APPENDIX A
Agency Coordination

Connecticut Department of
Energy & Environmental Protection
Bureau of Natural Resources
Wildlife Division

CPPU USE ONLY
App #: _____
Doc #: _____
Check #: No fee required
Program: Natural Diversity Database Endangered Species
Hardcopy Electronic _____

Request for Natural Diversity Data Base (NDDB) State Listed Species Review

Please complete this form in accordance with the instructions (DEEP-INST-007) to ensure proper handling of your request.
There are no fees associated with NDDB Reviews.

Part I: Preliminary Screening & Request Type

Before submitting this request, you must review the most current Natural Diversity Data Base "State and Federal Listed Species and Significant Natural Communities Maps" found on the DEEP website. These maps are updated twice a year, usually in June and December.

Does your site, including all affected areas, fall in an NDDB Area according to the map instructions:

☒ Yes ☐ No **Enter the date** of the map reviewed for pre-screening: **December 2017**

This form is being submitted for a :

☒ *New* NDDB request ☐ *Renewal/Extension* of a NDDB Request, ***without*** *modifications and within* ***two years*** *of issued NDDB determination* (no attachments required) [*CPPU Use Only - NDDB-Listed Species Determination* # 1736]	☐ *New* **Safe Harbor Determination** (optional) must be associated with an application for a GP for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities ☐ *Renewal/Extension* of an existing Safe Harbor Determination ☐ With modifications ☐ Without modifications (no attachments required) [*CPPU Use Only - NDDB-Safe Harbor Determination* # 1736]
Enter NDDB Determination Number for Renewal/Extension:	Enter Safe Harbor Determination Number for Renewal/Extension:

Part II: Requester Information

If the requester is a corporation, limited liability company, limited partnership, limited liability partnership, or a statutory trust, it must be registered with the Secretary of State. If applicable, the name shall be stated **exactly as it is registered with the Secretary of State. Please note, for those entities registered with the Secretary of State, the registered name will be the name used by DEEP. This information can be accessed at the Secretary of the State's database CONCORD.* (www.concord-sots.ct.gov/CONCORD/index.jsp)

If the requester is an individual, provide the legal name (include suffix) in the following format: First Name; Middle Initial; Last Name; Suffix (Jr, Sr., II, III, etc.).

If there are any changes or corrections to your company/facility or individual mailing or billing address or contact information, please complete and submit the Request to Change company/Individual Information to the address indicated on the form.

1. Requester*

Company Name: **State of Connecticut Department of Housing**

Contact Name: **Hermia Delaire**

Address: **505 Hudson Street**

City/Town: **Hartford** State: **CT** Zip Code: **06106-7106**

Business Phone: **860-270-8149** ext.

E-mail: **Hermia.Delaire@ct.gov

**By providing this email address you are agreeing to receive official correspondence from the department, at this electronic address, concerning this request. Please remember to check your security settings to be sure you can receive emails from "ct.gov" addresses. Also, please notify the department if your e-mail address changes

a) Requester can best be described as:

☐ Individual ☐ Federal Agency ☒ State agency ☐ Municipality ☐ Tribal

☐ *business entity (* if a business entity complete i through iii):

i) Check type ☐ corporation ☐ limited liability company ☐ limited partnership ☐ limited liability partnership ☐ statutory trust ☐ Other:

ii) Provide Secretary of the State Business ID #: This information can be accessed at the Secretary of the State's database (CONCORD). (www.concord-sots.ct.gov/CONCORD/index.jsp)

iii) ☐ Check here if your business is **NOT** registered with the Secretary of State's office.

b) Acting as (Affiliation), pick one:

☐ Property owner ☐ Consultant ☐ Engineer ☐ Facility owner ☒ Applicant

☐ Biologist ☐ Pesticide Applicator ☐ Other representative:

2. List Primary Contact to receive Natural Diversity Data Base correspondence and inquiries, if different from requester.

Company Name: **Arcadis, U.S., Inc.**

Contact Person: **Jessica Denzler** Title: **Scientist I**

Mailing Address: **17-17 Route 208 North**

City/Town: **Fair Lawn** State: **NJ** Zip Code: **07410**

Business Phone: **201.398.4306** ext.

E-mail: **Jessica.Denzler@arcadis.com

Part III: Site Information

This request can only be completed for one site. A separate request must be filed for each additional site.

1. SITE NAME AND LOCATION

Site Name or Project Name: **Resilient Bridgeport: National Disaster Resilience and Rebuild by Design**

Town(s): **Bridgeport**

Street Address or Location Description:
South End of Bridgeport, CT. Approximate project area boundaries are Iranistan Avenue on the west, the Northeast Corridor railroad viaduct to the north, the Long Island Sound to the south, and the Pequonnock River to the east

Size in acres, or site dimensions: **Approx. 382 acres**

Latitude and longitude of the center of the site in decimal degrees (e.g., 41.23456 -71.68574):

Latitude: **41.16671** Longitude: **-73.18879**

Method of coordinate determination (check one):

☐ GPS ☒ Photo interpolation using CTECO map viewer ☐ Other (specify):

2a. Describe the current land use and land cover of the site.

Approximately 17.5% of the land cover within the project area is transportation right-of-way. Some of the more predominant land uses within the project area include parks and open spaces (Seaside Park), heavy industrial and utility uses (PSEG, UI, Emera), and institutional uses (Bridgeport University). The remaining land cover within the project area consists of a diverse distribution of single-family dwellings, multi-family dwellings, commercial establishments, mixed-use establishments, and vacant parcels.

b. Check all that apply and enter the size in acres or % of area in the space after each checked category.

☒ Industrial/Commercial 26%	☒ Residential 19.5%	☐ Forest _____
☐ Wetland _____	☒ Field/grassland 20%	☐ Agricultural _____
☐ Water _____	☐ Utility Right-of-way _____	
☒ Transportation Right-of-way 17.5%	☒ Other (specify): Mixed-use 17%	

Part IV: Project Information

1. PROJECT TYPE:

Choose Project Type: Land Protection, If other describe: _____

2. Is the subject activity limited to the maintenance, repair, or improvement of an existing structure within the existing footprint? ☐ Yes ☒ No If yes, explain.

Part IV: Project Information (continued)

3. Give a detailed description of the activity which is the subject of this request and describe the methods and equipment that will be used. Include a description of steps that will be taken to minimize impacts to any known listed species

   The proposed project aims to: 1) reduce the risk of acute and chronic flooding in the South End of Bridgeport; 2) provide the South End community with dry egress during flood events; and 3) educate the public about flood risks and sea level rise. These goals will be achieved through a combination of natural (green) and fortified (grey) infrastructure solutions. Measures may include raised streets, flood walls, landscaped berms, detention/retention features, pump systems, installation of new pipes, and other drainage improvements. The project also entails the construction of an educational community space, as well as the creation of a 2.5 acre stormwater park to accept runoff from upland streets.

   Construction of flood walls will require the use of excavation equipment, such as backhoes, to excavate the area for the flood wall foundation, stormwater park, new stormwater piping, and any relocated underground utilities. Sheet driving may be necessary to create a trench for excavation of the wall foundation area in the vicinity of existing utilities or structures. Impact pile driving may be necessary along the flood wall corridor to provide structural support for the wall foundation, or for certain flood wall configurations (I-walls) or seepage systems. Cranes may be used to install pre-cast flood wall panels atop the foundation, or for other construction, installation, and support operations. Raised street construction will include bringing in, grading and compacting fill, installing drainage structures, and installing pavements, surface treatments and outfit.

   If field surveys document the presence or potential presence of known listed species within the construction zone of influence (based on noise modeling), a number of mitigation measures may be employed, including: requiring the contractor to develop a Noise Control and Mitigation Plan based on proposed equipment and methods to document expected noise; construct localized three-sided enclosures with roofs around stationary equipment such as compressors and generators; require use of broadband alarms in lieu of pure tone alarms; maintain equipment with effective mufflers; require the use of silencers on combustion engines; line all truck beds and dumpsters with noise dampening material.

4. If this is a renewal or extension of an existing Safe Harbor request *with* modifications, explain what about the project has changed.

5. Provide a contact for questions about the project details if different from Part II primary contact.

Name: **Richard Gilmour**

Phone: **201.398.4327**

E-mail: **Richard.Gilmour@arcadis.com**

Part V: Request Requirements and Associated Application Types

Check *one* box from either Group 1, Group 2 *or* Group 3, indicating the appropriate category for this request.

Group 1. If you check one of these boxes, complete Parts I – VII of this form and submit the required attachments A and B.

- ☐ Preliminary screening was negative but an NDDB review is still requested
- ☐ Request regards a municipally regulated or unregulated activity (no state permit/certificate needed)
- ☐ Request regards a preliminary site assessment or project feasibility study
- ☐ Request relates to land acquisition or protection
- ☐ Request is associated with a *renewal* of an existing permit or authorization, with no modifications

Group 2. If you check one of these boxes, complete Parts I – VII of this form and submit required attachments A, B, *and* C.

- ☐ Request is associated with a *new* state or federal permit or authorization application or registration
- ☐ Request is associated with modification of an existing permit or other authorization
- ☐ Request is associated with a permit enforcement action
- ☐ Request regards site management or planning, requiring detailed species recommendations
- ☒ Request regards a state funded project, state agency activity, or CEPA request

☐ **Group 3.** If you are requesting a **Safe Harbor Determination**, complete Parts I-VII and submit required attachments A, B, and D. Safe Harbor determinations can only be requested if you are applying for a GP for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

If you are filing this request as part of a state or federal permit application(s) enter the application information below.

Permitting Agency and Application Name(s): _____

Related State DEEP Permit Number(s), if applicable: _____

State DEEP Enforcement Action Number, if applicable: _____

State DEEP Permit Analyst(s)/Engineer(s), if known: _____

Is this request related to a previously submitted NDDB request? ☐ Yes ☒ No

If yes, provide the previous NDDB Determination Number(s), if known: _____

Part VI: Supporting Documents

Check each attachment submitted as verification that *all* applicable attachments have been supplied with this request form. Label each attachment as indicated in this part (e.g., Attachment A, etc.) and be sure to include the requester's name, site name and the date. **Please note that Attachments A and B are required for all new requests and Safe Harbor renewals/extensions with modifications.** Renewals/Extensions with no modifications do not need to submit any attachments. Attachments C and D are supplied at the end of this form.

☒ Attachment A:	**Overview Map:** an 8 1/2" X 11" print/copy of the relevant portion of a USGS Topographic Quadrangle Map clearly indicating the exact location of the site.
☒ Attachment B:	**Detailed Site Map:** fine scaled map showing site boundary and area of work details on aerial imagery with relevant landmarks labeled. (Site and work boundaries in GIS [ESRI ArcView shapefile, in NAD83, State Plane, feet] format can be substituted for detailed maps, see instruction document)
☒ Attachment C:	**Supplemental Information, Group 2 requirement (attached, DEEP-APP-007C)** ☒ Section i: Supplemental Site Information and supporting documents ☒ Section ii: Supplemental Project Information and supporting documents
☐ Attachment D:	**Safe Harbor Report Requirements, Group 3 (attached, DEEP-APP-007D)**

Part VII: Requester Certification

The requester *and* the individual(s) responsible for actually preparing the request must sign this part. A request will be considered incomplete unless all required signatures are provided.

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of the individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief."

Hermia Delaire	**5/30/2018**
Signature of Requester (a typed name will substitute for a handwritten signature)	Date
Hermia Delaire	**CDBG-DR Program Director**
Name of Requester (print or type)	Title (if applicable)
Jessica Denzler	**5/23/2018**
Signature of Preparer (if different than above)	Date
Jessica Denzler	**Scientist I**
Name of Preparer (print or type)	Title (if applicable)

Note: Please submit the completed Request Form and all Supporting Documents to:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Or email request to: deep.nddbrequest@ct.gov

Attachment C: Supplemental Information, Group 2 requirement

Section i: Supplemental Site Information

1. Existing Conditions

Describe all natural and man-made features including wetlands, watercourses, fish and wildlife habitat, floodplains and any existing structures potentially affected by the subject activity. Such features should be depicted and labeled on the site plan that must be submitted. Photographs of current site conditions may be helpful to reviewers.

Wildlife is primarily confined to tree-lined streets, residential yards, and public parks and beaches. Habitat potential is restricted by the intense development and urbanization that characterizes much of the project area. Hardened riprap is common along the shoreline, and few examples of historic coastal habitat (e.g. intertidal wetland) remain. Seaside Park, which is directly bordered by the Long Island Sound, provides some foraging and nesting potential to seabirds, shorebirds, wading birds, and waterfowl. The southern end of the park is characterized by an expansive, but heavily utilized beach with a fragmented dune habitat. An assemblage of native trees and cultivars has been planted further inland, creating a limited urban forest canopy. Opportunistic mammals and bird species can be found within this urban forest habitat.

An additional type of habitat found within Bridgeport, CT is intertidal mudflat. Intertidal mudflats occur along the southwestern edge of the project area, largely as a result of historic wetland loss and modified sediment transport. These shallow, unvegetated environments function as a habitat for various benthic invertebrates; benthic invertebrates, in turn, serve as a food source for both resident and migratory birds, fish, and other animals. Since the bulk of project activities will occur inland of the study area's mudflats, little to no adverse impact is anticipated to the majority of this habitat.

Two small, freshwater ponds are located north of Tongue Point and are subject to considerable human influence/ management. The ponds appear man-made, and the surrounding area is characterized primarily by industrial activity. Limited freshwater emergent wetlands are also found at Tongue Point and are likewise subject to significant disturbance. Another aquatic feature, Cedar Creek Reach, is located just beyond the northwestern corner of the study area. As part of the proposed project, a currently unused outfall on the south shore of Cedar Creek Reach may be re-purposed to accept stormwater runoff.

A large portion of the South End of Bridgeport is identified as a special flood hazard area. Much of the project site falls within a 100-year floodplain (FEMA Zones VE and AE) and, as such, has a 1% or more annual chance of flooding. Only a small, central area is located in a FEMA designated Zone X, indicating minimal flood hazard. See attached figures showing flood zones, wetlands, and habitats.

☐ **Site Photographs (optional) attached**
☒ **Site Plan/sketch of existing conditions attached**

2. Biological Surveys

Has a biologist visited the site and conducted a biological survey to determine the presence of any endangered, threatened or special concern species ☐ Yes ☒ No

If yes, complete the following questions and submit any reports of biological surveys, documentation of the biologist's qualifications, and any NDDB survey forms.

Biologist(s) name: _____

Habitat and/or species targeted by survey: _____

Dates when surveys were conducted: _____

☐ **Reports of biological surveys attached**

☐ **Documentation of biologist's qualifications attached**

☐ **NDDB Survey forms for any listed species observations attached**

Section ii: Supplemental Project Information

1. Provide a schedule for all phases of the project including the year, the month and/or season that the proposed activitywill be initiated and the duration of the activity.

   Project construction is anticipated to span from April 2019 through September 2021.

2. Describe and quantify the proposed changes to existing conditions and describe any on-site or off-site impacts. In addition, provide an annotated site plan detailing the areas of impact and proposed changes to existingconditions.

   As stated earlier, project goals will be achieved through a combination of natural (green) and fortified (grey) infrastructure solutions, including raised streets, flood walls, landscaped berms, detention/retention features, pump systems, and others. The majority of project activities will take place in areas that are already heavily developed or industrialized. Thus, limited adverse impact is anticipated for existing natural resources (e.g. wetlands, urban forest canopy, etc.), with the exception of some tree disturbance at the east end of Seaside Park. Moreover, project measures like bioswale creation will introduce additional vegetation to the area, generating new habitat potential. Successful flood mitigation will likely aid in the preservation of existing habitat by minimizing runoff, coastal erosion, and combined sewer overflow (CSO) events. See attached site plan for greaterdetail.

   ☒ **Annotated Site Plan attached**

Attachment D: Safe Harbor Report Requirements

Submit a report, as Attachment D, that synthesizes and analyzes the information listed below. Those providing synthesis and analysis need appropriate qualifications and experience. A request for a safe harbor determination shall include:

1. **Habitat Description and Map(s), including GIS mapping overlays, of a scale appropriate for the site, identifying:**

    - wetlands, including wetland cover types;
    - plant community types;
    - topography;
    - soils;
    - bedrock geology;
    - floodplains, if any;
    - land use history; and
    - water quality classifications/criteria.

2. **Photographs** - The report should include photographs of the site taken from the ground and also all reasonably available aerial or satellite photographs and an analysis of such photographs.

3. **Inspection** - A visual inspection(s) of the site should be conducted, preferably when the ground is visible, and described in the report. This inspection can be helpful in confirming or further evaluating the items noted above.

4. **Biological Surveys** - The report should include all biological surveys of the site where construction activity will take place that are reasonably available to a registrant. A registrant shall notify the Department's Wildlife Division of biological studies of the site where construction activity will take place that a registrant is aware of but are not reasonably available to the registrant.

5. **Based on items #1 through 4 above, the report shall include a Natural Resources Inventory of the site of the construction activity.** This inventory should also include a review of reasonably available scientific literature and any recommendations for minimizing adverse impacts from the proposed construction activity on listed species or their associated habitat.

6. **In addition, to the extent the following is available at the time a safe harbor determination is requested, a request for a safe harbor determination shall include and assess:**

    - Information on Site Disturbance Estimates/Site Alteration information
    - Vehicular Use
    - Construction Activity Phasing Schedules, if any; and
    - Alteration of Drainage Patterns

ATTACHMENT A
Overview Map

Requester: Hermia Delaire, State of Connecticut Department of Housing
Site Name: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design
Date: 05.23.2018



USGS The National Map: National Boundaries Dataset, National Elevation Dataset, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; U.S. Census Bureau - TIGER/Line; HERE Road Data

Legend

Study Area

Study Area Boundary

0 1,000 2,000 3,000 4,000 Feet

Scale in feet

RESILIENT BRIDGEPORT

Figure | 1

ATTACHMENT B
Detailed Site Map

Requester: Hermia Delaire, State of Connecticut Department of Housing
Site Name: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design
Date: 05.23.2018



Scale in feet: 0 500 1,000 2,000 3,000 4,000 Feet

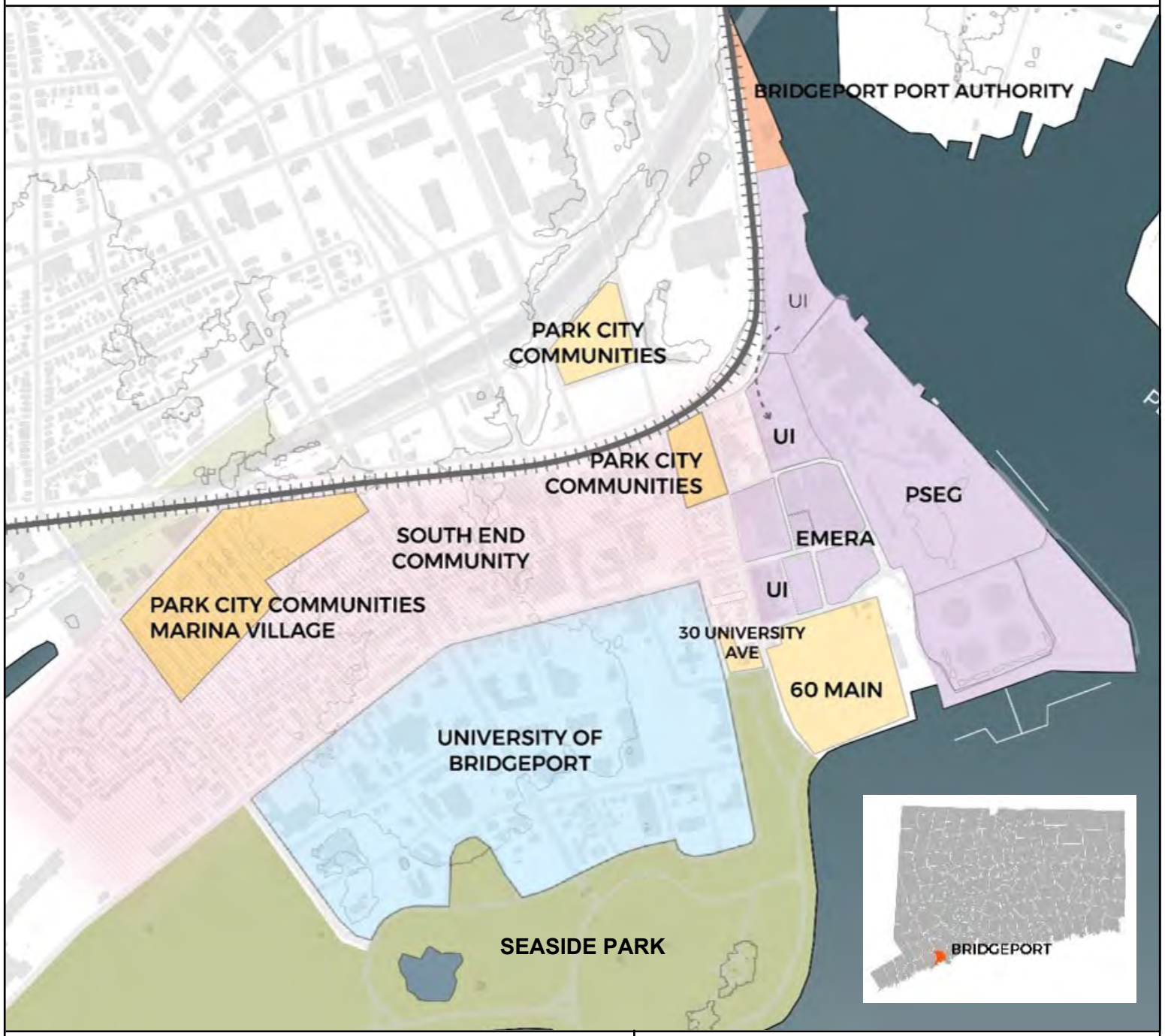
RESILIENT BRIDGEPORT

Figure | 2

ATTACHMENT C
Supplemental Information:
Existing Conditions

Requester: Hermia Delaire, State of Connecticut Department of Housing
Site Name: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design
Date: 05.23.2018

Resilient Bridgeport Land Use Conditions



RESILIENT BRIDGEPORT

Figure | 3

Mapped Shoreline Conditions



Data adapted from Connecticut 2002 Environmental Sensitivity Index. NOAA National Ocean Service, Office of Response and Restoration, Hazardous Materials Response Division and State of Connecticut, Department of Environmental Protection. 2004. Hartford, CT. Connecticut Department of Energy and Environmental Protection website. http://www.ct.gov/deep.

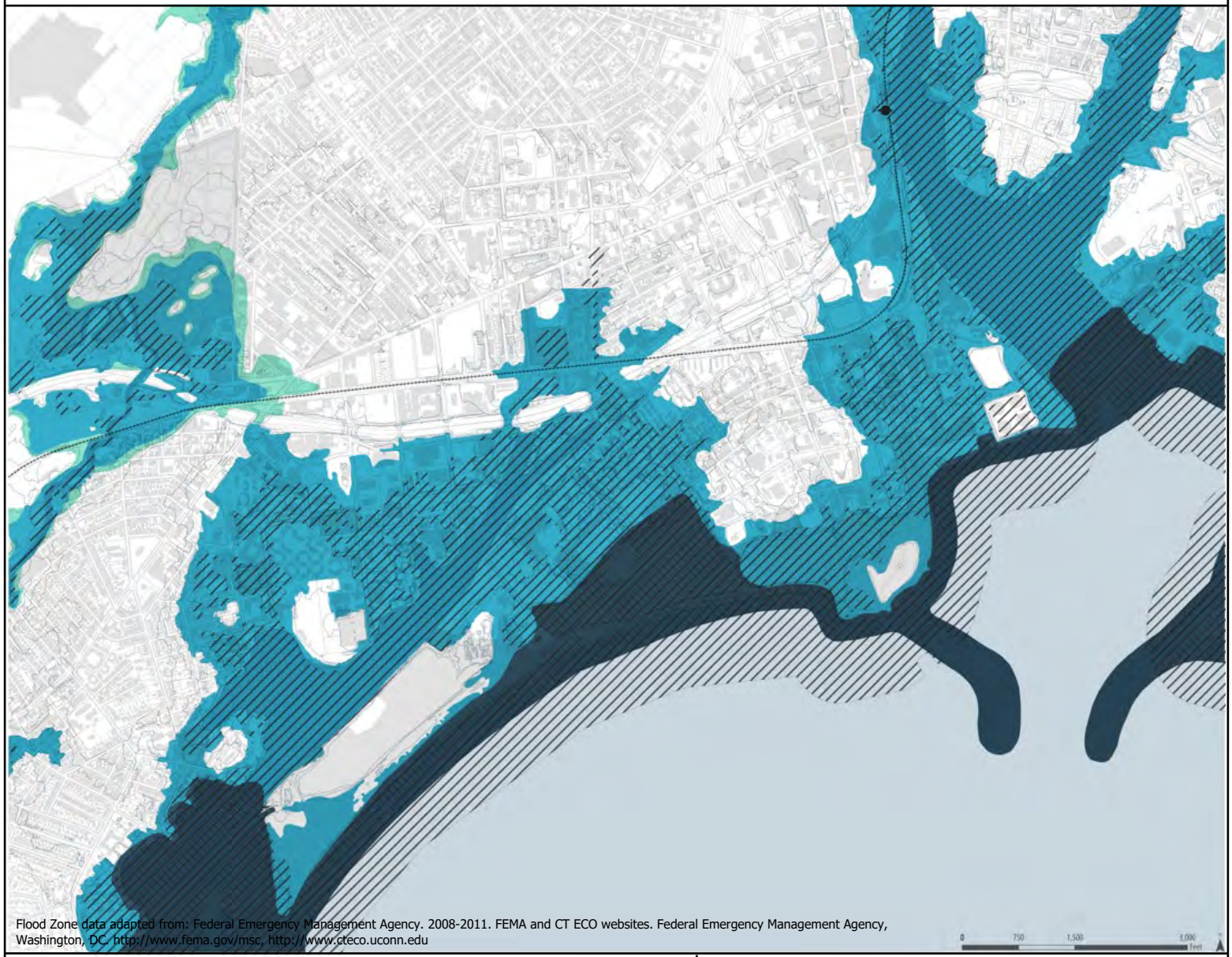
Legend

- Urban Tree Canopy
- Salt & Brackish Water Marshes
- Exposed Tidal Flats
- Sheltered Tidal Flats
- Sheltered Riprap
- Riprap
- Exposed Man-Made Structures
- Course-Grained Sand Beaches
- Mixed Sand and Gravel Beaches
- Fine to Medium-Grained Beaches

RESILIENT BRIDGEPORT

Figure | 4

FEMA FIRM Flood Zones



Legend

- VE Zone (waves above 3")
- 100 Year Floodplain (1% annual chance)
- 500 Year Floodplain (0.2% annual chance)
- Superstorm Sandy Inundation

RESILIENT BRIDGEPORT

Figure | 5

Wetlands Mapping



Legend:

- Estuarine and Marine Deepwater
- Freshwater Emergent Wetland
- Freshwater Pond
- Estuarine and Marine Wetland
- Study Area Boundary

0 500 1,000 2,000 3,000 4,000 Feet

Scale in feet

RESILIENT BRIDGEPORT

Figure | 6

Connecticut Critical Habitats



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Critical Habitat: State of Connecticut, Department of Environmental Protection. July 01 2009. Hartford, CT. Connecticut Department of Energy and Environmental Protection website. http://www.ct.gov/deep

Legend

Critical Habitat

- Estuarine, Beachshore, B
- Estuarine, Intertidal Marsh, IM

Study Area

- Study Area Boundary

0 1,250 2,500 3,750 5,000 Feet

Scale in feet

RESILIENT BRIDGEPORT

Figure | 7

ATTACHMENT C.1
Supplemental Information:
Annotated Site Plan(s)

Requester: Hermia Delaire, State of Connecticut Department of Housing
Site Name: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design
Date: 05.23.2018

Flood Risk Reduction Potential Alignments

- **Integrated Alignment.** This alignment would be constructed in coordination with key area stakeholders and include raised streets, flood walls and landscaped berms that take into account plans for growth, development and risk reduction taking place within the eastern South End community.
- **Interior Alignment.** The interior alignment would identify a street or streets that could be raised to provide dry egress for future development, provide some reduction in risk from storm events and generate opportunities for storm water management that produce co-benefits for the community.
- **Edge Alignment.** This alignment would be constructed either in-water or along the outer edge of the community along the waterfront.



Legend

Study Area

Flood Risk Reduction Potential Alignments

Edge Alignment

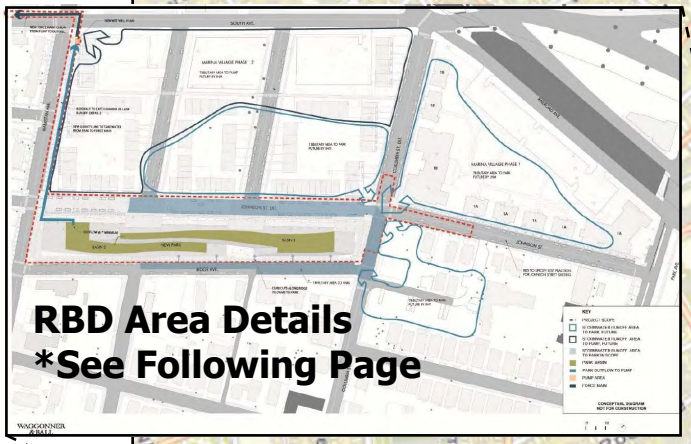
Integrated Alignment

Interior Alignment

RESILIENT BRIDGEPORT

Figure | 8

Area of Proposed Rebuild By Design (RBD) Pilot Elements





Legend

- Study Area Boundary
- RBD Area

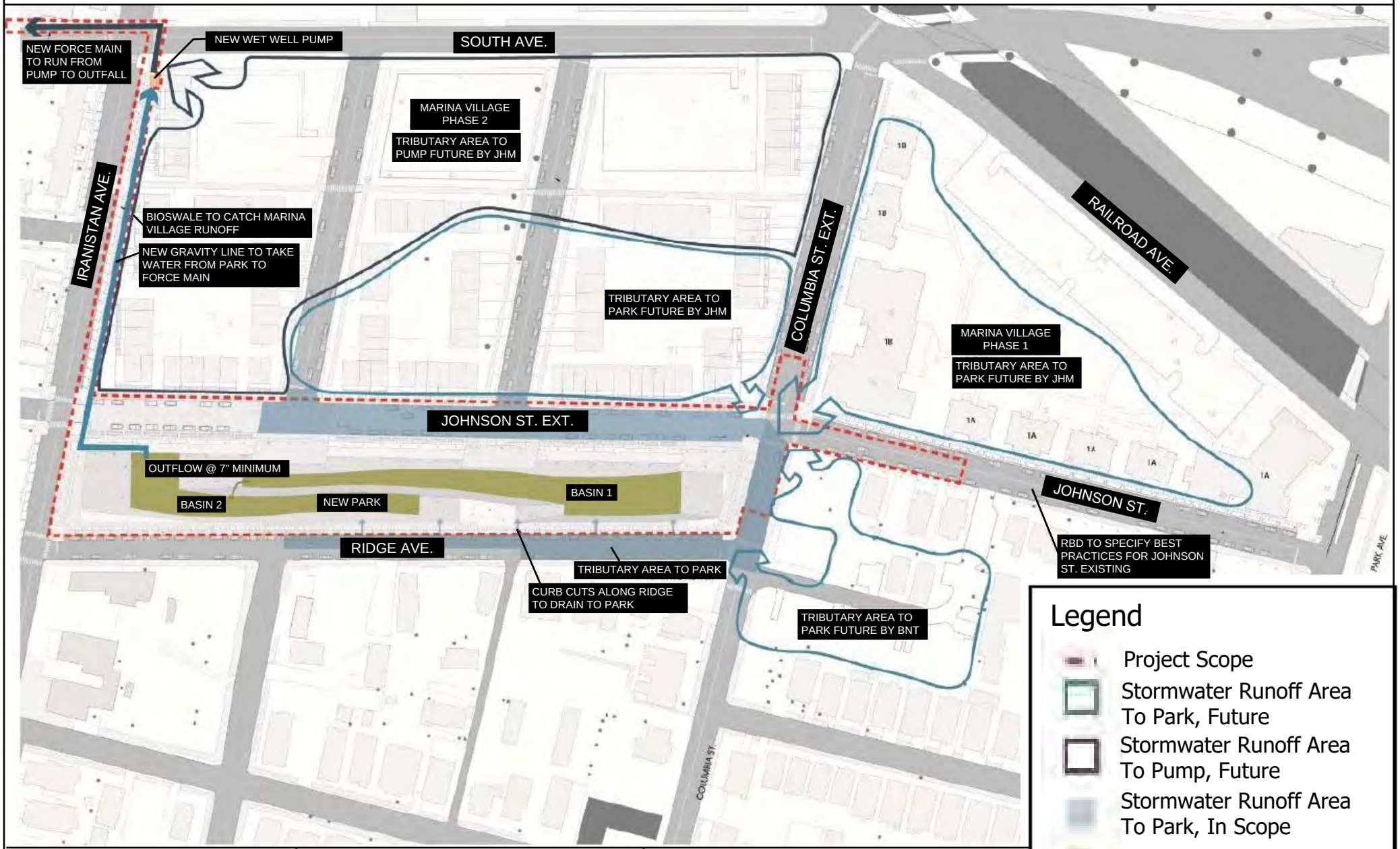
0 1,000 2,000 3,000 4,000 Feet

Scale in feet

RESILIENT BRIDGEPORT

Figure | 9

Proposed Rebuild By Design (RBD) Pilot Elements



Legend

- Project Scope
- Stormwater Runoff Area To Park, Future
- Stormwater Runoff Area To Pump, Future
- Stormwater Runoff Area To Park, In Scope
- Park Basin
- Park Outflow To Pump
- Pump Area
- Force Main

WAGGONNER & BALL

*Conceptual Diagram
Not For Construction

RESILIENT BRIDGEPORT

Figure | 10

From:	Delaire, Hermia
To:	Weymouth, Nicole
Cc:	Kennedy, Daniel
Subject:	FW: Technical Assistance: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Bridgeport, CT
Date:	Wednesday, June 13, 2018 10:14:37 AM

Good Morning Nicole,

Please see email below received from NOAA in response to our request for technical assistance regarding available data regarding essential fish habitat and threatened and endangered species at or near the project area for your information.

Let me know if you have any question or require any additional information.

Kindly,

Mia Delaire
Program Manager
"Team Sandy"
CDBG - Sandy Disaster Recovery Program

From: Edith Carson - NOAA Federal [mailto:edith.carson@noaa.gov]
Sent: Wednesday, June 13, 2018 10:07 AM
To: Delaire, Hermia
Cc: Alison Verkade - NOAA Affiliate; Zachary Jylkka - NOAA Affiliate
Subject: Technical Assistance: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Bridgeport, CT

Ms. Delaire,

We received your letter on June 6, 2018, regarding the proposed flood resiliency project for the south end of Bridgeport, CT. In your email, you requested any available data regarding Essential Fish Habitat and threatened and endangered Species at or near the study area. We offer the following comments.

Endangered Species Act

Sea Turtles
Four species of Endangered Species Act (ESA) listed threatened or endangered sea turtles under our jurisdiction are seasonally present off the north shore of Long Island, including its bays and tributaries: the threatened Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead, the threatened North Atlantic DPS of green, and the endangered Kemp's ridley and leatherback sea turtles. Sea turtles typically occur along the New York coast from May to mid-November, with the highest concentration of sea turtles present from June through October.

Atlantic Sturgeon
Atlantic sturgeon are present in the waters of Long Island and its adjacent bays and tributaries. The New York Bight, Chesapeake Bay, South Atlantic and Carolina DPS of Atlantic sturgeon are endangered; the Gulf of Maine DPS is threatened. Adult and subadult Atlantic sturgeon originating from any of these DPS could occur in the proposed project area. As young remain in their natal river/estuary until approximately age 2, and early life stages are not tolerant of saline waters, no eggs, larvae, or juvenile Atlantic sturgeon will occur within the waters of Long Island and its adjacent bays and tributaries.

Shortnose Sturgeon
Shortnose sturgeon are present in the waters of Long Island and could occur in their adjacent bays and tributaries. Shortnose sturgeon are listed as endangered throughout their range. As early life stages are not tolerant of saline waters, no eggs, larvae, or juvenile shortnose sturgeon will occur within the saline waters of Long Island and its adjacent bays and tributaries.

As project details develop, we recommend you consider the following effects of the project on sea turtles and sturgeon:

- For activities that increase levels of suspended sediment, consider the use of silt management and/or soil erosion best practices (i.e., silt curtains and/or cofferdams).
- Consider the related effects to water quality after the outfalls are built (i.e., will the standards still be met, will the effluent volume change, and will there be any effects to the species).
- For pile driving or other activities that may affect underwater noise levels, consider the use of cushion blocks and other noise attenuating tools to avoid reaching noise levels that will cause injury or behavioral disturbance to sturgeon - see the table below for more information regarding noise criteria for injury/behavioral disturbance in sturgeon.

Organism	**Injury**	**Behavioral Modification**
Sturgeon	206 dB re 1 µPaPeak and 187 dB cSEL	150 dB re 1 µPaRMS
Sea Turtles	180 dB re 1 µPaRMS	166 dB re 1 µPaRMS

Depending on the amount and duration of work that takes place in the water, listed species of sea turtles and sturgeon may occur within the vicinity of your proposed project.The federal action agency will be responsible for determining whether the proposed action may affect listed species. If they determine that the proposed action may affect a listed species, they should submit their determination of effects, along with justification and a request for concurrence to the attention of the Section 7 Coordinator, NMFS, Greater Atlantic Regional Fisheries Office, Protected Resources Division, 55 Great Republic Drive, Gloucester, MA 01930 or nmfs.gar.esa.section7@noaa.gov. Please be aware that we have recently provided on our website guidance and tools to assist action agencies with their description of the action and analysis of effects to support their determination. See - http://www.greateratlantic.fisheries.noaa.gov/section7. After receiving a complete, accurate comprehensive request for consultation, in accordance to the guidance and instructions on our website, we would then be able to conduct a consultation under section 7 of the ESA. Should project plans change or new information become available that changes the basis for this determination, further coordination should be pursued. If you have any questions regarding these comments, please contact me (978-282-8490; Edith.Carson@noaa.gov).

Essential Fish Habitat

NMFS Habitat Conservation Division (HCD) is responsible for overseeing programs related to Essential Fish Habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act and other NOAA trust resources under the Fish and Wildlife Coordination Act. If you have any questions regarding EFH, please contact Alison Verkade at (978) 281-9266 or Alison.Verkade@noaa.gov.

Thank you,

Edith

Edith Carson-Supino, M.Sc.
Section 7/Shortnose Sturgeon Fish Biologist
NOAA Fisheries
U.S. Department of Commerce

Greater Atlantic Regional Fisheries Office
Phone: 978-282-8490
edith.carson@noaa.gov

For ESA Section 7 guidance please see:
https://www.greateratlantic.fisheries.noaa.gov/section7



Connecticut
still revolutionary

Department of Economic and Community Development

State Historic Preservation Office

July 19, 2018

received
7-27-2018

Hermia Delaire
Department of Housing, State of CT
505 Hudson Street
Hartford, CT 06106

Subject: Resilient Bridgeport/National Disaster Resilience/Rebuild by Design Resources Evaluation report
Bridgeport, CT

Dear Ms. Delaire:

The State Historic Preservation Office has reviewed the information submitted for the above-named property pursuant to the provisions of Section 106 of the National Historic Preservation Act of 1966 and Connecticut Environmental Policy Act.

SHPO has received and reviewed the draft Historic and Archeological Resources Evaluation Report. This report focuses on the existing condition of sites listed or eligible for listing on the National Register of Historic Places within the APE for the HUD-funded Resilient Bridgeport/National Disaster Resilience and Rebuilt by Design programs as part of the federally mandated Environmental Impact Statement/Environmental Impact Evaluation. This report does not include definitive alternatives for impacts, as they are still in development.

SHPO is satisfied with the methodology, APE, and both above ground and below ground existing conditions. SHPO looks forward to continued consultation when the definitive alternatives are established.

The State Historic Preservation Office appreciates the opportunity to review and comment upon this project. These comments are provided in accordance with the Connecticut Environmental Policy Act and Section 106 of the National Historic Preservation Act. For further information please contact Todd Levine, Environmental Reviewer, at (860) 500-2337 or todd.levine@ct.gov.

Sincerely,

Catherine Labadia
Deputy State Historic Preservation Officer

Dannel P. Malloy
Governor

STATE OF CONNECTICUT
DEPARTMENT OF HOUSING

Evonne M. Klein
Commissioner

November 14, 2018

Marissa Turnbull
Tribal Historic Preservation Office (THPO)
Mashantucket (Western) Pequot Tribal Nation
2 Matts Path, PO Box 3060
Mashantucket, CT 06338

RE: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Projects

Dear Ms. Turnbull,

The State of Connecticut's Department of Housing (DOH) proposes to utilize funds from U.S. Department of Housing and Urban Development (HUD) through the Community Development Block Grant (CDBG) Disaster Recovery (DR) National Disaster Resilience (NDR) and Rebuild by Design (RBD) programs, for the proposed *Resilient Bridgeport: National Disaster Resilience and Rebuild by Design* projects (Proposed Action). Under HUD regulation 24 CFR 58.4, DOH has assumed environmental review responsibilities for the project, including tribal consultation related to historic properties.

The South End neighborhood of the city of Bridgeport (Figure 1) is exposed to storm surge from coastal storms and the risk of such events is increasing due to sea level rise. During Superstorm Sandy, the area was impacted by sustained 70 mph gale force winds and experienced a storm surge nearly 7 feet above normal high tide, resulting in flooded streets, damaged residential properties, and the loss of electric power. The vulnerability of the area to future storm events and sea level rise has limited the opportunities for redevelopment. Due to the low-lying geography, the area experiences flooding on a regular basis from rainfall or tidal inundation. Flooding of streets (particularly low-lying underpasses under Interstate 95 and the Northeast Corridor rail line) can cause safety concerns for the local residents when vehicles, including emergency responders (fire, police, medical), are prevented from accessing the area.

The purpose of the Proposed Action is to create a more resilient South End community, support its long-term viability, and improve health and safety for the community's vulnerable populations. The principal targeted outcomes are to lower the risk of acute and chronic flooding, provide dry egress during emergencies, and educate the public about flood risk and sea level rise. As discussed below, the Proposed Action would include three project components: RBD Pilot Project, Flood Risk Reduction Project, and Resilience Center (Figure 2).

- The **RBD Pilot Project** would be constructed within a portion of the former Marina Village Public Housing Complex in the northwestern part of the Study Area, and would include green and gray infrastructure improvements, a 2.5-acre stormwater facility; street extension and regrading to provide dry egress to future development on the site; and additional street beautification along project area streets.

preceded by an archaeological survey, to include either a system of geotechnical investigations or traditional shovel testing. Moreover, because of the unique preservation of open spaces associated with Seaside Park, efforts should be made to identify any human burials within the project area, preferably with a ground penetrating radar (GPR) survey. Work in the proximity to the Freeman Houses would be preceded by a systematic geotechnical investigation, such as a geoprobe survey. If the stone pavement on Singer Street must be destroyed or removed for the project, an archaeological shovel test pit survey would be carried out, once the stone pavement has been removed.

DOH has been conducting a review of the historic properties identified within the Study Area to comply with Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR Part 800. We would like to invite you to be a consulting party in this review to help identify historic propertied in the Study Area that may have religious and cultural significance to your tribe, and if such properties exist, to help assess how the Resilient Bridgeport projects might affect them. If the project might have an adverse effect, we would like to discuss possible ways to avoid, minimize, or mitigate potential adverse impacts.

To meet project timeframes, if you would like to be a consulting party on this program, please let us know of your interest within 30 days of this letter. If you have any initial concerns with impacts of the project on religious or cultural properties, please note them in your response.

More information on the Section 106 review process is available at https://www.hudexchange.info/environmental-review/historic-preservation/.

HUD's process for tribal consultation under Section 106 is described in a Notice available at https://www.hudexchange.info/resource/2448/notice-cpd-12-006-tribal-consultation-under-24-cfr-part-58/

DOH welcomes the consultation of the Mashantucket (Western) Pequot Tribal Nation as we strive for more effective public participation in NEPA and Section 106 analyses, in our efforts to achieve more informed decision making and to promote cultural heritage and identity. We value your assistance and look forward to consulting further if there are historic properties of religious and cultural significance to your tribe that may be affected by the Proposed Action. Should you have any questions regarding this notice, request, or draft agreement, please do not hesitate to contact me at Rebecca.French@ct.gov or 860-270-8231.

Sincerely,

Rebecca French

Rebecca A. French, Ph.D.
Director of Resilience

cc: Donna Mahon (HUD)
Nicole Weymouth (WSP)

ENCLOSURES

Figure 2: Project Areas

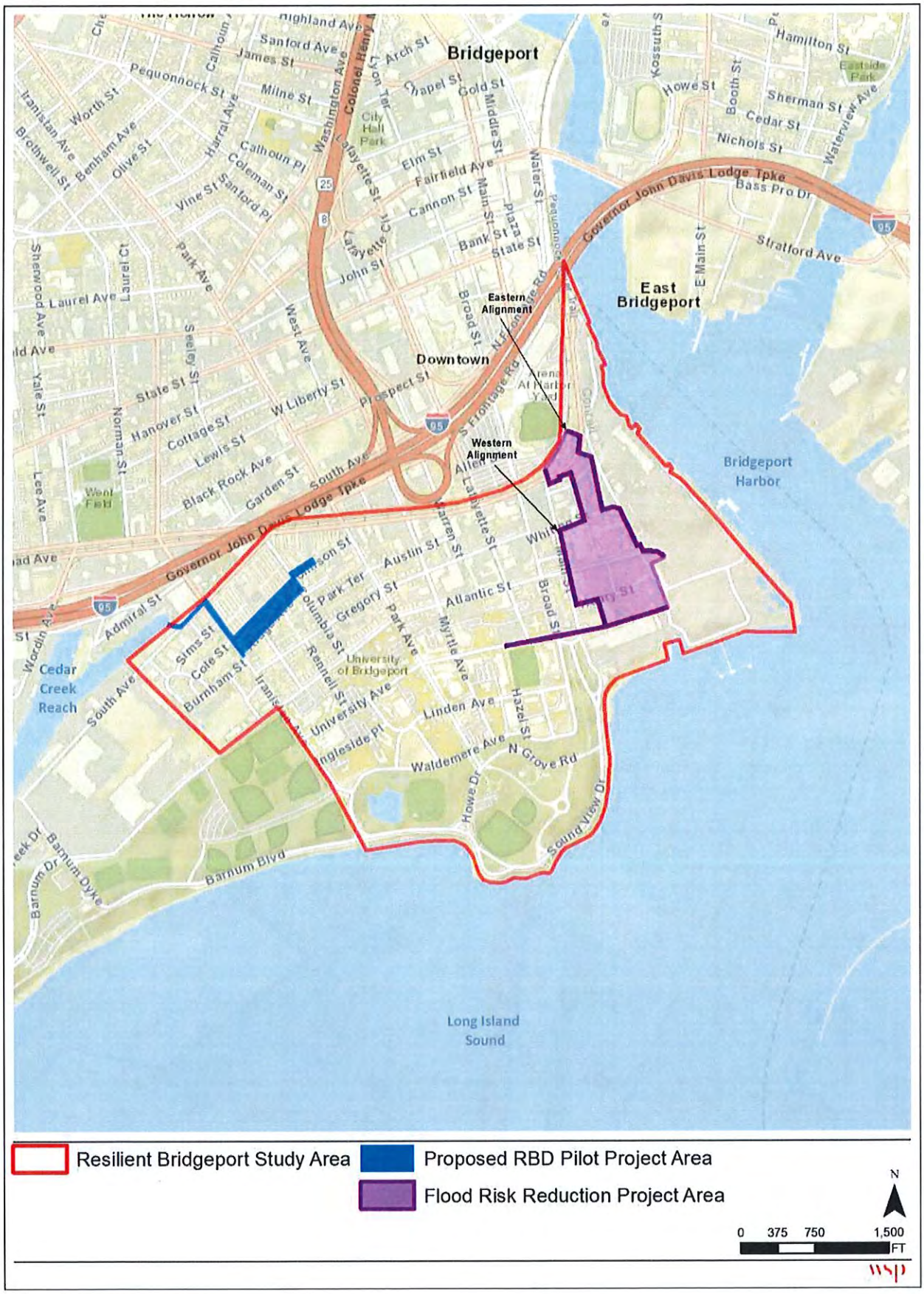
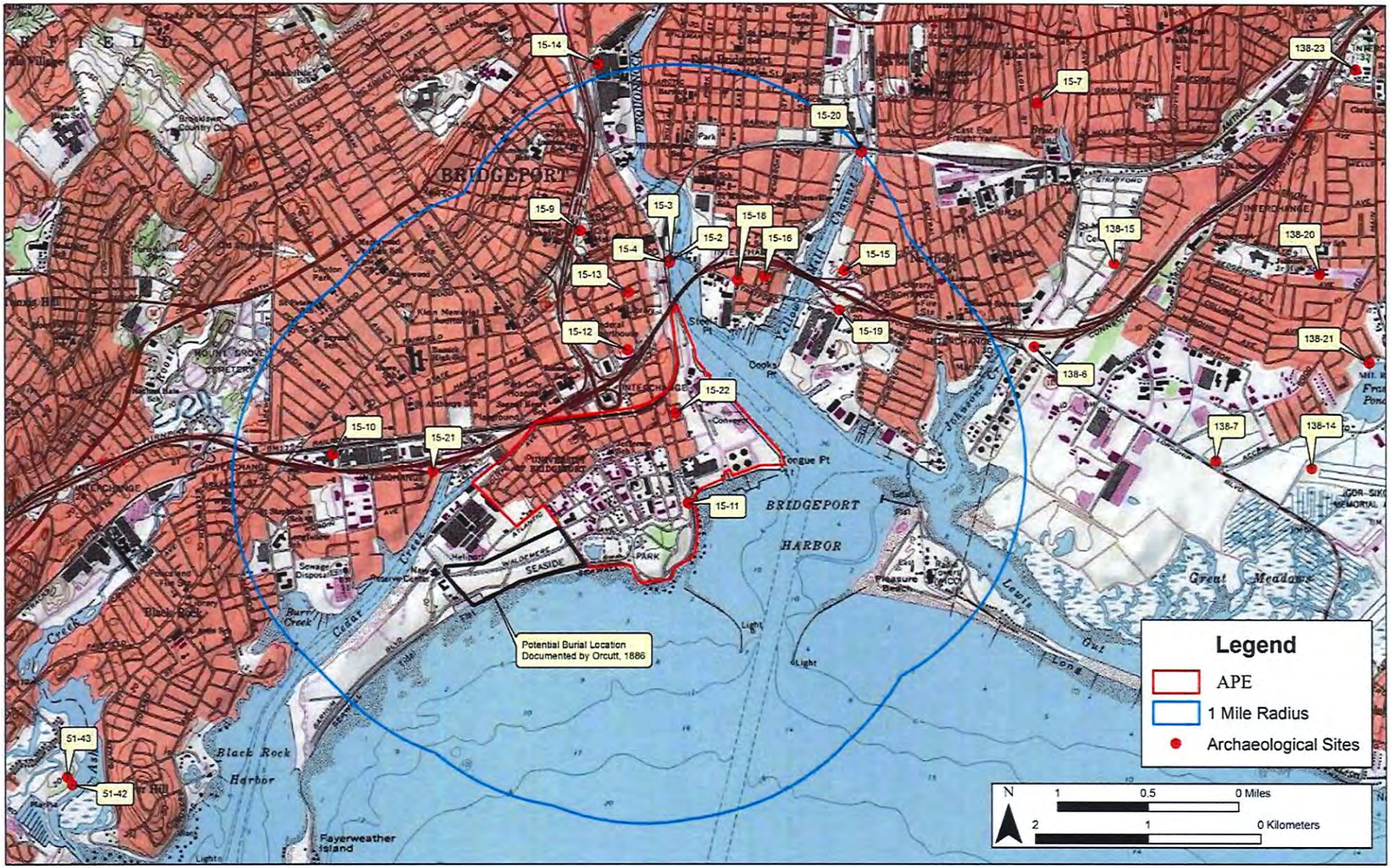


Figure 4: Previously Identified Archaeological Sites within 1 Mile of APE



Dannel P. Malloy
Governor

STATE OF CONNECTICUT
DEPARTMENT OF HOUSING

Evonne M. Klein
Commissioner

November 14, 2018

James Quinn
Tribal Historic Preservation Officer (THPO)
Mohegan Tribe of Indians of Connecticut
13 Crow Hill Road
Uncasville, CT 06382

RE: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Projects

Dear Mr. Quinn,

The State of Connecticut's Department of Housing (DOH) proposes to utilize funds from U.S. Department of Housing and Urban Development (HUD) through the Community Development Block Grant (CDBG) Disaster Recovery (DR) National Disaster Resilience (NDR) and Rebuild by Design (RBD) programs, for the proposed *Resilient Bridgeport: National Disaster Resilience and Rebuild by Design* projects (Proposed Action). Under HUD regulation 24 CFR 58.4, DOH has assumed environmental review responsibilities for the project, including tribal consultation related to historic properties.

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The purpose of the Proposed Action is to create a more resilient South End community, support its long-term viability, and improve health and safety for the community's vulnerable populations. The principal targeted outcomes are to lower the risk of acute and chronic flooding, provide dry egress during emergencies, and educate the public about flood risk and sea level rise. As discussed below, the Proposed Action would include three project components: RBD Pilot Project, Flood Risk Reduction Project, and Resilience Center (Figure 2).

- The **RBD Pilot Project** would be constructed within a portion of the former Marina Village Public Housing Complex in the northwestern part of the Study Area, and would include green and gray infrastructure improvements, a 2.5-acre stormwater facility; street extension and regrading to provide dry egress to future development on the site; and additional street beautification along project area streets.

preceded by an archaeological survey, to include either a system of geotechnical investigations or traditional shovel testing. Moreover, because of the unique preservation of open spaces associated with Seaside Park, efforts should be made to identify any human burials within the project area, preferably with a ground penetrating radar (GPR) survey. Work in the proximity to the Freeman Houses would be preceded by a systematic geotechnical investigation, such as a geoprobe survey. If the stone pavement on Singer Street must be destroyed or removed for the project, an archaeological shovel test pit survey would be carried out, once the stone pavement has been removed.

DOH has been conducting a review of the historic properties identified within the Study Area to comply with Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR Part 800. We would like to invite you to be a consulting party in this review to help identify historic propertied in the Study Area that may have religious and cultural significance to your tribe, and if such properties exist, to help assess how the Resilient Bridgeport projects might affect them. If the project might have an adverse effect, we would like to discuss possible ways to avoid, minimize, or mitigate potential adverse impacts.

To meet project timeframes, if you would like to be a consulting party on this program, please let us know of your interest within 30 days of this letter. If you have any initial concerns with impacts of the project on religious or cultural properties, please note them in your response.

More information on the Section 106 review process is available at https://www.hudexchange.info/environmental-review/historic-preservation/.

HUD's process for tribal consultation under Section 106 is described in a Notice available at https://www.hudexchange.info/resource/2448/notice-cpd-12-006-tribal-consultation-under-24-cfr-part-58/

DOH welcomes the consultation of the Mohegan Tribe of Indians of Connecticut as we strive for more effective public participation in NEPA and Section 106 analyses, in our efforts to achieve more informed decision making and to promote cultural heritage and identity. We value your assistance and look forward to consulting further if there are historic properties of religious and cultural significance to your tribe that may be affected by the Proposed Action. Should you have any questions regarding this notice, request, or draft agreement, please do not hesitate to contact me at Rebecca.French@ct.gov or 860-270-8231.

Sincerely,

Rebecca French

Rebecca A. French, Ph.D.
Director of Resilience

cc: Donna Mahon (HUD)
Nicole Weymouth (WSP)

ENCLOSURES

Figure 2: Project Areas

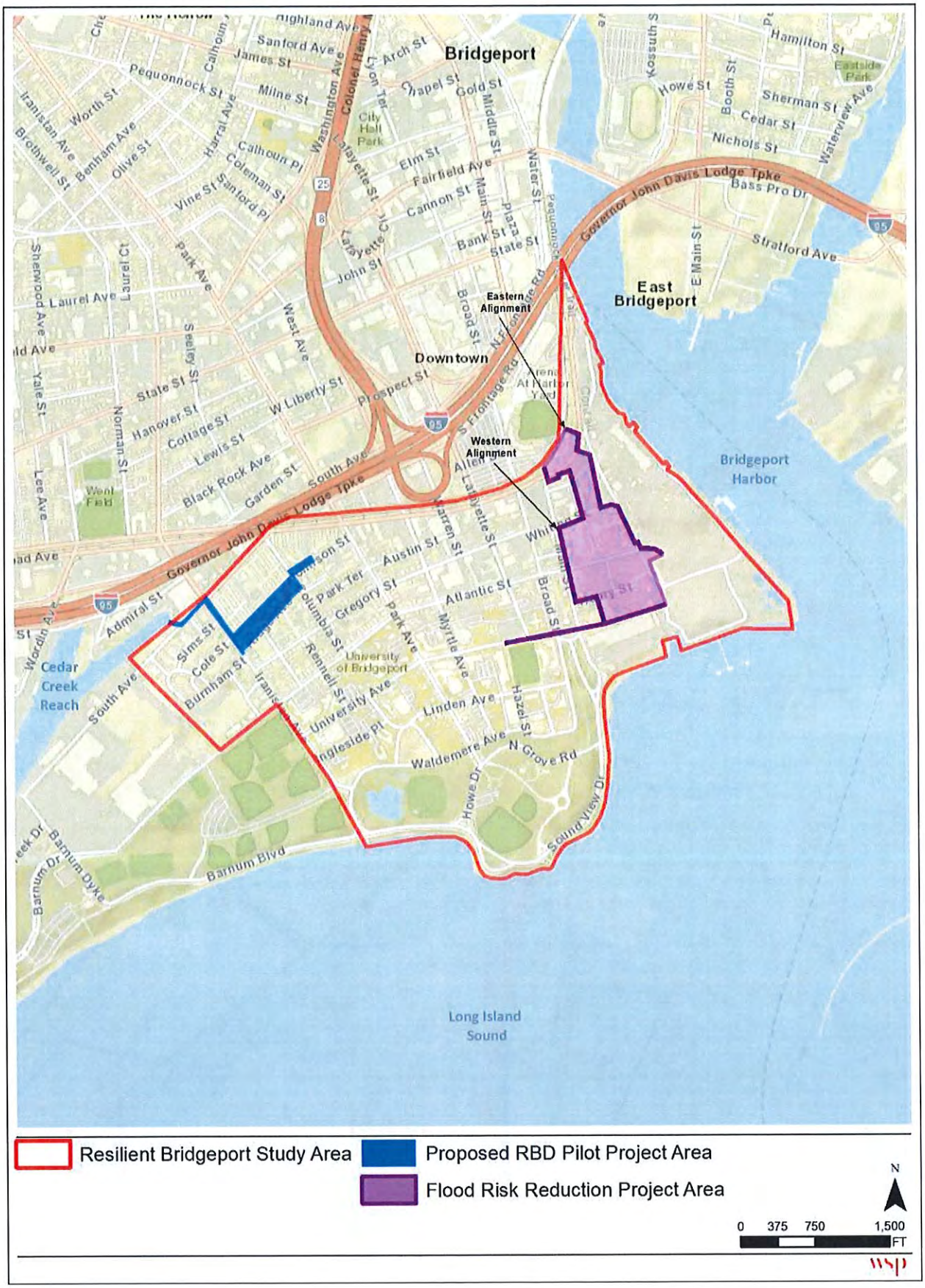
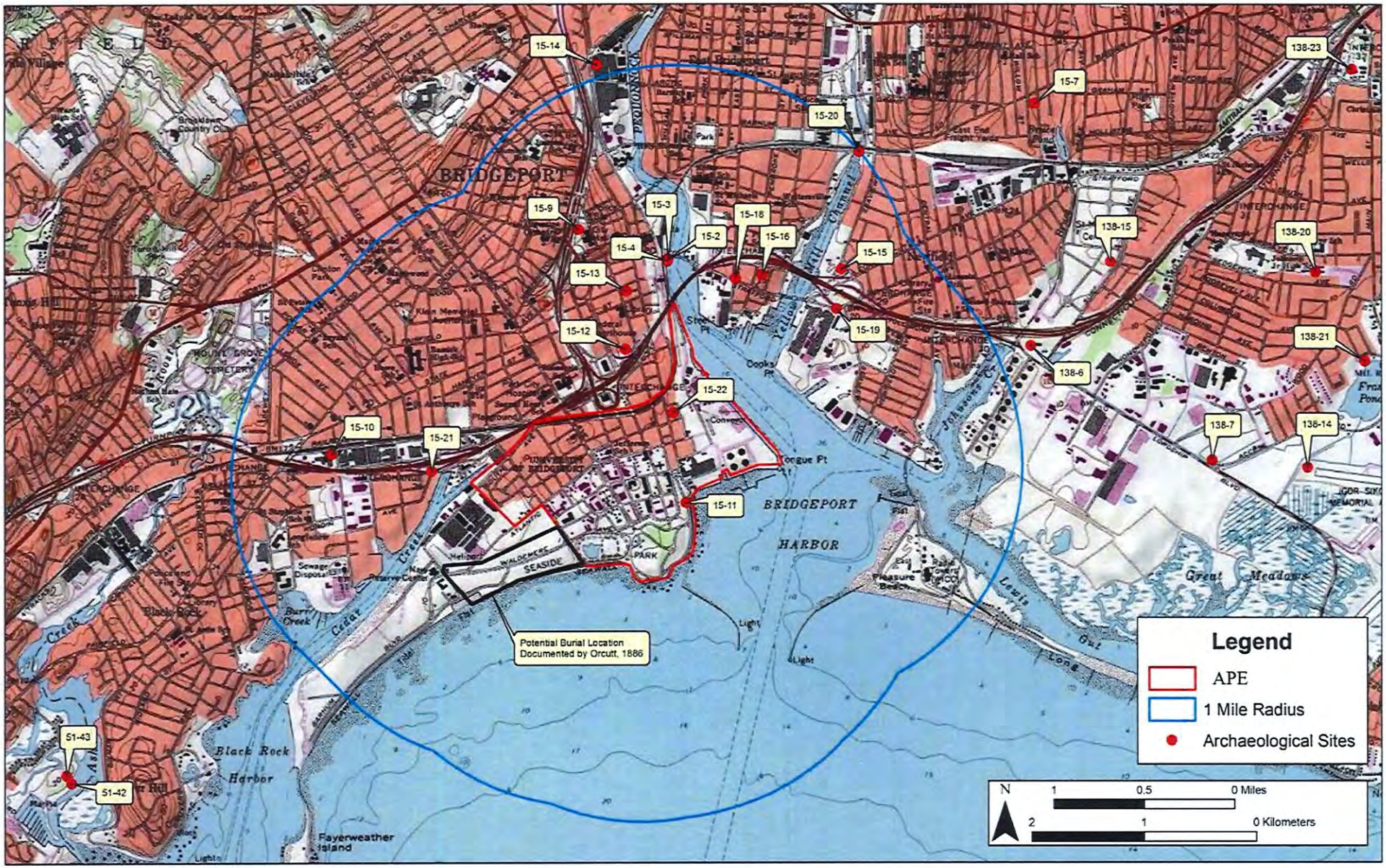


Figure 4: Previously Identified Archaeological Sites within 1 Mile of APE



From: Autumn Cholewa <ACholewa@moheganmail.com>
Date: 12/11/18 3:28 PM (GMT-05:00)
To: "French, Rebecca" <Rebecca.French@ct.gov>
Cc: James Quinn <jquinn@moheganmail.com>
Subject: RE: Resilient Bridgeport - Cultural Resources Section

THE MOHEGAN TRIBAL GOVERNMENT

Good Afternoon Ms. French,

Below are THPO James Quinn's comments regarding the above referenced project sent to our office:

Due to the potential of impacts to highly sensitive cultural resources including the potential for disturbance of burials outlined in the cultural resources assessment sent to our office, we strongly support the recommendations for geotechnical investigations, monitoring of ground disturbances, and archaeological Phase Ib surveying in areas determined to have high potential for intact resources. Please note the following:

- Elevation of University Avenue: We recommend a Phase Ib survey be completed and that our office be notified of a potential timeline/schedule if the geotechnical investigations determine a high potential for intact soils and/or cultural resources and/or burials.
- Elevation of Seaside Park's entrance between Broad and Main Streets: We concur with the recommendation for an archaeological survey. We strongly recommend that ground penetrating radar be used in the open spaces before ground disturbance to determine the presence or absence of burials. We recommend that occur before any shovel testing or other types of ground disturbance. We also agree with the recommendation for monitoring during construction related ground disturbance and also after archaeological and/or GPR are conducted.
- Sheet-piling through the 60 Main Street redevelopment site: We support the recommendation for geotechnical surveying and archaeological monitoring.

We look forward to future discussions around any potential mitigation measures to avoid or minimize any adverse effects to cultural resources and/or burials identified during the course of surveying. Also, we would like for you to provide a projected schedule of the above activities.

Please contact me directly if you have any questions,

Kind Regards,

Autumn Cholewa
Administrative Assistant of the THPO and Archaeology Dept.
13 Crow Hill Rd
Uncasville, CT 06382

Ph: 806-862-6289
Cell: 860-287-7166

From: Autumn Cholewa <ACholewa@moheganmail.com>
Sent: Friday, November 30, 2018 8:38 AM
To: French, Rebecca <Rebecca.French@ct.gov>
Cc: James Quinn <jquinn@moheganmail.com>
Subject: RE: Resilient Bridgeport - Cultural Resources Section

THE MOHEGAN TRIBAL GOVERNMENT

Good Morning Ms. French,

We have received the attachment. Once Mr. Quinn reviews, I will get back to you with comments.

Thank you and have a wonderful weekend,

Autumn Cholewa
Administrative Assistant of the THPO and Archaeology Dept.
13 Crow Hill Rd
Uncasville, CT 06382
PH: 806-862-6289
Cell: 860-287-7166

From: French, Rebecca [mailto:Rebecca.French@ct.gov]
Sent: Thursday, November 29, 2018 5:11 PM
To: Autumn Cholewa <ACholewa@moheganmail.com>
Cc: James Quinn <jquinn@moheganmail.com>
Subject: Resilient Bridgeport - Cultural Resources Section

WARNING: External email. Please verify sender before opening attachments or clicking on links.

Dear Ms. Cholewa,

Please see the attached pre-public draft chapter of the Cultural Resources section of the Draft EIS with chapters 1 & 2 to provide you with more background information on the project.

If you would like your comments to be included before we publish the Draft EIS for public review, please send them to us by close of business on Dec. 12. If you need additional time, you can submit comments to us at any point up to the end of the public comment period in the second half of January.

Thank you for your time and participation in this process.

Best regards,
Rebecca

Rebecca A. French, Ph.D.
Director of Resilience
Department of Housing
State of Connecticut

E-mail: Rebecca.French@ct.gov
Phone: 860-270-8231
Cell: 860-381-9372

From: French, Rebecca
Sent: Wednesday, November 21, 2018 4:27 PM
To: 'Autumn Cholewa' <ACholewa@moheganmail.com>
Cc: James Quinn <jquinn@moheganmail.com>
Subject: RE: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Project

Dear Ms. Cholewa,

Thank you for your email. I am delighted to hear from you and Mr. Quinn and we welcome your participation in the process.

Per your request, the Mohegan Tribal Historic Preservation Office will be included as a consulting party and we will keep you informed on any developments. Enclosed with the letter I sent, you have a copy of the Historic and Archaeological Resources Evaluation Report from May 4, 2018 with existing conditions. We are still addressing some initial review comments, but shortly we can send you the Cultural Resources section of Chapter 4 of our Draft Environmental Impact Statement that discusses the impacts from the Proposed Action along with the introductory chapters to provide you with more context for the larger Resilient Bridgeport project.

Thank you again for your prompt response to my inquiry and please do not hesitate to reach out with any questions. You can also find general documents about the Resilient Bridgeport project at resilientbridgeport.com and on the CT Dept. of Housing website.

Best regards,
Rebecca

Rebecca A. French, Ph.D.
Director of Resilience

Department of Housing
State of Connecticut

E-mail: Rebecca.French@ct.gov
Phone: 860-270-8231
Cell: 860-381-9372

From: Autumn Cholewa [mailto:ACholewa@moheganmail.com]
Sent: Monday, November 19, 2018 3:44 PM
To: French, Rebecca <Rebecca.French@ct.gov>
Cc: James Quinn <jquinn@moheganmail.com>
Subject: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Project

THE MOHEGAN TRIBAL GOVERNMENT

Good Afternoon Ms. French,

My name is Autumn Cholewa. I am the administrative assistant for Mohegan Tribal Historic Preservation Office. I am contacting you at the request of James Quinn to advise we would like to be a consulting party and ask that more information on the proposed action be sent to our office.

Kind Regards,

Autumn Cholewa
Administrative Assistant of the THPO and Archaeology Dept.
13 Crow Hill Rd
Uncasville, CT 06382
PH: 806-862-6289
Cell: 860-287-7166

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
http://www.fws.gov/newengland

In Reply Refer To: December 13, 2018
Consultation Code: 05E1NE00-2018-SLI-1280
Event Code: 05E1NE00-2019-E-01194
Project Name: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

Project Summary

Consultation Code: 05E1NE00-2018-SLI-1280

Event Code: 05E1NE00-2019-E-01194

Project Name: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design

Project Type: LAND - FLOODING

Project Description: The proposed project is located in the South End of Bridgeport, CT. The project area has the following approximate boundaries: Iranistan Avenue on the west, the Northeast Corridor railroad viaduct to the north, the Long Island Sound to the south, and the Pequonnock River to the east.

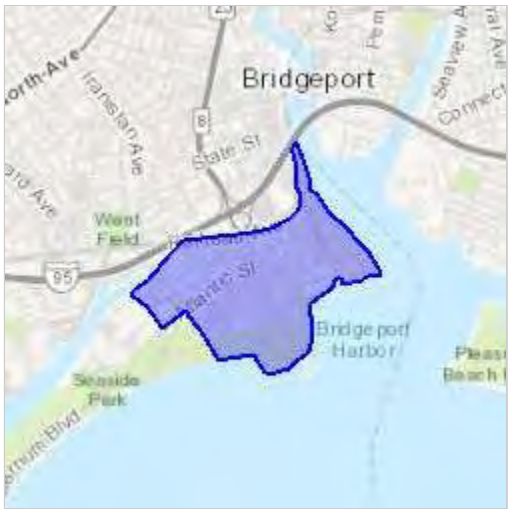
The project is aimed at reducing instances of acute and chronic flooding, providing the community with dry egress during flood events, and informing the public about flood risks and sea level rise.

The proposed project will involve a combination of natural (green) and fortified (grey) infrastructure solutions aimed at minimizing flood risk and improving flood recovery. Measures may include raised streets, floodwalls, landscaped berms, detention/retention features, pump systems, and others. The project will also include the funding and creation of a community space and/or application for disseminating information about flood events. Moreover, an approximately 2.5 acre stormwater park is planned to be constructed (just north of Ridge Avenue and east of Iranistan Avenue) to accept runoff from upland streets.

The NEPA process for this project is anticipated to span approximately 16 months, from February 2018 to June 2019. Construction is projected to begin late 2019-early 2020 and conclude by 2022.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/41.16792848398977N73.18861743869965W



Counties: Fairfield, CT

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Red Knot *Calidris canutus rufa* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Roseate Tern *Sterna dougallii dougallii* Population: northeast U.S. nesting pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2083	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

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

IPaC resource list

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

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

NOT FOR CONSULTATION

Project information

NAME

Resilient Bridgeport: National Disaster Resilience and Rebuild by Design

LOCATION

Fairfield County, Connecticut



DESCRIPTION

The
proposed project is located in the South End of Bridgeport, CT. The project area has the following approximate boundaries: Iranistan Avenue on the west, the Northeast Corridor railroad viaduct to the north, the Long Island Sound to the south, and the Pequonnock River to the east. The project is aimed at reducing instances of acute and chronic flooding, providing the community with dry egress during flood events, and informing the public about flood risks and sea level rise. The proposed project will involve a combination of natural (green) and

fortified (grey) infrastructure solutions aimed at minimizing flood risk and improving flood recovery. Measures may include raised streets, floodwalls, landscaped berms, detention/retention features, pump systems, and others. The project will also include the funding and creation of a community space and/or application for disseminating information about flood events. Moreover, an approximately 2.5 acre stormwater park is planned to be constructed (just north of Ridge Avenue and east of Iranistan Avenue) to accept runoff from upland streets. The NEPA process for this project is anticipated to span approximately 16 months, from February 2018 to June 2019. Construction is projected to begin late 2019-early 2020 and conclude by 2022.

Local office

New England Ecological Services Field Office

(603) 223-2541
(603) 223-0104

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

http://www.fws.gov/newengland

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Endangered species

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

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

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

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

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species

[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

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

NOT FOR CONSULTATION

Birds

NAME	STATUS
Red Knot Calidris canutus rufa No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1864	Threatened
Roseate Tern Sterna dougallii dougallii No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2083	Endangered

Critical habitats

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

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

NOT FOR CONSULTATION

Migratory birds

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

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted

birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
American Oystercatcher Haematopus palliatus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8935	Breeds Apr 15 to Aug 31
Bald Eagle Haliaeetus leucocephalus This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Oct 15 to Aug 31
Black Scoter Melanitta nigra This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Black Skimmer Rynchops niger This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15

NOT FOR CONSULTATION

Black-billed Cuckoo Coccyzus erythropthalmus — Breeds May 15 to Oct 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9399

Black-legged Kittiwake Rissa tridactyla — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Bobolink Dolichonyx oryzivorus — Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Bonaparte's Gull Chroicocephalus philadelphia — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Brown Pelican Pelecanus occidentalis — Breeds Jan 15 to Sep 30
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/6034

Buff-breasted Sandpiper Calidris subruficollis — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9488

Canada Warbler Cardellina canadensis — Breeds May 20 to Aug 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Clapper Rail Rallus crepitans — Breeds Apr 10 to Oct 31
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Common Eider Somateria mollissima — Breeds Jun 1 to Sep 30
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

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Common Loon gavia immer — Breeds Apr 15 to Oct 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/4464

Common Tern Sterna hirundo — Breeds May 10 to Sep 10

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/4963

Double-crested Cormorant phalacrocorax auritus — Breeds Apr 20 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/3478

Dunlin Calidris alpina arcticola — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Evening Grosbeak Coccothraustes vespertinus — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Great Black-backed Gull Larus marinus — Breeds Apr 15 to Aug 20

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Gull-billed Tern Gelochelidon nilotica — Breeds May 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9501

Herring Gull Larus argentatus — Breeds Apr 20 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

NOT FOR CONSULTATION

Hudsonian Godwit Limosa haemastica — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Kentucky Warbler Oporornis formosus — Breeds Apr 20 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Least Tern Sterna antillarum — Breeds Apr 20 to Sep 10
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Long-eared Owl asio otus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Long-tailed Duck Clangula hyemalis — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/7238

Manx Shearwater Puffinus puffinus — Breeds Apr 15 to Oct 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Nelson's Sparrow Ammodramus nelsoni — Breeds May 15 to Sep 5
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Northern Gannet Morus bassanus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

NOT FOR CONSULTATION

Parasitic Jaeger Stercorarius parasiticus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Prairie Warbler Dendroica discolor — Breeds May 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Purple Sandpiper Calidris maritima — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Razorbill Alca torda — Breeds Jun 15 to Sep 10
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red Phalarope Phalaropus fulicarius — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-breasted Merganser Mergus serrator — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-necked Phalarope Phalaropus lobatus — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Red-throated Loon Gavia stellata — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Ring-billed Gull Larus delawarensis — Breeds elsewhere
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

NOT FOR CONSULTATION

Roseate Tern Sterna dougallii — Breeds May 10 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Royal Tern Thalasseus maximus — Breeds Apr 15 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

Ruddy Turnstone Arenaria interpres morinella — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Rusty Blackbird Euphagus carolinus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Saltmarsh Sparrow Ammodramus caudacutus — Breeds May 15 to Sep 5
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Seaside Sparrow Ammodramus maritimus — Breeds May 10 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Semipalmated Sandpiper Calidris pusilla — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Short-billed Dowitcher Limnodromus griseus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9480

Snowy Owl Bubo scandiacus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Sooty Tern Onychoprion fuscatus — Breeds Mar 10 to Jul 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.

