line of Laydown Area A to capture any incidental runoff directed towards the adjacent property. Stormwater is conveyed towards a proposed outfall to Salem Harbor along the southeast corner of the site. Laydown Area B will be graded downslope towards the shoreline and stormwater will be captured by a trench drain through the middle of the laydown area. The trench drain is then routed towards a proposed drainage manhole then piped towards a water quality structure and proposed outfall with a tide gate. The existing parking lot will continue to drain towards an existing catch basin that is connected to the Salem Harbor Power Development Site stormwater network. The proposed piers along Salem Harbor will be drained via scuppers which will connect to the proposed stormwater infrastructure network. Proposed stormwater treatment measures for each upland area are noted in Table 5-1.

Table 5-1, Proposed Stormwater System Treatments

Location	Proposed Stormwater System Treatment
Laydown Yard A	Existing Manufactured Treatment Device and tide gate within Manhole in upland location.
Laydown Yard B	Deep sump Structure and tide gate within manhole in upland location
Parking Area	The stormwater system is existing and receives treatment.
Transition Yard	Proposed inlets with connections to existing pipes and receives treatment.

5.2.3 COMPLIANCE WITH DEP STORMWATER STANDARDS

The following section describes Project compliance with MassDEP Stormwater Management Standards, as outlined in the Wetlands Regulations:

Standard 1: No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

Compliance: Stormwater runoff on the existing site generally originates from the paved surfaces and compacted gravel areas, and eventually reaches the Salem Harbor with treatment.

Stormwater at the existing Project Site flows overland and eventually discharges at an existing 48-inch outfall into the Salem Harbor with treatment via deep sump catch basins and water quality structures. The proposed drainage areas, which will be similar to existing drainage areas, will be collected through both existing and proposed stormwater infrastructure, such as vegetated features, deep sump catch basins, piping, water quality structures, and piped outfalls and discharged to Salem Harbor. The proposed site design will maintain the existing flow patterns within each laydown area. No additional asphalt is proposed to be constructed beyond the existing limits, and parking lot construction will only entail restriping of existing parking areas. The parking lot runoff flows overland toward an existing catch basin, eventually reaching an existing 48-inch outfall.

With structural stormwater treatment measures in place, the Project will not discharge untreated stormwater into wetlands or waters of the Commonwealth. In this manner, the Project will not adversely affect adjacent parcels or wetlands or waters of the Commonwealth such as direct discharge of untreated stormwater.

Standard 2: Peak Rate Attenuation - Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

Compliance: This Standard is requested to be waived as the Project Site is located within Land Subject to Coastal Storm Flowage per Standard 2. The post-development peak rate comparison to existing rates is not necessary for coastal areas as defined in 310 CMR 10.04.

Standard 3: Recharge - Loss of annual recharge to groundwater shall be eliminated and at a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume in accordance with the DEP Stormwater Handbook.

Compliance: The intent of this Standard is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. Although the existing Project Site contains 4.61 acres of impervious area, there is no infiltration currently provided on-site. The soils are marine clay with historic fill. The Natural Resources Conservation Service classifies marine clay and fill soils into one hydrologic group: Urban Land, with characteristics of D soils with hydric soils and subsoil not practical for infiltration, precluding onsite groundwater recharge, despite the Project increasing impervious area by 3.77 acres.

Standard 4: Water Quality - Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The standard is met with pollution prevention plans, stormwater BMPs sized to capture required water quality volume, and pretreatment measures.

Compliance: This Standard will be met by the Project. The proposed site drainage area will be collected and pretreated through deep sump catch basins with additional treatment provided with proposed water quality structures and an existing water quality structure. These BMPs will remove at least 80% of the total suspended solids (TSS) prior to discharge to Salem Harbor.

Suitable practices for source control and pollution prevention will be identified in a long-term pollution prevention plan, and thereafter implemented and maintained by the property owner.

Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs) - Source control and pollution prevention shall be implemented in accordance with the Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable or provide specific structural BMPs determined by the Department to be suitable for such uses.

Compliance: The Project will not be considered a land use with higher pollutant load.

Standard 6: Critical Areas - Stormwater discharges to critical areas require the use of specific source control and pollution prevention measures and specific structural stormwater best management practices determined by DEP to be suitable for managing discharges to such areas.

Compliance: According to the Massachusetts Year 2018/2020 Integrated List of Waters, Salem Harbor is listed as a category 5 waterway requiring a TMDL with a listed impairment of fecal coliform and Enterococcus. The Project site will not generate impairments subject to TMDL.

Standard 7: A Redevelopment Project is Required to Meet Standards 1-6 only to the Maximum Extent Practicable - Remaining standards shall be met as well as the project shall improve the existing conditions.

Compliance: The Project Site is considered a Redevelopment Project and will meet Standards 1-6 to the maximum extent practicable.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan shall be Implemented.

Compliance: The Construction Pollution Prevention and Erosion & Sedimentation Control Plan will be prepared to address erosion and sedimentation during and after construction. The erosion control measures incorporated into the Project will include the placement of haybale/siltation barriers and the installation of silt sacks in catch basins during the construction period. Erosion control measures will be placed around stockpiles of loose materials. The measures will be inspected and maintained until the disturbed areas are stabilized. In addition, a NPDES Construction General permit will be required with a Stormwater Pollution Prevention Plan (SWPPP) prior to any site construction.

Standard 9: A Long-Term Operation and Maintenance Plan Shall be Implemented.

Compliance: Protocol will be established for the on-site drainage improvements. The goal of the Stormwater Operation and Maintenance Plan is not only to protect off-site wetlands and water resources abutting the Project Site, but also to protect those resources in the region that may be affected by Project-related activities. The proposed site drainage improvements include deep sump catch basins, water quality structures, piped outfalls, and the pipe network. The proposed water quality treatment measures will result in improved removal of the TSS load in runoff from the Project Site for the proposed improvements. An effective stormwater drainage maintenance program will ensure that the removal of TSS from the stormwater runoff continues for the life of the facility by the owner.

Standard 10: Prohibition of Illicit Discharges – Illicit discharges to the stormwater management system are prohibited.

Compliance: Crowley acknowledges that illicit discharges are prohibited and will acknowledge this in the stormwater maintenance procedures and service logs. All outside manholes and access covers will be clearly marked as “drainage” and “sewer” with no unsecured or open access areas.

5.3 WATER SYSTEM

Water consumption on the site is expected to be a maximum of 3,300 gallons per day (gpd), based on the Project's estimated sewage generation and number of full-time employees post-construction. A factor of 1.1 (conservative) is applied to the average daily wastewater flows to estimate average daily water use.

Water is supplied from the water filtration plant in Beverly. There is an existing 16-inch water main within Fort Avenue that currently services the site. The proposed system will have 8-inch" water main diameter loop and fire hydrant branches for fire protection on-site The 8-inch water main has hydrant branches throughout the site for fire protection purposes.

The domestic water service connections are at the loadout wharf and temporary trailers. All domestic connections will have an approved water meter.

5.4 WASTEWATER SYSTEM

The Project's sewage generation rates as presented in Table 5-2, Estimated Sewage Discharge, were estimated using the Massachusetts State Environmental Code (Title V) 310 CMR 15.203. The proposed development will accommodate up to 200 full-time employees on a typical day for peak post-construction operations.

Table 5-2, Estimated Sewage Discharge

Proposed Use	Use Description	Unit Flow (gpd)	Sewage Flow (gpd)
Off-Shore Wind Staging	200 full-time employees	15 gpd / person	3,000 gpd

There is an existing 84-inch gravity intercepting sanitary sewer service main within Fort Avenue. Based on the domestic demand of sewage flow, it is estimated there is sufficient capacity in the existing 10-inch service line. Temporary trailers will be provided with temporary pipe connections for sanitary sewer waste to tie into an existing gravity sewer lateral on-site. Sewage is treated at the adjacent property operated by the South Essex Sewerage District.

5.5 ELECTRICAL AND TELECOMMUNICATION SERVICES

The Project Site is serviceable with electric, telephone, and cable services. The existing overhead electrical power on-site will be removed but the existing underground electric will remain. The proposed underground electrical improvements include the installation of conduits to service new light poles and transformers on-site. All proposed utility connections will be coordinated with each respective utility provider.

5.6 NATURAL GAS SYSTEM

The Project Site does not require natural gas service.

5.7 FLOOD DESIGN AND GRADING

Portions of the Project Site are located within a Zone AE indicating a 1% annual chance flood elevation (i.e., Base Flood Elevation (BFE)) of 10.3 feet NAVD88 (see Figure 1-4, FEMA 100-year Flood Zone Overlay) per Flood Insurance Study by FEMA in 2014. Other portions of the Project Site are mapped as Zone VE at the shoreline. Zone VEs are coastal high hazard areas associated with wave heights of 3 feet or greater. The AE zones within the Project Site are located landward of the Limit of Moderate Wave Action (LiMWA) indicating wave heights of less than 1.5 feet per Figure 3-3.

The Design Flood Elevations (DFEs), as they apply to this project, refer to applicable and appropriate risk-based flood protection elevations and consider the projected useful life of the facility. For buildings and structures subject to state and local building codes, these are typically referenced to the effective FEMA BFE plus freeboard. The specialized use of the facility, which includes extensive laydown and storage of wind turbine components, also has established DFEs that are specific to flood protection of these features and their potential loss due to flooding. There are no established Flood Classes for laydown and storage areas, but these areas will be elevated to meet the requirements on Flood Class 2. To accommodate Flood Class 2, buildings and structures subject to state and local building codes, the minimum required DFE is the Effective FEMA BFE plus 1 foot of freeboard, which is Elevation 11 feet NAVD88.

The existing site grades vary but are typically at approximately Elevation 10 feet NAVD88. The proposed site grade is Elevation 12 feet NAVD88 or higher, with varying slopes throughout towards proposed drainage improvements. This proposed elevation provides a 2-foot freeboard above the current FEMA BFE of Elevation 10 feet NAVD88. Increasing site grades is a mechanism for flood protection, in particular, given the large areas of stored turbine components. The nature of the laydown use of the site also allows for grades to be increased in the future should sea level rise exceed current projections during the lifetime of the facility. The elevation of site grade will also not have any directly adverse effects on adjacent properties, and flood pathways through the Project Site towards adjacent properties will be intercepted. The proposed gradual slope from the shoreline inland will mitigate any potential increases in velocity, reflection, or channelization of floodwaters towards adjacent properties.

5.8 SOIL CONDITIONS AND DESIGN

GZA Environmental, Inc. has performed subsurface geotechnical testing between June and August 2022. They will continue with ongoing assessments in Fall of 2022 and then provide recommendations.

Based on the recent subsoil explorations and ground penetration radar testing performed for this Project, the subsurface conditions consist of urban fill overlying compressible deposits containing organics overlying marine clays and silts. Due to the variable density of the urban fill and the compressible nature of the soils containing organics and marine clay, conventional site clearing and grubbing are not suitable for laydown yards without planned ground improvement to the soils, consisting of 24″ to 60″ depth of dense grade aggregate. The proposed ground improvements in each laydown area are outlined in Table 5-3. The amount of imported dense grade soil material is estimated to be an order of magnitude 100,000 CY for the upland area.

Table 5-3, Proposed Ground Improvements

Location	Proposed Ground Improvement
Laydown Yard A	24″ to 60″ depth of dense grade aggregate
Laydown Yard B	24″ to 48″ depth of dense grade aggregate

Figure 5-1
Stormwater Plan
Source: Fort Point Associates, Inc., 2022

Chapter 6

HISTORIC RESOURCES

CHAPTER 6: HISTORIC RESOURCES

6.1 INTRODUCTION

The City of Salem has an incredible history, including the Salem Witch Trials, the rise and fall of the sea trade, and the City's role in the industrial revolution. Salem's remaining architecture and sites from these various eras reflects the City's rich historical background. Salem Harbor and the areas around the Project Site along Derby Street were historically maritime dating back to the 17^{th} century. The Project will help continue the historic maritime uses and invigorate the Commonwealth's second deepest port.

Inventoried historic buildings and districts discussed herein were identified via Massachusetts Historical Commission's ("MHC's") Massachusetts Cultural Resource Information System ("MACRIS") online database. These buildings and districts are referred to in this chapter by their MHC designations (e.g., SAL.3425).

6.2 HISTORIC AND ARCHAEOLOGICAL RESOURCES IN THE VICINITY

Historic resources were compiled based on the Massachusetts Inventory of Historic and Archeological Assets of the Commonwealth and the State and National Register of Historic Places.

6.2.1 HISTORIC RESOURCE STATUS

There are 394 historic resources within a quarter-mile radius of the Project Site. See Attachment E, Historic Resources within ¼ mile of the Project Site and Figure 6-1, Historic Resources. These resources are composed primarily of buildings, but also include structures and objects. These resources have received the following designations:

- 211 inventoried properties;
- 1 Local Historic District;
- 81 sites listed on the National Register of Historic Places;
- 88 National Register of Historic Places/Local Historic Districts; and
- 13 Preservation Restrictions.

The Project Site is directly across from several sites within the National Register of Historic Places/Local Historic District as part of the Derby Street Historic District. The majority of these sites are single and multi-family dwellings today. Notable locations in close proximity to the Project Site include Memorial Park (SAL.994), located at 17 Fort Avenue, the House of the Seven Gables (SAL.3425), located approximately 0.1 miles from the Project Site at 115 Derby Street, and Nathaniel Hawthorne's Birthplace (SAL.3429), also approximately 0.1 miles from the Project Site.

6.2.2 HISTORIC AREAS STATUS

In addition to historic resources, there are 14 Historic Areas within the quarter-mile boundary. These areas include the following designations:

- 6 inventoried areas;
- 2 Local Historic Districts;
- 1 Preservation Restriction;
- 4 National Register of Historic Places; and
- 1 National Register of Historic Places/Local Historic Districts.

The Project Site is partially within the Derby Street Local Historic District (SAL.HO) and abuts the Derby Waterfront Historic District (SAL.HN), which is on the National Register of Historic Places, and the inventoried area of Salem Neck and Winter Island (SAL.GZ).

6.3 HISTORIC RESOURCES ASSESSMENT

The entire Project Site is adjacent to and surrounded by the Salem Harbor Power Station, a gas-fired electricity generation plant that began operating in 2017 under the name Footprint Power Salem Harbor. This facility replaced the Salem Harbor Generating Station, a retired coal and oil-fired power plant built in the 1950s which encompassed both the current Salem Harbor Power Station and the Project Site. The site was used as a coal terminal for more than 30 years prior to the construction and operation of the power plant. The entire Project Site has been entirely industrial for more than 100 years and has been significantly re-graded and transformed over its history. Because of this, there are no historic resources found on the Project Site. There was a building located on the Project Site that was part of a local historic district, but it was demolished during previous work unrelated to this Project. The other existing buildings currently on the Project Site are various structures from the power plant facility that are no longer being used. These include two shed structures and two transformer buildings, and none of these buildings have historical significance.

Although there are no historic sites or buildings found within the Project Site, a small part of the Project Site next to India Street is partially within the Derby Street Local Historic District

(SAL.HO). This small section contained a building at 65 Derby Street that was also on the National Register of Historic Places (SAL.3396). This building, called the McDonald House, however, was demolished. This local historic district was established in 1974 and is significant to the City of Salem's maritime history. The majority of the historic resources on Derby Street and within the Derby Street Local Historic District across from the Project Site are historic houses from this maritime era, from 1760-1820, that are now single and multi-family residential dwellings. In addition, the House of the Seven Gables and Nathaniel Hawthorne's Birthplace are within this district on Turner Street, and these two sites are within the House of Seven Gables Historic District (SAL.JB).

The Derby Waterfront Historic District (SAL.HN) abuts the western side of the Project Site and also encompasses the Derby Street Local Historic District and the House of Seven Gables Historic District. This area was in the center of Salem's foreign commerce activities and consists of many historical residences, commercial buildings, and other sites that were significant to Salem's economic development from the American Revolution to the 1820s.

Salem Neck and Winter Island (SAL.GZ) is a residential district which abuts the northern side of the Project Site. Salem Neck was the center of the fishing industry in Salem starting in the mid-17th century. The Salem Willows Historic District (SAL.HA) and the Winter Island Historic and Archeological District (SAL.IH) are also within the area of Salem Neck and Winter Island. The Salem Willows area within Salem Neck is a historically residential district developed in the 19th century, and the architecture of the buildings there today reflects that time period. Winter Island was also an important area for Salem's fishing industry and also includes Fort Pickering, which was built in the 17th century and served many purposes, including as a coastal defense post, military barracks, the home of the Frigate Essex, and an aviation fuel depot for the U.S. Coast Guard. This island is located across the water from the northeastern corner of the Project Site.

6.4 STATUS OF PROJECT REVIEW WITH HISTORICAL AGENCIES

6.4.1 SALEM HISTORIC COMMISSION

An application for the Project will be submitted to the Salem Historic Commission ("SHC") in order to seek a demolition delay permit for the demolition of the existing structures on the Project Site from the old Salem Harbor Power Station. These structures are not historically significant.

6.4.2 MASSACHUSETTS HISTORICAL COMMISSION`

The Project will be subject to State Register Review (950 CMR 71) by the MHC. MHC review will be initiated upon the filing of this EENF. MHC's review of the EENF will yield one of three determinations:

- no effect,

- determination of no adverse effect, or
- determination of adverse effect.

An ENF for the construction of the Salem Harbor Power Station was submitted to MHC in 2012, and MHC did not submit any comments to MEPA during the public comment period.

6.5 POTENTIAL IMPACTS TO HISTORIC RESOURCES

6.5.1 DEMOLITION AND ALTERATION OF EXISTING BUILDINGS

The existing transformer stations and shed structures on the Project Site that will be demolished are not historic resources or within historic areas, so any demolition to existing buildings will not impact any registered or inventories historic areas or resources.

6.5.2 VISUAL IMPACTS TO HISTORIC RESOURCES

The Project Site is heavily industrial and has been for many decades, and the Project Site will continue to serve industrial purposes. Although this proposed industrial use is not consistent with the architecture and nature of the nearby historic districts the site itself is also mostly concealed by an existing barrier of vegetation between the Project Site and the bordering roads of Fort Avenue and Derby Street, so the Project Site should not interfere visually with any historic resources and districts.

6.5.3 SHADOW IMPACTS TO HISTORIC RESOURCES

The Project Site will not cause any permanent shadow impacts to nearby historic resources except for the construction of cranes on the Project Site, which may be up to 400 feet tall. Depending upon where these cranes are situated, there may be temporary shadows cast from the cranes onto historic resources on Derby Street, Fort Avenue, or other areas in the mornings in the winter months between the fall and spring equinox.

6.6 ARCHAEOLOGICAL RESOURCES WITHIN THE PROJECT SITE

There is no evidence that the Project Site is likely to have important archaeological resources as the history of the Project Site is largely industrial and the area has been significantly disturbed over the past 70 years.

6.7 UNDERWATER ARCHAEOLOGICAL RESOURCES

Current plans for the Project should not result in excavations that would disturb potential underwater archaeological resources. The Basin has been dredged several times, most recently in 2002, and there has been no previous evidence of underwater archaeological resources. In the 2012 ENF submitted by Footprint Power Salem Harbor, the narrative states that closest underwater archaeological resource to the Project Site is located south next to the pier at Salem Wharf and is outside of the Project Site area. However, the Massachusetts Board of Underwater Archaeological Resources will be notified of the planned work as part of the permitting process prior to construction.

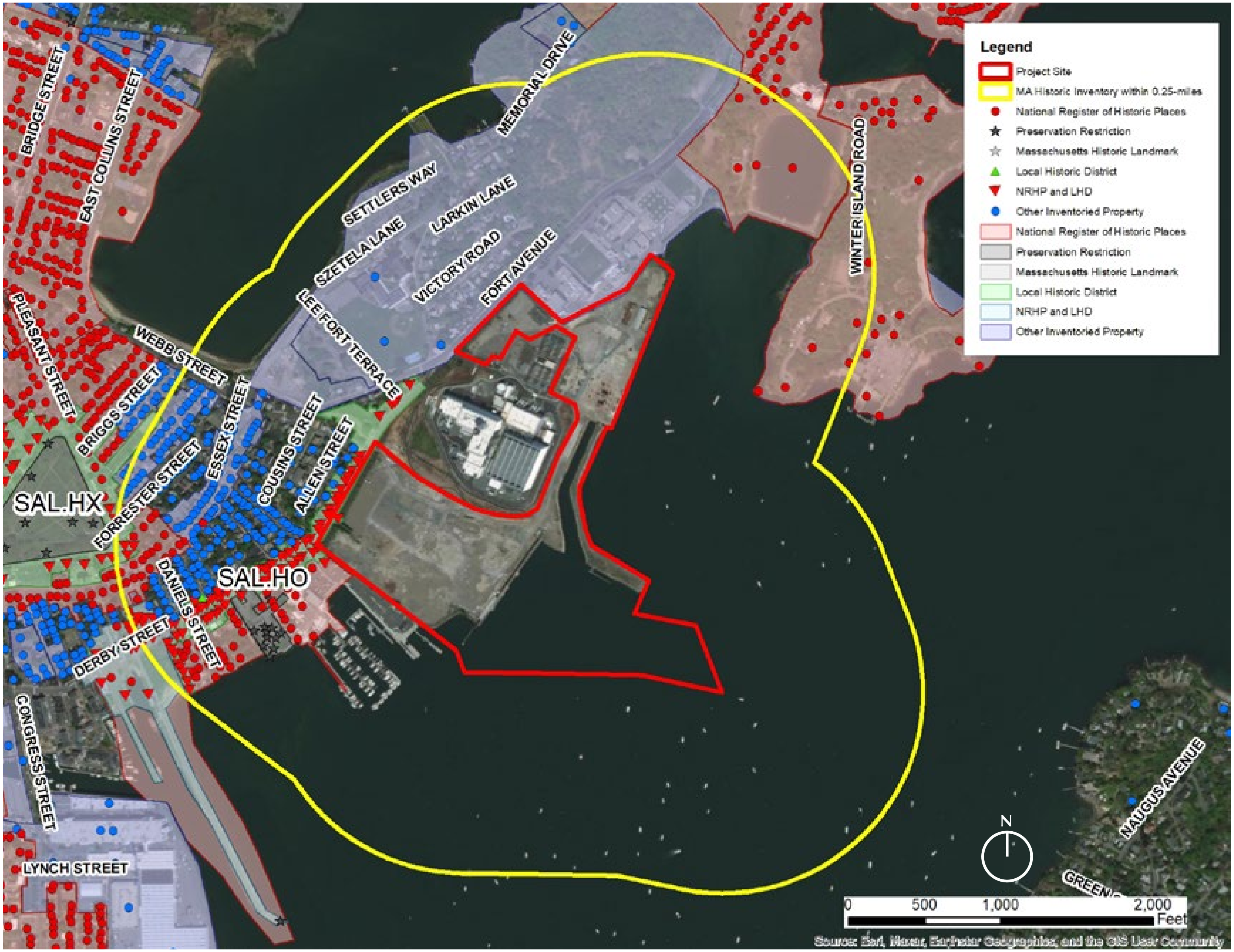


Figure 6-1
Historic Resources
Source: Massachusetts Historical Commission, 2021

Chapter 7

ENVIRONMENTAL JUSTICE

CHAPTER 7: ENVIRONMENTAL JUSTICE

7.1 INTRODUCTION

The Project is in a historically industrial area along the Salem Harbor Waterfront in a DPA. The Project Site is located next to a natural gas-fired power plant that was constructed and began operating in 2017. The Project Site is bordered by a sewage treatment plant to the north. Residential neighborhoods are in proximity to the Project Site on the west side of Derby Street, and the property of Bentley Academy Innovation School borders Fort Avenue, located northwest of the Project Site. The waterside area of the Project Site is located within and adjacent to the state navigation turning basin. The watersheet portion of the Project Site within Salem Harbor is mostly used for recreational and commercial purposes. Salem Wharf is located in Salem Harbor on the southern side of the Project Site, which contains a ferry that travels seasonally between Salem and Boston. The wharf and pier infrastructure currently on the Project Site is in poor condition and not used.

Residential neighborhoods are in proximity to the Project Site on the west side of Derby Street and Fort Avenue, and the Bentley Academy Innovation School is across Fort Avenue, northwest of the Project Site. The closest Environmental Justice (EJ) community is located along Derby Street next to the Project Site and encompasses the Bentley Academy Innovation School and the residential areas along Szetela Lane, Lee Fort Terrace, and Settlers Way. Since the Project does not meet or exceed air quality review thresholds under 301 CMR 11.03(8)(a)-(b) or generate 150 or more new average daily trips of diesel vehicle traffic over a duration of 1 year or more, only the EJ Populations within 1 mile of the Project Site will be included in the evaluation of potential project-related impacts.

The Project includes development of a marshalling terminal that will allow large vessels to deliver WTG components to the Project Site and then assembled on vessels that will transport them to wind farms off the Massachusetts coast. This Project will further the integration of renewable energy into the United States' energy grid, help reduce dependence on polluting fossil fuels, and slow the progression of climate change-related impacts, which are important concerns for traditionally marginalized communities.

7.2 EJ CHARACTERISTICS NEAR THE PROJECT SITE AND OUTREACH EFFORTS

The Project is in proximity to neighborhoods defined as EJ Populations based on the Massachusetts EEA 2020 EJ Map Viewer, which is derived from 2020 Census Block Groups. See Figure 7-1, Environmental Justice Populations,1-Mile. As defined by the Commonwealth, EJ is based on the principle that all people have a right to be protected from environmental hazards and live in and enjoy a clean and healthy environment. EJ is equal protection and meaningful involvement of all people with respect to development, implementation and enforcement of environmental laws, regulations, and policies, as well as the equitable distribution of environmental benefits. Within a 5-mile radius of the Project Site, there are 81 Census block group that trigger five EJ criteria. These criteria include Minority; Income; Income and Minority; Minority and English Isolation; and Minority, Income, and English Isolation (see Figure 7-2, Environmental Justice Populations, 5-Miles). Within a 1-mile radius there are twelve Census block group that trigger four EJ criteria. These criteria include Minority; Income; Income and Minority; and Minority, Income, and English Isolation (see Figure 7-1, Environmental Justice Populations,1-Mile). Since the Proposed Project does not meet or exceed air quality review thresholds under 301 CMR 11.03(8)(a)-(b) or generate 150 or more new average daily trips of diesel vehicle traffic over a duration of 1 year or more, only the EJ Populations within 1 mile of the Project Site will be included in the evaluation of potential project-related impacts.

7.2.1 CHARACTERISTICS OF EJ POPULATIONS

Each of the EJ criteria were evaluated within 1-mile of the Project Site using the EEA Environmental Justice Maps Viewer. The EJ criteria are as follows:

- The annual median household income is not more than 65 per cent of the statewide annual median household income;
- Minorities comprise 40 percent or more of the population;
- 25 percent or more of households lack English language proficiency; or
- Minorities comprise 25 percent or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150 percent of the statewide annual median household income.

EJ Populations within 1-mile of the Project Site meet the following EJ criteria: Minority, Income, Minority and Income, and Minority, Income, and English Isolation. Table 7-1 summarizes their characteristics. Bolded values in the table represent the EJ criteria met for the EJ communities within 1-mile of the Project Site.

Table 7-1, Summary of EJ Characteristics within 1-Mile

Block group (Essex County, Massachusetts)	EJ Criteria	Total Minority Population	Median Household Income	% of MA Median Income	Households with Language Isolation
Block Group 1, Census Tract 2042	Minority and Income	**34.8%**	$42,417	**49.4%**	3.5%
Block Group 1, Census Tract 2046	Minority	**25.8%**	$70,938	**82.6%**	11.9%

Block group (Essex County, Massachusetts)	EJ Criteria	Total Minority Population	Median Household Income	% of MA Median Income	Households with Language Isolation
Block Group 1, Census Tract 2045	Minority	**24.9%**	$101,583	**118.3%**	2.2%
Block Group 2, Census Tract 2042	Minority	**39.0%**	$0	**0.0%**	9.8%
Block Group 2, Census Tract 2043	Minority and Income	**73.5%**	$33,563	**39.1%**	0.0%
Block Group 3, Census Tract 2043	Minority, Income, and English Isolation	**89.0%**	$28,021	**32.6%**	**46.6%**
Block Group 3, Census Tract 2041.01	Minority	**34.7%**	$75,893	**88.4%**	0.0%
Block Group 4, Census Tract 2174	Minority and Income	**35.8%**	$40,476	**47.2%**	0.0%
Block Group 4, Census Tract 2044	Minority and Income	**25.7%**	$53,510	**62.3%**	8.4%
Block Group 4, Census Tract 2046	Minority	**25.6%**	$100,288	**116.8%**	4.9%
Block Group 4, Census Tract 2042	Minority	**47.5%**	$56,346	**65.6%**	0.0%
Block Group 5, Census Tract 2042	Income	3.6%	$54,964	**64.0%**	0.0%

7.2.2 LANGUAGES SPOKEN

Crowley will be working with Community Based Organizations (CBOs) to ensure meaningful engagement with EJ Populations. Crowley has identified languages spoken by 5 percent or more of residents who identify as not speaking English "very well" to conduct public involvement activities. There is one language spoken within the 1-mile radius of the Project Site, which is Spanish or Spanish Creole (Figure 7-3, Languages Spoken). Crowley is committed to conducting written and oral translation and interpretive services in Spanish during community outreach efforts.

7.2.3 EJ SCREENING FORM AND ADVANCED NOTIFICATION

In accordance with 301 CMR 11.05(4) the MEPA EJ Screening Form was sent to the CBOs, tribal groups, and other relevant parties on the MEPA distribution list on August 16, 2022. The distribution list shared by MEPA was expanded upon by the Proponent to include additional CBOs and relevant stakeholders on this advanced notification. The EJ Screening Form was translated into Spanish since this was the only additional language identified to be spoken by 5% or more of the population within 1-mile of the Project Site. See Attachment F, EJ Screening Form Advanced Notification, to see the EJ screening form and the distribution list.

7.2.4 PUBLIC INVOLVEMENT ACTIVITIES

In accordance with MEPA Public Involvement Protocol for Environmental Justice Populations, Crowley has been conducting formal and informal community processes with permitting agencies, neighboring residents, and a variety of advocacy groups since the beginning of 2022. This effort is detailed in Table 7-2 below.

Table 7-2, Environmental Justice Population, Community, and Community Outreach Efforts

Date	Participants	Description
February 2, 2022	Project Team and Salem Rotary Club	Introductory Meeting with the Salem Rotary Club
May 25, 2022	Salem Chamber of Commerce	Introductory Meeting with the Salem Chamber of Commerce
May 25, 2022	Project Team and Derby Street Neighborhood residents	Derby Street Neighborhood Meeting
June 14, 2022	Project Team and Willows Neighborhood residents	Willows Neighborhood Meeting
June 15, 2022	Project Team and Salem City Council	City Council Update
June 16, 2022	Project Team and the City of Salem	Charrette/design meeting with the City of Salem
June 16, 2022	Project Team and the Town of Marblehead	Meeting with the Town of Marblehead
June 22, 2022	Project Team and members of the public	Public Meeting: Kickoff and Introduction*
June 27, 2022	Project Team and Point Neighborhood residents	Point Neighborhood Meeting*

July 19, 2022	Project Team, Salem Conservation Commission, and members of the public	Request for Determination of Applicability for Geotechnical Borings and Dredge Sampling
July 27, 2022	Project Team and the MA Executive Office of Energy and Environmental Affairs	EOEEA Briefing
August 9, 2022	Project Team and the MEPA Office	MEPA Pre-Filing Meeting
September 8, 2022	Project Team and Salem Alliance for the Environment (SAFE)	Meeting about the Project with SAFE
September 14, 2022	Project Team and Salem Neighborhood Improvement Advisory Council	Meeting about the Project with the Salem Neighborhood Improvement Advisory Council
September 15, 2022	Project Team and the City of Salem	Charrette/design and community outreach meeting with the City of Salem
September 16, 2022	Project Team and The Salem Partnership	Meeting about the Project with The Salem Partnership

*Spanish translation services were provided

7.3 ASSESSMENT OF EXISTING UNFAIR OR INEQUITABLE BURDEN HEALTH CRITERIA

The Proponent has utilized additional resources through the Massachusetts Department of Public Health (MassDPH) EJ Tool to determine other potential sources of pollution within the boundaries of EJ communities. The MassDPH EJ Tool exhibits four vulnerable health criteria. These criteria include Heart Attack Hospitalization per 10,000, Pediatric Asthma Emergency Department (ED) Visits Rate per 10,000, Elevated Blood Lead Prevalence per 1,000, and Low Birth Weight per 1,000. Elevated Blood Lead Prevalence per 1,000 and Low Birth Weight per 1,000 are derived from 2010 census tract data. EJ communities within these vulnerable health areas could be viewed as exhibiting vulnerable health EJ criteria and therefore potentially bearing an unfair or inequitable environmental burden and related public health consequences. The EJ criterion is met if local levels are equal to or greater than 110% of the state prevalence.

7.3.1 HEART ATTACK (MUNICIPALITY)

According to MassDPH, heart attack hospitalization is a criterion used to identify EJ Populations with vulnerable health characteristics because exposure to air pollution can increase the risk for heart attack and other forms of heart disease, and it is indicative of a serious chronic illness that can lead to disability, decreased quality of life, and premature death. Individuals living in EJ areas with higher-than-average heart attack hospitalization rates may be more vulnerable to adverse environmental exposure. The City of Salem does not meet the vulnerable health criteria for heart attack rates. Salem has an age adjusted rate of 23.6 Heart Attacks per 10,000 with 61.4 case counts from 2013 – 2017, while the Massachusetts statewide rate is higher at 26.4 per 10,000.

7.3.2 CHILDHOOD ASTHMA (MUNICIPALITY)

According to MassDPH, childhood asthma is a criterion used to identify vulnerable health EJ Populations because people of color and low-income individuals are at an increased risk for asthma exacerbations due to increased exposure to asthma triggers, and uncontrolled asthma can impact an individual's overall health and wellbeing. Asthma has been directly linked to air pollution, exposure to environmental contaminants, and poor housing conditions. The City of Salem meets this vulnerable health criteria, with a crude rate of 102.7 Pediatric Asthma ED Visits per 10,000 with 43.8 case counts from 2013 -- 2017. The Massachusetts statewide rate was 83.1 Pediatric Asthma ED Visits per 10,000.

7.3.3 CHILDHOOD BLOOD LEAD (CENSUS TRACT)

According to MassDPH, childhood lead exposure is used to identify vulnerable health EJ Populations because lead exposure disproportionately affects lower income communities and communities of color. Childhood exposure to relatively low levels of lead can cause severe and irreversible health effects, including damage to a child's mental and physical development. Within 1-mile of the Project Site, four census tracts are triggered for having Elevated Blood Lead Presence with a total of 12 cases from 2015-2019. The Massachusetts statewide rate was 16.1 per 1,000. Census Tracts with higher-than-average elevated blood lead prevalence rates are included in Table 7-3, Elevated Blood Lead Prevalence Per 1,000, 2015 – 2019.

Table 7-3, Elevated Blood Lead Prevalence Per 1,000, 2015 – 2019

2010 Census Tract	Community Case Count	Statewide Rate per 1,000	Community Rate per 1,000
25009204200	2.6	16.1	26.5
25009204400	1.4	16.1	25
25009204500	3.2	16.1	42.2
25009204600	4.8	16.1	33.6
Total	12		

Massachusetts Department of Public Health – Bureau of Environmental Health, 2022

7.3.4 LOW BIRTH WEIGHT (CENSUS TRACT)

According to MassDPH, low birth weight (LBW) is a criterion used to identify vulnerable health EJ Populations because exposure to environmental contaminants can increase the chance of delivering a LBW baby, and LBW is a significant indicator of both infant and maternal health. Women of color and women of low income have a higher risk of delivering a LBW baby. LBW can increase the risk of infant mortality and morbidity, childhood health issues, developing cognitive disorders, developmental delay, and chronic diseases as an adult such as cardiovascular diseases and type 2 diabetes. Within 1-mile of the Project Site, two census tracts were triggered for being LBW vulnerable with a total of 2.9 cases from 2011-2015. The Massachusetts statewide rate was 216.8 per 1,000. Census Tracts with LBW rates are included in Table 7-4, Low Birth Weight Rate Per 1,000, 2011 – 2015.

Table 7-4, Low Birth Weight Rate Per 1,000, 2011 – 2015

2010 Census Tract	Community Case Count	Statewide Rate per 1,000	Community Rate per 1,000
25009204300	1.8	216.8	362.9
25009204500	1	216.8	308.6
Total	2.9		

Massachusetts Department of Public Health – Bureau of Environmental Health, 2022

7.3.5 OTHER POTENTIAL SOURCES OF POLLUTION

The Project Site is surrounded by the Salem Harbor Power Station, a natural gas-fired power plant. This power plant contributes to the existing pollution levels in the area surrounding the Project Site. The Proponent has also consulted the MassDPH EJ Tool to survey other potential sources of pollution within the boundaries of the EJ Populations. Within approximately 1-mile of the Project Site, there is: one Large Quantity Toxic User, one Toxics Release Inventory site, two Large Quantity Generators, ten M.G.L. c. 21E Sites, eleven Tier II Toxics Use Reporting Facilities, 35 MassDEP Sites with AULs, and six Underground Storage Tanks. On the Project Site, there is also one Air Operating Permit and one of the two Large Quantity Generators associated with the Salem Harbor Power Station. The Project Site is served by the multiple modes of transportation provided by the Massachusetts Bay Transportation Agency (MBTA). Within a mile of the Project Site, there are 45 MBTA bus stops, and there is a commuter rail line connecting Salem to Boston's North Station. There is also Salem Wharf located directly adjacent to the southern side of the Project Site, which contains a ferry that runs between Boston and Salem during the summer season.

7.3.6 ENVIRONMENTAL PROTECTION AGENCY ENVIRONMENTAL JUSTICE SCREEN

The Proponent also consulted the U.S. EPA's EJ Screen tool, which provides percentile ranking by census block group, compared against statewide averages, for 11 environmental indicators. The Proponent used the environmental indicators to assess potential environmental exposures that may further create unfair or inequitable environmental burdens on EJ Populations near the Project Site.

The EJ Screen assessed a 1-mile radius around the Project Site and reported an approximate population of 15,024 people (Attachment G, EPA EJ Screen Report). For Massachusetts, the Project Site falls within the 40^{th} percentile for Particular Matter (PM2.5) at 6.58 ug/m^3, the 62^{nd} percentile for Ozone at 39.7 ppb, the 63^{rd} percentile for Diesel PM at 0.292 ug/m^3, the 56^{th} percentile for Air Toxics Cancer Risk at 20 lifetime risk per million, the 81^{st} percentile for Air Toxics Respiratory HI at 0.3, the 86^{th} percentile for Traffic Proximity with 3,800 daily vehicles/meter, the 83^{rd} percentile for Lead Paint with 0.8 = fraction pre-1960, the 83^{rd} percentile for Superfund Proximity with 0.22 sites/km, the 70^{th} percentile for RMP Facility Proximity with 0.79 facilities/km, the 80^{th} percentile for Hazardous Waste Proximity with 6.4 facilities/km, the 67^{th} percentile for Underground Storage Tanks with 3.2 counts/km^2 and the 38^{th} percentile for the Wastewater Discharge with 0.00028 toxicity weighted concentration/meter.

7.4 ANALYSIS OF PROJECT IMPACTS TO DETERMINE DISPROPORTIONATE ADVERSE EFFECTS

7.4.1 NATURE AND SEVERITY OF PROJECT IMPACT

There may be potential temporary air quality and landscape impacts during the construction of the terminal and its components. These temporary impacts may include dust from demolition and site excavation and emissions from construction equipment, increased vehicular traffic to and from the Project Site, and building, road, and harbor construction and renovation. Crowley will follow local construction regulations and best practices to minimize these air quality impacts in the surrounding community.

To avoid or minimize the effects of fugitive dust and exhaust emissions from construction vehicles, appropriate mitigation measures will be employed, such as the use of diesel retrofitted equipment and wetting down areas during construction. To avoid, mitigate, or minimize temporary construction-period noise pollution impacts, the Project will comply with the City of Salem Noise Control Ordinance. Efforts will be made to minimize the noise impact of construction activities, including appropriate mufflers on all equipment such as air compressors and welding equipment, maintenance of intake and exhaust mufflers, turning off idling equipment, replacing specific operations and techniques with less noisy ones, and other appropriate noise reduction measures. Construction management and scheduling will minimize impacts on the surrounding environment and will include plans for construction worker commuting, routing plans for trucking and deliveries, and control of noise and dust in a comprehensive construction management plan. Designated truck routes will be established to govern where construction trucks access and egress the Project Site to minimize construction related traffic. The contractor will use BMPs for upland and in-water work as necessary, such as turbidity curtains, time of year restrictions, and slow start pile driving to minimize noise.

The Project is not expected to result in potential permanent adverse environmental or public health impacts that may affect EJ populations.

7.4.2 COMPARABLE IMPACTS ON ENVIRONMENTAL JUSTICE AND NON-ENVIRONMENTAL JUSTICE POPULATIONS

The Project Site is not located within an EJ community, but there are both EJ and Non-EJ populations within a 1-mile radius of the Project Site. However, the associated impacts from the construction and operation of the Project Site once completed would have a similar impact on both EJ and Non-EJ communities. Mitigation efforts, which are described in further detail in Chapter 9: Mitigation, will benefit both EJ and Non-EJ communities. The associated economic benefits from increased jobs and economic activity in Salem Harbor would also bring similar benefits to EJ and Non-EJ communities.

7.4.3 PROJECT BENEFITS

The development of the Project Site will turn a large, vacant, and underutilized portion of Salem’s waterfront into a productive and viable terminal that will replace dilapidated structures with a new and modern facility, which is being designed to last 50 years or more. The Project will improve the existing wharf infrastructure and raise certain existing portions of the Project Site an additional two feet to 12 feet NAVD88 so that flooding and sea level rise concerns are addressed. The new stormwater drainage system will improve the water quality and habitat of Salem Harbor, which is enjoyed by all those the recreate on and along this valuable community resource.

The Project is also expected to create approximately 100 full-time jobs during the approximately 2-year construction period and approximately 200 full time jobs when the operation begins. Major efforts are being undertaken to create training programs for the OSW workforce within the community. The Proponent aims to work with local colleges, non-profits, and academies to provide Global Wind Offshore certified training and commit to fair and safe work practices. Increasing employment opportunities within Salem will bring benefits to both EJ and Non-EJ communities.

This Project is a major next step for increasing OSW energy in the Commonwealth and for the country as a whole to reduce dependence on fossil fuels and its associated impacts on climate, the environment, and public health. Clean renewable energy is an environmental benefit as defined by 301 CMR 11.02, and while there will not be renewable energy directly produced on the Project Site, the wind terminal marshaling and construction services on the site will be an important part in meeting the state's renewable energy targets and achieving this environmental benefit, both for EJ and Non-EJ communities.

7.5 ANALYSIS OF PROJECT IMPACTS TO DETERMINE CLIMATE CHANGE EFFECTS

7.5.1 RMAT TOOL IDENTIFIED RISKS

The Proponent examined the Resilient MA Action Team Climate Resilience Design Standards Tool (RMAT Tool) to determine if the Project Site and nearby EJ Populations are at a potentially greater risk of increased flooding, storm surge, and extreme precipitation due to climate change. The RMAT Tool integrates statewide climate change projections into conceptual planning and design of project with physical assets to help inform and guide planning and design of infrastructure. See Attachment H for the RMAT Tool Report.

According to the RMAT Tool, the Project Site is at high risk of sea level rise and storm surge over the Project's expected life of approximately 30 years. The site is currently exposed to the 1% annual coastal flood event per the FEMA FIRM, and the site is located within the 0.1% annual coastal flood event within the Project's useful life.

Rainfall is expected to increase at the site, as an accelerated trend in precipitation events has been measured in recent decades for the Northeastern United States. The Project Site is classified as being moderately exposed to precipitation-related urban flooding over its expected lifetime because maximum annual daily rainfall exceeds 10 inches over the course of the Project's useful life, and existing imperious area at the Project Site is greater than 50%.

The Project Site is classified as having a high exposure to extreme heat due to expected changes in future climate conditions. It is expected that there will be a 10-30 day increase in the number of days with temperatures over 90 degrees Fahrenheit within the Project's useful life.

While the RMAT Tool provides important information about future climate conditions, the tool is not entirely accurate for existing and proposed conditions of the Project Site. The existing flood zone has changed as the Site has been regraded in recent years, so the current FEMA Firm flood zone, which shows the entire Project Site in the floodplain, no longer applies. The most recent FEMA report, which was produced in 2014, delineates Flood Zone AE up to Elevation 10 within the site. While this contained most of the site in 2014, the site has been elevated since the publishing of this report, limiting the flood zone effectively to a portion of the site closer to the shoreline. In addition, the elevation of the Project Site will be raised an additional two feet as part of the Project, which will help mitigate the impacts of sea level rise, storm surge, and flooding as identified in the RMAT Tool.

7.5.2 CLIMATE ADAPTATIONS

Rising sea levels are expanding the floodplain and an increase in the frequency and intensity of storm events leads to heightened flood risk in the City of Salem. The City expects to see up to a 5.4-inch increase in rainfall through 2050 and increased temperatures. The Project is adapting to future sea level rise and storm events by increasing the elevation of the Project Site to 12 feet NAVD88, which is two feet higher than the existing BFE. Landscape berms will also be incorporated on the Project Site to reduce flood risk to the surrounding neighborhood, including nearby EJ populations.

The Project Site is one of two flood pathways to Derby Street, which represents a flood risk to residents and other buildings on Derby Street and surrounding neighborhoods. Because of the Project Site's location on a peninsula and its existing conditions, it is difficult to adapt the Project Site to entirely prevent the effects of offsite flooding and coastal storm surge. The design and function of the Project Site will keep this in mind by having non-critical equipment and utilities away from potential flooding and storm surge areas to the maximum extent practicable. The equipment that will be stored on the Project Site does not need to be protected from flooding, so the use of the Project Site is resilient to future climate change and is able to adapt to potential flooding and storm surge. In addition, the Project Site can be adaptable to future flooding and sea level conditions and, if necessary, additional fill can be added to raise the elevation of the Project Site.

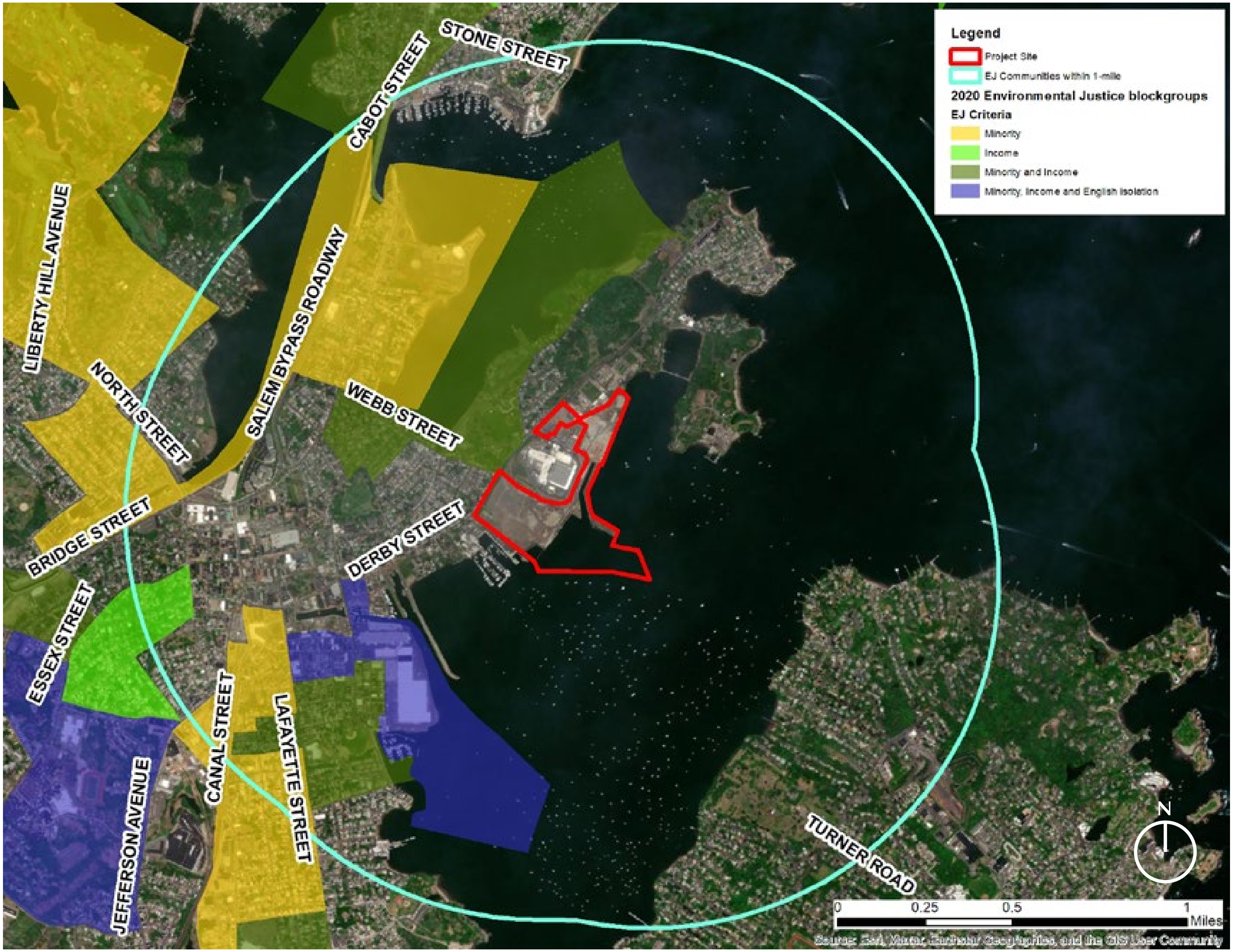


Figure 7-1
Environmental Justice Populations, 1-mile
Source: MA Executive Office of Energy and Environmental Affairs, 2020

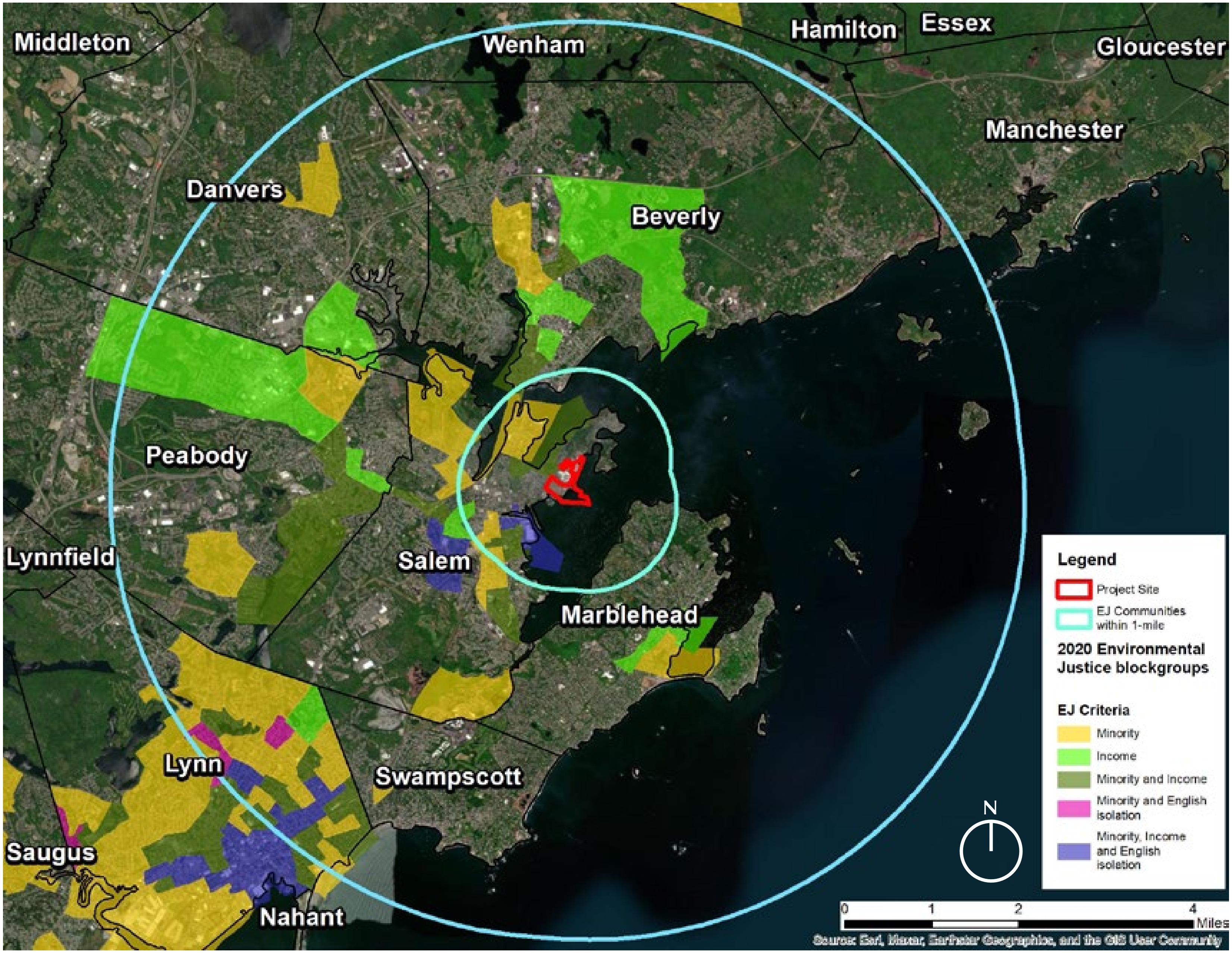


Figure 7-2
Environmental Justice Populations, 5-miles
Source: MA Executive Office of Energy and Environmental Affairs, 2020

Figure 7-3
Languages Spoken
Source: MA Executive Office of Energy and Environmental Affairs, 2020

Chapter 8

TRANSPORTATION

CHAPTER 8: TRANSPORTATION

8.1 INTRODUCTION

MDM Transportation Consultants, Inc. (MDM) has prepared this traffic impact assessment (TIA) for the Project to be located at 67 Derby Street in Salem, Massachusetts. The location of the Site relative to adjacent roadways is shown in Figure 8-1, Site Location. This TIA documents baseline traffic conditions along major roadways providing access to the Site, estimates traffic generation characteristics of the proposed facility during the peak construction activity period and under post-construction operating conditions, and provides a qualitative assessment of traffic impacts relative to baseline conditions. Access/egress improvements, elements of a transportation demand management plan (TDM), and framework for a construction management plan (CMP) are also identified to support the proposed operational needs of the facility while minimizing impact to adjacent roadways.

Key findings of the traffic assessment are as follows:

- **Baseline Traffic Volumes.** The weekday daily traffic volume on Fort Avenue adjacent to the Site is approximately 3,230 vehicles per day (vpd) on a weekday. Peak hour traffic flow on Fort Avenue ranges from approximately 198 to 314 vehicles per hour (vph) representing 6 to 10 percent of daily traffic flow. Vehicle flow patterns are oriented southbound in the morning and northbound in the evening, indicative of commuter travel.

- **Trip Generation – Peak Construction Activity.** Construction activity at the Site will include approximately 200 workers at the peak of construction with activity significantly lower during the beginning and end of the construction period. The construction period is a temporary condition (18 months) that will generate traffic on area roadways associated with construction worker and truck related trips. Much of the marine construction work and all of the dredging activities will take place from barges, and materials will be supplied by water. Accordingly, on-road truck traffic to/from the Site will be limited to aggregate, concrete, and similar building materials at much smaller volume that would otherwise occur without the barge operations. Under the peak construction activity scenario, the facility is conservatively estimated to generate approximately 150 entering vehicle trips during the weekday morning period and 150 exiting vehicle trips during the weekday evening period. These trips levels are expected to occur at the height of construction activity prior to typical commuter travel periods and do not account for carpooling, other alternative travel modes, and staggered work hours which may reduce actual vehicle demands at peak construction.

- **Trip Generation – Typical Post-Construction Operations.** New traffic generated by the project following the construction period is estimated to reflect typical/average employment levels at the facility. Trips for this scenario are estimated using trip rates published in ITE's Trip Generation for Land Use Code (LUC) 170 – Utility applied to 114 full time equivalent employees. Based on ITE, the proposed facility is estimated to generate approximately 82 vehicle trips during the weekday morning peak hour, 86 vehicle trips during the weekday evening peak hour, and approximately 440 (two-way) vehicle trips on a weekday.

- **Adequate Roadway Capacity & Operations.** Relative traffic increases for the Project during the peak of construction and operations of the facility as the Salem Wind Port represents an inconsequential change in area roadway volumes - a level of change that will be adequately accommodated below roadway capacity with LOS C or better operations expected at key "gateway" intersections serving the Site.

In summary, MDM finds that incremental traffic associated with the proposed development is not expected to materially degrade operating conditions at the study intersections once operational or during the construction period. Consequently, no off-site roadway improvements are warranted to accommodate the development project during the construction period or following full operation of the terminal. Recommended access/egress improvements, elements of a TDM program, and framework for a future CMP will support the proposed operational needs of the facility while minimizing on-site and adjacent roadway impacts.

8.2 PROJECT DESCRIPTION

The Project Site is an approximate 42.3-acre tract of land located at 67 Derby Street in Salem, Massachusetts. The Site was historically part of the Salem Harbor Power Station and is currently an undeveloped parcel adjacent to and surrounding the Power Station. The Project will serve to support the operation of OSW turbine assembly and transport with projected employment levels of up to 60 persons on non-vessel days and up to 200 persons on vessel days with a typical day operation of 114 FTE employees. Construction-period employment is estimated at 200 persons at the peak of construction. The preliminary Site layout sketch prepared by Fort Point Associates is presented in Figure 8-2, Preliminary Site Layout.

8.3 BASELINE TRAFFIC & SAFETY CHARACTERISTICS

This section provides a description of study area roadways as well as an overview of roadway traffic volumes, alternative transportation facilities, and intersection crash history are provided below.

8.3.1 ROADWAYS

Fort Avenue

Fort Avenue is classified by the Massachusetts Department of Transportation (MassDOT) as an Urban Collector roadway under Local (City) Jurisdiction. Fort Avenue is generally a northeast- southwest roadway in the project area which connects Webb Street to the southwest with Bay View Avenue to the northeast. The roadway in the immediate project area provides one lane of travel in each direction. The posted speed limit is 25 miles per hour northbound and 30 mph southbound. Sidewalks are provided along the northern side of Fort Avenue and a bike cycle track is provided along the southern side of Fort Avenue adjacent to the Site. Land use along Fort Avenue in the immediate project area include a mix of land uses including residential homes, a fire station and a park, a school, the Salem Harbor Power Station, and a sewage facility.

Derby Street

Derby Street is classified by the Massachusetts Department of Transportation (MassDOT) as an Urban Minor Arterial roadway under Local (City) Jurisdiction. Derby Street is generally a north-south roadway in the project area which connects Washington Street to the south with Fort Avenue to the north. The roadway in the immediate project area provides one lane of travel in the eastbound direction with a posted speed limit of 20 mph. Within the study area, sidewalks are provided along both sides of Derby Street and a bike cycle track is provided along the eastern side of the roadway between Webb Street and Fort Avenue. Land use along Derby Street in the immediate project area include the Salem Harbor Power Station, residential homes, and a park.

Webb Street

Webb Street is classified by the MassDOT as an Urban Minor Arterial roadway under Local (City) Jurisdiction. Webb Street is generally an east-west roadway in the Project area which connects Bridge Street to the west with Fort Avenue to the east. The roadway in the immediate project area provides one lane of travel in each direction. The posted speed limit is 25 miles per hour in both directions. Sidewalks are provided along both sides of Webb Street. A multi-use path is also provided proximate and parallel to Webb Street between Derby Street and Bridge Street. Land uses along Webb Street include a mix of land uses including residential homes, a beach, commercial properties, a park, and the Salem Harbor Power Station.

8.3.2 BASELINE TRAFFIC DATA

8.3.2.1 BASELINE TRAFFIC DATA

Traffic-volume data used in this study were obtained by mechanical and manual methods in September 2022. Automatic traffic recorder counts (ATRs) were conducted along Fort Avenue while manual turning movement counts (TMCs) were conducted at the existing study intersections. Traffic data were collected during the weekday morning (6:00 to 9:00 AM) and weekday evening (3:00 to 6:00 PM) peak periods. These hours represent the combination of busiest activity periods of the Site and adjacent roadway network. A review of MassDOT permanent count station data for the area indicated that September represents average traffic month conditions. Review of historical traffic data also indicates that traffic volumes have rebounded to normal compared to pre-Covid-19 pandemic conditions; therefore, no seasonal or pandemic adjustment of the data was required. The weekday morning and weekday evening peak hour traffic volumes for the study intersections are shown in Figure 8-3*,* 2022 Baseline Condition, Weekday Morning Peak Hour Volumes and Figure 8-4*,* 2022 Baseline Condition, Weekday Evening Peak Hour Volumes. Traffic count data, MassDOT permanent count station data, and pandemic adjustment calculations are provided in Attachment I, Transportation Attachments.

8.3.2.2 BASELINE TRAFFIC DATA

Traffic-volume data used in this study were obtained using an ATR along Fort Avenue to the north of Derby Street over a 24-hour period in September 2022. These data are summarized in Table 8-1.

Table 8-1, Baseline Traffic Volume Summary – Fort Avenue North of Derby Street

Time Period	Daily Volume (vpd)[1]	Percent Daily Traffic[2]	Peak Hour Volume (vph)[3]	Peak Flow Direction[4]	Peak Hour Directional Volume (vph)
Weekday Morning Peak Hour	3,230	6%	198	53% SB	105
Weekday Evening Peak Hour	3,230	10%	314	55% NB	174

[1]Two-way daily traffic expressed in vehicles per day without adjustment.
[2]The percent of daily traffic that occurs during the peak hour.
[3]Two-way peak-hour volume expressed in vehicles per hour.
[4]NB = Northbound, SB = Southbound

As summarized in Table 8-1, the weekday daily traffic volume on Fort Avenue near Derby Street is approximately 3,230 vehicles per day (vpd) on a weekday. Peak hour traffic flow on Fort Avenue ranges from approximately 198 to 314 vehicles per hour (vph) representing 6 to 10 percent of daily traffic flow. Vehicle flow patterns are oriented southbound in the morning and northbound in the evening, indicative of commuter travel.

8.3.3 INTERSECTION CRASH HISTORY

In order to identify crash trends and safety characteristics for Project area intersections, crash data were obtained from MassDOT for the City of Salem for the five-year period covering 2017-2021 (the most recent full year of data currently available from MassDOT). A summary of the crash data with crash rates for the Project area intersections with reported crashes is provided in Table 8-2 with detailed data provided in Attachment I, Transportation Attachments.

Crash rates were calculated for the study intersections as reported in Table 8-2. These rates quantify the number of crashes per million entering vehicles. MassDOT has determined the official District 4 (which includes the City of Salem) crash rate to be 0.73 for signalized intersections and 0.57 for unsignalized intersections. This rate represents MassDOT's "average" crash experience for District 4 communities and serves as a basis for comparing reported crash rates for the study intersections. Where calculated crash rates notably exceed the district average, some form of safety countermeasures may be warranted. A review of Highway Safety Improvement Project (HSIP) locations was also conducted.

Table 8-2, Intersection Crash Summary (2017 Through 2021)[1]

	Study Location				
Data Category	Bridge Street at Essex Bridge	Bridge St at Sgt James Dr	Bridge St at Webb St	Webb St at Essex St	Fort Ave at Derby St
Traffic Control	Signalized	Signalized	Signalized	Signalized	Unsignalized
Crash Rate[2]	0.26	0.17	0.12	0.81	0.25
MassDOT Avg. Rate[3]	0.73	0.73	0.73	0.73	0.57
Year:					
2017	2	0	2	3	0
2018	3	3	0	4	1
2019	5	4	0	1	0
2020	2	1	1	1	0
2021	2	0	1	3	1
Total	**14**	**8**	**4**	**12**	**2**
Type:					
Angle	1	3	1	10	1
Rear-End	10	3	3	0	1
Head-On	1	0	0	1	0
Sideswipe	0	2	0	1	0
Single Vehicle	1	0	0	0	0
Other/Unknown	1	0	0	0	0
Severity:					
P. Damage Only	9	5	3	7	1
Personal Injury	5	3	1	5	1
Fatality	0	0	0	0	0
Conditions:					
Dry	10	7	2	11	2
Wet	2	1	2	0	0
Snow	0	0	0	1	0
Not Reported/Other	2	0	0	0	0
Time:					
7:00 to 9:00 AM	3	1	1	0	0
4:00 to 6:00 PM	5	2	1	2	1
Rest of Day	6	5	2	10	1

[1]Source: MassDOT Crash Database
[2]Crashes per million entering vehicles
[3]District 4 Average Crash Rate

As summarized in Table 8-2

- *Bridge Street at Essex Bridge/Sgt. James Ayube Memorial Drive*. Fourteen (14) crashes were reported for the Bridge Street/Sgt. James Ayube Memorial Drive intersection resulting in a crash rate of 0.26, which is well below the MassDOT District 4 average of 0.73. The reported crashes included one (1) angle/sideswipe type collisions, ten (10) rear-end type collision, one (1) head-on type collisions, one (1) single vehicle type collision and one (1) not reported. The majority (64%) of the crashes resulted in personal injury type collision with the majority (71%) of the crashes under dry roadway. No fatalities were reported during the study period.

- *Bridge Street at Sgt. James Ayube Memorial Drive/Apartment Driveway*. Eight (8) crashes were reported for the Bridge Street/Sgt. James Ayube Memorial Drive/Apartment Driveway intersection resulting in a crash rate of 0.17, which is well below the MassDOT District 4 average of 0.73. The reported crashes included five (5) angle/sideswipe type collisions and three (3) rear-end type collisions. The majority (63%) of the crashes resulted in personal injury type collision with the majority (88%) of the crashes under dry roadway. No fatalities were reported during the study period.

- *Bridge Street at Webb Street*. Four (4) crashes were reported for the Bridge Street/Webb Street intersection resulting in a crash rate of 0.12, which is well below the MassDOT District 4 average of 0.73. The reported crashes included one (1) angle/sideswipe type collisions and three (3) rear-end type collisions. The majority (75%) of the crashes resulted in personal injury type collision with half (50%) of the crashes under dry roadway. Two of the reported crashes involved pedestrians in crosswalks. No fatalities were reported during the study period.

- *Webb Street at Essex Street*. Twelve (12) crashes were reported for the Webb Street/Essex Street intersection resulting in a crash rate of 0.81, which is slightly above the MassDOT District 4 average of 0.73. The reported crashes included eleven (11) angle/sideswipe type collisions and one (1) head-on type collision. The majority (58%) of the crashes resulted in personal injury type collision with the majority (92%) of the crashes under dry roadway. No fatalities were reported during the study period.

- *Fort Avenue at Derby Street*. Two (2) crashes were reported for the Fort Avenue/Derby Street intersection resulting in a crash rate of 0.25, which is well below the MassDOT District 4 average of 0.57. The reported crashes included one (1) angle/sideswipe type collisions and one (1) rear-end type collision. One (50%) of the crashes resulted in personal injury type collision with both (100%) of the crashes under dry roadway. No fatalities were reported during the study period.

In summary, all of the study intersections, with the exception of Webb Street at Essex Street, experienced crash rates that were below the MassDOT District 4 average and none of the intersections are listed by MassDOT as HSIP crash locations. No fatalities were reported during the study period. No immediate safety countermeasures are warranted based on the crash history at the study intersections.

8.3.4 ALTERNATIVE TRANSPORTATION FACILITIES

The Massachusetts Bay Transportation Authority (MBTA) operates the Newburyport/ Rockport commuter rail with a stop at the Salem Depot Station located approximately one mile from the Project Site. Additionally, the MBTA operates bus routes within the City of Salem with the closest bus stop to the Site located approximately ¾ of a mile away on Route 451 North Beverly Station – Salem Depot route. Specific route and schedule information is provided in Attachment I, Transportation Attachments**.** The Salem Wharf is located on the west side of the Project Site in Salem Harbor, where a seasonal ferry operates between Salem and Boston.

Adjacent to the Site, there is an existing bike cycle track along Derby Street and Fort Avenue extending from Webb Street to Columbus Avenue. Likewise, a multi-use path is also provided proximate and parallel to Webb Street between Derby Street and Bridge Street. There are sidewalks along the western side of Fort Avenue, both sides of Derby Street, and both sides of Webb Street. The existing local sidewalk system provides connections to the extensive sidewalk system and bikeways in the study area.

8.4 CONSTRUCTION PERIOD TRAFFIC VOLUMES

The construction period is a temporary condition that will generate traffic on area roadways associated with employee and truck related trips. The following is a summary of the expected impacts of construction traffic and measures to be used to reduce any potential negative impacts during the construction period. Once the Site is constructed, the traffic for the Project will be associated with day-to-day operations of the Salem Offshore Wind Terminal. Much of the marine construction work and all of the dredging activities will take place from barges and materials will be supplied by water.

The construction activity at the Site is anticipated to typically occur outside the peak commuter travel periods. However, to present a conservative analysis basis, this evaluation assumes that employee activity occurs concurrently with the peak of the area roadways. Construction worker parking is anticipated to be established in a designated area on-site with access/egress exclusively via the existing Fort Avenue driveway that serves the Salem Harbor Power Station.

Construction activities generating traffic will primarily be limited to Site preparation and pier construction. Activity on Fort Avenue and Derby Street may include construction at/near the Site driveways and necessary utility work. It is anticipated that traffic patterns on Fort Avenue will be maintained during construction and that no roadway closures or detours will be required during the construction period.

Crowley will establish truck routes that include Route 114, Bridge Street, and Webb Street which will serve as the sole access/egress gate for trucks and material. Construction staging areas will be provided entirely on-site for all material deliveries. The Project will be subject to a CMP that will memorialize and support the proposed operational needs of the facility's construction period activity while minimizing impacts to adjacent roadways and residents. An analysis of peak hour construction period impacts on area roadways at the height of construction is provided below.

8.4.1 TRIP GENERATION – PEAK CONSTRUCTION PERIOD

Crowley anticipates construction activity at the Site will generate a peak of approximately 150 workers with significantly lower activity during the beginning and end of the construction period. To present a conservative (worst case) scenario, trip generation for the facility's construction impact is estimated based on a peak construction scenario.

Table 8-3 summarizes the empirically derived trip estimates for the offshore wind facility under a peak construction scenario of 150 workers. It is assumed that construction truck activity will occur outside the peak hours with primarily access/egress via the Webb Street/Fort Avenue driveway.

Table 8-3, Trip-Generation Summary (Peak Construction Operations)

Study Period/Direction	Peak Construction Site Trips[1]
Weekday Morning Peak Hour	
Entering	150
Exiting	Negl.
Total	**150**
Weekday Evening Peak Hour	
Entering	Negl.
Exiting	150
Total	**150**

[1]Based on 150 construction workers with vehicle occupancy of 1.0 workers per vehicle. Analysis conservatively assumes that all workers will arrive and depart during the peak hour of the adjacent street.

As summarized in Table 8-3, under the peak construction activity scenario, the Project Site is conservatively estimated to generate approximately 150 entering vehicle trips during the weekday morning period and 150 exiting vehicle trips during the weekday evening period. These trips levels are expected to occur at the height of construction activity and are expected to largely occur before typical commuter hours. These trip estimates also conservatively do not account for carpooling, other alternative travel modes, and staggered work hours which may reduce actual vehicle demands at peak construction.

8.4.2 TRIP DISTRIBUTION – CONSTRUCTION PERIOD

The peak hour construction trip activity will be employee-related; therefore, the distribution for projected construction traffic is based on Journey to Work Census data. Primary routes to/from the Site associated with construction employee related trips are likely to use major area routes including Route 114 and Route 1A, with all construction employees directed to use the Fort Avenue entrance. This methodology indicates a primary employee trip distribution of 85% to/from Bridge Street to the south and 15% to/from the north as shown in Figure 8-5, Trip Distribution (Construction Trips). Trip distribution calculations are provided in Attachment I, Transportation Attachments.

Any truck trips associated with the construction of the Site are expected to occur outside of peak periods. Additionally, construction equipment and supplies may be delivered to the Site via barge if possible. The construction truck deliveries to the Site will be limited to primary commercial truck routes which include Route 114 and Route 1A. These roadways are well established commercial truck routes and provide the most direct and efficient means of travel to the Site, with allowable truck routes and hours of operation to be established through a CMP for the project.

Development-related trips for the Project Site are assigned to the roadway network using the ITE trip-generation estimates shown in Table 8-3 and the distribution pattern for the construction employees as shown in Figure 8-5. Construction employee-related trips at each intersection approach for the weekday morning and weekday evening during the peak of construction activity are quantified in Figure 8-6, Site-Generated Trips (Construction Period - 150 Employees), Weekday Morning Peak Hour, and Figure 8-7, Site-Generated Trips (Construction Period - 150 Employees), Weekday Evening Peak Hour.

8.4.3 CONSTRUCTION PERIOD TRAFFIC VOLUMES

Construction condition traffic volumes are derived by adding the incremental traffic increases for the Site's construction activity to the Baseline conditions. The 2022 Construction condition traffic-volume networks for the weekday morning and weekday evening during the peak of construction activity are quantified in Figure 8-8, Construction Period Condition, Weekday Morning Peak Hour Volumes, and Figure 8-9, Construction Period Condition, Weekday Evening Peak Hour Volumes.

8.5 POST-CONSTRUCTION PERIOD (DESIGN YEAR) TRAFFIC VOLUMES

Design Year traffic conditions are developed by adding additional site-generated trips associated with the proposed development as the Salem Offshore Wind Terminal to the Baseline traffic volumes within the study area. The Project will serve to support operation of offshore wind turbines with projected employment levels of up to 60 persons on non-vessel days and up to 200 persons on vessel days with a typical day operation of 114 FTE employees. Specific methodologies and assumptions used to estimate trips and trip distribution are discussed below.

8.5.1 SITE TRAFFIC ESTIMATES

The trip generation estimates for the proposed development of the Site are provided for the weekday morning and weekday evening periods, which correspond to the critical analysis periods for the proposed use and adjacent street traffic flow. For planning purposes, the new traffic generated by the project was estimated using trip rates published in ITE's *Trip Generation*[1] for Land Use Code (LUC) 170 – Utility. Table 8-4 presents a summary of the site trip generation for the proposed use of the Site. Trip generation calculations are provided in Attachment I, Transportation Attachments.

Table 8-4, Trip-Generation Summary – ITE Basis

Peak Hour/Direction	Utility (114 Employees)[1]
Weekday Morning Peak Hour	
Entering	71
Exiting	11
Total	**82**
Weekday Evening Peak Hour	
Entering	12
Exiting	74
Total	**86**
Weekday Daily (24-Hour)	440

[1]Based on ITE Trip Generation 11th Edition trip rates for LUC 170 – Utility applied to 114 Employees.

As summarized in Table 8-4, the proposed development is estimated to generate approximately 82 vehicle trips (71 entering and 11 exiting) during the weekday morning peak hour and 86 vehicle trips (12 entering and 74 exiting) during the weekday evening peak hour. On a daily basis, the development is estimated to generate approximately 440 vehicle trips on a weekday with 50 percent entering and exiting.

8.5.2 TRIP DISTRIBUTION

As the vast majority of peak hour trip activity will be employee-related, the distribution for projected traffic for the proposed facility is based on Journey to work patterns along the adjacent roadway system and populations of the adjacent communities. This methodology indicates a primary employee trip distribution of 60% to/from Bridge Street to the south, 25% to/from Derby Street to the south, and 15% to/from the north as shown in Figure 8-10, Trip Distribution. Trip distribution calculations are provided in Attachment I, Transportation Attachments.

Development-related trips for the proposed development are assigned to the roadway network using the ITE trip-generation estimates shown in Table 8-4 and the

[1]*Trip Generation*, 11th Edition; Institute of Transportation Engineers; Washington, DC; 2021.

distribution patterns described above. Development-related trips at each intersection approach for the weekday morning and weekday evening are quantified in Figure 8-11, Site-Generated Trips, Weekday Morning Peak Hour, and Figure 8-12, Site-Generated Trips, Weekday Evening Peak Hour.

8.5.3 DESIGN YEAR TRAFFIC CONDITIONS

Design Year conditions for the weekday morning and weekday evening peak hours include Baseline traffic volumes and site-generated trips. The resulting Design Year traffic volumes for typical operations of the proposed development as the Salem Offshore Wind Terminal are quantified in Figure 8-13, Design Year Condition, Weekday Morning Peak Hour Volumes, and Figure 8-14, Design Year Condition, Weekday Evening Peak Hour Volumes.

8.6 OPERATIONS ANALYSIS

This section provides an overview of operational analysis methodology as well as an assessment of driveway operations under Baseline, peak Construction Period, and projected Design Year conditions with the Salem Offshore Wind Terminal in place.

8.6.1 ANALYSIS METHODOLOGY

Intersection capacity analyses are presented in this section for the Baseline, Construction Period, and Design Year traffic-volume conditions. Capacity analyses, conducted in accordance with EEA/MassDOT guidelines, provide an index of how well the roadway facilities serve the traffic demands placed upon them. The operational results provide the basis for recommended access and roadway improvements in the following section if required.

Capacity analysis of intersections is developed using the Synchro® computer software, which implements the methods of the Highway Capacity Manual 6th Edition (HCM6). The resulting analysis presents a level-of-service (LOS) designation for individual intersection movements. The LOS is a letter designation that provides a qualitative measure of operating conditions based on several factors including roadway geometry, speeds, ambient traffic volumes, traffic controls, and driver characteristics. Since the LOS of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of LOS, depending on the time of day, day of week, or period of year. A range of six levels of service are defined on the basis of average delay, ranging from LOS A (the least delay) to LOS F (delays greater than 50 seconds for unsignalized movements). The specific control delays and associated LOS designations are presented in Attachment I, Transportation Attachments.

8.6.2 ANALYSIS RESULTS

The LOS analyses were conducted for the Baseline, Construction Period, and Design Year conditions for the study intersection. The results of the intersection capacity analyses are summarized below in Table 8-5 and Table 8-6. Detailed analysis results are presented in Attachment I, Transportation Attachments.

Table 8-5, Intersection Capacity Analysis Results (Weekday Morning Peak Hour)

		2022 Baseline			**Construction Period**			**Design Condition**		
Period	Approach	v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Sgt. James Ayube Mem. Drive at Bridge Street	Westbound	0.34	7	A	0.34	7	A	0.34	7	A
	Northbound	0.63	23	C	0.63	23	C	0.63	23	C
	Southbound	0.73	12	B	0.76	12	B	0.74	12	B
	Total	0.73	13	B	0.76	14	B	0.74	14	B
Sgt. James Ayube Mem. Drive at Bridge Street/ Apartment Dwy	Eastbound	0.03	11	B	0.03	13	B	0.03	12	B
	Westbound	0.76	26	C	0.80	31	C	0.80	30	C
	Northbound	0.40	19	B	0.74	17	B	0.72	19	B
	Southbound	0.53	18	B	0.49	17	B	0.50	18	B
	Total	**0.76**	**20**	**C**	**0.80**	**20**	**C**	**0.80**	**21**	**C**
Bridge Street at Webb Street	Westbound	0.43	16	B	0.46	19	B	0.45	17	B
	Northbound	0.73	17	B	0.81	19	B	0.77	18	B
	Southbound	0.45	10	A	0.64	14	B	0.53	12	B
	Total	**0.75**	**14**	**B**	**0.81**	**17**	**B**	**0.77**	**16**	**B**
Webb Street at Essex Street	Eastbound	0.24	5	A	0.38	6	A	0.29	5	A
	Westbound	0.32	6	A	0.33	6	A	0.34	6	A
	Northbound	0.22	9	A	0.23	10	A	0.22	9	A
	Southbound	0.25	6	A	0.26	7	A	0.25	6	A

		2022 Baseline			Construction Period			Design Condition		
	Total	**0.32**	**6**	**A**	**0.38**	**7**	**A**	**0.34**	**6**	**A**
Fort Avenue at Memorial Drive/ Derby Street	Eastbound	0.05	10	A	0.05	10	A	0.05	10	A
	Westbound	0.15	11	B	0.20	13	B	0.20	12	B
	Northbound	0.07	5	A	0.07	<5	A	0.07	<5	A
	Southbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Derby Street at Webb Street/ Site Driveway	Eastbound	0.01	12	B	0.01	12	B	0.01	12	B
	Westbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Fort Avenue at Site Driveway	Westbound	0.00	9	A	0.00	9	A	0.02	10	A
	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound	0.00	<5	A	0.00	<5	A	0.00	<5	A

[1]Volume-to-capacity ratio
[2]Average control delay per vehicle (in seconds)
[3]Level of service

Table 8-6, Intersection Capacity Analysis Results (Weekday Evening Peak Hour)

		2022 Baseline			Construction Period			Design Condition		
Period	Approach	v/c[1]	Delay[2]	LOS[3]	v/c	Delay	LOS	v/c	Delay	LOS
Sgt. James Ayube Mem. Drive at Bridge Street	Westbound	0.33	6	A	0.34	6	A	0.34	6	A
	Northbound	0.62	23	C	0.62	24	C	0.62	23	C
	Southbound	0.73	12	B	0.77	12	B	0.78	12	B
	Total	0.73	13	B	0.77	13	B	0.78	13	B
Sgt. James Ayube Mem. Drive at Bridge Street/ Apartment Dwy	Eastbound	0.04	10	A	0.03	10	A	0.03	10	A
	Westbound	0.63	20	C	0.74	25	C	0.68	22	C
	Northbound	0.59	13	B	0.64	16	B	0.60	14	B
	Southbound	0.49	13	B	0.54	17	B	0.50	14	B
	Total	**0.73**	**15**	**B**	**0.76**	**19**	**B**	**0.76**	**17**	**B**
Bridge Street at Webb Street	Westbound	0.37	15	B	0.61	20	B	0.46	17	B
	Northbound	0.73	17	B	0.76	20	B	0.76	18	B
	Southbound	0.66	14	B	0.73	18	B	0.69	15	B
	Total	**0.73**	**15**	**B**	**0.76**	**19**	**B**	**0.76**	**17**	**B**
Webb Street at	Eastbound	0.17	<5	A	0.19	<5	A	0.17	<5	A
	Westbound	0.24	<5	A	0.39	6	A	0.30	<5	A

		2022 Baseline			Construction Period			Design Condition		
Essex Street	Northbound	0.10	7	A	0.15	10	A	0.10	8	A
	Southbound	0.17	5	A	0.20	7	A	0.17	6	A
	Total	**0.24**	**<5**	**A**	**0.39**	**6**	**A**	**0.30**	**<5**	**A**
Fort Avenue at Memorial Drive/ Derby Street	Eastbound	0.01	9	A	0.01	10	A	0.01	10	A
	Westbound	0.13	10	A	0.14	10	A	0.14	10	A
	Northbound	0.02	<5	A	0.02	<5	A	0.02	<5	A
	Southbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Derby Street at Webb Street/ Site Driveway	Eastbound	0.01	12	B	0.01	12	B	0.01	12	B
	Westbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
Fort Avenue at Site Driveway	Westbound	0.00	11	B	0.27	13	B	0.13	12	B
	Northbound	0.00	<5	A	0.00	<5	A	0.00	<5	A
	Southbound	0.00	<5	A	0.00	<5	A	0.00	<5	A

[1]Volume-to-capacity ratio
[2]Average control delay per vehicle (in seconds)
[3]Level of service

As summarized in Table 8-5 and Table 8-6, the proposed development is not expected to materially impact study area intersections and will not result in any material changes in traffic operations in the study area during the Construction Period or projected Design conditions with the Salem Offshore Wind Terminal in place compared to Baseline conditions. Relative traffic increases for the Project represents an inconsequential change in area roadway volumes - a level of change that falls well within normal day-to-day fluctuations in traffic entering and exiting the study intersections and is immaterial to traffic operations in the area. Additionally, the incremental traffic increases at the study intersections during the construction period will be adequately accommodated below-capacity with LOS C or better operations expected**.** Accordingly, no roadway improvements are warranted to accommodate the projects construction activity or operations of the Salem Offshore Wind Terminal.

8.7 CONCLUSIONS AND RECOMMENDATIONS

Trip generation for the Project Site is projected to be moderate with approximately 86 new vehicles per hour or less during commuter peak hours. MDM finds that incremental traffic associated with the proposed development is not expected to materially impact operating conditions at the study intersections. Additionally, there will be no degradation in the LOS at any of the study intersections due to the project by employees during the peak construction period. Therefore, no additional off-site roadway improvements are warranted to accommodate the development project.

MDM recommends the following access/egress improvements, a TMP, and a CMP that support the proposed operational needs of the Project while minimizing impact to adjacent roadways.

8.7.1 SITE ACCESS/EGRESS IMPROVEMENTS

- *Driveway Design.* The driveway alignment, widths, and curb radii would be designed to achieve (a) approximate perpendicular orientation with Fort Avenue and Derby Street; and (b) curb radii as required to accommodate the design vehicle for the Site.

- *Signs and Markings.* A STOP sign (R1-1) and STOP line pavement marking is recommended on the driveway approaches to Fort Avenue and Derby Street. The sign and pavement marking shall be compliant with the Manual on Uniform Traffic Control Devices (MUTCD).

- *Pedestrian Connections.* The Site Plan should incorporate sidewalks that connect the proposed shed to the on-site surface parking areas as well as the existing sidewalk systems on Fort Avenue, Derby Street, and Webb Street. Crosswalks and ADA compliant ramps should be provided where applicable.

- *Bicycle Amenities.* The Proponent should locate secure weather-protected bicycle racks to encourage and facilitate this mode of transportation to/from the Site.

8.7.2 TRAVEL DEMAND MANAGEMENT (TDM) PROGRAM

TDM programs include a series of measures that are designed to encourage the use of alternative modes of travel to single-occupant vehicles (SOVs) by influencing the choice of travel modes. These elements are consistent with the MassDEP) directive to use all reasonable and feasible mitigation actions to reduce auto emissions. The benefits that are derived from an effective TDM program include less congestion on the roadway network; improved air quality; reduced parking demands and the need for construction of new parking spaces; and health benefits through walking and bicycling. A preliminary list of potential TDM program elements may include the following:

- *On-site Employee Transportation Coordinator*. The Proponent will designate a contact that will serve as transportation coordinator responsible for disseminating relevant TDM information and documentation of TDM information as part of a TDM Program Manual.

- *Shift Hours*. The proposed industrial use at the Site includes shift times that result in primary trip patterns to/from the Site that occur outside of traditional commuter periods.

- *Preferential Parking for Low-Emission Vehicles.* Preferential parking locations for employees and patrons who use low-emission vehicles will be considered;

charging stations for electric vehicles will also be considered during the Site Plan development process.

- *Preferential Parking for Carpools and Vanpools*. The Proponent will designate preferential parking locations for employees who use carpools and vanpools. The parking spaces will be designated with signs. Employees will be encouraged to carpool and vanpool and building tenants will be encouraged to sponsor and/or subsidize carpool incentives such as gift cards for first-time participation in a carpool or vanpool program.

- *Vehicle Charging Stations*. Electric vehicle charging stations/outlets should be provided for use of employees and visitors. Specific number of space and EV-ready spaces will be further evaluated during the Site Plan review process.

- *No Idling Signage*. Installation of "No Idling" signs at the Project Site's delivery vehicle parking and loading areas to reduce the amount of greenhouse gasses emitted.

- *Pedestrian Infrastructure*. The development will incorporate sidewalks that connect the parking areas to the public sidewalk system at the main Site entranceway and proposed building.

- *Bicycle Facilities*. Bike storage facilities for the Project will be provided on-site. The Proponent will also work with the City to explore the potential of adding a Bluebike station near the Project Site.

8.7.3 CONSTRUCTION MANAGEMENT PLAN (CMP)

The Proponent will be required to implement a construction management plan to accommodate the specific needs of the Site and to provide coordination with the City officials throughout the construction period. The Proponent will also coordinate with the City of Salem with regards to the length of the construction period and any construction permits which may be required. The construction management plan is expected to include but not be limited to the following:

- Designated parking for construction employees will be on-site and accessed via the Fort Avenue primary driveway.

- Construction periods and material deliveries will be designated to coincide with off peak travel periods of the area roadways – specifically to avoid peak school arrival/dismissal periods.

- The delivery of facility construction materials will prioritize barge transport rather than on-road transport to reduce/minimize roadway impacts. Materials to be transported to the Site by truck for site stabilization, earthwork, aggregate, paving and building materials will be limited to major routes that include Route 114, Bridge Street, and Webb Street as depicted on Figure 8-15, Construction Truck Route Map. The Proponent is reaching out to marine contractors that can deliver aggregate by barge and reduce truck trips.

- The Proponent will establish waiting and staging areas on-site for all material deliveries and the management of truck traffic via the Webb Street gate.

Figure 8-1
Site Location
Source: MDM Transportation Consultants, Inc., 2022

Figure 8-2
Preliminary Site Layout
Source: Fort Point Associates, Inc., 2022

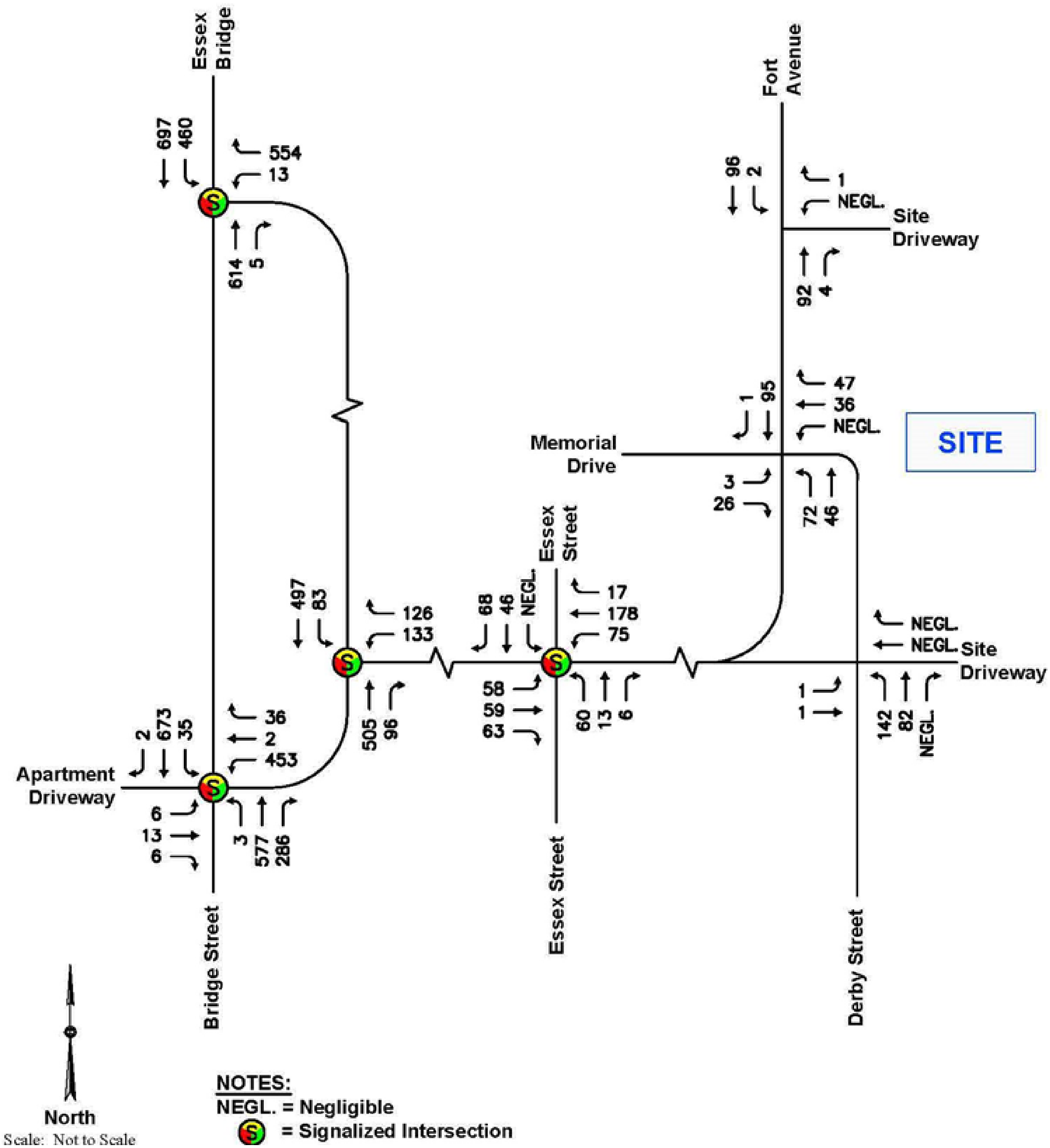


Figure 8-3
2022 Baseline Condition, Weekday Morning Peak Hour Volumes
Source: MDM Transportation Consultants, Inc., 2022

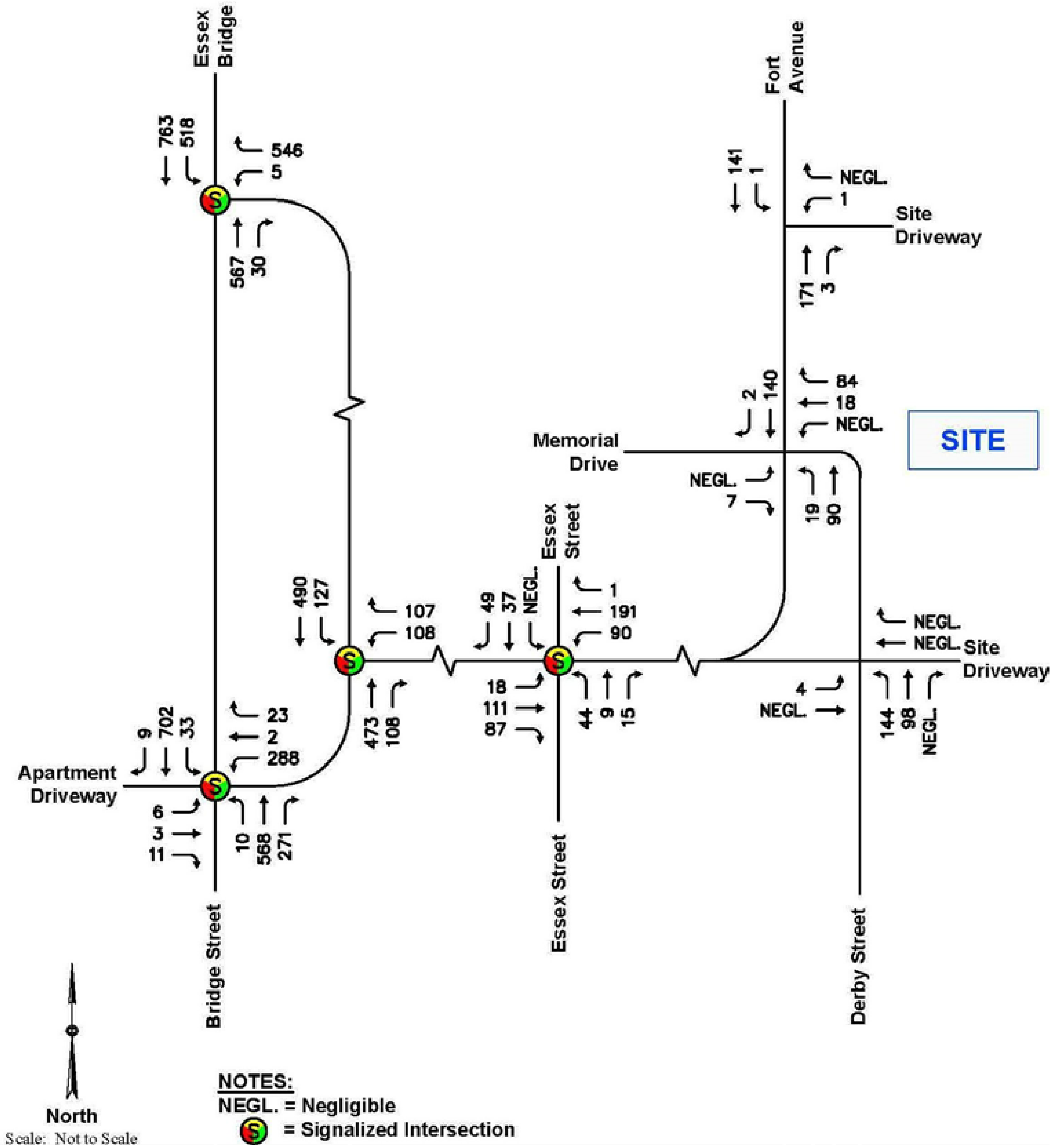


Figure 8-4
2022 Baseline Condition, Weekday Evening Peak Hour Volumes
Source: MDM Transportation Consultants, Inc., 2022

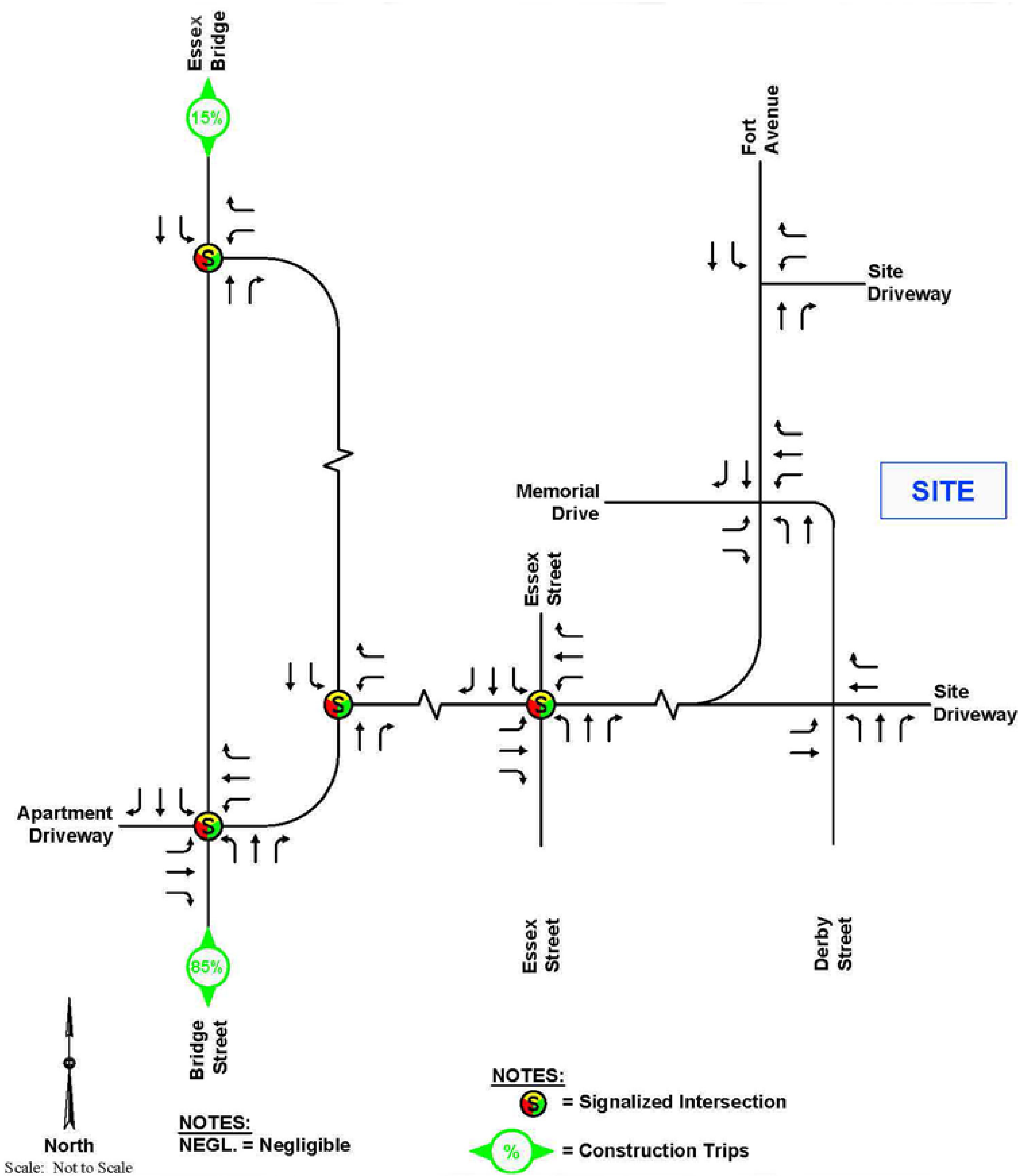


Figure 8-5
Trip Distribution (Construction Trips)
Source: MDM Transportation Consultants, Inc., 2022

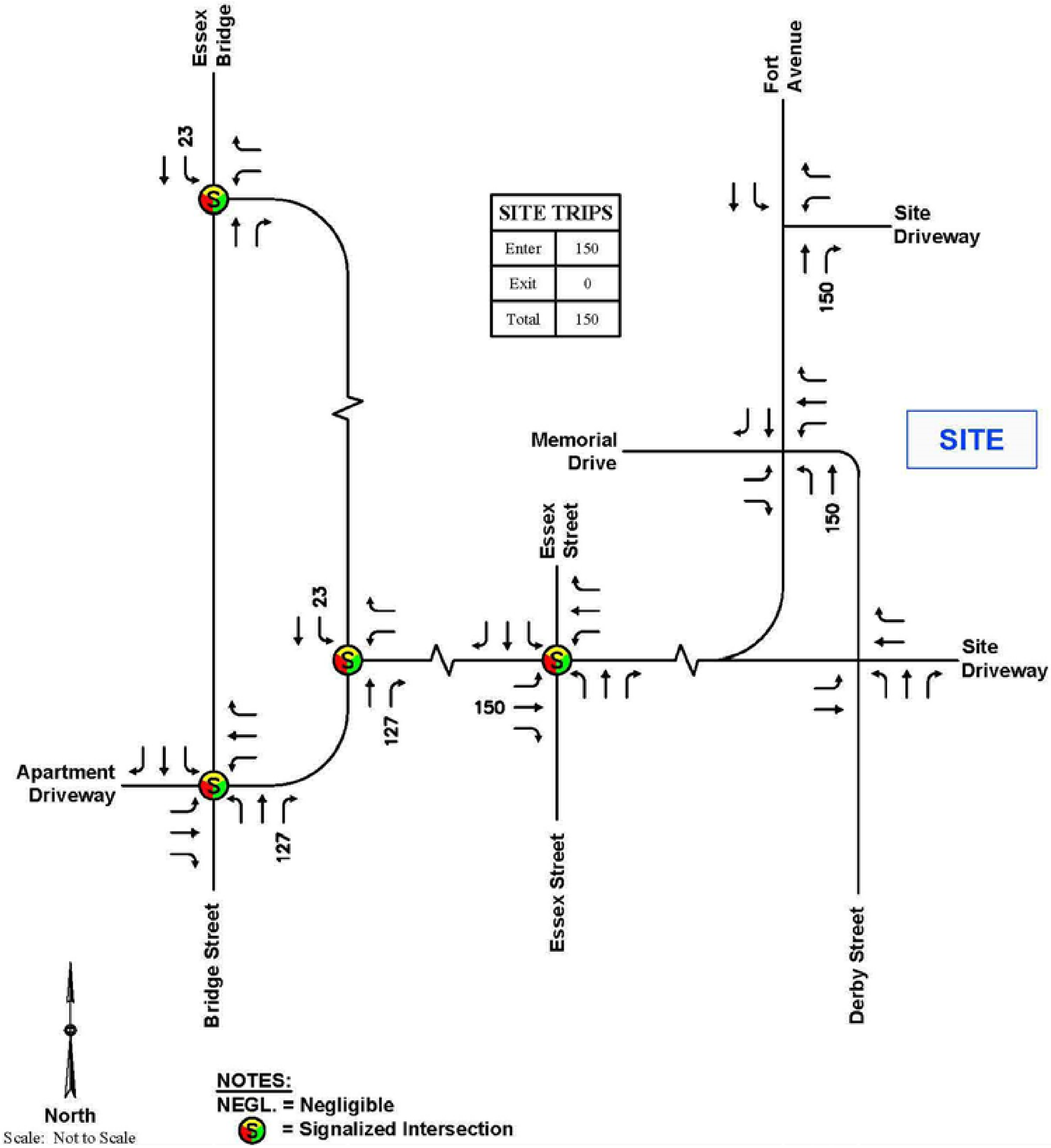


Figure 8-6
Site-Generated Trips (Construction Period - 150 Employees), Weekday Morning Peak Hour
Source: MDM Transportation Consultants, Inc., 2022

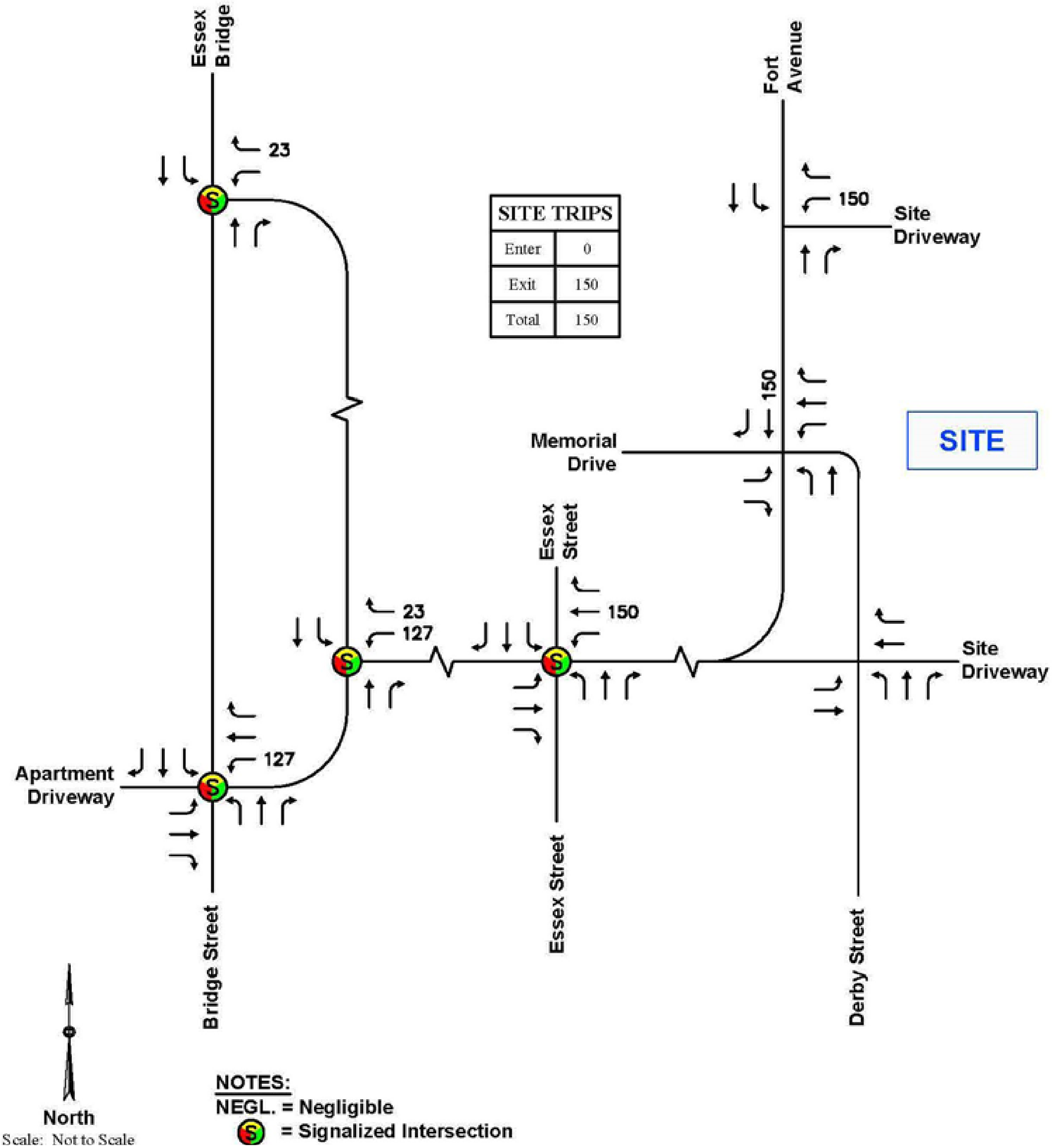


Figure 8-7
Site-Generated Trips (Construction Period - 150 Employees), Weekday Evening Peak Hour
Source: MDM Transportation Consultants, Inc., 2022

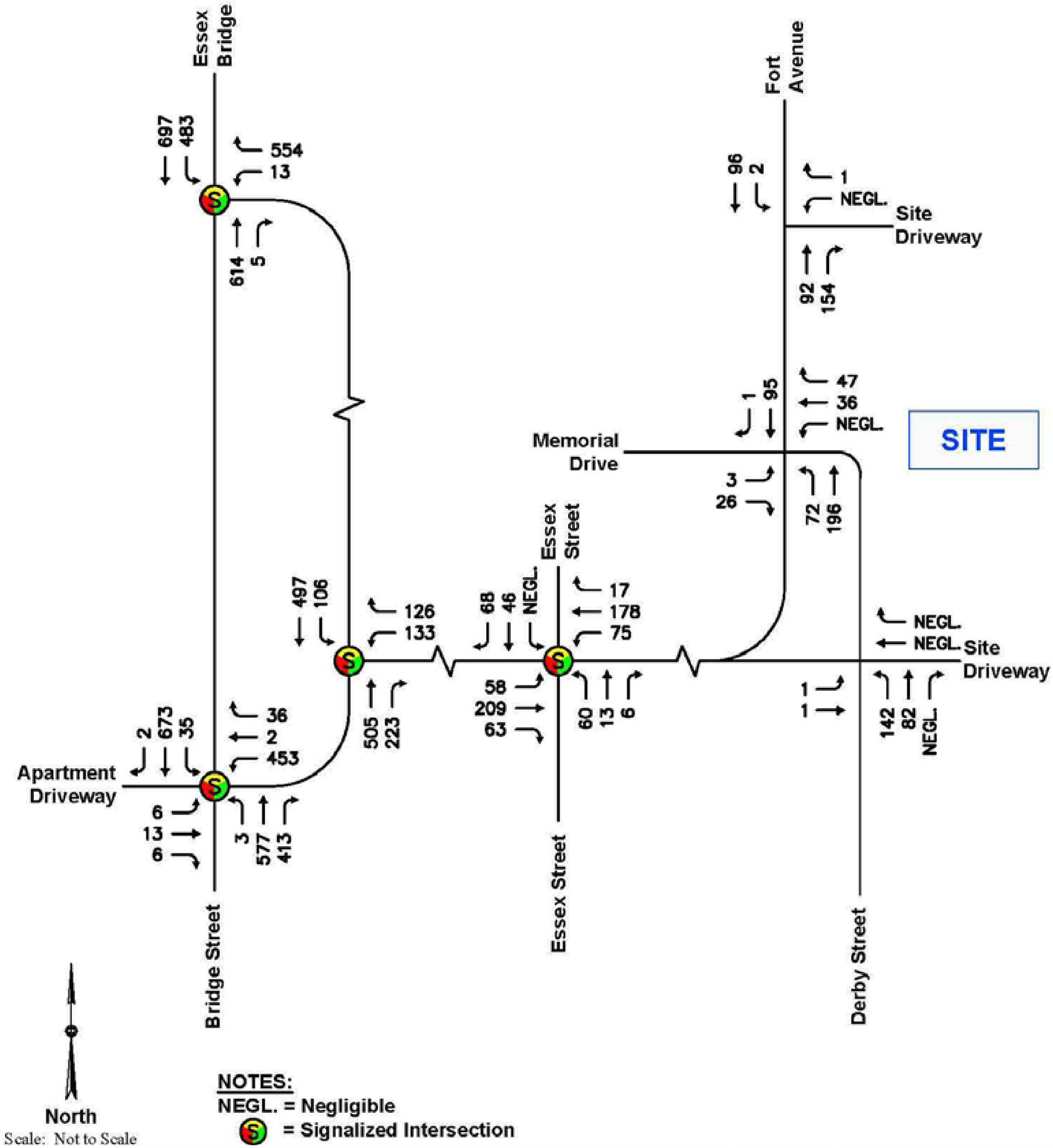


Figure 8-8
Construction Period Condition, Weekday Morning Peak Hour Volumes
Source: MDM Transportation Consultants, Inc., 2022

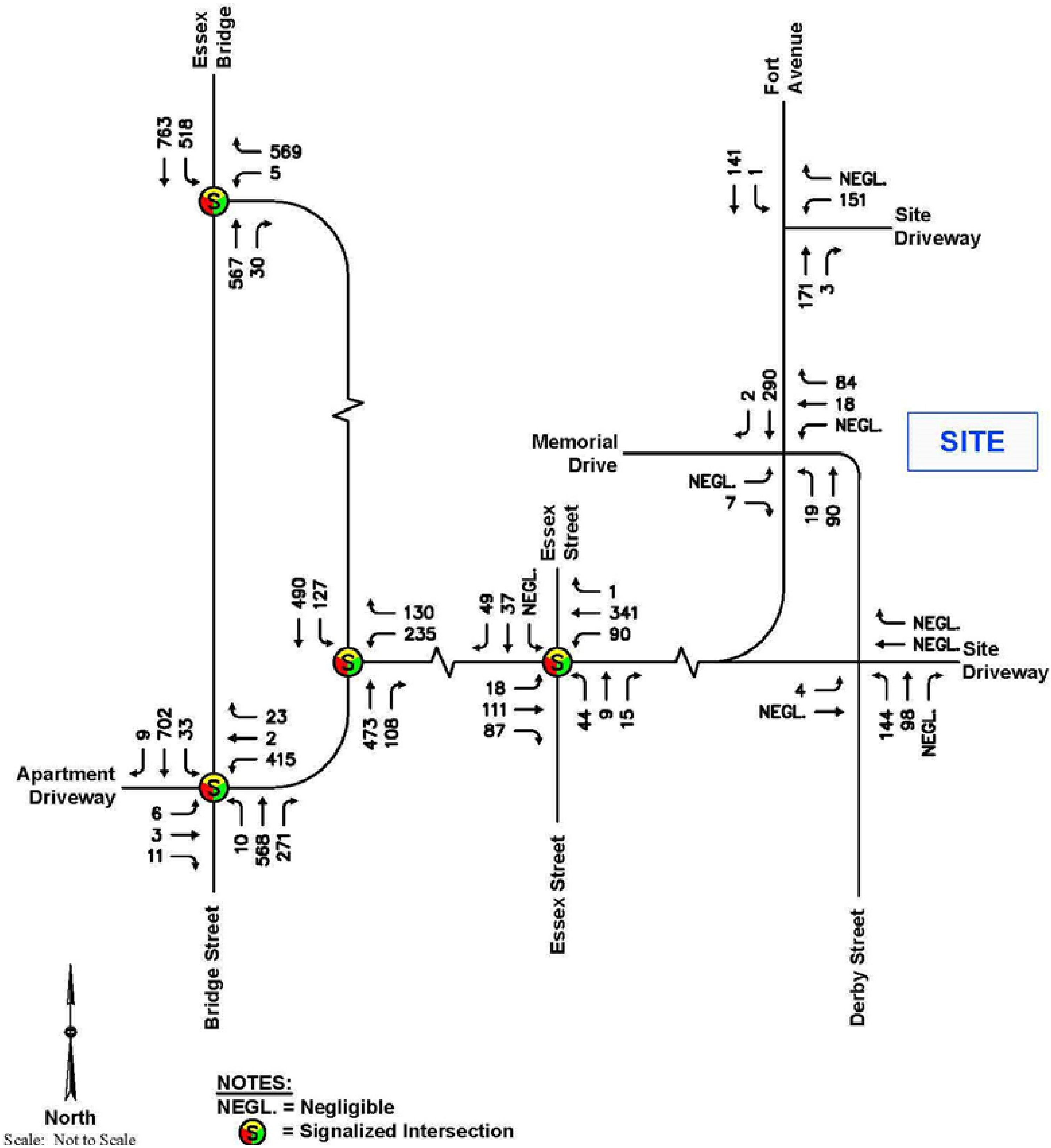


Figure 8-9
Construction Period Condition, Weekday Evening Peak Hour Volumes
Source: MDM Transportation Consultants, Inc., 2022

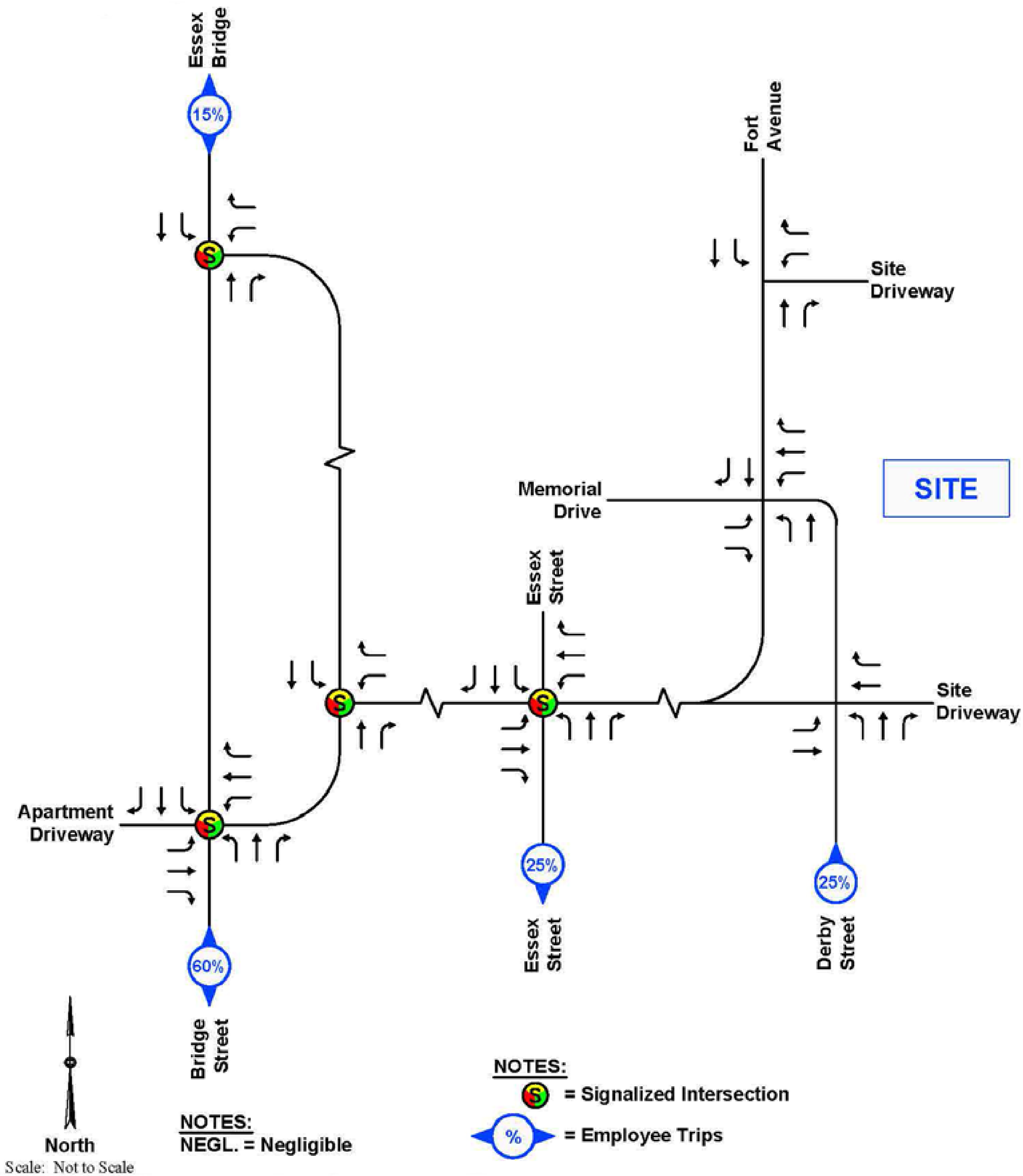


Figure 8-10
Trip Distribution
Source: MDM Transportation Consultants, Inc., 2022

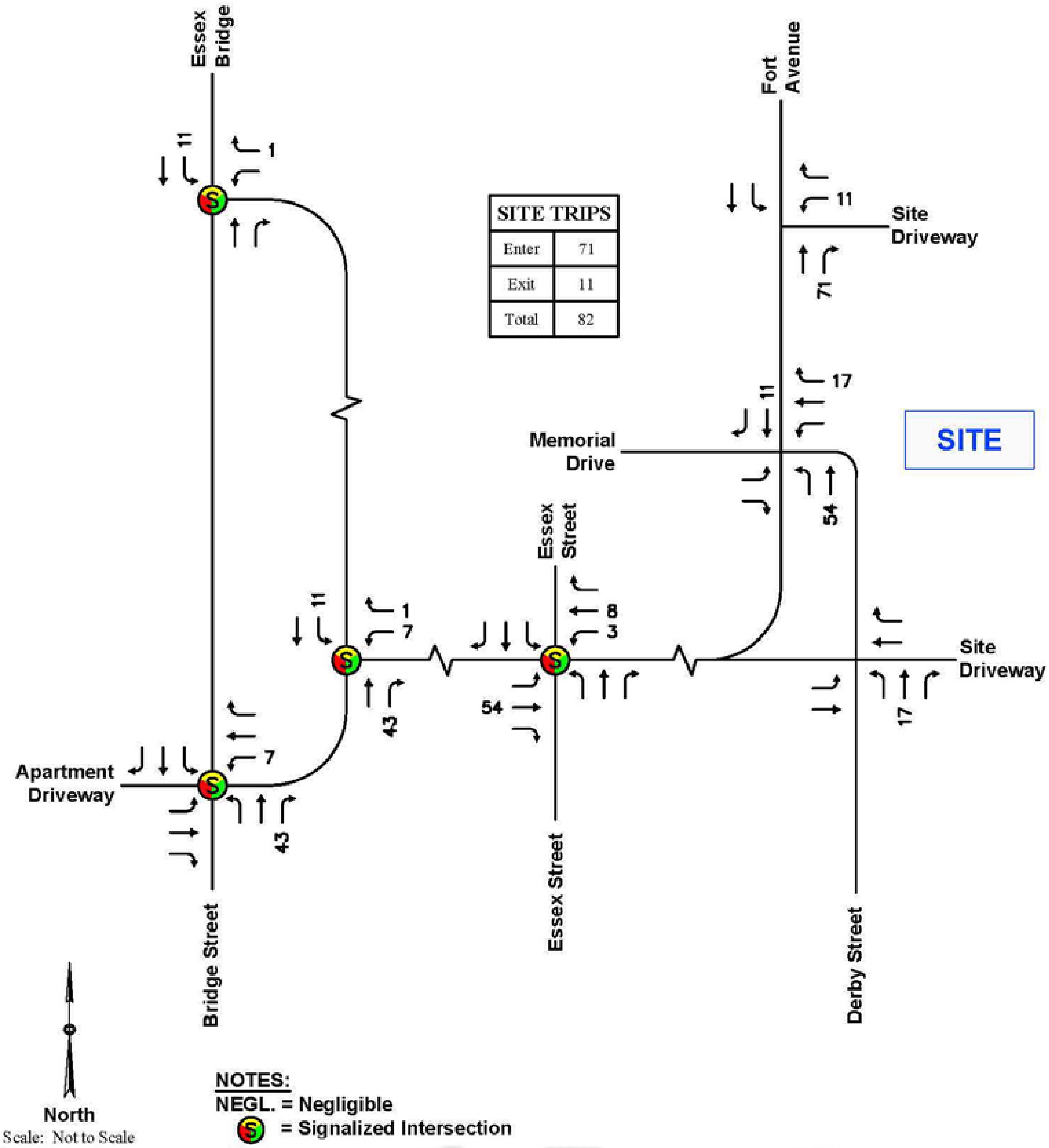


Figure 8-11
Site-Generated Trips, Weekday Morning Peak Hour
Source: MDM Transportation Consultants, Inc., 2022

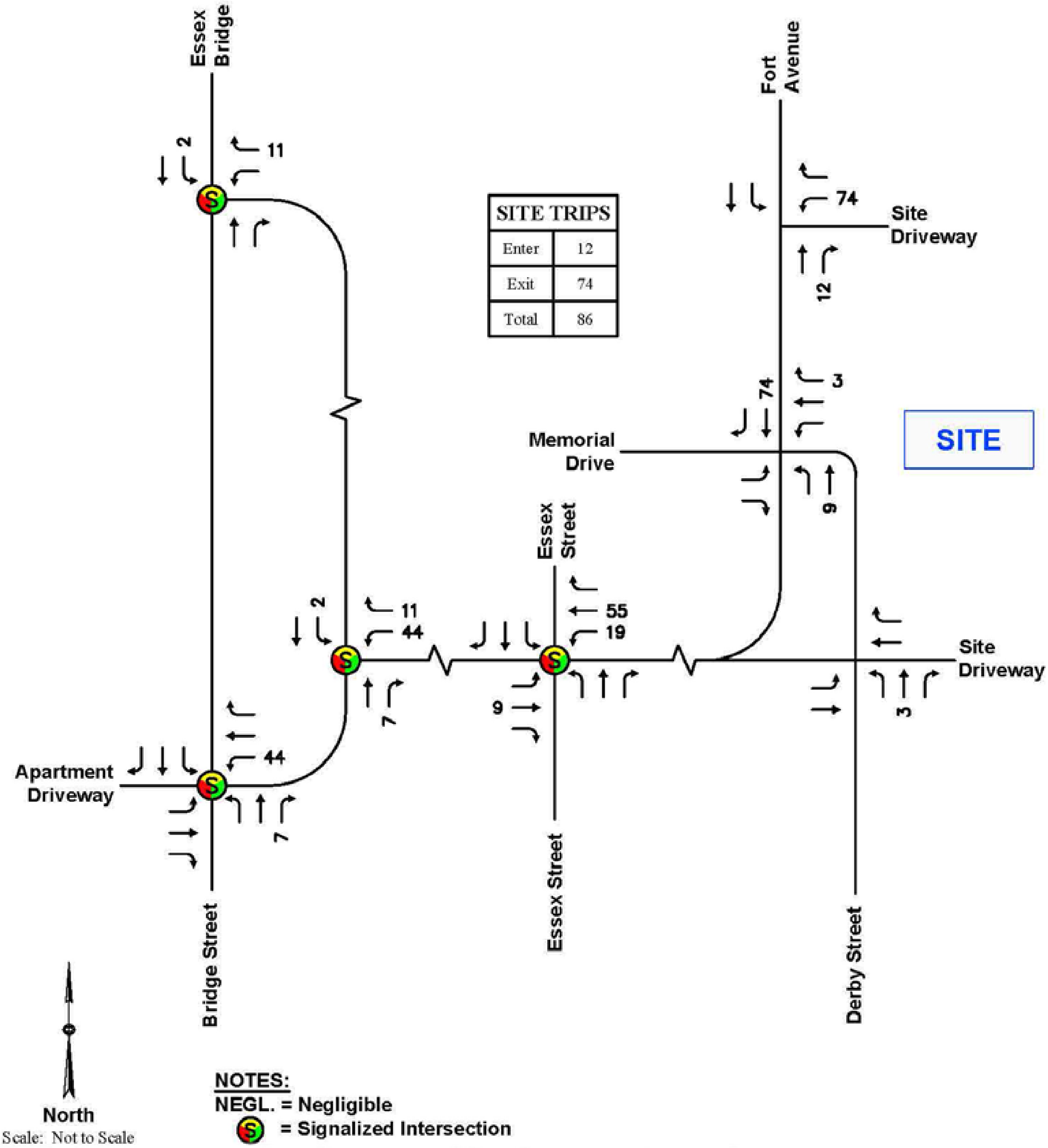


Figure 8-12
Site-Generated Trips, Weekday Evening Peak Hour
Source: MDM Transportation Consultants, Inc., 2022

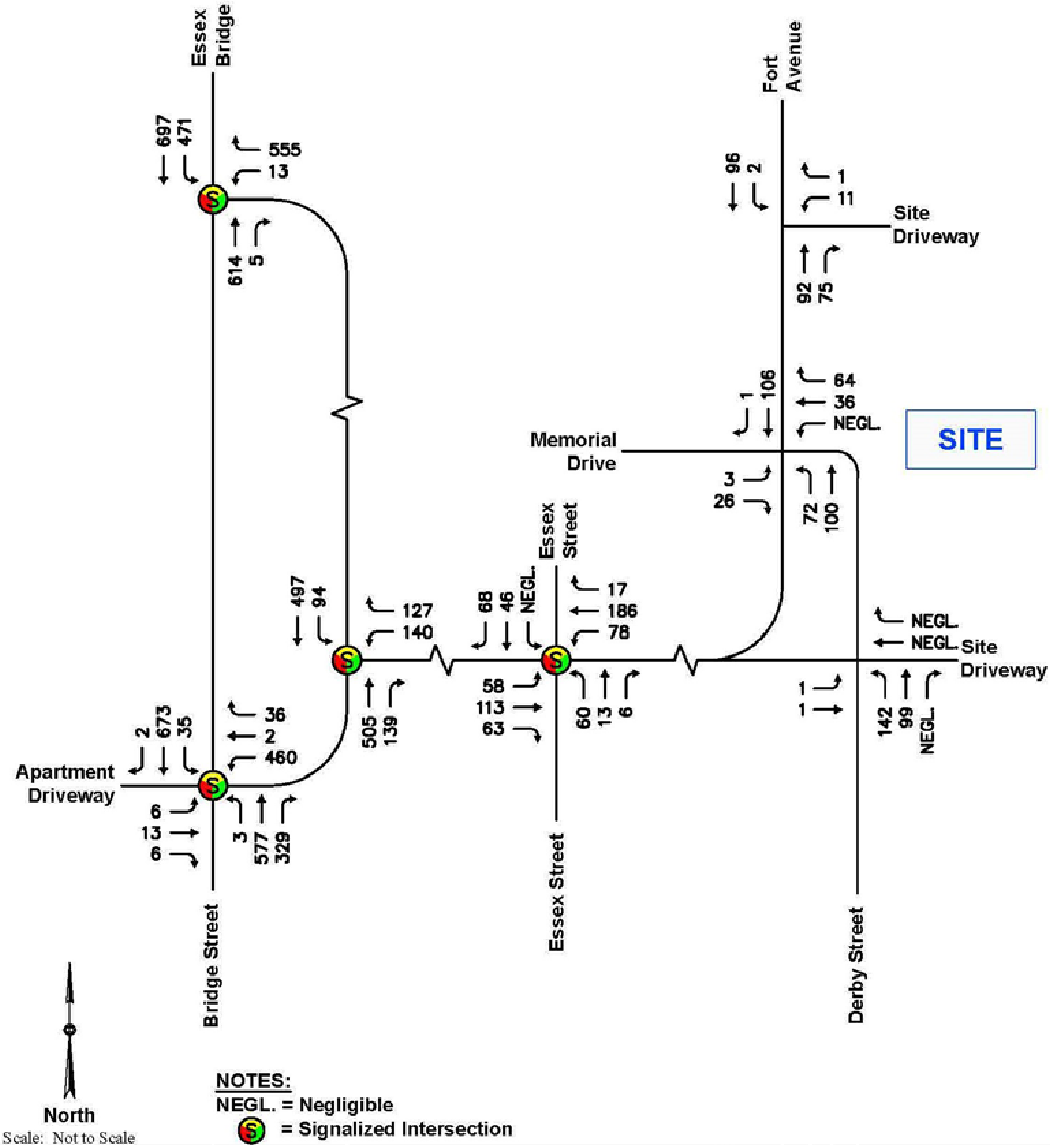


Figure 8-13
Design Year Condition, Weekday Morning Peak Hour Volumes
Source: MDM Transportation Consultants, Inc., 2022

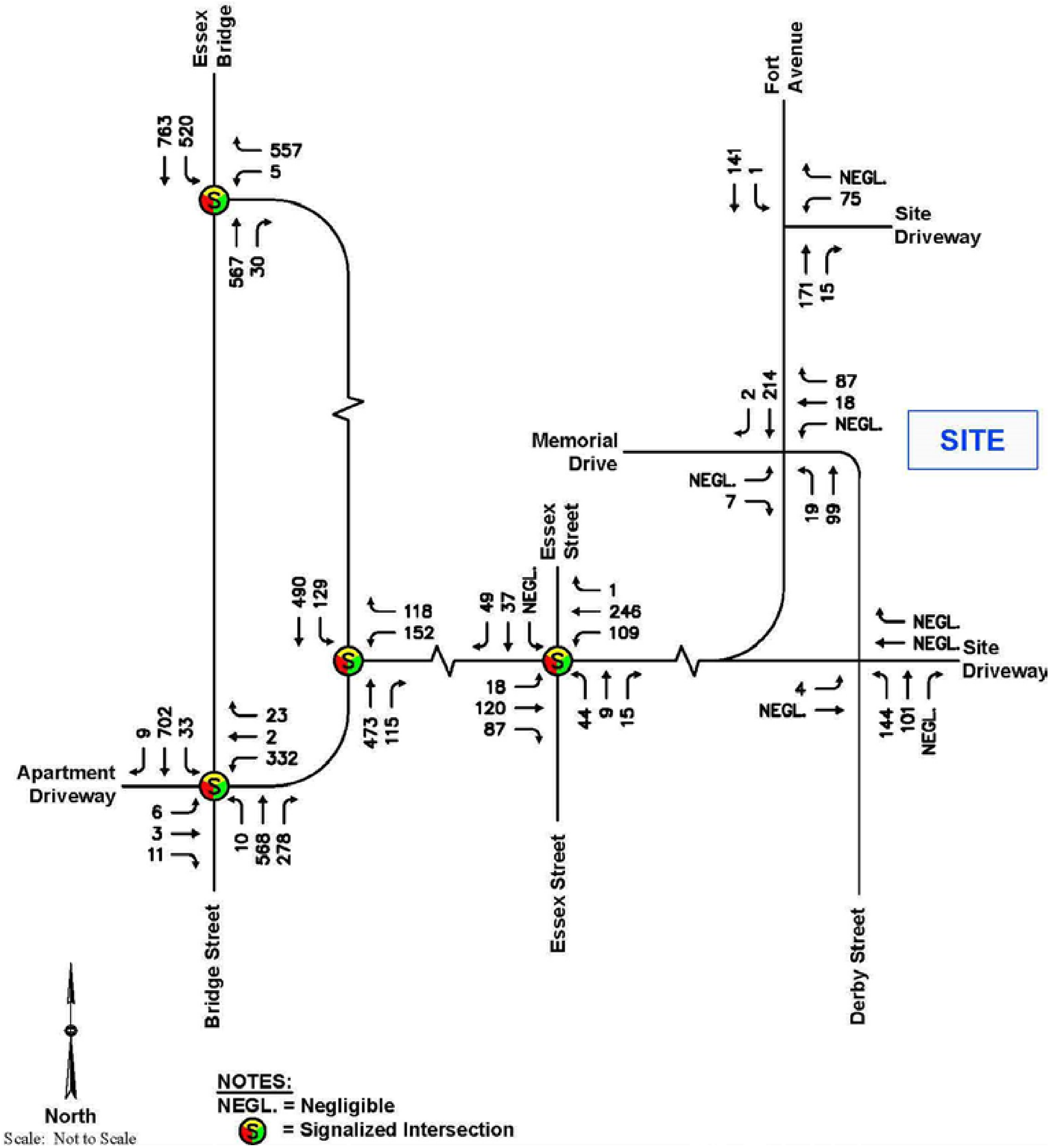


Figure 8-14
Design Year Condition, Weekday Evening Peak Hour Volumes
Source: MDM Transportation Consultants, Inc., 2022

Figure 8-15
Construction Truck Route Map
Source: MDM Transportation Consultants, Inc., 2022

Chapter 9

SUMMARY OF MITIGATION MEASURES

CHAPTER 9: SUMMARY OF MITIGATION MEASURES

The Project as described in previous sections has incorporated numerous mitigation measures that respond to potential impacts related to transportation, community resources, greenhouse gas emissions, climate change, and environmental justice (EJ). Mitigation areas include: dredging and construction mitigation, transportation mitigation, stormwater infrastructure, climate change adaptation, EJ populations, and community benefits and services. Proposed mitigation measures are described in more detail below.