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Surf Scoter *Melanitta perspicillata* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Whimbrel *Numenius phaeopus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9483	Breeds elsewhere
White-winged Scoter *Melanitta fusca* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 5
Wilson's Storm-petrel *Oceanites oceanicus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds elsewhere
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

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Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

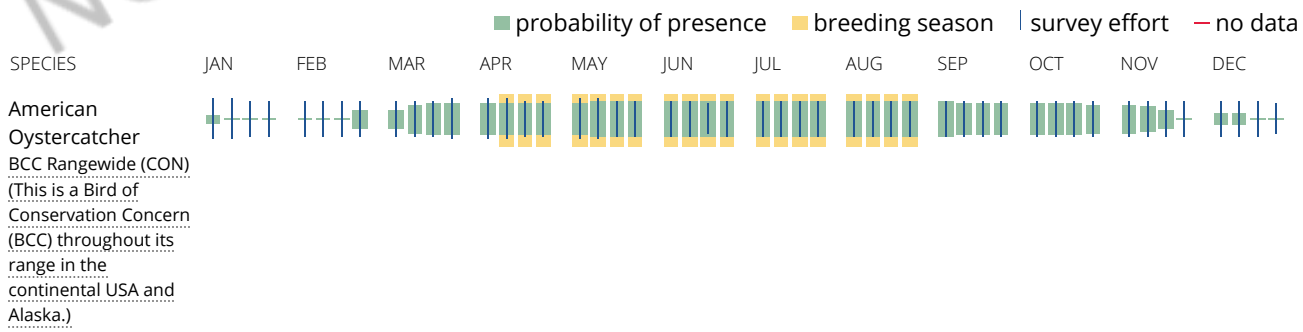
Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



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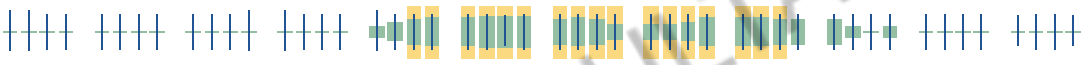
Bald Eagle
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



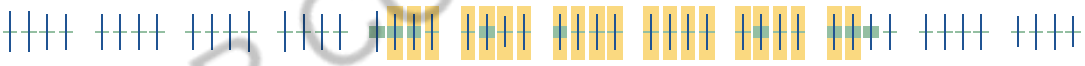
Black Scoter
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Black Skimmer
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



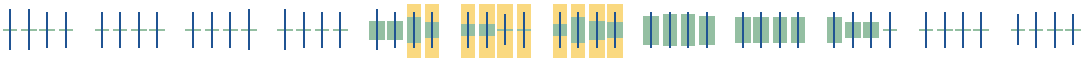
Black-billed Cuckoo
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Black-legged Kittiwake
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Bobolink
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



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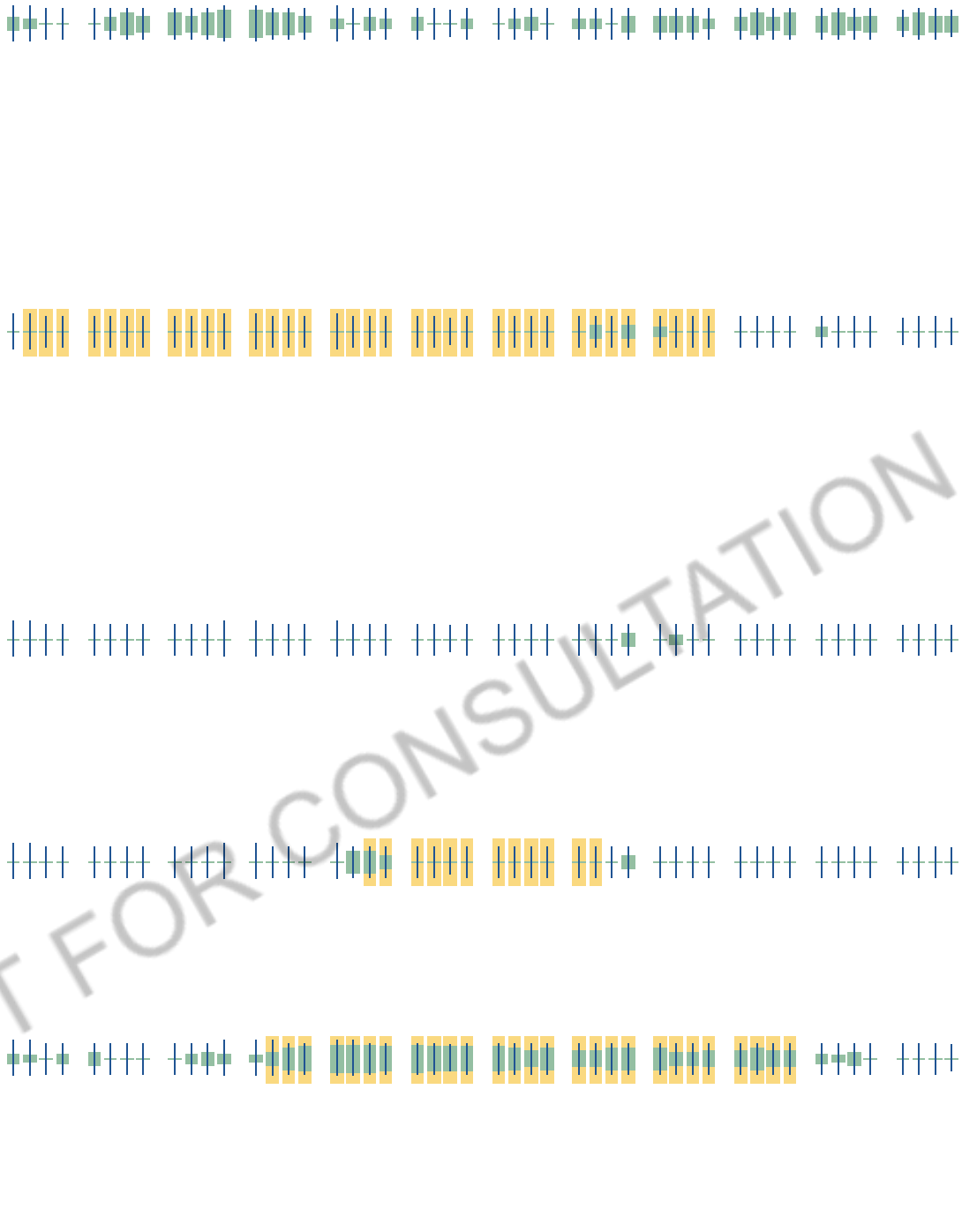
Bonaparte's Gull
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Brown Pelican
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

Buff-breasted Sandpiper
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Canada Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

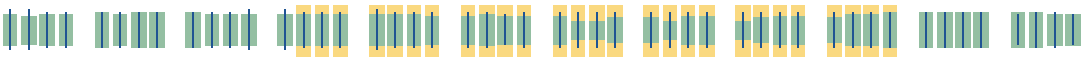
Clapper Rail
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



Common Eider
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

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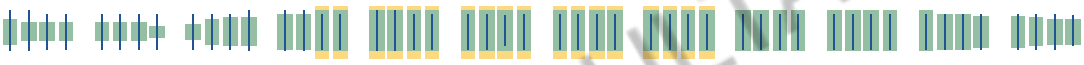
Common Loon
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Common Tern
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Double-crested Cormorant
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



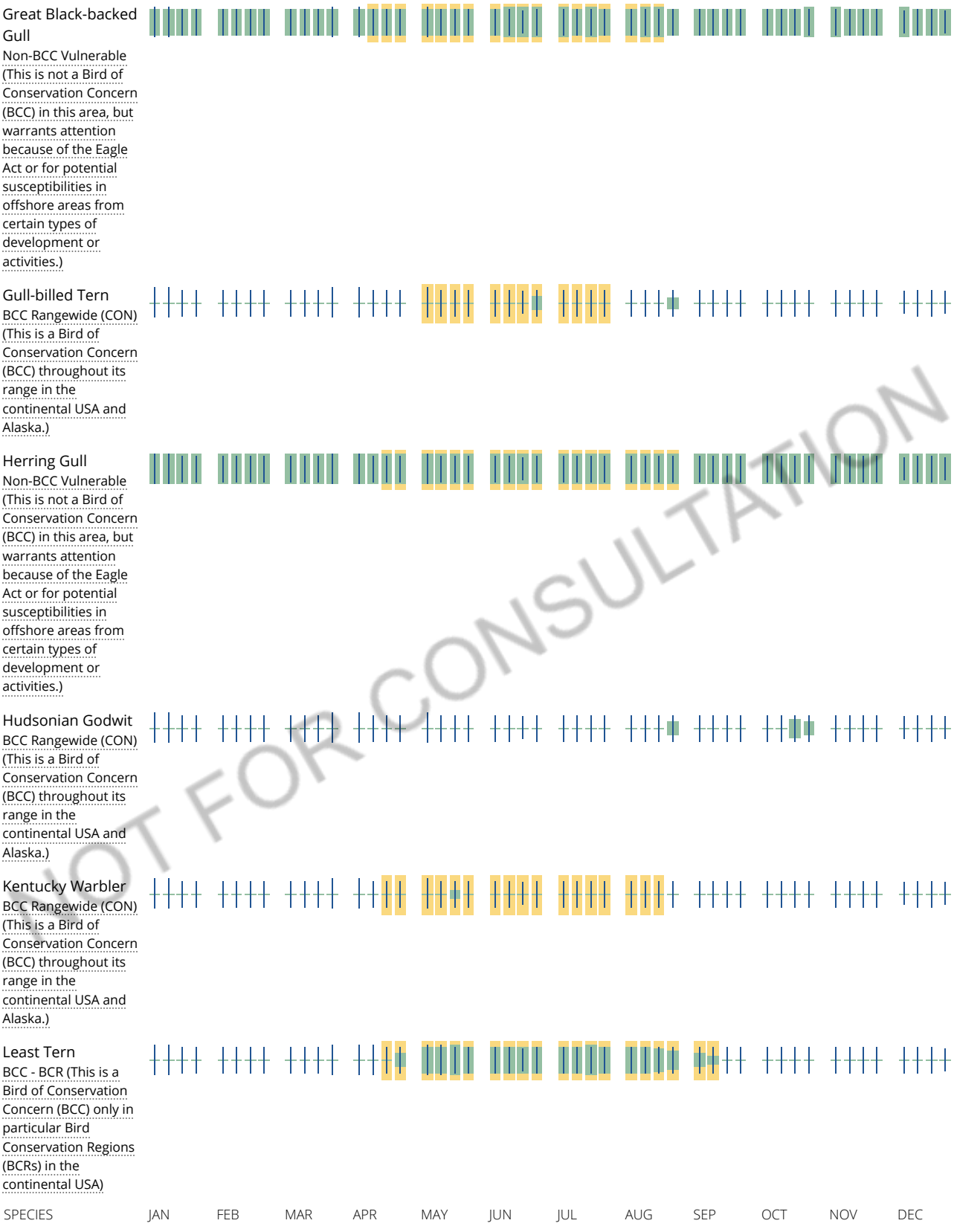
Dunlin
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



Evening Grosbeak
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



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Lesser Yellowlegs
BCC Rangewide (CON)
(This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



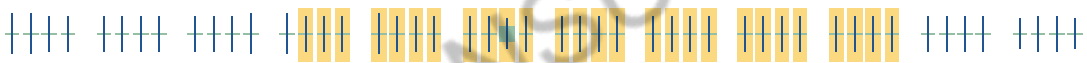
Long-eared Owl
BCC Rangewide (CON)
(This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Long-tailed Duck
Non-BCC Vulnerable
(This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Manx Shearwater
Non-BCC Vulnerable
(This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Nelson's Sparrow
BCC Rangewide (CON)
(This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Northern Gannet
Non-BCC Vulnerable
(This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

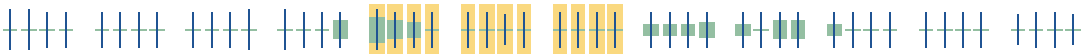


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Parasitic Jaeger
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



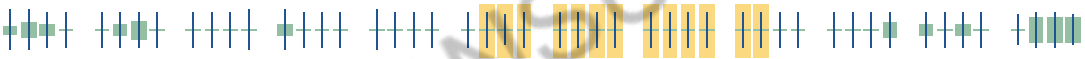
Prairie Warbler
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Purple Sandpiper
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Razorbill
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Red Phalarope
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



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Red-breasted Merganser
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

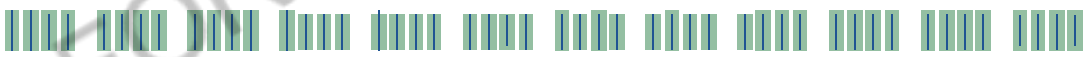
Red-necked Phalarope
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Red-throated Loon
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Ring-billed Gull
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)

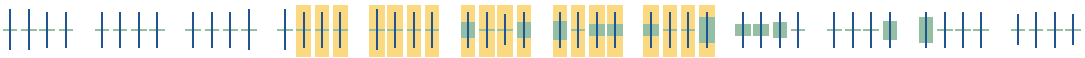


Roseate Tern
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



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Royal Tern
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



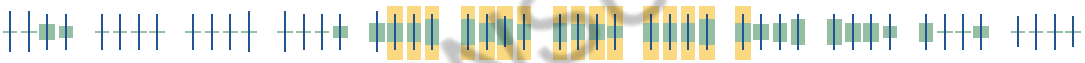
Ruddy Turnstone
BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)



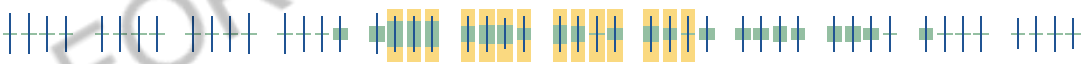
Rusty Blackbird
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



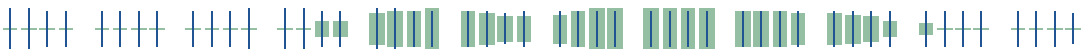
Saltmarsh Sparrow
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Seaside Sparrow
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Semipalmated Sandpiper
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Short-billed Dowitcher
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



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Snowy Owl
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



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Sooty Tern
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Surf Scoter
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Whimbrel
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



White-winged Scoter
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Willet
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

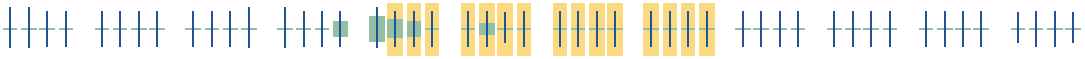


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Wilson's Storm-petrel
Non-BCC Vulnerable (This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.)



Wood Thrush
BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the E-bird Explore Data Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

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

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ “What does IPaC use to generate the migratory birds potentially occurring in my specified location”. Please be aware this report provides the “probability of presence” of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which

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means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

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

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

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Wetlands in the National Wetlands Inventory

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

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

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

ESTUARINE AND MARINE DEEPWATER

- E1UBL
- E1UBLx

ESTUARINE AND MARINE WETLAND

- E2USM
- E2US2P
- E2US2N

FRESHWATER EMERGENT WETLAND

PEM1Eh

FRESHWATER POND

PUBHx

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

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

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

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

Data exclusions

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

Data precautions

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

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Dannel P. Malloy
Governor

STATE OF CONNECTICUT
DEPARTMENT OF HOUSING

Evonne M. Klein
Commissioner

December 21, 2018

Kim Penrod
Director, Cultural Resources/106 Archives, Library and Museum
Delaware Nation, Oklahoma
31064 State Highway 281
P.O. Box 825
Anadarko, OK 73005

RE: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Projects

Dear Ms. Penrod,

The State of Connecticut's Department of Housing (DOH) proposes to utilize funds from U.S. Department of Housing and Urban Development (HUD) through the Community Development Block Grant (CDBG) Disaster Recovery (DR) National Disaster Resilience (NDR) and Rebuild by Design (RBD) programs, for the proposed *Resilient Bridgeport: National Disaster Resilience and Rebuild by Design* projects (Proposed Action). Under HUD regulation 24 CFR 58.4, DOH has assumed environmental review responsibilities for the project, including tribal consultation related to historic properties.

The South End neighborhood of the city of Bridgeport (Figure 1) is exposed to storm surge from coastal storms and the risk of such events is increasing due to sea level rise. During Superstorm Sandy, the area was impacted by sustained 70 mph gale force winds and experienced a storm surge nearly 7 feet above normal high tide, resulting in flooded streets, damaged residential properties, and the loss of electric power. The vulnerability of the area to future storm events and sea level rise has limited the opportunities for redevelopment. Due to the low-lying geography, the area experiences flooding on a regular basis from rainfall or tidal inundation. Flooding of streets (particularly low-lying underpasses under Interstate 95 and the Northeast Corridor rail line) can cause safety concerns for the local residents when vehicles, including emergency responders (fire, police, medical), are prevented from accessing the area.

The purpose of the Proposed Action is to create a more resilient South End community, support its long-term viability, and improve health and safety for the community's vulnerable populations. The principal targeted outcomes are to lower the risk of acute and chronic flooding, provide dry egress during emergencies, and educate the public about flood risk and sea level rise. As discussed below, the Proposed Action would include three project components: RBD Pilot Project, Flood Risk Reduction Project, and Resilience Center (Figure 2).

- The **RBD Pilot Project** would be constructed within a portion of the former Marina Village Public Housing Complex in the northwestern part of the Study Area, and would include green and gray infrastructure improvements, a 2.5-acre stormwater facility; street extension and regrading to

provide dry egress to future development on the site; and additional street beautification along project area streets.

- The **Flood Risk Reduction Project** would include a combination of measures to reduce the flood risk from future coastal surge and chronic rainfall events in the eastern part of the Study Area. These measures would include a coastal flood defense system comprised of raising a part of University Avenue, Main Street, and Broad Street and installing floodwalls and sheet piling, and implementing both green and gray stormwater and internal drainage management strategies. Two options for the north-south coastal flood defense system alignment are being considered as part of the Proposed Action, both starting from University Avenue in the south and connecting to the existing rail viaduct in the north, one roughly along the east side of Main Street and the second alignment further east along the western edge of the PSEG property.

- The **Resilience Center** would provide funding to the Mary and Eliza Freeman Center for the renovation of the Freeman Houses, a historic resource of local and national significance, that would provide a community space in the South End to operate as a central location for resilience information dissemination, and a location to store supplies to assist the community with recovery efforts during or after shock events. The project would also include other small, open-air design areas to serve as part of the South End Resilience Network.

The Area of Potential Effect (APE), related to historic resources, is delineated as the Study Area, roughly bounded by Metro-North Railroad and South Avenue to the north, Bridgeport Harbor and Long Island Sound to the east and south, and Iranistan Avenue, Atlantic Street, and the west side of Seaside Village to the west (Figure 3). This area was chosen to allow for the assessment of potential direct and indirect effects of the Proposed Action on historic resources. Historic resources include archaeological sites, burial grounds, sacred landscapes or features, ceremonial areas, traditional cultural places and landscapes, and buildings and structure with significant tribal association.

Based on the historic evaluation conducted by a cultural resources consultant (see attached *Historic and Archaeological Resources Evaluation Report*, dated May 4, 2018), it was determined that the APE retains a wide range of historic resources, the majority of which date from mid-19th to mid-20th centuries. Five National Register of Historic Places (NRHP)-listed individual historic properties and four districts are present; five districts and 11 individual properties were assessed as potentially NRHP-eligible. The NRHP eligibility of these properties is being determined as part of an ongoing consultative process between DOH and the Connecticut State Historic Preservation Office (CTSHPO). Two noteworthy resources include the Freeman Houses (NRHP-listed), located on Main Street, rare and valuable survivors of the Little Liberia community, and Seaside Park (NRHP-listed), designed by Frederick Law Olmsted and Calvert Vaux. The Proposed Action would have an adverse effect on the historic entrance of Seaside Park and an adverse effect on the potentially eligible New Haven and Hartford railroad viaduct.

In addition, there are two archaeological sites within the APE, and research indicates that this area was intensively occupied by Native Americans during the Late Woodland and Contact periods (Figure 4). Any ground disturbance has the potential to impact intact archaeological resources and human remains. Therefore, in advance of construction activities, additional review would include investigation of soil sequences within the project areas by a system of geotechnical investigations (geoprobes, augers, etc.) to

further explore the complicated soil sequences. Ground disturbances would also be monitored by an archaeologist, to limit any possible impacts to human remains that may be buried within the APE. Due to the high archaeological potential of the area of Seaside Park's entrance, any ground disturbance should be preceded by an archaeological survey, to include either a system of geotechnical investigations or traditional shovel testing. Moreover, because of the unique preservation of open spaces associated with Seaside Park, efforts should be made to identify any human burials within the project area, preferably with a ground penetrating radar (GPR) survey. Work in the proximity to the Freeman Houses would be preceded by a systematic geotechnical investigation, such as a geoprobe survey. If the stone pavement on Singer Street must be destroyed or removed for the project, an archaeological shovel test pit survey would be carried out, once the stone pavement has been removed.

DOH has been conducting a review of the historic properties identified within the Study Area to comply with Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR Part 800. We would like to invite you to be a consulting party in this review to help identify historic properties in the Study Area that may have religious and cultural significance to your tribe, and if such properties exist, to help assess how the Resilient Bridgeport projects might affect them. If the project might have an adverse effect, we would like to discuss possible ways to avoid, minimize, or mitigate potential adverse impacts.

To meet project timeframes, if you would like to be a consulting party on this program, please let us know of your interest within 30 days of this letter. If you have any initial concerns with impacts of the project on religious or cultural properties, please note them in your response. The Draft Environmental Impact Statement is expected to be published in early January 2019. We will notify you when the document is available.

More information on the Section 106 review process is available at https://www.hudexchange.info/environmental-review/historic-preservation/.

HUD's process for tribal consultation under Section 106 is described in a Notice available at https://www.hudexchange.info/resource/2448/notice-cpd-12-006-tribal-consultation-under-24-cfr-part-58/

DOH welcomes the consultation of the Delaware Nation, Oklahoma as we strive for more effective public participation in NEPA and Section 106 analyses, in our efforts to achieve more informed decision making and to promote cultural heritage and identity. We value your assistance and look forward to consulting further if there are historic properties of religious and cultural significance to your tribe that may be affected by the Proposed Action. Should you have any questions regarding this notice, request, or draft agreement, please do not hesitate to contact me at Rebecca.French@ct.gov or 860-270-8231.

Sincerely,

Rebecca French

Rebecca A. French, Ph.D.
Director of Resilience

cc: Donna Mahon (HUD)
Nicole Weymouth (WSP)

ENCLOSURES

Figure 1: Project Location

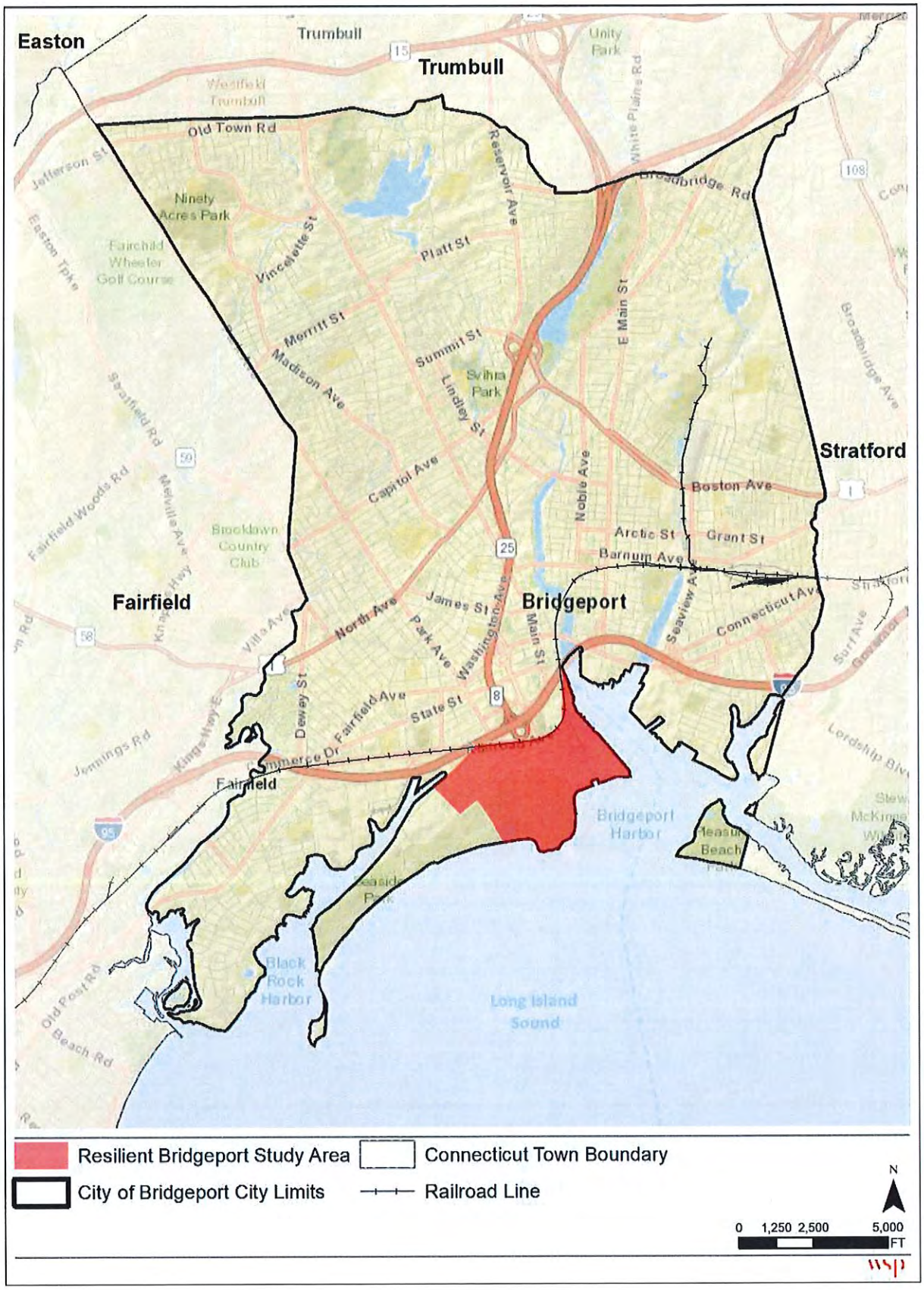


Figure 2: Project Areas

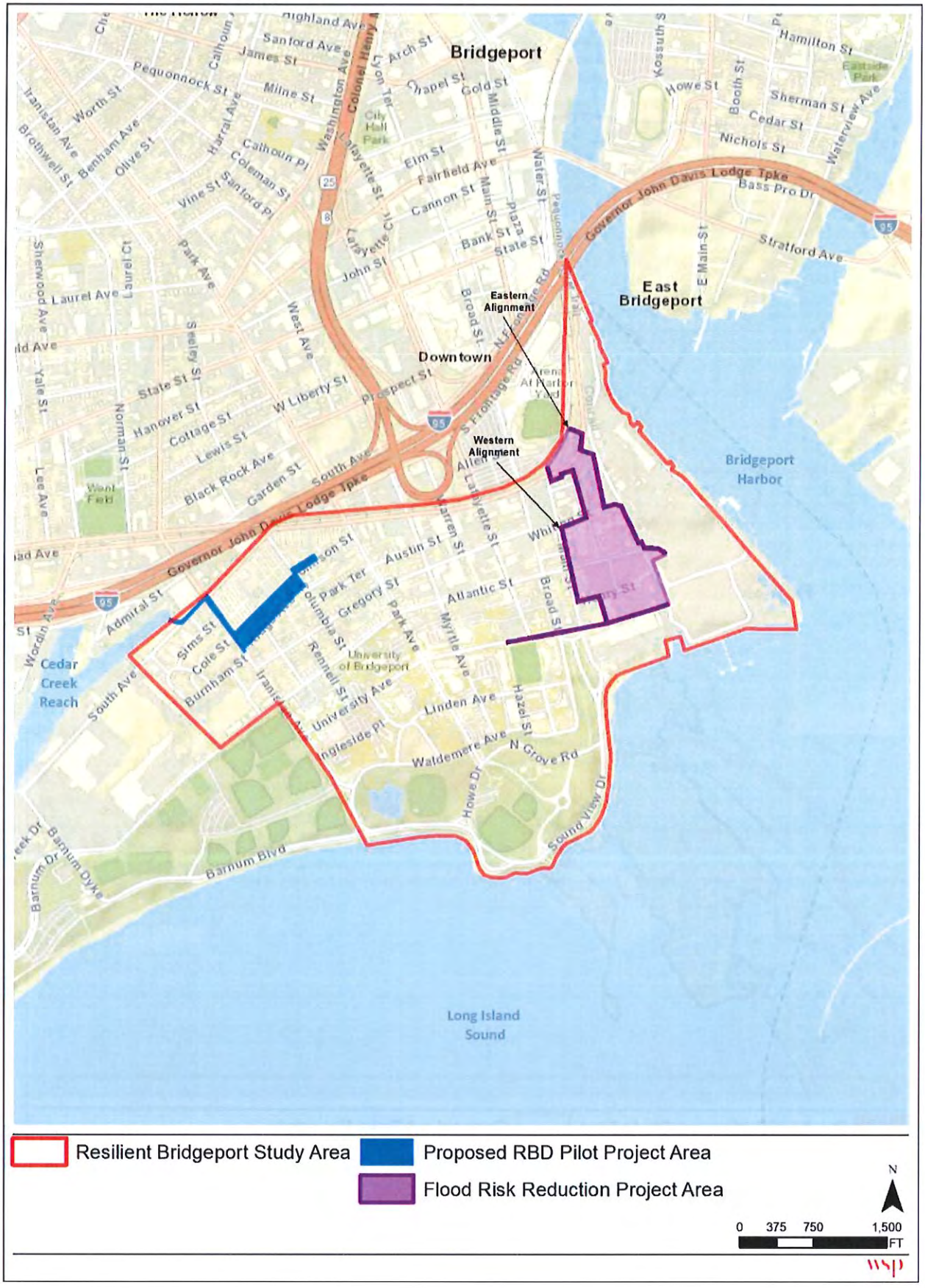


Figure 3: APE and NHRP-listed, and Potentially NHRP-eligible Historic Resources

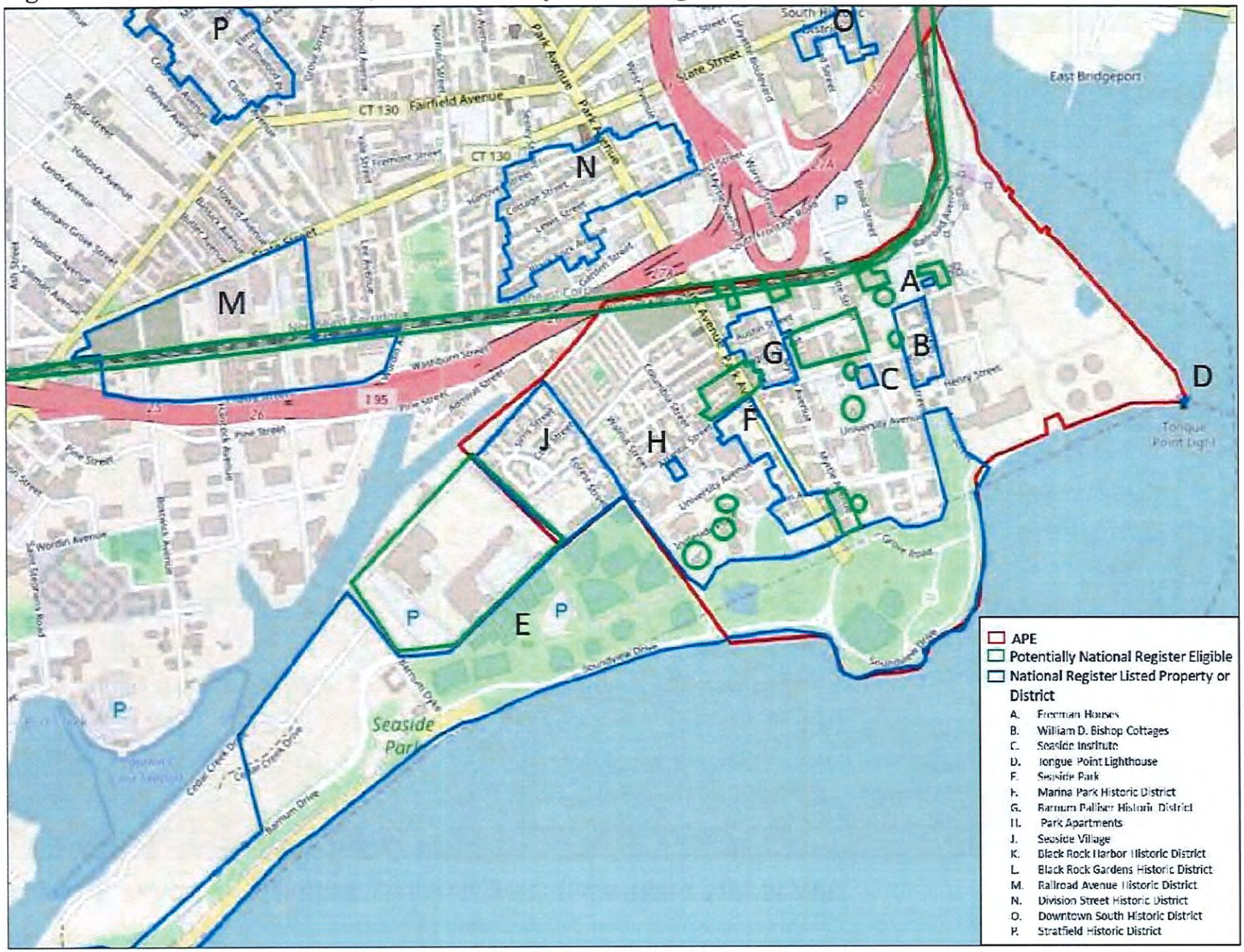
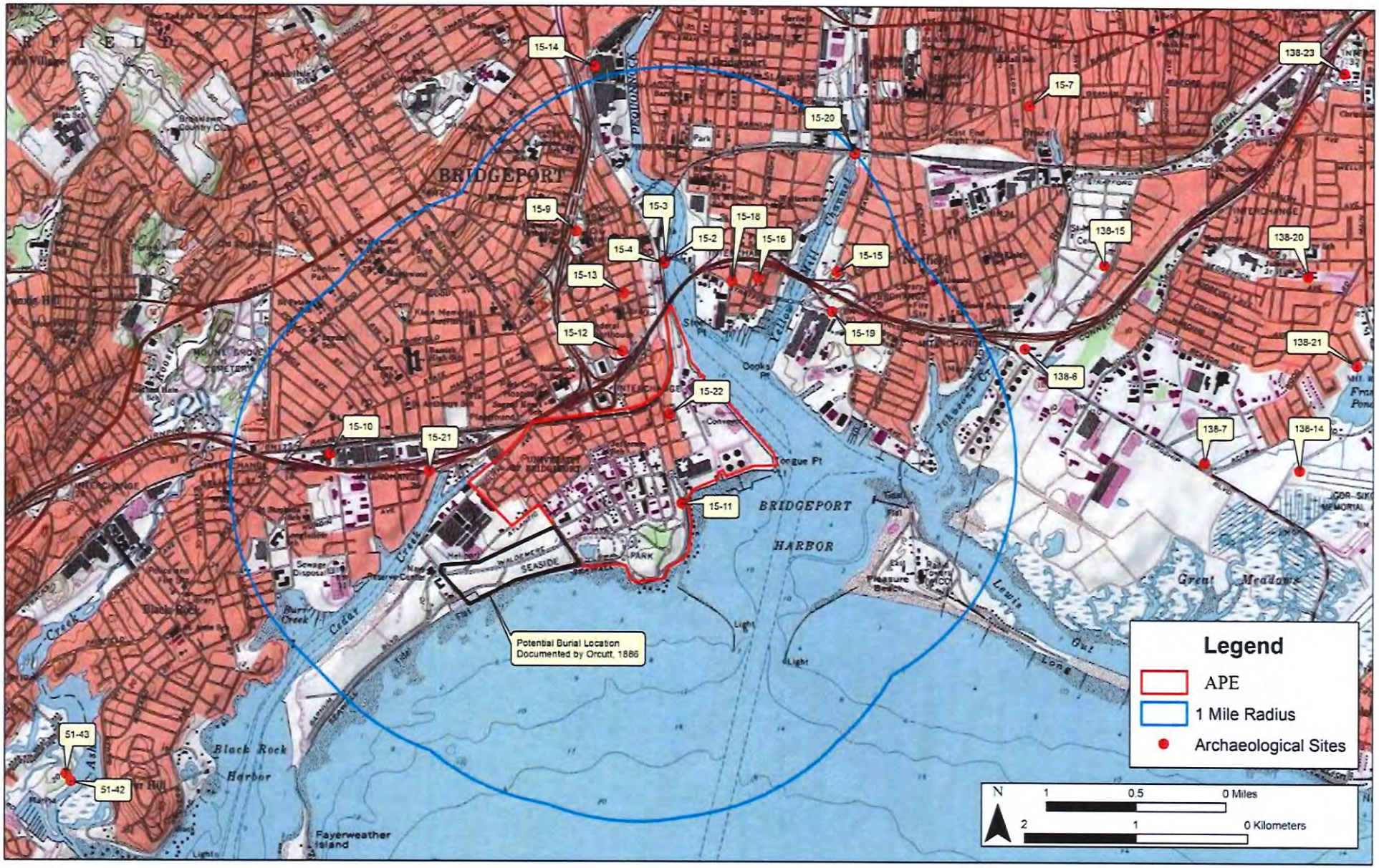


Figure 4: Previously Identified Archaeological Sites within 1 Mile of APE



Dannel P. Malloy
Governor

STATE OF CONNECTICUT
DEPARTMENT OF HOUSING

Evonne M. Klein
Commissioner

December 21, 2018

Brice Obermeyer
Director, Tribal Historic Preservation Office
Delaware Tribe of Indians
Roosevelt Hall, Rm 212
1200 Commercial Street
Emporia, KS 66801

RE: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Projects

Dear Mr. Obermeyer,

The State of Connecticut's Department of Housing (DOH) proposes to utilize funds from U.S. Department of Housing and Urban Development (HUD) through the Community Development Block Grant (CDBG) Disaster Recovery (DR) National Disaster Resilience (NDR) and Rebuild by Design (RBD) programs, for the proposed *Resilient Bridgeport: National Disaster Resilience and Rebuild by Design* projects (Proposed Action). Under HUD regulation 24 CFR 58.4, DOH has assumed environmental review responsibilities for the project, including tribal consultation related to historic properties.

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Dannel P. Malloy
Governor

STATE OF CONNECTICUT
DEPARTMENT OF HOUSING

Evonne M. Klein
Commissioner

December 21, 2018

John Brown
Tribal Historic Preservation Office
Narragansett Indian Tribe
4425 County Trail
Charlestown, RI 02813

RE: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Projects

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The Area of Potential Effect (APE), related to historic resources, is delineated as the Study Area, roughly bounded by Metro-North Railroad and South Avenue to the north, Bridgeport Harbor and Long Island Sound to the east and south, and Iranistan Avenue, Atlantic Street, and the west side of Seaside Village to the west (Figure 3). This area was chosen to allow for the assessment of potential direct and indirect effects of the Proposed Action on historic resources. Historic resources include archaeological sites, burial grounds, sacred landscapes or features, ceremonial areas, traditional cultural places and landscapes, and buildings and structure with significant tribal association.

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To meet project timeframes, if you would like to be a consulting party on this program, please let us know of your interest within 30 days of this letter. If you have any initial concerns with impacts of the project on religious or cultural properties, please note them in your response. The Draft Environmental Impact Statement is expected to be published in early January 2019. We will notify you when the document is available.

More information on the Section 106 review process is available at https://www.hudexchange.info/environmental-review/historic-preservation/.

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Sincerely,

Rebecca French

Rebecca A. French, Ph.D.
Director of Resilience

cc: Donna Mahon (HUD)
Nicole Weymouth (WSP)

ENCLOSURES

Figure 1: Project Location

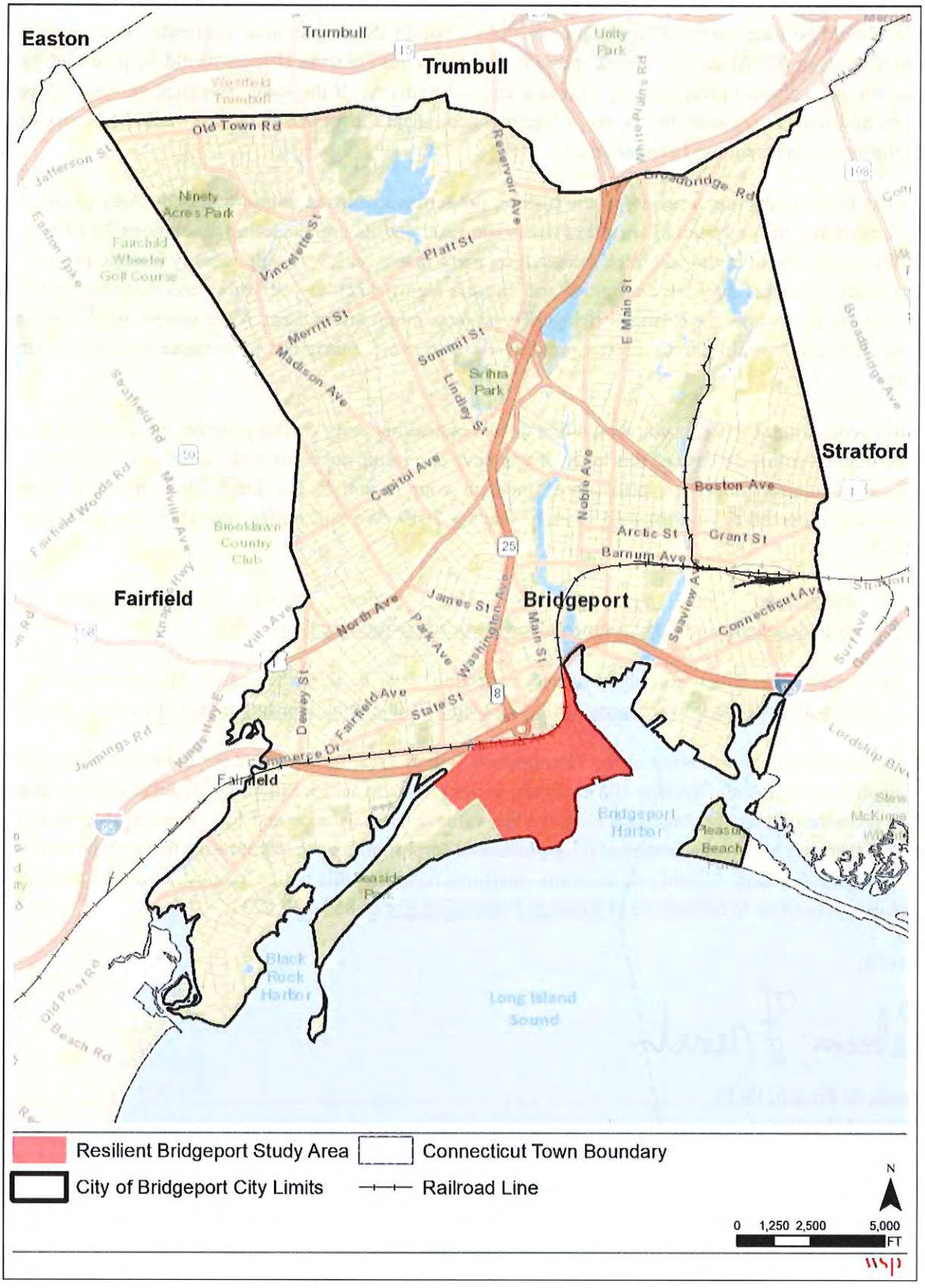


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Figure 3: APE and NHRP-listed, and Potentially NHRP-eligible Historic Resources

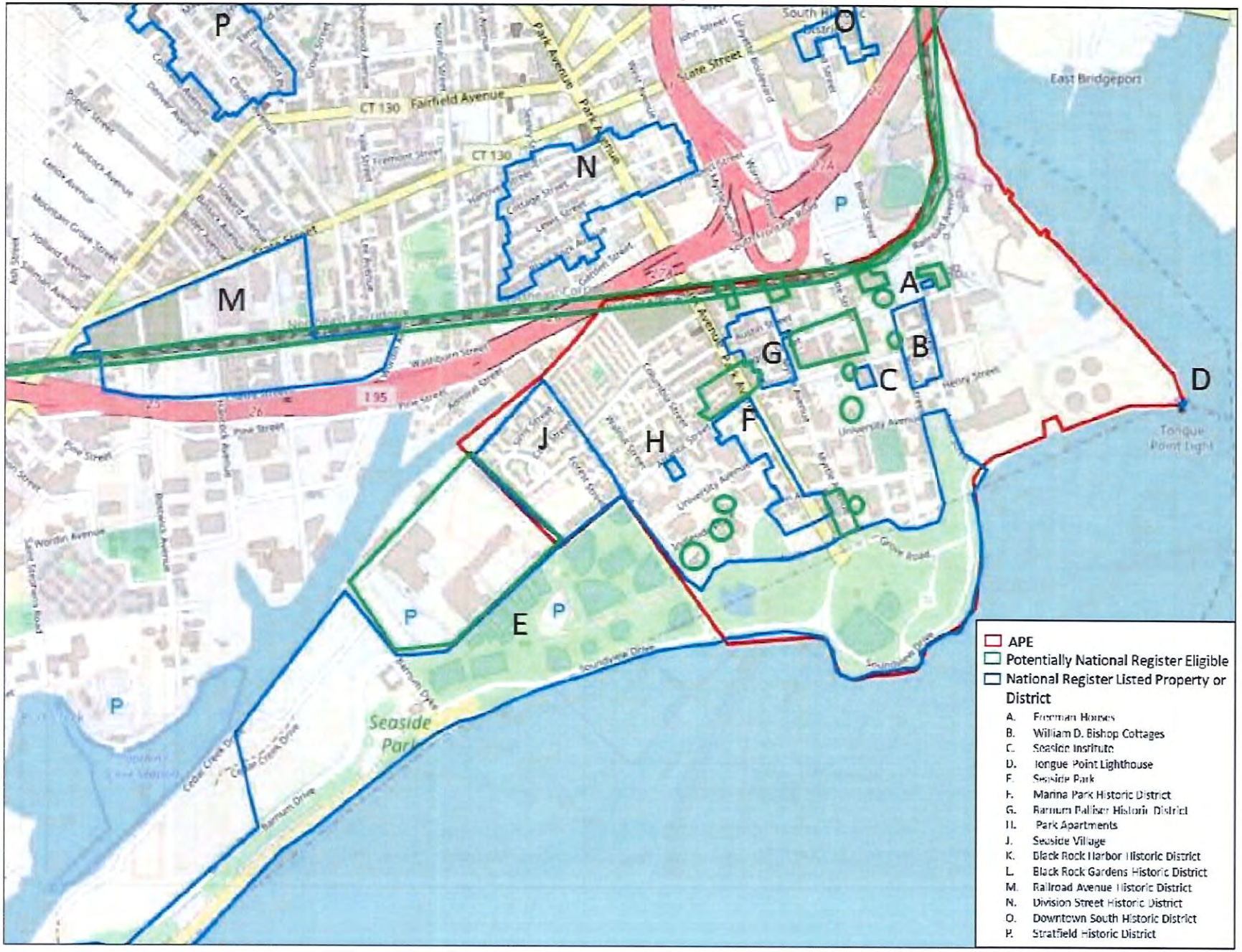
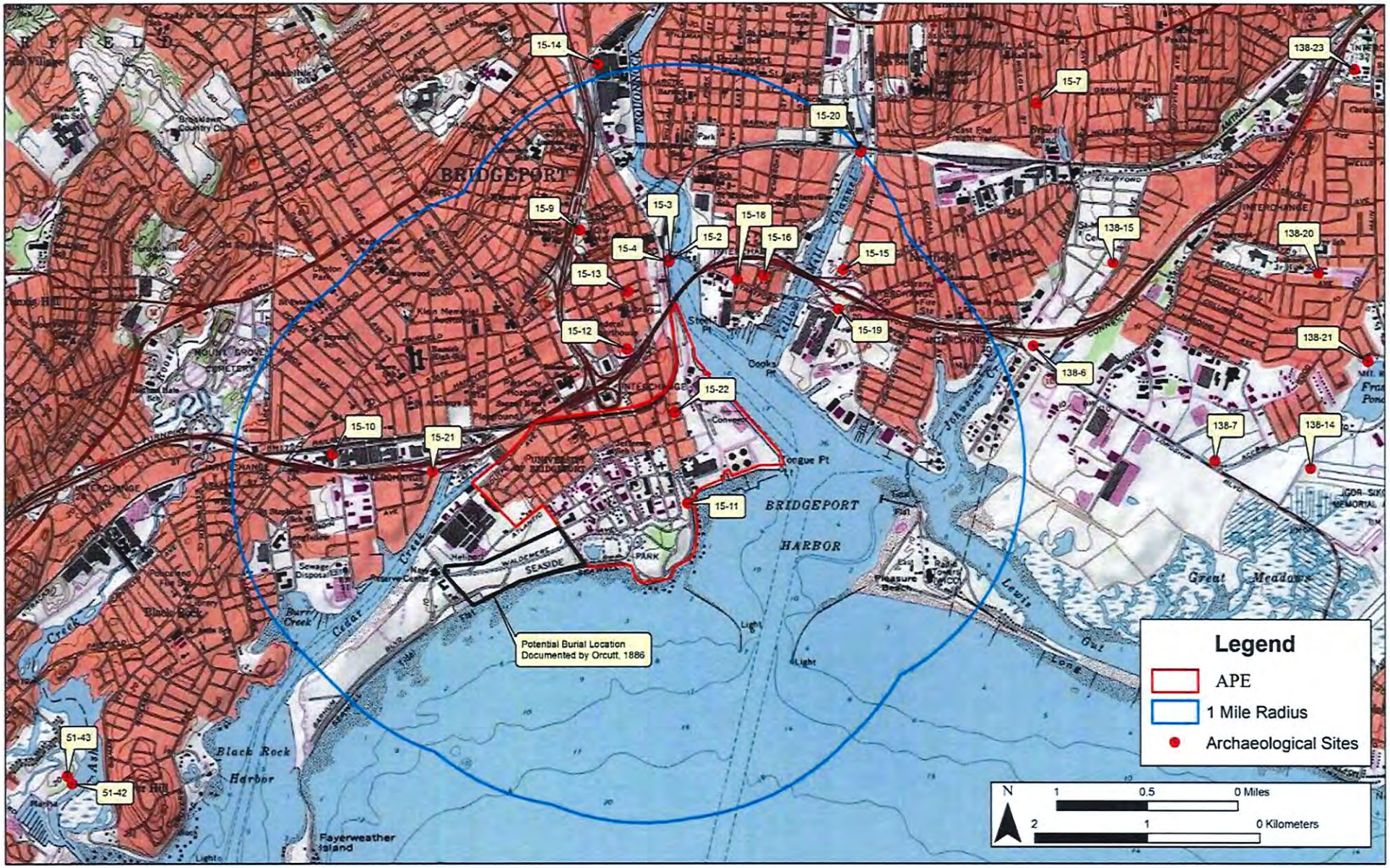


Figure 4: Previously Identified Archaeological Sites within 1 Mile of APE



Dannel P. Malloy
Governor

STATE OF CONNECTICUT
DEPARTMENT OF HOUSING

Evonne M. Klein
Commissioner

December 21, 2018

John Brown
Tribal Historic Preservation Office
Narragansett Indian Tribe
4425 County Trail
Charlestown, RI 02813

RE: Resilient Bridgeport: National Disaster Resilience and Rebuild by Design Projects

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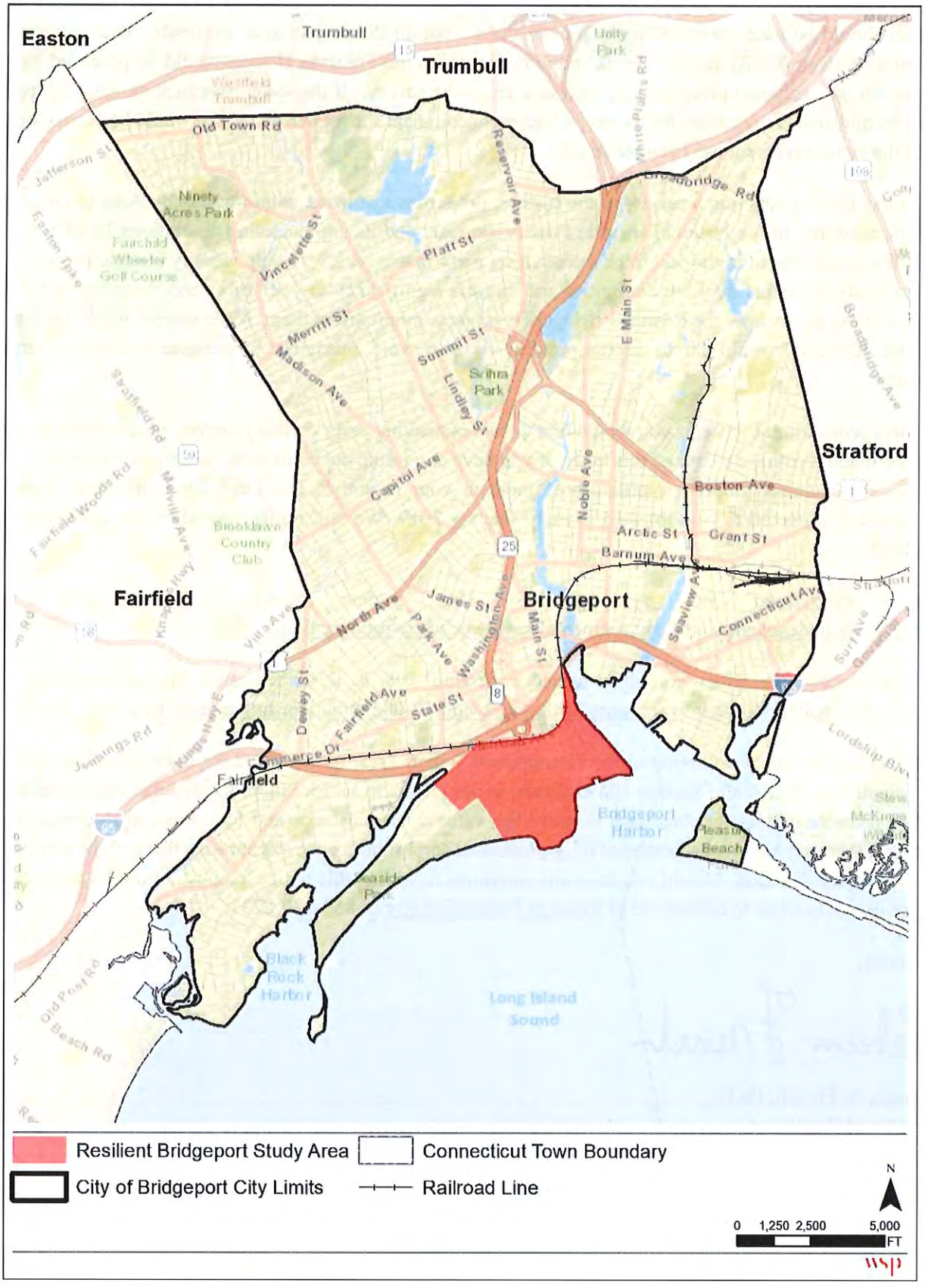


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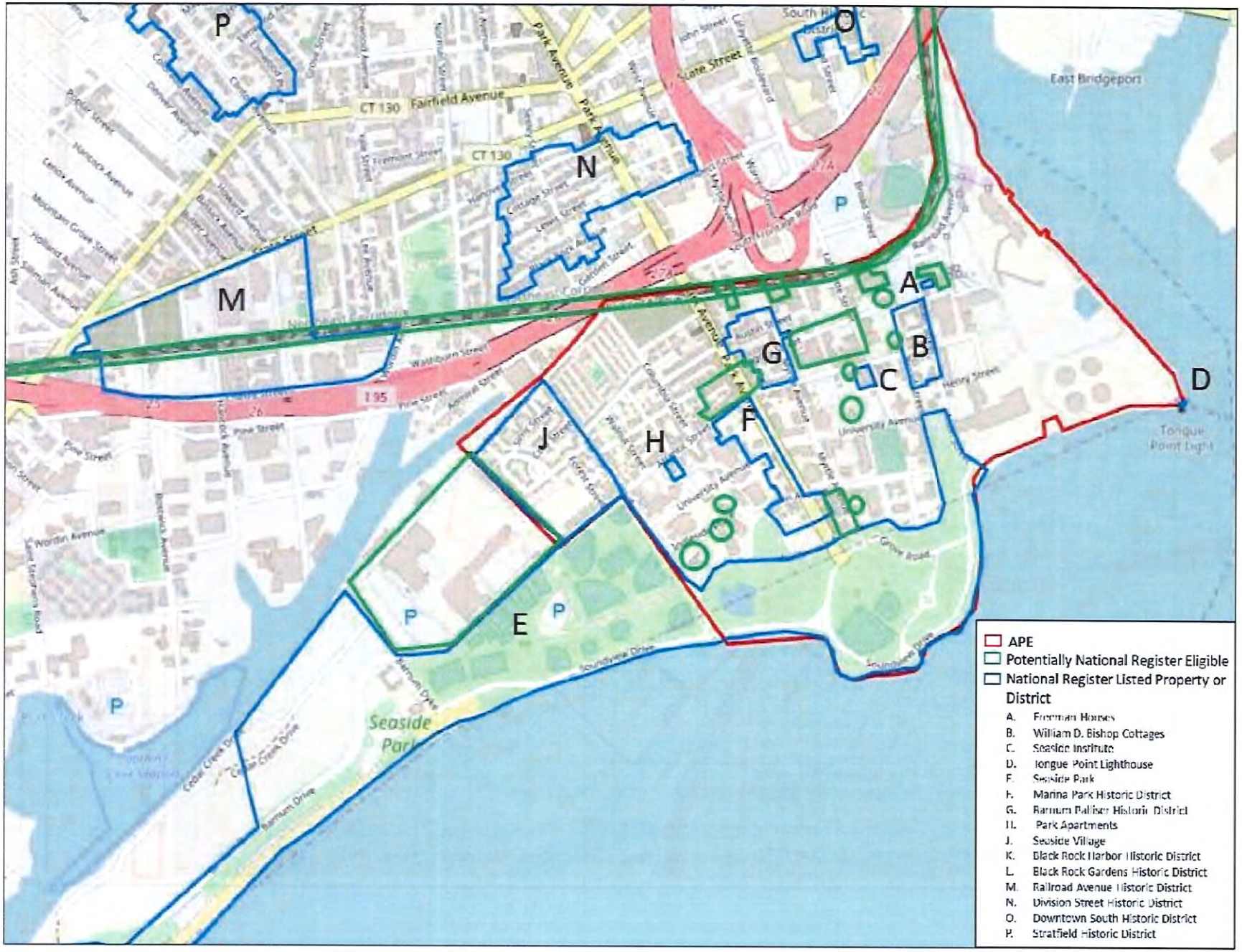
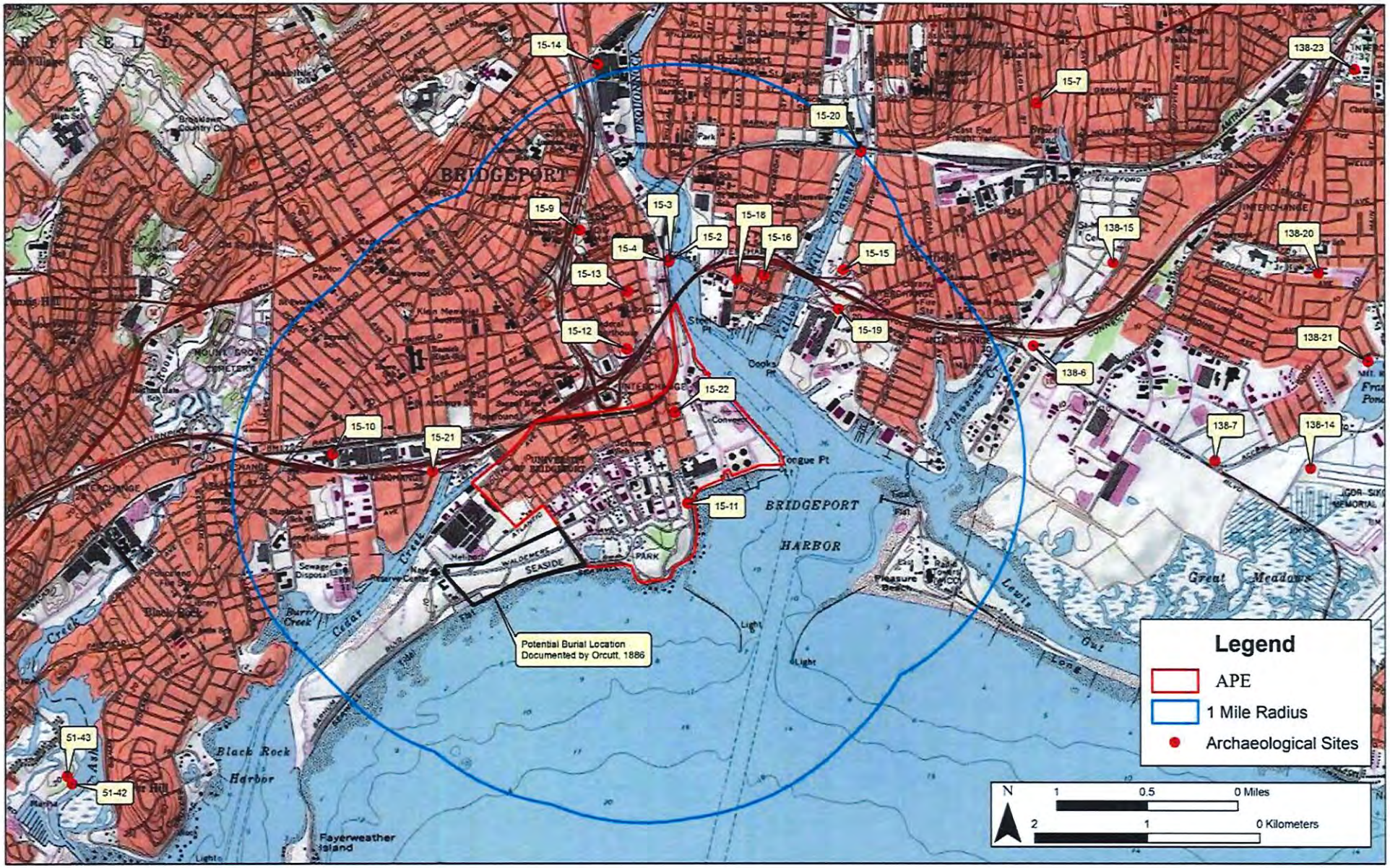


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APPENDIX B
Alternatives Evaluation Report

STATE OF CONNECTICUT DEPARTMENT OF HOUSING

RESILIENT BRIDGEPORT NATIONAL DISASTER RESILIENCE

PRELIMINARY ALTERNATIVES EVALUATION REPORT

DECEMBER 13, 2018



RESILIENT BRIDGEPORT NATIONAL DISASTER RESILIENCE

PRELIMINARY ALTERNATIVES EVALUATION REPORT

STATE OF CONNECTICUT DEPARTMENT OF HOUSING

PROJECT NO.: 52829
DATE: DECEMBER 2018

WSP
500 WINDING BROOK DRIVE
GLASTONBURY, CT 06033

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FAX: +1 860 633-8117
WSP.COM

500 Winding Brook Drive
Glastonbury, CT 06033

Tel.: +1 860 659-0444
Fax: +1 860 633-8117
wsp.com

December 13, 2018

Dr. Rebecca French - Director of Resilience
STATE OF CONNECTICUT DEPARTMENT OF HOUSING
505 Hudson Street
Hartford, CT 06106

Dear Dr. French:

Subject: Preferred Alternatives Evaluation Report

Please find enclosed the Preliminary Alternatives Evaluation Report, including a Preliminary Alternatives Analysis and an Alternatives Screening Matrix. This report forms the deliverable for Task 2.4, under the scope of services. Recommendations are provided for selection of three alternative alignments for flood risk reduction in Bridgeport's South End. These alternatives have been developed to a 10% level design submitted separately.

Please do not hesitate to contact me if you have any questions concerning this submission, at 1.617.960.4964 or Dan.J.Kennedy@wsp.com.

Yours sincerely,



Daniel Kennedy, P.E. ENV SP
Project Manager

WSP ref.: 52829

QUALITY MANAGEMENT

ISSUE/REVISION	FIRST ISSUE	REVISION 1	REVISION 2	REVISION 3
Remarks	Draft	Final		
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Signature				
Authorized by	Daniel Kennedy[1]	Daniel Kennedy[1]		
Signature				
Project number	52829	52829		

[1]WSP

[2]Arcadis

[3]Waggonner & Ball

This report was prepared by WSP USA for the account of STATE OF CONNECTICUT DEPARTMENT OF HOUSING, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP USA's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP USA accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

PRODUCTION TEAM

CLIENT

CT Department of Housing	Rebecca French, Director of Resilience

WSP

Project Manager	Daniel Kennedy, P.E.
Public Involvement Task Lead	Laura Toole
Environmental Lead	Nicole Weymouth
Civil Task Lead	Richard Pettinelli, P.E.

SUBCONSULTANTS

Stormwater and Coastal Features	Arcadis
Urban Design	Waggonner & Ball, LLC

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1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Resilient Bridgeport project is funded by two design competitions initiated by the U.S. Department of Housing and Urban Development (HUD): Rebuild by Design (RBD) and the National Disaster Resilience Competition (NDRC). The Hurricane Sandy Rebuilding Task Force launched the RBD competition in June 2013, as a multi-stage planning and design competition to promote resilience in the Sandy-affected region. The goal of the competition was to promote innovation by developing regionally-scalable but locally applied solutions that increase resilience in the region. The competition set aside HUD Community Development Block Grant Disaster Recovery (CDBG-DR) funding to incentivize the implementation of winning projects and proposals. Resilient Bridgeport was one of the seven winning ideas which received funding.

On September 17, 2014, HUD released a Notice of Funding Availability (NOFA) for the Community Development Block Grant National Disaster Resilience Competition (CDBG-NDRC). The State of Connecticut received funding to support the Resilient Bridgeport pilot program which aligns with the State's broader Connecticut Connections Coastal Resilience Plan. As part of the NDRC, HUD earmarked for Bridgeport, CT, approximately $42 million to advance resilience planning and implementation in the Bridgeport's South End:

WSP and a team of sub-consultants ("Project Team") have been engaged by the Connecticut Department of Housing (CTDOH) to perform professional engineering services for the NDRC project and the Environmental Impact Statement (EIS) for the RBD and NDRC projects. The RBD pilot project has progressed to approximately 30% design level under a separate contract. The following report is developed to evaluate potential Coastal Flood Defense System (CFDS) alignment alternatives for the NDRC grant funded portion of the Resilient Bridgeport project.

1.2 PROJECT LOCATION

The general project limits are defined as the area approximately bounded by the Metro North Rail Road (MNRR) line to the north, Park Avenue to the west, Long Island Sound to the south and the Pequonnock River to the east as shown in **Figure 1**. This low-lying area is home to residential neighborhoods, historic districts and landmarks, productive industrial facilities, educational institutions, regional transportation systems and critical regional energy and wastewater infrastructure that face growing environmental challenges.



Figure 1 - Approximate Project Area (highlighted yellow)

1.3 REPORT SCOPE

The scope of services includes identifying multiple conceptual alignment alternatives to construct a CFDS and narrowing down to three alternatives for further evaluation (10% Design). This report describes the process undertaken to set project goals and selection criteria, develop approaches for reducing flood risk, select a preferred approach, identify alignment alternatives for the preferred approach, analyze alignment alternatives and select three alternatives for 10% design.

With the goal of ultimately selecting three alignment alternatives, this report documents a three-step process implemented to develop a logical and transparent approach to determining alignments which best meets the project goals while considering the numerous constraints and opportunities of each alignment. The three-step process undertaken consists of the following:

1. Evaluate Approaches for Reducing Flood Risk: The Project Team established three general approaches for reduce the impacts of coastal flooding which are listed below. At the conclusion of this step, an approach for reducing flood risk was chosen by evaluating the three approaches against the project goals and selection criteria.
    a. Edge Alignment: This alignment would be constructed either in-water or along the outer edge of the community along the waterfront;
    b. Interior Alignment: The interior alignment would identify a street or streets that could be raised to provide dry egress for future development, provide some reduction in risk from storm events and generate opportunities for economic development; and,
    c. Integrated Alignment: This alignment would be constructed in coordination with key area stakeholders and include raised streets, walls and/or berms. The alignment would also consider future plans for growth, development, and other risk reduction efforts occurring within the project area.
2. Evaluate Preliminary Alignment Alternatives for the preferred approach: Within this step, all potentially feasible alignment segments for the preferred approach were identified for evaluation both on public and private property in

the South End. There are several major property owners/stakeholders in the project area including the University of Bridgeport (UB), PSEG, United Illuminating (UI), Emera, the developer for 60 Main Street, the developer for 30 University Avenue, the City of Bridgeport (City), Connecticut Department of Transportation (CTDOT), Bridgeport Port Authority, community groups and private property owners. Community, property owner and stakeholder input was sought and considered in the preliminary alignments.

3. Select Three Alternatives for Further Evaluation: Segments that were no longer implementable were eliminated from further consideration based on meetings with stakeholders; inconsistency with project goals and selection criteria; and, or, site constraints. Three alignments that were deemed implementable (at the current stage of design), while also achieving the goals of the project, were selected for further consideration (10% Design).

2 PROJECT GOALS AND SELECTION CRITERIA

The Project Team established a set of project goals and selection criteria to support those goals. The outcome of the goal setting process is described in "Resilient Bridgeport National Disaster Resilience Goals and Selection Criteria White Paper" first submitted to CTDOH on February 23, 2018. The goals and selection criteria are summarized in this section. In addition, a discussion is provided for the process implemented to identify and combine potential alignment segments.

2.1 PROJECT GOALS

The Project Team developed the following set of goals that encompass project objectives while pushing for innovation and fulfilment of a strategy for resilience. These goals were developed to guide the alternatives selection process and serve as the foundation to effectively measure, evaluate, and screen potential alternatives. The following goals are numbered to provide a unique identifier only and the numbering does not represent the order of importance.

2.1.1 GOAL 1: MINIMIZE RISKS ASSOCIATED WITH ACUTE AND CHRONIC FLOODING

Located on a peninsula, surrounded by the Pequonnock River to the east, Cedar Creek to the west, and Long Island Sound to the south, the South End is at risk of flooding from both coastal storm surge (see **Figure 2**) during storm events and from significant rainfall events that are projected to become more frequent in the future due to climate change and sea level rise. Resilient Bridgeport will seek to alleviate hardships associated with flooding from these types of events through creative and effective coastal and inland water impact mitigation strategies. Hurricane Sandy is a recent example of a major storm causing significant flooding to the South End. Inundation levels during the storm are provided in **Figure 3**

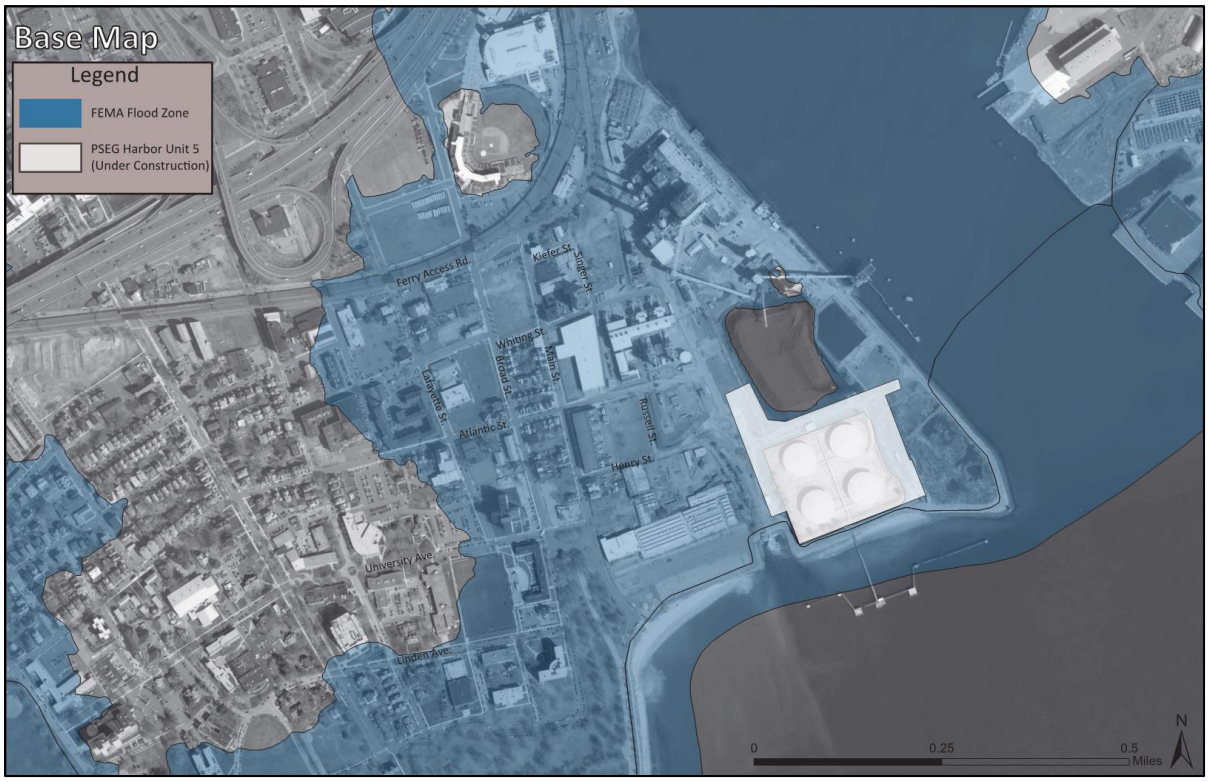


Figure 2 - FEMA 1% annual chance of occurrence flood zone

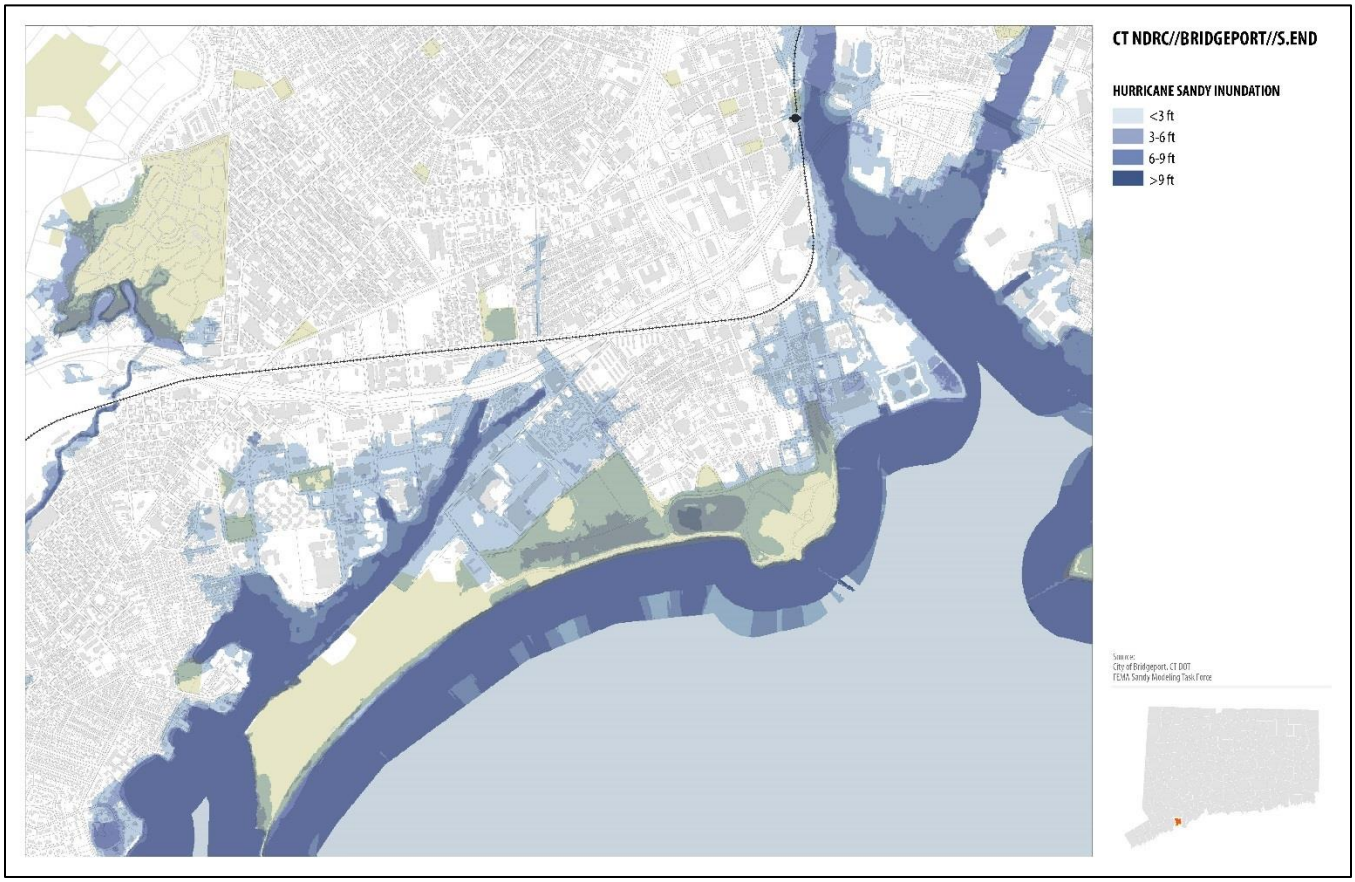


Figure 3 - Hurricane Sandy Inundation Levels

2.1.2 GOAL 2: INTEGRATE WITH PLANS AND PROJECTS OF KEY LOCAL STAKEHOLDERS

The South End Community includes a range of stakeholders with active projects and plans which will be considered for coordinated risk reduction measures. Key stakeholders include utility companies, major power generation facilities, private developers, and the University of Bridgeport. This goal will assess the extent to which shared efforts between these parties can lead to effective risk reduction, through integration with stakeholders' projects, plans and future operations.

There are several significant and ongoing plans, developments, and facility operations in the South End project area. Resilient Bridgeport will strive to integrate with and, at a minimum, coordinate with these stakeholder initiatives to maximize the leveraging of resources, impact, and ultimate success of this project. The project will seek to gain efficiencies through the coordination of risk reduction efforts and the ability to leverage projects in the community to achieve the highest positive impact achievable for the South End.

2.1.3 GOAL 3: DELIVER CO-BENEFITS TO ENHANCE COMMUNITY RESILIENCY

Resilience is defined broadly by the South End Community to include social, economic, and environmental factors in addition to risk reduction. Therefore, the project should employ this comprehensive approach to resilience and aim to reduce risk to the community while delivering co-benefits by: enabling new economic development opportunities, improving mobility, and enhancing quality of life. Risk reduction should create tangible physical, economic, environmental, and social benefits for the community and the extent to which those benefits enable long-term community resiliency.