9.1 PUBLIC BENEFITS

As described in Chapter 1, significant and substantial public benefits will be realized with the construction and operation of the Project. These public benefits will help mitigate any adverse impacts as a result of the Project. These benefits include, but are not limited to:

- **Community Benefits Agreement**: The Proponent have entered into a community benefits agreement with the City of Salem in order to preserve the City's long-term interests, identify local supply chain opportunities, establish OSW workforce training programs, support the local economy by accommodating potential future cruise ship operations, and establish with community organizations and residents.

- **New Jobs**: Approximately 200 jobs during the construction phase and approximately 200 full time jobs during the operations phase.

- **Workforce Development**: The Proponent is working with partners to create workforce development programs within the OSW industry, such as Global Wind Offshore Training (GWO).

- **Site Infrastructure Improvements and Climate Resilience**: The existing condition of the Project Site is run down and unused. The Project will bring needed and significant infrastructure improvements to Salem Harbor, and the upland area will be regraded and raised an additional 2 feet, which will make the Project Site more resilient to future climate change impacts.

- **Water Quality Improvements**: Improved stormwater management on the Project Site, as described in Chapter 5, will lead to enhanced water quality in the City of Salem and in Salem Harbor.

- **Renewable Energy Investment**: This Project will serve ongoing OSW farm projects around Massachusetts and beyond and will support the Commonwealth's clean energy and climate targets. This effort will help mitigate the future impact of climate change and further pollution from fossil fuels.

9.2 CLIMATE CHANGE AND RESILIENCY

As described in Chapter 1 and 7, the Project Site will be designed in a way to mitigate future climate change to the maximum extent possible. The relatively flat Project Site is located on a peninsula and on filled tidelands and borders properties on the south and west sides that are also low and subject to storm tidal flooding. However, the equipment that will be stored on site does not need to be protected from flooding. The site design will mitigate future climate change by:

- Incorporating state-recommended Resilient Massachusetts Action Team ("RMAT") design criteria in the design of flood resilience measures to account for future sea level rise, setting Design Flood Elevation ("DFE") more than two feet above the current 100-year base flood elevation ("BFE") of El. 10 NAVD88.

- Regrading the upland areas of the Project Site to be raised an additional 2 feet to elevation 12 feet NAVD88 so that flooding and sea level rise concerns are addressed.

- Improving and replacing the existing wharf infrastructure, which will be better able to withstand flooding and storm surge.

- Installing landscape berms on the Project Site in order to reduce the risk of flooding into the abutting neighborhoods.

9.3 WETLANDS AND WATERWAYS

As described in Chapters 3 and 5, a number of measures will be incorporated into the Project which will contribute to improved water quality through stormwater infrastructure and mitigation controls in order to reduce impacts of the Project on wetland resource areas. These efforts include:

- Implementing control measures during construction such as turbidity curtains, slow start pile driving, following time-of-year restrictions, wetting down areas to control dust, straw bales, and siltation fences to protect wetland resource areas.

- Upgrading the existing stormwater system which will comply with DEP stormwater standards

- Implementing stormwater treatment devices such as deep sump catch basins and proprietary water quality structures.

- Repairing and installing backflow prevention devices on existing storm drain outlets that lead to Salem Harbor to prevent saltwater intrusion and storm surge into drainage systems, which can impact utility infrastructure and disturb collected sediments in catch basin sump collection systems.

9.4 DREDGING MITIGATION

Dredging and marine construction activities will be mitigated through a variety of measures and will follow applicable local, state, and federal regulations. Dredging will follow relevant time-of-year restrictions as designated by the Division of Marine Fisheries, which for this area, based upon previous dredging activities in Salem Harbor, is from February 15 to June 30 to protect winter flounder spawning and for shellfish is till September 30. A waiver of Time of Year restrictions may be sought for certain pier construction activities with the implementation of appropriate mitigation measures. A turbidity curtain will be installed before any pile driving or dredging work begins in accordance with the Division of Marine Fisheries recommendations. Dredge sampling analysis will help determine the best option for dredging disposal, which will mitigate any potential impacts to the environment in the event that the dredged material is contaminated and not suitable for offshore disposal. A mechanical clamshell dredge with an environmental bucket will be used to dredge material, which will minimize turbidity so that the material can be deposited in a bottom-opening scow for ocean disposal.

9.5 ENVIRONMENTAL JUSTICE

As described in Chapter 7, the Project will mitigate potential impacts to EJ populations and will not cause any adverse effects to EJ populations compared to Non-EJ populations. Mitigation efforts stated previously will mitigate potential impacts on EJ populations, and the Project will bring similar benefits to both EJ and Non-EJ populations. Mitigation efforts that will help EJ populations include:

- Reducing air quality impacts during the construction-period, including using diesel retrofitted equipment, wetting down areas during construction, appropriate mufflers on all equipment to reduce noise, turning off idling equipment, replacing specific operations and techniques with less noisy ones, implementing a construction management plan, and following all local, state, and federal regulations concerning construction.

- Traffic reductions, including implementing a transportation demand management plan and access and egress improvements.

- Prioritizing the project benefits as described in Section 9.3 to ensure that project benefits are realized for EJ communities.

- Implementing climate resiliency measures as described in Section 9.4 to protect nearby EJ communities from future climate change impacts to the maximum extent practicable.

- Engaging with residents, community-based organizations, tribal organizations, government agencies, and other relevant stakeholders throughout the Project's design, construction, and operation to ensure that concerns and priorities from both EJ and Non-EJ communities are heard and incorporated into the Project.

9.6 TRANSPORTATION MITIGATION

As described in detail in Chapters 8, traffic impacts of the Project are minimal. However, efforts will be made to reduce the traffic and transportation impacts of the Project on the surrounding community. A study was conducted by MDM Transportation Consultants to analyze the traffic impacts as a result of Project construction and operation. While the study found that will be minimal increases in traffic from the Project, efforts will still be made to improve transportation and traffic conditions around the Project Site to mitigate any potential increases in traffic, greenhouse gas emissions, and congestion on local roadways. The results of this analysis identify specific transportation mitigation measures in the form of a construction management plan, a transportation demand management plan, and access/egress improvements, which are outlined below:

9.6.1 CONSTRUCTION MANAGEMENT PLAN

The Proponent will coordinate with the City of Salem during the construction period of the Project, and this will include the implementation of a construction management plan. The plan will include, but not be limited to:

- Designated parking for construction employees on-site accessible via the Fort Avenue primary driveway.

- Scheduling of construction periods and deliveries of materials to coincide with off-peak travel periods of nearby roadways. This scheduling will also avoid peak school arrival and dismissal periods, specifically of the nearby Bentley Academy Innovation School.

- Delivery of OSW farm components such as turbine equipment via barge rather than on-road transport to reduce roadway impacts. Aggregate, paving and terminal building materials, as well as materials for site stabilization work and earthwork, delivered via truck will be limited to major routes such as Route 114, Bridge Street, and Webb Street.

- Establishing queueing and staging areas on-site for all material deliveries and managing truck traffic via the Webb Street gate.

9.6.2 TRANSPORTATION DEMAND MANAGEMENT PLAN

TDM programs include a series of measures that are designed to encourage the use of alternative modes of travel to single-occupant vehicles (SOVs) through influencing the choice of travel modes. These elements are consistent with the Massachusetts Department of Environmental Protection (MassDEP) directive to use all reasonable and feasible mitigation actions to reduce auto emissions. The benefits that are derived from an effective TDM program include less congestion on the roadway network; improved air quality; reduced parking demands and the need for construction of new parking spaces; and health benefits through walking and bicycling. A preliminary list of potential TDM program elements may include the following:

- **On-site Employee Transportation Coordinator**. The Proponent will designate a contact that will serve as transportation coordinator responsible for disseminating relevant TDM information and documentation as part of a TDM Program Manual.

- **Shift Hours.** The proposed industrial use at the Site includes shift times that result in primary trip patterns to/from the Site that occur outside of traditional commuter periods.

- **Preferential Parking for Low-Emission Vehicles.** Preferential parking locations for employees and patrons who use low-emission vehicles will be considered.

- **Preferential Parking for Carpools and Vanpools.** The Proponent will designate preferential parking locations for employees who use carpools and vanpools. The parking spaces will be designated with signs. Employees will be encouraged to carpool and vanpool and site tenants will be encouraged to sponsor and/or subsidize carpool incentives such as gift cards for first-time participation in a carpool or vanpool program.

- **Vehicle Charging Stations.** Electric vehicle charging stations/outlets will be provided for use of employees and visitors. Specific number of space and EV-ready spaces will be further evaluated during the Site Plan review process.

- **No Idling Signage.** Installation of "No Idling" signs at the Project Site's delivery vehicle parking and loading areas to reduce the amount of greenhouse gasses emitted.

- **Pedestrian Infrastructure.** The development will incorporate sidewalks that connect the parking areas to the public sidewalk system at the main site entranceway and proposed building in the parking lot.

- **Bicycle Facilities.** Bike storage facilities for the project will be provided on-site.

9.6.3 ACCESS/EGRESS IMPROVEMENTS

Access and egress improvements will increase accessibility of the Project Site and will help mitigate any increases in traffic to and from the Project Site during construction and operation. Specific improvements include:

- Driveway alignment, which will be designed to be approximately perpendicular to Fort Avenue and Derby Street. The curb radii will be designed as required to accommodate the design vehicle for the Site.

- A STOP sign and STOP line pavement marking is recommended on the driveway approaches to Fort Avenue and Derby Street.

- Installing sidewalks that connect the proposed storage shed on the Project Site to the surface parking areas as well as the existing sidewalk systems located on Fort Avenue, Derby Street, and Webb Street. Crosswalks and ADA compliant ramps should also be provided where appropriate.

- Installing weather-protected bicycle racks to encourage and facilitate bicycle transportation to and from the Project Site as an alternative to singular occupancy vehicles.

Attachment A

DISTRIBUTION LIST

Attachment A: Distribution List

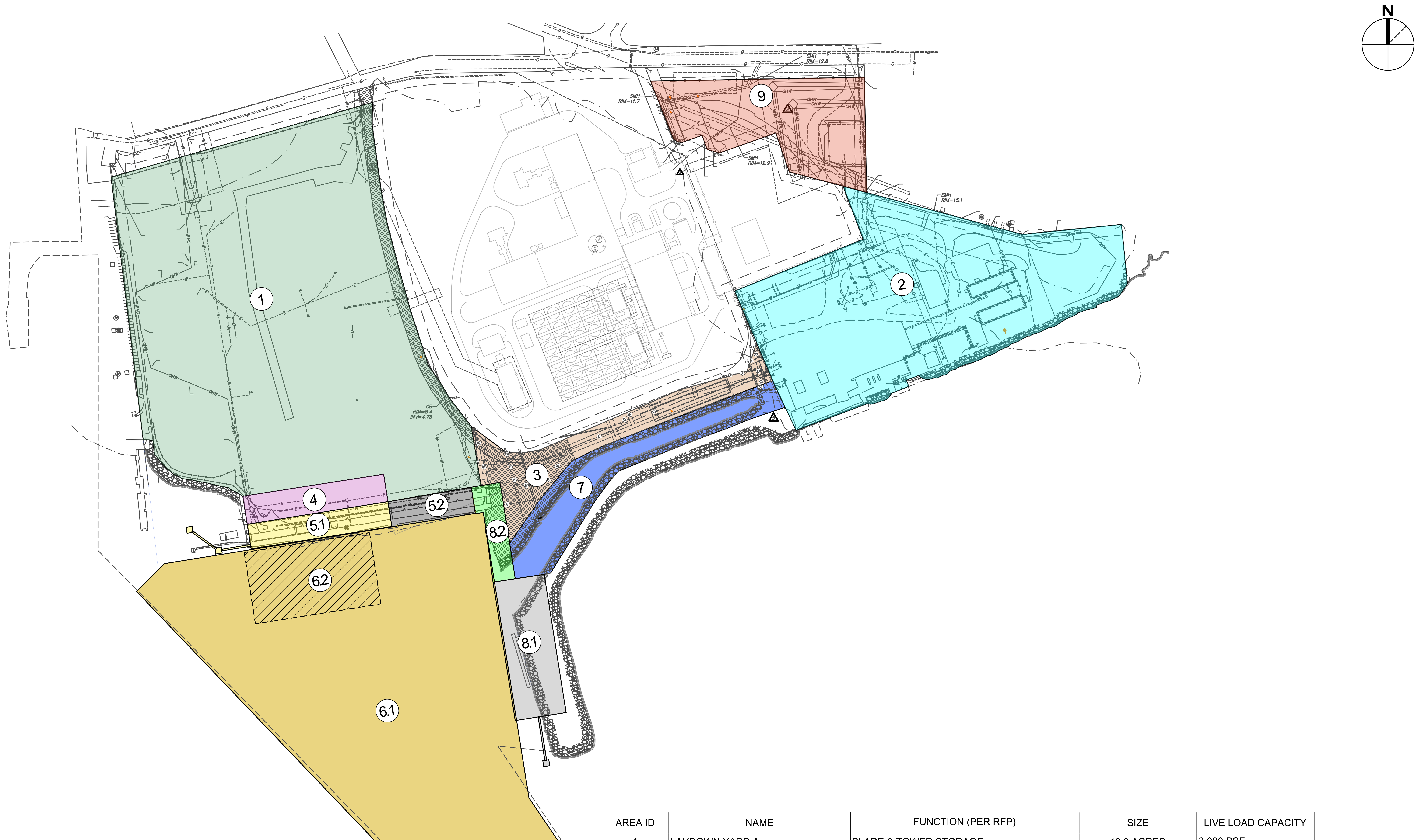
Agency	Contact	
	Email Address	Address
Massachusetts Environmental Policy Act (MEPA) Office	MEPA@mass.gov	MEPA Office 100 Cambridge Street, Suite 900 Boston, MA 02144
Department of Environmental Protection, Boston Office	helena.boccadoro@mass.gov	Commissioner's Office One Winter Street Boston, MA 02108
Department of Environmental Protection, Northeast Regional Office	john.d.viola@mass.gov	MassDEP Northeast Regional Office Attn: MEPA Coordinator 205B Lowell Street Wilmington, MA 01887
Massachusetts Department of Transportation-Boston	MassDOTPPDU@dot.state.ma.us	Public/Private Development Unit 10 Park Plaza, Suite #4150 Boston, MA 02116
Massachusetts Department of Transportation – District 4 Office	timothy.paris@dot.state.ma.us	MassDOT, District #4 Attn: MEPA Coordinator 519 Appleton Street Arlington, MA 02476
Massachusetts Historical Commission	Mail a hard copy of the filling	The MA Archives Building 220 Morrissey Boulevard Boston, MA 02125
Massachusetts Office of Coastal Zone Management	robert.boeri@mass.gov patrice.bordonaro@mass.gov	Project Review Coordinator 251 Causeway Street, Suite 800 Boston, MA 02114
EEA Environmental Justice Director	MEPA-EJ@mass.gov	MEPA Office Attn: EEA EJ Director 100 Cambridge Street, Suite 900 Boston, MA 02144
Coastal Zone Community	DMF.EnvReview-North@mass.gov	DMF – North Shore Attn: Environmental Reviewer 30 Emerson Avenue Gloucester, MA 01930
Massachusetts Water Resources Authority (MWRA)	Katherine.ronan@mwra.com	Massachusetts Water Resource Authority Charlestown Navy Yard

		100 First Avenue Boston, MA 02129
Metropolitan Area Planning Council (MAPC)	afelix@mapc.org mpillsbury@mapc.org	60 Temple Place, 6th Floor Boston, MA 02111
Salem City Council	jcohen@salem.com	93 Washington Street Salem, MA 01970
Salem Planning Board	eeimert@salem.com	City Hall Annex – Department of Planning & Community Development 98 Washington Street, 2nd Floor Salem, MA 01970
Salem Conservation Commission	kkennedy@salem.com	City Hall Annex – Department of Planning & Community Development 98 Washington Street, 2nd Floor Salem, MA 01970
Salem Board of Health	jschiller@salem.com	98 Washington Street, 3rd Floor Salem, MA 01970
Massachusetts Bay Transit Authority	MEPAcoordinator@mbta.com	Attn: MEPA Coordinator 10 Park Plaza, 6th Fl. Boston, MA 02116-3966

Attachment B

PROJECT PLANS

ANSI D 22" x 34"



AREA ID	NAME	FUNCTION (PER RFP)	SIZE	LIVE LOAD CAPACITY
1	LAYDOWN YARD A	BLADE & TOWER STORAGE	19.9 ACRES	3,000 PSF
2	LAYDOWN YARD B	NACELLE STORAGE	9.3 ACRES	4,000 PSF
3	TRANSITION YARD	TRANSIT TO LAYDOWN YARD B	1.9 ACRES	48T AXLE SBMT
4	PRE-ASSEMBLY & LOADOUT	PRE-ASSEMBLY & LOADOUT	416' X 78'	6,000 PSF
5.1	MAIN WHARF	MOORING WTIV & LOADOUT	416' X 78'	6,000 PSF
5.2	MAIN WHARF	RO/RO DELIVERY	243' X 78'	4,000 PSF
6.1	BERTH DREDGING	DEPTH -34' MLLW AT FACE OF WHARVES DEPTH -32' MLLW ELSEWHERE	20.6 ACRES	N/A
6.2	WTIV SPUDCAN SUPPORT	WTIV SUPPORT	0.4 ACRES	SPUDCAN
7	DISCHARGE CHANNEL FILL	SUPPLEMENT TO AREA 3	2.1 ACRES	48T AXLE SBMT
8.1	JETTY WHARF	INBOUND COMPONENT DELIVERY	405' X 150'	4,000 PSF
8.2	JETTY WHARF TRESTLE	ACCESS TO JETTY WHARF	280' X 65'	48T AXLE SBMT
9	PARKING	PARKING	3.6 ACRES	AASHTO HL-93

1 GENERAL LAYOUT PLAN
SCALE: 1" = 150'-0"

GRAPHIC SCALE: 1" = 150'-0"
150' 75' 0 75' 150' 300' 450'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

CLIENT
CROWLEY
CROWLEY WIND SERVICES, Inc.
9487 Regency Square Boulevard
Jacksonville, FL 32225

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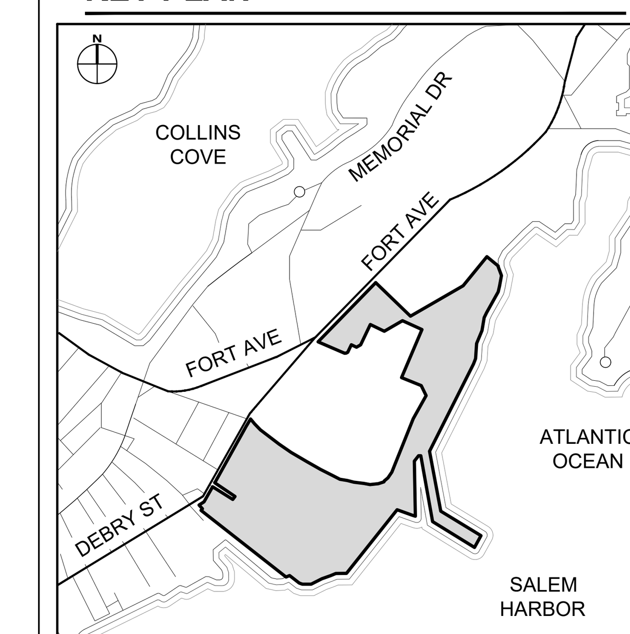
DREDGE & DREDGE MATERIAL MANAGEMENT
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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30% DESIGN DOCUMENTS

REVISION

R	DATE	DESCRIPTION

Designed By:	**J. KLEIN**
Drawn By:	**F. LIZANO**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
GENERAL LAYOUT PLAN

SHEET NUMBER
S100
- OF -

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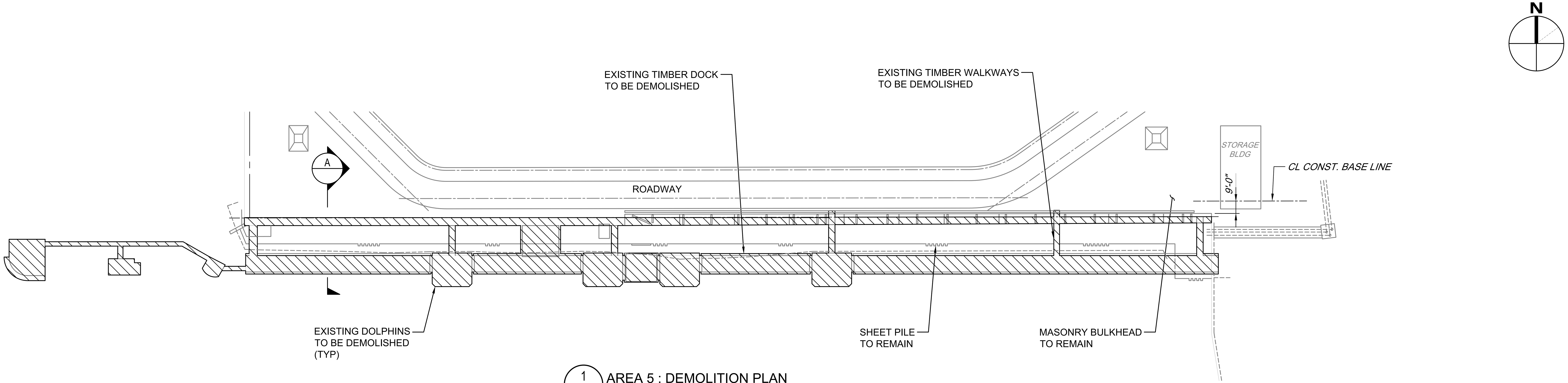

1 AREA 5 : DEMOLITION PLAN
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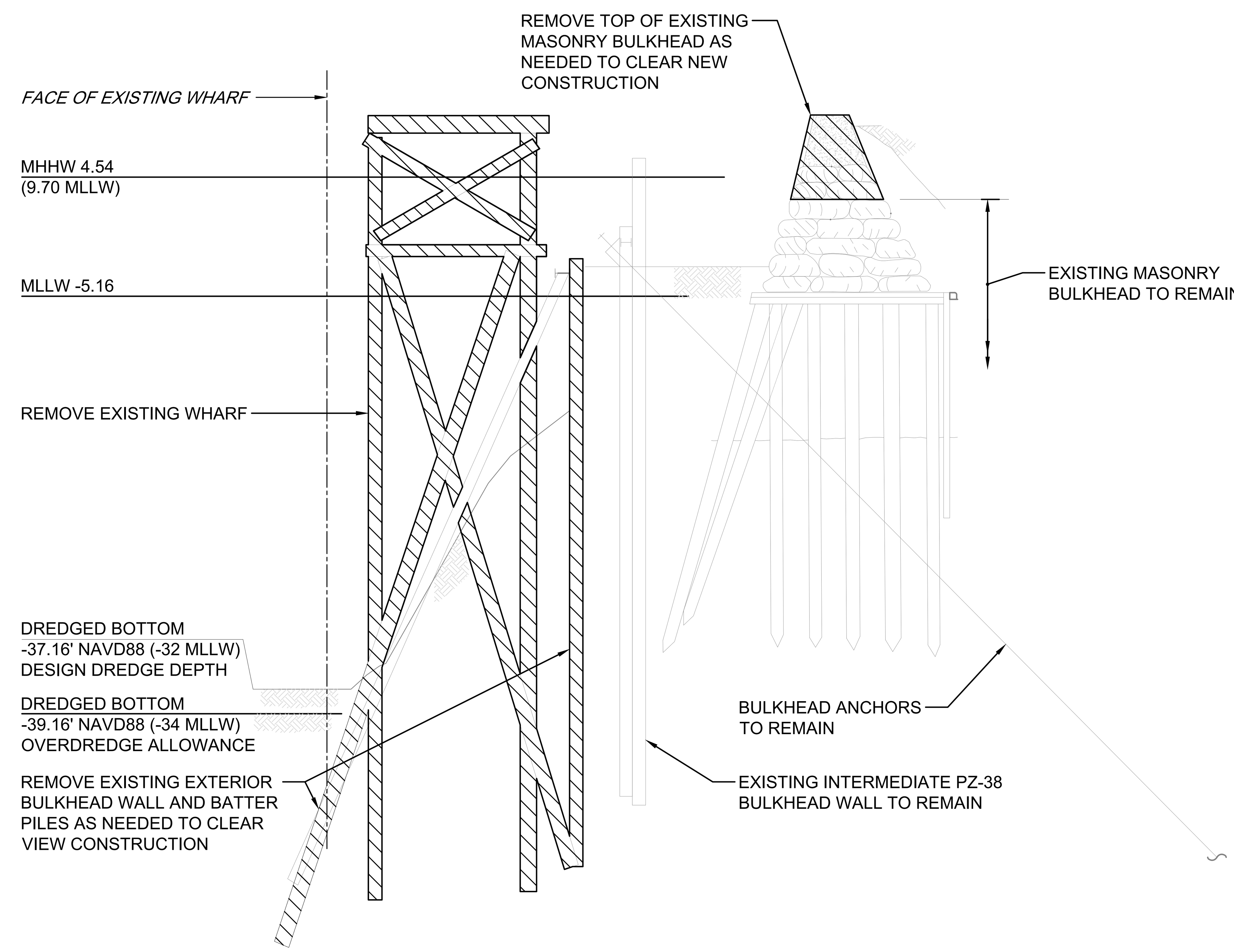

A AREA 5 : DEMOLITION SECTION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

GRAPHIC SCALE: 1" = 40'-0"
40' 20' 0 20' 40' 80' 120'

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SALEM WIND PORT
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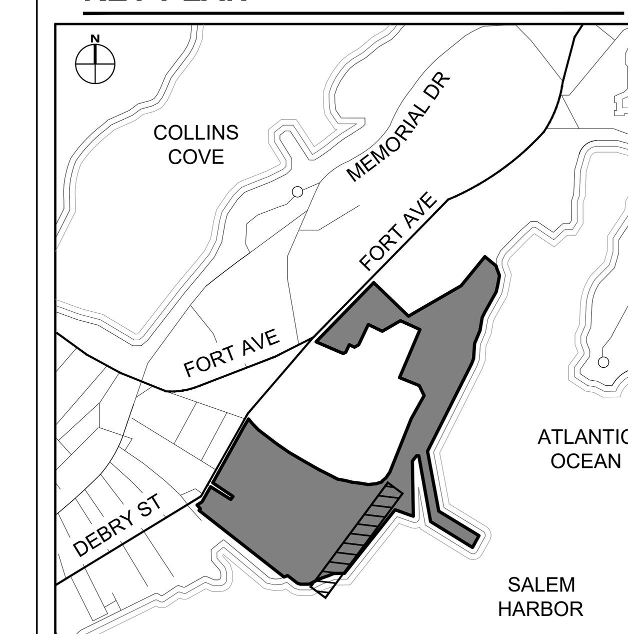
KEY PLAN



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R	DATE	DESCRIPTION

Designed By:	A. LU
Drawn By:	F. LIZANO
Checked By:	J. KLEIN
Approved By:	P. DELJOUI

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
DEMOLITION AREA 5

SHEET NUMBER
S201
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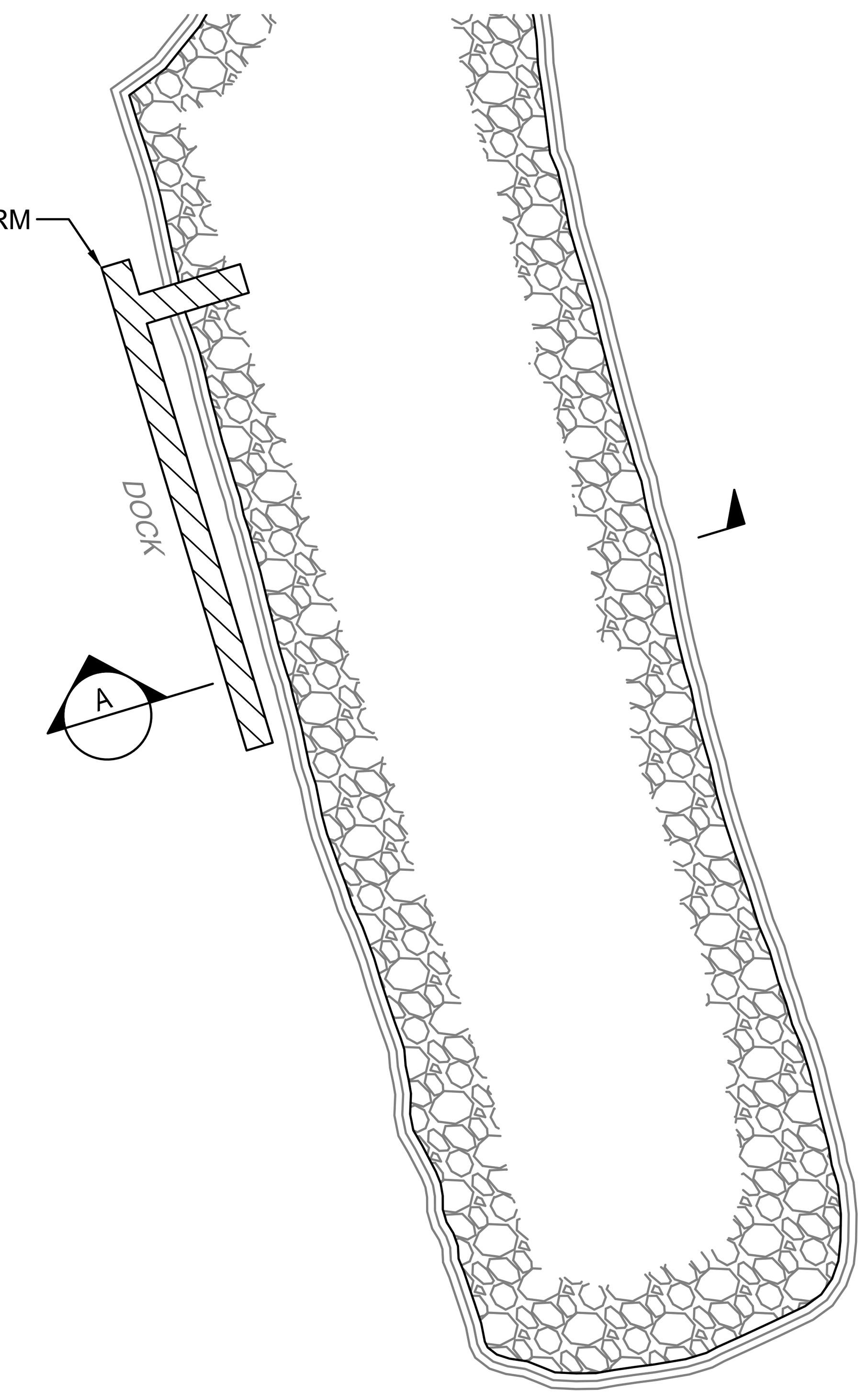

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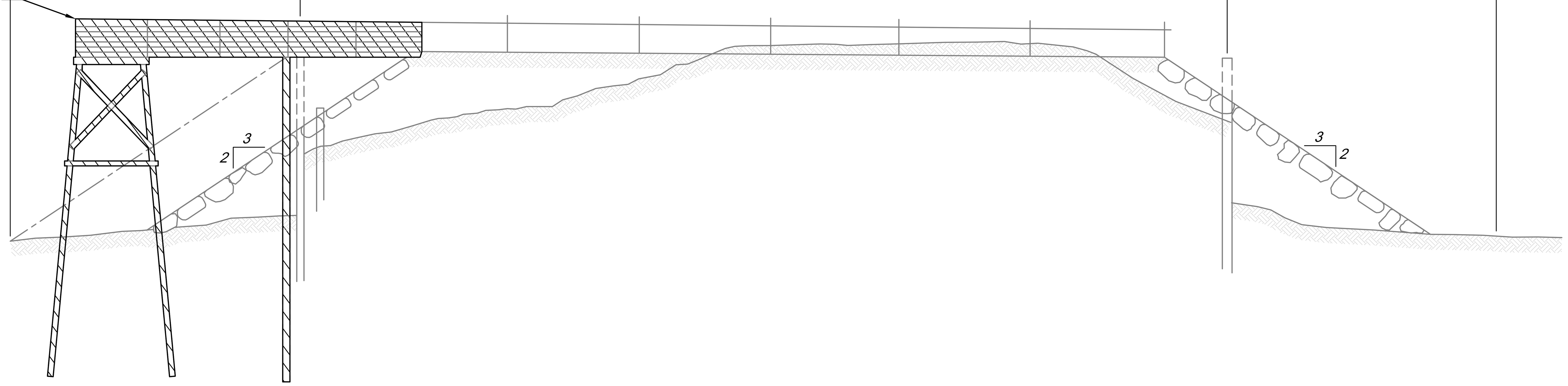

A AREA 8 - DEMOLITION SECTION
SCALE: 1/8"=1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

GRAPHIC SCALE: 1" = 50'-0"
50' 0 50' 100' 150'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

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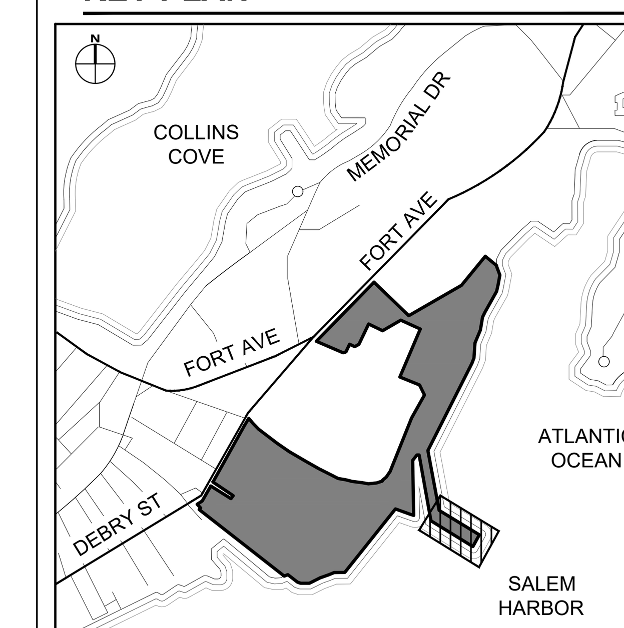
KEY PLAN



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Checked By:	**J. KLEIN**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
DEMOLITION AREA 8

SHEET NUMBER
S202
- OF -

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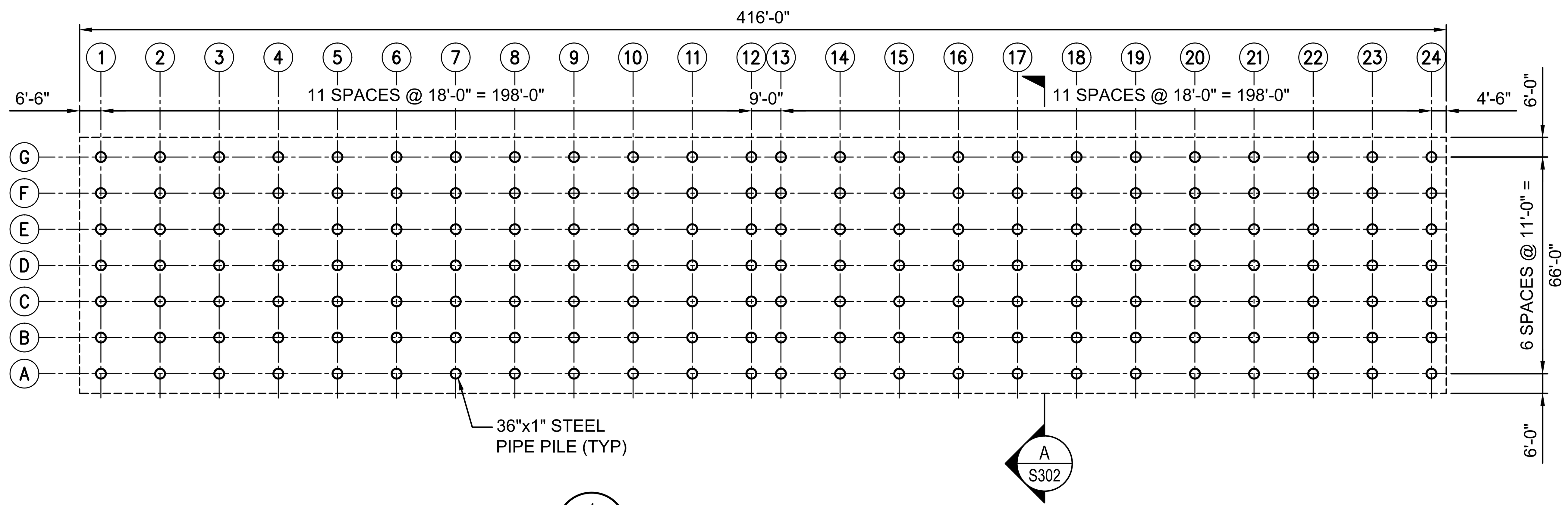

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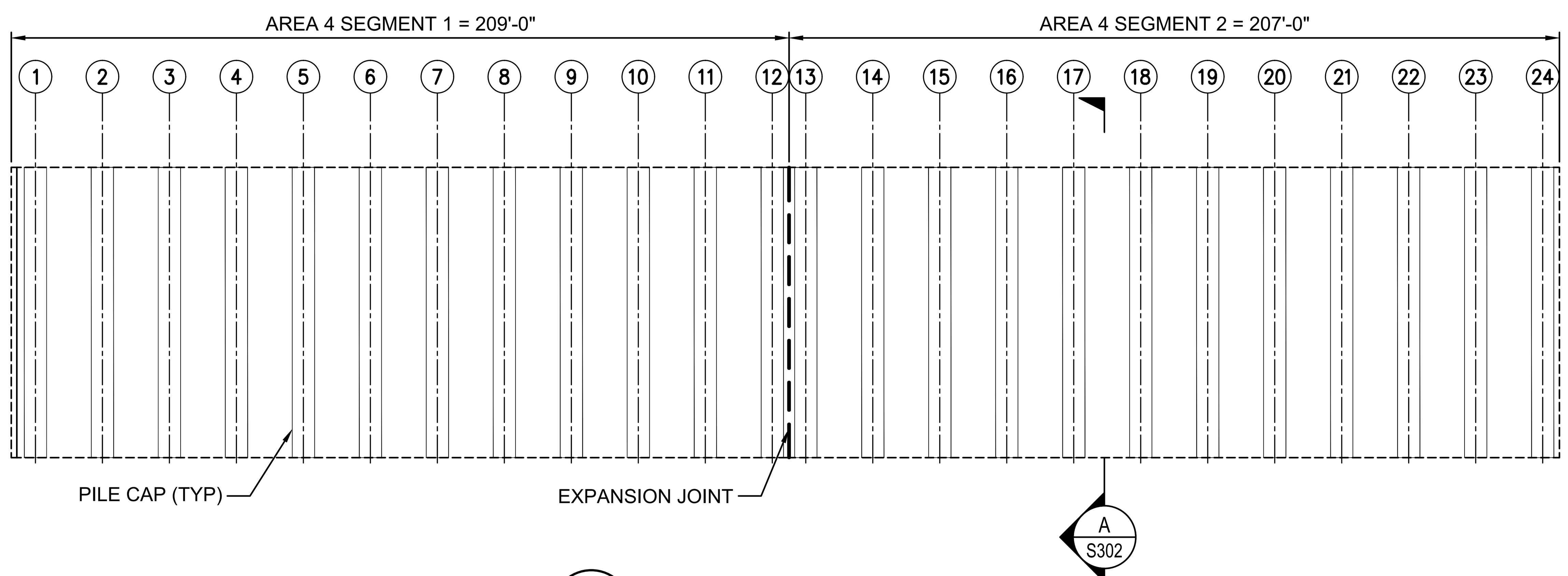

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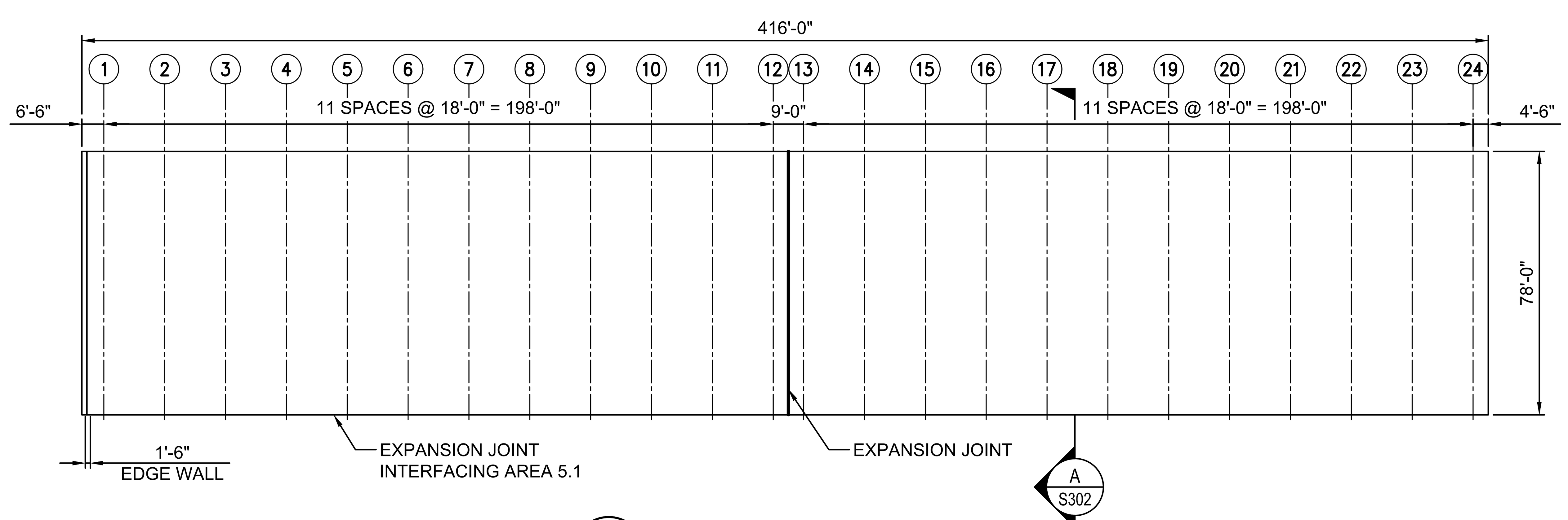

3 AREA 4 DECK PLAN
SCALE: 1" = 30'-0"

GRAPHIC SCALE: 1" = 30'-0"

30' 15' 0 15' 30' 60' 90'

PROJECT

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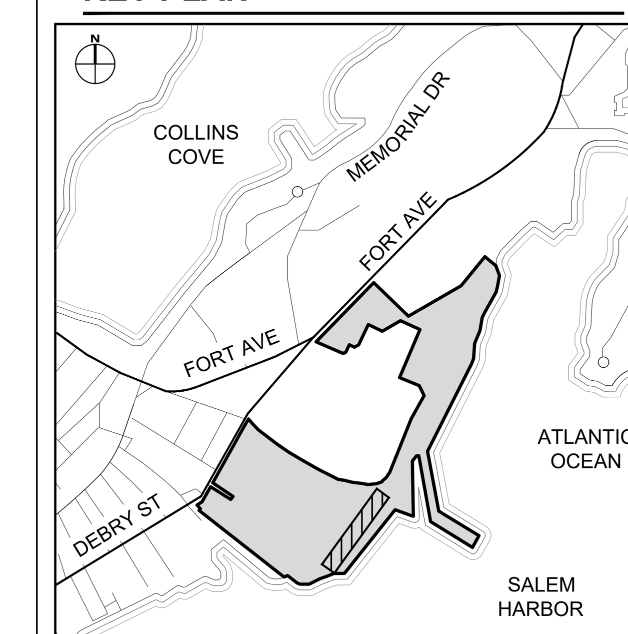
KEY PLAN



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Designed By:	J. KLEIN
Drawn By:	F. LIZANO
Checked By:	P. DELJOUI
Approved By:	P. DELJOUI

PROJECT/TERM CONTRACT NUMBER

60681893

SHEET TITLE

AREA 4
PRE-ASSEMBLY & LOADOUT
PILE,PILE CAP & DECK PLANS

SHEET NUMBER

S301

- OF -

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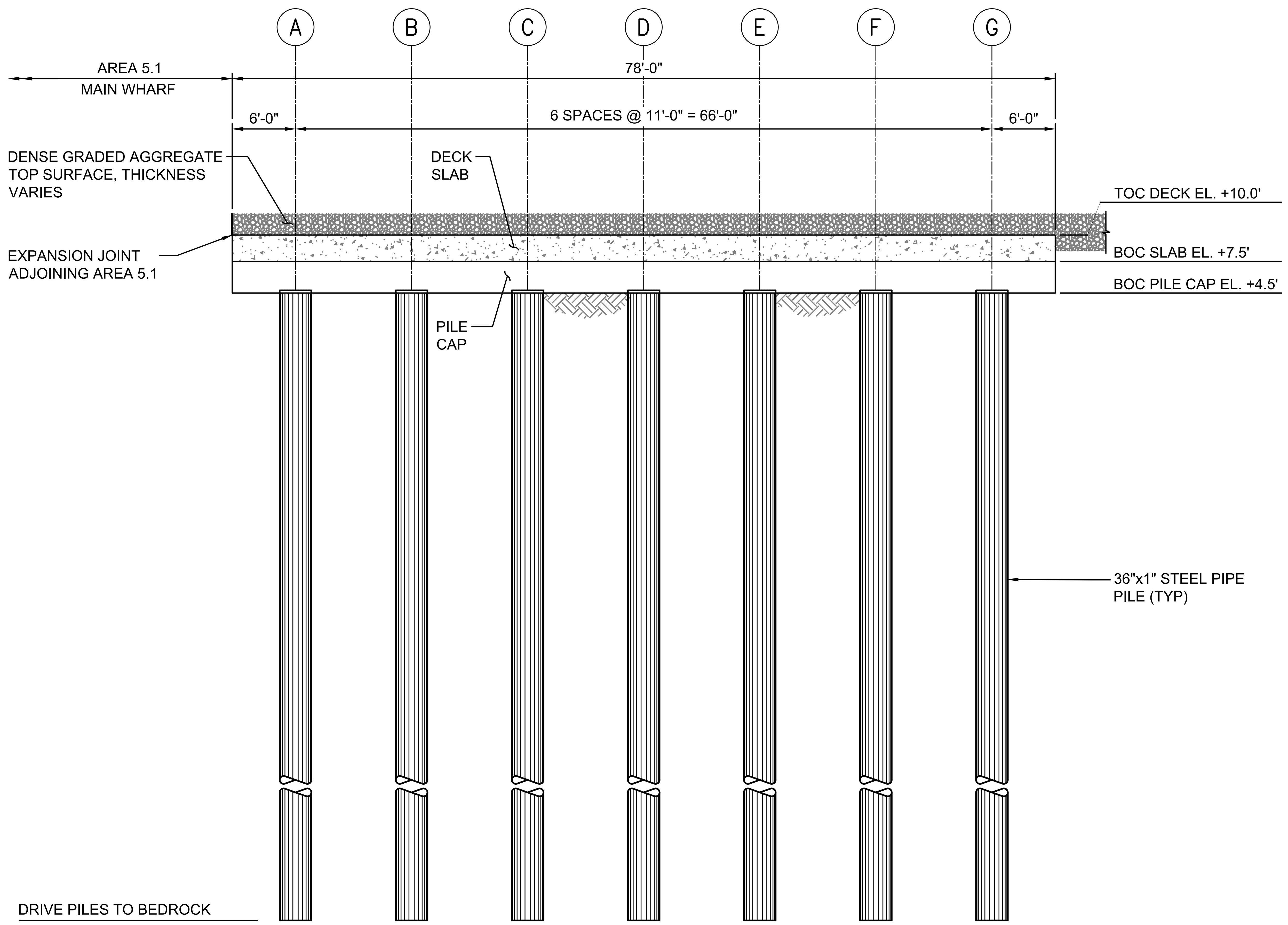

A
S301

AREA 4 PRE-ASSEMBLY & LOADOUT TYPICAL SECTION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

PROJECT

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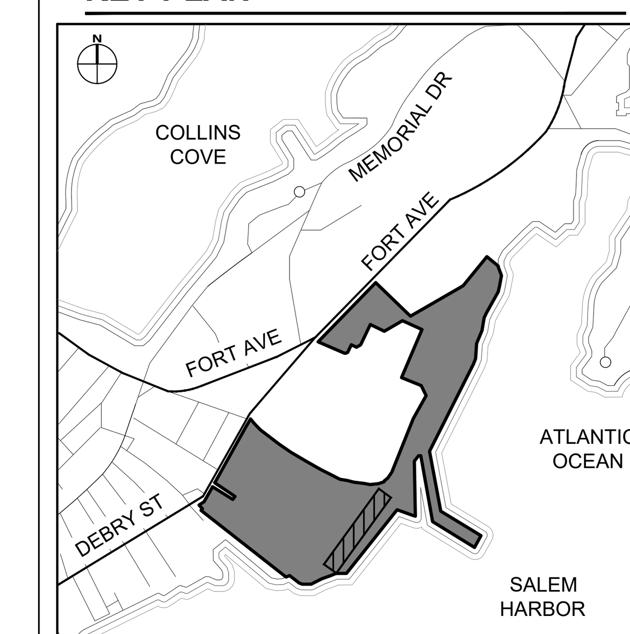

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Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER

60681893

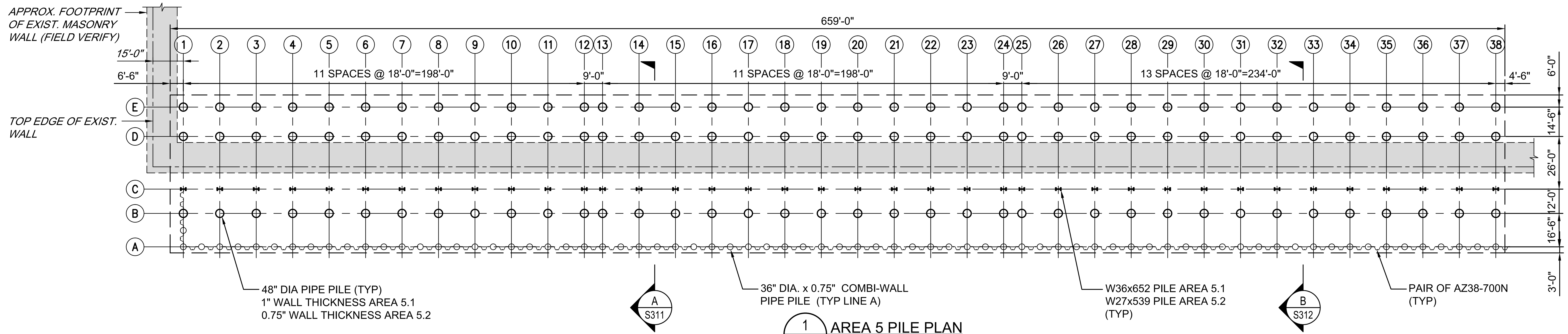
SHEET TITLE

AREA 4
PRE-ASSEMBLY & LOADOUT
TYPICAL SECTION

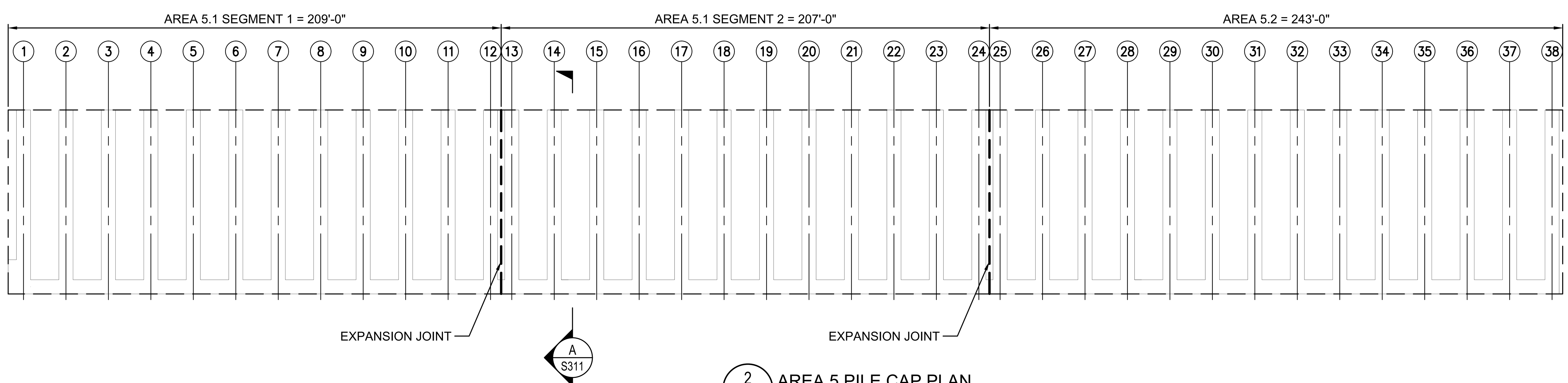
SHEET NUMBER

S302

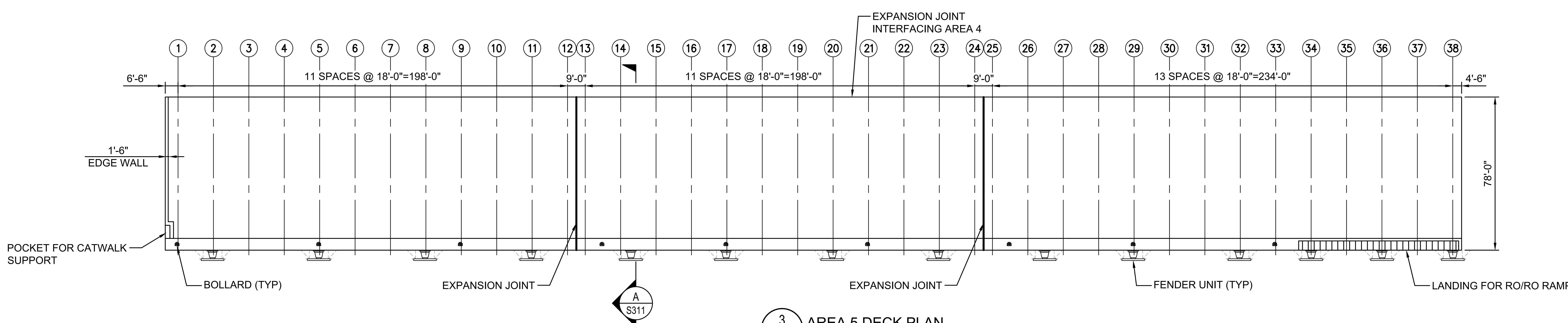
- OF -



1 AREA 5 PILE PLAN
SCALE: 1" = 30'-0"



2 AREA 5 PILE CAP PLAN
SCALE: 1" = 30'-0"



3 AREA 5 DECK PLAN
SCALE: 1" = 30'-0"

GRAPHIC SCALE: 1" = 30'-0"

ANSI D 22" x 34"

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PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

CLIENT
CROWLEY
CROWLEY WIND SERVICES, Inc.
9487 Regency Square Boulevard
Jacksonville, FL 32225

CONSULTANT
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AECOM TECHNICAL SERVICES, INC.
605 3rd Ave, 2nd Floor
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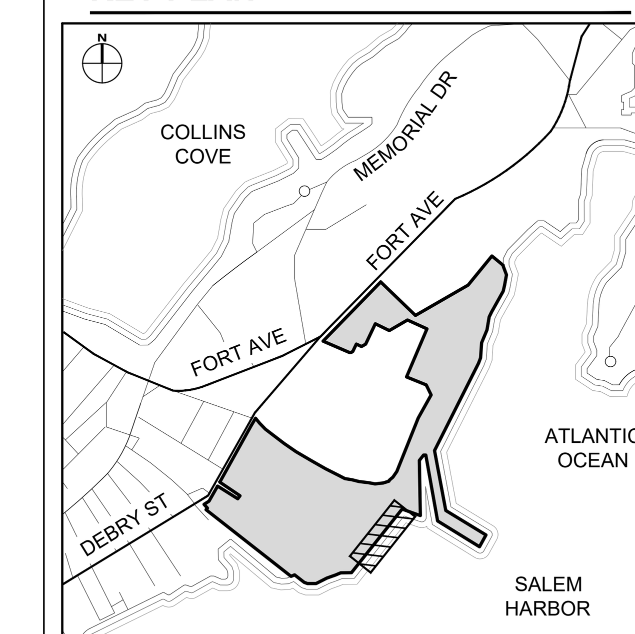
DREDGE & DREDGE MATERIAL MANAGEMENT
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	J. KLEIN
Drawn By:	F. LIZANO
Checked By:	P. DELJOUI
Approved By:	P. DELJOUI

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 5
MAIN WHARF
PILE,PILE CAP & DECK PLANS

SHEET NUMBER
S310

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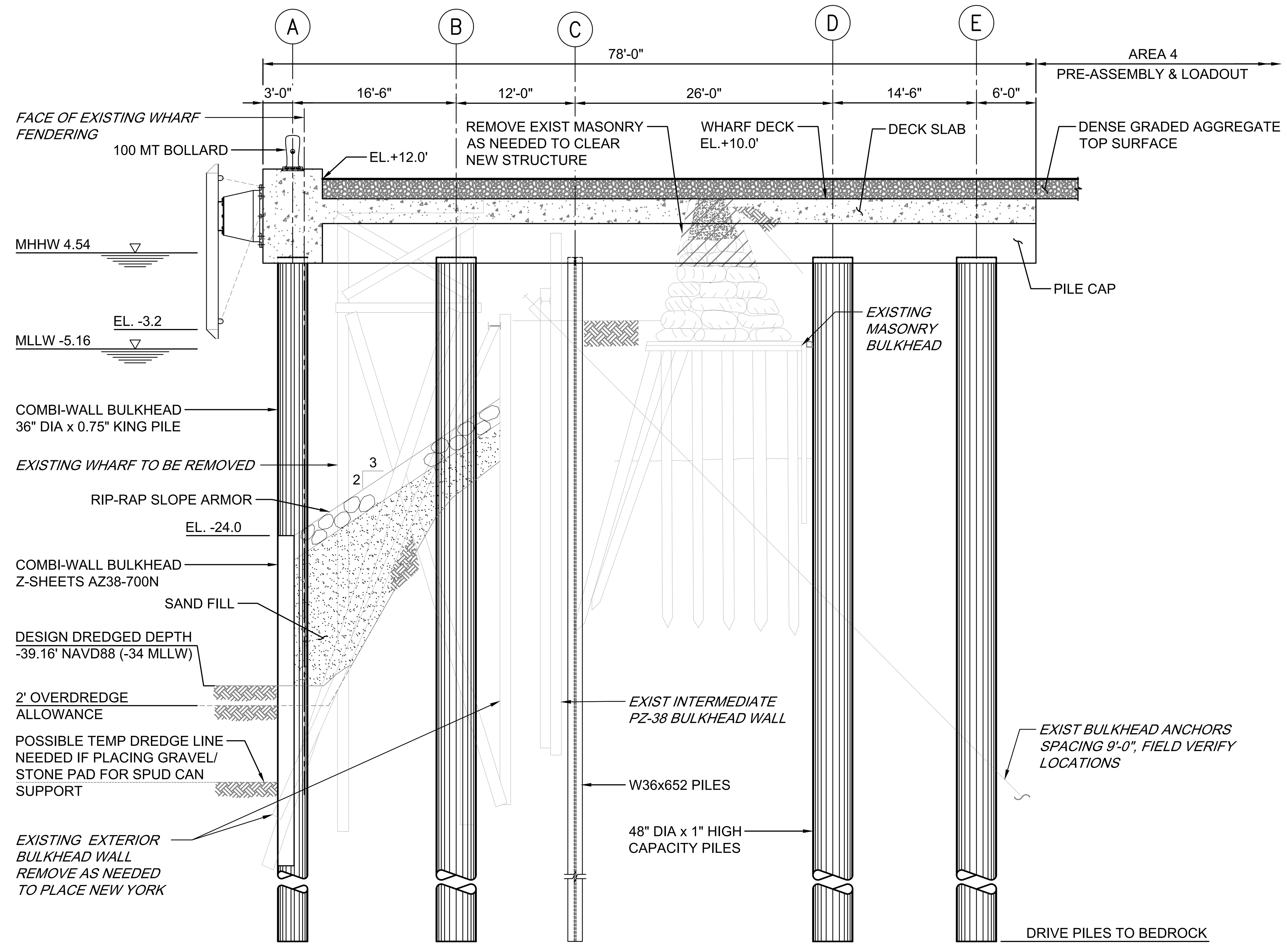

A / S310 AREA 5.1 TYPICAL MAIN WHARF SECTION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

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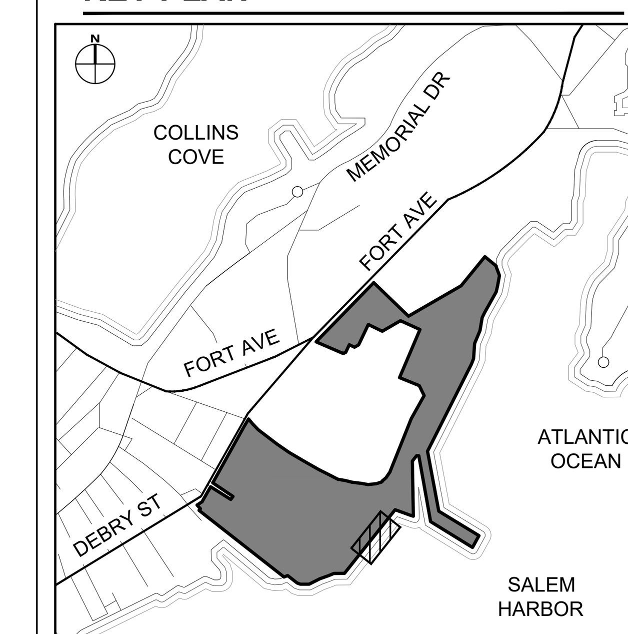
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	**J. KLEIN**
Drawn By:	**A. FERRER**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 5.1
MAIN WHARF
TYPICAL SECTION

SHEET NUMBER
S311
- OF -

ANSI D 22" x 34"

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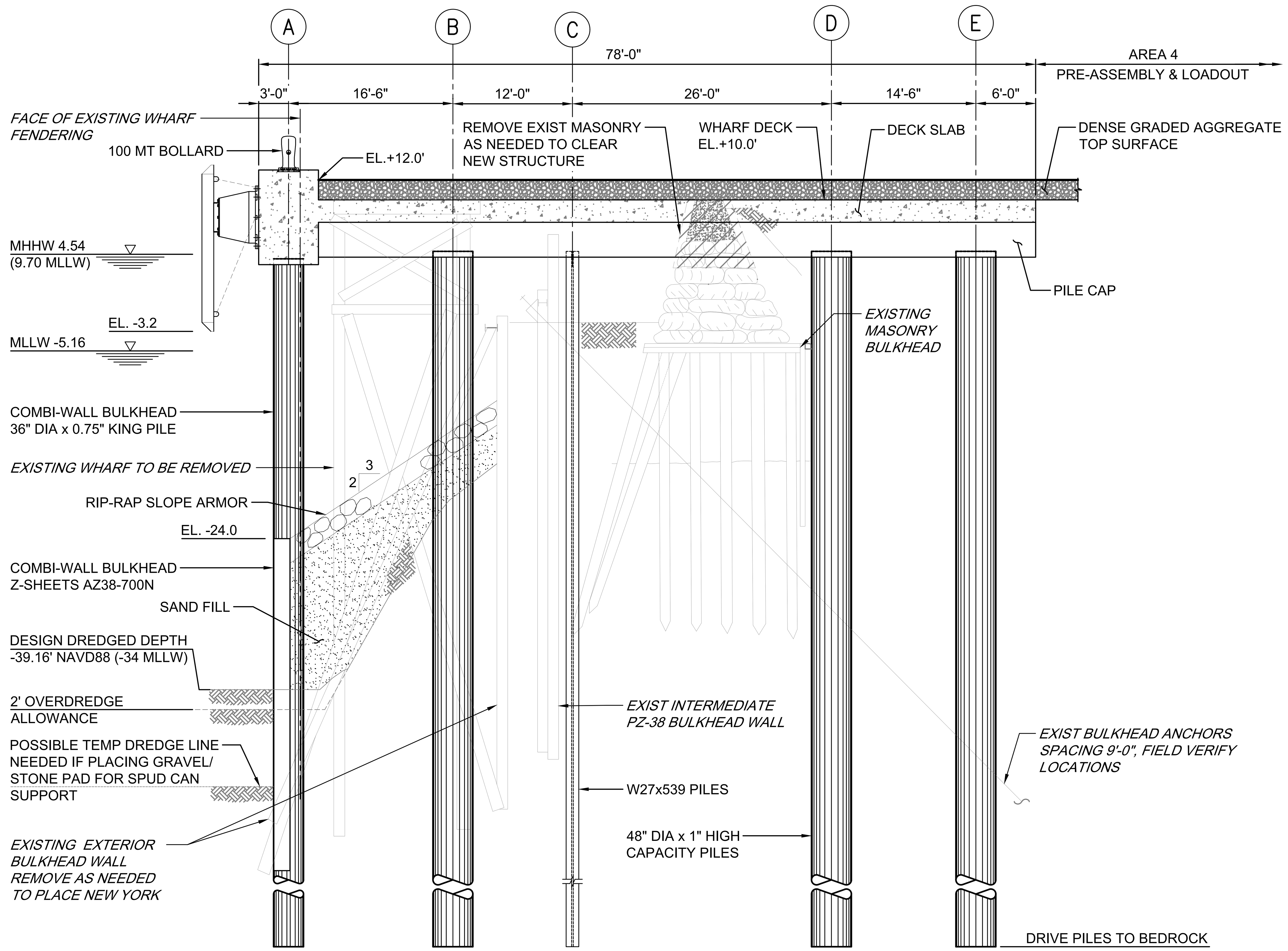

B / S310 AREA 5.2 TYPICAL MAIN WHARF SECTION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

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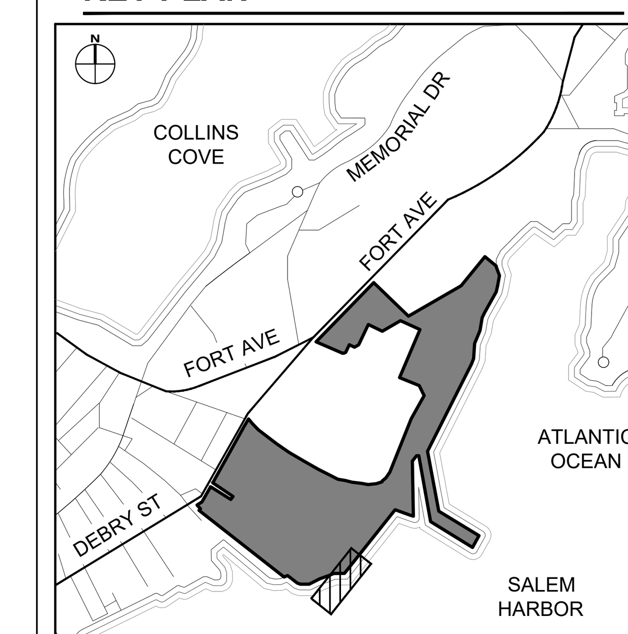
9 Water St., Amersbury, MA 01913

KEY PLAN



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R	DATE	DESCRIPTION

Designed By:	**J. KLEIN**
Drawn By:	**A. FERRER**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 5.2
MAIN WHARF
TYPICAL SECTION

SHEET NUMBER
S312
- OF -

ANSI D 22" x 34"

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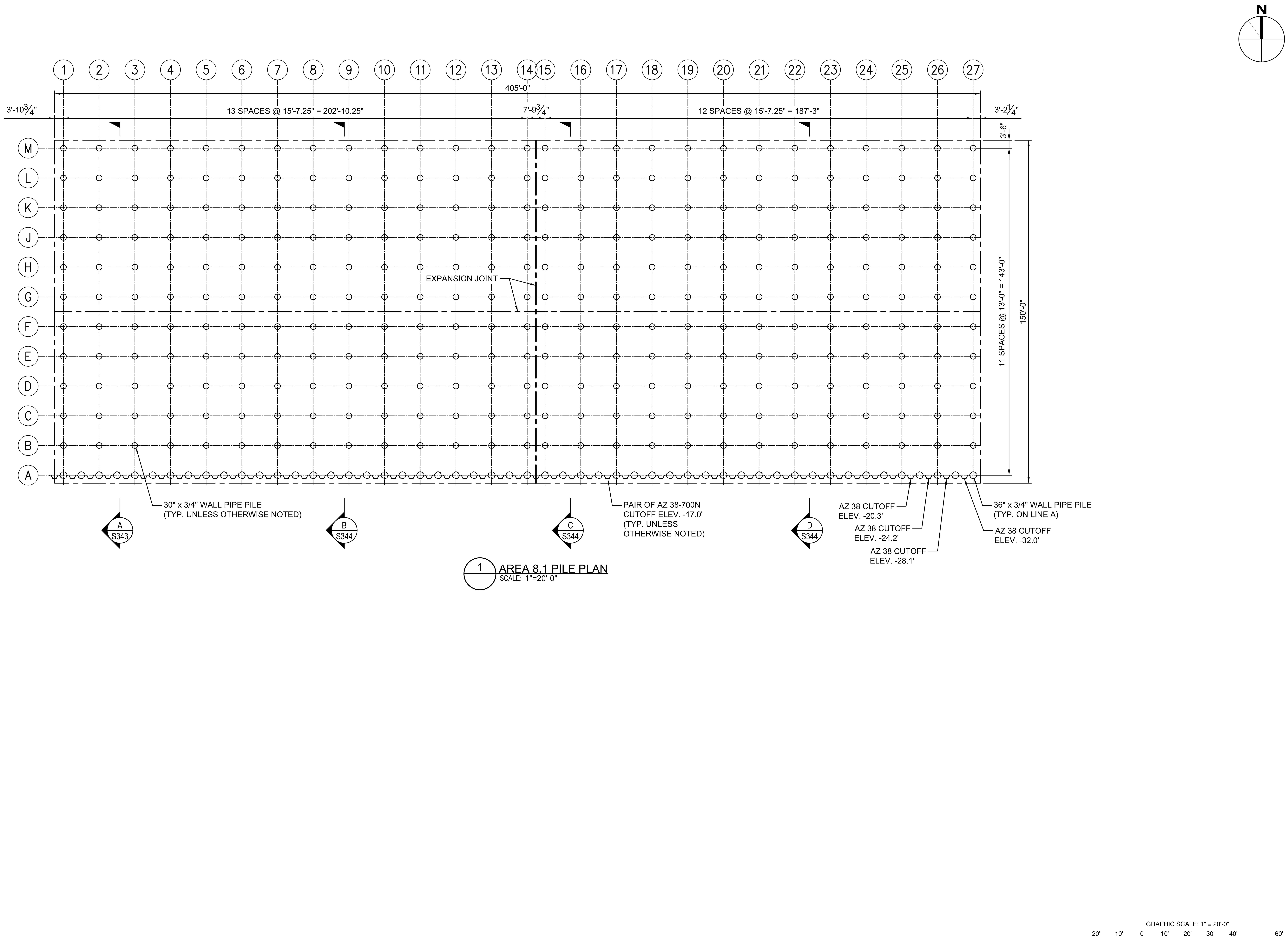

1 AREA 8.1 PILE PLAN
SCALE: 1"=20'-0"

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KEY PLAN

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R	DATE	DESCRIPTION

Designed By:	J. KLEIN
Drawn By:	A. FERRER
Checked By:	P. DELJOUI
Approved By:	P. DELJOUI

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 8.1
JETTY WHARF PILE PLAN

SHEET NUMBER
S340
- OF -

ANSI D 22" x 34"

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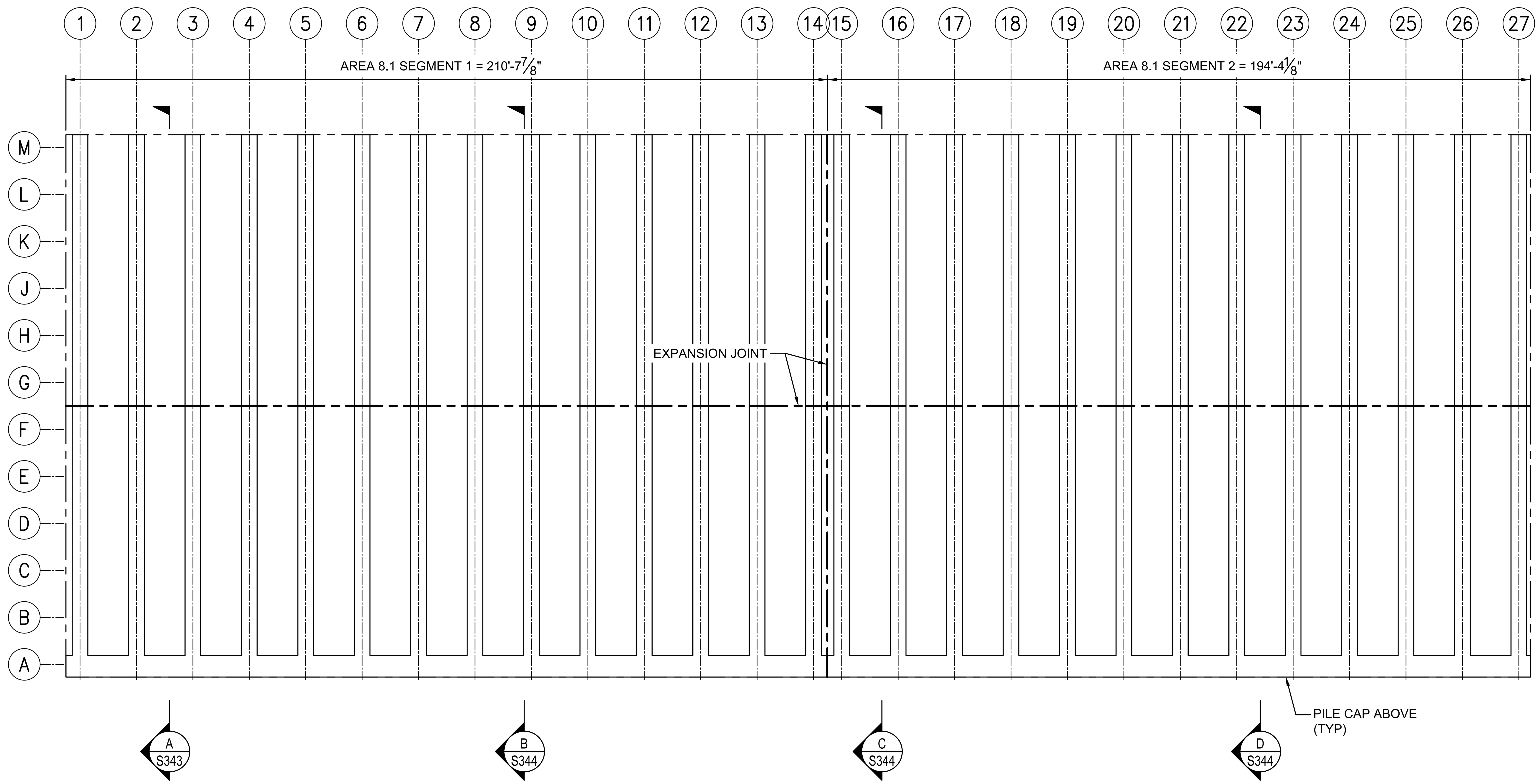

1 AREA 8.1 PILE CAP PLAN
SCALE: 1"=20'-0"

GRAPHIC SCALE: 1" = 20'-0"
20' 10' 0 10' 20' 30' 40' 60'

ANSI D 22" x 34"

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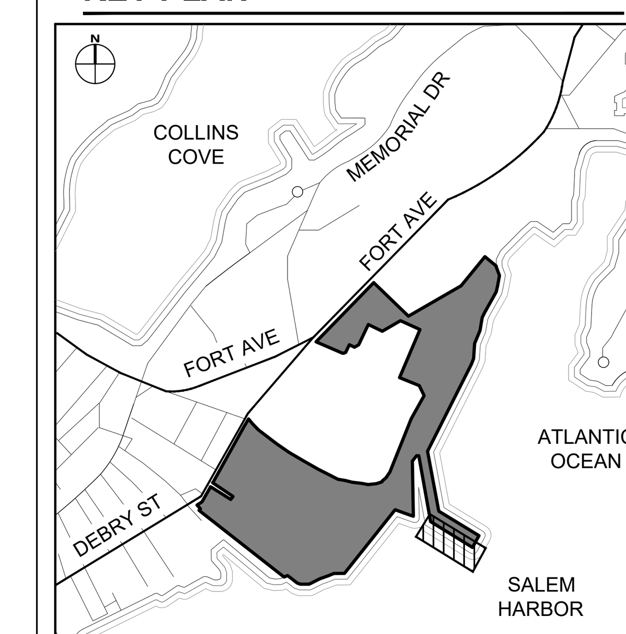
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

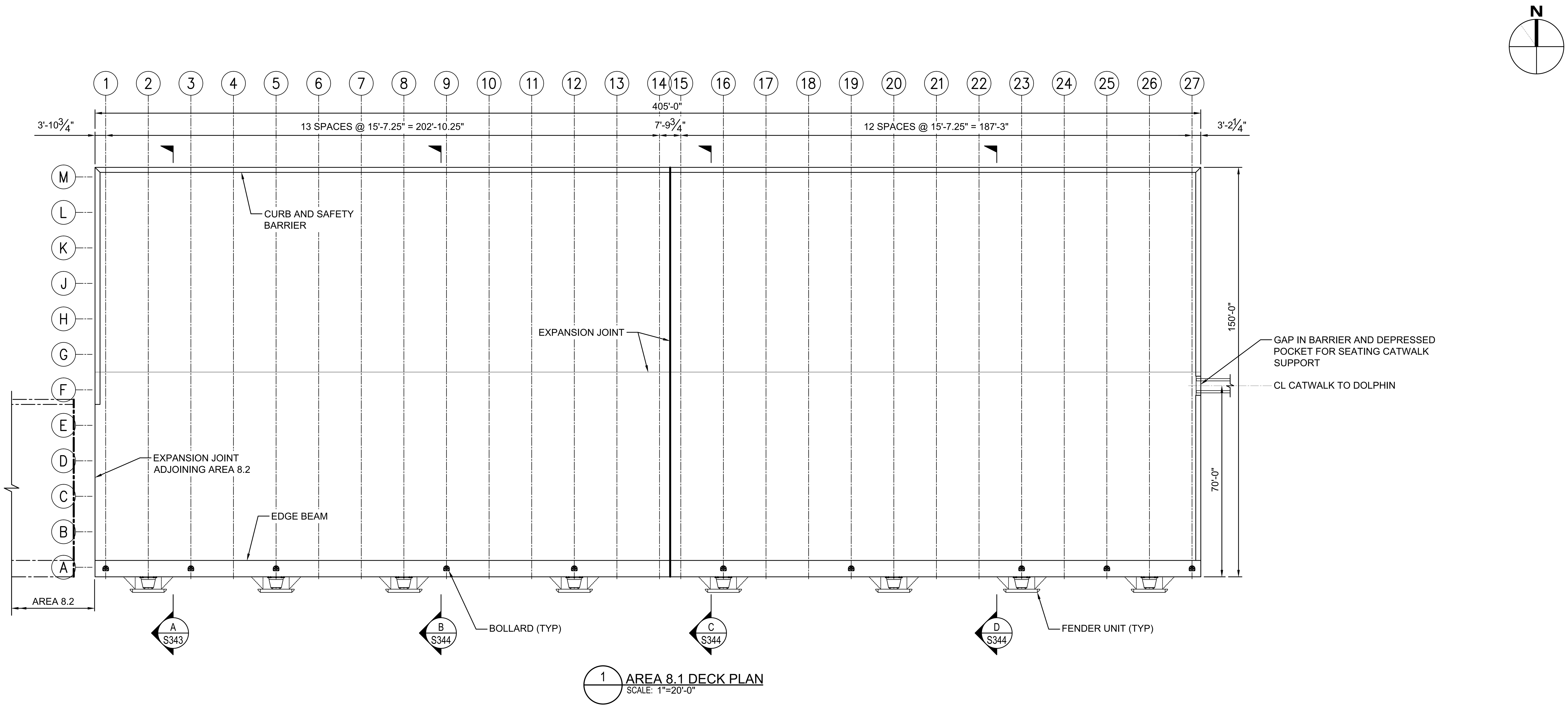
Designed By:	**J. KLEIN**
Drawn By:	**A. FERRER**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 8.1
JETTY WHARF PILE CAP PLAN

SHEET NUMBER
S341

- OF -



1 AREA 8.1 DECK PLAN
SCALE: 1"=20'-0"

GRAPHIC SCALE: 1" = 20'-0"
20' 10' 0 10' 20' 30' 40' 60'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

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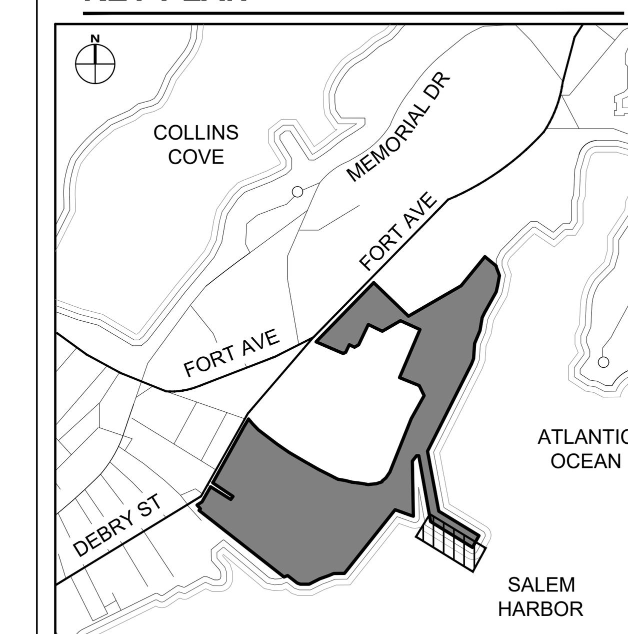
KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	**J. KLEIN**
Drawn By:	**A. FERRER**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 8.1
JETTY WHARF DECK PLAN

SHEET NUMBER
S342
- OF -

ANSI D 22" x 34"

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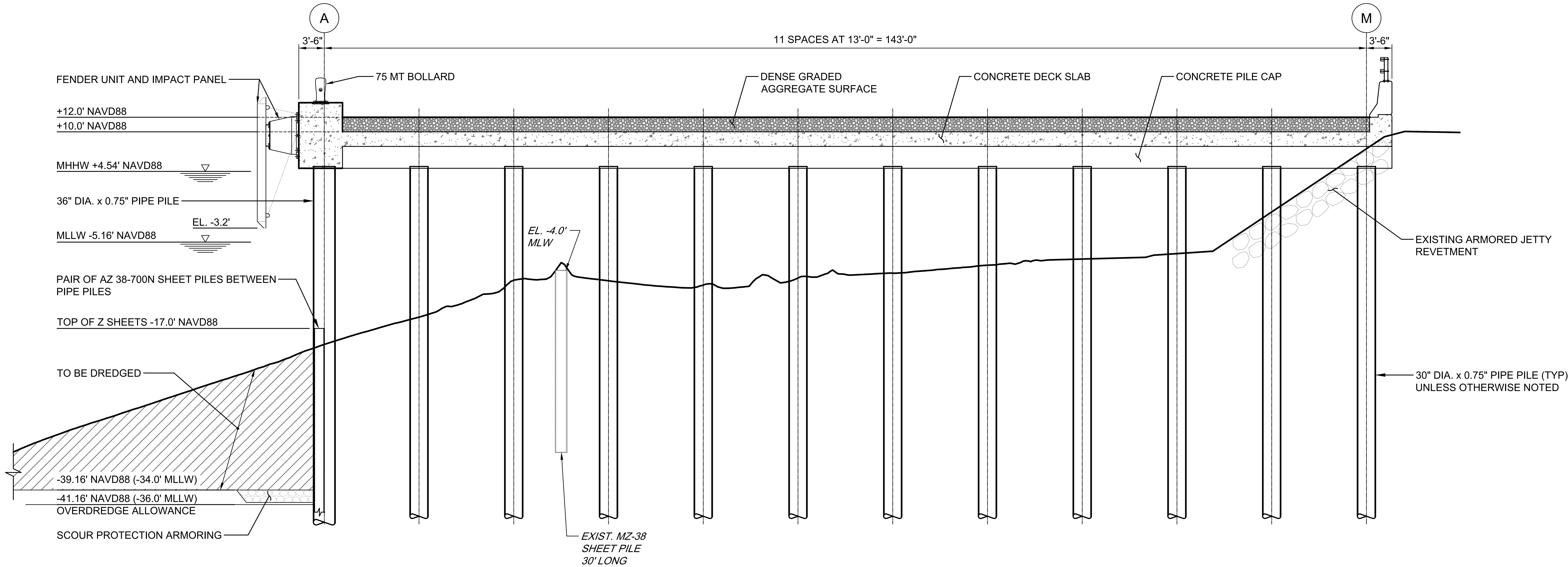

A / S342 **AREA 8.1 - SECTION**
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

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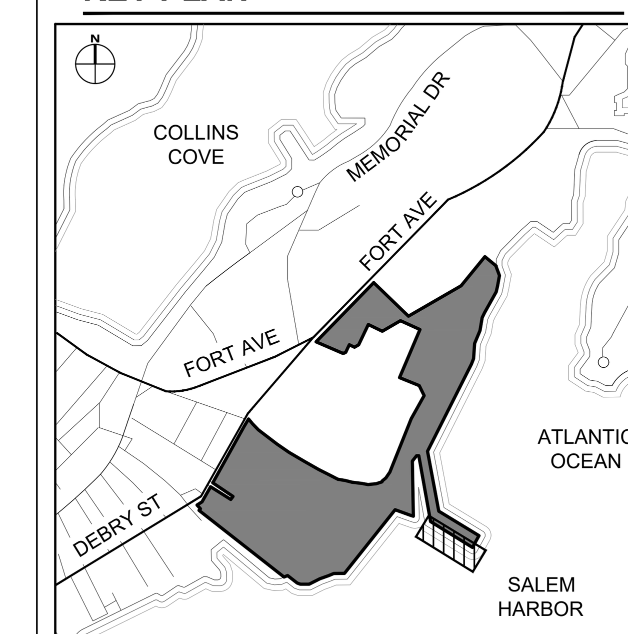
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	J. KLEIN
Drawn By:	A. FERRER
Checked By:	P. DELJOUI
Approved By:	P. DELJOUI

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 8.1
JETTY WHARF SECTIONS
1 OF 2

SHEET NUMBER
S343
- OF -

ANSI D 22" x 34"

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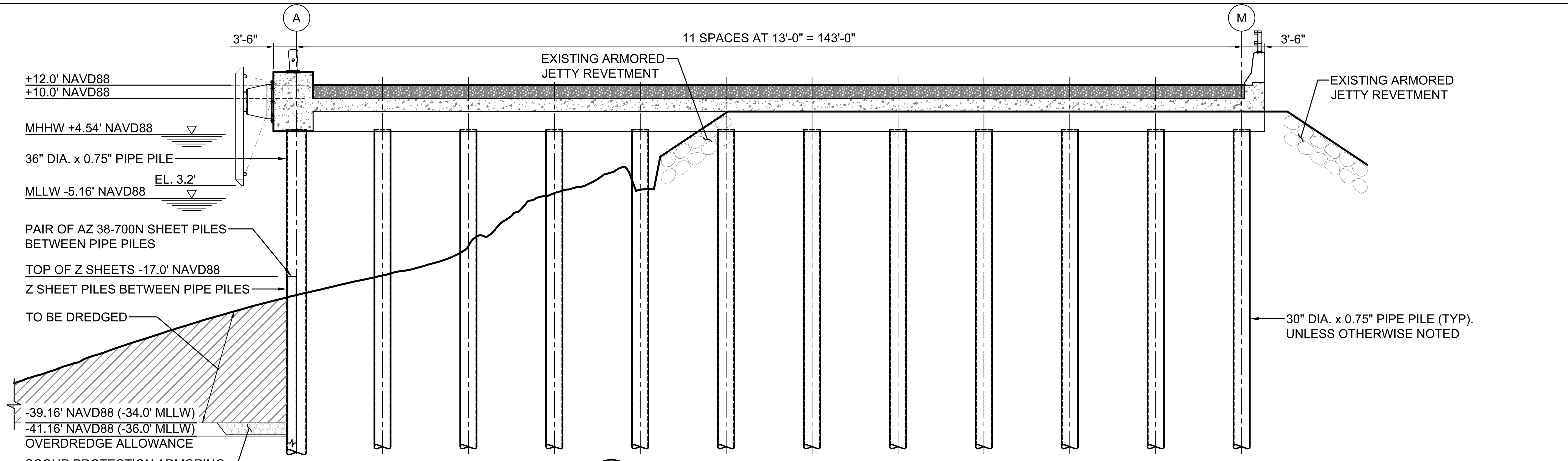
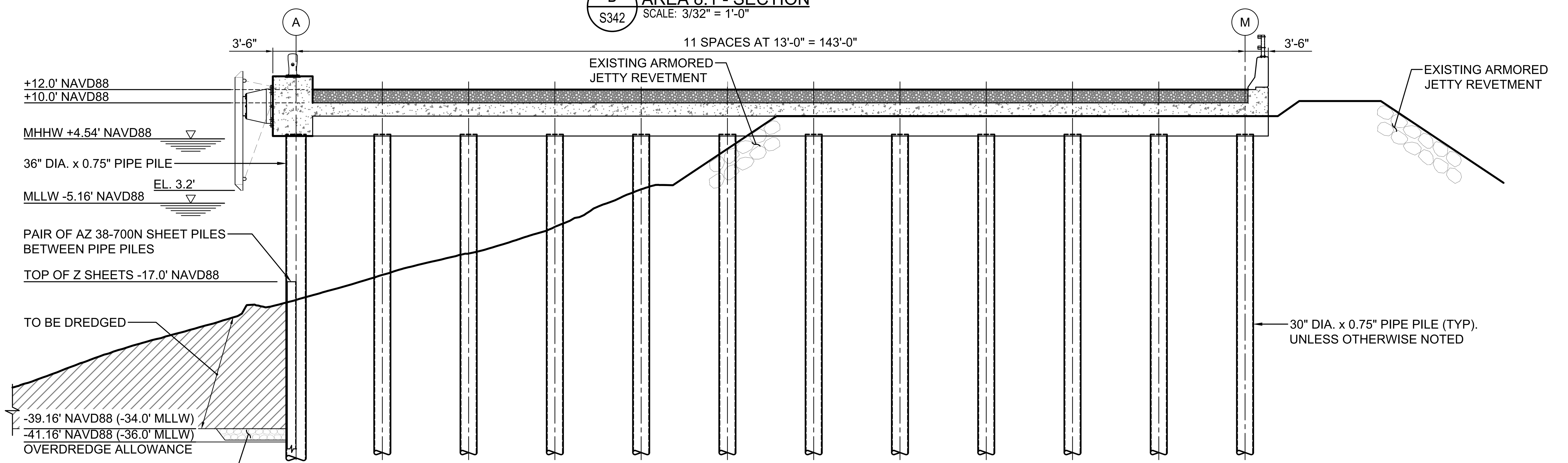
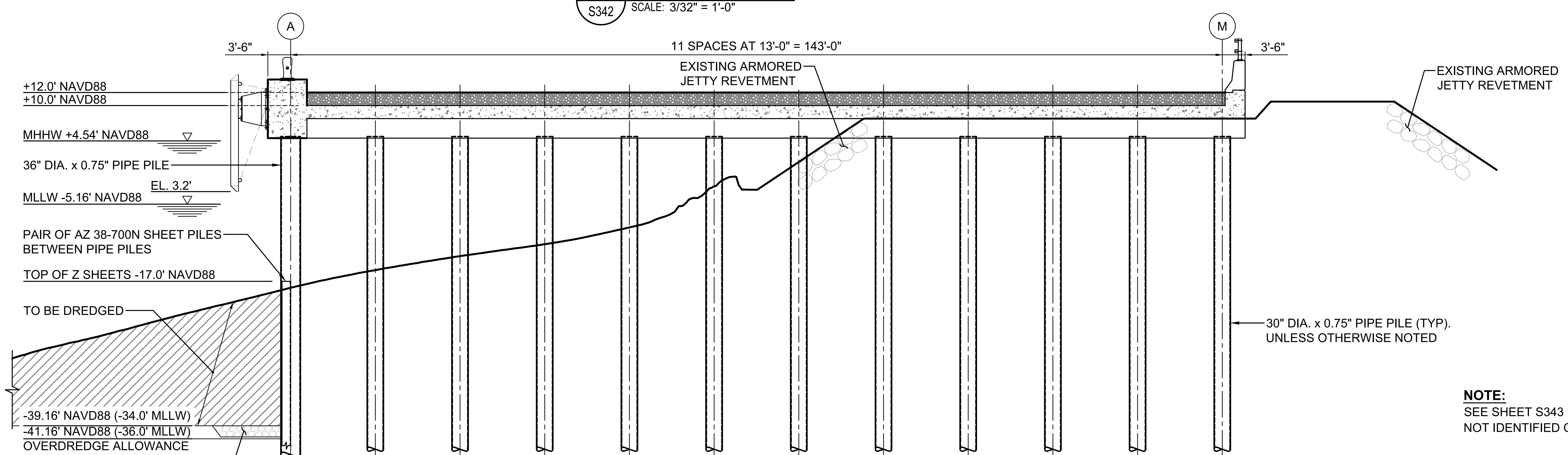


B / S342 AREA 8.1 - SECTION
SCALE: 3/32" = 1'-0"



C / S342 AREA 8.1 - SECTION
SCALE: 3/32" = 1'-0"



D / S342 AREA 8.1 - SECTION
SCALE: 3/32" = 1'-0"

NOTE:
SEE SHEET S343 FOR WHARF DETAILS NOT IDENTIFIED ON THIS SHEET.

GRAPHIC SCALE: 3/32" = 1'-0"
0 8' 16' 32'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

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CROWLEY WIND SERVICES, Inc.
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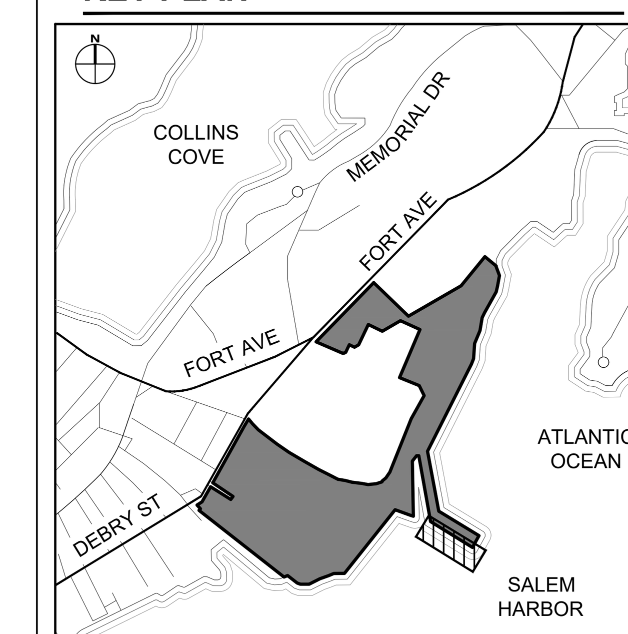
KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	**J. KLEIN**
Drawn By:	**A. FERRER**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 8.1
JETTY WHARF SECTIONS
2 OF 2

SHEET NUMBER
S344

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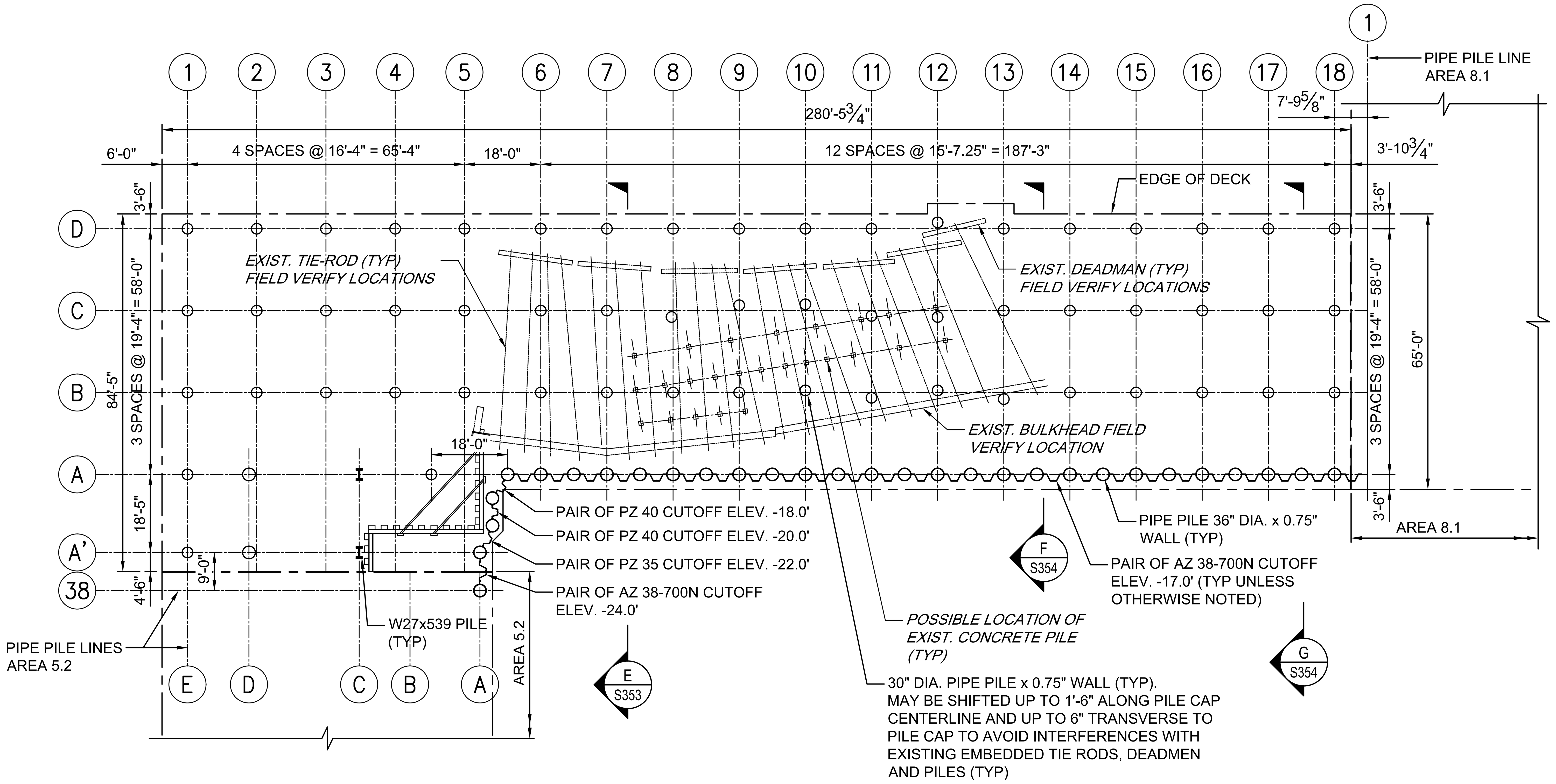

1 AREA 8.2 PILE PLAN
SCALE: 1"=20'-0"

GRAPHIC SCALE: 1" = 20'-0"
20' 10' 0 10' 20' 30' 40' 60'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

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CROWLEY WIND SERVICES, Inc.
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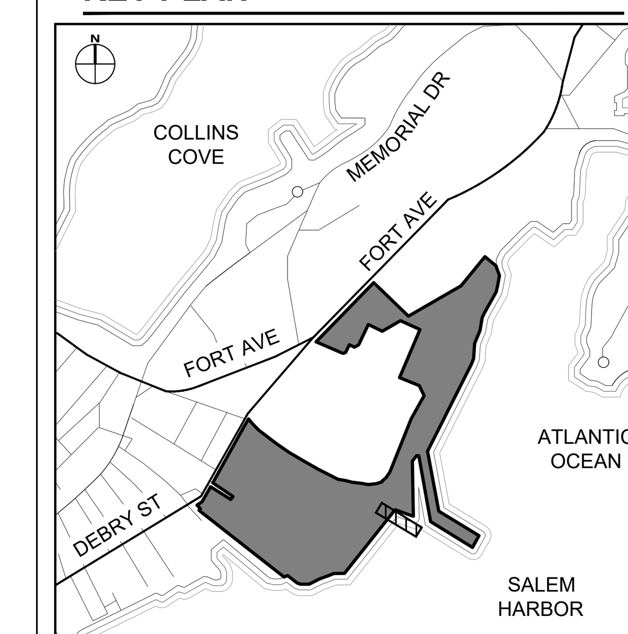
KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	J. KLEIN
Drawn By:	A. FERRER
Checked By:	P. DELJOUI
Approved By:	P. DELJOUI

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 8.2
TRESTLE PILE PLAN

SHEET NUMBER
S350
- OF -

ANSI D 22" x 34"
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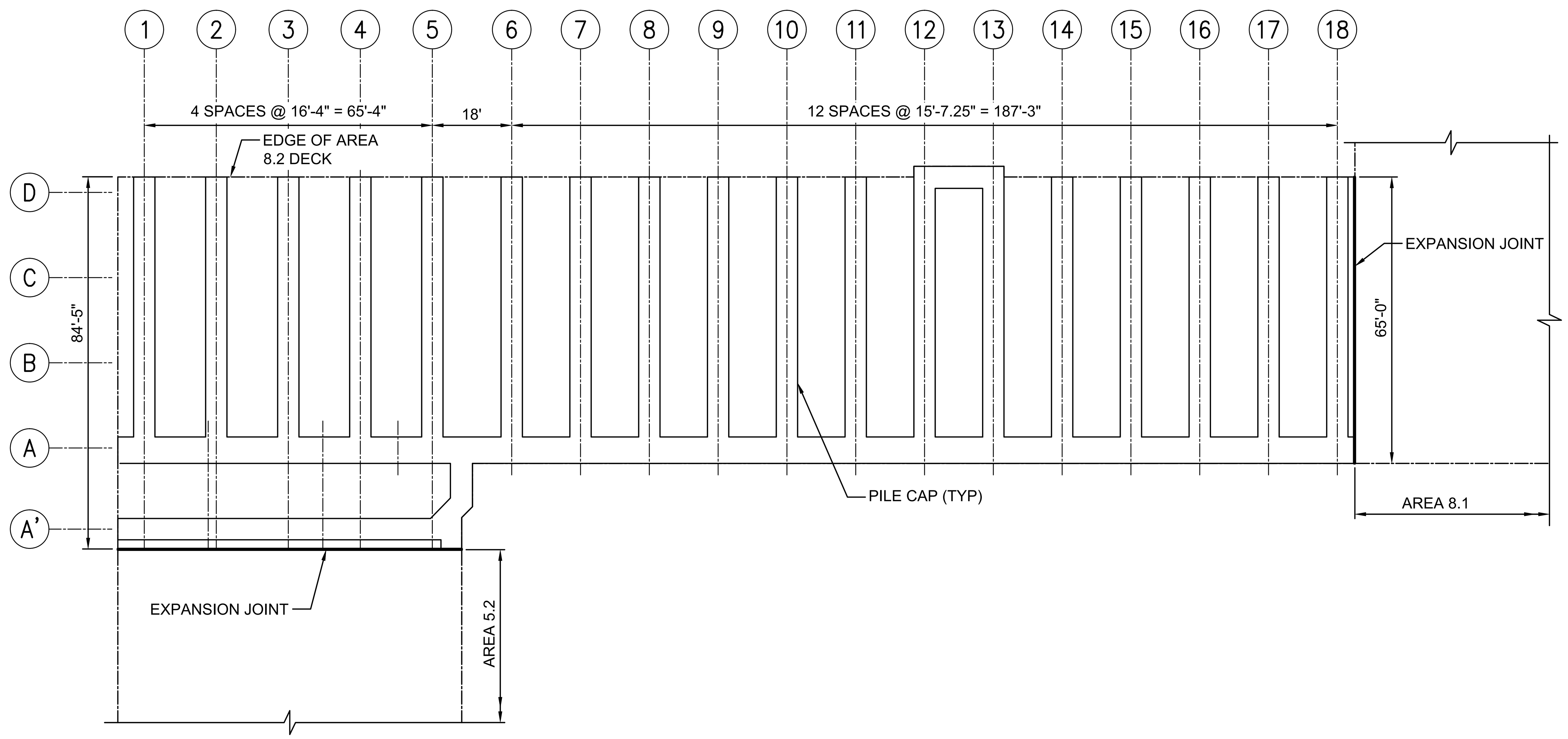
ANSI D 22" x 34"



1 AREA 8.2 PILE CAP PLAN
SCALE: 1"=20'-0"

GRAPHIC SCALE: 1" = 20'-0"
20' 10' 0 10' 20' 30' 40' 60'

PROJECT

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67 Derby Street, Salem, Massachusetts

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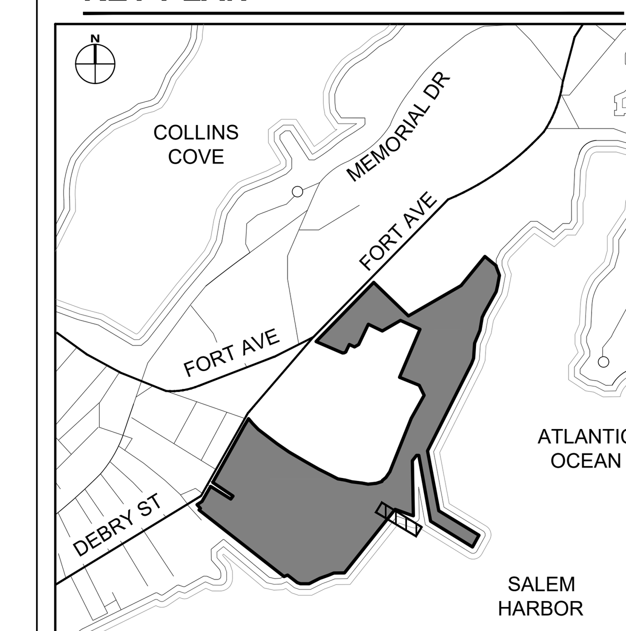
KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	**J. KLEIN**
Drawn By:	**A. FERRER**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER

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SHEET TITLE

AREA 8.2
TRESTLE PILE CAP PLAN

SHEET NUMBER

S351

- OF -

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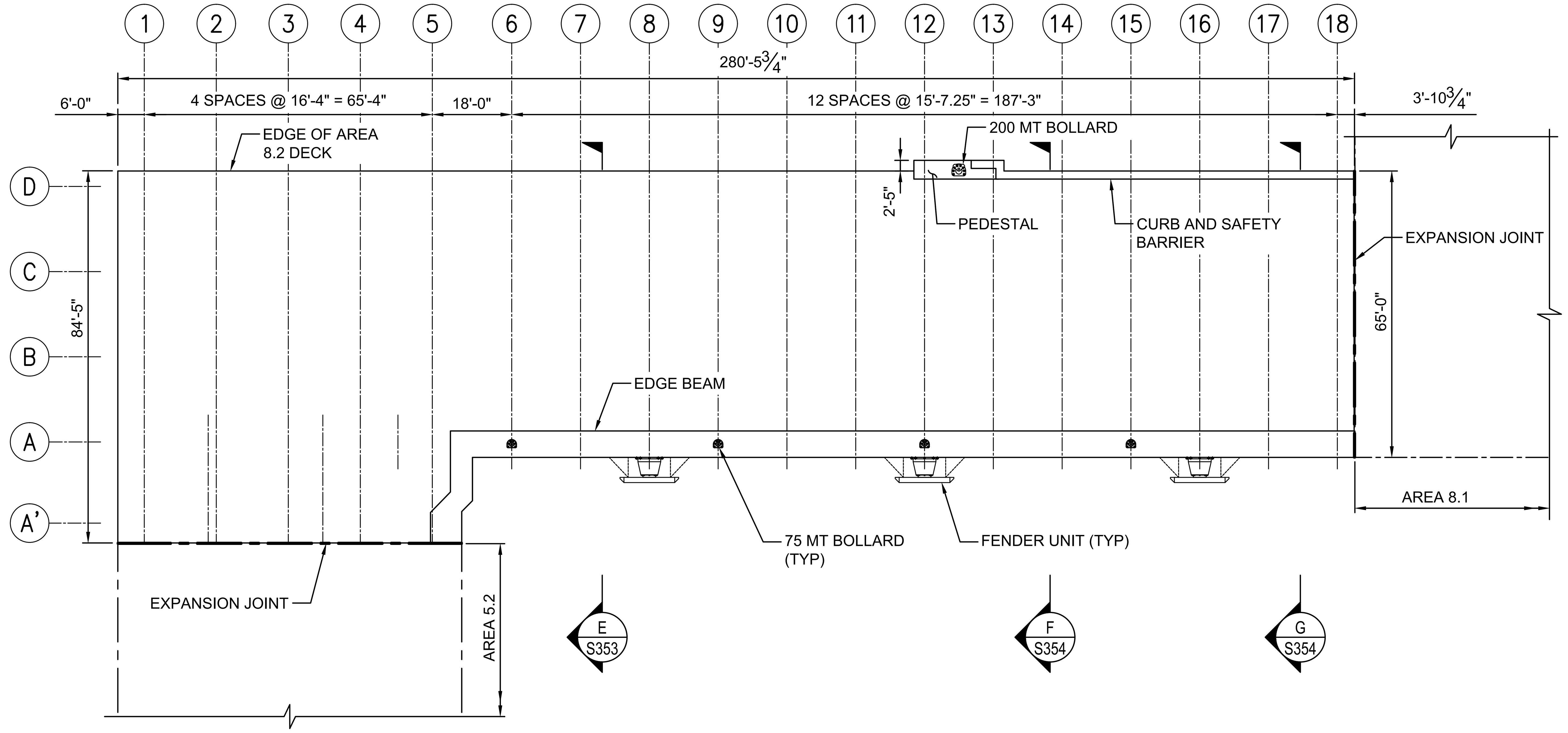

1 AREA 8.2 DECK PLAN
SCALE: 1"=20'-0"

GRAPHIC SCALE: 1" = 20'-0"
20' 10' 0 10' 20' 30' 40' 60'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

CLIENT
CROWLEY
CROWLEY WIND SERVICES, Inc.
9487 Regency Square Boulevard
Jacksonville, FL 32225

CONSULTANT
AECOM
AECOM TECHNICAL SERVICES, INC.
605 3rd Ave, 2nd Floor
New York, NY 10004
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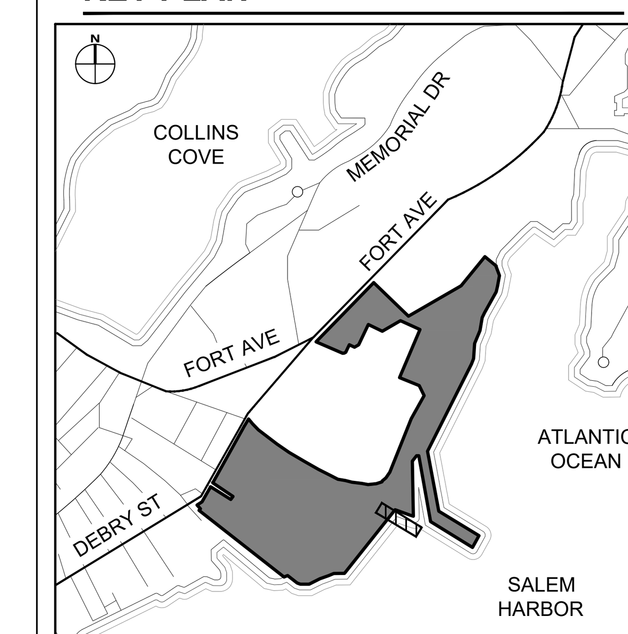
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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30% DESIGN DOCUMENTS

REVISION

R	DATE	DESCRIPTION

Designed By:	**J. KLEIN**
Drawn By:	**A. FERRER**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 8.2
TRESTLE DECK PLAN

SHEET NUMBER
S352

- OF -

ANSI D 22" x 34"

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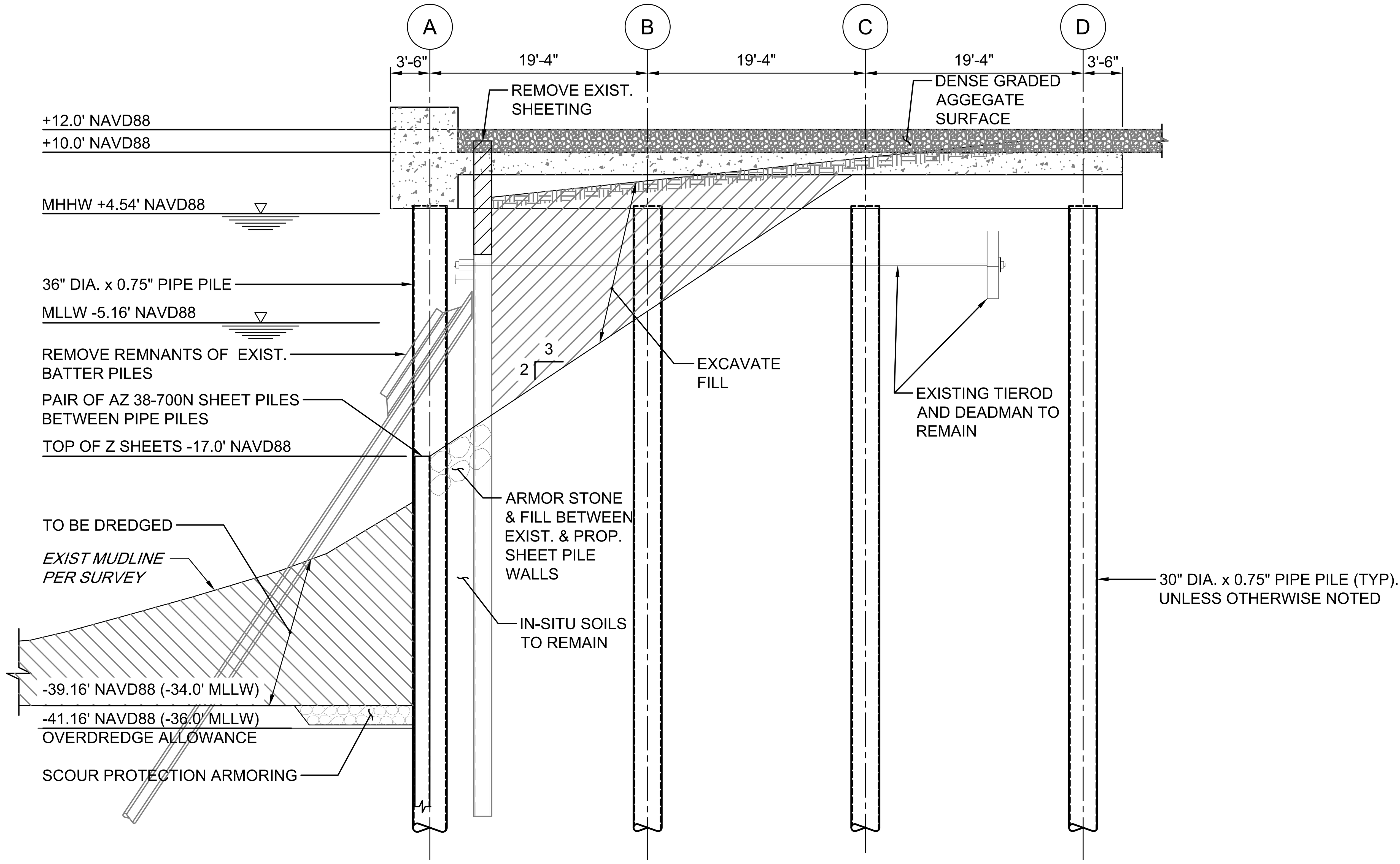

E / S352 AREA 8.2 - SECTION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

ANSI D 22" x 34"

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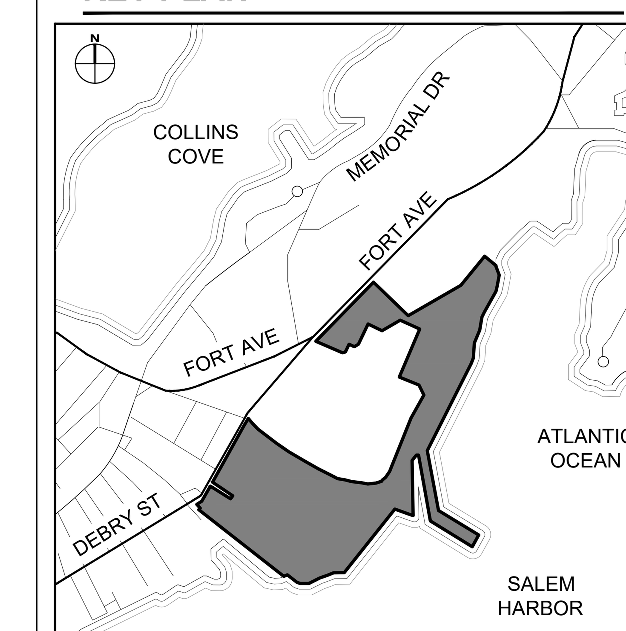
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

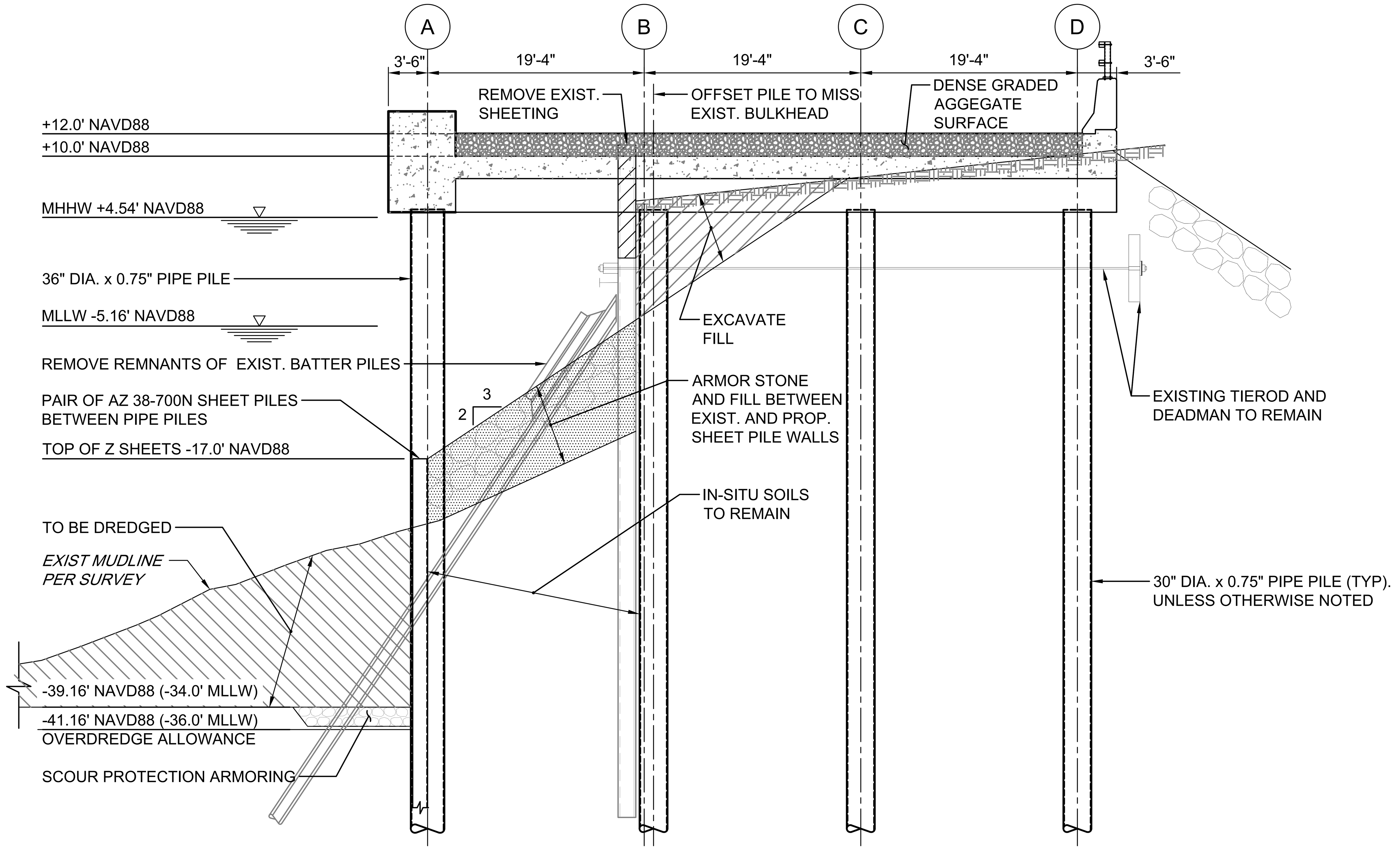
Designed By:	**J. KLEIN**
Drawn By:	**A. FERRER**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

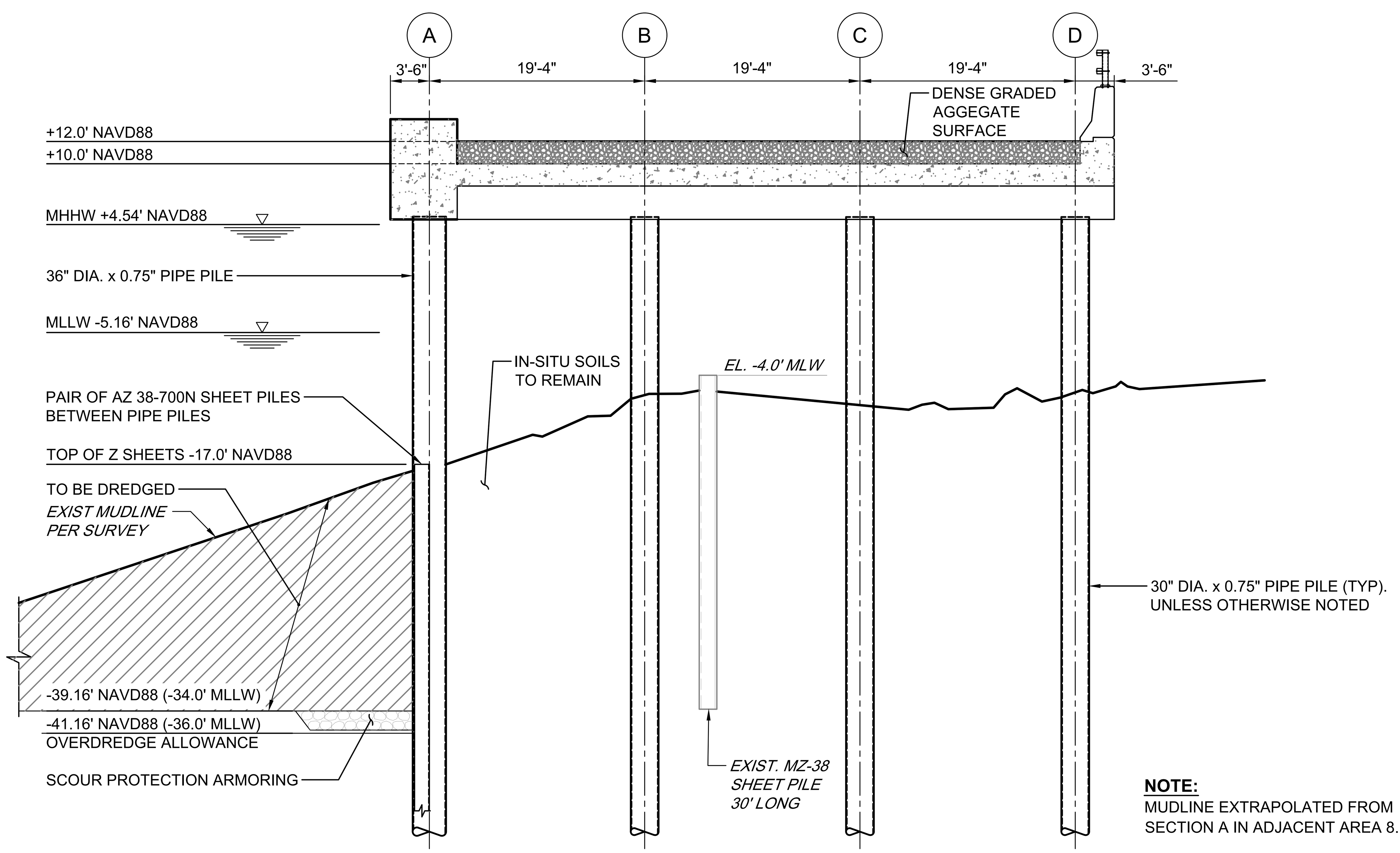
SHEET TITLE
AREA 8.2
TRESTLE SECTIONS - 1 OF 2

SHEET NUMBER
S353

- OF -



F
S352
AREA 8.2 - SECTION
SCALE: 1/8" = 1'-0"



NOTE:
MUDLINE EXTRAPOLATED FROM SECTION A IN ADJACENT AREA 8.1.

G
S352
AREA 8.2 - SECTION
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

PROJECT
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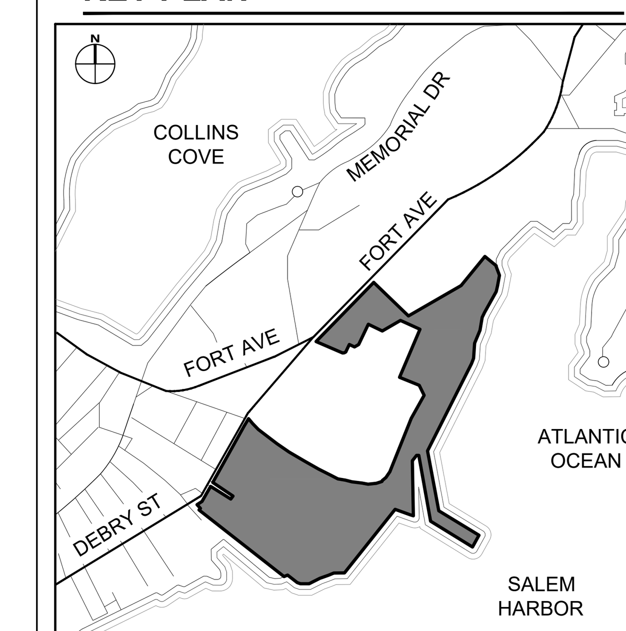
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	J. KLEIN
Drawn By:	A. FERRER
Checked By:	P. DELJOUI
Approved By:	P. DELJOUI

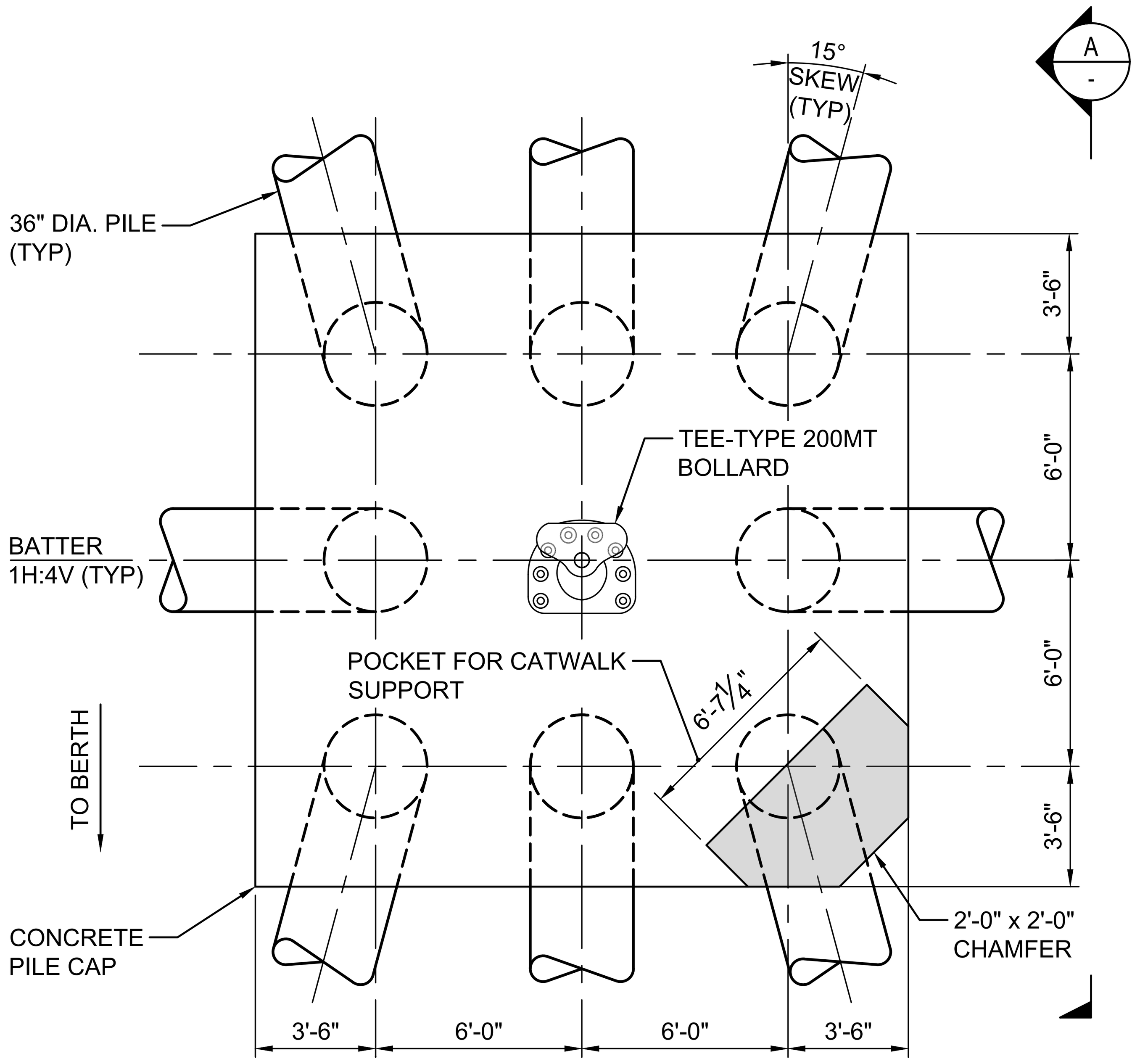
PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
AREA 8.2
TRESTLE SECTIONS - 2 OF 2

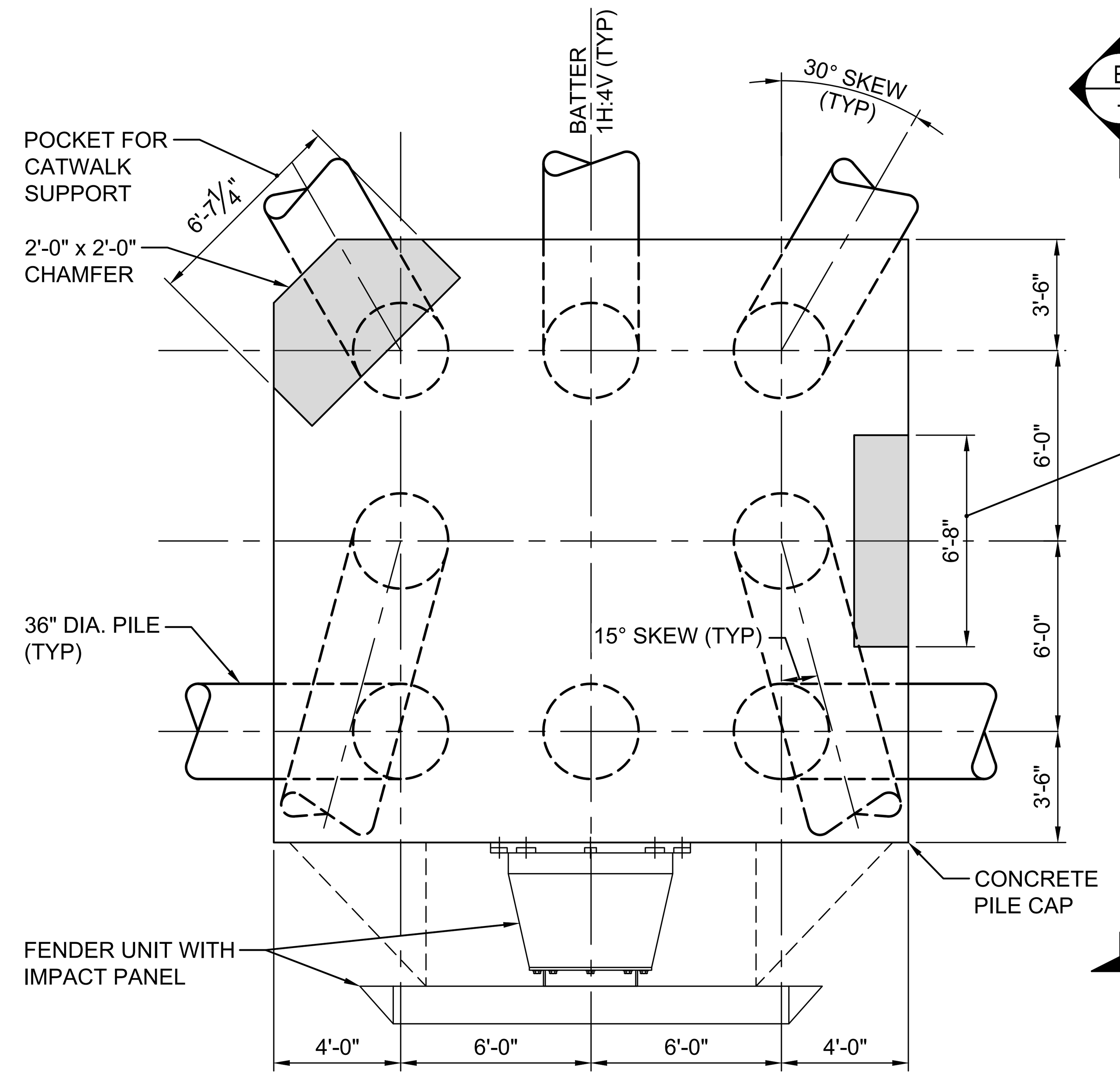
SHEET NUMBER
S354

- OF -

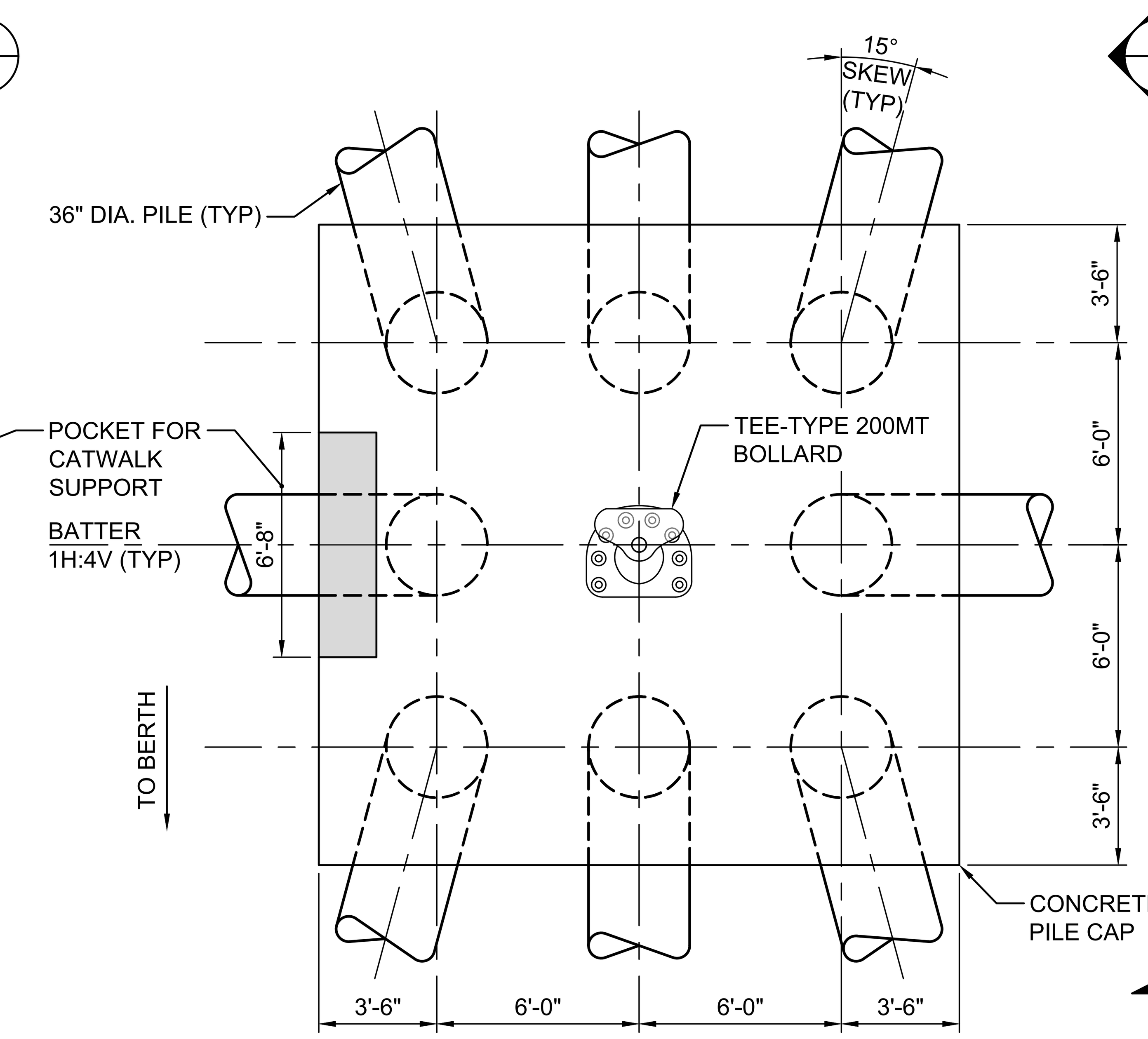
ANSI D 22" x 34"



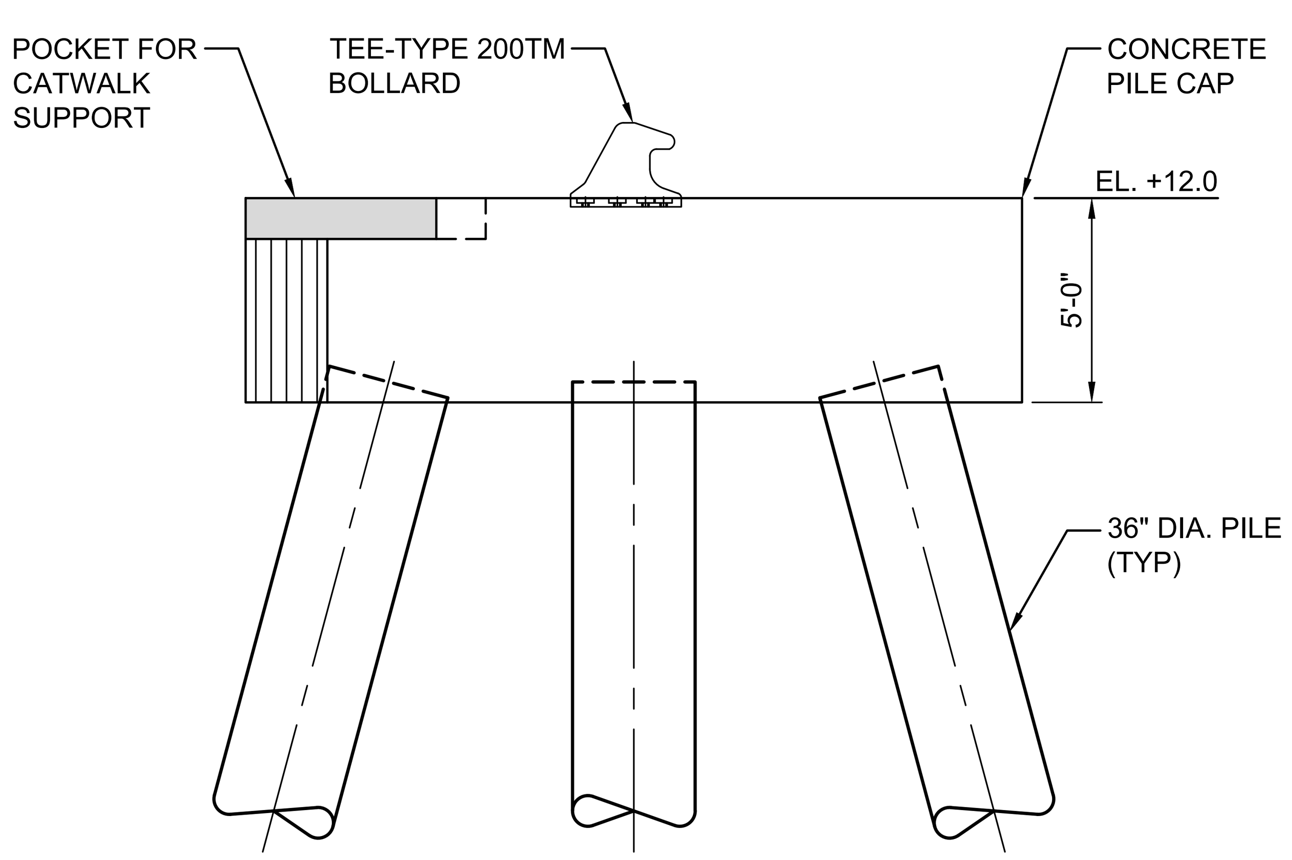
1 MOORING DOLPHIN DETAIL - AREA 5.1
SCALE: 1/4" = 1'-0"



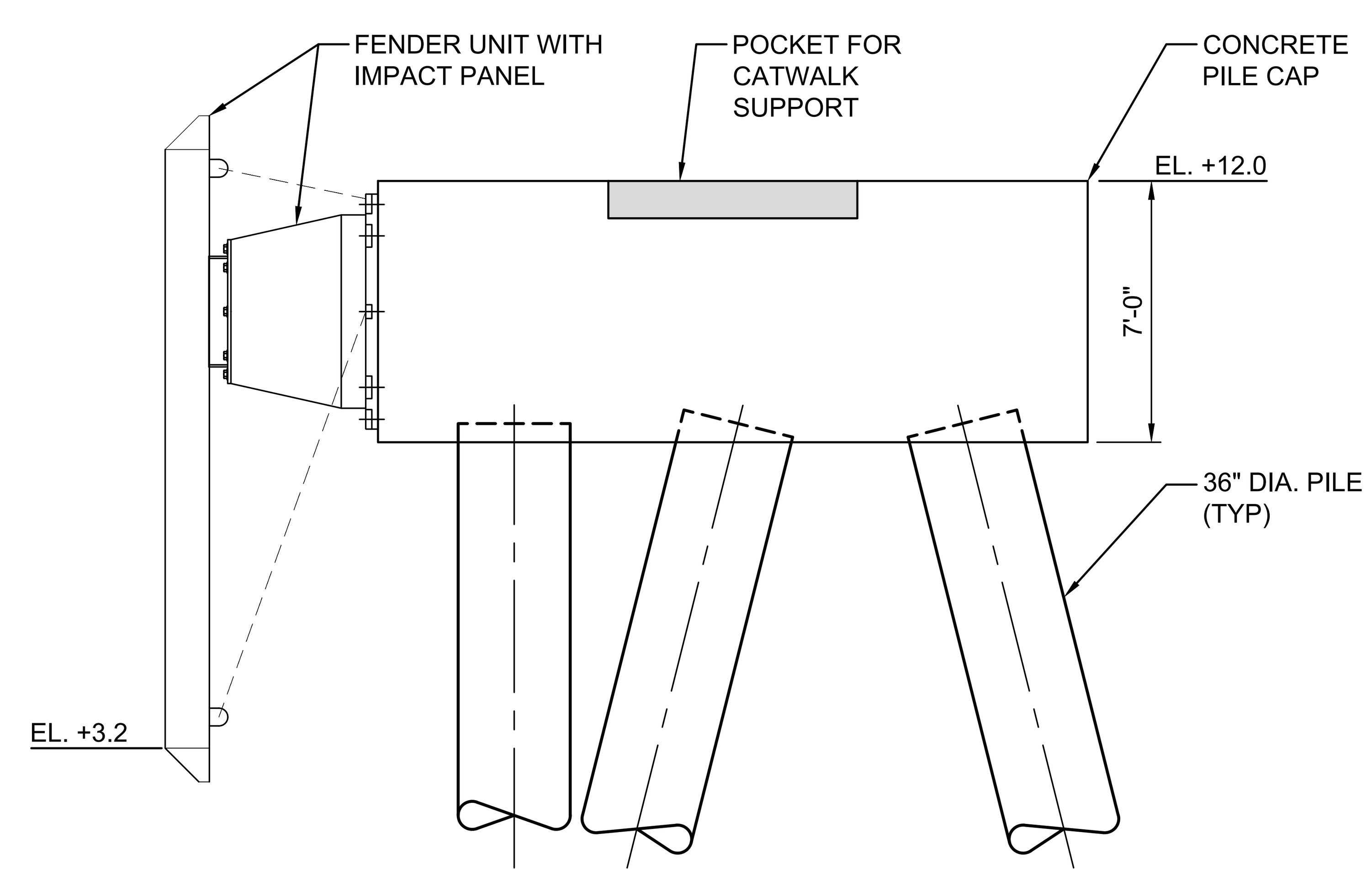
2 BREASTING DOLPHIN DETAIL - AREA 5.1
SCALE: 1/4" = 1'-0"



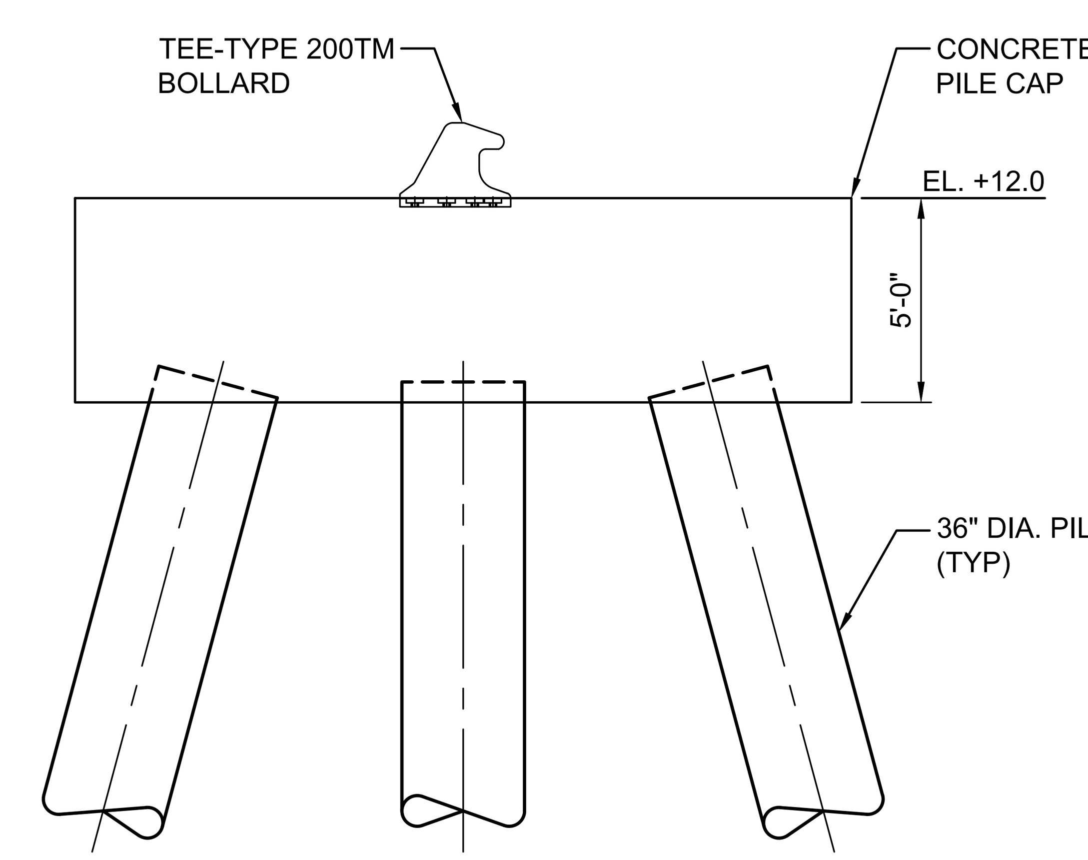
3 MOORING DOLPHIN DETAIL - AREA 8.1
SCALE: 1/4" = 1'-0"



A SECTION
SCALE: 1/4" = 1'-0"



B SECTION
SCALE: 1/4" = 1'-0"



C SECTION
SCALE: 1/4" = 1'-0"

GRAPHIC SCALE: 1/4" = 1'-0"
5' 4' 3' 2' 1' 0 5'

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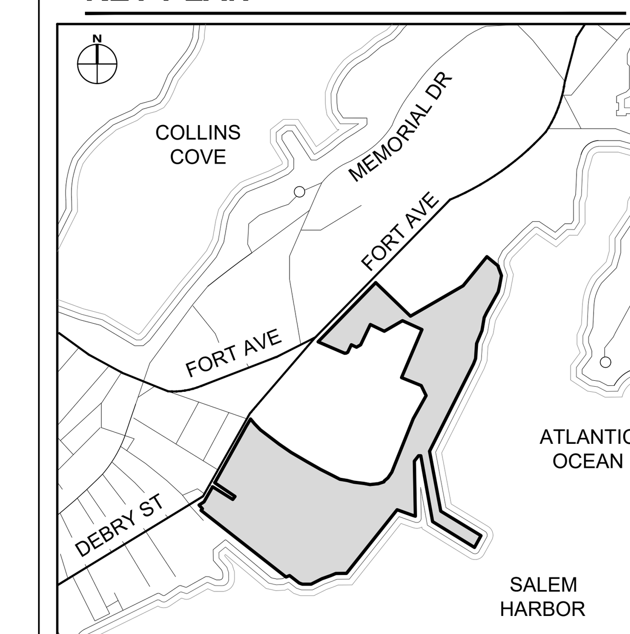
DREDGE & DREDGE MATERIAL MANAGEMENT
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

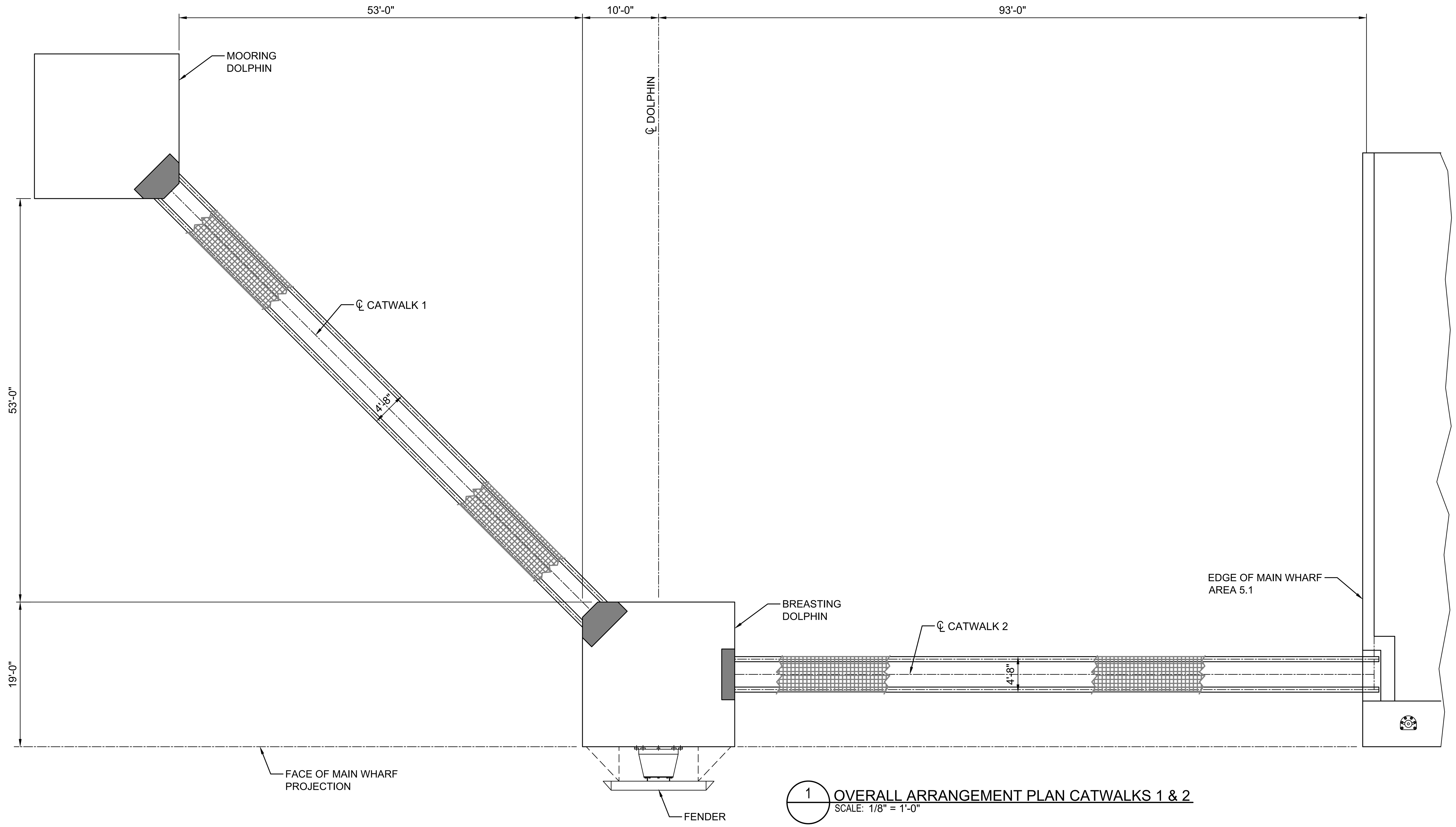
Designed By:	**J. KLEIN**
Drawn By:	**F. LIZANO**
Checked By:	**P. DELJOUI**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

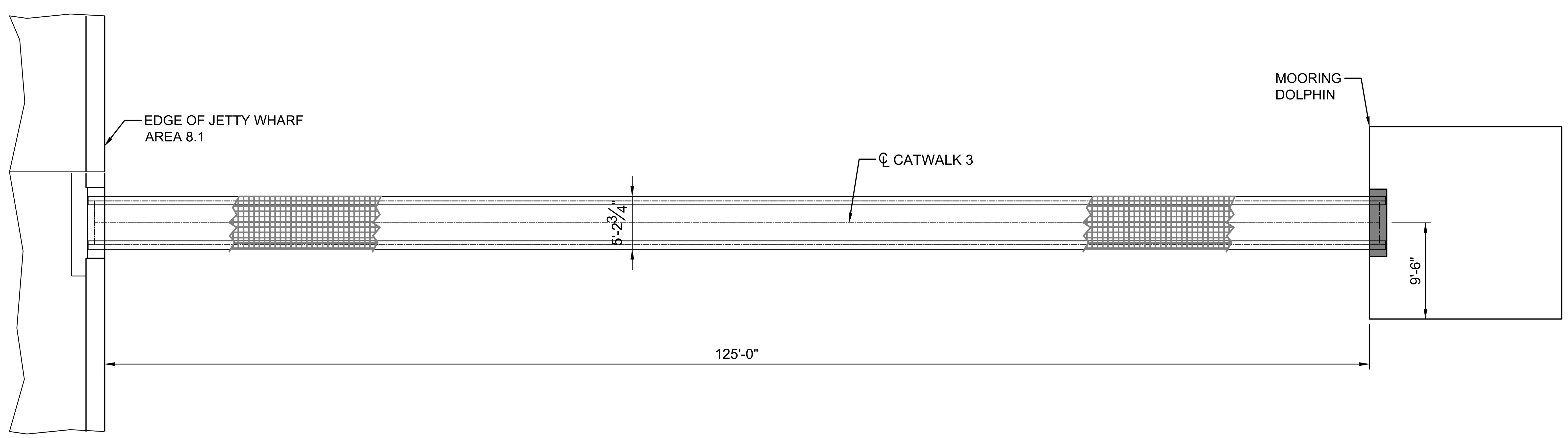
SHEET TITLE
MOORING & BREASTING DOLPHIN DETAILS

SHEET NUMBER
S405
- OF -

ANSI D 22" x 34"



1 OVERALL ARRANGEMENT PLAN CATWALKS 1 & 2
SCALE: 1/8" = 1'-0"



2 OVERALL ARRANGEMENT PLAN CATWALK 3
SCALE: 1/8" = 1'-0"

GRAPHIC SCALE: 1/8" = 1'-0"
5' 0' 5' 10' 15' 20' 25'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

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CROWLEY
CROWLEY WIND SERVICES, Inc.
9487 Regency Square Boulevard
Jacksonville, FL 32225

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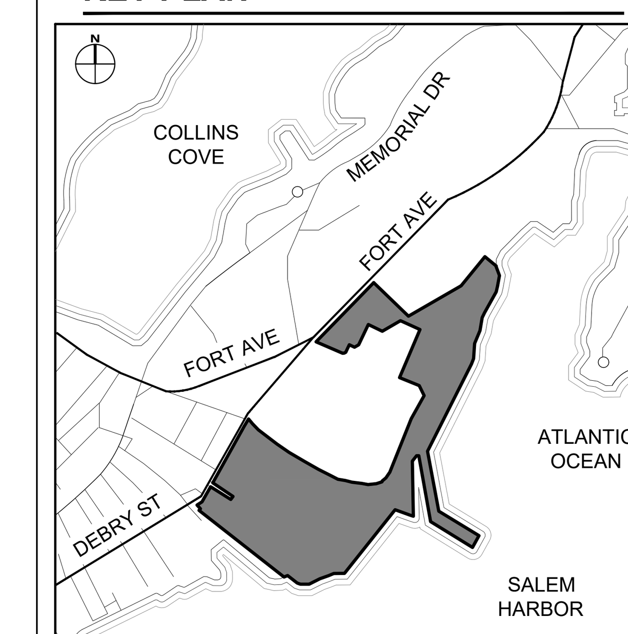
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	**J. CAREL**
Drawn By:	**F. LIZANO**
Checked By:	**J. KLEIN**
Approved By:	**P. DELJOUI**

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
CATWALK
DETAILS - 1 OF 2

SHEET NUMBER
S406
- OF -

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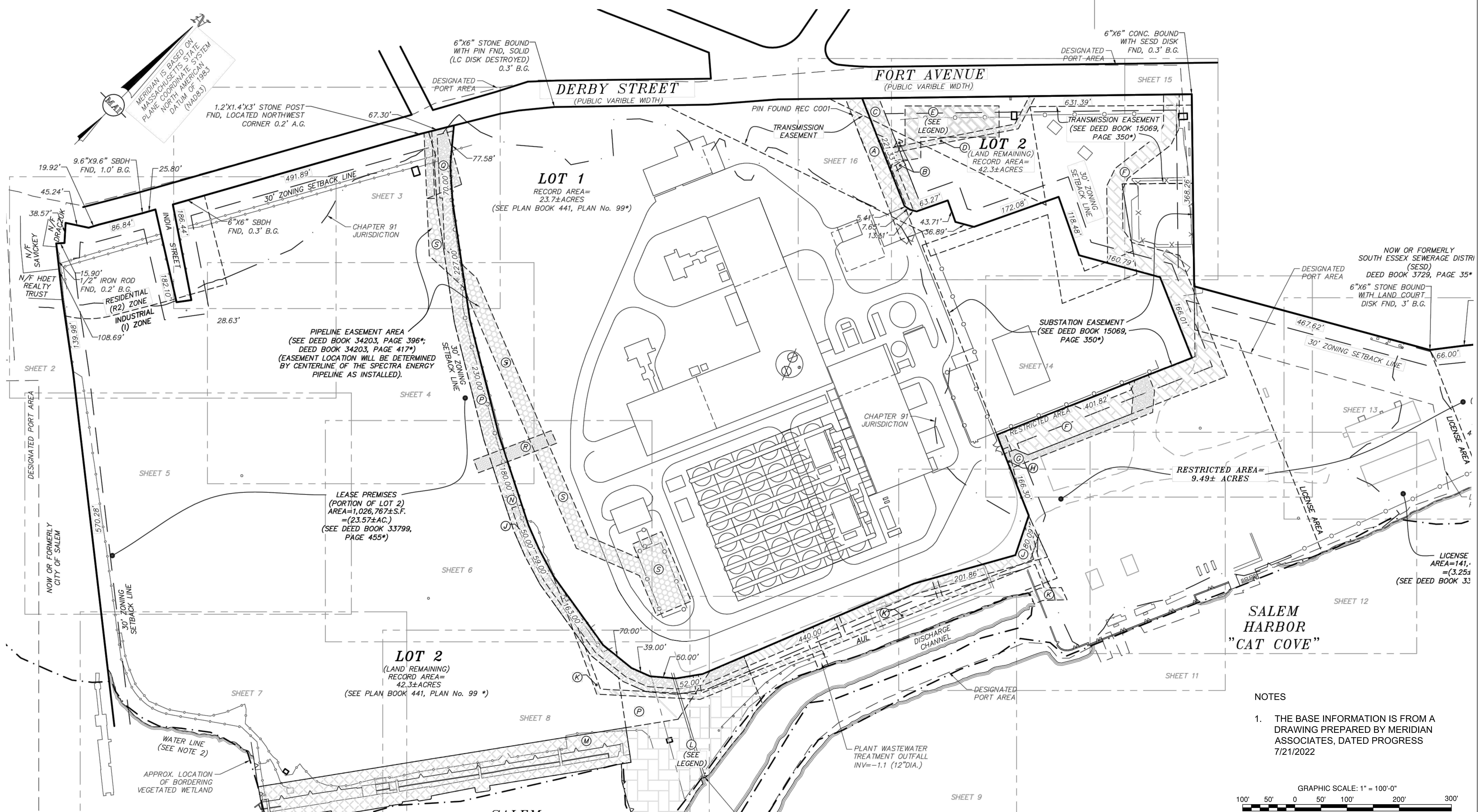
ANSI D 22" x 34"

EASEMENT LEGEND:

LEGEND	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(J)	(K)	(L)	(M)	(N)	(P)	(Q)	(R)	(S)
PROPOSED EASEMENT	ACCESS EASEMENT (OVER LOT 1)	DRAINAGE EASEMENT 3 (OVER LOT 2)	TELEPHONE/ELECTRIC/ CABLE EASEMENT (OVER LOT 2)	10' WIDE SEWER EASEMENT (OVER LOT 2)	PARKING EASEMENT (OVER LOT 2)	EMERGENCY ACCESS EASEMENT 2 (OVER LOT 2)	ELECTRIC EASEMENT (OVER LOT 2)	DRAINAGE EASEMENT 2 (OVER LOT 2)	BERM EASEMENT (OVER LOT 2)	DRAINAGE EASEMENT 1 (OVER LOT 2)	WHARF ACCESS EASEMENT (OVER LOT 2)	WHARF EASEMENT (OVER LOT 2)	EMERGENCY ACCESS EASEMENT (OVER LOT 2)	MOBILE CRANE EASEMENT (OVER LOT 2)	ACCESS EASEMENT (OVER LOTS 1 & 2)	ACCESS EASEMENT (OVER LOTS 1 & 2)	PIPELINE EASEMENT AREA (OVER LOTS 1 & 2)
AREA (S.F.) ±	8,562	847	6,895	4,677	13,254	48,686	7,179	457	26,585	15,041	46,074	50,463	41,776	92,803	6,718	4,141	36,990
EASEMENT SHAPE (NOT TO SCALE)																	



NOTES

1. THE BASE INFORMATION IS FROM A DRAWING PREPARED BY MERIDIAN ASSOCIATES, DATED PROGRESS 7/21/2022

GRAPHIC SCALE: 1" = 100'-0"

100' 50' 0 50' 100' 200' 300'

PROJECT

SALEM WIND PORT

67 Derby Street, Salem, Massachusetts

CLIENT

CROWLEY

CROWLEY WIND SERVICES, Inc.
9487 Regency Square Boulevard
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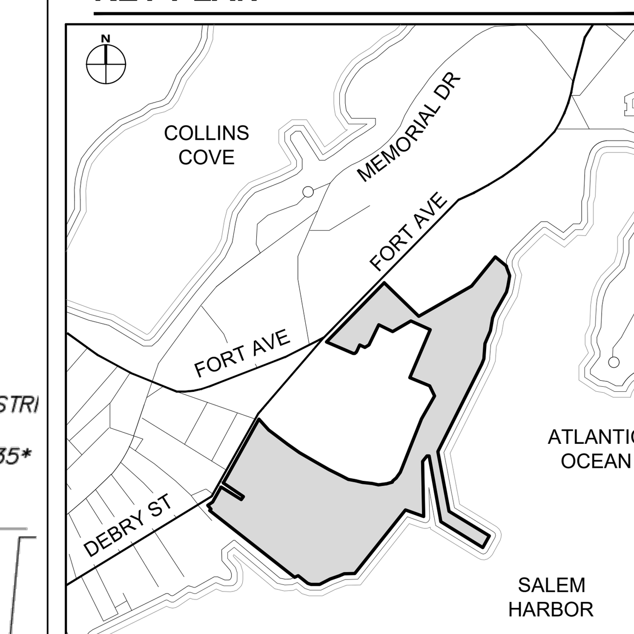
KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	**S.KLINGENER**
Drawn By:	**J.WRIGHT**
Checked By:	**D.GROTENHUIS**
Approved By:	

PROJECT/TERM CONTRACT NUMBER

60681893

SHEET TITLE

BASE SURVEY

SHEET NUMBER

V100

- OF -

Last saved by: SHAWN.KLINGENER(2022-08-04) Last Plotted: 2022-08-04
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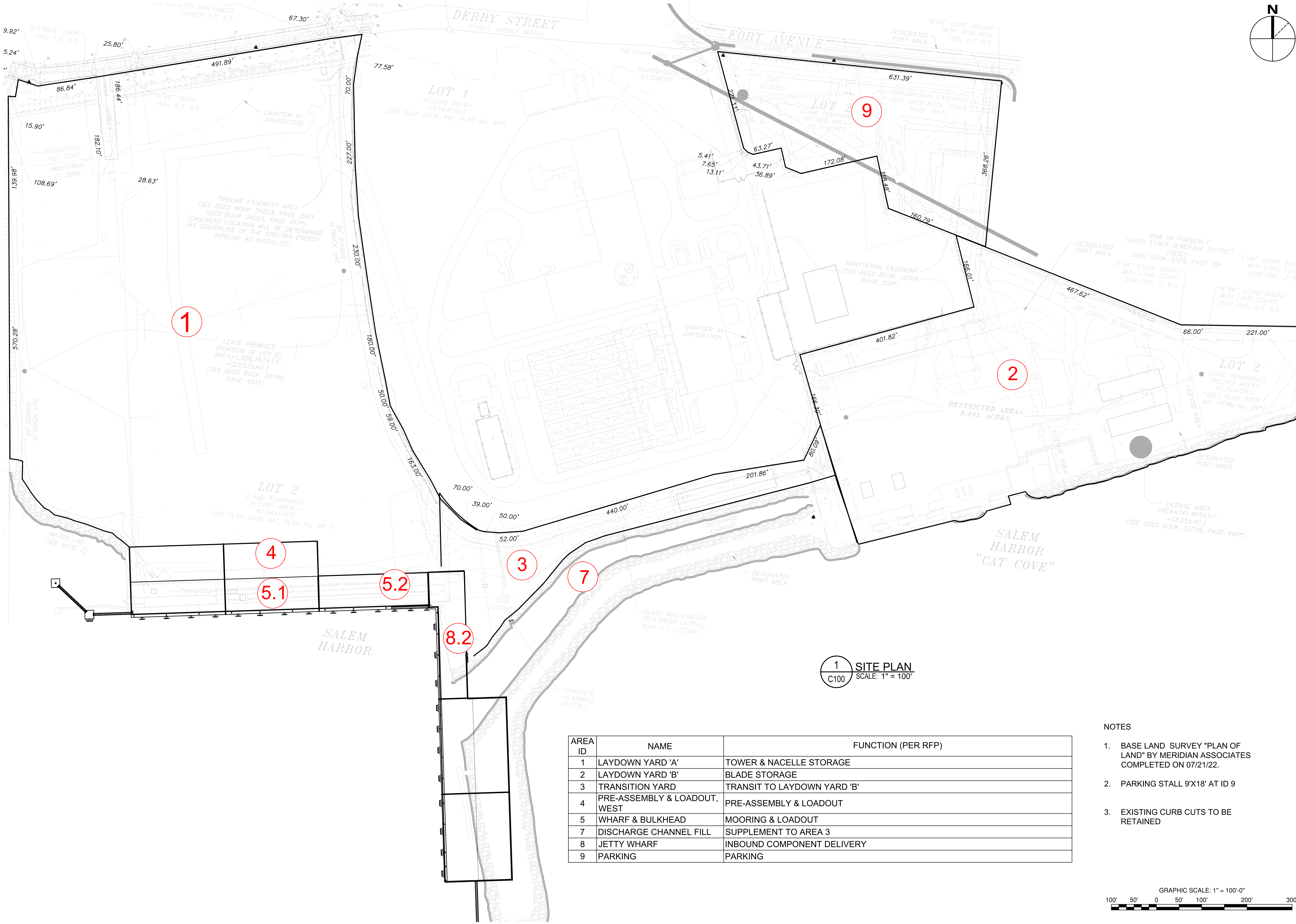

1 SITE PLAN
C100 SCALE: 1" = 100'

AREA ID	NAME	FUNCTION (PER RFP)
1	LAYDOWN YARD 'A'	TOWER & NACELLE STORAGE
2	LAYDOWN YARD 'B'	BLADE STORAGE
3	TRANSITION YARD	TRANSIT TO LAYDOWN YARD 'B'
4	PRE-ASSEMBLY & LOADOUT, WEST	PRE-ASSEMBLY & LOADOUT
5	WHARF & BULKHEAD	MOORING & LOADOUT
7	DISCHARGE CHANNEL FILL	SUPPLEMENT TO AREA 3
8	JETTY WHARF	INBOUND COMPONENT DELIVERY
9	PARKING	PARKING

NOTES

1. BASE LAND SURVEY "PLAN OF LAND" BY MERIDIAN ASSOCIATES COMPLETED ON 07/21/22.
2. PARKING STALL 9'X18' AT ID 9
3. EXISTING CURB CUTS TO BE RETAINED

GRAPHIC SCALE: 1" = 100'-0"

100' 50' 0 50' 100' 200' 300'

PROJECT

SALEM WIND PORT

67 Derby Street, Salem, Massachusetts

CLIENT

CROWLEY

CROWLEY WIND SERVICES, Inc.
9487 Regency Square Boulevard
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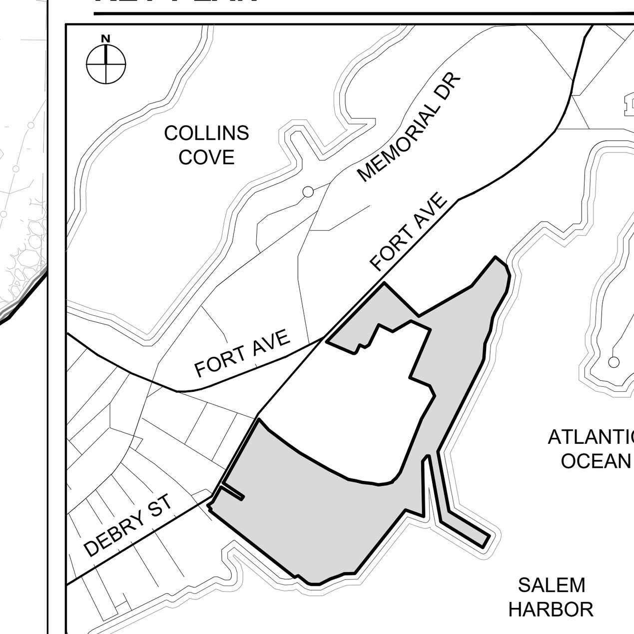
KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	**S.KLINGENER**
Drawn By:	**J.WRIGHT**
Checked By:	**D.GROTENHUIS**
Approved By:	

PROJECT/TERM CONTRACT NUMBER

60681893

SHEET TITLE

SITE LAYOUT

SHEET NUMBER

C100

- OF -

ANSI D 22" x 34"

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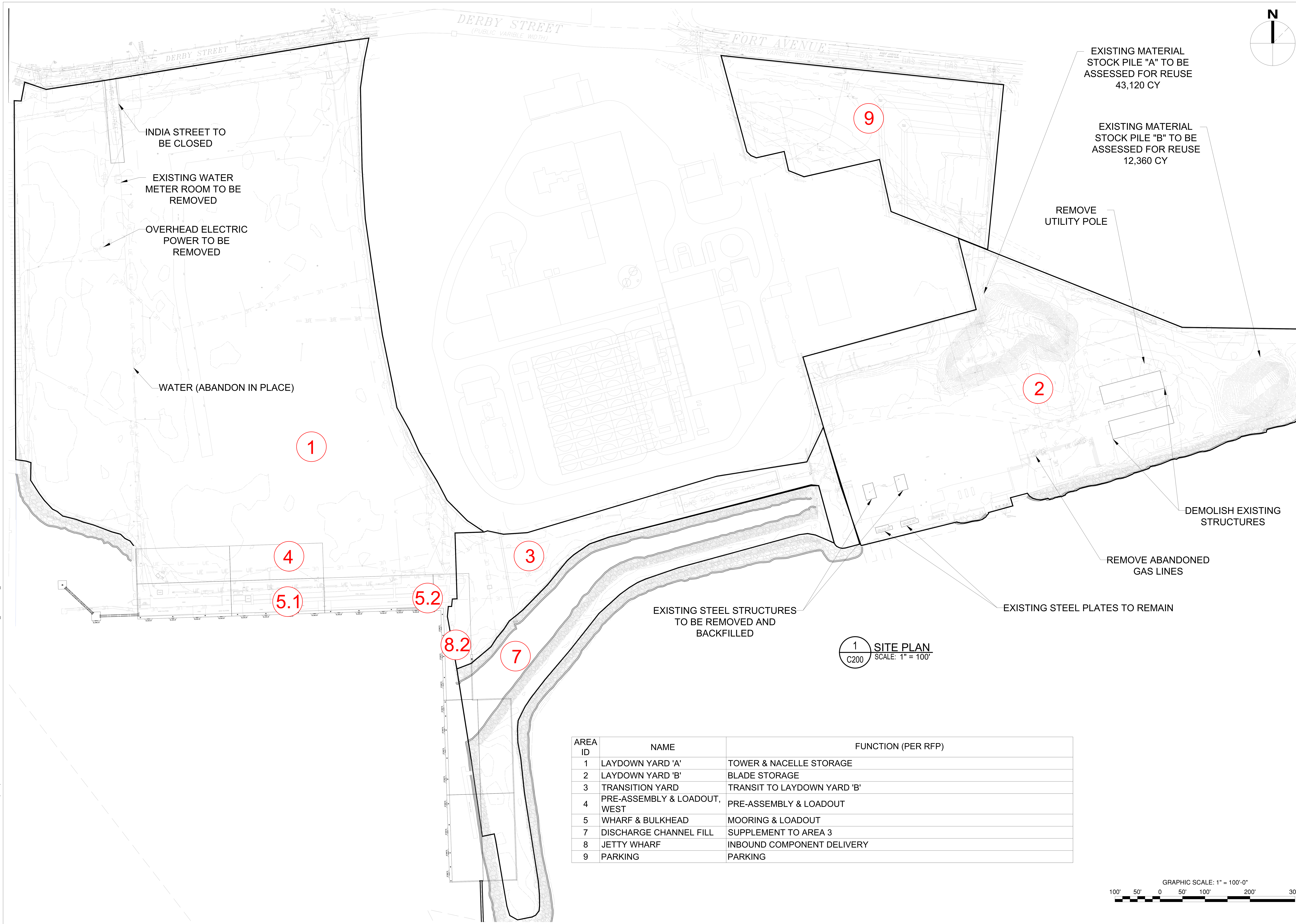

1 C200 SITE PLAN
SCALE: 1" = 100'

AREA ID	NAME	FUNCTION (PER RFP)
1	LAYDOWN YARD 'A'	TOWER & NACELLE STORAGE
2	LAYDOWN YARD 'B'	BLADE STORAGE
3	TRANSITION YARD	TRANSIT TO LAYDOWN YARD 'B'
4	PRE-ASSEMBLY & LOADOUT, WEST	PRE-ASSEMBLY & LOADOUT
5	WHARF & BULKHEAD	MOORING & LOADOUT
7	DISCHARGE CHANNEL FILL	SUPPLEMENT TO AREA 3
8	JETTY WHARF	INBOUND COMPONENT DELIVERY
9	PARKING	PARKING

GRAPHIC SCALE: 1" = 100'-0"
100' 50' 0 50' 100' 200' 300'

ANSI D 22" x 34"

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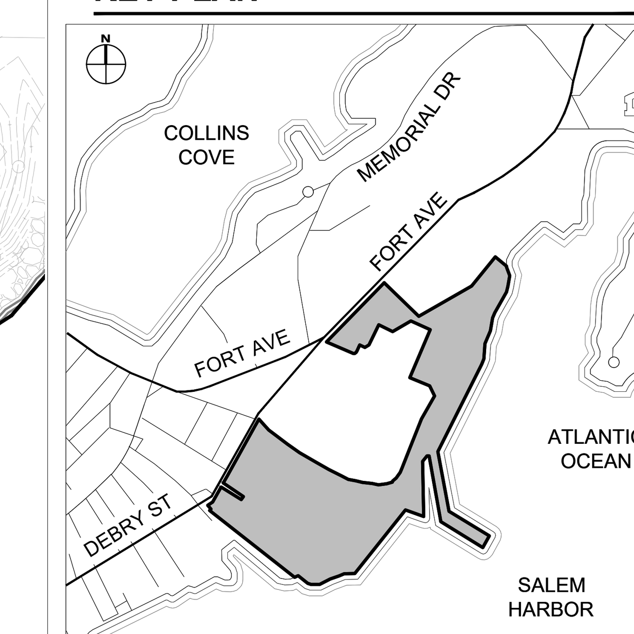
KEY PLAN



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REVISION

R	DATE	DESCRIPTION

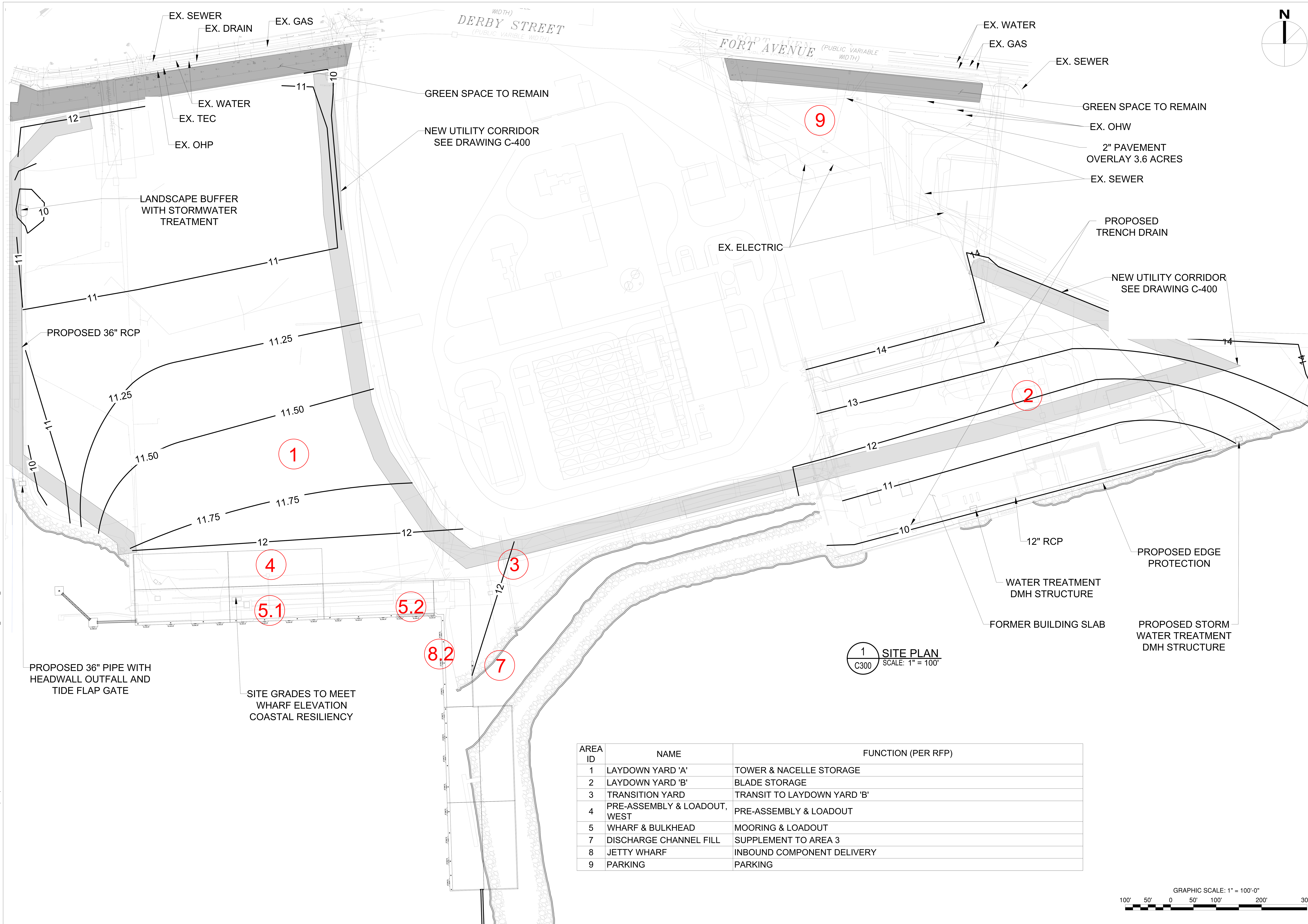
Designed By:	**S.KLINGENER**
Drawn By:	**J.WRIGHT**
Checked By:	**D.GROTENHUIS**
Approved By:	

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
DEMOLITION AND CLEARANCE

SHEET NUMBER
C200

- OF -



1 SITE PLAN
C300 SCALE: 1" = 100'

AREA ID	NAME	FUNCTION (PER RFP)
1	LAYDOWN YARD 'A'	TOWER & NACELLE STORAGE
2	LAYDOWN YARD 'B'	BLADE STORAGE
3	TRANSITION YARD	TRANSIT TO LAYDOWN YARD 'B'
4	PRE-ASSEMBLY & LOADOUT, WEST	PRE-ASSEMBLY & LOADOUT
5	WHARF & BULKHEAD	MOORING & LOADOUT
7	DISCHARGE CHANNEL FILL	SUPPLEMENT TO AREA 3
8	JETTY WHARF	INBOUND COMPONENT DELIVERY
9	PARKING	PARKING

ANSI D 22" x 34"

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

CLIENT
CROWLEY
CROWLEY WIND SERVICES, Inc.
9487 Regency Square Boulevard
Jacksonville, FL 32225

CONSULTANT
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AECOM TECHNICAL SERVICES, INC.
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SITE INVESTIGATION & ENVIRONMENTAL LOADS
GZA
188 Valley Street, Suite 300, Providence, RI 02909

DREDGE & DREDGE MATERIAL MANAGEMENT
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN

NOT FOR CONSTRUCTION

30% DESIGN DOCUMENTS

REVISION

R	DATE	DESCRIPTION

Designed By:	S.KLINGENER
Drawn By:	J.WRIGHT
Checked By:	D.GROTENHUIS
Approved By:	

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
SITE GRADING AND DRAINAGE

SHEET NUMBER
C300

- OF -

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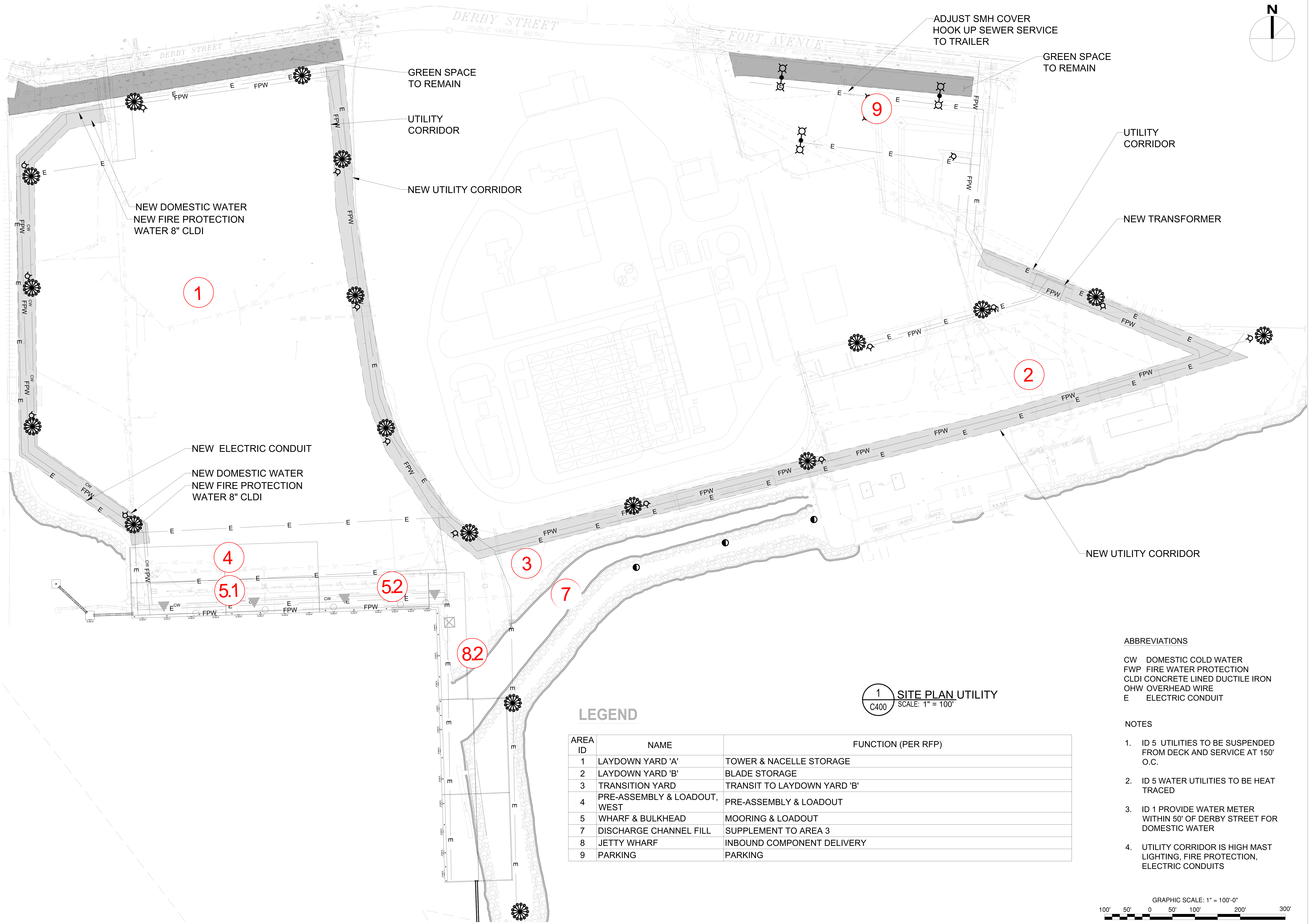

1 C400 SITE PLAN UTILITY
SCALE: 1" = 100'

LEGEND

AREA ID	NAME	FUNCTION (PER RFP)
1	LAYDOWN YARD 'A'	TOWER & NACELLE STORAGE
2	LAYDOWN YARD 'B'	BLADE STORAGE
3	TRANSITION YARD	TRANSIT TO LAYDOWN YARD 'B'
4	PRE-ASSEMBLY & LOADOUT, WEST	PRE-ASSEMBLY & LOADOUT
5	WHARF & BULKHEAD	MOORING & LOADOUT
7	DISCHARGE CHANNEL FILL	SUPPLEMENT TO AREA 3
8	JETTY WHARF	INBOUND COMPONENT DELIVERY
9	PARKING	PARKING

ABBREVIATIONS

CW DOMESTIC COLD WATER
FWP FIRE WATER PROTECTION
CLDI CONCRETE LINED DUCTILE IRON
OHW OVERHEAD WIRE
E ELECTRIC CONDUIT

NOTES

1. ID 5 UTILITIES TO BE SUSPENDED FROM DECK AND SERVICE AT 150' O.C.
2. ID 5 WATER UTILITIES TO BE HEAT TRACED
3. ID 1 PROVIDE WATER METER WITHIN 50' OF DERBY STREET FOR DOMESTIC WATER
4. UTILITY CORRIDOR IS HIGH MAST LIGHTING, FIRE PROTECTION, ELECTRIC CONDUITS

GRAPHIC SCALE: 1" = 100'-0"
100' 50' 0 50' 100' 200' 300'

ANSI D 22" x 34"

Last saved by: SHAWN.KLINGENER(2022-08-21) Last Plotted: 2022-08-22
Filename: C:\USERS\GARCIAW\ACCDOCS\AECOM\CI-AMER (USA) 60681893-SALEM OSW TERMINAL\900 DESIGN COLLABORATION\02_SHEETS\05_CIVIL\SOSWT-C400.DWG

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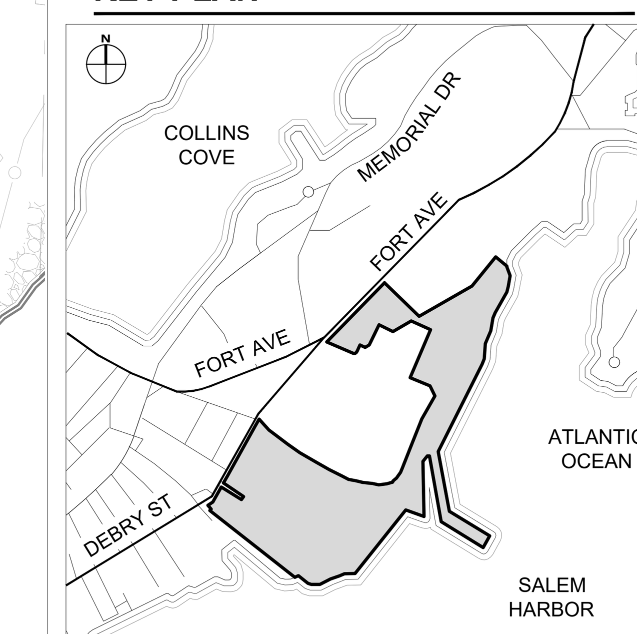
DREDGE & DREDGE MATERIAL MANAGEMENT
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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REVISION

R	DATE	DESCRIPTION

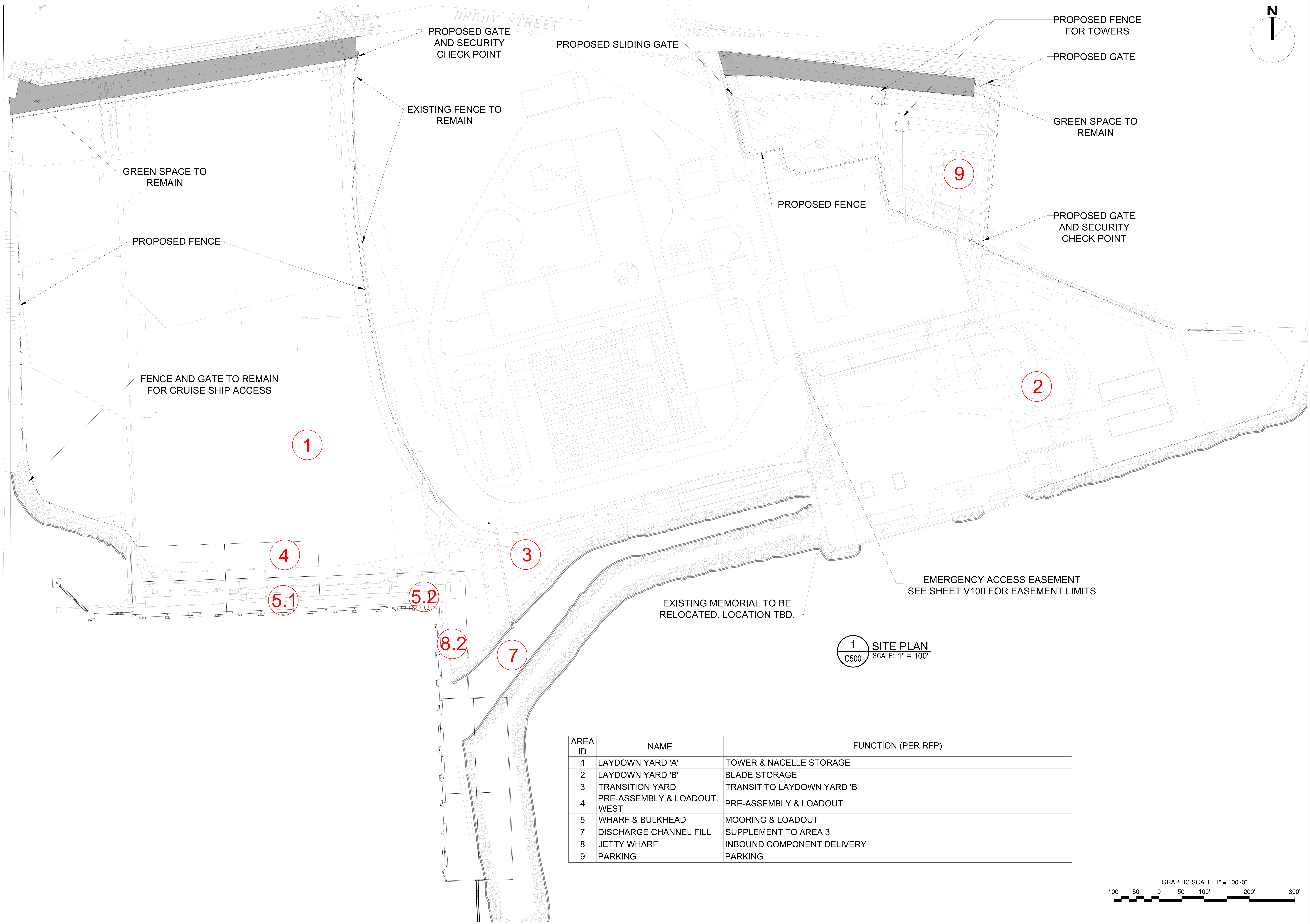
Designed By:	S.KLINGENER
Drawn By:	J.WRIGHT
Checked By:	D.GROTENHUIS
Approved By:	

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
SITE UTILITY

SHEET NUMBER
C400

- OF -



1 C500 SITE PLAN
SCALE: 1" = 100'

AREA ID	NAME	FUNCTION (PER RFP)
1	LAYDOWN YARD 'A'	TOWER & NACELLE STORAGE
2	LAYDOWN YARD 'B'	BLADE STORAGE
3	TRANSITION YARD	TRANSIT TO LAYDOWN YARD 'B'
4	PRE-ASSEMBLY & LOADOUT, WEST	PRE-ASSEMBLY & LOADOUT
5	WHARF & BULKHEAD	MOORING & LOADOUT
7	DISCHARGE CHANNEL FILL	SUPPLEMENT TO AREA 3
8	JETTY WHARF	INBOUND COMPONENT DELIVERY
9	PARKING	PARKING

GRAPHIC SCALE: 1" = 100'-0"
100' 50' 0 50' 100' 200' 300'

ANSI D 22" x 34"

Last saved by: GARCIAW(2022-08-22) Last Plotted: 2022-08-22
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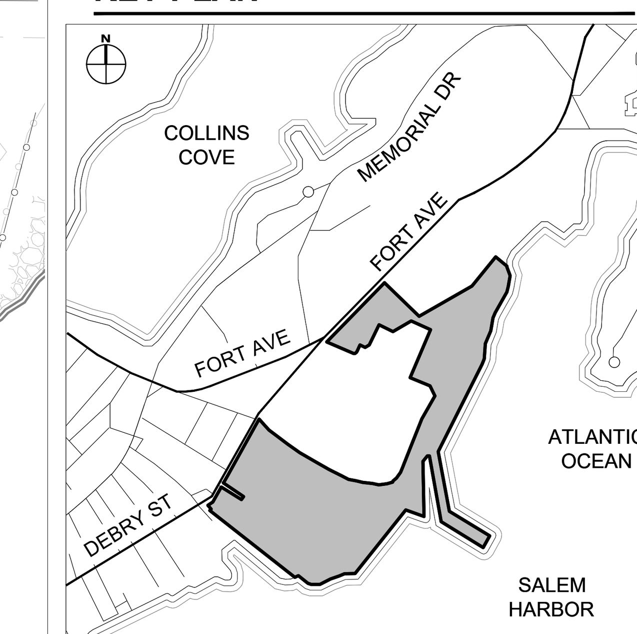
KEY PLAN



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30% DESIGN DOCUMENTS

REVISION

R	DATE	DESCRIPTION

Designed By:	**S.KLINGENER**
Drawn By:	**J.WRIGHT**
Checked By:	**D.GROTENHUIS**
Approved By:	

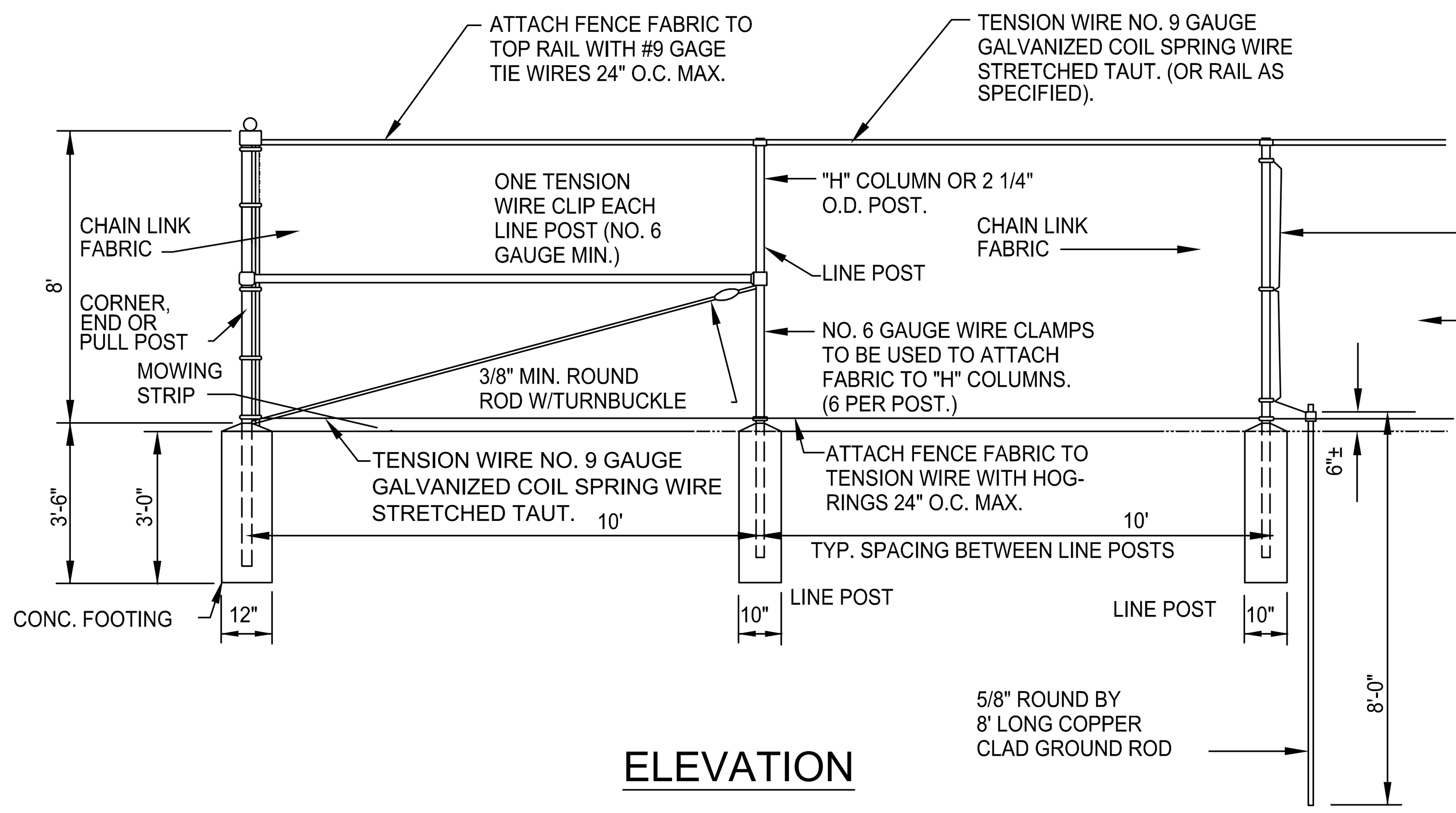
PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
SECURITY AND FENCING

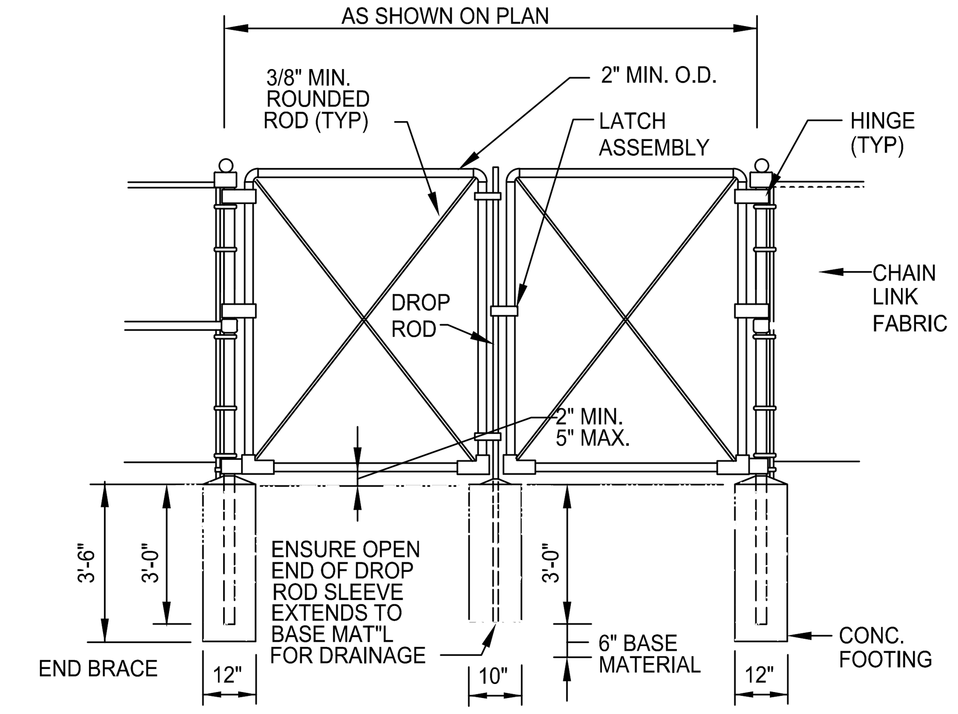
SHEET NUMBER
C500

- OF -

ANSI D 22" x 34"



ELEVATION

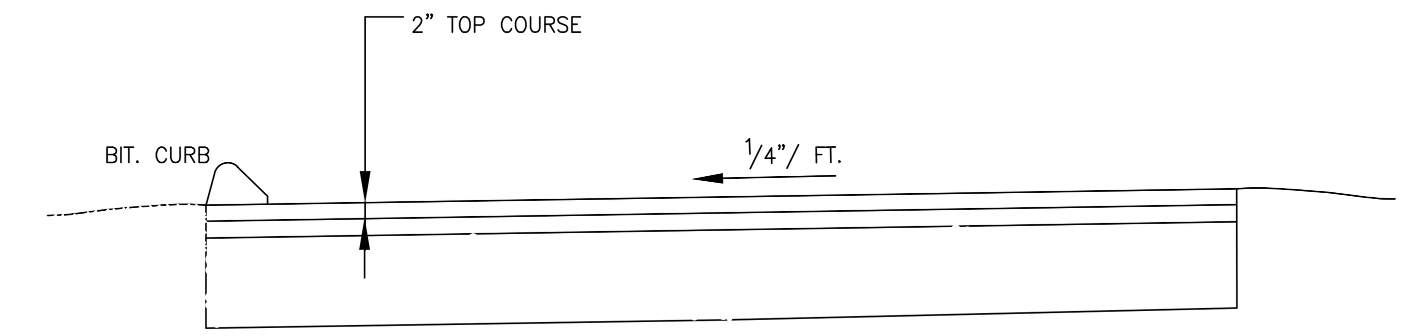


DOUBLE SWING GATE

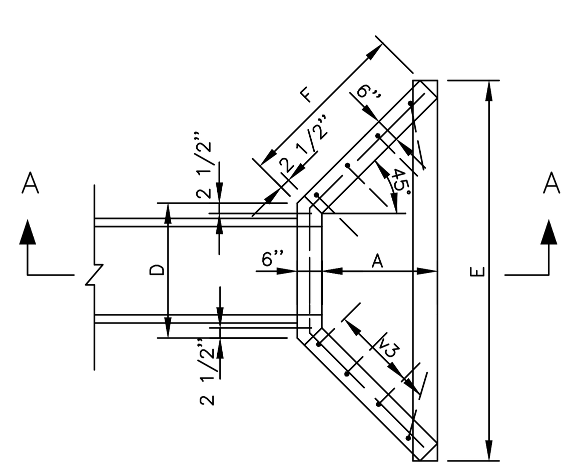
NOTES:

1. PROVIDE A MOISTURE-EXCLUDING CAP FOR EACH POST.
2. FOR GATES EXCEEDING 6'-0" WIDTH ROLLED FORMED STEEL POST WILL NOT BE ALLOWED.
3. IN LIEU OF SETTING POSTS IN CONCRETE, MANUFACTURER'S ANCHORING DEVICES MEETEING THE SPECIFICATION REQUIREMENTS MAY BE USED WHEN APPROVED BY THE ENGINEER.
4. CHAIN LINK FENCE TO BE GROUNDED IN ACCORDANCE WITH DETAILS SHOWN WHERE REQUIRED.
5. WIRE FABRIC SHALL HAVE A 2" MESH.

1 / C601 CHAIN LINK FENCE DETAILS
SCALE: N.T.S



2 / C601 PAVEMENT OVERLAY DETAIL
SCALE: N.T.S



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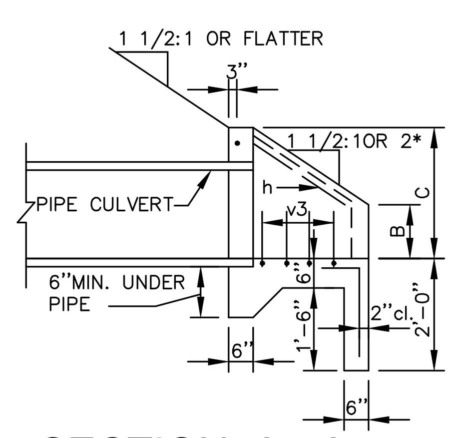

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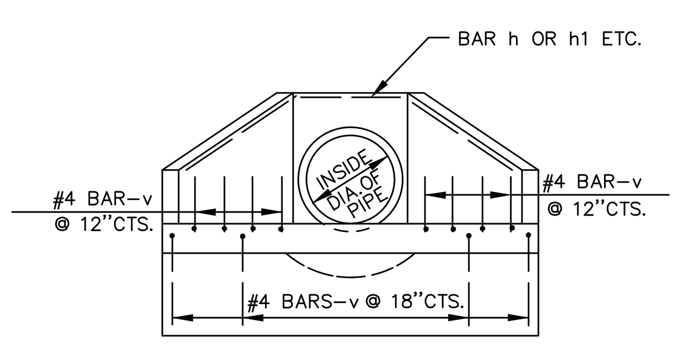
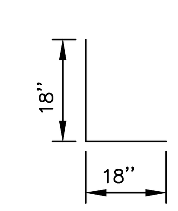


END VIEW



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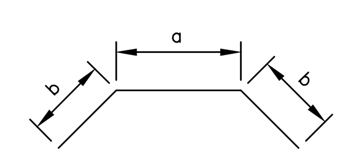

BARS h to h9

BEND IN FIELD. ONE REQ'D IN EACH HEADWALL

TABLE OF DIMENSIONS

DESIGN NO.	INSIDE DIA.OF PIPE	SLOPE OF FILL *	DIMENSIONS						CLASS X CONC. 2-HDWLS CU. YDS.	REINFORCEMENT BARS			
			A	B	C	D	E	F		h-BARS MARK	h-BARS LENGTH	V-BARS NO.	TOTAL WT. 2-HDWLS.
D900-D1-1/2	36	1:1-1/2	36	22	3'-10"	4'-1"	10' 4-1/2"	4' 5-1/2"	2.6	h8	13'-3"	30	80 lbs

MARK	a	b
h	1'-10"	2'-5 1/2"
h1	1'-10"	3'-2 1/2"
h2	2'-1"	2'-5 1/2"
h3	2'-1"	3'-2 1/2"
h4	2'-9"	3'-3"
h5	2'-9"	4'-1 1/2"
h6	3'-3"	3'-10 1/2"
h7	3'-3"	4'-10 1/2"
h8	3'-11"	4'-8"
h9	3'-11"	5'-9 1/2"

*IF EMBANKMENT SLOPE ABOVE HEADWALL IS FLATTER THAN 2:1, PROVIDE WINGS FOR 2:1 SLOPE.

NOTE: GRATINGS AS APPROVED BY THE CITY ENGINEER SHALL BE PROVIDED ON ALL PIPE OPENINGS.

REINFORCED CONCRETE HEADWALL
36" OUTFALL PIPE

3 / C601 HEADWALL DETAIL
SCALE: N.T.S

PROJECT

SALEM WIND PORT
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CLIENT

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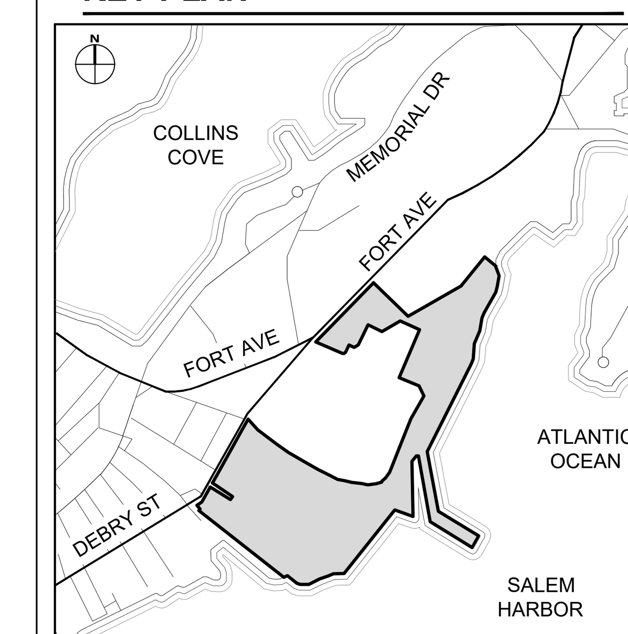
KEY PLAN



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30% DESIGN DOCUMENTS

REVISION

R	DATE	DESCRIPTION

Designed By:	**S. KLINGENER**
Drawn By:	**J. WRIGHT**
Checked By:	**D. GROTENHUIS**
Approved By:	

PROJECT/TERM CONTRACT NUMBER

60681893

SHEET TITLE

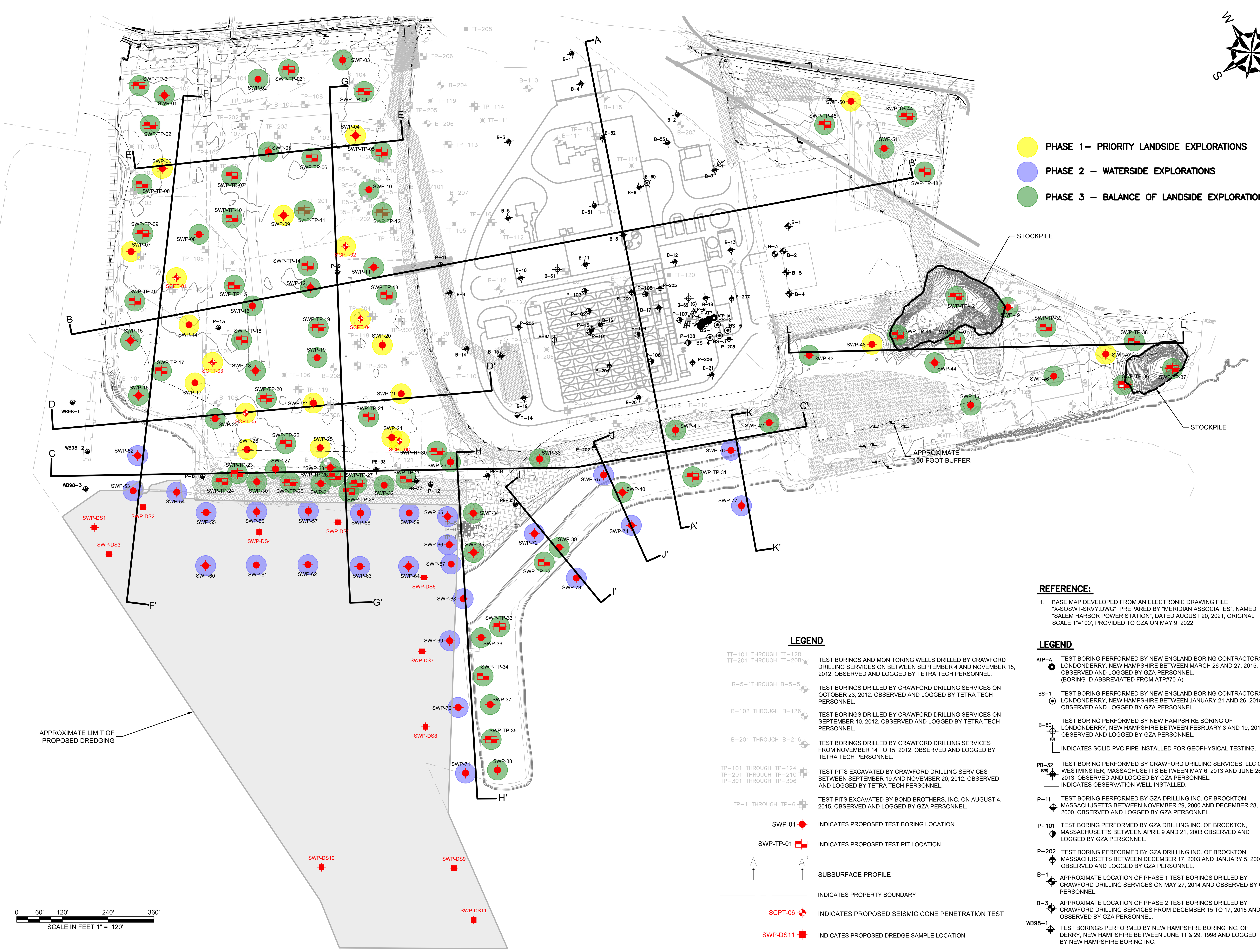
SITE DETAILS

SHEET NUMBER

C601

- OF -

Last saved by: JILLIAN.WRIGHT(2022-08-09) Last Plotted: 2022-08-09
Filename: C:\USERS\JILLIAN.WRIGHT\ACCDOCS\AECOM\CI-AMER (USA) 60681893-SALEM OSW TERMINAL\900 DESIGN COLLABORATION\02_SHEETS\05_CIVIL\SOSWT- C601.DWG



REFERENCE:

1. BASE MAP DEVELOPED FROM AN ELECTRONIC DRAWING FILE "X-SOSWT-SRVY.DWG", PREPARED BY "MERIDIAN ASSOCIATES", NAMED "SALEM HARBOR POWER STATION", DATED AUGUST 20, 2021, ORIGINAL SCALE 1"=100', PROVIDED TO GZA ON MAY 9, 2022.

LEGEND

TT–101 THROUGH TT–120 TT–201 THROUGH TT–208	TEST BORINGS AND MONITORING WELLS DRILLED BY CRAWFORD DRILLING SERVICES ON BETWEEN SEPTEMBER 4 AND NOVEMBER 15, 2012. OBSERVED AND LOGGED BY TETRA TECH PERSONNEL.
B–5–1THROUGH B–5–5	TEST BORINGS DRILLED BY CRAWFORD DRILLING SERVICES ON OCTOBER 23, 2012. OBSERVED AND LOGGED BY TETRA TECH PERSONNEL.
B–102 THROUGH B–126	TEST BORINGS DRILLED BY CRAWFORD DRILLING SERVICES ON SEPTEMBER 10, 2012. OBSERVED AND LOGGED BY TETRA TECH PERSONNEL.
B–201 THROUGH B–216	TEST BORINGS DRILLED BY CRAWFORD DRILLING SERVICES FROM NOVEMBER 14 TO 15, 2012. OBSERVED AND LOGGED BY TETRA TECH PERSONNEL.
TP–101 THROUGH TP–124 TP–201 THROUGH TP–210 TP–301 THROUGH TP–306	TEST PITS EXCAVATED BY CRAWFORD DRILLING SERVICES BETWEEN SEPTEMBER 19 AND NOVEMBER 20, 2012. OBSERVED AND LOGGED BY TETRA TECH PERSONNEL.
TP–1 THROUGH TP–6	TEST PITS EXCAVATED BY BOND BROTHERS, INC. ON AUGUST 4, 2015. OBSERVED AND LOGGED BY GZA PERSONNEL.
SWP-01	INDICATES PROPOSED TEST BORING LOCATION
SWP-TP-01	INDICATES PROPOSED TEST PIT LOCATION
A A'	SUBSURFACE PROFILE
	INDICATES PROPERTY BOUNDARY
SCPT-06	INDICATES PROPOSED SEISMIC CONE PENETRATION TEST
SWP-DS11	INDICATES PROPOSED DREDGE SAMPLE LOCATION

LEGEND

ATP–A	TEST BORING PERFORMED BY NEW ENGLAND BORING CONTRACTORS OF LONDONDERRY, NEW HAMPSHIRE BETWEEN MARCH 26 AND 27, 2015. OBSERVED AND LOGGED BY GZA PERSONNEL. (BORING ID ABBREVIATED FROM ATP#70-A)
BS–1	TEST BORING PERFORMED BY NEW ENGLAND BORING CONTRACTORS OF LONDONDERRY, NEW HAMPSHIRE BETWEEN JANUARY 21 AND 26, 2015. OBSERVED AND LOGGED BY GZA PERSONNEL.
B–60	TEST BORING PERFORMED BY NEW HAMPSHIRE BORING OF LONDONDERRY, NEW HAMPSHIRE BETWEEN FEBRUARY 3 AND 19, 2014. OBSERVED AND LOGGED BY GZA PERSONNEL.
(G)	INDICATES SOLID PVC PIPE INSTALLED FOR GEOPHYSICAL TESTING.
PB–32 (OW)	TEST BORING PERFORMED BY CRAWFORD DRILLING SERVICES, LLC OF WESTMINSTER, MASSACHUSETTS BETWEEN MAY 6, 2013 AND JUNE 26, 2013. OBSERVED AND LOGGED BY GZA PERSONNEL. INDICATES OBSERVATION WELL INSTALLED.
P–11	TEST BORING PERFORMED BY GZA DRILLING INC. OF BROCKTON, MASSACHUSETTS BETWEEN NOVEMBER 29, 2000 AND DECEMBER 28, 2000. OBSERVED AND LOGGED BY GZA PERSONNEL.
P–101	TEST BORING PERFORMED BY GZA DRILLING INC. OF BROCKTON, MASSACHUSETTS BETWEEN APRIL 9 AND 21, 2003 OBSERVED AND LOGGED BY GZA PERSONNEL.
P–202	TEST BORING PERFORMED BY GZA DRILLING INC. OF BROCKTON, MASSACHUSETTS BETWEEN DECEMBER 17, 2003 AND JANUARY 5, 2004. OBSERVED AND LOGGED BY GZA PERSONNEL.
B–1	APPROXIMATE LOCATION OF PHASE 1 TEST BORINGS DRILLED BY CRAWFORD DRILLING SERVICES ON MAY 27, 2014 AND OBSERVED BY GZA PERSONNEL.
B–3	APPROXIMATE LOCATION OF PHASE 2 TEST BORINGS DRILLED BY CRAWFORD DRILLING SERVICES FROM DECEMBER 15 TO 17, 2015 AND OBSERVED BY GZA PERSONNEL.
WB98–1	TEST BORINGS PERFORMED BY NEW HAMPSHIRE BORING INC. OF DERRY, NEW HAMPSHIRE BETWEEN JUNE 11 & 29, 1998 AND LOGGED BY NEW HAMPSHIRE BORING INC.

PROJECT

SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

CLIENT

CROWLEY
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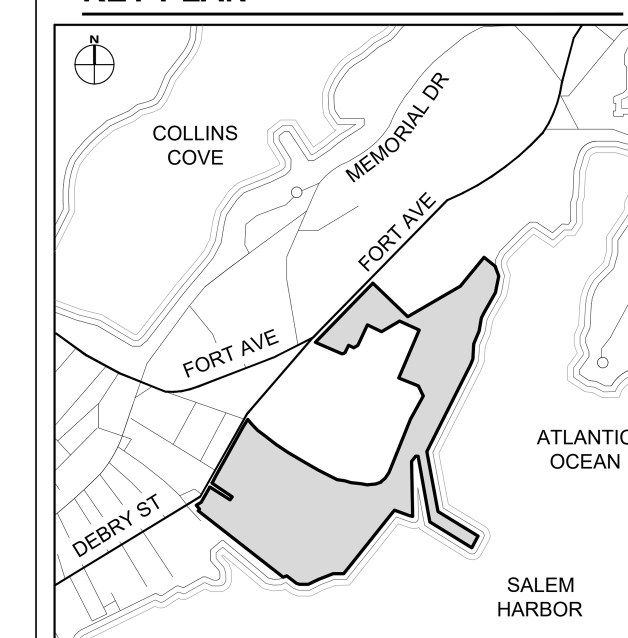
KEY PLAN



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REVISION

R	DATE	DESCRIPTION

Designed By:	JJM
Drawn By:	GRB
Checked By:	
Approved By:	

PROJECT/TERM CONTRACT NUMBER

60681893

SHEET TITLE

EXPLORATION LOCATION PLAN

SHEET NUMBER

B100

OF -

ANSI D 22" x 34"

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ANSI D 22" x 34"

LEGEND:

-30	EXISTING BATHYMETRY CONTOURS
	LIMITS OF DESIGNATED PORT AREA
	LIMITS OF USACE-MAINTAINED NAVIGATION CHANNEL
	LIMITS OF STATE-MAINTAINED TURNING BASIN
	PROPOSED WHARF FOOTPRINTS
	PROPOSED TRESTLE FOOTPRINT

SOURCE:

1. EXISTING CONDITIONS SURVEY PLAN FROM CAD FILE ENTITLED "SALEM HARBOR POWER STATION, 24 FORT AVENUE" BY MERIDIAN ASSOCIATES, BEVERLY, MASSACHUSETTS, DATED AUGUST 20, 2021. AERIAL IMAGE FROM BING MAPS 2002.
2. EXISTING BATHYMETRY BASED ON COMBINATION OF TWO SURVEYS: CR ENVIRONMENTAL SURVEY DATA, COLLECTED 6/14 TO 6/16/2022 WHERE APPLICABLE; USACE SURVEY DATA, COLLECTED 9/2/2021 WHERE CR ENVIRONMENTAL DATA DOES NOT PROVIDE COVERAGE.

NOTES:

1. HORIZONTAL DATUM: MASSACHUSETTS STATE PLANE, MAINLAND ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83), U.S. SURVEY FEET.
2. VERTICAL DATUM: MEAN LOWER LOW WATER (MLLW), FEET.
3. MLLW TO NAVD88 CORRECTIONS FOR THIS PROJECT RANGE FROM 5.13 FEET TO 5.16 FEET. THESE CORRECTIONS ARE REFERENCED FROM NOAA'S V-DATUM MODEL VERSION 4.1, ME/NH/MA REGION VERSION 2.3, IN THE VICINITY OF SALEM HARBOR, SALEM, MASSACHUSETTS. NAVD88 IS ABOVE MLLW; THEREFORE THE CORRECTION SHOULD BE ADDED TO NAVD88 TO CONVERT TO MLLW.
4. THE SITE DETAIL & SURFACE IMPROVEMENTS DEPICTED WERE OBTAINED FROM AN AERIAL PHOTOGRAMMETRIC SURVEY PREPARED BY COL-EAST, INC. FLOWN ON SEPTEMBER 11, 2012 AND AN INSTRUMENT SURVEY CONDUCTED ON THE GROUND BY MERIDIAN ASSOCIATES, INC. BETWEEN OCTOBER 3, 2013, JANUARY 28, 2014 AND JULY 22, 2021 TO SUPPLEMENT THE AERIAL MAPPING. THIS PLAN DOES NOT DEPICT ALL EXISTING SITE FEATURES AND STRUCTURES ON THE SURVEYED PREMISES.

1 MARINE EXISTING CONDITIONS
SCALE: 1"=80'-0"

GRAPHIC SCALE: 1" = 80'-0"
80' 0 80' 240'

Last saved by: DBINKNEY(2022-07-26) Last Plotted: 2022-07-26
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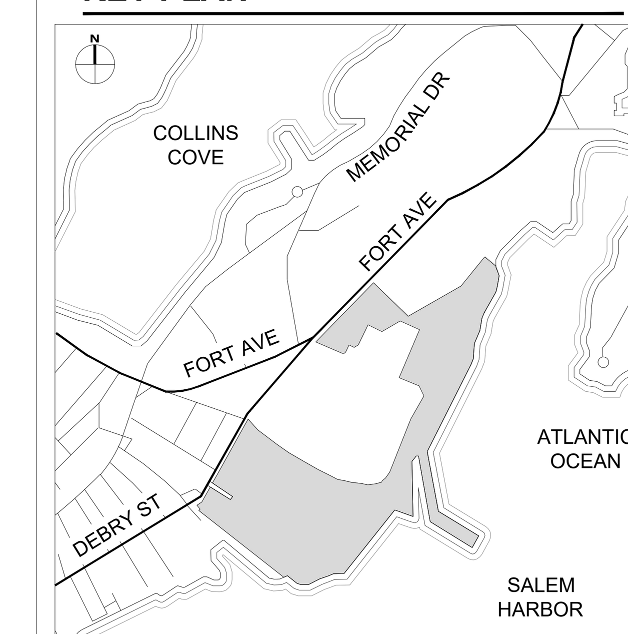

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REVISION

R	DATE	DESCRIPTION

Designed By:	D_BINKNEY
Drawn By:	P_SCIABA
Checked By:	M_MAHONEY
Approved By:	--

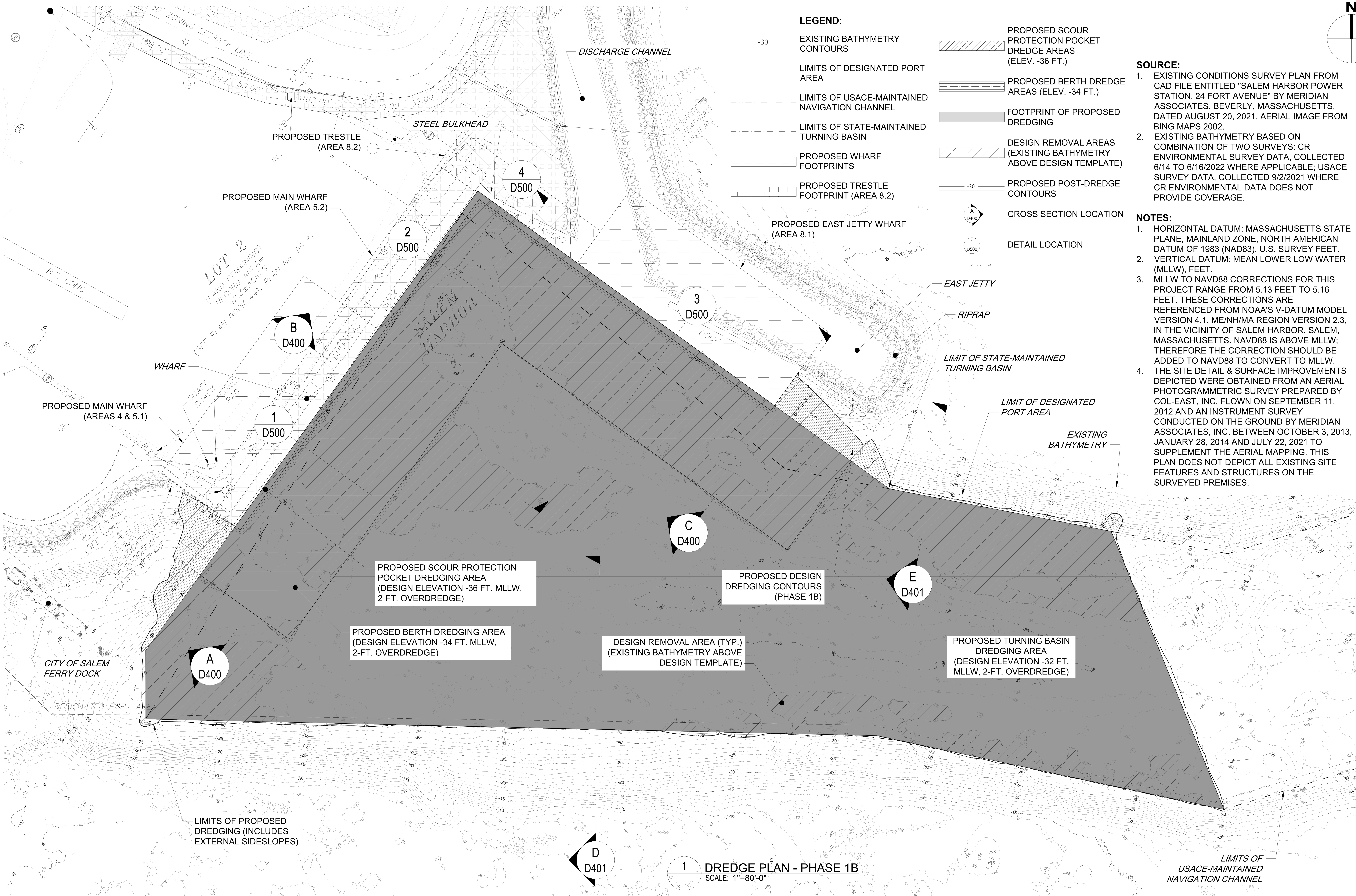
PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
MARINE
EXISTING CONDTIONS

SHEET NUMBER
D100

- OF -

ANSI D 22" x 34"



LEGEND:

- EXISTING BATHYMETRY CONTOURS
- LIMITS OF DESIGNATED PORT AREA
- LIMITS OF USACE-MAINTAINED NAVIGATION CHANNEL
- LIMITS OF STATE-MAINTAINED TURNING BASIN
- PROPOSED WHARF FOOTPRINTS
- PROPOSED TRESTLE FOOTPRINT (AREA 8.2)
- PROPOSED SCOUR PROTECTION POCKET DREDGE AREAS (ELEV. -36 FT.)
- PROPOSED BERTH DREDGE AREAS (ELEV. -34 FT.)
- FOOTPRINT OF PROPOSED DREDGING
- DESIGN REMOVAL AREAS (EXISTING BATHYMETRY ABOVE DESIGN TEMPLATE)
- PROPOSED POST-DREDGE CONTOURS
- CROSS SECTION LOCATION
- DETAIL LOCATION

SOURCE:

1. EXISTING CONDITIONS SURVEY PLAN FROM CAD FILE ENTITLED "SALEM HARBOR POWER STATION, 24 FORT AVENUE" BY MERIDIAN ASSOCIATES, BEVERLY, MASSACHUSETTS, DATED AUGUST 20, 2021. AERIAL IMAGE FROM BING MAPS 2002.
2. EXISTING BATHYMETRY BASED ON COMBINATION OF TWO SURVEYS: CR ENVIRONMENTAL SURVEY DATA, COLLECTED 6/14 TO 6/16/2022 WHERE APPLICABLE; USACE SURVEY DATA, COLLECTED 9/2/2021 WHERE CR ENVIRONMENTAL DATA DOES NOT PROVIDE COVERAGE.

NOTES:

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2. VERTICAL DATUM: MEAN LOWER LOW WATER (MLLW), FEET.
3. MLLW TO NAVD88 CORRECTIONS FOR THIS PROJECT RANGE FROM 5.13 FEET TO 5.16 FEET. THESE CORRECTIONS ARE REFERENCED FROM NOAA'S V-DATUM MODEL VERSION 4.1, ME/NH/MA REGION VERSION 2.3, IN THE VICINITY OF SALEM HARBOR, SALEM, MASSACHUSETTS. NAVD88 IS ABOVE MLLW; THEREFORE THE CORRECTION SHOULD BE ADDED TO NAVD88 TO CONVERT TO MLLW.
4. THE SITE DETAIL & SURFACE IMPROVEMENTS DEPICTED WERE OBTAINED FROM AN AERIAL PHOTOGRAMMETRIC SURVEY PREPARED BY COL-EAST, INC. FLOWN ON SEPTEMBER 11, 2012 AND AN INSTRUMENT SURVEY CONDUCTED ON THE GROUND BY MERIDIAN ASSOCIATES, INC. BETWEEN OCTOBER 3, 2013, JANUARY 28, 2014 AND JULY 22, 2021 TO SUPPLEMENT THE AERIAL MAPPING. THIS PLAN DOES NOT DEPICT ALL EXISTING SITE FEATURES AND STRUCTURES ON THE SURVEYED PREMISES.

1 DREDGE PLAN - PHASE 1B
SCALE: 1"=80'-0"

GRAPHIC SCALE: 1" = 80'-0"
80' 0 80' 240'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

CLIENT
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9487 Regency Square Boulevard
Jacksonville, FL 32225

CONSULTANT
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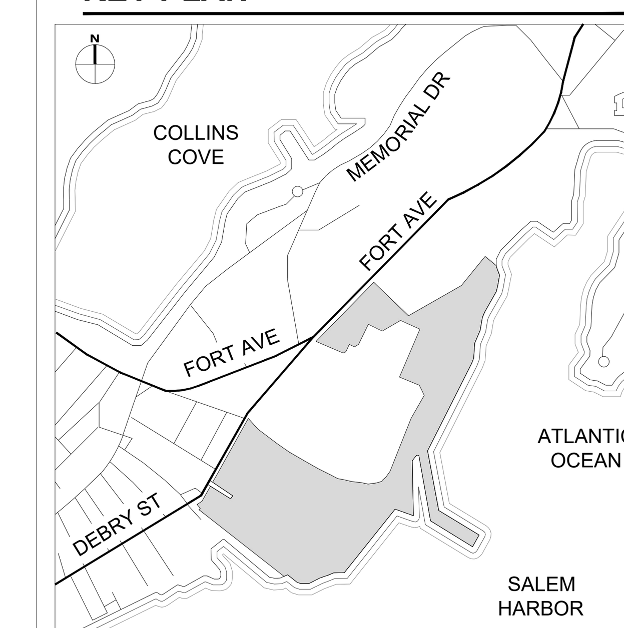
SITE INVESTIGATION & ENVIRONMENTAL LOADS
GZA
188 Valley Street, Suite 300, Providence, RI 02909

DREDGE & DREDGE MATERIAL MANAGEMENT
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



NOT FOR CONSTRUCTION

30% DESIGN DOCUMENTS

REVISION

R	DATE	DESCRIPTION

Designed By:	D_BINKNEY
Drawn By:	P_SCIABA
Checked By:	M_MAHONEY
Approved By:	--

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
DREDGE PLAN
PHASE 1B

SHEET NUMBER
D302
- OF -

Last saved by: DBINKNEY(2022-07-26) Last Plotted: 2022-07-26
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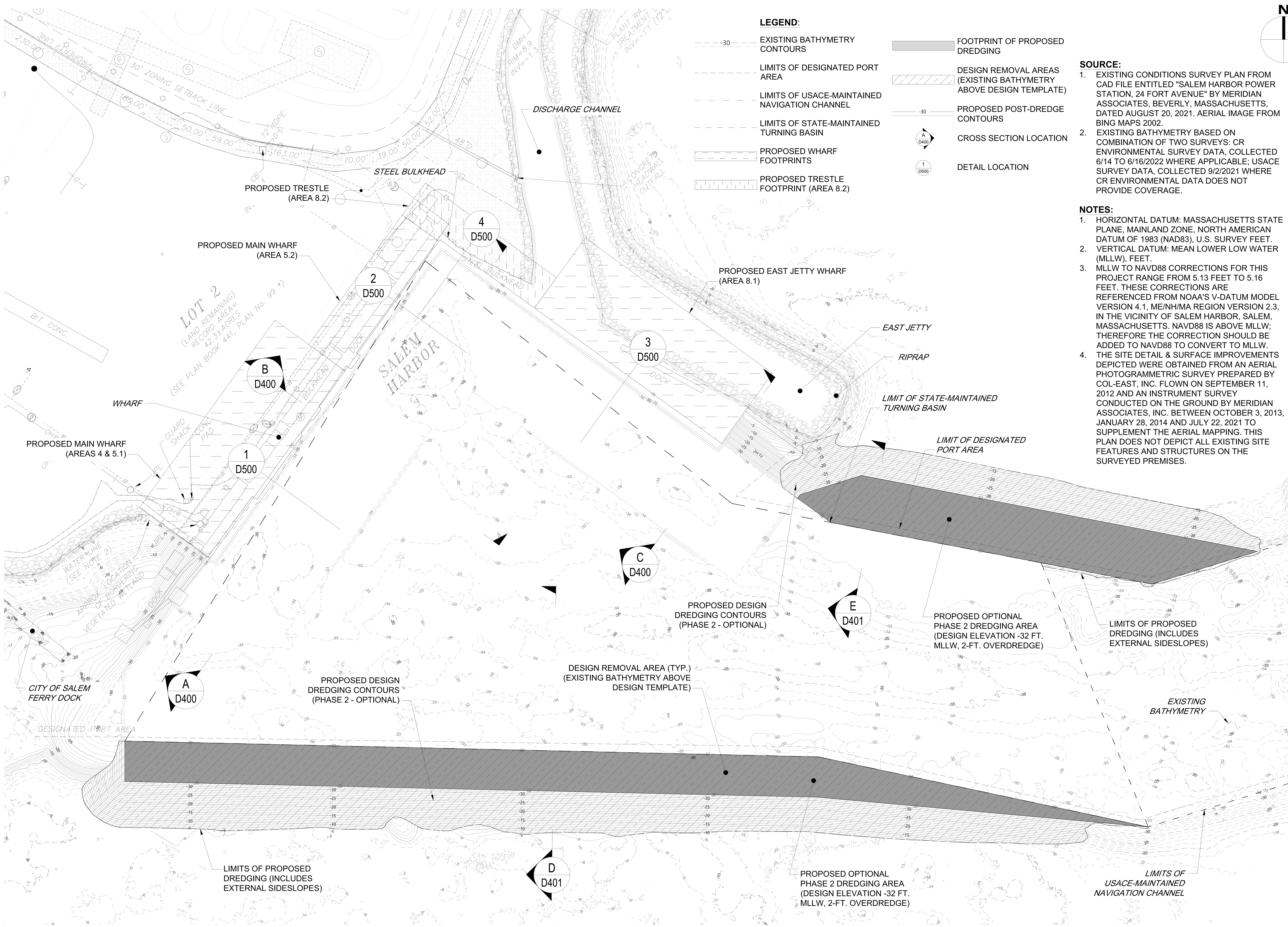
ANSI D 22" x 34"



LEGEND:

-30	EXISTING BATHYMETRY CONTOURS
	LIMITS OF DESIGNATED PORT AREA
	LIMITS OF USACE-MAINTAINED NAVIGATION CHANNEL
	LIMITS OF STATE-MAINTAINED TURNING BASIN
	PROPOSED WHARF FOOTPRINTS
	PROPOSED TRESTLE FOOTPRINT (AREA 8.2)
	FOOTPRINT OF PROPOSED DREDGING
	DESIGN REMOVAL AREAS (EXISTING BATHYMETRY ABOVE DESIGN TEMPLATE)
-30	PROPOSED POST-DREDGE CONTOURS
A / D400	CROSS SECTION LOCATION
1 / D500	DETAIL LOCATION

SOURCE:

1. EXISTING CONDITIONS SURVEY PLAN FROM CAD FILE ENTITLED "SALEM HARBOR POWER STATION, 24 FORT AVENUE" BY MERIDIAN ASSOCIATES, BEVERLY, MASSACHUSETTS, DATED AUGUST 20, 2021. AERIAL IMAGE FROM BING MAPS 2002.
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1 DREDGE PLAN - PHASE 2 (OPTIONAL)
SCALE: 1"=80'-0"

GRAPHIC SCALE: 1" = 80'-0"
80' 0 80' 240'

PROJECT
SALEM WIND PORT
67 Derby Street, Salem, Massachusetts

CLIENT
CROWLEY
CROWLEY WIND SERVICES, Inc.
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Jacksonville, FL 32225

CONSULTANT
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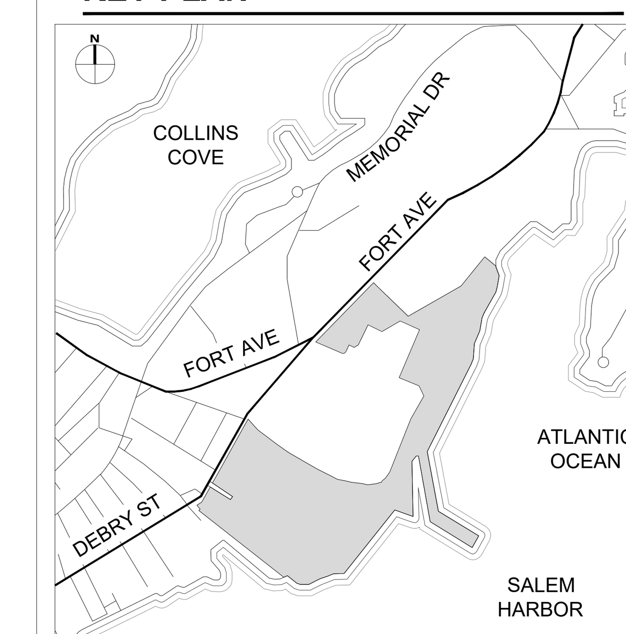
SITE INVESTIGATION & ENVIRONMENTAL LOADS
GZA
188 Valley Street, Suite 300, Providence, RI 02909

DREDGE & DREDGE MATERIAL MANAGEMENT
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



NOT FOR CONSTRUCTION

30% DESIGN DOCUMENTS

REVISION

R	DATE	DESCRIPTION

Designed By:	D_BINKNEY
Drawn By:	P_SCIABA
Checked By:	M_MAHONEY
Approved By:	--

PROJECT/TERM CONTRACT NUMBER
60681893

SHEET TITLE
DREDGE PLAN
PHASE 2 (OPTIONAL)

SHEET NUMBER
D303
- OF -

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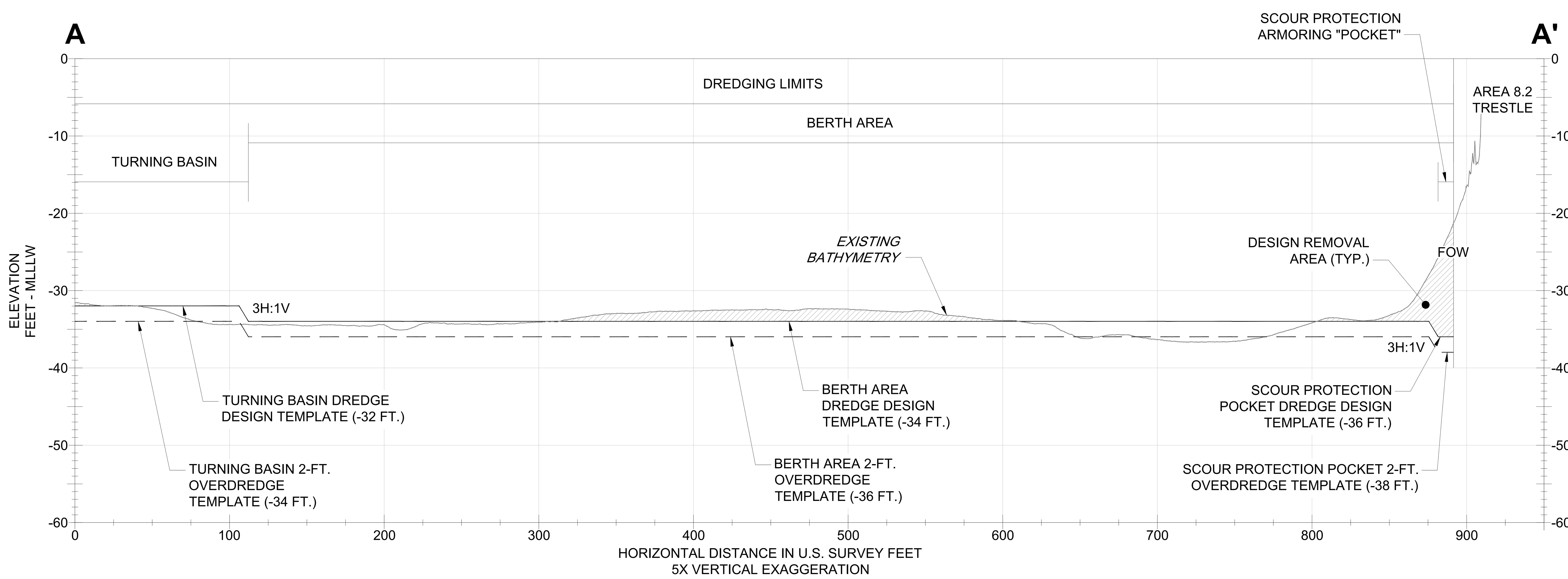


A
D302
SECTION A-A'
SCALE: 1" = 50'

NOTES:

1. HORIZONTAL DATUM: MASSACHUSETTS STATE PLANE, MAINLAND ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83), U.S. SURVEY FEET.
2. VERTICAL DATUM: MEAN LOWER LOW WATER (MLLW), FEET.
3. DEPICTED LIMITS AND ELEVATIONS OF DESIGN DREDGING ARE FOR ILLUSTRATIVE USE ONLY AND ARE SUBJECT TO CHANGE.
4. FOW = FACE OF WALL

LEGEND:

EXISTING BATHYMETRY

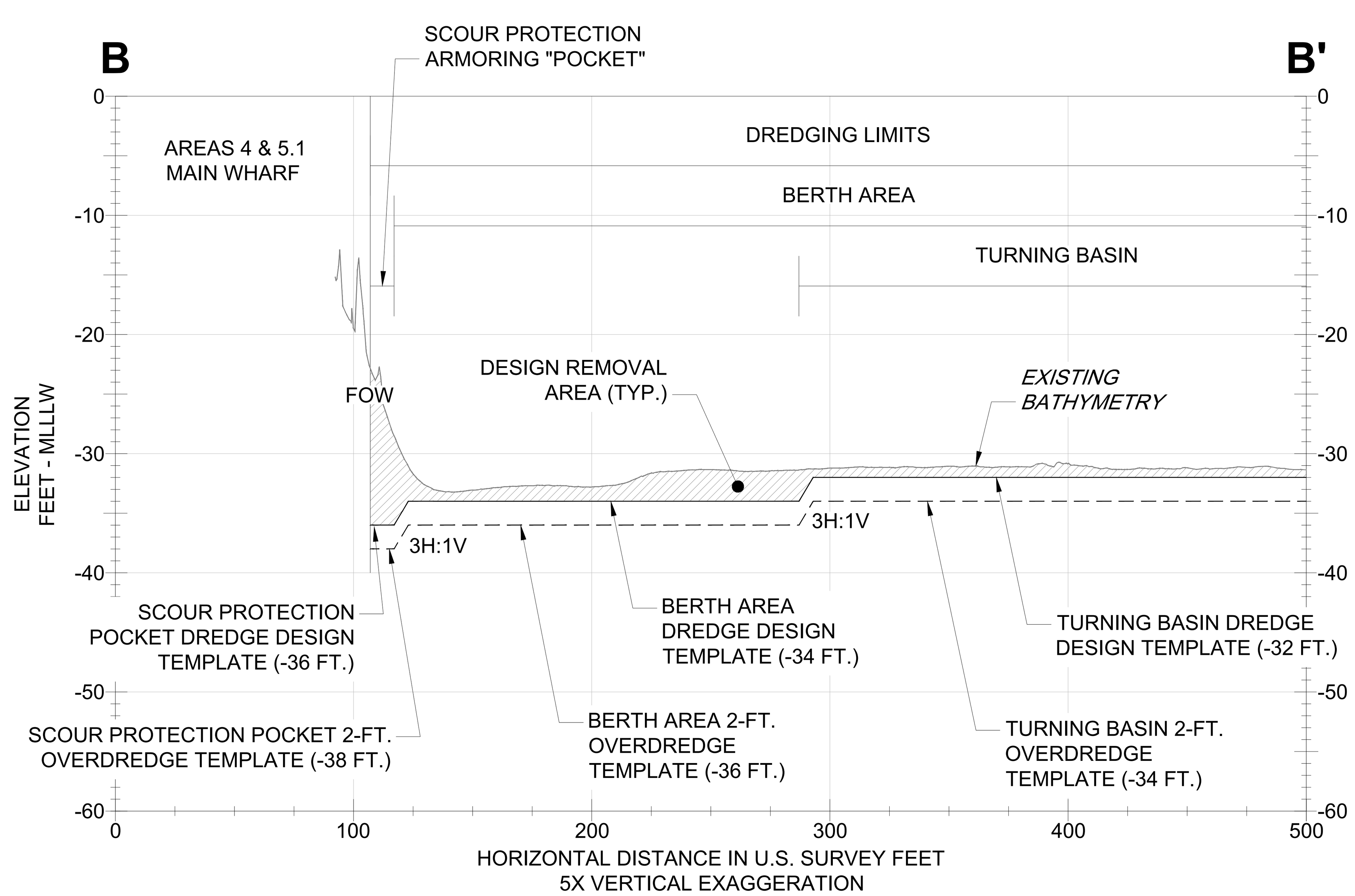
PROPOSED DREDGE DESIGN TEMPLATE

PROPOSED 2-FT. OVERDREDGE TEMPLATE

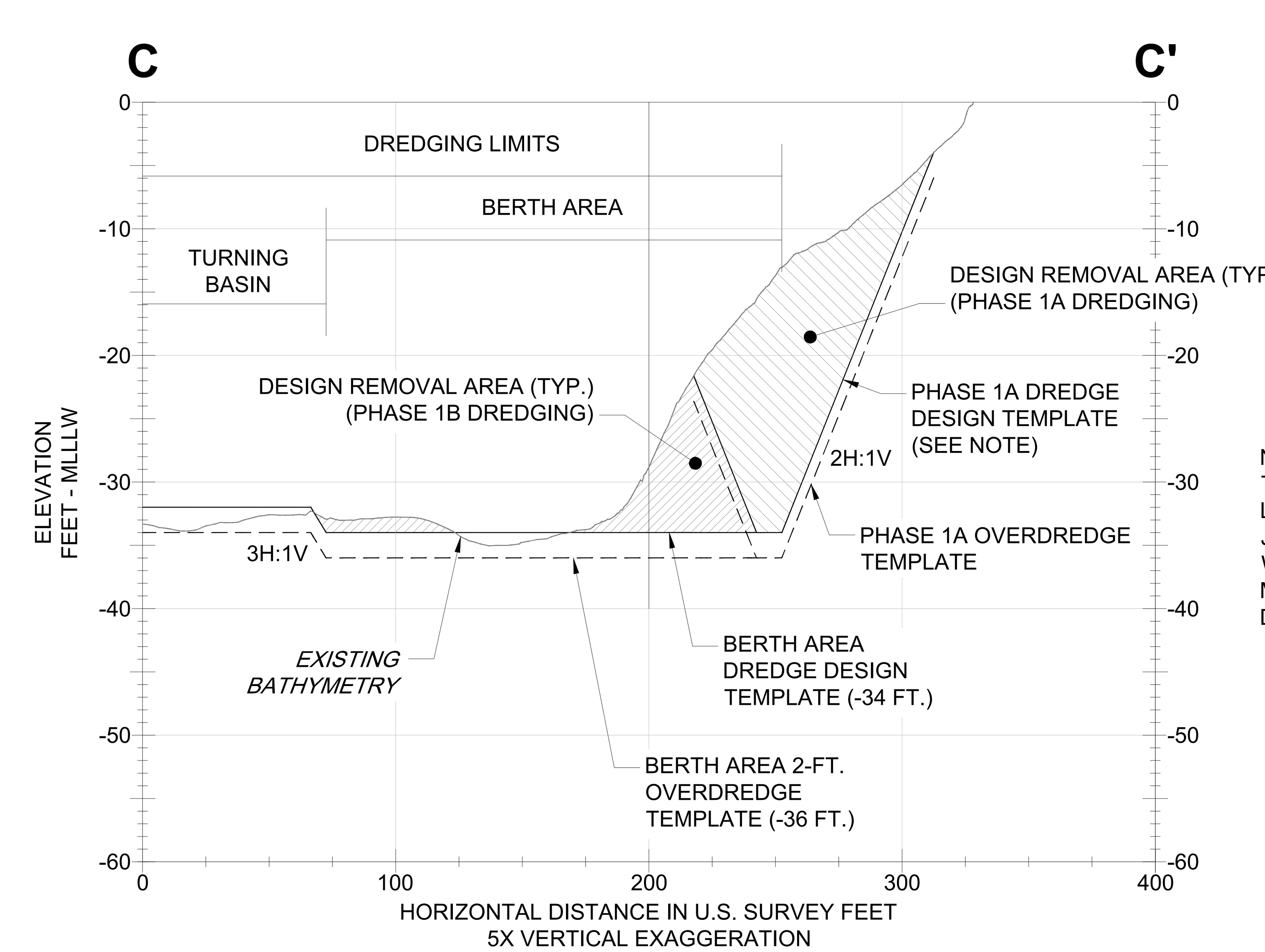
DESIGN TEMPLATE REMOVAL AREA (PHASE 1A DREDGING)