2.1.4 GOAL 4: PROJECT NEEDS TO BE IMPLEMENTABLE

Resilient Bridgeport has received a finite amount of funding through federal funding sources set on a defined schedule for implementation. The project must be achievable with the available resources, meet necessary relevant local, state, and federal permits and regulations and meet the finite construction timeline provided by HUD for funding. This goal serves as a baseline requirement for alternative evaluation.

2.2 SELECTION CRITERIA

The following selection criteria were developed to allow the Project Team to understand and evaluate how each alternative will contribute to, and/or achieve the agreed upon project goals. By qualitatively capturing the positive and negative effects of alternatives, the evaluation process supports development of a consensus for a shortlist of three alternatives.

2.2.1 SELECTION CRITERIA GOAL 1: MINIMIZE RISKS ASSOCIATED WITH ACUTE AND CHRONIC FLOODING

- Enhance reliability of energy generation, transmission, and distribution
- Reduce flood risk for vulnerable populations
- Reduce flood risk for residents, businesses, and institutions
- Consider present day and future flood risk based on local climate change projections on storm intensity and frequency
- Provide dry egress for residents and redevelopment sites
- Provide opportunities for green infrastructure management measures
- Provide opportunities for adaptability to future conditions
- Reduce flood risk for the design life of the project considering sea level rise
- Reduce flood risk for energy providers during storm events
- Result in low-level of impact on existing drainage system

2.2.2 SELECTION CRITERIA GOAL 2: INTEGRATE WITH PLANS AND PROJECTS OF KEY LOCAL STAKEHOLDERS

- Achieve stakeholder buy-in
- Achieve community buy-in
- Leverage investment through coordination with stakeholders
- Maintain and/or improve access to stakeholder properties
- Integrate with current master plans
- Provide dry egress to future development sites

2.2.3 SELECTION CRITERIA GOAL 3: DELIVER CO-BENEFITS TO ENHANCE COMMUNITY RESILIENCY

- Provide public amenities

- Improve connectivity to Downtown Bridgeport during flood event
- Improve mobility within South End
- Facilitate Transit Oriented Development (TOD)
- Preserve and/or enhance connection to water
- Preserve and enhance community character
- Integrate with and repair the urban fabric
- Unlock potential for future development
- Improve public health
- Create and/or enhance the public realm
- Serve as regional flood risk reduction prototype

2.2.4 SELECTION CRITERIA GOAL 4: PROJECT NEEDS TO BE IMPLEMENTABLE

- Avoid/minimize potential right-of-way (ROW) conflicts
- Avoid acquisition of private property
- Avoid significant utility obstructions/conflicts
- Avoid known major environmental impacts
- Avoid known unfavorable subsurface conditions
- Consider spatial constraints
- Estimated construction costs are within project budget or reachable with reasonable supplemental sources
- Provide relative life-cycle cost benefits
- Provide relative Operations and Maintenance (O+M) cost benefits
- Able to be permitted by local, state, and federal agencies
- Buildable within allowable timeframe
- Designed such that it could be accredited by FEMA

3 EVALUATE APPROACHES FOR FLOOD RISK REDUCTION

3.1 GENERAL

Three general approaches to reduce the risk of acute flooding to vulnerable areas of the eastern south end were developed for evaluation. The three alignments approaches are described in the following sections and further evaluated in Sections 5 and 6. Park Avenue provides a high ground "spine" running north-south through the South End. As the focus for this project is the south-east portion of the community, Park Avenue provides the western boundary of the CFDS and the tie-in point for dry egress from the South End.

3.2 EDGE ALIGNMENT

The edge alignment approach, shown in **Figure 4**, consists of a CFDS either in-water or directly above the Coastal Jurisdiction Line (Elevation +5.0 feet NAVD88). The alignment would start at the high ground on Park Avenue, continue east through the southern boundary of Seaside Park along the water's edge, and follow the shoreline of the Pequonnock River. A northern tie-in would be required along the MNRR line. This alignment would impact the shoreline along Seaside Park, 60 Main Street, PSEG, UI, and possibly the Bridgeport Port Authority.



Figure 4 - Edge Alignment Approach (shown in green)

3.3 INTERIOR ALIGNMENT

The interior alignment approach, shown in **Figure 5**, would consist of raising streets in the South End neighborhood to create a resilient corridor network, as well as provide dry egress to members of the community and key stakeholders. For

the purposes of this assessment, we have assumed that dry egress requirements will be met if new residential development can be accessed by a raised street elevated to meet the dry egress requirements of the CTDEEP flood plain management regulations. Raised streets may provide multi-model transportation options for residents while also reducing risk against future acute storm events. In this approach, University Avenue is the focus of the street raising, but consideration was also begiven to additional lateral street connections, such as Gregory Street and Atlantic Street.



Figure 5 - Interior Alignment Approach (shown in green)

3.4 INTEGRATED ALIGNMENT

The integrated approach, shown in **Figure 6**, combines aspects of both the edge and interior approach to reduce acute flood risk for the project area. Similar to the edge approach, the integrated approach consists of a closed loop CFDS with the intent of providing a raised perimeter to reduce the risk of acute flooding to vulnerable areas on the inside of the alignment. However, while the edge alignment only considers an in-water/water's edge perimeter, the integrated approach also considers alignments further inland. An integrated alignment may include construction of structures on both public and private property and requires extensive coordination with stakeholders, agencies and the community. In addition, the integrated alignment incorporates dry egress functions along University Avenue.



Figure 6 - Integrated Alignment Approach (shown in green)

3.5 EVALUATION OF APPROACHES

The Edge Alignment, Interior Alignment and Integrated Alignment approaches were evaluated for each of the project goals identified in Section 2. An evaluation matrix was used as an assessment tool, where each goal was converted to a question with the respective approach either meeting the goal (yes) or not meeting the goal (no). The total number of "yes's" were tallied to determine which approach best meets the selection criteria. While none of the approaches meet all the project goals, the Integrated approach emerged with the most "yes" responses. Although the Integrated alignment scored highest of the three approaches, the Edge Alignment and Interior Alignment were further evaluated (see Section 5) in coordination with stakeholder outreach (see Section 4) prior to deciding on which approach to carry forward.

Table 1 - Alignment Approach Evaluation

Goal	Selection Criteria	Alignment		
		Edge	Raised Street	Integrated
1. Minimize Risks Associated with Acute and Chronic Flooding	Enhances reliability of energy generation, transmission, and distribution?	Y	N	Y
	Reduces flood risk for vulnerable populations?	Y	N	Y
	Reduces flood risk for residents, businesses, and institutions?	Y	N	Y
	Considers present day and future flood risk based on local climate change projects and storm intensity and frequency?	Y	Y	Y
	Provide dry egress for residents and redevelopment sites?	Y	Y	Y
	Provides opportunities for green infrastructure and management measures?	Y	Y	Y
	Provides opportunities for adaptability to future conditions?	Y	Y	Y
	Reduces flood risk for the design life of the project considering sea level rise?	Y	Y	Y
	Reduces flood risk for energy providers during storm events?	Y	N	Y
	Results in low-level of impact on existing drainage system?	Y	N	N
2. Integrate with Plans and Projects of Key Local Stakeholders	Achieves stakeholder buy-in?	Y	Y	Y
	Leverages investment through coordination with stakeholders?	Y	N	Y
	Maintains and/or improve access to stakeholder properties?	Y	Y	Y
	Integrates with current master plans?	Y	Y	Y
	Provides dry egress to future development sites?	Y	Y	Y
3. Deliver Co-benefits to Enhance Community Resiliency	Provides a multifunctional solution?	Y	Y	Y
	Provides public amenities?	Y	Y	Y
	Improves connectivity to Downtown Bridgeport during flood event?	Y	Y	Y
	Improves mobility within South End?	N	Y	Y
	Facilitates Transit-oriented development?	N	N	N
	Preserves and/or enhance connection to water?	N	Y	Y
	Preserves and enhance community character?	N	Y	Y
	Integrates with and repair the urban fabric?	N	Y	Y
	Unlocks potential for future development?	Y	Y	Y
	Improves public health?	Y	Y	Y
	Creates and/or enhance the public realm?	N	Y	Y
	Serves as regional flood risk reduction prototype?	Y	Y	Y

Table 2 - Alignment Approach Evaluation (Continued)

Goal	Selection Criteria	Alignment		
		Edge	Raised Street	Integrated
 **4. Project Needs to be Implementable**	Avoids/minimizes potential right-of-way conflicts?	N	Y	Y
	Avoids acquisition of private property?	N	Y	N
	Avoids significant utility obstructions/conflicts?	N	Y	N
	Avoids known major environmental impacts?	N	Y	Y
	Avoids known unfavorable subsurface conditions?	N	Y	Y
	Considers spatial constraints?	Y	Y	Y
	Estimated construction costs are within project budget or researchable with reasonable supplemental sources?	N	Y	Y
	Provides relative life-cycle cost benefits?	Y	Y	Y
	Provides relative Operations and Maintenance (O+M) cost benefits?	Y	Y	Y
	Able to be permitted by local, state, and federal agencies?	Y	Y	Y
	Buildable within allowable timeframe?	N	Y	Y
	Designed such that it could be certified by Federal Emergency Management Agency?	Y	N	Y
	Total No. of Yes's	**26**	**31**	**35**

4 STAKEHOLDER OUTREACH

Stakeholder outreach was a critical component of the preliminary alternatives analysis process. The Project Team engaged with several key stakeholders to communicate the goals of Resilient Bridgeport, solicit feedback and seek opportunities for cooperation. A map showing key stakeholders is provided in **Figure 7**.

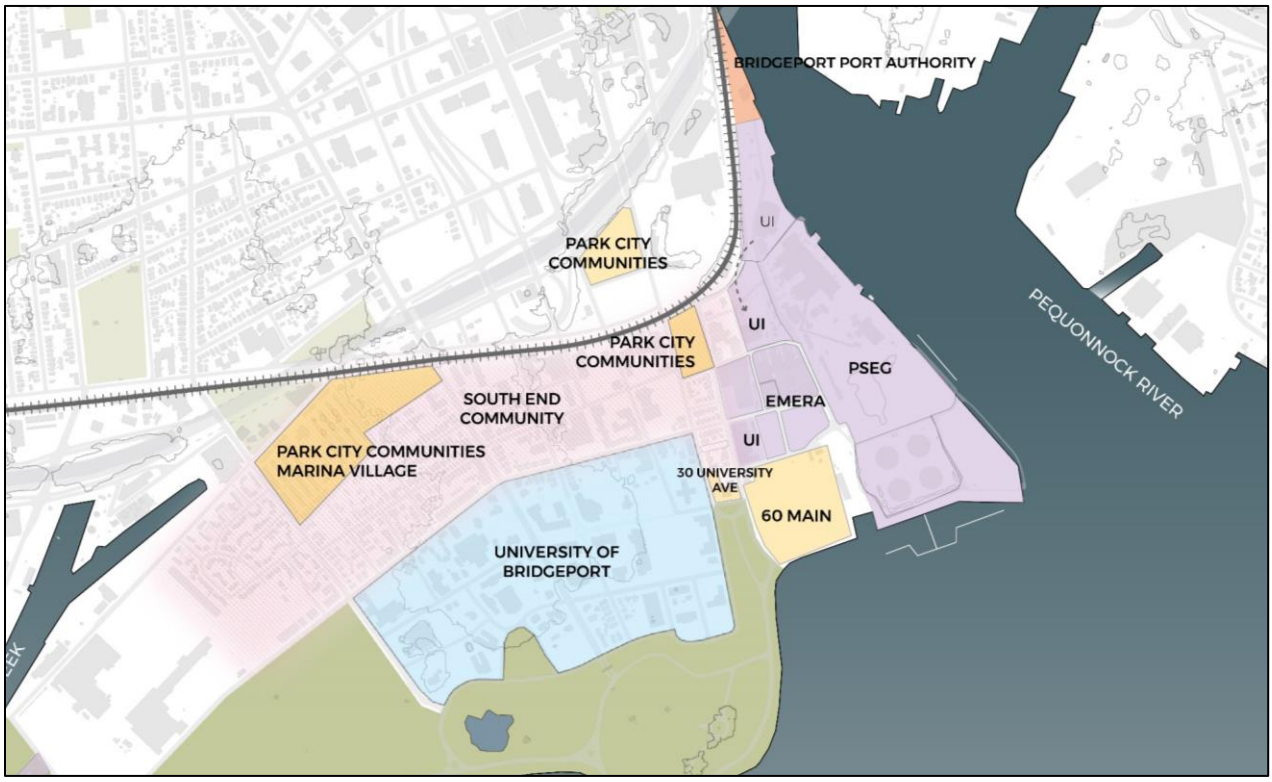


Figure 7 - Key Local Stakeholders

The Project Team conducted Stakeholder Outreach and engaged in a high-level review of potential approaches and alignments. Stakeholder outreach was primarily conducted to: collect data, better understand future development plans and initiatives, discuss the project goals and proposed alignment locations, and to look for opportunities to maximize the leveraging of resources. The purpose of the high-level review was to narrow the numerous alternatives down to three to evaluate in further detail. To qualitatively assess the effectiveness of each possible combination of segments against the project goals and selection criteria, an alignment alternatives screening matrix was also developed, as described herein.

4.1 UNIVERSITY OF BRIDGEPORT

The University of Bridgeport is in the center of the project area and contains University Avenue, which was earmarked as a resilient corridor within the NDRC project funding allocation. The Project Team met with representatives from the University multiple times throughout the alternatives development process to coordinate design, engage in integrated planning, and determine the most effective approach for integrating the raised University Avenue into the University's Master Plan. As a result of the meetings, the University agreed to be a partner for the project.

4.2 PRIVATE DEVELOPERS

The Project Team communicated and conducted meetings with Westport Property Management – the private developer seeking to develop 60 Main Street. Several meetings were held during the alternatives selection process with the goal of developing a coastal defense strategy that can be coordinated with the future development. Access needs, coastal defense,

maintenance and operations, public-private interface and construction sequencing were among the many issues considered in engaging the developer. In the meetings, the developer indicated a preference to avoid a coastal alignment in favor of an alignment that extended from the end of University Avenue westward.

CTDOH reached out to the developers of the 30 Main Street site; however, the developer was not responsive.

4.3 UNITED ILLUMINATING COMPANY (UI)

The Project Team coordinated with UI, a locally operated energy facility, to advance opportunities for a CFDS alignment that considers the needs of all parties, optimizes efficiencies, prioritizes risk reduction and produces co-benefits. The Project Team met individually with UI and jointly with PSEG, Bridgeport Energy and UI during the preliminary alternative development process, in addition to engaging via telephone and through correspondence. Key subjects of discussion included data collection for transmission and distribution lines, UI's existing Singer and Pequonnock Substation facilities, plans to relocate the Pequonnock Substation, and the company's long-term plans for resilience. UI possesses significant underground distribution lines within the project limits, which are a key consideration in assessing utility conflicts.

4.4 BRIDGEPORT ENERGY (EMERA)

Bridgeport Energy, owned by Emera is a 520 MW combined cycle natural gas-fired power plant whose facilities fall within the Resilient Bridgeport project area. As with UI, the Project Team met with Bridgeport Energy to seek opportunities for a favorable coastal defense alignment, optimize efficiencies, prioritize risk reduction and produce co-benefits. At individual meetings, as well as through direct correspondence and phone communication, the Project Team reviewed Bridgeport Energy's plans for reducing risk for its generating station; coordinated potential CFDS schemes and the related impact on Bridgeport Energy's operations, and; solicited partnership opportunities for an integrated risk reduction strategy.

4.5 PSEG

PSEG is located on the eastern border of the South End and is the largest property owner of the three energy providers. The Project Team met with PSEG during the preliminary alternatives analysis process to coordinate and obtain information regarding the following: site conditions, utility locations, the decommissioning strategy for Harbor Unit 3, the design and construction schedule for Harbor Unit 5, and the status of earlier decommissioned units and the jet fuel generator (Harbor Unit 4). The impact of all this existing and future infrastructure in relation to the Resilient Bridgeport project was reviewed. The Project Team presented potential CFDS options to PSEG to determine how risk reduction can be coordinated with PSEG's long-term planning for the site. At individual meetings, as well as through direct correspondence and phone communication, the Project Team reviewed PSEG's future plans; coordinated potential CDFS schemes and the related impact on PSEG's operations, and; solicited partnership opportunities for an integrated protection risk reduction strategy.

4.6 OTHER STAKEHOLDERS

In addition to the main property owners in the project area, the Project Team also met and / or corresponded with and solicited feedback from numerous other stakeholders as shown in .

Table 3 - Additional Stakeholder Meetings

Stakeholder	Main Discussion Topic(s)
City of Bridgeport (Engineering and WPCA)	Impact on existing utilities and plans for future stormwater improvements, Fire Marshall requirements
Connecticut Department of Energy and Environment (CTDEEP)	Flood Plain Management certification requirements
Connecticut Department of Transportation (CTDOT)	Northern tie-in (existing MNRR trestle and property)

The Mary & Eliza Freeman Center for History and Community	Potential impacts on the Freeman Houses and cottage district
US Army Corps of Engineers (USACE)	Public Law 84-99 (PL 84-99) Emergency Levee Rehabilitation Program
Federal Emergency Management Agency (FEMA)	FEMA Accreditation and Remapping process

5 FURTHER EVALUATION OF INTERIOR AND EDGE ALIGNMENT APPROACHES

5.1 INTERIOR ALIGNMENT APPROACH

The Interior Approach generally consists of raising streets. Streets can serve as a primary overland water-conveyance network. By anticipating storm surge and water flow both in and out, streets can function as a raised infrastructure corridor that doubles as flood defense. Streets can set the stage for new investment in key places, such as raised roads near potential redevelopment parcels. Making roadways more resilient would layer benefits of improving utilities, transportation, and flood risk reduction.

Providing dry egress to neighborhoods is a concern for both safety and redevelopment. Critical facilities, for which even a slight increase in flooding is too great a threat, required dry egress in order to be redeveloped. Raised connection corridors, or spines, can spur redevelopment in coastal areas while still promoting architectural adaptation to rising seas.

Raised corridors can be paired with a wayfinding program, such as signage and lighting, to provide clear directions during evacuations and better connections through the neighborhood year-round. Signage and lighting can denote important sites (e.g., shelters) or educational information (e.g., historic flooding heights). Better connections, raised or otherwise, can catalyze redevelopment in critical nodes around Bridgeport.

For the project, raised streets were considered to provide dry egress. As dry egress alone does not meet the full range of the project goals as shown in Section 3.5, the Interior Approach was not selected. However, when raised streets are incorporated into a full CFDS both dry egress and flood risk reduction are achieved. For this analysis, individual streets were examined for effectiveness for providing dry egress. Thereafter, raised streets were evaluated as segments of a full CFDS as discussed in Section 7.

The streets within the project area generally run east-west or north-south. For a raised street to provide dry egress, all or part of the street to be raised needs to be in the floodplain prior to raising. East-west and north-south streets in the floodplain in the project area include the following:

- **East-West Streets** - Soundview Drive, Monument Drive, Grove Road, Waldemere Avenue, Linden Avenue, University Avenue, Atlantic Street, Gregory Street, Henry Street, Whiting Street, Kiefer Street, Ferry Access Road/Railroad Avenue
- **North-South Streets** - Main Street; Broad Street; Lafayette Street, Hazel Street, Myrtle Avenue, Park Avenue, Singer Avenue, Russel Street

Each street was evaluated for its effectiveness for providing dry egress if raised in isolation and a process of elimination was undertaken to evaluate streets for raising as follows:

- **Seaside Park Streets** – Soundview Drive, Monument Drive and Grove Road are all located in Seaside Park. The park does not have occupied infrastructure and therefore does not require dry egress. These streets were eliminated from for consideration for raising.
- **Waldemere Avenue, Henry Street, Whiting Street, Keifer Street, Hazel Street, Russell Street, Singer Avenue, Lafayette Street, Main Street, Broad Street** – The option of raising these streets was eliminated as both ends of the street are in the flood plain and therefore raising the street in isolation would not provide dry egress.
- **Ferry Access Road/Railroad Avenue** – The option of raising this street was eliminated as the raising would result in non-operable underpasses at the intersections of Lafayette Street and Broad Street. In addition, there are sensitive, critical utilities under this street which may prohibit the additional of fill needed to raise the road.
- **University Avenue, Atlantic Street, Gregory Street** – Raising the western ends of these streets would provide dry egress from the floodplain. Raising University Avenue provides dry egress to the University of Bridgeport campus as well as future development planned at the 60 Main Street site. Raising Atlantic Street would provide dry egress to PSEG, Emera and properties along raised portions of the street. Raising Gregory Street provides dry egress to the vacant lot at 375 Main Street and properties along raised portions of the street. While raising Atlantic Street and Gregory Street could potentially provide dry egress, they were both eliminated from consideration when considering the full range of project goals. Most notable, raising of Atlantic Street and Gregory Street is problematic due to the proximity of structures (houses, businesses, places of worship etc.) to the street, making transitioning between the raised street and the

parcels along the street a challenge. **Figure 8** shows Gregory Street with elevation markers showing the height of raising that would be required and the proximity of the raised street to a local church. Raising streets also requires raising and transitioning cross streets at intersections to facilitate elevation transitions. For example, if Gregory Street is raised, the nearby intersection of Whiting Street and Broad Street would also need to be raised. As shown in **Figure 9**, properties at this intersection are also very close to the street. Raising Atlantic Street has similar issues.



Figure 8 - Gregory Street with elevation markers for raised street



Figure 9 - Intersection of Whiting Street and Broad Street with elevation markers for raised street

— **Myrtle Avenue** – While raising the southern end of Myrtle Street would provide dry egress opportunities, this would only benefit a very limited number of properties and therefore this option was eliminated.

Raised streets can provide dry egress and can also moderately lower the risk of acute and chronic flooding locally when water pumping systems are incorporated. Of the raised street options considered only raising University Avenue with additional measures for stormwater management emerged as a viable alternative. However, raising University Avenue only does not meet all the project goals. Additional risk reduction is achievable with a full CFDS in lieu of only a raised street. The development of alternatives that both provide dry egress and lower the risk of acute and chronic flooding including extreme events are provided in the following sections.

5.2 EDGE ALIGNMENT APPROACH

The Edge Alignment consists of a CFDS either in-water or directly above the Coastal Jurisdiction Line (Elevation +5.0 feet NAVD88). The in-water solution, where a CFDS would be built entirely in the water off the coast of Bridgeport, would have extended from the western end of Seaside Park, east along the coast, then north to tie-in to the MNRR. This option was eliminated for multiple reasons. The negative environmental impact would have been significant; the permitting process would have been lengthy and arduous, impacting schedule goals, and; the cost would have significantly exceeded funding availability. In addition, through the public engagement process members of the community voiced significant concern regarding both viewsheds and waterfront access. Because the shoreline lies at a relatively low elevation, the height of a CFDS would need to be much higher than would be necessary at locations further north to provide the same level of risk reduction. The coastal defense structure would be higher due to two primary factors: the lower ground elevation and larger waves which could reach the structure during a storm requiring more freeboard to prevent overtopping. The coastal edge solution, which would be just inshore of the Coastal Jurisdiction was eliminated for similar reasons.

6 INTEGRATED ALIGNMENT APPROACH

6.1 ALIGNMENT SEGMENTS ELIMINATED FROM FURTHER CONSIDERATION

The Integrated Alignment Approach consists of a closed loop CFDS located within the South End at some location landward of the shoreline. The Project Team explored numerous streets / segments to potentially be included in this alignment. The following locations were deemed insufficient to meet the project goals and were eliminated in the high-level initial alternatives evaluation. A plan showing the eliminated segments discussed in Section 5.2 above and the following sections is provided in **Figure 10**.

6.1.1 SEASIDE PARK

Seaside Park is a historic park within the project area that has been listed on the National Register of Historic Places since 1982. Due to the historic nature of the location, it was determined that any major impacts to the property should be avoided, where possible. In addition, an existing berm extending along the perimeter of the park currently provides a level of risk reduction against flooding. Since there are no residences, businesses or utility companies located in the park, it is also considered an area that can withstand flooding with little negative impact upon public safety or critical infrastructure. Due to the priority of historic preservation, as well as the lower risks associated with flooding in this location, constructing a coastal defense along this segment was discarded.

6.1.2 WALDEMERE AVENUE

Waldemere Avenue is south of and runs parallel to University Avenue; it marks the southern extent of the University of Bridgeport. Because this road lies at a relatively low elevation, the coastal defense structure height issues discussed in Section 5.2 for Seaside Park also apply to Waldemere Avenue. In addition, since Waldemere Avenue runs adjacent to Seaside Park, building a flood wall of the necessary height would isolate the park from the rest of the community; hindering the community's access to the water. This would be directly in contrast to key project goals. The proximity to the historic park would have instigated a lengthy environmental review and approval process, making it unfavorable with regards to schedule. With private property and structures near the right of way, constructing a CFDS on this street, would render vehicular access to some properties challenging and structure impacts would be likely. Therefore, Waldemere Avenue was eliminated from further consideration.

6.1.3 LINDEN AVENUE

Located between University Avenue and Waldemere Avenue, Linden Avenue poses similar challenges to the Waldemere Avenue alignment. While the existing elevation on Linden Avenue is slightly higher than Waldemere, it is still significantly lower than University Avenue, and thus would require construction of a very high CFDS. The size and cost of such a structure, along with the negative impact on community character and water access, resulted in the exclusion of this alignment.

6.1.4 MYRTLE AVENUE

Myrtle Avenue is a north-south roadway located in the southwest region of the project area. This location is too far west to be of any meaningful value to the coastal defense risk reduction alignment and was therefore rejected.

6.1.5 HAZEL STREET

Hazel Street is located one block east of Myrtle Avenue and was eliminated for similar reasons as the latter. While it is further east than Myrtle Avenue, any alignment established in this location would be too far west to support attainment of project goals.

6.1.6 LAFAYETTE STREET

One block to the east of Hazel Street is Lafayette Street. Potential alignments along this segment were also eliminated because the location is too far west to provide meaningful impact.

6.1.7 ATLANTIC STREET

Atlantic Street is a main thoroughfare which runs east-west adjacent to the north side of the University of Bridgeport campus. A flood reduction strategy constructed in this location would be too far north to be of significant value; and low vulnerable residential areas, 60 Main Street and a second future development to be located at 30 University Avenue would receive no benefit from the alignment being constructed along Atlantic Street. In addition, because this roadway provides access to both Bridgeport Energy and PSEG, constructing an alignment in this location would present significant construction constraints and would not be favorable. This option was therefore eliminated from consideration.

6.1.8 BROAD STREET

Broad Street is the final north-south alignment that was eliminated in the initial assessment for an Integrated Alignment Approach. Like the aforementioned north-south alignments, Broad Street is located too far west to provide a benefit to critical areas that need to be protected to meet project goals. Any north-south alignments located west of Main Street were thus eliminated, as they would not be positioned to provide adequate risk reduction to many residences and critical infrastructure.

6.1.9 GREGORY STREET

Gregory Street was considered as an option for a raised street to provide dry egress to the potential development property at 375 Main Street. Gregory Street is densely populated with residences and community religious centers. Raising the street would have a major impact on the community as many of the existing buildings are located close to the street making transitions and access from the raised road to the adjacent parcels a challenge. In addition, there are several cross streets that would have to be raised to meet the raised elevation of Gregory Street. As the impacts of raising Gregory Street outweighed the benefits, this segment was eliminated from consideration for the Integrated Alignment Approach.

6.1.10 RAILROAD AVENUE / FERRY ACCESS ROAD

Railroad Avenue / Ferry Access Road was considered as a potential northern alignment to tie-back to high ground on Park Avenue. However, the substantial additional length that this alignment would require, as well as numerous street crossings (requiring gates), and utility crossings would add a significant cost and complexity to the project. It was determined that a better solution would be to utilized the MNRR trestle as the northern tie-in.

6.2 ALIGNMENT ELIMINATION SUMMARY

The eliminated segments were plotted graphically, as shown in **Figure 10**. After inspection of the eliminated segments and considering current operations and infrastructure on PSEG's property an envelope of land within the central portion of the east side of the South End, was identified as the potential area which the CFDS alignment could be constructed. The envelope for potential alignment is shown in aqua in **Figure 10** and a description of the potential alignment segments within this zone is provided in the following section.



Figure 10 - Eliminated Alignment Segments with Envelope for Potential Alignments

6.3 ALIGNMENT SEGMENTS FOR CONSIDERATION

For the shaded area shown in **Figure 10**, potential segments were identified to develop a closed loop CFDS. The alignment segments require passing through various private and publicly owned land in the South End. Multiple crossings of the properties were explored and evaluated based on project goals, current operations and future plans for the properties. The segments were color coded and numbered. Numbering convention used for the major property owners is as follows:

- PSEG: PS_1 to PS_6
- Bridgeport Energy (Emera): E_1 to E_5
- UI: UI_1 to UI_6
- 60 Main St: 60_1 to 60_6
- University of Bridgeport: UB_1
- City of Bridgeport: B_1 to B_21
- CTDOT C_1 to C_4

In addition, to the numbered color-coded segments, **Figure 11** includes potential locations the gates would be needed. The gates would be open, except during flooding events, when they would be closed to complete the CFDS.

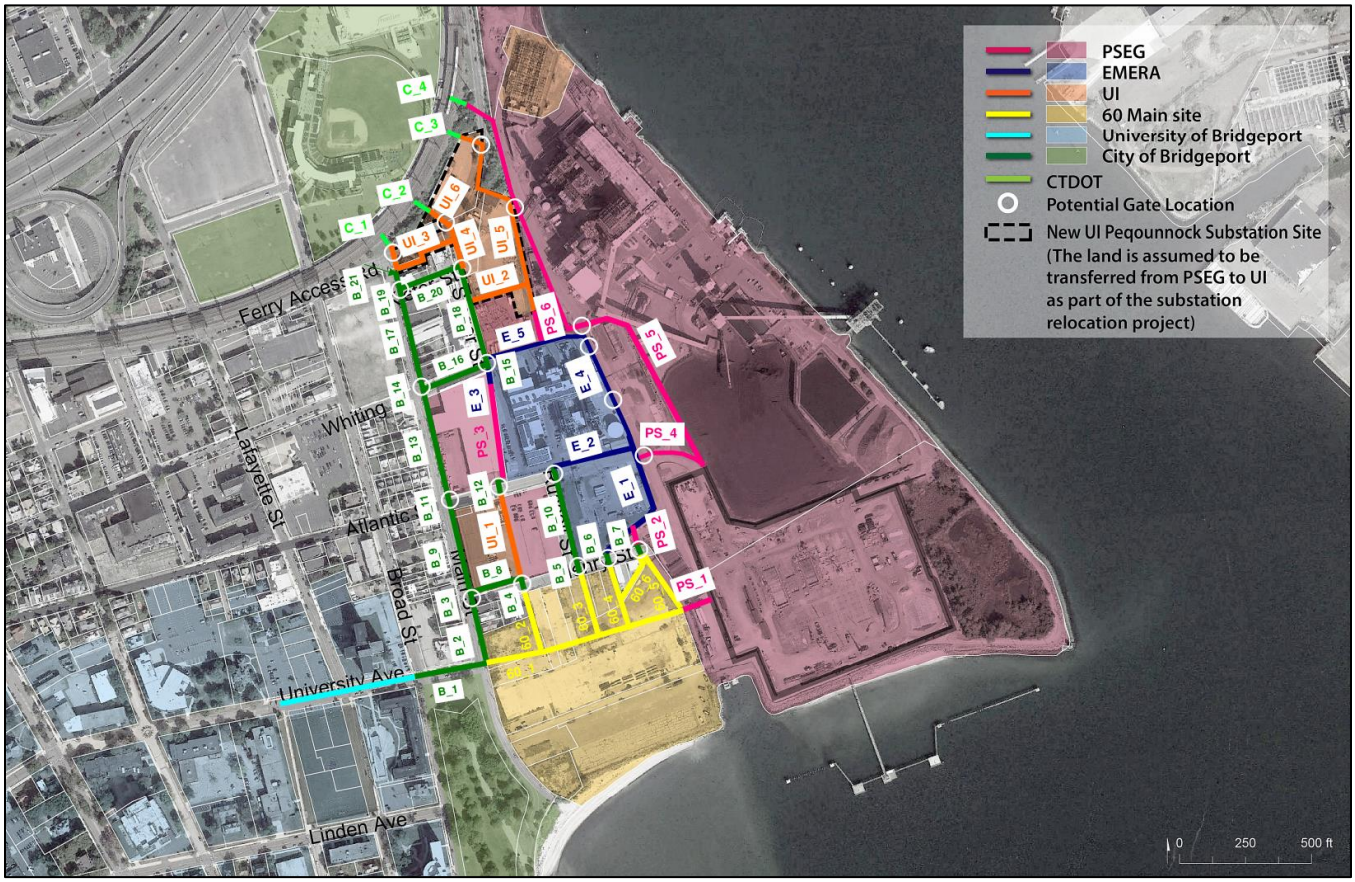


Figure 11 - Alignment Segment Options for Evaluation

6.4 EVALUATION MATRIX

The alignment segments identified in **Figure 11** were compared to the goal-based criteria and narrowed down by a process of elimination. The segments were evaluated against Goals 1 – 3, as Goal 4 primarily includes, land use, maintenance and operation and permitting. While a costing exercise will be performed for the three alignments selected for 10% design, one was not performed for development of the three preliminary alternatives as there was not sufficient information to make the exercise meaningful. Land use / ownership and operation and maintenance responsibilities are still under discussion and not evaluated herein. With the information available at this stage of the project, permitting considerations are not appreciably different for the segment under consideration and therefore were not considered in the evaluation. As the project moves forward Goal 4 will be revisited.

6.4.1 FLOOD RISK REDUCTION (GOAL 1)

The potential for each alignment segment to provide flood risk reduction for critical infrastructure, energy supply companies, vulnerable residential populations, local businesses and institutions was evaluated. This also included the ability to provide dry egress to future development locations (namely, 60 Main Street, 30 University Avenue and 375 Main Street).

6.4.2 DELIVERS CO-BENEFITS TO ENHANCE COMMUNITY RESILIENCE (GOAL 2)

The alignment segments were evaluated and compared for benefits to the community character and local resilience. For this exercise this primarily included looking at what was inside and outside of the CFDS for each alignment segment.

6.4.3 INTEGRATION WITH LOCAL STAKEHOLDERS (GOAL 3)

Each alignment segment was evaluated based on future plans and feedback provided by locally-based utility companies and the need to maintain adequate access to the various stakeholder properties. In addition, the need for easements or land transfer was considered. Furthermore, the potential to generate local stakeholder investment was considered.

6.4.4 QUALITATIVE ANALYSIS

By analyzing individual alignment segments and combinations through this matrix, the Project Team was able to conduct a comprehensive and holistic preliminary alternatives analysis to narrow down segments in the envelope for potential alignments. A summary of the alignments considered and eliminated through the matrix process is in **Table 4**.

Table 4 - Segment Evaluation Matrix

SEGMENT	NON-CONFORMING TO GOAL	REASON FOR ELIMINATION FOR 10% DESIGN
B_2	1, 3	Limits access to and does not reduce the risk of flooding or provide co-benefits to: 146, 154, and 160 Main St.
B_4	N/A	Eliminated due to elimination of UI_1 and 60_2.
B_5	N/A	Eliminated due to elimination of B_10 and 60_3.
B_6	N/A	Eliminated due to elimination of 60_4.
B_10	2	Bridgeport Energy expressed a preference for keeping the land to the east of B_10 within the CFDS due to existing critical infrastructure on the property. B_10 was therefore eliminated and replaced with E_1.
B_12	N/A	Eliminated due to elimination of UI_1 and PS_3.
B_17	1,3	Limits access to and does not reduce the risk of flooding or provide co-benefits to the Freeman Homes or other existing buildings between Whiting and Keifer St.
B_20	1,3	Limits access to and does not reduce the risk of flooding to the properties on the north side of Keifer St.
B_21	1,3	Limits access to and does not reduce the risk of flooding to the properties on the north side of 418-420 Main St.
60_3	2	60 Main St Developer prefers an alignment that continues east-west through the property and B_10 was eliminated which was the most logical northern connection.

SEGMENT	NON-CONFORMING TO GOAL	REASON FOR ELIMINATION FOR 10% DESIGN
60_4	2	60 Main St Developer prefers an alignment that continues east-west through the property and segment 60_4 is located on the west side 21 and 27 Henry Street, where an active business is located. 60_5 and 60_6 are adjacent segments that do provide flood risk reduction to the business, therefore 60_4 was eliminated.
60_6	2	60 Main St Developer prefers an alignment that continues east-west through the property so 60_6 was eliminated in favor of 60_5.
E_2	2	E_2 crosses the main entrance to Bridgeport Energy's site and bisects their property, it was eliminated in favor of E_1
E_3	2	Leaves Bridgeport Energy outside the CFDS, but is located on their property, eliminated in-favor of E_4.
E_5	2	Interferes with the utility lines for the operation of Bridgeport Energy's plant.
PS_3	2	Leaves Bridgeport Energy outside the CFDS, eliminated in-favor of E_4.
PS_5	2	Not preferred by PSEG for current and future operations, eliminated in favor of PS_4
PS_6	2	Interferes with PSEG's current operation of Harbor Unit 3.
UI_1	2	Leaves PSEG and Bridgeport Energy property outside of the CFDS, eliminated in favor of E_1.

6.5 ALIGNMENTS STILL UNDER CONSIDERATION

After completing the initial segment elimination analysis, the remaining segments were arranged into three CFDS alignments for further evaluation in the 10% design. The alignments are labeled the Eastern, Central and Western Alignment based on their relative proximity to one another. The CFDS (including the raised University Avenue – see below) will be designed to reduce the risk of acute flooding from infrequent coastal storms. The CFDS will be designed to reduce flood risk to the community and stakeholders including energy systems, vulnerable populations, businesses, and institutions; although the geographic extent of the risk reduction will vary with each alignment.

In any instances where a street is crossed in the north-south alignment segments, gate crossings are proposed due to the critical subsurface utilities in the roadways. The gates are also proposed to allow access across the line of defense under non-storm conditions. Where possible, it is proposed that the gates stay above or bridge over critical infrastructure.

Each of these alignments includes raising University Avenue. Raising University Avenue will further reduce flood risk by providing dry egress to the several potential development parcels in the study area.

The study area is subject to chronic flooding due to more frequent rainfall events. The proposed coastal defense alignments may restrict surface drainage and could exacerbate chronic flooding. As part of the overall CFDS alignment design, consideration will be given to internal drainage improvements to avoid excessive stormwater ponding within the alignment. It is anticipated the internal drainage improvements will be designed for infrequent storm events, but will also have a positive impact for more frequent rainfall events, reducing chronic flooding concerns. It is anticipated that interior drainage requirements will be similar for each alignment, although area and ponding characteristics will vary. At the time of the 10%

design, stormwater design was not completed in sufficient detail to allow a meaningful comparison between alignments in terms of reduce chronic flooding; as such, each alignment is considered adequate to reduce chronic flooding.

The alignments are shown from the westernmost to the easternmost solution. The intent of the alignments is to show an envelope of solutions to reduce flood risk. While each alignment shows a discrete set of interconnected segments, interchanging some of the north-south alignment segments is possible. The three alignments are described below.

6.5.1 EASTERN ALIGNMENT

The Eastern Alignment starts at approximately elevation +16 feet NAVD88 on University Avenue and continues east, down University Avenue and into the 60 Main Street site (Figure 12). The alignment continues parallel to shoreline across the 60 Main Street site to the eastern border, where it crosses to the east into PSEG's property and connects to the newly built Harbor Unit 5 perimeter sheet pile wall. Harbor Unit 5 provides the southeast corner of the CFDS, which extends north from the plant's access road ramp on the northwest corner of the perimeter wall. The alignment connects from the ramp over to Bridgeport Energy's eastern border north of Atlantic Street. The alignment continues along the eastern border of Bridgeport Energy's site until it reaches the Pequonnock Substation relocation site, where it continues north along the eastern property line of the site across Ferry Access road with a northern tie-in at the elevated MNRR.

The Eastern Alignment provides the greatest geographic extent of coastal flood risk reduction, removing approximately 64 acres from the current FEMA High Hazard Area. It provides risk reduction benefits for several existing and planned energy facilities including the Singer and new Pequonnock substations and the Emera generating facility. This arrangement also provides dry egress to Harbor Unit 5 via Atlantic Street. In addition, the CFDS provides risk reduction benefits for the Cottage District and other residential, industrial and commercial properties.

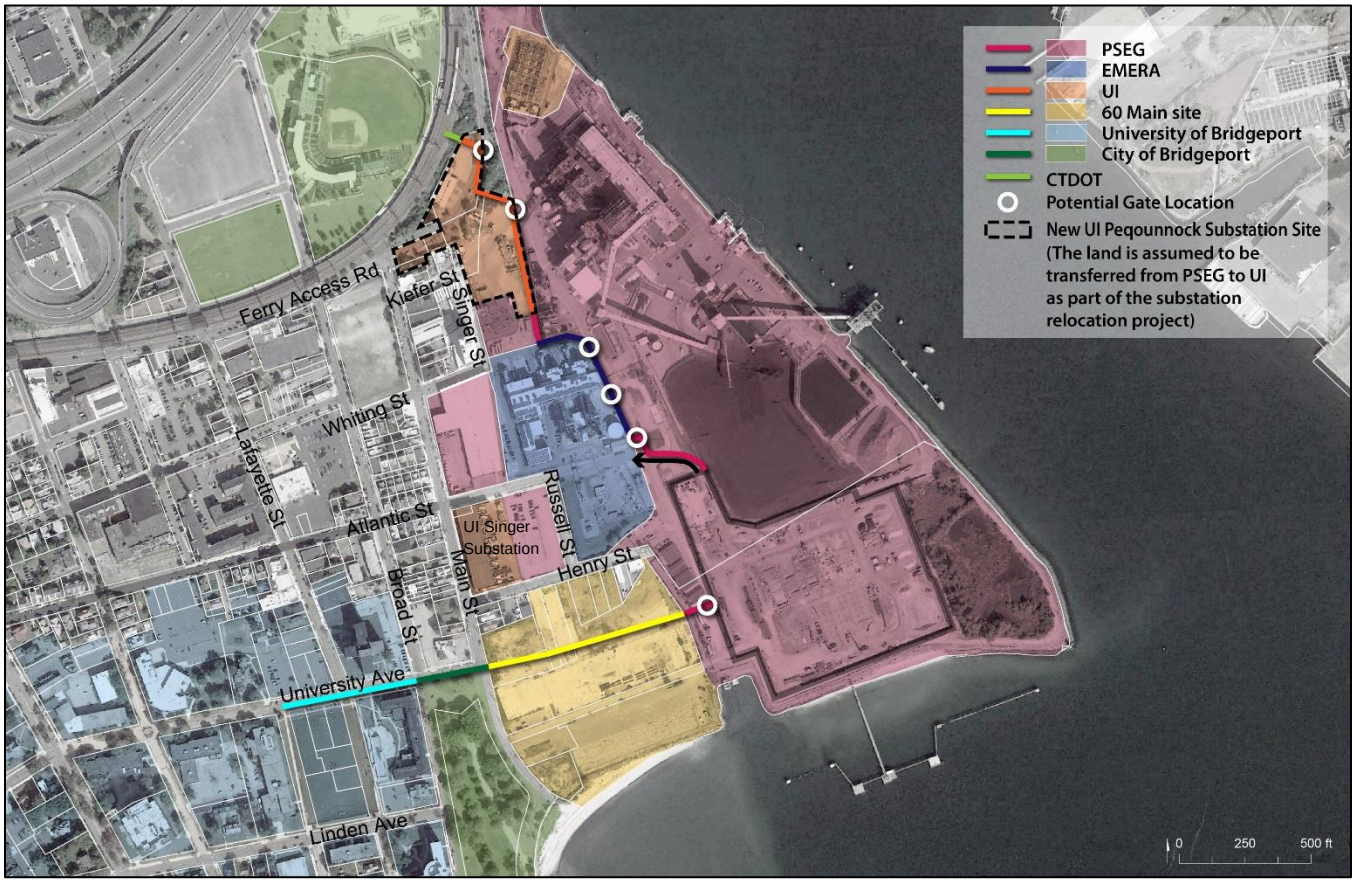


Figure 12 – Eastern Alignment

The Eastern Alignment provides dry egress to Harbor Unit 5 and coastal defense to the UI Singer Substation, Bridgeport Energy and the new UI Pequonnock Substation relocation site.

6.5.2 CENTRAL ALIGNMENT

The Central alignment is located between the Eastern and Western Alignment (Figure 13). The alignment starts at approximately elevation +16 feet NAVD88 on University Avenue and continues east, down University Avenue and into the 60 Main Street site. Within the 60 Main Street site, the alignment continues east to the eastern property line where it turns north along the property line and crosses Henry Street. North of Henry Street there is a short crossing of PSEG's property and thereafter the alignment continues along the eastern edge of Bridgeport Energy's property until it reaches the Pequonnock Substation relocation site. The alignment turns west just south of new substation location and then turns north across Ferry Access Road with its northernmost tie-in at the MNRR.

The Central Alignment provides significant coastal flood risk reduction, removing approximately 59 acres from the current FEMA High Hazard Area. It provides risk reduction benefits for both the Singer substation and the Emera generating facility. However, this arrangement does not provides dry egress to Harbor Unit 5 or risk reduction for the new Pequonnock substation. The CFDS provides risk reduction benefits for the Cottage District and other residential, industrial and commercial properties, similar to the Eastern Alignment.

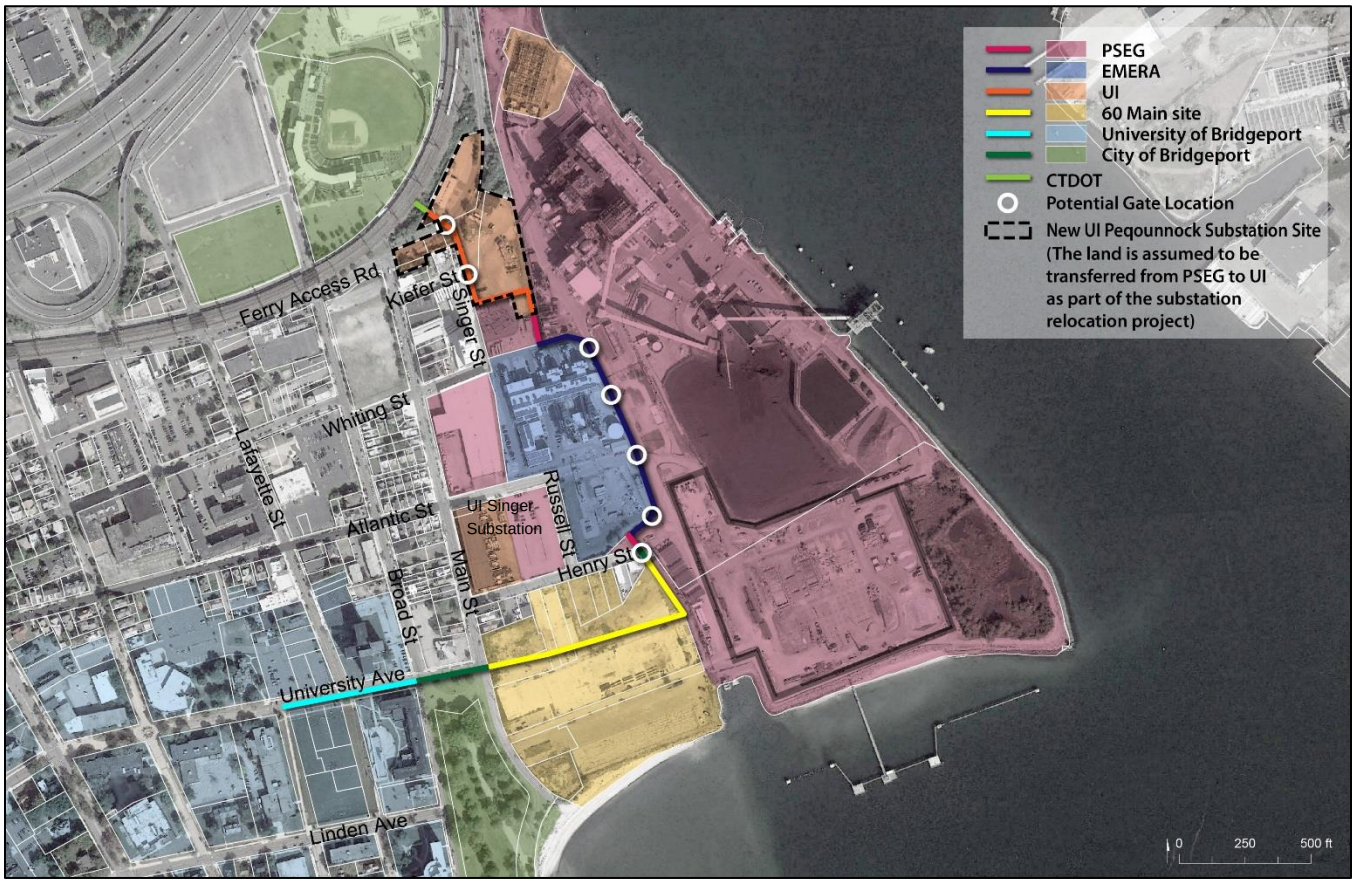


Figure 13 – Central Alignment

The Central alignment provides coastal defense to the community north of University Avenue, the UI Singer Substation, Bridgeport Energy as well as the full northern portion of the 60 Main Street site.

6.5.3 WESTERN ALIGNMENT

The Western Alignment resides primarily within the urban fabric of the South End community (Figure 14). The alignment starts at approximately elevation +16 feet NAVD88 on University Avenue and continues east, down University Avenue and into the 60 Main Street site. Within the 60 Main Street site, the alignment turns north to the east side of 107 Henry Street and continues across Henry Street. The alignment continues on the east side of Main Street for two blocks heading north before turning east to Singer Street. Thereafter, the alignment hugs the western edge of the future site of the Pequonnock Substation, crosses Ferry Access Road and ties in the MNRR.

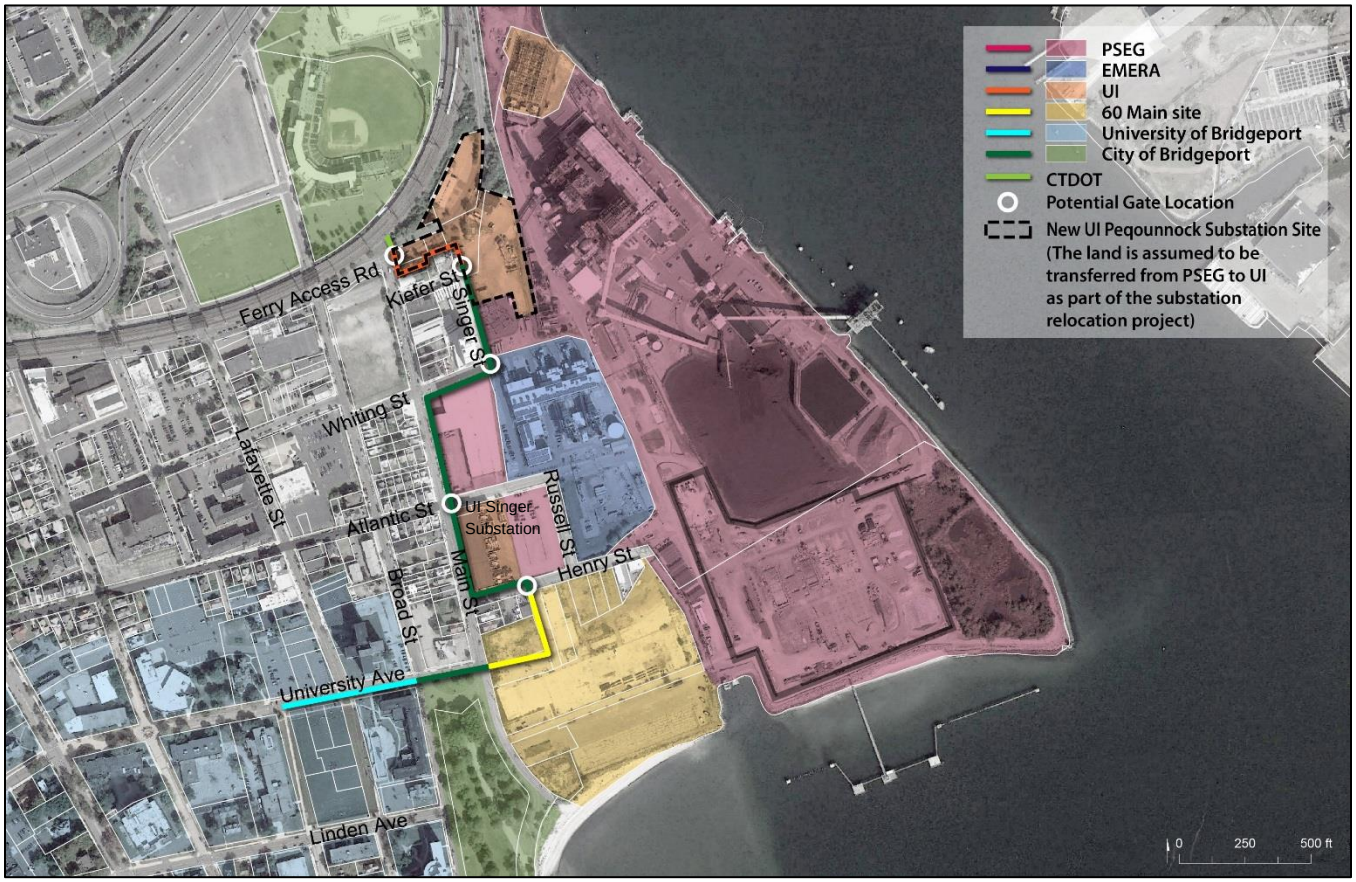


Figure 14 – Western Alignment

This alignment primarily avoids private utility provider property, with the exception of one segment (i.e., orange line in figure above) located on the future Pequonnock Substation site, which is currently owned by PSEG and planned to be transferred to UI as part of the Pequonnock Substation relocation project. The alternative has the largest portion of the alignment constructed on Public Land. While this alignment includes coastal defense and flood risk reduction for the South End community north of University Avenue, critical utility providers are located outside the line of defense.

The Western Alignment provides the least geographic extent of coastal flood risk reduction for the alignments still under consideration, removing approximately 39 acres from the current FEMA High Hazard Area. However, it does not provide risk reduction benefits for any of the existing or proposed energy facilities nor dry egress to Harbor Unit 5. The Western Alignment CFDS provides flood risk reduction benefits for the Cottage District and other residential, industrial and commercial properties, similar to the other alignments with the exception of several properties on Henry Street and south of Ferry Access road.

6.6 GREEN STORMWATER INFRASTRASTRUCTURE

Green stormwater infrastructure reintroduces ecological functions into the built environment and shall be incorporated into the selected alignment strategy, where possible. Soil-water-plant systems including biofiltration planters, bioretention swales, trees, and permeable pavements are green infrastructure options to intercept stormwater before it reaches gray infrastructure. Some water is infiltrated into the ground, some is evaporated into the air, and some is temporarily stored before being slowly released into the sewer system. Green stormwater infrastructure helps to reduce runoff volume to gray infrastructure and filter pollutants, protecting water quality and mitigating risks of flooding. Investments in green stormwater infrastructure complement gray infrastructure and may extend the useful life of major capital street and sewer projects. An integrated approach to green stormwater management in the public right-of-way is central to the design of resilient urban landscapes. Green infrastructure that collects, slows, and infiltrates stormwater can be integrated into parks and plazas.

Green stormwater infrastructure goes beyond improving stormwater management and provides environmental, economic, and social benefits. For example, retaining stormwater minimizes the operating costs of a wastewater treatment plant or pump station, planting trees and vegetation improves air quality by filtering and removing pollutants from vehicles, and providing green spaces serves additional functions such as park spaces, which add community amenities. Green stormwater infrastructure can be organized into three main categories: subsurface conveyance, surface conveyance, and storage. Specific strategies in each of these groups could apply, depending on goals, available land, existing infrastructure, cost, operations and maintenance, visibility, and effectiveness. Each type of green stormwater infrastructure should be carefully evaluated to fulfill the aspiration and best outcome. While green stormwater infrastructure installations provide many community benefits, they are typically better suited to handle the rainfall volume from small rain events. In addition, they usually require a significant amount of space to be effective, which can be a sizable limitation for a city and a barrier to implementation. Lastly, maintenance is a critical consideration; green stormwater infrastructure installations need to be routinely maintained for peak performance. Thus, the Project Team will evaluate green stormwater infrastructure opportunities to complement gray infrastructure improvements.

7 SUMMARY AND NEXT STEPS

A comprehensive analysis was performed starting with three approaches for meeting the project objectives, which were narrowed to a preferred approach with multiple alternatives considered. The three approaches analyzed included the Interior Alignment, Edge Alignment and Integrated Alignment. Where the Edge Alignment was eliminated primarily due to environmental impacts, avoidance of cutting the community off from the water and stakeholder preferences and the Interior Alignment was eliminated as it provided a solution that least met the project goals when compared to the other two options. The Integrated Alignment Approach was selected as the preferred approach for further study.

After conducting this comprehensive, holistic alternatives analysis process, three Integrated Alignment Approach alternatives have been developed to evaluate at a 10% design level. The Eastern Alignment has emerged as an alignment which provides the widest area of flood risk reduction including the community north of University Avenue, Singer Substation, Bridgeport Energy (Emera) and the new Pequonnock Substation site, in addition to providing dry egress to PSEG's Harbor Unit 5. While this alignment meets the objectives of the project, it requires construction on private utility provider properties. Negotiations are on-going to determine whether the alignment will be accepted by the impacted properties' owners.

The Central and Western Alignment move the alignment further west and in each case result in reduced impacts to private land owners. In all cases the alignments provide dry egress to 60 Main St, 30 University Avenue and 375 Main Street, unlocking future development to each of these sites. In addition, the community north of University Avenue is within the defense system, reducing the risk of flooding in all the options. As the alignment moves west, fewer critical utility provider properties are included and dry egress to PSEG's Harbor Unit 5 is only included in the Eastern Alignment.

The three alignments will be brought to a 10% level where preliminary community benefit and impacts and construction types will be explored. A preliminary construction cost estimate will be developed to determine order of magnitude costs for the purpose of comparing the alignment alternatives and evaluating the estimated construction cost in comparison to the project budget. Other project elements, such as the Resilience Hub, stormwater management and pumping requirements will be considered within the 10% design considering the three alignment options.

The 10% design alternatives will be further developed by the Project Team, vetted with the Client, community, local stakeholders and evaluated for cost with the goal of establishing a preferred alternative which best fits within the project goals. The agreed preferred alternative shall be progressed to 30% design.

APPENDIX C
Cultural Resources Documentation

Historic and Archaeological Resources Evaluation Report

DRAFT May 4, 2018

Prepared for
WSP
Glastonbury, Connecticut

by
Archaeological and Historical Services, Inc.
Storrs, Connecticut

for submission to
State of Connecticut Department of Housing

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Abstract and Management Summary

The State of Connecticut, through the Connecticut Department of Housing (CTDOH), is undertaking a feasibility study and alternatives analysis, an Environmental Impact Statement (EIS) and Environmental Impact Evaluation (EIE), and preliminary design and engineering to schematic design level at approximately 30 percent for three projects to be funded through a competitively awarded grant from the United States Department of Housing and Urban Development (HUD) to the State as an outcome of the National Disaster Resilience Competition (NDR). The NDR project consists of three coastal storm surge/flooding risk reduction segments, each of which has a distinct alignment, constructability, and regulatory and process goals and challenges:

- University Avenue segment – infrastructure along the existing University Avenue corridor will be raised to form a line of protection to a to-be-determined point above future flood level that connects to a current high point to the east of Park Avenue and extends to the location of 60 Main Street. This raised infrastructure segment will provide dry egress from existing and future development in the area.
- 60 Main Street segment – protection will be extended east from the western edge of the 60 Main property through an independent berm or other surge protection line of defense across (partially or fully) or adjacent to the planned 60 Main Street Development.
- Northern segment – protection will be extended from the 60 Main Street site north along multiple potential alignments using a berm or other surge-protection line of defense to a to-be-determined tie-in point at the railroad viaduct.

The project also includes a Resilience Hub to provide a location for dissemination of information to the community and assist the community in future recovery efforts. Typologies considered include continued use of 7 Middle Street, restoration of an existing building, construction of a new building, and one or more open air sites integrated within the community.

In addition, this project incorporates into the EIS/EIE a project to be funded through a competitively awarded grant from HUD to the State as an outcome of the Rebuild by Design (RBD) competition. The purpose of the RBD-funded project is to construct a pilot project for storm-water flooding mitigation at the Marina Village site.

The project Area of Potential Effect (APE) is delineated as the Resilient Bridgeport Study Area, roughly bounded by Railroad and South avenues to the north, Bridgeport Harbor and Long Island Sound to the east and south, and Iranistan Avenue, Atlantic Street, and the west side of Seaside Village to the west. This area was chosen to allow for the assessment of potential direct and indirect effects related to these resilience projects.

Within the APE, the majority of properties are over 50 years of age (with few exceptions, the minimum age to qualify for National Register of Historic Places (NRHP) eligibility). Five NRHP-listed individual historic properties and four districts are present; five districts and 11 individual properties were assessed as potentially NRHP-eligible. These resources may be affected, directly or indirectly, by the proposed project, depending on the alternative selected. Two previously identified archaeological sites are located within the APE, and research indicates that this area was intensively occupied by Native Americans during the Late Woodland and Contact periods.

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Figure 2. Area of Potential Effect (APE, shaded) shown on an aerial view of the vicinity (Google Earth™ 2017).
Figure 3. APE and NHRP-listed historic resources shown on an aerial view of the vicinity.
Figure 4. APE, NHRP-listed historic resources, and potentially NRHP-eligible resources.
Figure 5. Project APE (outlined in red) shown on 1934 Fairchild Aerial.
Figure 6. Previously identified archaeological sites within one mile of APE (outlined in red), shown on USGS topographic map.

Historical Maps

Map 1. Pre-Revolutionary War era map of the Connecticut coast, detailing the project area (in red). Map was in Sir Henry Clinton's possession while in command of the British forces operating in North America during the War for Independence, 1775-1782, and is on file at the Clements Library, University of Michigan (Adams 1928).
Map 2. Skinner 1777 Revolutionary War era map of the Connecticut coast, detailing the project area (in red). Map was in Sir Henry Clinton's possession while in command of the British forces operating in North America during the War for Independence, 1775-1782, and is on file at the Clements Library, University of Michigan (Adams 1928).
Map 3. The South End of Bridgeport on the 1850 Collins & Clark map. Little Liberia is circled in red.
Map 4. The South End on the 1856 Clark's Map of Fairfield County.
Map 5. Reconstructed bird's eye view of Little Liberia by John Wright, looking south toward Long Island Sound. The Freeman houses are labeled 1 and 2; the Zion A.M.E. Church is labeled 3. From "Reimagining Little Liberia: Restoration & Reunion," museum exhibit at Housatonic Community College, a collaboration between the Mary and Eliza Freeman Center for History and Community, Dr. Jamila Moore Pewu, and the Housatonic Museum of Art, 2017.
Map 6. The South End as shown on the 1867 Beers map, depicting Olmsted & Vaux's original design for Seaside Park.
Map 7. The South End as shown on the 1875 Bailey bird's eye view map. The inset depicts the Kiefer Furniture factory. P. T. Barnum's house Waldemere is shown north of the 1868 trotting park oval.
Map 8. The South End as shown in the 1876 Beers atlas, with Seaside Park and P. T. Barnum's house Waldemere.

Map 9. The South End as seen on the 1888 Hopkins map. It depicts P. T. Barnum's house Waldemere just after the property's subdivision. The Warner Brothers Company had not yet expanded west of Lafayette Street. Several factories (not extant) are located along the New York, New Haven & Hartford Railroad. The Bridgeport Malleable Iron Company (top left) is located on the future site of Marina Village.

Map 10. This 1888 Hopkins map plate shows Seaside Park's western expansion. Additional property owned by P. T. Barnum to the north of the park is now the Sikorsky site.

Map 11. The South End as shown on the 1910 Kershaw map, showing the south end of the railroad freight yard and the Henry Street slip (top right). The inset map depicts the Locomobile factory, located east of Seaside Park.

Map 12. The northern section of the South End as shown on the 1910 Kershaw map. The New York, New Haven & Hartford Railroad turntable and roundhouse are partially shown at the far right. By 1910, the Warner Brothers' factory complex west of Lafayette St. had been built, and factories along the railroad had expanded.

Map 13. A section of the 1915 New York, New Haven & Hartford Railroad valuation map, showing the 1903 under-grade bridge, designated Bridge 43.21 at the time. The bridge served as the entrance to the large freight yard that formerly occupied the power plant site. Note the streetcar lines running along Main Street.

Map 14. The northeast section of the South End as shown on the 1917 Kershaw map. In this area, the major changes since 1910 were along Singer Avenue, where houses were replaced by warehouses, including many belonging to Warner Brothers.

Map 15. The southeast section of the South End as shown on the 1917 Kershaw map, showing the Henry Street slip and the Locomobile factory to the east of Seaside Park. The inset map shows the Tongue Point Lighthouse, before the breakwater was demolished and the lighthouse was moved to its current location in 1919.

Map 16. The western section of the South End as shown on the 1917 Kershaw map, showing Seaside Park's additional westward expansion and the Crane Company (now the Sikorsky site). The Bridgeport Malleable Iron Company is now the Marina Village site; Walnut Street now ends at Ridge Street, and Columbia Street extends north to South Avenue.

Map 17. Broad and Main streets as shown on the 1939 Sanborn map. Much of the Bridgeport Storage Warehouse Company complex remains intact, including the 1917 nine-story building on Whiting Street and the buildings just north of the Freeman Houses on Main Street. Note the railroad siding on Singer Avenue.

Map 18. Several South End factory buildings shown on the 1939 Sanborn map remain extant.

Historical Images

Image 1. A horse-drawn streetcar on Main Street in the Little Liberia area in the winter of 1892, camera facing north (from Witkowski and Williams, p. 27).

Image 2. Walters Memorial A.M.E. Zion Church (1882) prior to the 1950s remodeling, camera facing west (from Witkowski and Williams, p. 26).

Image 3. Bird's eye view postcard of the Warner Brothers Company and Seaside Institute, view facing northwest (from the Museum of Connecticut History).

Image 4. Postcard of Seaside Park ca. 1900-1910, view facing south (from the Connecticut Historical Society).

Image 5. Postcard of Seaside Park and Locomobile factory, view facing northeast (private collection).

Image 6. Bird's eye view postcard of the Seaside Park beach and bath house, view facing west (private collection).

Image 7. Aerial view of Seaside Park, with the trotting park in the foreground and Park Avenue houses at the left. The Locomobile factory is in the background at left. Waldemere Hall (the current University of Bridgeport president's house) is at bottom left. Photo by Brewer H. Sholund; camera facing northeast (from Witkowski and Williams, p. 18).

Image 8. On the left is P. T. Barnum's 1869 house Waldemere, and on the right is his last house Marina under construction ca. 1888, camera facing south (from the Bridgeport History Center collection). After Marina was completed, Waldemere was dismantled.

Image 9. Aerial view of Seaside Village, camera facing northeast (from Witkowski and Williams, p. 49).

Image 10. A Locomobile vehicle photographed in Seaside Park ca. 1916 (from Witkowski and Williams, p. 73).

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1. Introduction and Scope of Work

1.1 INTRODUCTION

The State of Connecticut, through the Connecticut Department of Housing (CTDOH), is undertaking a feasibility study and alternatives analysis, an Environmental Impact Statement (EIS) and Environmental Impact Evaluation (EIE), and preliminary design and engineering to schematic design level at approximately 30 percent for three projects to be funded through a competitively awarded grant from the United States Department of Housing and Urban Development (HUD) to the State as an outcome of the National Disaster Resilience competition (NDR) (Figures 1 and 2). The NDR project consists of three coastal surge/flooding risk reduction segments, each of which has a distinct alignment, constructability, and regulatory and process goals and challenges:

- University Avenue segment – infrastructure along the existing University Avenue corridor will be raised to form a line of protection to a to-be-determined point above future flood level that connects to a current high point to the east of Park Avenue and extends to the location of 60 Main Street. This raised infrastructure segment will provide dry egress from existing and future development in the area.
- 60 Main Street segment – protection will be extended east from the western edge of the 60 Main property through an independent berm or other surge protection line of defense across (partially or fully) or adjacent to the planned 60 Main Street Development, a private mixed-use development project at the south end of Main Street.
- Northern segment – protection will be extended from the 60 Main Street site north along multiple potential alignments using a berm or other surge-protection line of defense to a to-be-determined tie-in point at the railroad viaduct.

The project also includes a Resilience Hub to provide a location for dissemination of information to the community and assist the community in future recovery efforts. Typologies considered include continued use of 7 Middle Street, restoration of an existing building, construction of a new building, and one or more open air sites integrated within the community.

In addition, this project incorporates into the EIS/EIE a project to be funded through a competitively awarded grant from HUD to the State as an outcome of the Rebuild by Design (RBD) competition. The purpose of the RBD-funded project is to construct a pilot project for storm-water flooding mitigation at the Marina Village site.

Because HUD will provide funding for the project, the project is required to comply with the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act of 1966, as amended. These federal laws and their implementing regulations require consultation with the State Historic Preservation Office (CTSHPO) regarding possible project-related impacts to historic properties listed in or eligible for listing in the National Register of Historic Places (NRHP). Historic properties are defined as above-ground resources such as buildings, structures, objects, districts, and landscapes, and archaeological (below-ground) sites that meet the criteria for listing in the NRHP. As the Responsible Entity (RE) of the HUD

Community Block Development Grant that funds this project, the CTDOH will administer NEPA, which requires preparation of an EIS. The project's state funding requires it to comply with the Connecticut Environmental Policy Act (CEPA), which requires that state projects be evaluated concerning "the disruption or alteration of a historic, architectural, or archaeological resource or its setting." Properties subject to CEPA include those listed in or eligible for listing in the NRHP or State Register of Historic Places (SRHP). The CTSHPO is a mandated review agency under CEPA, and CEPA compliance requires preparation of an EIE.

This report presents the results of documentary research, field inspections, and evaluation of historic properties that may be affected by the various proposed project alternatives. The report was prepared by Archaeological and Historical Services, Inc. (AHS) under contract to WSP, the project's consulting engineer. The Phase IA Archaeological and Historical Resource Reconnaissance survey that forms the basis of this report was conducted in accordance with The Secretary of the Interior's Standards and Guidelines for Identification for Archaeology and Historic Preservation and The Secretary of the Interior's Standards and Guidelines for Evaluation (1983 and ongoing revisions). The survey was confined to an Area of Potential Effect (APE) (Figures 1 and 2). AHS personnel inspected the APE several times from January through March 2018. Thorough surveys of the immediate vicinities of the NDR and RBD project areas were conducted on foot, resulting in field notes and over 500 photographs of potentially historic properties. Following the walking survey, all public streets within the APE were assessed in a windshield survey to identify additional historic properties that could be affected. Areas of archaeological sensitivity were noted based on documentary data, as no subsurface testing was conducted.

The results of the historic properties evaluation will be incorporated into a combined EIS/EIE prepared as part of the Bridgeport NDR and RBD projects under NEPA and CEPA. This technical report will be appended to the EIS/EIE.

The conclusions and recommendations herein are the opinion of the historic-preservation consultant. Actual determinations of National Register eligibility and assessment of effects are properly part of the ongoing consultative process among HUD, CTDOH, and CTSHPO, and will be further developed as the project progresses.

This report is organized as follows: Section 2 presents the methodology used; Section 3 provides the pre-colonial and historical-period background contexts of the APE; Section 4 addresses the historic resources (Existing Conditions); Section 5 addresses archaeological resources (Existing Conditions); and Section 6 presents conclusions and recommendations.

1.2 DELINEATION OF THE AREA OF POTENTIAL EFFECTS

The overall project APE is delineated as the Resilient Bridgeport Study Area, roughly bounded by Railroad and South avenues to the north, Bridgeport Harbor and Long Island Sound to the east and south, and Iranistan Avenue, Atlantic Street, and the west side of Seaside Village to the west (Figures 1 and 2). This area was chosen to allow for the assessment of potential direct and indirect effects related to three resilience projects: the NDR-funded flood risk reduction segments at University Avenue, 60 Main Street, and north to the railroad viaduct, the Resilience Hub, and the RBD-funded storm-water flooding-mitigation pilot project at the Marina Village site.

Because Section 106 requires projects to evaluate indirect effects, including the effect of visual intrusions posed by new construction, this report considered historic properties on nearby streets. The potential indirect visual effects are twofold: a) the loss of elements that are an important part of the properties' settings and historical character, and b) the introduction of incompatible modern construction that would diminish the properties' integrity of setting, feeling, and association.

No assessment of construction easement, staging, storage and access areas, noise and/or vibration effects on State or National Register-listed or eligible resources could be made, as these areas are not yet known. As the design process moves forward, additional potential impacts to historic properties may be noted.

1.3 PROJECT PERSONNEL

Historian Marguerite Carnell conducted the historical background research and historic (above-ground) resource identification. She and Senior Historian Bruce Clouette field-checked historic resources in the APE and photographed them to document existing conditions. Together they also evaluated the historic resources for potential listing in the NRHP and SRHP. Senior Archaeologist and GIS Specialist David Leslie conducted the archaeological and environmental background research and archaeological sensitivity assessment. AHS President Mary Harper served as project manager.

2. Methodology

2.1 HISTORICAL RESOURCES RESEARCH

In order to establish an overall historical context and help in the identification of historic (i.e., above-ground) resources, AHS consulted general published histories of Bridgeport such as Witkowski and Williams (2001), Palmquist (1985), Waldo (1897), and Orcutt (1886), as well as well as standard works on New England railroad history such as Turner and Jacobus (1989). Additional research was undertaken to establish the historic contexts for evaluating resources in the project vicinity, including materials in the CTSHPO inventory files, the records and photograph collections of the Bridgeport History Center at the Bridgeport Public Library, and the Connecticut Historical Society's digital collection.

Previous historic resource survey information in the Connecticut Historic Preservation Collection and railroad company records at the Dodd Research Center, University of Connecticut, Storrs, were also consulted, including the intensive-level surveys of historic resources (Loether 1986) and industrial historic resources in Bridgeport (Clouette and Roth 1984).

AHS also assembled a series of historic maps and images of the project area (Appendices B and C), reviewed existing NRHP forms for individual properties and districts, met with representatives from the Fairfield Garden Club regarding their research on Seaside Park, and participated in the March 14, 2018 scoping meeting to speak with other parties with interest in historic properties.

2.2 ARCHAEOLOGICAL AND CULTURAL RESOURCE RESEARCH

AHS researched the files of recorded archaeological sites at the Office of State Archaeology (OSA) and CTSHPO. Relevant cultural resource management reports and archaeological publications were reviewed to help develop a pre-colonial Native American and historic-period context preparatory to assessing the potential for significant buried archaeological sites to be present in the APE. Environmental sources on hydrology, geology and soils were reviewed to establish an understanding of the natural environment that existed prior to urbanization and to also help understand the level of disturbance in the APE.

Historic maps, local histories and primary documents were researched to establish a historic-period context and aid in identifying archaeologically sensitive areas in the APE parcels. Aerial photographs and windshield survey helped refine AHS's assessment of archaeological sensitivity. No subsurface testing in the form of hand-powered soil cores or shovel-test pits was conducted in the APE as part of the assessment survey, as access issues, time constraints, buried utilities, and the preponderance of paved areas within the APE made testing impractical. Geotechnical boring data were not available at the time of the survey, but will be incorporated when it is provided by WSP.

2.3 EVALUATION OF SIGNIFICANCE

Many historic resources within or adjacent to the APE are listed in the NRHP and SRHP. Other resources identified by the project historians were evaluated for their potential eligibility for listing in the NRHP by applying the National Register criteria of significance. At this time, archaeological sites are excluded from the eligibility evaluation because no subsurface testing was possible to ascertain their presence or eligibility.

2.3.1 National Register of Historic Places Criteria of Significance

The criteria for listing in the NHRP are generally used in historic and archaeological surveys as a bar metric for assessing the significance of historic, archaeological and cultural resources. Resources determined by CTSHPO or a federal agency to be NRHP-eligible are provided a measure of protection from federally funded or federally-permitted projects in that impacts to them must be avoided, minimized or mitigated. Such resources are also accorded state protection under CEPA.

The National Register criteria of significance state the following:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- Criterion A – That are associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B – That are associated with the lives of persons significant in our past; or
- Criterion C – That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- Criterion D – That have yielded or may be likely to yield, information important in history or prehistory.

Resources may qualify under one or more of the National Register eligibility criteria.

The NRHP generally excludes from consideration several types of properties. Besides those less than 50 years old, excluded categories include cemeteries, commemorative properties, resources that have been moved, and religious properties. Such properties can qualify by meeting one or more Criteria Considerations, however. For example, a cemetery may qualify if its overall layout typifies 19th-century cemetery landscape architecture or if the distinctive design of most of its markers illuminates the history of funerary art. Similarly, a church could qualify if its architecture were exceptional.

2.3.2 National Register of Historic Places Integrity

Historic properties were also evaluated for their integrity, which is the ability of a resource to visually convey its significance. The seven aspects of integrity are: location, design, setting, materials, workmanship, feeling, and association. Most historic resources have been altered from their original appearance over time, but the question of integrity hinges on the judgment of whether the resource as it exists today retains enough integrity to be able

to convey its historical or architectural significance. The property must still possess several, if not most, aspects of the historical identity for which it is significant. The NRHP defines these aspects of integrity as follows:

- Location is the place where the historic property was constructed or the place where the historic event occurred.
- Design is the combination of elements that create the form, plan, space, structure, and style of a property.
- Setting is the physical environment of a historic property.
- Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- Feeling is a property's expression of the aesthetic or historic sense of a particular period of time.
- Association is the direct link between an important historic event or person and a historic property.