DESIGN TEMPLATE REMOVAL AREA (PHASE 1B DREDGING)

DESIGN TEMPLATE REMOVAL AREA (OPTIONAL PHASE 2 DREDGING)



B
D302
SECTION B-B'
SCALE: 1" = 50'



C
D301
SECTION C-C'
SCALE: 1" = 50'

NOTE: PHASE 1A DREDGE TEMPLATE TARGETS SEDIMENT LOCATED BEHIND PROPOSED JETTY WHARF FOW PRIOR TO WHARF CONSTRUCTION TO MAINTAIN STABILITY OF DREDGE CUT EAST OF WHARF

GRAPHIC SCALE: 1" = 50'-0"
50' 0 50' 150'

PROJECT

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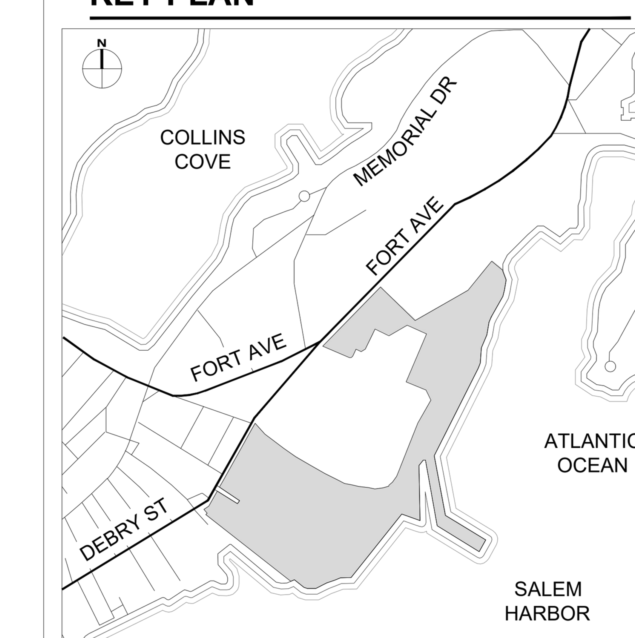
OCA-Anchor QEA Offshore Wind JV
9 Water St., Amersbury, MA 01913

KEY PLAN



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30% DESIGN DOCUMENTS

REVISION

R	DATE	DESCRIPTION

Designed By:	D_BINKNEY
Drawn By:	P_SCIABA
Checked By:	M_MAHONEY
Approved By:	--

PROJECT/TERM CONTRACT NUMBER

60681893

SHEET TITLE

DREDGING CROSS SECTIONS (A-A', B-B' & C-C')

SHEET NUMBER

D400

- OF -

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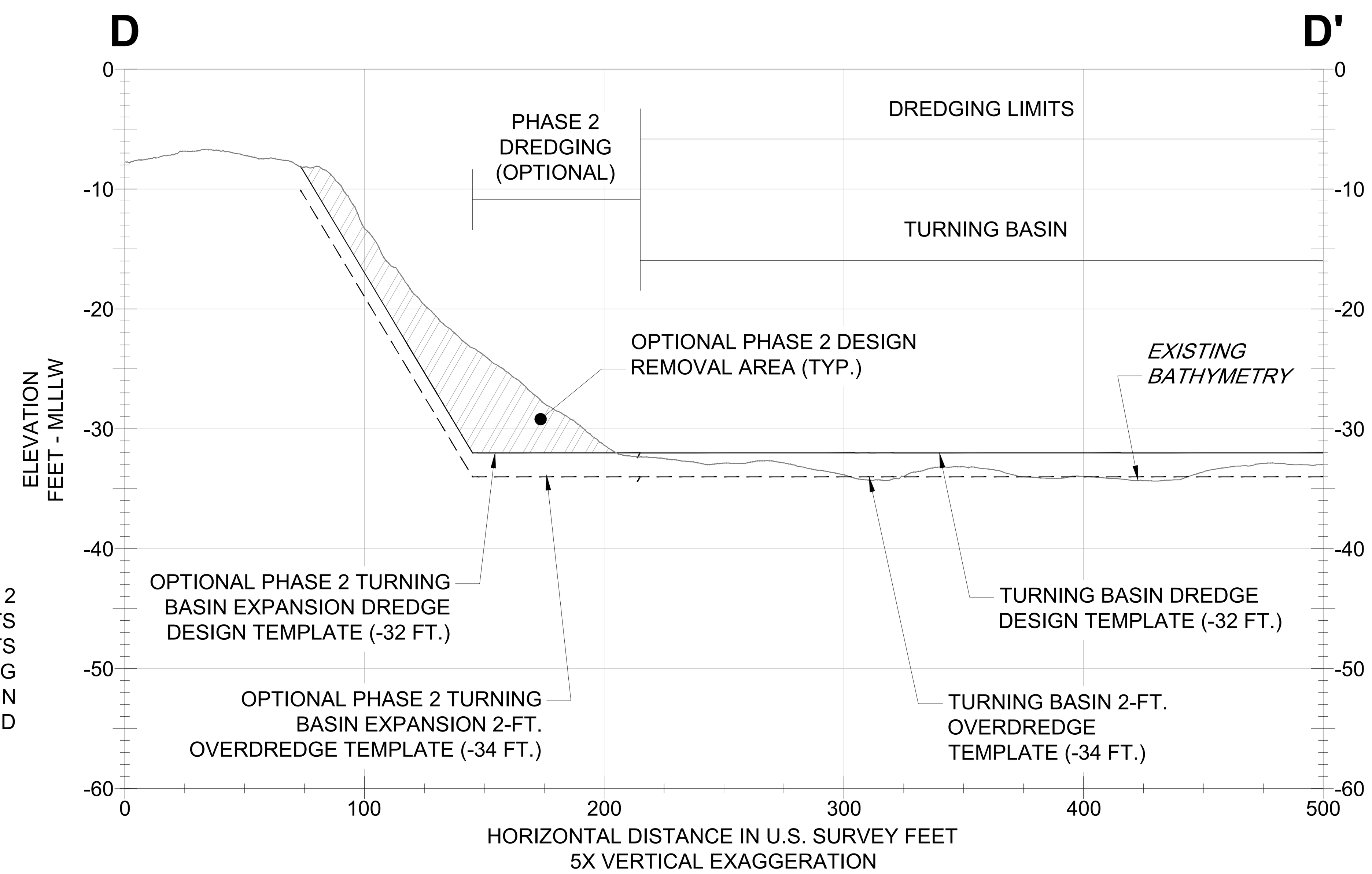
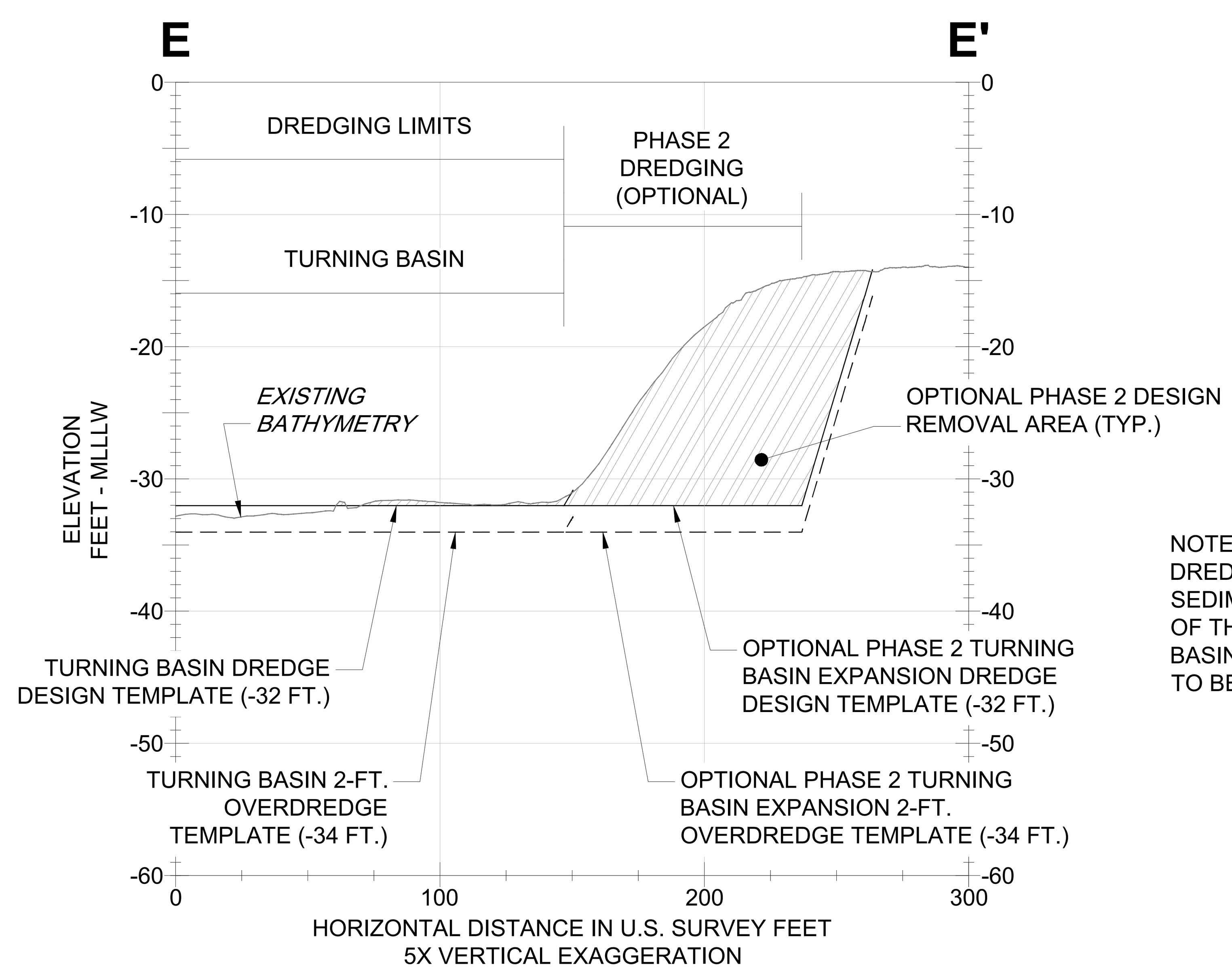


NOTE: OPTIONAL PHASE 2 DREDGE TEMPLATE TARGETS SEDIMENT BEYOND THE LIMITS OF THE EXISTING TURNING BASIN. INCLUSION IN DESIGN TO BE DETERMINED

D
D303
SECTION D-D'
SCALE: 1" = 50'



NOTE: OPTIONAL PHASE 2 DREDGE TEMPLATE TARGETS SEDIMENT BEYOND THE LIMITS OF THE EXISTING TURNING BASIN. INCLUSION IN DESIGN TO BE DETERMINED

E
D303
SECTION E-E'
SCALE: 1" = 50'

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LEGEND:

EXISTING BATHYMETRY

PROPOSED DREDGE DESIGN TEMPLATE

PROPOSED 2-FT. OVERDREDGE TEMPLATE

DESIGN TEMPLATE REMOVAL AREA (OPTIONAL PHASE 2 DREDGING)

GRAPHIC SCALE: 1" = 50'-0"
50' 0 50' 150'

PROJECT

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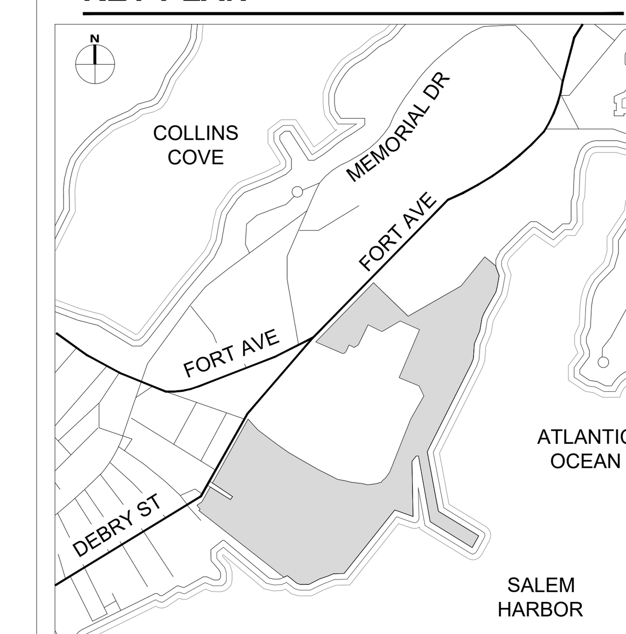

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Checked By:	M_MAHONEY
Approved By:	--

PROJECT/TERM CONTRACT NUMBER

60681893

SHEET TITLE

DREDGING CROSS SECTIONS (D-D' & E-E')

SHEET NUMBER

D401

- OF -

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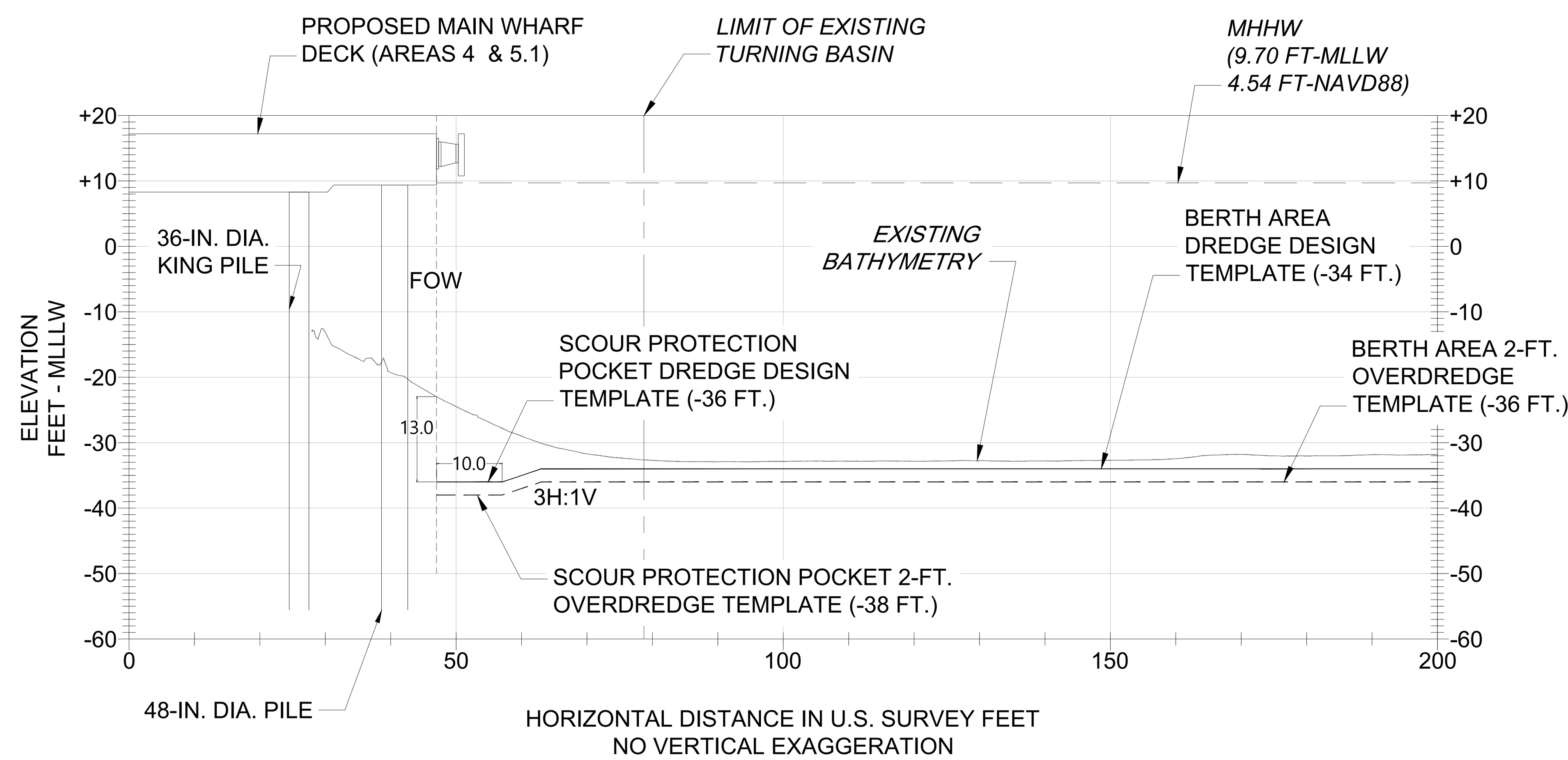
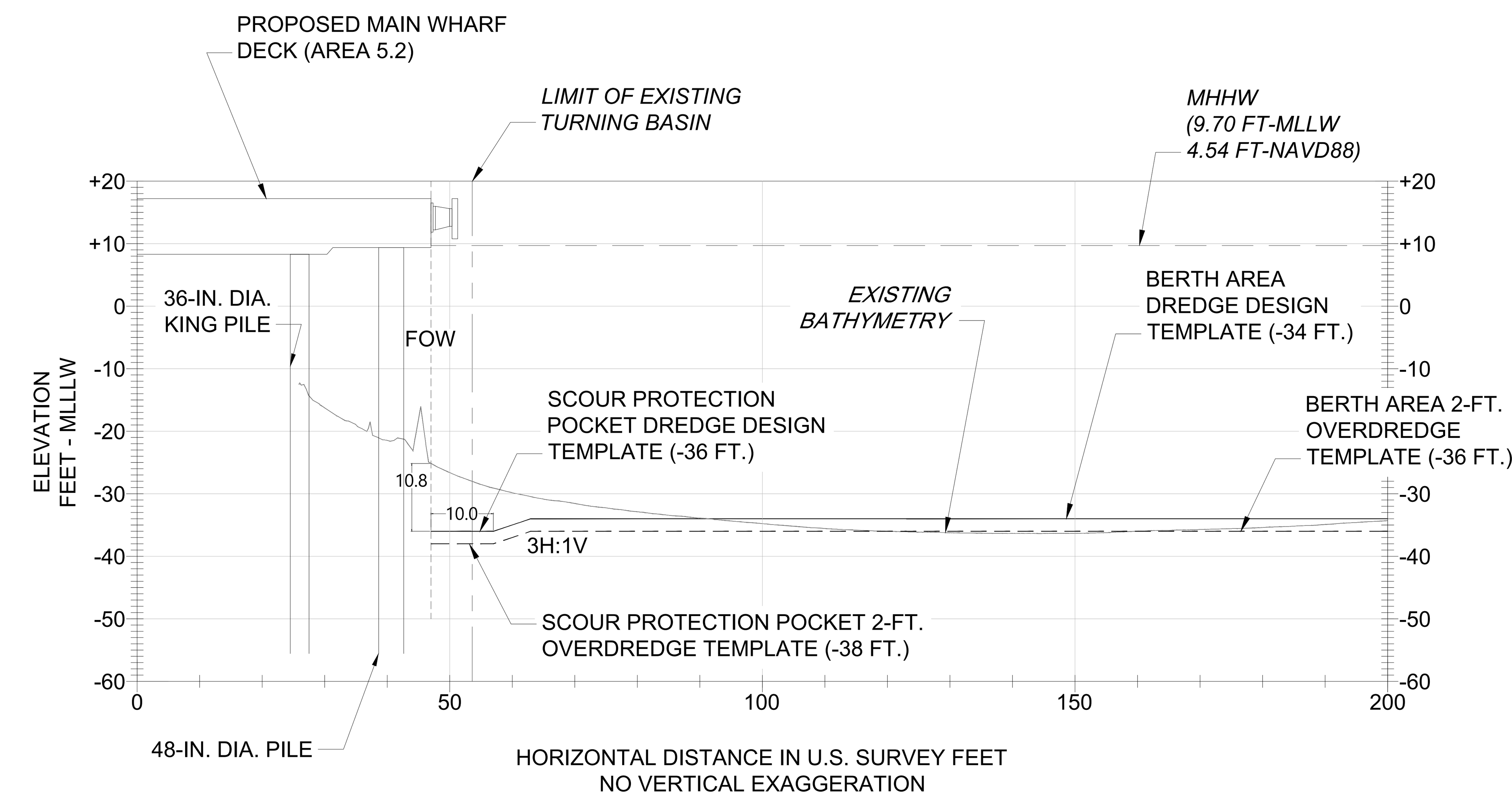
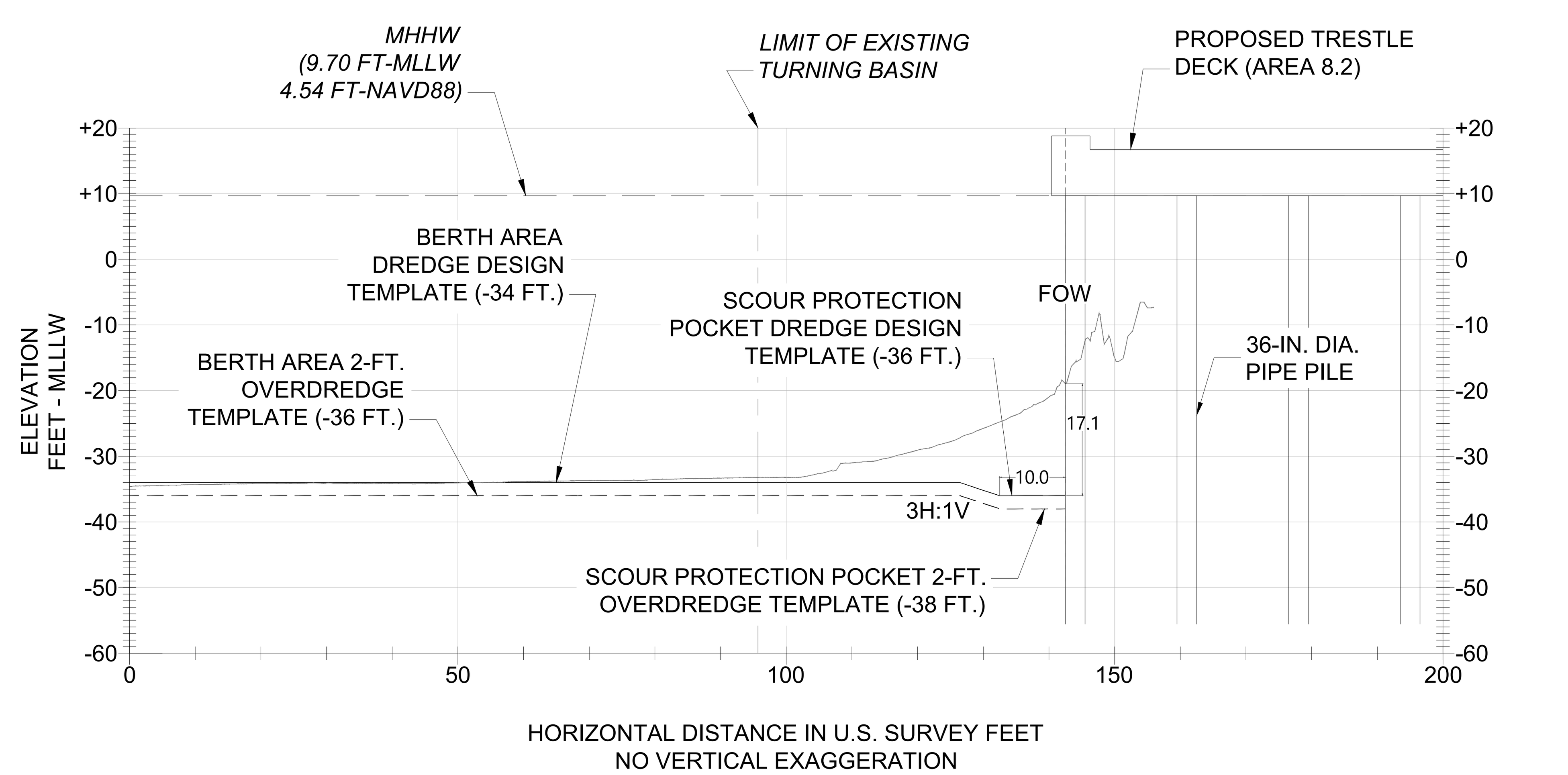
ANSI D 22" x 34"



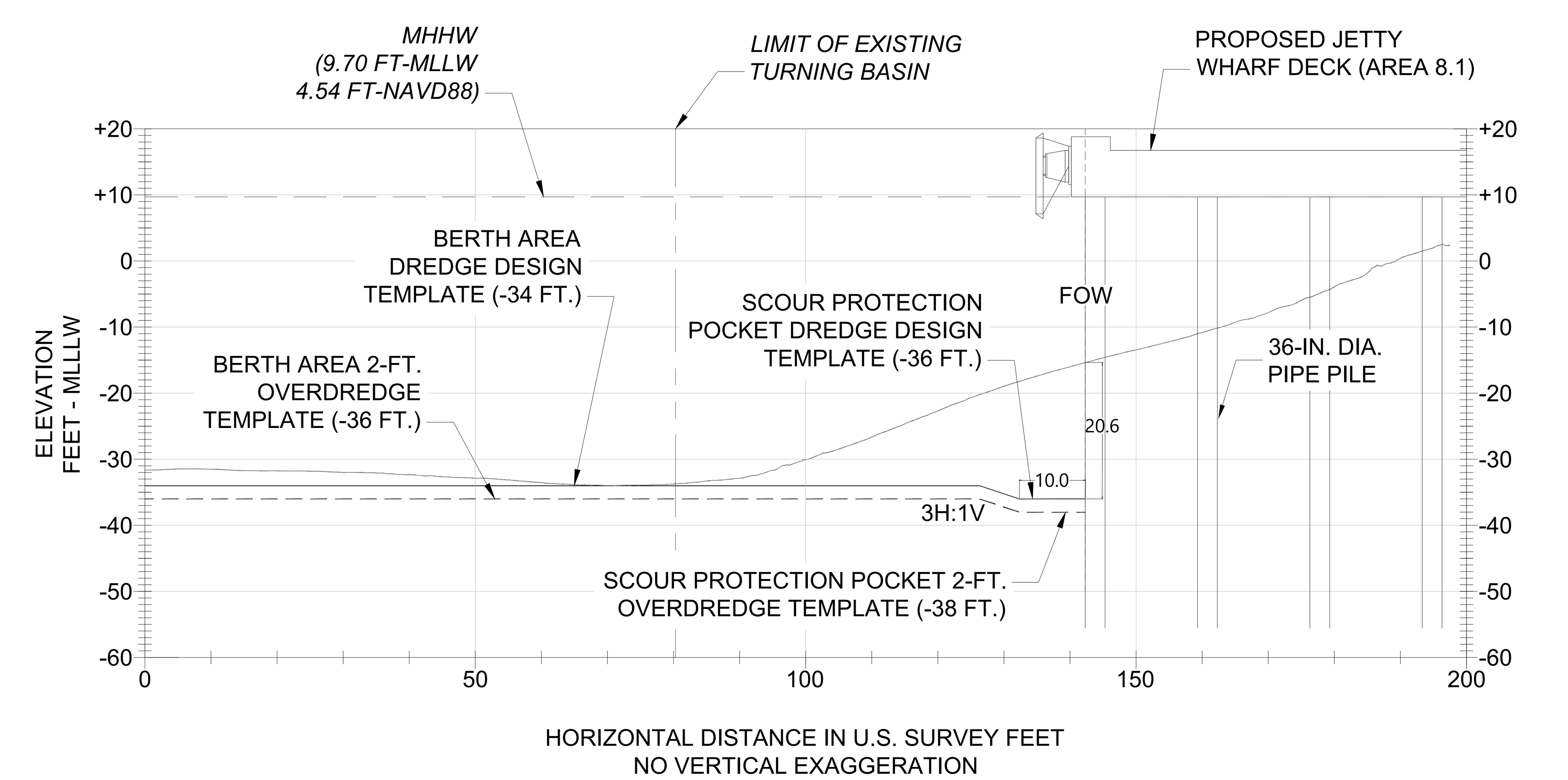
1
D-301
DETAIL 1
DREDGING INTERFACE AT MAIN WHARF (AREAS 4 & 5.1)
SCALE: 1" = 50'



2
D-301
DETAIL 2
DREDGING INTERFACE AT MAIN WHARF (AREA 5.2)
SCALE: 1" = 50'



3
D-301
DETAIL 3
DREDGING INTERFACE AT TRESTLE (AREA 8.2)
SCALE: 1" = 50'



4
D-301
DETAIL 4
DREDGING INTERFACE AT JETTY WHARF (AREA 8.1)
SCALE: 1" = 50'

NOTES:

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LEGEND:

EXISTING BATHYMETRY

PROPOSED DREDGE DESIGN TEMPLATE

PROPOSED 2-FT. OVERDREDGE TEMPLATE

GRAPHIC SCALE: 1" = 50'-0"
50' 0 50' 150'

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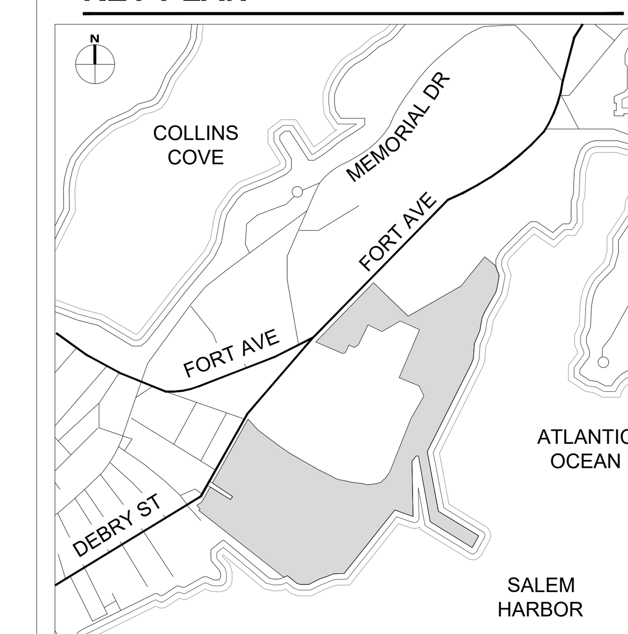

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REVISION

R	DATE	DESCRIPTION

Designed By:	**D_BINKNEY**
Drawn By:	**P_SCIABA**
Checked By:	**M_MAHONEY**
Approved By:	**--**

PROJECT/TERM CONTRACT NUMBER

60681893

SHEET TITLE

DREDGING DETAILS

SHEET NUMBER

D500

- OF -

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Attachment C

SALEM MHP UPDATE PRESENTATION

Salem Municipal Harbor Plan Update

February 24, 2020

Agenda

- Outreach
  - Footprint update on outreach
  - City update on outreach
  - Interim survey results and HPC feedback
- Next steps
  - March HPC / Public meetings
  - Current Timeline vs. Legislation
  - Future engagement

Priorities for the Footprint Property Survey

Community Feedback

- **361 people** have responded to the survey
- 82% of respondents **live in** Salem
  - Some of the neighborhoods include: Downtown, Derby Street, Collins Cove, North Salem, Willows, Castle HIll, Ward 2, Ward 5, and Ward 6
- 57% of respondents **work in** Salem

Share your priorities for the Footprint Property

The Footprint property features over 40 acres of waterfront land within the Designated Port Area (DPA). DPAs are land and water areas set aside for working port industrial uses that need to use the water to operate. Land and water uses are limited primarily to Water-Dependent Industrial (WDI) activities. In a DPA Master Plan, a municipality may request flexibility for certain use standards but must balance that flexibility with strategic elements that ensure that DPA interests are still protected.

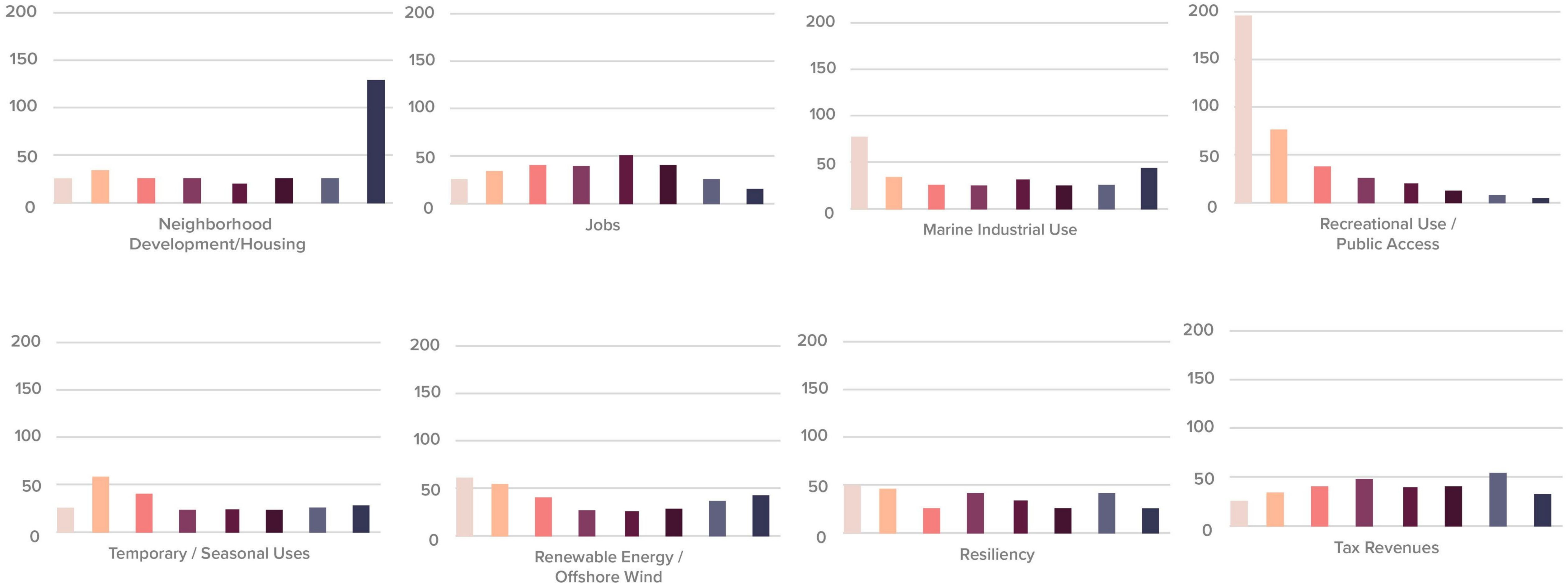
* Required

Salem's DPA boundary:

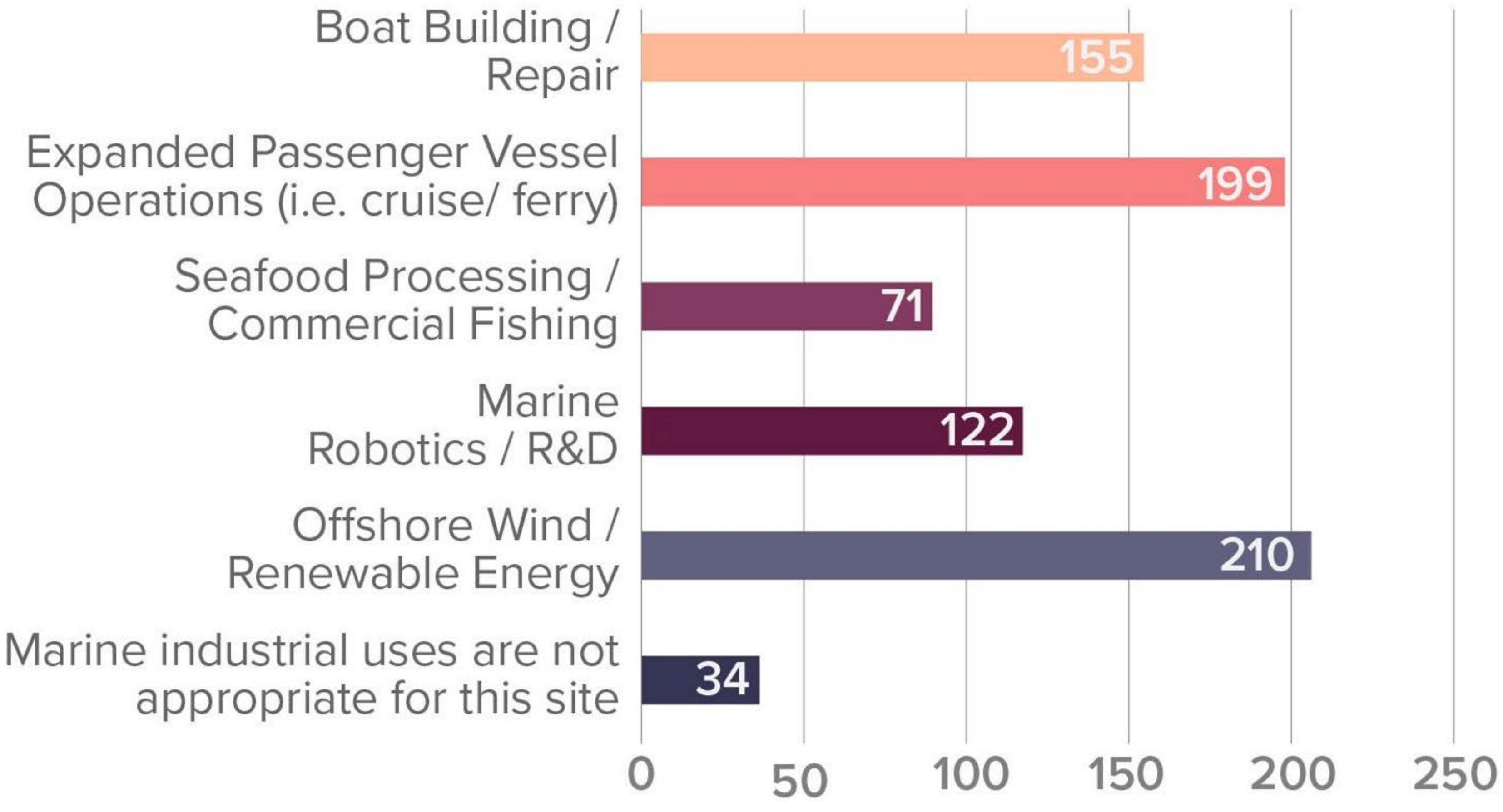
Priorities for the reuse of the Footprint property:

Ranked by importance

1st 2nd 3rd 4th 5th 6th 7th 8th

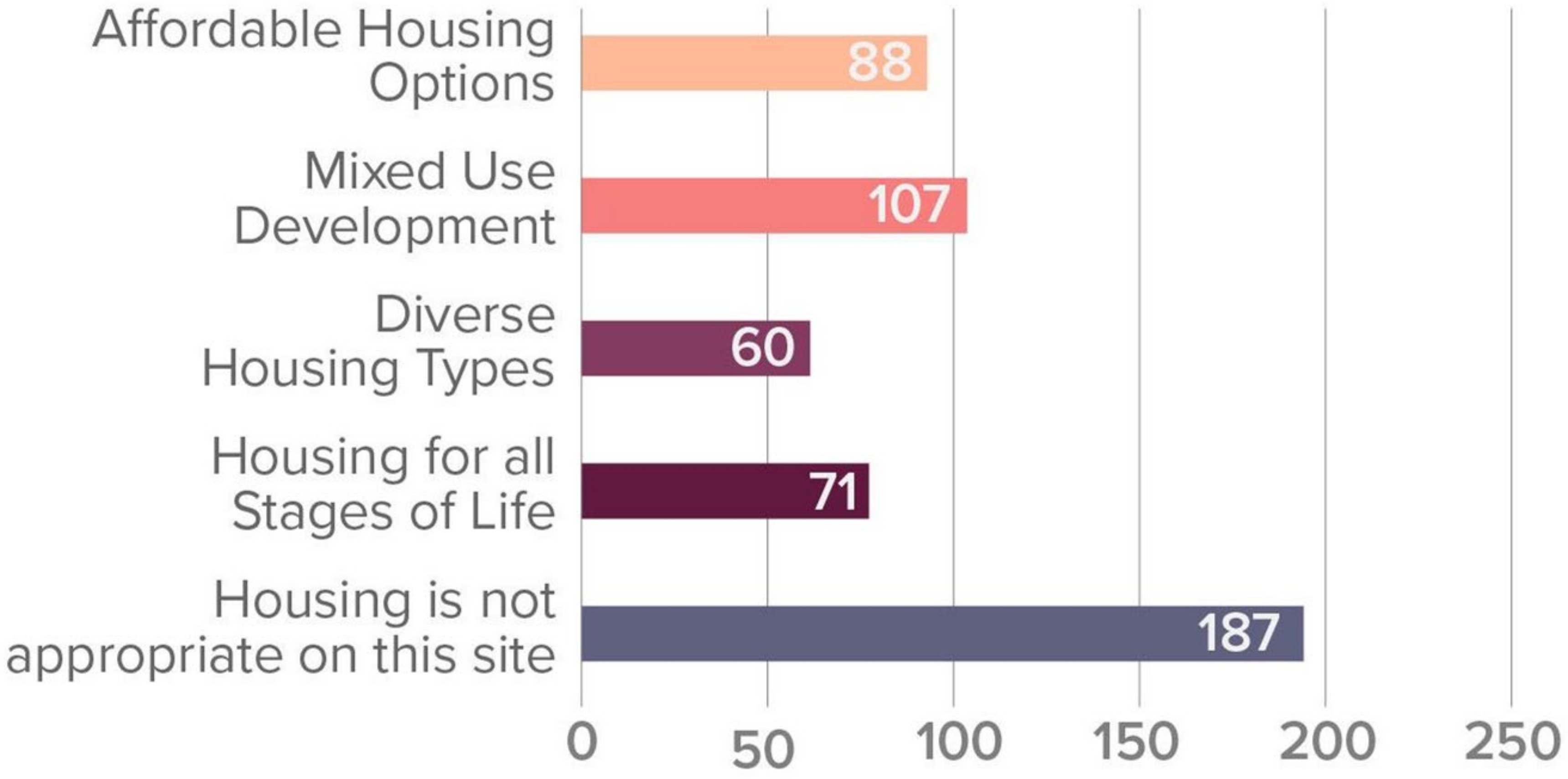


Marine industrial uses preferred for the Footprint site



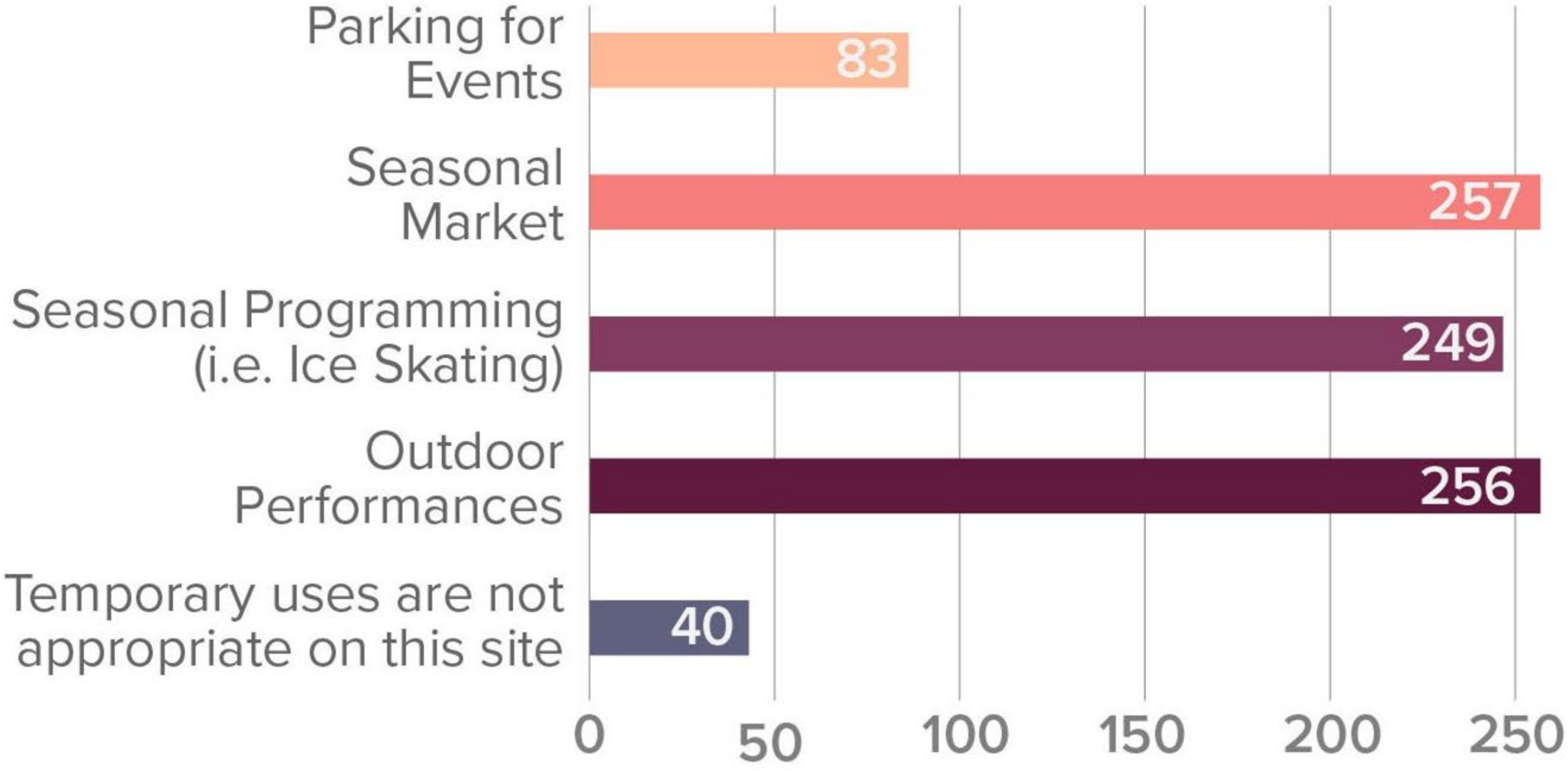
(all that apply)

Neighborhood development preferred for the site



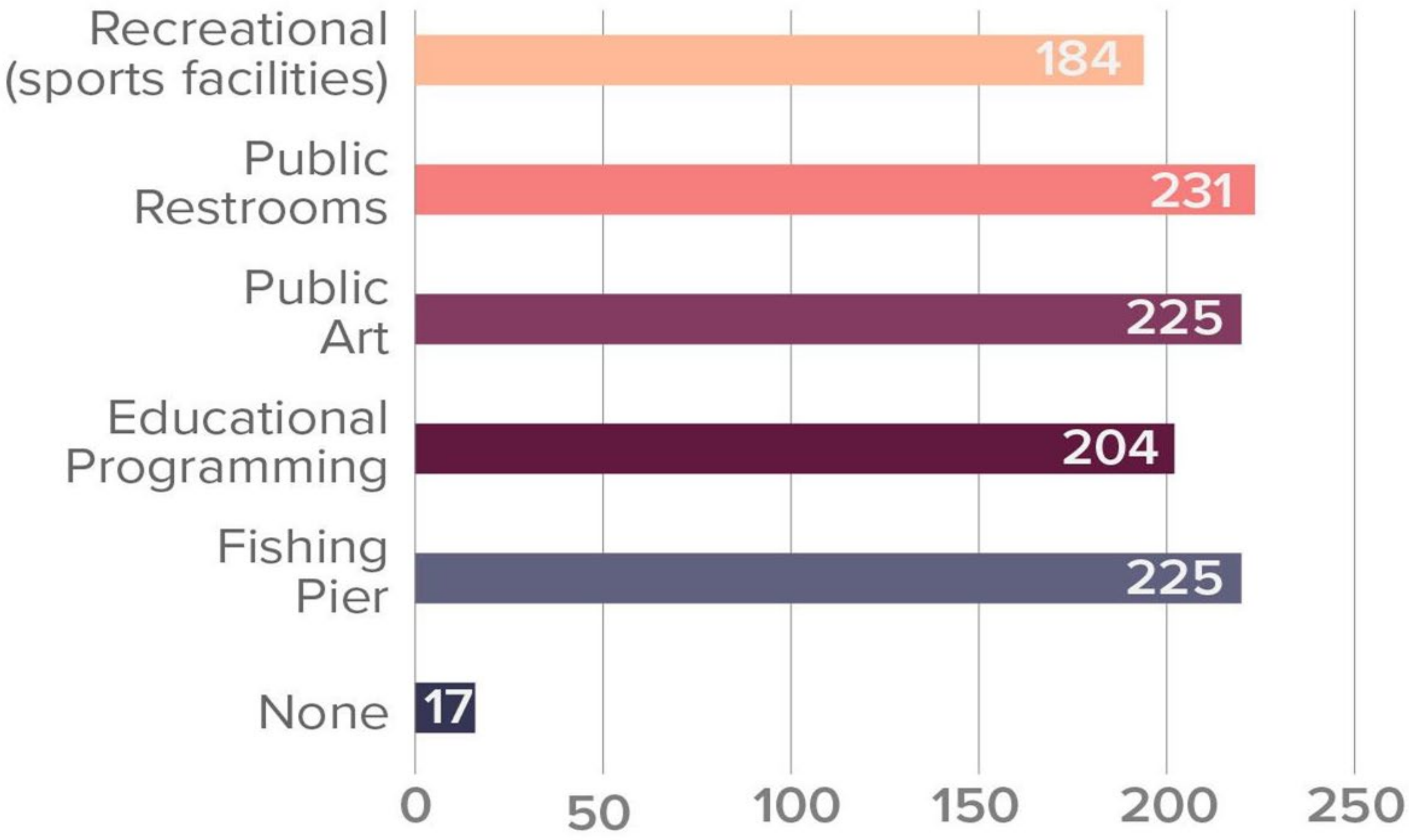
(all that apply)

Temporary uses preferred for the site



(all that apply)

Features and activities preferred for the site



(all that apply)

Schedule

I Complete Analysis of the 2008 Salem Harbor Plan

i. Identify accomplishments consistent with the 2008 Harbor Plan.
ii. Identify inconsistencies within the plan.

II Market Analysis of Land Adjacent to Power Plant

i. Analyze existing and projected market conditions.

III Develop Recommendations

i. Analyze development projects.
ii. Identify opportunities to improve resilience.
iii. Examine existing planning districts.
iv. Discuss recommendations to clarify inconsistencies.
v. Identify substitutions and amplifications.
vi. Develop an Action Plan.

IV Preparation of Draft Plan

i. Prepare a draft Revised Harbor Plan.
ii. Hold an additional public meeting(s).

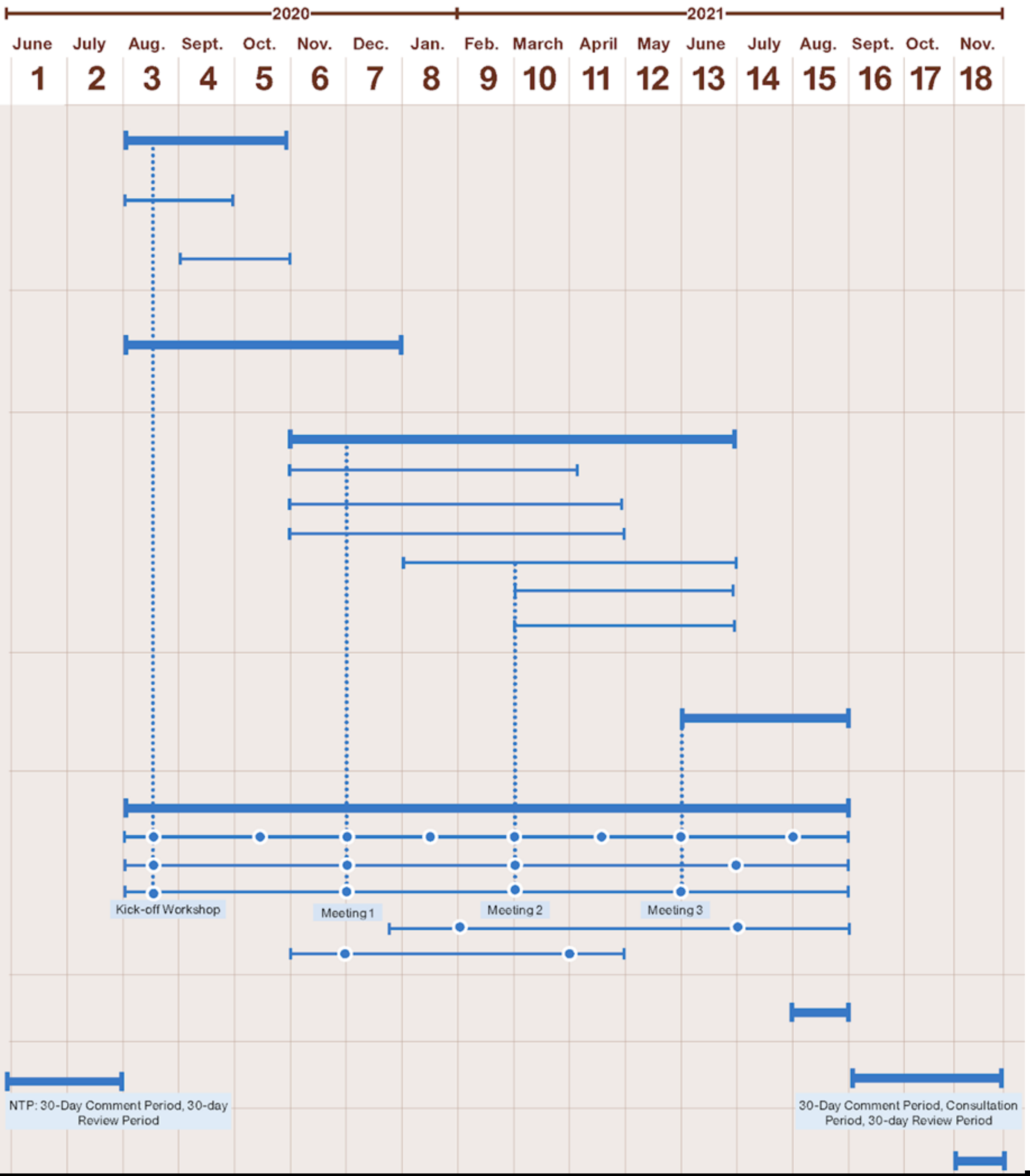
V Meetings

i. Harbor Plan Committee Members.
ii. Interdepartmental Meetings
iii. Public meetings.
iv. Meetings with the Salem City Council.
v. Meetings with Footprint.

VI City of Salem Review and Approval

VII EEA Review and Approval

VIII Final Salem Harbor Plan



Next Steps

Project Kickoff
August 19 2020

Introduction to the Project, Committee Role, and Regulations

Committee Meeting #2
Oct. 7 2020

Market Analysis

Committee Meeting #3
Nov.10 2020

Analysis

Committee Meeting #4
Jan 20 2021

Analysis

Committee Meeting #5
March 17 2021

Planning Recommendations

Public Meeting #3
March 24 2021

Planning Recommendations

Committee Meeting #6
June 2021

Action Plan

Committee Meeting #7 & #8
2021

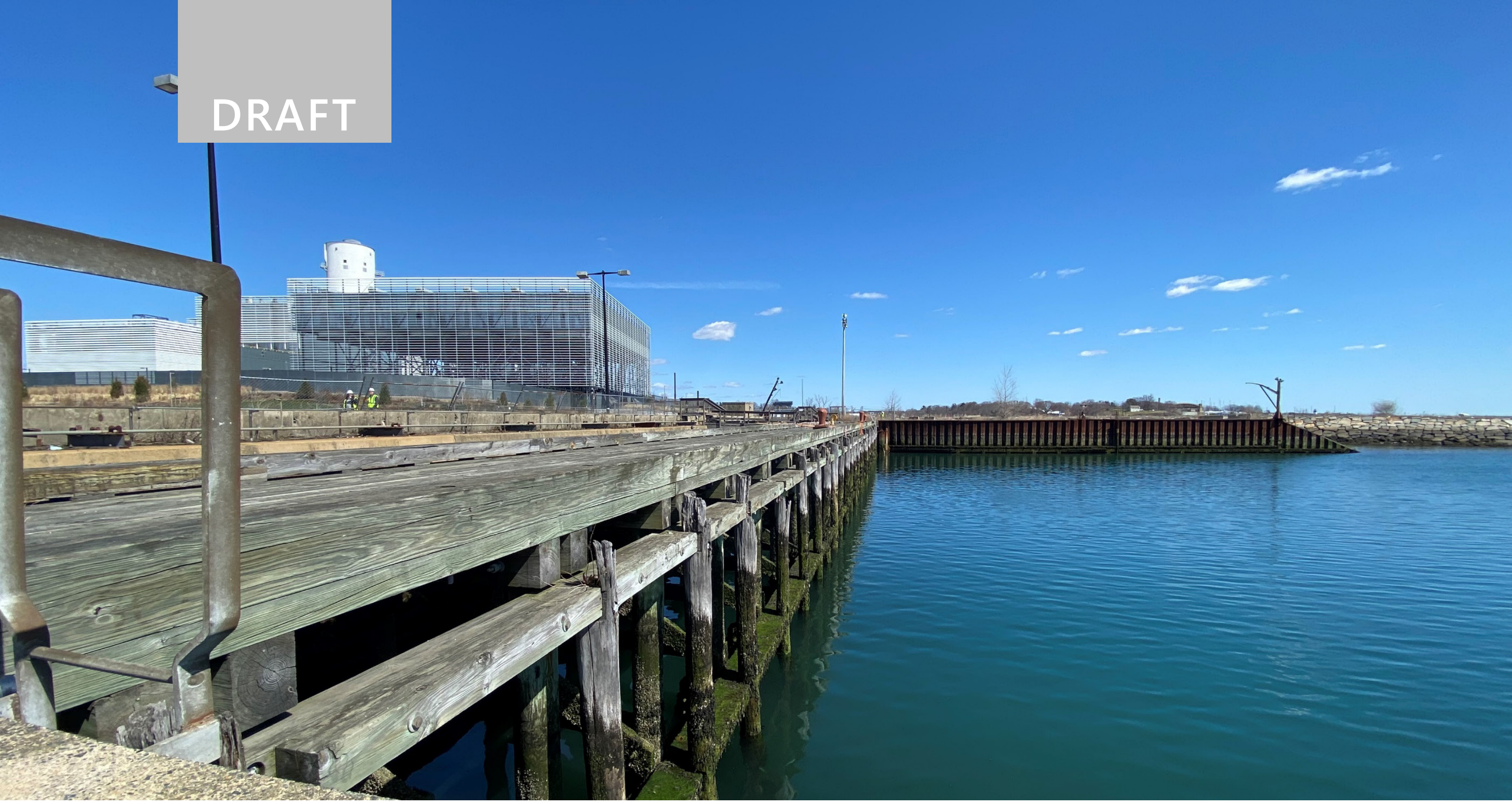
Master Plan Draft

Event Page: https://harborplan.salem.com/events/

WE ARE HERE

Attachment D

SAMPLING AND ANALYSIS PLAN AND QUALITY ASSURANCE PROJECT PLAN



DRAFT

August 2022
Salem Wind Port

ANCHOR QEA

Sampling and Analysis Plan and Quality Assurance Project Plan

Prepared for AECOM

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Prepared by
OCA-Anchor QEA Offshore Wind JV

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ABBREVIATIONS

%D	percent difference
%R	percent recovery
%RSD	percent relative standard deviation
µg/kg	microgram per kilogram
AASHTO	American Association of State Highway and Transportation Officials
ASTM	ASTM International
CFR	Code of Federal Regulations
COC	chain-of-custody
CPR	cardiopulmonary resuscitation
cy	cubic yard
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenylethylene
DDT	dichlorodiphenyltrichloroethane
DGPS	differential global positioning system
DQO	data quality objective
DU	dredging unit
EC_{50}	median effect concentration
EDD	electronic data deliverable
ERL	effect range low
ERM	effect range median
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
GTX	GeoTesting Express
H_2SO_4	sulfuric acid
HDPE	high-density polyethylene
HNO_3	nitric acid
HPAH	high-molecular-weight polycyclic aromatic hydrocarbons
ITM	*Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (Inland Testing Manual)*
IWA	in-water area
L	liter
LC_{50}	median lethal concentration
LCS	laboratory control sample
LIMS	Laboratory Information Management System
LPAH	low-molecular-weight polycyclic aromatic hydrocarbons
LPC	limiting permissible concentration

MassDEP	Massachusetts Department of Environmental Protection
MBDS	Massachusetts Bay Disposal Site
MDL	method detection limit
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
MLLW	mean lower low water
MPRSA	Marine Protection, Research, and Sanctuaries Act
MS	matrix spike
MSD	matrix spike duplicate
N/A	not applicable
NAD83	North American Datum 1983
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NH_3	ammonia
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOEC	no observed effects concentration
OHM	oil and/or hazardous material
OTM	*Evaluation of Dredged Material Proposed for Ocean Disposal: Testing Manual*
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
ppt	parts per thousand
QA	quality assurance
QC	quality control
RIM	*Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters*
RL	reporting limit
RPD	relative percent difference
RSD	relative standard deviation
SAP/QAPP	*Sampling and Analysis Plan and Quality Assurance Project Plan*
SERIM	*Southeast Regional Implementation Manual*
SHPS	Salem Harbor Power Station
SM	standard method
SOP	standard operating procedure
SQG	sediment quality guideline
SRM	standard reference material

STFATE	short-term fate of dredged material
SWP	Salem Wind Port
TB	turning basin
TDL	target detection limit
TOC	total organic carbon
UCLM	upper confidence level of the mean
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFDA	U.S. Food and Drug Administration
VOC	volatile organic compound
WQC	water quality criteria

1 Project Background

Crowley Wind Services, a subsidiary of Crowley Maritime Corporation, is proposing to redevelop an approximately 42.3-acre property at 67 Derby Street adjacent to the existing Footprint Power Salem Harbor facility in Salem, Massachusetts (Figure 1-1). The Salem Wind Port (SWP) property will be used to create an offshore wind marshalling terminal where turbine components will be assembled and deployed to offshore wind farms. Barges and other marine vessels will be used to deliver the components to the marshalling facility and transfer the assembled components to offshore wind farms. The project is on an accelerated timeline to support the equipment needs of the offshore wind farms with construction expected to commence in summer 2023.

Key components of the project include a reconstructed wharf, a new pier, and dredging to berth the large ships and transfer the turbine components. The in-water area (IWA) of the SWP is bounded to the west by an existing wharf, which was formerly used for power plant operations. On the north, it is bounded by a steel sheet pile bulkhead, a discharge channel, and the south revetment of the East Jetty. The federal navigation channel, which is authorized to -32 feet mean lower low water (MLLW), is located to the east, and Salem Harbor is located to the south (Figure 1-2).

Dredging within the IWA will be required to support development of the SWP. Dredging for the project will have the following two major phases:

- Maintenance dredging (Phase 1): Dredging the existing state-maintained turning basin (TB) to -32 feet MLLW plus a 2-foot overdepth for a total depth of -34 feet MLLW, and dredging the vessel berths to -34 feet MLLW plus a 2-foot overdepth for a total depth of -36 feet MLLW (Figure 1-3)
- New work dredging (Phase 2): Dredging two areas identified for a potential expansion of the existing TB to -32 feet MLLW plus a 2-foot overdepth for a total depth of -34 feet MLLW (Figure 1-4)

The Phase 2 new work dredging to potentially expand the TB is a project alternative that may eventually be implemented, based on project requirements. Samples to evaluate the dredged material from these areas are being included in this sampling effort to inform future permitting for additional site development.

The existing TB is located at the western terminus of the U.S. Army Corps of Engineers (USACE) maintained federal navigation channel and is approximately 19 acres (Figure 1-2). The TB was historically maintained at an elevation of -32 feet MLLW by private entities and was last dredged in 2002. Dredged material from the previous maintenance dredging event was placed at the Massachusetts Bay Disposal Site (MBDS).

The Salem Harbor federal navigation channel is 400 feet wide and ends approximately 500 feet east of the East Jetty. The channel is maintained by USACE at -32 feet MLLW and was last dredged in 2006 to 2007. Dredged material from the previous maintenance dredging event was placed at the MBDS. The federal navigation channel is outside of the project dredging footprint, and dredged material sampling or testing is not proposed for this area. It is anticipated that continued channel maintenance conducted by USACE will be sufficient to support the needs of the project.

Because dredged material from previous dredging events for the harbor TB and federal navigation channel was suitable for ocean placement, dredged material for both the maintenance and new work dredging components of the SWP project are proposed for ocean placement at the MBDS. Other options being evaluated for dredged material placement include on- or off-site processing and treatment prior to disposal at an upland landfill, on-site placement, and beneficial reuse on site or at an off-site location.

This *Sampling and Analysis Plan and Quality Assurance Project Plan* (SAP/QAPP) describes the field activities required to complete sediment and surface water sampling in the maintenance and proposed new work dredging areas and to conduct testing to evaluate ocean placement of proposed dredged material at the MBDS.

1.1 Project Objectives

The purpose of the work described herein is to collect and analyze sediment samples that are representative of dredged material from the project area to provide the data necessary to document the existing physical and chemical characteristics of sediment. An evaluation of the physical, chemical, and ecotoxicological characteristics of the dredged material is required to evaluate whether the proposed dredged material meets the requirement for ocean placement under Marine Protection, Research, and Sanctuaries Act (MPRSA) Section 103. The sampling and testing program was designed to support the determination for suitability of ocean placement of dredged material in the U.S. Environmental Protection Agency (USEPA)-designated MBDS.

This dredged material testing program includes the following:

- Sediment grab sampling (or equivalent method) at locations within the dredging template for maintenance dredging
- Vibracoring (or equivalent method) at locations within the dredging template for the new work dredging
- Surface water collection at one location in the TB
- Sediment grab sampling at the approved Massachusetts Bay reference site
- Conducting analytical testing of sediments, surface water, standard elutriate, and tissue samples

- Conducting ecotoxicological testing using water column bioassays, whole sediment bioassays, and bioaccumulation testing
- Short-term fate of dredged material (STFATE) modeling using the results of standard elutriate and water column bioassays
- Evaluating test results with respect to ocean placement at the MBDS

Specific objectives of the maintenance and new work dredging sampling program are as follows:

- Collect the required volume of sediment and water for physical and chemical analysis, standard elutriate preparation, and ecotoxicological testing from specified locations.
- Collect and transfer sediment to appropriate, laboratory-prepared containers and preserve/hold samples for analysis according to protocols that ensure sample integrity.
- Test and characterize sediments regarding physical, chemical, and ecotoxicological characteristics and the potential for release of chemicals during dredging.
- Test surface water and standard elutriates regarding chemical characteristics, the potential for release of chemicals during dredging, and compliance with state water quality standards.
- Use sediments and water to perform ecotoxicological and bioaccumulation testing.
- Use the results to conduct STFATE modeling of the behavior of dredged material at the MBDS.
- Produce a MPRSA Section 103 report to evaluate ocean placement of dredged material at the MBDS.

1.2 Previous Sampling and Testing

Maintenance dredging in the TB was last conducted in 2002, for U.S. Generating New England, Inc., and approximately 42,200 cubic yards (cy) were transported offshore and placed in the MBDS (Vine 2002; Environmental Laboratory 2022). Dredged material testing for ocean placement in accordance with MPRSA Section 103 (40 Code of Federal Regulations [CFR] 227.13) was conducted. Testing included sediment, standard and effluent elutriates, ecotoxicological, bioaccumulation, and tissue testing to evaluate the suitability of the dredged material for placement at the MBDS. All maintenance dredged material met the limiting permissible concentration (LPC) for ocean placement.

A summary of previous dredging events in the vicinity of the proposed project is included in Table 1-1.

Table 1-1
Salem Harbor Turning Basin and Approach Channel Previous Dredging Events

License Number	Date	Dredged Material Volume (cy)	Description
392	1924	—	Dredge material within berthing area and approach channel to a maximum depth of -26 feet
1100	1927	3,000	Dredge at the head of the Salem Terminal Corporation Dock
1069	1929	—	Dredge a 25-foot deep channel to connect the berthing area with the channel to be dredged by the federal government, deepen berth area to -30 feet, and a TB was approved for dredging to a depth between elevation -20 and -30 feet
2694	1935	5,000	Dredge material from the dock at the head of the wharf
3747	1940	20,000	Redredge from the berthing area and approach channel
3098	1948	—	Dredge the area in front of the Salem Harbor Generating Station intake screens to an elevation of -16 feet
4976	1951	130,000	Dredge material from the approach channel to an elevation of -25 feet and the berthing area to an elevation of -30 feet
3624	1954	—	Redredge in front of the intake structure to an elevation of -16 feet
5299	1956	—	Redredge in front of the intake structure to an elevation of -16 feet
5419	1958	—	Redredge the approach channel to an elevation of -25 feet and the berthing area to an elevation of -30 feet
5589	1969	—	Redredge in front of the intake structure to an elevation of -20 feet
MA Div. Waterways – Permit No. 5906/ USACE Permit No. MA-SALE-73-50	1973	—	Maintenance dredging of the TB, approach channel, and berthing area to an elevation of -32 feet
9383	2002	42,199 (Environmental Laboratory 2022)	Maintenance dredging of the TB, approach channel, and berthing area to an elevation of -32 feet
—	2006–2007	339,039	Federal navigation project (Environmental Laboratory 2022)

Notes:
Unless otherwise noted, dredging information is from the *Notice of Intent* (Vine 2002).
All elevations are referenced to MLLW.
— : information not available

A 23-acre portion of the upland property located adjacent to the berth area currently houses the Footprint Power Salem Harbor Power Station (SHPS). The SHPS includes a 674-megawatt natural gas-fired, quick-start, combined-cycle electric power generating plant and associated infrastructure. Prior to construction of the SHPS, the upland property had been occupied since 1951 by a 750 megawatt coal and petroleum-fired electric power generating plant. The upland property included aboveground storage and conveyance of coal and petroleum, and ash settling basins. Comprehensive environmental studies were performed as part of the Massachusetts Contingency Plan. The upland portion of the site was assigned release tracking number RTN-31327 (Tetra Tech 2017). Historical oil and/or hazardous material (OHM) releases, primarily associated with the storage of petroleum, were reported in approximately 30 previous release tracking numbers. Previous assessment activities indicated that the primary OHM at the site included combustion residuals (primarily nickel and vanadium) associated with the former ash settling basins, metals (primarily lead) associated with urban fill and petroleum impacts (primarily weathered No. 2 fuel oil/diesel fuel). In general, this OHM exhibited low or no volatility and very limited partitioning into groundwater. Numerous short- and long-term response actions have been implemented at the site to address OHM releases. The Massachusetts Contingency Plan, *Permanent Solution Statement with Conditions* (Tetra Tech 2017), for the site concluded that all unpermitted releases of OHM to the environment and all sources of OHM were eliminated to the extent feasible and are controlled.

OHM migration to the harbor is limited by the nature of the OHM, the presence of relatively low permeability subsurface materials that include silt, clay, shallow bedrock, and the use of dredged material as fill. The combination of past aboveground management of OHM (i.e., limited releases to the subsurface and potential for migration to the harbor), multiple response actions that have addressed and remediated OHM, subsurface conditions that are not conducive to OHM migration, and the results of previous sediment testing for past projects in the site vicinity indicate sediment quality has not been significantly impacted by OHM at the upland property.

1.3 Technical Approach

To demonstrate compliance with the LPC, specific testing methods are described in the *Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters* (RIM; USEPA and USACE 2004), the *Evaluation of Dredged Material Proposed for Ocean Disposal: Testing Manual* (OTM; USEPA and USACE 1991), and the *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (Inland Testing Manual)* (ITM; USEPA and USACE 1998). The sampling and physical/chemical, ecotoxicological, and bioaccumulation testing proposed in this SAP/QAPP will be conducted following this guidance to determine the suitability of the sediment for ocean placement.

Because the general testing program for ocean placement at the MBDS is the same for the maintenance and new work dredging, the overall sampling and testing program in this SAP/QAPP, including sampling methods and analytical and ecotoxicological testing data quality objectives (DQOs), applies to both programs. Where appropriate, details specific to each sampling project are described in the following individual sections. Field sampling and analytical testing for the maintenance and new work dredging projects will be conducted during a single field sampling event, tentatively scheduled for fall 2022. For each sampling program, distinct sediment samples representative of the material to be dredged will be collected.

To facilitate dredged material testing to support multiple placement alternatives, the project area was divided into four dredging units (DUs); two in the TB (maintenance dredging), one in the proposed northern TB expansion area (new work dredging), and one in the proposed southern TB expansion area (new work dredging) (Figure 1-2). The target depth of dredging for each DU is as follows:

- DU1, TB maintenance: -32 feet MLLW plus a 2-foot overdepth allowance, for a total project depth of -34 feet MLLW
- DU2, berth maintenance: majority to -34 feet MLLW plus a 2-foot overdepth allowance, for a total project depth of -36 feet MLLW; 0.3-acre (12,728 square foot) area to -36 feet MLLW plus a 2-foot overdepth allowance, for a total depth of -38 feet MLLW
- DU3, proposed north TB expansion: -32 feet MLLW plus a 2-foot overdepth allowance, for a total project depth of -34 feet MLLW
- DU4, proposed south TB expansion: -32 feet MLLW plus a 2-foot overdepth allowance, for a total project depth of -34 feet MLLW

Sampling for this project will include the following:

- Collecting sediment from 12 locations in the project footprint for physical, chemical, and ecotoxicological characterization for ocean placement testing as follows:
  - Sediment from three locations in DU1 (TB) and three locations in DU2 (the berth). Material from the three locations in each DU will be composited to create a total of one composite sample from each DU for analytical and ecotoxicological testing.
  - Sediment cores from three locations in DU3 (the proposed north TB expansion). Material from these three locations will be composited to create a total of one composite sample for analytical and ecotoxicological testing.
  - Sediment from three locations in DU4 (the proposed south TB expansion). Material from these three locations will be composited to create a total of one composite sample for analytical and ecotoxicological testing.
  - Submittal of four composite sediment samples (one sample from each DU) for physical and chemical characterization and ecotoxicological testing for ocean placement (Table 1-2).
- Collecting surface water from one location within the project area for chemical characterization, standard elutriate preparation, and ecotoxicological testing
- Collecting surficial sediment grabs from the Massachusetts Bay offshore reference site for physical and chemical characterization

At each location sediment will be collected to obtain minimally disturbed samples to support environmental testing to the target dredging depth. To obtain the sediment volumes required for testing, collection of multiple sediment grabs or cores may be required from each location.

Table 1-2
Salem Harbor Dredged Material Evaluation Sampling Scheme

Area	Dredging Unit	Dredged Material Volume (cy)	Sampling Locations	Composite Sample ID	Testing Program
Maintenance Dredging					
Turning Basin	DU1	26,820	SWPM-01 SWPM-02 SWPM-03	SWPM-TB	Sediment chemistry, standard elutriate, water column bioassay, whole sediment bioassay, bioaccumulation
Berth	DU2	53,370	SWPM-04 SWPM-05 SWPM-06	SWPM-BE	Sediment chemistry, standard elutriate, water column bioassay, whole sediment bioassay, bioaccumulation
New Work Dredging					
North Turning Basin expansion	DU3	39,230	SWPNW-07 SWPNW-08 SWPNW-09	SWPNW-NTB	Sediment chemistry, standard elutriate, water column bioassay, whole sediment bioassay, bioaccumulation
South Turning Basin expansion	DU4	68,140	SWPNW-10 SWPNW-11 SWPNW-12	SWPNW-STB	Sediment chemistry, standard elutriate, water column bioassay, whole sediment bioassay, bioaccumulation
Surface Water and Reference Site					
Surface water	—	—	—	SH-WAT	Water chemistry, standard elutriate, water column bioassay
Massachusetts Bay reference site	—	—	—	MB-REF	Sediment chemistry, whole sediment bioassay, bioaccumulation

Notes:
Dredged material volume includes a 2-foot overdepth volume.
— : Not applicable

1.4 Sampling and Analysis

The field investigation will consist of obtaining sediment samples using a Ponar sediment grab sampler, vibracore, or equivalent sampling equipment from within the dredging template. For the maintenance project, grab sampling will be used for locations where the shoaled dredged material (not including overdepth allowance) is 3 feet or less, and vibracores will be collected at locations where the thickness of shoaled dredged material is greater than 3 feet. All samples for the new work project areas (DUs 3 and 4) will be collected using a vibracore (or equivalent).

Samples will be submitted to analytical laboratories for physical and chemical analysis (Table 1-3). Samples will also be submitted to the ecotoxicological laboratory for biological testing. Details of the sampling program are provided in Section 3. The testing program will include the following components:

- Physical characterization of sediment, including grain size, specific gravity, bulk density, Atterberg limits, total organic carbon (TOC), bulk density, and total solids
- Chemical analysis of sediment to support the ocean placement evaluation, including metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) congeners, chlorinated pesticides, pentachlorophenol, and ammonia
- Chemical analysis of sediment for alternative disposal options, including extractable petroleum hydrocarbons, volatile organic compounds (VOCs), toxicity characteristic leaching procedure, ignitability, corrosivity (pH), sulfide, cyanide, and conductivity
- Chemical analysis of surface water and standard elutriates including metals, PAHs, PCB congeners, chlorinated pesticides, pentachlorophenol, and ammonia
- Water column bioassays with mysid shrimp (*Americamysis bahia*), fish (inland silverside; *Menidia beryllina*), and larval sea urchin (Atlantic purple sea urchin*; Arbacia punctulata*)
- Ten-day whole sediment bioassays with amphipods (*Leptocheirus plumulosus*) and mysid shrimp (*Americamysis bahia*)
- Twenty-eight-day bioaccumulation testing with clams (bent-nose clam; *Macoma nasuta*) and worms (*Nereis virens*)
- Tissue testing to evaluate the potential for bioaccumulation of chemical constituents to levels of concern

Table 1-3
Analytical and Ecotoxicological Testing Program

Analysis Parameter	Method	Reference
Physical Analysis (Sediment)		
Grain Size (Sieve and Hydrometer)	ASTM D422	ASTM 2021
Specific Gravity	ASTM D854	USEPA 2014
Atterberg Limits	ASTM D4318	ASTM 2010b
Unified Soil Classification	ASTM D2487	ASTM 2010b
Bulk Density	ASTM D7263	ASTM 2021
Total Solids	SM 2540G	USEPA 2014
Chemical Analysis (Sediment, Elutriates, and Surface Water)		
Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, and Zinc)	SW846 6020	USEPA 2014
Mercury	SW846 7471A	USEPA 2014
PAHs	SW846 8270D	USEPA 2014
PCBs (list of 22 congeners)	SW846 8082	USEPA 2014
Chlorinated Pesticides	SW846 8081B	USEPA 2014

Analysis Parameter	Method	Reference
Ammonia	SM4500	APHA 2017
Pentacholorphenol	SW846 8270E	USEPA 2014
TOC	USEPA 9060A	USEPA 2004
Chemical Analysis (Sediment Only)		
Extractable Petroleum Hydrocarbons	MassDEP	MassDEP 2019
Volatile Organic Compounds (PPL list)	SW846 8260D	USEPA 2014
Toxicity Characteristic Leaching Procedure	USEPA 1311	USEPA 2014
Ignitability	SW846 1030	USEPA 2014
Corrosivity (pH)	SW846 9045D	USEPA 2014
Sulfide	USEPA Ch7	USEPA 2014
Cyanide	USEPA Ch7	USEPA 2014
Conductivity	SW846 9050A	USEPA 2014
Bioassay and Bioaccumulation Tests		
Water Column Bioassay Toxicity tests will use three species: • *Americamysis bahia* (mysid shrimp) • *Menidia beryllina* (fish – inland silverside) • *Arbacia punctulata* (Atlantic purple sea urchin) Water column bioassays will be conducted for 96 hours using the shrimp and fish. The water column bioassays conducted with the urchin will be 48-hour bioassays *Whole Sediment Bioassay* Toxicity tests will use two species: the estuarine amphipod, *Leptocheirus plumulosus,* and the mysid shrimp *Americamysis bahia*. *Whole Sediment Bioaccumulation* The 28-day exposure bioaccumulation testing will use two test organisms: *Nereis virens* (worm) and *Macoma nasuta* (bent-nose clam).		
Chemical Analysis (Tissues)		
Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, and Zinc)	SW846 6020	USEPA 2014
Mercury	SW846 7471A	USEPA 2014
Lipids	Laboratory SOP	Laboratory SOP
Percent Moisture	SW846 2540G	APHA 2017
PAHs (if required*)	SW846 8270D	USEPA 2014
PCBs (if required*)	SW846 8270D	USEPA 2014
Chlorinated Pesticides (if required*)	SW846 8081B	USEPA 2014

Notes:
Chemical analysis of tissues will be determined in coordination with USACE New England District, based on the results of the sediment and standard elutriate testing. At a minimum, metals (including mercury) lipids, and percent moisture will be analyzed for all tissue samples in the program, including the reference site, control, and pre-exposure tissue samples.
QA/QC samples, including site-specific MS/MSDs, should also be analyzed.

1.5 Limiting Permissible Concentration for Ocean Placement

For ocean placement of the dredged material from the project area to be a feasible option, the material must meet the LPC, as defined in 40 CFR 227.27. Compliance with MPRSA Section 103 requires meeting the LPC in the following four components:

- Water quality criteria (WQC)
- Water column toxicity
- Benthic toxicity
- Benthic bioaccumulation

If LPC compliance is not met in one or more of these components, then the ocean placement requirements will not be met.

1.5.1 Water Quality Criteria

To evaluate LPC compliance for WQC, standard elutriates are prepared using the sediment and surface water collected from the project area. A standard elutriate is a sediment/water mixture that is thoroughly mixed for 30 minutes and allowed to settle. The supernatant then is siphoned off and analyzed for dissolved chemical constituents. Standard elutriates are used to simulate the potential release of dissolved chemical constituents during ocean placement of dredged material.

To determine whether the sediments from the project meet the acute WQC LPC requirement, STFATE modeling will be conducted using the specifications of the placement site (e.g., dimensions and water column properties) and the physical and chemical characteristics of the maintenance material.

The LPC for the WQC is the concentration that: 1) does not exceed the WQC outside the site boundary of the placement site during the first 4 hours; and 2) does not exceed the WQC anywhere in the marine environment after 4 hours.

1.5.2 Water Column Toxicity

Water column bioassays are conducted to evaluate the water column toxicity LPC. The water column bioassay tests include 96-hour water column bioassays with mysid shrimp (*Americamysis bahia*) and fish (inland silverside, *Menidia beryllina*) and 48-hour water column bioassays with Atlantic purple sea urchin (*Arbacia punctulata*). A median lethal concentration (LC_{50}) or median effective concentration (EC_{50}) is calculated for each test.

The LPC for the water column toxicity is the concentration that does not exceed 0.01 of the LC_{50} or EC_{50} values (of the most sensitive test species) within a 4-hour mixing period, inside the boundary of the placement site and at all times outside of the boundary of the placement site.

1.5.3 Benthic Toxicity

Whole sediment bioassays are conducted to evaluate the benthic toxicity LPC. Ten-day whole sediment bioassays are conducted using amphipods (*Leptocheirus plumulosus*) and mysid shrimp (*Americamysis bahia*). Dredged material does not meet the benthic toxicity LPC when mean test organism mortality meets the following parameters:

- Statistically greater than in the reference sediment
- Exceeds mortality (or other appropriate end point) in the reference sediment by at least 10% (or 20% for amphipods)

1.5.4 Benthic Bioaccumulation

Whole sediment bioaccumulation studies are conducted to evaluate the potential for uptake of constituents from the sediment into organism tissue. Worms (*Nereis virens*) and bent-nose clams (*Macoma nasuta*) will be exposed to sediment from the IWA for 28 days. When tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceed those of organisms exposed to the reference material, the dredged material has the potential to result in benthic bioaccumulation of contaminants.

Dredged material does not meet the benthic bioaccumulation LPC if the tissue concentrations are statistically greater than U.S. Food and Drug Administration (USFDA) action/guidance/tolerance levels (USFDA 2000). If the tissue concentrations statistically exceed those of organisms exposed to the reference site, the bioaccumulation is evaluated to determine if placement of dredged material is likely to cause unacceptable bioaccumulation.

1.6 Project Schedule

It is anticipated that the sampling will be performed in fall 2022 and will take approximately 2 to 3 weeks. The tentative project schedule is presented in Table 1-4 and is based on receiving the notice to proceed in August 2022. If the notice to proceed differs from the tentative schedule, the project schedule will be revised prior to the initiation of sampling. Other factors may also impact the project schedule, such as weather conditions, subcontractor availability, and laboratory turnaround times.

Table 1-4
Tentative Schedule for Sampling, Testing, and Reporting

Task	Timeline	Tentative Schedule
SAP/QAPP		
Concurrent submittal to USACE New England District and USEPA Region 1	Notice to proceed + 4 weeks	August 2022
Preliminary USACE New England District and USEPA Region 1 review period	2 weeks	End August 2022

Task	Timeline	Tentative Schedule
Receive comments from USACE New England District and USEPA Region 1	Submit draft + 4 week	Early September 2022
Submit Final SAP/QAPP to USACE New England District and USEPA Region 1	Receive comments + 1 week	End September 2022
Final SAP/QAPP with approval by USACE New England District and USEPA Region 1	Submit final + 1 week	End September 2022
Field Investigation		
Mobilization	SAP Approval + 2 weeks	October 2022
Sediment coring	2 weeks	Mid-October 2022
Submit samples to analytical and ecotoxicological laboratories	Complete sampling + 2 days	Mid-October 2022
Laboratory Analysis		
Sediment and standard elutriate analysis	6 weeks	End November 2022
Tissue analysis—Coordination with USACE New England District and USEPA Region 1	Receive data + 2 weeks	December 2022
Tissue analysis results	USEPA meeting + 8 weeks	End January 2023
Ecotoxicological Analysis		
Water column bioassays	Submit samples + 6 weeks	End November 2022
Whole sediment bioassays	Submit samples + 6 weeks	End November 2022
Bioaccumulation exposure	Submit samples + 8 weeks	Mid December 2022
Report		
Draft Report—Concurrent submittal to USACE New England District and USEPA Region 1	Tissue results + 4 weeks	End February 2023
Conference call with USACE and USEPA to review comments	Submit report + 2 weeks	Mid-March 2023
USACE New England District and USEPA Region 1 review period	Submit report + 4 weeks	End March 2023
Receive comments from USACE New England District and USEPA Region 1	Submit report + 4 weeks	End March 2023
Submit Final Report to USACE New England District and USEPA Region 1	Receive comments + 4 weeks	End April 2023

2 Project Organization and Responsibilities

The project team is organized to provide professional expertise for each of the components necessary for the completion of the project. Contact information and responsibilities of key technical staff are provided in Table 2-1. Additional personnel may assist with various project tasks on an as needed basis.

2.1 Project Planning and Coordination

The Project Manager, Ms. Karin Olsen of Anchor QEA, will be responsible for overall project coordination to ensure timely, successful completion of the project. Her responsibilities will include oversight of all project deliverables, coordination with the USACE New England District and USEPA Region 1, coordination with subcontractors to assure timely and successful completion of the project, and implementation of all quality control (QC) and health and safety standards required by the project. Ms. Olsen will be responsible for administrative coordination to ensure the timely and successful completion of the sampling, analyses, and reporting.

Ms. Billie-Jo Gauley will serve as the Field Team Leader for Anchor QEA and will be responsible for the overall direction of the field sampling logistics, field personnel assignments, and field operations. She will be responsible for summarizing field sampling activities that will include details of the sampling effort, sample preparation, sample storage and transport procedures, field quality assurance (QA), and documenting any deviation from the final SAP/QAPP and working with the Anchor QEA's Analytical Chemistry Team to ensure that appropriate protocols for sample preservation and holding times are observed.

In addition to the Field Team Leader, the field sampling team will consist of two to three environmental field scientists or engineers. The field sampling team will be responsible for implementing this SAP/QAPP, which includes conducting the following field-related activities:

- Communication with subcontractors
- Overseeing mobilization/demobilization
- Providing assistance with collection of sediment samples, as needed
- Ensuring accurate positioning and recording of sample locations, depths, and identification
- Processing sediment samples, including compositing and homogenization (as needed)
- Providing assistance with collection of surface water samples
- Documentation of work activities and site conditions in the field log
- Decontamination of equipment
- Labeling and packing of samples for delivery to laboratories

On-site personnel will review the applicable work plans, including this SAP/QAPP, before participation in on-site activities.

Ms. Cindy Fields will serve as Anchor QEA's QA Manager. She will provide QA oversight for the field sampling and laboratory programs, coordinate with the analytical laboratories, ensure data quality, oversee data validation, and supervise project QA coordination. QA responsibilities include ensuring all laboratory analyses meet the project DQOs and other specifications required by the RIM (USEPA and USACE 2004) and OTM (USEPA and USACE 1991).

Mr. Timothy Shaner will serve as Anchor QEA's Health and Safety Manager. He will be responsible for review of the Health and Safety Plan for the field activities.

2.2 Additional Team Members

Field activities will be performed with the support of a qualified and experienced sediment coring subcontractor, yet to be selected. Sampling will be coordinated with Port personnel to ensure sampling activities do not interfere with Port operations or traffic. During coring, the sampling vessel will be staffed with a captain and field technicians who will be responsible for operating the vibracore, Ponar sediment grab sampler, or equivalent equipment.

Alpha Analytical will provide the analytical chemistry services required for this investigation, including analysis of sediment, surface water, standard elutriates, and biological tissue for organic and inorganic compounds. Alpha Analytical routinely meets the target detection limit (TDL) requirements and DQOs of the RIM (USEPA and USACE 2004) and OTM (USEPA and USACE 1991). Ms. Elizabeth Porta will serve as the Alpha Analytical Laboratory Project Manager. She will be responsible for tracking project samples throughout the analytical testing process, and she will provide Anchor QEA with progress reports on the analyses.

Sediment physical property testing will be conducted by GeoTesting Express (GTX) of Boxborough, Massachusetts. GTX is fully accredited by several agencies, including the American Association for Laboratory Accreditation and the American Association of State Highway and Transportation Officials (AASHTO)/AASHTO Materials Reference Laboratory. They are also validated by USACE.

The laboratories are expected to meet the following minimum technical requirements:

- Adhere to the methods outlined in this SAP/QAPP.
- Deliver electronic data files as specified.
- Meet all reporting requirements.
- Implement QA/QC procedures outlined in this SAP/QAPP and required by OTM (USEPA and USACE 1991) and RIM (USEPA and USACE 2004) guidelines.
- Allow Anchor QEA to perform laboratory and data audits, if necessary.
- Follow documentation, chain-of-custody (COC), and sample logbook procedures.
- Meet turnaround times for deliverables.

Ecotoxicological testing will be performed by Aquatec Environmental (Aquatec) in Williston, Vermont. Aquatec is accredited under the National Environmental Laboratory Accreditation Program (NELAP) and provides a full range of environmental toxicological services specifically designed to address issues related to permitting and monitoring of dredging and placement projects. Aquatec has conducted Tier III sediment evaluations for private sector projects and federal navigation maintenance projects at locations throughout New England. Aquatec has an approved laboratory QA Plan on file with the USACE New England District covering all biological services necessary for conducting ecotoxicological testing.

2.3 Staff Requirements

Personnel will be properly trained in collecting, handling, and processing sediment and water samples. Employees are required to familiarize themselves with the contents of the Health and Safety Plan prior to starting work and review content during daily safety meetings. Because of the nature of the work, on-site employees will be required to have proficient swimming ability. Employees, subcontractors, and visitors will be required to wear a U.S. Coast Guard-approved personal floatation device.

It is strongly recommended that field personnel have 40 hours of Initial Offsite Hazardous Waste Operations and Emergency Response training and 3 days of on-site training under the direct supervision of a more experienced site worker. At least one on-site worker will be currently certified in first aid and cardiopulmonary resuscitation (CPR) by the American Red Cross or equivalent organization. First aid training and CPR training will be current.

Table 2-1
Project Team Contacts

Technical Expert	Company and Project Role	Address	Phone	Email	Responsibilities
Karin Olsen, PG	Anchor QEA Project Manager	10320 Little Patuxent Parkway, Suite 1140 Columbia, MD 21044	Office: (410) 794-7779 Cell: (443) 465-9783	kolsen@anchorqea.com	Project management, regulatory coordination, QA/QC, and reporting
Billie-Jo Gauley	Anchor QEA Field Team Leader	9 Water Street, First Floor Amesbury, MA 01913	Office: (228) 215-7164 Cell: (601) 941-6832	bgauley@anchorqea.com	Field logistics planning, sample collection and transport, chains of custody, QA management, and reporting
Ben Maher	CR Environmental Field Lead	639 Boxberry Hill Road East Falmouth, MA 02536	(508) 563-7970	ben@crenvironmental.com	Vessel support for field activities and sediment coring
Elizabeth Porta	Alpha Analytical Laboratory Project Manager	320 Forbes Boulevard Mansfield, MA 02048	(508) 822-9300	eporta@alphalab.com	Analytical testing of sediment, surface water, elutriate and tissue samples, and laboratory QA/QC
John Williams	Aquatec Environmental Project Manager	273 Commerce Street Williston, VT 05495	(802) 860-2960	jwilliams@aquatecenv.com	Ecotoxicological testing and laboratory QA/QC
Jon Campbell	GeoTesting Express (GTX) Project Manager	125 Nagog Park Acton, MA 01720	(978) 635-0424	jcampbell@geotesting.com	Geotechnical testing and laboratory QA/QC

3 Field Sampling

The methods and procedures for the collection of field samples, sampling schedule, rationale for the sampling design, and design assumptions for locating and selecting environmental samples are detailed in the following sections. Sampling procedures will be consistent with USEPA protocols or other approved sample collection standards.

The sampling and testing approach was derived from the following guidance documents:

- USEPA and USACE, 2004—*Regional Implementation Manual for Evaluation of Dredged Material Proposed for Disposal in New England Waters*
- USEPA and USACE, 1991 (EPA-503/8-91-001)—*Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.—Ocean Testing Manual* (commonly called "The Green Book")
- USEPA and USACE, 1998 (EPA-823-B-98-004)—*Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.—Inland Testing Manual*
- USEPA and USACE, 1995 (EPA-823-B-95-001)—*QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations, Chemical Evaluations*
- USEPA, 2001 (EPA-823-B-01-002)—*Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*

Sampling locations for the dredged material testing program were determined based on the sampling approach recommended in the RIM (USEPA and USACE 2004) and the estimated dredged material quantity of approximately 80,200 cy of maintenance material (DU1 and DU2) and an additional 107,400 cy of new work material (DU3 and DU4).

The field investigation will consist of collecting sediment grabs or cores (depending on total project depth) from a total of six locations in the maintenance dredging area and six locations within the new work dredging area, collecting surface water samples from one location in the TB and surficial sediment grab samples from the approved Massachusetts Bay reference site (Figure 2-1). Workdays will be approximately 10 hours in duration (dock-to-dock), including approximately 8 hours of sampling each day. The sequence of sample collection in any given area will be dependent upon local site and weather conditions. The day-to-day sequence of sampling will be determined at the discretion of the Field Team Leader. Upon completion of field activities, sediment cores will be composited to create samples, and the samples will be submitted to Alpha Analytical for sediment, water, and standard elutriate testing; to GTX for physical property testing; and to Aquatec Environmental for ecotoxicological testing.

3.1 Navigation and Vertical Control

On-vessel navigation and positioning will be accomplished using a differential global positioning system (DGPS). The DGPS uses the U.S. Coast Guard differential beacon system to obtain submeter accuracy. The navigation system will be used to guide the vessel to predetermined sample locations with an accuracy of plus or minus 10 feet. Horizontal positions for each location will be documented in the final report in Massachusetts State Plane, Mainland Zone coordinates (NAD83) to the nearest foot.

At each sample location, the depth to mudline will be measured using an onboard, calibrated fathometer or lead line and will be corrected to MLLW using the predicted tides from the closest National Oceanic and Atmospheric Administration (NOAA) tide gauge. The mudline elevation relative to the MLLW datum will be determined by adding the tidal elevation to the measured depth. All vertical elevations will be reported to the nearest 0.1 foot relative to MLLW. The most recent bathymetric surveys will be used as a reference in the field to confirm depths. Target coordinates (northings and eastings Massachusetts State Plane, Mainland Zone, North American Datum 1983 [NAD83]) are provided in Table 3-1.

3.2 Sample Volume Requirements

For each sediment sample submitted for analytical, physical property, and ecotoxicological testing, a total of 3 gallons of sediment will be required for sediment analysis, approximately 2 gallons of sediment will be required for the standard elutriate preparation, and approximately 20 gallons of sediment will be required for ecotoxicological testing. Therefore, a minimum of 25 gallons of sediment will be required for each composite sample. Additional sediment volume will be required from one location for analysis of a field duplicate sample, and additional volume will be collected from one location for matrix spike (MS) and matrix spike duplicate (MSD) analyses.

Discrete sediment samples from each individual location will be collected and held as archive samples. Sufficient volume will be archived to run analytical chemistry analysis only.

For each water sample, approximately 2 gallons of surface water will be required for chemical analysis, approximately 3 gallons of surface water will be required for standard elutriate preparation, and approximately 15 gallons of surface water will be required for ecotoxicological testing. Additional volume will also be collected for MS/MSD analysis.

3.3 Sampling Locations

Six locations will be sampled within the maintenance area, and six locations will be sampled within the new work area. Locations were selected to physically and chemically characterize the material that will be dredged. The number of samples was selected so that each sample will be representative of no more than 50,000 cy of material.

In each DU, three individual locations will be sampled and homogenized together to create one composite sediment sample that will be submitted for physical and chemical characterization and ecotoxicological testing for ocean placement.

The surface water sample will be collected from one location in the middle of the existing TB. Water collected at this location will be submitted for chemical analysis and will be used for standard elutriate preparation for analytical and ecotoxicological testing.

The reference site sediment sample will be collected from the approved Massachusetts Bay reference site (USEPA and USACE 2004) (Figure 2-1). The reference site sample will be submitted for physical and chemical analysis and will be used for ecotoxicological testing.

Table 3-1
Salem Harbor Target Sampling Locations

Area	Dredging Unit	Sampling Locations	Coordinates[a] Easting	Coordinates[a] Northing	Water Depth (feet MLLW)	Total Project Depth[b] (feet MLLW)	Collection Method	Target Core Length (feet)	Target Number of Cores	Sample ID
Maintenance Dredging										
Harbor TB	DU1	SWPM-01	824604.65	3015502.18	31	34	Grab	—	—	SWPM-TB
		SWPM-02	824222.54	3015821.87	31	34	Grab	—	—	
		SWPM-03	824912.86	3015759.72	31	34	Grab	—	—	
Harbor berth area	DU2	SWPM-04	823852.39	3015838.78	33	36	Grab	—	—	SWPM-BE
		SWPM-05	824149.07	3016198.27	32	36	Grab	—	—	
		SWPM-06	824406.37	3015972.84	33	36	Grab	—	—	
New Work Dredging										
North TB expansion	DU3	SWPNW-07	824849.76	3015887.64	20	34	Core	14	3	SWPNW-NTB
		SWPNW-08	825070.13	3015843.58	21	34	Core	13	3	
		SWPNW-09	825287.75	3015802.28	24	34	Core	10	3	
South TB expansion	DU4	SWPNW-10	823851.26	3015439.61	27	34	Core	7	4	SWPNW-STB
		SWPNW-11	824221.51	3015427.49	29	34	Core	5	4	
		SWPNW-12	824642.96	3015416.47	25	34	Core	9	4	
Surface Water and Reference Site										
Surface water	—	SWP-WAT	824382.48	3015656.05	35	—	Peristaltic	—	—	SWP-WAT
Massachusetts Bay reference site	—	SWP-REF	92504.79	2964462.34	—	Surface	Grab	—	—	MB-REF

Notes:

a. Massachusetts State Plane, Mainland Zone, NAD83, U.S. Survey Feet
b. Total project depth includes 2 feet of allowable overdepth.

Extra volume will be collected from one location for QC samples.
— : not applicable

3.4 Sample Collection

The sequence of sample collection in any given area will be dependent upon local vessel traffic and weather conditions. The day-to-day sequence of sampling will be determined at the discretion of the Field Team Leader. Upon completion of field activities, samples will be submitted to Alpha Analytical, GTX, and Aquatec for bulk sediment analysis, surface water analysis, and standard elutriate analysis (Table 3-2).

3.4.1 Sediment Cores

Field sampling consists of collecting sediment cores at each location to the total project depth (Table 3-1) or to refusal, whichever is encountered first. It is anticipated that for samples where cores will be required, refusal may be encountered because of the expected presence in the subsurface of a native clay layer. At these locations, dredged material samples will be submitted for analysis that are representative of the material to the depth of refusal and not to full target depth of dredging. It is anticipated that if and where refusal in native sediment is encountered, the results from the collected sediment will be sufficient to represent the full dredge depth.

Sediment cores will be collected using a vibracoring unit (or equivalent) supplied by the selected subcontractor. Vibracoring will be conducted by placing a clean core liner into a stainless-steel barrel. The barrel will be lowered to the sediment surface and vibrated to the required depth. After the core has penetrated to a sufficient depth, the core barrel will be retrieved and brought onto the barge deck. The core liner will be removed from the steel barrel, capped at both ends, sealed, and labeled.

After the core is on deck, the liner containing the sediment will be extracted and examined to determine compliance with the following acceptance criteria:

- Cored material shall not extend out the top of the core tube or contact any part of the sampling apparatus at the top of the core tube.
- No obstructions shall be present in the cored material that might have blocked the subsequent entry of sediment into the core tube and resulted in incomplete core collection.

Time and date of collection, coordinates, water depth, penetration, and recovery will be recorded. If core acceptance criteria are not achieved, the core will be rejected, the old liner will be replaced, and the procedure will be repeated until acceptance criteria are met. If three repeated deployments within a 50-foot radius of the proposed location do not yield a core that meets the appropriate acceptance criteria, the Anchor QEA Project Manager and Field Team Leader may select an alternate location within the general vicinity of the original sampling point.

If core refusal or limited recovery is encountered during coring operations, a limited number of additional attempts will be made to obtain sufficient sample volume. Three additional attempts will be conducted at the same location. After three attempts, the corer will be repositioned approximately 3 to 5 feet (in an area equally representative of material to be dredged), and penetration will be attempted again. If a sampling point needs to be relocated because the location is inaccessible or because cores cannot be collected from the site, the point will be relocated within the same general vicinity of the original sampling point, and the relocated sampling point will be recorded with a DGPS. The relocated point will coincide with depths and locations of the dredging prism.

After each of the three locations within each DU have been sampled, the composite sample will be created using approximately equal aliquots of sediment from each individual location. The aliquots will be combined and thoroughly homogenized. The composited sediment will then be placed immediately into appropriate prelabeled sample containers and stored on ice until delivered to the laboratory. Sediment from the composite sample will also be used for the standard elutriate test and for the ecotoxicological test.

Cores collected during each workday will be stored upright in secured containers on board the barge or sampling platform. Water will be decanted from the top of the core and the core will be laid down lengthwise, and the core liner will be split lengthwise using a wire or spatula to divide the core in half. Each core will be photographed and geologically logged, and the physical characteristics of each layer or strata within each core will be noted in the field logbook.

3.4.2 Sediment Core Processing

After completion of coring activities, the sediment cores will be logged, composited, and homogenized for testing. The whole-core composite will be submitted for both bulk sediment analysis and standard elutriate testing. Sediment for bulk sediment, elutriate preparation, and ecotoxicological testing will be stored in certified, cleaned, laboratory-prepared containers and placed on ice.

Cores will be cut for logging and sampling by removing the core caps and cutting the core tube longitudinally with a circular saw or tin shears. The core will be split into two halves with decontaminated wire or stainless-steel spatulas. If the core was divided into sections for easier transport, this step will be repeated for each section until the entire core is extracted. The entire length of each core will be logged, even if deeper than the target sample depth. Prior to sampling, color photographs will be taken, photoionization detector readings will be collected, and a sediment description of each core will be recorded on the core log. The following parameters will be noted:

- Water depth to mudline surface
- Tidal elevation at time of core collection
- Location of each sample collected, as determined by DGPS
- Date and time of collection of each sample

- Names of field supervisor and person(s) collecting and logging the sample
- Observations made during sample collection, including weather conditions, tidal state, complications, ship traffic, and other details associated with the sampling effort
- Physical soil description in accordance with ASTM International (ASTM) procedures (ASTM D 2488 and ASTM D 2487 – Unified Soil Classification System), including soil type, density, and consistency of soil, and color
- Odor (e.g., hydrogen sulfide or petroleum)
- Visual stratification, structure, and texture
- Vegetation and debris (e.g., wood chips or fibers, paint chips, concrete, or metal debris)
- Biological activity (e.g., detritus, shells, tubes, bioturbation, and live or dead organisms)
- Potential presence of oil or hazardous material (e.g., oil sheen, odor, staining, or discoloration)
- Any other distinguishing characteristics or features

Prior to compositing, discrete samples will be collected for VOC analysis from each individual sampling location. Sediments for each location will then be extracted from each core, composited, and homogenized using decontaminated stainless-steel bowls and spoons. Cores will be cut so that only the material representative of the proposed dredged material will be submitted for analytical and ecotoxicological testing (i.e., if a 4-foot-long core is collected but the proposed dredge cut is only 2 feet, only the upper 2 feet of sediment will be included in the composite sample). Each sample will be homogenized until the sediment is thoroughly mixed and of uniform consistency. After homogenization, sediment samples will be transferred directly into the appropriate sampling containers using stainless-steel spoons.

Sufficient volume of sediment will be transferred to certified cleaned, laboratory-prepared jars for physical and chemical analysis (Table 3-2). All jars will be firmly sealed with Teflon-lined lids. Waterproof sample labels will be filled out with an indelible ink pen and affixed to sample containers. Each label will contain the project name, sample identification, preservation technique, requested analyses, date and time of collection and preparation, and initials of the person preparing the sample. Remaining sediment will be placed into high-density polyethylene (HDPE) buckets and sealed airtight for ecotoxicological testing. Each container for ecotoxicological testing will be clearly labeled with an indelible ink pen. The sample containers, preservatives, and holding time requirements for bulk sediment samples are provided in Table 3-2. Holding times for the sediment samples will begin when the sediment is composited, homogenized, and placed in the appropriate sample containers. Samples will be shipped via overnight delivery to Alpha Analytical and GTX. at the end of each workday. Samples will be hand delivered to Aquatec for ecotoxicological testing once core processing is complete.

Table 3-2
Sample Containers, Preservation Techniques, and Holding Times for Samples

Parameter	Method	Container	Holding Time	Preservation
Sediment				
Grain size/specific gravity/bulk density/percent moisture	ASTM D422/D854/D7263/ Plumb 1981	16-ounce HDPE	6 months	Cool/4°C
Atterberg limits	ASTM D4318	16-ounce HDPE	None	Cool/4°C
TOC	USEPA 9060A	4-ounce	28 days	Cool/4°C
Ammonia	SM4500_NH3	4-ounce	28 days	Cool/4°C
Metals/mercury	SW846 6020/7470A	8-ounce glass	6 months 28 days for mercury	Cool/4°C
Total solids/TOC	Plumb 1981; Lloyd Kahn Method	4-ounce glass	14 days	Cool/4°C
Pesticides/PAHs/PCB congeners/pentachlorophenol	SW846 8081/8270/8082/ 8270	16-ounce glass	Extracted within 14 days	Cool/4°C
			Analyzed within 40 days of extraction	Cool/4°C
Extractable petroleum hydrocarbons	MassDEP 2019	4-ounce glass	14 days	Cool/4°C
VOCs	SW846 8260D	4-ounce glass	14 days	Cool/4°C
Standard elutriate test	OTM	2 × 1 gallon glass	14 days until elutriate generation	Cool/4°C
Toxicity characteristic leaching procedure	SW846 1311	32-ounce glass	Extracted within 14 days	Cool/4°C
			Analyzed within 14 (VOCs), 28 (mercury), or 180 (metals days of extraction	
Cyanide	SM4500_CN	4-ounce glass	14 days	Cool/4°C
Total sulfide	SM4500_S	4-ounce glass	7 days	Cool/4°C
Corrosivity (pH)	SW846 9045D	4-ounce glass	On arrival	Cool/4°C
Ignitability/conductivity	SW846 1030/9050A	4-ounce glass	14 days	Cool/4°C
Surface Water and Standard Elutriates				
Metals/mercury	SW846 6020/7470A	500 mL HDPE	6 months 28 days for mercury	HNO_3 to pH < 2; Cool/4°C

Parameter	Method	Container	Holding Time	Preservation
Ammonia	SM4500_NH3	250 mL HDPE	28 days	H_2SO_4 to pH < 2; Cool/4°C
Pesticides/PAHs/PCB congeners/pentachlorophenol	SW846 8081/8270/8082/ 8270	6 × 1 L amber glass	Extracted within 7 days of collection and analyzed within 40 days of extraction	Cool/4°C
Standard elutriate test	OTM	3 gallons	None specified	Cool/4°C
Tissue				
Lipids	Laboratory SOP	4-ounce glass	1 year	Freeze/-18°C
Metals	SW846 6020/7470A	4-ounce glass	1 year	Freeze/-18°C
Pesticides/PAHs/PCB congeners	SW846 8081A/8270D/ 8082	8-ounce glass	Extracted within 1 year	Freeze/-18°C
			Analyzed within 40 days of extraction	Cool/4°C
Ecotoxicological Testing				
Whole sediment bioassay and bioaccumulation testing	OTM	5 × 5-gallon HDPE	Optimum 14 days, maximum 8 weeks	Cool/4°C
Water column bioassays	OTM	5 × 5-gallon HDPE	Elutriate from sediment prepared within 24 hours of test initiation	Cool/4°C

3.4.3 Surficial Sediment Sampling

Surficial sediment sampling at the Massachusetts Bay reference site will be conducted from a sampling vessel provided by the selected subcontractor. Surficial sediment will be collected using a grab sampler at the designated Massachusetts Bay reference site (Figure 2-1) following the guidelines specified in the RIM (USEPA and USACE 2004). The sediment sample will be collected using a large stainless-steel grab sampler (e.g., Ponar or equivalent), which will be decontaminated prior to sample collection. The sampling position will be recorded using a DGPS. The sediment sample will be obtained by taking sediment directly from the grab sampler, homogenizing it in stainless-steel bowls, and placing it directly into the appropriate laboratory jars. The sample will be submitted to the appropriate laboratories with the COC forms.

The sampler is used to collect large-volume, undisturbed surficial sediment samples representative of the top 0 to 1 foot of the sediment. The sampler utilizes a hinged jaw assembly for sample collection, and upon contact with sediments, the jaws are drawn shut to collect the sample.

The grab sampler will be used to collect samples in the following manner:

- Maneuver the vessel to the sampling location using a DGPS to within 1 to 2 meters of the target sampling location.
- Open the decontaminated grab sampler jaws to the deployment position.
- Draw the winch cable to the grab sampler taut and vertical, then slowly lower the sampler through the water column to the bottom.
- Close the jaws of the sampler when the sampler reaches the bottom and record the time and DGPS coordinates.
- Retrieve the sampler, slowly raising it back to the sampling vessel.
- Evaluate the retrieved sediment sample aboard the vessel against the following acceptability criteria:
  - Grab sampler is not overfilled (i.e., sediment surface is not against the top of the sampler).
  - Sediment surface is relatively flat, indicating minimal disturbance or winnowing.
  - Overlying water is present, indicating minimal leakage.
  - Overlying water has low turbidity, indicating minimal sample disturbance.
  - Desired penetration depth is achieved.
- Siphon off overlying water and use a stainless-steel spoon to collect the top 1 foot sediment layer from inside the sampler, taking care not to collect sediment in contact with the sides of the sampler.
- Place the collected sediment in a stainless-steel mixing bowl, and when sufficient sample volume has been collected, homogenize the sediment using a stainless-steel spoon.

Two or more grab samples will be collected from each location to obtain the necessary sample volume for physical and chemical analysis and for standard elutriate preparation. Surficial sediment processing will occur immediately after sample collection on board the vessel at the time of sample collection using stainless-steel spoons and bowls. After homogenization of the sample, an aliquot will be set aside for the channel reach composite sample. The remaining sediment will be placed immediately into appropriate prelabeled sample containers and then placed on ice and maintained at 4°C until delivered to the laboratory. All jars will be firmly sealed with Teflon-lined lids.

Waterproof sample labels will be filled out with an indelible ink pen and affixed to sample containers. Each label will contain the project name, sample identification, preservation technique, requested analyses, date and time of collection and preparation, and initials of the person preparing the sample. Remaining sediment will be placed into HDPE buckets and sealed airtight for ecotoxicological testing. Each container for ecotoxicological testing will be clearly labeled with an indelible ink pen. The sample containers, preservatives, and holding time requirements for bulk sediment samples are provided in Table 3-2. Holding times for the sediment samples will begin when the sediment is composited, homogenized, and placed in the appropriate sample containers. Samples will be shipped via overnight delivery to Alpha Analytical at the end of each workday and will be hand delivered to Aquatec for ecotoxicological testing.

3.4.4 Surface Water

Surface water samples will be collected from one location within the IWA using a peristaltic pump outfitted with Tygon tubing. Water will be collected from within 1 meter of the bottom, taking care not to disturb the sediment. Once the tubing is at the desired location and depth, the pump will be allowed to run for a minimum of 1 minute or five times the hose volume, whichever is greater, before sample collection. The sample will then be pumped directly into the appropriate prelabeled sample containers. Care will be taken so that the inside of the sample container does not contact any surfaces during sampling or handling. If excess turbidity (relative to the natural turbidity of the water for that day) is observed in a collected sample, the sample will be discarded, and the sampler will be redeployed and allowed additional time for the disturbed bottom sediment to clear before resampling into new sample containers.

Sample containers will be kept in packaging as received from the analytical laboratory until use, and a sample container will be withdrawn only when a sample is to be collected and immediately placed in a cooler with ice. When filling a sample container, care will be taken to minimize head space without overfilling the container, particularly for sample containers with preservatives. Jars will be firmly sealed with Teflon-lined lids.

Waterproof sample labels will be filled out with an indelible ink pen and affixed to sample containers. Each label will contain the project name, sample identification, preservation technique, requested analyses, date and time of collection, and initials of the person preparing the sample. Table 3-2 indicates sample containers, holding times, and preservatives for surface water and standard elutriate samples.

Water samples will be used for chemical analysis, standard elutriate preparation, and to create water column bioassays and whole sediment bioassays.

Following surface water collection, field parameters will be measured at the surface, mid-depth, and bottom (within 1 meter) of the water column using a water column-deployed multiparameter water quality instrument (e.g., YSI water quality multiprobe or similar). The water quality probe will be lowered to the sample depth and allowed to equilibrate for 30 seconds or until readings have stabilized. Water temperature, salinity, dissolved oxygen, turbidity, and pH will be recorded in the field logbook. Calibration procedures and QC checks for the water quality meter will be documented in the field logbook.

3.5 Potential Deviations from Sampling Plan

It is not possible to accurately predict every problem that may arise when in the field. Anchor QEA's Project Manager and the Field Team Leader will be familiar with the project and project goals and make an educated, scientifically based decision if sampling plan modifications are required based on site conditions. If time allows, the USACE Project Manager may be contacted to discuss significant sampling program modifications before initiation of changes.

Sampling will be dependent upon daily weather conditions and severe weather forecasts may preclude sampling. Unforeseen sampling challenges could include submerged utility cables, vessel traffic (e.g., ships, tugboats/barges, and pleasure craft), weather-related delays (e.g., heavy rain, high winds, lightning, and fog), site access difficulties, and core refusal or limited recovery.

If vessel traffic is heavy in the sampling areas, the sampling locations could be relocated, the sampling could be postponed, or the samples could be taken around the traffic (safety dependent). If weather situations such as flooding or lightning arise, sampling will be postponed until the situation clears. If core refusal or limited recovery is encountered during coring operations, three additional attempts will be conducted at a single location. After three attempts, the corer will be repositioned approximately 3 to 5 feet from the location (in an area equally representative of material to be dredged) and penetration will be attempted again. If sufficient recovery cannot be attained after repositioning the corer three times, the Field Team Leader will contact the Anchor QEA Project Manager to discuss relocating the station. The USACE Project Manager will be notified if sampling locations must be substantially relocated.

Anchor QEA will report unanticipated logistical problems and will provide recommendations or modifications to the sampling program to achieve the project goals while adhering to the proposed schedule. Any deviation will be explained in the field logbook and the testing report.

3.6 Sample Preservation and Holding Times

Sampling containers, preservation techniques, and holding times for sediment samples are listed in Table 3-2. All holding times and preservation techniques are in accordance with the RIM (USEPA and USACE 2004), the OTM (USACE and USEPA 1991), and the *QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations: Chemical Evaluations* (USEPA and USACE 1995). For sediments collected in core liners, holding times for the composite sediment samples from each location will begin when the sediment is composited, homogenized, and placed in the appropriate sample containers.

Tissue samples will be held frozen until determination of target analytes through consultation with the USACE New England District and USEPA Region 1. Tissue samples will be submitted to the analytical laboratory at the completion of the bioaccumulation tests.

3.7 Field and Sample Documentation

All phases of the sampling program will be documented in a field logbook, on field forms, and on COC forms. Field documentation will include sediment core collection forms, photographs, and a description of all sampling activities, sampling personnel, and weather conditions, as well as a record of all modifications to the procedures and plans identified in this SAP/QAPP.

In addition to standard entries of personnel, date, and time, the form will include information regarding station coordinates, core penetration, and physical characteristics of the sediment, such as texture, color, odor, stratification, and sheen. All entries will be made with an indelible ink pen. A representative core from each location will be photographed. Project name, station identification, number of attempts (if more than one attempt), and sample date and time will be labeled on a whiteboard and included in each photograph.

3.7.1 Field Data

Field notes will be recorded in a permanently bound, dedicated field logbook in sufficient detail to enable readers to reconstruct events that occurred during the sampling period. The field logbook will provide a description of all sampling and sample processing activities, location coordinates, water depths, and sample descriptions as well as a record of all modifications to the procedures and plans identified in this SAP/QAPP. Personnel names, local weather conditions, and other information that may impact the field sampling program will also be recorded. Similar appropriate information will be recorded in this logbook as samples are processed and submitted to the laboratories for analyses. Each page of the logbook will be numbered and dated by the personnel entering information.

Corrections to documentation will be made with a single line through the error, with the author's initials and date. Full copies of the project logbooks and/or data sheets will be submitted as an appendix to the data report.

3.7.2 Sample Identification

The sample numbering system will be used to communicate sample location and sample type between the field crew and the laboratory. Each sampling location and individual sample will be assigned a unique alphanumeric identifier using the following format:

- The first characters identify the project: Salem Wind Port (i.e., SWP).
- One- or two-letter abbreviations will be used to distinguish between the maintenance samples (M) and the new work (NW) samples.
- Numeric characters will be used to identify the sampling location (e.g., 01, 04).
- Area identifiers will be used to identify composite samples for each DU (i.e., TB = turning basin, BE = berth, NTB = north turning basin expansion, and STB = south turning basin expansion).

3.7.3 Sample Labels

Waterproof sample labels will be filled out with an indelible ink pen and affixed to sample containers. Each label will contain the project name, sample identification, preservation technique, requested analyses, date and time of collection, and initials of the person preparing the sample.

3.7.4 Chain-of-Custody Procedures

COC procedures will be followed for all samples throughout the collection, handling, and analysis process. The COC forms will be the principal documents used to detail the possession and transfer of samples. The Field Team Leader or a designee will be responsible for all sample tracking and COC procedures. This person will be responsible for final sample inventory, maintenance of sample custody documentation, and completion of the COC and sample-tracking forms prior to transferring samples to the laboratory. A COC form will accompany each cooler of samples to the analytical laboratory. Each person who has custody of the samples will sign the COC form and ensure the samples are not left unattended unless properly secured. Copies of all COC forms will be retained in the project files and will be attached to the final report.

The Laboratory Project Manager will ensure COC forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the COC forms. The laboratory will contact the Anchor QEA QA Manager or designee immediately if discrepancies between the COC forms and the sample shipment are discovered upon receipt.

3.7.5 Sample Delivery Requirements

Surface sediment and surface water samples will be shipped via overnight courier (e.g., FedEx) no later than the day after collection. Samples target for ecotoxicological testing will be hand delivered to the lab once core processing is complete. The persons transferring custody of the sample container will sign the COC form upon transfer of sample possession to the analytical laboratory. When the samples are delivered to the laboratory, the receiver will record the condition of the samples on a sample receipt form. COC forms will be used internally in the laboratory to track sample handling and final disposition.

Sediment samples will be securely packed inside a cooler with crushed ice or frozen blue ice packs. Proper COC procedures will be followed. The Laboratory Project Manager will ensure that COC forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the COC forms. The laboratory will immediately contact the Anchor QEA Project Manager if discrepancies between the COC forms and the samples are discovered upon receipt. The laboratory sample custodian will measure and record the temperature of the temperature blank included in each cooler and specifically note any coolers that do not contain ice packs or are not cold enough upon receipt.

3.8 Sample Handling Procedures

Sample containers will be kept in packaging as received from the analytical and ecotoxicological testing laboratories until use, and a sample container will only be withdrawn when a sample is to be collected and returned to a cooler containing completed samples.

3.8.1 Analytical Samples

Samples will be temporarily stored in coolers supplied with crushed ice or frozen blue ice packs. Temperatures will be maintained at approximately 4°C plus or minus 2°C and monitored throughout storage. Sediment samples will be shipped via overnight delivery to Alpha Analytical once the cores are processed. Reference sediment and surface water samples for chemical analysis and standard elutriate creation will be packaged in bubble wrap, placed in an ice-filled cooler, and shipped via overnight express to Alpha Analytical on the day of sample collection. Surface water samples for water column bioassays will also hand delivered to Aquatec, where the standard elutriates will be created and shipped to Alpha Analytical for analysis.

Prior to shipping, samples will be securely packed inside a cooler with crushed ice or frozen blue ice packs. Proper COC procedures will be followed. The original, signed COC forms will be placed into a sealed plastic bag and taped to the inside lid of the cooler. Packing tape will be wrapped completely around the cooler, and a custody seal will be placed on the front lid seam. The Laboratory Project Manager will ensure COC forms are properly signed upon receipt of the samples and will note questions or observations concerning sample integrity on the COC forms. The laboratory will immediately contact the Anchor QEA Field Team Leader if discrepancies between the COC forms and the sample shipment are discovered upon receipt. The Laboratory Sample Custodian will measure and record the temperature of the temperature blank included in each cooler and will specifically note any coolers that do not contain ice packs or are not sufficiently cold upon receipt.

Samples will be shipped from the field to the following address:

Alpha Analytical
320 Forbes Boulevard
Mansfield, MA 02048
Attn: Sample Receiving

While in the laboratory, the samples will be kept in a secured refrigerator unless they are being used for analysis. All the refrigerators in the laboratory used for storage of samples have restricted access, are numbered, and the actual storage location is indicated in the Laboratory Information Management System (LIMS) system. In addition, there are dedicated refrigerators designated for extracts and analytical standards. Samples (e.g., tissue) that are required to be frozen are stored in a freezer. The sample storage areas are within the laboratory, and access is limited to laboratory chemists. The following specific requirements for sample storage will be used:

- Samples are removed from the shipping container and stored in their original containers, unless damaged.
- Damaged samples are disposed of in an appropriate manner and disposal is documented. Anchor QEA will be notified whenever samples arrive damaged at the laboratory.
- Samples and extracts are stored in a secure area designed to comply with the storage method(s) defined in the contract.
- The storage area is kept secure at all times. The Laboratory Sample Custodian controls access to the storage area.
- All transfers of samples into and out of storage are documented in an internal COC record by the Sample Management Office. These internal custody records are maintained in the laboratory Project Records Office.
- Standards are not stored with samples or sample extracts.
- So that the laboratory may satisfy sample COC requirements, the following standard operating procedures (SOPs) for laboratory/sample security are implemented:
  - Samples are stored in a secure area.
  - Access to the laboratory is through a monitored area. Other outside-access doors to the laboratory are kept locked.
  - Visitors sign a visitor’s logbook and are escorted while in the laboratory.
  - Refrigerators, freezers, and other sample storage areas are securely maintained.

3.8.2 Ecotoxicological Samples

Sediment samples for whole sediment bioassays and bioaccumulation potential testing will be temporarily stored in coolers supplied with crushed ice or frozen blue ice packs during the workday. Temperatures will be maintained at approximately 4°C plus or minus 2°C and monitored throughout storage. Sediment cores will be stored in a secured refrigerated truck at each staging area at the end of each sampling day. At the end of sampling activities, sediment samples will be hand-delivered via refrigerated truck to Aquatec at the following address:

Aquatec Environmental
273 Commerce Street
Williston, Vermont 05495
(802) 860-1638 Attn: Sample Receiving

3.9 Equipment Decontamination

Sampling apparatus used to collect sediment samples (e.g., core liners, Ponar, stainless-steel bowls, and stainless-steel spoons) will be decontaminated prior to use in the field and between sampling locations to minimize cross-contamination. To avoid cross-contamination, disposable nitrile gloves will be worn by the sampling personnel and changed between sampling points. While performing the decontamination procedure, nitrile gloves will be used to prevent phthalate contamination of the sampling equipment or the samples.

The following decontamination procedures will be used for cleaning equipment that will contact the sample:

- Rinse with surface water and wash with scrub brush until free of sediment.
- Wash with phosphate-free biodegradable soap solution.
- Rinse with distilled water.

Acid or solvent washes will not be used in the field because of safety considerations and problems associated with rinsate disposal and sample integrity.

3.10 Waste Disposal

Any incidental sediment remaining after sampling will be washed overboard at the collection site prior to moving to the next sampling location. Any sediment spilled on the deck of the sampling vessel will be washed into surface waters at the collection site after sampling.

All disposable sampling materials and personal protective equipment used in sample processing (e.g., disposable coveralls, gloves, and paper towels) will be placed into trash bags and appropriately disposed of at a local facility. Disposable supplies will be removed from the vessel by sampling personnel and placed into a normal refuse container for disposal as solid waste.

3.11 Corrective Actions

Corrective actions or deviations from this SAP/QAPP that are deemed necessary during field operations will be verbally approved by the Anchor QEA Project Manager or their designated representatives. Any corrective actions taken during field activities will be documented in the field logbook and filed at Anchor QEA's office in Amesbury, Massachusetts. Corrective actions will be discussed in the project report.

4 Analytical Testing

USEPA, standard methods, ASTM, or similar standard protocols will be followed for target analytes, TDLs, methodologies, elutriate preparation procedures, and sample holding times. Analytical support will be provided by Alpha Analytical in Medford, Massachusetts.

All inorganic and organic compounds will be determined using the methods listed below and as described in the laboratory's analytical SOPs. To meet program-specific regulatory requirements for contaminants of concern, all methods and SOPs are followed as stated with some specific requirements noted in the following paragraphs.

Sample weight for sediment samples will be adjusted for percent moisture (up to 50% moisture) for the following parameters prior to extraction or digestion to achieve the lowest possible reporting limits (RLs). Quantitation limits applicable to this project are listed in Tables 4-1 and 4-2. The tables include the TDLs referenced in the RIM (USEPA and USACE 2004) and *QA/QC Guidance for Sampling and Analysis of Sediment, Water, and Tissues for Dredged Material Evaluations: Chemical Evaluations* (USEPA and USACE 1995). All analytical parameters, except geotechnical parameters, will be quantitated to the method detection limit (MDL). All detected values greater than or equal to the MDL but less than the laboratory RL will be qualified as estimated. Geotechnical parameters will be quantitated to the laboratory RL.

4.1 Physical and Chemical Analysis of Sediments

Sufficient sediment will be collected during field work to run the required analyses and retest any of the analytical chemistry samples, if required. Archive sediment samples will be collected from each individual location and for sediment composite samples. Analyses shall be performed in a timely fashion, allowing for retesting prior to expiration of holding times. Table 4-1 provides the DQOs for sediment analysis.

Physical and chemical analyses of sediment in this testing program were selected to determine suitability of dredged material for ocean placement. Physical analyses of sediment will include grain size, TOC, total solids, Atterberg limits, and specific gravity. The following specific requirements and methods will be used for these analyses:

- For grain size distributions, in addition to reporting the percentages in each size class, a graph of the cumulative frequency percentages using USACE Form 2087 (Gradation Curves) or similar form will be used.
- Geotechnical testing will be conducted using the following methods:
  - Grain size: ASTM D422
  - Total solids: SM2540G
  - Specific gravity: ASTM D854

  - Unified Classification of Soils: ASTM D2487
  - Atterberg limits: ASTM D4318
- TOC in sediments will be determined using the 1988 USEPA Region 2 combustion oxidation procedure (referred to as Lloyd Kahn Method).

Analytical methods used will follow USEPA or ASTM protocols. Table 1-3 presents the proposed testing program and recommended analytical methods. TDLs for the evaluation of sediment samples are provided in Table 4-1. Concentrations in sediment samples are expressed in terms of weight per unit dry weight (e.g., milligrams per kilogram [mg/kg] [dry], micrograms per kilogram [µg/kg] [dry]). The laboratory RLs for the sediment samples meet the TDLs listed in the RIM (USEPA and USACE 2004). Samples will be maintained according to the appropriate holding times and temperatures for each analysis as presented in Table 3-2.

Table 4-1
Reporting Limits, Method Detection Limits, and Target Detection Limits for Sediment Samples

Analyte	Laboratory RL	Laboratory MDL	TDL (USEPA and USACE 2004)
Wet Chemistry (mg/kg)			
Ammonia	7.5	2.79	—
Total sulfide	0.5	0.156	—
Cyanide	1	0.212	—
TOC (Lloyd Kahn) (%)	0.01	0.01	0.1
Total solids (%)	0.1	0.1	—
PAHs (Low Level SW846 8270E) (µg/kg)			
1-Methylnaphthalene	8	3.48	10
2-Methylnaphthalene	8	3.48	10
Acenaphthene	8	3.11	10
Acenaphthylene	8	3.14	10
Anthracene	8	5.47	10
Benzo(a)anthracene	8	3.94	10
Benzo(a)pyrene	8	2.32	10
Benzo(b)fluoranthene	8	3.83	10
Benzo(g,h,i)perylene	8	5.15	10
Benzo(k)fluoranthene	8	2.30	10
Chrysene	8	2.90	10
Dibenzo(a,h)anthracene	8	4.74	10
Fluoranthene	8	3.69	10
Fluorene	8	4.73	10
Indeno(1,2,3-c,d)pyrene	8	2.28	10

Analyte	Laboratory RL	Laboratory MDL	TDL (USEPA and USACE 2004)
Naphthalene	8	3.14	10
Phenanthrene	8	5.15	10
Pyrene	8	4.42	10
Semivolatiles (Low Level SW846 8270E) µg/kg			
Pentachlorophenol	200	60	—
Chlorinated Pesticides (SW846 8081B) µg/kg			
Aldrin	0.1	0.1	1
alpha-BHC	0.1	0.1	1
beta-BHC	0.1	0.1	1
delta-BHC	0.1	0.1	1
gamma-BHC (Lindane)	0.1	0.1	1
Chlordane (technical)	5	5	1
4,4'-DDD	0.1	0.1	1
4,4'-DDE	0.1	0.1	1
4,4'-DDT	0.1	0.1	1
Endosulfan I	0.1	0.1	1
Endosulfan II	0.1	0.1	1
Endosulfan sulfate	0.1	0.1	1
Endrin	0.1	0.1	1
Heptachlor	0.1	0.1	1
Heptachlor epoxide	0.2	02	1
Methoxychlor	1	1	1
Oxychlordane	1	1	1
Toxaphene	5	5	25
PCB Congeners (SW846 8270E) µg/kg			
PCB 8	0.4	0.2	1
PCB 18	0.4	0.2	1
PCB 28	0.8	0.4	1
PCB 44	0.4	0.2	1
PCB 49	0.4	0.2	1
PCB 52	0.4	0.2	1
PCB 66	0.4	0.2	1
PCB 77	0.4	0.2	1
PCB 87	0.8	0.4	1
PCB 101	0.4	0.2	1
PCB 118	0.4	0.2	1
PCB 126	0.4	0.2	1

Analyte	Laboratory RL	Laboratory MDL	TDL (USEPA and USACE 2004)
PCB 128	0.4	0.2	1
PCB 138	0.8	0.4	1
PCB 153	0.4	0.2	1
PCB 156	0.4	0.2	1
PCB 169	0.4	0.2	1
PCB 170	0.4	0.2	1
PCB 180	0.4	0.2	1
PCB 183	0.4	0.2	1
PCB 184	0.4	0.2	1
PCB 187	0.8	0.4	1
PCB 195	0.4	0.2	1
PCB 206	0.4	0.2	1
PCB 209	0.4	0.2	1
Metals, SERIM List (SW846 6020A/7471A) mg/kg			
Arsenic	0.05	0.007	0.4
Cadmium	0.02	0.003	0.07
Chromium	0.2	0.047	0.5
Copper	0.2	0.019	0.5
Lead	0.06	0.015	0.5
Mercury	0.0125	0.0016	0.02
Nickel	0.1	0.027	0.5
Selenium	0.2	0.076	—
Silver	0.05	0.005	—
Zinc	1	0.260	1

Note:
— : no TDL listed

4.2 Chemical Analysis of Surface Water and Standard Elutriates

Chemical analysis of the surface water used to prepare standard elutriates will be performed. Table 4-2 provides the DQOs for surface water and elutriate analysis.

Standard elutriates will be used to predict the release of contaminants to the water column resulting from open-water disposal of dredged material. Elutriate chemical analyses will be performed to demonstrate compliance with USEPA WQC upon placement of dredged material. Standard elutriates will be prepared for analysis in accordance with OTM procedures (USEPA and USACE 1991). The dredged material and surface water will be combined in a sediment-to-water ratio of 1:4 on a volume basis. The mixture will be vigorously mixed at room temperature for 30 minutes and allowed to settle for 1 hour. The supernatant (liquid phase) is siphoned off and centrifuged to remove particulates. The liquid phase after centrifugation is the standard elutriate.

The laboratory RLs for surface water and standard elutriate samples meet the TDLs listed in the RIM (USEPA and USACE 2004), with the exception of nickel and zinc. These exceedances of the TDLs are generally a result of matrix interferences inherent in saltwater and elutriate sample analyses. The laboratory RLs for these metals are laboratory averages, based on annual RL studies. The laboratory MDL for these metals are well below the TDL, with exception of zinc. It is anticipated that the nickel, selenium, and zinc analyses for this project will achieve their respective TDLs based on the MDLs. If not, the results will be noted in the final report, and a discussion of the impact on the concentrations will be included in the data interpretation section.

Table 4-2
Reporting Limits, Method Detection Limits, and Target Detection Limits for Surface Water and Standard Elutriate Samples

Analyte	Laboratory RL	Laboratory MDL	TDL (USEPA and USACE 2004)
Wet Chemistry (mg/L)			
Ammonia	0.075	0.023	—
PAHs (Low Level SW846 8270D) (µg/L)			
1-Methylnaphthalene	0.5	0.0911	—
2-Methylnaphthalene	0.5	0.0911	—
Acenaphthene	0.5	0.0955	10
Acenaphthylene	0.5	0.112	10
Anthracene	0.5	0.137	10
Benzo(a)anthracene	0.5	0.184	10
Benzo(a)pyrene	0.5	0.0602	10
Benzo(b)fluoranthene	0.5	0.0655	10
Benzo(ghi)perylene	0.5	0.109	10
Benzo(k)fluoranthene	0.5	0.161	10
Chrysene	0.5	0.142	10
Dibenzo(a,h)anthracene	0.5	0.0641	10
Fluoranthene	0.5	0.156	10
Fluorene	0.5	0.104	10
Indeno(1,2,3-cd)pyrene	0.5	0.0896	10
Naphthalene	0.5	0.0876	10
Phenanthrene	0.5	0.111	10
Pyrene	0.5	0.17	10
Semivolatiles (USEPA 8270E) (µg/L)			

Analyte	Laboratory RL	Laboratory MDL	TDL (USEPA and USACE 2004)
Pentachlorophenol	2	0.43	13
Chlorinated Pesticides (SW846 8081A) (µg/L)			
Aldrin	0.0009	0.0009	0.26
alpha-BHC	0.0005	0.0005	—
beta-BHC	0.0005	0.0005	—
delta-BHC	0.0005	0.0005	—
gamma-BHC (Lindane)	0.0005	0.0005	0.26
Chlordane (technical)	0.025	0.025	0.02
4,4'-DDD	0.0005	0.0005	—
4,4'-DDE	0.0005	0.0005	—
4,4'-DDT	0.0005	0.0005	0.03
Dieldrin	0.0005	0.0005	0.14
Endosulfan I	0.0005	0.0005	0.007
Endosulfan II	0.0005	0.0005	0.007
Endosulfan sulfate	0.0005	0.0005	—
Endrin	0.0005	0.0005	0.007
Endrin aldehyde	0.0005	0.0005	—
Heptachlor	0.0005	0.0005	0.01
Heptachlor epoxide	0.0005	0.0005	0.01
Toxaphene	0.025	0.025	0.04
PCB Congeners (SW846 8082) (µg/L)			
PCB 8	0.0005	0.0005	0.006
PCB 18	0.0005	0.0005	0.006
PCB 28	0.0005	0.0005	0.006
PCB 44	0.0005	0.0005	0.006
PCB 49	0.0005	0.0005	0.006
PCB 52	0.0005	0.0005	0.006
PCB 66	0.0005	0.0005	0.006
PCB 77	0.0005	0.0005	0.006
PCB 87	0.0005	0.0005	0.006
PCB 101	0.0005	0.0005	0.006
PCB 118	0.0005	0.0005	0.006
PCB 126	0.0005	0.0005	0.006
PCB 128	0.0005	0.0005	0.006
PCB 138	0.0005	0.0005	0.006
PCB 153	0.0005	0.0005	0.006
PCB 156	0.0005	0.0005	0.006

Analyte	Laboratory RL	Laboratory MDL	TDL (USEPA and USACE 2004)
PCB 169	0.0005	0.0005	0.006
PCB 170	0.0005	0.0005	0.006
PCB 180	0.0005	0.0005	0.006
PCB 183	0.0005	0.0005	0.006
PCB 184	0.0005	0.0005	0.006
PCB 187	0.0005	0.0005	0.006
PCB 195	0.0005	0.0005	0.006
PCB 206	0.0005	0.0005	0.006
PCB 209	0.0005	0.0005	0.006
Metals, RIM List (SW846 6020/7470A) (µg/L)			
Arsenic	0.5	0.165	1
Cadmium	0.2	0.0599	1
Chromium, Total	1	0.178	1
Copper	1	0.384	0.6
Lead	1	0.384	1
Mercury	0.005	0.0261	0.4
Nickel	2	0.556	1
Selenium	5	1.73	1
Silver	0.4	0.163	0.5
Zinc	10	3.41	1

Note:
— : no TDL listed

4.3 Chemical Analysis of Tissues

Following bioaccumulation testing, tissue samples of surviving bent-nose clams (*Macoma nasuta*) and worms (*Nereis virens*) will be transferred to Alpha Analytical for analysis of potential contaminants. The final testing regime will be determined based on the sediment results after review and discussion with USACE New England District but is expected to include, at a minimum, metals and lipids. Tissue samples will be stored frozen and removed to thaw prior to analysis. TDLs for the evaluation of tissue samples are provided in Table 4-3. Concentrations in tissue samples are expressed in terms of weight per unit wet weight (e.g., mg/kg [wet], µg/kg [wet]).

Table 4-3
Reporting Limits, Method Detection Limits, and Target Detection Limits for Tissue Samples

Analyte	Laboratory RL	TDL (USEPA and USACE 2004)
PAHs, Low Level (SW846 8270D) (µg/kg)		
1-Methylnaphthalene	8	20
2-Methylnaphthalene	8	20
Acenaphthene	8	20
Acenaphthylene	8	20
Anthracene	8	20
Benzo(a)anthracene	8	20
Benzo(b)fluoranthene	8	20
Benzo(k)fluoranthene	8	20
Benzo(ghi)perylene	8	20
Benzo(a)pyrene	8	20
Chrysene	8	20
Dibenzo(a,h)anthracene	8	20
Fluoranthene	8	20
Fluorene	8	20
Indeno(1,2,3-cd)pyrene	8	20
Naphthalene	8	20
Phenanthrene	8	20
Pyrene	8	20
Pesticides (SW846 8081A) (µg/kg)		
Aldrin	2	1
alpha-BHC	2	1
beta-BHC	2	1
delta-BHC	2	1
gamma-BHC (Lindane)	2	1
Chlordane (technical)	2	1
4,4'-DDD	2	1
4,4'-DDE	2	1
4,4'-DDT	2	1
Dieldrin	2	1
Endosulfan I	2	1
Endosulfan II	2	1
Endosulfan sulfate	2	1
Endrin	2	1
Endrin aldehyde	2	1

Analyte	Laboratory RL	TDL (USEPA and USACE 2004)
Heptachlor	2	1
Heptachlor epoxide	2	1
Oxychlordane	2	1
Toxaphene	2	50
PCB Congeners (SW846 8082) (µg/kg)		
PCB 8	1	0.05
PCB 18	1	0.05
PCB 28	1	0.05
PCB 44	1	0.05
PCB 49	1	0.05
PCB 52	1	0.05
PCB 66	1	0.05
PCB 77	1	0.05
PCB 87	1	0.05
PCB 90	1	0.05
PCB 101	1	0.05
PCB 105	1	0.05
PCB 118	1	0.05
PCB 126	1	0.05
PCB 128	1	0.05
PCB 138	1	0.05
PCB 153	1	0.05
PCB 156	1	0.05
PCB 169	1	0.05
PCB 170	1	0.05
PCB 180	1	0.05
PCB 183	1	0.05
PCB 184	1	0.05
PCB 187	1	0.05
PCB 195	1	0.05
PCB 206	1	0.05
PCB 209	1	0.05
Metals, RIM List (SW846 6020/7471A) (mg/kg)		
Arsenic	0.1	0.5
Cadmium	0.04	0.1
Chromium	0.4	1
Copper	0.1	1

Analyte	Laboratory RL	TDL (USEPA and USACE 2004)
Lead	0.04	1.0
Mercury	0.0125	0.02
Nickel	0.1	1
Zinc	1	1
Lipids		
Percent Lipids	0.1	0.1
Percent Moisture	0.1	0.1

4.4 Data Calculations for Sediment and Tissue

4.4.1 Treatment of Non-Detects

When calculating the total PAH and total PCB concentrations, analyte concentrations below the RL will be treated in the following manner:

- If the RL for the analyte is below the TDL, then one-half the RL will be the concentration used in the calculation.
- If the RL for the analyte is above the TDL, then the RL will be the concentration used in the calculation.

4.4.2 Total PAH Calculation

PAHs will be summed together because PAHs are usually found in mixtures containing two or more compounds (ATSDR 1995). Total PAH concentrations will be determined for each sample by summing the concentrations of the individual PAHs. Two total PAH calculations will be reported: 1) low-molecular-weight polycyclic aromatic hydrocarbons (LPAHs); and 2) and high-molecular-weight polycyclic aromatic hydrocarbons (HPAHs), based on the LPAHs and HPAHs recommended by NOAA (1989).

HPAHs and LPAHs will be calculated as the sum of the PAHs that were classified into each PAH group. PAHs are assigned to groups based on their molecular weight. PAHs with two or three carbon rings are classified as LPAHs. PAHs with four, five, or six carbon rings are classified as HPAHs because they have different sources, as well as act differently in marine environments. LPAHs are often associated with petroleum, and HPAHs are associated with combustion products (NOAA 1989). If one of the PAHs was not-detected ("U" qualified), one half of the RL will be utilized in the calculation. The following PAHs are included in the LPAH and HPAH calculations:

- LPAHs included 1-methylnaphthalene, 2-methylnaphthalene, anthracene, acenaphthene, fluorene, naphthalene, and phenanthrene.

- HPAHs included benzo(a)anthracene, benzo(a)pyrene, pyrene, chrysene, dibenzo(a,h)anthracene, and fluoranthene.

4.4.3 Total PCB Calculation

For each sample, individual PCB congener concentrations will be reported in addition to total PCB concentrations. Total NOAA PCBs will be determined by summing the concentrations of the 18 summation congeners (as specified in Table 3 of the RIM [USEPA and USACE 2004]) and multiplying the total by a factor of two. Multiplying by a factor of two estimates the total PCB concentration and accounts for additional congeners that are not part of the calculation.

4.4.4 Calculations for Tissues

Bent-nose clam (*Macoma nasuta*) and worm (*Nereis virens*) tissue resulting from bioaccumulation testing will be analyzed. The final testing regime will be determined based on the sediment results but is expected to include, at a minimum, metals and lipids. The following calculations will be performed for tissue analytes if the analytes are included in the testing protocol.

Total PAHs and total PCBs will also be calculated for tissue samples (if analyzed). When calculating the total PAH concentrations in tissues, analyte concentrations below the RL will be treated in the following manner:

- If the RL for the analyte is below the TDL, then one-half the RL or the estimated ("J"-flagged) value, whichever is greater, will be the concentration used in the calculation.
- If the RL for the analyte is above the TDL, then the RL will be the concentration used in the calculation.

4.5 Data Evaluation and Screening Criteria

4.5.1 Sediment Quality Guidelines

Sediment chemistry data will be compared to concentrations at the reference site and to applicable sediment quality guidelines (SQGs) (Table 4-4) (MacDonald et al. 1996; Long et al. 1995; CCME 2001). Comparisons to SQGs will be used to evaluate overall sediment quality and to determine the analytical testing program but will not be used as decision criteria for determining compliance with the LPC.

Concentrations of detected analytes in sediment samples will be compared to SQGs (MacDonald et al. 1996) for marine sediments to assess the sediment quality of the material proposed for dredging. SQGs, specifically the effects range low (ERL)/effects range median (ERM; MacDonald et al. 1996) approach, will be used to identify potential adverse biological effects associated with contaminated sediments. ERL and ERM values for marine/estuarine sediments are provided in Table 4.5. The ERL and ERM values were derived using concentrations with effects and no observed effects (Long and MacDonald 1998). ERLs typically represent concentrations below which adverse biological effects were rarely observed, and ERMs typically represent concentrations in the middle of the effects range and above which effects were more frequently observed (Long and MacDonald 1998). Concentrations that are between the ERL and ERM represent the concentrations at which adverse biological effects occasionally occur.

Table 4-4
Marine Sediment Quality Guidelines

Chemical Name	Units	ERL	ERM
Metals			
Arsenic	mg/kg	8.2	70
Cadmium	mg/kg	1.2	9.6
Chromium	mg/kg	81	370
Copper	mg/kg	34	270
Lead	mg/kg	46.7	218
Mercury	mg/kg	0.15	0.71
Nickel	mg/kg	20.9	51.6
Silver	mg/kg	1	3.7
Zinc	mg/kg	150	410
Chlorinated Pesticides			
4,4-DDD	µg/kg	2	20
4,4-DDE	µg/kg	2.2	27
4,4-DDT	µg/kg	1	7
Total DDX	µg/kg	1.58	46.1
Chlordane	µg/kg	0.5	6
Dieldrin	µg/kg	0.02	8
PAHs			
2-Methylnaphthalene	µg/kg	70	670
Acenaphthene	µg/kg	16	500
Acenaphthylene	µg/kg	44	640
Anthracene	µg/kg	85.3	1,100
Benzo[a]anthracene	µg/kg	261	1,600
Benzo(a)pyrene	µg/kg	430	1,600
Chrysene	µg/kg	384	2,800
Dibenz(a,h)anthracene	µg/kg	63.4	260
Fluoranthene	µg/kg	600	5,100
Fluorene	µg/kg	19	540
Naphthalene	µg/kg	160	2,100

Chemical Name	Units	ERL	ERM
Phenanthrene	µg/kg	240	1,500
Pyrene	µg/kg	665	2,600
Total PAH	µg/kg	4,022	44,792
PCB Congeners			
Total PCBs	µg/kg	22.7	180

Note:
Source: MacDonald et al. 1996

4.5.2 Water Quality Criteria

Section 304(a)(1) of the Clean Water Act requires USEPA to develop, publish, and periodically revise criteria for water quality to accurately reflect the latest scientific knowledge. The WQC developed under Section 304(a)(1) are based solely on data and scientific judgements on the relationship between pollutant concentrations and environmental effects. National recommended WQC include previously published criteria that are unchanged, criteria that have been recalculated from earlier criteria, and newly calculated criteria based on peer-reviewed assessments and data.

Analytes detected in the surface water and standard elutriates will be compared to USEPA and Massachusetts saltwater acute and chronic WQC. Criteria were derived from USEPA's National Recommended Water Quality Criteria Tables (2022) and Massachusetts Department of Environmental Protection (MassDEP), Surface Water Quality Standards, 314 Code of Massachusetts Regulation 4 (MassDEP 2022; Table 4-5). The USEPA acute criterion is based on 1-hour average exposure concentrations, and the chronic criterion is based on 4-day average exposure concentrations. If any of the analytical results exceed the WQC, STFATE modeling will be conducted to determine if compliance will be met within the site boundaries after 4 hours of mixing.

Table 4-5
USEPA and State Water Quality Criteria for Target Analytes

Analyte	Units	Saltwater Criteria USEPA/Massachusetts	
		Acute[a]	Chronic[b]
Nutrients			
Ammonia (as in-ionized NH_3)	mg/L	0.233[c]	0.035[c]
Cyanide	µg/L	1.0[d]	1.0[d]
Metals			
Arsenic	µg/L	69[e,f]	36[e,f]
Cadmium	µg/L	33[f]	7.9[f]
Chromium	µg/L	1,100[f,g]	50[f,g]

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Analyte	Units	Saltwater Criteria USEPA/Massachusetts	
		Acute[a]	Chronic[b]
Copper	µg/L	4.8[f]	3.1[f]
Lead	µg/L	210[e]	8.1[e]
Mercury	µg/L	1.8[f,h]	0.94[f,h]
Nickel	µg/L	74[f]	8.2
Selenium	µg/L	290[f]	71[f]
Silver	µg/L	1.9/0.95[f]	—
Zinc	µg/L	90[f]	81[f]
Chlorinated Pesticides			
4,4'-DDT	µg/L	0.13/0.7[i]	0.001[i]
Aldrin	µg/L	1.3	0.65
Chlordane	µg/L	0.09/0.045	0.004
Dieldrin	µg/L	0.71/0.36	0.0019
Endosulfan I	µg/L	0.034/0.017[j]	0.0087[j]
Endosulfan II	µg/L	0.034/0.017[j]	0.0087[j]
Endrin	µg/L	0.037/0.018	0.0023
Gamma-BHC (Lindane)	µg/L	0.16/0.08	—
Heptachlor	µg/L	0.053/0.03	0.0036
Heptachlor Epoxide	µg/L	0.053/0.03[k]	0.0036[k]
Toxaphene	µg/L	0.21	0.0002
PCBs			
Total PCB	µg/L	—	0.03
Semivolatile organic compound			
Pentachlorophenol	µg/L	13	7.9

Notes:
If only one value is noted, it is an USEPA criteria that has been adopted by the state. State-specific values are identified, as applicable.
Sources: USEPA 2022; MassDEP 2022

c. Acute aquatic life criteria based on 1-hour average exposure concentrations.
d. Chronic aquatic life criteria based on 4-day average exposure concentrations.
e. Total ammonia as nitrogen, calculated for each location based on mean salinity, mean water temperature, and mean pH as measured at mid-depth of the water column.
f. Free cyanide as mg cyanide/L.
g. Derived based on data for arsenic^{+3} but applied to total arsenic concentrations.
h. Saltwater criteria expressed in terms of dissolved metal in the water column.
i. Derived for hexavalent chromium (Cr^{+6}) but applied to total chromium concentrations.
j. Derived from data for inorganic mercury^{+2} but applied to total mercury concentrations.
k. The total concentration of DDT and its metabolites should not exceed this value.
l. Value was derived for endosulfan and is most applied to the sum of endosulfan I and endosulfan II.
m. Value was derived from data for heptachlor, and the criteria document provides insufficient data to estimate the relative toxicities of heptachlor and heptachlor epoxide.

— : no criterion list for this analyte

4.5.3 Analytical Testing of Tissues

The purpose of the bioaccumulation testing is to predict the potential for uptake of chemical contaminants in the dredged material by aquatic organisms to levels of concern. Tissue analysis will only be conducted for analytes that are detected in the sediments. Prior to the initiation of the tissue testing program, a project team meeting will be held to discuss the scope of the tissue testing program with USACE and USEPA. A final determination on the scope of the tissue testing program will be made based on the results of the sediment analysis and results of the 10-day whole sediment bioassays.

In addition to comparing project tissue residues to tissue residues for reference sediment, the detected tissue residue concentrations in samples from the SWP project area will be compared to the USFDA action/guidance/tolerance levels (USFDA 2000), which are derived from risk assessment evaluations for application as critical limits for determining the acceptability of aquatic organisms as food sources to humans. Food lots that exceed the USFDA's action/guidance/tolerance levels are removed from the marketplace and are not considered safe for human consumption. The USFDA action/guidance/tolerance levels are generally applicable to shellfish, as well as finfish.

The USFDA levels do not indicate the potential for environmental impact on the contaminated organisms or the potential for biomagnification. Because contamination of food in excess of USFDA levels is considered a threat to human health, USEPA and USACE consider concentrations in excess of such levels in any test species to be predictive of benthic bioaccumulation of contaminants (USEPA and USACE 1998). Based on guidance from the OTM (USEPA and USACE 1991), if tissue-residue concentrations are statistically higher than an USFDA action/guidance/tolerance level (USFDA 2000), then the dredged material is not suitable for ocean placement.

USFDA levels exist for arsenic, cadmium, chromium, lead, mercury, and nickel. For substances with USFDA action levels, the criteria values were compared to the one-tailed 95% upper confidence level of the mean (UCLM) tissue-residue concentrations for each sample. If the UCLM was below the criterion value (indicating a 95% probability that the population mean tissue-residue concentration for the sample is below the criterion value), it was concluded that the criterion value was not exceeded.

To evaluate the results of the analytical testing for the bent-nose clam (*Macoma nasuta*) and worm (*Nereis virens*) tissues, the following step-wise process will be utilized:

1. Mean tissue concentrations will be calculated using the five replicates for each species. Details on the treatment of non-detects in this calculation are in Section 4.4.1. Data for organic constituents will be lipid-normalized prior to calculation of mean tissue concentrations.
2. Concentrations of target analytes in the worm (*Nereis virens*) and bent-nose clam (*Macoma nasuta*) tissues will be statistically compared to pre-exposure tissue (Day 0)

concentrations. If test tissue concentrations are the same or lower than the pre-exposure tissue concentrations, then no additional evaluation is required.

3. Concentrations of target analytes in the worm (*Nereis virens*) and bent-nose clam (*Macoma nasuta*) tissue will be compared to USFDA action/guidance/tolerance levels (USFDA 2000).
4. Chemical concentrations in worm (*Nereis virens*) and bent-nose clam (*Macoma nasuta*) tissues exposed to Salem Harbor sediments will be statistically compared to chemical concentrations in organisms exposed to the reference sediment to determine if uptake of contaminants was significantly higher in organisms exposed to the project sediments.
5. For constituents with mean concentrations that statistically significantly exceed mean reference site concentrations, mean concentrations will be compared to ecological non-specific effects thresholds (Appendix H of the *Southeast Regional Implementation Manual* [SERIM; USEPA and USACE 2008]). Constituents with mean concentration lower than the ecological non-specific threshold value will be interpreted as not predictive of an adverse effect and that dredged material placement will not result in bioaccumulation above existing ambient level. Therefore, these constituents met the LPC for benthic bioaccumulation.
6. Mean concentrations of analytes that statistically exceed reference site concentrations will be evaluated using a weight-of-evidence approach that includes the following:
   a. Evaluation of analytical variability (e.g., number of non-detects in the dataset, calculation of total PAHs and total PCBs using RLs)
   b. Evaluation using the eight criteria listed in the OTM (e.g., toxicological importance of contaminants, magnitude of exceedance, and propensity to biomagnify; USEPA and USACE 1991)

5 Ecotoxicological Testing

Ecotoxicological testing (Table 5-1) will be performed at Aquatec in Williston, Vermont, and will be in accordance with the following guidance documents:

- USEPA and USACE, 2004—*Regional Implementation Manual for the Evaluation of Dredged Material Proposed for Disposal in New England Waters*
- USEPA and USACE, 1991—*Evaluation of Dredged Material Proposal for Ocean Disposal – Ocean Testing Manual*
- USEPA and USACE, 1998 (EPA-823-B-98-004)—*Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Inland Testing Manual*
- USEPA and USACE, 1995 (EPA-823-B-95-001)—*QA/QC Guidance for Sampling and Analysis of Sediments, Water, and Tissues for Dredged Material Evaluations, Chemical Evaluations*
- USEPA, 2002 (EPA-821-R-02-012)—*Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*

Ammonia is not considered a contaminant of concern in marine and estuarine sediments but can accumulate in subsurface sediments because of naturally occurring processes, such as bacterial degradation of organic matter. Because test species are sensitive to ammonia, even low levels of ammonia have the potential to confound toxicity test results by causing toxicity to test organisms. Ammonia is anticipated to be present at elevated levels in the sediment porewater. Therefore, interstitial ammonia concentrations will be measured on project sediments prior to testing. Sediment porewater will be tested for ammonia concentrations upon receipt at the analytical laboratory and if elevated ammonia levels are observed, ammonia purging protocols for the water column (sea urchin larval development tests only) and whole sediment bioassays will be conducted prior to test initiation to reduce ammonia levels. Ammonia purging will be conducted consistent with methods in the RIM (USEPA and USACE 2004) as discussed in the following sections.

Table 5-1
Summary of Ecotoxicology Testing Requirements

Testing Requirements
Suspended Particulate Phase (Water Column) Toxicity
Crustacean Mysids, *Americamysis bahia*—1 to 5 days old; age difference within batch to be 24 hours or less ***Fish*** Inland Silverside, *Menidia beryllina*—9 to 14 days old; age difference within batch to be 24 hours or less ***Zooplankton*** Atlantic purple sea urchin, *Arbacia punctulate*—Embryos within 4 hours of fertilization

Testing Requirements
Solid Phase (Whole-Sediment) Toxicity
Infaunal Amphipod *Leptocheirus plumulosus* ***Crustacean*** *Americamysis bahia*
Bioaccumulation
Burrowing Polychaete Sand worm—*Nereis virens* ***Bivalve*** Bent-nose clam—*Macoma nasuta*—Relatively uniform in size

5.1 Water Column Bioassays

As per RIM guidance (USEPA and USACE 2004), three species of organisms, mysid shrimp (*Americamysis bahia*), fish (inland silverside; *Menidia beryllina*), and urchin (Atlantic purple sea urchin; *Arbacia punctulata*) will be tested in the water column bioassays for each sample. The three species chosen represent different phyla and cover a range of different species sensitivities (USEPA and USACE 1998). Water column bioassays will be conducted for 96 hours using the mysid shrimp (*Americamysis bahia*) and fish (*Menidia beryllina*). The water column bioassays conducted with the urchin (*Arbacia punctulata*) will be 48-hour bioassays. Dilution water for bioassays will consist of clean, uncontaminated seawater or an artificial sea salt mixture that does not exceed USEPA WQC for marine species (USEPA 2016).

In the water column tests, survival will be the endpoint for the mysid shrimp (*Americamysis bahia*) and fish (*Menidia beryllina*) tests. Larval development will be the endpoint for the urchin (*Arbacia punctulata*) tests. All water column tests will be conducted with larval or juvenile test organisms, which are considered the most sensitive life stages. The age ranges as specified by USEPA and USACE (2008) testing guidelines are as follows:

- Mysid shrimp (*Americamysis bahia*), 1 to 5 days old
- Fish (*Menidia beryllina*), 9 to 14 days old
- Urchin (*Arbacia punctulata*), embryo in less than 4-hours

In water column tests, results for 100% test elutriates will be statistically compared (single-point comparison) to results of the laboratory controls as per the RIM (USEPA and USACE 2004) evaluation protocols. An EC_{50} will be calculated for the larval development bioassay, and LC_{50} will be calculated for the mysid shrimp (*Americamysis bahia*) and fish (*Menidia beryllina*) bioassay.

5.1.1 Larval Development Bioassay

Water column tests will be performed using urchin (*Arbacia punctulata*) larvae. Because of seasonality in gamete availability, one of the alternative bivalve or echinoderm species listed in Table 6 of the RIM (USEPA and USACE 2004) may be substituted if gravid urchins are not available.

The larval development bioassay will be conducted with four concentrations of elutriate (i.e., 1%, 10%, 50%, and 100%) and prepared with clean filtered seawater or an artificial sea salt mixture. In addition, a control and site surface water sample will be tested. There will be five replicates per concentration. Each replicate will be inoculated with equal amounts of bivalve embryos (15 to 30 embryos per milliliter [mL]) and held for 48 hours at 16°C (±1°C), with a 16-hour-light/8-hour-dark photoperiod.

Water quality parameters will be measured daily during testing on an additional water quality replicate. At test termination, chambers will be preserved, and the number of normally developed larvae will be determined using a microscope. Test acceptability criteria are at least 90% survival and 70% normal larval development in the control. The relative sensitivity of each batch will be assessed by conducting a reference toxicant test. A summary of the urchin (*Arbacia punctulata*) larval development bioassay test conditions is provided in Table 5-2.

Table 5-2
Summary of Test Conditions for the Water Column Acute Bioassays for the Atlantic Purple Sea Urchins (*Arbacia punctulata*)

Test Parameter	Test Conditions
Test type	Static, non-renewal
Test duration	48 to 96 hours; incubation can end when >90% of embryos have reached the pluteus stage of development, as determined by surrogate vessels
Temperature	20 ±1°C
Light quality	Cool-white fluorescent
Light intensity	100 to 1,000 lux
Photoperiod	16 hours light, 8 hours dark
Salinity	30 ±2 ppt
Test chamber size	250 mL beaker, glass
Test volume	200 mL
Embryo concentration	25 to 35 embryos per mL
Age of test organisms	<4 hours
Number of replicates per treatment	5
Feeding	None
Test solution aeration	No aeration during the assay; samples must be aerated prior to testing if dissolved oxygen is <4 mg/L

Test Parameter	Test Conditions
Dilution water	Artificial seawater or as specified in the SAP/QAPP
Treatments	Laboratory control, undiluted elutriate solution (100%), and diluted elutriate solution (concentrations of 50%, 10%, and 1%) for a total of four concentrations
Effect measured	Survival and normal development to pluteus stage
Analysis	Calculate 48-hour EC_{50} and NOEC
Sample holding time	Elutriates used within 24 hours of preparation; sediment <8 weeks, held at 4 ±2°C
Test acceptability	Control survival of ≥70%

5.1.2 Mysid Shrimp (Americamysis bahia) Bioassay

Water column tests will be performed using mysid shrimp (*Americamysis bahia*). The water column toxicity test will be conducted with four concentrations of elutriate (i.e., 1%, 10%, 50%, and 100%) and prepared with clean filtered seawater or an artificial sea salt mixture. In addition, a control and site surface water sample will be tested. There will be five replicates per concentration with 10 mysid shrimp (*Americamysis bahia*) each. Organisms will be exposed for 96 hours under static-renewal conditions with a 16-hour-light/8-hour-dark photoperiod. The test temperature will be maintained at 20°C (±1°C). Organisms will be fed brine shrimp (*Artemia nauplii*) daily. Water quality parameters will be measured daily during testing. Test acceptability will be evaluated by survivorship in the control, which should be at least 90%. If the test does not meet control acceptability criteria, it will be repeated. The relative sensitivity of each batch of mysid shrimp (*Americamysis bahia*) will be assessed by conducting a 96-hour reference toxicant test. A summary of the mysid shrimp (*Americamysis bahia*) bioassay test conditions is provided in Table 5-3.

5.1.3 Juvenile Fish (Menidia beryllina) Bioassay

Water column tests will be performed using the inland silverside fish (*Menidia beryllina*). Criteria for test conditions and acceptability can be found in Appendix L of the SERIM (USEPA and USACE 2008). The water column toxicity test will be conducted with four concentrations of elutriate (i.e., 1%, 10%, 50%, and 100%) and prepared with clean filtered seawater or an artificial sea salt mixture. In addition, a control and site surface water sample will be tested. There will be five replicates per concentration with 10 fish (*Menidia beryllina*) each. Organisms will be exposed for 96 hours under static-renewal conditions with a 16-hour-light/8-hour-dark photoperiod. The test temperature will be maintained at 20°C (±1°C). Organisms will be fed brine shrimp at 48 hours. Water quality parameters will be measured daily during testing. Test acceptability will be evaluated by survivorship in the control, which should be at least 90%. If the test does not meet control acceptability criteria, it will be repeated. The relative sensitivity of each batch of fish (*Menidia beryllina*) will be assessed by conducting a 96-hour reference toxicant test. A summary of the fish (*Menidia beryllina*) bioassay test conditions is provided in Table 5-4.

Table 5-3
Summary of Test Conditions for the Water Column Acute Bioassays for the Mysid Shrimp (*Americamysis bahia*)

Test Parameter	Test Conditions
Test type	Static
Test duration	96 hours
Temperature	20 ± 1°C
Light quality	Cool-white fluorescent
Light intensity	100 to 1,000 lux
Photoperiod	16 hours light, 8 hours dark
Salinity	30 ± 3 part per thousand (ppt)
Test chamber size	>200 mL beaker, glass, or plastic
Test volume	200 mL
Age of test organisms	<5 days post-hatch with <24 hours variation
Number of organisms per test chamber	10
Number of replicates per treatment	5
Number of organisms per treatment	50
Food source	<24-hour-old brine shrimp (*Artemia nauplii*)
Feeding	Twice daily feeding of newly hatched brine shrimp prior to the start of assay; daily during testing
Test solution aeration	None unless dissolved oxygen is below 4.0 mg/L
Dilution Water	Artificial seawater or as specified in the SAP/QAPP
Treatments	Laboratory control, undiluted elutriate solution (100%) and diluted elutriate solution (concentrations of 50%, 10%, and 1%) for a total of four concentrations
Effect measured	Survival
Analysis	Calculate 96-hour LC_{50} and NOEC
Sample holding time	Elutriates used within 24 hours of preparation; sediment <8 weeks, held at 4 ±2°C
Analytical support	In all treatments, daily measurement of dissolved oxygen, pH, salinity. Ammonia in the controls and undiluted elutriate at the start and end of assay.
Test acceptability	≥90% survival in laboratory water control

Table 5-4
Summary of Test Conditions for the Water Column Acute Bioassays for the Inland Silverside Minnow (*Menidia beryllina*)

Test Parameter	Test Conditions
Test type	Static
Test duration	96 hours
Temperature	20 ± 1°C
Light quality	Cool-white fluorescent
Light intensity	100 to 1,000 lux
Photoperiod	16 hours light, 8 hours dark
Salinity	30 ± 3 ppt
Test chamber size	>200 mL beaker, glass, or plastic
Test volume	200 mL
Age of test organisms	9 to 14 days
Number of organisms per test chamber	10
Number of replicates per treatment	5
Number of organisms per treatment	50
Food source	<24-hour-old brine shrimp (*Artemia nauplii*)
Feeding	Twice daily feeding of newly hatched brine shrimp prior to the start of assay and at 48 hours
Test solution aeration	None unless dissolved oxygen is below 4.0 mg/L
Dilution water	Artificial seawater or as specified in the SAP/QAPP
Treatments	Laboratory control, undiluted elutriate solution (100%) and diluted elutriate solution (concentrations of 50%, 10%, and 1%) for a total of four concentrations
Effect measured	Survival
Analysis	Calculate 96-hour LC_{50} and NOEC
Sample holding time	Elutriates used within 24 hours of preparation; sediment <8 weeks, held at 4 ±2°C
Analytical support	In all treatments, daily measurement of dissolved oxygen, pH, salinity. Ammonia in the controls and undiluted elutriate at the start and end of assay.
Test acceptability	≥90% survival in laboratory water control

5.2 Whole Sediment Bioassays

Bioassays with whole sediment are designed to determine whether the dredged material is likely to produce unacceptable adverse effects on benthic organisms by exposing the organisms to the whole sediment for 10 days. Estuarine amphipods (*Leptocheirus plumulosus)* and mysid shrimp (*Americamysis bahia*) will be used in the whole sediment bioassays. Tests will be performed using the

SWP sediment, the reference site sediment, and a control sediment. Whole sediment bioassays for the reference site sediment and the control sediment will be performed simultaneously with testing of the SWP sediment.

Tests will consist of five replicates per species. Water for bioassays will consist of clean, uncontaminated seawater or an artificial sea salt mixture that does not exceed USEPA WQC for marine species. Prior to testing, all sediments will be sieved to remove indigenous organisms. Standard protocol will be followed regarding feeding the organisms during the test (e.g., test organisms will not be fed during the 10-day test). Summaries of the testing conditions for the amphipod (*Leptocheirus plumulosus*) and mysid shrimp (*Americamysis bahia*) whole sediment bioassays are provided in Tables 5-5 and 5-6, respectively.

If ammonia concentrations are elevated, ammonia concentrations will be reduced prior to testing. For amphipods, interstitial total and un-ionized ammonia concentrations must be less than 60 milligrams per liter (mg/L) and 0.8 mg/L, respectively. If elevated, ammonia reduction procedures described in the RIM (USEPA and USACE 2004) will be followed. For each test with elevated ammonia, test sediments will be purged by manually exchanging the overlying seawater in each test chamber twice daily. Additional water quality replicates will be set up and used to monitor interstitial ammonia throughout the purging. Once all ammonia concentrations meet the criteria, test organisms will be placed into the test chambers and the test will proceed as a static test, according to the procedures previously described. In accordance with the RIM (USEPA and USACE 2004), total ammonia concentrations should be reduced to 20 mg/L to ensure they remain within the required protocol range during testing.

5.2.1 Amphipod (Leptocheirus plumulosus) Bioassays

Amphipods (*Leptocheirus plumulosus*) will be exposed to sediments for 10 days under static conditions with continuous light. The test temperature will be maintained at 25°C plus or minus 1°C. Test chambers will be 1-liter (L) glass beakers or jars with approximately 200 mL of sediment and 700 mL of overlying seawater or artificial seawater mixture. There will be five replicates per treatment. Organisms will be fed prior to the initiation of the test.

At test initiation, 20 organisms will be placed into each replicate. Test chambers will be randomized and gently aerated during testing. Organisms will not be fed for the duration of the test but will be fed prior to the initiation of the test. Water quality parameters will be measured daily during testing. After 10 days, organisms will be sieved from the sediment and survivorship will be recorded. Test acceptability will be evaluated by survivorship in the control, which should be at least 90%. In addition, the test must meet requirements listed in Table 11.3 of *Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods* (Schlekat et al. 1994). If the test does not meet control acceptability criteria, it will be repeated.

Minimum survival in the reference sediment must be at least 75%. If survival does not meet this criterion, test results will be compared to the control to provide a conservative level of protection. The relative sensitivity of each batch of amphipods (*Leptocheirus plumulosus*) will be assessed by conducting a 96-hour water-only reference toxicant test.

Table 5-5
Summary of Test Conditions for the Whole Sediment Acute Bioassays for Marine Amphipods (*Leptocheirus plumulosus*)

Test Parameter	Test Conditions
Test type	Static, non-renewal
Test duration	10 days
Temperature	25 ±1°C daily mean temperature; not exceeding ±3°C of target temperature
Light quality	Wide-spectrum fluorescent
Light intensity	500 to 1,000 lux
Photoperiod	16 hours light, 8 hours dark
Salinity	20 ±2 ppt
Test chamber size	1,000 mL beaker
Test volume	700 mL overlying water (approximately)
Sediment depth	200 mL (approximately)
Renewal of test solutions	None
Age of test organisms	Sub-adult, 3 to 5 millimeters per organism, mixed sexes
Number of organisms per test chamber	20
Number of replicates per treatment	Minimum of five for endpoint determination; one for water quality observations
Number of organisms per treatment	100
Feeding	None
Test solution aeration	Aeration in all chambers and maintained at 60% saturation
Overlying water	Artificial seawater or as specified in the SAP/QAPP
Treatments	Project sediment, reference sediment, control sediment
Endpoint	Survival
Sample holding time	8 weeks, held at 4 ±2°C
Analytical support	Measurement of ammonia in porewater and overlying water from a surrogate for each treatment at start, at day 3 and at end of assay. Daily measurement of dissolved oxygen, pH, salinity, and temperature in overlying water of each test vessel on day 0 and day 10; in surrogate vessel for days 1 through 9 prior to daily water renewal. Hourly temperature readings in one surrogate vessel.
Test acceptability	≥ 90% mean survival in control; consistent with Table A1.3 (ASTM 2004) and Table 11.3 (Schlekat et al. 1994)

5.2.2 Mysid Shrimp (*Americamysis bahia*) Bioassays

Mysid shrimp (*Americamysis bahia*) tests will be conducted with 1- to 5-day-old organisms. Mysid shrimp (*Americamysis bahia*) will be exposed to sediments for 10 days under static conditions, with a 16-hour-light/8-hour-dark photoperiod. The test temperature will be maintained at 20°C plus or minus 1°C. Test chambers will be 1 L glass beakers or jars with approximately 200 mL of sediment and 700 mL of overlying seawater or artificial seawater mixture. There will be five replicates per treatment. At test initiation, 5 to 10 organisms will be placed into each replicate. Test vessels will be randomized and gently aerated during testing. Organisms will not be fed for the duration of the test but will be fed prior to the initiation of the test.

Water quality parameters will be measured daily during testing. After 10 days, organisms will be sieved from the sediment and survivorship will be recorded. Test acceptability will be evaluated by survivorship in the control, which should be at least 90% (at least 80% in the individual replicates). If the test does not meet control acceptability criteria, it will be repeated. The relative sensitivity of each batch of mysid shrimp (*Americamysis bahia*) will be assessed by conducting a 96-hour, water-only reference toxicant test.

Table 5-6
Summary of Test Conditions for the Whole Sediment Acute Bioassays for Mysid Shrimp (*Americamysis bahia*)

Test Parameter	Test Conditions
Test type	Static, non-renewal
Test duration	10 days
Temperature	20 ±1°C daily mean temperature; not exceeding 18 to 22°C
Light quality	Wide-spectrum fluorescent
Light intensity	100 to 1,000 lux
Photoperiod	16 hours light, 8 hours dark
Salinity	30 ±2 ppt
Test chamber size	1,000 mL beaker
Test volume	700 mL overlying water (approximately)
Sediment depth	200 mL (approximately)
Renewal of test solutions	None
Age of test organisms	<5 days post-hatch with <24 hours variation
Number of organisms per test chamber	Five
Number of replicates per treatment	Minimum of five for endpoint determination; one for water quality observations
Number of organisms per treatment	Five to eight
Feeding	None
Test solution aeration	Aeration in all chambers and maintained at 60% saturation

Test Parameter	Test Conditions
Overlying water	Artificial seawater or as specified in the SAP/QAPP
Treatments	Project sediment, reference sediment, and control sediment
Endpoint	Survival
Sample holding time	8 weeks, held at 4 ±2°C
Analytical support	Measurement of ammonia in porewater and overlying water from a surrogate for each treatment at start, at day 5, and at end of assay. Daily measurement of dissolved oxygen, pH, salinity, and temperature in overlying water of a surrogate for each treatment prior to water renewal. Hourly temperature measurement in a surrogate test vessel.
Test acceptability	≥ 90% survival in control, with >80% survival in individual replicates

5.3 Bioaccumulation Testing

The bioaccumulation studies will consist of 28-day whole sediment assays using bent-nose clams (*Macoma nasuta*) and worms (*Nereis virens*). Aquatic organisms to be used in the bioaccumulation tests were selected because they ingest sediments and survive equally well in dredged material and control and reference sediments. The bent-nose clam (*Macoma nasuta*) and worm (*Nereis virens*) species were selected based on the recommendation in the RIM (USEPA and USACE 2004) identifying these species as the primary benchmark species for near coastal waters that can also be used in estuarine waters down to appropriate low levels of salinity.

Tests will be performed using SWP sediment, reference site sediment, and a control sediment. Bioaccumulation tests for the reference site sediment and the control sediment will be performed simultaneously with the testing of the SWP sediment. Tests will consist of five replicates per species. Overlying water will consist of clean, uncontaminated seawater or an artificial sea salt mixture that does not exceed USEPA WQC for marine species (USEPA 2016). Prior to testing, all sediments will be sieved to remove indigenous organisms. Summaries of the testing conditions for the worm (*Nereis virens*) and clam (*Macoma nasuta*) bioaccumulation tests are provided in Tables 5-7 and 5-8, respectively.

The number of organisms used in the bioaccumulation tests will be dictated by the minimum amount of tissue that is required for analysis, and depends on the analytes, matrices, detection limits, and particular analytical laboratory. A minimum of 20 organisms per replicate is required for each test chamber, although more organisms may be required to conduct the specified tissue analyses at the end of the test exposure. All tissues will be depurated for 24 hours prior to freezing.

Target chemical analytes for tissue analysis will be selected following the receipt of the sediment chemistry results and discussions with USACE and USEPA. Pretest tissue (tissue from organisms not used in the bioaccumulation exposures representing time zero) will be retained for chemical analysis to evaluate the concentration of target analytes of the organisms prior to exposure to test sediments.

5.3.1 Worm (*Nereis virens*) Bioaccumulation

Organisms will be exposed to sediments for 28 days under flow-through or static-renewal conditions. The test temperature will be maintained at 10°C plus or minus 5°C. There will be five replicates per treatment. Test chambers will be randomized and gently aerated. At test initiation, at least 20 organisms will be placed into each replicate, although more may be necessary to obtain sufficient tissue for chemical analysis. Water quality parameters will be measured daily during testing. After 28 days, organisms will be sieved from the sediment and survivorship will be recorded. Test acceptability will be evaluated by survivorship, which should be at least 90% in the control and reference, and 75% in the test treatments. If the test does not meet control acceptability criteria, USACE and USEPA will be notified immediately. Surviving worms (*Nereis virens*) will be rinsed with clean seawater and depurated. After 24 hours, organisms will be placed into appropriately sized precleaned sample containers and immediately frozen. The frozen organisms will be shipped on dry ice to the appropriate laboratory for analysis of potential contaminants.

Table 5-7
Summary of Test Conditions for the Bioaccumulation Tests for Worms (*Nereis virens*)

Test Parameter	Test Conditions
Test type	Flow through (minimum of 6 volume additions per day) or static renewal
Test duration	28 days
Temperature	12 to 16 ±2°C daily mean temperature; not exceeding ±3°C of target temperature
Light quality	Cool-white fluorescent
Light intensity	100 to 1,000 lux; ambient laboratory levels
Photoperiod	16 hours light, 8 hours dark
Salinity	30 ±2 ppt
Test chamber size	38 L (10 gallon) aquaria
Test volume	20 to 30 L overlying water
Sediment depth	5 centimeters (minimum); approximately 6 L per vessel
Age of test organisms	Adult, 3 to 15 gram per organism
Number of organisms per test chamber	20 (minimum)
Number of replicates per treatment	5 (minimum)
Number of organisms per treatment	100
Feeding	May be fed up to two times during the test
Test solution aeration	Aeration in all chambers and maintained at 60% saturation
Overlying water	Artificial seawater or as specified in the SAP/QAPP

Test Parameter	Test Conditions
Renewal of overlying water	Flow through = 5 to 10 volumes/day Static = 3 times a week
Treatments	Project sediment, reference sediment, control sediment
Effect measured	Survival and bioaccumulation
Analysis	Statistical comparison of survival and body burdens
Sample holding time	8 weeks, held at 4 ±2°C
Analytical support	Daily measurement of dissolved oxygen, pH, salinity, and temperature in overlying water of all chambers. Hourly temperature readings in one surrogate vessel.
Test acceptability	≥ 90% survival in control and reference sediments; ≥ 75% survival in the test treatments; sufficient tissue mass for analysis

5.3.2 Bent-Nose Clam (Macoma nasuta) Bioaccumulation

Bent-nose clams (*Macoma nasuta*) will be exposed to sediments for 28 days under flow-through or static-renewal conditions. The test temperature will be maintained at 12°C to 16°C plus or minus 1°C. There will be five replicates per treatment. Test chambers will be randomized and gently aerated. At test initiation, at least 20 organisms will be placed into each replicate, although more may be necessary to obtain sufficient tissue for chemical analysis. Water quality parameters will be measured daily during testing. After 28 days, organisms will be sieved from the sediment and survivorship will be recorded. Test acceptability will be evaluated by survivorship, which should be at least 90% in the control and reference, and 75% in test treatments. If the test does not meet control acceptability criteria, USACE and USEPA will be notified immediately. Surviving bent-nose clams (*Macoma nasuta*) will be rinsed with clean seawater and depurated. After 24 hours, organisms will be placed into appropriately sized precleaned sample containers and immediately frozen. The frozen organisms will be shipped on dry ice to the appropriate laboratory for analysis of potential contaminants.

Table 5-8
Summary of Test Conditions for the Bioaccumulation Tests for Bent-Nose Clams (*Macoma nasuta*)

Test Parameter	Test Conditions
Test type	Flow through (minimum of 6 volume additions per day) or static renewal
Test duration	28 days
Temperature	12 to 16 ±2°C daily mean temperature; not exceeding ±3°C of target temperature
Light quality	Cool-white fluorescent
Light intensity	100 to 1,000 lux; ambient laboratory levels
Photoperiod	16 hours light, 8 hours dark

Test Parameter	Test Conditions
Salinity	30 ±2 ppt
Test chamber size	38 L (10 gallon) aquaria
Test volume	20 to 30 L overlying water
Sediment depth	5 centimeters (minimum); approximately 6 L per vessel
Age of test organisms	2 to 4 years old; 28 to 45 mm shell length
Number of organisms per test chamber	20 (minimum)
Number of replicates per treatment	5 (minimum)
Number of organisms per treatment	100
Feeding	None
Test solution aeration	Aeration in all chambers and maintained at 60% saturation
Overlying water	Artificial seawater or as specified in this SAP/QAPP
Renewal of overlying water	Flow through = 5 to 10 volumes/day Static = 3 times a week
Treatments	Project sediment, reference sediment, and control sediment
Effect measured	Survival and Bioaccumulation
Analysis	Statistical comparison of survival and body burdens
Sample holding time	8 weeks, held at 4 ±2°C
Analytical support	Daily measurement of dissolved oxygen, pH, salinity, and temperature in overlying water of all chambers. Hourly temperature readings in one surrogate vessel.
Test acceptability	≥ 90% survival in control and reference sediments; ≥ 75% survival in the test treatments; sufficient tissue mass for analysis

5.4 Ecotoxicological Laboratory Data Interpretation and Reduction

Final reports generated by the laboratories are subjected to QA review by Anchor QEA before they are sent to clients. Reports are reviewed for completeness, accuracy, and conformance with study plans, testing protocols, and approved guidelines and procedures. A QA Report Review Form is completed specific to the requirements of each test as part of the review process. A Report QA Record accompanies the report to document that QA/QC requirements have been met and the report is approved. Data generated in the laboratory, including bench sheets, reports, tables, and raw data, are stored in the respective client files for a minimum of 5 years.

5.4.1 Whole Sediment Bioassay Toxicity Test Data

RIM and OTM guidance require that sediment results be compared with reference sediment results to determine the potential impact of whole sediment on benthic organisms at and beyond the boundaries at the placement site. The comparative guidelines for acceptance are as follows:

- If survival in test sediment is greater than survival in reference sediment, test sediments are not acutely toxic to benthic organisms.
- If the difference between survival in reference sediment and survival in test sediment is not more than 20% for amphipods (*Leptocheirus plumulosus*) and not more than 10% for other test species, test sediments are not acutely toxic to benthic organisms.
- If the difference between survival in reference sediment and survival in test sediment is greater than 20% for amphipods and 10% for other test species, then survival in the test sediment must be compared statistically to survival in the reference sediment. If a difference is found, then the test sediments are considered to be acutely toxic to benthic organisms and do not meet the LPC requirements to ocean placement.

5.4.2 Water Column Toxicity Test Data

RIM (USEPA and USACE 2004) and OTM (USEPA and USACE 1991) guidance require that test results be compared with laboratory control results to determine the potential impact of sediment elutriates on water column organisms within the mixing zone during placement activities. Comparative guidelines for acceptance are as follows:

- If survival in the 100% elutriate prepared from test sediment is equal to or greater than survival in the control or the natural seawater dilution, the dredged material is not predicted to be acutely toxic to water column organisms.
- If survival in the 100% elutriate prepared from test sediment is no more than 10% less than survival in the natural seawater dilution, there is no need for statistical analyses and no indication of water column toxicity attributable to the test sediments.
- If the difference in survival between the 100% elutriate prepared from test sediment and the natural seawater dilution is greater than 10%, then data must be evaluated statistically to determine toxicity. A LC_{50} or EC_{50} should be calculated; however, if there is no effect greater than 50%, the LC_{50} or EC_{50} is assumed to be greater than or equal to 100%. If LC_{50} or EC_{50} values are calculated, OTM guidelines specify conducting a comparison with water quality standards (USEPA and USACE 1998). A dilution model (i.e., STFATE) will be used to determine the concentration of dissolved and suspended contaminants, after allowance of mixing. The guidelines stipulate that water column concentrations must not exceed 1% of the LC_{50} or EC_{50} outside the mixing zone.

5.4.3 Bioaccumulation Data

Bioaccumulation results will be evaluated in accordance with guidelines described in the OTM (USEPA and USACE 1991) and RIM (USEPA and USACE 2004). Mean tissue concentrations will be calculated using the five replicates for each species. Details on the treatment of non-detects in this calculation are in Section 4.4.1. Data for organic constituents will be lipid-normalized prior to calculation of mean tissue concentrations.

Concentrations of target analytes in the worm (*Nereis virens*) and bent-nose clam *(Macoma nasuta*) tissue will be statistically compared to pretest (day 0) tissue concentrations. If tissue concentrations of organisms exposed to test sediment do not statistically exceed the pretest tissue concentrations, then the dredged material meets the LPC requirements for bioaccumulation and may be suitable for open-ocean placement and no additional evaluation is required.

Concentrations of target analytes in the worm (*Nereis virens*) and bent-nose clam *(Macoma nasuta*) tissue that statistically exceed the pre-exposure concentrations will be compared to applicable USFDA action/guidance/tolerance levels (USFDA 2000) for poisonous or deleterious substances in fish and shellfish for human food, where such levels have been set. The USFDA levels are derived from risk assessment evaluations for application as critical limits for determining the acceptability of aquatic organisms as food sources to humans. Food lots that exceed the USFDA action/guidance/tolerance levels are removed from the marketplace and are not considered safe for human consumption. The USFDA levels are generally applicable to shellfish, as well as finfish.

The USFDA levels do not indicate the potential for environmental impact on the contaminated organisms or the potential for biomagnification. Because contamination of food exceeding USFDA levels is considered a threat to human health, USEPA and USACE consider concentrations in excess of such levels in any test species to be predictive of benthic bioaccumulation of contaminants (USEPA and USACE 1998). If tissue-residue concentrations are statistically higher than an USFDA action/guidance/tolerance level (USFDA 2000), then the dredged material is not suitable for open-water or ocean placement.

USFDA levels exist for arsenic, cadmium, chromium, lead, mercury, and nickel. For substances with USFDA action levels, the criteria values will be compared to the one-tailed upper 95% UCLM tissue-residue concentrations for each sample. If the UCLM is below the criterion value (indicating a 95% probability that the population mean tissue-residue concentration for the sample is below the criterion value), it is concluded that the criterion value has not been exceeded.

If tissue concentrations are greater than pretest tissue concentrations, results will be compared to tissue concentrations of organisms exposed to reference sediment. If tissue concentrations of organisms exposed to test sediment do not statistically exceed those of organisms exposed to reference sediment, then the dredged material meets the LPC requirements for bioaccumulation and may be suitable for open-ocean placement.

If tissue concentrations of organisms exposed to test sediment are statistically elevated compared to the organisms exposed to reference sediment, results will first be compared to bioaccumulation screening levels developed by USEPA, specifically the ecological non-specific effects thresholds (Appendix H of the SERIM [USEPA and USACE 2008]). Constituents with mean concentrations lower than the ecological non-specific threshold value will be interpreted as not predictive of an adverse effect, and dredged material placement in the MBDS will not result in bioaccumulation above the existing ambient level. Therefore, these constituents met the LPC for benthic bioaccumulation.

If tissue concentrations exceed the background bioaccumulation screening levels, concentrations will be further assessed using a weight-of-evidence approach to determine compliance with the LPC. The weight-of-evidence approach will include the following components:

- Evaluation of analytical variability (e.g., number of non-detects in the dataset, calculation of total PAHs and total PCBs using RLs)
- Evaluation using the eight criteria listed in the OTM (e.g., toxicological importance of contaminants, magnitude of exceedance, and propensity to biomagnify [USEPA and USACE 1991])

5.5 Data Evaluation

In the water column bioassays, survival will be the endpoint for the myside shrimp (*Americamysis bahia*) and fish (inland silverside; *Menidia beryllina*) tests and development will be the endpoint for the purple sea urchin tests (*Arbacia punctulata*). For the water column bioassays, LC_{50} and EC_{50} will be calculated for survival and effect data, respectively. Results will be statistically compared to the laboratory control samples (LCSs).

In the whole sediment tests, survival will be the endpoint for the amphipod (*Leptocheirus plumulosus*) and mysid shrimp (*Americamysis bahia*) tests. Dredged material is predicted to be acutely toxic to benthic organisms when mean test organism mortality meets the following criteria:

- Is statistically greater than in the reference site sediment
- Exceeds mortality (or other appropriate end point) in the reference site sediment by at least 10% (or 20% for amphipods)

For the 28-day bioaccumulation tests, survival in the project samples will be statistically compared to survival in the reference sediment to determine if survival is significantly lower than the reference sediment.

6 Quality Assurance Project Plan

The goal of this SAP/QAPP is to ensure that data of sufficiently high quality are generated to support the DQOs for the project. This section describes project management responsibilities, sampling and analytical QA/QC procedures, assessment and oversight, and data reduction, verification, and reporting. Field and laboratory activities must be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for the USEPA Contract Laboratory Program (USEPA 1986, 1999, 2004, and 2008).

A QC program is a systematic process that controls the validity of analytical results by measuring the accuracy and precision of method and matrix, developing expected control limits, using these to detect anomalous events, and requiring corrective action techniques to prevent or minimize the recurrence of these events. QC measurements for analytical protocols are designed to evaluate laboratory performance and measure biases resulting from the sample matrix and field performance. The QC program includes the following components:

- **Laboratory method performance:** All QC criteria for method performance must be met for all target analytes for data to be reported. These criteria generally apply to instrument tune, calibration, method blanks, and LCS. In some instances where method criteria fail, usable data can be obtained and are reported with client approval. The narrative will then include a thorough discussion of the impact on data quality.
- **Sample performance:** The accuracy and precision of sample analyses are influenced by internal and external factors. Internal factors are those associated with sample preparation and analysis. Internal factors are monitored using internal QC samples. QC field samples are analyzed to determine any measurement bias due to the sample matrix based on evaluation of MS, MSD, and/or matrix duplicates. If acceptance criteria are not met, matrix interferences are confirmed either by reanalysis or by inspection of the LCS results to verify that laboratory method performance is in control. Data are reported with appropriate qualifiers or discussion.
- **Field performance:** QC samples are used to evaluate the effectiveness of the sampling program to obtain representative samples, eliminating any cross-contamination. These include field replicates and field blanks.

Once data are received from the laboratory, QC procedures will be followed to provide an accurate evaluation of data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness. A USEPA Stage 2A data quality review will be performed in accordance with the National Functional Guidelines (USEPA 1999, 2004, and 2008) and this SAP/QAPP. All chemical data will be reviewed for the following, as appropriate, to the particular analyses:

- COC documentation

- Holding times
- Method blanks
- Detection limits
- RLs
- Surrogate recoveries
- MS/MSD recoveries
- LCS recoveries
- Laboratory and field duplicate relative percent differences (RPDs)

The results of the data quality review, including text assigning qualifiers in accordance with the National Functional Guidelines (USEPA 1999, 2004, and 2008) and a tabular summary of qualifiers, will be generated by the Anchor QEA Data Manager and submitted to the Anchor QEA QA Manager for final review and confirmation of the validity of the data. A copy of the validation report will be submitted by the QA Manager and will be presented as an appendix to the final report.

6.1 Chain-of-Custody Requirements

Samples are physical evidence and will be handled according to certain procedural safeguards. For the purposes of legal proceedings, a showing to the court that the laboratory is a secure area may be all that is required for the analyzed evidence to be admitted. However, it is anticipated that in some cases, the court may require a showing of the hand-to-hand custody of the samples from sampling through disposal.

Although the laboratories are not involved in sampling activities, if the court requires such a comprehensive COC demonstration, then the laboratory is prepared to produce documentation that traces the in-house custody of the samples from the time of receipt to the completion of the analysis.

The National Enforcement Investigations Center of USEPA defines evidence of custody in the following ways:

- It is in your actual possession.
- It is in your view, after being in your physical possession.
- It was in your possession and then you placed it in a secure area to prevent tampering.
- It is in a secure area.

The COC procedure begins with the preparation of the sample containers and preservatives to be used in sample collection. For this program, the laboratory will purchase and distribute precleaned sample containers with chemical preservatives. Vendors are required to provide documentation of analysis for each lot of containers, and the documentation is kept on file in the laboratory Sample Management Office.

Sample kits, which are coolers containing COC forms, custody seals, sample containers, preservatives, and packing material, are prepared by the Sample Management Office.

The importance of sample labeling is critical to the success of this program. Improperly labeled samples lead to questions regarding location, project, sampling station, date sampled, and sampler's initials. All this information is essential for proper sample handling.

While in the field, Anchor QEA personnel will document sediment samples collected on project-specific COC forms. This form provides sample-specific information and a listing of the parameters required on each sample. The COC form and appropriate field datasheets are sealed in a water-tight plastic bag and shipped with the samples to the laboratories.

COC forms will be filled out and accompany samples at all times during transport from the field operations area to the laboratory. The Field Team Leader or a designee will be responsible for all sample tracking and COC procedures. This person will be responsible for final sample inventory, maintenance of sample custody documentation, and completion of COC and sample tracking forms prior to transferring samples to the laboratory. The forms will note the sample identification and date and time of collection. Each sample will be identified by a unique alphanumeric system (see Section 3.7.3).

A COC form will accompany each cooler of samples to the analytical and ecotoxicological laboratories. Each person who has custody of the samples will sign the COC form and ensure the samples are not left unattended unless properly secured. Copies of all COC forms will be retained in the project files and will be attached to the final report. After samples are logged in at the laboratory and assigned a unique laboratory identification number, they will be stored, handled, processed, and analyzed as described in the QA manuals and/or SOPs of the testing laboratories.

The laboratory has a designated Sample Management Officer. This individual is responsible for receiving samples in the laboratory, opening the coolers to check the sample integrity and the custody seal, logging samples into the laboratory system, and controlling the handling and storage of samples while in the laboratory.

Upon receipt at the laboratory, the Sample Management Officer or designated Laboratory Sample Custodian inspects the samples for integrity and checks the shipment against the COC form. Cooler temperatures are checked and documented on the laboratory's cooler receipt form. The pH of preserved samples (except organics) is measured and documented on the cooler receipt forms, which are maintained in the project records. Discrepancies are addressed at this point, documented on the cooler receipt form, and resolved prior to laboratory analysis. When the shipment and the COC form are in agreement, the Laboratory Sample Custodian enters the sample and analysis information into the LIMS and assigns each sample a unique laboratory number.

This number is affixed to each sample bottle. The original COC form is given to the laboratory data management group, and the information it contains is copied to the appropriate laboratory operation areas. These log-in procedures are documented in the sample management SOPs of each analytical laboratory.

Alpha Analytical and Aquatec will retain all remaining unused sample volume under appropriate temperature and light conditions, at least until the data generated from the samples undergo Anchor QEA's QA/QC reviews and are approved as acceptable. Archive samples will be retained until the final report is submitted. Approval by the Anchor QEA Project Manager will be obtained prior to disposal of any sediment or tissue sample if disposal is needed before the final report is submitted. Samples will be disposed of according to federal, state, and local laws.

6.2 Analytical Quality Control

6.2.1 Laboratory Report

Analytical data records will be retained by the laboratory and stored electronically in the Anchor QEA project file and project database. Because data are a direct electronic output from the LIMS, hardcopy data packages will not be requested or stored for this project. The analytical laboratory will be required, where applicable, to report the following:

- **Project narrative**: This summary, in the form of a cover letter, will discuss any problems encountered during any aspect of analysis. This summary should discuss, but is not limited to, QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions, will be documented in as much detail as appropriate.
- **COC records**: Legible copies of the COC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of the sample custody by the laboratory will also be documented on a sample receipt form. The form must include all sample shipping container temperatures measured at the time of sample receipt.
- **Sample results**: The data package will summarize the results for each sample analyzed. The summary will include the following information, when applicable:
  - Field sample identification code and the corresponding laboratory identification code
  - Sample matrix
  - Date of sample extraction
  - Date and time of analysis
  - Analytical method
  - Weight and/or volume used for analysis
  - Final dilution volumes or concentration factor for the sample

  - Identification of the instrument used for analysis
  - MDLs
  - Method RLs accounting for sample-specific factors (e.g., dilution)
  - Analytical results with reporting units identified
  - Data qualifiers and their definitions
- **QA/QC summaries**: This section will contain the results of the laboratory QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results. No recovery or blank corrections will be made by the laboratory. The required summaries are listed below; additional information may be requested:
  - **Method blank analysis**: The method blank analysis associated with each sample and the concentration of all compounds of interest identified in these blanks will be reported.
  - **Surrogate spike recovery**: All surrogate spike recovery data for organic compounds will be reported. The name and concentration of all compounds added, percent recovery (%R), and range of recovery will be listed.
  - **MS recovery**: All MS recovery data for organic and metal compounds will be reported. The name and concentration of all compounds added, %R, and range of recovery will be listed.
  - **Matrix duplicate**: This information will include the %R and associated RPD for all matrix duplicate analyses.
  - **LCS**: All LCS recovery data for organic and metal compounds will be reported. The name and concentration of all compounds added, %R, and range of recovery will be listed. The RPD for all duplicate analyses will be included.

6.2.2 Quality Control Samples

Laboratory QC procedures include initial and continuing instrument calibrations, LCSs, standard reference materials (SRMs), laboratory replicates MS/MSD samples, surrogate spikes (for organic analyses), and method blanks. Laboratory QC objectives and acceptance criteria are listed in Table 7.1. In addition, QC criteria for the precision and accuracy for MS, MSD, surrogates, and LCSs are also provided in Table 6-1. SRMs will be obtained from National Institute of Standards and Technology (NIST) or a comparable source, if available.

SRMs represent performance-based QA/QC. The SRM is a sediment, tissue, or solution with a certified concentration that is analyzed as a sample and is used to monitor analytical accuracy. The analytical results for the SRMs are evaluated against the certified concentrations. If the certified concentrations are less than 10 times the MDL established for the method, then the SRM result will not be evaluated. The results of the SRMs are included with the associated analytical data.

The method (reagent) blank is used to monitor laboratory contamination. This is usually a sample of laboratory reagent water or standard solid material processed through the same analytical procedure as the sample (i.e., digested, extracted, and distilled). One method blank is analyzed at a frequency of one per every analytical preparation batch of 20 or fewer samples.

LCSs are analyzed to assess possible laboratory bias at all stages of sample preparation and analysis. The LCS is a fortified method blank consisting of reagent water or solid fortified with the analytes of interest for single-analyte methods and selected analytes for multi-analyte methods, according to the appropriate analytical method. They are prepared and analyzed with each analytical batch, and the analyte recoveries are used to monitor analytical accuracy and precision.

A fortified sample, or MS, is an aliquot of a field sample that is fortified with the analytes of interest and analyzed to monitor matrix effects associated with a particular sample. Samples to be spiked are chosen at random or assigned by the client. The final spiked concentration of each analyte in the sample should be at least 10 times the calculated MDL. Depending on the test, one duplicate fortified sample, or MSD, will be performed for every 20 project samples.

Sample duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates are subsamples of the original sample that are prepared and analyzed as a separate sample. Depending on the test, one sample duplicate will be performed for every 20 project samples.

Surrogates are organic compounds that are similar to analytes of interest in chemical composition, extraction, and chromatography but are not normally found in environmental samples. These compounds are spiked into all blank, standards, samples, and spiked samples prior to analysis for organic parameters. Generally, surrogates are not used for inorganic analyses. Percent recoveries are calculated for each surrogate. Surrogates are spiked into samples according to the method requirements. Surrogate spike recoveries are evaluated against the laboratory control limits and are used to assess method performance and sample measurement bias. If sample dilution causes the surrogate concentration to fall below the quantitation limit, surrogate recoveries will not be evaluated.

Frequency of analysis for laboratory QA/QC samples are presented in Table 6-2. When analyzing chemical parameters, USEPA methods require that initial calibrations must be completed before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet acceptance criteria. Ongoing calibrations are required at the frequencies listed in Table 6-2. Surrogates are required for all organic methods.

All samples will be diluted and reanalyzed if target compounds are detected at levels that exceed their respective established calibration ranges. Any sample cleanup procedure will be conducted prior to the dilutions. If surrogate, internal standard, or spike recoveries are outside of the laboratory QC limits, reanalysis will be performed. QC samples may be reanalyzed if results are not within control limits and the cause cannot be determined to be the sample matrix.

Results of QC samples from each group will be reviewed by the analyst immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are grossly exceeded in the sample group, the Laboratory QA/QC Manager will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

Table 6-1
Laboratory Quality Control Objectives

Parameter	Precision (Duplicates)	Laboratory Control Spike Recoveries	Matrix Spike Recoveries	Completeness
Grain size	± 20% RPD	N/A	N/A	90%
Specific gravity, bulk density, and Atterberg limits	± 20% RPD	N/A	N/A	90%
Total solids	± 20% RPD	N/A	N/A	90%
Lipids	± 20% RPD	N/A	N/A	90%
TOC	± 20% RPD	75–125 %R	75–125 %R	90%
Ammonia	± 20% RPD	75–125 %R	75–125 %R	90%
Total sulfide and cyanide	± 20% RPD	75–125 %R	75–125 %R	90%
Metals	± 30% RPD	70–130 %R	70–130 %R	90%
PAHs	± 30% RPD	50–150 %R	50–150 %R	90%
Pentachlorophenol	± 30% RPD	50–150 %R	50–150 %R	90%
PCB congeners	± 30% RPD	50–150 %R	50–150 %R	90%
Chlorinated pesticides	± 35% RPD	50–150 %R	50–150 %R	90%
Extractable petroleum hydrocarbons	± 30% RPD	50–150 %R	50–150 %R	90%
VOCs	± 30% RPD	50–150 %R	50–150 %R	90%

Table 6-2
Laboratory Quality Control Sample Analysis Frequency

Analysis Type	Initial Calibration	Ongoing Calibration	LCS/SRM[1]	Replicates	MSs	MSDs	Method Blanks	Surrogate Spikes
Ammonia	Each batch	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A	1 per 20 samples	N/A
Cyanide/total sulfide	Each batch	N/A	1 per 20 samples	N/A	N/A	N/A	1 per 20 samples	N/A
Grain size/specific gravity/ bulk density/Atterberg limits	Each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A
Total solids	Each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A
Lipids	Each batch	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A
TOC	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A	1 per 20 samples	N/A
Metals	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A	1 per 20 samples	N/A
PAHs/pesticides/PCB congeners	As needed[2]	Every 12 hours	1 per 20 samples	N/A	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample
Extractable petroleum hydrocarbons	Daily	1 per 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A
VOCs	As needed[2]	Every 12 hours	1 per 20 samples	N/A	1 per 20 samples	1 per 20 samples	1 per 20 samples	Every sample

Notes:
1. When an SRM is available, it may be used in lieu of an LCS.
2. Initial calibrations are considered valid until the continuing calibration no longer meets specifications. At that point, a new initial calibration is performed.

6.3 Ecotoxicological Quality Control

All ecotoxicological tests will incorporate standard QA/QC procedures, per the OTM (USEPA and USACE 1991), to ensure the test results are valid. Standard QA/QC procedures include the use of negative controls, positive controls, reference sediment samples, replicates, and measurements of water quality during testing.

The negative control is used to establish the health of the test organisms and ensure that acceptability criteria are met. For whole sediment bioassays and bioaccumulation testing, control material will consist of clean sediment. Positive controls (i.e., reference toxicant tests) will be used to establish the sensitivity of test organisms.

Proper water quality conditions will be maintained for all tests to ensure organisms survive and do not experience undue stress unrelated to test sediments. If water quality measurements fall outside of the protocol ranges, corrective action will be taken. Laboratory equipment will be maintained, and all instruments will be calibrated regularly. All laboratory work will be documented on approved datasheets.

The ecotoxicological laboratory report will include the following information, where applicable:

- **Project narrative**: This summary, in the form of a cover letter, will discuss any problems encountered during any aspect of testing. This summary should discuss, but is not limited to, QC, sample shipment, sample storage, and testing difficulties.
- **Test methods**: These methods will include a summary of test conditions for each sediment bioassay and bioaccumulation potential test. All methods should be in accordance with guidelines described in this SAP/QAPP, OTM (USEPA and USACE 1991), and RIM (USEPA and USACE 2004), or otherwise noted.
- **Test results**: These results will include a summary of the following information, when applicable:
  - Test dates
  - Source of control material
  - Source of organisms
  - Water quality measurements
  - Appropriate lethal or sublethal endpoint results for each species
  - LC_{50} or EC_{50}, when appropriate
  - Control acceptability statement
  - Summary of reference toxicant test results
- **Statistical analyses**: Statistical analyses will be performed, when applicable.
- **QA/QC summaries**: This summary will include a QC review with any protocol deviations and corrective actions taken.

- **Raw data**: Legible copies of raw datasheets will be used in testing, including water quality, daily observations, and final lethal or sublethal endpoint results.
- **Reference toxicant test data**: These data will include raw datasheets, statistical analyses, and control charts.
- **COC records**: Legible copies of the COC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of each sample received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include all sample shipping container temperatures measured at the time of sample receipt.

6.4 Data Quality Objectives and Criteria

The purpose of this SAP/QAPP is to provide a standard for control and review of measurement data to ensure they are scientifically sound, defensible, and of known acceptable quality. The data will be used to evaluate the physical and chemical attributes of sediments proposed for dredging. The project objective for analytical testing is to characterize sediments representative of the proposed dredging activities regarding physical characteristics and chemical constituents.

The precision, accuracy, representativeness, completeness, and comparability parameters are the characteristics of data quality.

Precision is the mutual agreement among individual measurements of the same property and a measure of the random error component of the data collection process. The overall precision of the data is the sum of that due to sampling and analysis. To determine the analytical precision of the method or laboratory analyst, a routine program of replicate analyses is performed. The results of the replicate analyses are used to calculate the RPD, which is the governing QC parameter for precision.

Precision is represented as the RPD between measurement of an analyte in duplicate samples or in duplicate spikes. RPD is defined in Equation 1 as follows:

Equation 1

$$RPD = \frac{|C_1 - C_2|}{(C_1 + C_2)/2} * 100$$

where:

C_1 = First measurement value

C_2 = Second measurement value

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The percent relative standard deviation (%RSD) is calculated by the standard deviation of the analytical results of the replicate determinations relative to the average of those results for a given analyte. This method of precision measurement can be expressed by the formula presented in Equation 2:

Equation 2

$$\% RSD = \frac{\text{Standard Deviation}}{\text{Mean}} * 100 = \frac{[\sum (X_i - X_{mean})^2 / n - 1]^{1/2}}{(X_1 + X_2 + \ldots X_n)/n} * 100$$

where:

X_i	=	individual value
X_{mean}	=	mean value
n	=	total number of individual values
X_1	=	value 1
X_2	=	value 2
X_n	=	value n

The percent difference (%D) is calculated by expressing, as a percentage, the difference between the original value and new value relative to the original value. This method for precision measurement can be expressed by the formula presented in Equation 3:

Equation 3

$$\% D = \frac{C_1 + C_2}{C_1} * 100$$

where:

C_1	=	Concentration of analyte in the initial aliquot of the sample
C_2	=	Concentration of analyte in replicate

Accuracy is the agreement between a measurement and the true value. It is a measure of the bias or systematic error of the entire data collection process. Sampling accuracy is assessed by evaluating the results of field and trip blanks. To determine the accuracy of an analytical method, a periodic program of LCS spiking is conducted. The results of sample spiking are used to calculate the QC parameter for accuracy evaluation (i.e., the %R).

The %R is defined in by the formula presented in Equation 4:

Equation 4

$$\% R = \frac{A_T - A_O}{A_F} * 100$$

where:

A_T	=	Total amount recovered in fortified sample
A_O	=	Amount recovered in unfortified sample
A_F	=	Amount added to sample

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias assessments for environmental measurements are made using personnel, equipment, and spiking materials or reference materials as independent as possible from those used in the calibration of the measurement system. When possible, bias assessments should be based on analysis of spiked samples rather than reference materials so that the effect of the matrix on recovery is incorporated into the assessment. A documented spiking protocol and consistency in following that protocol are important to obtaining meaningful data quality estimates.

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a quantitative parameter that is most concerned with the proper design and implementation of the sampling program. The sampling program has been designed so the samples collected are as representative as possible of the medium being sampled and so a sufficient number of samples will be collected. Representativeness is addressed by the description of the sampling techniques and the rationale used to select the sampling locations.

Completeness is the adequacy in quantity of valid measurements to prevent misinterpretation and to be valid in proportion to the amount of data collected. For this project, the DQO for completeness is 90%. Data that are qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that are qualified as rejected will not be considered valid for the purpose of assessing completeness.

Completeness will be calculated by the formula presented in Equation 5:

Equation 5

$$\text{Completeness} = \frac{\text{Number of acceptable reported QC data}}{\text{Total number of reported QC data}} * 100$$

Interbatch comparability is the extent to which comparisons among different measurements of the same quantity or quality will yield valid conclusions. For this project, comparability among measurements will be achieved through the use of control limits for LCS.

The objectives for precision and accuracy for each chemical are based on the capabilities of the approved USEPA analytical method with respect to laboratory performance. The quantitative objectives for accuracy and precision for the various parameter groups for laboratory performance and evaluation of sample measurement bias are presented.

6.5 Laboratory Instrumentation

Periodic preventative maintenance is required for all sensitive equipment. In accordance with the QA program, the laboratory shall maintain an inventory of instruments and equipment, and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in their QA Plan, is organized to maintain proper instrument and equipment performance and to prevent instrument and equipment failure during use. The QA program considers instrumentation, equipment, and parts that are subject to wear, deterioration, or other changes in operational characteristics; the availability of spare parts; and the frequency at which maintenance is required. Any equipment that has been overloaded, mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to ensure it is in proper operational condition. Anchor QEA will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. Anchor QEA will also be notified immediately regarding any delays because of instrument malfunctions that could impact holding times.

The analytical laboratory will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. All maintenance will be documented and maintained in permanent records by the responsible individual. The Laboratory QA/QC Manager, or designee, shall be responsible for verifying compliance.

All laboratory instruments used for this investigation will be calibrated according to the method, laboratory QA Manual, SOP, or other National Environmental Laboratory Accreditation Conference (NELAC)-approved method. Proper calibration of equipment and instrumentation is an integral part of the process that provides quality data. Instrumentation and equipment used to generate data must be calibrated at a frequency that ensures sufficient and consistent accuracy and reproducibility. As part of their QC program, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals for laboratory equipment such as balances, drying ovens, refrigerators, and thermometers; and operational calibrations are performed daily, at a specified frequency, or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequency are discussed in the laboratory's QA Plan. Calibrations are discussed in the laboratory SOPs for analyses.

The Laboratory QA/QC Manager will be responsible for ensuring laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program shall be the responsibility of the respective laboratory group supervisors. Recognized procedures (e.g., USEPA, ASTM, or manufacturer's instructions) shall be used when available.

Physical standards (e.g., weights or certified thermometers) shall be traceable to nationally recognized standards, such as the NIST. Chemical reference standards shall be NIST SRMs or vendor-certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions shall be accessible, either in the laboratory SOPs or the laboratory's QA Plan, for each instrument or analytical method in use. Equipment that cannot be calibrated or becomes inoperable will be removed from service. Such equipment must be repaired and satisfactorily recalibrated before reuse. For equipment that fails calibration, analysis cannot proceed until appropriate corrective action is taken and the laboratory analyst achieves an acceptable calibration. This will be documented in a nonconformance memorandum.

Records are prepared and maintained for each piece of equipment subject to calibration. Records demonstrating accuracy of preparation, stability, and proof of continuity of reference standards are also maintained. Records for periodically calibrated equipment are maintained in the instrument logbooks or in the equipment file maintained by the Laboratory Section Supervisor or Department Manager, or designee. Records for periodically calibrated equipment shall include the following information, as appropriate:

- A unique identification number for each type of equipment
- Calibration frequency and acceptable tolerances
- Identification of calibration procedure used
- The date calibration was performed

- The identity of laboratory personnel and/or external agencies performing calibration
- Identification of the reference standards used for calibration
- Certificates or statements of analysis provided by manufacturers and external agencies and traceability to national standards
- Information regarding calibration acceptance or failure and any repair of failed equipment

For instruments and equipment that are calibrated on an operational basis, calibration generally consists of determining instrumental response against compounds of known composition and concentration or the preparation of a standard response curve of the same compound at different concentrations. Records of these calibrations are maintained in the following documents:

- Standard preparation information, to trace the standards to the original source solution of neat compound, is maintained in the LIMS reagent system or laboratory standard preparation logbooks.
- The instrument logbook provides an ongoing record of the calibration undertaken for a specific instrument. The logbook should be indexed in the laboratory operations records but should be maintained at the instrument by the chemist. All entries should be signed and dated by the chemist and reviewed periodically by the Laboratory Section Supervisor or Department Manager, or designees.
- Copies of the raw calibration data are kept with the analytical sample data. In this way, results can be readily processed and verified because the raw data package is complete as a unit. If samples from several projects are processed together, the calibration data are copied and included with each group of data.

6.6 Analytical Laboratory Data Interpretation and Reduction

The analytical laboratory (Alpha Analytical) has established NELAP-approved procedures for data management, collection, validation, reduction, and reporting. As such, the analytical results will be extensively reviewed in house by the laboratories submitting the data.

Each laboratory will submit an electronic data deliverable (EDD) and a hard copy data packet to Anchor QEA. All data tables will be generated from the EDD and will be cross-checked against the hard copy data packet. When a data packet is received by Anchor QEA, it will be reviewed by the QA Manager, with emphasis on NELAC standards. All laboratory reports received will include laboratory QC data generated in the analysis of the project samples, including results of all method blanks, laboratory duplicates/triplicates, MSs, spike duplicates/triplicates, reference material, surrogate spikes, standards, check standards, and calibration verifications.

The analytical results for these QC samples will be reviewed and documented in a data validation report for each analytical data packet received. This report will be incorporated into the final data report. The data validation report consists of a checklist and a case narrative of the analytical runs.

Any nonconformance, QC deficiency, or other problem that would impact data quality will be addressed in the data validation report. If any DQO is not reached, the laboratory will reanalyze the sample(s) and provide documentation for the failed criteria. The data validation report will contain a written record of the validity of each data package and its subsequent use in the report.

6.6.1 Data Collection

For inorganic and general organic analyses where the instruments are not directly coupled to computerized data systems, the raw data are instrument responses in the form of meter, recorder, or printer output. The chemist performing the analysis enters the bench-generated data into a bound laboratory workbook specific for each parameter. All entries are made in indelible ink. These data consist of instrumental responses (e.g., absorbances and percent transmittances), standard and spike concentrations, sample numbers, and any other pertinent information. The workbooks are under the control of the Laboratory Group Supervisor, who is responsible for their security. For computerized instruments, the output is in the form of printer output and files are on magnetic disks, which are filed by sample batch.

For chromatographic organic analyses, the raw data are instrument responses in the form of chromatograms, integrator outputs, or computer-generated data files. The chromatograms and printer output are stored in project-specific files.

6.6.2 Data Reduction

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction includes all processes that change either the values or numbers of data items. The data reduction processes used in the laboratory include establishment of calibration curves, calculation of sample concentrations from instrument responses, and computation of QC.

Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by the Laboratory Project Manager, Laboratory QA Manager, and independent reviewers. Data reduction may be performed manually or electronically. If performed electronically, all software used must be demonstrated to be true and free from unacceptable errors.

6.6.3 Sample Calculation

The reduction of instrument responses to sample concentrations takes different forms for different types of methods. The discussion below deals with nonchromatographic and chromatographic methods and solid sample calculations.

For most spectrophotometric analyses, the sample concentrations are calculated from the measured instrument responses using a calibration curve. The sample concentrations can be back-calculated from a regression equation fitted to calibration data. For gravimetric and titrimetric analyses, the calculations are performed according to equations given in the method. For chromatographic analyses, the unknown concentrations are determined using either calibration factors (external standard procedure) or relative response factors (internal standard procedure). Gas chromatography (GC) analyses are generally quantitated using the external standard technique, and gas chromatography/mass spectrometry (GC/MS) analyses are quantitated using the internal standard technique. These calculations are generally performed by the associated computerized data systems.

The final concentrations will be reported on a dry-weight basis for sediments. To meet program detection limit requirements for several parameters, the percent solids of a sediment sample will be determined prior to analysis, and the method initial weight will be adjusted (up to 50% moisture) to achieve the method initial weight on a dry-weight basis. For sediments where the percent moisture is greater than 50%, an initial sample aliquot equivalent to twice the method initial weight will be used where appropriate.

6.6.4 Reporting Conventions and Units

The number of conventions set forth in the figures for reported data will be consistent with standard laboratory procedures. Reporting units used are those commonly used for the analyses performed. Concentrations in sediment samples are expressed in terms of weight per unit dry weight (e.g., mg/kg [dry], µg/kg [dry]). Concentrations in tissue samples are expressed in terms of weight per unit wet weight (e.g., mg/kg [wet], µg/kg [wet]).

The Laboratory Reports Group receives the data package after the Laboratory Section Supervisor or Department Manager has released it. The Laboratory Reports Group assembles the draft report by collecting and incorporating the following information:

- All the data packages for each analysis associated with the reported samples
- The analytical narratives
- Other report-related information, such as copies of COC forms, communication records, and nonconformance forms

The draft data report is prepared and reviewed by the Laboratory Reports Group. The draft data report is then reviewed by the appropriate Laboratory Project Manager, who signs the report narrative to certify the report meets the DQOs for precision, accuracy, and completeness specified for the project. The report is released to the client, and a copy is archived by the laboratory for a period of 5 years.

6.7 Data Review, Validation, and Verification Requirements

Data verification is a process of evaluating the completeness, correctness, and contractual compliance of a data set against the method standard, SOP, or contract requirements documented in this SAP/QAPP. Data validation is an analyte and sample-specific process that extends the qualification of data beyond data verification to determine the quality of a specific data set.

The internal data verification requirements for this project include the maintenance and periodic review of field documentation (i.e., site logbooks, instrument calibration logs, COC forms, field summary reports, and field modification records) and laboratory analytical data packages.

During the validation process, analytical data will be evaluated for method and laboratory QC compliance and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved, as needed.

Laboratory QC criteria for method performance and sample measurement bias are listed in Table 6-2 and include the following information:

- Holding times
- Initial and continuing calibration
- Laboratory blanks
- Surrogate recoveries
- MS and MSD

In addition to the QC parameters, data are assessed against the stated requirements on the COC and sample handling procedures (Section 3). The reviewers also check that transcriptions of raw or final data are correct and that calculations are performed correctly and verified.

The data review process includes a full first-level technical review by the laboratory analyst during sample analysis and data generation. This is followed by a second-level technical review of the data. The second-level review may be performed by a peer trained in the procedures being reviewed or by the appropriate Laboratory Group Supervisor. Data review checklists are used to document the performance and review of the QC and analytical data. Prior to final release to the client, the data get a final review by the Laboratory Project Manager or designee. This third-level review is to ensure the report is complete and meets project requirements for performance and documentation and to determine that all DQOs have been met. DQOs will be assessed by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability. All reports involving nonconforming data issues must be reviewed by the Laboratory Project Manager and the Laboratory QA Manager. A summary of all nonconformances will be included in the case narrative.

Data validation includes signed entries by the field and laboratory technicians on field datasheets and laboratory datasheets, respectively; review for completeness and accuracy by the Field Team Leader and Laboratory QA Manager; review by the Anchor QEA Data Manager for outliers and omissions; and the use of QC criteria to accept or reject specific data. All data will be entered into the EQuIS database, and a raw data file will be generated. Ten percent verification of the database raw data file, and 100% verification of validation qualifiers applied will be performed by a second Anchor QEA Data Manager or designee. Any errors found will be corrected on the raw data printout sheet. After the raw data are checked, the top sheet will be marked with the date the check is completed and the initials of the person doing the check. Any errors in the raw data file will be corrected, and the database will be established.

All laboratory data will be reviewed and verified to determine whether all DQOs have been met and that appropriate corrective actions have been taken, when necessary. The project QA Manager or designee will be responsible for the final review of all data generated from analyses of samples. During the validation process, analytical data will be evaluated for method QC and laboratory QC compliance and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned.

Data packages will be checked for completeness immediately upon receipt from the laboratory to ensure data and QA/QC information requested are present. Data quality will be assessed by a reviewer using the following current National Functional Guidelines data validation requirements (USEPA 1999, 2004, 2008):

- Holding times
- Method blanks
- Surrogate recoveries
- Detection limits
- RLs
- LCSs
- MS/MSD samples
- SRM results

Data will be validated in accordance with the project-specific DQOs previously described, analytical method criteria, and the laboratory's internal performance standards based on their SOPs.

6.8 Reconciliation with Data Quality Objectives

Data assessment is a systematic process of reviewing data against a set of criteria to identify outliers or errors and to delete suspect values or to flag them for the user. The QC data produced are reviewed by the laboratory analyst, a second laboratory analyst or supervisor (peer review), the Laboratory Reports Group, Laboratory Project Manager, and QA staff throughout sample analysis and data generation using the criteria and procedures described in this section to validate data integrity during collection and reporting of analytical data. Data review checklists are used to document the performance and review of the QC and analytical data.

Review of analytical and QC data is initially performed by the responsible laboratory analyst. The data are checked for errors in transcription, calculations, and dilution factors and for compliance with QC requirements. Failure to meet method performance QC criteria may result in the reanalysis of the sample or analytical batch. After the initial review is completed, the data are collected from summary sheets, workbooks, or computer files and assembled into a data package.

The next level of data review is the responsibility of a second laboratory analyst or supervisor who is charged with a 100% data review of the data package.

The Laboratory Project Manager checks the data packages for completeness and compliancy with the project requirements. The report narrative is generated at this stage of the data review.

The QA Manager is responsible for a 5% review of all laboratory reports and for the review and closure of all nonconformance memoranda.

The following areas will be routinely reviewed at all levels:

- Proper COC and sample-handling procedures are followed
- Parametric holding times are met
- Samples are prepared and analyzed according to specified methods
- Instruments are calibrated according to specified methods
- Spike (surrogate or standard) recoveries are within specified ranges
- Blanks are prepared and analyzed as required
- Calculations are performed correctly and verified
- Transcriptions of raw and final data are correct
- Detection limits are correct

Any problems discovered during the review and the corrective actions necessary to resolve them are communicated to the responsible Section Supervisor or Department Manager, who discusses the findings with the QA Manager for resolution.

The QA/QC program is to be regularly and formally assessed in terms of the adequacy of and compliance with this SAP/QAPP; the effectiveness of established controls, procedures, and systems; and the adequacy of resources to achieve and ensure quality on project activities. Audit activities will correspond to the type of work being evaluated and its significance within the context of the project. Results of auditing activities are to be documented and included in the permanent project file. To the extent practical, on-site audits and reviews are to be conducted during early stages of activities to evaluate the planning, design, execution, and documentation of quality-affecting activities and to help identify and correct problems in a timely manner. Specific audit actions are described in the following sections.

6.9 Analytical Laboratory Assessment and Oversight

The QA/QC program is to be regularly and formally assessed in terms of adequacy and compliance with the program; the effectiveness of established controls, procedures, and systems; and the adequacy of resources to achieve and ensure quality on project activities. Audit activities are to correspond to the type of work being evaluated and its significance within the context of the project. Results of auditing activities are to be documented and included in the permanent project file. To the extent practical, on-site audits and reviews are to be conducted during early stages of activities to evaluate the planning, design, execution, and documentation of quality-affecting activities and to help identify and correct problems in a timely manner.

The Laboratory QA Manager conducts routine internal audits of each laboratory section for completeness, accuracy, and adherence to SOPs. The intention of the internal audit team is to verify that the laboratory's measurement systems are operated within specified acceptable control criteria, and that a system is in place to ensure out-of-control conditions are efficiently identified and corrected. Raw instrument data for GC, high-performance liquid chromatography, and GC/MS analyses are maintained on magnetic tape media or optical media by the laboratory's Local Area Network Administrator in a secured fireproof safe. During routine audits, the audit team will verify the processing of the raw data file by reviewing randomly selected electronic data files and comparing the results with the hard copy report. Records are archived for a period of 3 years. Records are also available for audit by regulatory agencies upon request.

The corrective action process is the mechanism for identifying and solving nonconformance problems. The objective of the corrective action process is to ensure recognized nonconformances in the performance of any activity associated with environmental data collection and management lead to effective remedial measures and the steps taken to correct an existing condition are documented to provide assurance that any deficiencies are recognized in later interpretation and are not recurrent.

The following steps comprise the corrective action process:

- Define the problem
- Investigate
- Determine the cause
- Develop a corrective action plan
- Implement and document the corrective action
- Follow up to verify the corrective action has eliminated the problem

- Document the process

A nonconforming item or situation is one that has the potential to affect the quality or quantity of data generated by the laboratory or the interpretation or use of the data by the client. These include the following:

- Deviations or variances from the prescribed requirements in this SAP/QAPP, SOP, or Method SOP
- Out-of-control laboratory performance QC samples
- Malfunctions of equipment or instruments or any unusual occurrences or circumstances

Nonconformances may be identified at any point along the flow of samples and data through the laboratory. Nonconformances are designated as a deficiency or an anomaly and are differentiated with respect to the impact on the quality of the sample data for its intended use. Deficiency and anomaly are defined as follows:

- **Deficiency**: An unplanned deviation from an established protocol or plan, which was the result of the laboratory's actions.
- **Anomaly**: An unplanned deviation from an established protocol or plan, which was the result of events beyond the control of the laboratory.

All nonconformances that may affect the use of the analytical data are communicated to the client by the Laboratory Project Manager verbally and summarized in the report narrative. Nonconformances are recorded and reported using Alpha Analytical's nonconformance documentation tracking systems and nonconformance memoranda. Each nonconformance memorandum has a unique control number that is used to cross-reference the nonconformance and its resolution to the associated project records. Project-specific communication and any nonconformance memoranda will be communicated to Anchor QEA via email by the Laboratory Project Manager. The email communication will be followed up with a phone call to verify receipt and discuss any necessary resolution.

6.10 Field Nonconformance

Any event that does not conform to this SAP/QAPP or SOPs is considered a nonconformance event. These will be identified as quickly as possible and reported to the Anchor QEA QA Manager as soon as practical. If the nonconformance event happens during field sampling, it will be documented in the field logbook. The Anchor QEA QA Manager will confer with the USACE Project Manager and outline a procedure for accomplishing the task so quality of the project is not compromised. Every effort will be taken to contact the USEPA and USACE representatives in writing prior to any deviation from the procedures documented in this SAP/QAPP. All corrective measures will be documented in the field logbook.

6.11 Performance and Systems Audits

An individual audit plan will be developed to provide a basis for each audit. This plan will identify the audit scope, activities to be audited, audit personnel, any applicable documents, and the schedule. Checklists will be prepared by the auditors and used to conduct all audits. They will be developed to accomplish the necessary reviews and to document the results of the audit.

Audits may involve on-site visits by the auditor. Items to be examined may include the availability and implementation of approved work procedures; implementation and documentation of health and safety procedures; calibration and operation of equipment; packaging, storage, and shipping of samples obtained; performance documentation; and nonconformance (variance) documentation. The records of operations will be reviewed to verify laboratory activities were performed in accordance with the appropriate approved procedures. Items reviewed will include the calibration records of equipment, COC documentation, and data resulting from laboratory operations.

6.11.1 Laboratory Performance and Systems Audits

Audits are performed routinely to review and evaluate the adequacy and effectiveness of laboratory performance and the QA Program to ascertain if the SAP/QAPP is being completely and uniformly implemented, to assess the effectiveness of the laboratory QA program, to identify nonconformances, and verify identified deficiencies are corrected. The Laboratory QA Manager is responsible for such audits and will perform them according to a schedule planned to coincide with appropriate activities on the project schedule. Such scheduled audits may be supplemented by additional audits for one or more of the following reasons:

- When significant changes are made in this SAP/QAPP
- When it is necessary to verify that corrective action has been taken on a nonconformance reported in a previous audit
- When requested by the Anchor QEA Project Manager or Laboratory QA Manager

6.11.2 Performance Audits

Performance audits are independent sample checks made by a supervisor or auditor to arrive at a quantitative measure of the quality of the data produced by one section or the entire measurement process. Performance audits are conducted by introducing control samples, in addition to those used routinely, into the data production process. These control samples will include performance evaluation samples of known concentrations. When the SRM for similar matrix is available, it will be used.

The results of performance audits are evaluated against acceptance criteria. The results are summarized and maintained by the QA Manager and distributed to the supervisors who must investigate and respond to the results that are outside the control limits.

6.11.3 System Audits

Systems audits are on-site qualitative inspections and reviews of the QA system used by some part of or the entire measurement system. System audits are conducted by the QA group with the assistance and involvement of laboratory personnel. The audits are performed against the requirements, specified in the SAP/QAPP. A checklist is generally generated from the requirements and becomes the basis for the audit. The results of any deficiencies noted during the audit are summarized in an audit report.

6.11.4 Audit Procedures

Prior to an audit, the designated Lead Auditor prepares an audit checklist. During an audit and upon its completion, the auditor(s) will discuss the findings with the individuals audited and discuss and agree on corrective actions to be initiated. The Lead Auditor will prepare and submit an audit report to the Section Supervisor or Department Manager of the audited group, the Anchor QEA Project Manager, and the Anchor QEA QA Manager. Minor administrative findings, that can be resolved to the satisfaction of the Lead Auditor during an audit, are not required to be cited as items requiring corrective action. Findings that are not resolved during the course of the audit and findings affecting the overall quality of the project will be included in the audit report.

The Laboratory Section Supervisor or Department Manager of the audited group will prepare and submit to the QA Manager a reply to the audit. This reply will include, at a minimum, a plan for implementing the corrective action to be taken on nonconformances indicated in the audit report, the date by which such corrective action will be completed, and actions taken to prevent reoccurrence. If the corrective action has been completed, supporting documentation should be attached to the reply. The Lead Auditor will ascertain (by re-audit or other means) if appropriate and timely corrective action has been implemented.

6.11.5 Documentation

To ensure the previously defined scope of the individual audits is accomplished and the audits follow established procedures, a checklist will be completed during each audit. The checklist will detail the activities to be executed and ensure the auditing plan is accurate. Audit checklists will be prepared in advance and will be available for review. At a minimum, the checklist will allow space for the following information:

- Data and type of audit
- Name and title of auditor
- Description of group, task, or facility being audited
- Names of lead technical personnel present at audit
- Checklist of audit items according to scope of audit
- Deficiencies or nonconformances

Following each system, performance, and data audit, the QA Manager will prepare a report to document the findings of the specific audit. The report is submitted to the General Manager, Laboratory Director, and the Section Supervisor or Department Manager of the audited group to ensure objectives of the QA Program are met. In general, the format of the audit QA reports will consist, at a minimum, of the following information:

- Description and date of audit
- Name of auditor
- Copies of completed, signed, and dated audit form and/or checklist
- Summary of findings of the audit, including any nonconformance or deficiencies
- Date of report and appropriate signatures
- Description of corrective actions

A copy of the signed and dated report for each audit will be maintained by the QA Manager and will also be placed in the project files, as necessary.

7 References

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Figures

DRAFT

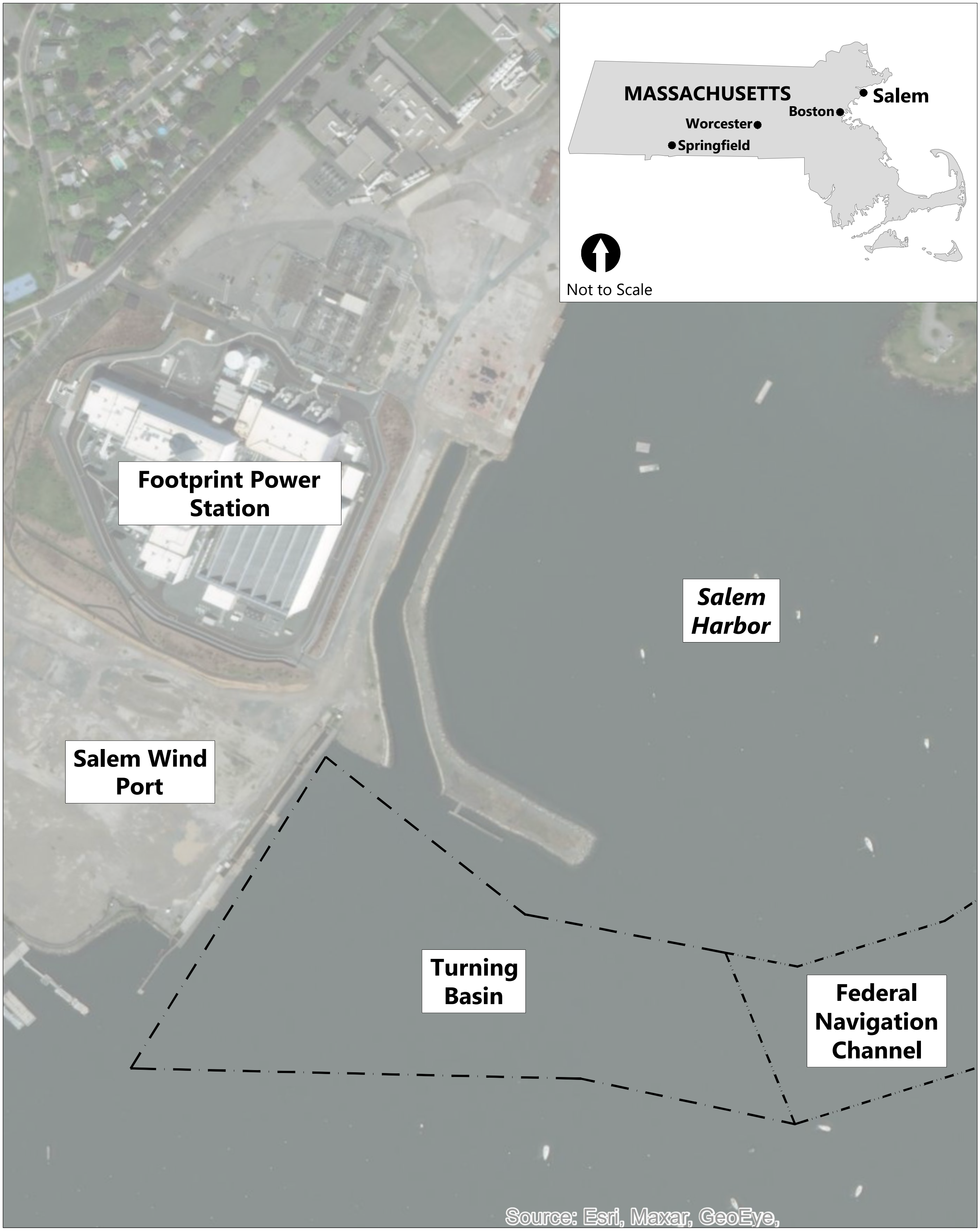

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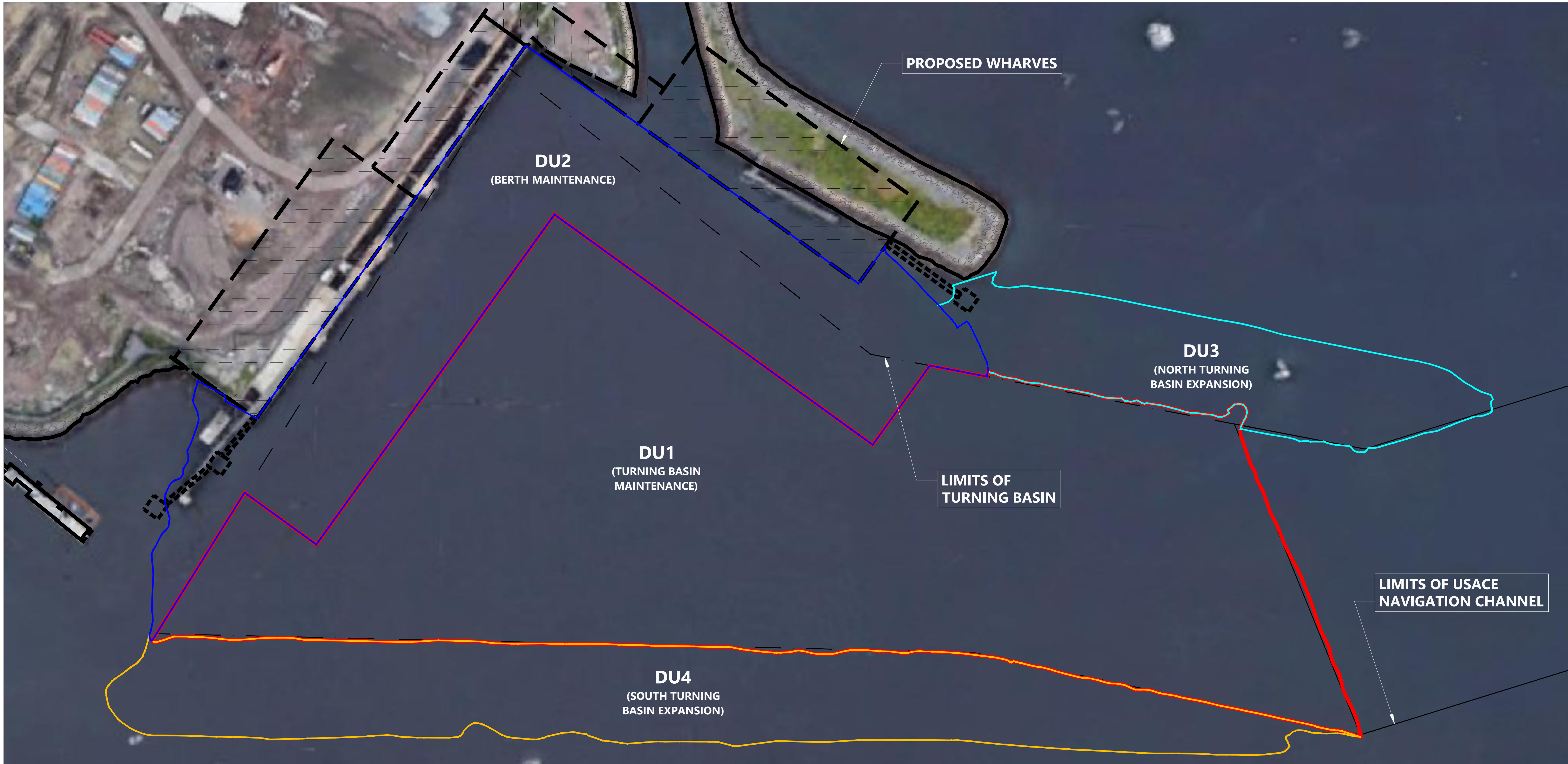
Figure 1-1
General Site Location

Sampling and Analysis Plan and Quality Assurance Project Plan
Salem Wind Port

DRAFT



SOURCE: Aerial image from Google Earth Pro, July 2022.
HORIZONTAL DATUM: Massachusetts State Plane - Mainland Zone, North American Datum (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)

NOTES:
1. Not to be used for construction.

LEGEND:
- Limits of Turning Basin
- Limits of USACE Federal Navigation Channel
- Proposed Wharves
- DU1 (Turning Basin Maintenance)
- DU2 (Berth Maintenance)
- DU3 (North Turning Basin Expansion)
- DU4 (South Turning Basin Expansion)

0 150
Feet

Publish Date: 2022/08/04 1:43 PM | User: dbinkney
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ANCHOR QEA

Figure 1-2
Proposed Dredging Units (DUs)
Sampling and Analysis Plan and Quality Assurance Project Plan
Salem Wind Port

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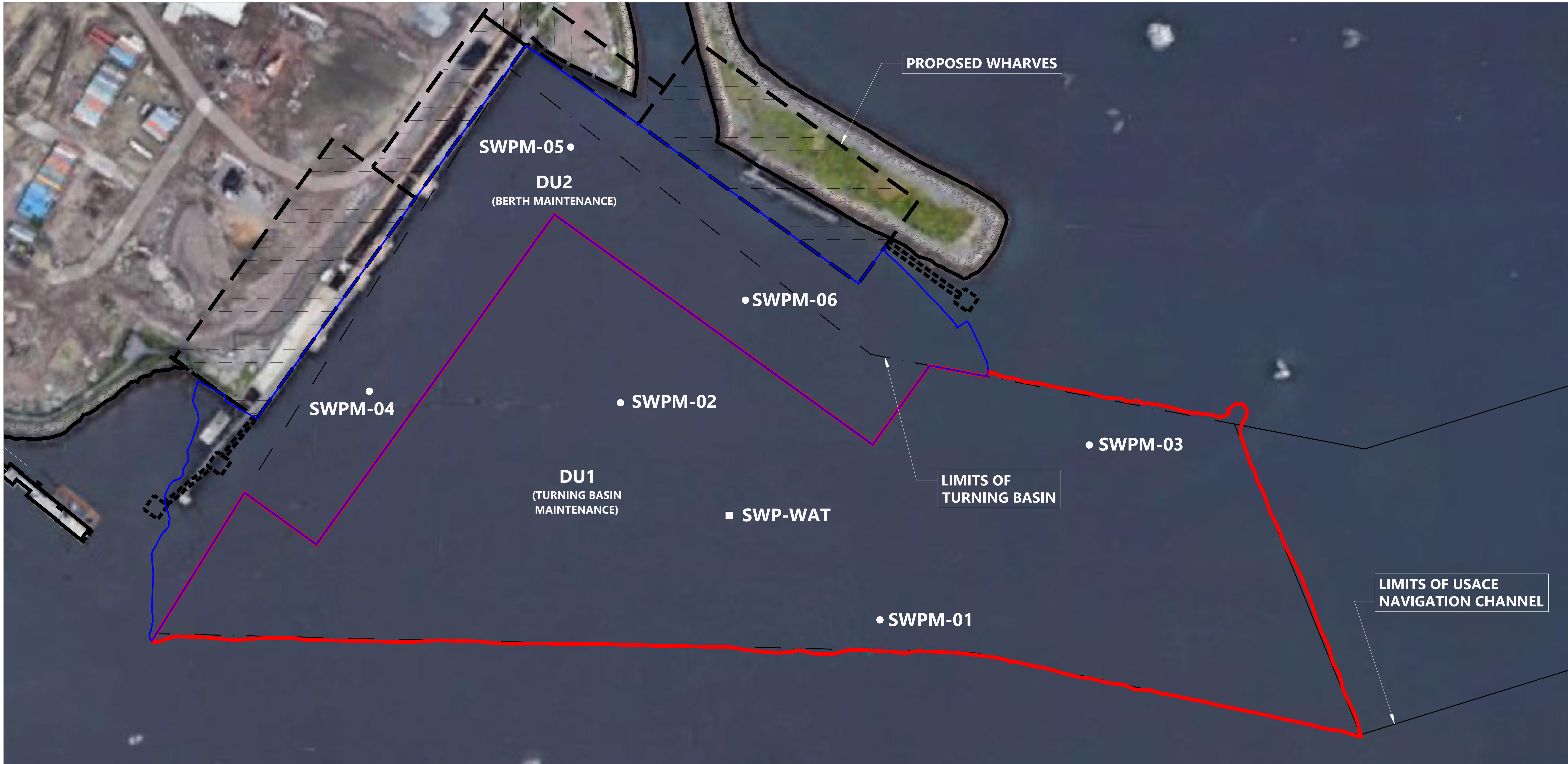

SOURCE: Aerial image from Google Earth Pro, July 2022.
HORIZONTAL DATUM: Massachusetts State Plane - Mainland Zone, North American Datum (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)

NOTES:
1. Not to be used for construction.

LEGEND:
- Limits of Turning Basin
- Limits of USACE Federal Navigation Channel
- Proposed Wharves
- DU1 (Turning Basin Maintenance)
- DU2 (Berth Maintenance)

0 150
Feet

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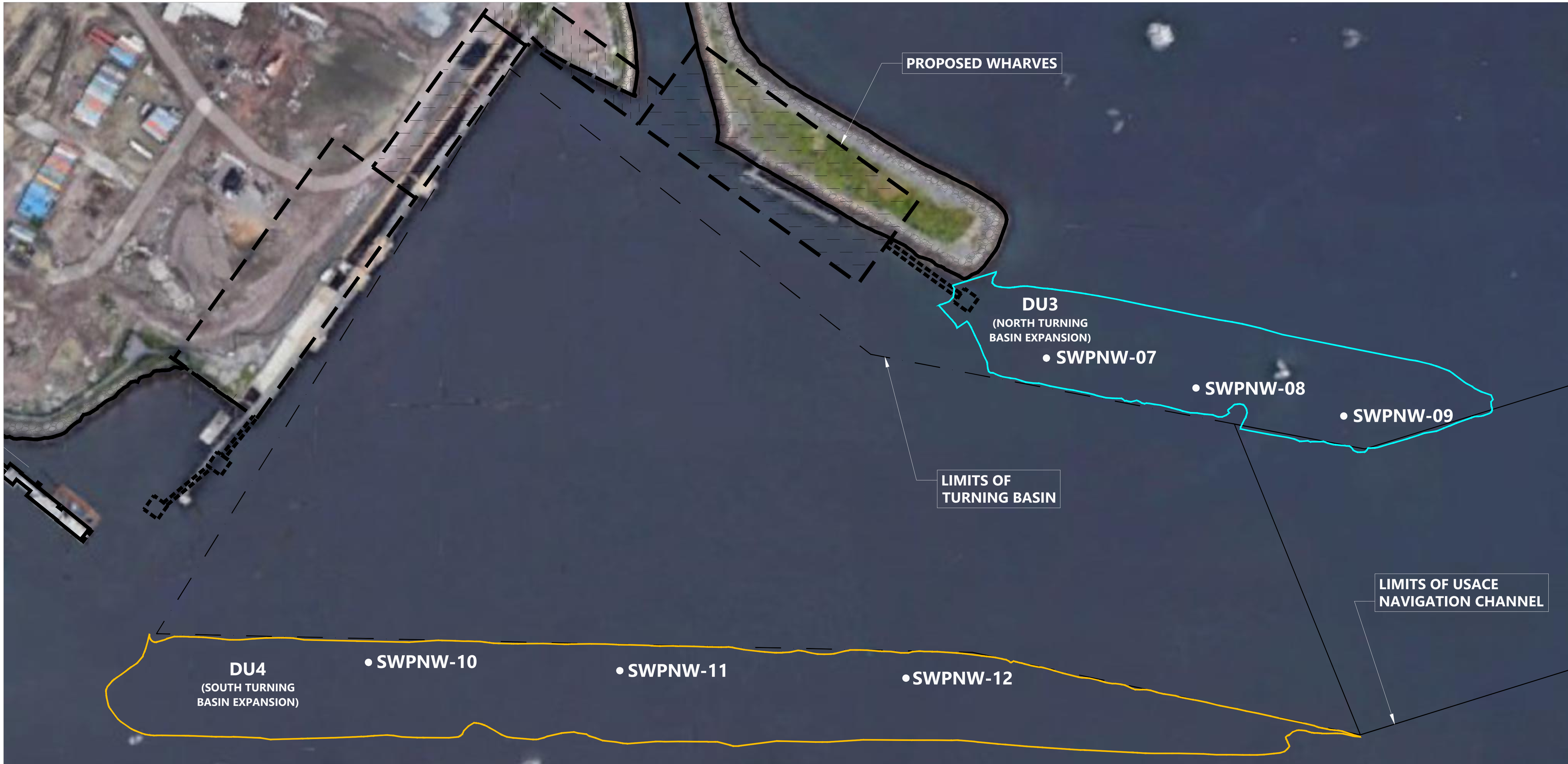
ANCHOR QEA

Figure 1-3
Phase 1 Sampling Plan

Sampling and Analysis Plan and Quality Assurance Project Plan
Salem Wind Port

DRAFT



SOURCE: Aerial image from Google Earth Pro, July 2022.
HORIZONTAL DATUM: Massachusetts State Plane - Mainland Zone, North American Datum (NAD83), U.S. Survey Feet
VERTICAL DATUM: Mean Lower Low Water (MLLW)

NOTES:
1. Not to be used for construction.

LEGEND:
- Limits of Turning Basin
- Limits of USACE Federal Navigation Channel
- Proposed Wharves
- DU3 (North Turning Basin Expansion)
- DU4 (South Turning Basin Expansion)

0 150
Feet

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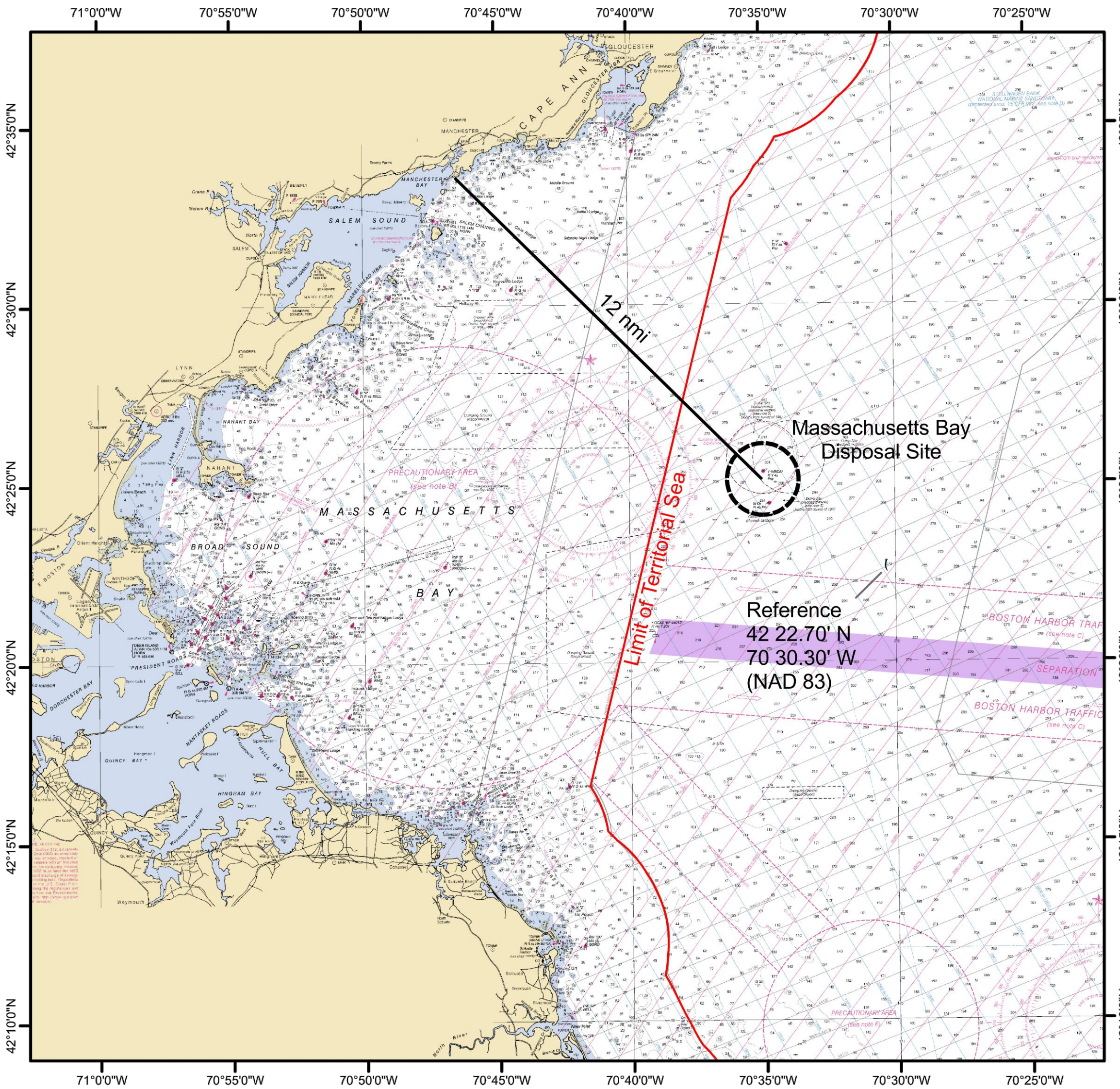
Figure 1-4
Phase 2 Sampling Plan

Sampling and Analysis Plan and Quality Assurance Project Plan
Salem Wind Port



MASSACHUSETTS BAY DISPOSAL SITE

Description: The Massachusetts Bay Disposal Site (MBDS), a 2.0 nmi (3.7 km) diameter circular area centered at 42° 25.106' N, 70° 34.969' W (NAD 83), is located 12 nmi (22 km) southeast of Gales Point, MA. Water depths range from 269 to 302 ft (82 to 92 m). The authorized disposal point (within the overall disposal area) is specified for each dredging project in other project documents.

D A M O S

DISPOSAL AREA MONITORING SYSTEM

SCALE 1:304,011

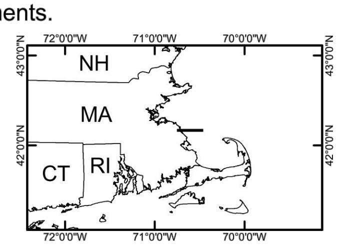
Kilometers

1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 0 1 2 3 4 5 6 7

Nautical Miles

NOTE: This chart is not intended for use in navigation.