2.3.3 State Register of Historic Places

Properties listed in the NRHP are automatically listed in the Connecticut SRHP. The criteria for listing in the SRHP are similar to Criteria A, C, and D of the NRHP. The SRHP numbers its criteria: SRHP Criterion 1 combines NRHP Criteria A and B, SRHP Criterion 2 is the same as NRHP Criterion C, and SRHP Criterion 3 is the same as NRHP Criterion D. The exclusions associated with the NRHP, however, do not apply to SRHP eligibility, so churches, cemeteries, moved properties, etc. that might be ineligible for the NRHP could qualify for the SRHP.

3. Historical Background of the Project Area

3.1 ENVIRONMENTAL BACKGROUND

The purpose of this section is to provide general information on the environmental context of the APE. Humans, like most species, are sensitive to variations in habitat, and can be generally expected to settle in areas providing both reliable and predictable resources. While climate change over the course of the last 11,000 years has repeatedly transformed the environment in the Northeast, many basic characteristics of the landscape have remained relatively stable. Local geology and topography present important controls on the development and potential organization of habitats, and provide archaeologists with one means of identifying enduring features of the landscape around which people in the past would have organized themselves.

3.1.1 Physiography

The APE is located in the Coastal Slope region of Connecticut (Bell 1985). The coastal slope commences about 12 miles north of the coast, where the topography begins to drop steeply (about 50 feet per mile) to the coast. The Coastal Slope represents a portion of southern New England that was once covered by loose sediments from the former Coastal Plain. Those sediments protected the bedrock from eroding as quickly as surrounding areas. Erosion eventually washed these sediments away, but this period of protection spared the bedrock of the Coastal Slope from the deep erosion that occurred further inland. This process resulted in a gentler topography, which increased the agricultural potential of the Coastal Slope relative to upland areas and contributed to the intensive Woodland period (agricultural) and early European settlement of the Connecticut coast.

3.1.2 Bedrock and Surficial Geology

Bridgeport lies within the volcanic belt of Connecticut (one of three belts – carbonate, clastic, and volcanic). The volcanic belt is composed of metamorphic schists and granites that formed during the Ordovician period, between 500 and 400 million years ago.

Approximately 21,000 years ago, Connecticut and Long Island Sound were covered with glacial ice that was about a mile thick. The glacial ice continually moved south, picking up loose material on the ground surface. As the glacier melted, the material it had collected was re-deposited, creating a long east-west moraine. As the climate warmed, the glacier retreated to the north. About 17,500 years ago, a temporary cooling of the climate caused the ice front to cease its northward movement. The ice front halted along a line that ran off shore from the Bridgeport project area, forming the Captain Islands - Norwalk Islands moraine.

The water released from the melting glacier washed large quantities of finer-grained sediments into low-lying areas resulting in sand and gravel deposits in the Connecticut valleys. In higher and flatter areas, the glacier deposited till, a mixture of variously-sized sediments. As the glacier retreated, it left behind a series of outwash features, including drumlins, eskers, and kettle lakes and kames. The majority of the APE is overlain in fine-grained outwash sediments of finely bedded sand layers indicative of former deltaic deposits, and artificial fill deposits. Recent work in a similar coastal environment in Norwalk has shown that artificial fill units mapped

on the statewide surficial and quaternary geologic maps are often incorrect and that intact soil sequences may remain in developed coastal settings (Leslie and Ouimet 2017).

3.1.3 Soils

The soils in the APE are mapped as Urban Land, Udorthents, Udorthent-Urban Land complex, and Beaches Verrazano-Urban Land complex soils, all with slopes less than 8 percent. Udorthent and Urban-land complex soils are found on excavated and filled lands, generally in areas where the original soil has been covered with impervious surfaces like asphalt or concrete. Urban land soils can also refer to areas where the natural soils have been cut away or covered with fill deposits (USDA 2015). In areas with these designations, natural soil sequences may sometimes be found in vacant lots, lawns, wooded areas, parks, and other undeveloped areas interspersed between roads and buildings, and some are capped by roads, sidewalks, etc. Therefore, the Urban Land or Udorthent complex designation does not necessarily indicate pervasive disturbance. The potential for intact archaeological resources remains in undeveloped areas and beneath developed areas.

3.1.4 Ecological Context

The APE is located on the Connecticut coast, near the mouth of the Pequonnock River. The Pequonnock River is an approximately 17-mile-long river, which originates in Monroe and flows in a generally south-oriented direction until emptying into the Long Island Sound at Bridgeport Harbor. The Pequonnock River has one main tributary, the West Branch of the Pequonnock River, which also originates in Monroe. Historically, the Pequonnock River hosted the southernmost Atlantic salmon (Salmo salmar) spawning runs, which would have provided an important spring food source for pre-colonial Native Americans.

The APE was historically a rich outwash plain of the Pequonnock River. It is situated to the west of Black Rock Harbor, a natural harbor at the mouth of Cedar Creek. The APE would have provided rich soils amenable to Late Woodland Period agriculture and later European farmers. Historically, the APE contained an abundance of hard and soft woods such as oak, chestnut, hickory, maple, hemlock, and elm. The surrounding forests contained plentiful game animals and coastal areas and associated wetlands provided a profusion of important plant and terrestrial and marine animal resources. Numerous pre-colonial Native American camp, village, and shell-midden sites have been identified in the vicinity of the APE (Figure 1), illustrating the importance of the local environment to the past human inhabitants of coastal Connecticut.

3.2 PRE-COLONIAL NATIVE AMERICAN BACKGROUND

Although a relatively large number of Native American archaeological sites have been identified in coastal Connecticut, the understanding of pre-colonial cultures in the area remains incomplete. Only a small percentage of the recorded sites along the coast have undergone professional archaeological investigations. Many of the sites were recorded and excavated by avocational archaeologists and many others were destroyed by extensive modern development of coastal areas. Information from several important sites, investigated by avocational and/or professional archaeologists (Coffin 1937, 1938, 1940, 1946, 1951; Glynn 1953; Lavin 1988; Praus 1942; Russell 1942), has contributed to the understanding of Native lifeways in coastal areas. Important coastal sites include Grannis Island (Site 93-3) in New Haven Harbor (Glynn 1953; Lavin 1988), the Old Lyme Shell Heap (Lavin 1988), Mago Point in Waterford (McBride 1984), Fort Shantok and Shantok Cove in Montville (Salwen 1966; Salwen and Ottesen 1972; Williams 1972), the Thomas Site in Groton (Butler 1946), and the Davis Farm

Site in Stonington. A number of regional archaeological surveys have also been conducted in coastal areas of Connecticut and have provided a great deal of information on the nature and distribution of archaeological sites in these areas (McBride 1984a).

Below is a summary of the regional and local culture history, based on the current local archaeological record for Connecticut and the greater Northeast. The era predating the arrival of Europeans, which lasted roughly 11,000 years, is subdivided into several major periods coinciding with broad technological and settlement patterns observed in the archaeological record.

3.2.1 Paleoindian Period (11,000-9,500 BP)

In the Northeast, the Paleoindian Period dates from 11,000 to 9,500 years before present (BP), as measured in radiocarbon years, and coincides with the final glacial period, known as the Younger Dryas. Following a brief warming trend in the region, the Younger Dryas marked a return to colder, glacial conditions and ice-sheet re-expansion in portions of eastern North America (McWeeney 1999).

The earliest archaeological evidence for human occupation in New England dates to approximately 11,000 BP (Spiess et al. 1998) and in Connecticut to around 10,200 BP (Moeller 1980, Jones 1999). Paleoindian sites are characterized by distinctive lithic tools kits that include fluted points and unifacial tools such as side- and end-scrapers. Data reflecting Paleoindian land-use patterns and subsistence activities in the Northeast is relatively scarce (Spiess et al. 1998). It is assumed that Paleoindian people exploited a wide range of food resources, including large and small game, fish, wild plant foods, and perhaps extinct megafauna (Meltzer 1988; Jones 1998). Most archaeologists also believe that caribou played a significant, if seasonal, role in the Paleoindian subsistence strategy. Settlement patterns during this period are poorly understood. The range of identified sites includes large base camps, small residential camps, and small, task-specific loci. Taken all together, the archaeological evidence suggests a settlement system based on small, highly mobile social groups exploiting dispersed seasonally available resources.

Few intact Paleoindian sites have been found in Connecticut. According to former State Archaeologist Nicholas Bellantoni, about 50 fluted points have been recovered as isolated finds across Connecticut (Bellantoni 1995), but only two sites have been investigated and published in detail: the Templeton Site in Washington (Moeller 1980, 1984; Singer 2017) and the Hidden Creek Site on the Mashantucket Pequot Reservation in Ledyard (Jones 1997). More recently, excavations were conducted at the Ohomowauke Paleoindian Site, which is also located on the Mashantucket Pequot reservation, indicating repeated use of wetlands by Paleoindians (Singer 2017). A handful of other sites have received more cursory attention. In 2005, a probable Paleoindian component was identified in the Route 7/15 Interchange in Norwalk (Jones et al. 2005). The scarcity of identified Paleoindian sites suggests a low population density during this period. The small size of most Paleoindian sites and the high degree of landscape disturbance over the past 10,000 years likely contribute to poor site visibility. And, rising sea levels have likely inundated early sites, which are now offshore.

3.2.2 Archaic Period (9,500-2,700 BP)

The Archaic Period dates from 9,500 to 2,700 BP in the Northeast and it marks a time of dynamic and shifting subsistence and settlement patterns, but the general trend is one of generalist hunter-gatherer populations utilizing a variety of seasonally available resources. The period is subdivided into the Early, Middle and Late

Archaic periods on the basis of associated changes in environment, projectile point styles, and inferred adaptations (Snow 1980; McBride 1984a). Each sub-period is discussed briefly below.

3.2.2.1 The Early Archaic Period (9,500-8,000 BP)

Pollen evidence from swamp cores indicates a gradual warming and drying trend beginning around 10,000 BP (McWeeney 1999). By this time Pleistocene megafauna had been replaced by modern cool-temperate game species such as moose, muskrat, and beaver. Deer populations likely increased in abundance at the end of this period, when oak began to dominate upland forests. As the climate stabilized, plant and animal resources may have become more abundant and predictable, enabling Early Archaic populations to exploit a wider range of seasonal resources. Early Archaic sites are poorly represented in the regional archaeological record and this likely reflects continued low population densities. The dearth of Early Archaic sites may be due in part to changing environmental conditions which have deeply buried, inundated, or destroyed many early sites, or to the difficulty of recognizing some Early Archaic assemblages (Funk 1997; Jones 1998; Forrest 1999).

Archaeologists have recovered Early Archaic stone tool assemblages from several sites in the Northeast. The recovered data suggest that this period can be characterized by a number of distinct traditions. The most poorly understood period, that between 9,500 and 9,000 BP, appears to reflect both local Late Paleoindian and intrusive southern Piedmont Tradition Early Archaic influences. A quartz lithic industry in which projectile points are extremely rare occurs locally between roughly 9,000 and 8,500 BP. The Sandy Hill Site on the Mashantucket Pequot Reservation demonstrates this pattern (Forrest 1999, Jones and Forrest 2003). The site represents a local expression of a much broader techno-complex referred to as the Gulf of Maine Archaic Tradition (Robinson et al. 1992). Sandy Hill produced evidence of multiple semi-subterranean living structures and a variety of plant-food remains, including abundant cattail roots and hazelnuts. More recently, Jones and Leslie (2017) presented evidence for a Gulf of Maine Archaic Tradition site in Plainville, Massachusetts, dated to approximately 8,700 B.P., uncalibrated.

Archaeological evidence indicates a shift in Early Archaic period technology about 8,500 years ago, marked by the arrival of an apparently intrusive temperate forest-adapted culture that utilized bifurcate-based projectile points typically manufactured from non-regional materials (Jones 1998, 1999). The Dill Farm Site in East Haddam is one of the best-documented bifurcate sites in Connecticut (Pfeiffer 1986). Archaeological investigations at this site identified cooking/refuse features, quartz flakes, retouched tools, bifurcate-based projectile points, and subsistence remains, including charred nuts and mammal bone associated with a radiocarbon date of 8,560 +/- 270 BP. Bifurcate points are documented throughout the state, though most appear to represent isolated finds without apparent associated artifacts. Bifurcate points are commonly manufactured from rhyolite probably originating from a Boston Basin source or from Hudson Valley chert, but few are made from local lithic materials such as quartzite.

3.2.2.2 The Middle Archaic Period (8,000-6,000 BP)

Based on pollen evidence, the climate became warmer and drier during the Middle Archaic period and alluvial terraces developed along the state's major river systems (Jones 1999; Jones et al. 2008). This period marks the establishment of most modern nut tree species, which provided a new and abundant food resource for both human foragers and game animals such as bear, deer, and turkey. Evidence of Middle Archaic period occupation in Connecticut is more widely documented than for the preceding periods and it suggests adaptation to local resources during a period of population increase (McBride 1984a; Jones 1999). Archaeological evidence of grooved axes suggests that wood became an increasingly important raw material during the Middle Archaic,

while the presence of pebble net-sinkers and plummets on some regional sites implies a growing reliance on marine and riverine resources (Dincauze 1976; Snow 1980). Despite their relative abundance, sites in Connecticut have yielded limited information on Middle Archaic subsistence and land-use patterns (Jones 1999). Archaeological assemblages are characterized by the presence of Neville and Stark projectile points and large flake tools usually manufactured from local materials such as quartzite. The Middle Archaic settlement pattern appears to have been seasonally oriented toward large upland interior wetlands (McBride 1984a and b; Jones 1999) and the data suggest seasonal re-use of such locales over long periods of time. The Dill Farm Site and the sites around Great Cedar Swamp on the Mashantucket Pequot Reservation reflect this pattern (Jones 1999, 2004). The limited number of period coastal and riverine sites may be due to rising sea levels that have resulted in deep alluvial burial.

3.2.2.3 Late Archaic Period (6,000-2,700 BP)

The Late Archaic period in the Northeast is characterized by an essentially modern distribution of plant and animal populations. Based on archaeological evidence for population increase, burial ritual, and long-distance exchange networks, the Late Archaic is often considered a time of cultural florescence (Dincauze 1975; Snow 1980; Ritchie 1994; Cassedy 1999). This period is one of the best-documented temporal sequences in southern New England, and is characterized by three major cultural traditions: the Laurentian (ca. 5,500-4,500 BP), the Narrow-stemmed (ca. 4,500-3,500 BP), and the Terminal Archaic (ca. 3,800-2,700 BP). Late Archaic sites are common throughout the state, although the period between ca. 6,000 and 5,000 BP remains poorly documented. During most of this period, settlement strategies revolved around large, seasonally revisited settlements located in riverine areas and along large wetland terraces, and smaller, more temporary special-purpose sites in the interior and uplands (Ritchie 1969; McBride 1984a and b; Cassedy 1997, 1999). The nature and distribution of sites suggest aggregation during summer months, with seasonal dispersal into smaller groups during the cold weather (McBride and Dewar 1981). In general, the Late Archaic appears to represent a continuation of the land-use and resource-acquisition patterns observed during the Middle Archaic.

The Laurentian Tradition (Ritchie 1965) was originally thought to reflect a hunting and fishing culture with origins in the upper St. Lawrence Valley. In Connecticut, its local manifestations may simply represent the adoption of Laurentian technological traits by local residents (Hoffman 1990; Ives 2009). The settlement pattern appears to reflect a central-based wandering pattern (sensu Beardsley et al. 1956) in which numerous small communities exploited a wide variety of settings (Snow 1980: 230). In southern New England, Laurentian sites are more common in the interior than along the coast. This pattern suggests that Laurentian groups were primarily adapted to upland and riverine environments, with more limited exploitation of coastal areas on a seasonal basis (e.g., Snow 1980, Kingsley and Roulette 1990). Laurentian sites are characterized by a distinctive tool kit which includes diagnostic side-notched and corner-notched projectile points, often found in association with adzes, axes, gouges, ulus, and slate knives.

The transition to the Small- or Narrow-stem phase of the Late Archaic includes notable changes in lithic raw material use. During this phase, the use of quartzite declines significantly and quartz becomes by far the most commonly used material. This pattern has promoted the argument that population increase at this time restricted the availability of even regionally available resources like quartzite. The Narrow-stem phase is characterized by the development of a new quartz cobble technology that focused on the reduction of cobble cores into useful blanks for the production of projectile points, especially the narrow-stemmed forms. It is not known whether restrictions on raw material access drove the development of this new technology or if the

technology drove raw material selection. Archaeologically identifiable features are more common on sites from this period and include broad fire-cracked-rock pavements, earth ovens, and some fire-cracked-rock hearths.

Narrow-stemmed phase sites are the most abundant of any period represented in Connecticut. The more notable Narrow Stemmed sites in Connecticut's coastal zones include the Archaic Midden Site in Haddam and the Grannis Island Site in New Haven (Glynn 1953; Lavin 1988). The Archaic Midden Site has been partially submerged by rising sea levels and is only visible at low tide. This may be typical of many Late Archaic sites in the region, indicating the potential of encountering sites under salt marshes or in coves or bays. Recent research interprets the Cove River Site in West Haven to represent a seasonal base camp associated with the Narrow Stemmed Tradition (Cuzzone et al. 2009).

The Terminal Archaic period appears to mark a transition in settlement and perhaps subsistence strategies (Dincauze 1975). A number of technological innovations appear during this period, including the manufacture and use of steatite bowls and the rare production of cord-marked and grit-tempered pottery. The use of quartz declined during this period, while the exploitation of regionally available quartzites increased. Imported chert and other non-local lithics such as argillite, rhyolite, and felsite are found in high proportions in Terminal Archaic lithic assemblages. This pattern appears to indicate renewed social and economic contact with a broader region. Fire-cracked-rock features are often associated with this period and likely reflect intensive food-processing activities. Identified site locations suggest that settlement was focused on expansive lacustrine and wetland areas and upper river terraces, rather than floodplains (McBride and Dewar 1981). The interior and uplands appear to have been less extensively used during this period (McBride 1984a and b), though this may be a reflection of small, difficult-to-locate logistical hunting sites. The Terminal Archaic period also marks the appearance of human cremation burials (Dincauze 1968; Robinson 1996; Leveillee 1999). These cultural attributes may represent intrusive peoples or ideas, but the debate over the possibility of migration remains active (see, for example, Robinson 1996: 38-39).

3.2.3 The Woodland Period (2,700-450BP)

The Woodland period is characterized by the increased use of clay pottery, celts, and exotic raw materials, as well as the introduction of bow-and-arrow technology, smoking pipes and horticulture (Lavin 1984; Feder 1984, 1999). An increase in site size and complexity suggests a trend toward greater sedentism and social complexity, probably the result of a growth in the population base, particularly at the end of this period (McBride and Dewar 1987; Lavin 1988; Jones 2002). The Woodland Period has been traditionally subdivided into Early, Middle, and Late periods on the basis of ceramic styles, settlement and subsistence patterns, and political and social developments (Ritchie 1969, 1994; Snow 1980; Lavin 1984). Despite these changes, most recent scholars see the Woodland as a period well-rooted in the traditions and lifeways of the preceding Archaic period (Feder 1984, 1999).

3.2.3.1 Early Woodland Period (2,700-2,000 BP)

Most documented sites in Connecticut containing Early Woodland components are situated along the coast or at the mouths of major rivers such as the Quinnipiac, Connecticut, Thames, and Mystic, although a number of interior upland locations have also been documented.

The Early Woodland period remains poorly understood, and sites from this period are less well-represented in the archaeological record than sites from the preceding phases of the Late Archaic. This leads some to argue for a probable population decline during the Early Woodland (Fiedel 2001). On the other hand, the apparent

dearth of Early Woodland sites may simply reflect the biases of site-recognition strategies (Juli and McBride 1984). Direct association of Narrow-stemmed projectile points with Woodland Period radiocarbon-dated contexts (Herbster and Chereau 1999, 2001, 2003; Herbster 2004), as well as the stratigraphic association of Narrow-stemmed points with Woodland types (Lavin and Russell 1985; Cuzzone and Hartenberger 2009), suggest the possibility that Woodland Period assemblages are frequently misidentified as Late Archaic. The observed change in site patterning from the previous periods may also be a reflection of shifting settlement strategies that promoted the formation of larger, but fewer, seasonal aggregation camps (Jones 2002). Research suggests that year-round habitation of some sites was established by the late Early Woodland period (Ceci 1980; Bernstein 1990).

Early Woodland regional complexes are generally characterized by stemmed, tapered, and side-notched (Meadowood) point forms and preforms, often of Onondaga chert; thick, grit-tempered, cord-marked ceramics; tubular stone pipes; burial ritual; and indications of long-distance trade/exchange networks (Lavin 1984; Juli 1999). It is possible that incipient horticulture focused on native plant species such as goosefoot (Chenopodium sp.) had begun by this time (George 1997). The existence of stone pipes also suggests that tobacco was being traded into the region, if not locally produced, by the Early Woodland.

Despite the rarity of Early Woodland sites, a number of very large, deep pit features attributed to this period have been found across southern New England. These pits may represent nut-storage facilities and clusters of these features could indicate repeated use of nut-gathering locations by families, perhaps with established rights to certain groves. This would represent a break from presumed earlier patterns based on more mobile kin-based social units with relatively open access to local areas (Jones 2002).

3.2.3.2 Middle Woodland Period (2,000-1,200 BP)

The Middle Woodland Period is characterized by increased diversity in ceramic style and form, continued examples of long-distance exchange (especially of jasper), and at its end, the introduction of tropical cultigens (Dragoo 1976; Snow 1980; Juli 1999). Much of the current knowledge of the Middle Woodland Period in southern New England is extrapolated from Ritchie's (1994) work in New York State. Ritchie noted an increased use of plant foods such as goosefoot (Chenopodium sp.), which he suggested had a substantial impact upon social and settlement patterns. George (1997) reiterated this hypothesis for the Middle Woodland of Connecticut. Ritchie also noted an increase in the frequency and size of storage facilities during the Middle Woodland period, which may reflect a growing trend toward sedentism (Ritchie 1994; Snow 1980). At this time, jasper tool preforms imported from eastern Pennsylvania appear to have been entering the region through broad, formalized exchange networks (Luedtke 1987).

In Connecticut, Middle Woodland sites are relatively rare outside of coastal and near-coastal contexts. Archaeological evidence of settlement patterns suggests an increased frequency of large sites adjacent to wetlands and tidal marshes along the Connecticut River, a decline in large upland occupations, and a corresponding increase in upland temporary camps (McBride 1984a). This pattern may reflect a reduction in residential mobility, likely related to the development, by 2,000 BP, of modern tidal marshes and estuaries in low-lying riverine areas. The tidal marshes would have supported a wide variety of terrestrial and aquatic animal and plant resources, allowing longer residential stays (McBride 1984a).

3.2.3.3 Late Woodland Period (1,200-450 BP)

The Late Woodland period is characterized by population aggregation in villages along coastal and riverine locales; more intensive use of maize, beans, and squash; changes in ceramic technology, form, style, and

function; the eventual establishment of year-round villages; and the use of the upland-interior areas by small, domestic units or organized task groups on a temporary and short-term basis. The settlement pattern suggests a trend toward intensified settlement in larger villages and hamlets in coastal and riverine areas. It has been hypothesized that these changes can be attributed to the introduction of maize, beans, and squash, but the importance of cultigens in the diet of southern New England groups, especially those with access to coastal resources remains unclear (Ceci 1980; McBride 1984a; McBride and Dewar 1987; Bendremer and Dewar 1993; Ritchie 1994; Chilton 1999). Although sites clearly demonstrate the use of tropical cultigens in the Connecticut River valley, wild plant and animal resources were still a primary component of the aboriginal diet. The use of imported cherts increased over time in the Connecticut River valley, suggesting possible social, economic, and/or political ties to the Hudson Valley region. Affinities in pottery styles also suggest western ties at this end of this period (Feder 1999).

3.3 CONTACT PERIOD NATIVE AMERICAN HISTORY

While the APE today is characterized by industrial and urban development, it has a rich Contact and early historic past. Between 1520 and 1650, initial European settlement in southern New England had a significant impact on Native American groups in Connecticut and profoundly altered the pre-Contact geopolitical landscape. In the Late Woodland and early Contact periods, indigenous settlement focused on or adjacent to the floodplains of major rivers and tributaries, reflecting the importance of agricultural activities, fishing, and access to transportation and communication routes (Pagoulatos 1990). After 1600 AD, contact with Europeans likely catalyzed documented shifts in settlement and subsistence strategies, including the intensification of maize agriculture. Planting in the spring required a focused, cooperative kin-based effort, while the capture of anadromous fish at waterfalls and choke-points brought together households as it had for millennia. From late summer through winter, small household groups from larger village-based communities continued to use upland areas for hunting, trapping, and gathering. The introduction of a market economy related to the development of a large-scale fur-trading industry led to rapidly shifting alliances and power struggles between the various Native American groups in Connecticut. At the same time, Native communities struggled to maintain traditional lifeways as epidemic diseases decimated populations (Carlson et al 1992). Encroachment by newly arrived European settlers also contributed to the rearrangement of the physical and social landscape.

The explorations of Giovanni da Verrazanno in 1524 and Adriaen Block in 1614 are the most often noted examples of early contact between the region's Native population and Europeans, although it is likely that numerous less well-documented fishermen and traders infiltrated the waters of Long Island Sound and interacted with Native populations throughout the 16th century. For the interior tribes, contact with Europeans took longer. By the end of the Pequot War in 1637, however, rapid colonization and sales of land by Native sachems to English colonists were well underway. In the decade that followed, new towns were quickly established and an estimated 20,000 English settled Connecticut during the Great Migration (1629-1642).

At the time of European contact in the early 17th century, the APE was inhabited or at least utilized by Native Americans. It is likely that the Native people in the area during the Contact and Historic periods identified as Pequonnocks, a subset of the Paugussett Tribe that occupied southwestern Connecticut from Norwalk to West Haven. Wilcoxson (1939) identifies a possible Contact-era fortified village, lying somewhere between the Black Rock Cove and Ash Creek (previously referred to as the Uncaway River). This contact-era fort was likely a fortified village, was located near an "old Indian planting field" and may have held a garrison of 200 warriors during the Pequot War (Wilcoxson 1940). Following the Great Swamp Fight in Fairfield, which ended the

Pequot War in 1637, the English pursued the Pequots to the mouth of the Pequonnock River, and a small skirmish ensued. This area was eventually sold to the town of Fairfield by the Pequonnocks in 1681 (Wilcoxson 1940). A pre-revolutionary war era map delineates the project area as "Indian Harbor", indicating the likely contact period use of the APE by the Pequonnock (Adams 1928) (Map 1).

Following the end of the Pequot War, English colonists began settling coastal towns previously (and still) occupied by Native peoples and a number of land deeds were negotiated with Native American leaders. The APE lies within the original town bounds of Stratford and adjacent to the Town of Fairfield, which were both settled in 1639. The territory of the Pequonnocks lay between the Towns of Fairfield and Stratford, within the current APE. Local natives suffered a process of dispossession that involved the definition of land reservations within the boundaries of present-day Bridgeport, Fairfield, Orange, Stratford, and Westport. Due to their relatively small sizes, these reservations were not well-suited to supporting large populations through foraging or agriculture. One such reservation, the Golden Hill Reservation, was created by the colonists in 1639, at a sacred spring location to the north of the APE (in modern downtown Bridgeport), divesting the Pequonnocks of their land. Many Pequonnocks lived at this reservation, at least early on; Wilcoxson (1940) suggests that over 100 wigwams (houses) and associated peoples were present at the reservation. The Golden Hill Reservation was sold off by a state-appointed overseer in 1802 (Brilvitch 2007). None of the original Indian reservations exist today, all having passed into non-Indian ownership by the mid-19th century.

Consequently, some Native Americans relocated to communities upriver. Others joined ethnically admixed communities that formed in the state's developing coastal urban centers, where careers in the maritime and service industries were available. A prime example of this type of coastal community can be found in Bridgeport: Little Liberia (or Ethiope) (see below, Section 3.4.2)

3.4 GROWTH AND DEVELOPMENT OF BRIDGEPORT

3.4.1 Euro-American Settlement to the Mid-19th Century

Bridgeport is Connecticut's largest city, located at the mouth of the Pequonnock River on Long Island Sound. The area was first inhabited by the native Paugussett tribe, which farmed and fished in the river and Long Island Sound. The first documented English settlers arrived in 1644, and they also subsisted on farming and fishing. During the Revolutionary War, a settlement known as Newfield grew near State and Water streets. To the west, Black Rock Harbor was a natural harbor used by privateers as a safe landing place for captured prizes (Orcutt 1886). The APE was lightly settled by this point, as indicated in a 1777 map used by Sir Henry Clinton during the Revolutionary War (Adams 1928) (Map 2). Connecticut coastal shipping began to expand in the 1790s, fueled by the West Indies trade for sugar and rum, as demand increased for provisions such as livestock, grains, lumber, and manufactured goods. The Newfield community was incorporated as the borough of Bridgeport in the town of Stratford in 1800, allowing it to establish regulations and control development as its harbor grew into a prosperous port. Bridgeport separated from Stratford in 1821 to become a town, which also included land from the eastern side of Fairfield. Bridgeport was chartered as a city in 1836, giving it additional powers. One of its first actions as a city was obtaining bond funding for the Housatonic Railroad and secure the line's terminus in Bridgeport. The Housatonic line opened in 1840, connecting the city to Danbury, New Milford, and Albany, and providing an alternate route for goods shipped on the Erie Canal (when the Hudson River was frozen). Beginning in 1849, the Naugatuck Railroad linked Bridgeport to Waterbury and Winsted. The New

York and New Haven Railroad began operation in 1848, connecting Bridgeport to New York City as well as to shoreline towns (Clouette 1984: 17-19; Brilvitch 2007: 30).

3.4.2 The South End's Little Liberia: Community of People of Color

In the 1820s, Bridgeport's South End was notable for its settlement of free people of color, including members of the Paugussett tribe, African Americans, and immigrants from the Caribbean, including Jamaica and Haiti. The community had about 30 houses, a school, two churches, a Masonic lodge, the Duncan House Hotel (catering to affluent African Americans), a shipyard, and other businesses and social organizations (Maps 3 to 5) (Brilvitch 2007: 12; Brilvitch 2014). The community was referred to as Ethiope in its early decades, according to property deeds. Later residents called it Liberia; according to local oral tradition, the name change was a reference to the American Colonization Society's emigration program of African Americans to the West African coast, which began in 1822. After the Republic of Liberia declared its independence in 1847, the community was referred to as Liberia on deeds; later it became known as Little Liberia. Many men in the Liberia community worked as seamen, waiters, and barbers. Both men and women found employment in the Duncan House Hotel and on steamboats as cooks, and women also worked in laundry services (Brilvitch 2007: 12, 45-53; Brilvitch 2014; "Reimagining Little Liberia" 2017).

Joel Freeman (1793-1865) was a founding and pivotal member of the Ethiope community. He was a seaman from Derby and a member of the Turkey Hill Paugussett tribe. Freeman was one of three founders of the Zion Church (first building completed in 1835; current building 1882), the leading petitioner for the founding of a school for "colored children" in 1841, and a substantial property owner (Brilvitch 2007: 29-31) (Map 4; Image 2; Photograph 1). His sisters Eliza Freeman (1805 -1862) and Mary Freeman (1815-1883) were of Paugussett and African-American descent, also born in Derby. The women moved to Bridgeport in 1848, bought adjacent lots close to Joel Freeman's house and built two houses, which served as rental properties while they lived and worked in New York City (Maps 3 to 5; Photograph 2). Eliza moved back to Bridgeport in the early 1850s and worked as a "domestic." African American women boarded in her Main Street house and she owned several other houses in the community. Mary Freeman worked for a time as a cook in a Manhattan hotel and became the first person of color to join Bridgeport's First Methodist Episcopal Church in 1858. She too owned several properties in Bridgeport as well as a house on Long Island. The Freeman sisters' property holdings and financial success were unusual for women of color in the 19th century (Brilvitch 1998; Brilvitch 2007: 46-49; "Reimagining Little Liberia" 2017).

3.4.3 Bridgeport's 19th-Century Industrial Growth

In the 1830s Bridgeport emerged as a major production center for saddles, carriages, and clothing. These products were made by hand, in large workshops, and in sufficient quantities for export. As a major railroad hub for western Connecticut and a city with a good harbor and a skilled workforce, Bridgeport was in a prime position for industrial growth by the 1850s.

At that time, the APE was still lightly settled, and portions of Little Liberia are visible on both the 1850 (Collins and Clark) and 1856 (Clark) maps of the APE (Maps 3 and 4). The city's lack of a significant source of water power was overcome by importing coal for steam power. Bridgeport lacked a seed industry that would begin processes of diversification and mass production, and it was P. T. Barnum that led the importation of manufacturing that required skilled workers to produce highly complex, valuable goods (Clouette 1984: 20-21).

In 1851, Barnum and his partner William H. Noble undertook the building of a "new city" on the east side of the Pequonnock River, including factories, housing, shops, churches, schools, and Washington Park (Saxon 1989: 11, 192; Barnum 1871: 758). They built a factory on speculation that, beginning in the mid-1850s, was occupied by the highly successful Wheeler and Wilson sewing machine company (Waldo 1897: 955). Drawn by the city's growing expertise in precision metalwork manufacturing, the Howe sewing machine company moved to Bridgeport in the 1860s. Industry continued to grow as enterprising metalwork workers established their own shops. Bridgeport became known for a wide range of metal products such as steam engines, machine and hand tools, gauges, wire, pipes, springs, chains, mechanical toys, knives, scissors, cutlery, locks, and bronze monuments and statuary.

Clothing remained an important industry in Bridgeport throughout the 19th century and, with the city's proximity to New York's fashion world and its own metal parts specialty, it became a major center for corset production. Bridgeport Brass was established in 1865, producing metal goods for corsets and many other locally-made products. Warner Brothers Company, founded in 1874 and incorporated in 1894, was the largest corset maker (Image 3). Others included Langdon, Batcheller & Company; the Bridgeport Corset Company; L. L. Loomer & Sons, and the Crown Corset Company (Waldo 1897: 957). Other clothing products included elastics, rubber dress shields, silk and pile fabrics, and patent leather. Furniture, organs, and pianos were other consumer-driven Bridgeport products; the Kiefer Furniture Company was located in the South End near its namesake street.

Demographically, Bridgeport was a diverse working-class city of immigrants. Worker housing was needed near factories, and landowners in the South End saw the development opportunities. William D. Bishop (1827-1904), president of the Naugatuck Railroad as well as the first president of the New York, New Haven and Hartford Railroad, was among them. Bishop left the railroad in 1879 because of ill health; several years later he developed a planned community of workers' cottages several blocks from the New York, New Haven and Hartford freight yard, between Main and Broad streets (Orcutt 1886: 700-703; Waldo 1897: 787). The designer for Bishop cottage development—close to South End factories as well as Seaside Park—is attributed to George and Charles Palliser, architects from England who became nationally known for their widely influential pattern books (Photographs 3 to 5). Their first major Bridgeport project (with P. T. Barnum in the mid 1870s) was successful and they continued to design housing for the working class, including four developments in Bridgeport. Completed in 1881, the Bishop cottages were first occupied by German, Irish, and rural New England families, representative of Bridgeport's late 19th-century working class (Brilvitch 1979).

3.4.4 Seaside Park and P. T. Barnum's South End Developments

P. T. Barnum (1810-1891), the businessman, showman, and politician, was a prominent landowner and developer in the South End as well as in East Bridgeport and was deeply involved in the establishment of Seaside Park and nearby residential development. In his autobiography Barnum devoted a chapter to Seaside Park, describing his ideas for a public park and how he enlisted other prominent citizens to support the plan (Barnum 1871). Barnum negotiated with landowners and purchased some of the land for the city (Barnum 1871; Waldo 1897: 66-68).

The original (eastern) section of the park was designed by the preeminent landscape architecture team of Frederick Law Olmsted (1822-1903) and Calvert Vaux (1824-1895), who designed Central Park in New York City in 1858, followed by parks and landscapes through the country (Map 6; Images 4 and 5). They were hired by Nathaniel Wheeler of Wheeler and Wilson; along with Barnum, Wheeler was a substantial landowner in the

South End. Their design work for Seaside Park is documented by an 1867 topographical map stamped by Olmsted, Vaux and Company (Waldo 1897: 66-68; Golovin 1972: 8). In 1868 the west end (between Howe Drive and Iranistan Avenue) was redesigned as a horse trotting park (Map 8; Image 7). After the original part of Seaside Park was built, it is possible that Olmsted was involved in portions of the park's expansion, as he and Barnum corresponded in 1873 about the layout of the grounds and roads around Waldemere, Barnum's estate adjacent to the park built in 1869 (Map 7) (Saxon 1989: 215). Barnum's autobiography includes this description of the park's setting:

> The branch horse-railroad already reaches one of the main entrances, and brings down crowds of people every day and evening, and especially on the evenings in which the band plays. At such times the avenues are not only thronged with superb equipages and crowds of people, but the whole harboris alive with row-boats, sail-boats and yachts. The views on all sides are charming. In the rear is the city, with its roofs and spires; Black Rock and Stratford lights are in plain sight; to the eastward and southward "Old Long Island's sea-girt shore"; and between lies the broad expanse of the salt water, with its ever "fresh" breezes, and the perpetual panorama of sails and steamers (Barnum 1871: 766-767).

Estimates of the original size of the park vary from 35 to 44 acres. In 1878, Barnum bought 33 acres of tidal marsh west of the park and built a dyke and a tidal pond to drain the land, then donated the parcel for the park in 1884 (from Iranistan Avenue to Barnum Dyke; see Maps 9 and 10) (Waldo 1897: 68; Roth 1981: 32-33; Gilchrist 1982). After Barnum's death in 1891, the city continued Seaside Park's expansion (Image 6). A seawall was extended west of the dyke in 1894-1895, and the marsh behind it was infilled. The breakwater connecting Fayerweather Island to the mainland was built in 1917, and the island (with its 1823 lighthouse) was incorporated into the park the same year (Danenberg 1936: 91; Gilchrist 1982).

Barnum saw Seaside Park as an integral part of the South End's development. An 1865 Bridgeport Standard article (possibly written by Barnum himself, as he "agitated in the Bridgeport papers" (Barnum 1871: 760)) stated:

> We have heard some talk among mechanics and others about this being an aristocratic arrangement intended or suitable only for those who have establishments to drive. This is a great mistake. The Horse Railroad is to be extended to a convenient distance and all for a mere trifle can avail themselves of the privilege of the Park. The intention is to make it especially the resort of this class of citizens, land being cheaper in this part of town, houses of cheaper rent will be put up, and those of moderate circumstances will be better provided for than they have even been before (Brilvitch 1982, Barnum/Palliser; Gilchrist 1982).

Several blocks north of the park, Barnum purchased land between Park and Myrtle avenues (north of Atlantic Street) in 1876 and developed it through the 1880s, holding mortgages on some of the properties (Map 8). Most of the houses (including duplexes, rowhouses, and a few single-family dwellings) in this development are attributed to Palliser, Palliser & Co., like the Bishop cottages. The majority are duplexes with a high level of architectural ornament (Photograph 6 and 7). The John Cummings House, an 1885 duplex at 380-386 Myrtle Avenue, was identical to a design in the Palliser's book American Architecture (Photograph 8). George and Charles Palliser themselves lived in the duplex at 371-373 Myrtle Avenue prior to moving their firm to New York City (Brilvitch 1982, Barnum/Palliser).

Concurrently, Barnum was developing his land directly adjacent to Seaside Park. In 1869 he built Waldemere next to the park for the ocean breezes, in large part for his wife Charity's health (Barnum 1871:772). Barnum wrote of his plan to build fine housing near the park: "On the western and northern margins of this public ground, in sight of the Sound and in full view of every part of the park, will hereafter be the villas and mansions of the wealthiest citizens" (Barnum 1871: 767). His plan was realized, with many high-style houses built along Park Avenue and adjacent to Marina Park to the west, from the mid 1880s through the first decade of the 20th century (Photographs 9 to 16). Most were designed by prominent Bridgeport architects, such as George Longstaff, Warren Briggs, Joseph W. Northrup, and built for the city's leading merchants, factory owners, and professionals. Charles B. Read, Secretary of the D. M. Read department store, built 66 Marina Park Circle in 1892. William A. Grippin, president of Bridgeport Malleable Iron Works, built the house next door at 82 Marina Park Circle in 1908 (Photograph 13). George W. Wheeler, a Connecticut Supreme Court justice, built 115 Park Avenue in 1905 (Photograph 14). Albert J. Erslew, a design engineer, built the International Style-house at 185 Park Avenue in 1938 (Photograph 15). His wife Emma was a graduate of the NY Palmer School of Design and she was responsible for much of the innovative floor plan. The house at 219 Park Avenue was built as a summer residence in 1890 by Lavinia L. Parmly, a wealthy New York City widow (Photograph 16).

Charity Barnum died in 1873 and P. T. Barnum married Nancy Fish, the daughter of his friend John Fish, the following year. In 1889 they completed the last Barnum house, a smaller brick house called Marina, next to Waldemere, which was dismantled after Marina's completion (Image 8). (A portion of Waldemere was moved a few blocks north to the northeast corner of Atlantic and Rennell streets; another part was moved to Stratford.) The Waldemere estate was subdivided for more houses (compare Maps 8 and 9). Marina was demolished in 1961 by the University of Bridgeport; its iron gate surmounted with the initial "M" stands just north of Marina Park oval (Photograph 17) (Witkowski, "P. T. Barnum: The Later Years").

3.4.5 Bridgeport in the 20th Century

Bridgeport had surpassed Hartford, Waterbury, and New Haven in industrial production by 1905, and the city continued to grow as it improved its transportation infrastructure (Maps 11 to 16). Beginning in the 1890s, the U.S. Army Corps of Engineers undertook a number of harbor improvement projects that continued for several decades. The Corps built breakwaters, enlarged navigation channels, dredged portions of the harbor and a channel for a slip at Henry Street, and added fill that enlarged Tongue Point (Riess 1998). The harbor shipping channel was again widened in 1919. Concurrently, the two-track New York, New Haven & Hartford railroad corridor in Bridgeport was reconstructed in the first decade of the 20th century as an elevated, electrified four-track main line that eliminated grade-level crossings. This project was a major undertaking that required lengthy cut-stone retaining walls for the viaduct and new bridges that carried it over city streets and watercourses.

The New York, New Haven & Hartford Railroad's main freight yard was in East Bridgeport, but it also had a large freight yard (inherited from its predecessors, the Housatonic and Naugatuck railroads) along the South End's eastern waterfront, accessed by an under-grade bridge (Maps 13 and 14; Photograph 18). The yard included freight facilities on the north and west side of the tracks as well as on the south and east sides. (Since this bridge entrance was adjacent to the east end of South Avenue at Water Street, the entire yard was known as the South Avenue Yard; South Avenue and Water Street no longer intersect due to interstate highway I-95 and its frontage roads.) The former freight yard area in the project APE (now occupied by a power plant) was known as the Lower Yard.

Trucking companies and warehouse businesses thrived, such as the Bridgeport Storage Warehouse Company that built a nine-floor warehouse in 1917 at 10 Whiting Street, and Menard & Shepard trucking company, which occupied an adjacent 1919 brick building on Main Street (Map 17; Photographs 19 to 21). By 1939 the Bridgeport Storage Warehouse Company had incorporated the trucking company's building into their complex, and the company had its own railroad siding (Photograph 22). Some large companies had their own warehouses in the South End, such as Warner Brothers Company and the D. M. Read Company, Bridgeport's upscale department store (Photographs 23 and 24).

In the 20th century, Bridgeport factories were producing a wide array of electrical devices, including graphophones, along with products such as gauges, typewriters, automobile parts, and armaments. Bridgeport industrial production reached its zenith during World War I, particularly with munitions. The production increase required more wartime workers, and workers needed housing. The first WWI wartime housing development in the city was the Park Apartments at 59 Rennell Street, designed by Bridgeport architect Herbert Lucas for the Bridgeport Housing Company (Photograph 25). The U.S. Housing Corporation built four wartime developments, including one for the Crane Company on South Avenue. A key defense manufacturer, Crane produced valves and pipe fittings (Map 16). The Crane Development, now known as Seaside Village, was a planned residential community designed by a collaborative team of planner Arthur Shurtleff and architects R. Clipston Sturgis, Skinner and Walker (Image 9; Photographs 26 and 27) (Bedford 1989).

The automobile industry was also significant in Bridgeport. Locomobile was a company established in 1899 as an innovator in vehicles powered by steam, gasoline, and electric engines. In the factory at the south end of Main Street (adjacent to Tongue Point), the company produced trucks during World War I, but it was best known for custom-produced luxury automobiles (Map 15; Images 5, 7 and 10). Through the 1920s the company expanded too quickly, and it closed by 1930. Nonetheless, automobile production played a role in Bridgeport's survival of the Great Depression. A few Bridgeport companies made automobile bodies, but many more produced component parts such as cigarette lighters, brakes, windshield defrosters, and upholstery webbing (Clouette 1984: 26-27).

During World War II some Bridgeport defense companies thrived, such as the Auto-Ordnance Company that produced the submachine gun popularly known as the "Tommy Gun" (Clouette 2000). In the early 1940s the Sikorsky Aircraft Company established a helicopter manufacturing facility (and the first U.S. dedicated heliport, along Barnum Dyke) at the Crane Company site on South Avenue (Photograph 28). Sikorsky produced helicopters during the war and expanded its plant in 1948, 1950, and 1980, remaining active at the complex until 2015 (Connecticut Trust 2018).

Although not as extensive as Bridgeport's World War I housing expansion, there were several major World War II developments. Two were built in the South End by the U. S. Housing Authority. Marina Village is a development of plainly-detailed brick rowhouses laid out on two superblocks that flank Columbia Street just south of Railroad Avenue, the former site of the Eastern Malleable Iron Company (Photograph 29). The similarly named Marina Village Apartments, no longer extant, was a three-story brick apartment complex on the site bounded by Railroad Avenue and Main, Broad, and Whiting streets (not extant).

In the post-World War II period, a great deal of manufacturing moved from Bridgeport to outlying towns, out of state, and overseas. Some companies adapted to changing markets and held on. The Warner Brothers Company, for example, transitioned from corset production to modern types of lingerie in the 1920s and 1930s, and expanded to women's and men's sportwear in the late 1950s. The company remained active in Bridgeport

through the late 20th century, expanding through acquisitions and changing its name to Warnaco in 1968, but its South End manufacturing facilities shrank over time. The complex was renovated in the early 1970s by Modernist architect Victor Christ-Janer of New Canaan as Warnaco office space and University Square, a mix of retail and restaurant spaces, including the University of Bridgeport's bookstore ("Bridgeport" 1976).

In the South End, one of the most significant changes in the mid-20th century was the arrival of the University of Bridgeport, now the principal landowner south of Atlantic Avenue. Founded as the Junior College of Connecticut in 1927, the school expanded after World War II to accommodate returning veterans (compare Images 11 and 12). It purchased P. T. Barnum's property and moved to the South End in 1947, the same year that the college became the University of Bridgeport. The school continued to acquire properties over the next several decades, converting stately houses into dormitories and offices and erecting larger new buildings of more modest architectural character (Photographs 30 and 31).

Another major change came in 1957, when the United Illuminating (UI) power plant was constructed on the New York, New Haven & Hartford Railroad's Lower Yard (Images 13 and 14). UI added two more power generation units in 1967 and 1968, which burned oil and coal, followed by a 22-MW jet-fueled combustion turbine (Photograph 32). Today, Public Service Energy Group (PSEG) owns the harbor-front stations built by UI. In 2019, the coal-fueled plant will be replaced by a new 485 MW gas-fired combined cycle power plant, currently under construction at the south end of the complex. Another power company, EMERA, operates a 520-MW gas-fired combined cycle power plant between Whiting and Atlantic streets. UI operates the Pequonnock Substation (north of the coal-powered plant) and the Singer Electric Substation at 120 Henry Street. Currently, the South End power complex provides energy generation, transmission, and distribution on a regional basis.

4. Existing Conditions: Historic Resources

The APE has a rich, complex history and retains many historic-period resources (defined as at least fifty years old). The South End includes one known pre-Revolutionary War-period house; two mid-19th-century houses and a church that survive from Little Liberia; a variety of working-class, middle-class, and high-style housing from the mid-19th through the mid-20th centuries; churches, schools, and small mixed-use and commercial buildings; a waterfront park and two lighthouses; a railroad viaduct with bridges and catenary structures; factories and warehouse buildings; 20th-century university buildings; and a major power-generating complex (Figures 3 and 4). Within the APE, the majority of properties are over 50 years of age (with few exceptions, the minimum age to qualify for NRHP eligibility). There are dozens of houses, churches, former factories, and commercial buildings dating primarily from the mid-19th to the early 20th centuries. AHS noted NRHP-listed historic properties and districts, as well as potentially eligible historic resources that may be affected, directly or indirectly, by the proposed project. A review of their historic status follows, along with AHS's recommendations regarding NRHP eligibility. Table 1 calls out the status of historic resources relative to NRHP and SRHP criteria. All NRHP-listed resources are automatically in the SRHP.

4.1 NATIONAL REGISTER-LISTED INDIVIDUAL PROPERTIES

4.1.1 Seaside Park

Seaside Park is roughly bounded by Waldemere and Iranistan avenues and Atlantic Street, including the peninsula formed by Cedar Creek and Fayerweather Island (except the peninsula's landfill) (Images 4 to 6; Photographs 34 to 42). The entire park is listed as an individual property in the NRHP (Gilchrist 1982). The eastern section was designed by Frederick Law Olmsted and Calvert Vaux, as documented by a topographical map stamped by their firm (Golovin 1972: 8). In the NRHP nomination, the park meets Criterion B for its association with P. T. Barnum, who was involved with the park until his death in 1891, purchasing additional land and donating it to the city for use as parkland. It also meets Criterion C as a significant 19th-century civil engineering project. Some alterations have been made to the park's original Olmsted and Vaux design that affect its historical integrity, such as sports fields and parking areas. According to members of the Fairfield Garden Club who have studied early plans of the park, the most intact portions of the Olmsted and Vaux section are the park entrance at Broad and Main streets and the long tree allées south of the entrance, along with remnants of the long green and carriage concourse, and a section of woods north of the Civil War monument. Other alterations and additions made through the early 20th century have acquired their own historical significance, including monuments, some drives and paths, park buildings, and specimen trees. Seaside Park includes as a contributing structure the 1823 brownstone Black Rock Harbor Lighthouse (also known as Fayerweather's Island Lighthouse) (Gilchrist 1982; Palmquist 1985: 207).

4.1.2 Tongue Point Lighthouse

Tongue Point Lighthouse (also known as Bridgeport Breakwater Light, Buglight, and Inner Harbor Light) is located at the eastern tip of Tongue Point, on the west side of Bridgeport Harbor (Photograph 43). It is a small

cast-iron lighthouse built in 1894. It is entirely painted black. The lighthouse was moved in 1919, when a breakwater was demolished for harbor improvements. It is individually listed in the NRHP with statewide significance in the multiple property submission for "Operating Lighthouses in Connecticut."

4.1.3 Freeman Houses

The Freeman Houses at 352-54 and 358-60 Main Street, north of Whiting Street, were built for Mary and Eliza Freeman in 1848 (Photograph 2). They are the last remaining dwellings of Little Liberia and together are individually listed in the NRHP under Criterion A. They are also included on the Connecticut Freedom Trail.

4.1.4 Seaside Institute

Seaside Institute (now the Bridgeport International Academy) is located at 299 Lafayette Street, on the southwest corner of Lafayette and Atlantic streets (Image 15; Photograph 44). Designed by local architect Warren Briggs as an eclectic interpretation of Romanesque-Revival style, it was built in 1887 by the Warner Brothers Company for their female employees, providing a library, concert hall, classrooms, sewing room, parlor, and restaurant. It was later occupied by the Bridgeport Herald, which built the 1930s addition. It is individually listed in the NRHP under Criteria A and C.

4.1.5 Park Apartments

The Park Apartments is a four-story brick building at 59 Rennell Street, at the southwest corner of Atlantic and Rennell streets (Photograph 25). Designed by local architect Herbert Lucas, this Colonial Revival-style building was completed in 1916 as the first development project of the Bridgeport Housing Authority and the first Bridgeport housing built for wartime workers. It is individually listed in the NRHP under Criteria A and C in the multiple property submission for "Wartime Emergency Housing in Bridgeport, 1916-1920."

4.2 NATIONAL REGISTER-LISTED DISTRICTS

4.2.1 William D. Bishop Cottage Development Historic District

The William D. Bishop Cottage Development Historic District is roughly bounded by Broad, Whiting, Main, and Henry streets (Photographs 3 to 5). It includes approximately 35 wood-frame workers' cottages built 1880-81 that are attributed to local architects George and Charles Palliser, pioneers of mail-order architecture in America. It also includes several adjacent late 19th-century buildings. The district is listed in the NRHP under Criteria B and C.

4.2.2 Barnum/Palliser Historic District (also a Local Historic District)

The Barnum/Palliser Development Historic District is roughly bounded by Myrtle and Park avenues, Atlantic Street, and both sides of Austin Street (Photographs 6 to 8). It includes about 21 duplex wood-frame buildings for worker housing, many with a high level of architectural ornament, which are attributed to George and Charles Palliser. The district also includes 349-51 Myrtle Avenue, brick rowhouses at 374-84 Atlantic Street, 276 Gregory Street, and the brick Myrtle Avenue School/Jefferson School (1884; 1916) at 325 Myrtle Avenue.

Most of the buildings date to ca. 1882 to 1894. The district is listed in the NRHP under Criteria A, B and C, and it is also a designated Local Historic District (LHD).

4.2.3 Marina Park Historic District (also a Local Historic District)

The Marina Park Historic District is located along Park Avenue, south of Atlantic Street (Photographs 13 to 16). This district comprises a fine collection of about 13 high-style late 19th- and early 20th-century houses designed for Bridgeport's prominent merchants, factory owners, and professionals. The extant buildings in the district date from 1887 to 1937; some houses were demolished by the University of Bridgeport for parking and post-World War II academic buildings. The district is listed in the NRHP under Criteria B and C, and it is also a designated LHD.

4.2.4 Seaside Village Historic District

The Seaside Village Historic District is located on the west side of Iranistan Avenue between South and Burnham streets, including Albert Square, Alsace, Cole, and Flanders streets, Forest Court, and Sims Street (Image 9; Photographs 26 and 27). The complex was designed by R. Clipson Sturgis, Skinner and Walker, along with planner Arthur Shurtleff. It was built 1916-1920 for wartime workers at the nearby Crane Company plant on South Avenue (most recently occupied by Sikorsky Aircraft). There are about 58 contributing buildings. The district is listed in the NRHP under Criteria A and C in the multiple property submission for "Wartime Emergency Housing in Bridgeport, 1916-1920."

4.3 POTENTIAL NATIONAL REGISTER-ELIGIBLE INDIVIDUAL PROPERTIES

4.3.1 Walters Memorial A.M.E. Zion Church and Parsonage (also State Register-listed)

The church and parsonage at 427 Broad Street are individually listed in the SRHP under Criteria 1 and 2, and they are also included on the Connecticut Freedom Trail (Photograph 1). This church was the focal point for a community of free people of color, originally called Ethiope and later known as Little Liberia. The congregation was founded by Joel Freeman, brother of Mary and Eliza Freeman, along with two other trustees. The original church was built in 1835; the current building dates to 1882 and is attributed to George and Charles Palliser (Image 1). The church was renovated in 1951, removing a belfry and adding clapboard siding, but much of the 19th-century interior remains intact. Both buildings have been sided with vinyl, which conceals wood clapboards and shingles. Because of their historical significance, the buildings appear to be potentially individually NRHP-eligible under Criterion A. This is the only resource in the APE that is listed in the SRHP but not in the NRHP.

4.3.2 Bridgeport Storage Warehouse Company

Several buildings on the block bounded by Main, Whiting, and Kiefer streets and Singer Avenue were owned by the Bridgeport Storage Warehouse Company (Photographs 19 to 22). The warehouses at 376 Main Street were connected to the nine-story warehouse (1917) at 10 Whiting Street and shared a railroad siding, comprising a single operation at least as early as 1939 (Map 17). The surviving buildings are on the parcel listed at 376 Main Street, and Singer Avenue retains remnants of stone paving and tracks from the company's siding. The property

was recommended for individual NRHP listing in the 1984 survey of Bridgeport industrial sites (Clouette and Roth 1984); it is recommended that the property be considered NRHP-eligible under Criteria A and C.

4.3.3 Crown Corset and Crown Paper Box Company Factories

The Crown Corset factory (1909) at 345 Railroad Avenue and the Crown Paper Box factory (1910) at 347 Railroad Avenue (between Park and Myrtle avenues) were linked by financial and managerial connections, and their closely spaced, three-story brick buildings share many design details (Map 18; Photograph 45). Both retain much of their historical integrity; it is recommended that the property be considered NRHP-eligible under Criteria A and C. This property was recommended for NRHP listing in the 1984 survey of Bridgeport industrial sites as part of a small district that included another corset factory on the same block (Clouette and Roth 1984). The other factory (G. C. Batchellor & Co.; Thomas, Langdon & Co.) is not extant.

4.3.4 D. M. Read Company Warehouse

The D. M. Read Company Warehouse at 461 Broad Street was built ca.1941 (Photographs 23 and 24). In the early 1900s the Warner Brothers Company built warehouses on this site; by 1939 they were owned by D. M. Read, Bridgeport's premier department store. The company replaced two smaller warehouses facing Broad Street with this brick building, and the concrete block addition along Railroad Avenue replaced several smaller warehouses sometime after 1950. Besides the modern overhead doors, the building appears to be intact (the windows are not visible). It is recommended that the property be considered NRHP-eligible under Criteria A and C as an example of a typical mid-20th-century warehouse.

4.3.5 Carstensen Hall

Carstensen Hall at 174 University Avenue was historically known as the G. C. Edwards House (Photograph 10). Built ca. 1900, this fine Colonial Revival house retains its original windows and many fine details, despite the vinyl siding. It is owned by the University of Bridgeport and serves as office space; inside, the hall and stairway retain much historical integrity. It is recommended that the property be considered NRHP-eligible as an individual property under Criteria A and C.

4.3.6 Ingleside Hall

Ingleside Hall (ca. 1895) is located on Ingleside Avenue on the University of Bridgeport campus (Photograph 9). With its asymmetrical plan, steeply-pitched irregular roof with multiple gables, and wall surfaces enlivened with multiple materials and surface planes, the building was once a high-style Queen Anne house. It is currently vacant. The brick, stucco, and shingle walls are in fair condition; the interior was not accessible. It is recommended that the property be considered NRHP-eligible as an individual property under Criteria A and C.

4.3.7 Waldemere Hall

This ca. 1913 Colonial Revival brick house at 409 Waldemere Avenue (at the northeast corner of Waldemere and Iranistan avenues) is owned by the University of Bridgeport and serves as the University president's residence (Photograph 11). Despite a modern garage addition, the house retains a significant amount of exterior

integrity; the interior was not accessible. The house is potentially NRHP-eligible as an individual property under Criteria A and C.

4.3.8 Wisteria Hall

Owned by the University of Bridgeport, Wisteria Hall (ca. 1915) at 405 Linden Avenue was historically known as the Dudley M. Morris House (Photograph 12). It is an excellent example of the Tudor Revival style that retains a great deal of architectural integrity; the interior was not accessible. This property was recommended for NRHP listing in the 1986 survey of Bridgeport's Western Neighborhoods (Loether 1986); it appears to be potentially eligible under Criteria A and C.

4.3.9 247 Atlantic Street

This 1879 Stick Style house retains much of its integrity, most notably its clapboard and board-and-batten siding, timber-frame trusses at the gable ends, and porch details (Image 16; Photograph 46). Its first known occupant was Charles L. Peck, a salesman with Flint & Warren. It is located between the Warner Brothers Company to the north (just west of the NRHP-listed Seaside Institute), and the University of Bridgeport to the south. The house was recommended for individual NRHP listing in the 1986 survey of Bridgeport's Western Neighborhoods (Loether 1986). Since the survey, the original 2-over-2 windows have been replaced. It is recommended that the property still be considered NRHP-eligible under Criteria A and C because it retains enough integrity to convey its significance.

4.3.10 337-341 Broad Street

This wood-framed Queen Anne triple tenement (ca. 1890) has many original details, including Jacobean-style chimneys, entrance with brick veneer, wood panel and glass doors, and porch details (Photographs 47 and 48). Beneath the asphalt siding there may be wall surfaces with equal architectural interest. It is located across the street from the NRHP-listed William D. Bishop Cottages Development Historic District. The building's first known resident was Willis W. Wilmot, a molder employed by the Eaton, Cole & Burnham Company on Water Street. Despite its asphalt siding, this property was recommended for individual NRHP listing in the 1986 survey of Bridgeport's Western Neighborhoods. Since the survey, the original windows (with multi-light upper sash, like the central entrance door) have been replaced. It is recommended that the property still be considered NRHP-eligible under Criteria A and C because it retains enough integrity to convey its signficance.

4.3.11 Seagrove Cottage

The house at 36 Myrtle Avenue is known as Seagrove Cottage (Photograph 49). According to local lore, this diminutive Second Empire-style house was built ca. 1868 and belonged to P. T. Barnum's secretary J. J. Gorham. The house might have been moved from another location; it is depicted on Myrtle Avenue on the 1910 Kershaw map but not on the 1876 Beers or the 1888 Hopkins maps. It is currently owned by the University of Bridgeport. Most of the other houses on the street date to early 1920s (see Section 4.4.2 Myrtle Avenue Housing). This property was recommended for individual NRHP listing in the 1986 survey of Bridgeport's Western Neighborhoods (Loether 1986). It is recommended that the property be considered NRHP-eligible under Criteria A and C.

4.4 POTENTIAL NATIONAL REGISTER-ELIGIBLE DISTRICTS

4.4.1 Housing on Park Avenue and Atlantic and Gregory Streets

Just north of the Marina Park Historic District and west of the Barnum/Palliser Historic District is a block of single and multifamily houses on both sides of Park Avenue from Atlantic to Gregory streets, and extending west on both Atlantic and Gregory streets (Photographs 50 to 53). This collection of buildings, primarily multifamily houses dating from 1882 to 1921, retains a good degree of architectural character and historical integrity. The potential district would be a connecting link between the Barnum/Palliser and the Marina Park NRHP-listed districts. The 24 houses in the proposed district are as follows: 351-353, 359-361, 367-369, 373-375, 379-381, 387-389, 393-395, and 399 Gregory Street; 319-323, 320, 328, 331-333, 337-339, 340, 343-345, 349-351, 350, 358-360, and 357-359 Park Avenue; 492-494, 502-504, 510-512, 518-520, and 526 Atlantic Avenue. The north side of Atlantic Street is included; the south side is part of the NRHP-listed Marina Park Historic District. On Gregory Street, the south side buildings have a greater degree of cohesion and integrity than the north side, so only the south side is included in the proposed district (see Photographs 53 and 54). On Gregory and Atlantic streets, the cohesion and integrity of the streetscape west of this group is substantially reduced (Photographs 55 and 56).

4.4.2 Myrtle Avenue Housing

On Myrtle and Waldemere avenues just north of Seaside Park is a group of seven remarkably intact duplex houses (Photographs 57 and 58). They date from 1919 to 1924 and are associated with prolific local builder William Chatlos. They are currently owned by the University of Bridgeport and private owners. The houses in this proposed district are as follows: 25-27, 49-51, 53-55, 59-61, and 65-67 Myrtle Avenue; and 174-176 and 186-188 Waldemere Avenue. These properties were recommended for NRHP listing as a district in the 1986 survey of Bridgeport's Western Neighborhoods (Loether 1986). It is recommended that the potential district be considered NRHP-eligible under Criteria A and C.

4.4.3 New York, New Haven & Hartford Railroad

The former New York, New Haven and Hartford Railroad line within the APE represents a potential historic linear district that would include railroad viaduct retaining walls, catenary structures, and bridges at Park and Myrtle avenues and Warren, Lafayette, and Broad streets, as well as the under-grade railroad bridge (known as Bridge 43.21) on the east side of Webster Bank Arena at 600 Main Street (Photographs 59 to 65). It is recommended that the railroad be considered a NRHP-eligible linear historic district under Criteria A and C; CTSHPO has found similar railroad sections in Stamford and Norwalk to be NRHP-eligible.

4.4.4 Bassick Company Factory

The Bassick Company Factory complex is located at 275 Warren Street, bounded by Warren and Austin streets and Myrtle and Railroad avenues (Map 18; Photographs 66 to 68). It consists of roughly six adjoining blocks of buildings constructed between 1885 and 1960, ranging from one to five stories. The 1885 building Canfield Rubber Company was purchased by the Bassick Company, which produced hardware for furniture and cabinetry, and the company quickly grew and expanded, including a large die-casting plant erected at the corner of Warren Street and Austin Avenue in 1930. While the five-story block (1920) has metal siding that conceals

its original design details, the complex has a whole retains sufficient historical integrity to be able to convey its significance for the industrial history of Bridgeport. The complex was recommended as a candidate for the SRHP in the Connecticut Trust for Historic Preservation's (CTHP) mill survey. It is recommended that the property be considered NRHP-eligible under Criterion A.

4.4.5 Warner Brothers Company Factory

The Warner Brothers Company Factory complex is located at 325 Lafayette Street and 330 Myrtle Avenue, bounded by Gregory, Lafayette, and Atlantic streets and Myrtle Avenue (Maps 9 and 18; Image 3; Photographs 69 to 75). It has roughly 16 building blocks dating from 1876 through ca. 1950, including a large expansion in 1910-1912. The complex was renovated in the early 1970s by Modernist architect Victor Christ-Janer of New Canaan as Warnaco office space and University Square, a mix of retail and restaurant spaces ("Bridgeport" 1976). The western half has been vacant for about 20 years, and the eastern half was rehabilitated ca. 2007 for multifamily housing. This property was recommended for individual NRHP listing in the 1984 survey of Bridgeport industrial sites (Clouette and Roth 1984). It was also recommended as a candidate for the SRHP in the CTHP mill survey. Despite the alterations to the eastern section in the 1970s and its more recent rehabilitation, the complex retains sufficient integrity to be able to convey its significance for the industrial history of Bridgeport. It is recommended that the property be considered NRHP-eligible under Criterion A.

4.4.6 United Aircraft Company (Sikorsky Aircraft Division) (on border of APE)

The United Aircraft Company (Sikorsky Aircraft Division) complex is located at 1000 and 1225 South Avenue (Image 12; Photograph 28). The property borders the study area, just west of the NRHP-listed Seaside Village. The surviving buildings comprise roughly five blocks built in 1912, 1948, 1951, and 1980. Sikorsky Aircraft occupied this factory complex from the early 1940s to 2015 for helicopter production. Final determination of the complex's NRHP eligibility need not be part of this project, unless the design changes to expand the APE westward. The complex was recommended as a candidate for the SRHP in the CTHP mill survey.

4.5 PROPERTIES MORE THAN 50 YEARS OLD THAT DO NOT APPEAR TO BE ELIGIBLE FOR THE NRHP

There are dozens of buildings dating from the mid-19th to the mid-20th century within the APE which were assessed as not eligible for listing in the NRHP, primarily because of diminished integrity of design, materials, and/or setting. The following are some individual properties that were considered, along with several groups of buildings, which illustrate typical levels of diminished integrity. Photographs of these properties appear in Appendix D.

4.5.1 45 Columbia Street

This house is probably the only extant pre-Revolutionary War dwelling in the South End (Photograph 76). In local legend, it is associated with John Mallett, a French Huguenot farmer whose property was purchased by P. T. Barnum in 1864. Much of Mallett's farm became part of Seaside Park and Barnum's Waldemere property. This house was moved from the southeast corner of Park Avenue and Atlantic Street to 45 Columbia Street sometime after Waldemere's completion in 1869. Its first known occupant in the current location was Charles H. Bonner, a plumber (1894). Despite significant alterations, this property was recommended for individual

NRHP listing in the 1986 survey of Bridgeport's Western Neighborhoods because of its early date and its association with the area's agricultural history (Loether 1986). Since the 1986 survey, the property has been further compromised with vinyl siding and replacement windows and doors, leading to the conclusion that it no longer possesses sufficient integrity to convey its significance. Local residents, however, recognize the building's history.

4.5.2 160-162 Main Street and Neighboring Multifamily Houses

This trio of ca. 1915 three-story wood-frame buildings is at the southeast corner of Main and Henry streets (Photograph 77). The house appears on the 1917 Hopkins map as the property of H. Schine, together with several smaller buildings fronting Henry Street on the same lot. They are just south of the modern UI Singer Substation, and the property south of them is vacant. Across Main Street is one house of slightly earlier vintage that is flanked by a vacant mid 20th-century restaurant and vacant lots. These buildings represent typical early 20th-century urban mixed-use and multifamily housing, although their integrity has been compromised to varying degrees with replacement siding, doors, windows, and porches. Given their diminished integrity and lack of historic neighborhood context, NRHP-eligibility is not recommended for these buildings under Criterion C. At this time, the extent of historical background associated with this property is insufficient to support NRHP-eligibility under Criterion A.

4.5.3 250 through 281 Myrtle Avenue

This group of single and multifamily houses is on the south side of Atlantic Street (Photographs 78 and 79). It is adjacent to the Barnum/Pallister NRHP-listed district to the north and the University of Bridgeport to the south. These houses were built in the late 19th through early 20th centuries. Their integrity varies; some have been altered with replacement siding, doors, windows, and porches. They appear unrelated to the Barnum/Palliser development, and they have lost their historic context to the south. Therefore, NRHP-eligibility is not recommended for these buildings under Criterion C, although additional research could reveal sufficient historical importance for Criterion A.

4.5.4 East side of Iranistan Avenue near Gregory Street

Opposite the NRHP-listed Seaside Village on Iranistan Avenue, near Gregory Street, is an eclectic group of buildings (Photograph 80). They include a few ca. 1930 commercial buildings and houses ranging from late 19th-century multifamily dwellings to mid 20th-century Cape-type houses and more recent construction. Their integrity varies; many have been altered with replacement siding, doors, windows, and/or porches. The Seaside Market building has been altered with large roof-mounted billboards. NRHP-eligibility is not recommended for this disparate collection of buildings under Criteria A or C.

4.5.5 Marina Village

Marina Village (1941) was one of two major World War II housing developments in the South End built by the U. S. Housing Authority (Images 12 and 13; Photograph 29). It consisted of two superblocks of plainly-detailed, two-story brick rowhouses and a community building, located south of Railroad Avenue and bounded by South, Iranistan, Ridge, and Park avenues and Columbia and Johnson streets. The eastern section (west of Columbia Street has been demolished, with plans for the entire site to be redeveloped as mixed used and this project's

storm-water park). In the context of the redevelopment project, the CTSHPO did not identify this property as NRHP-eligible.

4.5.6 United Illuminating Pier

This pier structure located west of Tongue Point was built in 1968 (Image 13; Photograph 81). It was used for unloading oil into the four large tanks that formerly stood on the southern end of the PSEG property. Because the oil tanks were recently demolished and the plant has been extensively altered, the pier lacks a historic context and is unlikely to meet NRHP Criteria A or C.

4.5.7 University of Bridgeport's Mid 20th-Century Buildings

The University of Bridgeport includes residence halls, classroom buildings, and administrative offices built throughout the second half of the 20th century (Images 12 and 13; Photographs 30 and 31). Most are brick, multi-story, of no particular style, with flat roofs and little architectural detail. Some have been altered with replacement windows and doors and/or additions. Interspersed with older houses converted for the University's use and more recent construction, it is not likely that these buildings would be NRHP-eligible under Criteria A or C.

5. Existing Conditions: Archaeological Resources

5.1 PREVIOUSLY IDENTIFIED PRE-COLONIAL ARCHAEOLOGICAL SITES

AHS reviewed the files of previously-documented archaeological sites in the site files of the OSA and CTSHPO. Several archaeological assessment surveys have been conducted within or near the APE, one previously recorded pre-colonial archaeological site is located within the APE and another eight pre-colonial sites are recorded within one mile of the APE. A review and discussion of those sites is presented below (Figure 6). Sites reported in the general vicinity of the APE are clustered along the shore and waterways on either side of waterways, which would have provided an ideal place for Native American subsistence and settlement, adjacent to abundant fish and shellfish and coastal resources, and freshwater rivers. The sites include numerous large shell heaps and burial grounds, the majority of which are dated to the Late Woodland period. In fact, an early, Revolutionary War-era map of the APE identifies the modern Bridgeport Harbor as "Indian Harbor" (Map 1). However, due to the massive disturbances from urban development and early excavation dates, none of these archaeological sites are thought to be preserved or eligible for listing in the NRHP.

Several pre-colonial human burial locations have been identified within or near the APE. Within the APE, at the Main/Broad Street entrance to Seaside Park, on the west side of the Pequonnock River at the mouth of Bridgeport Harbor, a shell midden and multiple burials are recorded as Site 15-11. This site is likely much larger than a single point on a map, as burials were exposed farther south, along the sea wall area, and to the west. To the north of the APE, Site 15-12 was discovered in 1870 and earlier, when more than 50 burials were exposed during the construction of the Prospect School; tobacco pipes and a pot were also found. Recorded by the OSA in 1968, the site was reported in the Bulletin of the Archaeological Society of Connecticut (ASC Bulletin) (Coffin 1940; Batchelor and Steck 1941). A short distance to the north, Site 15- 13 was recorded by the OSA in 1968 as an "Indian cemetery;" it was reported in the ASC Bulletin (Batchelor and Steck 1941). Yet another Native American burial ground was discovered and disturbed or destroyed during railroad construction near the old site of the Bridgeport Gas Works. This site, designated 15-14, lies just over one mile from the APE and was reported in 1941 (Batchelor and Steck 1941). Site 15-15, located on the east bank of the Yellow Mill Channel, is recorded in the site files as a "shell outcropping" inclusive of a single human burial and grave goods (Batchelor and Steck 1941: 22-23). Site 15-7, which lies approximately 1.25 miles northeast of the APE near Bruce Pond, contained ten human skeletons and associated grave goods dating to the Late Woodland period; a shell-midden layer covered the burials, which were found in coarse gravel. This site was reported in the ASC Bulletin (Coffin 1940). The OSA, according to the site form completed in the 1960s, believed the site, excavated in 1900, was destroyed in 1905 when the area was graded and houses were constructed. In 2004 PAST, Inc., an affiliate of AHS, Inc., conducted archaeological monitoring of a Connecticut Department of Transportation project based on reports in 19th- and 20th-century sources that the remains of two human skeletons were observed during construction of an industrial building on Bostwick Avenue (recorded by the OSA as Site 15-10); the reports indicated that the remains lay directly beneath a brick wall and could not be removed (Forrest and Harper 2004). No human remains were found in the monitoring, but the documentation of building construction on top of burial sites indicated that the potential for human remains to be present even in disturbed settings is a very real possibility. Samuel Orcutt, in 1886, also recorded numerous Native American burials that were unearthed as part of an extension of Waldemere Avenue, associated with an expansion of Seaside Park.

These burials are not recorded in the OSA site files, but are located approximately on Figure 6, adjacent to the APE.

The OSA considers Sites 15-7 and 10 through 15 to have been destroyed; however, undisturbed portions of these sites may remain below fill deposits. Human remains, regardless of their integrity (disturbed or intact) are also subject to Connecticut General Statute 10-388, which applies to the treatment of human remains discovered in a project area, that are determined by the Chief Medical Examiner's Office to be archaeological in nature.

In addition to burial sites, numerous Native American activity/occupation sites have been reported from the Bridgeport Harbor vicinity. Site 15-20, northeast of the APE where the railroad line crosses the Yellow Mill Channel, is the "Stone Post Site" (15-20), thought by the OSA to be a possible "medicine or ceremonial ground," consisting of a number of large stone posts. The posts were found around 1840 (Orcutt 1886: 63-64; Batchelor and Steck 1941: 23- 24). The archaeological site files show two reported shell-midden sites (that are absent human burials) near the APE (Figure 6). Site 15-18, at the northeast corner of East Main Street and Stratford Avenue, was reported to the CTSHPO/OSA in 1968; the site form, completed by the OSA, describes it as "a shell heap that is undoubtedly the largest in Bridgeport; the shell heap proper lies beneath a large brick storage house; during construction of the storage house, excavations showed a solid mass of black earth and broken shell." The OSA wrote that the site was "probably destroyed or inaccessible" (Batchelor and Steck 1941). One block east, the site files list Site 15-16 at the northeast corner of Pembroke Street and Stratford Avenue (Figure 6). This site, although mapped at Pembroke Street and Stratford Avenue, is labeled the "East Main Street Shell Heap." AHS trenched and monitored a redevelopment project in the Steel Point area, in the vicinity of Site 15-16 (Harper et al. 2010). Based on the results of the monitoring, AHS concluded that Site 15-16 was likely either mistakenly reported and actually refers to Site 15-18, which is on East Main Street, or that the Site 15-18 shellheap extends eastward to the mapped location of Site 15-16.

5.2 PREVIOUSLY IDENTIFIED HISTORIC-PERIOD ARCHAEOLOGICAL SITES

One previously identified historic-period archaeological site has been recorded within the APE, and five historical archaeological sites have been reported within one mile of the APE (Figure 6). Site 15-22, the Mary and Eliza Freeman Houses property, is within the APE, at 360 Main Street, and are listed on the NRHP under Criterion A. Constructed in the 1848, these houses represent the oldest houses constructed by African Americans in Connecticut, and the last remaining houses of Little Liberia, a community of free African American and Native peoples that was centered around maritime activities. In 2008, then State Archaeologist Nicholas Bellantoni and Natural Resource Conservation Service (NRCS) Soil Scientist Deborah Surabian performed electromagnetic induction (EMI) survey of the front yard portions of the houses, identifying several possible buried features, and concluding that a ground penetrating radar (GPR) survey should be performed to further delineate features (Surabian 2008). A remnant cobbled street is exposed on Singer Avenue, located one block behind the Freeeman Houses, underscoring the sensitivity of this area relative to preserved fragments of Little Liberia, and possibly earlier, intact soil sequences below the cobbled street (Photograph 22).

Sites 15-2, 3, and 4 are submerged vessels that lie just north of the APE within the Peqounnock River. Site 15-2, the Berkshire No. 7, is a wooden and steel barge that was constructed in 1935 and measures approximately 104 feet in length. Sites 15-3 is the Elmer S. Dailey, measuring 105 feet in length, built in 1915, and modified in 1928; it is the only known surviving wooden canal boat that was used along the Erie Canal. Site 15-4, the

Priscilla Dailey, is a wooden canal boat that measures 111 feet in length and was originally built in 1928 for use along the Champlain Canal. Stewart J. Dailey, a former driver on the Erie Canal, purchased these three boats for use as lighterage cargo transport along the New Jersey, New York, and Connecticut coasts (Clouette 1978a; Clouette 1978b; Clouette 1978c). Each of these vessels are listed individually in the NRHP under criterion A.

Site 15-21, the Pequannock Old Fort, is located to the west of the APE, along the banks of Cedar Creek within Black Rock Harbor. The site was located near the "old Indian planting field" at the end of Black Rock cove, between the cove and Ash Creek (formerly the Uncaway River). The OSA records this site at the headwaters of Cedar Creek; however, this conjecture is based on Wilcoxson's (1940) work, not on actual excavation or field identifications. Given the pervasive industrial and urban development in the APE and surrounding area, it is likely that the fortifications remnants have been destroyed, although pockets of integrity may be preserved adjacent to or underneath modern- and historic-period fill deposits.

Site 15-9, located to the north of the APE, is believed to be the 18th-century reservation of the Golden Hill Paugusset Tribe; "2 or 3 skeletons" were found during the construction of Bridgeport High School. The OSA, when it recorded the site in 1968, believed it to be destroyed (Batchelor and Steck 1941). This reservation was sold off in 1802, and it was this catalyst that likely set into motion the resettling of the APE by Pequonnocks, into the area that would become Little Liberia. The remnants of the reservation are likely destroyed today, as with the fortified village, although intact portions may still be preserved underneath urban and industrial fill.

5.3 ARCHAEOLOGICAL SENSITIVITY OF THE APE

Two previously identified archaeological sites are located within the APE, but this low number is likely artificial and representative of the lack of archaeological survey and reporting, and pervasive disturbances associated with the industrial and urban development of this area over the 19th and 20th centuries (Figure 6). However, the presence of burials within the APE, and the documentation of numerous burials adjacent to the APE by Orcutt (1886), indicates that the entire APE is likely sensitive for Late Woodland and Contact period archaeological sites, including burial and village remnants. Urbanization should not be assumed to have unilaterally destroyed archaeological sites; rather, it is entirely possible that sites are buried deeply under fill or that there are lots on which buildings were never constructed. The cobbled street shown in Photograph 22, paired with the standing Freeman Houses, indicates that intact portions of Little Liberia may be found within the APE. Overall, the APE is very sensitive for archaeological resources, although the integrity of these may have been compromised by later historic period urban and industrial development. Only Phase IB testing in the form of Ground Penetrating Radar (GPR), Geoprobe borings, shovel test pits and/or machine testing can ascertain whether sites are present in the APE.'

6. Conclusion and Recommendations

6.1 HISTORIC RESOURCES

The APE retains a wide range of historic-period resources, the majority of which date from the mid-19th to the mid-20th centuries. These buildings, landscapes, structures, and objects reflect Bridgeport's rich and complex history. The Freeman Houses, in particular, are rare and valuable survivors of the Little Liberia community. While a number of the South End's historic resources are NRHP-listed as individual properties and as historic districts, additional potential NRHP-eligible properties were identified throughout the APE. Actual determination of NRHP eligibility is properly part of the ongoing consultative process among CTDOH, and CTSHPO.

As the project design process moves forward, the potential effects will need to be evaluated accordingly, including both direct effects and indirect effects. Indirect effects involve a) the loss of elements that are an important part of the properties' settings and historical character, and b) the introduction of incompatible modern construction that would diminish the properties' integrity of setting, feeling, and association. No assessment of construction easement, staging, storage and access areas, noise and/or vibration effects on National Register-listed or eligible resources could be made, as there is not yet sufficient data. As the project design evolves, additional potential impacts to historic resources should be noted.

6.2 ARCHAEOLOGICAL AND CULTURAL RESOURCES

The APE is characterized by pervasive disturbance from industrial and urban development. In such settings, intact archaeological resources are rarely encountered at the current ground surface, although they may be preserved underneath industrial and urban fill deposits. The APE was clearly an important area for pre-colonial peoples, particularly during the Late Woodland Period Contact-era Native Americans (the Pequonnocks) also lived here. Numerous Native American burial grounds have been recorded within or adjacent to the APE and the presence of the Freeman Houses in the APE is a testament to the importance of the APE to people of color during the 19th century. Any ground disturbance has the potential to impact intact archaeological resources and human remains. Once alternatives have been defined, and in advance of construction activities, additional Section 106 review should include investigation of soil sequences within the project area by a system of geotechnical investigations (geoprobes, augers, etc.). Ground disturbances should also be monitored by an archaeologist, to limit any possible impacts to human remains that may be buried within the APE.

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Appendix A: Figures

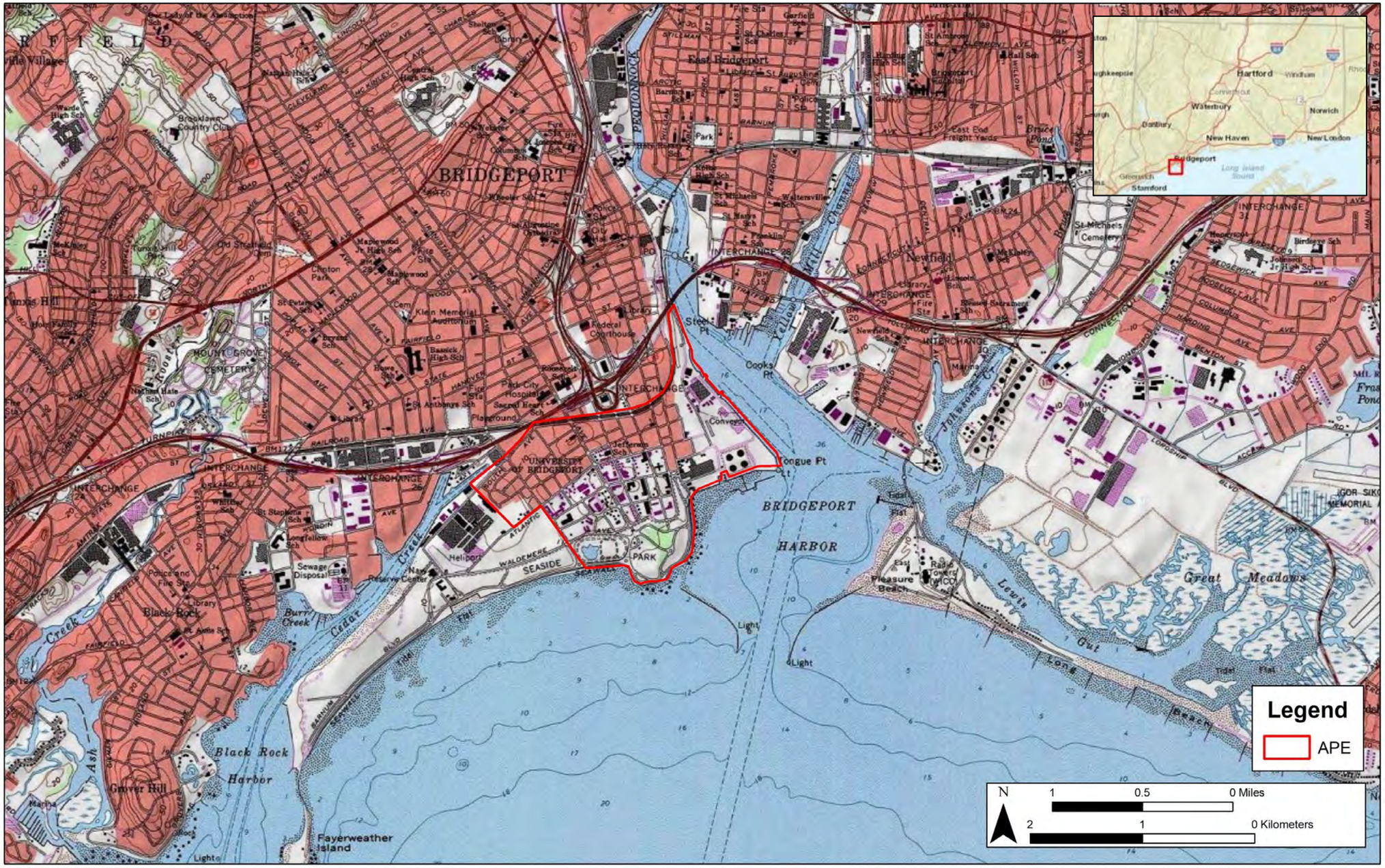


Figure 1: Location of project (outlined in red) shown on USGS topographic map.



Figure 2: Area of Potential Effect (APE, shaded) shown on an aerial view of the vicinity (Google Earth™ 2017).



Figure 3: APE and NHRP-listed historic resources shown on an aerial view of the vicinity.

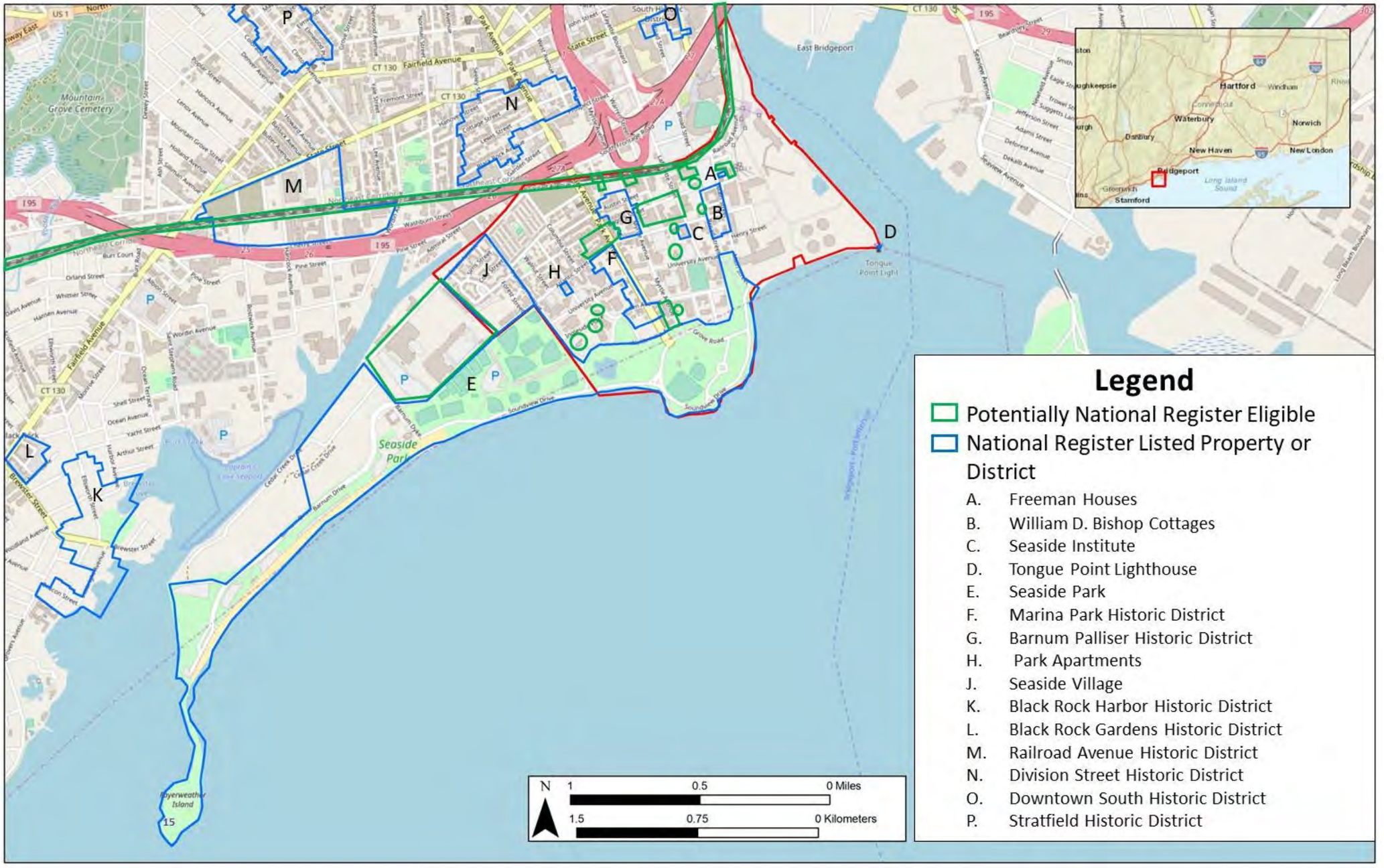


Figure 4: APE, NHRP-listed historic resources, and potentially NRHP-eligible resources.

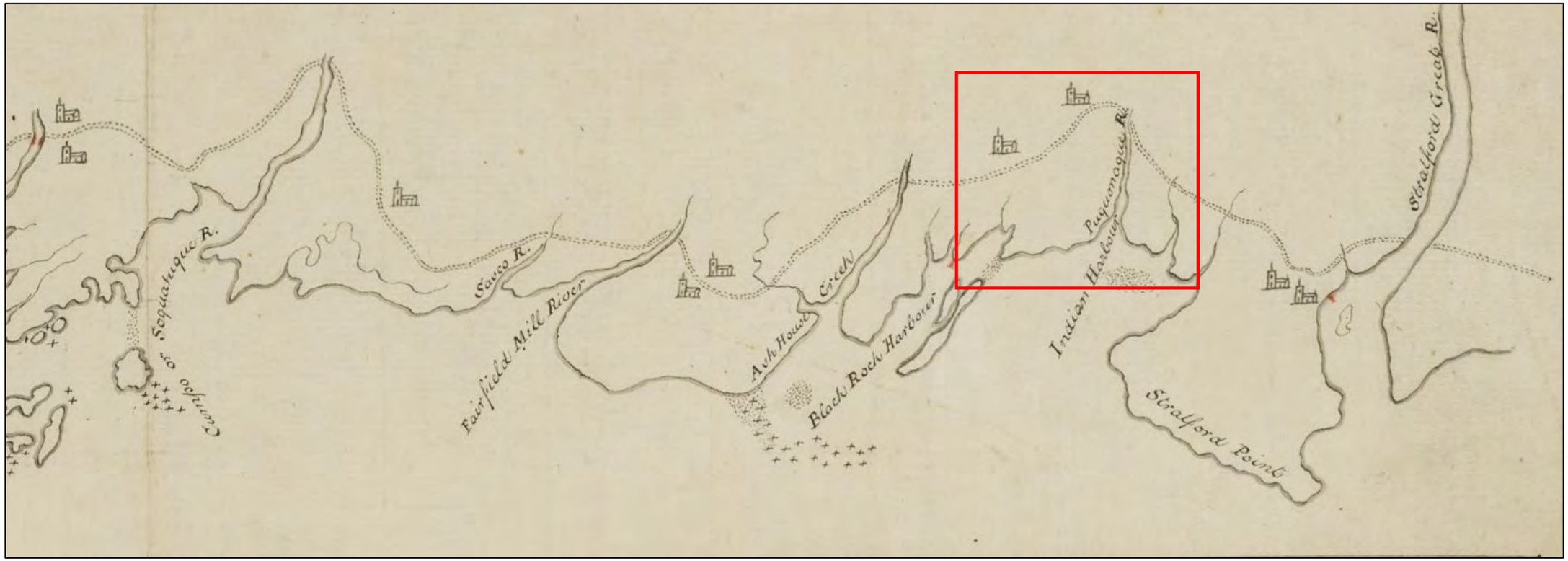


Figure 5: Project APE (outlined in red) shown on 1934 Fairchild Aerial.



Figure 6: Previously identified archaeological sites within one mile of APE (outlined in red), shown on USGS topographic map.

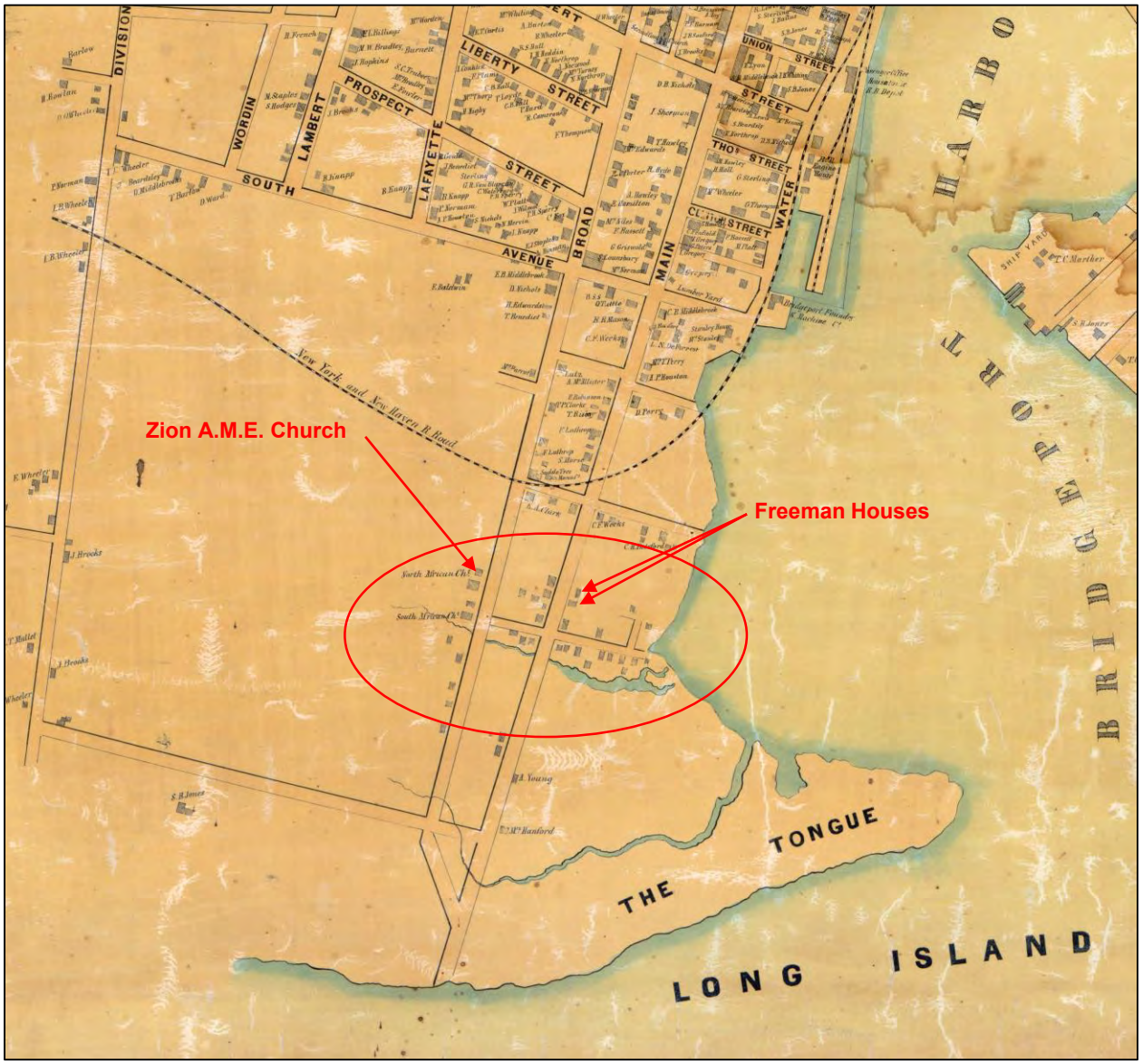
Appendix B: Historical Maps



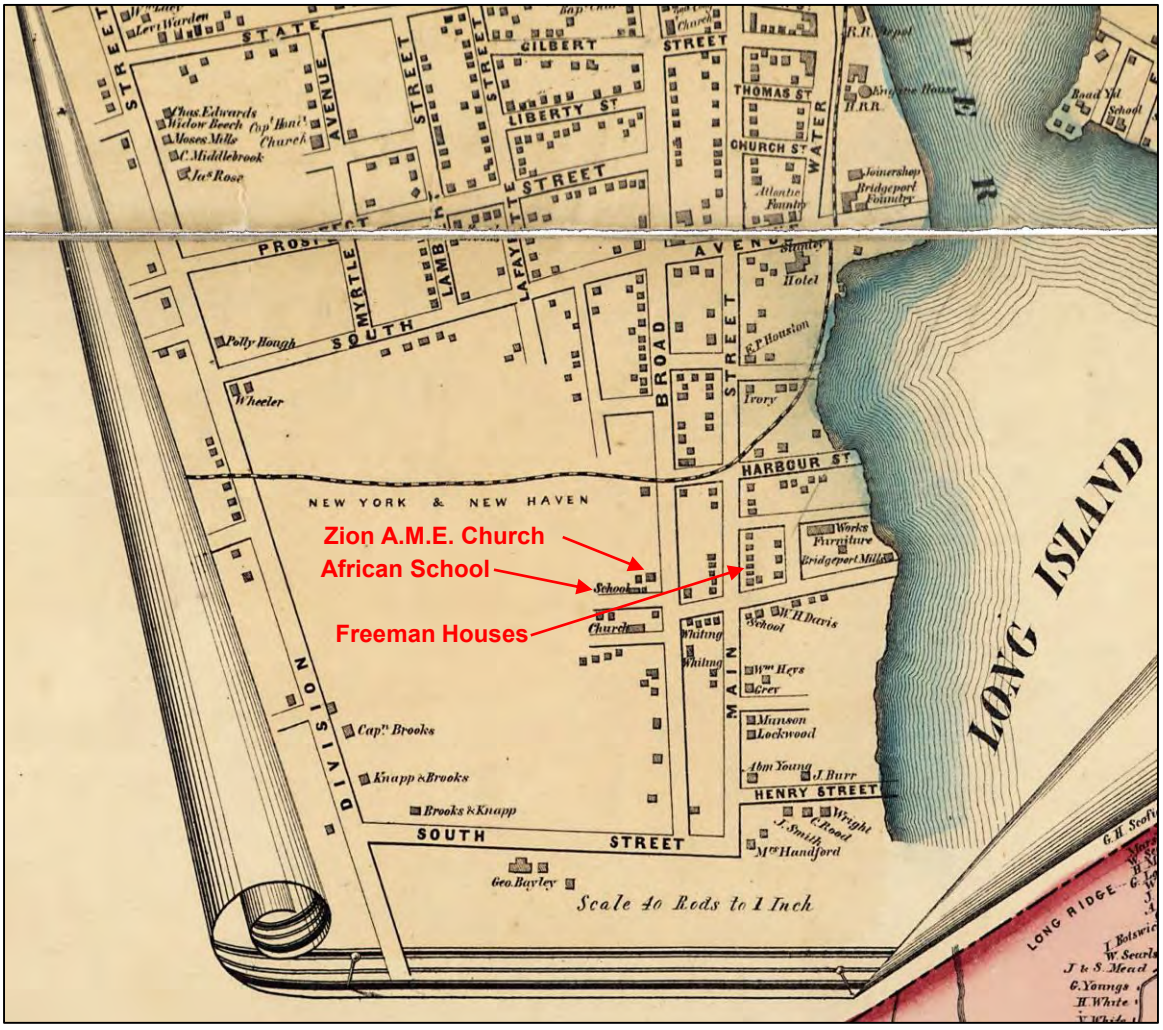
Map 1: Pre-Revolutionary War era map of the Connecticut coast, detailing the project area (in red). Map was in Sir Henry Clinton's possession while in command of the British forces operating in North America during the War for Independence, 1775-1782, and is on file at the Clements Library, University of Michigan (Adams 1928).



Map 2: Skinner 1777 Revolutionary War era map of the Connecticut coast, detailing the project area (in red). Map was in Sir Henry Clinton's possession while in command of the British forces operating in North America during the War for Independence, 1775-1782, and is on file at the Clements Library, University of Michigan (Adams 1928).



Map 3: The South End of Bridgeport on the 1850 Collins & Clark map. Little Liberia is circled in red.



Map 4: The South End on the 1856 Clark's Map of Fairfield County.

A Plan

Reimagining Little Liberia

A Community of Free People of Color

Living in

Bridgeport, Connecticut

1821-1855

Atlantic Street

Cottage Place

Whiting Street

Lafayette Street

Main Street

Broad Street

Singer Avenue

Kiefer Street

"Pond Gutter"

Bridgeport Harbor

N

Legend

Buildings, Owners & Date Built

1. Mary Freeman, 1848
2. Eliza Freeman, 1848
3. Zion A.M.C. Church, 1843
4. Ebenezer A.M.C. Church, 1835
5. Simeon Dickson, 1841
6. Philp Freeman, 1830
7. Benjamin Freeman, 1830
8. Jacob Freeman, 1825 / John Feely
9. James Elsey, 1853
10. Grant Hawley, 1856
11. Harry Morris, 1845
12. William Allen, 1845
13. Salisbury Lane, 1843
    Samuel Semington, 1844
14. & 15. Henry Cook, 1833,
    Presence Jackson, 1853
16. & 17. Tunis Green, 1834
18. William Jackson, 1846
19. Edward Jackson, 1845
20. Joseph Bloom, 1835
21. John Gowdy, 1839
22. William Thomas
23. William Allen, 1838
24. Alexander Duncan, 1840, Duncan Hotel, 1853
25. Eliza & Moses Hayes, 1847
26. Stratfield School, 1845
27. Minerva Simons, 1844
28. William H. Davis, 1841
29. Alson Judd, 1841
30. & 31. John Johnson, 1829
32. Joel Freeman, 1831
33. Rensellaer Pease, 1855

Streets

Atlantic St. (Originally called South Franklin St.)
Whiting St. (Originally called South Third St.)
Kiefer St. (Named after the period we are interpreting)
Cottage Pl. (Named after the period we are interpreting)

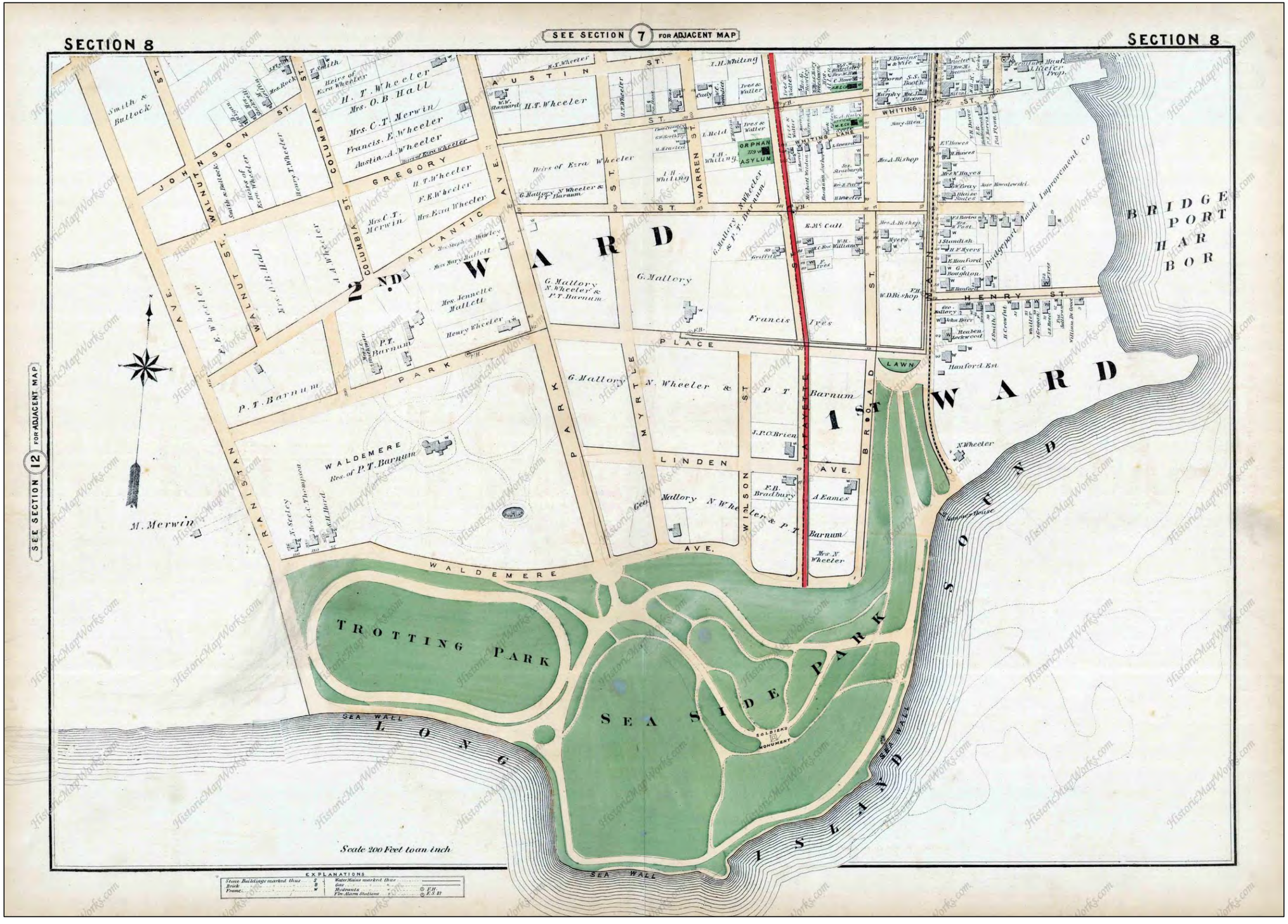
Map 5: Reconstructed bird's eye view of Little Liberia by John Wright, looking south toward Long IslandSound. The Freeman houses are labeled 1 and 2; the Zion A.M.E. Church is labeled 3. From "Reimagining Little Liberia: Restoration & Reunion," museum exhibit at Housatonic Community College, a collaboration between the Mary and Eliza Freeman Center for History and Community, Dr. Jamila Moore Pewu, and the Housatonic Museum of Art.



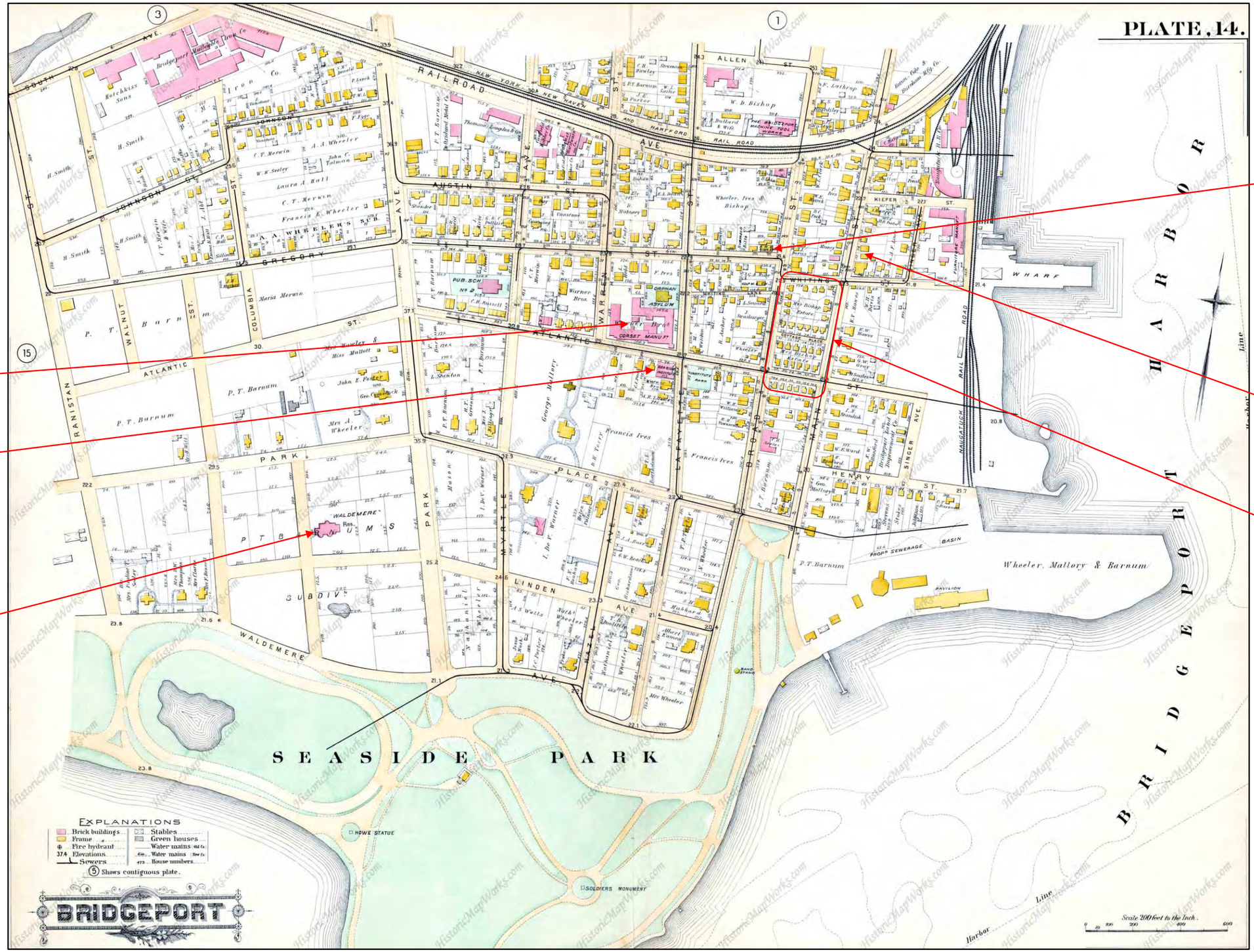
Map 6: The South End as shown on the 1867 Beers map, depicting Olmsted & Vaux's original design for Seaside Park.



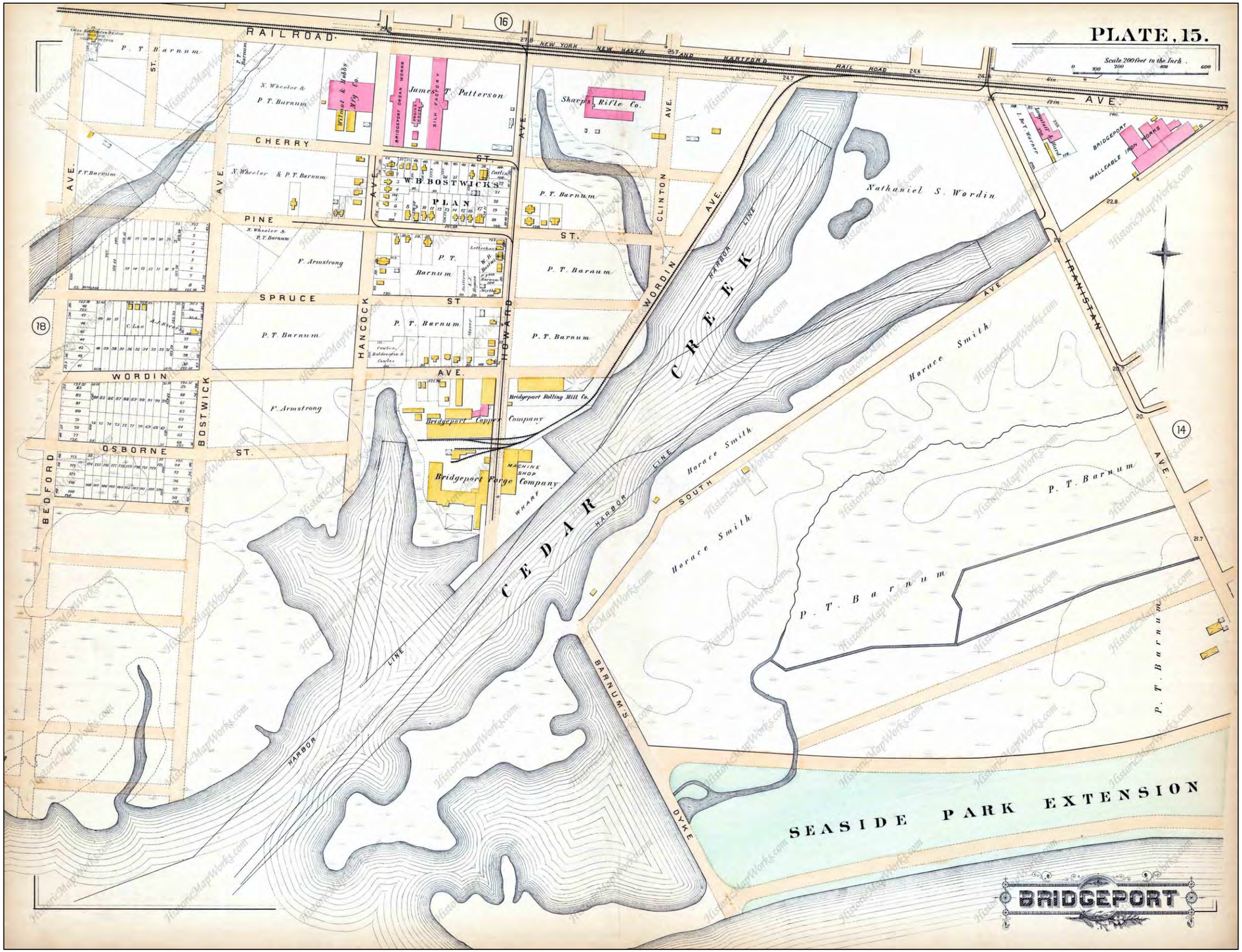
Map 7: The South End as shown on the1875 Bailey bird's eye view map. The inset depicts the Kiefer Furniture factory. P. T. Barnum's house Waldemere is shown north of the 1868 trotting park oval.



Map 8: The South End as shown in the 1876 Beers Atlas, with Seaside Park and P. T. Barnum's house Waldemere.



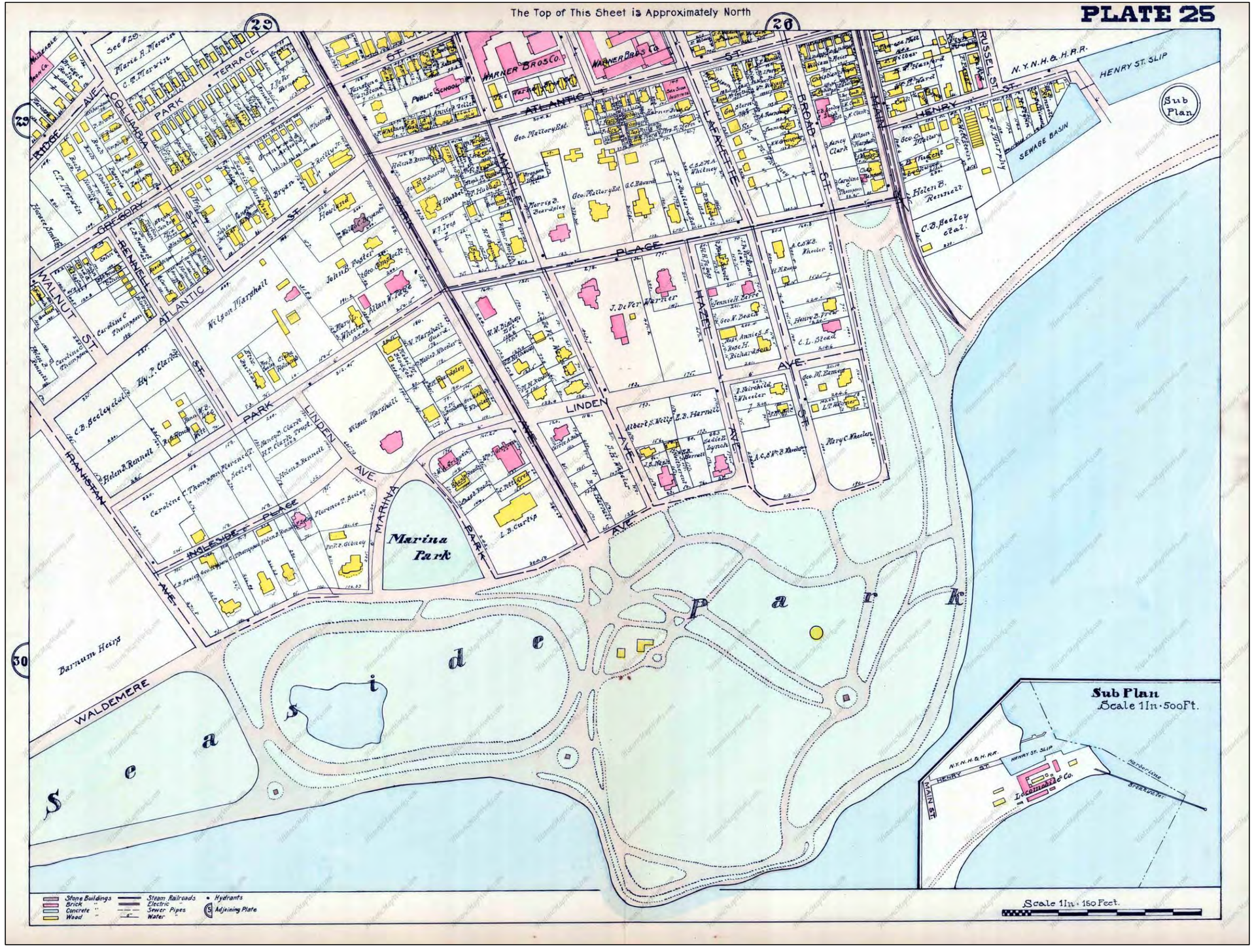
Map 9: The South End as seen on the 1888 Hopkins map. It depicts P. T. Barnum's house Waldemere just after the property's subdivision. The Warner Brothers Company had not yet expanded west of Lafayette Street. Several factories (not extant) are located along the New York, New Haven & Hartford Railroad. The Bridgeport Malleable Iron Co. (top left) is located on the future site of Marina Village.



Map 10: This 1888 Hopkins map plate shows Seaside Park's western expansion. Additional property owned by P. T. Barnum to the north of the park is now the Sikorsky site.

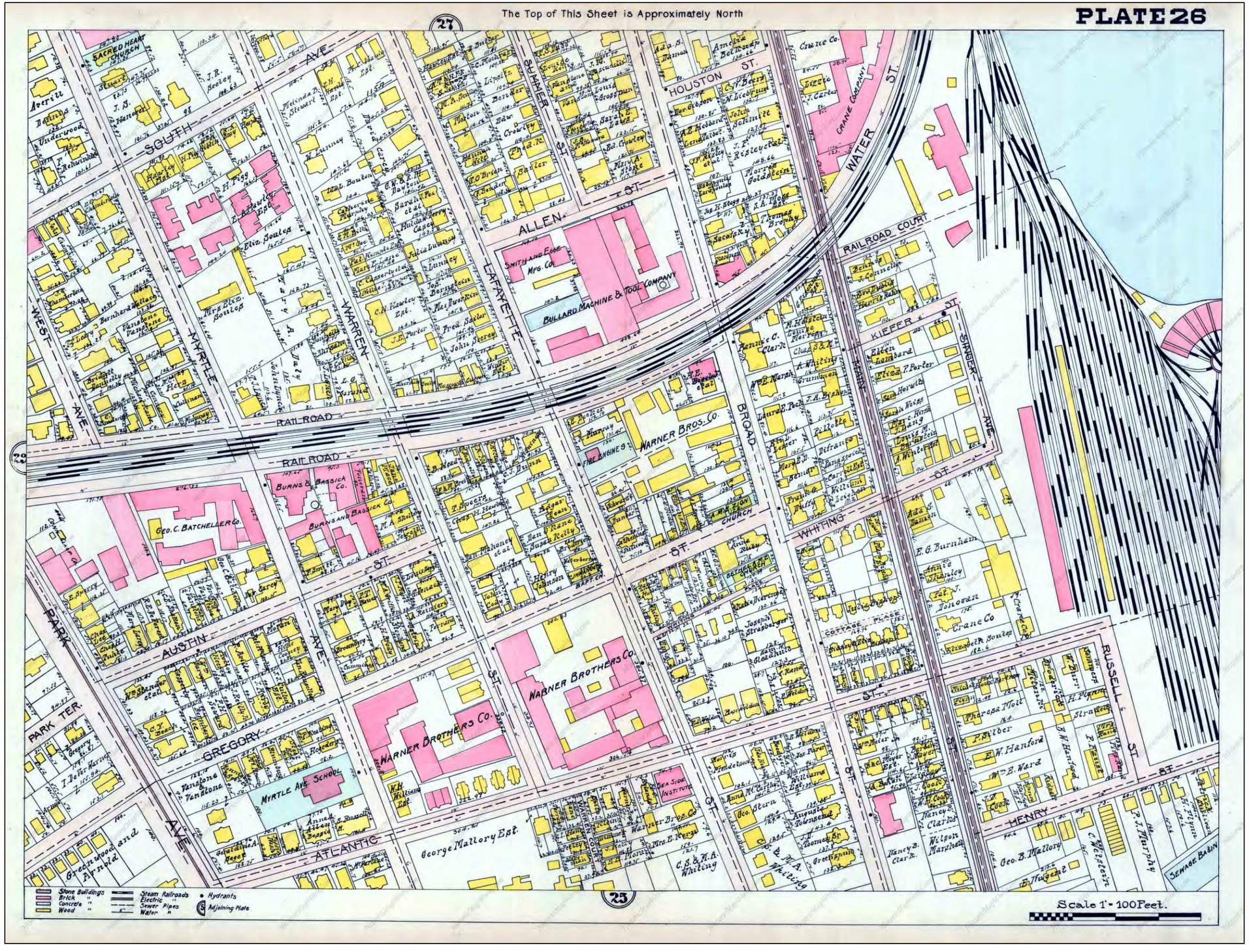
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PLATE 25

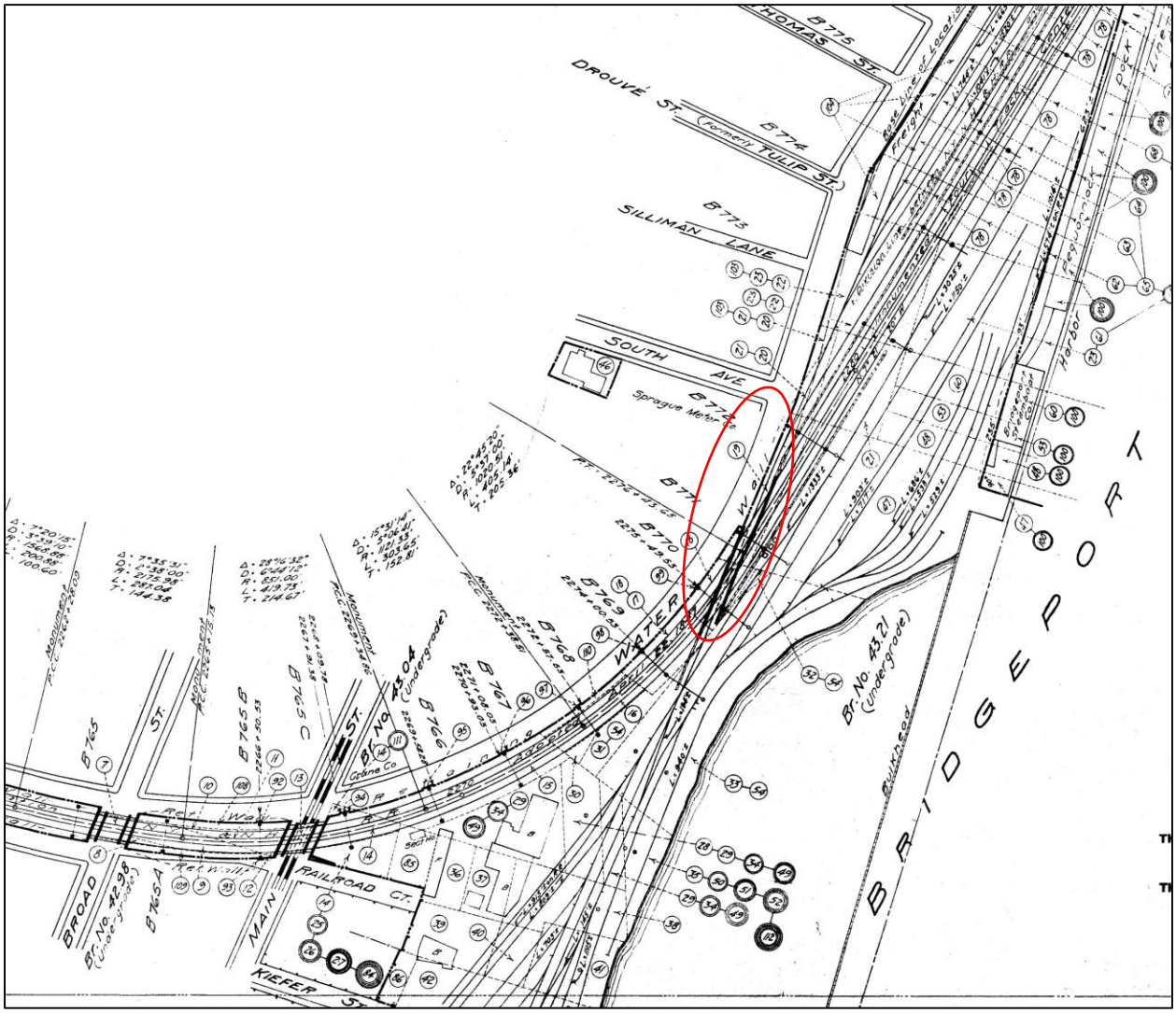


Map 11: The South End as shown on the 1910 Kershaw map, showing the south end of the railroad freight yard and the Henry Street slip (top right). The inset map depicts the Locomobile factory, located east of Seaside Park.

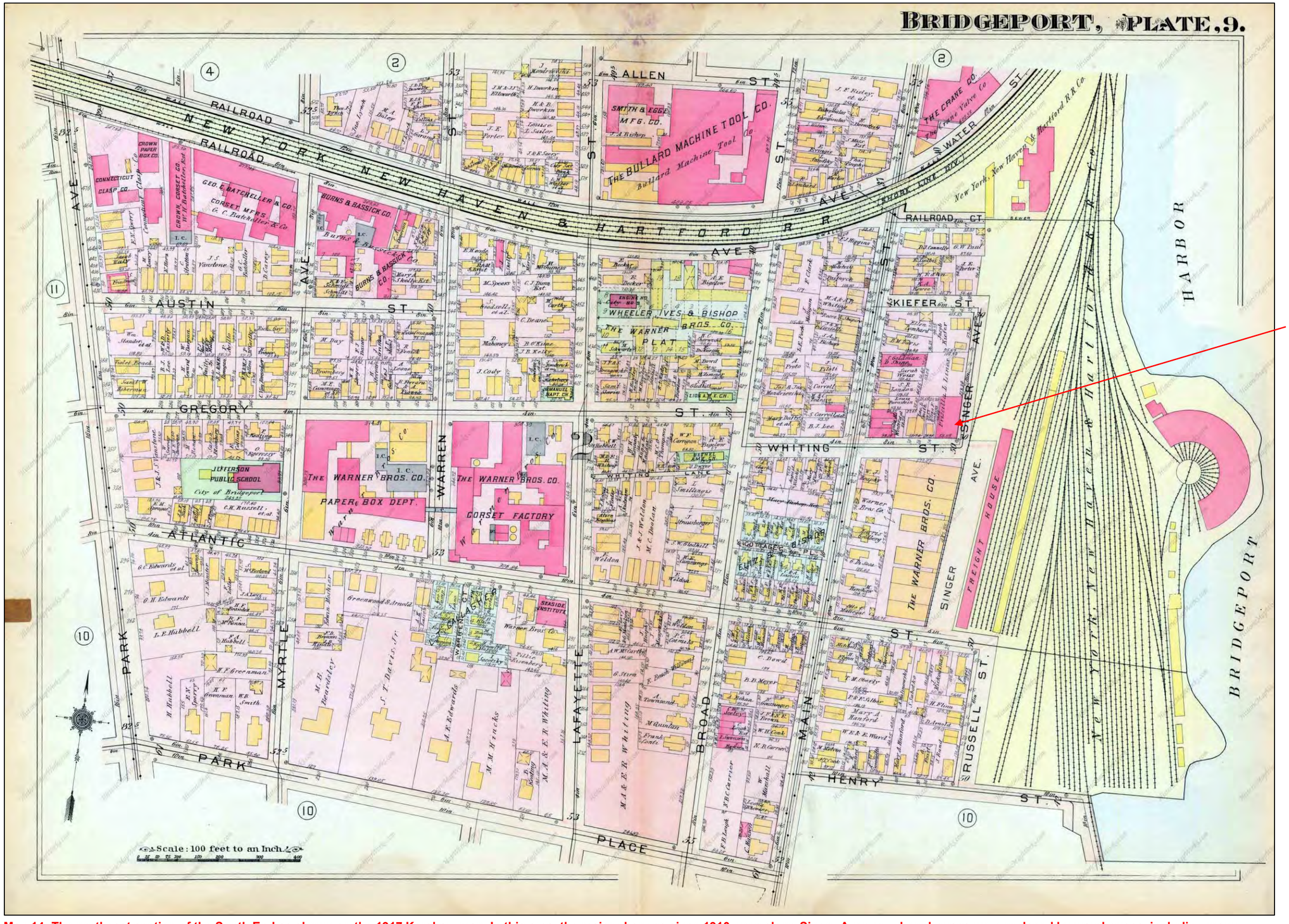
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Map 12: The northern section of the South End as shown on the 1910 Kershaw map. The New York, New Haven & Hartford Railroad turntable and roundhouse are partially shown at the far right. By 1910, the Warner Brothers' factory complex west of Lafayette St. had been built, and factories along the railroad had expanded.

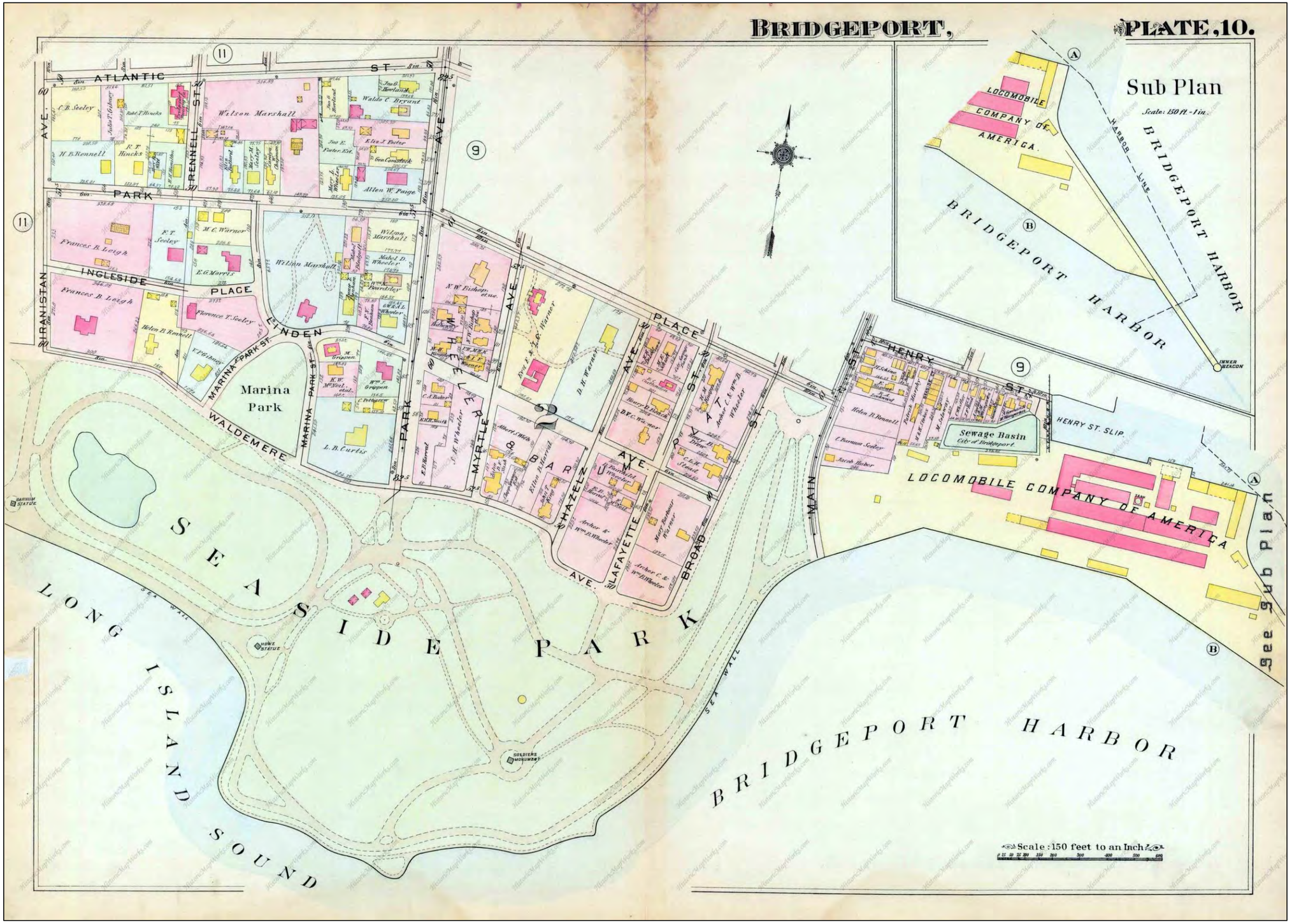


Map 13: A section of the 1915 New York, New Haven & Hartford Railroad valuation map, showing the 1903 under-grade bridge, designated Bridge 43.21 at the time. The bridge served as the entrance to the large freight yard that formerly occupied the power plant site. Note the streetcar lines running along Main Street.

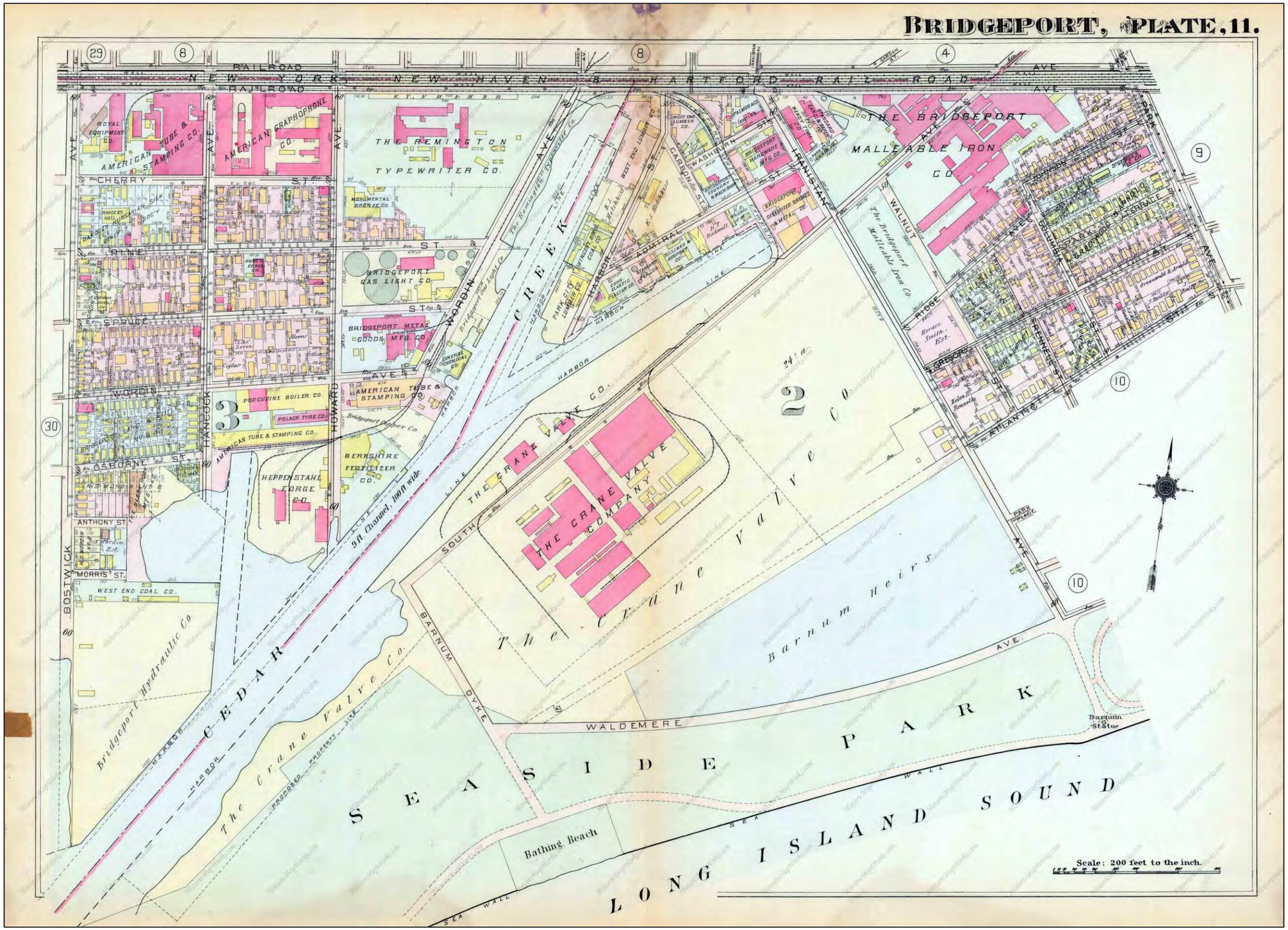


Bridgeport Storage Company Warehouse

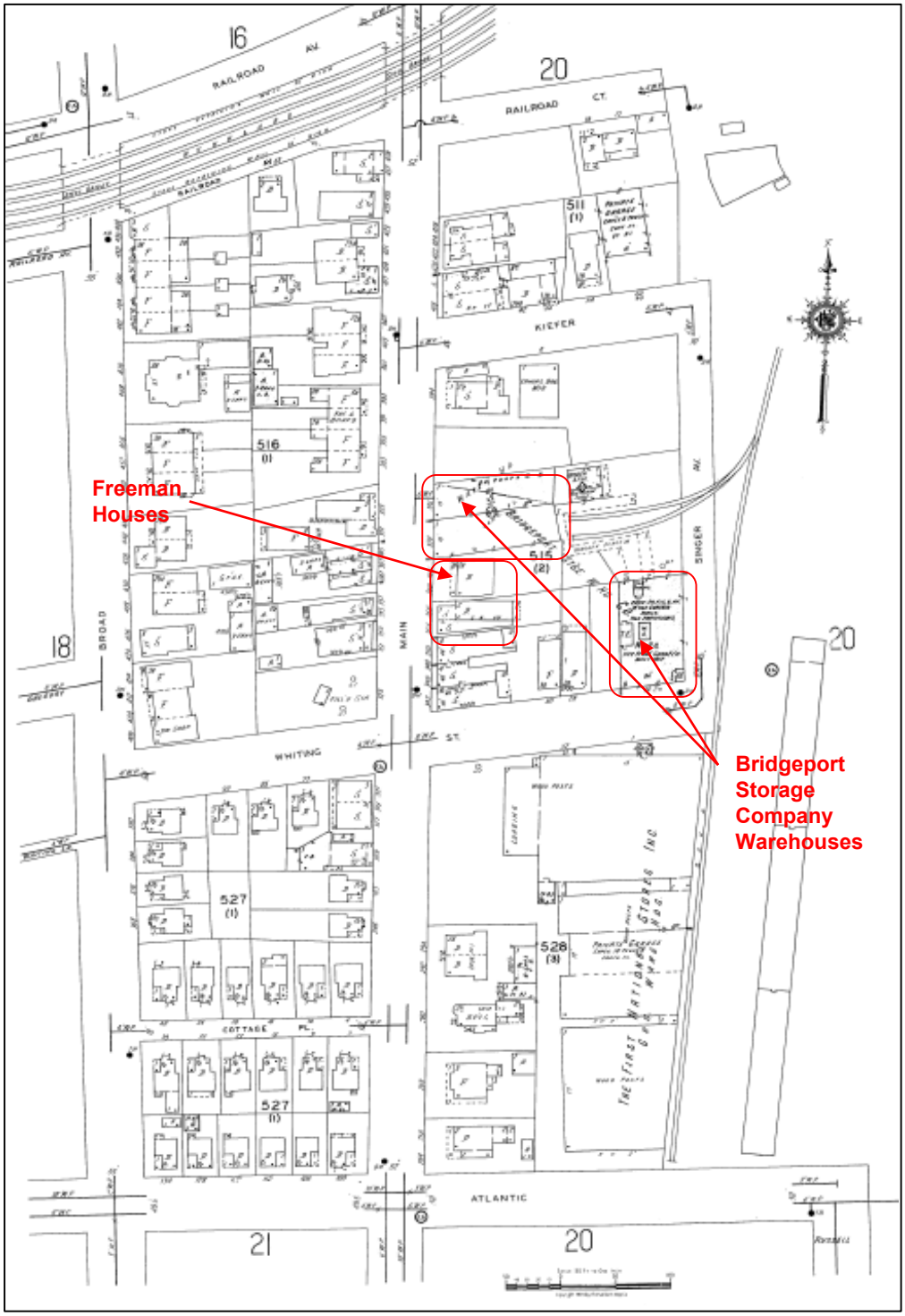
Map 14: The northeast section of the South End as shown on the 1917 Kershaw map. In this area, the major changes since 1910 were along Singer Avenue, where houses were replaced by warehouses, including many belonging to Warner Brothers.



Map 15: The southeast section of the South End as shown on the 1917 Kershaw map, showing the Henry Street slip and the Locomobile factory to the east of Seaside Park. The inset map shows the Tongue Point Lighthouse, before the breakwater was demolished and the lighthouse was moved to its current location in 1919.



Map 16: The western section of the South End as shown on the 1917 Kershaw map, showing Seaside Park's additional westward expansion and the Crane Company (now the Sikorsky site). The Bridgeport Malleable Iron Company is now the Marina Village site; Walnut Street now ends at Ridge Street, and Columbia Street extends north to South Avenue.



Map 17: Broad and Main streets as shown on the 1939 Sanborn map. Much of the Bridgeport Storage Warehouse Co. complex remains intact, including the 1917 nine-story building on Whiting Street and the buildings just north of the Freeman Houses on Main Street. Note the railroad siding on Singer Avenue.



Map 18: Several South End factory buildings shown on the 1939 Sanborn map remain extant.

Appendix C: Historical Images



Image 1: A horse-drawn streetcar on Main Street in the Little Liberia area in the winter of 1892, camera facing north (from Witkowski and Williams, p. 27).

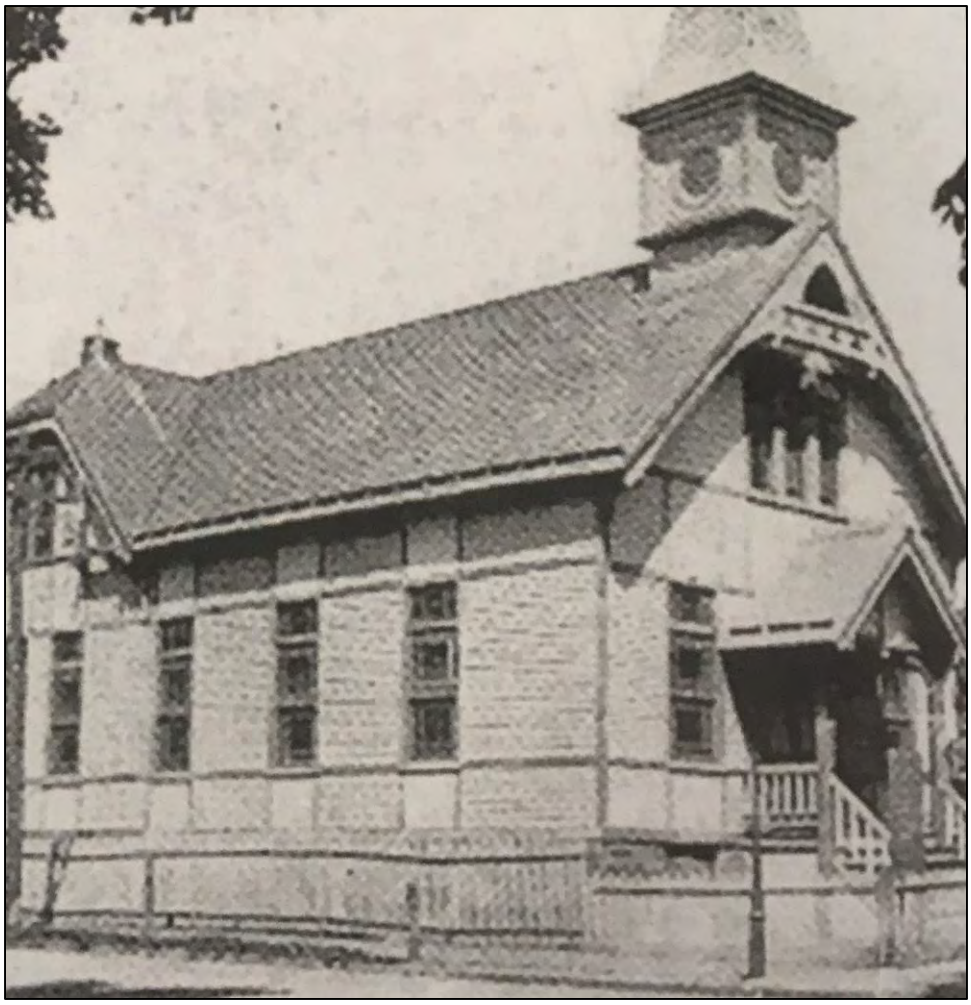


Image 2: Walters Memorial A.M.E. Zion Church (1882) prior to the 1950s remodeling, camera facing west (from Witkowski and Williams, p. 26).

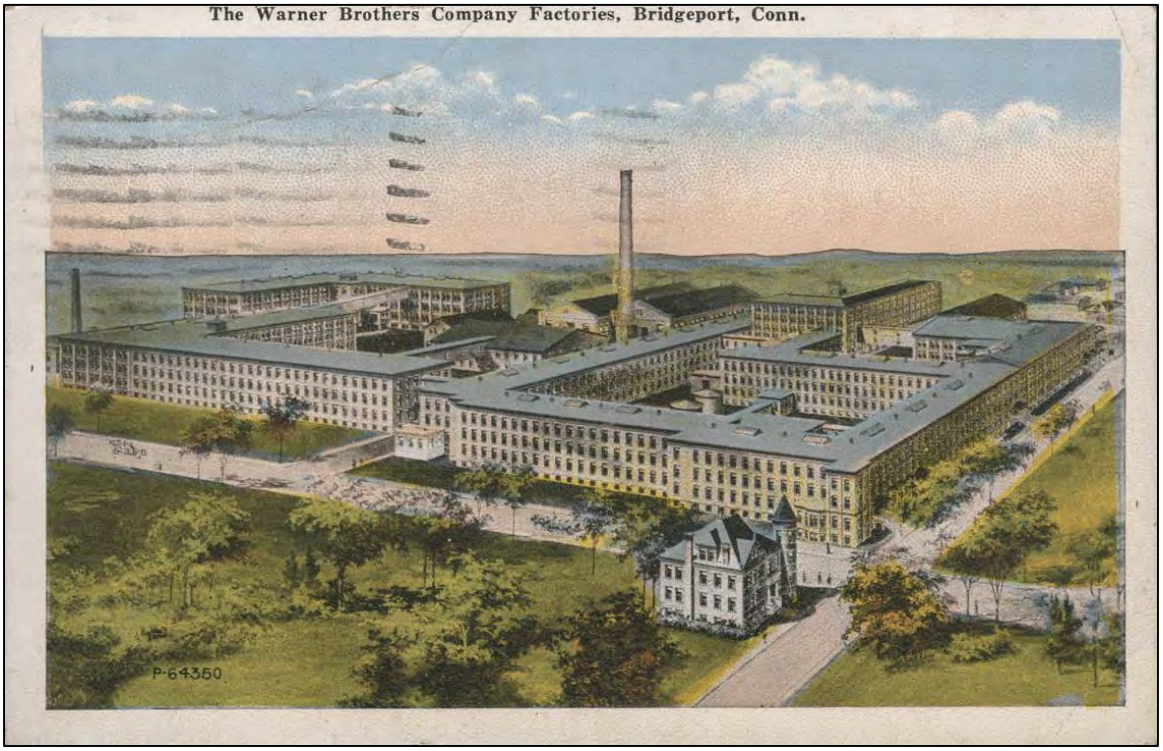


Image 3: Bird's eye view postcard of the Warner Brothers Company and Seaside Institute, view facing northwest (from the Museum of Connecticut History).



Image 4: Postcard of Seaside Park ca. 1900-1910, camera facing south (from the Connecticut Historical Society).



Image 5: Postcard of Seaside Park and Locomobile factory, view facing northeast (private collection).



Image 6: Bird's eye view postcard of the Seaside Park beach and bath house, view facing west (private collection).



Image 7: Aerial view of Seaside Park, with the trotting park in the foreground and Park Avenue houses at the left. The Locomobile factory is in the background at left. Waldemere Hall (the current University of Bridgeport president's house) is at bottom left. Photo by Brewer H. Sholund, camera facing northeast (from Witkowski and Williams, p. 18).



Image 8: On the left is P. T. Barnum's 1869 house Waldemere, and on the right is his last house Marina under construction ca. 1888, camera facing south (from the Bridgeport History Center collection). After Marina was completed, Waldemere was dismantled.

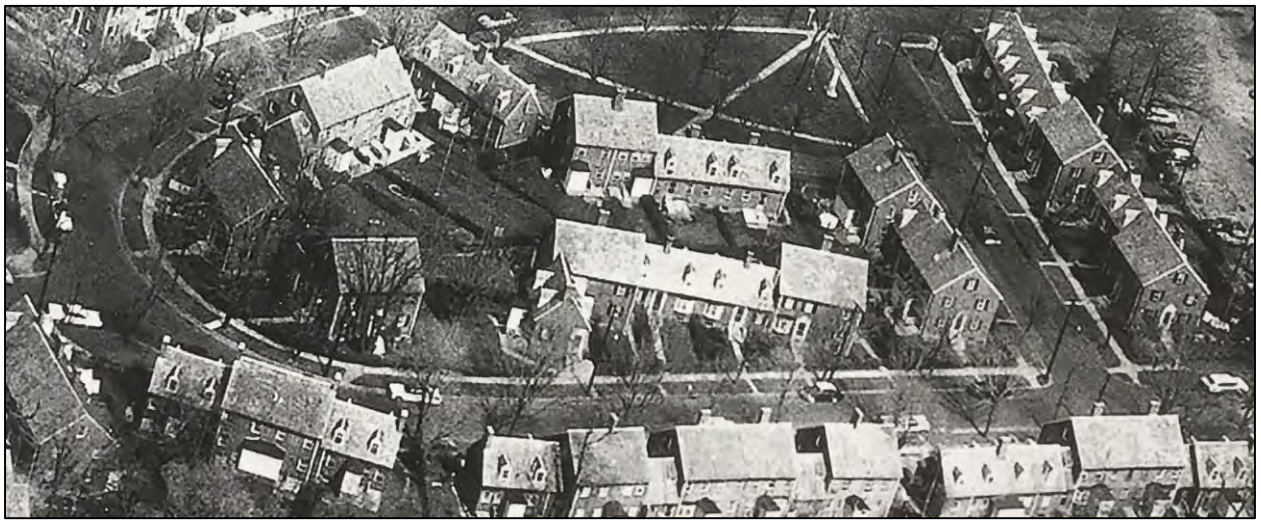


Image 9: Aerial view of Seaside Village, camera facing northeast (from Witkowski and Williams, p. 49).

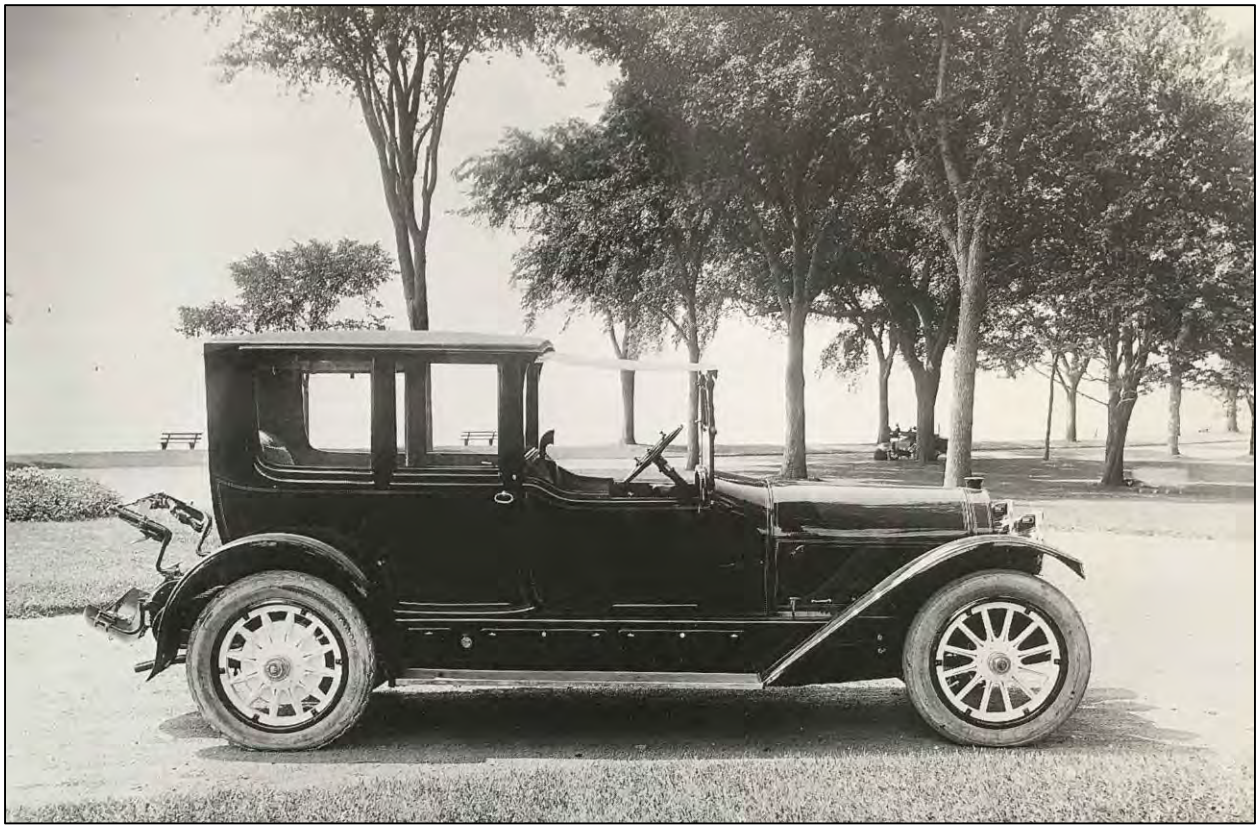


Image 10: A Locomobile vehicle photographed in Seaside Park ca. 1916 (from Witkowski and Williams, p. 73).