SOURCE:
https://www.nae.usace.army.mil/Missions/Disposal-Area-Monitoring-System-DAMOS/Disposal-Sites/Massachusetts-Bay/

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ANCHOR QEA

Figure 2-1
Massachusetts Bay Disposal Site

Attachment E

HISTORIC RESOURCES WITHIN ¼ MILE OF THE PROJECT SITE

Attachment E: Historic Resources within ¼ mile of the Project Site

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.2572	Derby, Richard House	164-174 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.2573	Derby, Elias Haskell - Hawkes, Benjamin House	164-174 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.2574	Rum Shop	164-174 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.2575		14 Palfrey Ct		N/A
SAL.2576		10 Palfrey Ct		N/A
SAL.2577	Saint Joseph's Roman Catholic Society Hall	158-162 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.2578	Derby Sole and Cut Leather Company	156 Derby St	LHD NRDIS	N/A
SAL.2579		152 Derby St	LHD NRDIS	N/A
SAL.2580	Collins, John House	16 Daniels St		N/A
SAL.2581		14 Daniels St		N/A
SAL.2582		12 Daniels St		N/A
SAL.2583	Brooks, Alfred R. - Brown, Joseph B. House	10 Daniels St		N/A
SAL.2584		6-8 Daniels St		N/A
SAL.2585		4 Daniels St		N/A
SAL.2586	Stevenson, Elizabeth House	2 Daniels St		N/A
SAL.2587	Whittemore, Edmund House	59-61 Essex St	NRDIS	N/A
SAL.2588		65R Essex St	NRDIS	N/A
SAL.2589	Weston, Samuel - Harding, John B. House	65 Essex St	NRDIS	N/A
SAL.2590	Noble, Edward H. Building	65-67 1/2 Essex St	NRDIS	N/A
SAL.2591	Robinson, Samuel - Chapleman, Michael House	69 Essex St	NRDIS	N/A
SAL.2592	Upton, Moses T. House	69R Essex St	NRDIS	N/A
SAL.2593	Ives, Thomas - Narbonne House	71 Essex St	NHL NRDIS NRDIS	N/A
SAL.2598	Dubetsky, Morris Grocery and Provision Store	148 Derby St	LHD NRDIS	N/A
SAL.2599		142-144 Derby St	LHD NRDIS	N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.2600		140 Derby St	LHD NRDIS	N/A
SAL.2601		136 Derby St	LHD NRDIS	N/A
SAL.2602	Kohn, Alexander Variety Store	136 1/2 Derby St	LHD NRDIS	N/A
SAL.2603		136 Derby St	LHD NRDIS	N/A
SAL.2604		132-134 Derby St	LHD NRDIS	N/A
SAL.2605		16 Bentley St	LHD	N/A
SAL.2606		14 Bentley St		N/A
SAL.2607		12 Bentley St		N/A
SAL.2608		10 1/2 Bentley St		N/A
SAL.2609		10 Bentley St		N/A
SAL.2610		8 Bentley St		N/A
SAL.2611	O'Hare, J. Three Decker	6 Bentley St		N/A
SAL.2612		4 Bentley St		N/A
SAL.2613	Forness, Augustus House	2 Bentley St		N/A
SAL.2614	Goodhue, William P. House	49-51 Essex St	NRDIS	N/A
SAL.2615		53 Essex St	NRDIS	N/A
SAL.2616	Daniels, Stephen House	1 Daniels St	NRDIS	N/A
SAL.2617		5 Daniels St		N/A
SAL.2618	Palfrey, Walter - Dean, Thomas House	7 Daniels St		N/A
SAL.2619	Salem Polish American Citizens Club	9 Daniels St		N/A
SAL.2620		11 Daniels St		N/A
SAL.2621	Wright, Charles W. House	13 Daniels St		N/A
SAL.2622	White, Margaret House	15 Daniels St		N/A
SAL.2623		17 Daniels St		N/A
SAL.2624		40 Daniels St	NRDIS	N/A
SAL.2625	Grodski, B. Three Decker	34 Daniels St	NRDIS	N/A
SAL.2626		28-30 Daniels St	NRDIS	N/A
SAL.2627		26 Daniels St	NRDIS	N/A
SAL.2628		149-151 Derby St	LHD NRDIS	N/A
SAL.2629		155-157 Derby St	LHD NRDIS	N/A
SAL.2631		9 Kosciusko St	NRDIS	N/A
SAL.2632		11-13 Kosciusko St	NRDIS	N/A
SAL.2634		19 Kosciusko St	NRDIS	N/A
SAL.2635		21-23 Kosciusko St	NRDIS	N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.2636		22 Kosciusko St	LHD NRDIS	N/A
SAL.2637		18-20 Kosciusko St	LHD NRDIS	N/A
SAL.2638	Curran, James House	16 Kosciusko St	LHD NRDIS	N/A
SAL.2639		14 Kosciusko St	LHD NRDIS	N/A
SAL.2640		12 Kosciusko St	LHD NRDIS	N/A
SAL.2641	Flynn, James House	8 Kosciusko St	LHD NRDIS	N/A
SAL.2642		6 Kosciusko St	LHD NRDIS	N/A
SAL.2643		159 Derby St	LHD NRDIS	N/A
SAL.2656	Burbank, Thomas F. House	70 Essex St	NRDIS	N/A
SAL.2662		64-68 Essex St	NRDIS	N/A
SAL.2663	Stevenson, Elizabeth House and Variety Store	60 Essex St	NRDIS	N/A
SAL.2664	Stevenson, John Double House	56-58 Essex St	NRDIS	N/A
SAL.2665		54 Essex St	NRDIS	N/A
SAL.2666	Sage - Webb - Wilkins House	52 Essex St	NRDIS	N/A
SAL.2667	Bentley Elementary School	50-50 1/2 Essex St	NRDIS	N/A
SAL.2668	Abdo, Azma Building	48 Essex St		N/A
SAL.2669	Babage, Christopher House	46 1/2 Essex St		N/A
SAL.2671		44 Essex St		N/A
SAL.2672		42 Essex St		N/A
SAL.2673	Lovejoy, John House	40 Essex St		N/A
SAL.2674		38 Essex St		N/A
SAL.2675	Lovejoy, John House	22 Forrester St		N/A
SAL.2676	Dutra, Joseph House	14 Forrester St	NRDIS	N/A
SAL.2677	Jackson, Jane House	12 Forrester St	NRDIS	N/A
SAL.2678	Yasinski, Edmund A. House	8 Forrester St	NRDIS	N/A
SAL.2679	Parsons, John H. and Joseph M. House	2-4 Forrester St	NRDIS	N/A
SAL.2680	Crowinshield, Clifford House	74 Washington Sq East	LHD NRDIS	N/A
SAL.2681	Goodell, Zina Double House	72 Washington Sq East	LHD NRDIS	N/A
SAL.2682		2-4 Emmerton St		N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.2683	Cook, Mary G. House	31 Forrester St		N/A
SAL.2684		33-35 Forrester St		N/A
SAL.2685		30 Boardman St		N/A
SAL.2686		26-28 Boardman St		N/A
SAL.2687		24 Boardman St		N/A
SAL.2688		22 Boardman St		N/A
SAL.2689		20 Boardman St		N/A
SAL.2690		18 Boardman St		N/A
SAL.2691	Moulton House	7 Emmerton St		N/A
SAL.2692	Clapp, William A. House	17-19 Emmerton St		N/A
SAL.2693	Gardner House	21 Emmerton St		N/A
SAL.2694		12 Boardman St		N/A
SAL.2695		10 Boardman St		N/A
SAL.2696		8 Boardman St		N/A
SAL.2697		4-6 Boardman St		N/A
SAL.2698		2 Boardman St		N/A
SAL.2701	Ives, John House	1 Forrester St	LHD NRDIS	N/A
SAL.2702	Whipple, Charles C. House	7 Forrester St	NRDIS	N/A
SAL.2703	Fairfield, Charles E. House	9 Forrester St	NRDIS	N/A
SAL.2704	Chever, Capt. William J. House	11 Forrester St	NRDIS	N/A
SAL.2705	Washburn House	21 Forrester St		N/A
SAL.2706	Kinsman, John House	13-15 Boardman St		N/A
SAL.2707		17 Boardman St		N/A
SAL.2708		19 Boardman St		N/A
SAL.2709		21 Boardman St		N/A
SAL.2710		23 Boardman St		N/A
SAL.2711		25 Boardman St		N/A
SAL.2712		29 Boardman St		N/A
SAL.2713		31 Boardman St		N/A
SAL.2714		33 Boardman St		N/A
SAL.2715		35 Boardman St		N/A
SAL.2716		37 Boardman St		N/A
SAL.2717		39 Boardman St		N/A
SAL.2718		71 Webb St		N/A
SAL.2809	Conlon, William J. House	60-62 Webb St		N/A
SAL.3218	Donahue, Michael House	126 Derby St	LHD NRDIS	N/A
SAL.3219		124 Derby St	LHD NRDIS	N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.3220	Donahue, Michael House	16 Hardy St	LHD NRDIS	N/A
SAL.3221	Goldthwaite, Joel House	14 Hardy St		N/A
SAL.3222		12 Hardy St		N/A
SAL.3223		10 Hardy St		N/A
SAL.3224		8 Hardy St		N/A
SAL.3225	Bowditch, Daniel C. House	6 Hardy St		N/A
SAL.3226		4 Hardy St		N/A
SAL.3227		45 Essex St	NRDIS	N/A
SAL.3228	Whipple, J. Lovett House	47 Essex St	NRDIS	N/A
SAL.3229	Sechovicz, L. Children's Shoe Company	7-9 Bentley St		N/A
SAL.3230	Wieczorek, Antoni Building	11 Bentley St		N/A
SAL.3231		17 Bentley St		N/A
SAL.3232	Bowditch House	19 Bentley St		N/A
SAL.3233	Nichols, David Augustus Grocery Store	122 Derby St	LHD NRDIS	N/A
SAL.3234	Norfolk, Joseph House - Betram Home for Aged Men	118 Derby St	LHD NRDIS	N/A
SAL.3235	Waters, Capt. Joseph House	114 Derby St	LHD NRDIS NRDIS PR	N/A
SAL.3236		20 Turner St		N/A
SAL.3237		10-12 Turner St		N/A
SAL.3238		4 Turner St		N/A
SAL.3239	Murray, William House	39 Essex St	NRIND NRTRA	N/A
SAL.3240	Berry, George E. House	41 Essex St		N/A
SAL.3241		43 Essex St		N/A
SAL.3242		3 Hardy St		N/A
SAL.3243	Valpy, Richard House	5 Hardy St		N/A
SAL.3244	Collins House	7 Hardy St		N/A
SAL.3245		7 1/2 Hardy St		N/A
SAL.3246	Driver, Captain William House	11 Hardy St		N/A
SAL.3247	Bullock, Isaac House	15 Hardy St		N/A
SAL.3248	Brown, Captain Nathaniel House	17 Hardy St		N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.3249	Lane, Capt. William House	110-112 Derby St	LHD NRDIS	N/A
SAL.3250	Salem Seamans' Bethel	106 Derby St	LHD NRDIS	N/A
SAL.3251		104 Derby St	LHD NRDIS	N/A
SAL.3252		102 Derby St	LHD NRDIS	N/A
SAL.3253	Fairfield, Margaret Building - Goodwin, Enoch Shop	100 Derby St	LHD NRDIS	N/A
SAL.3254		18 Carlton St		N/A
SAL.3255		12 Carlton St		N/A
SAL.3256		10 Carlton St		N/A
SAL.3257	Kimball, Philip House	8 Carlton St		N/A
SAL.3258		33 Essex St		N/A
SAL.3259		35 Essex St		N/A
SAL.3260		1 Turner St		N/A
SAL.3261		5 Turner St		N/A
SAL.3262		7 Turner St		N/A
SAL.3263	Very, Nathaniel House	15 Turner St		N/A
SAL.3264	Ellison, John House	21 Turner St		N/A
SAL.3265	Ward, Frederick G. - Townsend, Capt. Moses House	96-98 Derby St	LHD NRDIS	N/A
SAL.3266		94 Derby St	LHD NRDIS	N/A
SAL.3267	Waters, Joseph G. House	90-92 Derby St	LHD NRDIS	N/A
SAL.3268	Cashman - Kulak, John House and Grocery and Variety Store	84-86 Derby St	LHD NRDIS	N/A
SAL.3269	McGroarty, Annie House	28 Becket St	LHD NRDIS	N/A
SAL.3270		24-26 Becket St		N/A
SAL.3271		22R Becket St		N/A
SAL.3272		22 Becket St		N/A
SAL.3273		20 Becket St		N/A
SAL.3274		18 1/2 Becket St		N/A
SAL.3275		18 Becket St		N/A
SAL.3276		16 Becket St		N/A
SAL.3277		14 Becket St		N/A
SAL.3278		12 Becket St		N/A
SAL.3279		10 Becket St		N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.3280		8 Becket St		N/A
SAL.3281		6 Becket St		N/A
SAL.3282		6 Becket St		N/A
SAL.3283		4 Becket St		N/A
SAL.3284		2 1/2 Becket St		N/A
SAL.3285		25 Essex St		N/A
SAL.3286		27 Essex St		N/A
SAL.3287		1 Carlton St		N/A
SAL.3288		5 Carlton St		N/A
SAL.3289		7 Carlton St		N/A
SAL.3290		11 Carlton St		N/A
SAL.3291		13 Carlton St		N/A
SAL.3292		15 Carlton St		N/A
SAL.3293		17 Carlton St		N/A
SAL.3294		21 Carlton St		N/A
SAL.3295		23 Carlton St		N/A
SAL.3296		25 Carlton St		N/A
SAL.3297		29 Carlton St		N/A
SAL.3298	Goodhue, William P. Ship Chandlery	82 Derby St	LHD NRDIS	N/A
SAL.3299	Kenney, Jesse - Becket, Jonathan House	78 Derby St	LHD NRDIS	N/A
SAL.3301	Peterson, John House	5 Becket Ave	LHD NRDIS	N/A
SAL.3302		72 Derby St	LHD NRDIS	N/A
SAL.3303	Hill, Abner E. Grocery Store - Casey, John Building	66-68 Derby St	LHD NRDIS	N/A
SAL.3304		62 Derby St	LHD NRDIS	N/A
SAL.3305		44-46 English St		N/A
SAL.3306		40 English St		N/A
SAL.3307		36-38 English St		N/A
SAL.3308	Rice, Martha House	30 English St		N/A
SAL.3309		22 English St		N/A
SAL.3310		14 English St		N/A
SAL.3311	Carr, Arthur House	10 English St		N/A
SAL.3312		4 English St		N/A
SAL.3313		13 Essex St		N/A
SAL.3314		15-17 Essex St		N/A
SAL.3315		1-3 Gerrish Pl		N/A
SAL.3316		19-21 Essex St		N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.3317		3 Becket St		N/A
SAL.3318		5 Becket St		N/A
SAL.3320		7 1/2 Becket St		N/A
SAL.3321		9 Becket St		N/A
SAL.3322		11 Becket St		N/A
SAL.3323		13 Becket St		N/A
SAL.3324		15 Becket St		N/A
SAL.3325	Barker, Henry M. House	17 Becket St		N/A
SAL.3326		19 Becket St		N/A
SAL.3327		21 Becket St		N/A
SAL.3328		23 Becket St		N/A
SAL.3329		25 Becket St		N/A
SAL.3330		27 Becket St		N/A
SAL.3331	Gauss, Stephen House	3 Becket Ave		N/A
SAL.3332	Gotchell, Josiah - Magoun, Thomas House	60 Derby St	LHD NRDIS	N/A
SAL.3333	Gotchell, Josiah - Magoun, Thomas House	58 Derby St	LHD NRDIS	N/A
SAL.3334	Cogswell, Epes Augustus - Cotter, Simon House	54 Derby St	LHD NRDIS	N/A
SAL.3335	Cogswell, Epes Augustus - Cleveland House	50 Derby St	LHD NRDIS	N/A
SAL.3336	Cogswell, Epes Augustus - Kennedy, John House	48 Derby St	LHD NRDIS	N/A
SAL.3337	Driscoll, Martin House	44 Derby St	LHD NRDIS	N/A
SAL.3338		40 Derby St	LHD NRDIS	N/A
SAL.3339		36 Derby St	LHD NRDIS	N/A
SAL.3341		1 Allen St		N/A
SAL.3342	Rowell, Edward House	5 Allen St		N/A
SAL.3343		9 Allen St		N/A
SAL.3344	Cogswell, Epes House	13 Allen St		N/A
SAL.3345	Gatchell, Joseph House	45 English St		N/A
SAL.3346		7 Webb St		N/A
SAL.3347	India Manufacturing Company Jute Mill	1-11 Cousins St		N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.3348		39 English St		N/A
SAL.3349	Brown, Elizabeth House	41 English St		N/A
SAL.3350		32 Boardman St		N/A
SAL.3351	Cogswell, Epes House	8 Allen St		N/A
SAL.3352	Manning, Jacob Jr. House	6 Allen St		N/A
SAL.3353		3 1/2 Essex St		N/A
SAL.3354		5-5 1/2 Essex St		N/A
SAL.3355	Remon, William G. House	7 Essex St		N/A
SAL.3356		9 Essex St		N/A
SAL.3357		11 Essex St		N/A
SAL.3358	Rubinovitz, Jacob House	5 English St		N/A
SAL.3359		14 Cousins St		N/A
SAL.3360		8 Cousins St		N/A
SAL.3361	DeBaker, Victor F. House	36 Essex St		N/A
SAL.3362		34 Essex St		N/A
SAL.3363		32 Essex St		N/A
SAL.3364		30 Essex St		N/A
SAL.3365		28 Essex St		N/A
SAL.3366	Ringe, Daniel House	26 Essex St		N/A
SAL.3367		24 Essex St		N/A
SAL.3368		20 Essex St		N/A
SAL.3369		34 Forrester St		N/A
SAL.3370		32 Forrester St		N/A
SAL.3371	Briggs, Edward L. B. House	57 Forrester St		N/A
SAL.3372	Upton, George L. House	40 Boardman St		N/A
SAL.3373	Rose, Mary House	38 Boardman St		N/A
SAL.3374		12 1/2 Essex St		N/A
SAL.3375		12 Essex St		N/A
SAL.3376	Murphy, David House	10 Essex St		N/A
SAL.3378		8R Essex St		N/A
SAL.3379	Dalrymple, James House	8 Essex St		N/A
SAL.3380		6 Essex St		N/A
SAL.3381		4 Essex St		N/A
SAL.3382		2 1/2 Essex St		N/A
SAL.3383		2 Essex St		N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.3384	Saint Nicholas Orthodox Church and Rectory	64-66 Forrester St	NRIND PR	N/A
SAL.3385		56 Webb St		N/A
SAL.3386		1 Essex St		N/A
SAL.3387		3 Essex St		N/A
SAL.3388		18 Webb St		N/A
SAL.3389		8 Webb St		N/A
SAL.3391		12-14 Derby St	LHD NRDIS	N/A
SAL.3392		10 Derby St	LHD NRDIS	N/A
SAL.3393		8 Derby St	LHD NRDIS	N/A
SAL.3394		6 Derby St	LHD NRDIS	N/A
SAL.3395		1 Block House Sq	LHD NRDIS	N/A
SAL.3396		65 Derby St	LHD NRDIS	N/A – this building has been demolished
SAL.3397	Najechalski, Ignacy House	81 Derby St	LHD NRDIS	N/A
SAL.3398	Palfrey, Richard - Perry, Horatio House	83-85 Derby St	LHD NRDIS	N/Af
SAL.3399		5 Blaney St	LHD NRDIS	N/A
SAL.3400	Rope, Samuel House	4-12 Blaney St	NRDIS	N/A
SAL.3401		2 Blaney St	LHD NRDIS	N/A
SAL.3402		91 Derby St	LHD NRDIS	N/A
SAL.3403	Saint Anthony's Polish Club	95 Derby St	LHD NRDIS	N/A
SAL.3404		3 White St	NRDIS	N/A
SAL.3406		10 White St	NRDIS	N/A
SAL.3407		8 White St	NRDIS	N/A
SAL.3408		6 White St	NRDIS	N/A
SAL.3409	Williams, William - Abbott, Nathaniel House	97 Derby St	LHD NRDIS	N/A
SAL.3410	Yardon, Syzman Grocery Store	99 Derby St	LHD NRDIS	N/A
SAL.3411	Young, William - Symonds, M. House	101 Derby St	LHD NRDIS	N/A
SAL.3413	Ropes, David - Beadle House	105 Derby St	LHD NRDIS	N/A
SAL.3414	McMillan, Capt. John - Vincent, Amos J. House	109 Derby St	LHD NRDIS	N/A
SAL.3415	Ropes, David - Elkins, Capt. John House	111 Derby St	LHD NRDIS	N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.3416	Kenney, Jesse House	37 Turner St	NRDIS	N/A
SAL.3417		39 Turner St	NRDIS NRDIS PR	N/A
SAL.3418		41 Turner St	NRDIS	N/A
SAL.3419	Townsend, Penn House	43 Turner St	NRDIS	N/A
SAL.3420	Collins, Captain John House	45-47 Turner St	NRDIS	N/A
SAL.3421	Whipple, Jonathan House	49 Turner St	NRDIS	N/A
SAL.3422	Whipple, Stephen and Sons Worker Housing	53-55 Turner St	NRDIS	N/A
SAL.3423		57R Turner St	NRDIS	N/A
SAL.3424		57 Turner St	NRDIS	N/A
SAL.3425	House of Seven Gables	54 Turner St	LHD MA/HL NHL NRDIS NRDIS NRIND PR PR PR	N/A
SAL.3426	Hathaway House - Old Bakery	54 Turner St	LHD NHL NRDIS NRDIS PR PR	N/A
SAL.3427	Beckett, Retire House	54 Turner St	LHD NHL NRDIS NRDIS PR PR	N/A
SAL.3428	Counting House	31 Hardy St	LHD NHL NRDIS NRDIS PR PR	N/A
SAL.3429	Hawthorne, Nathaniel Birthplace	29 Hardy St	LHD NHL NRDIS NRDIS PR PR PR	N/A
SAL.3431	Phippen, Benjamin House	25 Hardy St	LHD NHL NRDIS NRDIS PR PR	N/A
SAL.3432	Bowditch, Ebenezer House	42 Turner St	NRDIS	N/A
SAL.3433		117 Derby St	LHD NRDIS	N/A
SAL.3434		26 Hardy St	NRDIS	N/A
SAL.3435		24 1/2 Hardy St	NRDIS	N/A
SAL.3436		24 Hardy St	NRDIS	N/A
SAL.3437		22 Hardy St	NRDIS	N/A
SAL.3438		20 Hardy St	NRDIS	N/A
SAL.3439		18 Hardy St	NRDIS	N/A
SAL.3440	Allen, Capt. Edward House	125 Derby St	LHD NRDIS	N/A
SAL.3441	Allen, Capt. Edward Store -	127 Derby St	LHD NRDIS	N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
	Waters, Capt. Joseph House			
SAL.3442	Berry, John M. Triple Decker - Christian Army Home	131 Derby St	LHD NRDIS	N/A
SAL.3443	Shafts, Pearl Triple Decker	135 Derby St	LHD NRDIS	N/A
SAL.3444	Caller, Abraham Triple Decker	137 Derby St	LHD NRDIS	N/A
SAL.3446	Lynch, Dennis - Moynahan House	143 Derby St	LHD NRDIS	N/A
SAL.3448	Riley, James House	25 Daniels St	NRDIS	N/A
SAL.3449	Silsbee, Captain Nathaniel House	27-29 Daniels St	NRDIS	N/A
SAL.3450	Silsbee, Sarah House	35 Daniels St	NRDIS	N/A
SAL.3451		37 Daniels St	NRDIS	N/A
SAL.3452	Coughlin, Patrick House	39 Daniels St	NRDIS	N/A
SAL.3453		1 Daniels Street Ct	NRDIS	N/A
SAL.3455	Scanlon, Patrick House	5 Daniels Street Ct	NRDIS	N/A
SAL.3456	Smith, James H. House	3 Daniels Street Ct	NRDIS	N/A
SAL.3457	Little, Philip Studio	1A Daniels Street Ct	NRDIS	N/A
SAL.3458	Kenneally, Patrick Three Decker	4 Daniels Street Ct	NRDIS	N/A
SAL.3459		45 Daniels St	NRDIS	N/A
SAL.3517		7 Becket St		N/A
SAL.3578		7 Daniels Street Ct	NRDIS	N/A
SAL.3669		3 Columbus Sq	NRDIS	N/A
SAL.3672		7 Columbus Sq	NRDIS	N/A
SAL.3679	Cat Cove Marine Laboratory	80 Fort Ave	NRDIS	N/A
SAL.3745		1 Winter Island Rd	NRDIS	N/A
SAL.3757	Winter Island Park Gate House	Winter Island Park	NRDIS	N/A
SAL.3759	Winter Island Park Restaurant	Winter Island Park	NRDIS	N/A
SAL.3760	Winter Island Radio Shack	Winter Island Park	NRDIS	N/A
SAL.3761	U. S. Coast Guard Sea and Rescue Officers Quarters	Winter Island	NRDIS	N/A
SAL.3765	Salem Maritime Park Comfort Station	Derby St	NHL NRDIS	N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.3841	Crowinshield, Clifford Stable	74 Washington Sq East	LHD NRDIS	N/A
SAL.3854	LeFavour Double House	15-17 Forrester St		N/A
SAL.3855	FitzGerald, Joseph House	25 Forrester St		N/A
SAL.3856	Reed, George W. House	27 Forrester St		N/A
SAL.3857	Hewes, Matthew House	29 Forrester St		N/A
SAL.3858	Newmark, Morris Three Decker	36 Forrester St		N/A
SAL.3859	Stickney, George A. D. House	37 Forrester St		N/A
SAL.3860	Hill, Benjamin F. House	41 Forrester St		N/A
SAL.3861	McKeough, John F. House	52 Forrester St		N/A
SAL.3862	Alpert, Jacob Three Decker	54 Forrester St		N/A
SAL.3863	Block House Square Fire Station	37 Fort Ave		N/A
SAL.3875	Bentley School	21 Memorial Dr		N/A
SAL.3877	Hurley, John House	6 Palfrey Ct		N/A
SAL.4179	House of Seven Gables Barn	54 Turner St	LHD NHL NRDIS NRDIS PR PR	N/A
SAL.4180	House of Seven Gables Tearoom	54 Turner St	LHD NHL NRDIS NRDIS PR PR	N/A
SAL.4181	Seamans Visitor Center	54 Turner St	LHD NHL NRDIS NRDIS PR PR	N/A
SAL.9019	House of Seven Gables Colonial Revival Garden	54 Turner St	LHD NHL NRDIS NRDIS PR PR	N/A
SAL.931	Derby Powderhouse Wharf	50 Winter Island Rd	NRDIS	N/A
SAL.945	Swinwich Park	128 Derby St	LHD NRDIS	N/A
SAL.959	Columbus Square	Columbus Sq	NRDIS	N/A
SAL.960	Cat Cove Marine Laboratory Pier	80 Fort Ave	NRDIS	N/A
SAL.961	Smith, John C. B. Memorial Pool	80 Fort Ave	NRDIS	N/A
SAL.973	Winter Island Park Pergola	Winter Island Park	NRDIS	N/A
SAL.981	Customs House Court	178 Derby St	LHD NHL NRDIS NRDIS	N/A

MHC #	Historic Name	Address	Designations	Impact to Resource
SAL.982	Derby House - Gravel Pathway	164-174 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.983	Hawkes House - Brick Paving	164-174 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.986	Derby House - Board Fence	164-174 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.987	Derby House - Front Fence	164-174 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.988	Derby House - Picket Fence	164-174 Derby St	LHD NHL NRDIS NRDIS	N/A
SAL.994	Memorial Park	17 Fort Ave		N/A

Attachment F

EJ SCREENING FORM ADVANCED NOTIFICATION

Hunter, Emily

From: Hunter, Emily
Sent: Tuesday, August 16, 2022 5:42 PM
To: MEPA-EJ@mass.gov; danielledolan@massriversalliance.org; juliablatt@massriversalliance.org; Andrea@n2nma.org; elvis@n2nma.org; ben@environmentmassachusetts.org; claire@uumassaction.org; cluppi@cleanwater.org; deb.pasternak@sierraclub.org; hclish@outdoors.org; hricci@massaudubon.org; kelly.boling@tpl.org; kerry@msaadapartners.com; ngoodman@environmentalleague.org; rob@oceanriver.org; robb@massland.org; sarah@massclimateaction.net; srubin@clf.org; sylvia@communityactionworks.org; wvaughan@hcwh.org; tribalcouncil@chappaquiddick-wampanoag.org; crwritings@aol.com; john.peters@mass.gov; acw1213@verizon.net; melissa@herringpondtribe.org; rockerpatriciad@verizon.net; rhalsey@naicob.org; Coradot@yahoo.com; Solomon.Elizabeth@gmail.com; thpo@wampanoagtribe-nsn.gov; bonney.hartley@mohican-nsn.gov; Brian.Weeden@mwtribe-nsn.gov; mbejjani8@gmail.com
Cc: Jabba, Richard; Fay, Jamie
Subject: MEPA Advanced Notification: Salem Wind Port Project, 67 Derby Street, Salem, MA
Attachments: EJ Notification Form - Salem Wind Port 8-16-2022.pdf

Good evening,

I am reaching out on behalf of Crowley Wind Services, Inc. regarding the proposed Salem Wind Port project. Crowley, in partnership with the City of Salem and Avangrid Renewables, Inc., proposes a project on Salem Harbor located on the property of the Salem Harbor Power Development LP facility. This redevelopment will transform Salem Harbor into a port terminal which will be responsible for the import, staging, construction, and export of wind turbines for various offshore wind developments around the Commonwealth and beyond. Crowley plans to file an Expanded Environmental Notification Form (EENF) with the Massachusetts Environmental Policy Act (MEPA) office in September 2022.

The attached EJ Screening Form provides contact information for the project team, further details about the project, anticipated permits, and potential benefits and impacts of the project. The form has also been translated into Spanish. Community-based organizations and tribal organizations are receiving this notification in accordance with the MEPA Public Involvement Protocol for Environmental Justice Populations, which took effect on January 1, 2022. More information is available on the MEPA website: https://www.mass.gov/orgs/massachusetts-environmental-policy-act-office.

The project team is conducting outreach to community-based organizations near the project site to promote awareness of and offer opportunities to engage with the project. In particular, the project team aims to provide the neighboring Environmental Justice populations with opportunities to engage with the project. I am reaching out to you with the hope that you or your organization may be able to help the project team spread awareness of the project within the local community.

Please do not hesitate to contact our project team with any questions, comments, or other feedback concerning this project.

Thank you.

Emily Hunter | Environmental Planner
Pronouns: she, her, hers
Fort Point Associates, Inc. | A Tetra Tech Company
31 State Street, 3rd Floor | Boston, MA 02109
Direct: (617) 279-4381 | Business: (617) 357-7044

Hunter, Emily

From: Hunter, Emily
Sent: Thursday, August 18, 2022 10:46 AM
To: 'mbejjani8@gmail.com'; 'MRiccardi@Salem.com'; 'bridgestneck@gmail.com'; 'mriggin@leap4ed.org'; 'wendymeigs@yahoo.com'; 'christinhatch@comcast.net'; 'gallowshillwardfourgroup@yahoo.com'; 'lucycorchado@yahoo.com'; 'federalstreetsalem@gmail.com'; 'cynthia.jerzylo@gmail.com'; 'mackparkorg@gmail.com'; 'gesna.salem@gmail.com'; 'events@salemcommon.org'; 'northshoremass@citizensclimatelobby.org'; 'pgozemba@gmail.com'; 'ckeegan@analogic.com'; 'barbara.warren@salemsound.org'; 'jrolke@salem.com'; 'jhayes@salem.com'; 'jide@salem.com'; 'Ebisono@salem.com'; 'kkennedy@salem.com'; 'acaffrey@rootns.org'; 'info@rootns.org'; 'lsaris@leap4ed.org'; 'llcsalem.president@gmail.com'; 'info@northshorecdc.org'; 'nslatinobusinessasso@comcast.net'; 'info@7gables.org'; 'info@nscap.org'; 'info@nschi.org'; 'raceequity@salem.com'; 'info@northshorenaacp.org'
Cc: Fay, Jamie; Jabba, Richard; MEPA-EJ (EEA)
Subject: MEPA Advanced Notification: Salem Wind Port Project, 67 Derby Street, Salem, MA
Attachments: EJ Notification Form - Salem Wind Port 8-16-2022.pdf

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Please do not hesitate to contact our project team with any questions, comments, or other feedback concerning this project.

Thank you.

Emily Hunter | Environmental Planner
Pronouns: she, her, hers
Fort Point Associates, Inc. | A Tetra Tech Company
31 State Street, 3rd Floor | Boston, MA 02109
Direct: (617) 279-4381 | Business: (617) 357-7044
ehunter@fpa-inc.com
www.fpa-inc.com

Environmental Justice Screening Form

Project Name	Salem Wind Port
Anticipated Date of MEPA Filing	Expanded Environmental Notification Form (EENF): September 30, 2022
Proponent Name	Crowley Wind Services, Inc.
Contact Information (e.g., consultant)	Proponent: Crowley Wind Services, Inc. 225 Dyer Street Providence, RI 02903 John Berry, Terminal Manager John.Berry@crowley.com Planning and Permitting Consultant: Fort Point Associates, Inc. 31 State Street, 3rd Floor Boston, MA 02109 Richard Jabba, AICP rjabba@fpa-inc.com
Public website for project or other physical location where project materials can be obtained (if available)	Project materials can be found at: salemoffshorewind.com
Municipality and Zip Code for Project (if known)	Municipality: Salem Zip Code: 01970
Project Type* (list all that apply)	Dredging; Industrial; Marine Industrial; Coastal Infrastructure; Other: Marine Cargo
Is the project site within a mapped 100-year FEMA flood plain? Y/N/ unknown	Yes
Estimated GHG emissions of conditioned spaces (click **here** for GHG Estimation tool)	6.3 lbs CO2/sf-yr, 3 tons per year

Project Description

1. Provide a brief project description, including overall size of the project site and square footage of proposed buildings and structures if known.

Crowley Wind Services (the "Proponent"), a subsidiary of Crowley Maritime Corporation, is proposing to redevelop an approximately 42.3-acre property at 67 Derby Street, Salem which is located next to the existing Salem Harbor Power Development LP facility. The Proponent will create an offshore wind marshalling terminal to assemble turbine components and deploy them to offshore wind farms along the northeast coast. Freighters, barges and other marine vessels will be used to deliver the turbine components to the marshalling facility including towers, blades, and nacelles, where they will be staged and partially assembled and transferred to specialized vessels for offshore installation. The project is on a fast track design and permitting schedule in order to support the equipment needs of the offshore wind farms with site construction expected to commence in the spring of 2023.

Key components of the project include a reconstructed 659-foot long wharf, a new 685-foot long pile-supported pier, a new 845-foot long loading berth, a 780-foot long delivery berth, approximately 80,000 cubic yards of maintenance and improvement dredging in the State turning basin (the "basin") and along the piers, and reinforcing existing onshore infrastructure to support the storage and assembly of wind turbine components. A 32'-deep Federal Navigation Channel leads into the proposed 34'-deep basin, which is adjacent to the existing wharf and future pier. An approximately 32.5-acre portion of the site will be used to store the components. There will also be several acres for moving the components around the site, parking, and possible use of temporary site construction trailers. The wharfs and adjacent bulkheads will support heavy lift operations and the mooring of Wind Turbine Installation Vessels (WTIVs), feeder barges, ocean going tugs, and other vessels.

To support the redevelopment of this facility including the pier construction and dredging for future large ship traffic, Crowley is seeking permits from the federal, state, and local agencies.

2. List anticipated MEPA review thresholds (301 CMR 11.03) (if known)
ENF Thresholds
11.03(1)(b)1.: Direct alteration of 25 or more acres of land
11.03(3)(b)1.a.: Alteration of a coastal bank
11.03(3)(b)1.e.: New fill or structure in a velocity zone (VE13)
11.03(3)(b)3.: Dredging >10,000 cy
11.03(3)(b)6.: Solid fill structure >1,000 sf, pile-supported structure >2,000 sf
EIR Thresholds
11.03(1)(a)2.: Creation of 10 or more acres of impervious area
11.03(3)(a)1.b.: Alteration of 10 or more acres of any wetlands other than salt marsh (i.e. dredging basin)

2. List all anticipated state, local and federal permits needed for the project (if known)

Agency	Approval
Local	
Salem Conservation Commission	• WPA Form 5 and local bylaw – Order of Conditions
Salem Zoning Board of Appeals	• Special Permit
Salem Planning Board	• Site Plan Review
State	
Executive Office of Energy and Environmental Affairs	• Massachusetts Environmental Policy Act (MEPA) Certificate on EENF • Massachusetts Environmental Policy Act (MEPA) Certificate on Single Environmental Impact Report
Massachusetts Department of Environmental Protection	• Chapter 91 License • 401 Water Quality Certification
Massachusetts Office of Coastal Zone Management	• Coastal Zone Management Federal Consistency Review

	Massachusetts Historical Commission	• No Adverse Effects on Historic Properties (Section 106 and State Chapter 254)
	Federal	
	U.S. Army Corps of Engineers	• Finding of No Significant Impact under NEPA • General Permit (USACE Individual Section 10, 103 and 404)
	Federal Aviation Administration	• Determination of No Hazard to Air Navigation for Permanent or Temporary Structures
	U.S. Environmental Protection Agency	• EPA NPDES Dewatering General Permit

4. Identify EJ populations and characteristics (Minority, Income, English Isolation) within 5 miles of project site (can attach map identifying 5-mile radius from EJ Maps Viewer in lieu of narrative)

Please see attached map.

5. Identify any municipality or census tract meeting the definition of "vulnerable health EJ criteria" in the DPH EJ Tool located in whole or in part within a 1 mile radius of the project site

Municipality: Salem
Census Tract:

- 25,009,204,200
- 25,009,204,300
- 25,009,204,400
- 25,009,204,500
- 25,009,204,600

6. Identify potential short-term and long-term environmental and public health impacts that may affect EJ Populations and any anticipated mitigation.

There may be potential temporary air quality impacts during the construction of the terminal and its components. These impacts may include dust from demolition and site excavation, emissions from construction equipment, and increased vehicular traffic to and from the Project Site. The Proponents will follow local and state construction regulations and best practices to minimize these air quality impacts in the surrounding community. Although there may also be temporary impacts to the bottom habitats and water quality due to dredging operations, the health of Salem Harbor will not be permanently impacted.

To avoid or minimize the effects of fugitive dust and exhaust emissions from construction vehicles, appropriate mitigation measures will be employed, such as the use of diesel retrofitted equipment and wetting down areas during construction. To avoid, mitigate, or minimize temporary construction-period noise pollution impacts, the Project will comply with the City of Salem Noise Control Ordinance. Efforts will be made to minimize the noise impact of construction activities, including appropriate mufflers on all equipment such as air compressors and welding equipment, maintenance of intake and exhaust mufflers, turning off idling equipment, replacing specific operations and techniques with less noisy ones, and other appropriate noise reduction measures. Construction management and scheduling will minimize impacts on the surrounding environment and will include plans for construction worker commuting, routing plans for trucking and deliveries, and control of noise and dust. Designated truck routes will be established to govern where construction trucks access and egress the Project Site to minimize construction related traffic. The contractor will use best management practices, for upland and in-water work as necessary, such as turbidity curtains and time of year restrictions.

The Project is not expected to result in potential permanent adverse environmental or public health impacts that may affect EJ populations.

7. Identify project benefits, including “Environmental Benefits” as defined in 301 CMR 11.02, that may improve environmental conditions or public health of the EJ population

This project is expected to create 900 full-time equivalent (FTE) jobs through the development of the project and the first five years of the project’s operation once construction is completed. Increasing offshore wind developments will help Massachusetts meet its clean energy and climate goals, and this project will be an important next step for the Commonwealth to reduce dependence on fossil fuels and its associated impacts on climate, the environment, and public health. Clean renewable energy is an environmental benefit as defined by 301 CMR 11.02, and while there will not be renewable energy directly produced on the Project Site, the wind terminal marshaling and construction services on the site will be a crucial part in meeting the state’s renewable energy targets and achieving this environmental benefit.

The development of the site will turn a large, vacant, and underutilized portion of Salem’s waterfront into a productive and viable terminal that will replace dilapidated structures with a new modern facility, which is being designed to last 50 years or more. The new stormwater drainage system will improve the water quality and habitat of Salem Harbor, which is enjoyed by all those the recreate on and along this valuable community resource.

8. Describe how the community can request a meeting to discuss the project, and how the community can request oral language interpretation services at the meeting. Specify how to request other accommodations, including meetings after business hours and at locations near public transportation.

Members of the community can request a meeting or obtain information, including translated materials, by contacting John Berry at 603.247.3363 or John.Berry@crowley.com. Requests for accommodations, including meetings after business hours and at locations near public transportation, can also be sent to Jared.

Project information in English or Spanish will be maintained on the websites below:

www.salemoffshorewind.com

SPANISH

Formulario de Evaluación de la Justicia Medioambiental

Nombre del Proyecto	Puerto de Viento de Salem
Fecha Prevista de Presentación ante la MEPA	Formulario de Notificación Ambiental Ampliado (EENF): 30 de septiembre de 2022
Nombre del Proponente	Crowley Wind Services, Inc.
Información de Contacto (por ejemplo, consultor)	Proponente: Crowley Wind Services, Inc. 225 Dyer Street Providence, RI 02903 John Berry, Terminal Manager John.Berry@crowley.com Consultor de Planificación y Permisos: Fort Point Associates, Inc. 31 State Street, 3rd Floor Boston, MA 02109 Richard Jabba, AICP rjabba@fpa-inc.com
Sitio web público del proyecto u otro lugar físico donde se puedan obtener los materiales del proyecto (si está disponible)	Los materiales del proyecto se pueden encontrar en: salemoffshorewind.com
Municipio y Código Postal del proyecto (si se conocen)	Municipio: Salem Código Postal: 01970
Tipo de Proyecto* (enumere todos los que correspondan)	Dragado; Industrial; Industrial Marítimo; Infraestructura Costera; Otros: Carga Marítima
¿Se encuentra el lugar del proyecto dentro de un terreno inundable de 100 años mapeado por FEMA? Sí/No/desconocido	Sí
Emisiones estimadas de GEI de los espacios acondicionados (haga clic aquí para ver la Herramienta de Estimación de GEI)	6,3 lbs CO_2/pc-año, 3 toneladas por año

Descripción del Proyecto

1. Describa brevemente el proyecto, incluyendo el tamaño total del sitio del proyecto y los pies cuadrados de los edificios y estructuras propuestos, si se conocen.

Crowley Wind Services (el "Proponente"), una subsidiaria de Crowley Maritime Corporation, propone reurbanizar una propiedad de aproximadamente 42,3 acres en el 67 de Derby Street, Salem, que se encuentra junto a las actuales instalaciones de Salem Harbor Power Development LP. El Proponente creará una terminal de clasificación de energía eólica marina para ensamblar los componentes de las turbinas y desplegarlos en los parques eólicos marinos a lo largo de la costa noreste. Se utilizarán cargueros, barcazas y otras embarcaciones marítimas para llevar los componentes de las turbinas a la instalación de almacenamiento, incluidas las torres, las palas y las góndolas, donde se montarán parcialmente y se transferirán a embarcaciones especializadas para su instalación en alta mar. El proyecto tiene un calendario de diseño y permisos acelerados para satisfacer las necesidades de equipamiento de los parques eólicos marinos, y se espera que la construcción de las instalaciones comience en la primavera de 2023.

Los componentes clave del proyecto incluyen un muelle reconstruido de 659 pies de largo, un nuevo muelle de 685 pies de largo apoyado en pilotes, un nuevo muelle de carga de 845 pies de largo, un muelle de entrega de 780 pies de largo, aproximadamente 80.000 yardas cúbicas de dragado de mantenimiento y mejora en la cuenca de giro del Estado (la "cuenca") y a lo largo de los muelles, y el refuerzo de la infraestructura existente en tierra para apoyar el almacenamiento y el montaje de los componentes de las turbinas eólicas. Un canal de navegación federal de 32 pies de profundidad desemboca en la cuenca propuesta de 34 pies de profundidad, que es adyacente al muelle existente y al futuro muelle. Una parte de aproximadamente 32,5 acres del sitio se utilizará para almacenar los componentes. También habrá varios acres para el traslado de los componentes por el sitio, el estacionamiento y el posible uso de remolques temporarios para la construcción del sitio. Los muelles y los mamparos adyacentes soportarán las operaciones de elevación de cargas pesadas y el amarre de los buques de instalación de aerogeneradores (WTIV), las barcazas de alimentación, los remolcadores oceánicos y otros buques.

Para apoyar la remodelación de esta instalación, incluyendo la construcción del muelle y el dragado para el futuro tráfico de grandes buques, Crowley está buscando permisos de las agencias federales, estatales y locales.

2. Indique los umbrales de revisión de la MEPA anticipados (301 CMR 11.03) (si se conocen)
Umbrales de la ENF
11.03(1)(b)1.: Alteración directa de 25 o más acres de terreno
11.03(3)(b)1.a.: Alteración de un margen costero
11.03(3)(b)1.e.: Nuevo relleno o estructura en una zona de velocidad (VE13)
11.03(3)(b)3.: Dragado >10.000 cy
11.03(3)(b)6.: Estructura de relleno sólido >1.000 pies cuadrados, estructura soportada por pilotes >2.000 pies cuadrados
Umbrales de la RIE
11.03(1)(a)2.: Creación de 10 o más acres de superficie impermeable
11.03(3)(a)1.b.: Alteración de 10 o más acres de cualquier humedal que no sea una marisma (por ejemplo, una cuenca de dragado)

3. Indique todos los permisos estatales, locales y federales previstos que se necesitan para el proyecto (si se conocen)

Agencia	Aprobación
Local	
Comisión de Conservación de Salem	• Formulario 5 de la WPA y reglamento local - Orden de Condiciones
Junta de Apelación de Zonificación de Salem	• Permiso Especial
Junta de Planificación de Salem	• Revisión del Plan de Sitio
Estado	

Oficina Ejecutiva de Energía y Asuntos Medioambientales	• Certificado de la Ley de Política Medioambiental de Massachusetts (MEPA) sobre la EENF • Certificado de la Ley de Política Ambiental de Massachusetts (MEPA)
Departamento de Protección Ambiental de Massachusetts	• Licencia del Capítulo 91 • Certificado de Calidad del Agua 401
Oficina de Gestión de la Zona Costera de Massachusetts	• Revisión de la Consistencia Federal de la Gestión de la Zona Costera
Comisión Histórica de Massachusetts	• Sin Efectos Adversos en Propiedades Históricas (Sección 106 y Capítulo 254 del Estado)
Federal	
Cuerpo de Ingenieros del Ejército de los EE.UU.	• Declaración de No Impacto Significativo según la NEPA • Permiso General (Sección 10, 103 y 404 del USACE)
Administración Federal de Aviación	• Determinación de que No hay Peligro para la Navegación Aérea para Estructuras Permanentes o Temporarias
Agencia de Protección del Medio Ambiente de los Estados Unidos	• Permiso General de Desagüe NPDES de la EPA

4. Identifique las poblaciones y las características de justicia ambiental (EJ) (Minorías, Ingresos, Aislamiento por el idioma Inglés) en un radio de 5 millas del sitio del proyecto (puede adjuntar un mapa de EJ Maps Viewer en lugar de una descripción).

Véase el mapa adjunto.

5. Identifique cualquier municipio o zona censal que cumpla con la definición de "criterios de justicia ambiental por salud vulnerable" en la herramienta DPH EJ Tool que se encuentre total o parcialmente dentro de un radio de 1 milla del sitio del proyecto.

Municipio: Salem
Zona Censal:

- 25,009,204,200
- 25,009,204,300
- 25,009,204,400
- 25,009,204,500
- 25,009,204,600

6. Identifique los posibles impactos ambientales y de salud pública a corto y largo plazo que puedan afectar a las poblaciones EJ y cualquier mitigación prevista.

Pueden producirse impactos temporarios sobre la calidad del aire durante la construcción de la terminal y sus componentes. Estos impactos pueden incluir el polvo de la demolición y la excavación del sitio, las emisiones de los equipos de construcción y el aumento del tráfico vehicular hacia y desde el Sitio del Proyecto. Los Proponentes seguirán las normas de construcción locales y estatales y las mejores prácticas para minimizar estos impactos en la calidad del aire en la comunidad circundante. Aunque también puede haber impactos temporarios en los hábitats del fondo y en la calidad del agua debido a las operaciones de dragado, la salud del puerto de Salem no se verá afectada en forma permanente.

Para evitar o minimizar los efectos del polvo fugitivo y las emisiones de escape de los vehículos de construcción, se emplearán medidas de mitigación apropiadas, como el uso de equipos retroadaptados para el uso de diésel y la humectación de las zonas durante la construcción. Para evitar, mitigar o minimizar los impactos de la contaminación acústica durante el período de construcción, el Proyecto cumplirá con la Ordenanza de Control de Ruido de la Ciudad de Salem. Se harán esfuerzos para minimizar el impacto sonoro de las actividades de construcción, incluyendo silenciadores apropiados en todos los equipos, como compresores de aire y equipos de soldadura, mantenimiento de silenciadores de admisión y escape, apagado de equipos en ralentí, sustitución de operaciones y técnicas específicas por otras menos ruidosas, y otras medidas apropiadas de reducción del ruido. La gestión y la programación de la construcción minimizarán el impacto en el medio ambiente circundante e incluirán planes para el desplazamiento de los trabajadores de la construcción, planes de ruta para el transporte en camión y las entregas, y el control del ruido y el polvo. Se establecerán rutas de camiones designadas para regular el acceso y la salida de los camiones de construcción del sitio del proyecto para minimizar el tráfico relacionado con la construcción. El contratista utilizará las mejores prácticas de gestión, para los trabajos en tierra firme y en el agua, según sea necesario, como cortinas de turbidez y restricciones de la época del año.

No se espera que el Proyecto resulte en potenciales impactos ambientales o de salud pública adversos permanentes que puedan afectar a las poblaciones de justicia ambiental.

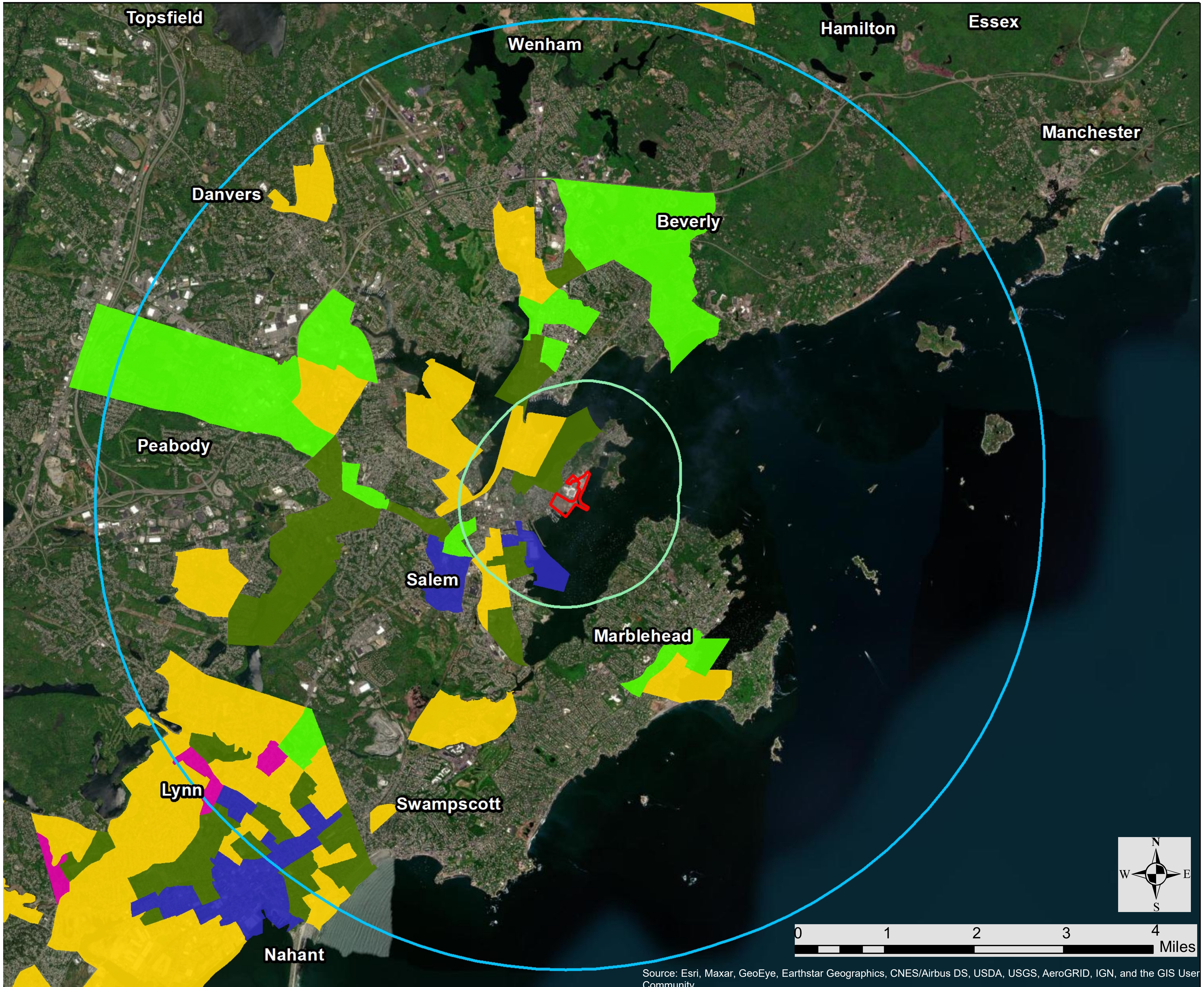
7. Identifique los beneficios del proyecto, incluidos los " Beneficios Ambientales " tal como se definen en 301 CMR 11.02, que puedan mejorar las condiciones ambientales o la salud pública de la población de justicia ambiental

Se espera que este proyecto cree 900 puestos de trabajo equivalentes a tiempo completo (ETC) durante el desarrollo del proyecto y los primeros cinco años de funcionamiento del mismo, una vez finalizada su construcción. El aumento del desarrollo de la energía eólica marina ayudará a Massachusetts a cumplir sus objetivos en materia de energía limpia y clima, y este proyecto será un paso importante para que la Commonwealth reduzca la dependencia de los combustibles fósiles y sus impactos asociados en el clima, el medio ambiente y la salud pública. La energía limpia y renovable es un beneficio medioambiental según la definición de 301 CMR 11.02, y aunque no habrá energía renovable producida directamente en el Sitio del Proyecto, los servicios de construcción y de marquetería de la terminal eólica en el sitio serán una parte crucial para alcanzar los objetivos de energía renovable del estado y lograr este beneficio medioambiental.

El desarrollo del sitio convertirá una parte grande, vacía e infrautilizada del paseo marítimo de Salem en una terminal productiva y viable que sustituirá las estructuras ruinosas por una nueva instalación moderna, que se está diseñando para durar 50 años o más. El nuevo sistema de drenaje de aguas

pluviales mejorará la calidad del agua y el hábitat del puerto de Salem, del que disfrutan todos los que se recrean en y a lo largo de este valioso recurso comunitario.
8. Describa cómo la comunidad puede solicitar una reunión para debatir el proyecto y cómo puede solicitar servicios de interpretación oral en la reunión. Especifique cómo solicitar otras adaptaciones, incluidas las reuniones fuera del horario comercial y en lugares cercanos al transporte público. Los miembros de la comunidad pueden solicitar una reunión u obtener información, incluido el material traducido, poniéndose en contacto con John Berry en el 603.247.3363 o en John.Berry@crowley.com. Las solicitudes de alojamiento, incluidas las reuniones fuera del horario laboral y en lugares cercanos al transporte público, también pueden enviarse a Jared. La información del proyecto en inglés o en español se mantendrá en los sitios web que se indican a continuación: www.salemoffshorewind.com

EJ COMMUNITIES WITHIN 5-MILES OF THE PROJECT SITE



Legend

- Project Site
- EJ Communities within 5-miles
- EJ Communities within 1-mile

2020 Environmental Justice blockgroups

EJ Criteria

- Minority
- Income
- Engllish isolation
- Minority and Income
- Minority and English isolation
- Income and English isolation
- Minority, Income and English isolation

Prepared For:

Crowley Wind Services, Inc.

Prepared By:

Fort Point Associates, Inc.
A TETRA TECH COMPANY

Works Cited:

Mass EEA, 2020
Esri, 2021

Coordinate System:

NAD 1983
2011 Massachusetts State Plane, Mainland

Date: 8/16/2022

Attachment G

EPA EJ SCREEN REPORT

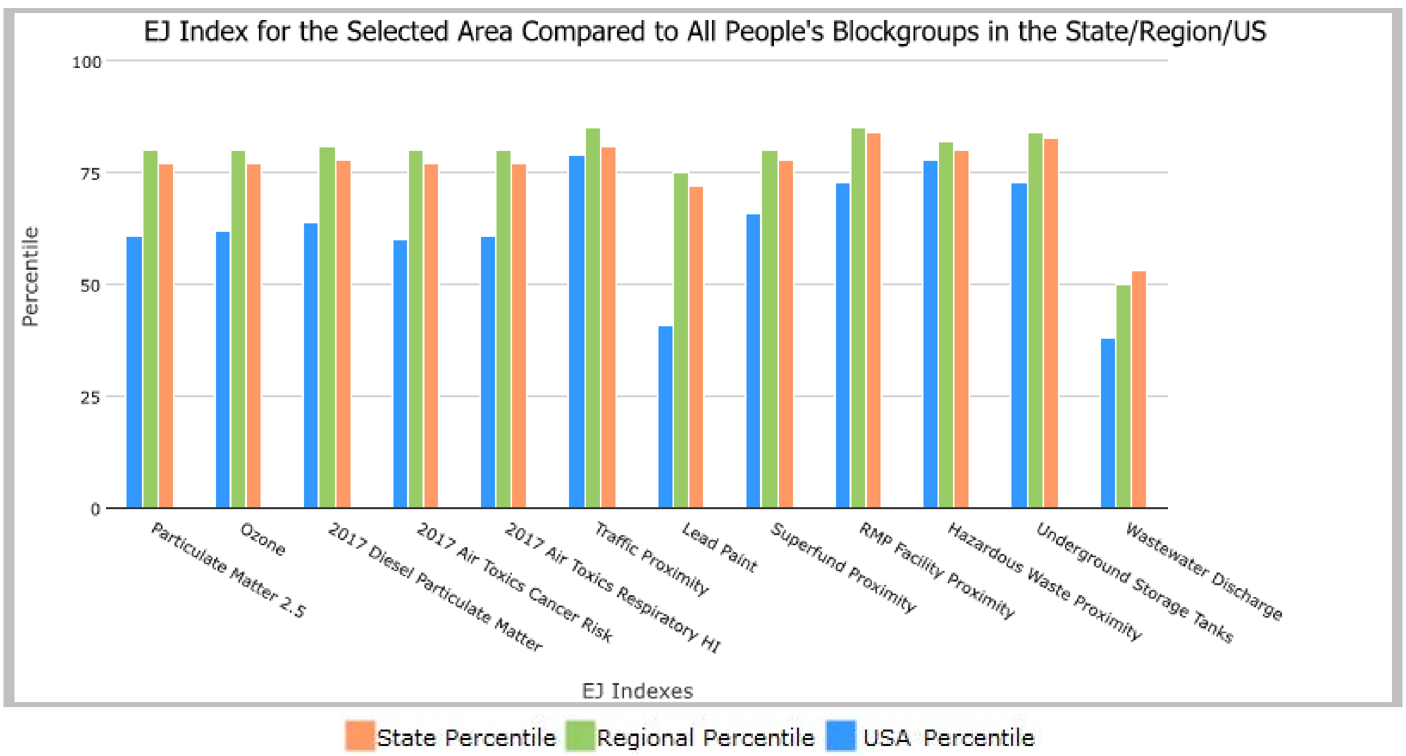
EJScreen Report (Version 2.0)

1 mile Ring Centered at 42.523710,-70.882220, MASSACHUSETTS, EPA Region 1

Approximate Population: 15,024

Input Area (sq. miles): 3.14

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	77	80	61
EJ Index for Ozone	77	80	62
EJ Index for 2017 Diesel Particulate Matter*	78	81	64
EJ Index for 2017 Air Toxics Cancer Risk*	77	80	60
EJ Index for 2017 Air Toxics Respiratory HI*	77	80	61
EJ Index for Traffic Proximity	81	85	79
EJ Index for Lead Paint	72	75	41
EJ Index for Superfund Proximity	78	80	66
EJ Index for RMP Facility Proximity	84	85	73
EJ Index for Hazardous Waste Proximity	80	82	78
EJ Index for Underground Storage Tanks	83	84	73
EJ Index for Wastewater Discharge	53	50	38



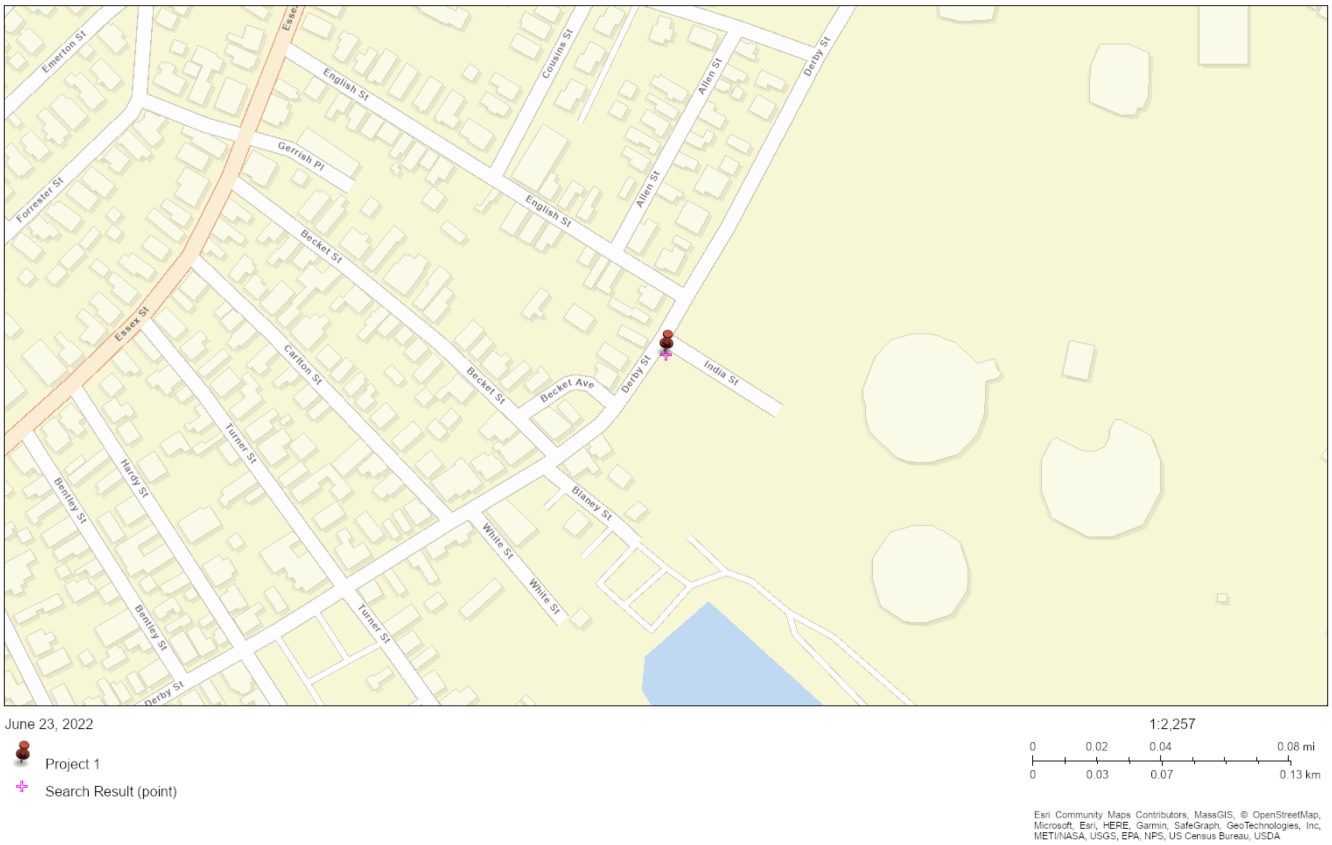
This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJScreen Report (Version 2.0)

1 mile Ring Centered at 42.523710,-70.882220, MASSACHUSETTS, EPA Region 1

Approximate Population: 15,024

Input Area (sq. miles): 3.14



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	1

EJScreen Report (Version 2.0)

1 mile Ring Centered at 42.523710,-70.882220, MASSACHUSETTS, EPA Region 1

Approximate Population: 15,024

Input Area (sq. miles): 3.14

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Pollution and Sources							
Particulate Matter 2.5 (μg/m^3)	6.58	6.78	40	6.68	45	8.74	8
Ozone (ppb)	39.7	39.5	62	39.8	51	42.6	30
2017 Diesel Particulate Matter* (μg/m^3)	0.292	0.295	63	0.227	70-80th	0.295	60-70th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	20	24	56	23	60-70th	29	<50th
2017 Air Toxics Respiratory HI*	0.3	0.3	81	0.28	90-95th	0.36	<50th
Traffic Proximity (daily traffic count/distance to road)	3800	2100	86	1300	92	710	96
Lead Paint (% Pre-1960 Housing)	0.8	0.49	83	0.44	88	0.28	93
Superfund Proximity (site count/km distance)	0.22	0.17	83	0.15	84	0.13	87
RMP Facility Proximity (facility count/km distance)	0.79	0.7	70	0.6	74	0.75	70
Hazardous Waste Proximity (facility count/km distance)	6.4	5.2	80	3.8	85	2.2	91
Underground Storage Tanks (count/km^2)	3.2	3.1	67	3	70	3.9	68
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00028	0.21	38	0.4	42	12	39
Socioeconomic Indicators							
Demographic Index	34%	25%	73	24%	76	36%	56
People of Color	33%	28%	66	25%	72	40%	50
Low Income	36%	22%	79	23%	78	31%	63
Unemployment Rate	6%	5%	70	5%	70	5%	65
Linguistically Isolated	5%	6%	67	5%	74	5%	73
Less Than High School Education	11%	9%	69	9%	71	12%	58
Under Age 5	5%	5%	54	5%	55	6%	43
Over Age 64	16%	16%	55	17%	50	16%	58

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

Attachment H

RMAT TOOL REPORT

Climate Resilience Design Standards Tool Project Report

Salem Wind Port

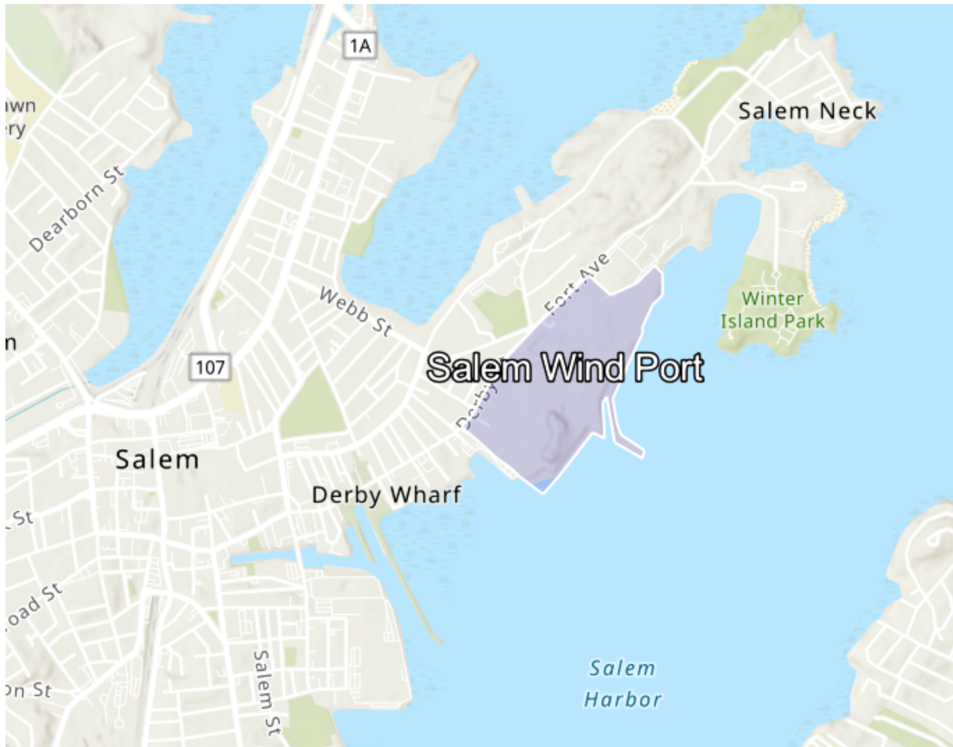
Date Created: 6/28/2022 10:43:55 AM
Created By: ehunter
Date Report Generated: 9/13/2022 12:04:55 PM
Tool Version: Version 1.2
Project Contact Information: Richard Jabba (rjabba@fpa-inc.com)

Project Summary

Link to Project

Estimated Capital Cost: $160000000.00
End of Useful Life Year: 2053
Project within mapped Environmental Justice neighborhood: Yes

Ecosystem Service Benefits	Scores
Project Score	Low
Exposure	**Scores**
Sea Level Rise/Storm Surge	High Exposure
Extreme Precipitation - Urban Flooding	High Exposure
Extreme Precipitation - Riverine Flooding	High Exposure
Extreme Heat	High Exposure



Asset Preliminary Climate Risk Rating Summary

Number of Assets: 3

Asset Risk	Sea Level Rise/Storm Surge	Extreme Precipitation - Urban Flooding	Extreme Precipitation - Riverine Flooding	Extreme Heat
Warehouse	High Risk	High Risk	High Risk	High Risk
Wharf	High Risk	High Risk	High Risk	High Risk
Office Trailer	High Risk	High Risk	High Risk	High Risk

Climate Resilience Design Standards Summary

	Target Planning Horizon	Intermediate Planning Horizon	Percentile	Return Period	Tier
Sea Level Rise/Storm Surge					
Warehouse	2030			20-yr (5%)	
Wharf	2050			100-yr (1%)	
Office Trailer	2050			50-yr (2%)	
Extreme Precipitation					
Warehouse	2030			5-yr (20%)	Tier 1
Wharf	2050			10-yr (10%)	Tier 2
Office Trailer	2050			10-yr (10%)	Tier 2
Extreme Heat					
Warehouse	2030		50th		Tier 1

Wharf	2050	50th	Tier 2
Office Trailer	2050	50th	Tier 2

Scoring Rationale - Project Exposure Score

The purpose of the Exposure Score output is to provide a preliminary assessment of whether the overall project site and subsequent assets are exposed to impacts of natural hazard events and/or future impacts of climate change. For each climate parameter, the Tool will calculate one of the following exposure ratings: Not Exposed, Low Exposure, Moderate Exposure, or High Exposure. The rationale behind the exposure rating is provided below.

Sea Level Rise/Storm Surge

This project received a "High Exposure" because of the following:

- Located within the predicted mean high water shoreline by 2030
- Exposed to the 1% annual coastal flood event as early as 2030
- Located within the 0.1% annual coastal flood event within the project's useful life

Extreme Precipitation - Urban Flooding

This project received a "High Exposure" because of the following:

- Increased impervious area
- Maximum annual daily rainfall exceeds 10 inches within the overall project's useful life
- Existing impervious area of the project site is greater than 50%
- No historic flooding at project site

Extreme Precipitation - Riverine Flooding

This project received a "High Exposure" because of the following:

- Part of the project is within a mapped FEMA floodplain, outside of the Massachusetts Coast Flood Risk Model (MC-FRM)
- No historic riverine flooding at project site
- Project is more than 500ft from a waterbody
- Project is not likely susceptible to riverine erosion

Extreme Heat

This project received a "High Exposure" because of the following:

- Increased impervious area
- Existing impervious area of the project site is greater than 50%
- 10 to 30 day increase in days over 90 deg. F within project's useful life
- Located within 100 ft of existing water body
- No tree removal

Scoring Rationale - Asset Preliminary Climate Risk Rating

A Preliminary Climate Risk Rating is determined for each infrastructure and building asset by considering the overall project Exposure Score and responses to Step 4 questions provided by the user in the Tool. Natural Resource assets do not receive a risk rating. The following factors are what influenced the risk ratings for each asset.

Asset - Warehouse
Primary asset criticality factors influencing risk ratings for this asset:

- Asset may inaccessible/inoperable for more than a day but less than a week after natural hazard event
- Less than 1,000 people would be directly affected by the loss/inoperability of the asset
- Inoperability of the asset would not be expected to result in injuries
- Inoperability may moderately impact other facilities, assets, or buildings, but is not expected to affect their ability to operate
- Spills and/or releases of hazardous materials would be relatively easy to clean up

Asset - Wharf
Primary asset criticality factors influencing risk ratings for this asset:

- Asset may inaccessible/inoperable for more than a day but less than a week after natural hazard event
- Loss/inoperability of the asset would have impacts limited to the location of infrastructure only
- Inoperability of the asset would not be expected to result in injuries
- Inoperability may moderately impact other facilities, assets, or buildings, but is not expected to affect their ability to operate
- There are no hazardous materials in the asset

Asset - Office Trailer
Primary asset criticality factors influencing risk ratings for this asset:

- Asset may inaccessible/inoperable for more than a day but less than a week after natural hazard event
- Loss/inoperability of the asset would have impacts limited to the site only
- Inoperability of the asset would not be expected to result in injuries
- Inoperability may moderately impact other facilities, assets, or buildings, but is not expected to affect their ability to operate
- There are no hazardous materials in the asset

Project Climate Resilience Design Standards Output

Climate Resilience Design Standards and Guidance are recommended for each asset and climate parameter. The Design Standards for each climate parameter include the following: recommended planning horizon (target and/or intermediate), recommended return period (Sea Level Rise/Storm Surge and Precipitation) or percentile (Heat), and a list of applicable design criteria that are likely to be affected by climate change. Some design criteria have numerical values associated with the recommended return period and planning horizon, while others have tiered methodologies with step-by-step instructions on how to estimate design values given the other recommended design standards.

Asset: Warehouse — Building/Facility

Sea Level Rise/Storm Surge — High Risk

Target Planning Horizon: 2030
Intermediate Planning Horizon: Not Applicable
Return Period: 20-yr (5%)

LIMITATIONS: The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

The projected values, Standards, and Guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.

Applicable Design Criteria

Projected Tidal Datums: APPLICABLE

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2030	6.3	5.9	1.3	-3.3	-3.6

Projected Water Surface Elevation: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Warehouse	2030	5% (20-Year)	10.7	9.2	10.2

Projected Wave Action Water Elevation: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Warehouse	2030	5% (20-Year)	16.4	9.2	10.5

Projected Wave Heights: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(Feet)		
Warehouse	2030	5% (20-Year)	10.5	0.0	0.7

ATTENTION: This project intersects areas influenced by wave overtopping based flooding. These areas are where flooding is caused by intermittent pulses that come from wave run-up and overtopping at a coastal structure. Additional site analyses are recommended to establish design values associated with design criteria.

Projected Duration of Flooding: APPLICABLE
Methodology to Estimate Projected Values

Projected Design Flood Velocity: APPLICABLE
Methodology to Estimate Projected Values

Projected Scour & Erosion: NOT APPLICABLE

Extreme Precipitation — High Risk

Target Planning Horizon: 2030
Return Period: 5-yr (20%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

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Applicable Design Criteria

Tiered Methodology: Tier 1

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Warehouse	2030	5-Year (20%)	4.7	Downloadable Methodology PDF

ATTENTION: This is a Tier 1 project. It is advised to compare the extreme precipitation output values to the NOAA+ methodology to calculate total precipitation depth for 24-hr design storms.

This methodology can be found in the following PDF. (Link).

Projected Riverine Peak Discharge & Peak Flood Elevation: APPLICABLE
Methodology to Estimate Projected Values : Tier 1

Extreme Heat High Risk

Target Planning Horizon: 2030
Percentile: 50th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 1

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE
Methodology to Estimate Projected Values : Tier 1

Projected Heat Index: APPLICABLE
Methodology to Estimate Projected Values : Tier 1

Projected Growing Degree Days: NOT APPLICABLE

Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: APPLICABLE
Methodology to Estimate Projected Values : Tier 1

Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE
Methodology to Estimate Projected Values : Tier 1

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): APPLICABLE
Methodology to Estimate Projected Values : Tier 1

Sea Level Rise/Storm Surge High Risk

Target Planning Horizon: 2050
Intermediate Planning Horizon: Not Applicable
Return Period: 100-yr (1%)

LIMITATIONS: The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

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Applicable Design Criteria

Projected Tidal Datums: APPLICABLE

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2050	7.5	7.1	2.5	-2.1	-2.4

Projected Water Surface Elevation: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Wharf	2050	1% (100-Year)	13.3	11.5	11.8

Projected Wave Action Water Elevation: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Wharf	2050	1% (100-Year)	21.2	11.5	12.5

Projected Wave Heights: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(Feet)		
Wharf	2050	1% (100-Year)	13.5	0.0	1.3

ATTENTION: This project intersects areas influenced by wave overtopping based flooding. These areas are where flooding is caused by intermittent pulses that come from wave run-up and overtopping at a coastal structure. Additional site analyses are recommended to establish design values associated with design criteria.

Projected Duration of Flooding: APPLICABLE
Methodology to Estimate Projected Values

Projected Design Flood Velocity: APPLICABLE
Methodology to Estimate Projected Values

Projected Scour & Erosion: APPLICABLE
Methodology to Estimate Projected Values

Extreme Precipitation High Risk

Target Planning Horizon: 2050
Return Period: 10-yr (10%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

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Applicable Design Criteria

Tiered Methodology: Tier 2

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Wharf	2050	10-Year (10%)	6.1	Downloadable Methodology PDF

Projected Riverine Peak Discharge & Peak Flood Elevation: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Extreme Heat High Risk

Target Planning Horizon: 2050
Percentile: 50th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 2

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Projected Heat Index: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Projected Growing Degree Days: NOT APPLICABLE

Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): NOT APPLICABLE

Asset: Office Trailer Building/Facility

Sea Level Rise/Storm Surge High Risk

Target Planning Horizon: 2050
Intermediate Planning Horizon: Not Applicable
Return Period: 50-yr (2%)

LIMITATIONS: The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

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Applicable Design Criteria

Projected Tidal Datums: APPLICABLE

Planning Horizon	MHHW	MHW	MTL	MLW	MLLW
	(ft-NAVD88)				
2050	7.5	7.1	2.5	-2.1	-2.4

Projected Water Surface Elevation: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Office Trailer	2050	2% (50-Year)	12.7	10.7	11.4

Projected Wave Action Water Elevation: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(ft - NAVD88)		
Office Trailer	2050	2% (50-Year)	20.2	10.7	12.0

Projected Wave Heights: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period	Max	Min	Area Weighted Average
			(Feet)		
Office Trailer	2050	2% (50-Year)	12.5	0.0	1.1

ATTENTION: This project intersects areas influenced by wave overtopping based flooding. These areas are where flooding is caused by intermittent pulses that come from wave run-up and overtopping at a coastal structure. Additional site analyses are recommended to establish design values associated with design criteria.

Projected Duration of Flooding: APPLICABLE
Methodology to Estimate Projected Values

Projected Design Flood Velocity: APPLICABLE
Methodology to Estimate Projected Values

Projected Scour & Erosion: NOT APPLICABLE

Extreme Precipitation High Risk

Target Planning Horizon: 2050
Return Period: 10-yr (10%)

LIMITATIONS: The recommended Standards for Total Precipitation Depth & Peak Intensity are determined by the user drawn polygon and relationships as defined in the Supporting Documents. The projected Total Precipitation Depth values provided through the Tool are based on the climate projections developed by Cornell University as part of EEA's Massachusetts Climate and Hydrologic Risk Project, GIS-based data as of 10/15/21. For additional information on the methodology of these precipitation outputs, see Supporting Documents.

While Total Precipitation Depth & Peak Intensity for 24-hour Design Storms are useful to inform planning and design, it is recommended to also consider additional longer- and shorter-duration precipitation events and intensities in accordance with best practices. Longer-duration, lower-intensity storms allow time for infiltration and reduce the load on infrastructure over the duration of the storm. Shorter-duration, higher-intensity storms often have higher runoff volumes because the water does not have enough time to infiltrate infrastructure systems (e.g., catch basins) and may overflow or back up during such storms, resulting in flooding. In the Northeast, short-duration high intensity rain events are becoming more frequent, and there is often little early warning for these events, making it difficult to plan operationally. While the Tool does not provide recommended design standards for these scenarios, users should still consider both short- and long-duration precipitation events and how they may impact the asset.

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Applicable Design Criteria

Tiered Methodology: Tier 2

Projected Total Precipitation Depth & Peak Intensity for 24-hr Design Storms: APPLICABLE

Asset Name	Recommended Planning Horizon	Recommended Return Period (Design Storm)	Projected 24-hr Total Precipitation Depth (inches)	Step-by-Step Methodology for Peak Intensity
Office Trailer	2050	10-Year (10%)	6.1	Downloadable Methodology PDF

Projected Riverine Peak Discharge & Peak Flood Elevation: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Extreme Heat High Risk

Target Planning Horizon: 2050
Percentile: 50th Percentile

Applicable Design Criteria

Tiered Methodology: Tier 2

Projected Annual/Summer/Winter Average Temperatures: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Projected Heat Index: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Projected Growing Degree Days: NOT APPLICABLE

Projected Days Per Year With Max Temp > 95°F, >90°F, <32°F: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Projected Number of Heat Waves Per Year & Average Heat Wave Duration: APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Projected Cooling Degree Days & Heating Degree Days (base = 65°F): APPLICABLE
Methodology to Estimate Projected Values : Tier 2

Sea Level Rise/Storm Surge Project Maps

The following three maps illustrate the Projected Water Surface Elevation for the 2030, 2050, and 2070 planning horizons corresponding to the lowest return period (largest design storm) recommended across the assets identified for this project in the Tool. For projects that only have Natural Resource assets, the maps will show the Projected Water Surface Elevations corresponding to the 5% (20-year) return period. Refer to the Climate Resilience Design Standards Output - Sea Level Rise/Storm Surge Section for additional values associated with other assets. The maps include the project area as drawn by the user with a 0.1 mile minimum buffer, but do not reflect the location of specific assets on the site.

LIMITATIONS: The recommended Climate Resilience Design Standards for the Sea Level Rise / Storm Surge Design Criteria are based on the user drawn polygon and relationships as defined in the Supporting Documents. The projected values and maps provided through the Tool are based on the Massachusetts Coast Flood Risk Model (MC-FRM) outputs as of 9/13/2021, which included GIS-based data for three planning horizons (2030, 2050, 2070) and six return periods (0.1%, 0.2%, 0.5%, 1%, 2%, 5%). These values are projections based on assumptions as defined in the model and the LiDAR used at the time. For additional information on the MC-FRM, review the additional resources provided on the Start Here page.

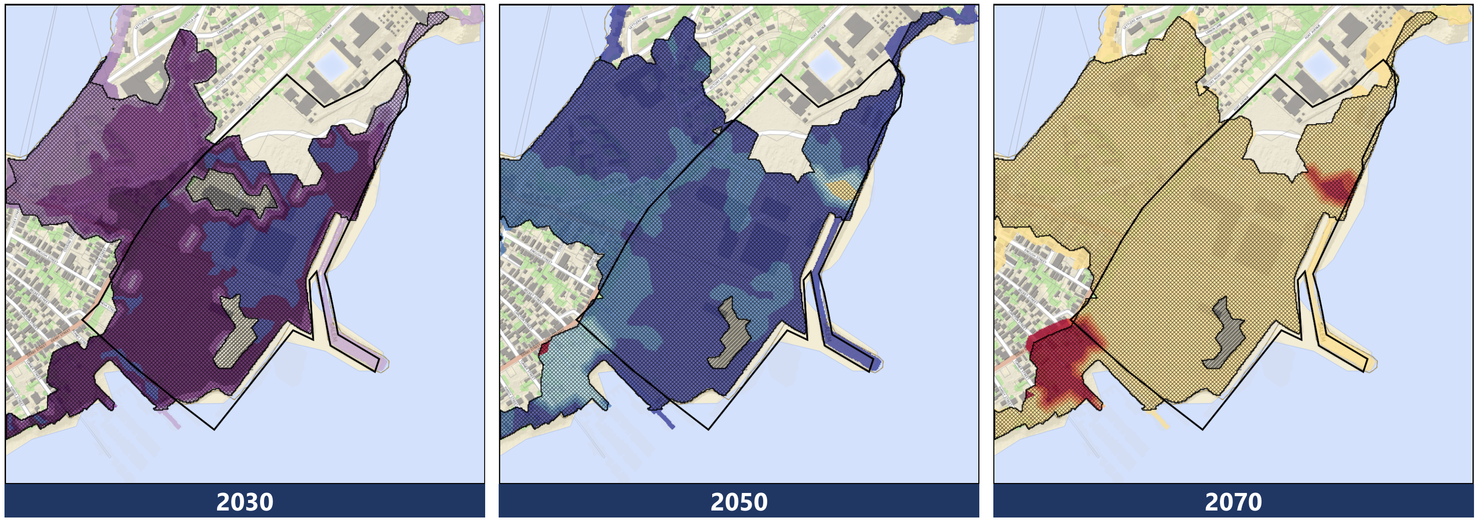
The projected values, maps, Standards, and Guidance provided within this Tool may be used to inform plans and designs, but they do not provide guarantees for future conditions or resilience. The projected values are not to be considered final or appropriate for construction documents without supporting engineering analyses. The guidance provided within this Tool is intended to be general and users are encouraged to do their own due diligence.

Legend

Project Boundary
Influenced by wave overtopping

Projected Water Surface Elevation (ft-NAVD88)

≤ 10.0
10.0 - 10.3
10.3 - 10.8
10.8 - 11.3
11.3 - 11.8
11.8 - 12.3
12.3 - 12.8
12.8 - 13.3
13.3 - 13.8
13.8 - 14.3
14.3 - 14.8
14.8 - 15.3
≥ 15.3



Climate Resilience Design Standards Tool:
Sea Level Rise/Storm Surge Design Criteria
Projected Water Surface Elevation Map: 1% (100-yr)

Project Name: Salem Wind Port
Location (Town): Salem

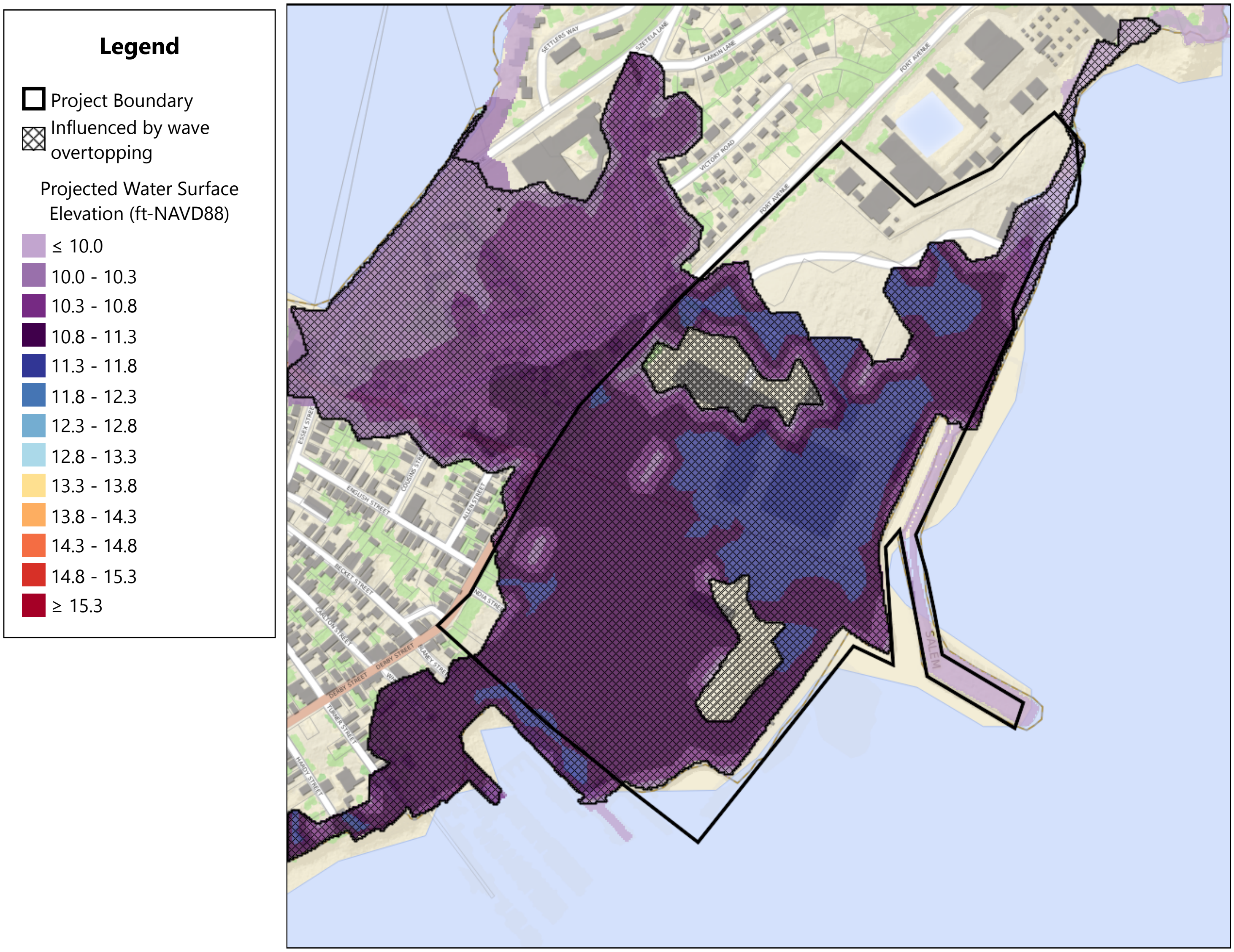
0.25 0.5 1.0 Miles

Created by: ehunter
Date Created: 6/28/2022
Tool Version: 1.2

N

Asset Name	Planning Horizon	Return Period	Max	Min	Area Weighted Average
			(ft-NAVD88)		
Wharf	2030	1% (100-yr)	11.5	10.0	11.0
	2050	1% (100-yr)	13.3	11.5	11.8
	2070	1% (100-yr)	15.3	13.4	13.5

ATTENTION: This project intersects areas influenced by wave overtopping based flooding. These areas are where flooding is caused by intermittent pulses that come from wave run-up and overtopping at a coastal structure. Additional site analyses are recommended to establish design values associated with design criteria.



Climate Resilience Design Standards Tool:
Sea Level Rise/Storm Surve Design Criteria
Projected Water Surface Elevation Map: 2030, 1% (100-yr)

Project Name: Salem Wind Port
Location (Town): Salem

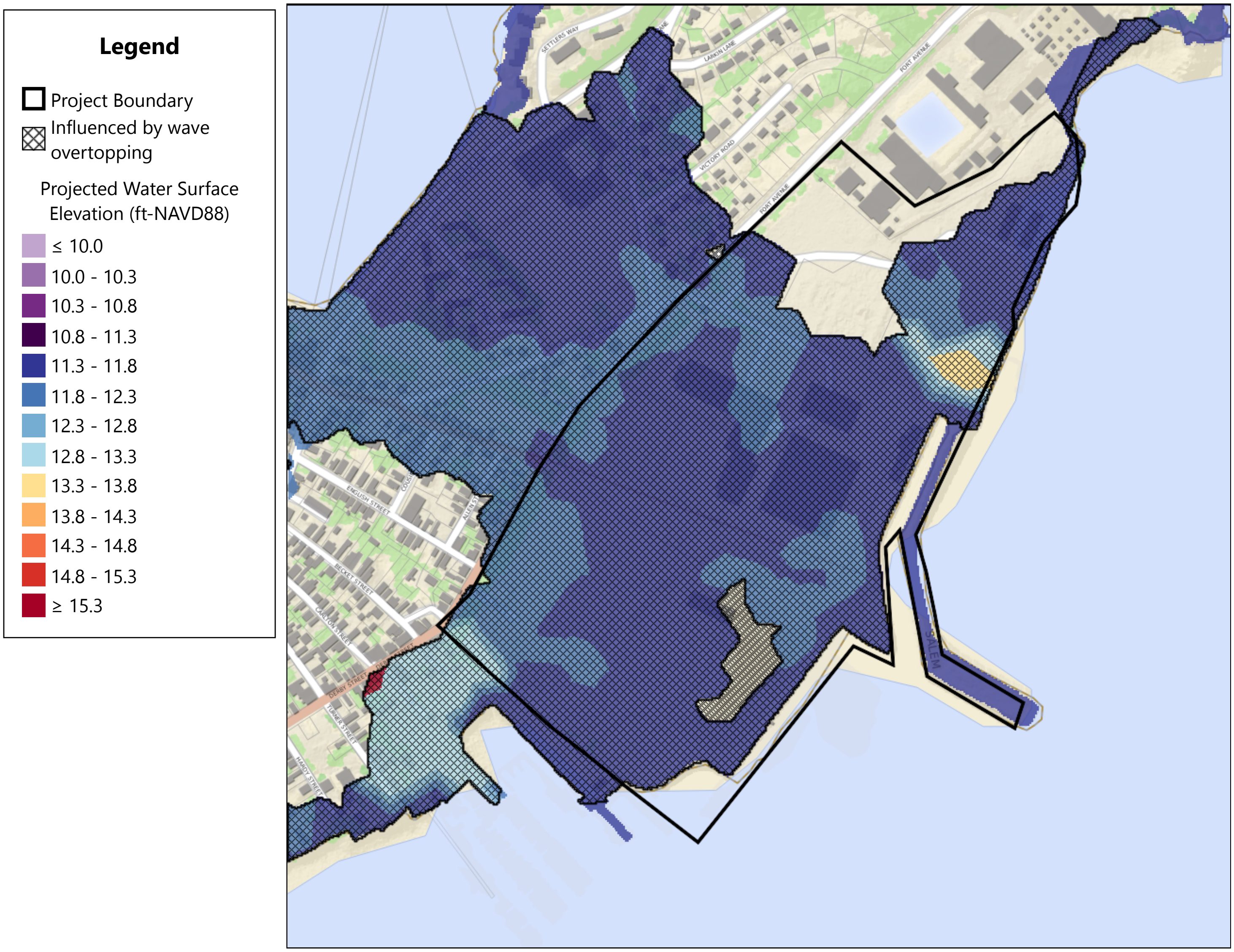
0.05 0.1 0.25 Miles

Created by: ehunter
Date Created: 6/28/2022
Tool Version: 1.2

N

Asset Name	Planning Horizon	Return Period	Max	Min	Area Weighted Average
			(ft-NAVD88)		
Wharf	2030	1% (100-yr)	11.5	10.0	11.0

ATTENTION: This project intersects areas influenced by wave overtopping based flooding. These areas are where flooding is caused by intermittent pulses that come from wave run-up and overtopping at a coastal structure. Additional site analyses are recommended to establish design values associated with design criteria.



Climate Resilience Design Standards Tool:
Sea Level Rise/Storm Surve Design Criteria
Projected Water Surface Elevation Map: 2050, 1% (100-yr)

Project Name: Salem Wind Port
Location (Town): Salem

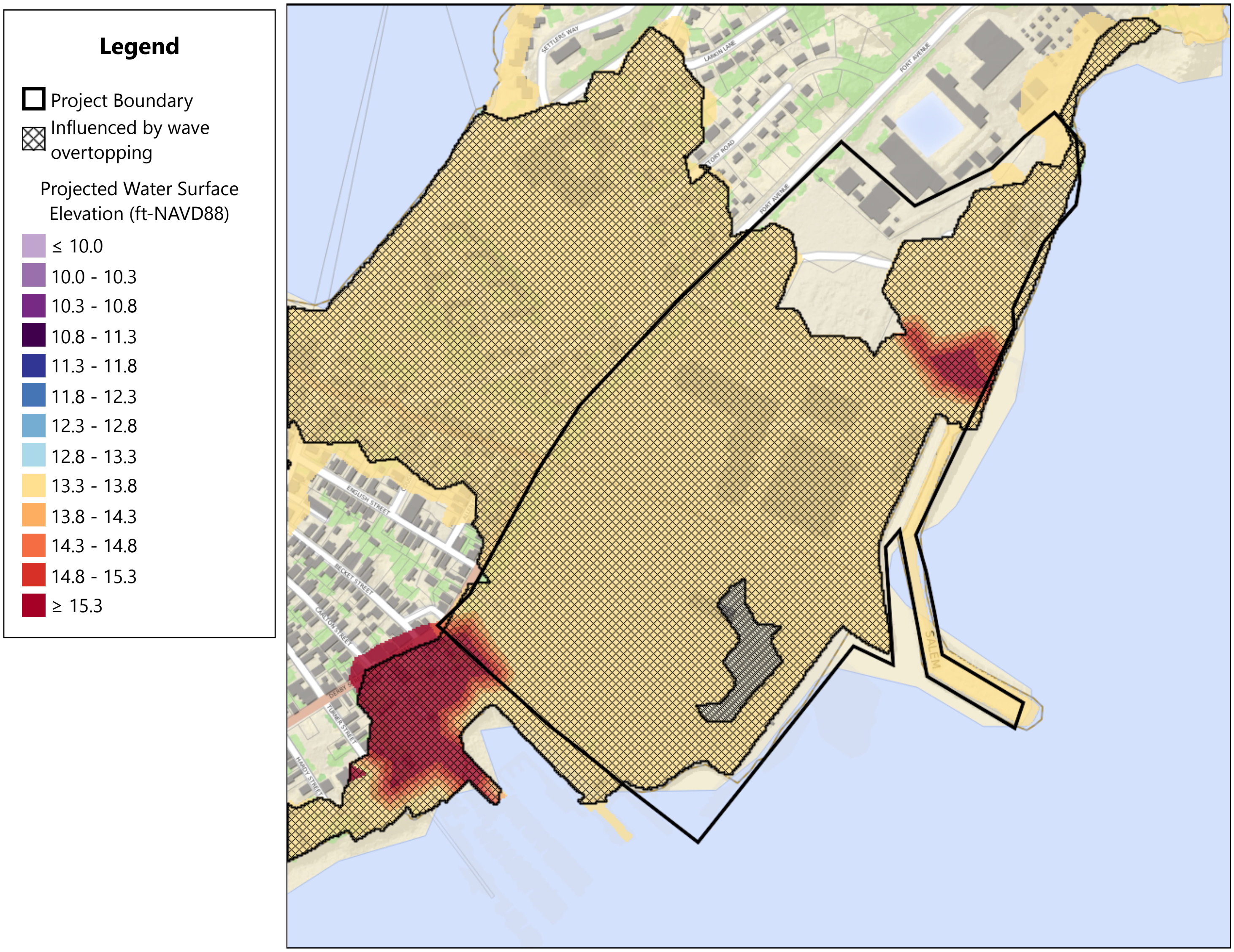
0.05 0.1 0.25
Miles

Created by: ehunter
Date Created: 6/28/2022
Tool Version: 1.2

N

Asset Name	Planning Horizon	Return Period	Max	Min	Area Weighted Average
			(ft-NAVD88)		
Wharf	2050	1% (100-yr)	13.3	11.5	11.8

ATTENTION: This project intersects areas influenced by wave overtopping based flooding. These areas are where flooding is caused by intermittent pulses that come from wave run-up and overtopping at a coastal structure. Additional site analyses are recommended to establish design values associated with design criteria.



Climate Resilience Design Standards Tool:
Sea Level Rise/Storm Surve Design Criteria
Projected Water Surface Elevation Map: 2070, 1% (100-yr)

Project Name: Salem Wind Port
Location (Town): Salem

0.05 0.1 0.25 Miles

Created by: ehunter
Date Created: 6/28/2022
Tool Version: 1.2

N

Asset Name	Planning Horizon	Return Period	Max	Min	Area Weighted Average
			(ft-NAVD88)		
Wharf	2070	1% (100-yr)	15.3	13.4	13.5

ATTENTION: This project intersects areas influenced by wave overtopping based flooding. These areas are where flooding is caused by intermittent pulses that come from wave run-up and overtopping at a coastal structure. Additional site analyses are recommended to establish design values associated with design criteria.

Project Inputs

Core Project Information

Name:	Salem Wind Port
Given the expected useful life of the project, through what year do you estimate the project to last (i.e. before a major reconstruction/renovation)?	2053
Location of Project:	Salem
Estimated Capital Cost:	$160,000,000
Who is the Submitting Entity?	Private Other Fort Point Associates, Inc. Richard Jabba (rjabba@fpa-inc.com)
Is this project being submitted as part of a state grant application?	No
Which grant program?	
What stage are you in your project lifecycle?	Design
Is climate resiliency a core objective of this project?	No
Is this project being submitted as part of the state capital planning process?	No
Is this project being submitted as part of a regulatory review process or permitting?	Yes
Brief Project Description:	This project seeks to develop 42 acres of remediated waterfront property in Salem Harbor. It is expected the site will import offshore wind turbine components including towers, nacelles, blades, transition pieces and foundations by vessel from overseas or domestically. These components will then undergo partial pre-assembly including installation of secondary steel, electronics, elevators, etc. before being loaded out onto a wind turbine installation vessel (WTIV) or a feeder vessel/barge for transport and installation offshore. Required permits include, but arenot limited to, a Finding of No Significant Impact under NEPA; USACE Individual Section 10, 103, and 404 Permit; Essential Fish Habitat Assessment; FAA Determination of No Hazard to Air Navigation for Permanent or Temporary Structures; Construction General Permit for EPA National Pollution Discharge Elimination System Stormwater Program; MEPA Environmental Notification Form; MEPA Single Environmental Impact Report; Chapter 91 Waterways License; 401 Water Quality Certification; Coastal Zone Management Federal Consistency Review; Determination of No Adverse Effect from Massachusetts Historical Commission; Order of Conditions from Conservation Commission; Special Permit from Salem Zoning Board of Appeals, and; Site Plan Review from Salem Planning Board.
Project Submission Comments:	

Project Ecosystem Service Benefits

Factors Influencing Output

✓ Project promotes decarbonization
✓ Project improves air quality

Factors to Improve Output

✓ Incorporate nature-based solutions that may provide flood protection
✓ Incorporate nature-based solutions that may reduce storm damage
✓ Protect public water supply by reducing the risk of contamination, pollution, and/or runoff of surface and groundwater sources used for human consumption
✓ Incorporate green infrastructure or nature-based solutions that recharge groundwater
✓ Incorporate green infrastructure to filter stormwater
✓ Incorporate nature-based solutions that improve water quality
✓ Incorporate nature-based solutions that sequester carbon carbon
✓ Increase biodiversity, protect critical habitat for species, manage invasive populations, and/or provide connectivity to other habitats
✓ Preserve, enhance, and/or restore coastal shellfish habitats
✓ Incorporate vegetation that provides pollinator habitat
✓ Identify opportunities to remediate existing sources of pollution
✓ Provide opportunities for passive and/or active recreation through open space
✓ Increase plants, trees, and/or other vegetation to provide oxygen production
✓ Identify opportunities to prevent pollutants from impacting ecosystems
✓ Incorporate education and/or protect cultural resources as part of your project

Is the primary purpose of this project ecological restoration?

No

Project Benefits

Provides flood protection through nature-based solutions	No
Reduces storm damage	No
Recharges groundwater	No
Protects public water supply	No
Filters stormwater using green infrastructure	No
Improves water quality	No
Promotes decarbonization	Yes
Enables carbon sequestration	No
Provides oxygen production	No
Improves air quality	Yes
Prevents pollution	No
Remediates existing sources of pollution	No
Protects fisheries, wildlife, and plant habitat	No
Protects land containing shellfish	No
Provides pollinator habitat	No
Provides recreation	No
Provides cultural resources/education	No

Project Climate Exposure

Is the primary purpose of this project ecological restoration?	No
Does the project site have a history of coastal flooding?	No
Does the project site have a history of flooding during extreme precipitation events (unrelated to water/sewer damages)?	No
Does the project site have a history of riverine flooding?	No
Does the project result in a net increase in impervious area of the site?	Yes
Are existing trees being removed as part of the proposed project?	No

Project Assets

Asset: Warehouse
Asset Type: Typically Unoccupied
Asset Sub-Type: Maintenance facility
Construction Type: Major Repair/Retrofit
Construction Year: 2023
Useful Life: 5

Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building may be inaccessible/inoperable for more than a day, but less than a week after natural hazards events without consequences

Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.
Impacts limited to site only

Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.
Less than 1,000 people

Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The building/facility does not provide services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.

If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the building/facility would not be expected to result in injuries

If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?
Spills and/or releases of hazardous materials would be relatively easy to clean up

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Moderate – Inoperability may impact other facilities, assets, or buildings, but is not expected to affect their ability to operate

If this building/facility was damaged beyond repair, how much would it approximately cost to replace?
Less than $10 million

Is this a recreational facility which can be vacated during a natural hazard event?
No

If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?
Many alternative programs and/or services are available to support the community

If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
No impact on surrounding natural resources is expected

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?
Loss of building is not expected to reduce the ability to maintain government services.

If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in

government (i.e. the building is not able to serve or operate its intended users or function)?
No Impact
Asset: Wharf
Asset Type: Transportation
Asset Sub-Type: Other Transportation
Construction Type: Major Repair/Retrofit
Construction Year: 2023
Useful Life: 30
Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Infrastructure may be inaccessible/inoperable for more than a day, but less than a week after natural hazard without consequences.
Identify the geographic area directly affected by permanent loss or significant inoperability of the infrastructure.
Impacts limited to location of infrastructure only
Identify the population directly served that would be affected by the permanent loss or significant inoperability of the infrastructure.
Less than 5,000 people
Identify if the infrastructure provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The infrastructure does not provide services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
Will the infrastructure reduce the risk of flooding?
Yes
If the infrastructure became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the infrastructure would not be expected to result in injuries
If there are hazardous materials in your infrastructure, what are the extents of impacts related to spills/releases of these materials?
There are no hazardous materials in the infrastructure
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Moderate – Inoperability may impact other facilities, assets, or buildings, but cascading impacts do not affect the ability of other facilities, assets, or buildings to operate
If the infrastructure was damaged beyond repair, how much would it approximately cost to replace?
Less than $10 million
Does the infrastructure function as an evacuation route during emergencies? This question only applies to roadway projects.
No
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
No impact on surrounding natural resources is expected
If the infrastructure became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the infrastructure is not able to serve or operate its intended users or function)?
Loss of infrastructure is not expected to reduce the ability to maintain government services
What are the impacts to loss of confidence in government resulting from loss of infrastructure functionality (i.e. the infrastructure asset is not able to serve or operate its intended users or function)?
No Impact
Asset: Office Trailer
Asset Type: Typically Occupied
Asset Sub-Type: Non-residential building (office, commercial, retail)
Construction Type: New Construction
Construction Year: 2024
Useful Life: 20
Identify the length of time the asset can be inaccessible/inoperable without significant consequences.
Building may be inaccessible/inoperable for more than a day, but less than a week after natural hazards events without consequences
Identify the geographic area directly affected by permanent loss or significant inoperability of the building/facility.
Impacts limited to site only
Identify the population directly served that would be affected by the permanent loss of use or inoperability of the building/facility.
Less than 100 people
Identify if the building/facility provides services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
The building/facility does not provide services to populations that reside within Environmental Justice neighborhoods or climate vulnerable populations.
If the building/facility became inoperable for longer than acceptable in Question 1, how, if at all, would it be expected to impact people's health and safety?
Inoperability of the building/facility would not be expected to result in injuries
If there are hazardous materials in your building/facility, what are the extent of impacts related to spills/releases of these materials?
There are no hazardous materials in the building/facility
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts on other facilities, assets, and/or infrastructure?
Moderate – Inoperability may impact other facilities, assets, or buildings, but is not expected to affect their ability to operate
If this building/facility was damaged beyond repair, how much would it approximately cost to replace?

Less than $10 million
Is this a recreational facility which can be vacated during a natural hazard event?
No
If the building/facility became inoperable for longer than acceptable in Question 1, what are the public and/or social services impacts?
Many alternative programs and/or services are available to support the community
If the building/facility became inoperable for longer than acceptable in Question 1, what are the environmental impacts related to natural resources?
No impact on surrounding natural resources is expected
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to government services (i.e. the building is not able to serve or operate its intended users or function)?
Loss of building is not expected to reduce the ability to maintain government services.
If the building/facility became inoperable for longer than acceptable in Question 1, what are the impacts to loss of confidence in government (i.e. the building is not able to serve or operate its intended users or function)?
No Impact

Report Comments

N/A

Attachment I

TRANSPORTATION ATTACHMENTS

TRANSPORTATION ATTACHMENTS

- ◻ Traffic Volume Data
- ◻ Seasonal/Yearly Growth Data
- ◻ Alternative Transportation Information
- ◻ Crash Data
- ◻ Trip Generation
- ◻ Trip Distribution
- ◻ Capacity Analysis

- Traffic Volume Data

Fort Avenue
Adjacent to Site
Salem, MA

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA 01752

Site Code:

Start Time	13-Sep-22 Tue	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		1	27			1	28				
12:15		0	36			0	18				
12:30		1	37			0	31				
12:45		0	38	2	138	0	21	1	98	3	236
01:00		2	35			0	18				
01:15		0	36			0	32				
01:30		1	38			0	25				
01:45		0	33	3	142	0	19	0	94	3	236
02:00		1	23			2	20				
02:15		1	39			0	21				
02:30		0	28			0	22				
02:45		0	40	2	130	0	33	2	96	4	226
03:00		1	34			0	50				
03:15		0	35			0	32				
03:30		0	23			0	38				
03:45		0	47	1	139	0	15	0	135	1	274
04:00		0	37			0	32				
04:15		1	41			0	34				
04:30		0	44			2	45				
04:45		0	48	1	170	2	32	4	143	5	313
05:00		1	41			5	29				
05:15		2	30			7	22				
05:30		2	39			8	30				
05:45		3	30	8	140	2	27	22	108	30	248
06:00		10	29			8	22				
06:15		16	29			10	22				
06:30		22	35			12	20				
06:45		22	33	70	126	19	20	49	84	119	210
07:00		27	24			21	19				
07:15		8	32			18	16				
07:30		23	32			16	13				
07:45		21	17	79	105	26	6	81	54	160	159
08:00		24	22			32	16				
08:15		18	23			25	9				
08:30		30	18			22	4				
08:45		22	20	94	83	17	6	96	35	190	118
09:00		23	12			19	5				
09:15		25	13			25	5				
09:30		25	15			20	7				
09:45		21	4	94	44	14	4	78	21	172	65
10:00		21	11			18	6				
10:15		32	6			24	5				
10:30		23	7			17	2				
10:45		24	7	100	31	21	3	80	16	180	47
11:00		25	4			20	10				
11:15		23	8			18	3				
11:30		25	5			16	4				
11:45		35	6	108	23	26	2	80	19	188	42
Total		562	1271			493	903			1055	2174
Percent		30.7%	69.3%			35.3%	64.7%			32.7%	67.3%
Total		562	1271			493	903			1055	2174
Percent		30.7%	69.3%			35.3%	64.7%			32.7%	67.3%
Combined Total		1833				1396				3229	

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Bridge Street
E/W: Webb Street
Salem, MA

File Name : 1237 Bridge at Webb
Site Code : 1237
Start Date : 9/13/2022
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	Bridge Street From North					Webb Street From East					Pleasant Street From Southeast					Bridge Street From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
06:00 AM	31	1	5	0	37	6	15	0	0	21	0	1	0	0	1	1	4	28	0	33	92
06:15 AM	38	1	4	0	43	6	17	0	0	23	0	4	0	0	4	1	8	38	0	47	117
06:30 AM	69	0	12	0	81	13	25	0	0	38	0	1	0	0	1	2	15	61	0	78	198
06:45 AM	64	0	12	0	76	16	27	0	0	43	0	5	0	0	5	0	15	67	0	82	206
Total	202	2	33	0	237	41	84	0	0	125	0	11	0	0	11	4	42	194	0	240	613
07:00 AM	80	1	18	0	99	18	24	0	0	42	0	7	0	0	7	1	23	103	0	127	275
07:15 AM	101	1	11	0	113	21	38	0	0	59	0	7	0	0	7	1	24	106	0	131	310
07:30 AM	96	0	13	0	109	31	52	0	0	83	0	10	0	0	10	2	22	125	0	149	351
07:45 AM	114	2	27	0	143	23	39	0	0	62	0	4	1	0	5	2	17	126	0	145	355
Total	391	4	69	0	464	93	153	0	0	246	0	28	1	0	29	6	86	460	0	552	1291
08:00 AM	120	1	23	0	144	33	27	0	0	60	0	11	2	0	13	4	17	127	0	148	365
08:15 AM	143	1	19	0	163	37	26	0	0	63	0	7	1	0	8	2	29	120	0	151	385
08:30 AM	115	1	14	0	130	33	41	0	0	74	0	5	0	0	5	2	33	132	0	167	376
08:45 AM	113	2	24	0	139	29	47	0	0	76	0	5	0	0	5	5	12	96	0	113	333
Total	491	5	80	0	576	132	141	0	0	273	0	28	3	0	31	13	91	475	0	579	1459
03:00 PM	90	2	20	0	112	29	59	0	0	88	0	5	1	0	6	4	12	111	0	127	333
03:15 PM	90	5	20	0	115	28	33	0	0	61	0	5	0	0	5	2	25	121	0	148	329
03:30 PM	94	3	20	0	117	28	26	0	0	54	0	7	0	0	7	3	15	146	0	164	342
03:45 PM	110	2	31	0	143	23	16	0	0	39	0	4	0	0	4	4	19	113	0	136	322
Total	384	12	91	0	487	108	134	0	0	242	0	21	1	0	22	13	71	491	0	575	1326
04:00 PM	109	1	28	0	138	27	29	0	0	56	0	10	1	0	11	2	24	104	0	130	335
04:15 PM	101	8	29	0	138	27	27	0	0	54	0	1	1	0	2	2	20	140	0	162	356
04:30 PM	82	4	33	0	119	35	21	0	0	56	0	3	0	0	3	5	24	100	0	129	307
04:45 PM	127	3	27	0	157	35	27	0	0	62	0	3	0	0	3	1	33	130	0	164	386
Total	419	16	117	0	552	124	104	0	0	228	0	17	2	0	19	10	101	474	0	585	1384
05:00 PM	110	3	31	0	144	26	32	0	0	58	0	8	0	0	8	4	26	101	0	131	341
05:15 PM	119	1	32	0	152	18	18	0	0	36	1	6	0	0	7	4	26	108	0	138	333
05:30 PM	123	4	37	0	164	28	31	0	0	59	0	14	0	0	14	3	22	103	0	128	365
05:45 PM	96	6	25	0	127	21	32	0	0	53	0	4	0	0	4	2	20	95	0	117	301
Total	448	14	125	0	587	93	113	0	0	206	1	32	0	0	33	13	94	407	0	514	1340
Grand Total	2335	53	515	0	2903	591	729	0	0	1320	1	137	7	0	145	59	485	2501	0	3045	7413
Apprch %	80.4	1.8	17.7	0		44.8	55.2	0	0		0.7	94.5	4.8	0		1.9	15.9	82.1	0		
Total %	31.5	0.7	6.9	0	39.2	8	9.8	0	0	17.8	0	1.8	0.1	0	2	0.8	6.5	33.7	0	41.1	
Lights	2268	52	500	0	2820	581	705	0	0	1286	1	136	7	0	144	57	472	2427	0	2956	7206
% Lights	97.1	98.1	97.1	0	97.1	98.3	96.7	0	0	97.4	100	99.3	100	0	99.3	96.6	97.3	97	0	97.1	97.2
Mediums	62	1	15	0	78	9	22	0	0	31	0	1	0	0	1	2	13	60	0	75	185
% Mediums	2.7	1.9	2.9	0	2.7	1.5	3	0	0	2.3	0	0.7	0	0	0.7	3.4	2.7	2.4	0	2.5	2.5
Articulated Trucks % Articulated Trucks	0.2	0	0	0	0.2	0.2	0.3	0	0	0.2	0	0	0	0	0	0	0	0.6	0	0.5	0.3

MDM TRANSPORTATION CONSULTANTS, INC.
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28 Lord Road, Suite 280
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N/S: Bridge Street
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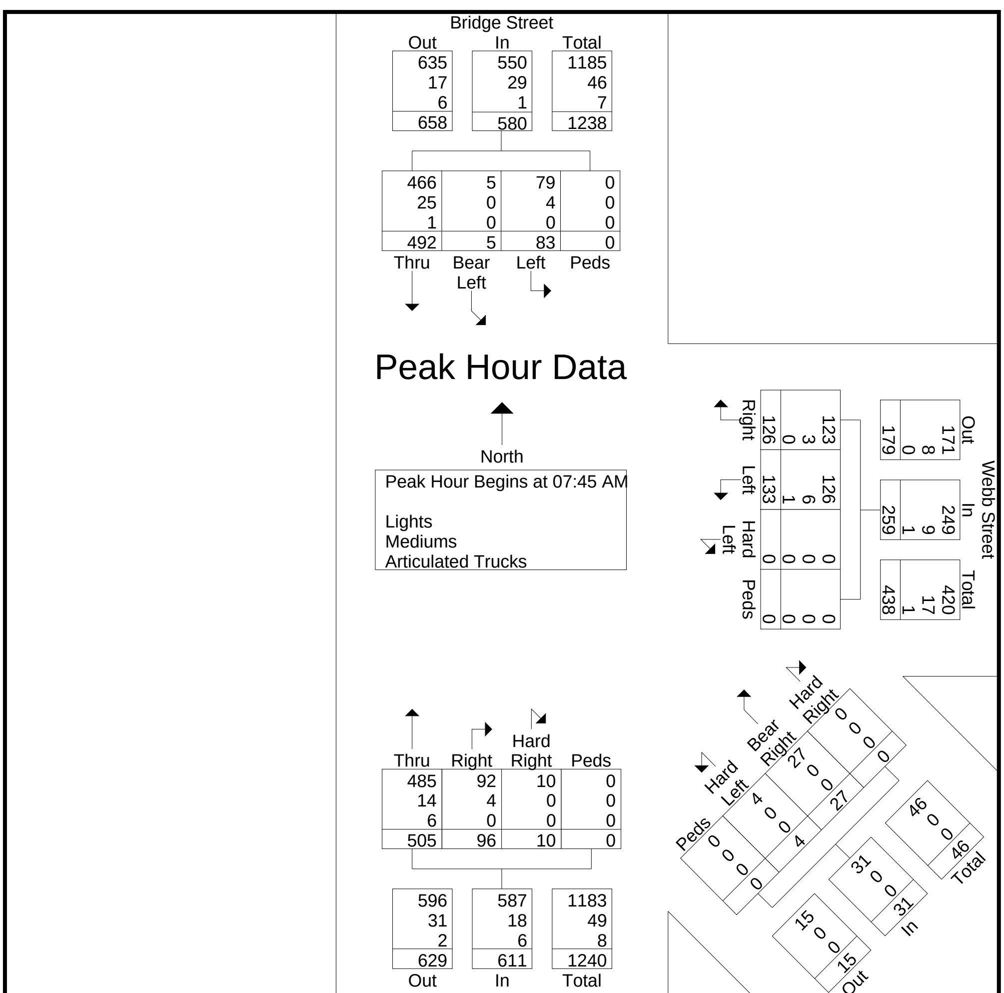
Salem, MA

File Name : 1237 Bridge at Webb
Site Code : 1237
Start Date : 9/13/2022

	Bridge Street From North					Webb Street From East					Pleasant Street From Southeast					Bridge Street From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	114	**2**	**27**																		
08:00 AM	**120**	**1**	**23**	**0**	**144**	**33**	**27**	**0**	**0**	**60**	**0**	**11**	**2**	**0**	**13**	**4**	**17**	**127**	**0**	**148**	**365**
08:15 AM	**143**	**1**	**19**	**0**	**163**	**37**	**26**	**0**	**0**	**63**	**0**	**7**	**1**	**0**	**8**	**2**	**29**	**120**	**0**	**151**	**385**
08:30 AM	115	1	14	0	130	33	**41**	0	0	**74**	0	5	0	0	5	2	**33**	**132**		**167**	376
Total Volume	492	5	83	0	580	126	133	0	0	259	0	27	4	0	31	10	96	505	0	611	1481
% App. Total	84.8	0.9	14.3	0		48.6	51.4	0	0		0	87.1	12.9	0		1.6	15.7	82.7	0		
PHF	.860	.625	.769	.000	.890	.851	.811	.000	.000	.875	.000	.614	.500	.000	.596	.625	.727	.956	.000	.915	.962
Lights	466	5	79	0	550	123	126	0	0	249	0	27	4	0	31	10	92	485	0	587	1417
% Lights	94.7	100	95.2	0	94.8	97.6	94.7	0	0	96.1	0	100	100	0	100	100	95.8	96.0	0	96.1	95.7
Mediums	25	0	4	0	29	3	6	0	0	9	0	0	0	0	0	0	4	14	0	18	56
% Mediums	5.1	0	4.8	0	5.0	2.4	4.5	0	0	3.5	0	0	0	0	0	0	4.2	2.8	0	2.9	3.8
Articulated Trucks	1	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	6	0	6	8
% Articulated Trucks	0.2	0	0	0	0.2	0	0.8	0	0	0.4	0	0	0	0	0	0	0	1.2	0	1.0	0.5



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28 Lord Road, Suite 280
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N/S: Bridge Street
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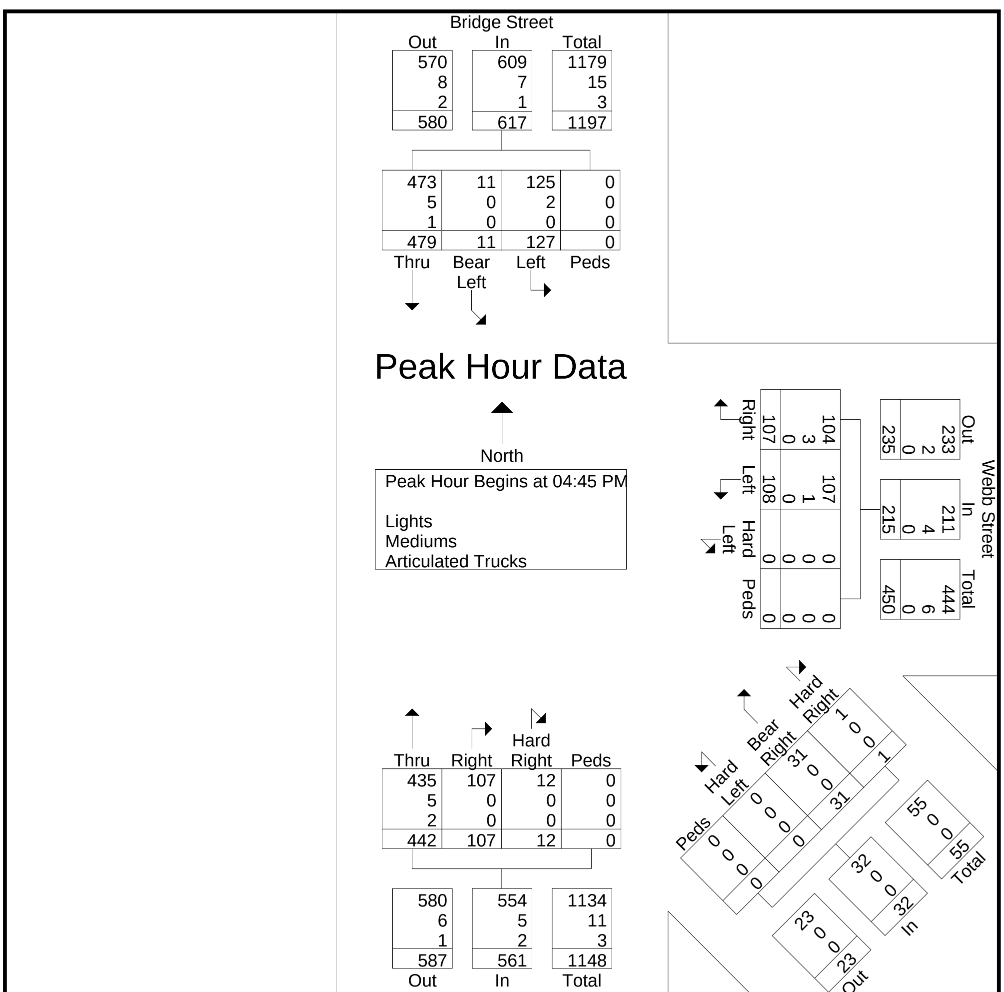
Page No : 3

	Bridge Street From North					Webb Street From East					Pleasant Street From Southeast					Bridge Street From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	**127**					**35**				**62**	0	3	0	0	3	1	**33**	**130**		**164**	**386**
05:00 PM	110	3	31	0	144	26	**32**	0	0	58	0	8	0	0	8	**4**					
05:15 PM	**119**	**1**	**32**	**0**	**152**	**18**	**18**	**0**	**0**	**36**	**1**	**6**	**0**	**0**	**7**	**4**	**26**	**108**	**0**	**138**	**333**
05:30 PM	**123**	**4**	**37**	**0**	**164**	28	31	0	0	59	0	**14**	0	0	**14**	3	22	103	0	128	365
Total Volume	479	11	127	0	617	107	108	0	0	215	1	31	0	0	32	12	107	442	0	561	1425
% App. Total	77.6	1.8	20.6	0		49.8	50.2	0	0		3.1	96.9	0	0		2.1	19.1	78.8	0		
PHF	.943	.688	.858	.000	.941	.764	.844	.000	.000	.867	.250	.554	.000	.000	.571	.750	.811	.850	.000	.855	.923
Lights	473	11	125	0	609	104	107	0	0	211	1	31	0	0	32	12	107	435	0	554	1406
% Lights	98.7	100	98.4	0	98.7	97.2	99.1	0	0	98.1	100	100	0	0	100	100	100	98.4	0	98.8	98.7
Mediums	5	0	2	0	7	3	1	0	0	4	0	0	0	0	0	0	0	5	0	5	16
% Mediums	1.0	0	1.6	0	1.1	2.8	0.9	0	0	1.9	0	0	0	0	0	0	0	1.1	0	0.9	1.1
Articulated Trucks	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	3
% Articulated Trucks	0.2	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0.4	0.2



MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Derby Street
E/W: Site Driveway/Webb Street
Salem, MA

File Name : 1237 Derby at Site
Site Code : 1237
Start Date : 9/13/2022
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	Derby Street From North		Derby Site Drive From East				Derby Street From South					Webb Street From West				
Start Time	Peds	App. Total	Right	Thru	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	0	0	0	0	0	0	0	7	10	0	17	0	0	0	0	17
06:15 AM	0	0	0	0	0	0	0	6	6	0	12	0	0	0	0	12
06:30 AM	0	0	0	0	0	0	0	10	20	0	30	0	0	0	0	30
06:45 AM	0	0	0	0	0	0	0	7	18	0	25	0	0	0	0	25
Total	0	0	0	0	0	0	0	30	54	0	84	0	0	0	0	84
07:00 AM	0	0	0	0	0	0	0	17	24	0	41	0	1	0	1	42
07:15 AM	0	0	0	0	0	0	0	12	31	0	43	0	0	0	0	43
07:30 AM	0	0	0	0	0	0	0	22	40	0	62	1	0	0	1	63
07:45 AM	0	0	0	0	0	0	0	13	31	0	44	0	0	0	0	44
Total	0	0	0	0	0	0	0	64	126	0	190	1	1	0	2	192
08:00 AM	0	0	0	0	0	0	0	19	32	0	51	0	0	0	0	51
08:15 AM	0	0	0	0	0	0	0	28	39	0	67	0	1	0	1	68
08:30 AM	0	0	0	0	0	0	0	35	27	0	62	0	1	0	1	63
08:45 AM	0	0	0	0	0	0	0	18	25	0	43	0	0	0	0	43
Total	0	0	0	0	0	0	0	100	123	0	223	0	2	0	2	225
03:00 PM	0	0	0	0	0	0	0	27	26	0	53	0	1	0	1	54
03:15 PM	0	0	0	0	0	0	0	24	29	0	53	0	0	0	0	53
03:30 PM	0	0	0	0	0	0	0	14	39	0	53	0	0	0	0	53
03:45 PM	0	0	0	0	0	0	0	29	35	0	64	0	0	0	0	64
Total	0	0	0	0	0	0	0	94	129	0	223	0	1	0	1	224
04:00 PM	0	0	0	0	0	0	0	21	34	0	55	0	1	0	1	56
04:15 PM	0	0	0	0	0	0	0	23	37	0	60	0	1	0	1	61
04:30 PM	0	0	0	0	0	0	0	25	38	0	63	0	2	0	2	65
04:45 PM	0	0	0	0	0	0	0	23	37	0	60	0	1	0	1	61
Total	0	0	0	0	0	0	0	92	146	0	238	0	5	0	5	243
05:00 PM	0	0	0	0	0	0	0	29	28	0	57	0	0	0	0	57
05:15 PM	0	0	0	0	0	0	0	15	38	0	53	0	1	0	1	54
05:30 PM	0	0	0	0	0	0	0	33	32	0	65	0	1	0	1	66
05:45 PM	0	0	0	0	0	0	0	21	34	0	55	0	1	0	1	56
Total	0	0	0	0	0	0	0	98	132	0	230	0	3	0	3	233
Grand Total	0	0	0	0	0	0	0	478	710	0	1188	1	12	0	13	1201
Apprch %	0		0	0	0		0	40.2	59.8	0		7.7	92.3	0		
Total %	0	0	0	0	0	0	0	39.8	59.1	0	98.9	0.1	1	0	1.1	
Lights	0	0	0	0	0	0	0	459	697	0	1156	1	12	0	13	1169
% Lights	0	0	0	0	0	0	0	96	98.2	0	97.3	100	100	0	100	97.3
Mediums	0	0	0	0	0	0	0	17	12	0	29	0	0	0	0	29
% Mediums	0	0	0	0	0	0	0	3.6	1.7	0	2.4	0	0	0	0	2.4
Articulated Trucks	0	0	0	0	0	0	0	2	1	0	3	0	0	0	0	3
% Articulated Trucks	0	0	0	0	0	0	0	0.4	0.1	0	0.3	0	0	0	0	0.2

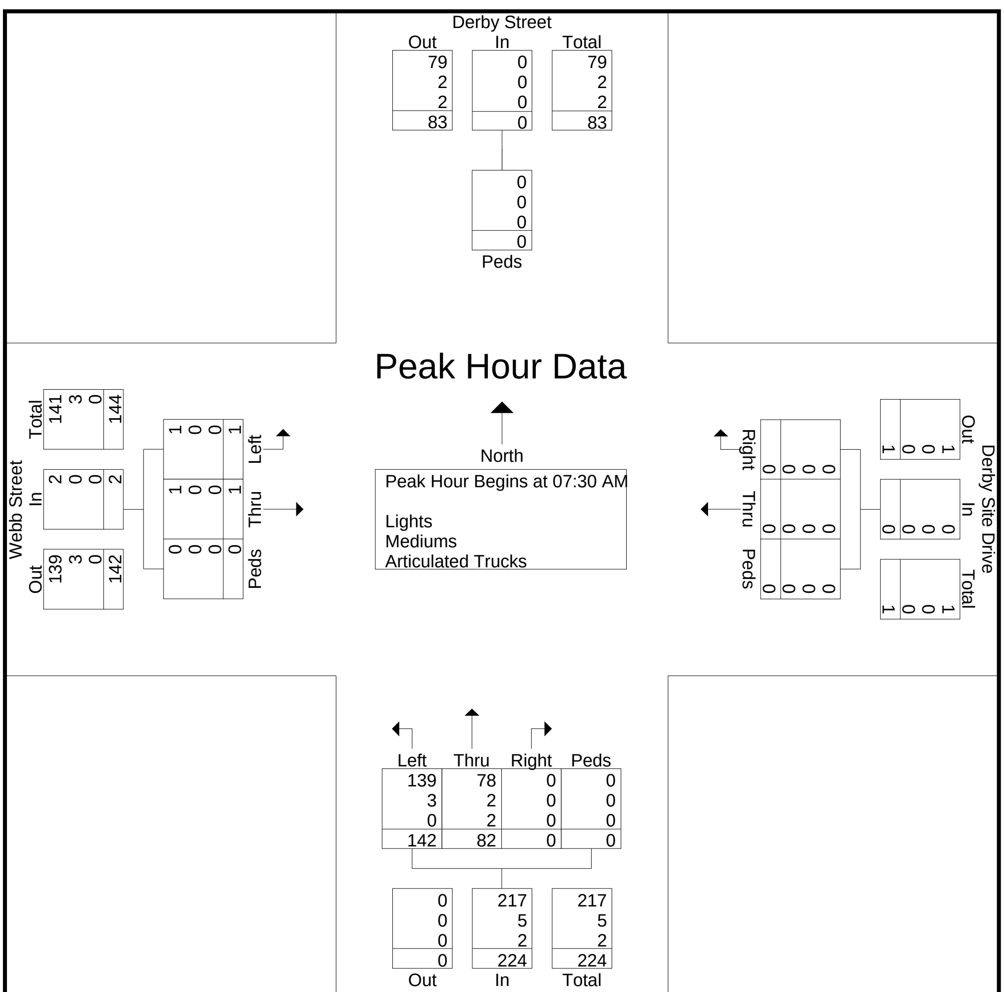
MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Derby Street
E/W: Site Driveway/Webb Street
Salem, MA

File Name : 1237 Derby at Site
Site Code : 1237
Start Date : 9/13/2022
Page No : 2

	Derby Street From North		Derby Site Drive From East				Derby Street From South					Webb Street From West				
Start Time	Peds	App. Total	Right	Thru	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 12:00 PM - Peak 1 of 1																
Peak Hour for Entire Intersection Begins at 07:30 AM																
07:30 AM	0	0	0	0	0	0	0	22	**40**	0	62	**1**	0	0	**1**	63
07:45 AM	0	0	0	0	0	0	0	13	31	0	44	0	0	0	0	44
08:00 AM	0	0	0	0	0	0	0	19	32	0	51	0	0	0	0	51
08:15 AM	0	0	0	0	0	0	0	**28**	39	0	**67**	0	**1**	0	1	**68**
Total Volume	0	0	0	0	0	0	0	82	142	0	224	1	1	0	2	226
% App. Total	0		0	0	0		0	36.6	63.4	0		50	50	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.732	.888	.000	.836	.250	.250	.000	.500	.831
Lights	0	0	0	0	0	0	0	78	139	0	217	1	1	0	2	219
% Lights	0	0	0	0	0	0	0	95.1	97.9	0	96.9	100	100	0	100	96.9
Mediums	0	0	0	0	0	0	0	2	3	0	5	0	0	0	0	5
% Mediums	0	0	0	0	0	0	0	2.4	2.1	0	2.2	0	0	0	0	2.2
Articulated Trucks	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	2
% Articulated Trucks	0	0	0	0	0	0	0	2.4	0	0	0.9	0	0	0	0	0.9