Image 11: The South End in a 1934 aerial photograph (from Connecticut Historical Aerial Photography, University of Connecticut).



Image 12: The South End in a 1965 aerial photograph (from Connecticut Historical Aerial Photography, University of Connecticut). Note the large University of Bridgeport buildings a few blocks north of Seaside Park.



Image 13: The South End in a 1970 aerial photograph (from Connecticut Historical Aerial Photography, University of Connecticut). Note the power plant, oil tanks, and pier on the right.

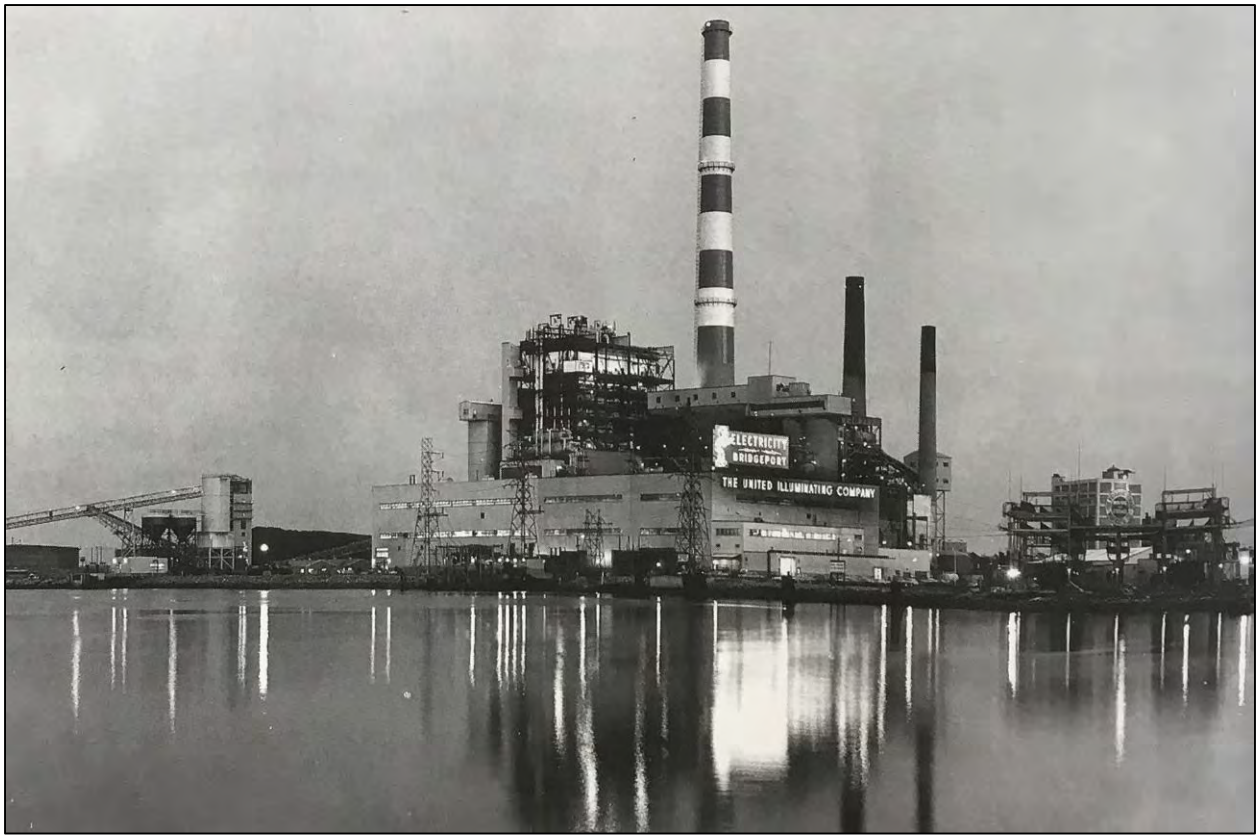


Image 14: Power plant as seen from Bridgeport Harbor with the 500' high United Illuminating smokestack built in 1967. The Bridgeport Storage Warehouse Co. building is on the far right. Photo by Brewer H. Sholund, camera facing west (from Witkowski and Williams, p. 20; photo appears to be printed backwards).



Image 15: Artist's rendering of Seaside Institute, view facing southwest (from Orcutt, p. 741b).



Image 16: House at 247 Atlantic Street (at right) after the Hurricane of 1938 (from Witkowski and Williams, p. 48).

Appendix D: Photographs



Photograph 1. Walters Memorial A.M.E. Zion Church and Parsonage at 427 Broad Street (northwest corner of Broad Street and Gregory Street/Bishop J.C. White Boulevard), camera facing northwest.



Photograph 2. Mary Freeman House at 358-60 Main Street and Eliza Freeman House at 352-4 Main Street, camera facing east.



Photograph 3. Houses on Main and Atlantic streets in the William D. Bishop Cottage Development Historic District, camera facing southwest.



Photograph 4. Houses at the corner of Atlantic and Broad streets in the William D. Bishop Cottage Development Historic District, camera facing southeast.



Photograph 5. Houses on Broad Street in the William D. Bishop Cottage Development Historic District, camera facing south.



Photograph 6. Duplexes on Myrtle Avenue in the Barnum/Palliser Historic District, camera facing northwest.



Photograph 7. Duplexes on Atlantic Street in the Barnum/Palliser Historic District, camera facing northwest.



Photograph 8. 380-386 Myrtle Avenue in the Barnum/Palliser Historic District, camera facing northeast.



Photograph 9. University of Bridgeport's Ingleside Hall on Ingleside Avenue, camera facing north.



Photograph 10. University of Bridgeport's Carstensen Hall at 174 University Avenue, camera facing northeast.



Photograph 11. University of Bridgeport's Waldemere Hall at 460 Waldemere Avenue, camera facing west.



Photograph 12. University of Bridgeport's Wisteria Hall at 405 Linden Avenue, camera facing west.



Photograph 13. University of Bridgeport's Bauer Hall at 82 Marina Park Street in the Marina Park Historic District, camera facing east.



Photograph 14. George W. Wheeler House at 115 Park Avenue in the Marina Park Historic District, camera facing west.



Photograph 15. Albert J. Erslew House at 185 Park Avenue (corner of University Avenue) in the Marina Park Historic District, camera facing south.



Photograph 16. Lavinia Parmly House at 219 Park Avenue in the Marina Park Historic District,, camera facing west.



Photograph 17. Gate to Marina, Barnum's house built in 1889, at the north end of Marina Park; camera facing north. The gate has probably been relocated.



Photograph 18. Railroad retaining wall and railroad bridge (formerly bridge #43.21; now #08059R) along Ferry Access Road, camera facing north.



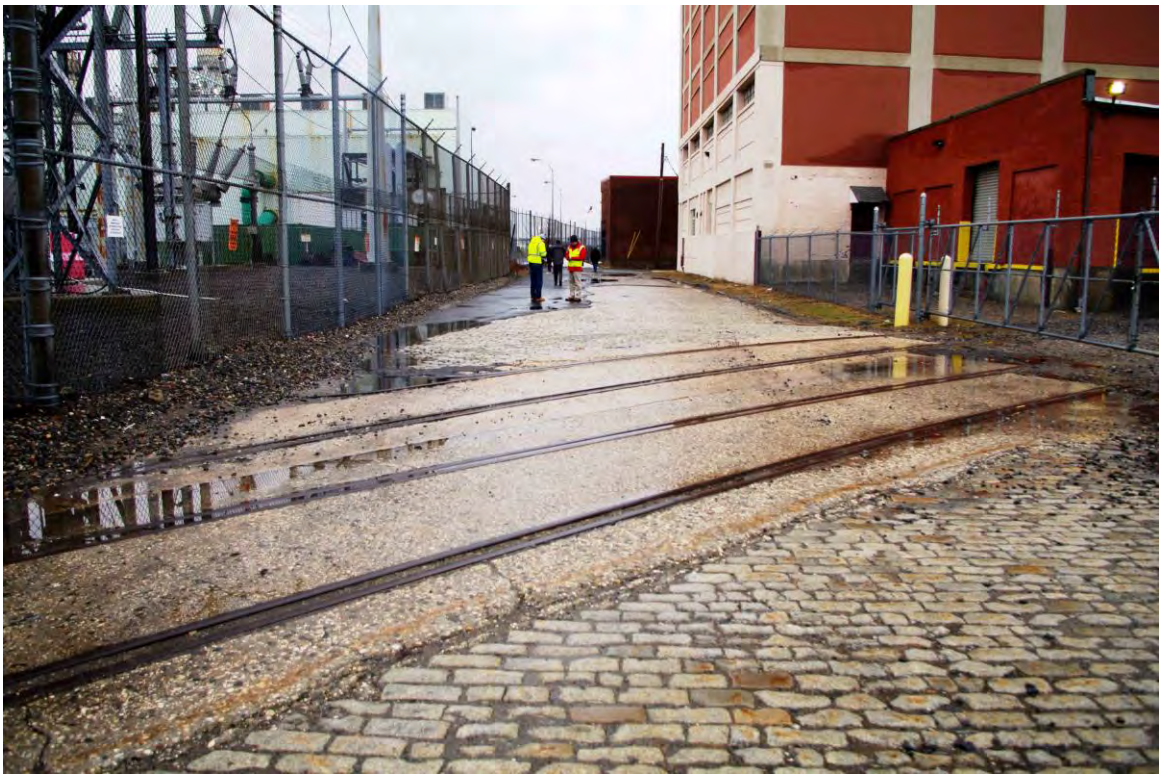
Photograph 19. Warehouse buildings at 376 Main Street (center left) are connected to the nine-story warehouse on Whiting Street (now P. J. Murphy Moving & Storage). The Freeman Houses are at center right.



Photograph 20. Bridgeport Storage Warehouse Company buildings (formerly the Menard & Shepard trucking company) at 376 Main Street, camera facing east.



Photograph 21. Bridgeport Storage Warehouse Company, camera facing west.



Photograph 22. Singer Avenue stone paving and tracks from the Bridgeport Storage Warehouse Company's railroad siding, camera facing south.



Photograph 23. D. M. Read Warehouse at 461 Broad Street, camera facing southwest.



Photograph 24. D. M. Read Warehouse addition as seen from Railroad Avenue, camera facing southwest.



Photograph 25. Park Apartments at 59 Rennell Street, camera facing northwest.



Photograph 26. Seaside Village housing and World War I monument, camera facing west.



Photograph 27. Seaside Village housing on Burnham Street, camera facing southwest.



Photograph 28. United Aircraft Company (Sikorsky Aircraft Division) complex on South Avenue, camera facing south.



Photograph 29. Marina Village housing on Iranistan Avenue, camera facing north.



Photograph 30. University of Bridgeport buildings at the corner of Broad Street and University Avenue, as seen from the entrance to Seaside Park, camera facing west. The ASPCA founder Henry Bergh monument (1897) is at the left.



Photograph 31. University of Bridgeport buildings at the corner of Linden and Hazel avenues, camera facing southeast.



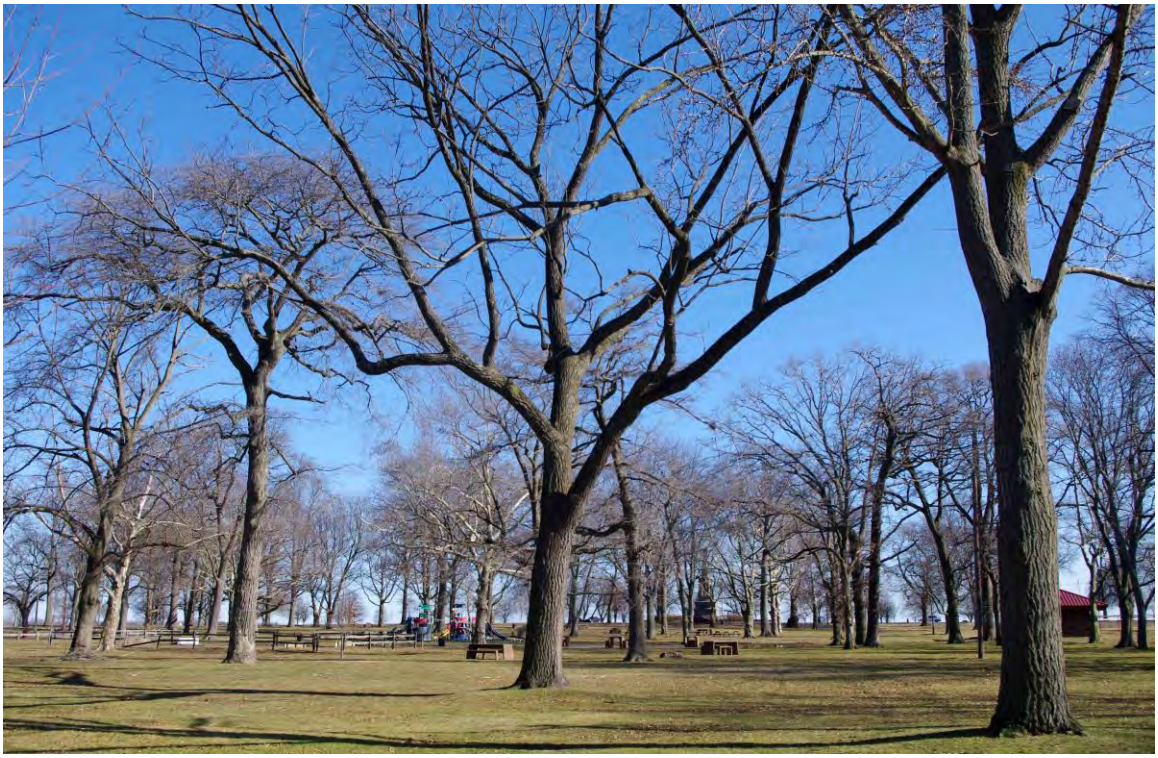
Photograph 32. PSEG's coal-burning plant, camera facing northwest.



Photograph 33. Seaside Park entrance at Broad Street, camera facing south. The ASPCA founder Henry Bergh monument (1897) is at the left.



Photograph 34. William H. Perry Memorial Arch (1918), camera facing northeast.



Photograph 35. Seaside Park's eastern section, camera facing south.



Photograph 36. Sailors and Soldiers Civil War Monument (1876), camera facing east.



Photograph 37. Elias Howe statue (1884), camera facing north.



Photograph 38. P. T. Barnum statue (1891), camera facing north.



Photograph 39. Spanish-American War monument (1913), camera facing southeast.



Photograph 40. Seaside Park Bath House (1918) at the corner of Barnum Dyke and Soundview Drive, camera facing north.



Photograph 41. Seaside Park Stables (ca. 1918), camera facing east.



Photograph 42. Breakwater to Fayerweather Island (1917) and Black Rock Lighthouse (1823), camera facing south.



Photograph 43. Tongue Point Lighthouse, camera facing east.



Photograph 44. Seaside Institute at 299 Lafayette Street (corner of Atlantic Street), camera facing southwest.



Photograph 45. Crown Corset Company at 345 Railroad Avenue and Crown Paper Box Company at 347 Railroad Avenue, camera facing southeast.



Photograph 46. 247 Atlantic Street, camera facing southwest.



Photograph 47. 337-341 Broad Street, camera facing northwest.



Photograph 48. Entrance of 337-341 Broad Street, camera facing west.



Photograph 49. Seagrove Cottage at 36 Myrtle Avenue, camera facing northeast.



Photograph 50. Multifamily housing on the north side of Atlantic Street between Columbia Street and Park Avenue, camera facing northeast.



Photograph 51. Houses on the west side of Park Avenue, between Gregory and Atlantic streets, camera facing northwest.



Photograph 52. Houses on the east side of Park Avenue, between Gregory and Atlantic streets, camera facing north.



Photograph 53. Multifamily housing on the south side of Gregory Street, between Park Avenue and Columbia Street, camera facing southwest.



Photograph 54. Multifamily housing on the north side of Gregory Street, between Park Avenue and Columbia Street, camera facing west.



Photograph 55. Multifamily houses on the north side of Gregory Street (east of the Columbia Street intersection), camera facing northeast.



Photograph 56. Multifamily houses on the north side of Atlantic Street, between Columbia Street and Park Avenue, camera facing northeast.



Photograph 57. Multifamily houses on Myrtle Avenue, camera facing southwest.



Photograph 58. Multifamily houses on Waldemere Avenue, camera facing northeast.



Photograph 59. Railroad viaduct stone retaining walls, catenary structures, and the Park Avenue Railroad Bridge, camera facing northwest.



Photograph 60. Railroad viaduct retaining walls, catenary structures, and the Myrtle Avenue Railroad Bridge, camera facing northwest.



Photo 61. Warren Street Railroad Bridge and catenary structures, camera facing northeast.



Photograph 62. Lafayette Street Railroad Bridge, viaduct stone retaining walls, and catenary structures, camera facing northeast.



Photograph 63. Railroad viaduct stone retaining walls on Railroad Avenue, east of Lafayette Street, camera facing east.



Photograph 64. Broad Street Railroad Bridge, viaduct stone retaining walls and catenary structures, camera facing north.



Photograph 65. Infilled section of the railroad viaduct where the Main Street Bridge was removed, camera facing northeast.



Photograph 66. Bassick Company, Google 3D aerial view, camera facing north.



Photograph 67. Bassick Company, corner of Myrtle and Railroad, camera facing southeast.



Photograph 68. Bassick Company, corner of Railroad Avenue and Warren Street, camera facing southwest.



Photograph 69. Warner Brothers Company, Google 3D aerial view, camera facing north.



Photograph 70. Warner Brothers Company, corner of Gregory Street and Myrtle Avenue, camera facing southeast.



Photograph 71. Warner Brothers Company on Atlantic Street, camera facing northeast. This area was an open street in the 1970s University Square redevelopment, and many of this building's alternations date to that period.



Photograph 72. Warner Brothers Company on Atlantic Street, camera facing northeast.



Photograph 73. Warner Brothers Company on Lafayette Street, camera facing northwest.



Photograph 74. Warner Brothers Company on Gregory Street, camera facing southwest.



Photograph 75. Warner Brothers Company on Gregory Street, camera facing southwest.



Photograph 76. 45 Columbia Street, camera facing south.



Photograph 77. Buildings on east side of Main Street, south of Henry Street, camera facing northeast. At the far left is the United Illuminating Singer Substation.



Photograph 78. Houses on east side of Myrtle Avenue, south of Atlantic Street, camera facing southeast.



Photograph 79. Houses on west side of Myrtle Avenue, south of Atlantic Street, camera facing northwest.



Photograph 80. Buildings on the east side of Iranistan Avenue, at intersection with Gregory Street, camera facing southeast.



Photograph 81. United Illuminating pier, camera facing southwest.

Appendix E: Table

Table 1. Status of Historic Resources

Property Name	NR Listed (indiv.)	NR Listed (district)	NR Pot. Elig. (indiv.)	NR Pot. Elig. (district)	SR Listed Only	LHD
Seaside Park	X					
Tongue Point Lighthouse	X					
Freeman Houses	X					
Seaside Institute	X					
Park Apartments	X					
Willam D. Bishop Cottages Development Historic District		X				
Barnum/Palliser Historic Distict		X				X
Marina Park Historic District		X				X
Seaside Village Historic District		X				
Walters Memorial AME Zion Church			X		X	
Bridgeport Storage Warehouse Company			X			
Crown Corset & Crown Paper Box Company Factories			X			
D. M. Read Company Warehouse			X			
Carstensen Hall			X			
Ingleside Hall			X			
Waldemere Hall			X			
Wisteria Hall			X			
247 Atlantic Street			X			
337-341 Broad Street			X			
Seagrove Cottage			X			
Housing on Park Avenue & Atlantic & Gregory Streets (24 houses)				X		
Myrtle Avenue Housing (7 houses)				X		
New York, New Haven & Hartford Railroad				X		
Bassick Company Factory				X		
Warner Brothers Company Factory				X		

APPENDIX D
Hazardous Materials Documentation

Task 110 Corridor Land Use Evaluation for the National Disaster Resilience Project

RESILIENCY PROJECT

Connecticut Department of Housing
Bridgeport, Connecticut

FINAL

PROJECT NO.: 52829NDR 6.08.02
DATE: DECEMBER 2018

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TABLE 1: Summary of Corridor Land Use Evaluation

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FIGURE 1: Site Location Map
FIGURE 2: Parcel Risk Assessment

APPENDICES

I Photographic Locations
II Aerial Photographs
III Topographic Maps Tax
IV Assessor Records (available upon request)
V Sanborn Fire Maps (available upon request)
VI EDR Report (available upon request)

1.0 INTRODUCTION

WSP USA (WSP) has completed a Task 110 Corridor Land Use Evaluation for the National Disaster Resilience (NDR) project located in the South End area of Bridgeport, Connecticut (Figure 1). The objective of the Corridor Land Use Evaluation is to assess the relative environmental risk associated with current and former land use in the study area and to determine the potential need for further evaluation.

1.1 Project Description

In 2014, the U.S. Department of Housing and Urban Development (HUD) selected the City of Bridgeport and a multidisciplinary design team to prepare an integrated resilience framework for Bridgeport for the federal Rebuild by Design Competition. A HUD grant, which was received by the State of Connecticut, is being used to develop a plan for reducing flood risk and improving resilience for the South End and Black Rock Harbor areas, and to build a pilot project in the South End that serves as a catalyst for full implementation of broader flood protection and resilience strategies. This Task 110 Corridor Land Use Evaluation focuses on the pilot study area in the South End (Figure 2), which contemplates the installation of a sea wall in this area. Three potential alignments of the sea wall are being considered, and the Task 110 study area focuses on the properties adjacent to three potential sea wall alignments (Figure 2).

1.2 Scope of Services

The scope of work included: a survey of the study area, identification of the current land uses within the study area, a search of federal and state regulatory databases, a review of aerial photographs, topographic maps, and Sanborn fire insurance maps. Future land uses or situations within the study area are outside the scope of work. The following report summarizes present and former land use information to provide a professional opinion regarding the relative environmental risk associated with each parcel abutting the various alignments.

All proposed alignments for the sea wall are located within areas that likely contain urban fill that typically are comprised of constituents of concern (COCs) at concentrations near or above the Connecticut Department of Energy and Environmental Protection (CTDEEP) Remediation Standard Regulation (RSR) soil criteria. In addition, the environmental media within the alignments may also have been impacted by operations occurring on the parcels in the immediate vicinity of the alignments. This evaluation will provide baseline data to develop a scope necessary to assess environmental media in the various proposed alignments.

2.0 PHYSICAL SETTING

2.1 Regional Physiology

The study area is located on the U.S. Geological Survey (USGS) Bridgeport, Connecticut quadrangle. The elevation of the Site is approximately 20 feet above mean sea level (ft amsl) on the western portion of the study area, and 10 ft asml along the northwestern portion of the study area. The elevation slopes downward to sea level at the Bridgeport Harbor located on the east and south side of the study area.

2.2 Geologic Conditions

The property is located within the Southwest Coastal Major Drainage Basin. The surficial materials at the Site are mapped primarily as sand overlying fines with thin till in the west. A large portion of the eastern side of the study area is also mapped as Artificial fill (Stone, et al., 1985). Artificial fill includes any materials, natural or manmade, that have been artificially placed. Bedrock beneath the Site is mapped as the Derby Hill Member of the Orange Formation (Crowley, 1968), a thin-bedded, fine- to medium-grained schist and gneiss interlayered with a medium- to coarse-grained gneiss.

2.3 Hydrologic Characteristics and Known Uses

The nearest surface water is the Bridgeport Harbor to the east and south, which abuts the study area. The Bridgeport Harbor is mapped as a Class SB surface water (CTDEEP, 2015). A Class SB designation indicates a best usage for habitat for marine fish and other aquatic life and wildlife, commercial shellfish harvesting, recreation, industrial water supply, and navigation.

Groundwater at the study area is classified by the CTDEEP as "GB". A "GB" classification applies to groundwater within highly urbanized areas or areas of intense industrial activity and where public water-supply service is available rather than private water-supply wells. Groundwater with a GB classification may be impaired and the State's goal is to prevent further degradation of the aquifer.

Based on local topography, groundwater at the site is presumed to flow generally to the south and east. Once groundwater exits the Site, it is presumed to discharge to the Bridgeport Harbor. Groundwater flow would be influenced by the tides. Depth to groundwater is anticipated to be shallowest near the shoreline, and increase in depth as the elevation of land increases westward away from the shoreline.

3.0 LAND USE EVALUATION

3.1 Initial Site Survey

An initial survey of the study area was conducted on June 7, 2018 by Patrick Staub of WSP and June 27, 2018 by Timothy McBride of WSP. The initial survey involved a visual assessment of the study area from publicly accessible thoroughfares. Several properties in the eastern portion of the study area were not directly accessible at the time of the survey. Construction activity associated with what appeared to be active redevelopment of the 60 Main Street complex prevented access to nearly all of Henry Street (except the area adjacent to parcel Map ID 27). Separate road construction activity prevented access to all of Russell Street. Atlantic Street was inaccessible east of the intersection with Russell Street due to security measures surrounding the PSEG power plant and the Bridgeport Energy parcel (parcel Map IDs 40 and 12, respectively). Likewise, the entirety of the PSEG power plant parcel was inaccessible, preventing direct visual access to the majority of the Eastern and Central Alignments.

During the initial site survey, no chemical storage or indications of releases of hazardous substances were noted in the area west of Main Street. In the eastern portion of the study area, large quantities of petroleum (in est. 500,000 to 5,000,000-gallon silos) and coal (in an approximately 5-acre pile) were visible from public streets and from publicly available satellite imagery, presumably associated with power generation on these parcels. Because of the lack of access to these areas, specific identification of the storage of other chemical substances was not directly observed, though it is reasonable to infer additional

chemical use and storage based on the current use of the parcels as power generation and associated facilities.

As it is located in a highly urbanized area, a significant portion of the study area is comprised of buildings or other impermeable surface cover. No significant staining of pavement was noted in areas visible during the initial site survey. A slight solvent odor in the ambient air was noted during the initial site survey on June 7 while walking along Singer Avenue; it was unclear whether the odor was emanating from the eastern or western side of the street. Bare patches in grassy areas were noted throughout the study area, though these were likely the result of neglected maintenance rather than an indication of a release to the environment. No other stressed vegetation was observed in the study area. The inspection also identified that, as proposed, the Central Alignment may be located through a portion of the existing former Remington Products factory and loading dock area (parcel Map ID 10). A photographic log of observations made during the initial site survey is provided in Appendix I.

3.2 Current Land Use

The study area (Figure 2) consists of 73 individual parcels totaling approximately 107-acres. The current land use of parcels within the study area was determined based on information gathered during the initial site survey and from municipal land records.

Land use within the study area consists of heavy industrial, light industrial, commercial, educational, residential, and recreational, as well as vacant parcels. A total of 73 parcels are located within the study area, though in many cases multiple adjacent parcels are part of the same development, or owned by the same entity. A list of the parcels contained within the study area and their current land use designation and ownership is provided in Table 1. Locations of the individual parcels are shown on Figure 2.

3.3 Historical Land Use

Bridgeport has history rich in industry, dating back to the 19th century. The study area has been home to a variety of industries including clothing manufacturing, rail and sea shipping, electrical manufacturing, and power generation. These industrial activities have been focused primarily in the eastern portion of the study area. Seaside Park, which lies in the south-central portion of the study area and extends well beyond the study area limits, was established in the late 19th century. The remainder of the study area is composed primarily of the University of Bridgeport and residential homes. Historical land use within the study area was compiled from aerial photographs, United States Geological Survey (USGS) topographic maps, Sanborn Fire Insurance Maps, the City of Bridgeport Tax Assessor's records, and Sanborn Fire Insurance Maps.

3.3.1 Aerial Photographs

Aerial photographs of the study area were reviewed for the years 1934, 1951, 1965, 1970, 1985, 1995, and 2006. These aerial images illustrate the development of the eastern portion of the study area and corresponding progression of the shoreline. The 1934 and 1951 images indicate the shoreline was much further west than it is today, with a railyard and harbor along the coast. Industrial development, including the former Remington Products factory, is also visible in the southeastern portion of the study area, with

the western portion of the study area appearing to be either undeveloped or residential. The development of Seaside Park, located in the south-central portion of the study area and expanding beyond the limits of the study area, predates the first available aerial photograph and is observed in all reviewed aerial photographs, separating the industrial harbor in the east from the more residential area to the west. A power plant is first visible along the eastern edge of the study area in the 1965 aerial image with expansions appearing in the 1970 image. Industrial development extended eastward and is at its approximate current extent in the 1995 and 2006 aerial images. It should be noted that there is no railyard evident in these later images.

In addition to the development of the eastern shoreline, the development of the University of Bridgeport in the southwestern portion of the project area is first visible in the 1951 aerial image. The University Campus expanded northward and eastward through the 1965 aerial image, reaching its approximate current extent by the 1970 image. Concurrent with the expansion of the University of Bridgeport is the loss of residential housing, as this land was purchased and developed for other uses by the University.

Filling of the eastern and southern portions of the study area are first evident in the 1965 image. The filling appears to be completed in the 1970 image, and matches the current shoreline configuration.

Reviewed aerial photographs are provided in Appendix II.

3.3.2 Topographic Maps

WSP reviewed USGS topographic maps from 1889, 1943, 1951, 1960, 1970, and 1984. Copies of the maps are included in Appendix III. Reviewed maps illustrate the changing shoreline over time. Topographic maps from 1889 and 1943 indicate the shoreline was considerably further west than today, with the eastern portion of the study area under water. The shoreline configuration begins to change gradually in the 1951 topographic map, with development progressively moving eastward and approximately matching the current shoreline in 1970. Along with the changing shoreline, additional development in the study area is identified in the 1951 topographic maps, including the University of Bridgeport in the west as well as the railyard and the former Remington Products factory along the eastern shoreline. The power plant along the shoreline is first visible in 1960 with the expansions visible on the 1970 topographic map. Seaside Park is identified in all reviewed topographic maps. The railyard located in the eastern portion of the site is visible in the 1951, 1960, and 1970 topographic maps.

3.3.3 Tax Assessor Records

WSP reviewed records from the City of Bridgeport Tax Assessor's Office for the 73 parcels within the study area. Tax cards are available in Appendix IV and were used to identify current ownership and land use designation of the parcels. In some cases, historical ownership was also available from these records. Information obtained from the tax assessor's office is summarized in Table 1. Below is a summary of parcels where historical use may have included the use and/or storage of petroleum or other hazardous products.

Map ID 1-2 – From at least 1968 until 2002, these parcels were owned by a bag and canvas manufacturer who maintained a factory on the property.

Map ID 3-11: Records for these properties identify ownership by Remington Products Company from at least 1992 to 2006.

Map ID 12: Records indicate this property is designated as a public utility and is owned by Bridgeport Energy LLC.

Map ID 15: Records for this property identify United Illuminating as an owner in 1996.

Map ID 40-41: Records identify PSEG Power Connecticut as the owner of these properties beginning in 2003.

Map ID 49-50: Records identify United Illuminating Company as the current owner of these properties.

3.3.4 Sanborn Fire Maps

Sanborn Fire Maps were reviewed and portions of the study area were identified in the years 1884, 1889, 1904, 1913, and 1939 and are available in Appendix V. Below is a summary of parcels where historical use may have included the use and/or storage of petroleum or other hazardous products.

Map ID 1-2: Sanborn maps indicate these properties contained a bag and canvas manufacturer beginning in at least 1939.

Map ID 3-11 – Portions of this parcel were identified in the 1913 Sanborn map indicate historical use of this parcel included the Bridgeport Sewer Basin in the northern portion and as part of the rail yard that occupied the 1 Atlantic Avenue parcel to the east. Additionally, the southern portion of the parcel was identified in the 1939 Sanborn map and contained a Remington Products factory and a printing company, which consisted of various warehouses, machine shops, auto shops, and coal storage facilities.

Map ID 40: Railroad related structures are identified on the western portion of this property beginning in 1884 with the harbor located to the east. Railroad activities are identified on this parcel on all reviewed Sanborn maps and include a coal storage shed, a mechanic shop, and an oil storage area. Sanborn maps from 1884 and 1889 also identify a furniture manufacturing company on the northeastern area of the parcel.

Map ID 41: The 1913 Sanborn map identifies multiple storage boxes on the northern portion of the parcel. The use of these storage containers is not specified.

Map ID 21: The 1939 Sanborn map identifies a warehouse on this parcel which included an oxygen storage area and an acetylene storage area.

Map ID 50: The 1939 Sanborn map indicated that a portion of this parcel was used for storage of plumbing and heating supplies.

Map ID 51 and 64-66: Multiple auto houses or garages were identified on the 1913 Sanborn map in the general area of these parcels.

4.0 ENVIRONMENTAL RECORDS REVIEW

Federal, state and tribal environmental databases were reviewed for parcels within the study area in an effort to identify potential hazards. A search of U.S. Environmental Protection Agency (U.S. EPA) and Connecticut Department of Energy and Environmental Protection (CTDEEP) databases was completed by an independent firm, Environmental Data Resources Inc. (EDR).

The databases reviewed include:

- National Priorities List (NPL), Proposed NPL and Delisted NPL database
- Federal Superfund Liens (NPL LIENS)
- Federal Facility Site Information Listing (FEDERAL FACILITY)
- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and CERCLIS - No Further Remedial Action Planned (CERCLIS-NFRAP) database of potentially hazardous waste sites.
- Resource Conservation and Recovery Act Hazardous Waste Treatment, Storage or Disposal Facility (RCRA-TSD).
- Corrective Action Reports (CORRACTS) for Hazardous Waste handlers.
- RCRA Large, Small and Conditionally Exempt Small Quantity Generators (RCRA-LQG, RCRA-SQG & RCRA-CESQG) of Hazardous Waste
- Federal Institutional Control/Engineering Control Registries (US ENG CONTROLS & US INST CONTROL)
- Federal Emergency Response Notification System list (ERNS)
- Facility Index System/Facility Registry System (FINDS)
- State Hazardous Waste Sites (SHWS) database of hazardous waste disposal sites.
- Site Discovery and Assessment Database (SDADB) database of facilities suspected of hazardous waste disposal.
- State Solid Waste Facility/Landfills (SWF/LF) database of solid waste disposal facilities, landfills and transfer stations.
- State Leaking Underground Storage Tank (LUST) and Leaking Underground Storage Tanks on Indian Land (INDIAN LUST) databases.
- Connecticut Leachate and Wastewater Discharge Sites (LWDS) includes discharges, waste disposal sites and spills historically mapped by the Connecticut Department of Environmental Protection.
- State Registered Underground Storage Tanks (USTs)
- State Registered Aboveground Storage Tank (AST) database of bulk petroleum facilities that receive petroleum by marine vessels. Underground Storage Tanks on Indian Land (INDIAN UST) and Underground Storage Tank Listing (FEMA UST).
- ELUR Sites (AUL) database of state and tribal institutional control and engineering control registries.
- State Voluntary Cleanup Program Sites (VCP) and voluntary cleanup sites on Indian land (INDIAN VCP).
- Brownfield Sites

A full list of databases included in the EDR report are available in Appendix VI. Twenty-two (22) parcels within the study area were identified in these databases, including CT MANIFEST, CT SPILLS, CT UST, and RCRA NonGen/NLR. Appearance in these databases suggests a property is at risk of environmental contamination. Properties identified in the EDR report are summarized in Table 1.

5.0 EVALUATION AND SUMMARY

Current land use, historical land use, and environmental records were used to determine the relative risk of environmental contamination associated with each parcel within the study area (Table 1 and shown on Figure 2). Parcels where records identified no environmental concerns, such as residential properties, were designated low risk. A moderate risk designation was assigned to those parcels where records suggest the potential use or storage of potential contaminants, but where there is no indication of a release or direct environmental impact. A high-risk designation was assigned to parcels with records of contaminant release or where such a release is likely based on current or past land use.

While parcels are designated as a low, moderate and high risk designations, the likelihood exists that urban fill is present in surficial materials throughout the subject areas, and contain COCs at concentrations which are near or above soil criteria DD identified in the CTDEEP RSRs. Typical COCs identified in urban fill in Bridgeport include metals, polynuclear aromatic hydrocarbons (PAHs) and petroleum hydrocarbons. In addition, if part of the alignment were constructed through an existing building, a hazardous building materials inspection would be required to determine appropriate disposal of the building material (i.e. asbestos, lead-based paint, PCBs).

Within the study area, (27) parcels were designated low risk, (23) moderate risk, and (23) high risk. The relative risk designation of each parcel is identified in Table 1 and Figure 2. Table 1 also includes COCs potentially associated with each of the parcels. As noted above, because of the potential of urban fill underlying the study area, all parcels would include metals, PAHs and petroleum hydrocarbons as COCs. Low risk parcels account for the smallest portion of the study area and consist primarily of residential or commercial parcels located along Main Street. Moderate risk parcels are concentrated primarily west of Main Street. High risk parcels are concentrated east of Main Street and account for largest portion of the study area. However, each of the three proposed Alignments intersect a significant number of high risk parcels.

6.0 CONCLUSIONS

Based upon the information gathered during the Corridor Land Use Evaluation, it is recommended that a Task 210 – Subsurface Site Investigation be performed in all areas of anticipated intrusive construction activities and/or right-of-way activities. Because of the likely presence of urban fill, WSP recommends that the investigation include low to high risk parcels, with a greater density of sampling occurring in the right-of-way's adjacent to the moderate to high risk parcels identified in this report.

7.0 LIMITATIONS

The purpose of this Corridor Land Use Evaluation is to identify potential impacts to the environment status of the physical conditions (i.e., soil, ground water, structure, etc.) in the study area, due

to the use, storage or disposal of hazardous or toxic materials or wastes. As such, any other property conditions or characteristics are not addressed in the scope of work for this report. The scope of work does not include, nor should the report be considered as, an audit of compliance with environmental permits, management practices, or federal, state or local laws and regulations, even though in the course of work such information may be obtained and noted in the report.

The conclusions stated above have been developed from what is considered to be a reasonable investigation based on the present and past land use of the study area. The conclusions, to some degree, are based upon information provided by others as referenced or noted in the report. Reasonable efforts have been made to confirm the information with other sources; however, WSP is not responsible for missing or incomplete information if such information is not available at the source or provided at WSP's request, or if such information cannot be obtained within the time constraints of the work or within a level of effort reasonable for the work being completed.

The conclusions and/or recommendations are applicable to areas of the study area that were accessible at the time of inspection and represent the conditions observed in those areas. Areas that were hidden, covered or otherwise inaccessible to inspection are not covered by the conclusions and recommendations. The conclusions and recommendations are based in part on conditions observed within the study area at the time of the inspection. The conclusions do not include subsequent changes to or use of properties, which could alter the environmental status from its present condition.

WSP asserts that the data are complete and appropriate at the time and for the work conducted, but is not responsible for the use of the information for purposes for which it was not intended.

cmm
December 19, 2018
H:\Bridgeport (C)\2018\Resiliency Project\Task 110 Report.docx

TABLE

TABLE 1
RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

Summary of Corridor Land Use Evaluation

Map ID	Address	Current Owner	Current Land Use Designation	Previous Owners	EDR Database Review	COCs	Risk
1	388 MAIN ST	388 MAIN STREET LLC	Industrial	Josephson Bag & Canvas Company	EDR Historical Cleaner	ETPH, PAHs, Metals, VOCs	High
2	394 MAIN ST		Industrial	Josephson Bag & Canvas Company		ETPH, PAHs, Metals, VOCs	
3	37 HENRY ST #41	60 MAIN STREET LLC ET AL	Industrial	Adelman Hiram et al. Remington Products Company	CT MANIFEST, CT SDADB, RCRA NonGen/NLR, ICIS, US AIRS, FINDS, ECHO, CT CPCS, RI MANIFEST, NY MANIFEST, CT NPDES, CT BROWNFIELDS, CT ENF	ETPH, PAHs, Metals, PCBs,VOCs	High
4	51 HENRY ST		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
5	57 HENRY ST #65		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
6	97 HENRY ST		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
7	12 MAIN ST		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
8	50 MAIN ST.		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
9	110 MAIN ST		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
10	76 MAIN ST		Industrial	H & B CT LLC Adelman Hiram et al. Remington Products Company		ETPH, PAHs, Metals, PCBs,VOCs	
11	122 MAIN ST		Commercial	Adelman Hiram et al. Remington Products Company		ETPH, PAHs, Metals, PCBs,VOCs	
12	10 ATLANTIC ST	BRIDGEPORT ENERGY LLC	Pub Util	Main Atlantic Associates	CT SDADB, CT PROPERTY, CT CPCS, CT SPILLS, CT MANIFEST	ETPH, PAHs, Metals	High
13	149 MAIN ST #153	BRIDGEPORT OCEAN VIEW LLC	Residential	Taffee Place LLC Seaside Waterview LLC	--	ETPH, PAHs, Metals	Low
14	30 UNIVERSITY AV		Commercial	Taffee Place LLC Seaside Waterview LLC		ETPH, PAHs, Metals	Low
15	330 WATER ST	BRIDGEPORT PORT AUTHORITY	Industrial	United Illuminating City of Bridgeport	--	ETPH, PAHs, Metals	High
16	154 MAIN ST #156	BUSH CHRYSTAL	Residential	--	--	ETPH, PAHs, Metals	Low
17	350 WALDEMERE AV	CITY OF BRIDGEPORT PARK DEPT	Tax Exempt	--	CT LWDS	ETPH, PAHs, Metals	Moderate
18	211 MAIN ST #213	CONNECTICUT LIGHT & POWER	Vacant Land	--	--	ETPH, PAHs, Metals	Low
19	264 BROAD ST	DE TUYA III OSCAR C	Residential	--	--	ETPH, PAHs, Metals	Low
20	181 MAIN ST	DEWITT-SMITH WILLIAM S & JANET	Residential	--	--	ETPH, PAHs, Metals	Low
21	376 MAIN ST	ESM HOLDINGS LLC	Industrial	PJ Murphy Mov & Stor Co	CT LWDS	ETPH, PAHs, Metals	High
22	28 WHITING ST #30		Industrial	--	--	ETPH, PAHs, Metals	Moderate
23	183 MAIN ST	HOUSING AUTHORITY OF CITY OF BRIDGEPORT	Residential	--	--	ETPH, PAHs, Metals	Low
24	258 BROAD ST	HYER CHARLES W	Residential	--	--	ETPH, PAHs, Metals	Low
25	418 MAIN ST	KIEFER MAIN INCORPORATED	Commercial	--	--	ETPH, PAHs, Metals	Low
26	203 MAIN ST	KONG SIMON TATCHEE	Residential	Secretary of Housing and Urban	--	ETPH, PAHs, Metals	Low
27	160 MAIN ST #162	MALINOWSKI JOANN L	Commercial	--	--	ETPH, PAHs, Metals	Low
28	146 MAIN ST #148	MARTIN ROBERT F & FLORENCE	Residential	--	--	ETPH, PAHs, Metals	Low
29	354 MAIN ST	MARY & ELIZA FREEMAN CNTR FOR	Commercial	City of Bridgeport	--	ETPH, PAHs, Metals	Low
30	360 MAIN ST #366	HISTORY &	Residential	ABCD Inc	--	ETPH, PAHs, Metals	Low
31	107 HENRY ST #109	MASON CHARLES J & JOSEPH L	Industrial	--	--	ETPH, PAHs, Metals	High
32	113 HENRY ST	MASON JOSEPH L JR & LOUISE	Vacant Land	--	--	ETPH, PAHs, Metals	Low

TABLE 1
RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

Summary of Corridor Land Use Evaluation

Map ID	Address	Current Owner	Current Land Use Designation	Previous Owners	EDR Database Review	COCs	Risk
33	21 HENRY ST	MAUZERALL MICHAEL	Industrial	--	--	ETPH, PAHs, Metals	High
34	27 HENRY ST		Industrial	--	--	ETPH, PAHs, Metals	High
35	30 KIEFER ST	O'HARA'S LLC	Industrial	Cavalleri Marie R	--	ETPH, PAHs, Metals	High
36	38 KIEFER ST		Commercial		--	ETPH, PAHs, Metals	Moderate
37	54 KIEFER ST		Industrial		--	ETPH, PAHs, Metals	High
38	340 MAIN ST #350	PARKSIDE PROPERTIES LLC	Commercial	Polanco Rene & Margarita Mechanics & Farmers Savings Burr Jonathan	--	ETPH, PAHs, Metals	Low
39	268 BROAD ST	PLOTKIN NATHANIEL W	Residential	--	--	ETPH, PAHs, Metals	Low
40	1 ATLANTIC ST	PSEG POWER CONNECTICUT LLC	Pub Util	--	CT SPILLS, CT NPDES, CT ASBESTOS, ERNS, CT CPCS, CT AST, CT PROPERTY, TSCA, CT UST, ICIS, MLTS, FINDS, ECHO, US AIRS, SEMS-ARCHIVE, CORRACTS, RCRA-TSDF, RCRA-SQG	ETPH, PAHs, Metals, PCBs, VOCs	High
41	280 MAIN ST		Commercial	United Illuminating Company Main Atlantic Associates	--	ETPH, PAHs, Metals, PCBs	
42	TONGUE POINT LIGHT	FEDERAL GOVERNMENT	National Register of Historic Places	--	--	ETPH, PAHs, Metals, PCBs	Moderate
43	256 BROAD ST	SILJKOVIC SABAN	Residential	Alleyne Wayne A Sanjo Realy LLC Celli Joseph et al Meyers Richard J A/K/A	--	ETPH, PAHs, Metals	Low
44	167 MAIN ST	SEASIDE WATERVIEW LLC	Vacant Land	Lacont Laurence J Laconte Clara	--	ETPH, PAHs, Metals	Low
45	262 BROAD ST	STEPANOVA TATYANA	Residential	--	--	ETPH, PAHs, Metals	Low
46	270 BROAD ST		Residential	--	--	ETPH, PAHs, Metals	Low
47	195 MAIN ST #199	TENG WAN LING ETAL	Residential	St Raymond Stephen C St Raymond Raymond Murphy William S Murphy Vernon S Est	--	ETPH, PAHs, Metals	Low
48	274 BROAD ST	TEO PUAY LAM ET AL	Residential	Davis Thomas S Davis Carolyn H Estate	--	ETPH, PAHs, Metals	Low
49	282 BROAD ST #288	THE CONNECTICUT LIGHT & POWER	Vacant Land	Davis Carloyn H Trustee et al Davis Carolyn Murphy William S & Murphy Vernon S Est	--	ETPH, PAHs, Metals, PCBs	Low
50	3 ATLANTIC ST	UNITED ILLUMINATING COMPANY	Industrial	--	--	ETPH, PAHs, Metals, PCBs, VOCs	High
51	120 HENRY ST		Pub Util	PSEG Power Development LLC United Illuminating Co	NY MANIFEST, CT SPILLS, CT MANIFEST	ETPH, PAHs, Metals, PCBs, VOCs	High

TABLE 1
RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

Summary of Corridor Land Use Evaluation

Map ID	Address	Current Owner	Current Land Use Designation	Previous Owners	EDR Database Review	COCs	Risk
52	115 BROAD ST	UNIVERSITY OF BRIDGEPORT	Single Fam	Lee Jung Sook Noh	--	ETPH, PAHs, Metals	Moderate
53	136 LAFAYETTE ST #170		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
54	239 LAFAYETTE ST		Commercial	--	--	ETPH, PAHs, Metals	
55	245 LAFAYETTE ST #247		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
56	253 LAFAYETTE ST #255		2 Family	--	--	ETPH, PAHs, Metals	
57	262 LAFAYETTE ST #264		Commercial	--	--	ETPH, PAHs, Metals	
58	269 LAFAYETTE ST		Tax Exempt	--	--	ETPH, PAHs, Metals	
59	274 LAFAYETTE ST		Commercial	--	--	ETPH, PAHs, Metals	
60	320 LINDEN AV		Tax Exempt	--	--	ETPH, PAHs, Metals	
61	68 UNIVERSITY AV		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
62	114 UNIVERSITY AV		Commercial	--	--	ETPH, PAHs, Metals	
63	128 UNIVERSITY AV		Commercial	--	--	ETPH, PAHs, Metals	
64	152 UNIVERSITY AV		Tax Exempt	--	--	ETPH, PAHs, Metals	
65	169 UNIVERSITY AV		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
66	174 UNIVERSITY AV		Tax Exempt	--	--	ETPH, PAHs, Metals	
67	225 UNIVERSITY AV		Tax Exempt	--	--	ETPH, PAHs, Metals	
68	244 UNIVERSITY AV		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
69	(UB Football Field)		--	--	--	ETPH, PAHs, Metals	
70	420 MAIN ST #422	VUKAJ ALEKSANDER	Commercial	--	--	ETPH, PAHs, Metals	Low
71	271 BROAD ST	ZAMBON KARL L & KATHARINA T	Residential	Wells Fargo Bank NA Choi Chung Woo Yasutake Yohio Paul et al	--	ETPH, PAHs, Metals	Moderate
72	189 MAIN ST #191	ZAMBON MICHAEL ET AL	Residential	Song Zhitao	--	ETPH, PAHs, Metals	Low
73	(Henry/Russell/Atlantic)	--	--	--	CT UST	ETPH, PAHs, Metals, PCBs, VOCs	Moderate

COC: Contaminant of concern

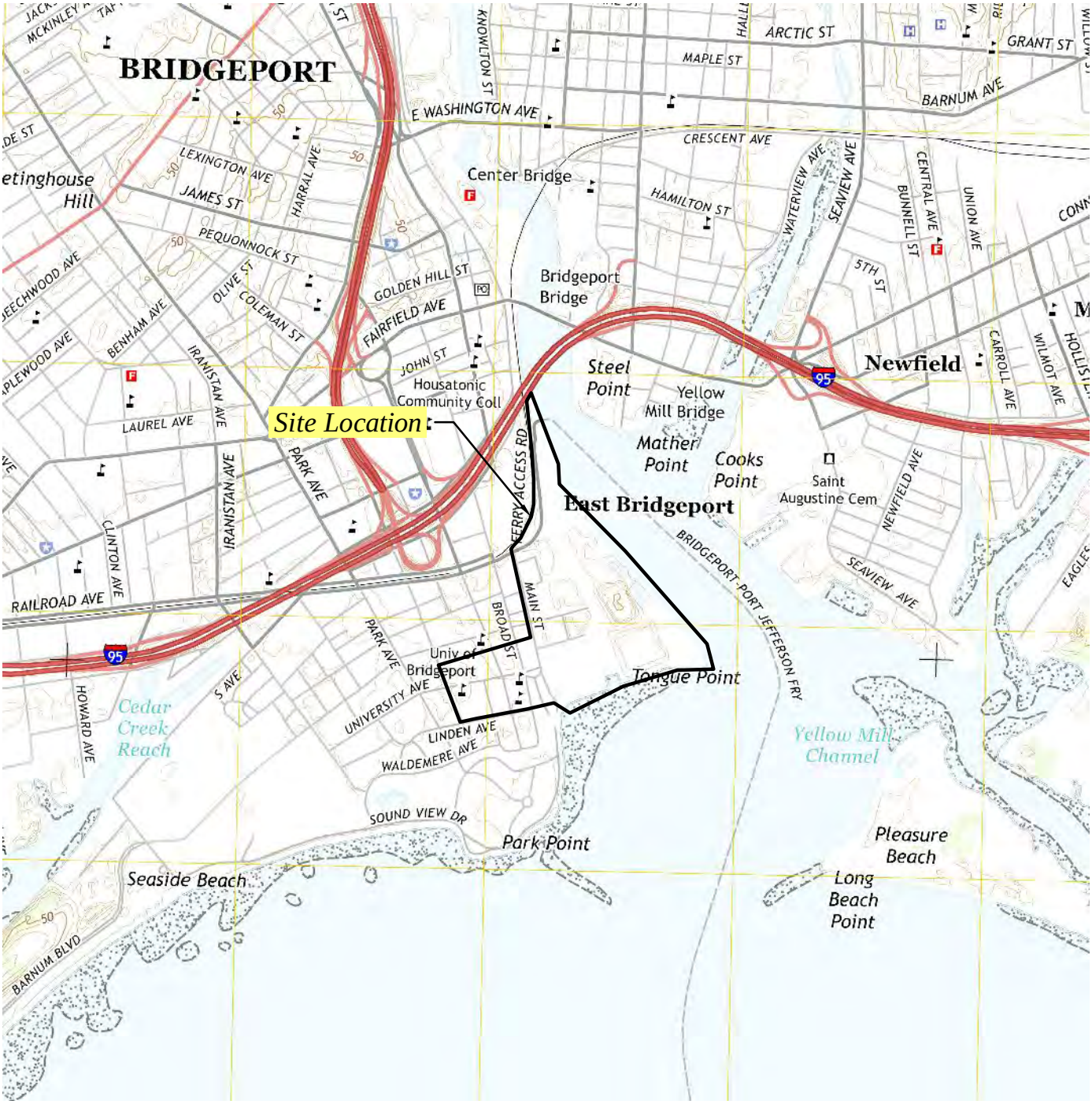
ETPH: Extractable total petroleum hydrocarbons

PAHs: Polynuclear aromatic hydrocarbons

PCBs: Polychlorinated biphenyls

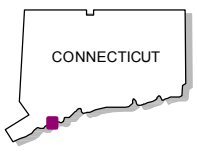
VOCs: Volatile organic compounds

FIGURES



SOURCE: USGS TOPOGRAPHIC QUADRANGLE BRIDGEPORT, CONNECTICUT (2015).





QUADRANGLE LOCATION

0 2000

SCALE IN FEET

RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

SITE LOCATION MAP

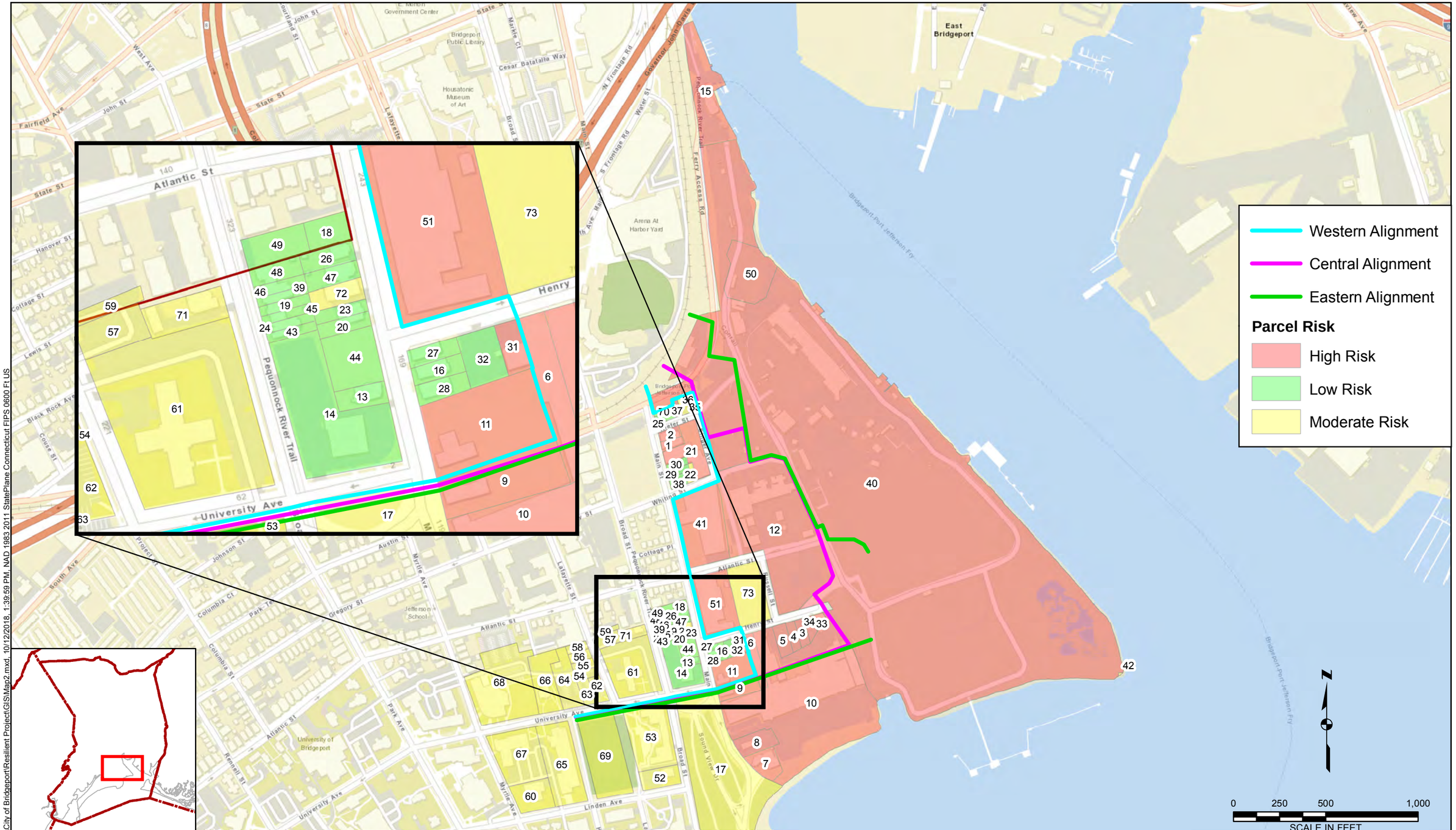
DATE	REVISED

PREPARED BY:

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Suite 204
Shelton, Connecticut 06484
(203) 929-8555

DRAWN:	RAC	CHECKED:	SQ	DATE:	06/28/18	FIGURE:	1

O:\DWG\City of Bridgeport\Resilienct Project\F1_SLM.dwg, Layout1, 6/28/2018 7:33:17 AM, PDF-XChange for AcroPlot Pro



Drawn: 10/12/2018

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

WSP Office: Shelton, CT | Source: K:\Jobs\City of Bridgeport\Resilient Project\GIS\Map2.mxd, 10/12/2018, 1:39:59 PM, NAD 1983 2011 StatePlane Connecticut FIPS 0600 Ft US

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RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

PREPARED FOR

The City of Bridgeport

FIGURE 2

PARCEL RISK ASSESSMENT
OCTOBER 2018

APPENDIX I

PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
1	June 7, 2018

University of Bridgeport campus near southernmost terminus of proposed alignments



Photo No.	**Date**
2	June 7, 2018

University of Bridgeport campus – University avenue



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
3	June 7, 2018

University of Bridgeport campus residence hall



Photo No.	**Date**
4	June 7, 2018

Derelict building at 30 University Avenue



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
5	June 7, 2018

Construction activity at the 60 Main Street site



Photo No.	**Date**
6	June 7, 2018

View north on Main Street, from entrance of 60 Main Site



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
7	June 7, 2018

Several residential/mixed use buildings located at the corner of Henry and Main Streets



Photo No.	**Date**
8	June 7, 2018

Residences and a UI facility on Main Street, facing North



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
9	June 7, 2018

280 Main Street from Main and Atlantic Streets



Photo No.	**Date**
10	June 7, 2018

Unpaved parking area located at the corner of Russell and Henry Streets



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
11	June 7, 2018

10 Atlantic Street



Photo No.	**Date**
12	June 7, 2018

Light industrial style building at the corner of Main St and Cottage Pl



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
13	June 7, 2018

Loading docks at 280 Main Street and mixed use building located at Whiting and Main Streets



Photo No.	**Date**
14	June 7, 2018

Rear of PJ Murphy Self Storage (376 Main Street) and view north on Singer Avenue



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
15	June 7, 2018

Rear loading docks at PJ Murphy Self Storage



Photo No.	Date
16	June 7, 2018

1 Atlantic Avenue viewed from Singer Avenue



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
17	June 7, 2018

Commercial property storing excavators and triaxle dump trucks on Kiefer Street



Photo No.	**Date**
18	June 7, 2018

View west on Kiefer Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
19	June 7, 2018

WM Evans Painting, LLC located at the corner of Kiefer/Main



Photo No.	**Date**
20	June 7, 2018

Vacant lot located at the corner of Ferry Access Road and Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
21	June 27, 2018

Bridgeport Harbor Generating Station



Photo No.	Date
22	June 27, 2018

Commercial Property on Singer Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
23	June 27, 2018

Commercial Property on Singer Street



Photo No.	**Date**
24	June 27, 2018

Storage facility at corner of Whiting Street and Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
25	June 27, 2018

Several residential buildings on Main Street



Photo No.	Date
26	June 27, 2018

Commercial Property at 280 Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
27	June 27, 2018

Bridgeport Energy LLC on Atlantic Street



Photo No.	Date
28	June 27, 2018

Commercial Buildings on Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
29	June 27, 2018

Commercial Buildings at 340 Main Street



Photo No.	**Date**
30	June 27, 2018

Construction along Russell Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
31	June 27, 2018

Construction along Henry Street



Photo No.	Date
32	June 27, 2018

Construction along Henry Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
33	June 27, 2018

Residential Property along Henry Street



Photo No.	**Date**
34	June 27, 2018

Construction site along Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
35	June 27, 2018

University of Bridgeport property along Myrtle Ave



Photo No.	Date
36	June 27, 2018

Residential Properties along Lafayette Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
37	June 27, 2018

Parking lot for a commercial building at University of Bridgeport



Photo No.	Date
38	June 27, 2018

Commercial buildings associated with University of Bridgeport



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
39	June 27, 2018

Administrative buildings associated with University of Bridgeport



Photo No.	Date
40	June 27, 2018

Administrative buildings associated with University of Bridgeport



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
41	June 27, 2018

Administrative buildings associated with University of Bridgeport



Photo No.	Date
42	June 27, 2018

Park between Main Street and Harbor



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
43	June 27, 2018

Park between Main Street and Harbor



Photo No.	**Date**
44	June 27, 2018

Construction between Park and Harbor



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
45	June 27, 2018

Residential building at corner of Linden Ave and Broad Street



Photo No.	**Date**
46	June 27, 2018

Administrative Buildings for the University of Bridgeport



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
47	June 27, 2018

Construction between Park and Harbor



Photo No.	Date
48	June 27, 2018

Atlantic Street entrance to PSEG Power Property



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
49	June 27, 2018

Ferry Access Road Entrance to PSEG Power Property



Photo No.	**Date**
50	June 27, 2018

Industrial building located at 280 Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
51	June 27, 2018

View from Atlantic Avenue of 120 Henry Street.



APPENDIX II



CITY OF BRIDGEPORT
RESILIENT PROJECT

1934 Aerial Photograph

DATE	REVISED

PREPARED BY:

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Suite 204
Shelton, CT 06484
Tel: (203) 944-5000

DRAWN: | CHECKED: | DATE: 1/4/18 | FIGURE: 1



CITY OF BRIDGEPORT
RESILIENT PROJECT

1951 Aerial Photograph

DATE	REVISED

PREPARED BY:

WSP USA Inc.
4 Research Drive
Suite 204
Shelton, CT 06484
Tel: (203) 944-5000

DRAWN: | CHECKED: | DATE: 1/4/18 | FIGURE: 2



CITY OF BRIDGEPORT
RESILIENT PROJECT

1965 Aerial Photograph

DATE	REVISED	PREPARED BY:
		WSP USA Inc. 4 Research Drive Suite 204 Shelton, CT 06484 Tel: (203) 944-5000

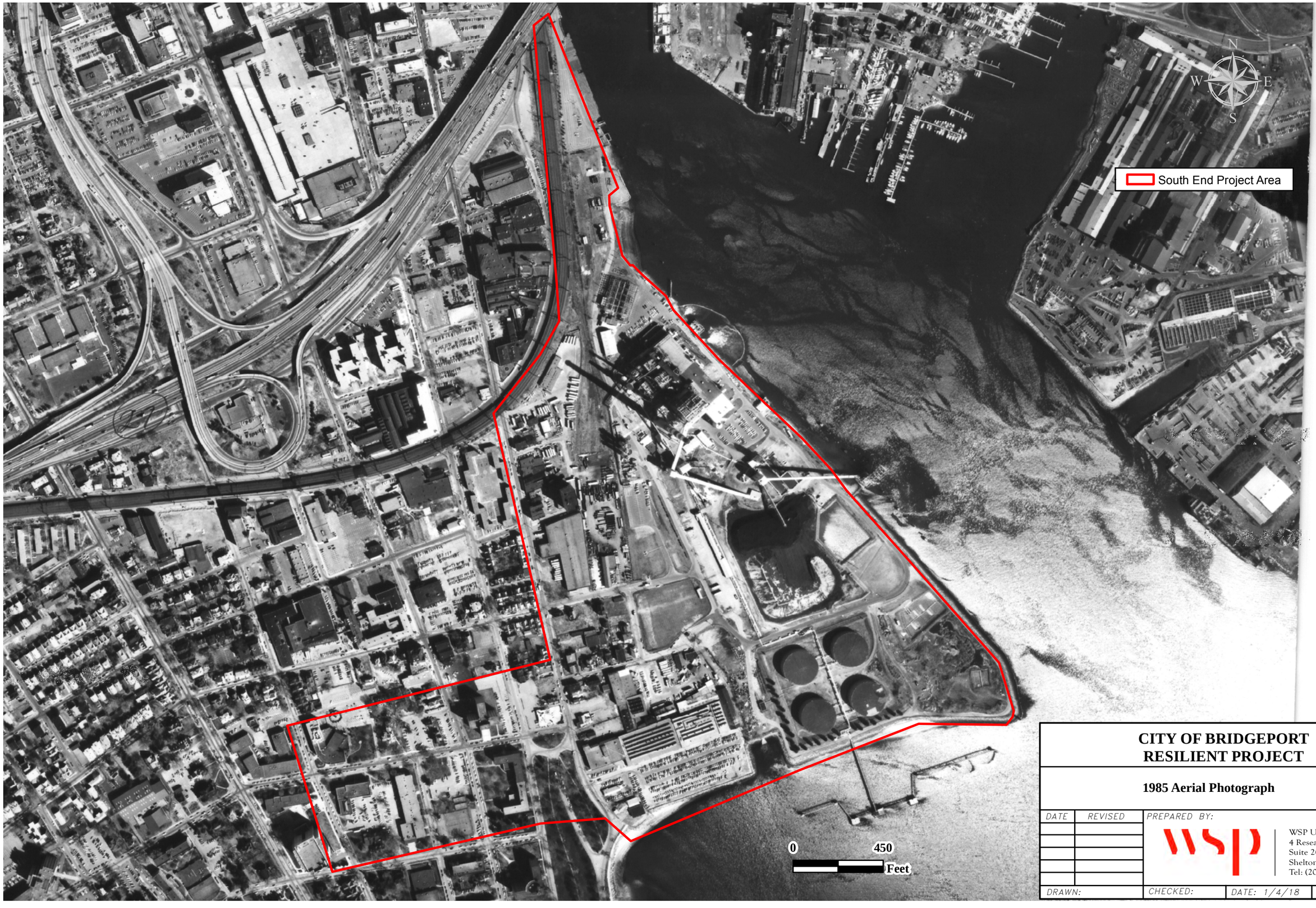
DRAWN:	CHECKED:	DATE: 1/4/18	FIGURE: 3



CITY OF BRIDGEPORT
RESILIENT PROJECT

1970 Aerial Photograph

DATE	REVISED	PREPARED BY:
		WSP USA Inc. 4 Research Drive Suite 204 Shelton, CT 06484 Tel: (203) 944-5000
DRAWN:	CHECKED:	DATE: 1/4/18 — FIGURE: 4



CITY OF BRIDGEPORT
RESILIENT PROJECT

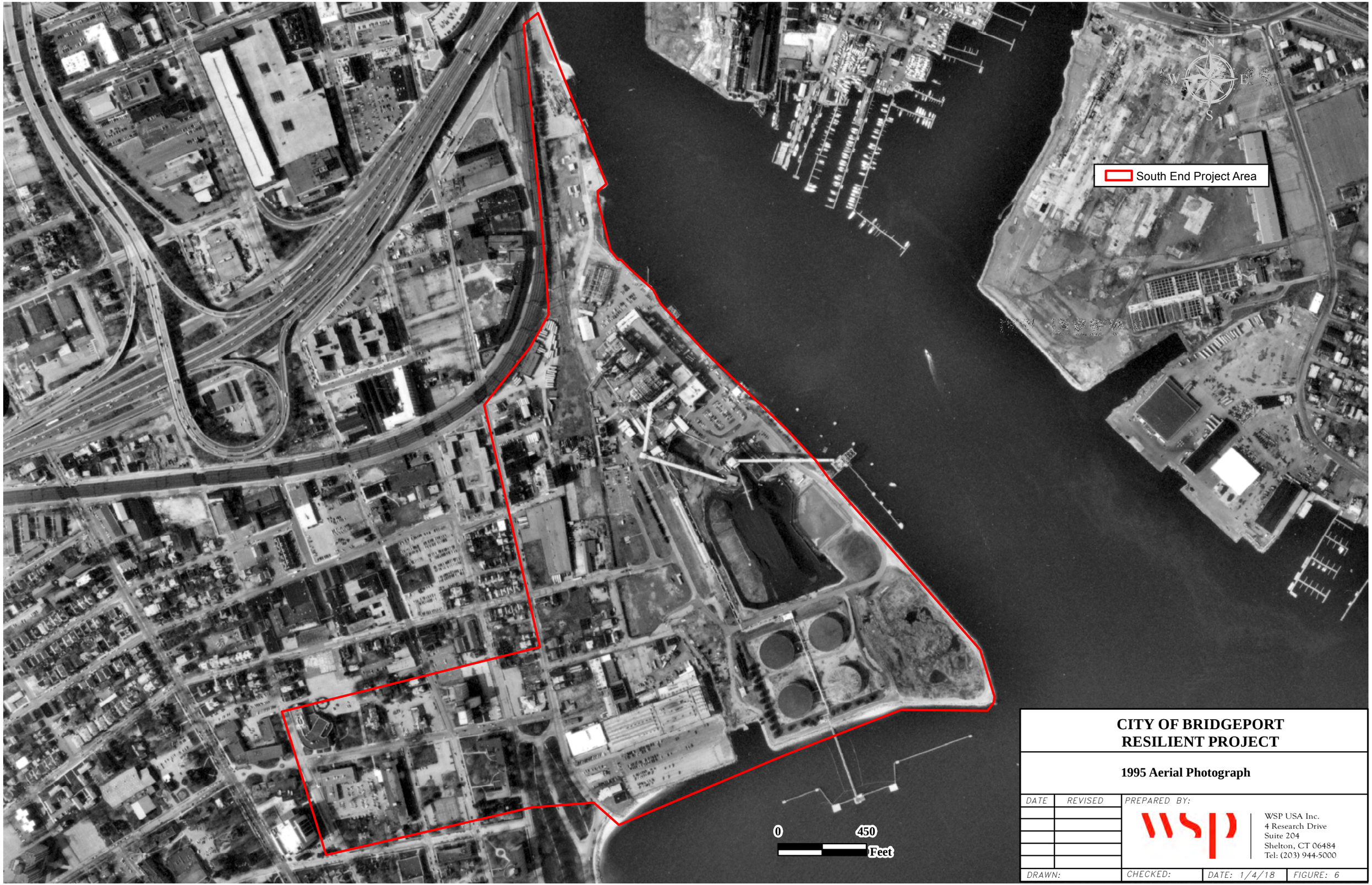
1985 Aerial Photograph

DATE	REVISED

PREPARED BY:

WSP USA Inc.
4 Research Drive
Suite 204
Shelton, CT 06484
Tel: (203) 944-5000

DRAWN:	CHECKED:	DATE: 1/4/18	FIGURE: 5



CITY OF BRIDGEPORT
RESILIENT PROJECT

1995 Aerial Photograph

DATE	REVISED	PREPARED BY:
		WSP USA Inc. 4 Research Drive Suite 204 Shelton, CT 06484 Tel: (203) 944-5000
DRAWN:	CHECKED:	DATE: 1/4/18 FIGURE: 6



CITY OF BRIDGEPORT
RESILIENT PROJECT

2006 Aerial Photograph

DATE	REVISED	PREPARED BY:
		WSP USA Inc. 4 Research Drive Suite 204 Shelton, CT 06484 Tel: (203) 944-5000

DRAWN:	CHECKED:	DATE: 1/4/18	FIGURE: 7

APPENDIX III

U.S. GEOLOGICAL SURVEY
J.W. POWELL,
DIRECTOR.

№ 33
CONNECTICUT
BRIDGEPORT SHEET
(Derby)

STATE OF CONNECTICUT
WM H. BREWER.
JAMES H. CHAPIN. } COMMISSIONERS
JOHN W. BACON.

73°15' 41°15' 10' 5' 73° 41°15'

Trumbull
Nichols Farms
Baldwin
Fowlers Island
Wepawaug River
Indian River
RAILROAD
Horse Tavern Reservoir
Ox Stream Reservoir
Island Brook Reservoir
Stratford Hill
Popes Flat
Long Island
Milford
Success Hill
Beardsley Park
North Bridgeport
Naugatuck Junction
Welches Point
Pond Point
Berkshire Mill Pond
Stillman Pond
Pembroke Lake
East Bridgeport
Stratford
Meadows End
Charles Island
Nells Island
BRIDGEPORT
Moody's Mill Pond
East End
Milford Point
BEACON
Pleasure Beach
Seaside Park
THE GUT
LIGHT
Stratford Point
Black Rock
Cedar Creek
Ash Creek
Long Beach
Point no Point
Fayerweather Island
Grover Hill
BLACK ROCK HARBOR
Fairfield Beach
(Norwalk)

BOUNDARY LINE
CONNECTICUT
NEW YORK

Henry Gannett. Chief Topographer.
Marcus Baker. Topographer in charge.
Triangulation by the U.S. Coast and Geodetic Survey.
Topography by E.B. Clark.
Surveyed in 1889.

Scale 1/62,500
0 1/2 1 2 3 4 5 Miles

Contour Interval 20 feet
Datum is mean Sea level

CONNECTICUT-NEW YORK

BRIDGEPORT QUADRANGLE

GRID ZONE "A"

WAR DEPARTMENT
CORPS OF ENGINEERS, U. S. ARMY

FIRST EDITION - AMS 1

(POUGHKEEPSIE)

(FARMINGTON)

73°30' — 73°00' — 41°30' — 41°00'

15° 14° 13° 12° 11° 10° 0°

400000 Conn. 6 MI. SHERMAN — U S HY NO 7 2.4 MI. — LANESVILLE 2.4 MI. — BRIDGEWATER 2 MI. — (LITCHFIELD) — STATE HY NO 67 0.7 MI. — STATE HWY NO 172 1.5 MI. — WHITE OAKS 0.5 MI. — MIDDLEBURY 2.9 MI. — STATE HY. NO 135 0.6 MI. — UNION CITY 0.1 MI.

240000 Conn.

2120 — 2110 — 2100 — 2090 — 2080 — 2070000

STATE HIGHWAY NO 37A 0.9 MI. — STATE HIGHWAY NO 37A 1 MI. — STATE HIGHWAY NO 39 1.5 MI. — DEFOREST CORNERS 4.1 MI. — MILL PLAIN 1 MI. — RIDGEFIELD 1.1 MI. — STATE HY NO 33 2 MI. — NORTH SALEM 5.3 MI. — STATE HY NO 123 4.3 — STATE H NO 123 1.8 MI. — (WEST POINT) — STATE HY NO 123 0.4 MI. — VISTA 1.5 MI. — STATE HY NO 29 0.6 MI. — POUNDRIDGE 6.2 MI. — STATE HY NO 137 2.3 MI. — SPRINGDALE 2.8 MI. — STAMFORD GLENBROOK 2.2 MI. — 1.2 MI.

STATE HY NO 68 2.2 MI. — BETHANY 3.5 MI. — BETHANY 0.7 MI. — STATE HY NO 69 3 MI. — NEW HAVEN 4 MI. — WESTVILLE 1.5 MI. — (NEW HAVEN) — NEW HAVEN 4.5 MI. — STATE HY. NO 122 1.4 MI. — WOODMOUNT 0.3 MI.

GRID DECLINATION 0°20' OR 6 MILS W — GRID DECLINATION 0°00' OR 0 MILS

20 Miles — 19 — 18 — 17 — 16 — 15 — 14 — 13 — 12 — 11 — 10 — 9 — 8 — 7 — 6 — 5 — 4 — 3 — 2 — 1 — 0 — 1/2

960000 — 970 — (ISLIP) — P — 990 — 520000 Conn. — 1000 — 80000 Conn.

(NEW YORK) — (RIVERHEAD)

Danbury, Danbury Airport, Bethel, Brookfield, Brookfield Center, Brookfield Junction, New Fairfield, Southville, Shepaug, Lake Candlewood, Lake Lillinonah, Still R., Broadbrook, Kohanza Lake, Upper Kohanza Lake, East Lake, Margerie Reservoir, Pump Sta, Beaver Brook Mt., Hawleyville, Newtown, Taunton Road, Shelter Rock, Taunton Hill, Dodgingtown, Bennett Pds, Town Hill, Thomas Mt, Moses Mt, Wooster Mt, Eureka Lake, Spruce Mt, Pine Mt, Sugar Hollow Pd, Bethel Reservoir, State Park, State Forest, Hattertown, West Redding, Redding Ridge, Redding, Umpawaug Pond, Topstone, Ridgefield, Georgetown, Branchville, Valley Forge, Devils Den, Hovey Hill, Bald Hill Street, Bald Hill, North Wilton, Turner Ridge, Cannondale, Wilton, South Wilton, Belden Hill, Norwalk Reservoir, South Norwalk Res, Silvermine, New Canaan, Four Corners, Five Corners, Winnipauk, Norwalk Airport, Cranbury, Saugatuck, Talmadge Hill Sta, West Norwalk, NORWALK, East Norwalk, South Norwalk, Darien, Rowayton, Noroton Sta, Noroton, Scott Cove, Pine Pt, Noroton Pt, Fish Islands, Long Neck Pt, Bell I, Sheffield I, Manrissa I, Betts I, Grassy I, Chimon I, Copp I, Ram I, Keyser Pt, Wilson Pt, NORWALK ISLANDS, Cockenoe I, Calfpasture I, Calfpasture Pt, Seymour Pt, Sprite I, Cedar Pt, Alvord Beach, Sherwood Pt, Frost Pt, Greens Farm, Greens Farm Sta, Southport, Fairfield, Pine Creek Pt, Fayerweather I, Black Rock, BRIDGEPORT, Greenfield Hill, Prospect Hill, Mill Plain, Westport, Saugatuck R., Sasco Br., Mill R., Aspetuck R., Aspetuck, Aspetuck Reservoir, Hemlock Reservoir, Plattsville, Lyon Plain, Easton, Long Hill, Tashua Hill, Tashua Knob, Easton Lake, Trumbull, Nichols, Oronoque, Beaver Dam Lake, Fowlers Island, Pipes Flat, Long Hill, Milford, Devon, Stratford, East Bridgeport, Bridgeport Airport, Milford Pt, Chimbo Pt, Myrtle Beach, Walnut Beach, Charles Island, Laurel Beach, Welch Pt, Pond Pt, Stratford Pt, Lordship, Long Beach, Point No Point, Gul, Port Jefferson Ferry, Sound, Long Island, Connecticut / New York

Southbury, Strongtown, Walnut Tree Hill, Preston Hill, Woodruff Hill, Long Meadow Pond, French Mt, Flat Hill, South Britain, Southbury Sta, Horse Hill, George Hill, Southford, Towantic, Towantic Hill, State Forest, Tobys Rock Mt, Andrews Hill, Millville, Huntington Hill, Spring, Naugatuck, Mulberry Hill, Straitsville, Hopkins Hill, Beacon Hill, High Rock Grove, Beacon Falls, Rock Rimmon, Rimmon Hill, Skokorat Hill, Mt Pisgah, Red City, Oxford, Quaker Farms, Nichols Rd, Hulls Hill, Good Hill, Moose Hill, Rocky Glen, Sandy Hook Sta, Sandy Hook, Hawleyville, Housatonic River, Stevenson, Riverside, Rockhouse Hill, Botsford, Huntington, Great Hill, Seymour, Peet Swamp Reservoir, Prospect Hill, Woodbridge, East Village, Upper White Hills, Lower White Hill, Monroe, Ansonia, Derby, Shelton, Walnut Tree Hill, Huntington, Stepney, Upper Stepney, Long Hill, Booth Hill, Trap Falls, Corum Hill, Grassy Hill, Georges Cellar Hill, Orange, Turkey Hill, Rock Rimmon, Round Hill, Terrmill River, Eightmile River, Housatonic River, Naugatuck River, Pootatuck R., Still R., Lake Lillinonah, Lake Zoar, Zoar Br., Zoar Tunnel, Zoar Gap, Zoar Dam, Zoar Sta, Lovers Leap, Indian Wells, Indian Wells Sta, Indian Wells Tunnel, Paugussett, Paugussett Sta, Paugussett Tunnel, Paugussett Br., Paugussett Trail, Pootatuck Trail, Housatonic Trail, Appalachian Trail, Housatonic Ridge, Housatonic Valley, Housatonic Hills, Housatonic Br., Housatonic Br. Sta, Housatonic Br. Tunnel, Housatonic Br. Trail, Housatonic Br. Ridge, Housatonic Br. Valley, Housatonic Br. Hills, Housatonic Br. Br., Housatonic Br. Br. Sta, Housatonic Br. Br. Tunnel, Housatonic Br. Br. Trail, Housatonic Br. Br. Ridge, Housatonic Br. Br. Valley, Housatonic Br. Br. Hills, Housatonic Br. Br. Br., Housatonic Br. Br. Br. Sta, Housatonic Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Trail, Housatonic Br. Br. Br. Ridge, Housatonic Br. Br. Br. Valley, Housatonic Br. Br. Br. Hills, Housatonic Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. 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Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Hills, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br., Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Sta, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Tunnel, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Trail, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Ridge, Housatonic Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Br. Valley, Housatonic Br.

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF CONNECTICUT
HIGHWAY DEPARTMENT

BRIDGEPORT QUADRANGLE

CONNECTICUT-FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 BRIDGEPORT 15' QUADRANGLE

(BOTSFORD) (ANSONIA) (MONROE) (WESTPORT) (MILFORD) (SHERWOOD POINT)

73°15' 12'30" 10' 490 000 FEET 73°07'30"
41°15' 150 000 FEET 12'30" 10' 110 000 FEET 41°07'30"

NEWTOWN 13 MI.
STEPNEY DEPOT 3.9 MI.
0.8 MI. TO CONN. 25
SHELTON 6.9 MI.
HUNTINGTON 3.4 MI.
0.9 MI. TO CONN. 8
WATERBURY 24 MI.
SHELTON 5.6 MI.
GEORGE WASHINGTON BRIDGE, N.Y. 53 MI.
0.4 MI. TO CONN. 59
1.9 MI. TO CONN. 110
HARTFORD 46 MI.
UPPER STEPNEY 8.8 MI.
0.5 MI. TO CONN. 15
2.4 MI. TO CONN. 15
SHELTON 7.9 MI.
0.4 MI. TO U.S. 1
MILFORD 4.4 MI.
NEW HAVEN 14 MI.
DANBURY 23 MI.
2 MI. TO CONN. 15
NORWALK 9.7 MI.
WESTPORT 6.1 MI.

EASTON
Chestnut Hill
Long Hill
Ehrsham Pond
Canoe Brook Lake
Trumbull
Brinsmade Cem
Center Sch
Poquonock
Riverside Cem
Long Hill Cem
Frog Pond
Nichols Farm Cem
Nichols (BM 257)
Beaver Dam Lake
Pumpkin Ground
Cooks Pond
Ox Hill
Mill River
Lake Forest
Woodrow Wilson Sch
Ninety Acres Park
Fairchild Wheeler Park
Ireland Brook Lagoon
Englewood Hospital
Stratfield
Childrens Home
Toilsome Hill
Madison Sch
St Vincents Hospital
Seeleys Pond
Park Cemetery
Lincoln Sch
Melville Village
Read Sch
Shelton Sch
Columbus Sch
Nathan Hale Sch
County Jail
Beechwood Park
Brooklawn Country Club
Webster Sch
Golden Hill
Courthouse
Post Office
City Hall
Maplewood Jr High Sch
Mc Kinley Sch
Tunxis Hill Park
Old Stratfield Cem
Washington Sch
Tunxis Hill
Bryant Sch
Bassick High School
Mount Grove Cemetery
Lovejoy Cem
Holland Hill Sch
Whittier Sch
Longfellow Sch
Gas
Oil
Sewage Disposal
St Anns Sch
Black Rock
Black Rock Sch
Burr Creek
Cedar Creek
Ash Creek
Grover Hill
Fairfield
Jennings Beach
Shoal Pt
Fairfield Beach
Penfield Reef
Fayerweather Island
Light
Black Rock Harbor
Bunnells Pond
Success Lake
Success Hill
Second Hill
Hooker Sch
Hallen Sch
Ireland Brook
Television Relay Sta
Hill-Side Home
Bullard-Haven Sch
Beardsley Sch
Stillman Pond
Lakeview Cem
Seaside Park
Mill Hill
Harding High Sch
Garfield Sch
East Bridgeport
St Augustine Cem
Hall Sch
Bridgeport Hospital
East End Freight Yards
Bruce Pond
Waltersville Sch
Newfield
Lincoln Sch
Mc Kinley Sch
Sherman Sch
Steel Pt
Cooks Pt
Radio Tower (WNAB)
Tongue Pt
Radio Tower (WLIZ)
Light
Pleasure Beach
Radio Towers (WICC)
Great Meadows
Lewis Gut
Long Beach
Lordship
Point No Point
Eli Whitney Sch
Sunnyside Hospital
Stonybrook Sch
Garden Sch
Brewster Pond
Long Brook Park
Nichols Sch
Stratford
Union Cem
High Sch
Post Office
Franklin Sch
Center Sch
Academy Hill
Selby Pond
Birdseye Sch
Sedgwick Sch
Housatonic River
Frash Pond
Sewage Disposal
Johnsons Ct
Oil
BRIDGEPORT MUNICIPAL AIRPORT
BRIDGEPORT HARBOR
LONG ISLAND SOUND

INTERIOR-GEOLOGICAL SURVEY, WASHINGTON, D. C.-1953

Mapped, edited, and published by the Geological Survey

Control by USC&GS, USGS, USCE, and Connecticut Geodetic Survey

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1949. Field check 1951
Hydrography from USC&GS charts

Polyconic projection. 1927 North American datum
10,000-foot grid based on Connecticut coordinate system

Red tint indicates areas in which only landmark buildings are shown

12° MAGNETIC NORTH TRUE NORTH
APPROXIMATE MEAN DECLINATION, 1951

SCALE 1:31680

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS 7 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CONNECTICUT
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty 4 LANE | 6 LANE Light-duty
Medium-duty 4 LANE | 6 LANE Unimproved dirt
U. S. Route State Route

BRIDGEPORT, CONN.
NW/4 BRIDGEPORT 15' QUADRANGLE
N4107.5—W7307.5/7.5

1951

10

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF CONNECTICUT
HIGHWAY DEPARTMENT

BRIDGEPORT QUADRANGLE
CONNECTICUT–FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

(BOTSFORD) (LONG HILL) (ANSONIA) (SHERWOOD POINT) (WESTPORT) (MILFORD)

73°15′ 41°15′ 647000m.E. 4567000m.N. NEWTOWN 13 MI. STEPNEY DEPOT 3.9 MI. 0.8 MI. TO CONN. 25 12′30″ HUNTINGTON 3.4 MI. 10′ 0.9 MI. TO CONN. 8 WATERBURY 24 MI. SHELTON 5.6 MI. 490 000 FEET 73°07′30″ 41°15′ 150 000 FEET

GEORGE WASHINGTON BRIDGE, N.Y. 53 MI. 0.4 MI. TO INTERCHANGE 45
UPPER STEPNEY 8.8 MI. 0.5 MI. TO CONN. 15
DANBURY 23 MI. 2 MI. TO CONN. 15
NORWALK 8 MI. 1 MI. TO INTERCHANGE 21
NORWALK 9.7 MI. WESTPORT 6.1 MI.
1.2 MI. TO INTERCHANGE 53 HARTFORD 46 MI.
2.4 MI. TO CONN. 15 SHELTON 7.9 MI.
0.2 MI. TO INTERCHANGE 33 MILFORD 4.4 MI. NEW HAVEN 14 MI.

12′30″ 10′ 110 000 FEET 4555000m.N. 41°07′30″ 73°15′ 470 000 FEET 12′30″ 10′ 41°07′30″ 657000m.E. 73°07′30″

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1963

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, USCE, and Connecticut Geodetic Survey

Topography by photogrammetric methods from aerial photographs taken 1949. Field checked 1951. Revised 1960

Selected hydrographic data compiled from USC&GS Chart 220 (1959)
This information is not intended for navigational purposes

Polyconic projection. 1927 North American datum
10,000-foot grid based on Connecticut coordinate system
1000-meter Universal Transverse Mercator grid ticks,
zone 18, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Red tint indicates areas in which only landmark buildings are shown

12½° MAGNETIC NORTH TRUE NORTH
APPROXIMATE MEAN DECLINATION, 1960

SCALE 1:24000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 6.8 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CONNECTICUT
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route U. S. Route State Route

BRIDGEPORT, CONN.
N4107.5—W7307.5/7.5

1960

10

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF CONNECTICUT
HIGHWAY DEPARTMENT

BRIDGEPORT QUADRANGLE
CONNECTICUT—FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

6366 IV SE (BOTSFORD)
6366 I SW (LONG HILL)
6366 SE (ANSONIA)
6366 III NE (WESTPORT)
6366 II NE (MILFORD)
6366 III SE (SHERWOOD POINT)

73°15′ 41°15′ 73°07′30″ 41°15′
12′30″ 10′
647000m E. 648 649 650 651 653 656 657000m E.
4567000m N. 4565 4564 4563 4562 4560 4559 4558 4557 4556 4555000m N.
490 000 FEET 470 000 FEET
150 000 FEET 110 000 FEET

UPPER STEPNEY 6 MI.
HUNTINGTON 3.4 MI.
DERBY 6 MI.
GEORGE WASHINGTON BRIDGE, N.Y. 53 MI.
0.5 MI. TO INTERCHANGE 48
0.5 MI. TO CONN. 15
2 MI. TO CONN. 15
NORWALK 9 MI.
1.1 MI. TO INTERCHANGE 21
STAMFORD 19 MI.
WESTPORT 16 MI.
1.2 MI. TO INTERCHANGE 53
HARTFORD 46 MI.
0.4 MI. TO CONN. 110
0.2 MI. TO INTERCHANGE 33
NEW HAVEN 13 MI.

EASTON
TRUMBULL
STRATFORD
FAIRFIELD
BRIDGEPORT
LONG ISLAND SOUND
BRIDGEPORT HARBOR

Canoe Brook Lake
Long Hill
Ehrsam Pond
Trumbull
Pequonnock River
Beaver Dam Lake
Pumpkin Ground Brook
Cranberry Brook
Twin Brooks Park
Nichols
Cooks Pond
Chestnut Hill
Ox Hill
Lake Forest
Fairchild Memorial Park
Second Hill
Success Hill
Success Lake
Nichols Farm Cem
Trop Pond
Unity Park
Unity Cem
Spring Pond
North End Park
Ninety Acres Park
Fairchild-Wheeler Park
Island Brook Lagoon
Burnells Pond
Chamberland Pond
Seeleys Pd
Stillman Pond
Lakeview Cem
Toilsome Hill
Stratfield
Tunxis Hill
Mount Grove Cemetery
Melville Village
Mill Hill
East Bridgeport
Newfield
Stratford
Academy Hill
Brewsters Pond
Frash Pond
Housatonic River
Great Meadows
Lewis Gut
Long Beach
Lordship
Point No Point
Black Rock Harbor
Grover Hill
Fayerweather Island
Jennings Beach
Fairfield Beach
Shoal Pt
Tidal Flat
Penfield Reef
Tongue Pt
Steel Pt
Cooks Pt
Pleasure Beach
Bridgeport Municipal Airport

Interchange 47 · 48 · 49 · 50 · 51 · 52 · 53 · 54 · 24 · 25 · 26 · 27 · 28 · 29 · 30 · 31 · 32 · 33

Merritt Parkway · Toll Road · Connecticut Turnpike · Penn Central · Railroad

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, USCE, and Connecticut Geodetic Survey

Topography by photogrammetric methods from aerial photographs taken 1949. Field checked 1951. Revised from aerial photographs taken 1969. Field checked 1970

Selected hydrographic data compiled from USC&GS Chart 220 (1969)
This information is not intended for navigational purposes

Polyconic projection. 1927 North American datum
10,000-foot grid based on Connecticut coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue

Red tint indicates areas in which only landmark buildings are shown

MN GN
12½° 222 MILS
1°12′ 21 MILS
UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 6.8 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CONNECTICUT
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route · U. S. Route · State Route

BRIDGEPORT, CONN.
N4107.5—W7307.5/7.5

1970

AMS 6366 II NW—SERIES V816

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1972

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF CONNECTICUT
HIGHWAY DEPARTMENT

BRIDGEPORT QUADRANGLE
CONNECTICUT—FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

6366 IV SE (BOTSFORD)
6366 I SE (ANSONIA)
6366 I SW (LONG HILL)
6366 II NE (WESTPORT)
6366 II NW (SHERWOOD POINT)
6366 I NE (MILFORD)

73°15′ 41°15′ 73°07′30″ 41°15′
10′ 12′30″ 10′ 12′30″
647000m E. 648 650 651 653 656 490 000 FEET
4567000m N. 4565 4563 4562 4559 4558 4555 110 000 FEET 4554
150 000 FEET 4567 4564 4563 4560 4559 4558 4557 4556 4555000m N.
648 649 470 000 FEET 650 651 652 653 654 655 656 657000m E.

UPPER STEPNEY 6 MI.
HUNTINGTON 3.4 MI. DERBY 6 MI.
0.4 MI. TO INTERCHANGE 46
0.5 MI. TO CONN. 15
2 MI. TO CONN. 15
NORWALK 9 MI. 1 MI. TO INTERCHANGE 21
STAMFORD 19 MI. WESTPORT 6 MI.
1.2 MI. TO INTERCHANGE 53 HARTFORD 46 MI.
0.4 MI. TO CONN. 110
0.2 MI. TO INTERCHANGE 33 NEW HAVEN 13 MI.

EASTON
TRUMBULL
STRATFORD
FAIRFIELD
BRIDGEPORT
LONG ISLAND SOUND
BRIDGEPORT HARBOR

Canoe Brook Lake
Canoe Brk.
Long Hill
Long Hill Cem
Middlebrook Sch
Riverside Cem
Pequonnock
Ehrsam Pond
Beaver Dam Lake
Pumpkin Ground Brook
Cemetery Pond Brk.
Chestnut Hill
Water Tank
St Theresas Sch
Edison Sch
Brinsmade Cem
Center Sch
TWIN BROOKS PARK
St Catherines Ch
BM 289
Frog Pond
Nichols Farm Cem
Nichols
Cooks Pond
INTERCHANGE 50
INTERCHANGE 51
INTERCHANGE 52
INTERCHANGE 49
INTERCHANGE 48
INTERCHANGE 47
Unity Cem
Unity Park
Pequonnock River
Ox Hill
Ox Hill Brook
St Nicholas Ch
Notre Dame High Sch
Substation
Cross Sch
FAIRCHILD MEMORIAL PARK
Lake Forest
Johnson Sch
Fire Sta
Hallen Sch
Woodrow Wilson Sch
NINETY ACRES PARK
St Andrews Sch
Island Brook Lagoon
Sheridan Sch
Water Tank
FAIRCHILD WHEELER PARK
Londons Brk.
Dunigan Sch
Holy Trinity Ch
Notre Dame High Sch
Radio Tower (WNAB)
Fire Sta
Police Sta
Bunnells Pond
Success Lake
Success Hill
Stratford
Brewsters Pond
Garden Sch
Nichols Avenue Sch
Stonybrook Sch
Brook
East Side Sch
Hill Side Homes
Bollard-Haven Sch
Bethany Ch
High Sch
Union Cem
Tollgate
Stratfield
Stratfield Sch
Unquowa Sch
Our Lady of the Assumption Sch
Tollsome Hill
Salem Ch
Park
Fire Sta
Madison Sch
Blackham Sch
Read Sch
Park Cemetery
St Vincents Hospital
Svihra Park
St Pauls Ch
Beardsley Sch
Drive-in Theaters
Stillman Pond
Lakeview Cem
Old Mill Green
Edison Sch
Clover Field
Holy Name of Jesus Sch
Frank Franklin Sch
St Johns Ch
Center Sch
Melville Village
Warde High Sch
Jennings Sch
Fairfield Woods Sch
Brooklawn Country Club
Nathan Hale Sch
Central High Sch
Wetstone Sch
Columbus Sch
St Josephs Sch
Shelton Sch
Library
Fire Sta
Police Sta
Holy Rosary Sch
East Bridgeport
Library
St Augustine Cem
Barnum Sch
St Charles Sch
Garfield Sch
Fire Sta
Harding High Sch
St Amrose Sch
Bridgeport Hospital
Hall Sch
Mill Hill
East End Freight Yards
Bruce Pond
Second Hill
Second Hill Lane Sch
Our Lady of Grace Sch
Hooker Sch
Wooster Park
Wooster Jr High Sch
Eli Whitney Sch
Bunnell High Sch
St Marks Sch
North End Park
Spring Pond Park
Armory
St Johns Cem
St John the Baptist Ch
Beaver Dam Lake
Pumpkin Ground
Cemetery Pond
Brk.
Ranney Stream
Success Hill
Success Lake
Newfield
Library
Lincoln Sch
McKinley Sch
Blessed Sacrament Sch
Honeyspot Sch
Birdseye Sch
Johnson Jr High Sch
Sewage Disposal
Housatonic River
U.S. MIL RES Frash Pond
Cooks Pt
Steel Pt
Tongue Pt Lt
Light
Light
Light
Light
Fayerweather Island
Black Rock Harbor
Grover Hill
Jennings Beach
Fairfield
Veterans Park
Shoal Pt
Penfield Reef
Tidal Flat
Tidal Flat
Tidal Flat
Tidal Flat
Pleasure Beach
Great Meadows
Lewis Gut
Long Beach
Point No Point
Lordship
IGOR SIKORSKY MEMORIAL AIRPORT
Housatonic River
Academy Hill
Christ Ch
St James Sch
Selby Pond
Tunxis Hill
Tunxis Hill Park
Old Stratfield Cem
Loyalty Cem
Holy Family Sch
Holland Hill Sch
Fire Sta
MOUNT GROVE CEMETERY
Nathan Hale Sch
Clinton Park
Maplewood Jr High Sch
Maplewood Sch
St Peters Sch
Bryant Sch
Bassick High Sch
Howe Sch
Roosevelt Sch
Klein Memorial Auditorium
Federal Courthouse
Park City Hospital
St Anthonys Sch
Sacred Heart Sch
Playground
Library
Police Sta
City Hall
St Augustine Cathedral
St Michaels Sch
St Marys Sch
Franklin Sch
Waltersville Sch
St Michaels Cemetery
McKinley Sch
Lincoln Sch
Blessed Sacrament Sch
Newfield Sch
Marina
Convent
Jefferson Sch
UNIVERSITY OF BRIDGEPORT
Whittier Sch
St Stephens Sch
Longfellow Sch
Sewage Disposal
Police and Fire Sta
Library
Black Rock
St Anns Sch
Grasmere Sch
Heliport
Navy Reserve Center
Burr Creek
Cedar Creek
Ash Creek
Mill Creek
Rooster River
Pequonnock River
Yellow Mill Channel
Bunnells Pond
Success Lake
Stillman Pond
Bruce Pond
Brook
Marina
Mill Hill
Edison Sch
St Amrose Sch
Harding High Sch
Bridgeport Hospital
Hall Sch
Police Sta
Fire Sta
Garfield Sch
St Charles Sch
Fire Sta
Putnam
Arctic
Park
Barnum Sch
Holy Rosary Sch
Koltbe High Sch
Wetstone Sch
Columbus Sch
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Library
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Klein Memorial Auditorium
Cem
Fire Sta
Maplewood Sch

Phase I Environmental Site Assessment Update for the RBD Pilot Project

PHASE I ENVIRONMENTAL SITE ASSESSMENT UPDATE

RBD PILOT AREA

CONNECTICUT DEPARTMENT OF HOUSING/BRIDGEPORT, CT

DRAFT

PROJECT NO.: 52829NDR
DATE: DECEMBER 2018

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1.0 SUMMARY

WSP USA (WSP) completed a Phase I Environmental Site Assessment (ESA) Update for the property identified as the Rebuild by Design (RBD) Pilot Area in Bridgeport, Connecticut (the "Site"). This Phase I ESA was conducted in general conformance with the American Society for Testing Materials (ASTM) Standard E 1527-13. The purpose of this Phase I ESA update was to investigate and identify land uses that may have the potential to impact the environmental conditions at the Site.

The Site consists of approximately 4.44 acres of land. Approximately 3.29 acres of the Site is part of the western parcel, known as Block 1 of the Marina Village Housing Complex. The southern portions of four, two-story brick apartment buildings extend onto the Site. Adjacent areas to the northeast and south, also within the complex and part of the Site are vacant. The vacant areas are an active construction site, as former Marina Village Housing Complex apartment buildings have been recently demolished. The remaining 1.15 acres of the Site include portions of adjacent concrete sidewalks and paved roadways along South Street, Iranistan Avenue, Ridge Avenue, Columbia Street and Johnson Street. Currently, the four Site apartment buildings appear to be occupied by tenants. The Site buildings are heated by natural gas and serviced by municipal sewer services.

The Site is located in an area identified by the Connecticut Department of Energy and Environmental Protection (CTDEEP) as Class "GB", indicating that the groundwater is presumed to be unsuitable for direct human consumption without pretreatment. Public water service is available at the Site and surrounding properties. Based on topography at the Site and surrounding area, groundwater flow is presumed to flow to the west. Previous environmental reports inferred groundwater flow in a westerly direction. Observed groundwater from monitoring wells installed in the vicinity of the Site were reported at depths of approximately 8 and 9 ft bg (feet below grade).

Historical resources indicate the Site, aside from the roadway portions which appear to have remained constant, was originally occupied by several residential dwellings prior to the construction of the Marina Village Housing Complex in the late-1940s to 1950. However, early Sanborn Fire Insurance Maps indicate a thin strip of the Site, the approximate northern perimeter parallel to Ridge Avenue, may have been occupied by buildings associated with former foundry operations of the Bridgeport Malleable Iron Works/Eastern Malleable Iron Company. Site operations associated with the metal foundry reportedly included the manufacturing of malleable and grey iron castings. Additionally, coal was utilized to fuel the foundry operations which were listed as annealing, trimming, core making, tumbling and molding. As such, historical material use likely involved use of coal, metals, oils and solvents.

Previous environmental investigations have been completed for the entire Marina Village Housing Complex in preparation for redevelopment of the neighborhood. Results of these investigations identified recognized environmental concerns (RECs) across the complex, generally as result of historical manufacturing and industrial operations conducted by Bridgeport Malleable Iron Works/Eastern Malleable Iron Works, Hotchkiss Sons Manufacturers Curry Combs & Company and Reliable Steel Drum Corporation, as well as tanks associated with former Site heating systems and a #2 fuel oil release at the complex. A total of nine RECs were identified as follows: 1) historical foundry operations; 2) historical metal pickling operations; 3) historical manufacturing operations; 4) historical japanning operations; 5) historical steel drum reconditioning; 6) historical coal storage; 7) historical urban fill; 8) #2 fuel oil release; and 9) underground storage tanks.

Two previous subsurface investigations completed across the entire housing complex, and included the advancement of 20 soil borings, the installation of 7 monitoring wells, and the sampling and collection of 20 soil samples and 7 groundwater samples. Two monitoring wells and one soil boring were completed near the Site boundary, however, without a survey of the area, it appears that only one monitoring well maybe located within the RBD Pilot Area. Urban fill materials and elevated concentrations of polyaromatic hydrocarbons (PAHs) and select total and leachable metals were detected in the nearby soil samples. Elevated PAHs and select metals were also

identified in the two nearby groundwater samples above CTDEEP Remediation Standard Regulation (RSR) groundwater criteria. Remedial efforts completed in 2016 by Freeman Companies included the excavation, removal and offsite transport and disposal of over 4,235 tons of impacted soils on Block 2/eastern parcel of the Marina Village Housing Complex. Impacted soils included elevated concentrations of PAHs, extractable total petroleum hydrocarbons (ETPH), arsenic and polychlorinated biphenyls (PCBs) above CTDEEP RSR soil criteria. The remedial excavation was complete offsite to the northeast of the Site.

The Site appears to be identified in researched environmental databases, including the Voluntary Cleanup Program, and Asbestos and National Pollutant Discharge Elimination Database as a result of recent redevelopment and construction activities at the Site. Several area properties were identified on the ASTM database, which could have an impact on the environmental quality of the Site; however, most were located in an area where a potential offsite release would not be expected to have a significant impact on the Site. One possible exception is 401 Park Avenue, located approximately 487 feet east/northeast of the Site. This Site was identified on the Connecticut Leaking Underground Storage Tank database with releases of motor fuel, gasoline and waste oil from an underground storage tank. The LUST status is listed as complete and the database indicates soil was excavated and monitoring wells were sampled however additional details were not provided.

Previous environmental investigations completed for the Marina Village Housing Complex indicated a release of #2 fuel oil was reported in December 1999 in the basement of Community Building located adjacent to the north of the Site. Eighteen (18) inches of #2 fuel oil (estimated as 4,500-gallons) was observed covering the 400-square foot basement floor. Two days later when the spill was reported, only 4 inches of oil covered the basement floor. The release was attributed to the boiler room associated tanks for the complex. No additional documentation of any cleanup, tank removals or remediation has been located, and based on its proximity to the Site, it may have impacted the environmental quality of the Site.

Section 22a-134 of the Connecticut General Statutes (CGS), known as the Connecticut Transfer Act, requires environmental investigation and potentially remediation of hazardous waste "establishments" after a qualifying "transfer of establishment". Based on the information obtained in the course of this investigation, the RBD Pilot Area does not appear to qualify as an "establishment" based upon its use as a dry cleaner, furniture stripper or vehicle body repair facility. Additionally, no documentation of any hazardous wastes was located for the Site.

This assessment has revealed evidence of recognized environmental condition (RECs) in connection with the Site as follows:

1. Historic Urban Fill: Previous subsurface investigations of the Marina Village Housing Complex have identified urban fill containing asphalt, concrete, red brick, coal, ash, etc. from previous industrial and manufacturing site operations including the demolition of associated former factory structures. These materials were observed in shallow soils up to approximately 12 ft bg in areas investigated across the Marina Village Housing Complex and were identified in soil samples collected on or directly adjacent to the Site. Laboratory results of the urban fill materials identified elevated concentrations including PAHs and select total and leachable metals above CTDEEP RSR soil criteria. Similarly, these constituents of concern were also detected in groundwater samples collected from monitoring wells installed across the complex.
2. Several residential dwellings were formerly located along the north side of Ridge Avenue at the Site prior to the construction of the Marina Village Housing Complex. Based on the age of these structures, it is likely potential fuel oil USTs associated with former heating systems of the residences were utilized and may still be in place.

3. Previous investigations of the Site vicinity identified a spill report for a #2 fuel oil release within the basement of the Marina Village Housing Complex Community building which is located adjacent to the north of the Site. On December 7, 1999 18 inches of #2 fuel oil was observed covering the 400-square foot basement and estimated to be a 4,500-gallon spill. However, the release was reported on December 9, 1999, and at that time only 4 inches of oil remained on the floor. The spill status is reported as closed, however no additional information was located in the file search. Based on the quantity and proximity of the release, it may have impacted the soil and groundwater at the Site.

Without a survey of the Site boundaries previous soil boring/monitoring well locations, and approximate boundaries of former industrial/manufacturing occupants, it is unclear if site operations associated with former industrial processes with Bridgeport Malleable Iron Works/Eastern Malleable Iron Works were conducted at the RBD Pilot Area. Regardless, site operations including a historic foundry and metal pickling operations are also considered RECs for the Site based on the long history of site usage and the proximity to the Site. These former operations involved the use of petroleum products/oils, solvents, heavy metals and hazardous materials from the metal foundry, manufacturing and metal pickling operations, including coal ash, other foundry by-products.

2.0 INTRODUCTION

WSP USA (WSP) has completed a Phase I Environmental Site Assessment (ESA) for the property identified as the Rebuild by Design (RBD) Pilot Area in Bridgeport, Connecticut. This Phase I ESA was conducted in general conformance with the American Society for Testing Materials (ASTM) Standard E 1527, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment".

2.1 Purpose

Connecticut Department of Housing requested that WSP conduct a Phase I ESA update to evaluate the current environmental condition of the Site. The purpose of this Phase I ESA update was to investigate and identify current and past uses of the Site and the practices that may have led to situations referred to as recognized environmental conditions (REC). REC means the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater or surface water of the property. The term is not intended to include de minimis conditions that generally do not represent a material risk of harm and that generally would not be the subject of an enforcement action. Historical recognized environmental conditions (HREC), a term defined as closed releases that have been cleaned up to the satisfaction of the applicable regulatory authority or an unrestricted use criteria and controlled recognized environmental conditions (CREC) defined as a closed release that has been cleaned up but not to unrestricted use criteria such as industrial or commercial standards. Finally, significant data gaps are identified and commented upon when they affect the ability of the environmental professional to identify RECs.

2.2 Scope-of-Services

The scope of work included: a Site inspection, identification of the current land uses on the Site and adjacent properties, a search of federal and state regulatory databases, a review of aerial photographs, city directories, and Sanborn fire insurance maps; and inquiries of persons knowledgeable of the property and local agencies, including the Fire Marshal and Health Department. Future land uses or situations on either the Site or adjacent properties are outside the scope of work.

2.3 Significant Assumption

Based on topography of the Site and surrounding area, it is assumed the groundwater flow for the Site is generally to the west. Additionally, information provided by others is assumed to be fair and accurate.

2.4 User Reliance

This Phase I ESA update was conducted for the use and reliance by the Connecticut Department of Housing. No use of the information contained in this report by others is permissible without receiving prior written authorization to do so from WSP.

3.0 SITE DESCRIPTION

3.1 Location and Legal Description

The Site generally consists of the southern portion of the 400 Iranistan Avenue parcel (the western parcel or Block 1 of the Marina Village Housing Complex) and adjacent sections of South Street, Iranistan Avenue, Columbia and Johnson Streets in Bridgeport, Connecticut (Figure 1). In total, the Site consists of approximately 4.4 acres of land of which 3.29-acres are within the 400 Iranistan Avenue parcel. The remaining approximate 1.15 acres consist of adjacent paved sections of the abovementioned roadways. The portion of the Site that lies within the 400 Iranistan Avenue parcel is listed on the Bridgeport Tax Assessor's property records as Map 21, Block 401, Lot 1. The remainder of the Site consists of portions of city streets and avenues which are not included in tax assessor property records. A copy of an online map that include the Site and the property tax cards for the Site, including the entire Block 1 of the Marina Village Housing Complex are attached as Appendix I.

3.2 Current Use of Property

The Site consists of approximately 4.4-acres of land, which is currently occupied by the southern portions of four residential apartment buildings totaling approximately 21,492 square feet. A summary of the Site parcel information is presented in the following table.

Address	Description	Construction Date
400 Iranistan Avenue	Bldg 18 (5,508 square foot 2-story building)	1950
	Bldg 19 (5,238 square foot 2-story building)	1950
	Bldg 20 (5,238 square foot 2-story building)	1950
	Bldg 21 (5,508 square foot 2-story building)	1950

The Site buildings are residential. The western portion/Block 1 of the Marina Village Housing Complex formerly consisted of 26 apartment buildings and 1 community building/boiler room. Since 2016, 10 of the apartment buildings have been demolished (#22 to 31) and the majority of these former building footprints appear to be within the boundaries of the Site RBD Pilot Area. A Site Map depicting the relative locations of pertinent Site features is presented as Figure 2.

3.3 Site Vicinity General Characteristics

The Site is zoned R-C indicating a multi-family residential zone. The general vicinity of the Site is developed with residential uses or vacant land that was previously occupied by residential buildings. The Site area is served by public water and sewer services.

3.4 Description of Structures, Roads & Other Improvements on the Site

The Site buildings consist of two-story brick buildings reportedly constructed with crawl space basements. The areas surrounding the buildings are grassed/landscaped areas with concrete sidewalks. Vacant land, which is an active construction site, is located adjacent to the south and northeast of the Site buildings. This portion of the property is surrounded by chain-link fencing with locked gates. Former Marina Village Housing Complex residential apartment buildings have been demolished and the ground cover consists of soil and rubble piles. The remaining portions of the Site include concrete sidewalks along the adjacent streets and/or portions of paved roads including South Street, Iranistan Avenue, Ridge Avenue, Columbia Street and Johnson Street.

3.5 Current Uses of the Adjoining Properties

The Site abuts by the additional Marina Village Housing Complex apartment buildings to the north with South Avenue beyond; by residential properties to the east; by Ridge Avenue to the south with residential properties beyond and by residential properties to the west.

4.0 USER PROVIDED INFORMATION

WSP requested information from Connecticut Department of Housing, the User, including items identified within the User Questionnaire as specified in ASTM E1527-13. Information provided by the User is included in the section below.

4.1 Title Records

Chain of Title research documents were not provided.

4.2 Environmental Liens or Activity and Use Limitations

Information identifying the presence of environmental liens or activity and use limitations was not provided. We note that limited title research completed at the Bridgeport Town Clerk's office did not identify any evidence of environmental liens or activity and use limitations (Section 5.2.1). Furthermore, such instruments were not identified within the environmental database research (Section 5.4) or by regulatory agency file reviews (Section 5.5).

4.3 Specialized Knowledge

Connecticut Department of Housing does not have any specialized knowledge or experience related to the property or nearby properties.

4.4 Commonly Known or Reasonably Ascertainable Information

Connecticut Department of Housing was not aware of any commonly known or reasonably ascertainable information, which would assist the environmental professional in identifying conditions indicative of a release or threatened release of hazardous or toxic substances except as presented in previous environmental reports (Section 5.3).

4.5 Valuation Reduction for Environmental Issues

Connecticut Department of Housing did not provide information that would indicate that the property value was reduced for environmental issues.

4.6 Reason for Phase I ESA

This Phase I ESA update was completed to determine current or past uses may have impaired soil and/or groundwater on the Site.

5.0 RECORDS REVIEW

5.1 Physical Setting Sources

5.1.1 Regional Physiology

The Site is located on the U.S. Geological Survey (USGS), Bridgeport, Connecticut topographical quadrangle. Topography at the Site generally slopes down to the south and southwest from an approximate elevation of 15 feet above mean sea level (ft amsl) along Johnson Avenue to approximately 6 ft amsl at the northern corner of Iranistan and Ridge Avenues. Locally, the area topography is similar to the Site topography and slopes gently to the southwest.

5.1.2 Geologic Conditions

The surficial geology at the Site is mapped on the Surficial Material Map of Connecticut (1992) as two units. The majority of the Site is mapped as sands overlying finer materials. A small portion of the western end of the Site is mapped as artificial fill which indicates the area was filled with material from an unknown source. Previous subsurface investigations completed in the vicinity of the Site encountered fill materials (including concrete, brick and ash) over sand and silty soils. Fill materials were noted in soils located between the Site and South Avenue to the north at depths ranging up to 6 ft with deeper fill materials, including an old building foundation in the vicinity of the Marina Village Community building.

The Bedrock Geologic Map of Connecticut (1985) does not provide a determination of the bedrock underlying the Site. Surrounding bedrock types are metamorphic in nature.

5.1.3 Hydrologic Characteristics and Known Uses

The Site is located in an area identified by the Connecticut Department of Energy and Environmental Protection (CTDEEP) as Class "GB" indicating that the groundwater is presumed to be unsuitable for direct human consumption without pretreatment. Based on the topography at the Site and surrounding area, groundwater flow is presumed to flow to the west. Groundwater was observed in the vicinity of the Site in previous investigations at depths approximately 8 to 9 ft bg.

The closest water body is the Cedar Creek, which is located approximately 350 feet west of the Site. The water body is mapped as Class SC/SB (CTDEEP, 2006). This designation indicates that it is known or presumed to not meet the water quality criteria for one or more of the designated uses, which may include habitat for marine fish, other aquatic lift and wildlife; commercial shellfish harvesting; recreation; industrial water supply and navigation.

The State of Connecticut Department of Public Health (DPH) GIS mapping does not identify any regulated public water supply sources, reservoirs or watershed areas within one-half mile radius of the Site. The DPH mapping indicates that public water service is available to the Site and surrounding area by the Aquarion Water Company.

The CTDEEP Aquifer Protection Program web-based mapping does not identify aquifer protection areas in Bridgeport.

5.2 HISTORICAL USE INFORMATION

5.2.1 Aerial Photographs

WSP reviewed aerial photographs of the Site at online resources for the years 1934, 1951, 1965, 1970, 1985, 1996 and 2004. The following is a summary of the aerial photographs.

The 1934 aerial photograph is difficult to distinguish however several small structures appear visible adjacent to the north of Ridge Avenue. Larger rectangular buildings are depicted to the north of the Site. The 1951 and subsequent photographs illustrate the Site parcel and areas beyond as developed with the Marina Village Housing Complex. Adjacent roadways including South Street, Iranistan and Ridge Avenues, Columbia and Johnson Streets appear similar as they do today.

5.2.2 City Directories

WSP reviewed City Directories at the State Library in Hartford, Connecticut to supplement our understanding of historical Site occupancy. Bridgeport Directories were reviewed as approximately 10-year intervals for the available years spanning 1961 through 2018. WSP reviewed addresses for the Marina Village Housing Complex which were listed on Iranistan Avenue, Ridge Avenue, Columbia and Johnson Streets. Residential listings were identified for the occupied apartments located at the Site. A copy of the reviewed city directories are included in Appendix II.

5.2.3 Historical Topographic Maps

WSP reviewed historical topographic maps for the years 1951, 1960, 1970 and 1984 on on-line resources. Each of the reviewed topographic maps illustrate the Site and vicinity as shaded pink indicating a heavy developed area with only landmarks shown. Interstate 95 is illustrated to the north and the University of Bridgeport is shown to the southeast of the Site.

5.2.4 Sanborn Fire Insurance Maps

Sanborn Fire Insurance Maps included coverage for the Site vicinity for the years 1884, 1889, 1898, 1913, 1939, 1950 and 1972. The 1884 Sanborn map did not provide coverage for the Site, however areas to the west along South Avenue were illustrated with several buildings associated with Hotchkiss Sons Mfrs. Curry Combs & Co. and Bridgeport Malleable Iron Works. By the 1889 Sanborn, Bridgeport Malleable Iron Works appears to have expanded to the southeast, and beyond several residential dwellings are depicted at the northwest corner of Columbia Street and Ridge Avenue. The 1898 Sanborn appears similar to the 1889 Sanborn with additional building development at Bridgeport Malleable. Additional residential dwellings are visible to the southwest corner of Columbia Street and Ridge Avenue intersection. By the 1913 Sanborn residential dwellings are depicted to the north of Ridge Avenue between Iranistan Avenue and Columbia Street and north of Johnson Street at the eastern

end of the Site. Additionally, the Sanborn map appears to show Johnson Street, Columbia Street, Ridge Avenue, Iranistan Avenue and South Avenue in similar configurations as they are today. By the 1939 Sanborn, residential dwellings are shown at the northwest corner of Ridge Avenue and Columbia Street to approximately halfway down Ridge Avenue. Residential dwellings are also shown along the north side of Johnson Avenue. Areas west and north of the Site appear vacant as the former industrial buildings have been razed. The 1950 and 1972 Sanborn map illustrate a total of 27 buildings at the western, Block 1 parcel of the Marina Village Housing Complex. Twenty-six (26) of the buildings are two-story brick apartment buildings and one building is labeled as Community Hall with an associated boiler room and office.

5.2.5 Municipal Sources

The City of Bridgeport's Assessor records indicate the Site buildings were constructed in 1950.

5.3 Previous Environmental Investigations

WSP was provided with several previous environmental reports that were prepared for the Marina Village Housing Complex. These reports included the following:

1. September 2013 Phase I Environmental Assessment of Marina Village, 400 Iranistan Avenue in Bridgeport, Connecticut by Fuss & O'Neill (p. 13)
2. May 2015 Environmental Evaluation and Materials Management Report, Marina Village Housing Complex, Bridgeport, Connecticut by Freeman Companies, LLC. (p. 766)
3. June 2016 Environmental Evaluation and Materials Management Report, Marina Village Housing Complex, Bridgeport, Connecticut by Freeman Companies, LLC. (p. 945)
4. August 2016 Close-Out Report, Marina Village Redevelopment – Phase I, Bridgeport, Connecticut by Freeman Companies, LLC (p. 1062)
5. November 7, 2016 Phase I Environmental Site Assessment Update of Marina Village Housing Complex in Bridgeport, Connecticut by Freeman Companies, LLC.

Copies of these reports are included electronically on the flash drive included as Appendix III. Details from these reports are distributed throughout this report and a summary of the key findings of the various investigations follows.

Fuss & O'Neill 2013 Phase I ESA

Fuss & O'Neill (F & O) completed a Phase I ESA for the Marina Village Housing Complex which consists of thirty-nine buildings, a 389 unit apartment complex with a community/maintenance building with a former heating plant. The complex includes two parcels bound by Iranistan Avenue to the west, South Avenue to the northwest, Railroad Avenue to the north, Park Avenue to the east, Johnson Street to the southeast and Ridge Avenue to the south. Columbia Street bisects the village complex. F&O indicates the buildings were constructed in the late-1940s to 1950. The Site buildings were reportedly heated by steam from a central boiler room located in the Community Building located at the north end of the western parcel along South Street. F&O indicated the switch

from steam to natural gas was sometime in the 1990s, likely around the time the oil tanks were removed from the Community Building basement in 1999. These oil tanks fueled a former oil-fired boiler system.

F&O indicated a leaking underground storage tank (LUST) was reported on December 9, 1999 at 733 South Avenue, the Marina Village Community building located along South Street at the northern end of the parcel (west of Columbia Street). A total of eighteen inches of #2 fuel oil from an underground tank failure covered the floor of a 400-square foot room on December 7, 1999. By December 9, 1999 four inches of oil covered the floor, however it was unclear as to where/why the thickness of oil had decreased, how many associated tanks were buried outside, and the quantities of these supposed tanks. F&O indicated the EDR report noted that the local fire department, fire marshal and CTDEEP (formerly the Connecticut Department of Environmental Protection (CTDEP)) were notified, however no other pertinent information was located. F&O concluded that the oil release was likely from an aboveground storage tank in the basement rather than underground storage tanks following their site inspection.

F&O did not identify any activities that would qualify the Marina Village parcel as an "establishment" however they recommended the use of legal counsel to determine the regulatory status with respect to the Connecticut Transfer Act. F&O identified nine RECs, including: 1) historical foundry operations; 2) historical metal pickling operations; 3) historical manufacturing operations; 4) historical japanning operations; 5) historical steel drum reconditioning; 6) historical coal storage; 7) historical urban fill; 8) #2 fuel oil release and 9) underground storage tanks.

Freeman Companies May 2015 Environmental Evaluation and Materials Management Report

Freeman Companies (Freeman) completed a subsurface investigation of the eastern parcel (east of Columbia Street), known as Block 2 of the Marina Village housing complex based on the long history of industrial activities and manufacturing operations at the property identified in the 2013 F&O Phase I ESA. Bridgeport Malleable Iron Works (a/k/a Eastern Malleable Iron Company) manufactured malleable and grey iron castings. This property is the northeastern abutting property. Site operations included annealing, trimming, core making, tumbling, grinding, rolling and molding. Additional former occupants included the Hotchkiss Sons' Manufacturers Curry Combs & Company which included japanning, tempering and scouring various metals and the former Reliable Steel Drum Corporation reconditioned steel drums.

Freeman completed a total of ten soil borings (B-1 to B-10) across the eastern parcel. These borings were advanced up to 20 feet below grade. Materials encountered included fill (containing concrete, brick, asphalt, glass, brick and unknown white and black materials) up to ten feet below grade over sandy and silty soils. Groundwater was measured from approximately 6 to 11 feet below grade. One soil sample from each boring was collected from a discrete two foot interval (ranging between 2 and 12 feet below grade) and analyzed for volatile organic compounds (VOCs) by EPA Method 8260, extractable total petroleum hydrocarbons by Connecticut methodologies (CT ETPH), polyaromatic hydrocarbons (PAHs) by EPA Method 8270, polychlorinated biphenyls (PCBs) by EPA Method 8082, Total CT listed metals and/or selected leachable CT metals using the synthetic precipitation leaching procedures (SPLP). Concentrations of PAHs and ETPH were reported above CTDEEP Remediation Standard Regulations (RSR) soil criteria in the fill materials detected in borings B5 and B7. Total arsenic was also detected in these two soil samples, and in boring B8, above CTDEEP RSR soil criteria. PCBs were detected in boring B7 above CTDEEP RSR soil criteria. Additional select total metals were detected in each of the soil samples, however none were above CTDEEP RSR soil criteria. These locations are generally centrally located at the northern end of the parcel.

Three monitoring wells were completed (MW-1 to MW-3) at Block 2 and groundwater samples were collected for analyses for VOCs, PAHs and CT listed total metals. Freeman indicated that VOCs were not detected in any of the wells above the CTDEEP RSR Residential Volatilization Criteria. Concentrations of PAHs were

identified in wells MW-2 and MW-3 above the Surface Water Protection Criteria (SWPC) and total metals were reported above the SWPC in wells MW-1 and MW-3.

Based on their investigation, Freeman identified three distinct soil types and included recommendations for soil management and remediation. In general, they concluded the contaminated soils detected from borings B5 and B7 should be excavated and transported offsite for proper disposal. Freeman recommended further analytical testing during future demolition activities to define, delineate and characterize site soils, and the report included an estimate of 2,000 to 5,000 tons of material that may need to be transported offsite for disposal.

Freeman Companies June 2016 Environmental Evaluation and Materials Management Report

Freeman completed a subsurface investigation of the western parcel (a/k/a Block 1) of the Marina Village Housing Complex that included the advancement of ten soil borings, completion of four groundwater monitoring wells and the sampling and collection of ten soil and four groundwater samples. The soil borings and wells were installed to the north/northwest of the Site (Figure 2). Select soil samples were analyzed for VOCs, ETPH, PAHs, PCBs and total and leachable RSR listed metals whereas groundwater samples were analyzed for VOCs, PAHs and total RSR listed metals. Soils encountered included "urban fill" which contained asphalt, concrete, red brick, coal and ash over sand and silty soils. One soil sample from each of the ten locations was collected from depths ranging from 2 to 8 feet below grade. Laboratory results identified PAHs and ETPH at concentrations above CTDEEP RSR soil criteria in borings SB-1 and SB-4. PAHs were also reported above CTDEEP RSR soil criteria in soil from boring MW-2. These three soil samples were collected from the northern portion of the parcel, in the vicinity of the South Avenue and Columbia Street intersection. Other detections including naphthalene and select total and leachable metals were detected in other soil samples at the parcel, however reported below CTDEEP RSR soil criteria. VOCs were not detected above CTDEEP RSR groundwater criteria in the groundwater samples collected from the four site wells. PAHs and select total metals were identified above the SWPC in wells MW-3 and MW-4; select total metals were also reported above the SWPC in well MW-1.

Freeman Companies Close-Out Report August 2016

Based on the May 2015 subsurface investigation of the eastern parcel of the Marina Village Housing Complex, also known as Block 2, Freeman monitored the excavation, removal and offsite disposal of contaminated soil and fill materials. Freeman indicated three types of soil/fill materials were removed from the parcel including ash filled areas, demolition debris and soils impacted with PAHs and PCBs. In total, approximately 4,235 tons of material was excavated, removed and transported offsite to the Chicopee Landfill in Chicopee, Massachusetts (~732 tons) and the Coventry Landfill in Coventry Rhode Island (~3,503 tons) for reuse. The remedial excavation is generally located across the central portion of the eastern parcel.

The impacted materials were reportedly the result of historical site operations from the Eastern Malleable Iron Company which included fill materials and ash. Freeman reported these materials were removed to depths of native sand encountered below. Freeman indicated closure soil samples were collected from the bottom of the remedial excavation areas for analyses of PAHs. PAHs were not detected in the analyzed closure samples.

Lastly, Freeman described reusing the urban fill materials as part of the redevelopment. Freeman indicated urban fill material that contains soil demolition debris, asphalt, brick, concrete, glass, ceramics, wood ash, coal and or coal ash with typical low level concentrations of PAHs and metals will be reused under new building foundations, below 2 feet of clean fill or below paved parking areas with three-inches of asphalt.

Freeman Companies November 2016 Phase I ESA

Freeman Companies (Freeman) completed a Phase I ESA update (of the 2013 F&O Phase I) for the entire Marina Village Housing Complex. Freeman indicated the Site is located at 400 Iranistan Avenue in Bridgeport, Connecticut and includes two adjacent parcels of land that total 15.9 acres. The Site is bound to the north by South Street and Railroad Avenue, Park Street to the east, Johnson Street and Ridge Avenue to the south and Iranistan Avenue to the west. Columbia Street is located between the two Site lots. Freeman indicated the Site has a long history of industrial and manufacturing operations prior to the construction of the Marina Village in the late-1940s. Nine RECs, the same identified in the 2013 F&O Phase I ESA were listed and include: 1) historical foundry operations; 2) historical metal pickling operations; 3) historical manufacturing operations; 4) historical japanning operations; 5) historical steel drum reconditioning; 6) historical coal storage; 7) historical urban fill; 8) #2 fuel oil release; and 9) underground storage tanks.

This 2016 ESA update also summarized the previous 2015 and 2016 Freeman investigations and remedial efforts conducted at the Site.

5.4 Standard Environmental Record Sources

Federal, state and tribal environmental databases were reviewed for the Site in an effort to determine the regulatory status of the Site and to establish the location of surrounding properties with environmental records. A search of U.S. Environmental Protection Agency (U.S. EPA) and Connecticut Department of Energy and Environmental Protection (CTDEEP) databases was completed by an independent firm, Environmental Data Resources Inc. (EDR).

Based on the topography of the area and the inferred groundwater flow direction, releases within approximately 500 feet to the east of the Site were considered to have the potential to impact the environmental condition of the Site. The facilities identified by the EDR database search were evaluated to determine if they are within this potential area of concern. Search Radii, Geographic Information Systems (GIS) maps of the appropriate databases, and a copy of the database report are included in Appendix IV.

5.4.1 Federal Environmental Record Sources

Information from ASTM E 1527-13 specified Federal databases for the Site area as provided by EDR was reviewed by WSP. The databases reviewed, and the approximate search distances used are presented in the table below.

Federal Database	Radius Searched
National Priorities List (NPL), Proposed NPL and Delisted NPL database.	1 mile
Federal Superfund Liens (NPL LIENS)	Target Property (TP)
Federal Facility Site Information Listing (FEDERAL FACILITY)	1 mile
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and CERCLIS - No Further Remedial Action Planned (CERCLIS-NFRAP) database of potentially hazardous waste sites.	0.5-mile
Resource Conservation and Recovery Act Hazardous Waste Treatment, Storage or Disposal Facility (RCRA-TSD).	0.5-mile
Corrective Action Reports (CORRACTS) for Hazardous Waste handlers.	1 mile
RCRA Large, Small and Conditionally Exempt Small Quantity Generators (RCRA-LQG, RCRA-SQG & RCRA-CESQG) of Hazardous Waste	0.25-mile
Federal Institutional Control/Engineering Control Registries (US ENG CONTROLS & US INST CONTROL)	0.5-mile
Federal Emergency Response Notification System list (ERNS)	TP
Facility Index System/Facility Registry System (FINDS)	TP

The Site was not identified in the Federal environmental databases.

Several properties within the ASTM search distances were listed in federal agency databases facilities within the EDR report; however, none were located in an area where a potential off-site release would be expected to have a significant impact on the environmental condition of the Site.

5.4.2 State and Tribal Environmental Record Sources

Information from ASTM E 1527-13 specified State and Tribal databases for the Site area as provided by EDR was reviewed by WSP. The databases reviewed, and the approximate search distances used are presented in the table below.

State Database	Radius Searched
State Hazardous Waste Sites (SHWS) database of hazardous waste disposal sites.	1 mile
Site Discovery and Assessment Database (SDADB) database of facilities suspected of hazardous waste disposal.	0.5-mile
State Solid Waste Facility/Landfills (SWF/LF) database of solid waste disposal facilities, landfills and transfer stations.	0.5-mile
State Leaking Underground Storage Tank (LUST) and Leaking Underground Storage Tanks on Indian Land (INDIAN LUST) databases.	0.5-mile

State Database	Radius Searched
Connecticut Leachate and Wastewater Discharge Sites (LWDS) includes discharges, waste disposal sites and spills historically mapped by the Connecticut Department of Environmental Protection.	1 mile
State Registered Underground Storage Tanks (USTs)	0.25-mile
State Registered Aboveground Storage Tank (AST) database of bulk petroleum facilities that receive petroleum by marine vessels. Underground Storage Tanks on Indian Land (INDIAN UST) and Underground Storage Tank Listing (FEMA UST).	0.25-mile
ELUR Sites (AUL) database of state and tribal institutional control and engineering control registries.	0.5-mile
State Voluntary Cleanup Program Sites (VCP) and voluntary cleanup sites on Indian land (INDIAN VCP).	0.5-mile
Brownfield Sites	0.5-mile

The Site was listed in one of the State environmental databases. Bridgeport Community Renewal Associates LLP c/o JHM FIN of 400 Iranistan Avenue Bldg 28 was listed in the State Voluntary Cleanup Program Sites (VCP) database. The certifying party is listed as the Housing Authority of the City of Bridgeport and the database indicates the property entered the program in July 2018. No other pertinent information was provided.

Several properties within the ASTM search distances were listed in the State agency database facilities within the EDR report; however, most were located in an area where a potential off-site release would not be expected to have a significant impact on the Site. One possible exception includes the parcel listed as the White Property of 401 Park Avenue located approximately 487 feet east/northeast of the Site. The White Property is identified in the CT UST and LUST databases. A total of five former underground storage tanks (USTs) are associated with the property and include one 4,000-gallon tank, three 3,000-gallon tanks and one 550-gallon used oil tank. The contents of the larger USTs were not reported however all five tanks were listed as installed circa 1950 and permanently removed from the ground (dates not reported). The LUST database indicates an incident was reported on July 22, 2010. The database indicates release(s) include motor fuel, gasoline and waste oil. The LUST status is listed as complete and the database indicates soil was excavated and monitoring wells were sampled however additional details were not provided.

5.4.3 Additional Environmental Record Sources

The CTDEEP maintains a database of Hazardous Waste Manifests that have been returned to the State following the shipment of a hazardous waste. The database spans from 1984 through 2008 and 2012 through 2014 and reportedly includes hazardous waste disposal from registered U.S. EPA generators and waste shipped under temporary one-time identification numbers. The CTDEEP indicates that manifest data prior to 1984, between 2008 and 2012 and after 2014 are currently unavailable. No hazardous waste shipments were located for the Site in the file search.

The CTDEEP Oil & Chemical Spills (OCS) database includes releases which were reported to the CTDEEP between 1990 and the present. No spill files were located for the Site in the file search.

Additional database records were provided in the EDR report, presented in Appendix IV. WSP reviewed these non-ASTM scope databases for listings for the Site. The Site, listed as Bridgeport Community Renewal Associates LLP c/o JHM FIN located at 400 Iranistan Avenue, Bldg 28 was listed in the Asbestos and NPDES databases. The property was listed in the Asbestos database on August 18, 2016. The listing indicates asbestos was removed by October 19, 2016 by A. Vets Demo LLC and transported offsite by Red. No additional information was given. The National Pollutant Elimination System (NPDES) database identifies an active permit for the "portion of the former Marina Village development" was issued by the CTDEEP. The general permit for stormwater construction activities (#GSN003365) was issued on October 9, 2018 and expires on September 30, 2019.

5.5 Regulatory Agency File Review

The following sections summarize relevant information obtained from State and Municipal Regulatory Agency files.

5.5.1 City of Bridgeport Assessor's Office

WSP reviewed records at the City of Bridgeport Tax Assessor's Office. Relevant information is included in the appropriate sections of the report. The City of Bridgeport Assessor's cards are not currently up to date. Each of the property cards located for Block 1 of the Marina Village Housing Complex, which includes a portion of the Site are included in Appendix I. No property cards were identified for Buildings 5 and 29. Building 29 was located within the Site boundaries prior to its recent demolition. Additionally, some of the attached cards do not indicate former Site buildings have been demolished (Buildings 22 to 31). Copies of the Assessor's cards and a portion of an online map for the Site are included in Appendix I.

5.5.2 City of Bridgeport Building Department

The Bridgeport Building Department identified ten demolition permits for ten former apartment buildings located within or partially within the Site. These permits were dated between October 2016 and September 2018 for buildings along Ridge Avenue (former buildings 26 to 31) and the corner of Columbia Street and Ridge Avenue (former Buildings 22 to 25).

5.5.3 City of Bridgeport Fire Marshal

WSP requested copies of files for the Site from the City of Bridgeport Fire Marshal's office. A response has not yet been received from the Fire Marshal, however pertinent information will be sent as an addendum letter to this report.

5.5.4 City of Bridgeport Health Department

WSP requested copies of files for the Site from the City of Bridgeport Health Department office. A response has not yet been received from the Health Department, however pertinent information will be sent as an addendum letter to this report.

5.5.5 Connecticut Department of Energy and Environmental Protection (CTDEEP)

WSP reviewed available public files for the Site at the CTDEEP public file room. A request was made for files associated with the Site addresses with Remediation, Oil and Chemical Spills Reports, Oil and Chemical Spills Correspondences, Solid Waste, Hazardous Waste, Underground Storage Tanks, Tank Closure Report and Sub-Surface Disposal Permits. No files were located for the Site.

6.0 SITE RECONNAISSANCE

6.1 Methodology and Limiting Conditions

A drive-by Site inspection was completed by Melanie Sheperd of WSP in December 2018. The inspection was completed to obtain information regarding RECs and to evaluate potential environmental concerns on or adjacent to the Site. Interior inspections of the existing Site buildings were not completed. Photographs from the drive-by inspection are included in Appendix V.

6.2 Exterior Observations

The majority of the Site exterior consists of paved roadways (South Street, Iranistan and Ridge Avenues and Johnson and Columbia Streets) and a vacant construction site inaccessible within locked chain-link fencing located north of Ridge Avenue and west of Columbia Street. The remaining southern end of the Site is developed with four, two-story residential brick buildings, part of the remaining Marina Village Housing Complex. A southern portion of these buildings are located within the Site and the structures are known as buildings 21, 20, 19 and 18 (from east to west). Each of these buildings appear to have tenants. Grassed and landscaped areas and concrete sidewalks are located surrounding the apartment buildings.

6.3 Interior Observations

As stated earlier, the interior portions of the four residential apartment buildings that extend to the Site were not observed during the time of the Site inspection.

6.4 Hazardous Substances or Petroleum Products

Hazardous substances and petroleum products were not observed during the time of the drive-by inspection. However, track-mounted excavators were parked within chain-link fenced areas just northwest of Ridge Avenue. The diesel-fuel powered heavy machinery is associated with the recent demolition of the former Marina Village apartment buildings. Evidence of a significant release in the vicinity of the construction machinery was not noted; however, past investigations has identified constituents of concern (COCs) above CTDEEP RSR soil criteria on abutting properties.

6.5 Aboveground and Underground Storage Tanks

At least two excavators with diesel fuel tanks were located in the construction site portion of the Site during the time of the drive-by inspection. Evidence of a release from the machinery was not observed.

No documentation of any current or historic aboveground or underground storage tanks was located in the file review for the Site. Previous environmental reports indicated the Site buildings, including the other Marina Village Housing Complex buildings were heated by steam until natural gas was connected sometime in the 1990s.

F&O indicated oil tanks were removed from the Community building basement in 1999 and these tanks reportedly fueled the former boiler steam heating system. Also, as stated previously in Section 5.3, a release of #2 fuel oil was reported on December 7, 1999 that described 18-inches of oil covering the basement floor of the Community Building as a result from an underground tank failure. Local fire department, fire marshal and DEP were notified and two days later approximately 4-inches of #2 oil was reportedly covering the floor. No other documentation of this incident was identified by others or during our file research. The source of the #2 fuel oil, the amount released, the associated cleanup activities are all unknown. However, F&O concluded the oil release was likely from aboveground tank(s) in the basement rather than underground tank(s) following an inspection of the building exterior. It is noteworthy to mention the Community building is located offsite but adjacent to the north of the Site.

Based on the age of the Site buildings and the uncertainty of former heating system(s) of the Marina Village apartment buildings, it is possible that historic oil-fired systems with associated heating oil underground storage tanks (USTs) were utilized.

7.0 INTERVIEWS

WSP interviewed several employees of the City of Bridgeport for our Phase I ESA update. Our interviews were generally conducted to obtain knowledge of current and former Site operations, petroleum storage practices and usage, and usage and management of hazardous materials at the Site. Information gathered during interviews is generally incorporated throughout this report.

8.0 FINDINGS

The findings below are based on the work conducted as part of this assessment:

- The Site consists of a southern portion of the Block 1 parcel associated with the Marina Village Housing Complex and adjacent concrete sidewalks and sections of paved roadways along South Street, Iranistan Avenue, Ridge Avenue, Columbia and Johnson Streets. The Site, known as the RBD Pilot Area is encompasses approximately 4.44-acres. The paved roadway areas and adjacent sidewalks total approximately 1.15-acres and the remaining approximate 3.29-acres are part of the Marina Village Block 1 apartment complex. Southern ends of four Marina Village Housing Complex buildings (18-21) are located at the southern end of the Site. These buildings consist of two-story brick structures reportedly constructed on crawl space basement areas. Grassed/landscapes and concrete sidewalks are located surrounding the Site buildings. To the south and northeast of the Site buildings, the rest of the complex area is vacant and an active construction site as former apartment buildings have been recently demolished.
- The Site is located in an area identified by the CTDEEP as Class "GB", indicating that the groundwater is presumed to be unsuitable for direct human consumption without pretreatment. Public water service is available at the Site and surrounding properties. Based on topography at the Site and surrounding area, groundwater flow is presumed to flow to the west. Previous environmental investigations identified groundwater approximately 8 to 9 feet below grade at areas adjacent to the northwest of the Site.
- Historical resources indicate the Site, aside from the roadway portions which appear to have remained constant, was mainly occupied by residential dwellings prior to the construction of the Marina Village Housing Complex in the late-1940s to 1950. However, early Sanborn Fire Insurance Maps indicate a thin strip of the Site, the approximate northern perimeter of the Site parallel to Ridge Avenue may have been occupied by foundry buildings associated with Bridgeport Malleable Iron Works/Eastern Malleable Iron Company. Site operations associated with the metal foundry reportedly included the manufacturing of malleable and grey iron castings. Additionally, coal was utilized to fuel the foundry operations which were listed as annealing, trimming, core making, tumbling and molding. As such, material use historically involved extensive amounts of coal, metals, oils and solvents.
- Previous environmental investigations have been completed for the entire Marina Village Housing Complex in preparation for redevelopment of the neighborhood. Results of these investigations identified recognized environmental concerns (RECs) across the complex generally as result of historical manufacturing and industrial operations conducted by Bridgeport Malleable Iron Works/Eastern Malleable Iron Works, Hotchkiss Sons Manufacturers Curry Combs & Company and Reliable Steel Drum Corporation. These RECs were listed as 1.) historical foundry operations; 2.)

historical metal pickling operations; 3.) historical manufacturing operations; 4.) historical japanning operations; 5.) historical steel drum reconditioning; 6.) historical coal storage; 7.) historical urban fill; 8.) #2 fuel oil release and 9) underground storage tanks.

- Two previous subsurface investigations completed across the entire housing complex and included the advancement of twenty soil borings, the installation of seven monitoring wells and the sampling and collection of twenty soil samples and seven groundwater samples. Two monitoring wells and one soil boring were completed near the Site, however without a survey of the Site boundaries and these three locations, it is unclear if the subsurface investigation extended to the RBD Pilot Area. Urban fill material and elevated concentrations of PAHs and select total and leachable metals were detected in the nearby soil samples. Elevated PAHs and select metals were also identified in the two nearby groundwater samples above CTDEEP RSR soil criteria.
- The Site appears to be identified in researched environmental databases, including the Voluntary Cleanup Program, and Asbestos and National Pollutant Discharge Elimination Database as a result of recent redevelopment and construction activities at the Site.
- Previous environmental investigations completed for the Marina Village Housing Complex indicated a release of #2 fuel oil was reported in December 1999 at the Community Building basement. A total of eighteen inches of oil was noted in the basement, yet no additional documentation of any cleanup, tank removals or remediation has been located and based on its proximity to the Site; this release may have impacted the soil and groundwater of the Site.
- Several area properties were identified on the ASTM database, which could have an impact on the environmental quality of the Site; however, most were located in an area where a potential off-site release would not be expected to have a significant impact on the Site. One possible exception is 401 Park Avenue, located approximately 487 feet east/northeast of the Site. This Site was identified on the Connecticut Leaking Underground Storage Tank database with releases of motor fuel, gasoline and waste oil from an underground storage tank. The LUST status is listed as complete and the database indicates soil was excavated and monitoring wells were sampled however additional details were not provided.
- Eastern portions of the Site, within the Marina Village Housing Complex, is currently an active construction site and within locked chain-link fenced areas. Former apartment buildings were recently demolished (Buildings 22 to 31) and the ground surface conditions of these areas were observed as soil covered with piles of construction rubble and vegetation. Construction equipment, such as track-mounted excavators were stored in the construction site area of the property.
- The western portion of the Site, within the Marina Village apartment complex, generally consists of the southern end of four, two-story brick apartment buildings and surrounding grassed/landscaped areas with concrete sidewalks.

9.0 APPLICABILITY OF THE CONNECTICUT TRANSFER ACT

Section 22a-134 of the Connecticut General Statutes (CGS), known as the Connecticut Transfer Act, requires environmental investigation and potentially remediation of "establishments" after a qualifying "transfer of establishment". An "establishment" is defined as "any real property at which or any business operation from which (A) on or after November 19, 1980, there was generated, except as the result of remediation of polluted soil, groundwater or sediment, more than one hundred kilograms of hazardous waste in any one month, (B) hazardous waste generated at a different location was recycled, reclaimed, reused, stored, handled, treated, transported or disposed of, (C) the process of dry-cleaning was conducted on or after May 1, 1967, (D) furniture stripping was conducted on or after May 1, 1967, or (E) a vehicle body repair facility was located on or after May 1, 1967." Our research has not identified any uses that would automatically qualify the Site as an "establishment" under the Transfer Act based upon its use as a dry cleaner, furniture stripper or vehicle body repair facility. Additionally, no documentation of any hazardous wastes are located for the Site.

10.0 OPINIONS AND CONCLUSIONS

We have completed a Phase I ESA in conformance with the scope and limitations of ASTM Practice E1527-2013 for the property identified as the RBD Pilot Area in Bridgeport, Connecticut. This assessment has revealed evidence of recognized environmental conditions (RECs) in connection with the Site as follows:

1. Historic Urban Fill: Previous subsurface investigations of the Marina Village Housing Complex have identified urban fill containing asphalt, concrete, red brick, coal, ash, etc. from previous industrial and manufacturing site operations including the demolition of associated former factory structures. These materials were observed in shallow soils up to approximately 12 feet below grade in areas investigated across the Marina Village Housing Complex and likely extend to the Site. Laboratory results of such fill materials identified elevated concentrations including PAHs and select total and leachable metals above CTDEEP RSR soil criteria. Similarly, these constituents of concern were also detected in groundwater samples collected from monitoring wells installed across the complex.
2. Several residential dwellings were formerly located along the north side of Ridge Avenue at the Site prior to the construction of the Marina Village Housing Complex. Based on the age of these structures, it is likely potential fuel oil USTs associated with former heating systems of the residences were utilized and may still be in place.
3. Previous investigations of the Site vicinity identified a spill report for a #2 fuel oil release within the basement of the Marina Village Housing Complex Community building which is located adjacent to the north of the Site. On December 7, 1999 eighteen-inches of #2 fuel oil was observed covering the 400-square foot basement and estimated to be a 4,500-gallon spill. However, the release was reported on December 9, 1999 and at that time only four inches of oil remained on the floor. The spill status of the reported is closed however no additional information was located in the file search. Based on the quantity and proximity of the release, it may have impacted the soil and groundwater at the Site.

As noted earlier, without a survey of the Site boundaries, previous soil boring/monitoring well locations and approximate boundaries of former industrial/manufacturing occupants, it is unclear if site operations associated with former industrial processes with Bridgeport Malleable Iron Works/Eastern Malleable Iron Works were conducted at the RBD Pilot Area. Regardless, site operations including a historic foundry and metal pickling operations are also considered RECs for the Site based on the long history of site usage and the proximity to the Site. These former operations involved the use of petroleum products/oils, solvents, heavy metals and hazardous materials from the metal foundry, manufacturing and metal pickling operations including coal ash, other foundry by-products.

11.0 DEVIATIONS/DATA GAPS

Data gaps identified by the ASTM standard include:

- Chain of Title documentation for the Site was not provided. A limited review of property deeds filed at the Bridgeport Clerk's office was performed and evidence of an environmental related deed encumbrance was not noted. Further, the EDR research included a search of State and Federal environmental deed restriction databases and none were identified for the Site.
- Significant portions of the Site were not accessible at the time of our inspection as a result of gated chain-link fencing (construction site). We note that interior inspections of the Site buildings were not completed. Our investigation included drive-by inspections of the Site. Previous investigations of the Site did involve more comprehensive inspections.

It is our opinion that the identified data gaps are not significant. However, it is our understanding that portions of the Superfund protection offered by the All Appropriate Inquiry Phase I Environmental Site Assessment process may not be afforded the User in the event that resolution of these data gap would have resulted in the identification of significant environmental issues at the Site.

12.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

Resumes for WSP personnel involved in the ESA are presented in Appendix VI.

13.0 LIMITATIONS

The purpose of this Phase I Environmental Site Assessment is to identify potential impacts to the environment status of the physical conditions (i.e., soil, ground water, structure, etc.) at the Site, due to the use, storage or disposal of hazardous or toxic materials or wastes. As such, any other property conditions or characteristics are not addressed in the scope of work for this report. The scope of work does not include, nor should the report be considered as, an audit of compliance with environmental permits, management practices, or

federal, state or local laws and regulations, even though in the course of work such information may be obtained and noted in the report.

The conclusions stated above have been developed from what is considered to be a reasonable investigation based on the present and past land use of the Site and the property's location with respect to adjacent land uses. The conclusions, to some degree, are based upon information provided by others as referenced or noted in the report. Reasonable efforts have been made to confirm the information with other sources; however, WSP is not responsible for missing or incomplete information if such information is not available at the source or provided at WSP's request, or if such information cannot be obtained within the time constraints of the work or within a level of effort reasonable for the work being completed.

The conclusions and/or recommends are applicable to areas of the Site that were accessible at the time of inspection and represent the conditions observed in those areas. Areas that were hidden, covered or otherwise inaccessible to inspection are not covered by the conclusions and recommendations. The conclusions and recommendations are based in part on conditions observed on the Site at the time of the inspection. The conclusions do not include subsequent changes to the Site, or use of the Site, which could alter the environmental status of the property from its present condition.

This report, and all work associated with it, has been completed solely for the use of the Connecticut Department of Housing. Use of the report by others, or conclusions drawn from the information contained herein without confirmation by WSP, is done at the users risk. WSP asserts that the data are complete and appropriate at the time and for the work conducted, but is not responsible for the use of the information for purposes for which it was not intended.

14.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental Professional as defined in 312.10 CFR 312. We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the Site. We have developed and completed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

cmm

December 14, 2018

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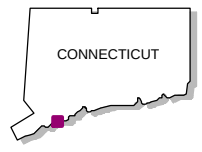
USGS 1984. Bridgeport, Connecticut Quadrangle Map.

FIGURES



SOURCE: USGS TOPOGRAPHIC QUADRANGLE BRIDGEPORT, CONNECTICUT (2015).