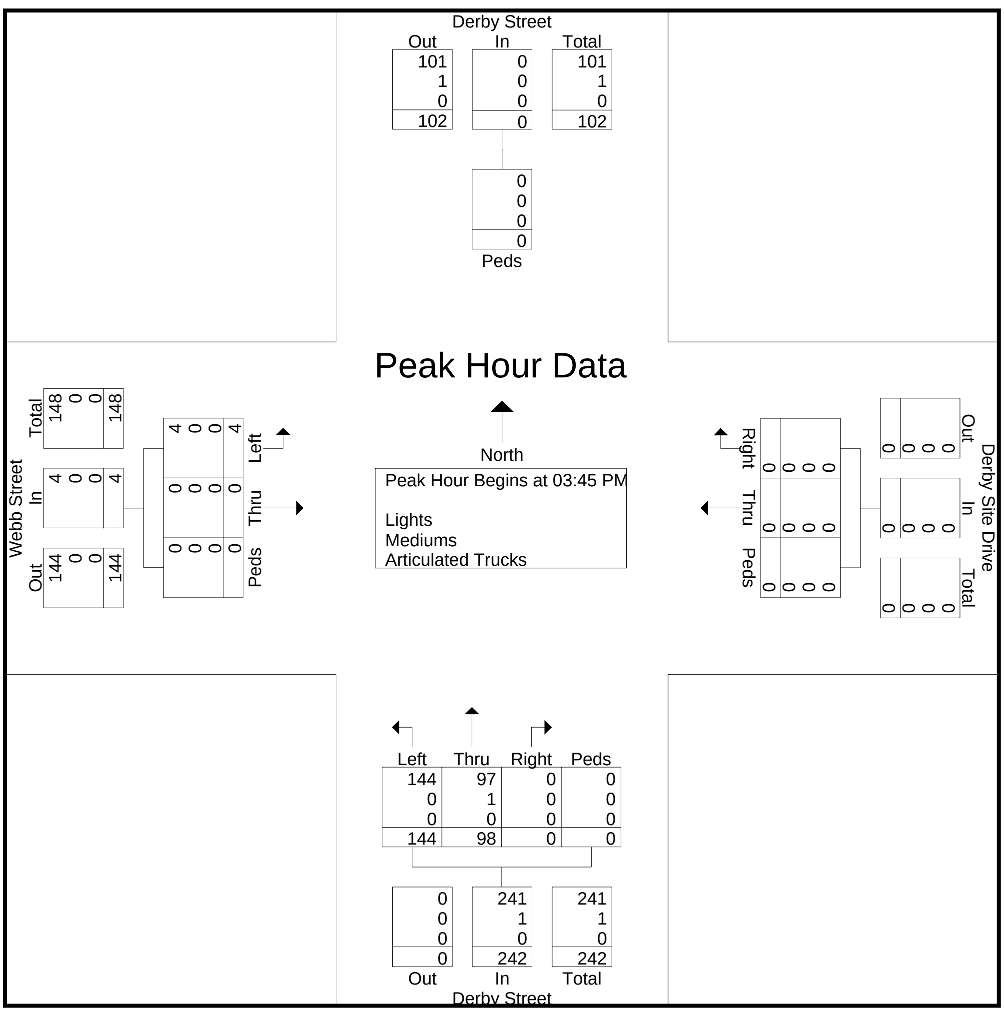
MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Derby Street
E/W: Site Driveway/Webb Street
Salem, MA

File Name : 1237 Derby at Site
Site Code : 1237
Start Date : 9/13/2022

	Derby Street From North		Derby Site Drive From East				Derby Street From South					Webb Street From West				
Start Time	Peds	App. Total	Right	Thru	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:15 PM to 05:45 PM - Peak 1 of 1																
Peak Hour for Entire Intersection Begins at 03:45 PM																
03:45 PM	0	0	0	0	0	0	0	**29**	35	0	**64**	0	0	0	0	64
04:00 PM	0	0	0	0	0	0	0	21	34	0	55	0	1	0	1	56
04:15 PM	0	0	0	0	0	0	0	23	37	0	60	0	1	0	1	61
04:30 PM	0	0	0	0	0	0	0	25	**38**	0	63	0	**2**	0	**2**	**65**
Total Volume	0	0	0	0	0	0	0	98	144	0	242	0	4	0	4	246
% App. Total	0		0	0	0		0	40.5	59.5	0		0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.845	.947	.000	.945	.000	.500	.000	.500	.946
Lights	0	0	0	0	0	0	0	97	144	0	241	0	4	0	4	245
% Lights	0	0	0	0	0	0	0	99.0	100	0	99.6	0	100	0	100	99.6
Mediums	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1
% Mediums	0	0	0	0	0	0	0	1.0	0	0	0.4	0	0	0	0	0.4
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Fort Avenue
E/W: Site Driveway/Memorial Drive
Salem, MA

File Name : 1237 Fort Ave at Site
Site Code : 1237
Start Date : 9/13/2022
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

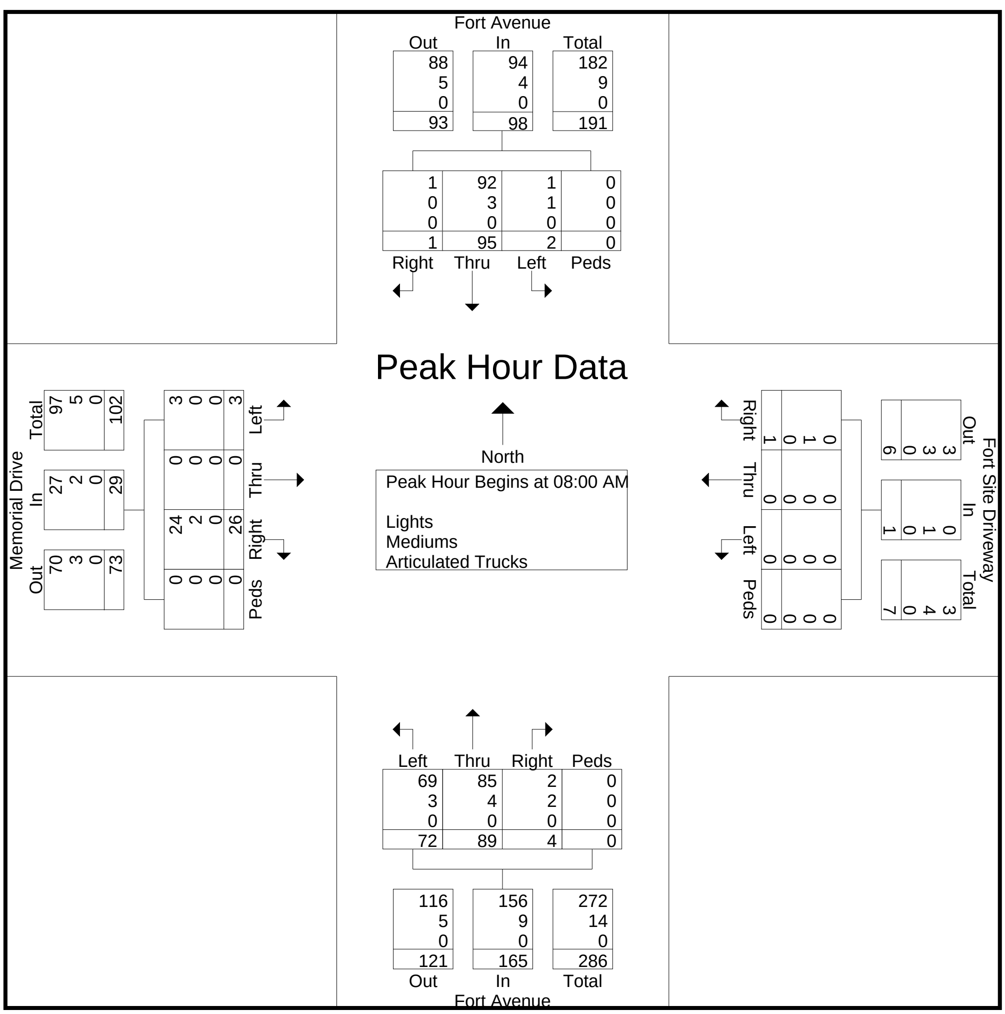
	Fort Avenue From North					Fort Site Driveway From East					Fort Avenue From South					Memorial Drive From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	0	8	0	0	8	0	0	0	0	0	3	6	2	0	11	1	0	0	0	1	20
06:15 AM	0	10	0	0	10	0	0	0	0	0	2	14	0	0	16	2	0	0	0	2	28
06:30 AM	0	12	0	0	12	0	0	0	0	0	1	21	3	0	25	1	0	1	0	2	39
06:45 AM	0	19	0	0	19	0	0	0	0	0	2	19	1	0	22	1	0	0	0	1	42
Total	0	49	0	0	49	0	0	0	0	0	8	60	6	0	74	5	0	1	0	6	129
07:00 AM	0	21	0	0	21	0	0	0	0	0	1	26	8	0	35	0	1	0	0	1	57
07:15 AM	0	18	0	0	18	0	0	0	0	0	1	7	12	0	20	2	1	0	0	3	41
07:30 AM	1	14	0	0	15	0	0	1	0	1	0	23	6	0	29	6	0	0	0	6	51
07:45 AM	0	26	0	0	26	0	0	0	0	0	0	21	5	0	26	5	0	0	0	5	57
Total	1	79	0	0	80	0	0	1	0	1	2	77	31	0	110	13	2	0	0	15	206
08:00 AM	0	32	1	0	33	0	0	0	0	0	0	25	8	0	33	2	0	0	0	2	68
08:15 AM	1	25	0	0	26	1	0	0	0	1	0	18	21	0	39	2	0	0	0	2	68
08:30 AM	0	22	0	0	22	0	0	0	0	0	2	26	34	0	62	10	0	3	0	13	97
08:45 AM	0	16	1	0	17	0	0	0	0	0	2	20	9	0	31	12	0	0	0	12	60
Total	1	95	2	0	98	1	0	0	0	1	4	89	72	0	165	26	0	3	0	29	293
03:00 PM	0	49	0	0	49	0	0	1	0	1	0	34	7	0	41	12	0	0	0	12	103
03:15 PM	0	29	0	0	29	0	0	4	0	4	0	35	2	0	37	2	0	0	0	2	72
03:30 PM	0	36	0	0	36	0	0	2	0	2	0	22	0	0	22	2	0	0	0	2	62
03:45 PM	0	15	0	0	15	0	0	0	0	0	0	48	4	0	52	2	0	0	0	2	69
Total	0	129	0	0	129	0	0	7	0	7	0	139	13	0	152	18	0	0	0	18	306
04:00 PM	2	30	0	0	32	0	0	0	0	0	0	37	2	0	39	3	0	0	0	3	74
04:15 PM	1	32	0	0	33	0	0	1	0	1	0	41	4	0	45	2	0	0	0	2	81
04:30 PM	0	46	0	0	46	0	0	0	0	0	1	43	6	0	50	2	0	0	0	2	98
04:45 PM	1	32	1	0	34	0	0	0	0	0	2	46	5	0	53	2	0	0	0	2	89
Total	4	140	1	0	145	0	0	1	0	1	3	167	17	0	187	9	0	0	0	9	342
05:00 PM	0	29	0	0	29	0	0	0	0	0	0	41	4	0	45	1	0	0	0	1	75
05:15 PM	0	21	0	0	21	0	0	1	0	1	0	30	5	0	35	0	0	0	0	0	57
05:30 PM	1	28	0	0	29	0	0	0	0	0	0	39	7	0	46	1	0	0	0	1	76
05:45 PM	0	29	0	0	29	0	0	0	0	0	0	30	3	0	33	2	0	0	0	2	64
Total	1	107	0	0	108	0	0	1	0	1	0	140	19	0	159	4	0	0	0	4	272
Grand Total	7	599	3	0	609	1	0	10	0	11	17	672	158	0	847	75	2	4	0	81	1548
Apprch %	1.1	98.4	0.5	0		9.1	0	90.9	0		2	79.3	18.7	0		92.6	2.5	4.9	0		
Total %	0.5	38.7	0.2	0	39.3	0.1	0	0.6	0	0.7	1.1	43.4	10.2	0	54.7	4.8	0.1	0.3	0	5.2	
Lights	7	581	1	0	589	0	0	8	0	8	15	650	153	0	818	70	1	4	0	75	1490
% Lights	100	97	33.3	0	96.7	0	0	80	0	72.7	88.2	96.7	96.8	0	96.6	93.3	50	100	0	92.6	96.3
Mediums	0	15	2	0	17	1	0	1	0	2	2	22	5	0	29	5	0	0	0	5	53
% Mediums	0	2.5	66.7	0	2.8	100	0	10	0	18.2	11.8	3.3	3.2	0	3.4	6.7	0	0	0	6.2	3.4
Articulated Trucks	0	3	0	0	3	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	5
% Articulated Trucks	0	0.5	0	0	0.5	0	0	10	0	9.1	0	0	0	0	0	0	50	0	0	1.2	0.3

MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers
28 Lord Road, Suite 280
Marlborough, MA

N/S: Fort Avenue
E/W: Site Driveway/Memorial Drive
Salem, MA

File Name : 1237 Fort Ave at Site
Site Code : 1237
Start Date : 9/13/2022
Page No : 2

	Fort Avenue From North					Fort Site Driveway From East					Fort Avenue From South					Memorial Drive From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	**32**	**1**		**33**	0	0	0	0	0	0	25	8	0	33	2	0	0	0	2	68
08:15 AM	**1**					**1**				**1**	0	18	21	0	39	2	0	0	0	2	68
08:30 AM	0	22	0	0	22	0	0	0	0	0	**2**	**26**	**34**		**62**	10	0	**3**		**13**	**97**
08:45 AM	0	16	1	0	17	0	0	0	0	0	2	20	9	0	31	**12**					
Total Volume	1	95	2	0	98	1	0	0	0	1	4	89	72	0	165	26	0	3	0	29	293
% App. Total	1	96.9	2	0		100	0	0	0		2.4	53.9	43.6	0		89.7	0	10.3	0		
PHF	.250	.742	.500	.000	.742	.250	.000	.000	.000	.250	.500	.856	.529	.000	.665	.542	.000	.250	.000	.558	.755
Lights	1	92	1	0	94	0	0	0	0	0	2	85	69	0	156	24	0	3	0	27	277
% Lights	100	96.8	50.0	0	95.9	0	0	0	0	0	50.0	95.5	95.8	0	94.5	92.3	0	100	0	93.1	94.5
Mediums	0	3	1	0	4	1	0	0	0	1	2	4	3	0	9	2	0	0	0	2	16
% Mediums	0	3.2	50.0	0	4.1	100	0	0	0	100	50.0	4.5	4.2	0	5.5	7.7	0	0	0	6.9	5.5
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



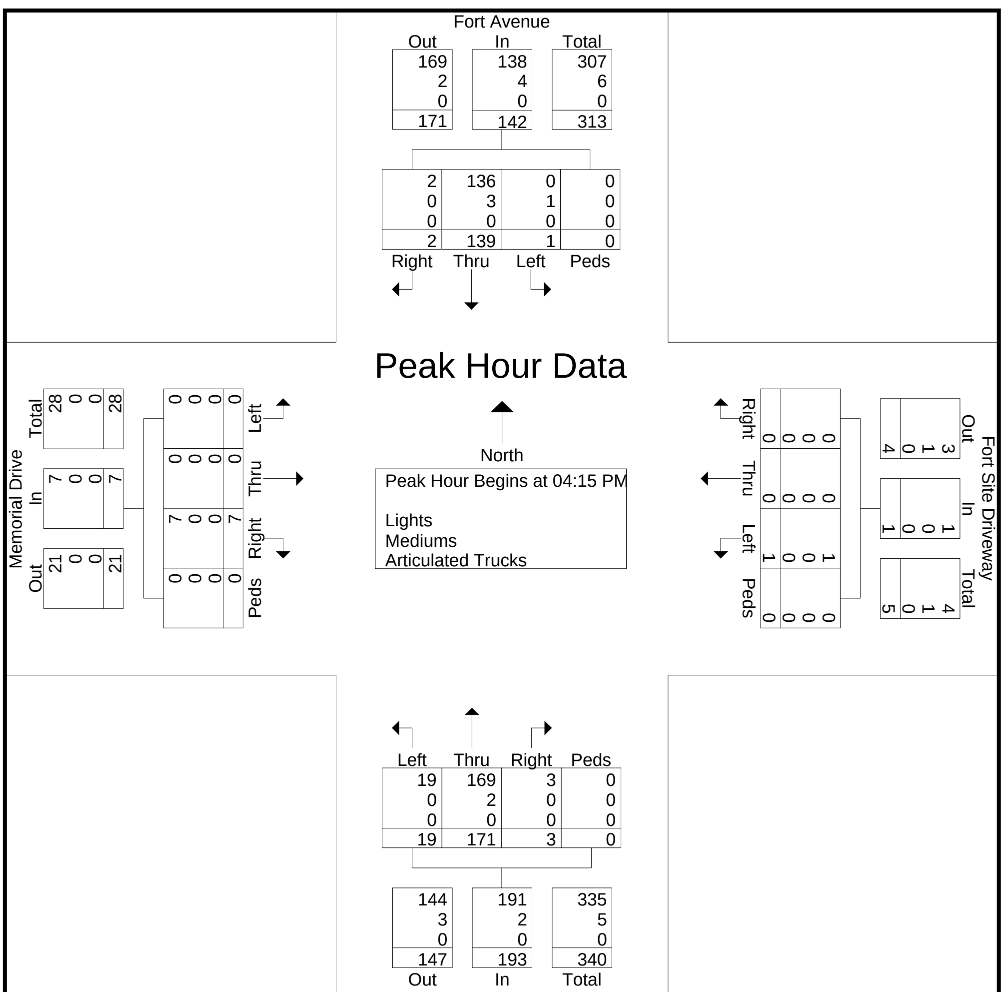
MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Fort Avenue
E/W: Site Driveway/Memorial Drive
Salem, MA

File Name : 1237 Fort Ave at Site
Site Code : 1237
Start Date : 9/13/2022
Page No : 3

	Fort Avenue From North					Fort Site Driveway From East					Fort Avenue From South					Memorial Drive From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	**1**							**1**		**1**	0	41	4	0	45	**2**				**2**	81
04:30 PM	0	**46**	0	0	**46**	0	0	0	0	0	1	43	**6**								**98**
04:45 PM	1	32	**1**								**2**	**46**	5	0	**53**	2	0	0	0	2	89
05:00 PM	0	29	0	0	29	0	0	0	0	0	0	41	4	0	45	1	0	0	0	1	75
Total Volume	2	139	1	0	142	0	0	1	0	1	3	171	19	0	193	7	0	0	0	7	343
% App. Total	1.4	97.9	0.7	0		0	0	100	0		1.6	88.6	9.8	0		100	0	0	0		
PHF	.500	.755	.250	.000	.772	.000	.000	.250	.000	.250	.375	.929	.792	.000	.910	.875	.000	.000	.000	.875	.875
Lights	2	136	0	0	138	0	0	1	0	1	3	169	19	0	191	7	0	0	0	7	337
% Lights	100	97.8	0	0	97.2	0	0	100	0	100	100	98.8	100	0	99.0	100	0	0	0	100	98.3
Mediums	0	3	1	0	4	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	6
% Mediums	0	2.2	100	0	2.8	0	0	0	0	0	0	1.2	0	0	1.0	0	0	0	0	0	1.7
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Sgt. James Ayube Mem. Dr.
E/W: Bridge Street/Apartment Driveway
Salem, MA

File Name : 1237 Parkway at Bridge
Site Code : 1237
Start Date : 9/13/2022

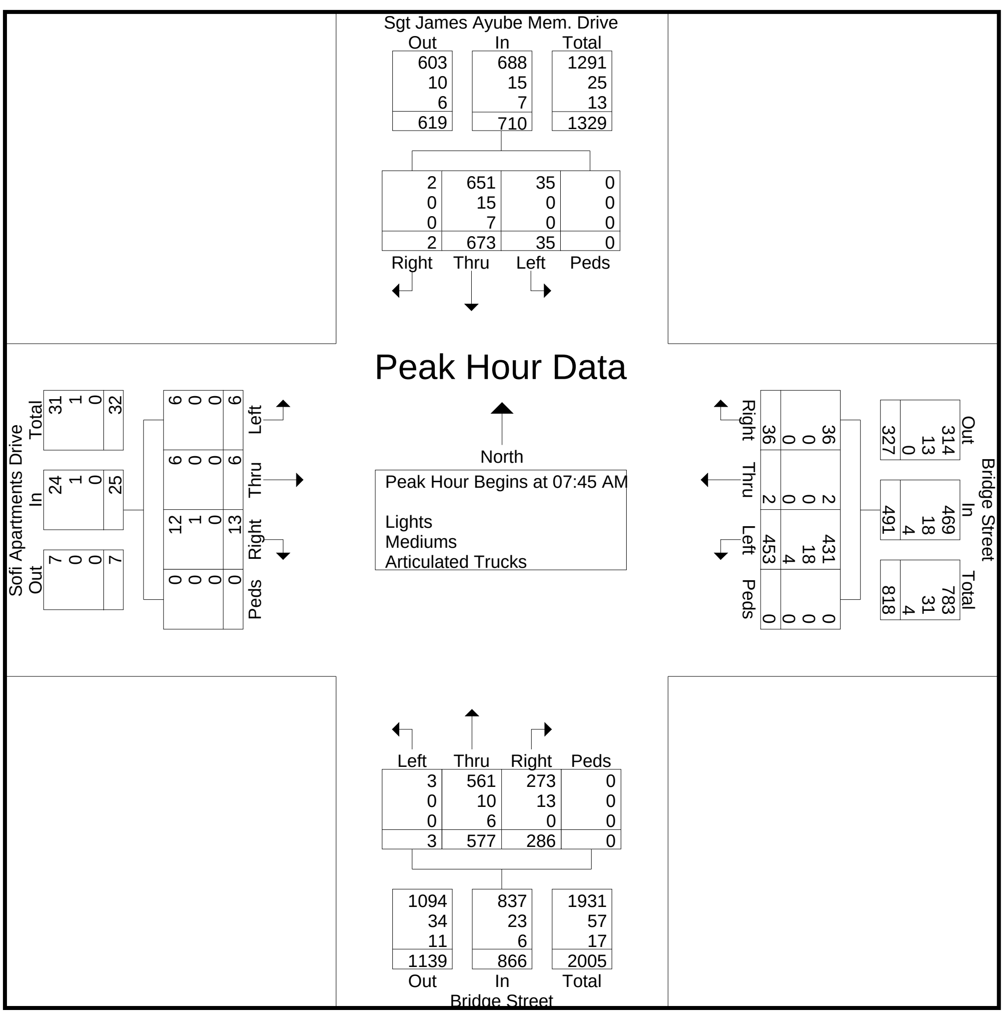
Groups Printed- Lights - Mediums - Articulated Trucks

	Sgt James Ayube Mem. Drive From North					Bridge Street From East					Bridge Street From South					Sofi Apartments Drive From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	0	49	0	0	49	0	0	43	0	43	13	57	0	0	70	0	0	1	0	1	163
06:15 AM	0	61	2	0	63	0	0	53	0	53	16	65	0	0	81	0	1	1	0	2	199
06:30 AM	0	99	1	0	100	2	1	64	0	67	28	96	0	0	124	2	0	1	0	3	294
06:45 AM	0	117	1	0	118	1	0	67	0	68	49	151	0	0	200	1	0	0	0	1	387
Total	0	326	4	0	330	3	1	227	0	231	106	369	0	0	475	3	1	3	0	7	1043
07:00 AM	0	130	2	0	132	2	0	72	0	74	51	109	1	0	161	4	0	0	0	4	371
07:15 AM	1	148	5	0	154	5	0	82	0	87	58	134	1	0	193	2	1	0	0	3	437
07:30 AM	1	148	2	0	151	12	0	98	0	110	52	158	3	0	213	4	1	1	0	6	480
07:45 AM	0	154	10	0	164	10	0	129	0	139	70	160	0	0	230	2	3	0	0	5	538
Total	2	580	19	0	601	29	0	381	0	410	231	561	5	0	797	12	5	1	0	18	1826
08:00 AM	1	199	7	0	207	7	1	104	0	112	72	128	2	0	202	3	0	2	0	5	526
08:15 AM	1	153	10	0	164	12	1	122	0	135	83	143	0	0	226	5	2	2	0	9	534
08:30 AM	0	167	8	0	175	7	0	98	0	105	61	146	1	0	208	3	1	2	0	6	494
08:45 AM	3	143	10	0	156	1	2	123	0	126	53	112	3	0	168	3	0	1	0	4	454
Total	5	662	35	0	702	27	4	447	0	478	269	529	6	0	804	14	3	7	0	24	2008
03:00 PM	0	183	9	0	192	3	0	117	0	120	56	113	7	0	176	2	0	1	0	3	491
03:15 PM	0	200	11	0	211	2	1	83	0	86	69	136	6	0	211	1	0	2	0	3	511
03:30 PM	2	190	12	0	204	2	1	60	0	63	58	124	3	0	185	0	1	0	0	1	453
03:45 PM	1	172	17	0	190	4	2	68	0	74	68	119	2	0	189	2	0	1	0	3	456
Total	3	745	49	0	797	11	4	328	0	343	251	492	18	0	761	5	1	4	0	10	1911
04:00 PM	2	195	13	0	210	6	0	70	0	76	67	122	3	0	192	4	2	4	0	10	488
04:15 PM	2	174	4	0	180	6	0	75	0	81	68	148	1	0	217	1	0	0	0	1	479
04:30 PM	1	163	11	0	175	4	1	66	0	71	69	137	3	0	209	3	1	1	0	5	460
04:45 PM	4	170	5	0	179	7	1	77	0	85	67	161	3	0	231	3	0	1	0	4	499
Total	9	702	33	0	744	23	2	288	0	313	271	568	10	0	849	11	3	6	0	20	1926
05:00 PM	3	144	11	0	158	12	1	81	0	94	62	140	1	0	203	2	0	3	0	5	460
05:15 PM	1	168	13	0	182	6	2	74	0	82	67	126	3	0	196	3	0	3	0	6	466
05:30 PM	5	204	19	0	228	4	2	74	0	80	73	94	3	0	170	3	2	1	0	6	484
05:45 PM	5	141	6	0	152	1	1	66	0	68	74	136	2	0	212	2	1	3	0	6	438
Total	14	657	49	0	720	23	6	295	0	324	276	496	9	0	781	10	3	10	0	23	1848
Grand Total	33	3672	189	0	3894	116	17	1966	0	2099	1404	3015	48	0	4467	55	16	31	0	102	10562
Apprch %	0.8	94.3	4.9	0		5.5	0.8	93.7	0		31.4	67.5	1.1	0		53.9	15.7	30.4	0		
Total %	0.3	34.8	1.8	0	36.9	1.1	0.2	18.6	0	19.9	13.3	28.5	0.5	0	42.3	0.5	0.2	0.3	0	1	
Lights	32	3596	188	0	3816	116	17	1900	0	2033	1362	2960	48	0	4370	53	16	30	0	99	10318
% Lights	97	97.9	99.5	0	98	100	100	96.6	0	96.9	97	98.2	100	0	97.8	96.4	100	96.8	0	97.1	97.7
Mediums	1	65	1	0	67	0	0	59	0	59	37	46	0	0	83	2	0	1	0	3	212
% Mediums	3	1.8	0.5	0	1.7	0	0	3	0	2.8	2.6	1.5	0	0	1.9	3.6	0	3.2	0	2.9	2
Articulated Trucks	0	11	0	0	11	0	0	7	0	7	5	9	0	0	14	0	0	0	0	0	32
% Articulated Trucks	0	0.3	0	0	0.3	0	0	0.4	0	0.3	0.4	0.3	0	0	0.3	0	0	0	0	0	0.3

N/S: Sgt. James Ayube Mem. Dr.
E/W: Bridge Street/Apartment Driveway
Salem, MA

File Name : 1237 Parkway at Bridge
Site Code : 1237
Start Date : 9/13/2022
Page No : 2

	Sgt James Ayube Mem. Drive From North					Bridge Street From East					Bridge Street From South					Sofi Apartments Drive From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 12:00 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	0	154	**10**					**129**		**139**	70	**160**	0	0	**230**	2	**3**	0	0	5	**538**
08:00 AM	**1**	**199**	7	0	**207**	7	**1**	104	0	112	72	128	**2**					**2**			
08:15 AM	**1**	**153**	**10**	**0**	**164**	**12**	**1**	**122**	**0**	**135**	**83**	**143**	**0**	**0**	**226**	**5**	**2**	**2**	**0**	**9**	534
08:30 AM	0	167	8	0	175	7	0	98	0	105	61	146	1	0	208	3	1	2	0	6	494
Total Volume	2	673	35	0	710	36	2	453	0	491	286	577	3	0	866	13	6	6	0	25	2092
% App. Total	0.3	94.8	4.9	0		7.3	0.4	92.3	0		33	66.6	0.3	0		52	24	24	0		
PHF	.500	.845	.875	.000	.857	.750	.500	.878	.000	.883	.861	.902	.375	.000	.941	.650	.500	.750	.000	.694	.972
Lights	2	651	35	0	688	36	2	431	0	469	273	561	3	0	837	12	6	6	0	24	2018
% Lights	100	96.7	100	0	96.9	100	100	95.1	0	95.5	95.5	97.2	100	0	96.7	92.3	100	100	0	96.0	96.5
Mediums	0	15	0	0	15	0	0	18	0	18	13	10	0	0	23	1	0	0	0	1	57
% Mediums	0	2.2	0	0	2.1	0	0	4.0	0	3.7	4.5	1.7	0	0	2.7	7.7	0	0	0	4.0	2.7
Articulated Trucks	0	7	0	0	7	0	0	4	0	4	0	6	0	0	6	0	0	0	0	0	17
% Articulated Trucks	0	1.0	0	0	1.0	0	0	0.9	0	0.8	0	1.0	0	0	0.7	0	0	0	0	0	0.8



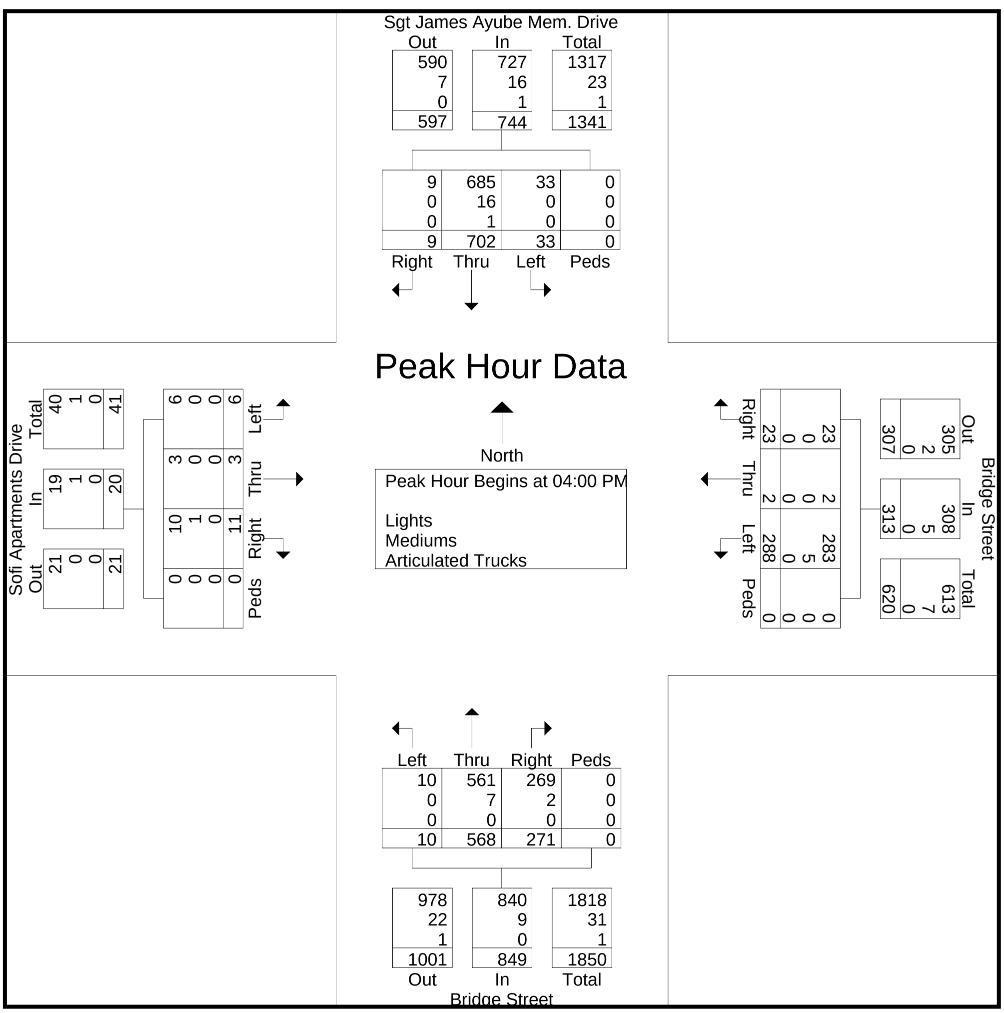
MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Sgt. James Ayube Mem. Dr.
E/W: Bridge Street/Apartment Driveway
Salem, MA

File Name : 1237 Parkway at Bridge
Site Code : 1237
Start Date : 9/13/2022

	Sgt James Ayube Mem. Drive From North					Bridge Street From East					Bridge Street From South					Sofi Apartments Drive From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:15 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	2	**195**	**13**		**210**	6	0	70	0	76	67	122	**3**			**4**	**2**	**4**		**10**	488
04:15 PM	2	174	4	0	180	6	0	75	0	81	68	148	1	0	217	1	0	0	0	1	479
04:30 PM	1	163	11	0	175	4	**1**	66	0	71	**69**										
04:45 PM	**4**	**170**	**5**	**0**	**179**	**7**	**1**	**77**	**0**	**85**	67	**161**	3	0	**231**	3	0	1	0	4	**499**
Total Volume	9	702	33	0	744	23	2	288	0	313	271	568	10	0	849	11	3	6	0	20	1926
% App. Total	1.2	94.4	4.4	0		7.3	0.6	92	0		31.9	66.9	1.2	0		55	15	30	0		
PHF	.563	.900	.635	.000	.886	.821	.500	.935	.000	.921	.982	.882	.833	.000	.919	.688	.375	.375	.000	.500	.965
Lights	9	685	33	0	727	23	2	283	0	308	269	561	10	0	840	10	3	6	0	19	1894
% Lights	100	97.6	100	0	97.7	100	100	98.3	0	98.4	99.3	98.8	100	0	98.9	90.9	100	100	0	95.0	98.3
Mediums	0	16	0	0	16	0	0	5	0	5	2	7	0	0	9	1	0	0	0	1	31
% Mediums	0	2.3	0	0	2.2	0	0	1.7	0	1.6	0.7	1.2	0	0	1.1	9.1	0	0	0	5.0	1.6
Articulated Trucks	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0.1	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1



MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers
28 Lord Road, Suite 280
Marlborough, MA

N/S: Bridge Street
Salem, MA

File Name : 1237 Bridge at Northern Split
Site Code : 1237
Start Date : 9/13/2022
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	Bridge Street From North					Peninsula Road From East					Diner Driveway From Southeast					Bridge Street From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
06:00 AM	16	0	0	0	16	0	0	0	0	0	0	0	1	0	1	1	1	29	0	31	48
06:15 AM	30	0	1	0	31	1	0	0	0	1	0	0	0	0	0	0	0	41	0	41	73
06:30 AM	60	0	0	0	60	2	1	0	0	3	0	0	1	0	1	2	2	70	0	74	138
06:45 AM	57	0	2	0	59	2	0	0	0	2	0	0	0	0	0	1	0	73	0	74	135
Total	163	0	3	0	166	5	1	0	0	6	0	0	2	0	2	4	3	213	0	220	394
07:00 AM	83	0	0	0	83	0	0	0	0	0	0	0	0	0	0	2	0	115	0	117	200
07:15 AM	71	0	2	0	73	3	1	0	0	4	0	1	0	0	1	1	0	149	0	150	228
07:30 AM	97	0	2	0	99	2	6	0	0	8	0	0	3	0	3	6	1	142	0	149	259
07:45 AM	108	0	3	0	111	3	3	0	0	6	0	0	0	0	0	6	0	138	0	144	261
Total	359	0	7	0	366	8	10	0	0	18	0	1	3	0	4	15	1	544	0	560	948
08:00 AM	116	0	4	0	120	4	3	0	0	7	0	0	1	0	1	3	1	123	0	127	255
08:15 AM	129	0	1	0	130	1	3	0	0	4	0	2	0	0	2	2	1	126	0	129	265
08:30 AM	103	0	1	0	104	1	0	0	0	1	0	0	0	0	0	0	0	169	0	169	274
08:45 AM	122	0	2	0	124	1	1	0	0	2	0	0	0	0	0	2	2	119	0	123	249
Total	470	0	8	0	478	7	7	0	0	14	0	2	1	0	3	7	4	537	0	548	1043
03:00 PM	94	0	1	0	95	1	1	0	0	2	0	1	1	0	2	1	0	152	0	153	252
03:15 PM	110	0	2	0	112	7	2	0	0	9	0	3	1	0	4	1	3	128	0	132	257
03:30 PM	114	0	1	0	115	6	2	0	0	8	0	4	0	0	4	2	0	160	0	162	289
03:45 PM	136	0	2	0	138	2	4	0	0	6	0	1	2	0	3	1	0	143	0	144	291
Total	454	0	6	0	460	16	9	0	0	25	0	9	4	0	13	5	3	583	0	591	1089
04:00 PM	131	0	0	0	131	0	2	0	0	2	0	1	1	0	2	2	1	134	0	137	272
04:15 PM	140	0	1	0	141	0	3	0	0	3	0	0	1	0	1	3	2	152	0	157	302
04:30 PM	124	0	2	0	126	5	2	0	0	7	0	0	3	0	3	2	1	140	0	143	279
04:45 PM	157	0	2	0	159	4	0	0	0	4	0	1	1	0	2	4	1	146	0	151	316
Total	552	0	5	0	557	9	7	0	0	16	0	2	6	0	8	11	5	572	0	588	1169
05:00 PM	127	0	3	0	130	4	5	0	0	9	0	1	2	0	3	0	0	123	0	123	265
05:15 PM	166	2	1	0	169	4	1	0	0	5	0	0	1	0	1	0	0	140	0	140	315
05:30 PM	153	0	0	0	153	2	1	0	0	3	0	2	3	0	5	1	0	124	0	125	286
05:45 PM	134	0	1	0	135	4	1	0	0	5	0	1	1	0	2	0	0	94	0	94	236
Total	580	2	5	0	587	14	8	0	0	22	0	4	7	0	11	1	0	481	0	482	1102
Grand Total	2578	2	34	0	2614	59	42	0	0	101	0	18	23	0	41	43	16	2930	0	2989	5745
Apprch %	98.6	0.1	1.3	0		58.4	41.6	0	0		0	43.9	56.1	0		1.4	0.5	98	0		
Total %	44.9	0	0.6	0	45.5	1	0.7	0	0	1.8	0	0.3	0.4	0	0.7	0.7	0.3	51	0	52	
Lights	2521	2	34	0	2557	57	42	0	0	99	0	17	23	0	40	42	16	2870	0	2928	5624
% Lights	97.8	100	100	0	97.8	96.6	100	0	0	98	0	94.4	100	0	97.6	97.7	100	98	0	98	97.9
Mediums	51	0	0	0	51	2	0	0	0	2	0	1	0	0	1	1	0	46	0	47	101
% Mediums	2	0	0	0	2	3.4	0	0	0	2	0	5.6	0	0	2.4	2.3	0	1.6	0	1.6	1.8
Articulated Trucks																					
% Articulated Trucks	0.2	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0.5	0.3

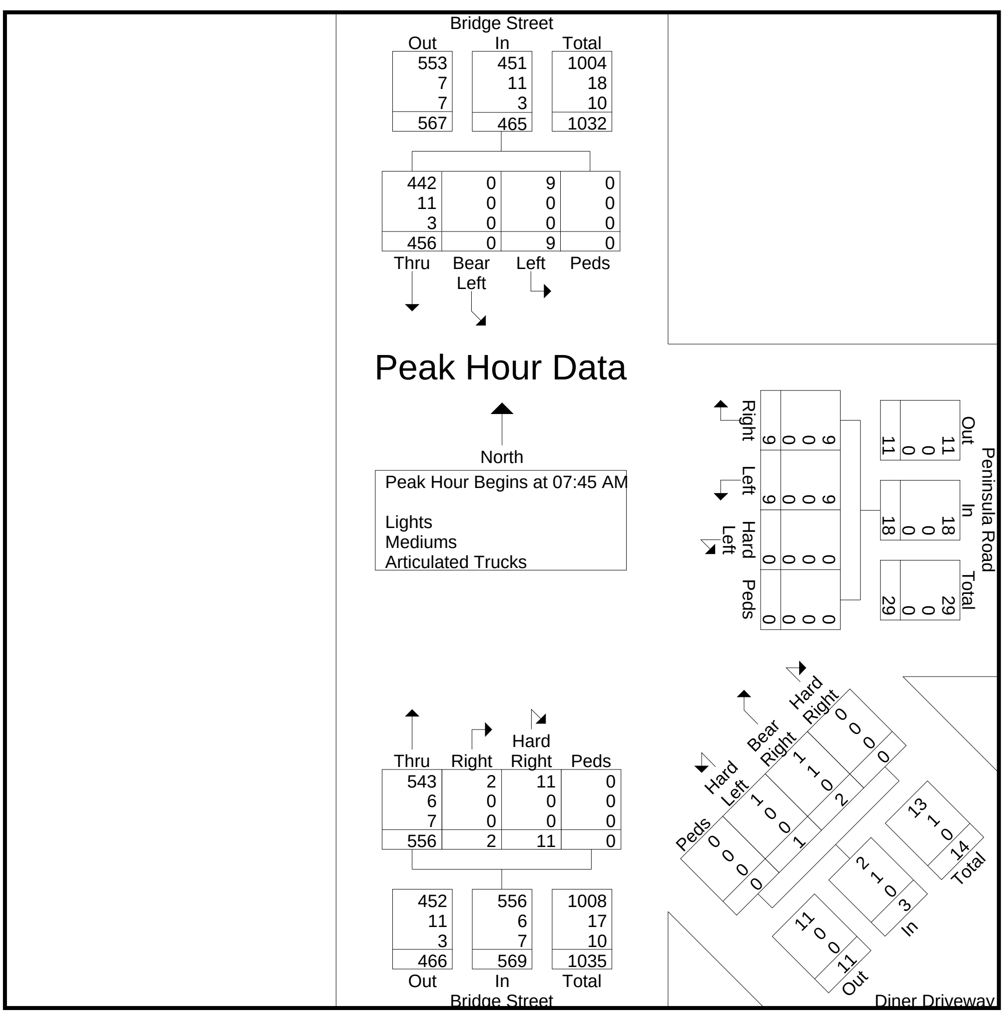
MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Bridge Street
Salem, MA

File Name : 1237 Bridge at Northern Split
Site Code : 1237
Start Date : 9/13/2022
Page No : 2

	Bridge Street From North					Peninsula Road From East					Diner Driveway From Southeast					Bridge Street From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	108	0	3	0	111	3	**3**	0	0	6	0	0	0	0	0	**6**					
08:00 AM	**116**	**0**	**4**	**0**	**120**	**4**	3	**0**	**0**	**7**	0	0	**1**	**0**	**1**	**3**	**1**	123	0	127	255
08:15 AM	**129**				**130**	1	3	0	0	4	0	**2**	0	0	**2**	2	1	126	0	129	265
08:30 AM	103	0	1	0	104	1	0	0	0	1	0	0	0	0	0	0	0	**169**		**169**	**274**
Total Volume	456	0	9	0	465	9	9	0	0	18	0	2	1	0	3	11	2	556	0	569	1055
% App. Total	98.1	0	1.9	0		50	50	0	0		0	66.7	33.3	0		1.9	0.4	97.7	0		
PHF	.884	.000	.563	.000	.894	.563	.750	.000	.000	.643	.000	.250	.250	.000	.375	.458	.500	.822	.000	.842	.963
Lights	442	0	9	0	451	9	9	0	0	18	0	1	1	0	2	11	2	543	0	556	1027
% Lights	96.9	0	100	0	97.0	100	100	0	0	100	0	50.0	100	0	66.7	100	100	97.7	0	97.7	97.3
Mediums	11	0	0	0	11	0	0	0	0	0	0	1	0	0	1	0	0	6	0	6	18
% Mediums	2.4	0	0	0	2.4	0	0	0	0	0	0	50.0	0	0	33.3	0	0	1.1	0	1.1	1.7
Articulated Trucks	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	10
% Articulated Trucks	0.7	0	0	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	1.3	0	1.2	0.9



MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Bridge Street
Salem, MA

File Name : 1237 Bridge at Northern Split
Site Code : 1237
Start Date : 9/13/2022
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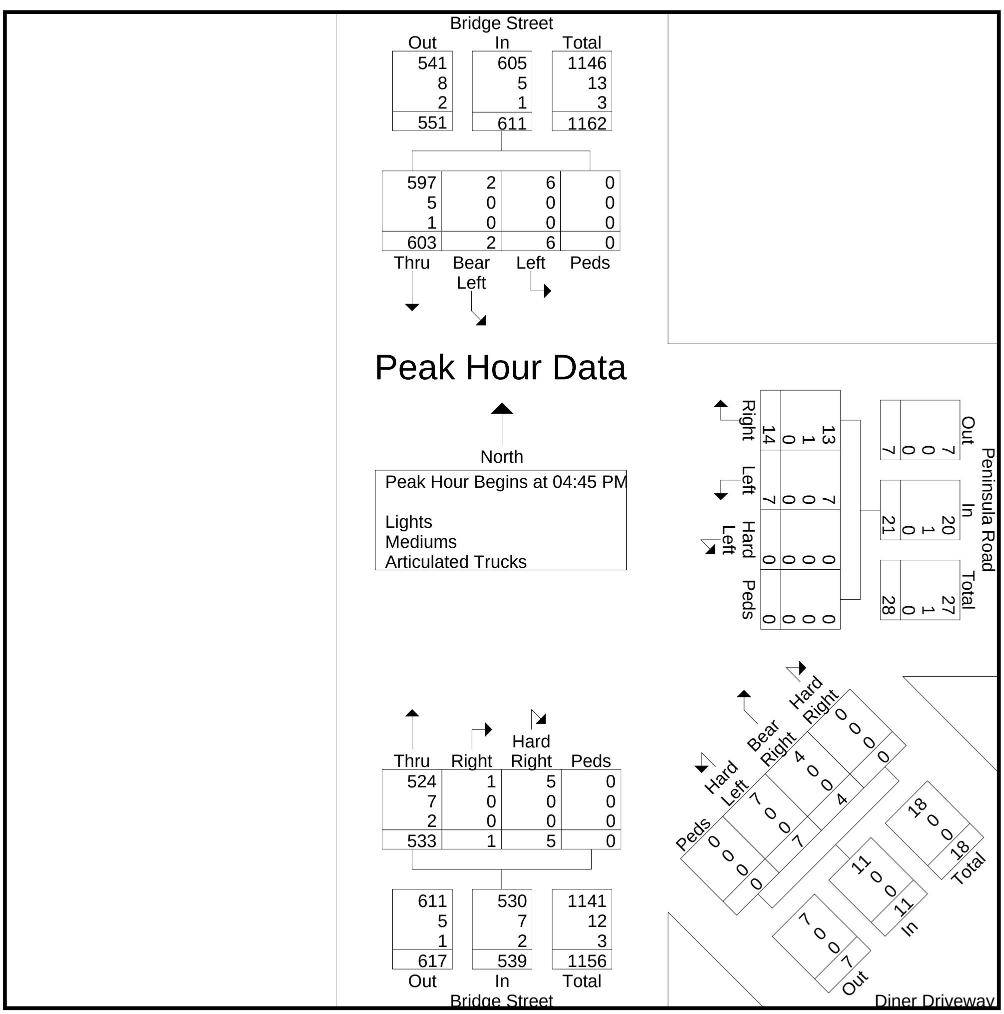
	Bridge Street From North					Peninsula Road From East					Diner Driveway From Southeast					Bridge Street From South					
Start Time	Thru	Bear Left	Left	Peds	App. Total	Right	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	157	0	2	0	159	**4**										**4**	**1**	**146**		**151**	**316**
05:00 PM	127	0	**3**				**5**	0	0	**9**	0	1	2	0	3	0	0	123	0	123	265
05:15 PM	**166**	**2**	1	0	**169**	4	1	0	0	5	0	0	1	0	1	0	0	140	0	140	315
05:30 PM	153	0	0	0	153	2	1	0	0	3	0	**2**	**3**		**5**	1	0	124	0	125	286
Total Volume	603	2	6	0	611	14	7	0	0	21	0	4	7	0	11	5	1	533	0	539	1182
% App. Total	98.7	0.3	1	0		66.7	33.3	0	0		0	36.4	63.6	0		0.9	0.2	98.9	0		
PHF	.908	.250	.500	.000	.904	.875	.350	.000	.000	.583	.000	.500	.583	.000	.550	.313	.250	.913	.000	.892	.935
Lights	597	2	6	0	605	13	7	0	0	20	0	4	7	0	11	5	1	524	0	530	1166
% Lights	99.0	100	100	0	99.0	92.9	100	0	0	95.2	0	100	100	0	100	100	100	98.3	0	98.3	98.6
Mediums	5	0	0	0	5	1	0	0	0	1	0	0	0	0	0	0	0	7	0	7	13
% Mediums	0.8	0	0	0	0.8	7.1	0	0	0	4.8	0	0	0	0	0	0	0	1.3	0	1.3	1.1
Articulated Trucks	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	3
% Articulated Trucks	0.2	0	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0.4	0.3



MDM TRANSPORTATION CONSULTANTS, INC.
Planners & Engineers

28 Lord Road, Suite 280
Marlborough, MA

N/S: Essex Street
E/W: Webb Street
Salem, MA

File Name : 1237 Webb at Essex
Site Code : 1237
Start Date : 9/13/2022
Page No : 1

Groups Printed- Lights - Mediums - Articulated Trucks

	Essex Street From North					Webb Street From East					Essex Street From South					Webb Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	4	3	0	0	7	1	17	3	0	21	0	0	4	0	4	1	4	2	0	7	39
06:15 AM	4	2	0	0	6	1	14	7	0	22	0	0	6	0	6	3	7	1	0	11	45
06:30 AM	1	5	0	0	6	1	24	8	0	33	2	1	5	0	8	8	16	3	0	27	74
06:45 AM	6	0	0	0	6	2	31	11	0	44	0	2	4	0	6	7	15	10	0	32	88
Total	15	10	0	0	25	5	86	29	0	120	2	3	19	0	24	19	42	16	0	77	246
07:00 AM	8	7	0	0	15	7	39	8	0	54	0	2	9	0	11	10	19	15	0	44	124
07:15 AM	14	19	0	0	33	15	25	12	0	52	0	13	12	0	25	12	8	26	0	46	156
07:30 AM	32	29	0	0	61	11	41	20	0	72	2	10	14	0	26	13	10	19	0	42	201
07:45 AM	12	8	0	0	20	1	46	14	0	61	2	2	16	0	20	12	16	7	0	35	136
Total	66	63	0	0	129	34	151	54	0	239	4	27	51	0	82	47	53	67	0	167	617
08:00 AM	9	4	0	0	13	1	45	25	0	71	0	0	14	0	14	16	14	12	0	42	140
08:15 AM	15	5	0	0	20	4	46	16	0	66	2	1	16	0	19	22	19	20	0	61	166
08:30 AM	32	18	0	0	50	2	45	20	0	67	2	3	15	0	20	20	23	11	0	54	191
08:45 AM	20	16	0	0	36	1	39	16	0	56	2	2	10	0	14	13	12	5	0	30	136
Total	76	43	0	0	119	8	175	77	0	260	6	6	55	0	67	71	68	48	0	187	633
03:00 PM	28	22	2	0	52	0	62	26	0	88	5	5	14	0	24	13	14	2	0	29	193
03:15 PM	17	8	0	0	25	1	46	19	0	66	2	1	8	0	11	23	14	9	0	46	148
03:30 PM	14	6	0	0	20	1	51	25	0	77	2	1	13	0	16	18	10	5	0	33	146
03:45 PM	6	3	0	0	9	2	34	19	0	55	2	6	9	0	17	14	23	4	0	41	122
Total	65	39	2	0	106	4	193	89	0	286	11	13	44	0	68	68	61	20	0	149	609
04:00 PM	14	6	0	0	20	0	47	19	0	66	4	2	16	0	22	17	28	5	0	50	158
04:15 PM	7	13	0	0	20	0	44	26	0	70	5	2	11	0	18	30	22	6	0	58	166
04:30 PM	15	10	0	0	25	1	56	23	0	80	4	1	9	0	14	16	31	5	0	52	171
04:45 PM	13	8	0	0	21	0	44	22	0	66	2	4	8	0	14	24	30	2	0	56	157
Total	49	37	0	0	86	1	191	90	0	282	15	9	44	0	68	87	111	18	0	216	652
05:00 PM	5	12	0	0	17	0	43	20	0	63	2	6	9	0	17	16	24	7	0	47	144
05:15 PM	7	12	0	0	19	1	33	25	0	59	1	0	8	0	9	26	24	8	0	58	145
05:30 PM	9	7	0	0	16	0	54	17	0	71	0	2	9	0	11	25	25	6	0	56	154
05:45 PM	11	7	0	0	18	3	36	20	0	59	2	3	9	0	14	16	16	9	0	41	132
Total	32	38	0	0	70	4	166	82	0	252	5	11	35	0	51	83	89	30	0	202	575
Grand Total	303	230	2	0	535	56	962	421	0	1439	43	69	248	0	360	375	424	199	0	998	3332
Apprch %	56.6	43	0.4	0		3.9	66.9	29.3	0		11.9	19.2	68.9	0		37.6	42.5	19.9	0		
Total %	9.1	6.9	0.1	0	16.1	1.7	28.9	12.6	0	43.2	1.3	2.1	7.4	0	10.8	11.3	12.7	6	0	30	
Lights	300	218	2	0	520	55	935	411	0	1401	41	67	242	0	350	360	413	198	0	971	3242
% Lights	99	94.8	100	0	97.2	98.2	97.2	97.6	0	97.4	95.3	97.1	97.6	0	97.2	96	97.4	99.5	0	97.3	97.3
Mediums	3	12	0	0	15	1	23	10	0	34	1	2	6	0	9	15	11	1	0	27	85
% Mediums	1	5.2	0	0	2.8	1.8	2.4	2.4	0	2.4	2.3	2.9	2.4	0	2.5	4	2.6	0.5	0	2.7	2.6
Articulated Trucks	0	0	0	0	0	0	4	0	0	4	1	0	0	0	1	0	0	0	0	0	5
% Articulated Trucks	0	0	0	0	0	0	0.4	0	0	0.3	2.3	0	0	0	0.3	0	0	0	0	0	0.2

MDM TRANSPORTATION CONSULTANTS, INC.
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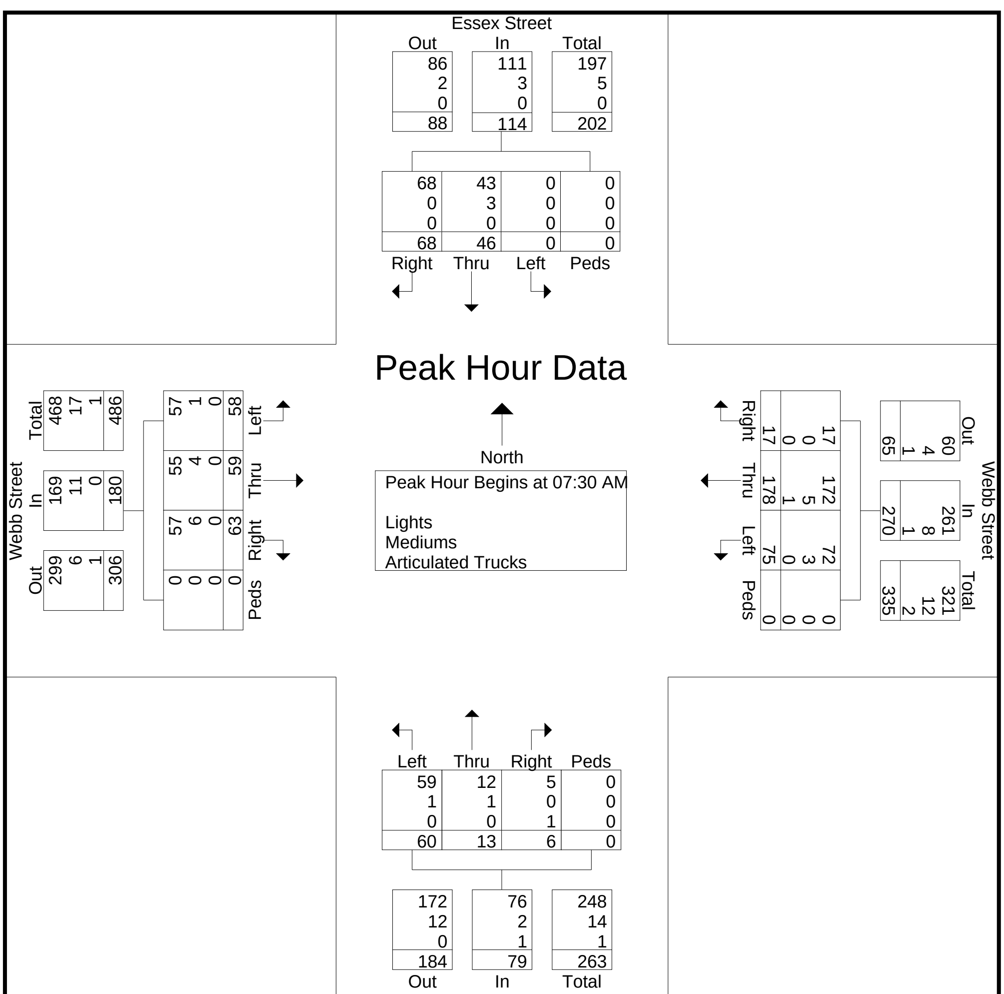
Site Code : 1237
Start Date : 9/13/2022
Page No : 2

	Essex Street From North					Webb Street From East					Essex Street From South					Webb Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	**32**	**29**	0	0	**61**	**11**				**72**	**2**	**10**	14	0	**26**	13	10	19	0	42	**201**
07:45 AM	12	8	0	0	20	1	**46**	14	0	61	2	2	**16**								
08:00 AM	**9**	**4**	**0**	**0**	**13**	**1**	**45**	**25**	**0**	**71**	**0**	**0**	**14**	**0**	**14**	**16**	**14**	**12**	**0**	**42**	**140**
08:15 AM	**15**	**5**	**0**	**0**	**20**	**4**	**46**	**16**	**0**	**66**	**2**	**1**	**16**	**0**	**19**	**22**	**19**	**20**	**0**	**61**	166
Total Volume	68	46	0	0	114	17	178	75	0	270	6	13	60	0	79	63	59	58	0	180	643
% App. Total	59.6	40.4	0	0		6.3	65.9	27.8	0		7.6	16.5	75.9	0		35	32.8	32.2	0		
PHF	.531	.397	.000	.000	.467	.386	.967	.750	.000	.938	.750	.325	.938	.000	.760	.716	.776	.725	.000	.738	.800
Lights	68	43	0	0	111	17	172	72	0	261	5	12	59	0	76	57	55	57	0	169	617
% Lights	100	93.5	0	0	97.4	100	96.6	96.0	0	96.7	83.3	92.3	98.3	0	96.2	90.5	93.2	98.3	0	93.9	96.0
Mediums	0	3	0	0	3	0	5	3	0	8	0	1	1	0	2	6	4	1	0	11	24
% Mediums	0	6.5	0	0	2.6	0	2.8	4.0	0	3.0	0	7.7	1.7	0	2.5	9.5	6.8	1.7	0	6.1	3.7
Articulated Trucks	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	2
% Articulated Trucks	0	0	0	0	0	0	0.6	0	0	0.4	16.7	0	0	0	1.3	0	0	0	0	0	0.3



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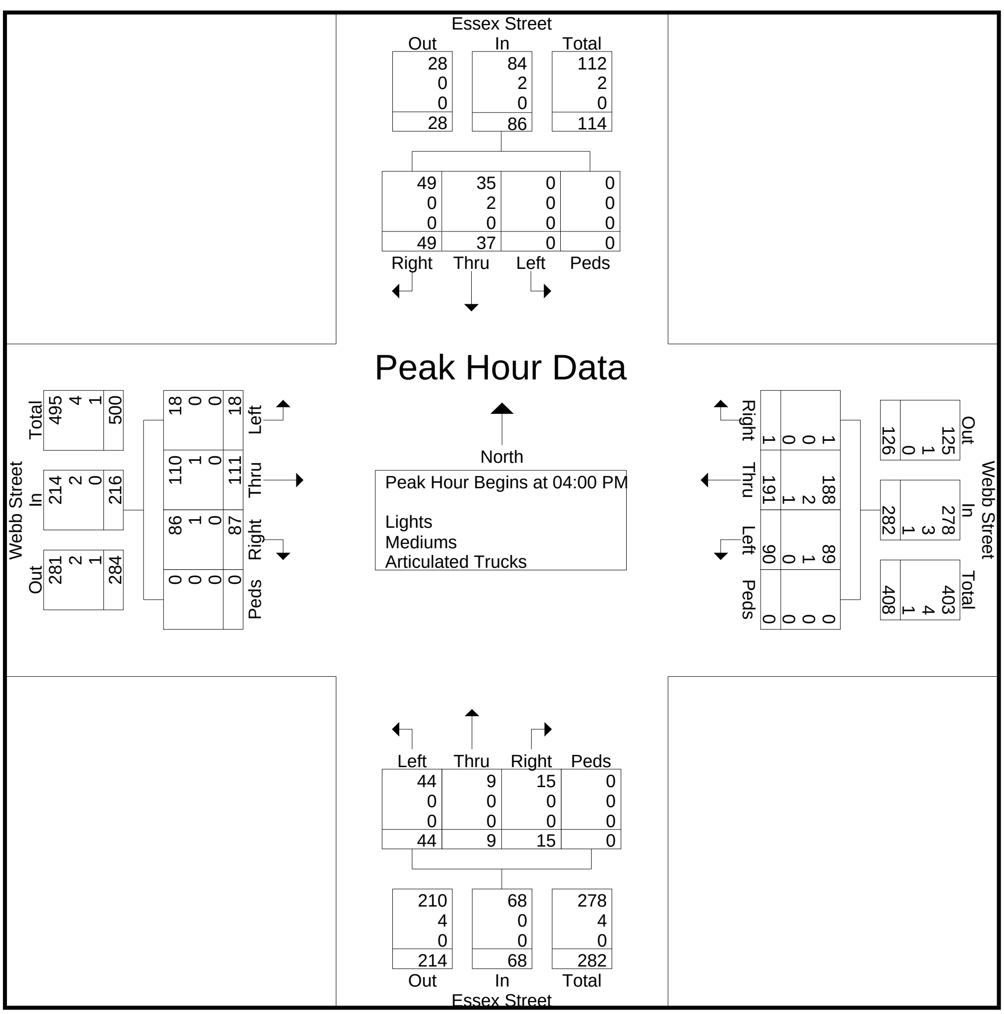
	Essex Street From North					Webb Street From East					Essex Street From South					Webb Street From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	14	6	0	0	20	0	47	19	0	66	4	2	**16**		**22**	17	28	5	0	50	158
04:15 PM	7	**13**	0	0	20	0	44	**26**			**5**					**30**		**6**		**58**	166
04:30 PM	**15**				**25**	**1**	**56**	23	0	**80**	4	1	9	0	14	16	**31**	5	0	52	**171**
04:45 PM	13	8	0	0	21	0	44	22	0	66	2	**4**	8	0	14	24	30	2	0	56	157
Total Volume	49	37	0	0	86	1	191	90	0	282	15	9	44	0	68	87	111	18	0	216	652
% App. Total	57	43	0	0		0.4	67.7	31.9	0		22.1	13.2	64.7	0		40.3	51.4	8.3	0		
PHF	.817	.712	.000	.000	.860	.250	.853	.865	.000	.881	.750	.563	.688	.000	.773	.725	.895	.750	.000	.931	.953
Lights	49	35	0	0	84	1	188	89	0	278	15	9	44	0	68	86	110	18	0	214	644
% Lights	100	94.6	0	0	97.7	100	98.4	98.9	0	98.6	100	100	100	0	100	98.9	99.1	100	0	99.1	98.8
Mediums	0	2	0	0	2	0	2	1	0	3	0	0	0	0	0	1	1	0	0	2	7
% Mediums	0	5.4	0	0	2.3	0	1.0	1.1	0	1.1	0	0	0	0	0	1.1	0.9	0	0	0.9	1.1
Articulated Trucks	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
% Articulated Trucks	0	0	0	0	0	0	0.5	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0.2



- □ Seasonal/ Yearly Growth Data

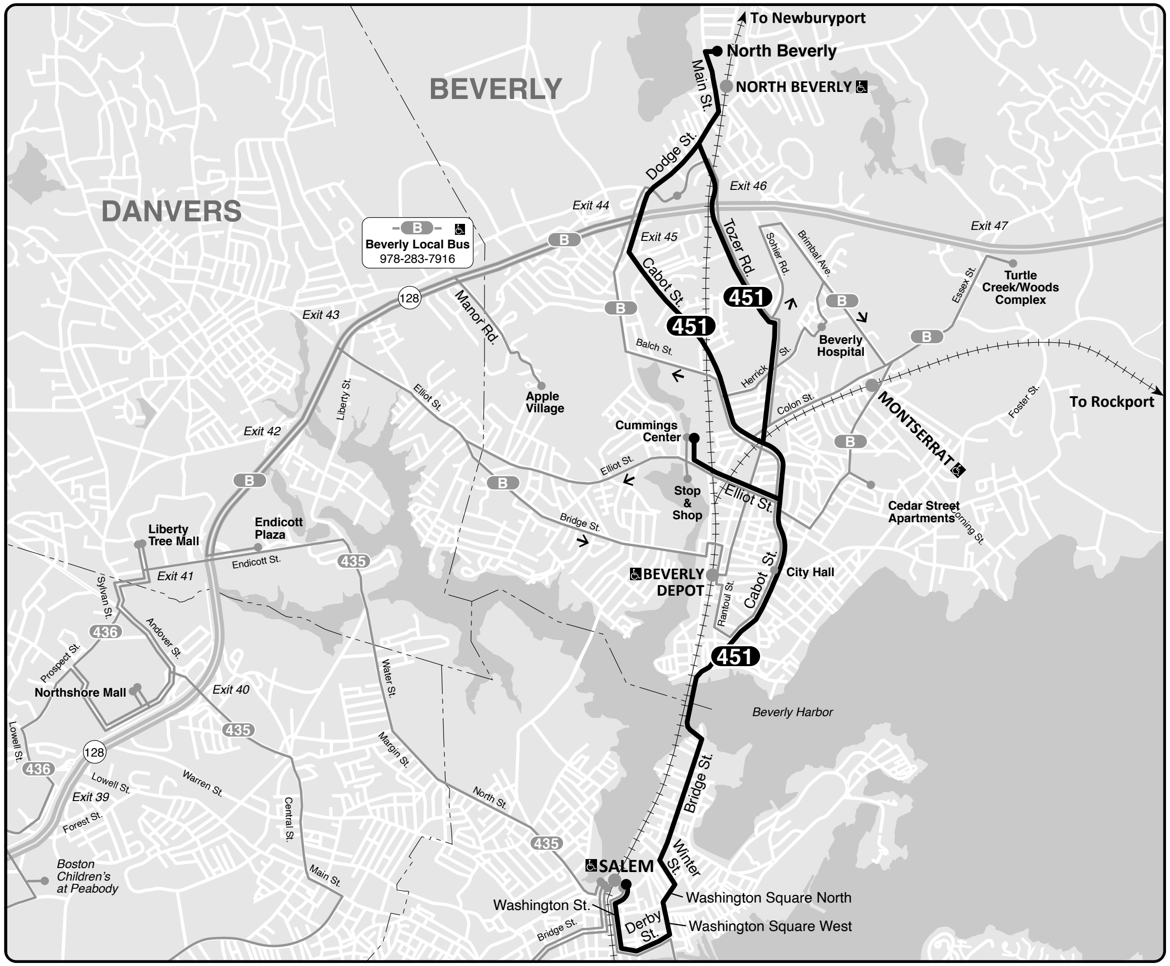
STATION 550 - PEABODY - RTE.1 - NORTH OF LOWELL ST.

YR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
05	42,000	41,328	41,928	46,353	47,000	45,000	43,207	43,133	44,632	44,742	43,480	43,557	43,863
	-3%	-1%	5%	-3%	-7%	2%	-1%	2%	-1%	-2%	-2%	1%	-1%
06	40,910	40,968	43,840	44,805	43,655	45,703	42,838	44,074	44,277	44,022	42,524	43,890	43,459
	-5%	-1%	-3%	-4%	8%	3%	3%	1%	-1%	1%	1%	-5%	0%
07	38,886	40,669	42,661	43,204	46,954	47,202	44,243	44,521	43,975	44,388	42,915	41,485	43,425
	4%	0%	-1%	3%	-3%	-3%	-1%	-2%	0%	1%	-1%	0%	0%
08	40,432	40,617	42,102	44,626	45,673	45,559	43,651	43,782	43,893	44,663	42,446	41,581	43,252
	-1%	2%	0%	-1%	-1%	-1%	0%	-2%	0%	-1%	-2%	0%	-1%
09	40,000	41,446	41,996	44,100	45,374	44,907	43,496	42,968	44,065	44,345	41,766	41,591	43,005
	7%	1%	7%	7%	6%	8%	5%	7%	1%	5%	8%	6%	6%
13	42,837	41,755	44,812	47,099	*48,320*	*48,280*	*45,635*	46,042	44,393	46,686	45,298	44,287	45,454
	-10%	0%	0%	-1%	-1%	0%	-1%	0%	5%	-1%	-2%	15%	0%
14	38,499	41,749	44,885	46,624	*47,921*	*48,052*	*45,083*	46,081	46,489	46,271	44,235	50,872	45,563
	10%	3%	1%	-1%	0%	0%	0%	-1%	-6%	-1%	3%	-13%	-1%
16	42,292	43,000	45,179	46,324	*47,911*	*48,275*	*45,230*	45,687	43,917	45,773	45,698	44,277	45,297
	-1%	-5%	-2%	-1%	-2%	-1%	-2%	-2%	2%	-1%	-1%	-5%	-2%
17	42,052	41,023	44,486	45,704	47,134	*47,745*	*44,531*	44,926	44,943	45,276	45,242	42,238	44,608
Seasonal Adjustment Factor (to average month)	1.08	1.07	1.02	0.98	0.96	0.96	1.01	1.00	1.00	0.99	1.02	1.02	
												Growth	**-0.3%**

ITALICS = ESTIMATED DATA

MADT

- □ Alternative Transportation Information



Effective **August 28, 2022**

Replaces March 2022

451 North Beverly – Salem Depot

Connections

NEWBURYPORT/ROCKPORT LINE

- Transfer to bus/subway available on CharlieCard—good for 2 hours, pay fare difference.
- Children 11 & under ride free with a paying customer.
- All MBTA buses are accessible to people with disabilities.

	CharlieCard	Cash on board	Reduced fare
Bus	**$1.70**	**$1.70**	**$0.85**
Bus + Subway	**$2.40**	**$4.10**	**$1.10**

Complete fare/pass rules and free/reduced fare eligibility:
mbta.com/fares or call **617-222-3200**

Information **617-222-3200**
Lost and Found **617-222-5263**
TTY **617-222-5146**

Realtime arrival information, maps, and more

mbta.com

A129-3-22.1

Weekday 451

Inbound

North Beverly	Tozer Road	Dodge St & Cabot St	Cummings Center	Salem Depot
6:42	-	6:44	6:51	7:11
8:04	-	8:08	8:16	8:39
9:30	-	9:33	9:41	10:02
4:37	**4:40**	**-**	**4:47**	**5:11**
6:08	**6:11**	**-**	**6:18**	**6:36**
7:25	**7:28**	**-**	**7:33**	**7:54**

Outbound

Salem Depot	Cummings Center	Dodge St & Cabot St	Tozer Road	North Beverly
5:55	6:15	-	6:26	6:35
7:17	7:38	-	7:47	7:56
8:45	9:05	-	9:14	9:23
3:45	**4:08**	**4:15**	**-**	**4:30**
5:20	**5:42**	**5:53**	**-**	**6:00**
6:45	**7:03**	**7:11**	**-**	**7:20**

No Saturday service

No Sunday service

PM times are **bold**

Information in this timetable is subject to change without notice. Traffic and weather may affect running times.

Always check bus destination signs before boarding. Some buses may only serve a part, or skip portions of this route.

2022 Holidays

SUN Memorial Day	SUN Christmas Day
SUN Independence Day	SUN Christmas Day Observed
SUN Labor Day	SAT New Year's Eve
SUN Thanksgiving Day	SUN New Year's Day

NEWBURYPORT/ROCKPORT LINE

2022 SPRING/SUMMER SCHEDULE
Effective June 13, 2022

Monday to Friday

Inbound to Boston

ZONE	STATION		140	100	142	102	144	104	146	106	148	108	150	192	110	152	112	154	114	156	198	116	158	118	160	120	162	122	124	164
			AM														PM													
	Bikes Allowed		🚲	🚲								🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲
8	Rockport	♿	-	5:08	-	6:13	-	7:13	-	8:13	-	9:13	-	-	10:43	-	12:13	-	1:43	-	-	3:13	-	4:37	-	5:46	-	7:46	8:50	-
7	Gloucester	♿	-	5:15	-	6:20	-	7:20	-	8:20	-	9:20	-	-	10:50	-	12:20	-	1:50	-	-	3:20	-	4:44	-	5:53	-	7:53	8:57	-
7	West Gloucester	♿	-	5:21	-	6:26	-	7:26	-	8:26	-	f 9:26	-	-	f 10:56	-	f 12:26	-	f 1:56	-	-	f 3:26	-	f 4:50	-	f 5:59	-	f 7:59	f 9:03	-
6	Manchester	♿	-	5:28	-	6:33	-	7:33	-	8:33	-	9:33	-	-	11:03	-	12:33	-	2:03	-	-	3:33	-	4:57	-	6:06	-	8:06	9:10	-
5	Beverly Farms	♿	-	5:34	-	6:39	-	7:39	-	8:39	-	f 9:39	-	-	f 11:09	-	f 12:39	-	f 2:09	-	-	f 3:39	-	f 5:03	-	f 6:12	-	f 8:12	f 9:16	-
4	Montserrat	♿	-	5:40	-	6:45	-	7:45	-	8:45	-	f 9:45	-	-	f 11:15	-	f 12:45	-	f 2:15	-	-	f 3:45	-	f 5:09	-	f 6:18	-	f 8:18	f 9:22	-
8	Newburyport	♿	4:49	-	5:54	-	6:54	-	7:54	-	8:54	-	9:54	-	-	11:24	-	12:54	-	2:24	-	-	3:54	-	5:07	-	6:57	-	-	9:39
7	Rowley	♿	4:54	-	5:59	-	6:59	-	7:59	-	8:59	-	f 9:59	-	-	f 11:29	-	f 12:59	-	f 2:29	-	-	f 3:59	-	f 5:12	-	f 7:02	-	-	f 9:44
6	Ipswich	♿	5:00	-	6:05	-	7:05	-	8:05	-	9:05	-	10:05	-	-	11:35	-	1:05	-	2:35	-	-	4:05	-	5:18	-	7:08	-	-	9:50
5	Hamilton/Wenham	♿	5:06	-	6:11	-	7:11	-	8:11	-	9:11	-	f 10:11	-	-	f 11:41	-	f 1:11	-	f 2:41	-	-	f 4:11	-	f 5:31	-	f 7:14	-	-	f 9:56
5	North Beverly	♿	5:10	-	6:15	-	7:15	-	8:15	-	9:15	-	f 10:15	-	-	f 11:45	-	f 1:15	-	f 2:45	-	-	f 4:15	-	f 5:35	-	f 7:18	-	-	f 10:00
4	Beverly	♿	5:15	5:45	6:20	6:50	7:20	7:50	8:20	8:50	9:20	9:50	10:20	10:50	11:20	11:50	12:50	1:20	2:20	2:50	3:20	3:50	4:20	5:14	5:42	6:23	7:23	8:23	9:27	10:05
3	Salem	♿	5:19	5:49	6:24	6:54	7:24	7:54	8:24	8:54	9:24	9:54	10:24	10:54	11:24	11:54	12:54	1:24	2:24	2:54	3:24	3:54	4:24	5:18	5:46	6:27	7:27	8:27	9:31	10:09
3	Swampscott	♿	5:26	5:56	6:31	7:01	7:31	8:01	8:31	9:01	9:31	10:01	10:31	11:01	11:31	12:01	1:01	1:31	2:31	3:01	3:31	4:01	4:31	5:25	5:53	6:34	7:34	8:34	9:38	10:16
2	Lynn	♿	5:29	5:59	6:34	7:04	7:34	8:04	8:34	9:04	9:34	10:04	10:34	11:04	11:34	12:04	1:04	1:34	2:34	3:04	3:34	4:04	4:34	5:28	5:56	6:37	7:37	8:37	9:41	10:19
2	River Works		f 5:32	f 6:02	f 6:37	f 7:07	-	f 8:07	f 8:37	-	-	-	-	-	-	-	-	-	f 2:37	f 3:07	f 3:37	f 4:07	f 4:37	f 5:31	f 5:59	f 6:40	f 7:40	-	-	f 10:22
1A	Chelsea		5:39	6:09	6:45	7:15	7:44	8:15	8:45	9:14	f 9:43	f 10:13	f 10:43	f 11:13	f 11:43	f 12:13	f 1:13	f 1:43	f 2:44	f 3:14	f 3:44	f 4:14	f 4:44	f 5:38	f 6:06	f 6:47	f 7:47	f 8:46	f 9:50	f 10:29
1A	North Station	♿	5:53	6:24	7:00	7:31	7:59	8:31	9:00	9:29	9:58	10:28	10:57	11:26	11:58	12:27	1:28	1:57	2:59	3:28	3:57	4:29	4:58	5:53	6:21	7:02	8:01	9:01	10:05	10:43

Monday to Friday

Outbound from Boston

ZONE	STATION		141	101	143	103	145	105	191	147	107	149	109	151	111	197	153	113	155	115	157	117	159	119	161	121	163	123	165	125	167
			AM										PM																		
	Bikes Allowed		🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲								🚲	🚲	🚲	🚲	🚲	🚲
1A	North Station	♿	5:35	6:35	7:35	7:50	8:35	9:05	9:35	10:05	10:35	11:35	12:05	1:05	1:35	2:05	2:35	3:05	3:35	4:05	4:35	5:05	5:35	6:05	6:40	7:20	8:05	8:50	9:35	11:00	Board Rockport Train 125 and change trains at Salem for a Newburyport connection
1A	Chelsea		f 5:46	f 6:46	f 7:46	-	f 8:46	f 9:16	f 9:46	f 10:16	f 10:46	f 11:46	f 12:16	f 1:16	f 1:46	f 2:16	f 2:46	f 3:16	3:46	4:16	4:46	5:16	5:46	6:16	6:51	f 7:31	f 8:16	f 9:01	f 9:46	f 11:11	
2	River Works		f 5:53	f 6:53	f 7:53	-	-	-	-	-	-	-	-	-	f 1:54	-	f 2:54	f 3:24	f 3:54	f 4:24	-	f 5:24	f 5:54	-	f 6:59	f 7:39	-	-	-	f 11:19	
2	Lynn	♿	5:56	6:56	7:56	-	8:55	9:25	9:55	10:25	10:55	11:55	12:25	1:25	1:56	2:25	2:56	3:26	3:56	4:26	4:55	5:26	5:56	6:25	7:01	7:41	8:25	9:10	9:55	11:21	
3	Swampscott	♿	5:59	6:59	7:59	-	8:58	9:28	9:58	10:28	10:58	11:58	12:28	1:28	1:59	2:28	2:59	3:29	3:59	4:29	4:58	5:29	5:59	6:28	7:04	7:44	8:28	9:13	9:58	11:24	
3	Salem	♿	6:06	7:06	8:06	8:16	9:05	9:35	10:05	10:35	11:05	12:05	12:35	1:35	2:06	2:35	3:06	3:36	4:06	4:36	5:05	5:36	6:06	6:35	7:11	7:51	8:35	9:20	10:05	11:31 ➔	11:40
4	Beverly	♿	6:10	7:10	8:10	8:20	9:09	9:39	10:10	10:39	11:09	12:09	12:39	1:39	2:10	2:40	3:10	3:40	4:10	4:40	5:09	5:40	6:10	6:39	7:15	7:55	8:39	9:24	10:09	11:35	11:44
5	North Beverly	♿	f 6:14	-	f 8:14	-	f 9:13	-	-	f 10:43	-	f 12:13	-	f 1:43	-	-	f 3:14	-	4:14	-	5:13	-	6:14	-	7:19	-	8:43	-	10:13	-	11:48
5	Hamilton/Wenham	♿	f 6:18	-	f 8:18	-	f 9:17	-	-	f 10:47	-	f 12:17	-	f 1:47	-	-	f 3:18	-	4:19	-	5:18	-	6:19	-	7:24	-	8:47	-	10:17	-	11:52
6	Ipswich	♿	6:24	-	8:24	-	9:23	-	-	10:53	-	12:23	-	1:53	-	-	3:24	-	4:25	-	5:25	-	6:26	-	7:30	-	8:53	-	10:23	-	11:58
7	Rowley	♿	f 6:30	-	f 8:30	-	f 9:29	-	-	f 10:59	-	f 12:29	-	f 1:59	-	-	f 3:30	-	4:31	-	5:31	-	6:32	-	7:36	-	f 8:59	-	f 10:29	-	f 12:04
8	Newburyport	♿	6:39	-	8:39	-	9:39	-	-	11:09	-	12:39	-	2:09	-	-	3:40	-	4:41	-	5:41	-	6:42	-	7:46	-	9:09	-	10:39	-	12:14
4	Montserrat	♿	-	f 7:14	-	f 8:24	-	f 9:43	-	-	f 11:13	-	f 12:43	-	f 2:14	-	-	f 3:44	-	4:44	-	5:44	-	6:43	-	f 7:59	-	f 9:28	-	f 11:39	-
5	Beverly Farms	♿	-	f 7:20	-	f 8:30	-	f 9:49	-	-	f 11:19	-	f 12:49	-	f 2:20	-	-	f 3:50	-	4:51	-	5:51	-	6:50	-	f 8:05	-	f 9:34	-	f 11:45	-
6	Manchester	♿	-	7:26	-	8:36	-	9:55	-	-	11:25	-	12:55	-	2:26	-	-	3:56	-	4:57	-	5:57	-	6:56	-	8:11	-	9:40	-	11:51	-
7	West Gloucester	♿	-	f 7:32	-	f 8:42	-	f 10:01	-	-	f 11:31	-	f 1:01	-	f 2:32	-	-	f 4:02	-	5:03	-	6:03	-	7:02	-	f 8:17	-	f 9:46	-	f 11:57	-
7	Gloucester	♿	-	7:38	-	8:48	-	10:08	-	-	11:38	-	1:08	-	2:39	-	-	4:09	-	5:11	-	6:11	-	7:10	-	8:24	-	9:53	-	12:04	-
8	Rockport	♿	-	7:48	-	8:58	-	10:19	-	-	11:49	-	1:19	-	2:50	-	-	4:20	-	5:22	-	6:22	-	7:21	-	8:35	-	10:03	-	12:14	-

Weekend

Inbound to Boston

ZONE	STATION		1150	1100	1152	1102	1154	1104	1156	1106	1158	1108	1160	1110	1162	1112	1164	1114	1166	1116
	SATURDAY TRAIN #		1150	1100	1152	1102	1154	1104	1156	1106	1158	1108	1160	1110	1162	1112	1164	1114	1166	1116
	SUNDAY TRAIN #		2150	2100	2152	2102	2154	2104	2156	2106	2158	2108	2160	2110	2162	2112	2164	2114	2166	2116
			AM							PM										
	Bikes Allowed		🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲
8	Rockport	♿	-	6:00	-	8:00	-	10:00	-	12:00	-	2:00	-	4:00	-	6:00	-	8:00	-	10:00
7	Gloucester	♿	-	6:07	-	8:07	-	10:07	-	12:07	-	2:07	-	4:07	-	6:07	-	8:07	-	10:07
7	West Gloucester	♿	-	6:13	-	8:13	-	10:13	-	12:13	-	2:13	-	4:13	-	6:13	-	8:13	-	10:13
6	Manchester	♿	-	6:20	-	8:20	-	10:20	-	12:20	-	2:20	-	4:20	-	6:20	-	8:20	-	10:20
5	Beverly Farms	♿	-	f 6:26	-	f 8:26	-	f 10:26	-	f 12:26	-	f 2:26	-	f 4:26	-	f 6:26	-	f 8:26	-	f 10:26
4	Montserrat	♿	-	f 6:32	-	f 8:32	-	f 10:32	-	f 12:32	-	f 2:32	-	f 4:32	-	f 6:32	-	f 8:32	-	f 10:32
8	Newburyport	♿	5:10	-	7:10	-	9:10	-	11:10	-	1:10	-	3:10	-	5:10	-	7:10	-	9:10	-
7	Rowley	♿	5:15	-	7:15	-	9:15	-	11:15	-	1:15	-	3:15	-	5:15	-	7:15	-	9:15	-
6	Ipswich	♿	5:21	-	7:21	-	9:21	-	11:21	-	1:21	-	3:21	-	5:21	-	7:21	-	9:21	-
5	Hamilton/Wenham	♿	5:27	-	7:27	-	9:27	-	11:27	-	1:27	-	3:27	-	5:27	-	7:27	-	9:27	-
5	North Beverly	♿	f 5:31	-	f 7:31	-	f 9:31	-	f 11:31	-	f 1:31	-	f 3:31	-	f 5:31	-	f 7:31	-	f 9:31	-
4	Beverly	♿	5:37	6:37	7:37	8:37	9:37	10:37	11:37	12:37	1:37	2:37	3:37	4:37	5:37	6:37	7:37	8:37	9:37	10:37
3	Salem	♿	5:41	6:41	7:41	8:41	9:41	10:41	11:41	12:41	1:41	2:41	3:41	4:41	5:41	6:41	7:41	8:41	9:41	10:41
3	Swampscott	♿	5:48	6:48	7:48	8:48	9:48	10:48	11:48	12:48	1:48	2:48	3:48	4:48	5:48	6:48	7:48	8:48	9:48	10:48
2	Lynn	♿	5:51	6:51	7:51	8:51	9:51	10:51	11:51	12:51	1:51	2:51	3:51	4:51	5:51	6:51	7:51	8:51	9:51	10:51
1A	Chelsea		f 6:00	f 7:00	f 8:00	f 9:00	f 10:00	f 11:00	f 12:00	f 1:00	f 2:00	f 3:00	f 4:00	f 5:00	f 6:00	f 7:00	f 8:00	f 9:00	f 10:00	f 11:00
1A	North Station	♿	6:14	7:15	8:14	9:15	10:14	11:15	12:14	1:15	2:14	3:15	4:14	5:15	6:14	7:15	8:14	9:15	10:14	11:15

Weekend

Outbound from Boston

ZONE	STATION		1151	1101	1153	1103	1155	1105	1157	1107	1159	1109	1161	1111	1163	1113	1165	1115	1167	1117
	SATURDAY TRAIN #		1151	1101	1153	1103	1155	1105	1157	1107	1159	1109	1161	1111	1163	1113	1165	1115	1167	1117
	SUNDAY TRAIN #		2151	2101	2153	2103	2155	2105	2157	2107	2159	2109	2161	2111	2163	2113	2165	2115	2167	2117
			AM							PM										
	Bikes Allowed		🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲	🚲
1A	North Station	♿	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:30	1:30	2:30	3:30	4:30	5:30	6:30	7:30	8:30	10:00	11:00
1A	Chelsea		f 5:41	f 6:41	f 7:41	f 8:41	f 9:41	f 10:41	f 11:41	f 12:41	f 1:41	f 2:41	f 3:41	f 4:41	f 5:41	f 6:41	f 7:41	f 8:41	f 10:11	f 11:11
2	Lynn	♿	5:50	6:50	7:50	8:50	9:50	10:50	11:50	12:50	1:50	2:50	3:50	4:50	5:50	6:50	7:50	8:50	10:20	11:20
3	Swampscott	♿	5:53	6:53	7:53	8:53	9:53	10:53	11:53	12:53	1:53	2:53	3:53	4:53	5:53	6:53	7:53	8:53	10:23	11:23
3	Salem	♿	6:00	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:30	11:30
4	Beverly	♿	6:04	7:04	8:04	9:04	10:04	11:04	12:04	1:04	2:04	3:04	4:04	5:04	6:04	7:04	8:04	9:04	10:34	11:34
5	North Beverly	♿	f 6:08	-	f 8:08	-	f 10:08	-	f 12:08	-	f 2:08	-	f 4:08	-	f 6:08	-	f 8:08	-	f 10:38	-
5	Hamilton/Wenham	♿	6:12	-	8:12	-	10:12	-	12:12	-	2:12	-	4:12	-	6:12	-	8:12	-	10:42	-
6	Ipswich	♿	6:18	-	8:18	-	10:18	-	12:18	-	2:18	-	4:18	-	6:18	-	8:18	-	10:48	-
7	Rowley	♿	6:24	-	8:24	-	10:24	-	12:24	-	2:24	-	4:24	-	6:24	-	8:24	-	10:54	-
8	Newburyport	♿	6:35	-	8:35	-	10:35	-	12:35	-	2:35	-	4:35	-	6:35	-	8:35	-	11:05	-
4	Montserrat	♿	-	f 7:08	-	f 9:08	-	f 11:08	-	f 1:08	-	f 3:08	-	f 5:08	-	f 7:08	-	f 9:08	-	f 11:38
5	Beverly Farms	♿	-	f 7:14	-	f 9:14	-	f 11:14	-	f 1:14	-	f 3:14	-	f 5:14	-	f 7:14	-	f 9:14	-	f 11:44
6	Manchester	♿	-	7:20	-	9:20	-	11:20	-	1:20	-	3:20	-	5:20	-	7:20	-	9:20	-	11:50
7	West Gloucester	♿	-	f 7:26	-	f 9:26	-	f 11:26	-	f 1:26	-	f 3:26	-	f 5:26	-	f 7:26	-	f 9:26	-	f 11:56
7	Gloucester	♿	-	7:33	-	9:33	-	11:33	-	1:33	-	3:33	-	5:33	-	7:33	-	9:33	-	12:03
8	Rockport	♿	-	7:44	-	9:44	-	11:44	-	1:44	-	3:44	-	5:44	-	7:44	-	9:44	-	12:14

Times in purple with "f" indicate a flag stop: Passengers must tell the conductor that they wish to leave. Passengers waiting to board must be visible on the platform for the train to stop.

Times in blue with "L" indicate an early departure: The train may leave ahead of schedule at these stops.

Bikes: Bicycles are allowed on trains with the bicycle symbol shown below the train number.

Connect to a different train for continued service outbound.

High level platform and bridge plate available. Visit **mbta.com/accessibility** for more information.

Keep in Mind:

This schedule will be effective from June 13, 2022 and will replace the schedule of October 11, 2021.

Holiday Service
Memorial Day (May 30th), July 4th and Labor Day (September 5th) operate on a weekend schedule.
Columbus Day (October 10th) and Juneteenth (observed on June 20th) operate on a regular weekday schedule.

For all holiday schedules, please check MBTA.com/holidays or call 617-222-3200.

- ☐ Crash Data

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Salem, MA   COUNT DATE : Sep-22

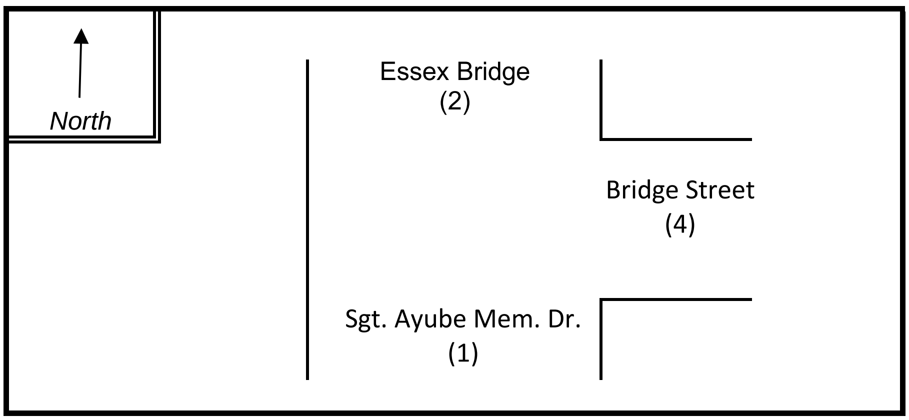
DISTRICT : 4   UNSIGNALIZED : [ ]   SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Sergeant James Ayube Memorial Drive

MINOR STREET(S) : Bridge Street

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM+PM) :	1,216	2,438		1,118		**4,772**

" K " FACTOR : **0.160**   INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **29,825**

TOTAL # OF CRASHES : 14   # OF YEARS : 5   AVERAGE # OF CRASHES PER YEAR (**A**) : **2.80**

CRASH RATE CALCULATION : **0.26**   RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 4 Avg: Signalized = 0.73; Unsignalized = 0.57

Project Title & Date: 1237 - Salem

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Salem, MA   COUNT DATE : Sep-22

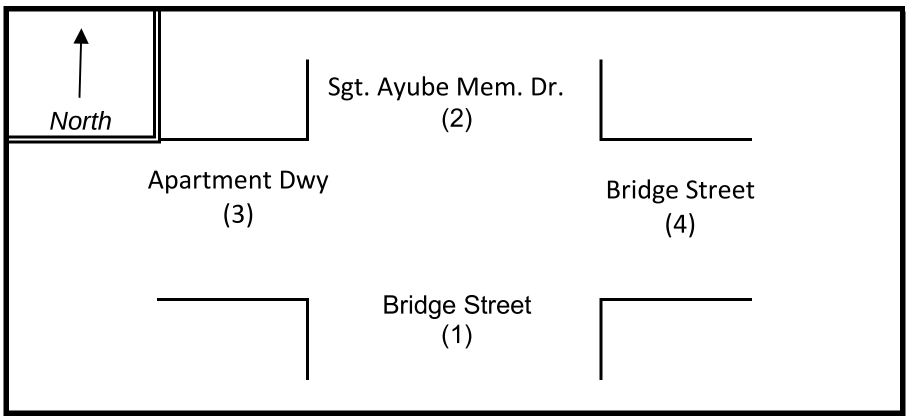
DISTRICT : 4   UNSIGNALIZED : [ ]   SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Sergeant James Ayube Memorial Drive

MINOR STREET(S) : Bridge Street/Apartment Driveway

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM+PM) :	1,715	1,454	45	804		**4,018**

" K " FACTOR : **0.160**   INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **25,113**

TOTAL # OF CRASHES : 8   # OF YEARS : 5   AVERAGE # OF CRASHES PER YEAR (**A**) : **1.60**

CRASH RATE CALCULATION : **0.17**   RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 4 Avg: Signalized = 0.73; Unsignalized = 0.57

Project Title & Date: 1237 - Salem

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Salem, MA　　COUNT DATE : Sep-22

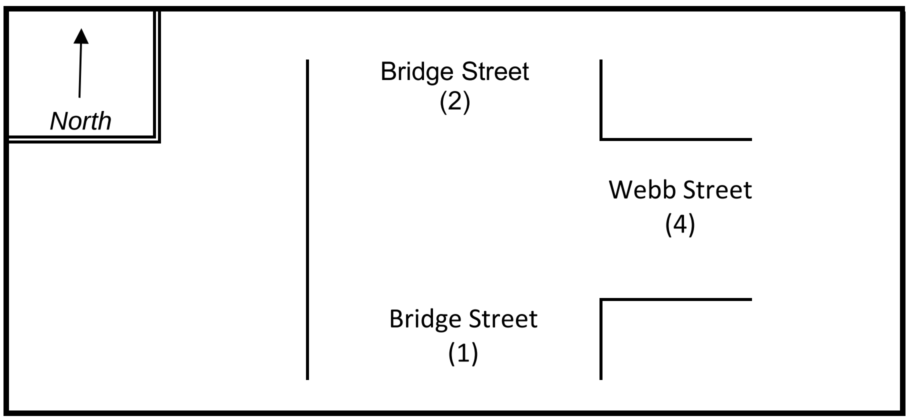
DISTRICT : 4　　UNSIGNALIZED : X　　SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Bridge Street

MINOR STREET(S) : Webb Street

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM+PM) :	1,182	1,197		474		**2,853**

" K " FACTOR : **0.160**　　INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **17,831**

TOTAL # OF CRASHES : 4　　# OF YEARS : 5　　AVERAGE # OF CRASHES PER YEAR (**A**) : **0.80**

CRASH RATE CALCULATION : **0.12**　　RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : MassDOT District 4 Avg: Signalized = 0.73; Unsignalized = 0.57

Project Title & Date: 1237 - Salem

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Salem, MA COUNT DATE : Sep-22

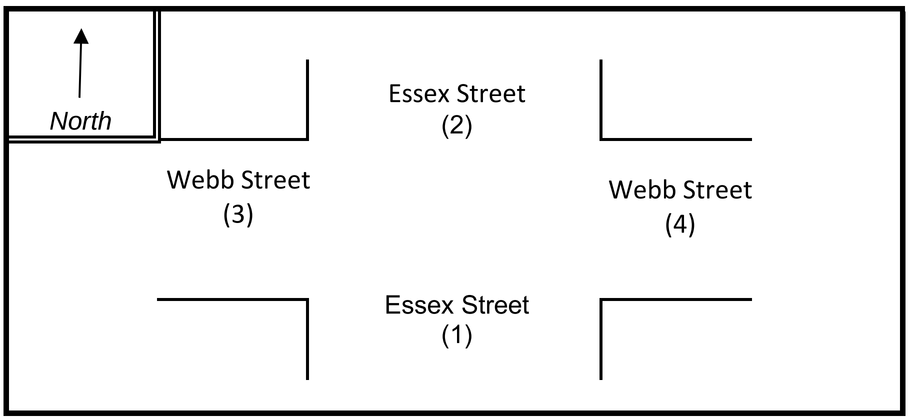
DISTRICT : 4 UNSIGNALIZED : SIGNALIZED : X

~ INTERSECTION DATA ~

MAJOR STREET : Webb Street

MINOR STREET(S) : Essex Street

INTERSECTION DIAGRAM (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM+PM) :	147	200	396	552		1,295

" K " FACTOR : **0.160**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **8,094**

TOTAL # OF CRASHES : 12

OF YEARS : 5

AVERAGE # OF CRASHES PER YEAR (**A**) : **2.40**

CRASH RATE CALCULATION : **0.81**

RATE = $\frac{(A * 1,000,000)}{(V * 365)}$

Comments : MassDOT District 4 Avg: Signalized = 0.73; Unsignalized = 0.57

Project Title & Date: 1237 - Salem

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Salem, MA

COUNT DATE : Sep-22

DISTRICT : 4

UNSIGNALIZED :

SIGNALIZED : X

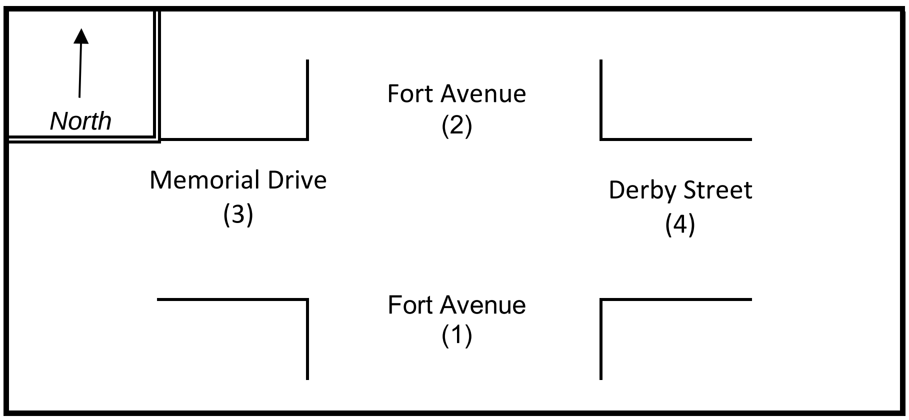
~ INTERSECTION DATA ~

MAJOR STREET : Fort Avenue

MINOR STREET(S) : Derby Street

Memorial Drive

INTERSECTION DIAGRAM
(Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	NB	SB	EB	WB		
PEAK HOURLY VOLUMES (AM+PM) :	227	238	36	188		**689**

" K " FACTOR : **0.160**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **4,306**

TOTAL # OF CRASHES : 2

OF YEARS : 5

AVERAGE # OF CRASHES PER YEAR (**A**) : **0.40**

CRASH RATE CALCULATION : **0.25**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : MassDOT District 4 Avg: Signalized = 0.73; Unsignalized = 0.57

Project Title & Date: 1237 - Salem

Crash Date	Crash Severity	Crash Time	Number of Vehicles	Light Conditions	Manner of Collision	Road Surface Condition	Total Fatalities	Total Non-Fatal Injuries	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Configuration (All Vehicles)	Vehicle Travel Directions (All Vehicles)	Weather Conditions	Most Harmful Event (All Vehicles)	X	Y	Roadway
Sgt. James Ayube Memorial Drive at Bridge Street																
03/04/2016	Non-fatal injury	6:37 PM	4	Dark - lighted roadway	Rear-end	Ice	0	3	V1: Travelling straight ahead / V2: Travelling straight ahead / V3: Travelling straight ahead / V4: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car) / V3:(Passenger car) / V4:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: Not Reported / V3: S / V4: S	Snow/Snow	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic) / V3:(Collision with parked motor vehicle) / V4:(Collision with motor vehicle in traffic)	250249.879	920902.419	JAMES AYUBE BYPASS ROAD Rte SR107 S / BRIDGE STREET Rte SR1A S
08/03/2016	Non-fatal injury	7:05 AM	2	Daylight	Angle	Dry	0	1	V1: Travelling straight ahead / V2: Turning left	V1:(Motorcycle) / V2:(Passenger car)	V1: N / V2: S	Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250249.879	920902.419	AYUBE BYPASS ROAD Rte SR107 S / BRIDGE STREET Rte SR1A S / BRIDGE STREET Rte SR1A S
12/08/2016	Property damage only (none injured)	1:35 PM	1	Dark - lighted roadway	Single vehicle crash	Dry	0	0	V1: Turning right	V1:(Passenger car)	V1: Not Reported	Cloudy	V1:(Collision with median barrier)	250270.485	920940.372	BRIDGE STREET Rte SR1A N / JAMES AYUBE BYPASS RD Rte SR107 N
11/13/2017	Property damage only (none injured)	9:45 AM	2	Daylight	Rear-end	Wet	0	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: Not Reported / V2: Not Reported	Rain	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250238.349	920865.061	BRIDGE STREET
01/05/2018	Non-fatal injury	2:11 PM	1	Not reported	Not reported	Not reported	0	0	V1: Not reported	V1:(Passenger car)	V1: Not Reported	Not Reported		250252.306	920871.305	BRIDGE STREET Rte SR1A S / SALEM BYPASS ROADWAY Rte SR107 N
12/11/2017	Property damage only (none injured)	7:57 AM	1	Daylight	Rear-end	Dry	0	0	V1: Slowing or stopped in traffic	V1:(Passenger car)	V1: N	Cloudy/Cloudy	V1:(Collision with motor vehicle in traffic)	250270.485	920940.372	BRIDGE STREET Rte SR1A N / SALEM BYPASS ROADWAY Rte SR107 N /
02/09/2018	Non-fatal injury	12:22 PM	2	Daylight	Angle	Dry	0	1	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: Not Reported / V2: Not Reported	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250250.517	920904.887	BRIDGE STREET Rte 1A S
11/18/2018	Property damage only (none injured)	4:58 PM	1	Dusk	Head-on	Dry	0	0	V1: Travelling straight ahead	V1:(Passenger car)	V1: N	Clear/Clear	V1:(Collision with bridge)	250269.694	920897.624	BRIDGE STREET Rte SR1A N
05/22/2019	Property damage only (none injured)	9:28 AM	2	Daylight	Rear-end	Dry	0	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250249.828	920903.387	BRIDGE STREET Rte SR1A S / SALEM BYPASS ROADWAY Rte SR107 S
06/23/2019	Non-fatal injury	7:19 AM	1	Daylight	Single vehicle crash	Dry	0	0	V1: Turning right	V1:(Passenger car)	V1: S	Clear/Clear	V1:(Collision with curb)	250252.254	920872.273	BRIDGE STREET Rte SR1A S / SALEM BYPASS ROADWAY Rte SR107 N
07/31/2019	Non-fatal injury	5:38 PM	2	Other	Front to Rear		0	2	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: N / V2: N	Cloudy/Rain	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250277.858	920973.232	BRIDGE STREET Rte SR1A N
11/04/2019	Property damage only (none injured)	4:07 PM	3	Dusk	Rear-end	Dry	0	0	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility)) / V3:(Light truck(van, mini-van, pickup, sport utility))	V1: Not Reported / V2: Not Reported / V3: Not Reported	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic) / V3:(Collision with motor vehicle in traffic)	250252.254	920872.273	BRIDGE STREET Rte SR1A / SALEM BYPASS ROADWAY Rte SR107 N
12/13/2019	Property damage only (none injured)	11:52 PM	2	Dark - lighted roadway	Rear-end	Wet	0	0	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: S	Rain/Rain	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250252.254	920872.273	BRIDGE STREET Rte SR1A E / SALEM BYPASS ROADWAY Rte SR107
01/08/2020	Property damage only (none injured)	5:09 PM	2	Dark - lighted roadway	Rear-end	Dry	0	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: S	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250275.624	921007.126	BRIDGE STREET Rte SR1A S
07/27/2020	Non-fatal injury	4:29 PM	2	Daylight	Front to Rear	Dry	0	0	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: N	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250272.916	920884.869	Rte SR1A N / BRIDGE STREET Rte SR1A N
06/22/2021	Property damage only (none injured)	8:51 AM	2	Daylight	Front to Rear	Dry	0	0	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250270.433	920941.34	BRIDGE STREET Rte SR1A N / SALEM BYPASS ROADWAY Rte SR107 N
09/17/2021	Property damage only (none injured)	11:32 PM	2	Dark - lighted roadway	Rear-end	Dry	0	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: S	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250249.828	920903.387	0 BRIDGE ST / SERGEANT JAMES AYUBE MEMORIAL DRIVE
Sgt. James Ayube Memorial Drive at Bridge Street/Apartments																
06/11/2018	Non-fatal injury	5:38 PM	2	Daylight	Rear-end	Dry	0	1	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: S	Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	249837.48	919602.305	BRIDGE STREET / SALEM BYPASS ROADWAY
7/31/2018	Non-fatal injury	1:10 PM	2	Daylight	Sideswipe, same direction	Dry	0	1	V1: Travelling straight ahead / V2: Not reported	V1:(Passenger car) / V2:(Unknown heavy truck, cannot classify)	V1: E / V2: Not Reported	Clear	V1:(Collision with motor vehicle in traffic)	249837.48	919602.305	SALEM BYPASS ROADWAY Rte SR107 N / BRIDGE STREET
5/24/2018	Property damage only (none injured)	7:18 PM	2	Daylight	Rear-end	Dry	0	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	249837.48	919602.305	SALEM BYPASS ROADWAY / BRIDGE STREET
5/4/2019	Property damage only (none injured)	6:00 PM	2	Dark - roadway not lighted	Angle	Dry	0	0	V1: Turning left / V2: Turning left	V1:(Passenger car) / V2:(Passenger car)	V1: W / V2: W	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	249837.48	919602.305	BRIDGE STREET / JAMES AYUBE BYPASS ROAD
5/21/2019	Property damage only (none injured)	8:32 AM	2	Daylight	Angle	Dry	0	0	V1: Turning left / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: S	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	249837.48	919602.305	BRIDGE STREET / BRIDGE STREET / SERGEANT JAMES AYUBE MEMORIAL DRIVE
11/1/2019	Property damage only (none injured)	2:15 PM	2	Daylight	Sideswipe, same direction	Dry	0	0	V1: Slowing or stopped in traffic / V2: Changing lanes	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: S	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	249837.48	919602.305	SALEM BYPASS ROADWAY Rte SR107 S / BRIDGE STREET
11/28/2019	Non-fatal injury	9:20 PM	2	Dark - lighted roadway	Rear-end	Dry	0	0	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: N / V2: Not Reported	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	249837.48	919602.305	SALEM BYPASS ROADWAY Rte SR107 N / BRIDGE STREET
7/22/2020	Property damage only (none injured)	9:10 PM	2	Dark - lighted roadway	Angle	Water (standing, moving)	0	0	V1: Travelling straight ahead / V2: Turning right	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Rain/Rain	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	249849.32	919600.726	BRIDGE STREET / SALEM BYPASS ROADWAY Rte SR107 N
Bridge Street at Webb Street																
8/28/2016	Non-fatal injury	10:04 PM	1	Dark - lighted roadway	Single vehicle crash	Dry	0	1	V1: Turning left	V1:(Passenger car)	V1: S	Clear	V1:(Collision with pedestrian)	250094.977	919927.989	BRIDGE STREET Rte 1A / WEBB STREET
2/10/2017	Property damage only (none injured)	2:25 PM	2	Daylight	Rear-end	Dry	0	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: S	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250094.977	919927.989	WEBB STREET / BRIDGE STREET
8/20/2017	Non-fatal injury	6:17 PM	2	Daylight	Rear-end	Dry	0	2	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: N	Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250094.977	919927.989	BRIDGE STREET Rte 1A / WEBB STREET / PLEASANT STREET
1/26/2020	Property damage only (none injured)	7:00 AM	1	Dawn	Angle	Wet	0	0	V1: Turning right	V1:(Light truck(van, mini-van, pickup, sport utility))		Clear/Clear	V1:(Collision with pedestrian)	250094.976	919927.989	WEBB ST / BRIDGE ST
12/18/2021	Property damage only (none injured)	5:58 PM	2	Dark - lighted roadway	Front to Rear	Wet	0	0	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: Not Reported / V2: Not Reported	Rain/Rain	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250094.976	919927.989	WEBB ST / BRIDGE ST / WEBBB ST
Fort Avenue at Derby Street																
3/18/2015	Non-fatal injury	3:30 PM	2	Daylight	Angle	Dry	0	1	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: W	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250993.484	919762.875	FORT AVE / DERBY ST
9/3/2018	Property damage only (none injured)	11:44 AM	2	Daylight	Rear-end	Dry	0	0	V1: Other / V2: Entering traffic lane	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250963.469	919745.437	24 FORT AVE / DERBY ST / FORT AVE
11/6/2021	Non-fatal injury	5:10 PM	2	Daylight	Angle	Dry	0	0	V1: Making U-turn / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: N / V2: N	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250941.103	919734.994	FORT AVE
Webb Street at Essex Street																
5/27/2017	Property damage only (none injured)	6:55 PM	2	Dusk	Sideswipe, opposite direction	Dry	0	0	V1: Travelling straight ahead / V2: Turning left	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: E / V2: N	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	ESSEX STREET / WEBB STREET
10/12/2017	Property damage only (none injured)	12:06 PM	2	Daylight	Angle	Dry	0	0	V1: Not reported / V2: Making U-turn	V1:(Passenger car) / V2:(Passenger car)	V1: Not Reported / V2: S	Clear/Clear	V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	ESSEX STREET / WEBB STREET
12/27/2017	Property damage only (none injured)	3:56 PM	2	Daylight	Angle	Snow	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: E	Clear/Snow	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	ESSEX STREET / WEBB STREET
1/2/2018	Non-fatal injury	2:40 PM	2	Daylight	Angle	Dry	0	1	V1: Slowing or stopped in traffic / V2: Turning right	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: Not Reported / V2: Not Reported	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	ESSEX STREET / WEBB STREET
3/29/2018	Non-fatal injury	6:55 AM	2	Dawn	Angle	Dry	0	1	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: W	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250589.524	919652.031	ESSEX STREET
7/18/2018	Property damage only (none injured)	5:06 PM	2	Daylight	Angle	Dry	0	0	V1: Slowing or stopped in traffic / V2: Turning right	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Passenger car)	V1: E / V2: S	Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	ESSEX STREET / WEBB STREET
9/3/2018	Property damage only (none injured)	5:15 PM	2	Daylight	Angle	Dry	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: E / V2: S	Clear/Reported but invalid	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	WEBB STREET / ESSEX STREET
4/25/2019	Non-fatal injury	12:22 PM	2	Daylight	Angle	Dry	0	2	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Passenger car) / V2:(Passenger car)	V1: S / V2: W	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	WEBB ST / ESSEX ST
4/11/2020	Non-fatal injury	11:13 PM	2	Dark - lighted roadway	Angle	Dry	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: S / V2: W	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	WEBB ST / ESSEX ST
6/21/2021	Non-fatal injury	1:09 PM	3	Daylight	Front to Front	Dry	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead / V3: Turning left	V1:(Passenger car) / V2:(Passenger car) / V3:(Passenger car)	V1: W / V2: N / V3: E	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic) / V3:(Collision with motor vehicle in traffic)	250590.469	919655.062	ESSEX ST / WEBB ST / ESSEX ST
6/22/2021	Property damage only (none injured)	1:12 PM	2	Daylight	Angle	Dry	0	0	V1: Travelling straight ahead / V2: Turning left	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: E / V2: W	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	WEBB STREET / ESSEX STREET
10/22/2021	Property damage only (none injured)	12:47 PM	2	Daylight	Angle	Dry	0	0	V1: Travelling straight ahead / V2: Travelling straight ahead	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	V1: N / V2: W	Clear/Clear	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	250590.469	919655.062	ESSEX ST / WEBB ST

- Trip Generation

Utility
(170)

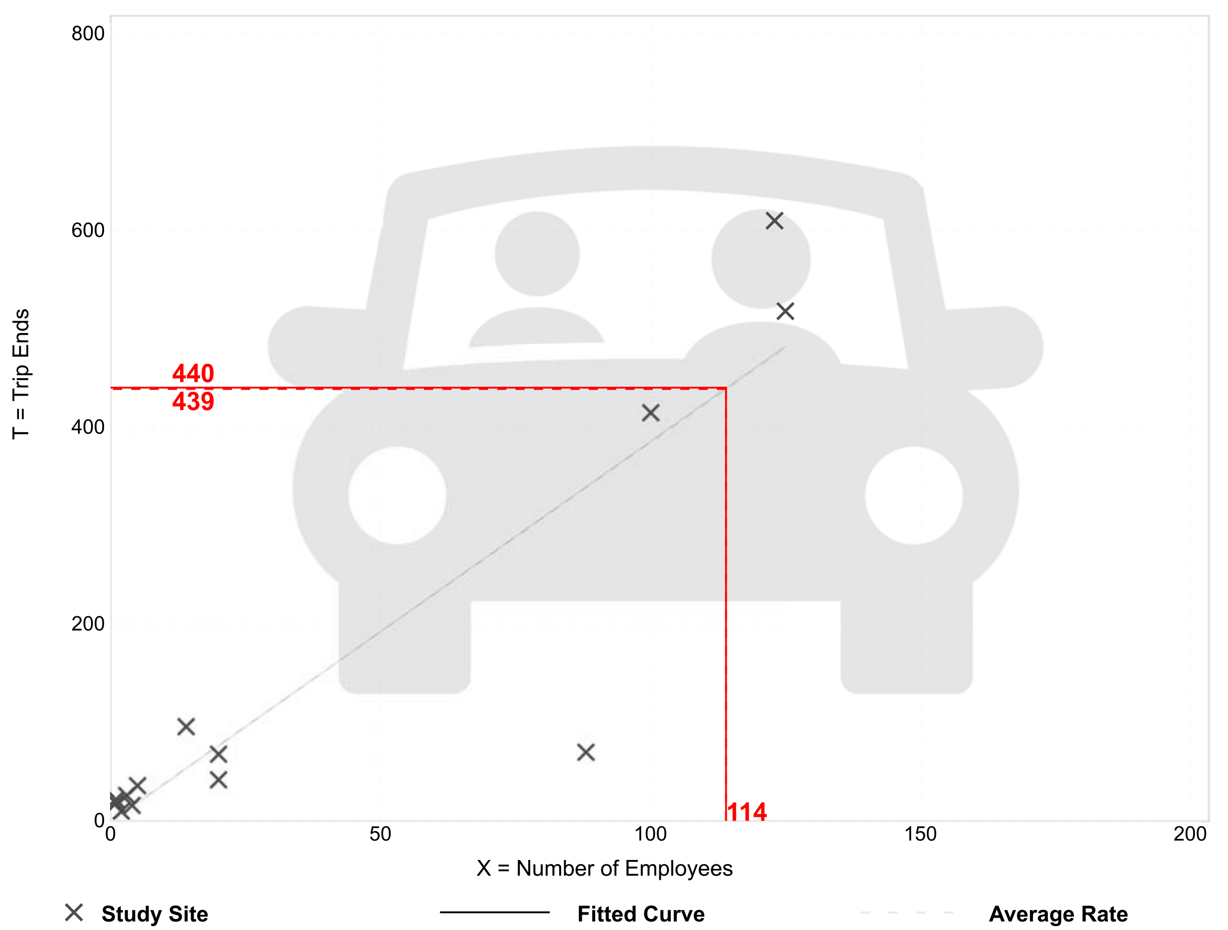
Vehicle Trip Ends vs:	**Employees**
On a:	**Weekday**

Setting/Location:	**General Urban/Suburban**
Number of Studies:	13
Avg. Num. of Employees:	39
Directional Distribution:	50% entering, 50% exiting

Vehicle Trip Generation per Employee

Average Rate	Range of Rates	Standard Deviation
3.85	0.80 - 22.00	1.99

Data Plot and Equation



Fitted Curve Equation: T = 3.87(X) - 0.92 **R^2= 0.82**

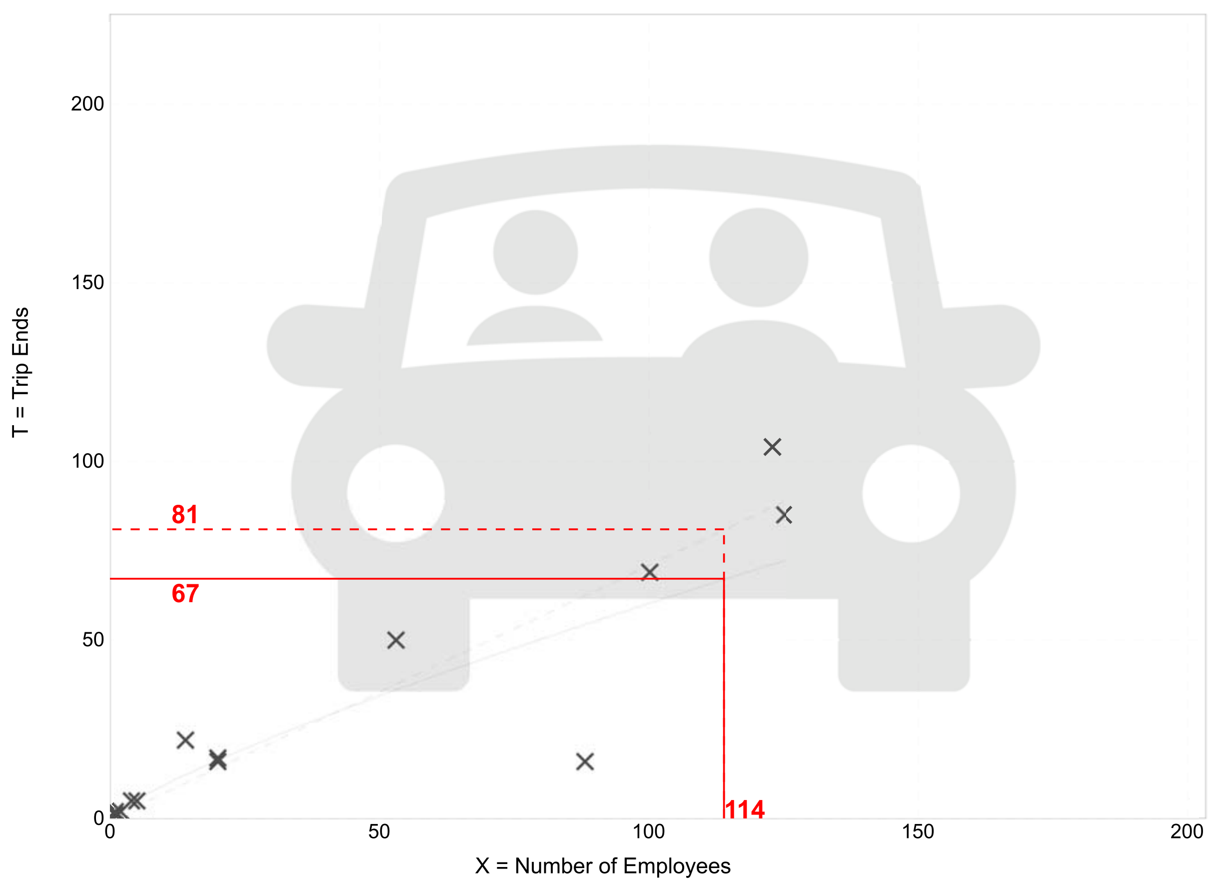
Utility
(170)

Vehicle Trip Ends vs:	**Employees**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	13
Avg. Num. of Employees:	43
Directional Distribution:	87% entering, 13% exiting

Vehicle Trip Generation per Employee

Average Rate	Range of Rates	Standard Deviation
0.71	0.18 - 2.00	0.29

Data Plot and Equation



× **Study Site** ——— **Fitted Curve** - - - **Average Rate**

Fitted Curve Equation: Ln(T) = 0.81 Ln(X) + 0.37 **R^2= 0.91**

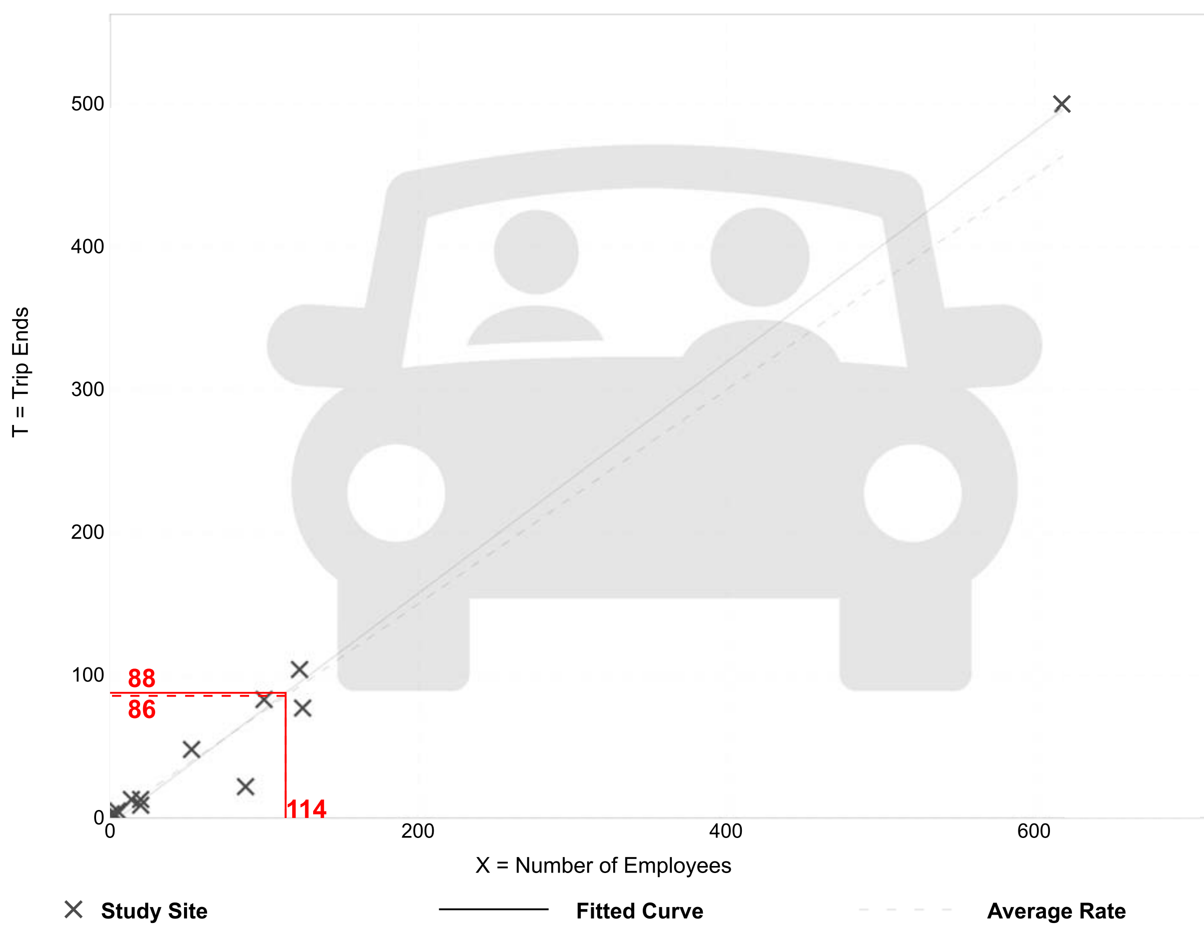
Utility
(170)

Vehicle Trip Ends vs:	**Employees**
On a:	**Weekday,** **Peak Hour of Adjacent Street Traffic,** **One Hour Between 4 and 6 p.m.**
Setting/Location:	**General Urban/Suburban**
Number of Studies:	14
Avg. Num. of Employees:	84
Directional Distribution:	14% entering, 86% exiting

Vehicle Trip Generation per Employee

Average Rate	Range of Rates	Standard Deviation
0.75	0.25 - 3.00	0.19

Data Plot and Equation



Fitted Curve Equation: T = 0.81(X) - 4.70

R^2= 0.99

- Trip Distribution

	Number	%	To/From Routes						
MCD			Essex Bridge (North)		Bridge Street (South)		Derby Street (South)		Total
Salem city	6,598	33.4%		0.0%	65%	21.7%	35%	11.7%	33.4%
Lynn city	2,320	11.7%		0.0%	50%	5.9%	50%	5.9%	11.7%
Peabody city	1,767	8.9%		0.0%	100%	8.9%		0.0%	8.9%
Beverly city	1,465	7.4%	100%	7.4%		0.0%		0.0%	7.4%
Danvers town	846	4.3%	50%	2.1%	50%	2.1%		0.0%	4.3%
Marblehead town	747	3.8%		0.0%		0.0%	100%	3.8%	3.8%
Swampscott town	561	2.8%		0.0%		0.0%	100%	2.8%	2.8%
Gloucester city	385	1.9%	100%	1.9%		0.0%		0.0%	1.9%
Boston city	283	1.4%		0.0%	100%	1.4%		0.0%	1.4%
Haverhill city	260	1.3%		0.0%	100%	1.3%		0.0%	1.3%
Saugus town	206	1.0%		0.0%	100%	1.0%		0.0%	1.0%
Revere city	193	1.0%		0.0%	50%	0.5%	50%	0.5%	1.0%
Malden city	185	0.9%		0.0%	100%	0.9%		0.0%	0.9%
Lawrence city	179	0.9%		0.0%	100%	0.9%		0.0%	0.9%
Ipswich town	136	0.7%	100%	0.7%		0.0%		0.0%	0.7%
Methuen Town city	131	0.7%		0.0%	100%	0.7%		0.0%	0.7%
Salem town	119	0.6%		0.0%	100%	0.6%		0.0%	0.6%
Andover town	113	0.6%		0.0%	100%	0.6%		0.0%	0.6%
Somerville city	111	0.6%		0.0%	100%	0.6%		0.0%	0.6%
Middleton town	106	0.5%		0.0%	100%	0.5%		0.0%	0.5%
Wakefield town	104	0.5%		0.0%	100%	0.5%		0.0%	0.5%
Lynnfield town	99	0.5%		0.0%	100%	0.5%		0.0%	0.5%
Woburn city	97	0.5%		0.0%	100%	0.5%		0.0%	0.5%
Everett city	95	0.5%		0.0%	100%	0.5%		0.0%	0.5%
Chelsea city	93	0.5%		0.0%	100%	0.5%		0.0%	0.5%
Melrose city	89	0.5%		0.0%	100%	0.5%		0.0%	0.5%
Sub-Total	17,288	87.4%		12.2%		50.6%		24.6%	87.4%
Other	2,488	12.6%		1.8%		7.3%		3.5%	12.6%
Total	19,776	100%		14%		58%		28%	100.0%
			SAY	15%		60%		25%	100%

- Capacity Analysis

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	13	554	614	5	460	697
Future Volume (vph)	13	554	614	5	460	697
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	0.95
Frt		0.850	0.999			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	2787	3502	0	1752	3505
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	2787	3502	0	1752	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		144	1			
Link Speed (mph)	30		30			30
Link Distance (ft)	500		600			500
Travel Time (s)	11.4		13.6			11.4
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	3%	2%	3%	3%
Adj. Flow (vph)	13	571	633	5	474	719
Shared Lane Traffic (%)						
Lane Group Flow (vph)	13	571	638	0	474	719
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)	8.0		10.0		10.0	10.0
Minimum Split (s)	12.0		14.0		14.0	14.0
Total Split (s)	12.0		30.0		38.0	68.0
Total Split (%)	15.0%		37.5%		47.5%	85.0%
Maximum Green (s)	8.0		26.0		34.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		None		None	Min
Act Effct Green (s)	8.4	35.1	17.7		22.5	44.4
Actuated g/C Ratio	0.14	0.57	0.29		0.37	0.73
v/c Ratio	0.05	0.34	0.63		0.74	0.28
Control Delay	30.2	6.1	22.7		24.7	2.9
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	30.2	6.1	22.7		24.7	2.9
LOS	C	A	C		C	A
Approach Delay	6.6		22.7			11.6
Approach LOS	A		C			B
90th %ile Green (s)	8.0		26.0		34.0	64.0
90th %ile Term Code	Max		Max		Max	Hold
70th %ile Green (s)	8.0		21.1		28.0	53.1
70th %ile Term Code	Max		Gap		Gap	Hold
50th %ile Green (s)	8.0		18.1		23.2	45.3
50th %ile Term Code	Max		Gap		Gap	Hold
30th %ile Green (s)	8.0		14.5		18.0	36.5
30th %ile Term Code	Max		Gap		Gap	Hold
10th %ile Green (s)	8.0		10.6		12.4	27.0
10th %ile Term Code	Max		Gap		Gap	Hold
Queue Length 50th (ft)	4	39	106		145	33
Queue Length 95th (ft)	23	87	189		282	45
Internal Link Dist (ft)	420		520			420
Turn Bay Length (ft)						
Base Capacity (vph)	242	2188	1558		1019	3313
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.05	0.26	0.41		0.47	0.22

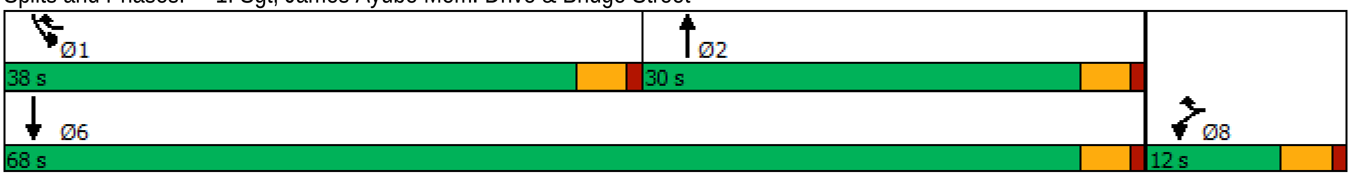
Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 61.2
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.74

Intersection Signal Delay: 13.3
Intersection Capacity Utilization 59.3%
Analysis Period (min) 15
90th %ile Actuated Cycle: 80
70th %ile Actuated Cycle: 69.1
50th %ile Actuated Cycle: 61.3
30th %ile Actuated Cycle: 52.5
10th %ile Actuated Cycle: 43

Intersection LOS: B
ICU Level of Service B

Splits and Phases: 1: Sgt, James Ayube Mem. Drive & Bridge Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	13	6	453	2	36	3	577	286	35	673	2
Future Volume (vph)	6	13	6	453	2	36	3	577	286	35	673	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	75		0	200		200
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.968				0.850		0.950				
Flt Protected		0.988			0.953		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1725	1615	1805	3308	0	1805	3505	0
Flt Permitted		0.926			0.709		0.950			0.950		
Satd. Flow (perm)	0	1671	0	0	1283	1615	1805	3308	0	1805	3505	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				51		133				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		250			500			500			320	
Travel Time (s)		5.7			11.4			11.4			7.3	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	8%	5%	0%	0%	0%	3%	5%	0%	3%	0%
Adj. Flow (vph)	6	13	6	467	2	37	3	595	295	36	694	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	25	0	0	469	37	3	890	0	36	696	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	

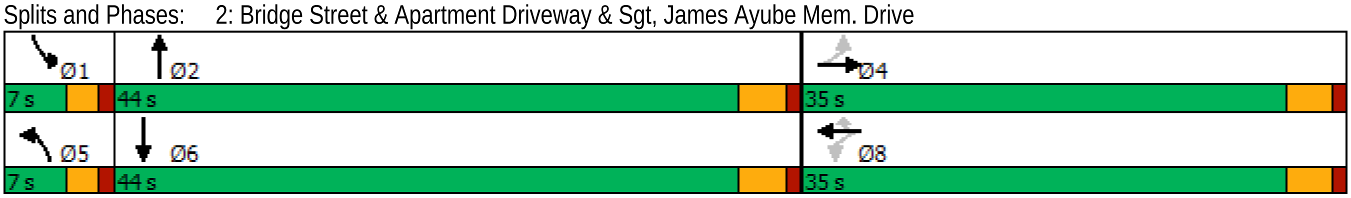
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8		8						
Detector Phase	4	4		8	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	4.0	10.0		4.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0	11.0	7.0	14.0		7.0	14.0	
Total Split (s)	35.0	35.0		35.0	35.0	35.0	7.0	44.0		7.0	44.0	
Total Split (%)	40.7%	40.7%		40.7%	40.7%	40.7%	8.1%	51.2%		8.1%	51.2%	
Maximum Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	40.0		4.0	40.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	2.0	3.0		2.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		4.0			4.0	4.0	3.0	4.0		3.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	None	Min		None	Min	
Act Effct Green (s)		31.6			31.6	31.6	4.1	23.5		4.1	24.8	
Actuated g/C Ratio		0.48			0.48	0.48	0.06	0.36		0.06	0.38	
v/c Ratio		0.03			0.76	0.05	0.03	0.70		0.32	0.53	
Control Delay		11.3			27.9	3.6	35.0	18.4		41.6	17.2	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		11.3			27.9	3.6	35.0	18.4		41.6	17.2	
LOS		B			C	A	C	B		D	B	
Approach Delay		11.3			26.1			18.5			18.4	
Approach LOS		B			C			B			B	
90th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	33.9		4.0	33.9	
90th %ile Term Code	Hold	Hold		Max	Max	Max	Max	Gap		Max	Hold	
70th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	27.4		4.0	34.4	
70th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Max	Hold	
50th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	23.6		0.0	23.6	
50th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Skip	Hold	
30th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	19.3		0.0	19.3	
30th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Skip	Hold	
10th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	15.4		0.0	15.4	
10th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Skip	Hold	
Queue Length 50th (ft)		3			132	0	1	121		13	104	
Queue Length 95th (ft)		21			#409	13	10	206		#48	174	
Internal Link Dist (ft)		170			420			420			240	
Turn Bay Length (ft)							75			200		
Base Capacity (vph)		807			617	803	112	2105		112	2177	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.03			0.76	0.05	0.03	0.42		0.32	0.32	

Intersection Summary

Area Type: Other
Cycle Length: 86
Actuated Cycle Length: 65.7

Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 20.2 Intersection LOS: C
Intersection Capacity Utilization 67.6% ICU Level of Service C
Analysis Period (min) 15
90th %ile Actuated Cycle: 79.9
70th %ile Actuated Cycle: 73.4
50th %ile Actuated Cycle: 62.6
30th %ile Actuated Cycle: 58.3
10th %ile Actuated Cycle: 54.4
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Bridge Street & Apartment Driveway & Sgt, James Ayube Mem. Drive



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	133	126	505	96	83	497
Future Volume (vph)	133	126	505	96	83	497
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	150		0	130	
Storage Lanes	1	1		0	1	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.978			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1719	1583	1787	0	1719	1810
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1719	1583	1787	0	1719	1810
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		131	17			
Link Speed (mph)	30		30			30
Link Distance (ft)	1800		500			500
Travel Time (s)	40.9		11.4			11.4
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	5%	2%	4%	4%	5%	5%
Adj. Flow (vph)	139	131	526	100	86	518
Shared Lane Traffic (%)						
Lane Group Flow (vph)	139	131	626	0	86	518
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						
Minimum Initial (s)	7.0		10.0		5.0	10.0
Minimum Split (s)	11.0		14.0		9.0	14.0
Total Split (s)	26.0		58.0		10.0	68.0
Total Split (%)	27.7%		61.7%		10.6%	72.3%
Maximum Green (s)	22.0		54.0		6.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		Min		None	Min
Act Effct Green (s)	10.3	20.7	26.1		6.2	36.5
Actuated g/C Ratio	0.19	0.38	0.47		0.11	0.66
v/c Ratio	0.43	0.19	0.73		0.45	0.43
Control Delay	26.1	4.4	17.2		36.3	5.9
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	26.1	4.4	17.2		36.3	5.9
LOS	C	A	B		D	A
Approach Delay	15.6		17.2			10.3
Approach LOS	B		B			B
90th %ile Green (s)	15.6		40.0		6.0	50.0
90th %ile Term Code	Gap		Gap		Max	Hold
70th %ile Green (s)	11.8		29.5		6.0	39.5
70th %ile Term Code	Gap		Gap		Max	Hold
50th %ile Green (s)	9.8		23.5		6.0	33.5
50th %ile Term Code	Gap		Gap		Max	Hold
30th %ile Green (s)	8.3		19.5		6.0	29.5
30th %ile Term Code	Gap		Gap		Max	Hold
10th %ile Green (s)	7.0		20.3		6.0	30.3
10th %ile Term Code	Min		Dwell		Max	Dwell
Queue Length 50th (ft)	37	0	141		25	60
Queue Length 95th (ft)	105	33	285		#101	141
Internal Link Dist (ft)	1720		420			420
Turn Bay Length (ft)		150			130	
Base Capacity (vph)	709	744	1661		193	1763
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.20	0.18	0.38		0.45	0.29

Intersection Summary

Area Type: Other

Cycle Length: 94

Actuated Cycle Length: 55.1

Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 14.1 Intersection LOS: B
Intersection Capacity Utilization 54.4% ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 73.6
70th %ile Actuated Cycle: 59.3
50th %ile Actuated Cycle: 51.3
30th %ile Actuated Cycle: 45.8
10th %ile Actuated Cycle: 45.3
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Bridge Street & Webb Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	59	63	75	178	17	60	13	6	0	46	68
Future Volume (vph)	58	59	63	75	178	17	60	13	6	0	46	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		100	0		0
Storage Lanes	0		0	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.953			0.992				0.850		0.920	
Flt Protected		0.984			0.986			0.960				
Satd. Flow (prot)	0	1674	0	0	1803	0	0	1770	1380	0	1700	0
Flt Permitted		0.834			0.870			0.745				
Satd. Flow (perm)	0	1419	0	0	1591	0	0	1374	1380	0	1700	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		57			7				18		85	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1800			850			500			500	
Travel Time (s)		40.9			19.3			11.4			11.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	7%	10%	4%	3%	0%	2%	8%	17%	0%	7%	0%
Adj. Flow (vph)	73	74	79	94	223	21	75	16	8	0	58	85
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	226	0	0	338	0	0	91	8	0	143	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm		NA	
Protected Phases		4			8			2			6	

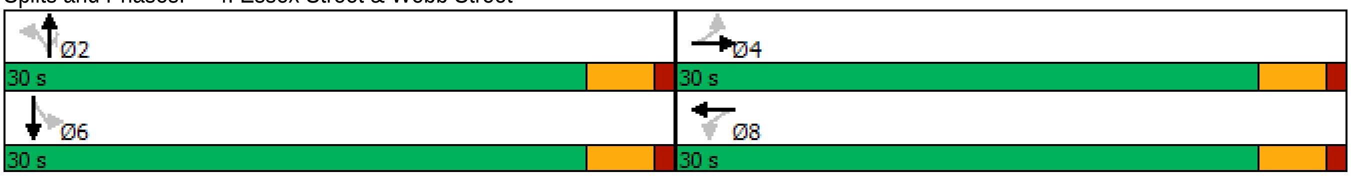
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	14.0	14.0		14.0	14.0		11.0	11.0	11.0	11.0	11.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	26.0	26.0		26.0	26.0		26.0	26.0	26.0	26.0	26.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0	0.0		0.0	
Total Lost Time (s)		4.0			4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None	None	None	None	
Act Effct Green (s)		18.3			18.3			8.3	8.3		8.3	
Actuated g/C Ratio		0.66			0.66			0.30	0.30		0.30	
v/c Ratio		0.24			0.32			0.22	0.02		0.25	
Control Delay		4.7			6.1			9.7	3.5		5.7	
Queue Delay		0.0			0.0			0.0	0.0		0.0	
Total Delay		4.7			6.1			9.7	3.5		5.7	
LOS		A			A			A	A		A	
Approach Delay		4.7			6.1			9.2			5.7	
Approach LOS		A			A			A			A	
90th %ile Green (s)	17.1	17.1		17.1	17.1		11.0	11.0	11.0	11.0	11.0	
90th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	12.4	12.4		12.4	12.4		8.5	8.5	8.5	8.5	8.5	
70th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	10.5	10.5		10.5	10.5		7.3	7.3	7.3	7.3	7.3	
50th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
30th %ile Green (s)	14.7	14.7		14.7	14.7		0.0	0.0	0.0	0.0	0.0	
30th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
10th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
10th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
Queue Length 50th (ft)		12			27			9	0		5	
Queue Length 95th (ft)		36			65			30	3		27	
Internal Link Dist (ft)		1720			770			420			420	
Turn Bay Length (ft)									100			
Base Capacity (vph)		1287			1438			1241	1248		1543	
Starvation Cap Reductn		0			0			0	0		0	
Spillback Cap Reductn		0			0			0	0		0	
Storage Cap Reductn		0			0			0	0		0	
Reduced v/c Ratio		0.18			0.24			0.07	0.01		0.09	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 27.7

Natural Cycle: 40
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.32
Intersection Signal Delay: 6.0 Intersection LOS: A
Intersection Capacity Utilization 35.6% ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 36.1
70th %ile Actuated Cycle: 28.9
50th %ile Actuated Cycle: 25.8
30th %ile Actuated Cycle: 18.7
10th %ile Actuated Cycle: 29

Splits and Phases: 4: Essex Street & Webb Street



Intersection	
Int Delay, s/veh	5.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	0	26	0	36	47	72	46	0	0	95	1
Future Vol, veh/h	3	0	26	0	36	47	72	46	0	0	95	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	76	76	76	76	76	76	76	76	76
Heavy Vehicles, %	0	0	8	0	2	2	4	5	0	0	3	0
Mvmt Flow	4	0	34	0	47	62	95	61	0	0	125	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	432	377	126	394	377	61	126	0	-	-	-	0
Stage 1	126	126	-	251	251	-	-	-	-	-	-	-
Stage 2	306	251	-	143	126	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.28	7.1	6.52	6.22	4.14	-	-	-	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.372	3.5	4.018	3.318	2.236	-	-	-	-	-
Pot Cap-1 Maneuver	537	558	909	569	555	1004	1448	-	0	0	-	-
Stage 1	883	796	-	758	699	-	-	-	0	0	-	-
Stage 2	708	703	-	865	792	-	-	-	0	0	-	-
Platoon blocked, %								-			-	-
Mov Cap-1 Maneuver	445	520	909	519	517	1004	1448	-	-	-	-	-
Mov Cap-2 Maneuver	445	520	-	519	517	-	-	-	-	-	-	-
Stage 1	823	796	-	706	651	-	-	-	-	-	-	-
Stage 2	574	655	-	832	792	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.6	11	4.7	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	WBLn2	SBT	SBR
Capacity (veh/h)	1448	-	820	-	713	-	-
HCM Lane V/C Ratio	0.065	-	0.047	-	0.153	-	-
HCM Control Delay (s)	7.7	0	9.6	0	11	-	-
HCM Lane LOS	A	A	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.1	-	0.5	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1	0	0	0	0	142	82	0	0	0	0
Future Vol, veh/h	1	1	0	0	0	0	142	82	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	0	0	0	0	0	0	2	4	0	0	0	0
Mvmt Flow	1	1	0	0	0	0	171	99	0	0	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	441	441	-	-	441	99	0	0	0
Stage 1	0	0	-	-	441	-	-	-	-
Stage 2	441	441	-	-	0	-	-	-	-
Critical Hdwy	7.1	6.5	-	-	6.5	6.2	4.12	-	-
Critical Hdwy Stg 1	-	-	-	-	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	-	-	4	3.3	2.218	-	-
Pot Cap-1 Maneuver	530	513	0	0	513	962	-	-	-
Stage 1	-	-	0	0	580	-	-	-	-
Stage 2	599	580	0	0	-	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	530	513	-	-	513	962	-	-	-
Mov Cap-2 Maneuver	530	513	-	-	513	-	-	-	-
Stage 1	-	-	-	-	580	-	-	-	-
Stage 2	599	580	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	11.9	0	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1
Capacity (veh/h)	-	-	-	521	-
HCM Lane V/C Ratio	-	-	-	0.005	-
HCM Control Delay (s)	-	-	-	11.9	0
HCM Lane LOS	-	-	-	B	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	1	92	4	2	96
Future Vol, veh/h	0	1	92	4	2	96
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	5	2	3	2
Mvmt Flow	0	1	100	4	2	104

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	210	102	0	0	104	0
Stage 1	102	-	-	-	-	-
Stage 2	108	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.13	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.227	-
Pot Cap-1 Maneuver	778	953	-	-	1481	-
Stage 1	922	-	-	-	-	-
Stage 2	916	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	777	953	-	-	1481	-
Mov Cap-2 Maneuver	777	-	-	-	-	-
Stage 1	922	-	-	-	-	-
Stage 2	915	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.8	0	0.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	953	1481	-
HCM Lane V/C Ratio	-	-	0.001	0.001	-
HCM Control Delay (s)	-	-	8.8	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	5	546	567	30	518	763
Future Volume (vph)	5	546	567	30	518	763
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	0.95
Frt		0.850	0.992			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	2787	3544	0	1787	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	2787	3544	0	1787	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		176	7			
Link Speed (mph)	30		30			30
Link Distance (ft)	500		600			500
Travel Time (s)	11.4		13.6			11.4
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	1%	2%	1%	2%
Adj. Flow (vph)	5	563	585	31	534	787
Shared Lane Traffic (%)						
Lane Group Flow (vph)	5	563	616	0	534	787
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						

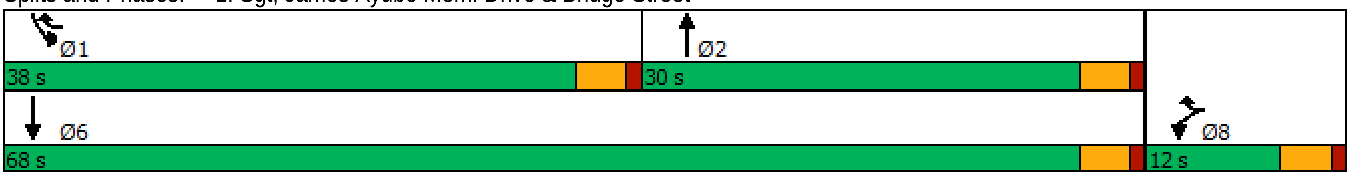
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)	8.0		10.0		10.0	10.0
Minimum Split (s)	12.0		14.0		14.0	14.0
Total Split (s)	12.0		30.0		38.0	68.0
Total Split (%)	15.0%		37.5%		47.5%	85.0%
Maximum Green (s)	8.0		26.0		34.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		None		None	Min
Act Effct Green (s)	8.4	36.7	17.4		24.1	45.7
Actuated g/C Ratio	0.13	0.59	0.28		0.39	0.73
v/c Ratio	0.02	0.33	0.62		0.77	0.30
Control Delay	30.6	5.3	23.1		25.8	2.9
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	30.6	5.3	23.1		25.8	2.9
LOS	C	A	C		C	A
Approach Delay	5.5		23.1			12.2
Approach LOS	A		C			B
90th %ile Green (s)	8.0		25.6		34.0	63.6
90th %ile Term Code	Max		Gap		Max	Hold
70th %ile Green (s)	8.0		21.3		31.4	56.7
70th %ile Term Code	Max		Gap		Gap	Hold
50th %ile Green (s)	8.0		17.0		24.8	45.8
50th %ile Term Code	Max		Gap		Gap	Hold
30th %ile Green (s)	8.0		14.3		19.6	37.9
30th %ile Term Code	Max		Gap		Gap	Hold
10th %ile Green (s)	8.0		10.4		13.5	27.9
10th %ile Term Code	Max		Gap		Gap	Hold
Queue Length 50th (ft)	2	33	104		164	36
Queue Length 95th (ft)	13	78	180		325	50
Internal Link Dist (ft)	420		520			420
Turn Bay Length (ft)						
Base Capacity (vph)	237	2164	1548		1018	3315
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.02	0.26	0.40		0.52	0.24

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 62.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77

Intersection Signal Delay: 13.4
Intersection LOS: B
Intersection Capacity Utilization 62.0%
ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 79.6
70th %ile Actuated Cycle: 72.7
50th %ile Actuated Cycle: 61.8
30th %ile Actuated Cycle: 53.9
10th %ile Actuated Cycle: 43.9

Splits and Phases: 1: Sgt, James Ayube Mem. Drive & Bridge Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	3	11	288	2	23	10	568	271	33	702	33
Future Volume (vph)	6	3	11	288	2	23	10	568	271	33	702	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	75		0	200		200
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.926				0.850		0.952			0.993	
Flt Protected		0.985			0.953		0.950			0.950		
Satd. Flow (prot)	0	1651	0	0	1775	1615	1805	3403	0	1805	3518	0
Flt Permitted		0.918			0.713		0.950			0.950		
Satd. Flow (perm)	0	1539	0	0	1328	1615	1805	3403	0	1805	3518	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11				51		124			7	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		250			500			500			320	
Travel Time (s)		5.7			11.4			11.4			7.3	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	9%	2%	0%	0%	0%	1%	1%	0%	2%	0%
Adj. Flow (vph)	6	3	11	297	2	24	10	586	279	34	724	34
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	299	24	10	865	0	34	758	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	

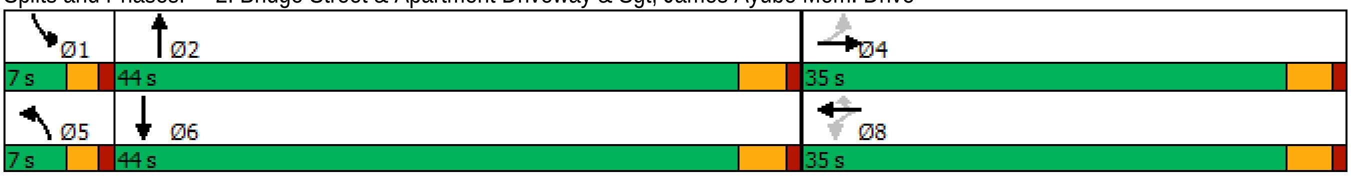
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8		8						
Detector Phase	4	4		8	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	4.0	10.0		4.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0	11.0	7.0	14.0		7.0	14.0	
Total Split (s)	35.0	35.0		35.0	35.0	35.0	7.0	44.0		7.0	44.0	
Total Split (%)	40.7%	40.7%		40.7%	40.7%	40.7%	8.1%	51.2%		8.1%	51.2%	
Maximum Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	40.0		4.0	40.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	2.0	3.0		2.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		4.0			4.0	4.0	3.0	4.0		3.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	None	Min		None	Min	
Act Effct Green (s)		17.7			17.7	17.7	4.6	20.4		4.6	21.5	
Actuated g/C Ratio		0.36			0.36	0.36	0.09	0.41		0.09	0.44	
v/c Ratio		0.04			0.63	0.04	0.06	0.59		0.20	0.49	
Control Delay		9.8			21.6	1.8	31.3	12.5		32.7	12.1	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		9.8			21.6	1.8	31.3	12.5		32.7	12.1	
LOS		A			C	A	C	B		C	B	
Approach Delay		9.8			20.2			12.7			13.0	
Approach LOS		A			C			B			B	
90th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	32.3		4.0	32.3	
90th %ile Term Code	Hold	Hold		Max	Max	Max	Max	Gap		Max	Hold	
70th %ile Green (s)	21.6	21.6		21.6	21.6	21.6	0.0	24.7		4.0	31.7	
70th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Max	Hold	
50th %ile Green (s)	17.1	17.1		17.1	17.1	17.1	0.0	20.0		0.0	20.0	
50th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
30th %ile Green (s)	12.0	12.0		12.0	12.0	12.0	0.0	14.4		0.0	14.4	
30th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
10th %ile Green (s)	8.9	8.9		8.9	8.9	8.9	0.0	10.7		0.0	10.7	
10th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
Queue Length 50th (ft)		1			59	0	3	66		8	66	
Queue Length 95th (ft)		15			191	6	20	198		44	191	
Internal Link Dist (ft)		170			420			420			240	
Turn Bay Length (ft)							75			200		
Base Capacity (vph)		1077			926	1142	168	2780		168	2851	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.02			0.32	0.02	0.06	0.31		0.20	0.27	

Intersection Summary

Area Type: Other
Cycle Length: 86
Actuated Cycle Length: 49.3

Natural Cycle: 40
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.63
Intersection Signal Delay: 14.0 Intersection LOS: B
Intersection Capacity Utilization 56.8% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 78.3
70th %ile Actuated Cycle: 61.3
50th %ile Actuated Cycle: 45.1
30th %ile Actuated Cycle: 34.4
10th %ile Actuated Cycle: 27.6

Splits and Phases: 2: Bridge Street & Apartment Driveway & Sgt, James Ayube Mem. Drive



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	108	107	473	108	127	490
Future Volume (vph)	108	107	473	108	127	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	150		0	130	
Storage Lanes	1	1		0	1	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.975			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1787	1568	1823	0	1787	1863
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	1568	1823	0	1787	1863
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		116	20			
Link Speed (mph)	30		30			30
Link Distance (ft)	1800		500			500
Travel Time (s)	40.9		11.4			11.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	3%	2%	0%	1%	2%
Adj. Flow (vph)	117	116	514	117	138	533
Shared Lane Traffic (%)						
Lane Group Flow (vph)	117	116	631	0	138	533
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						
Minimum Initial (s)	7.0		10.0		5.0	10.0
Minimum Split (s)	11.0		14.0		9.0	14.0
Total Split (s)	26.0		58.0		10.0	68.0
Total Split (%)	27.7%		61.7%		10.6%	72.3%
Maximum Green (s)	22.0		54.0		6.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		Min		None	Min
Act Effct Green (s)	9.4	19.7	24.8		6.2	35.1
Actuated g/C Ratio	0.18	0.37	0.47		0.12	0.67
v/c Ratio	0.37	0.18	0.73		0.66	0.43
Control Delay	24.5	4.4	16.5		44.9	5.5
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	24.5	4.4	16.5		44.9	5.5
LOS	C	A	B		D	A
Approach Delay	14.5		16.5			13.6
Approach LOS	B		B			B
90th %ile Green (s)	13.6		37.4		6.0	47.4
90th %ile Term Code	Gap		Gap		Max	Hold
70th %ile Green (s)	10.5		28.0		6.0	38.0
70th %ile Term Code	Gap		Gap		Max	Hold
50th %ile Green (s)	8.9		22.4		6.0	32.4
50th %ile Term Code	Gap		Gap		Max	Hold
30th %ile Green (s)	7.6		18.7		6.0	28.7
30th %ile Term Code	Gap		Gap		Max	Hold
10th %ile Green (s)	7.0		19.4		6.0	29.4
10th %ile Term Code	Min		Dwell		Max	Dwell
Queue Length 50th (ft)	30	0	135		39	57
Queue Length 95th (ft)	87	31	267		#156	129
Internal Link Dist (ft)	1720		420			420
Turn Bay Length (ft)		150			130	
Base Capacity (vph)	767	746	1729		209	1836
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.15	0.16	0.36		0.66	0.29

Intersection Summary

Area Type: Other

Cycle Length: 94

Actuated Cycle Length: 52.7

Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 14.9
Intersection LOS: B
Intersection Capacity Utilization 54.5%
ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 69
70th %ile Actuated Cycle: 56.5
50th %ile Actuated Cycle: 49.3
30th %ile Actuated Cycle: 44.3
10th %ile Actuated Cycle: 44.4
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Bridge Street & Webb Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	111	87	90	191	1	44	9	15	0	37	49
Future Volume (vph)	18	111	87	90	191	1	44	9	15	0	37	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		100	0		0
Storage Lanes	0		0	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.946							0.850		0.923	
Flt Protected		0.996			0.984			0.960				
Satd. Flow (prot)	0	1774	0	0	1839	0	0	1824	1615	0	1739	0
Flt Permitted		0.969			0.857							
Satd. Flow (perm)	0	1726	0	0	1602	0	0	1900	1615	0	1739	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		72							18		52	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1800			850			500			500	
Travel Time (s)		40.9			19.3			11.4			11.4	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	1%	1%	1%	2%	0%	0%	0%	0%	0%	2%	0%
Adj. Flow (vph)	19	117	92	95	201	1	46	9	16	0	39	52
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	228	0	0	297	0	0	55	16	0	91	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm		NA	
Protected Phases		4			8			2			6	

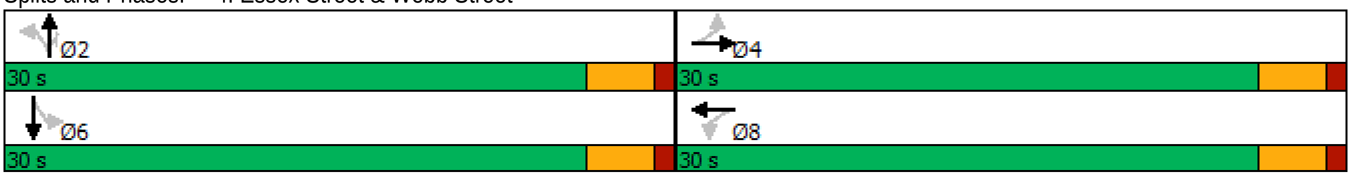
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	14.0	14.0		14.0	14.0		11.0	11.0	11.0	11.0	11.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	26.0	26.0		26.0	26.0		26.0	26.0	26.0	26.0	26.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0	0.0		0.0	
Total Lost Time (s)		4.0			4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None	None	None	None	
Act Effct Green (s)		20.4			20.4			7.6	7.6		7.6	
Actuated g/C Ratio		0.78			0.78			0.29	0.29		0.29	
v/c Ratio		0.17			0.24			0.10	0.03		0.17	
Control Delay		3.0			4.2			7.5	4.5		5.0	
Queue Delay		0.0			0.0			0.0	0.0		0.0	
Total Delay		3.0			4.2			7.5	4.5		5.0	
LOS		A			A			A	A		A	
Approach Delay		3.0			4.2			6.8			5.0	
Approach LOS		A			A			A			A	
90th %ile Green (s)	13.7	13.7		13.7	13.7		8.4	8.4	8.4	8.4	8.4	
90th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	11.0	11.0		11.0	11.0		7.1	7.1	7.1	7.1	7.1	
70th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	13.2	13.2		13.2	13.2		0.0	0.0	0.0	0.0	0.0	
50th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
30th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
30th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
10th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
10th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
Queue Length 50th (ft)		0			0			2	0		1	
Queue Length 95th (ft)		31			54			18	6		20	
Internal Link Dist (ft)		1720			770			420			420	
Turn Bay Length (ft)									100			
Base Capacity (vph)		1611			1490			1768	1504		1622	
Starvation Cap Reductn		0			0			0	0		0	
Spillback Cap Reductn		0			0			0	0		0	
Storage Cap Reductn		0			0			0	0		0	
Reduced v/c Ratio		0.14			0.20			0.03	0.01		0.06	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 26.3

Natural Cycle: 40
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.24
Intersection Signal Delay: 4.2 Intersection LOS: A
Intersection Capacity Utilization 46.8% ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 30.1
70th %ile Actuated Cycle: 26.1
50th %ile Actuated Cycle: 17.2
30th %ile Actuated Cycle: 29
10th %ile Actuated Cycle: 29

Splits and Phases: 4: Essex Street & Webb Street



Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	7	0	18	84	19	90	0	0	140	2
Future Vol, veh/h	0	0	7	0	18	84	19	90	0	0	140	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	0	0	8	0	20	95	22	102	0	0	159	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	364	306	160	310	307	102	161	0	-	-	-	0
Stage 1	160	160	-	146	146	-	-	-	-	-	-	-
Stage 2	204	146	-	164	161	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	-	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	-	-	-
Pot Cap-1 Maneuver	596	611	890	646	610	959	1430	-	0	0	-	-
Stage 1	847	769	-	861	780	-	-	-	0	0	-	-
Stage 2	803	780	-	843	769	-	-	-	0	0	-	-
Platoon blocked, %								-			-	-
Mov Cap-1 Maneuver	516	601	890	632	600	959	1430	-	-	-	-	-
Mov Cap-2 Maneuver	516	601	-	632	600	-	-	-	-	-	-	-
Stage 1	833	769	-	847	768	-	-	-	-	-	-	-
Stage 2	693	768	-	835	769	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.1	9.8	1.3	0
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	WBLn2	SBT	SBR
Capacity (veh/h)	1430	-	890	-	867	-	-
HCM Lane V/C Ratio	0.015	-	0.009	-	0.134	-	-
HCM Control Delay (s)	7.6	0	9.1	0	9.8	-	-
HCM Lane LOS	A	A	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	0.5	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	0	0	0	0	144	98	0	0	0	0
Future Vol, veh/h	4	0	0	0	0	0	144	98	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	0	0
Mvmt Flow	4	0	0	0	0	0	152	103	0	0	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	407	407	-	-	407	103	0	0	0
Stage 1	0	0	-	-	407	-	-	-	-
Stage 2	407	407	-	-	0	-	-	-	-
Critical Hdwy	7.1	6.5	-	-	6.5	6.2	4.1	-	-
Critical Hdwy Stg 1	-	-	-	-	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	-	-	4	3.3	2.2	-	-
Pot Cap-1 Maneuver	558	537	0	0	537	957	-	-	-
Stage 1	-	-	0	0	601	-	-	-	-
Stage 2	625	601	0	0	-	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	558	537	-	-	537	957	-	-	-
Mov Cap-2 Maneuver	558	537	-	-	537	-	-	-	-
Stage 1	-	-	-	-	601	-	-	-	-
Stage 2	625	601	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	11.5	0	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1
Capacity (veh/h)	-	-	-	558	-
HCM Lane V/C Ratio	-	-	-	0.008	-
HCM Control Delay (s)	-	-	-	11.5	0
HCM Lane LOS	-	-	-	B	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	1	0	171	3	1	141
Future Vol, veh/h	1	0	171	3	1	141
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	2	2	1	2	2	2
Mvmt Flow	1	0	194	3	1	160

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	358	196	0	0	197	0
Stage 1	196	-	-	-	-	-
Stage 2	162	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	640	845	-	-	1376	-
Stage 1	837	-	-	-	-	-
Stage 2	867	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	639	845	-	-	1376	-
Mov Cap-2 Maneuver	639	-	-	-	-	-
Stage 1	837	-	-	-	-	-
Stage 2	866	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.6	0	0.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	639	1376	-
HCM Lane V/C Ratio	-	-	0.002	0.001	-
HCM Control Delay (s)	-	-	10.6	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	13	554	614	5	483	697
Future Volume (vph)	13	554	614	5	483	697
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	0.95
Frt		0.850	0.999			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	2787	3502	0	1752	3505
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	2787	3502	0	1752	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		144	1			
Link Speed (mph)	30		30			30
Link Distance (ft)	500		600			500
Travel Time (s)	11.4		13.6			11.4
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	3%	2%	3%	3%
Adj. Flow (vph)	13	571	633	5	498	719
Shared Lane Traffic (%)						
Lane Group Flow (vph)	13	571	638	0	498	719
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)	8.0		10.0		10.0	10.0
Minimum Split (s)	12.0		14.0		14.0	14.0
Total Split (s)	12.0		30.0		38.0	68.0
Total Split (%)	15.0%		37.5%		47.5%	85.0%
Maximum Green (s)	8.0		26.0		34.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		None		None	Min
Act Effct Green (s)	8.4	36.1	18.0		23.5	45.7
Actuated g/C Ratio	0.13	0.58	0.29		0.38	0.73
v/c Ratio	0.05	0.34	0.63		0.76	0.28
Control Delay	30.8	6.0	23.2		25.5	2.8
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	30.8	6.0	23.2		25.5	2.8
LOS	C	A	C		C	A
Approach Delay	6.6		23.2			12.1
Approach LOS	A		C			B
90th %ile Green (s)	8.0		26.0		34.0	64.0
90th %ile Term Code	Max		Max		Max	Hold
70th %ile Green (s)	8.0		21.8		30.4	56.2
70th %ile Term Code	Max		Gap		Gap	Hold
50th %ile Green (s)	8.0		18.4		24.3	46.7
50th %ile Term Code	Max		Gap		Gap	Hold
30th %ile Green (s)	8.0		14.7		18.8	37.5
30th %ile Term Code	Max		Gap		Gap	Hold
10th %ile Green (s)	8.0		10.7		13.0	27.7
10th %ile Term Code	Max		Gap		Gap	Hold
Queue Length 50th (ft)	4	40	108		157	33
Queue Length 95th (ft)	23	87	189		302	45
Internal Link Dist (ft)	420		520			420
Turn Bay Length (ft)						
Base Capacity (vph)	237	2155	1527		999	3285
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.05	0.26	0.42		0.50	0.22

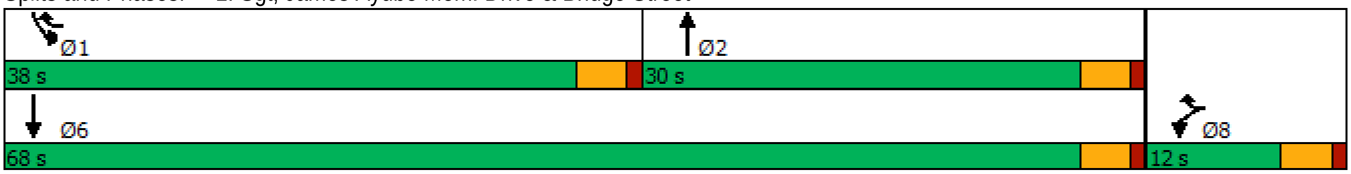
Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 62.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76

Intersection Signal Delay: 13.7
Intersection Capacity Utilization 60.6%
Analysis Period (min) 15
90th %ile Actuated Cycle: 80
70th %ile Actuated Cycle: 72.2
50th %ile Actuated Cycle: 62.7
30th %ile Actuated Cycle: 53.5
10th %ile Actuated Cycle: 43.7

Intersection LOS: B
ICU Level of Service B

Splits and Phases: 1: Sgt, James Ayube Mem. Drive & Bridge Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	13	6	453	2	36	3	577	413	35	673	2
Future Volume (vph)	6	13	6	453	2	36	3	577	413	35	673	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	75		0	200		200
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.968				0.850		0.937				
Flt Protected		0.988			0.953		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1725	1615	1805	3258	0	1805	3505	0
Flt Permitted		0.925			0.709		0.950			0.950		
Satd. Flow (perm)	0	1669	0	0	1283	1615	1805	3258	0	1805	3505	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				51		280				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		250			500			500			320	
Travel Time (s)		5.7			11.4			11.4			7.3	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	8%	5%	0%	0%	0%	3%	5%	0%	3%	0%
Adj. Flow (vph)	6	13	6	467	2	37	3	595	426	36	694	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	25	0	0	469	37	3	1021	0	36	696	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	

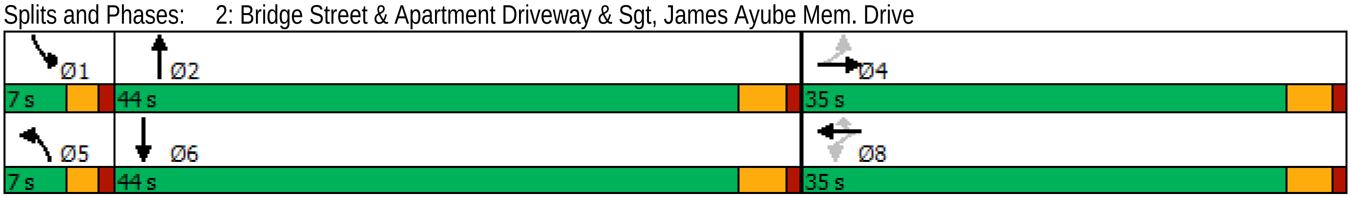
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8		8						
Detector Phase	4	4		8	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	4.0	10.0		4.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0	11.0	7.0	14.0		7.0	14.0	
Total Split (s)	35.0	35.0		35.0	35.0	35.0	7.0	44.0		7.0	44.0	
Total Split (%)	40.7%	40.7%		40.7%	40.7%	40.7%	8.1%	51.2%		8.1%	51.2%	
Maximum Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	40.0		4.0	40.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	2.0	3.0		2.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		4.0			4.0	4.0	3.0	4.0		3.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	None	Min		None	Min	
Act Effct Green (s)		31.8			31.8	31.8	4.1	25.7		4.1	28.3	
Actuated g/C Ratio		0.46			0.46	0.46	0.06	0.37		0.06	0.41	
v/c Ratio		0.03			0.80	0.05	0.03	0.74		0.34	0.49	
Control Delay		13.0			33.1	3.9	37.3	16.8		45.1	16.0	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		13.0			33.1	3.9	37.3	16.8		45.1	16.0	
LOS		B			C	A	D	B		D	B	
Approach Delay		13.0			30.9			16.9			17.4	
Approach LOS		B			C			B			B	
90th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	38.2		4.0	38.2	
90th %ile Term Code	Hold	Hold		Max	Max	Max	Max	Gap		Max	Hold	
70th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	30.8		4.0	37.8	
70th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Max	Hold	
50th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	26.5		4.0	33.5	
50th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Max	Hold	
30th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	20.6		0.0	20.6	
30th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Skip	Hold	
10th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	15.3		0.0	15.3	
10th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Skip	Hold	
Queue Length 50th (ft)		5			183	0	1	148		16	104	
Queue Length 95th (ft)		22			#441	14	10	213		#54	172	
Internal Link Dist (ft)		170			420			420			240	
Turn Bay Length (ft)							75			200		
Base Capacity (vph)		767			587	767	106	2040		106	2071	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.03			0.80	0.05	0.03	0.50		0.34	0.34	

Intersection Summary

Area Type: Other
Cycle Length: 86
Actuated Cycle Length: 69.5

Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 20.1 Intersection LOS: C
Intersection Capacity Utilization 67.7% ICU Level of Service C
Analysis Period (min) 15
90th %ile Actuated Cycle: 84.2
70th %ile Actuated Cycle: 76.8
50th %ile Actuated Cycle: 72.5
30th %ile Actuated Cycle: 59.6
10th %ile Actuated Cycle: 54.3
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Bridge Street & Apartment Driveway & Sgt, James Ayube Mem. Drive



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	133	126	505	223	106	497
Future Volume (vph)	133	126	505	223	106	497
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	150		0	130	
Storage Lanes	1	1		0	1	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.959			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1719	1583	1752	0	1719	1810
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1719	1583	1752	0	1719	1810
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		131	40			
Link Speed (mph)	30		30			30
Link Distance (ft)	1800		500			500
Travel Time (s)	40.9		11.4			11.4
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	5%	2%	4%	4%	5%	5%
Adj. Flow (vph)	139	131	526	232	110	518
Shared Lane Traffic (%)						
Lane Group Flow (vph)	139	131	758	0	110	518
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						
Minimum Initial (s)	7.0		10.0		5.0	10.0
Minimum Split (s)	11.0		14.0		9.0	14.0
Total Split (s)	26.0		58.0		10.0	68.0
Total Split (%)	27.7%		61.7%		10.6%	72.3%
Maximum Green (s)	22.0		54.0		6.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		Min		None	Min
Act Effct Green (s)	11.1	21.6	33.4		6.3	44.0
Actuated g/C Ratio	0.17	0.34	0.53		0.10	0.69
v/c Ratio	0.46	0.21	0.81		0.64	0.41
Control Delay	31.9	5.4	19.2		53.2	5.5
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	31.9	5.4	19.2		53.2	5.5
LOS	C	A	B		D	A
Approach Delay	19.1		19.2			13.8
Approach LOS	B		B			B
90th %ile Green (s)	17.1		54.0		6.0	64.0
90th %ile Term Code	Gap		Max		Max	Hold
70th %ile Green (s)	13.1		39.2		6.0	49.2
70th %ile Term Code	Gap		Gap		Max	Hold
50th %ile Green (s)	10.6		30.9		6.0	40.9
50th %ile Term Code	Gap		Gap		Max	Hold
30th %ile Green (s)	8.7		25.2		6.0	35.2
30th %ile Term Code	Gap		Gap		Max	Hold
10th %ile Green (s)	7.0		21.6		6.0	31.6
10th %ile Term Code	Min		Dwell		Max	Dwell
Queue Length 50th (ft)	45	0	196		39	64
Queue Length 95th (ft)	126	39	391		#166	145
Internal Link Dist (ft)	1720		420			420
Turn Bay Length (ft)		150			130	
Base Capacity (vph)	627	682	1506		171	1675
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.22	0.19	0.50		0.64	0.31

Intersection Summary

Area Type: Other
Cycle Length: 94
Actuated Cycle Length: 63.5

Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 17.1 Intersection LOS: B
Intersection Capacity Utilization 63.4% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 89.1
70th %ile Actuated Cycle: 70.3
50th %ile Actuated Cycle: 59.5
30th %ile Actuated Cycle: 51.9
10th %ile Actuated Cycle: 46.6
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Bridge Street & Webb Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	209	63	75	178	17	60	13	6	0	46	68
Future Volume (vph)	58	209	63	75	178	17	60	13	6	0	46	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		100	0		0
Storage Lanes	0		0	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.974			0.992				0.850		0.920	
Flt Protected		0.991			0.986			0.960				
Satd. Flow (prot)	0	1719	0	0	1803	0	0	1770	1380	0	1700	0
Flt Permitted		0.900			0.823			0.745				
Satd. Flow (perm)	0	1561	0	0	1505	0	0	1374	1380	0	1700	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		25			7				18		85	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1800			850			500			500	
Travel Time (s)		40.9			19.3			11.4			11.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	7%	10%	4%	3%	0%	2%	8%	17%	0%	7%	0%
Adj. Flow (vph)	73	261	79	94	223	21	75	16	8	0	58	85
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	413	0	0	338	0	0	91	8	0	143	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm		NA	
Protected Phases		4			8			2			6	

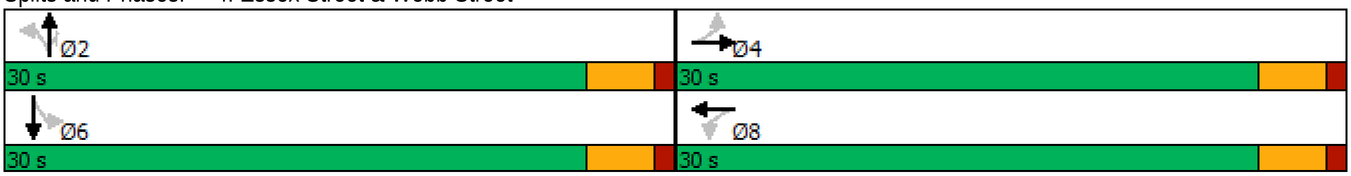
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	14.0	14.0		14.0	14.0		11.0	11.0	11.0	11.0	11.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	26.0	26.0		26.0	26.0		26.0	26.0	26.0	26.0	26.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0	0.0		0.0	
Total Lost Time (s)		4.0			4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None	None	None	None	
Act Effct Green (s)		20.0			20.0			8.5	8.5		8.5	
Actuated g/C Ratio		0.68			0.68			0.29	0.29		0.29	
v/c Ratio		0.38			0.33			0.23	0.02		0.26	
Control Delay		6.1			5.9			10.9	4.0		6.5	
Queue Delay		0.0			0.0			0.0	0.0		0.0	
Total Delay		6.1			5.9			10.9	4.0		6.5	
LOS		A			A			B	A		A	
Approach Delay		6.1			5.9			10.4			6.5	
Approach LOS		A			A			B			A	
90th %ile Green (s)	20.2	20.2		20.2	20.2		11.2	11.2	11.2	11.2	11.2	
90th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	15.3	15.3		15.3	15.3		9.0	9.0	9.0	9.0	9.0	
70th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	11.8	11.8		11.8	11.8		7.5	7.5	7.5	7.5	7.5	
50th %ile Term Code	Gap	Gap		Hold	Hold		Gap	Gap	Gap	Hold	Hold	
30th %ile Green (s)	14.7	14.7		14.7	14.7		0.0	0.0	0.0	0.0	0.0	
30th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
10th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
10th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
Queue Length 50th (ft)		34			28			9	0		6	
Queue Length 95th (ft)		80			67			34	4		31	
Internal Link Dist (ft)		1720			770			420			420	
Turn Bay Length (ft)									100			
Base Capacity (vph)		1350			1299			1185	1193		1478	
Starvation Cap Reductn		0			0			0	0		0	
Spillback Cap Reductn		0			0			0	0		0	
Storage Cap Reductn		0			0			0	0		0	
Reduced v/c Ratio		0.31			0.26			0.08	0.01		0.10	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 29.3

Natural Cycle: 40
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.38
Intersection Signal Delay: 6.5 Intersection LOS: A
Intersection Capacity Utilization 40.8% ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 39.4
70th %ile Actuated Cycle: 32.3
50th %ile Actuated Cycle: 27.3
30th %ile Actuated Cycle: 18.7
10th %ile Actuated Cycle: 29

Splits and Phases: 4: Essex Street & Webb Street



Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	0	26	0	36	47	72	196	0	0	95	1
Future Vol, veh/h	3	0	26	0	36	47	72	196	0	0	95	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	76	76	76	76	76	76	76	76	76
Heavy Vehicles, %	0	0	8	0	2	2	4	5	0	0	3	0
Mvmt Flow	4	0	34	0	47	62	95	258	0	0	125	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	629	574	126	591	574	258	126	0	-	-	-	0
Stage 1	126	126	-	448	448	-	-	-	-	-	-	-
Stage 2	503	448	-	143	126	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.28	7.1	6.52	6.22	4.14	-	-	-	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.372	3.5	4.018	3.318	2.236	-	-	-	-	-
Pot Cap-1 Maneuver	398	432	909	422	429	781	1448	-	0	0	-	-
Stage 1	883	796	-	594	573	-	-	-	0	0	-	-
Stage 2	555	576	-	865	792	-	-	-	0	0	-	-
Platoon blocked, %								-			-	-
Mov Cap-1 Maneuver	314	399	909	382	396	781	1448	-	-	-	-	-
Mov Cap-2 Maneuver	314	399	-	382	396	-	-	-	-	-	-	-
Stage 1	815	796	-	548	529	-	-	-	-	-	-	-
Stage 2	429	532	-	832	792	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10	13.2	2.1	0
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	WBLn2	SBT	SBR
Capacity (veh/h)	1448	-	760	-	549	-	-
HCM Lane V/C Ratio	0.065	-	0.05	-	0.199	-	-
HCM Control Delay (s)	7.7	0	10	0	13.2	-	-
HCM Lane LOS	A	A	B	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.2	-	0.7	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1	0	0	0	0	142	82	0	0	0	0
Future Vol, veh/h	1	1	0	0	0	0	142	82	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	0	0	0	0	0	0	2	4	0	0	0	0
Mvmt Flow	1	1	0	0	0	0	171	99	0	0	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	441	441	-	-	441	99	0	0	0
Stage 1	0	0	-	-	441	-	-	-	-
Stage 2	441	441	-	-	0	-	-	-	-
Critical Hdwy	7.1	6.5	-	-	6.5	6.2	4.12	-	-
Critical Hdwy Stg 1	-	-	-	-	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	-	-	4	3.3	2.218	-	-
Pot Cap-1 Maneuver	530	513	0	0	513	962	-	-	-
Stage 1	-	-	0	0	580	-	-	-	-
Stage 2	599	580	0	0	-	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	530	513	-	-	513	962	-	-	-
Mov Cap-2 Maneuver	530	513	-	-	513	-	-	-	-
Stage 1	-	-	-	-	580	-	-	-	-
Stage 2	599	580	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	11.9	0	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1
Capacity (veh/h)	-	-	-	521	-
HCM Lane V/C Ratio	-	-	-	0.005	-
HCM Control Delay (s)	-	-	-	11.9	0
HCM Lane LOS	-	-	-	B	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	0.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	1	92	154	2	96
Future Vol, veh/h	0	1	92	154	2	96
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	5	2	3	2
Mvmt Flow	0	1	100	167	2	104

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	292	184	0	0	267	0
Stage 1	184	-	-	-	-	-
Stage 2	108	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.13	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.227	-
Pot Cap-1 Maneuver	699	858	-	-	1291	-
Stage 1	848	-	-	-	-	-
Stage 2	916	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	698	858	-	-	1291	-
Mov Cap-2 Maneuver	698	-	-	-	-	-
Stage 1	848	-	-	-	-	-
Stage 2	914	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0	0.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	858	1291	-
HCM Lane V/C Ratio	-	-	0.001	0.002	-
HCM Control Delay (s)	-	-	9.2	7.8	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	5	569	567	30	518	763
Future Volume (vph)	5	569	567	30	518	763
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	0.95
Frt		0.850	0.992			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	2787	3544	0	1787	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	2787	3544	0	1787	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		176	7			
Link Speed (mph)	30		30			30
Link Distance (ft)	500		600			500
Travel Time (s)	11.4		13.6			11.4
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	1%	2%	1%	2%
Adj. Flow (vph)	5	587	585	31	534	787
Shared Lane Traffic (%)						
Lane Group Flow (vph)	5	587	616	0	534	787
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)	8.0		10.0		10.0	10.0
Minimum Split (s)	12.0		14.0		14.0	14.0
Total Split (s)	12.0		30.0		38.0	68.0
Total Split (%)	15.0%		37.5%		47.5%	85.0%
Maximum Green (s)	8.0		26.0		34.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		None		None	Min
Act Effct Green (s)	8.3	36.9	17.4		24.4	45.9
Actuated g/C Ratio	0.13	0.59	0.28		0.39	0.73
v/c Ratio	0.02	0.34	0.62		0.77	0.30
Control Delay	30.6	5.5	23.2		25.5	2.9
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	30.6	5.5	23.2		25.5	2.9
LOS	C	A	C		C	A
Approach Delay	5.7		23.2			12.0
Approach LOS	A		C			B
90th %ile Green (s)	8.0		25.6		34.0	63.6
90th %ile Term Code	Max		Gap		Max	Hold
70th %ile Green (s)	8.0		21.3		31.4	56.7
70th %ile Term Code	Max		Gap		Gap	Hold
50th %ile Green (s)	8.0		17.0		24.8	45.8
50th %ile Term Code	Max		Gap		Gap	Hold
30th %ile Green (s)	8.0		14.3		19.6	37.9
30th %ile Term Code	Max		Gap		Gap	Hold
10th %ile Green (s)	8.0		10.5		14.5	29.0
10th %ile Term Code	Max		Gap		Gap	Hold
Queue Length 50th (ft)	2	36	104		164	36
Queue Length 95th (ft)	13	83	180		325	50
Internal Link Dist (ft)	420		520			420
Turn Bay Length (ft)						
Base Capacity (vph)	235	2164	1538		1012	3315
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.02	0.27	0.40		0.53	0.24

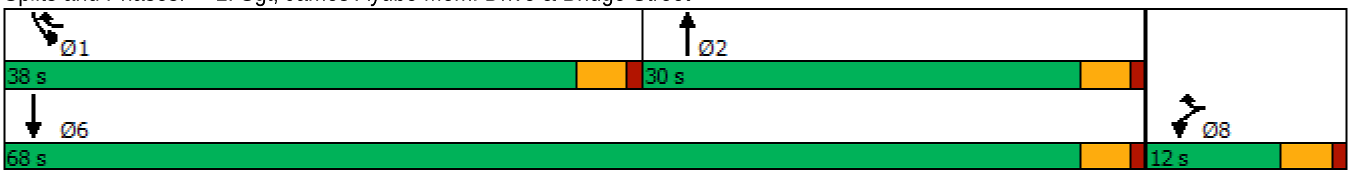
Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 62.6
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77

Intersection Signal Delay: 13.3
Intersection Capacity Utilization 62.0%
Analysis Period (min) 15
90th %ile Actuated Cycle: 79.6
70th %ile Actuated Cycle: 72.7
50th %ile Actuated Cycle: 61.8
30th %ile Actuated Cycle: 53.9
10th %ile Actuated Cycle: 45

Intersection LOS: B
ICU Level of Service B

Splits and Phases: 1: Sgt, James Ayube Mem. Drive & Bridge Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	3	11	415	2	23	10	568	271	33	702	33
Future Volume (vph)	6	3	11	415	2	23	10	568	271	33	702	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	75		0	200		200
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.926				0.850		0.952			0.993	
Flt Protected		0.985			0.953		0.950			0.950		
Satd. Flow (prot)	0	1651	0	0	1775	1615	1805	3403	0	1805	3518	0
Flt Permitted		0.913			0.713		0.950			0.950		
Satd. Flow (perm)	0	1531	0	0	1328	1615	1805	3403	0	1805	3518	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11				51		124			7	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		250			500			500			320	
Travel Time (s)		5.7			11.4			11.4			7.3	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	9%	2%	0%	0%	0%	1%	1%	0%	2%	0%
Adj. Flow (vph)	6	3	11	428	2	24	10	586	279	34	724	34
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	430	24	10	865	0	34	758	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	

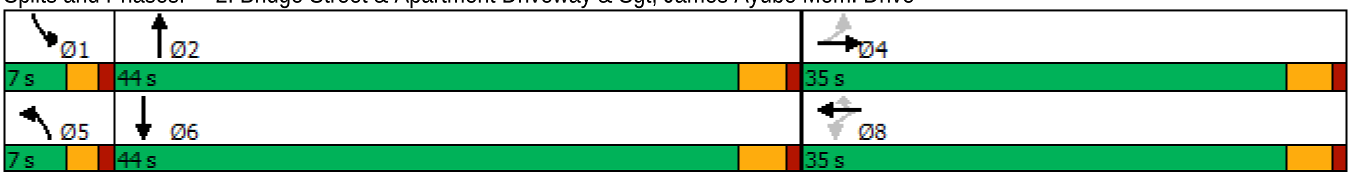
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8		8						
Detector Phase	4	4		8	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	4.0	10.0		4.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0	11.0	7.0	14.0		7.0	14.0	
Total Split (s)	35.0	35.0		35.0	35.0	35.0	7.0	44.0		7.0	44.0	
Total Split (%)	40.7%	40.7%		40.7%	40.7%	40.7%	8.1%	51.2%		8.1%	51.2%	
Maximum Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	40.0		4.0	40.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	2.0	3.0		2.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		4.0			4.0	4.0	3.0	4.0		3.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	None	Min		None	Min	
Act Effct Green (s)		25.7			25.7	25.7	4.3	22.0		4.3	23.1	
Actuated g/C Ratio		0.44			0.44	0.44	0.07	0.38		0.07	0.39	
v/c Ratio		0.03			0.74	0.03	0.08	0.64		0.26	0.54	
Control Delay		9.5			25.8	1.8	34.6	15.9		37.7	15.7	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		9.5			25.8	1.8	34.6	15.9		37.7	15.7	
LOS		A			C	A	C	B		D	B	
Approach Delay		9.5			24.6			16.2			16.6	
Approach LOS		A			C			B			B	
90th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	32.3		4.0	32.3	
90th %ile Term Code	Hold	Hold		Max	Max	Max	Max	Gap		Max	Hold	
70th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	26.2		4.0	33.2	
70th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Max	Hold	
50th %ile Green (s)	29.3	29.3		29.3	29.3	29.3	0.0	22.6		0.0	22.6	
50th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
30th %ile Green (s)	20.8	20.8		20.8	20.8	20.8	0.0	17.5		0.0	17.5	
30th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
10th %ile Green (s)	15.6	15.6		15.6	15.6	15.6	0.0	12.5		0.0	12.5	
10th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
Queue Length 50th (ft)		2			109	0	4	110		12	109	
Queue Length 95th (ft)		15			#343	6	20	198		44	191	
Internal Link Dist (ft)		170			420			420			240	
Turn Bay Length (ft)							75			200		
Base Capacity (vph)		883			762	949	133	2482		133	2532	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.02			0.56	0.03	0.08	0.35		0.26	0.30	

Intersection Summary

Area Type: Other
Cycle Length: 86
Actuated Cycle Length: 58.6

Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 18.1 Intersection LOS: B
Intersection Capacity Utilization 63.9% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 78.3
70th %ile Actuated Cycle: 72.2
50th %ile Actuated Cycle: 59.9
30th %ile Actuated Cycle: 46.3
10th %ile Actuated Cycle: 36.1
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Bridge Street & Apartment Driveway & Sgt, James Ayube Mem. Drive



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	235	130	473	108	127	490
Future Volume (vph)	235	130	473	108	127	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	150		0	130	
Storage Lanes	1	1		0	1	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.975			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1787	1568	1823	0	1787	1863
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	1568	1823	0	1787	1863
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		141	20			
Link Speed (mph)	30		30			30
Link Distance (ft)	1800		500			500
Travel Time (s)	40.9		11.4			11.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	3%	2%	0%	1%	2%
Adj. Flow (vph)	255	141	514	117	138	533
Shared Lane Traffic (%)						
Lane Group Flow (vph)	255	141	631	0	138	533
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						
Minimum Initial (s)	7.0		10.0		5.0	10.0
Minimum Split (s)	11.0		14.0		9.0	14.0
Total Split (s)	26.0		58.0		10.0	68.0
Total Split (%)	27.7%		61.7%		10.6%	72.3%
Maximum Green (s)	22.0		54.0		6.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		Min		None	Min
Act Effct Green (s)	14.1	24.7	26.9		6.4	37.5
Actuated g/C Ratio	0.23	0.41	0.45		0.11	0.62
v/c Ratio	0.61	0.19	0.76		0.73	0.46
Control Delay	29.3	4.1	20.3		57.9	7.8
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	29.3	4.1	20.3		57.9	7.8
LOS	C	A	C		E	A
Approach Delay	20.3		20.3			18.1
Approach LOS	C		C			B
90th %ile Green (s)	22.0		43.1		6.0	53.1
90th %ile Term Code	Max		Gap		Max	Hold
70th %ile Green (s)	16.8		33.3		6.0	43.3
70th %ile Term Code	Gap		Gap		Max	Hold
50th %ile Green (s)	13.6		26.1		6.0	36.1
50th %ile Term Code	Gap		Gap		Max	Hold
30th %ile Green (s)	11.2		21.2		6.0	31.2
30th %ile Term Code	Gap		Gap		Max	Hold
10th %ile Green (s)	8.4		14.8		6.0	24.8
10th %ile Term Code	Gap		Gap		Max	Hold
Queue Length 50th (ft)	79	0	165		48	81
Queue Length 95th (ft)	188	34	337		#192	189
Internal Link Dist (ft)	1720		420			420
Turn Bay Length (ft)		150			130	
Base Capacity (vph)	693	756	1599		189	1755
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.37	0.19	0.39		0.73	0.30

Intersection Summary

Area Type: Other
Cycle Length: 94
Actuated Cycle Length: 60.1

Natural Cycle: 55
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 19.4 Intersection LOS: B
Intersection Capacity Utilization 61.5% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 83.1
70th %ile Actuated Cycle: 68.1
50th %ile Actuated Cycle: 57.7
30th %ile Actuated Cycle: 50.4
10th %ile Actuated Cycle: 41.2
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Bridge Street & Webb Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	111	87	90	341	1	44	9	15	0	37	49
Future Volume (vph)	18	111	87	90	341	1	44	9	15	0	37	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		100	0		0
Storage Lanes	0		0	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.946							0.850		0.923	
Flt Protected		0.996			0.990			0.960				
Satd. Flow (prot)	0	1774	0	0	1848	0	0	1824	1615	0	1739	0
Flt Permitted		0.959			0.900			0.816				
Satd. Flow (perm)	0	1708	0	0	1680	0	0	1550	1615	0	1739	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		72							18		52	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1800			850			500			500	
Travel Time (s)		40.9			19.3			11.4			11.4	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	1%	1%	1%	2%	0%	0%	0%	0%	0%	2%	0%
Adj. Flow (vph)	19	117	92	95	359	1	46	9	16	0	39	52
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	228	0	0	455	0	0	55	16	0	91	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm		NA	
Protected Phases		4			8			2			6	

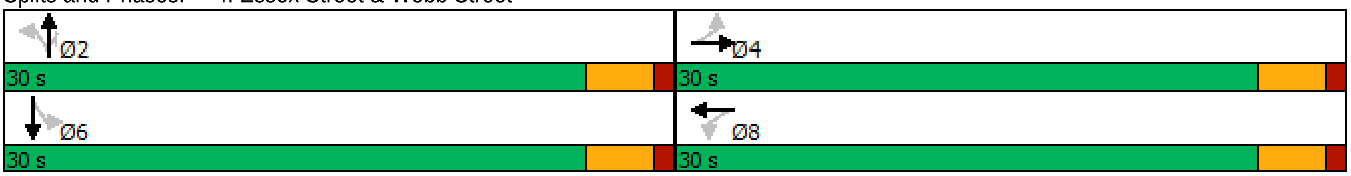
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	14.0	14.0		14.0	14.0		11.0	11.0	11.0	11.0	11.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	26.0	26.0		26.0	26.0		26.0	26.0	26.0	26.0	26.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0	0.0		0.0	
Total Lost Time (s)		4.0			4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None	None	None	None	
Act Effct Green (s)		21.4			21.4			7.5	7.5		7.5	
Actuated g/C Ratio		0.70			0.70			0.25	0.25		0.25	
v/c Ratio		0.19			0.39			0.15	0.04		0.20	
Control Delay		3.3			5.6			11.1	6.1		7.1	
Queue Delay		0.0			0.0			0.0	0.0		0.0	
Total Delay		3.3			5.6			11.1	6.1		7.1	
LOS		A			A			B	A		A	
Approach Delay		3.3			5.6			9.9			7.1	
Approach LOS		A			A			A			A	
90th %ile Green (s)	20.5	20.5		20.5	20.5		8.8	8.8	8.8	8.8	8.8	
90th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	15.3	15.3		15.3	15.3		7.5	7.5	7.5	7.5	7.5	
70th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	12.1	12.1		12.1	12.1		7.0	7.0	7.0	7.0	7.0	
50th %ile Term Code	Hold	Hold		Gap	Gap		Hold	Hold	Hold	Min	Min	
30th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
30th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
10th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
10th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
Queue Length 50th (ft)		11			39			6	0		4	
Queue Length 95th (ft)		33			92			27	8		28	
Internal Link Dist (ft)		1720			770			420			420	
Turn Bay Length (ft)									100			
Base Capacity (vph)		1476			1442			1331	1389		1500	
Starvation Cap Reductn		0			0			0	0		0	
Spillback Cap Reductn		0			0			0	0		0	
Storage Cap Reductn		0			0			0	0		0	
Reduced v/c Ratio		0.15			0.32			0.04	0.01		0.06	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 30.6

Natural Cycle: 40
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.39
Intersection Signal Delay: 5.5
Intersection LOS: A
Intersection Capacity Utilization 54.7%
ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 37.3
70th %ile Actuated Cycle: 30.8
50th %ile Actuated Cycle: 27.1
30th %ile Actuated Cycle: 29
10th %ile Actuated Cycle: 29

Splits and Phases: 4: Essex Street & Webb Street



Intersection												
Int Delay, s/veh	2.5											

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	7	0	18	84	19	90	0	0	290	2
Future Vol, veh/h	0	0	7	0	18	84	19	90	0	0	290	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	0	0	8	0	20	95	22	102	0	0	330	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	535	477	331	481	478	102	332	0	-	-	-	0
Stage 1	331	331	-	146	146	-	-	-	-	-	-	-
Stage 2	204	146	-	335	332	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	-	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	-	-	-
Pot Cap-1 Maneuver	459	490	715	499	489	959	1239	-	0	0	-	-
Stage 1	687	649	-	861	780	-	-	-	0	0	-	-
Stage 2	803	780	-	683	648	-	-	-	0	0	-	-
Platoon blocked, %								-			-	-
Mov Cap-1 Maneuver	394	481	715	487	480	959	1239	-	-	-	-	-
Mov Cap-2 Maneuver	394	481	-	487	480	-	-	-	-	-	-	-
Stage 1	674	649	-	845	765	-	-	-	-	-	-	-
Stage 2	690	765	-	675	648	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.1	10.1	1.4	0
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	WBLn2	SBT	SBR
Capacity (veh/h)	1239	-	715	-	815	-	-
HCM Lane V/C Ratio	0.017	-	0.011	-	0.142	-	-
HCM Control Delay (s)	8	0	10.1	0	10.1	-	-
HCM Lane LOS	A	A	B	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0	-	0.5	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	0	0	0	0	144	98	0	0	0	0
Future Vol, veh/h	4	0	0	0	0	0	144	98	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	0	0
Mvmt Flow	4	0	0	0	0	0	152	103	0	0	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	407	407	-	-	407	103	0	0	0
Stage 1	0	0	-	-	407	-	-	-	-
Stage 2	407	407	-	-	0	-	-	-	-
Critical Hdwy	7.1	6.5	-	-	6.5	6.2	4.1	-	-
Critical Hdwy Stg 1	-	-	-	-	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	-	-	4	3.3	2.2	-	-
Pot Cap-1 Maneuver	558	537	0	0	537	957	-	-	-
Stage 1	-	-	0	0	601	-	-	-	-
Stage 2	625	601	0	0	-	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	558	537	-	-	537	957	-	-	-
Mov Cap-2 Maneuver	558	537	-	-	537	-	-	-	-
Stage 1	-	-	-	-	601	-	-	-	-
Stage 2	625	601	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	11.5	0	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1
Capacity (veh/h)	-	-	-	558	-
HCM Lane V/C Ratio	-	-	-	0.008	-
HCM Control Delay (s)	-	-	-	11.5	0
HCM Lane LOS	-	-	-	B	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	4.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	151	0	171	3	1	141
Future Vol, veh/h	151	0	171	3	1	141
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	2	2	1	2	2	2
Mvmt Flow	172	0	194	3	1	160

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	358	196	0	0	197	0
Stage 1	196	-	-	-	-	-
Stage 2	162	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	640	845	-	-	1376	-
Stage 1	837	-	-	-	-	-
Stage 2	867	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	639	845	-	-	1376	-
Mov Cap-2 Maneuver	639	-	-	-	-	-
Stage 1	837	-	-	-	-	-
Stage 2	866	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.7	0	0.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	639	1376	-
HCM Lane V/C Ratio	-	-	0.269	0.001	-
HCM Control Delay (s)	-	-	12.7	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	1.1	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	13	555	614	5	471	697
Future Volume (vph)	13	555	614	5	471	697
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	0.95
Frt		0.850	0.999			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	2787	3502	0	1752	3505
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	2787	3502	0	1752	3505
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		144	1			
Link Speed (mph)	30		30			30
Link Distance (ft)	500		600			500
Travel Time (s)	11.4		13.6			11.4
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	3%	2%	3%	3%
Adj. Flow (vph)	13	572	633	5	486	719
Shared Lane Traffic (%)						
Lane Group Flow (vph)	13	572	638	0	486	719
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						

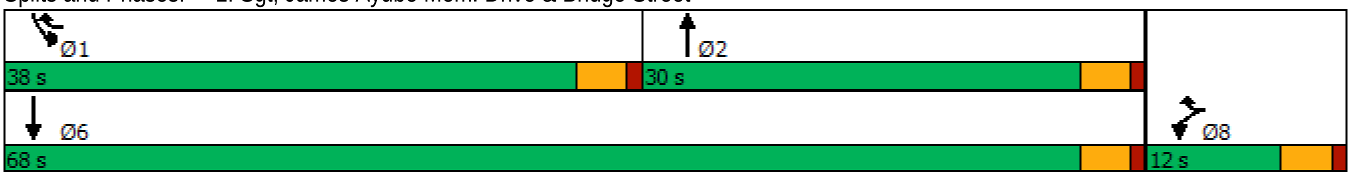
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)	8.0		10.0		10.0	10.0
Minimum Split (s)	12.0		14.0		14.0	14.0
Total Split (s)	12.0		30.0		38.0	68.0
Total Split (%)	15.0%		37.5%		47.5%	85.0%
Maximum Green (s)	8.0		26.0		34.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		None		None	Min
Act Effct Green (s)	8.4	35.7	17.9		23.1	45.1
Actuated g/C Ratio	0.14	0.58	0.29		0.37	0.73
v/c Ratio	0.05	0.34	0.63		0.74	0.28
Control Delay	30.7	6.0	23.0		25.1	2.8
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	30.7	6.0	23.0		25.1	2.8
LOS	C	A	C		C	A
Approach Delay	6.6		23.0			11.8
Approach LOS	A		C			B
90th %ile Green (s)	8.0		26.0		34.0	64.0
90th %ile Term Code	Max		Max		Max	Hold
70th %ile Green (s)	8.0		21.6		29.7	55.3
70th %ile Term Code	Max		Gap		Gap	Hold
50th %ile Green (s)	8.0		18.3		23.8	46.1
50th %ile Term Code	Max		Gap		Gap	Hold
30th %ile Green (s)	8.0		14.6		18.4	37.0
30th %ile Term Code	Max		Gap		Gap	Hold
10th %ile Green (s)	8.0		10.6		12.7	27.3
10th %ile Term Code	Max		Gap		Gap	Hold
Queue Length 50th (ft)	4	40	107		151	33
Queue Length 95th (ft)	23	87	189		292	45
Internal Link Dist (ft)	420		520			420
Turn Bay Length (ft)						
Base Capacity (vph)	239	2167	1540		1007	3293
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.05	0.26	0.41		0.48	0.22

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 61.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.74

Intersection Signal Delay: 13.5
Intersection LOS: B
Intersection Capacity Utilization 59.9%
ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 80
70th %ile Actuated Cycle: 71.3
50th %ile Actuated Cycle: 62.1
30th %ile Actuated Cycle: 53
10th %ile Actuated Cycle: 43.3

Splits and Phases: 1: Sgt, James Ayube Mem. Drive & Bridge Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	13	6	460	2	36	3	577	329	35	673	2
Future Volume (vph)	6	13	6	460	2	36	3	577	329	35	673	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	75		0	200		200
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.968				0.850		0.946				
Flt Protected		0.988			0.953		0.950			0.950		
Satd. Flow (prot)	0	1783	0	0	1725	1615	1805	3292	0	1805	3505	0
Flt Permitted		0.925			0.709		0.950			0.950		
Satd. Flow (perm)	0	1669	0	0	1283	1615	1805	3292	0	1805	3505	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6				51		173				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		250			500			500			320	
Travel Time (s)		5.7			11.4			11.4			7.3	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	8%	5%	0%	0%	0%	3%	5%	0%	3%	0%
Adj. Flow (vph)	6	13	6	474	2	37	3	595	339	36	694	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	25	0	0	476	37	3	934	0	36	696	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	

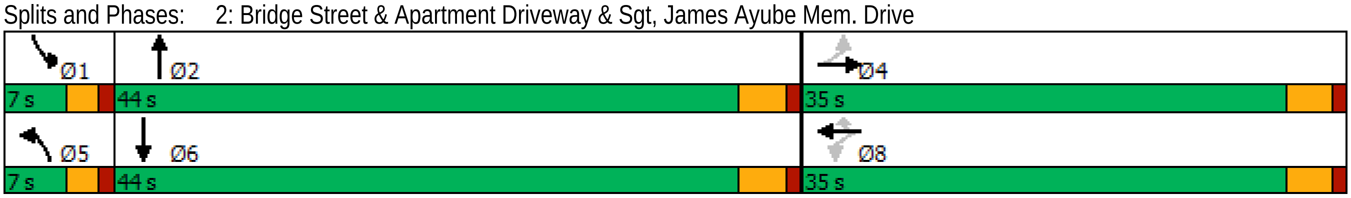
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8		8						
Detector Phase	4	4		8	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	4.0	10.0		4.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0	11.0	7.0	14.0		7.0	14.0	
Total Split (s)	35.0	35.0		35.0	35.0	35.0	7.0	44.0		7.0	44.0	
Total Split (%)	40.7%	40.7%		40.7%	40.7%	40.7%	8.1%	51.2%		8.1%	51.2%	
Maximum Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	40.0		4.0	40.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	2.0	3.0		2.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		4.0			4.0	4.0	3.0	4.0		3.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	None	Min		None	Min	
Act Effct Green (s)		31.7			31.7	31.7	4.1	24.5		4.1	27.1	
Actuated g/C Ratio		0.46			0.46	0.46	0.06	0.36		0.06	0.40	
v/c Ratio		0.03			0.80	0.05	0.03	0.72		0.33	0.50	
Control Delay		12.4			32.1	3.8	36.3	18.6		43.7	16.4	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		12.4			32.1	3.8	36.3	18.6		43.7	16.4	
LOS		B			C	A	D	B		D	B	
Approach Delay		12.4			30.0			18.6			17.7	
Approach LOS		B			C			B			B	
90th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	35.8		4.0	35.8	
90th %ile Term Code	Hold	Hold		Max	Max	Max	Max	Gap		Max	Hold	
70th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	29.1		4.0	36.1	
70th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Max	Hold	
50th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	25.1		4.0	32.1	
50th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Max	Hold	
30th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	19.5		0.0	19.5	
30th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Skip	Hold	
10th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	0.0	15.5		0.0	15.5	
10th %ile Term Code	Hold	Hold		Max	Max	Max	Skip	Gap		Skip	Hold	
Queue Length 50th (ft)		5			179	0	1	150		16	104	
Queue Length 95th (ft)		21			#432	13	10	211		#51	173	
Internal Link Dist (ft)		170			420			420			240	
Turn Bay Length (ft)							75			200		
Base Capacity (vph)		779			596	778	108	2045		108	2104	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.03			0.80	0.05	0.03	0.46		0.33	0.33	

Intersection Summary

Area Type: Other
Cycle Length: 86
Actuated Cycle Length: 68.2

Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 20.9 Intersection LOS: C
Intersection Capacity Utilization 68.0% ICU Level of Service C
Analysis Period (min) 15
90th %ile Actuated Cycle: 81.8
70th %ile Actuated Cycle: 75.1
50th %ile Actuated Cycle: 71.1
30th %ile Actuated Cycle: 58.5
10th %ile Actuated Cycle: 54.5
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Bridge Street & Apartment Driveway & Sgt, James Ayube Mem. Drive



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	140	127	505	139	94	497
Future Volume (vph)	140	127	505	139	94	497
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	150		0	130	
Storage Lanes	1	1		0	1	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.971			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1719	1583	1774	0	1719	1810
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1719	1583	1774	0	1719	1810
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		132	25			
Link Speed (mph)	30		30			30
Link Distance (ft)	1800		500			500
Travel Time (s)	40.9		11.4			11.4
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	5%	2%	4%	4%	5%	5%
Adj. Flow (vph)	146	132	526	145	98	518
Shared Lane Traffic (%)						
Lane Group Flow (vph)	146	132	671	0	98	518
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						
Minimum Initial (s)	7.0		10.0		5.0	10.0
Minimum Split (s)	11.0		14.0		9.0	14.0
Total Split (s)	26.0		58.0		10.0	68.0
Total Split (%)	27.7%		61.7%		10.6%	72.3%
Maximum Green (s)	22.0		54.0		6.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		Min		None	Min
Act Effct Green (s)	10.8	21.3	28.0		6.3	38.5
Actuated g/C Ratio	0.19	0.37	0.49		0.11	0.67
v/c Ratio	0.45	0.20	0.77		0.53	0.43
Control Delay	28.1	4.6	18.4		42.2	6.0
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	28.1	4.6	18.4		42.2	6.0
LOS	C	A	B		D	A
Approach Delay	16.9		18.4			11.7
Approach LOS	B		B			B
90th %ile Green (s)	16.8		44.7		6.0	54.7
90th %ile Term Code	Gap		Gap		Max	Hold
70th %ile Green (s)	12.5		32.5		6.0	42.5
70th %ile Term Code	Gap		Gap		Max	Hold
50th %ile Green (s)	10.4		26.7		6.0	36.7
50th %ile Term Code	Gap		Gap		Max	Hold
30th %ile Green (s)	8.6		21.1		6.0	31.1
30th %ile Term Code	Gap		Gap		Max	Hold
10th %ile Green (s)	7.0		18.4		6.0	28.4
10th %ile Term Code	Min		Dwell		Max	Dwell
Queue Length 50th (ft)	43	0	160		31	62
Queue Length 95th (ft)	116	35	324		#128	147
Internal Link Dist (ft)	1720		420			420
Turn Bay Length (ft)		150			130	
Base Capacity (vph)	685	730	1605		186	1739
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.21	0.18	0.42		0.53	0.30

Intersection Summary

Area Type: Other
Cycle Length: 94
Actuated Cycle Length: 57.7

Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 15.5 Intersection LOS: B
Intersection Capacity Utilization 58.0% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 79.5
70th %ile Actuated Cycle: 63
50th %ile Actuated Cycle: 55.1
30th %ile Actuated Cycle: 47.7
10th %ile Actuated Cycle: 43.4
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Bridge Street & Webb Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	113	63	78	186	17	60	13	6	0	46	68
Future Volume (vph)	58	113	63	78	186	17	60	13	6	0	46	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		100	0		0
Storage Lanes	0		0	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.964			0.992				0.850		0.920	
Flt Protected		0.988			0.986			0.960				
Satd. Flow (prot)	0	1698	0	0	1803	0	0	1770	1380	0	1700	0
Flt Permitted		0.862			0.851			0.745				
Satd. Flow (perm)	0	1482	0	0	1556	0	0	1374	1380	0	1700	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		39			7				18		85	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1800			850			500			500	
Travel Time (s)		40.9			19.3			11.4			11.4	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	2%	7%	10%	4%	3%	0%	2%	8%	17%	0%	7%	0%
Adj. Flow (vph)	73	141	79	98	233	21	75	16	8	0	58	85
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	293	0	0	352	0	0	91	8	0	143	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm		NA	
Protected Phases		4			8			2			6	

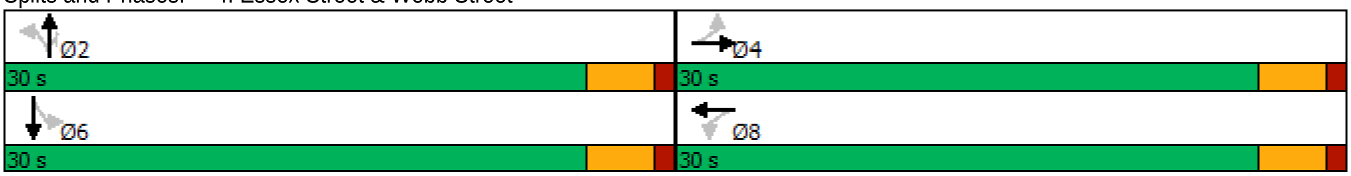
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	14.0	14.0		14.0	14.0		11.0	11.0	11.0	11.0	11.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	26.0	26.0		26.0	26.0		26.0	26.0	26.0	26.0	26.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0	0.0		0.0	
Total Lost Time (s)		4.0			4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None	None	None	None	
Act Effct Green (s)		18.7			18.7			8.3	8.3		8.3	
Actuated g/C Ratio		0.67			0.67			0.30	0.30		0.30	
v/c Ratio		0.29			0.34			0.22	0.02		0.25	
Control Delay		5.4			6.2			9.9	3.5		5.9	
Queue Delay		0.0			0.0			0.0	0.0		0.0	
Total Delay		5.4			6.2			9.9	3.5		5.9	
LOS		A			A			A	A		A	
Approach Delay		5.4			6.2			9.4			5.9	
Approach LOS		A			A			A			A	
90th %ile Green (s)	17.8	17.8		17.8	17.8		11.1	11.1	11.1	11.1	11.1	
90th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	12.9	12.9		12.9	12.9		8.6	8.6	8.6	8.6	8.6	
70th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	10.8	10.8		10.8	10.8		7.3	7.3	7.3	7.3	7.3	
50th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
30th %ile Green (s)	14.7	14.7		14.7	14.7		0.0	0.0	0.0	0.0	0.0	
30th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
10th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
10th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
Queue Length 50th (ft)		20			29			9	0		5	
Queue Length 95th (ft)		52			69			31	3		28	
Internal Link Dist (ft)		1720			770			420			420	
Turn Bay Length (ft)									100			
Base Capacity (vph)		1331			1394			1230	1238		1531	
Starvation Cap Reductn		0			0			0	0		0	
Spillback Cap Reductn		0			0			0	0		0	
Storage Cap Reductn		0			0			0	0		0	
Reduced v/c Ratio		0.22			0.25			0.07	0.01		0.09	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 28

Natural Cycle: 40
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.34
Intersection Signal Delay: 6.2 Intersection LOS: A
Intersection Capacity Utilization 38.4% ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 36.9
70th %ile Actuated Cycle: 29.5
50th %ile Actuated Cycle: 26.1
30th %ile Actuated Cycle: 18.7
10th %ile Actuated Cycle: 29

Splits and Phases: 4: Essex Street & Webb Street



Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	0	26	0	36	64	72	100	0	0	106	1
Future Vol, veh/h	3	0	26	0	36	64	72	100	0	0	106	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	76	76	76	76	76	76	76	76	76	76	76	76
Heavy Vehicles, %	0	0	8	0	2	2	4	5	0	0	3	0
Mvmt Flow	4	0	34	0	47	84	95	132	0	0	139	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	528	462	140	479	462	132	140	0	-	-	-	0
Stage 1	140	140	-	322	322	-	-	-	-	-	-	-
Stage 2	388	322	-	157	140	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.28	7.1	6.52	6.22	4.14	-	-	-	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.372	3.5	4.018	3.318	2.236	-	-	-	-	-
Pot Cap-1 Maneuver	464	500	892	500	497	917	1431	-	0	0	-	-
Stage 1	868	785	-	694	651	-	-	-	0	0	-	-
Stage 2	640	655	-	850	781	-	-	-	0	0	-	-
Platoon blocked, %								-			-	-
Mov Cap-1 Maneuver	367	464	892	455	461	917	1431	-	-	-	-	-
Mov Cap-2 Maneuver	367	464	-	455	461	-	-	-	-	-	-	-
Stage 1	806	785	-	644	604	-	-	-	-	-	-	-
Stage 2	497	608	-	817	781	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.9	11.6	3.2	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	WBLn2	SBT	SBR
Capacity (veh/h)	1431	-	777	-	676	-	-
HCM Lane V/C Ratio	0.066	-	0.049	-	0.195	-	-
HCM Control Delay (s)	7.7	0	9.9	0	11.6	-	-
HCM Lane LOS	A	A	A	A	B	-	-
HCM 95th %tile Q(veh)	0.2	-	0.2	-	0.7	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	1	1	0	0	0	0	142	99	0	0	0	0
Future Vol, veh/h	1	1	0	0	0	0	142	99	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	0	0	0	0	0	0	2	4	0	0	0	0
Mvmt Flow	1	1	0	0	0	0	171	119	0	0	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	461	461	-	-	461	119	0	0	0
Stage 1	0	0	-	-	461	-	-	-	-
Stage 2	461	461	-	-	0	-	-	-	-
Critical Hdwy	7.1	6.5	-	-	6.5	6.2	4.12	-	-
Critical Hdwy Stg 1	-	-	-	-	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	-	-	4	3.3	2.218	-	-
Pot Cap-1 Maneuver	514	500	0	0	500	938	-	-	-
Stage 1	-	-	0	0	569	-	-	-	-
Stage 2	584	569	0	0	-	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	514	500	-	-	500	938	-	-	-
Mov Cap-2 Maneuver	514	500	-	-	500	-	-	-	-
Stage 1	-	-	-	-	569	-	-	-	-
Stage 2	584	569	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	12.1	0	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1
Capacity (veh/h)	-	-	-	507	-
HCM Lane V/C Ratio	-	-	-	0.005	-
HCM Control Delay (s)	-	-	-	12.1	0
HCM Lane LOS	-	-	-	B	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	1	92	75	2	96
Future Vol, veh/h	11	1	92	75	2	96
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	5	2	3	2
Mvmt Flow	12	1	100	82	2	104

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	249	141	0	0	182	0
Stage 1	141	-	-	-	-	-
Stage 2	108	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.13	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.227	-
Pot Cap-1 Maneuver	739	907	-	-	1387	-
Stage 1	886	-	-	-	-	-
Stage 2	916	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	738	907	-	-	1387	-
Mov Cap-2 Maneuver	738	-	-	-	-	-
Stage 1	886	-	-	-	-	-
Stage 2	914	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.9	0	0.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	750	1387	-
HCM Lane V/C Ratio	-	-	0.017	0.002	-
HCM Control Delay (s)	-	-	9.9	7.6	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	5	557	567	30	520	763
Future Volume (vph)	5	557	567	30	520	763
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.88	0.95	0.95	1.00	0.95
Frt		0.850	0.992			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1770	2787	3544	0	1787	3539
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1770	2787	3544	0	1787	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		176	7			
Link Speed (mph)	30		30			30
Link Distance (ft)	500		600			500
Travel Time (s)	11.4		13.6			11.4
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	1%	2%	1%	2%
Adj. Flow (vph)	5	574	585	31	536	787
Shared Lane Traffic (%)						
Lane Group Flow (vph)	5	574	616	0	536	787
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						

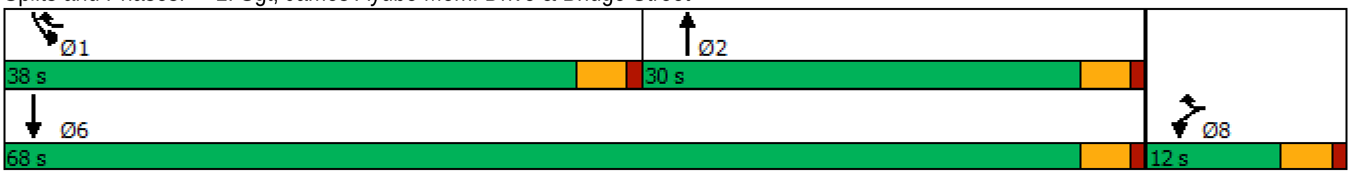
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Minimum Initial (s)	8.0		10.0		10.0	10.0
Minimum Split (s)	12.0		14.0		14.0	14.0
Total Split (s)	12.0		30.0		38.0	68.0
Total Split (%)	15.0%		37.5%		47.5%	85.0%
Maximum Green (s)	8.0		26.0		34.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		None		None	Min
Act Effct Green (s)	8.4	36.8	17.4		24.2	45.8
Actuated g/C Ratio	0.13	0.59	0.28		0.39	0.73
v/c Ratio	0.02	0.34	0.62		0.78	0.30
Control Delay	30.6	5.4	23.2		25.8	2.9
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	30.6	5.4	23.2		25.8	2.9
LOS	C	A	C		C	A
Approach Delay	5.6		23.2			12.2
Approach LOS	A		C			B
90th %ile Green (s)	8.0		25.6		34.0	63.6
90th %ile Term Code	Max		Gap		Max	Hold
70th %ile Green (s)	8.0		21.3		31.6	56.9
70th %ile Term Code	Max		Gap		Gap	Hold
50th %ile Green (s)	8.0		17.0		24.9	45.9
50th %ile Term Code	Max		Gap		Gap	Hold
30th %ile Green (s)	8.0		14.3		19.6	37.9
30th %ile Term Code	Max		Gap		Gap	Hold
10th %ile Green (s)	8.0		10.4		13.6	28.0
10th %ile Term Code	Max		Gap		Gap	Hold
Queue Length 50th (ft)	2	34	104		165	36
Queue Length 95th (ft)	13	80	180		327	50
Internal Link Dist (ft)	420		520			420
Turn Bay Length (ft)						
Base Capacity (vph)	236	2163	1546		1017	3314
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.02	0.27	0.40		0.53	0.24

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 62.5
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.78

Intersection Signal Delay: 13.4
Intersection LOS: B
Intersection Capacity Utilization 62.1%
ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 79.6
70th %ile Actuated Cycle: 72.9
50th %ile Actuated Cycle: 61.9
30th %ile Actuated Cycle: 53.9
10th %ile Actuated Cycle: 44

Splits and Phases: 1: Sgt, James Ayube Mem. Drive & Bridge Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	3	11	332	2	23	10	568	278	33	702	33
Future Volume (vph)	6	3	11	332	2	23	10	568	278	33	702	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	75		0	200		200
Storage Lanes	0		0	0		1	1		0	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	0.95
Frt		0.926				0.850		0.951			0.993	
Flt Protected		0.985			0.953		0.950			0.950		
Satd. Flow (prot)	0	1651	0	0	1775	1615	1805	3399	0	1805	3518	0
Flt Permitted		0.916			0.713		0.950			0.950		
Satd. Flow (perm)	0	1536	0	0	1328	1615	1805	3399	0	1805	3518	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11				51		131			7	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		250			500			500			320	
Travel Time (s)		5.7			11.4			11.4			7.3	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	9%	2%	0%	0%	0%	1%	1%	0%	2%	0%
Adj. Flow (vph)	6	3	11	342	2	24	10	586	287	34	724	34
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	344	24	10	873	0	34	758	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2		1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100		20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0		0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	

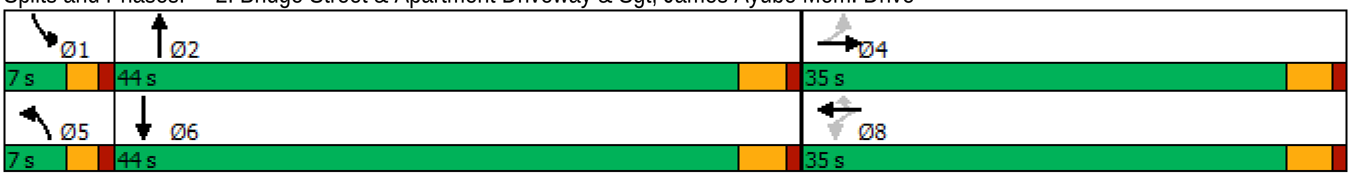
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8		8						
Detector Phase	4	4		8	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0	7.0	4.0	10.0		4.0	10.0	
Minimum Split (s)	11.0	11.0		11.0	11.0	11.0	7.0	14.0		7.0	14.0	
Total Split (s)	35.0	35.0		35.0	35.0	35.0	7.0	44.0		7.0	44.0	
Total Split (%)	40.7%	40.7%		40.7%	40.7%	40.7%	8.1%	51.2%		8.1%	51.2%	
Maximum Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	40.0		4.0	40.0	
Yellow Time (s)	3.0	3.0		3.0	3.0	3.0	2.0	3.0		2.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		4.0			4.0	4.0	3.0	4.0		3.0	4.0	
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None	None	None	Min		None	Min	
Act Effct Green (s)		19.8			19.8	19.8	4.6	21.2		4.6	22.2	
Actuated g/C Ratio		0.38			0.38	0.38	0.09	0.41		0.09	0.43	
v/c Ratio		0.03			0.68	0.04	0.06	0.60		0.22	0.50	
Control Delay		9.8			23.5	1.8	32.6	13.2		34.4	12.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		9.8			23.5	1.8	32.6	13.2		34.4	12.9	
LOS		A			C	A	C	B		C	B	
Approach Delay		9.8			22.1			13.5			13.9	
Approach LOS		A			C			B			B	
90th %ile Green (s)	31.0	31.0		31.0	31.0	31.0	4.0	32.4		4.0	32.4	
90th %ile Term Code	Hold	Hold		Max	Max	Max	Max	Gap		Max	Hold	
70th %ile Green (s)	25.3	25.3		25.3	25.3	25.3	0.0	26.3		4.0	33.3	
70th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Max	Hold	
50th %ile Green (s)	19.9	19.9		19.9	19.9	19.9	0.0	21.2		0.0	21.2	
50th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
30th %ile Green (s)	13.9	13.9		13.9	13.9	13.9	0.0	15.2		0.0	15.2	
30th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
10th %ile Green (s)	10.1	10.1		10.1	10.1	10.1	0.0	11.1		0.0	11.1	
10th %ile Term Code	Hold	Hold		Gap	Gap	Gap	Skip	Gap		Skip	Hold	
Queue Length 50th (ft)		1			75	0	3	76		9	76	
Queue Length 95th (ft)		16			228	6	20	199		45	191	
Internal Link Dist (ft)		170			420			420			240	
Turn Bay Length (ft)							75			200		
Base Capacity (vph)		1025			884	1091	158	2696		158	2763	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.02			0.39	0.02	0.06	0.32		0.22	0.27	

Intersection Summary

Area Type: Other
Cycle Length: 86
Actuated Cycle Length: 52.1

Natural Cycle: 45
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 15.1 Intersection LOS: B
Intersection Capacity Utilization 59.3% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 78.4
70th %ile Actuated Cycle: 66.6
50th %ile Actuated Cycle: 49.1
30th %ile Actuated Cycle: 37.1
10th %ile Actuated Cycle: 29.2

Splits and Phases: 2: Bridge Street & Apartment Driveway & Sgt, James Ayube Mem. Drive



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	152	118	473	115	129	490
Future Volume (vph)	152	118	473	115	129	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	150		0	130	
Storage Lanes	1	1		0	1	
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.974			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1787	1568	1821	0	1787	1863
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	1568	1821	0	1787	1863
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		128	22			
Link Speed (mph)	30		30			30
Link Distance (ft)	1800		500			500
Travel Time (s)	40.9		11.4			11.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	1%	3%	2%	0%	1%	2%
Adj. Flow (vph)	165	128	514	125	140	533
Shared Lane Traffic (%)						
Lane Group Flow (vph)	165	128	639	0	140	533
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (ft)	20	20	100		20	100
Trailing Detector (ft)	0	0	0		0	0
Detector 1 Position(ft)	0	0	0		0	0
Detector 1 Size(ft)	20	20	6		20	6
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(ft)			94			94
Detector 2 Size(ft)			6			6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Prot	pt+ov	NA		Prot	NA
Protected Phases	8	1 8	2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases						
Detector Phase	8	1 8	2		1	6
Switch Phase						
Minimum Initial (s)	7.0		10.0		5.0	10.0
Minimum Split (s)	11.0		14.0		9.0	14.0
Total Split (s)	26.0		58.0		10.0	68.0
Total Split (%)	27.7%		61.7%		10.6%	72.3%
Maximum Green (s)	22.0		54.0		6.0	64.0
Yellow Time (s)	3.0		3.0		3.0	3.0
All-Red Time (s)	1.0		1.0		1.0	1.0
Lost Time Adjust (s)	0.0		0.0		0.0	0.0
Total Lost Time (s)	4.0		4.0		4.0	4.0
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Recall Mode	None		Min		None	Min
Act Effct Green (s)	11.0	21.5	25.2		6.3	35.7
Actuated g/C Ratio	0.20	0.39	0.46		0.11	0.65
v/c Ratio	0.46	0.19	0.76		0.69	0.44
Control Delay	26.5	4.3	18.3		49.8	6.3
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	26.5	4.3	18.3		49.8	6.3
LOS	C	A	B		D	A
Approach Delay	16.8		18.3			15.3
Approach LOS	B		B			B
90th %ile Green (s)	16.8		41.0		6.0	51.0
90th %ile Term Code	Gap		Gap		Max	Hold
70th %ile Green (s)	12.7		30.1		6.0	40.1
70th %ile Term Code	Gap		Gap		Max	Hold
50th %ile Green (s)	10.5		24.9		6.0	34.9
50th %ile Term Code	Gap		Gap		Max	Hold
30th %ile Green (s)	8.8		19.8		6.0	29.8
30th %ile Term Code	Gap		Gap		Max	Hold
10th %ile Green (s)	7.0		14.1		6.0	24.1
10th %ile Term Code	Min		Gap		Max	Hold
Queue Length 50th (ft)	47	0	147		44	65
Queue Length 95th (ft)	122	33	298		#176	152
Internal Link Dist (ft)	1720		420			420
Turn Bay Length (ft)		150			130	
Base Capacity (vph)	750	754	1677		204	1805
Starvation Cap Reductn	0	0	0		0	0
Spillback Cap Reductn	0	0	0		0	0
Storage Cap Reductn	0	0	0		0	0
Reduced v/c Ratio	0.22	0.17	0.38		0.69	0.30

Intersection Summary

Area Type: Other
Cycle Length: 94
Actuated Cycle Length: 55.1

Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 16.8 Intersection LOS: B
Intersection Capacity Utilization 57.5% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 75.8
70th %ile Actuated Cycle: 60.8
50th %ile Actuated Cycle: 53.4
30th %ile Actuated Cycle: 46.6
10th %ile Actuated Cycle: 39.1
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Bridge Street & Webb Street

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	18	120	87	109	246	1	44	9	15	0	37	49
Future Volume (vph)	18	120	87	109	246	1	44	9	15	0	37	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		100	0		0
Storage Lanes	0		0	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.948							0.850		0.923	
Flt Protected		0.996			0.985			0.960				
Satd. Flow (prot)	0	1778	0	0	1840	0	0	1824	1615	0	1739	0
Flt Permitted		0.966			0.853							
Satd. Flow (perm)	0	1724	0	0	1594	0	0	1900	1615	0	1739	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		67							18		52	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1800			850			500			500	
Travel Time (s)		40.9			19.3			11.4			11.4	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	1%	1%	1%	2%	0%	0%	0%	0%	0%	2%	0%
Adj. Flow (vph)	19	126	92	115	259	1	46	9	16	0	39	52
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	237	0	0	375	0	0	55	16	0	91	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm		NA	
Protected Phases		4			8			2			6	

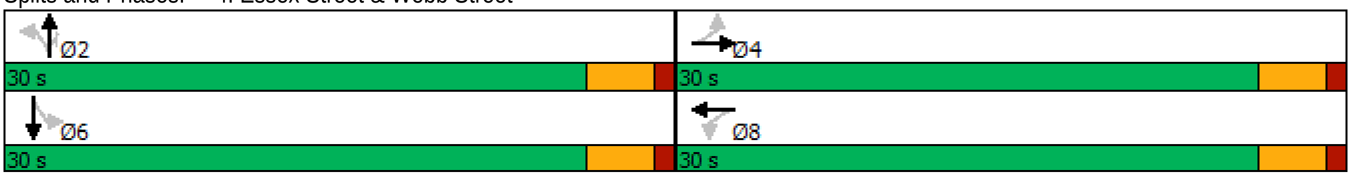
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		7.0	7.0	7.0	7.0	7.0	
Minimum Split (s)	14.0	14.0		14.0	14.0		11.0	11.0	11.0	11.0	11.0	
Total Split (s)	30.0	30.0		30.0	30.0		30.0	30.0	30.0	30.0	30.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	50.0%	50.0%	50.0%	
Maximum Green (s)	26.0	26.0		26.0	26.0		26.0	26.0	26.0	26.0	26.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0	0.0		0.0	
Total Lost Time (s)		4.0			4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min		Min	Min		None	None	None	None	None	
Act Effct Green (s)		22.0			22.0			7.7	7.7		7.7	
Actuated g/C Ratio		0.79			0.79			0.28	0.28		0.28	
v/c Ratio		0.17			0.30			0.10	0.03		0.17	
Control Delay		2.9			4.3			8.6	5.2		5.8	
Queue Delay		0.0			0.0			0.0	0.0		0.0	
Total Delay		2.9			4.3			8.6	5.2		5.8	
LOS		A			A			A	A		A	
Approach Delay		2.9			4.3			7.9			5.8	
Approach LOS		A			A			A			A	
90th %ile Green (s)	17.3	17.3		17.3	17.3		8.8	8.8	8.8	8.8	8.8	
90th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
70th %ile Green (s)	12.8	12.8		12.8	12.8		7.3	7.3	7.3	7.3	7.3	
70th %ile Term Code	Hold	Hold		Gap	Gap		Gap	Gap	Gap	Hold	Hold	
50th %ile Green (s)	14.1	14.1		14.1	14.1		0.0	0.0	0.0	0.0	0.0	
50th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
30th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
30th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
10th %ile Green (s)	25.0	25.0		25.0	25.0		0.0	0.0	0.0	0.0	0.0	
10th %ile Term Code	Dwell	Dwell		Dwell	Dwell		Skip	Skip	Skip	Skip	Skip	
Queue Length 50th (ft)		0			0			2	0		1	
Queue Length 95th (ft)		34			74			23	7		24	
Internal Link Dist (ft)		1720			770			420			420	
Turn Bay Length (ft)									100			
Base Capacity (vph)		1552			1428			1702	1449		1563	
Starvation Cap Reductn		0			0			0	0		0	
Spillback Cap Reductn		0			0			0	0		0	
Storage Cap Reductn		0			0			0	0		0	
Reduced v/c Ratio		0.15			0.26			0.03	0.01		0.06	

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 27.7

Natural Cycle: 40
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.30
Intersection Signal Delay: 4.4
Intersection LOS: A
Intersection Capacity Utilization 51.2%
ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 34.1
70th %ile Actuated Cycle: 28.1
50th %ile Actuated Cycle: 18.1
30th %ile Actuated Cycle: 29
10th %ile Actuated Cycle: 29

Splits and Phases: 4: Essex Street & Webb Street



Intersection	
Int Delay, s/veh	2.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	7	0	18	87	19	99	0	0	214	2
Future Vol, veh/h	0	0	7	0	18	87	19	99	0	0	214	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	88	88	88	88	88	88	88	88	88	88	88	88
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	2	0
Mvmt Flow	0	0	8	0	20	99	22	113	0	0	243	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	461	401	244	405	402	113	245	0	-	-	-	0
Stage 1	244	244	-	157	157	-	-	-	-	-	-	-
Stage 2	217	157	-	248	245	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	-	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	-	-	-
Pot Cap-1 Maneuver	514	541	800	560	540	945	1333	-	0	0	-	-
Stage 1	764	708	-	850	772	-	-	-	0	0	-	-
Stage 2	790	772	-	760	707	-	-	-	0	0	-	-
Platoon blocked, %								-			-	-
Mov Cap-1 Maneuver	440	531	800	547	530	945	1333	-	-	-	-	-
Mov Cap-2 Maneuver	440	531	-	547	530	-	-	-	-	-	-	-
Stage 1	750	708	-	835	758	-	-	-	-	-	-	-
Stage 2	676	758	-	752	707	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.5	10	1.2	0
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	WBLn1	WBLn2	SBT	SBR
Capacity (veh/h)	1333	-	800	-	833	-	-
HCM Lane V/C Ratio	0.016	-	0.01	-	0.143	-	-
HCM Control Delay (s)	7.7	0	9.5	0	10	-	-
HCM Lane LOS	A	A	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0	-	0.5	-	-

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	4	0	0	0	0	0	144	101	0	0	0	0
Future Vol, veh/h	4	0	0	0	0	0	144	101	0	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	1	0	0	0	0
Mvmt Flow	4	0	0	0	0	0	152	106	0	0	0	0

Major/Minor	Minor2			Minor1			Major1		
Conflicting Flow All	410	410	-	-	410	106	0	0	0
Stage 1	0	0	-	-	410	-	-	-	-
Stage 2	410	410	-	-	0	-	-	-	-
Critical Hdwy	7.1	6.5	-	-	6.5	6.2	4.1	-	-
Critical Hdwy Stg 1	-	-	-	-	5.5	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	-	-	4	3.3	2.2	-	-
Pot Cap-1 Maneuver	556	534	0	0	534	954	-	-	-
Stage 1	-	-	0	0	599	-	-	-	-
Stage 2	623	599	0	0	-	-	-	-	-
Platoon blocked, %								-	-
Mov Cap-1 Maneuver	556	534	-	-	534	954	-	-	-
Mov Cap-2 Maneuver	556	534	-	-	534	-	-	-	-
Stage 1	-	-	-	-	599	-	-	-	-
Stage 2	623	599	-	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	11.5	0	
HCM LOS	B	A	

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1
Capacity (veh/h)	-	-	-	556	-
HCM Lane V/C Ratio	-	-	-	0.008	-
HCM Control Delay (s)	-	-	-	11.5	0
HCM Lane LOS	-	-	-	B	A
HCM 95th %tile Q(veh)	-	-	-	0	-

Intersection	
Int Delay, s/veh	2.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	75	0	171	15	1	141
Future Vol, veh/h	75	0	171	15	1	141
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	88	88	88	88	88	88
Heavy Vehicles, %	2	2	1	2	2	2
Mvmt Flow	85	0	194	17	1	160

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	365	203	0	0	211	0
Stage 1	203	-	-	-	-	-
Stage 2	162	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	635	838	-	-	1360	-
Stage 1	831	-	-	-	-	-
Stage 2	867	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	634	838	-	-	1360	-
Mov Cap-2 Maneuver	634	-	-	-	-	-
Stage 1	831	-	-	-	-	-
Stage 2	866	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.6	0	0.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	634	1360	-
HCM Lane V/C Ratio	-	-	0.134	0.001	-
HCM Control Delay (s)	-	-	11.6	7.6	0
HCM Lane LOS	-	-	B	A	A
HCM 95th %tile Q(veh)	-	-	0.5	0	-

Attachment J

RELEASE TRACKING NUMBER SUMMARY AND PLAN

Table 1 - Summary of Release Tracking Numbers (RTNs) for Salem Harbor Power Station

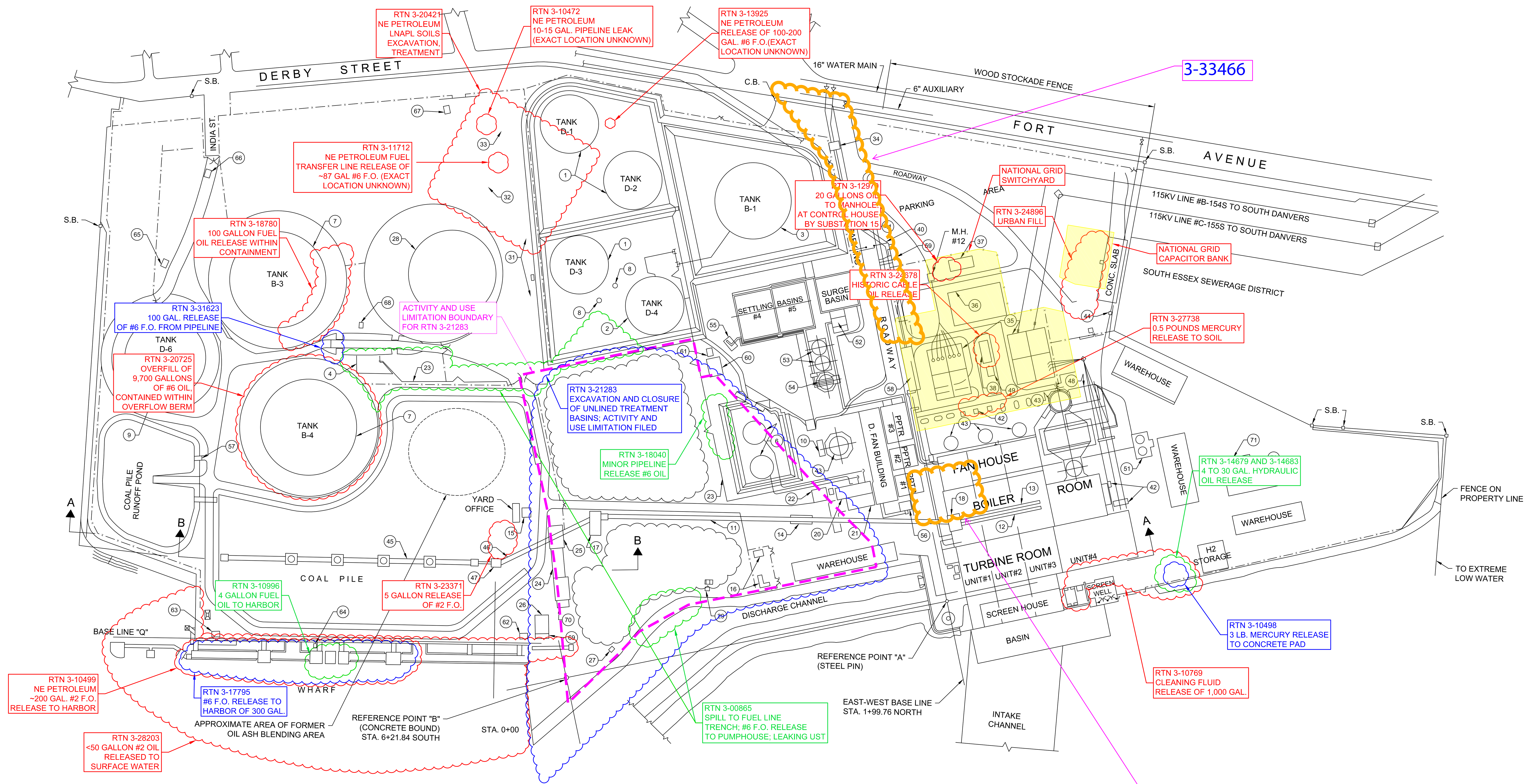
RTN ID	Release Summary and Response Actions	Achieved Regulatory Closure?
3-00865	RTN assigned due to 3 separate releases as follows: the identification of petroleum contaminated soil during the removal of a 275 gallon UST on 10/26/1988 (Spill #N88-168); the release of oil in a fuel line trench on 10/26/1988 (Spill N#88-1809); and the release of approx. 6,000 gallons of #6 fuel oil in the pump house due to a ruptured pump transfer gauge on 12/2/1988. Response actions included product recovery and excavation of impacted soils. A Risk Assessment indicated a condition of No Significant Risk.	Yes - Class A-2 RAO (1997)
3-0010472	On January 24, 1994 a release of approximately 10 to 15 gallons of Number 2 fuel oil was discovered at 25 Derby Street (Northeast Petroleum/Cargill). A coupling between an out of service pipeline and valve became disconnected and leaked fuel oil onto ice and snow beneath. Four 55-gallon drums of oil-impacted snow and ice were collected for recycling at the Station. Soils beneath the snow and ice were not impacted; therefore no soil samples were collected.	Yes - Class A-1 RAO (1994)
3-10498	A release of approximately 3 pounds (1 cup) of mercury to a roll-off container and concrete pad occurred on 1/29/1994. The release was due to ruptured mercury-containing flow meters which had been deposited into a roll-off container for recycling. Immediate Response Actions consisted of the removal of mercury-contaminated materials from within the roll-off container, the collection of contaminated ice from the concrete pad, and the cleaning of residual mercury from the container and concrete pad using a zinc powder. Confirmatory sampling found that contamination had been reduced to background levels.	Yes - Class A-1 RAO (1994)
3-10499	A release of approximately 200 gallons of Number 2 fuel oil to Salem Harbor occurred on February 1, 1994 during a fuel delivery for Northeast Petroleum from a barge. Static head in the barge off-loading hose resulted in the contents of the hose (approximately 200 gallons) overflowing into the Harbor as the barge prepared to unload at the dock. Clean Harbors set up a containment boom and absorbent booms and skimmed approximately 570 gallons of oil-impacted water using a vactor truck. The spent booms were drummed and disposed off-site. All visible oil was recovered, and no continuing impacts to the Harbor were observed.	Yes - Class A-1 RAO (1994)
3-10769	A release of approximately 1,000 gallons of acidic cleaning fluid containing hydrochloric acid and thiourea occurred on 3/27/1994. The release occurred from a drain line during cleaning/maintenance of the Unit 4 boiler. The release impacted pavement outside the building exterior and partly (up to 500 gallons) reached Salem Harbor. Response actions included the application of soda ash to neutralize the acid on the pavement, and the subsequent recovery of cleaning solution. Surface water within the Salem Harbor was treated with an anti-foaming agent to mitigate a foam layer that had developed. A Risk Assessment indicated a condition of No Significant Risk.	Yes - Class A-1 RAO (1994)
3-10996	A release of approximately 4 gallons of #6 fuel oil to the Harbor from a fuel tanker docked at the Salem Harbor Station on 5/13/1994. Fuel was released from the supply line manifold upon completion of an oil delivery. The release was contained using booms, and product recovery was conducted using a vacuum truck. Impacted surfaces were cleaned with absorbent pads and steam cleaned.	Yes - Class A-1 RAO (1994)
3-11712	On October 8, 1994 a leaking gasket on a fuel transfer line released approximately 87 gallons of Number 6 fuel oil at 25 Derby Street, the area of the Site leased by Northeast Petroleum/Cargill. The release occurred at the Enhanced Fuel Trailer of Dike Area D3 and D4, and overflowed into the trailer's steel secondary containment box. Clean Harbors responded, collecting the oil with absorbents and cleaning the secondary containment box. Recovered oil and absorbents were placed into two 55-gallon drums for disposal. The spill was confined to the steel secondary containment box, therefore no samples were collected.	Yes - Class A-1 RAO (1994)
3-12970	A release of approximately 100 gallons of PCB-containing transformer oil was discovered on 9/25/1995 during an inspection of pad-mounted transformers located in an underground vault at Substation #15. Most of the contents of Transformer #2 had been released to its containment vault, and had mixed with water accumulated in the vault. Approx. 10-20 gallons of the oil-water mixture had migrated through the subsurface conduit to the Control House basement and was discharged by a sump pump to a 3 foot by 24 foot area of crushed stone adjacent to the Control House. Oil-impacted soils adjacent to the Control House were removed, along with the oil-water mixture from the containment vault. Confirmatory soil samples were consistent with background conditions.	Yes - Class A-1 RAO (1995)
3-13925	A release of 100 to 200 gallons of Number 6 fuel oil occurred during filling of a tanker truck on June 26, 1996. The release occurred at 25 Derby Street, the area of the Site leased by Northeast Petroleum/Cargill. Clean Harbors responded, and used absorbent materials, pads and booms to contain the release and clean the pavement. Approximately 179 gallons of Number 6 fuel oil was recovered into a vacuum truck and sixteen 55-gallon drums of absorbent materials were collected. The release was confined to the pavement; therefore, no samples were collected.	Yes - Class A-1 RAO (1996)

Table 1 - Summary of Release Tracking Numbers (RTNs) for Salem Harbor Power Station

RTN ID	Release Summary and Response Actions	Achieved Regulatory Closure?
3-14679	A release of approximately 30 gallons of hydraulic oil from a trash compactor occurred on 1/2/1997. Hydraulic oil was released to the concrete pad beneath the compactor, asphalt pavement, a chain link fence and rip rap stone at the edge of Cat Cove. Response actions included the removal of oil-impacted snow, recovery of hydraulic oil using oil absorbent materials and the excavation of oil-impacted soil. 7 to 10 @ 55 gallon drums of contaminated soil and debris were disposed off-site. Confirmatory soil samples indicated that the cleanup was complete.	Yes - Class A-1 RAO (1997)
3-14683	A release of hydraulic oil from a trash compactor occurred on 1/2/1997. This release is related to RTN 3-14679; however, it was assigned a separate RTN due to oil-impacted melt water resulting in a sheen on surface water of the Salem Harbor. A Class A-1 RAO was filed on 1/14/1997 indicating regulatory closure.	Yes - Class A-1 RAO (1997)
3-17795	A release of approximately 300 gallons of #6 fuel oil occurred during fuel transfer from a fuel delivery barge on 12/28/1998. Fuel oil was released to the barge, dock and Salem Harbor. Response actions included removal of fuel oil from the Harbor using a vacuum truck and oil absorbent materials. Visual monitoring of the Harbor was conducted through April 1998 and no additional sheens on surface water were observed.	Yes - Class A-1 RAO (1999)
3-18040	A small leak of #6 fuel oil from a 16-inch transfer pipeline from an on-site AST was discovered on 2/26/1999. The leaking pipe was repaired on 3/5/1999. Response actions included the excavation of contaminated soil that was observed near the pipeline. A total of 12 drums of oil-impacted soils were disposed off-site. Confirmatory soil sampling indicated that the cleanup was complete.	Yes - Class A-1 RAO (1999)
3-18780	A release of approximately 100 gallons of #2 fuel oil occurred during a hydrostatic test of oil transfer lines on 9/22/1999. During the test, one of the oil lines for Tank B-3 failed resulting in the release of #2 fuel oil within the secondary containment area. Approximately 200 tons of petroleum impacted soil was excavated and disposed off-site from within the secondary containment area. Confirmatory soil sampling indicated that the cleanup was complete.	Yes - Class A-1 RAO (2000)
3-20421	Release reported due to the discovery on 2/22/2001 of 0.72 inches (0.06 feet) of light non-aqueous phase liquid (LNAPL) in a monitoring well located on a portion of the Station property that was previously operated by Northeast Petroleum as a fuel oil storage and distribution facility. Preliminary response actions included the removal of 94 cubic yards of #2 fuel oil-impacted soils and the application of oxygen releasing compound to assist with biodegradation of petroleum hydrocarbons. Vacuum enhanced LNAPL recovery (bioslurping) and a dual-phase extraction (DPE) system were also completed as part of remediation activities. Post-remediation sampling has confirmed that LNAPL is no longer present and a Risk Assessment concluded that a condition of No Significant Risk exists.	Yes - Class A-2 RAO (2009)
3-20725	A release of approximately 9,700 gallons of #6 fuel oil occurred at aboveground Tank B-4 during filling of nearby Tank D-6 on 5/21/2001. The release impacted soil within the containment area surrounding Tank B-4. Pumpable, separate-phase #6 fuel oil was removed from within the containment area, along with approximately 124 cubic yards of oil-impacted soil. Impacted tank insulation material was also cleaned using absorbent pads. Following the completion of cleanup activities and subsequent soil sampling, a Risk Characterization indicated a condition of No Significant Risk.	Yes - Class A-2 RAO (2002)
3-21283	A release of metals to soil and groundwater was identified in four former unlined wastewater treatment system (WWTS) basins and former Windrow Storage Area. Contamination was attributed to former on-site settling of oil ash, coal fly ash, bottom ash, coal pile runoff, neutralized rinse water from a make-up demineralizer, wash water, floor and equipment drains and storm water since approximately 1968. Remediation was conducted in conjunction with an Administrative Consent Order issued by DEP (ACO-BO-00-2002). Approximately 15,200 tons of WWTS solids were dredged, dewatered and disposed off-site. The basins were subsequently backfilled with clean fill, and metals concentrations in groundwater were monitored. At the time of the RAO in 2007, most metals concentrations in groundwater were at or near background levels. Vanadium, the primary COC in groundwater was below UCLs. A Risk Assessment concluded that a condition of No Significant Risk exists with the implementation of an Activity and Use Limitation (AUL) designed to restrict the Site to non-residential uses and protect future construction workers from elevated vanadium concentrations in groundwater.	Yes - Class A-3 RAO (2007) with AUL

Table 1 - Summary of Release Tracking Numbers (RTNs) for Salem Harbor Power Station

RTN ID	Release Summary and Response Actions	Achieved Regulatory Closure?
3-23371	Release reported on 11/11/2003 due to a drip from an abandoned and drained aboveground pipeline that supplied #2 fuel oil from the dock to the former fuel storage area. The leak was repaired and approximately 16 cubic yards of impacted soils were removed. Confirmatory soil sampling indicated that the cleanup was complete. No surface or groundwater was impacted. The amount of the release was calculated as approximately 5.7 gallons, which is below the 10 gallon reportable quantity for a fuel oil release; therefore the release was retracted and deleted from the MassDEP State Site database.	Yes - Release Retracted (2004)
3-24678	Oil staining on a concrete pad supporting 6 aboveground cable oil reservoirs and surrounding trap rock was discovered in September 2004 in the switch yard. Release attributed to historic releases of cable oil. An approximately 400 square foot fenced area was impacted. Impacted surface soils were removed (6 CY). In September 2005, additional staining of the concrete pad was observed, suggesting that a leak of <10 gallons had occurred from a faulty reservoir cap. The extent of oil-impacted soil beneath the concrete pad could not be determined due to concerns regarding the integrity of the concrete foundation for the cable oil reservoirs. Impacts to groundwater were not identified. A Risk Assessment indicated a condition of No Significant Risk.	Yes - Class A-2 RAO (2008)
3-24896	During soil precharacterization in connection with planned construction activities in the northern expansion area, petroleum hydrocarbons were identified in soil above applicable standards, resulting in a 120-day reportable condition to the MassDEP. The source of contamination was attributed to urban fill materials. A Risk Assessment indicated a condition of No Significant Risk.	Yes - Class B-1 RAO (2005)
3-27738	A historic release of <0.5 pounds of liquid-phase mercury to the concrete pad of an electrical transformer (Transformer 1, Bank C) was discovered on 2/21/2008. Mercury was recovered from the concrete surface, and mercury-impacted trap rock adjacent to the foundation and soil beneath the trap rock were excavated and approx. 27 CY of impacted soil and trap rock were disposed off-site. The area of impact was approximately 10 feet by 8 feet by 7.5 feet deep. Confirmatory soil sampling was conducted to determine the extent of the excavation. A Risk Assessment indicated a condition of No Significant Risk.	Yes - Class A-2 RAO (2008)
3-28203	A release of approximately 10 to 50 gallons of #2 fuel oil from a leak in an inactive, out-of-service fuel oil pipeline was discovered on 12/11/2008. The fuel oil flowed into a concrete-lined pipeline pit and pipe trench and discharged to surface water in the Salem Harbor, resulting in a sheen. Oil, oily solids, and debris were removed from the concrete pipe trench and a containment boom was deployed in the Salem Harbor. Approx. 3,425 gallons of oily water and 16 cubic yards of oily pads, booms and debris were disposed off-site. Soil excavation and/or sampling was not conducted since background conditions were achieved and there is no continuing source.	Yes - Class A-1 RAO (2009)
3-31327	Extensive Site-wide assessment identified releases attributable to historic power generating activities and use, storage and transfer of oil. On 1/10/2013, DEP was notified of the 120-day reportable condition relative to metals (primarily arsenic, cadmium, lead, nickel and vanadium), polycyclic aromatic hydrocarbons (PAHs), and to a lesser extent VOCs, petroleum hydrocarbons and petroleum related VOCs. Impacts appear limited to soil. Areas of concern include: (1) Former oil ash blending area where oil ash was previously blended with coal in the area of the existing coal storage stockpile. COCs include metals (particularly nickel and vanadium) and to a lesser extent PAHs and EPH compounds. (2) Southwesterly urban fill area where elevated concentrations of arsenic, lead, nickel, vanadium and PAHs were identified likely due to historic filling. (3) Northeasterly portion of the Site where elevated nickel and vanadium concentrations and PAHs may be due to fill containing fossil fuel combustion residuals. A RAM Plan is being developed for the proposed remediation of impacted soils.	No - MCP Phase I - ISI & Tier Classification due 1/10/2014
3-31623	Release of approximately 100 gallons of Number 6 fuel oil was discovered on 7/1/2013. The release was caused by a pinhole leak in a fuel oil transfer line between two ASTs (B-3 and B-4), and resulted in oil impacts to soils in a pipe trench located beneath the transfer lines. Response actions included use of clean sand to absorb the spilled oil, and manual excavation of petroleum impacted soil sand crushed stone up to 2 feet beneath the piping. Confirmatory sampling found that oil was contained within the immediate area of the release. Approximately 40 tons of remediation waste were shipped off-site. This fuel oil release occurred within an area of previously identified petroleum impacts associated with RTN 3-0865. IRA activities have been completed and an RAO is being prepared to achieve regulatory closure.	No - RAO in preparation



1	TANKS D-1, D-2, D-3 72010 BBLS. EACH,	WASTEWATER TREATMENT
2	TANK D-4, 72010 BBLS. EACH, SPARE	
3	TANK B-1 143200 BBLS., BUNKER FUEL OIL	
4	FUEL OIL SUPPLY PUMP HOUSE	
5		
6	SERVICE TANKS S-1 & S-2 8060 BBLS. EACH	
7	TANK B-3, B-4 223-800 BBLS. BUNKER FUEL OIL	
8	TANK KEROSENE 10,000 GAL	
9	TANK D-6 200 000 BBLS. COMMERCIAL FUEL OIL	
10	GEMS ENCLOSURE	
11	36" CONVEYOR "E" CAPACITY 650 TONS / HOUR	
12	36" CONVEYOR "F" CAPACITY 650 TONS / HOUR	
13	36" CONVEYOR "F-1" CAPACITY 650 TONS / HOUR	
14	C.O.S. SUB STATION BUILDING	
15	JUNCTION HOUSE A-B	
16	C02 STORAGE BLDG. AND HYDROGEN STORAGE SLAB	
17	BREAKER HOUSE	
18	JUNCTION HOUSE E-F-F1	
19	COAL BUNKERS.	CAPACITY:-UNIT #1-1870 TONS, UNIT #2-2070 TONS, UNIT #3-3000 TONS. (40CU. FT. = 1 TON)
20	FOAM PUMP HOUSE	
21	FOAM HOUSE	
22	METAL GARAGE	
23	FUEL OIL LINE	
24	DOZER STORAGE (STORAGE HOUSE)	
25	CHANGE HOUSE	
26	BOAT STORAGE (MACHINE SHOP)	
27	ENVIRONMENTAL MONITORING EQUIPMENT BLDG.	

28	
29	CHANNEL WATER SAMPLING BLDG. AND WASTEWATER METERING
30	
31	LOADING RACKS - REMOVED
32	LOADING RACK - REMOVED
33	OFFICE - REMOVED
34	GATE HOUSE
35	115KV BUS STRUCTURE
36	23KV BUS STRUCTURE
37	4160V BUS STRUCTURE
38	RELAY HOUSE
39	
40	8" CITY WATER
41	8" FIRE MAIN
42	TRANSFORMERS 14.4 / 23 / 115KV
43	STACKS
44	WATER METER PIT
45	48" CONVEYOR "T" CAPACITY 650 TONS / HOUR
46	48" CONVEYOR "U" CAPACITY 650 TONS / HOUR
47	JUNCTION HOUSE T-U
48	UNIT #4 FLY ASH RECYCLE BUILDING
49	PUMP HOUSE - TRANSFORMER OIL
50	OIL PUMPS
51	ASH SILO STRUCTURE
52	ASH SLUICE PUMPHOUSE
53	HYDROBINS
54	FLY ASH SILO

55	TRUCK WASH
56	FLY ASH TRANSPORT AIR BUILDING
57	COAL PILE RUN OFF POND PUMPHOUSE
58	SWITCHGEAR BUILDING
59	SECURITY BUILDING
60	WASTEWATER STABILIZATION BUILDING
61	WASTEWATER TREATMENT ELECTRICAL ENCLOSURE
62	NORTH DOCK MOTOR CONTROL CENTER BUILDING
63	SOUTH DOCK MOTOR CONTROL CENTER BUILDING
64	DOCK OFFICE
65	TANK D6 PUMP CONTROL CENTER BUILDING
66	INDIA STREET WATER METERING BUILDING
67	DERBY STREET WATER METERING BUILDING
68	HEAT TRACE BUILDING
69	OIL SPILL SUPPLY STORAGE ROOM
70	LUBE OIL BULK STORAGE ROOM
71	CLEAN ASBESTOS TRAILER
72	DIRTY ASBESTOS TRAILER

LEGEND

ACTIVITY AND USE LIMITATION BOUNDARY

NATIONAL GRID SWITCHYARD AND CAPACITOR BANKS

APPROXIMATE RELEASE LOCATIONS

NOTES:
1. APPROXIMATE RELEASE LOCATION COLORS ARE FOR VISUAL CLARITY ONLY.

TETRA TECH
www.tetratech.com
1 Grant Street
Framingham, MA 01701

0 50 100 200
SCALE: 1" = 100'

MARK	DATE	DESCRIPTION	BY

SALEM HARBOR POWER STATION

FIGURE 1

MCP Release Tracking Number Locations

Project No.:
Designed By:
Drawn By:
Checked By:

6

Bar Measures 1 inch

12/30/2013 3:10:39 PM - P:\62117\127-62117-11001\CAD\SHEETFILES\FIGURE06.DWG - BLACK, JEFF