QUADRANGLE LOCATION

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SCALE IN FEET

CONNECTICUT DEPARTMENT OF HOUSING
RBD PILOT AREA
BRIDGEPORT, CONNECTICUT

SITE LOCATION MAP

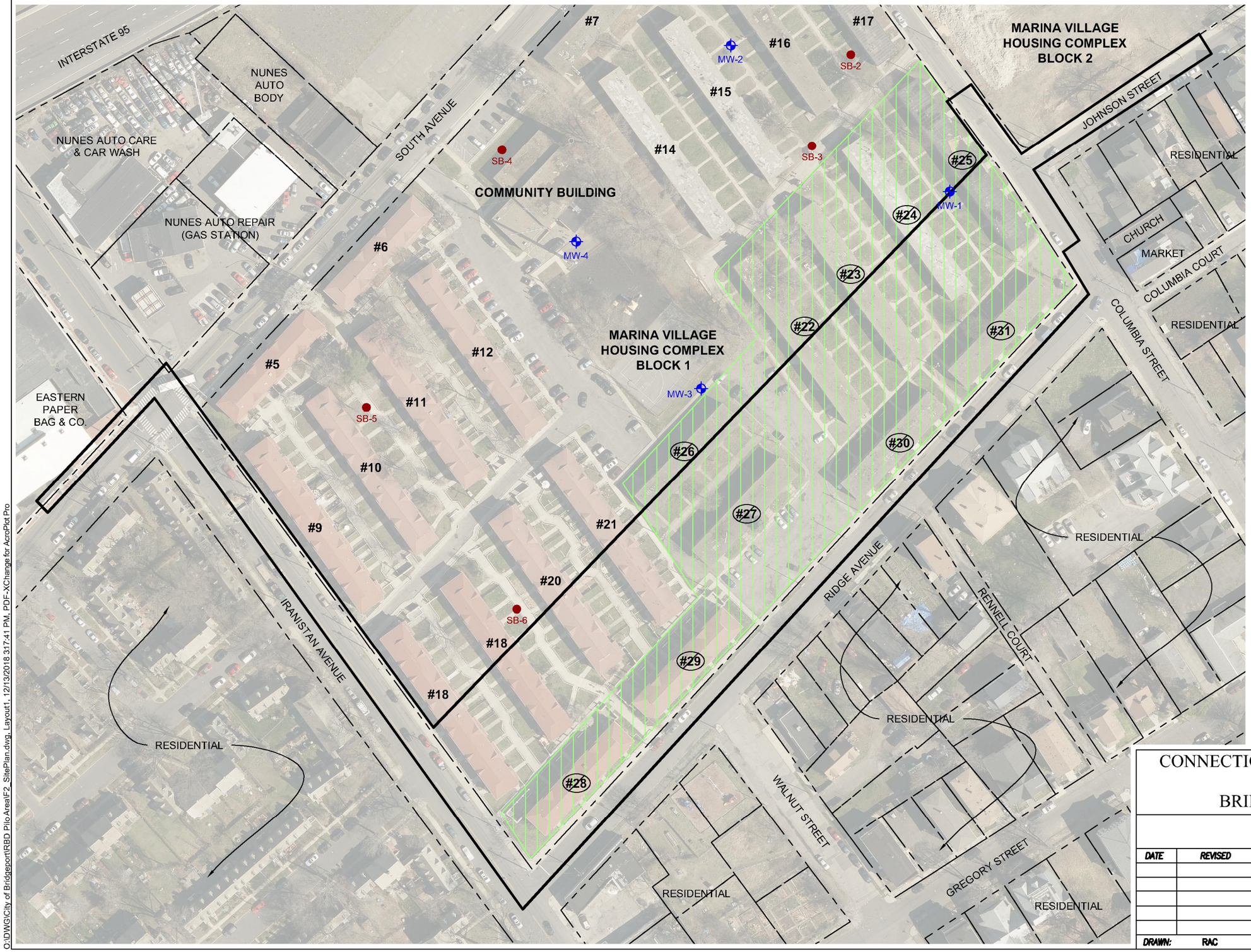
DATE	REVISED

PREPARED BY:

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DRAWN:	RAC	CHECKED:	MS	DATE:	12/11/18	FIGURE:	1

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LEGEND

- RBD PILOT AREA
- PROPERTY BOUNDARY
- #5 — MARINA VILLAGE HOUSING COMPLEX APARTMENT BUILDING
- #28 — DEMOLISHED APARTMENT BUILDING (CONSTRUCTION SITE)
- APPROXIMATE SOIL BORING LOCATION COMPLETED BY FREEMAN COMPANIES (2016)
- APPROXIMATE MONITOR WELL LOCATION COMPLETED BY FREEMAN COMPANIES (2016)

0 100
SCALE IN FEET

CONNECTICUT DEPARTMENT OF HOUSING
RBD PILOT AREA
BRIDGEPORT, CONNECTICUT

SITE PLAN

DATE	REVISED

PREPARED BY:

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DRAWN:	RAC	CHECKED:	MS	DATE:	12/13/18	FIGURE:	2

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APPENDIX I
Tax Cards and Tax Maps

(Available Upon Request)

APPENDIX II
Historical Resources

(Available Upon Request)

APPENDIX III
Previous Environmental Reports

FREEMAN
COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Phase I Environmental Site Assessment Update
Marina Village Marina Village Housing Complex
Bridgeport, Connecticut

November 7, 2016

Prepared for:

Bridgeport Community Renewal Associates, LP
c/o JHM Group
1281 East Main Street, Suite 201
Stamford, Connecticut 06902

Prepared by:

Freeman Companies, LLC
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1 INTRODUCTION

1.1 Summary

This report provides an update to the September 2013 Phase I Environmental Site Assessment (ESA) performed for JHM Group by Fuss & O'Neill of Manchester, CT. A copy of the Phase I is attached as Appendix A. The subject property is currently utilized for residential housing.

The Site, located at 400 Iranistan Avenue, consists of a two adjacent parcels of land totaling 15.9 acres located in the City of Bridgeport. The Site is bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

1.2 Phase I Findings

Based on the information presented within the Phase I report, the Site has a long history of heavy industrial and manufacturing operations prior to its development as a residential housing complex in the late 1940s. Based on Section 8.2 of the Phase I report, the following recognized environmental conditions were identified:

- REC-1: Historic Foundry Operations - The Bridgeport Malleable Iron Works / Eastern Malleable Iron Company was present at the Site from prior to 1884 to the mid-1930s.
- REC-2: Historic Metal Pickling Operations - Historic metal pickling operations associated with the former foundry operations likely generated waste sludge that would currently be classified as hazardous.
- REC-3: Historic Manufacturing Operations - Hotchkiss Sons Manufacturers Curry Combs & Company / Edward S. Hotchkiss Hardware Manufacturing were present at the Site from prior to 1884 and were gone by 1913.
- REC-4: Historic Japanning Operations - Japanning operations associated with the Hotchkiss Sons Manufacturers Curry Combs & Company / Edward S. Hotchkiss Hardware Manufacturing have the potential to generate a release of petroleum based materials at the Site.
- REC-5: Historic Steel Drum Reconditioning - Following the closure of the Bridgeport Malleable Iron Works / Eastern Malleable Iron Company one of the former annealing buildings at the east end of the foundry was occupied by the Reliable Steel Drum Corporation for reconditioning steel drums and the area to the east of the former annealing building was used for the storage of steel drums.
- REC-6: Historic Coal Storage - Two historic coal storage areas were identified on the site. A coal storage shed was located along Railroad Avenue on the Bridgeport malleable Iron Works property and a coal bin associated with the Hotchkiss Sons Manufacturers Curry Combs & Company was located behind their manufacturing facility.
- REC-7: Historic Urban Fill - As with any site located in heavily urbanized area where former structures have been razed or with multiple generations of development, the potential for the presence of urban fill containing ash, coal, asphalt fragments, or manufacturing by-products exists.
- REC-8: #2 Fuel Oil Release - On December 9, 1999, release of 4,500 gallons of #2 fuel was reported to DEEP which occurred within the basement of the HACB's Marina Village office building (733 South Ave).
- REC-9: USTs - Approximately 30 former homes, storefronts, and apartment buildings were previously located on the Site along Ridge Avenue, Columbia Street, Johnson Street, Park Avenue and Railroad Avenue. There is potential for fuel oil USTs associated with these structures to have been abandoned in place.

1.3 Scope of Work

This Phase I ESA Update was conducted to identify Recognized Environmental Conditions (RECs) resulting from past or present activities on the site and to determine if any of the surrounding properties have the potential to impact the environmental integrity of the site. The assessment update consisted of a reconnaissance of accessible site areas and adjoining properties, a review of State and Federal environmental databases as they pertain to the site and an interview with the site owner/operator.

This ESA was conducted in a manner consistent with industry standard and practice and in general accordance with the Standards of the American Society for Testing and Materials (ASTM) E1527-13 Standard Practice for Environmental Site Assessment Updates.

2 SITE DESCRIPTION

2.1 Location

The Site, located at 400 Iranistan Avenue, consists of a two adjacent parcels of land totaling 15.9 acres located in the City of Bridgeport. The Site is bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

2.2 Current Usage

The Site is currently used for residential housing.

2.3 Historical Land Usage

Marina Village was originally constructed during the late 1940s. Prior to its construction, the Site was occupied by the Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings, Hotchkiss Sons' Manufacturers Curry Combs & Company and by a number of homes.

The foundry used coal to fuel their operations, which included operations such as annealing, trimming, core making, tumbling, and molding. Hotchkiss Sons Manufacturers Curry Combs & Company was located southwest of the Bridgeport Malleable Iron Works along South Avenue. The Hotchkiss Sons Manufacturers Curry Combs & Company property included a manufacturing building, a wood shop, coal storage, and lumber storage. Operations included scouring, tempering, and japanning. A number of homes were located along the north side of Johnson Street, the west side of Columbia Street, the west side of Park Avenue, and the south side of Railroad Avenue at the east end of the site.

2.4 Surrounding Land Use

The surrounding land use consists primarily of high-density housing to the southwest, southeast and northeast; and a mix of commercial and light industrial to the northwest.

2.5 Utilities

Marina Village is currently served by municipal sewer and water.

The Site's buildings were once heated by steam from the central boiler room of the Community Building, located on the northern side of Marina Village along South Avenue. The buildings made a switch from steam heat to natural gas sometime in the late 1990s. Electric, cable, and telephone services enter the Site via overhead wires.

2.6 Groundwater Classification

According to the CTDEEP water quality classification maps groundwater at the site is classified as GB. A GB classified groundwater is defined as groundwater within a historically highly urbanized area or an area of intense

industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts.

2.7 Environmental Assessment Activities

Several rounds of subsurface investigation activities have been conducted on the Site since the date of the original Phase I ESA. The initial round of sampling was conducted between the dates of May 12 through May 14, 2015. This investigation was conducted entirely within the "triangle" section of the Site. A total of ten soil borings were advanced at the Site as part of this investigation. The second subsurface investigation was conducted between the dates of May 25 through May 26, 2016. A total of ten soil borings were advanced at the Site as part of the second investigation.

2.7.1 Initial Subsurface Assessment "Triangle Property"

The initial assessment was conducted between the dates of May 12 through May 14, 2015. On the western section of the property. The primary purpose of the assessment was to define the nature/presence of target contaminants in the unconsolidated materials in both the saturated and unsaturated zones associated with historical Site activities. In addition, the boring program also provided information on Site stratigraphy and physical properties of the unconsolidated materials in both the saturated and unsaturated zones with particular emphasis on the characteristics of those materials that affect contaminant migration pathways and transport mechanisms.

New England Boring Contractors of Glastonbury, CT advanced the soil borings utilizing a hollow stemmed auger (HSA) drilling rig under the direct supervision of Freeman Companies field personnel. The location for each of the soil borings was chosen to maximize the information obtained based on Freeman Companies' understanding of existing site conditions.

All ten soil borings (B-1 through B-10) were advanced using a HSA drill rig spinning 4 ¼-inch inner diameter augers. Soil samples were collected with stainless steel, 2-inch diameter, two-foot split-spoon sampler advanced ahead of the augers in two-foot intervals using a weighted hammer. In general, sampling was conducted semi continuously at 2 foot intervals into the observed water table. Bedrock was not encountered at any boring locations.

Three of the soil borings were completed as overburden-monitoring wells (MW-1 through MW-3). The wells were set to depths of approximately 12 to 16 feet below grade. The wells are constructed of approximately 10 feet of 2-inch diameter, 0.010-inch slotted PVC screen, with 2-inch PVC riser extending to grade.

Laboratory analysis of the soil samples collected from sample locations B-5, B-7 and B-8, identified the presence of one or more of the following; poly aromatic hydrocarbons, total petroleum hydrocarbons, total arsenic and/or PCBs at concentrations exceeding default remediation criteria.

Laboratory analysis of groundwater samples did not detect the presence of any volatile organic compounds at concentrations that exceeded the RES VC within any of the monitoring wells. Analytical results of the groundwater samples identified the following poly aromatic hydrocarbons; benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and phenanthrene and the following metals; arsenic, copper, lead, mercury, and zinc at concentration exceeding the default SWPC in one or more of the monitoring wells. A copy of the assessment report is included as Appendix B.

2.7.2 Additional Assessment "Second Phase"

The second phase of the Marina Village redevelopment project involves the demolition of the portion of the complex that is bounded by South Avenue, Columbia Street, Ridge Avenue, and Iranistan Avenue (Buildings Numbered 5-31). The Second Phase Assessment activities were conducted between the dates of May 25 through May 26, 2016. A total of ten soil borings were advanced at the Site as part of the investigation.

Six of the ten soil borings proposed as part of the second phase (SB-1 through SB-6) were advanced using a direct push drill rig utilizing static force and dynamic percussion to drive steel boring rods into the ground. Soil samples were collected with a stainless steel, 2-inch diameter, five-foot spoon sampler interiorly lined within a single use acetate sleeve. Sampling was conducted continuously into the observed water table.

The remaining four soil borings (MW-1 through MW-4) were advanced using a HSA drill rig spinning a 4 ¼-inch inner diameter auger. Soil samples were collected with stainless steel, 2-inch diameter, two-foot split-spoon sampler advanced ahead of the augers in two-foot intervals using a weighted hammer. Sampling was conducted continuously at 2 foot intervals into the observed water table.

Soil encountered during the advancement of the second phase soil borings consisted primarily of a mixture of Urban Fill and ash, followed by brown and tan, fine to coarse sand intermixed with silt at several locations. Bedrock was not encountered at any boring locations.

Laboratory analysis of the soil samples collected from sample locations SB-1, SB-4, and MW-2 identified the presence of one or more of the following; poly-aromatic hydrocarbons and/or extractable total petroleum hydrocarbons, exceeding the RDEC and/or the GB PMC.

Although analytical results from groundwater samples collected as part of the did not detect the presence of any volatile organic compounds at concentrations that exceeded the RES VC; results did identify the presence of one or more poly aromatic hydrocarbons and or metals at concentrations exceeding the default SWPC within the samples collected from MW-1, MW-3 and MW-4.

2.8 Remedial Activities

The primary purpose of the soil removal activities was to excavate and disposal of contaminated soil/fill material that was encountered during the subsurface assessment activities of the "triangle property". Soil excavation and removal activities, conducted over an approximately eight week period, were initiated on April 21, 2016 and completed on June 16, 2016. A copy of the Close Out Report is included as Appendix D.

2.8.1 Previous Building Slab

During initial excavation activities it was identified that the floor slab from the former Eastern Malleable Iron Company was still present on the property. The slab was generally encountered at a depth of approximately 1-2 feet below the existing surface. Only within areas where the Marina Village buildings were constructed was the original slab removed. Inspection of the slab revealed that the slab consisted of approximately 4-6" of non-reinforced concrete. The slab appeared to be in good condition with no signs of staining. A small section of the slab was removed at a location to the southwest of building 35 in order to identify soil conditions under the slab. Soil conditions under the slab consisted of native sand. In order to confirm he initial findings Freeman Companies directed the contractor to remove small areas of slab at several additional locations. In all instances native sand was identified to be present under the slab. Since the slab did not appear to be stained and that native sand was located under the slab, the decision was made to leave the slab in place.

2.8.2 Ash Fill Areas

During the soil removal activities serval areas of ash material were encountered and removed. The ash was identified to contain small pieces of ceramic debris and glass. One of the larger areas of ash material was located to

the west of building 36, which is located just south of the former annealing area of the Eastern Malleable Company. The ash area measured approximately 30 feet long by 20 feet wide and extended to a depth of approximately 10-12 feet.

2.8.3 Demolition Debris

Various amounts of brick, asphalt, and broken concrete were encountered throughout the excavation area. The larger amounts of these materials were encountered primarily at locations on top of the former building slab. It appeared that the former building was crushed in place and filled with urban fill material to allow of the shaping of the property for construction of Marina Village.

2.8.4 Impacted Soil

Soil material identified to be impacted by PAHs and low concentration of PCBs was selected for removal from the site. The target areas for removal were primarily located to the northwest of building 36 and to the south and southwest of building 35. The largest of the impacted areas was located to the northwest of building 36, which was located within the former coal storage area for the former Eastern Malleable Iron Company. Soil within this area was primarily impacted from 1-4 feet in depth and encompassed almost the entire area north of the former building slab extending to Railroad Avenue. Other smaller pockets of impact generally consisted of areas measuring approximately 10 feet by 10 feet by 5 feet in depth.

2.8.5 Soil Disposal

Impacted soil and ash material excavated for removal from the site was brought to one of two locations for disposal. The soil and ash material located to the east of building 35 was brought to the Chicopee Landfill, in Chicopee Massachusetts. The remaining impacted material was brought to the Coventry Landfill in Coventry Rhode Island.

Based on weight tickets generated from the landfills, approximately 731.92 tons of impacted material were excavated and removed from the site for reuse at the Chicopee Landfill and approximately 3,503.11 tons of impacted material were excavated and removed from the site for reuse at the Coventry landfill.

2.8.6 Closure Sampling

As identified, impacted material related to the historical operations of the Eastern Malleable Iron Company primarily consisted of discolored fill material and ash which contained moderate concentrations of PAHs and low concentrations of PCBs. This impacted material was visually identifiable due to its composition and color as compared to the native sands located at depth. Removal of impacted material was generally conducted until the native sand material was encountered.

Upon completion of the removal of the impacted material soil removal, soil samples were collected from the floor of excavation areas in order to demonstrate removal of the impacted material. Since PAHs were the primary driver for removal activities and were present at the greatest concentrations, the closure samples were submitted for the analysis of PAHs. No PAHs were detected within the samples submitted.

3 RECORDS REVIEW

3.1 Standard Environmental Records Search

A database search report that identifies sites listed on state and federal databases within the ASTM-required radii was obtained for the property from Environmental Data Resources, Inc (EDR). A copy of EDR's complete report is provided as Appendix E.

The report included the following databases specified by the ASTM Phase I protocol as well as non-ASTM databases (not listed):

Database*	Search Radius
National Priorities List (NPL)	1 mile
Comprehensive Environmental Response, Compensation and Liability Information System	0.5 mile
Resource Conservation and Recovery Information System (RECRIS) Treatment, Storage, and Disposal Facilities (RCRA TSD)	0.5 mile
Resource Conservation and Recovery Corrective Action Sites (RCRA COR)	1 mile
RCRA Large and Small Quantity Generators (RCRA GEN)	0.25 mile
Emergency Response Notification System (ERNS)	Target Property
The Facility Index System (FINDS)	Target Property
State Hazardous Waste Sites	Target Property
Regulated State Underground Storage Tank (UST) and Aboveground Storage Tank database (AST)	0.25 mile
State Leaking Underground Storage Tank (LUST)	0.5 mile
Brownfield Site Database	0.5 mile
Engineering Controls Sites	0.5 mile
Institutional Controls Sites	0.5 mile
Indian Reservation Database	1 mile

*A description of these databases and additional sources searched is provided in the EDR report. A complete listing of sites identified on the above-referenced databases is provided in the EDR report.

Freeman Companies evaluated the following to determine whether additional environmental records with respect to these facilities, including the orphan sites, should be reviewed.

- Case status (i.e., whether a No Further Action letter has been issued or a case has been closed);
- Type of database and whether the presence of soil or groundwater contamination is known;
- Distance of the site from the subject property; and,
- Whether the site is upgradient or downgradient of the subject property based on local topography and the anticipated easterly groundwater flow direction.

Freeman Companies reviewed the information provided using the above criteria and the findings are discussed in the following Sections.

3.1.1 Subject Site

The subject Site was not listed within the any of the databases

3.1.2 Surrounding Properties

Based on the review of the database search, no new information regarding potential environmental impact to the Site was identified.

4 SITE RECONNAISSANCE

4.1 Methodology

As part of on-going abatement/demolition activities, Freeman Companies has conducted numerous site visits since the date of the original Phase I ESA. The latest visual inspection of the Site occurred on November 3, 2016. The inspection included a walk-through of the site for the purpose of identifying RECs.

A visual inspection of adjoining properties from the subject property line, public rights-of-way or other vantage points (e.g. aerial photography) including a visual inspection where hazardous substances may be or may have been stored, treated, handled or disposed was also conducted.

4.2 Observations

At the time of the initial Phase I ESA, the property contained 38 multi-family buildings and one community building which was the former boiler house. From 2015-2016, 12 of the 38 buildings (all within the "triangle" parcel) were demolished. As of November 3rd, 2016 two of the remaining 26 building are in the process of being demolished.

5 INTERVIEWS

5.1 Owner

An interview with was conducted with Site Manager Mike Cundiff on November 3, 2016. According to Mr. Cundiff, there have been no changes to the Site since the date of the original Phase I ESA.

6 FINDINGS AND CONCLUSIONS

Freeman Companies has performed a Phase I Environmental Site Assessment Update in conformance with the scope and limitations of ASTM Practice E 1527-13 Limitations of this assessment are described in Section 7.

6.1 Recognized Environmental Conditions

An REC is the presence or likely presence of any hazardous substance or petroleum products in, on, or at a property due to the release to the environment, under conditions indicative for a release to the environment, or under conditions that pose a material threat of a future release to the environment.

The following RECs were identified at the Site as part of the 2013 Phase I:

- REC-1: Historic Foundry Operations
- REC-2: Historic Metal Pickling Operations
- REC-3: Historic Manufacturing Operations
- REC-4: Historic Japanning Operations
- REC-5: Historic Steel Drum Reconditioning
- REC-6: Historic Coal Storage

- REC-7: Historic Urban Fill
- REC-8: #2 Fuel Oil Release
- REC-9: USTs

Based on assessment and remedial activities that have been conducted since the original Phase I was conducted, REC#5 has been closed. In addition, one of the coal storage areas identified as REC#6 has also been closed. Lastly, no USTs (REC#9) have yet been identified on the site.

7 ENVIRONMENTAL CERTIFICATION

7.1 Limitations

This report is prepared on behalf of and for the exclusive use of JHM Group (Client) and is subject to and issued in accordance with the Agreement and the provisions thereof. This report and any findings contained therein shall not, in whole or in part, be provided to or used by any other person, firm, entity or governmental agency in whole or in part, without the prior written consent of Client and Freeman Companies. However, Freeman Companies acknowledges and agrees that, subject to the Limitations set forth herein and prior written approval by Freeman Companies, this report may be provided to specific financial institutions, attorneys, title insurers, lessees and/or governmental agencies identified by Client at or about the time of issuance of the report in connection with the conveyance, mortgaging, leasing, or similar transaction involving the real property which is the subject matter of a report and any work product. Use of this report for any purpose by any persons, firm, entity, or governmental agency shall be deemed acceptance of the restrictions and conditions contained therein, these Limitations and the provisions of Freeman Companies' Agreement with Client. No warranty, express or implied, is made by way of Freeman Companies' performance of services or providing an environmental site assessment, including but not limited to any warranty with the contents of a report or with any and all work product.

In preparing a report, Freeman Companies may rely on certain information provided by governmental agencies or personnel as well as information and/or representations provided by other persons, firms, or entities, and on information in the files of governmental agencies made available to Freeman Companies at the time of the site assessment. To the extent that such information, representations, or files may be inaccurate, missing, incomplete or not provided to Freeman Companies, Freeman Companies is not responsible. Although there may be some degree of overlap in the information provided by these various sources, Freeman Companies does not assume responsibility for independently verifying the accuracy, authenticity, or completeness of any and all information reviewed by or received from others during the course of the site assessment.

Unless otherwise noted, a survey (which includes observations, sampling and analysis) for the presence of polychlorinated biphenyls (PCBs) and asbestos contained in building materials, mold and/or lead-based paint is not conducted as part of an assessment.

Unless otherwise noted, an evaluation (which includes observation, sampling and analysis) for Vapor Intrusion Conditions (VIC) is not conducted as part of an assessment.

No attempt is made to assess the compliance status of any past or present Owner or Operator of a site with any Federal, state, or local laws or regulations, unless specifically indicated otherwise in writing.

Findings, observations, and conclusions presented in this report, including but not limited to the extent of any subsurface explorations or other tests performed by Freeman Companies, are limited by the scope of services outlined in the Agreement, which may establish schedule and/or budgetary constraints for an environmental assessment or phase thereof. Furthermore, while it is anticipated that each assessment will be performed in accordance with generally accepted professional practices and applicable standards (such as ASTM, etc.) and then applicable state and Federal regulations, as may be further described in the report and/or the Agreement, Freeman Companies does not assume responsibility for

the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of its services.

The assessment presented in each report is based solely upon information obtained or received prior to issuance of the report, including a limited number of subsurface explorations (if performed) made on the dates indicated. If additional environmental or other relevant information is developed at a later date, Client agrees to bring such information to the attention of Freeman Companies promptly. Upon evaluation of such information, Freeman Companies reserves the right to recommend modification of this report and its conclusions.

If groundwater samples are collected for analysis or water level measurements are made in monitoring wells, such results/observations are provided as representative of conditions at the times stated in this report. Fluctuations in groundwater elevation may occur due to variations in precipitation cycle and multiple other factors, which may influence the concentrations of constituents present in the groundwater. Should additional data become available in the future, such data should be provided to Freeman Companies for review and Freeman Companies reserves the right to recommend modification of this report and its conclusions.

Except as may be noted specifically within the text of this report, no laboratory testing is performed as part of a site assessment. If such analyses have been conducted by an outside laboratory, Freeman Companies may rely upon the analyses or data provided, and makes no representation that an independent evaluation of the reliability of such testing has been conducted, with the exception of reviewing standard quality assurance/quality control data that may have been provided with the test results.

Although chemical analyses may be performed for specific parameters at specific locations during the course of a site assessment, as described in a report, the results are not definitive regarding the presence of the parameters at other concentrations or the absence of the parameters at other locations on the site. Additional chemical constituents not included in the list of analyzed parameters for a study may be present in soil and/or ground water at a site, and Freeman Companies assumes no responsibility for chemical constituents or parameters not analyzed.

If included, any database search is conducted under the Notice of Disclaimer/Waiver of Liability included in the database search report.

7.2 Reliance

The Environmental Professional hereby states that this Phase I ESA Update has been conducted in accordance ASTM E 1527-13, or the most current ASTM standard, and the EPA Rules. This Phase I ESA Update has been prepared for the sole use of JHM Group. This Phase I ESA Update should not be relied upon by other parties without the express written consent of Freeman Companies and JHM Group.

7.3 Environmental Professional Signature

The author of this report declares that, to the best of our professional knowledge and belief, I meet the definition of Environmental Professional as defined in §312.10 of 40 CFR 312. The author of this report has the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. The author has developed and performed the all appropriate inquiries in the conformance with the standards and practices set for the in 40 CFR 312.



Charles D. Brink, LEP
Manager of Environmental Services

APPENDIX A

FUSS AND O'NEILL PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT – SEPTEMBER 2013

Phase I Environmental Site Assessment

Marina Village

400 Iranistan Avenue
Bridgeport, CT

September 2013

FUSS & O'NEILL

56 Quarry Road
Trumbull, Connecticut 06611

20121111.A12

FUSS & O'NEILL

September 24, 2013

Ms. Sharon Lee, Associate AIA, PM
Planning Development & Modernization
Housing Authority of the City of Bridgeport
150 Highland Avenue
Bridgeport, CT 06604

RE: Phase I Environmental Site Assessment
Marina Village
400 Iranistan Avenue, Bridgeport, CT

Dear Ms. Lee:

We are pleased to submit the enclosed report of the Phase I Environmental Site Assessment (Phase I ESA) for the above-referenced site. The assessment was conducted in conformance with Standard Practice E 1527-05 for Environmental Site Assessments published by the American Society for Testing and Materials.

ASTM 1527-05 requires that certain elements of a Phase I ESA be updated if the data for the report are more than six months old. Therefore, if this report is to be relied on after March 24, 2014, we recommend you contact us to discuss options for such an update.

We have identified nine recognized environmental conditions associated with the site. This is discussed in the conclusion of our report (*Section 8.0*).

In accordance with the requirements of the ASTM 1527-05 Standard, we declare that to the best of our professional knowledge and belief, we meet the definition of an environmental professional as defined in §312.10 of 40 CFR 312 and we have the specific qualifications based on education, training, and experience to assess the nature, history, and setting of the subject property. We have developed and performed all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Thank you for the opportunity to conduct this work. Please contact us if we can be of further assistance.

Sincerely,

Richard S. Kulzer, LEP
Project Manager

Andrew R. Zlotnick, LEP, LEEP AP
Senior Vice President

Enclosure

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FUSS & O'NEILL

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400 Iranistan Avenue

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1 Introduction

Fuss & O'Neill, Inc. has been retained by the Housing Authority of the City of Bridgeport (HACB) to conduct a Phase I Environmental Site Assessment (Phase I ESA) of the Marina Village located at 400 Iranistan Avenue in Bridgeport, Connecticut (the "Site"). Marina Village is a thirty-nine building, 389 unit apartment complex owned by HACB. We understand that HACB requested this Phase I ESA in anticipation of obtaining financing from Housing and Urban Development (HUD) for demolition of the buildings.

1.1 Objective

The objective of this Phase I ESA was to identify recognized environmental conditions (RECs) present at the Site. As defined by Standard Practice for Environmental Site Assessments E 1527-05 developed by the American Society for Testing and Materials (ASTM, 2005), REC means:

> *…the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimis conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.*

In portions of this report we refer to the Connecticut Department of Energy and Environmental Protection (DEEP). The Connecticut Department of Environmental Protection (CTDEP) was re-named the Department of Energy and Environmental Protection (DEEP) in July 2011. For convenience and consistency, we refer to the agency as the DEEP throughout this report, including the timeframe prior to July 2011.

1.2 Scope of Services

Our Phase I ESA was performed in conformance with Standard Practice E 1527-05 for Environmental Site Assessments by the American Society for Testing and Materials (ASTM, 2005).

Unless otherwise stated in this report, assessments for asbestos-containing materials, PCB-containing building materials, lead-based paint or plumbing materials, radon gas, and mold were not conducted as part of this Phase I ESA. Furthermore, we did not investigate the potential for the Site to contain wetlands, endangered species, ecological resources or historic/cultural resources. Additionally, environmental compliance or permitting issues were not considered during this investigation.

It is our understanding that this work is not being conducted under a United States Environmental Protection Agency (USEPA) Brownfield Assessment and Characterization Program grant awarded under CERCLA 9604(k)(2)(b); therefore, our investigation did not include an assessment of controlled

substances. Refer to *Appendix A* for the scope of work and restrictions of this ESA and to *Section 10.0* of this report for limitations on this work product.

2 Site Overview

2.1 Site Information

2.1.1 Property Location, Size of Parcel, and Site Plan

The Site, Marina Village, is located on the east side of Iranistan Avenue in a residential/commercial zone of Bridgeport, Connecticut (Fairfield County). A portion of a United States Geological Survey (USGS) topographic map showing the Site location is provided as *Figure 1* (USGS, 1970).

According to City of Bridgeport records, the Site is located on an 11.80-acre irregular-shaped parcel owned by HACB. The site is bound by South Avenue to the northwest, Railroad Avenue to the north, Park Avenue to the northeast, Johnson Street to the southeast, Ridge Avenue to the south, and Iranistan Avenue to the west. The site is bisected by Columbia Street which runs through the site. The Site includes 39 buildings constructed in the late 1940s to 1950. Seven of the buildings are currently vacant. A Site plan is provided as *Figure 2*. A copy of the online property description card available through the Bridgeport Assessor's Office website is attached in *Appendix B*. A description of the Site developed during the site inspection is presented in *Section 6.2*.

2.1.2 Utilities

According to the facility manager, Marina Village is served by municipal sewer and water. The City of Bridgeport Public Works Department, Building Department, and Aquarion, the public water supply company for the City of Bridgeport, did not have any information regarding the 400 Iranistan Avenue parcel hook-up dates. The public works department noted the buildings were built in the late 1940s to 1950 and the Water Pollution Control Authority for the City of Bridgeport was not established until 1989. Sanborn mapping indicates that municipal water was available in the vicinity of the site by 1889.

The Site's buildings were once heated by steam from the central boiler room of the Community Building, located on the northern side of Marina Village along South Avenue. According to the facility manager, the buildings made a switch from steam heat to natural gas. Although the exact date of the switch over to natural gas was not known by the site contact and not identified in our site research, we believe the switch over occurred in the late 1990s coinciding with removal of the oil supply tanks in 1999 which were formally located in the basement of the Community Building.

Electric, cable, and telephone services enter the Site via overhead wires.

2.1.3 Adjoining Land Use

Based on observations made during the site inspection and available mapping, properties adjoining the Site include the following:

Address	Description	Direction from Site
800 South Avenue	Industrial	NW
816 South Avenue	Warehouse	NW
824 South Avenue	Parking Lot	NW
840 South Avenue	Auto Repair	NW
478 Iranistan Avenue	Gas Station	NW
255 Iranistan Avenue #445	Residential	SW
310 Iranistan Avenue #320	Retail Store	S
139 Ridge Avenue	Vacant	S
123 Ridge Avenue #125	Playground	S
204 Walnut Street	Commercial	SE
99 Ridge Avenue #103	Vacant	SE
95 Ridge Avenue #97	Vacant	SE
91 Ridge Avenue #93	Vacant	SE
81 Ridge Avenue	Residential	SE
75 Ridge Avenue #77	Vacant	SE
67 Ridge Avenue #69	Vacant	SE
61 Ridge Avenue #63	Residential	SE
45 Ridge Avenue #51	Residential	SE
29 Ridge Avenue #35	Residential	SE
131 Columbia Street #137	Vacant	SE
160 Columbia Street	Commercial	SE
119 Johnson Street #123	Vacant	SE
109 Johnson Street #111	Residential	SE
105 Johnson Street #107	Residential	SE
99 Johnson Street #101	Vacant	SE
91 Johnson Street	Residential	SE
83 Johnson Street	Residential	SE
77 Johnson Street	Vacant	SE
67 Johnson Street	Residential	SE
59 Johnson Street	Residential	SE
49 Johnson Street #51	Residential	SE
41 Johnson Street #43	Vacant	SE
33 Johnson Street #35	Vacant	SE
25 Johnson Street	Church Property	SE

475 Park Avenue	Car Wash	SE
500 Park Avenue	Retail Stores	E
513 Park Avenue	Retail/Residential	N (Across Railroad Tracks)
561 Park Avenue	Retail/Residential	N (Across Railroad Tracks)
569 Park Avenue #571	Vacant	N (Across Railroad Tracks)

2.2 Environmental Setting

2.2.1 Physical Setting

Topography and Geology

The topography of the Site is flat (USGS, 1970). The regional topography generally slopes down gradually to the south, towards the Long Island Sound.

The University of Connecticut's Connecticut Environmental Conditions Online (CTECO) Advanced Map Viewer describes surficial material at the Site as sands overlying fines. Bedrock is not mapped underneath the Site.

Hydrology and Hydrogeology

The quality of groundwater beneath the Site is classified by the Connecticut Department of Energy and Environmental Protection as GB (DEEP, 2011). Such groundwater is presumed not to be suitable for human consumption without treatment and is used for industrial process water and cooling waters (DEEP, 2011).

The direction of groundwater flow within the surficial geological unit is influenced by a number of factors, including the physical characteristics of the geological unit (such as particle size), the local topography, the presence of surface water bodies, the depth to bedrock, and the type of aquifer. For an unconsolidated, unconfined aquifer, groundwater generally flows in the direction of the greatest topographic gradient. Based on USGS mapping and field observations of the local topography and surface water hydrology, the inferred groundwater flow direction is to the west. Depth to groundwater is estimated to be 10 feet.

The nearest surface water body, Cedar Creek, is located approximately 920 feet west of the Site (USGS, 1970). Cedar Creek is a tidally influenced river that discharges into the Long Island Sound and is classified by the State of Connecticut as SB (DEEP, 2011). Designated uses of such coastal and marine surface waters are for marine fish, shellfish and wildlife habitat, shellfish harvesting for transfer to approved areas for purification prior to human consumption, recreation, industrial and other legitimate uses including navigation (DEEP, 2011).

2.2.2 Location of Public Water Supply Sources

The DEEP's 2011 Connecticut Environmental Conditions Online (DEEP, 2011) and the Atlas of Public Water Supply Sources and Drainage Basins of Connecticut (CTDEP, 1982) show no public water-supply wells or aquifer protection areas within a one-half mile radius of the Site.

2.3 Previous Environmental Investigations

Key site manager, Sharon Lee of the HACB, is unaware of any previous environmental investigations having been performed on the Site.

3 Site History

The following sources were used to develop the history of the Site and, to the extent required by ASTM Practice E 1527-05, the nearby sites:

- City street directories (available at the Connecticut State Library) reviewed at approximately five-year intervals dating back to the year 1960
- Sanborn Fire Insurance Maps (available at the Connecticut State Library) for the years 1884, 1889, 1898, 1913, 1939, 1950 and 1972
- Aerial photographs (available at the State Archives of the Connecticut State Library) for the years 1975 and 1980
- Aerial photographs (obtained electronically from the State Archives of the Connecticut State Library) for the years 1934 and 1965
- Aerial photographs (obtained electronically from the University of Connecticut Map and Geographic Information Center) for the years 1951, 1970, 1986, 1990 and 1995
- Aerial photographs (obtained electronically from the DEEP's 2011 Connecticut Environmental Conditions Online (DEEP, 2011) for the years 2004 and 2010
- Historical USGS Topographic Maps for the years 1893 and 1951, available on-line from the Documents Department and Data Center of the University of New Hampshire (http://docs.unh.edu/nhtopos/nhtopos.htm)
- Sharon Lee, Associate AIA, PM, for the Planning Development & Modernization division at the Housing Authority of the City of Bridgeport

- Files and personnel at the City of Bridgeport offices of the City Clerk, Building Department, Engineering Department, Planning and Zoning Department, Health Department, and Fire Marshal.

The past uses of the Site and nearby properties based on the sources above are summarized below.

Site
The Marina Village was constructed during the late 1940s and is shown in its current location on the 1950 Sanborn fire insurance map. Prior to the 1930s, the Site was occupied by the Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings, Hotchkiss Sons' Manufacturers Curry Combs & Company and by a number of homes. The 1884 Sanborn map shows the foundry buildings located predominantly along both the northern and southern sides of South Avenue. The foundry used coal to fuel their operations, which included operations such as annealing, trimming, core making, tumbling, and molding. Hotchkiss Sons Manufacturers Curry Combs & Company was located southwest of the Bridgeport Malleable Iron Works along South Avenue. The Hotchkiss Sons Manufacturers Curry Combs & Company property included a manufacturing building, a wood shop, coal storage, and lumber storage. Operations included scouring, tempering, and japanning. A number of homes were located along the north side of Johnson Street, the west side of Columbia Street, the west side of Park Avenue, and the south side of Railroad Avenue at the east end of the site.

The 1889 Sanborn map shows that several residential dwellings were located on the Site along the north side of Johnson Street and near the corner of Railroad Avenue and Park Avenue. The Hotchkiss Sons Manufacturers and Curry Combs & Company site was vacant and the Bridgeport Malleable Iron Works had expanded its operations to the east.

The 1898 Sanborn Map shows the former Hotchkiss Sons Manufacturers Curry Combs & Company property was occupied by Edward S. Hotchkiss Hardware Manufacturing. Operations at the property included stamping, polishing, a machine shop, wood working, and japanning.

The 1913 Sanborn Map shows the Edward S. Hotchkiss Hardware Manufacturing buildings were no longer present at the Site and the Bridgeport Malleable Iron Works became the Eastern Malleable Iron Company. The Eastern Malleable Iron Company had expanded to the south toward Walnut Street adding additional foundry, core making, and sand bins. According to the 1913 Sanborn map, core making (or molding) buildings, foundry buildings, annealing, trimming, pickling, brick and old casting storage, carpentry shop, grinding, rolling, furnaces, shipping and storage, offices, a locomotive house, and storage sheds were present at the Site. The 1913 Sanborn map shows that the area between Walnut Street and Iranistan Avenue and between Ridge Avenue and South Avenue was vacant. The 1913 Sanborn map also shows that homes and stores were located along the north side of Ridge Avenue.

By 1939, the Sanborn maps show that the majority of the Eastern Malleable Iron Company had been razed and was no longer present at the Site or surrounding areas. One of the former annealing buildings located at the eastern end of the Site remained and was being utilized by The Reliable Steel Drum Corporation for reconditioning steel drums. A number of homes, apartments, and stores remained along Ridge Avenue, Columbia Street, Johnson Street, Railroad Avenue, and Park Avenue. As with any

site located in a heavily urbanized area where former structures have been razed, the potential exists for the presence of urban fill containing ash, coal, and asphalt fragments.

The 1950 Sanborn map shows the Marina Village was complete in its current layout.

Nearby Properties
Properties located to the south and east along Ridge Avenue, Columbia Street, and Johnson Street have historically been used for residential and retail store uses going back to the 1890s. Properties to the north were historically part of the Bridgeport Malleable Iron Works foundry going back to the 1880s. The Connecticut Clasp Company which manufactured metal corset parts was located to the east of the Site across Park Avenue from the early 1900s until after 1950. By 1972 the Connecticut Clasp Company buildings were razed and a retail store was located at the Site. The Bridgeport Deoxidized Bronze & Metal Company was historically located to the west of the site at the west corner of Iranistan Avenue and South Avenue. By 1950, the property along the northern side of South Avenue was occupied by a motor freight station. Outdoor parking areas are visible from aerial photographs and a gas tank was located outside the southeastern corner of the building. From approximately 1960 to 1980, this property was occupied by a beer distributor warehouse. The property located at 816 South Avenue, located northeast of the Site, has been occupied by a scrap metal yard since the 1960s. The property located at 840 South Avenue/478 Iranistan Avenue, located northwest of the Site has been occupied by Nunes Auto Repair, an auto body shop and gasoline station, since the 1960s.

4 Federal, State, and Local File Review

Files of Federal, State and local agencies were reviewed for environmentally-related issues pertinent to the Site and nearby parcels, such as permits, inspection reports, enforcement history or documented releases of hazardous materials. The sources of information listed in the following table were researched to identify properties of concern within distances of the Site specified by ASTM Practice E 1527-05.

Information Source*	Search Distance
Federal Files	
National Priorities List (NPL)	1 mile
Delisted NPL Sites	0.5 mile
Resource Conservation and Recovery Act (RCRA) CORRACTS list (RCRA Site Subject to Corrective Action)	1 mile
Resource Conservation and Recovery Act (RCRA) Treatment, Storage or Disposal Facility (TSDF) List	0.5 mile
Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) List, including No Further Remedial Action Planned (NFRAP) sites	0.5 mile
RCRA Generators List	property and adjoining
RCRA No Longer Regulated (NLR) List	property and adjoining
Federal Institutional / Engineered Control List	property only

Information Source*	Search Distance
Emergency Response and Notification (ERNS) List	property only
State Files	
Hazardous Waste Site List (State sites equivalent to NPL)	1 mile
Hazardous Waste Site List (State sites equivalent to CERCLIS)	0.5 mile
Landfill and Solid Waste Site	0.5 mile
Leaking Underground Storage Tank (LUST) List	0.5 mile
State Voluntary Clean-up or Brownfield Sites	0.5 mile
Oil & Chemical Spills Database	property and adjoining
Registered Underground Storage Tank (UST) List	property and adjoining
State Institutional / Engineered Control List	property only

*Fuss & O'Neill used Environmental Data Resources, Inc. (EDR), an environmental database search service, to obtain the information referenced in the above table. EDR provides access to publicly available environmental databases maintained by various Federal, State, and local agencies. A copy of the information provided by EDR relative to the Site and nearby properties is included in *Appendix C*. The listed information sources are defined and described in detail in the EDR report.

4.1 Summary of Regulatory Database Information

Site

As reported in the EDR Report in *Appendix C*, one environmental concerns was identified for the Site in the environmental databases searched.

- 733 South Avenue: On December 9, 1999, a LUST was reported at HACB's Marina Village office building. Eighteen inches of #2 fuel oil from an underground tank failure covered the floor of a 400 square-foot room on December 7, 1999. The local fire department, fire marshal, and DEP dispatch was notified. When recorded on December 9, 1999 only four inches of oil remained on the floor. According to the EDR Report, it was unknown where oil was going, how many tanks were buried outside, and of what volume they were. Groundwater and surface water was affected. The status for this event is closed. Upon completion of the site walk, we believe this was more likely a release from the above ground storage tank in the basement, not underground storage tanks.

Nearby Properties

As reported in the EDR Report in *Appendix C*, several properties were identified in the environmental databases within the minimum search radii required by ASTM Practice 1527-05. Based on distance from the Site and the local hydrogeology, these parcels are not anticipated to have a negative effect on the subject property, with the following exceptions:

- 478 Iranistan Avenue: Nunes Auto Repair Inc. is a general automotive repair shop and gasoline station located adjacent to the site on the opposite side of South Avenue. It is currently in use and includes three underground storage tanks installed in 2009. Two 3,000 gallon tanks and one 8,000 gallon tank store gasoline. Three underground storage tanks installed in 1992, two 8,000 and one 3,000 gallon, have been closed and removed.

- 800 South Avenue: A waste oil spill was reported on September 13, 1996. Current status is closed. The City of Bridgeport WPCA was listed as the discharger.

- 750 South Avenue: According to an emergency incident field report by John Aceto (CTDEEP), the Department of Transportation (DOT) discovered a 550-gallon leaking underground storage tank (LUST) during an I-95 highway project on April 23, 1997. The DOT wanted to remove the tank and address the impacted soils at a later date. Soil samples collected indicated high levels of total petroleum hydrocarbon (TPH) in surrounding soils. The LUST was removed, #2 fuel oil originally stored within the tank was pumped out and contained. Contaminated soil was removed and the status is closed.

- 720 South Avenue: The DOT closed and removed a 1,000-gallon underground storage tank located at the Former Westek Corporation. The former UST stored gasoline/motor fuel. On March 1, 1997 the tank was closed. Removal occurred March 26, 1997. The status for this event is closed. A LUST with an incident date of March 26, 1997 was also recorded for this address, but the EDR report does not include any release information other than the material was motor fuel and the status is completed.

Due to the inferred groundwater flow direction and/or the proximity of these properties to the Site, the potential exists for releases that occur at these sites to have an adverse impact on groundwater quality at the Site. However, the DEEP's policy on upgradient sources of contamination is that a downgradient property owner is not responsible for remediating groundwater contamination flowing onto his or her property from another site, as long as the contamination is present solely as a result of the off-site sources (Policy on Upgradient Contamination, Michael Harder, Director of Permitting, Enforcement, and Remediation Division, August 28, 1997).

4.2 State File Review

As part of our records review, correspondence files for the following were requested on November 13, 2012 from the DEEP Records Center and PCB Programs Department:

- 400 Iranistan Avenue
- Marina Village
- Miscellaneous Town Files

Files requested include the following:

- Property Transfer Program filings
- UST files
- Leaking UST files

- P-5 Inspection Reports
- Water Industrial/Remediation files
- Pre-1990 Spill files
- PCB files
- Hazardous Waste/RCRA files
- Environmental Land Use Restrictions

No correspondence files for the Site were available at the DEEP Records Center or the PCB Programs Department.

In addition, the DEEP Hazardous Waste Manifests Database, which summarizes manifests submitted from 1984 through 2007, was reviewed. No hazardous waste manifests were listed for the Site.

4.3 Wastewater and Leachate Discharge Sources

The Connecticut Leachate and Wastewater Discharge Sources Map (CTDEP, 1997) was reviewed to determine if any historical discharges to the ground in the area of the Site have been reported. The historical discharges listed below are located within a one half-mile radius of the Site.

Facility-Discharge	Distance / Direction from Site
Industrial wastewater	2,400' W
Miscellaneous	3,000' W
Cooling water	3,000' W
Cooling water	3,000' W
Oil/chemical spill	2,600' N
Oil/chemical spill	2,600' N
Oil/chemical spill	2,300' E
Leaking Underground Storage Tank	1,800' E

Due to distance from the Site and/or the inferred groundwater flow direction, none of these discharges are inferred to have a significant potential to adversely impact the Site.

4.4 Local File Review

The City of Bridgeport Assessor's office provided a record of ownership of the Site. Note that this review does not constitute a full title search.

According to the Tax Assessor and City Clerk, the Housing Authority of the City of Bridgeport has been the owner of the 400 Iranistan Avenue parcel since 1963. No ownership information dating further back than 1963 was available. The site plan, *Figure 2*, with a revision date of August 23, 1940 and titled, *South*

End Housing Project for the Housing Authority of the City of Bridgeport, Conn. under Loan Contract with the United States Housing Authority provides evidence of HACB ownership prior to 1963.

Files and personnel at the Bridgeport offices of the City Clerk, Tax Assessor, Building Department, Planning and Zoning Department, Health Department, and Fire Marshal were queried regarding environmental concerns at the Site and surrounding sites. No environmental concerns were identified for the Site.

As part of this assessment, staff members at the Office of the Fire Marshal were queried for any information pertinent to the Site. They stated they have no knowledge of releases or threatened releases of hazardous substance at the Site.

5 User-Provided Information

ASTM Practice 1527-05 describes certain tasks to be performed by the user of this assessment that will help to identify RECs at the parcel if they exist. ASTM Practice 1527-05 defines the user as "the party seeking to use Practice E 1527 to complete an environmental site assessment of the property." Users can include a potential purchaser or tenant of the property, a lender, a property manager, or a property owner.

As part of our agreement to conduct this work, we provided Sharon Lee, Associate AIA, PM for the Planning Development & Modernization division of HACB, with a User Questionnaire. A copy of this questionnaire and responses is provided in *Appendix E*.

The responses to this questionnaire were used to address the items in the subsections below.

5.1 Record of Environmental Liens or Activity and Use Limitations

Chain of title and title restriction records filed under federal, tribal, state or local law contain records of environmental liens or activity and use limitations (AULs), such as environmental land use restrictions in the State of Connecticut.

Ms. Lee reported, on behalf of HACB, that they are unaware of a chain of title and title restrictions records review having been performed for the Site. In addition, Ms. Lee reported that they have no actual knowledge of an environmental lien or ELURs recorded against the property.

Fuss & O'Neill reviewed the Connecticut database of recorded environmental land use restrictions on file at the DEEP. No environmental land use restrictions were identified for the Site.

5.2 Specialized Knowledge or Experience of the User

Ms. Lee, on behalf of HACB**,** reported that they have no specialized knowledge with respect to the Site or activities conducted at the Site.

5.3 Commonly Known or Reasonably Ascertainable Knowledge

Ms. Lee, on behalf of the HACB, reported that they are not aware of any commonly known or reasonably ascertainable knowledge within the local community that could assist the environmental professional with the identification of RECs.

5.4 Property Valuation, Reduction for Environmental Issues

Ms. Lee, on behalf of HACB did not provide information pertaining to the valuation of the Site as the Site is not subject to a property transaction. The HACB currently owns the property.

6 Site Reconnaissance and Interviews

6.1 Interviews

Owner/Key Site Manager

This assessment included an interview with the key site contact, Sharon Lee of the HACB. Prior to conducting the interview, Fuss & O'Neill forwarded a Phase I ESA Questionnaire to Ms. Lee. The completed questionnaires are included in *Appendix E*. Information provided by her is presented below and in previous sections of this report.

Ms. Lee of the Housing Authority of the City of Bridgeport, responded with, "No" to the each of the questions including:

> *4. Are there currently or have their previously been any damaged or discarded automotive or industrial batteries, pesticides, paints, or other chemicals in individual containers of greater than 5 gal (19 L) in volume or 50 gal (190 L) in the aggregate, stored on or used at the property or at the facility?*
>
> *5. Are there currently or previously has there been any industrial drums (typically 55 gal (208L)) or sacks of chemicals located on the property or at the facility?*
>
> *7. Are there currently or has there previously been any floor drains, septic systems, dry wells, pits, ponds, or lagoons located on the property in connection with waste treatment or waste disposal?*

12. Does the owner or occupant of the property have any knowledge of any environmental site assessment of the property or facility that indicated the presence of hazardous substances or petroleum products on, or contamination of, the property or recommended further assessment of the property?

6.2 Site Reconnaissance

The site reconnaissance was conducted on September 18, 2013 by Gregory Toothill, PE accompanied by a member of the facility maintenance team. The inspection included the physical observation of the exterior of the entire Site, the interior of the Community/Maintenance building, the interior of several vacant apartments, and the crawlspaces below 31 of the apartment buildings. Photographs taken during the inspection are presented in *Appendix F*.

Site Description

The Site consists of 39 buildings, including 38 apartment buildings and one community/maintenance building with a former heating plant. A playground is located on the Site as well as several parking areas. Refer to *Figure 2* for a site plan.

Building

According to the property card there are 39 building located at the site. Two are 7,028 square-feet, 19 are 7,236 square-feet, ten are 10,476 square-feet, and eight are 11,016 square feet. The buildings were built in 1950 and are constructed of a brick exterior. Twelve of the buildings are constructed with gable roofs with asphalt shingles while the remainder are flat, tar and gravel roofs. The apartment buildings consist of a first floor, a finished upper story, and an unfinished crawlspace below the buildings. A natural gas hot water heater and furnace are located in each unit. Suspect asbestos containing material was used as pipe insulation in many of the basement crawl spaces. An electric box and a natural gas meter hookup with associated piping are attached to each unit.

Seven of the buildings are currently vacant (Building #s 7, 25, 26, 27, 28, 29, and 34).

The Community/Maintenance Building consists of offices and a large community meeting room on the first floor and a maintenance area and a former boiler and fuel oil storage tank area in the basement. The Maintenance Area consisted of a carpentry shop, a storage area, an office, bathrooms, and a break room. Small quantities of paint, PVC cement, motor oil, and other chemicals were stored in the storage areas and the carpentry shop. All stored chemicals appeared to be properly stored in original sealed containers. The former boiler and fuel oil storage tank had been removed. A sump pump was located in the former boiler room.

A maintenance garage is located off the south side of the community building that is used for storage of lawn and maintenance equipment. Minor staining was observed on the concrete floor in the area where the lawn equipment was stored. The concrete floor in the maintenance garage appeared to be in good condition and the stains are believed to be a de minimis condition.

A shed located on the east side of the Community/Maintenance Building was inaccessible at the time of the inspection.

Grounds

The surrounding grounds are flat and landscaped with grass, trees, and sidewalks leading to individual units of the buildings.

6.3 Non-ASTM Scope Considerations

Housing and Urban Development requires a Phase I to include a discussion of available wetland, flood zone, and radon mapping for the Site. The University of Connecticut's CTECO Advanced Map Viewer shows no wetlands for the Site. The FEMA Flood Insurance Rate Map shows that a large portion of the south end of the Site, including all or portions of Buildings 5-14, 18-23, and 26-31 are located within the 100-year flood plain. Radon mapping is available online through CTDEEP. The indoor radon potential rating for the Site is low to medium.

7 Connecticut Transfer Law Status

The State of Connecticut Property Transfer Law, described in Sections 22a-134a through 22a-134e of the Connecticut General Statutes, requires the disclosure of environmental conditions when certain real properties and/or businesses are transferred. The law applies only to those properties that are deemed to be "establishments" as defined under the law. As defined by the Transfer Act (Sections 22a-134a et seq. of the Connecticut General Statutes, as amended), an establishment is:

> *…any real property at which or any business operation from which (A) on or after November 19, 1980, there was generated, except as the result of remediation of polluted soil, groundwater or sediment, more than one hundred kilograms of hazardous waste in any one month, (B) hazardous waste generated at a different location by another person or municipality was recycled, reclaimed, reused, stored, handled, treated, transported or disposed of, (C) the process of dry cleaning was conducted on or after May 1, 1967, (D) furniture stripping was conducted on or after May 1, 1967, or (E) a vehicle body repair facility is or was located on or after May 1, 1967.*

If the Site is determined to be an establishment, DEEP reporting and involvement may be required in order to transfer the property, and DEEP will require identification, delineation, and remediation of all environmental concerns in accordance with Connecticut's Remediation Standard Regulations.

Activities that would qualify the facility as an "establishment" have not been identified. However, should a determination as to the regulatory status of the Site with regard to the Connecticut Transfer Law be desired, legal counsel should be consulted.

8 Data Gaps, Findings and Conclusions

8.1 Data Gaps

Standard Practice 1527-05 requires the identification and evaluation of data gaps or data failures, which are defined as a lack of or inability to obtain information required by the practice despite good faith

efforts by the environmental professional to gather such information. The following data gaps were identified during this investigation:

- It was not possible to identify past uses of the Site back to its first known development. Past uses were identified back to 1889, at which time the parcel was used for industrial purposes. The potential for the presence of RECs resulting from activities conducted prior to 1889 is mitigated by the less common use of hazardous substances or petroleum products in the United States prior to the mid-1800s.

8.2 Findings and Conclusions

Fuss & O'Neill, Inc. prepared this Phase I ESA report in general conformance with the scope and limitations of ASTM Practice E 1527-05. Any exceptions to, or deletions from, this practice are described in *Appendix A* of this report.

This assessment has revealed several RECs in connection with the subject property that warrants additional investigation or action at this time.

REC-1: Historic Foundry Operations
The Bridgeport Malleable Iron Works / Eastern Malleable Iron Company was present at the Site from prior to 1884 to the mid-1930s. Releases of petroleum products or hazardous materials resulting from the historic metal foundry and manufacturing operations and/or deposition of coal ash or other foundry by-products used as fill at the Site may have occurred.

REC-2: Historic Metal Pickling Operations
Historic metal pickling operations associated with the former foundry operations likely generated waste sludge that would currently be classified as hazardous. A release of release of hazardous materials resulting from the historic pickling operations at the Site may have occurred.

REC-3: Historic Manufacturing Operations
Hotchkiss Sons Manufacturers Curry Combs & Company / Edward S. Hotchkiss Hardware Manufacturing were present at the Site from prior to 1884 and were gone by 1913. Releases of petroleum or hazardous materials from the manufacturing operations may have occurred.

REC-4: Historic Japanning Operations
Japanning operations associated with the Hotchkiss Sons Manufacturers Curry Combs & Company / Edward S. Hotchkiss Hardware Manufacturing have the potential to generate a release of petroleum based materials at the Site.

REC-5: Historic Steel Drum Reconditioning
Following the closure of the Bridgeport Malleable Iron Works / Eastern Malleable Iron Company one of the former annealing buildings at the east end of the foundry was occupied by the Reliable Steel Drum Corporation for reconditioning steel drums and the area to the east of the former annealing building was used for the storage of steel drums. Releases of petroleum products or hazardous materials resulting from the historic steel drum reconditioning operations may have occurred.

REC-6: Historic Coal Storage
Two historic coal storage areas were identified on the site. A coal storage shed was located along Railroad Avenue on the Bridgeport malleable Iron Works property and a coal bin associated with the Hotchkiss Sons Manufacturers Curry Combs & Company was located behind their manufacturing facility.

REC-7: Historic Urban Fill
As with any site located in heavily urbanized area where former structures have been razed or with multiple generations of development, the potential for the presence of urban fill containing ash, coal, asphalt fragments, or manufacturing by-products exists.

REC-8: #2 Fuel Oil Release
On December 9, 1999, release of #2 fuel was reported to DEEP which occurred within the basement of the HACB's Marina Village office building (733 South Ave). The spill report indicated that eighteen inches of #2 fuel oil was released to the basement the floor of a 400 square-foot room on December 7, 1999. The release was estimated at 4,500 gallons. When the spill was reported on December 9, 1999 only four inches of oil remained on the floor. The status of the spill report is closed; however, no confirmatory samples were available for review. There is a potential that the release has impacted soil and groundwater at the Site.

REC-9: USTs
Approximately 30 former homes, storefronts, and apartment buildings were previously located on the Site along Ridge Avenue, Columbia Street, Johnson Street, Park Avenue and Railroad Avenue. There is potential for fuel oil USTs associated with these structures to have been abandoned in place.

Potential off-site concerns:

- Petroleum releases were identified in areas nearby and inferred to be upgradient of the Site. These releases were generally small and appear to have been adequately addressed. Therefore, we believe that little risk of impact from these releases to groundwater at the Site exists, and no additional action is recommended.

Fuss & O'Neill has followed the guidelines described in ASTM E1527-05 to identify the RECs at the Site in a manner consistent with standard practice in the industry. However, as indicated in the ASTM standard, "No environmental site assessment can wholly eliminate uncertainty regarding the potential for RECs in connection with a property. Performance of this practice is intended to reduce, but not eliminate, uncertainty regarding the potential for RECs in connection with a property, and the practice recognizes reasonable limits of time and cost."

9 References

American Society for Testing and Materials, 2005, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process: ASTM Practice E 1527-05.

Connecticut Department of Environmental Protection, 1982, The Atlas of Public Water Supply Sources and Drainage Basins of Connecticut; CTDEP Natural Resources Center.

Connecticut Department of Environmental Protection, 1997, Water Quality Classifications for the Housatonic River, Hudson River, and Southwest Coastal Basins; CTDEP, Bureau of Water Management; adopted April 8, 1997.

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Connecticut Department of Environmental Protection, 2011, Water Quality Standards; CTDEP, Effective February 25, 2011.

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10 Limitations of Work Product

This document was prepared for the sole use of the Housing Authority of the City of Bridgeport, the only intended beneficiaries of our work. Those who may use or rely upon the report and the services (hereafter "work product") performed by Fuss & O'Neill, Inc. and/or its subsidiaries or independent professional associates, subconsultants and subcontractors (collectively the "Consultant") expressly accept the work product upon the following specific conditions.

1. Consultant represents that it prepared the work product in accordance with the professional and industry standards prevailing at the time such services were rendered.

2. The work product may contain information that is time sensitive. The work product was prepared by Consultant subject to the particular scope limitations, budgetary and time constraints and business objectives of the Client which are detailed therein or in the contract between Consultant and Client. Changes in use, tenants, work practices, storage, Federal, state or local laws, rules or regulations may affect the work product.

3. The observations described and upon which the work product was based were made under the conditions stated therein. Any conclusions presented in the work product were based solely upon the services described therein, and not on scientific or engineering tasks or procedures beyond the scope of described services.

4. In preparing its work product, Consultant may have relied on certain information provided by state and local officials and information and representations made by other parties referenced therein, and on information contained in the files of state and/or local agencies made available at the time of the project. To the extent that such files which may affect the conclusions of the work product are missing, incomplete, inaccurate or not provided, Consultant is not responsible. Although there may have been some degree of overlap in the information provided by these various sources, Consultant did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this project. Consultant assumes no responsibility or liability to discover or determine any defects in such information which could result in failure to identify contamination or other defect in, at or near the site. Unless specifically stated in the work product, Consultant assumes no responsibility or liability for the accuracy of drawings and reports obtained, received or reviewed.

5. If the purpose of this project was to assess the physical characteristics of the subject site with respect to the presence in the environment of hazardous substances, waste or petroleum and chemical products and wastes as defined in the work product, unless otherwise noted, no specific attempt was made to check the compliance of present or past owners or operators of the subject site with Federal, state, or local laws and regulations, environmental or otherwise.

6. If water level readings have been made, these observations were made at the times and under the conditions stated in the report. However, it must be noted that fluctuations in water levels may occur due to variations in rainfall, passage of time and other factors and such fluctuations may affect the conclusions and recommendations presented herein.

7. Except as noted in the work product, no quantitative laboratory testing was performed as part of the project. Where such analyses have been conducted by an outside laboratory, Consultant has relied upon the data provided, and unless otherwise described in the work product has not conducted an independent evaluation of the reliability of these tests.

8. If the conclusions and recommendations contained in the work product are based, in part, upon various types of chemical data, then the conclusions and recommendations are contingent upon the validity of such data. These data (if obtained) have been reviewed and interpretations made by Consultant. If indicated in the work product, some of these data may be preliminary or screening-level data and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors.

9. Chemical analyses may have been performed for specific parameters during the course of this project, as described in the work product. However, it should be noted that additional chemical constituents not included in the analyses conducted for the project may be present in soil, groundwater, surface water, sediments or building materials at the subject site.

10. Ownership and property interests of all documents, including reports, electronic media, drawings and specifications, prepared or furnished by Consultant pursuant to this project are subject to the terms and conditions specified in the contract between the Consultant and Client, whether or not the project is completed.

11. Unless otherwise specifically noted in the work product or a requirement of the contract between the Consultant and Client, any reuse, modification or disbursement of documents to third parties will be at the sole risk of the third party and without liability or legal exposure to Consultant.

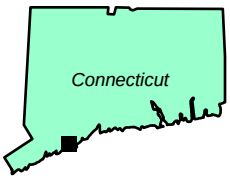
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13. Any use of or reliance on the work product shall constitute acceptance of the terms hereof.

Figures



MAP REFERENCE:
THIS MAP WAS PREPARED FROM THE FOLLOWING
7.5 MINUTE SERIES TOPOGRAPHIC MAP:
BRIDGEPORT, CONN. 1970 REVISED 1984



Quadrangle Location

0 1000 2000
GRAPHIC SCALE

SCALE: 1"=2000'

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FUSS & O'NEILL
56 QUARRY ROAD TRUMBULL, CT 06611 860.646.2469

PHASE I ESA

SITE LOCATION MAP

400 IRANASTAN AVENUE – MARINA VILLAGE

BRIDGEPORT CONNECTICUT

PROJ. No: 20121111.A12
DATE: SEPTEMBER 2013

FIGURE 1



FIGURE 2

NOTES:

BASE MAP OBTAINED AT HTTP://POI.PICTOMETRY.COM LOCATION OF ANNOTATED FEATURES ARE APPROXIMATE AND BASED ON FIELD OBSERVATIONS, AERIAL PHOTOGRAPHS, AND SANBORN MAPS.

www.FandO.com

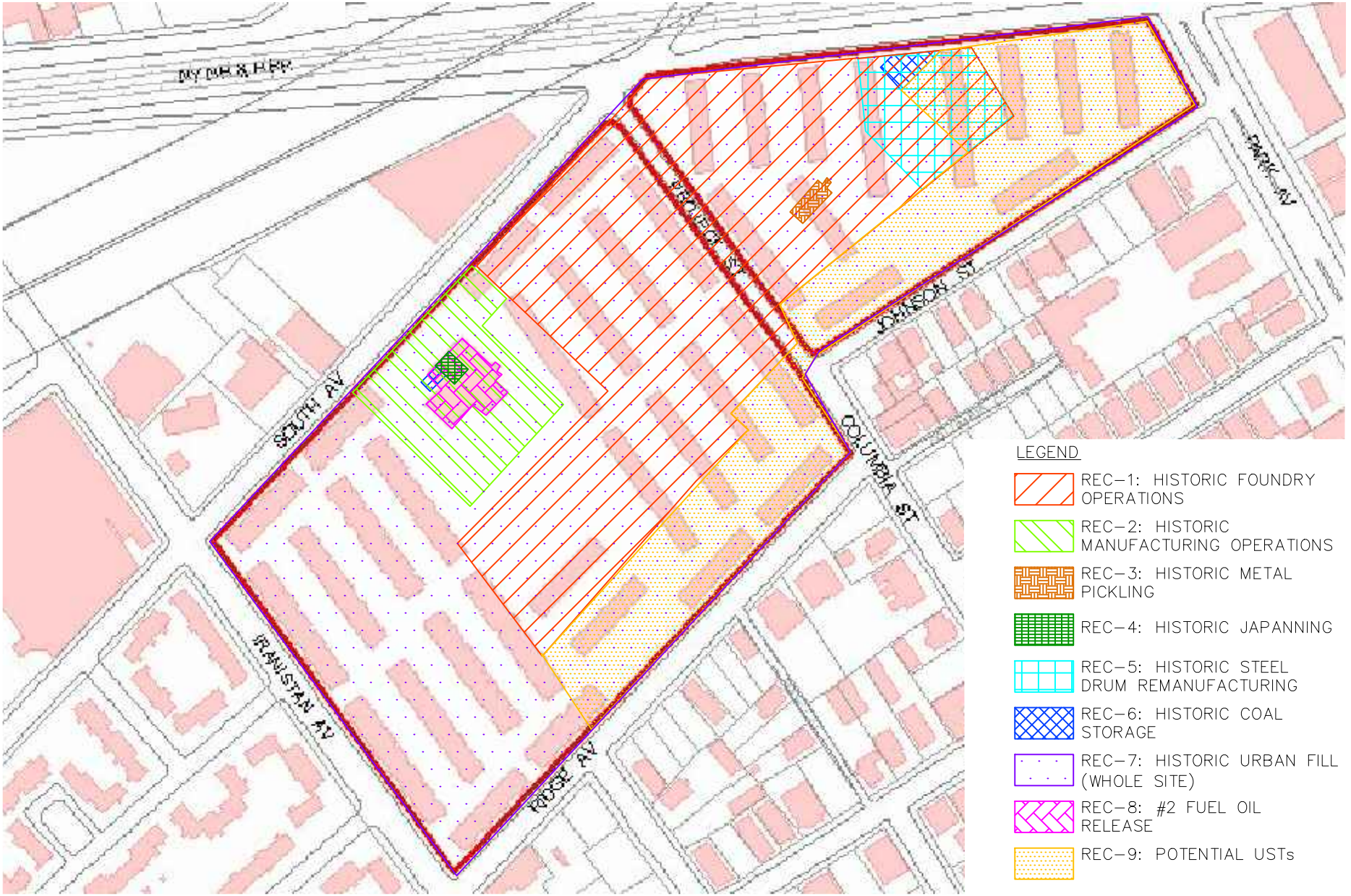
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SITE PLAN
MARINA VILLAGE

400 IRANISTAN AVENUE **BRIDGEPORT, CT**

PROJ NO. 20121111.A12 **DATED: AUGUST 2013** **SCALE = GRAPHIC**



File Path: J:\DWG\P2012\1111\A12\Environmental\Plan\20121111A12_STP01.dwg Layout: 08.5X11-L_DWG TO PDF Plotted: Wed, September 18, 2013 - 5:48 PM User: gtoothill
MS VIEW: LAYER STATE: Plotter: DWG TO PDF.PC3 CTB File: FO HALF.STB

SCALE:	
HORZ.: 1" = 200'	
VERT.:	
DATUM:	
HORZ.:	
VERT.:	

0 100 200
GRAPHIC SCALE

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TRUMBULL, CONNECTICUT 06611
203.374.3748
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BRIDGEPORT HOUSING AUTHORITY

RECOGNIZED ENVIRONMENTAL CONDITIONS PLAN

MARINA VILLAGE
400 IRANISTAN AVENUE

BRIDGEPORT CONNECTICUT

PROJ. No.: 20121111.A12
DATE: SEPTEMBER 2013

FIG. 3

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Appendix A

Scope of Work and Restrictions

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All Appropriate Inquiry Phase I ESA Scope of Work

Fuss & O'Neill uses Standard Practice E 1527-05 as the general standard for conducting Phase I ESAs. For consistency, this scope of work is generally presented based on the outline of our standard Phase I ESA report. The descriptions of the procedures and sources for obtaining the information for each section follow the section headings. As specified by Standard Practice E 1527-05, the scope of work described below allows for use of professional judgment to determine the extent to which specific sources are reviewed.

Unless otherwise specified, the following items are not considered in the course of completing an ASTM E 1527-05 Phase I ESA:

- Asbestos, Lead (paint/plumbing), Radon, Mold, Fluorescent Light Ballasts
- Wetlands, Ecological Resources, Historical/Cultural Resources
- Regulatory and Health & Safety Compliance
- Endangered species

These items typically present little environmental risk to the grounds of a site; however, these items may be liabilities during property transfer, regulatory audits, construction, renovation, or demolition projects.

1.0 Introduction

The objective of the ESA and the party that this ESA was conducted for are identified in this section.

2.0 Site Overview

2.1 Site Information

2.1.1 Property Location, Size of Parcel, and Site Plan
Review of USGS topographic maps, local assessor and zoning maps and property description cards, field observations and sketches, and, if available, plans provided by a contact for the Site. A site plan is included that is derived from these sources.

2.1.2 Potable Water Supply and Sewage Disposal
Query the local Department of Public Works, local Engineering Department, appropriate local utilities, and/or other local municipal sources and/or a knowledgeable site contact.

2.1.3 Adjoining Land Use
Site reconnaissance and assessor's mapping.

2.2 Physical Setting of Site

2.2.1 Geologic and Physiographic Setting
Site reconnaissance, USGS topographic maps, and available geological maps.

2.2.2 Groundwater
Site reconnaissance, USGS topographic maps, and DEEP water quality maps and water quality standards.

2.2.3 Surface Water
Site reconnaissance, USGS topographic maps, and DEEP water quality maps and water quality standards.

2.2.4 Location of Public Water Supply Sources
Site reconnaissance, DEEP water supply source mapping, and mapping available in local departments queried as part of the ESA.

2.3 Previous Environmental Investigations
Provided by the appropriate site contact or identified by other means during the course of conducting the ESA.

3.0 Site History

Site reconnaissance, knowledgeable site contacts, aerial photographs available at the State Archives and DEEP, Sanborn fire insurance maps available at the State Library, street directories

available at the State Library (note that street directories are reviewed at approximately five-year intervals, but may be reviewed at smaller intervals for multi-tenant properties), and local municipal sources (local municipal Building Department, Engineering Department, Planning and Zoning Department, Health Department,
and Fire Marshal).

4.0 Federal, State, and Local File Review

4.1 Summary of Regulatory Database Information
Regulatory databases specified by Standard Practice E 1527-05 are reviewed using Environmental Data Resources, Inc. (EDR) or a different environmental database search service.

The report provided by the environmental database search service is reviewed in detail. Sites that are inferred to present a significant risk to adversely impact the Site are identified and explained within the ESA report. However, sites inferred to pose little risk to adversely impact the Site are disclaimed within the attached environmental database search service report.

4.2 State File Review

DEEP Orders, Notices of Violation, and Connecticut Transfer Act Forms are provided for the Site using environmental database search service.

Correspondence files for the Site are requested from the DEEP solid waste and water management bureaus. If available, these files are reviewed for pertinent information, which is either copied or noted.

CTDEEP Connecticut Leachate and Wastewater Discharge Source maps are reviewed to identify any sites within one-half mile of the Site that may adversely impact the Site.

4.3 Local File Review
Files for the local municipal Tax Assessor, Building Department, Planning and Zoning Department, Health Department, and Fire Marshal are reviewed.

5.0 User Provided Information
Information provided by the user as required by the practice is discussed in this section

6.0 Site Reconnaissance, Interviews and Non-ASTM Scope Considerations

Field observations the results of required interviews are discussed in this section. In addition, surveys conducted to identify non-scope considerations are addressed.

7.0 Connecticut Transfer Act Status

Based on information obtained as part of the ESA, our opinion regarding the site's status with respect to the Connecticut Transfer Act is provided.

Hazardous waste manifests may be requested from DEEP or appropriate site contact to help resolve questions regarding the quantity of hazardous waste generated at the site.

8.0 Data Gaps, Findings and Conclusions

Data gaps relevant to the identification of recognized environmental conditions are discussed. In addition, recognized environmental conditions are summarized in this section as well as recommendations for further investigation, if appropriate.

9.0 References

References used as part of the ESA are presented here.

Restrictions: Exceptions to or Deletions from the Scope of Work

- Access to a shed located adjacent to the Community/Maintenance Building was not possible because a key could not be located.

- Access to the crawl spaces in seven buildings at the site was not possible because the entrances had either been welded shut or keys for the locks could not be located.
- Limited accessibility within the crawlspaces below the buildings limited inspection to the areas closest to the entrances.
- Equipment stored in the maintenance garage limited visibility of the floor surface.
- Due to the size of the Site and the large number of occupied units, only three representative vacant apartment units were inspected.

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Appendix B

Town File Information

AVAILABLE UPON REQUEST

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Appendix C

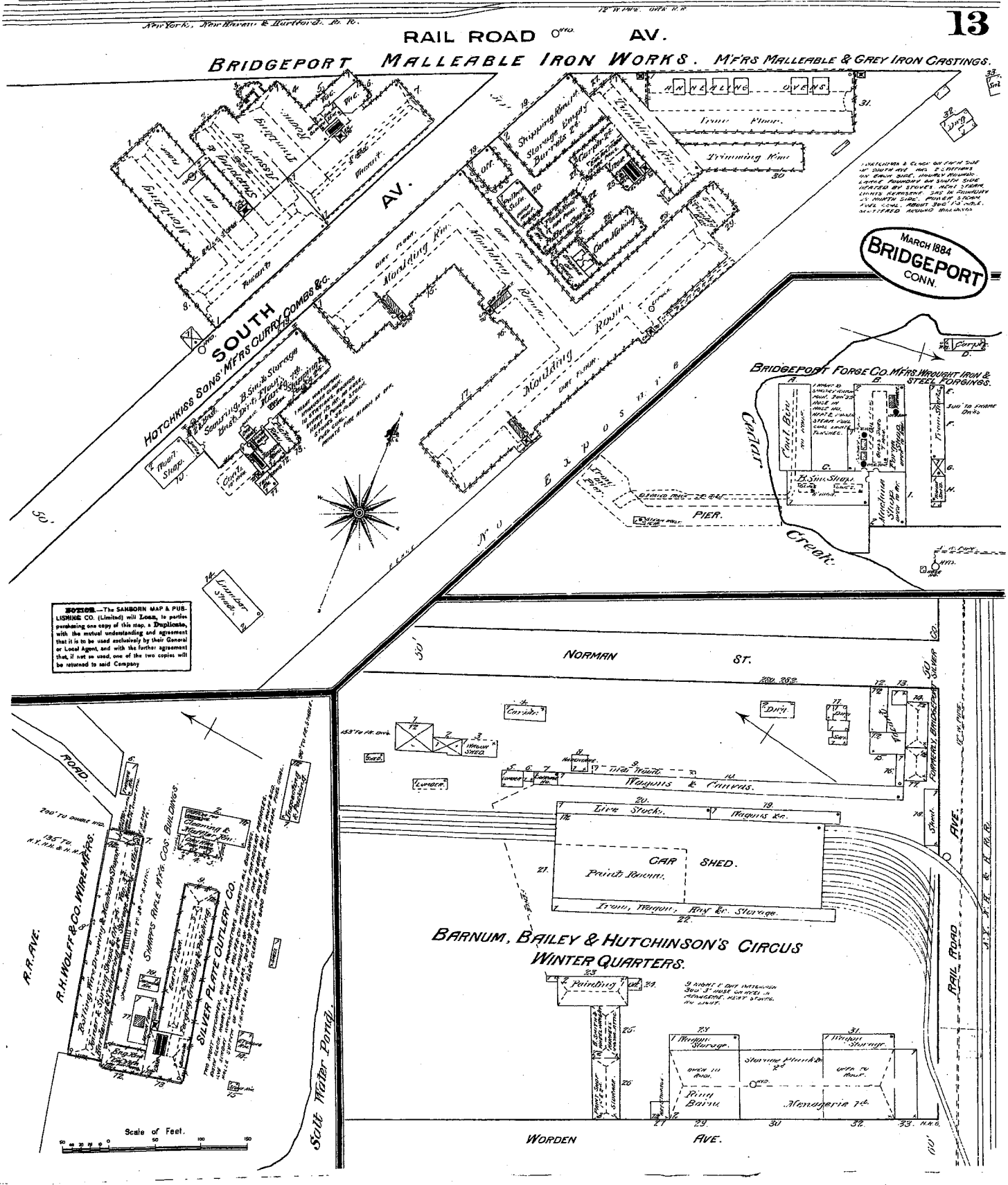
Environmental Database Search
Environmental Data Resources, Inc.

AVAILABLE UPON REQUEST

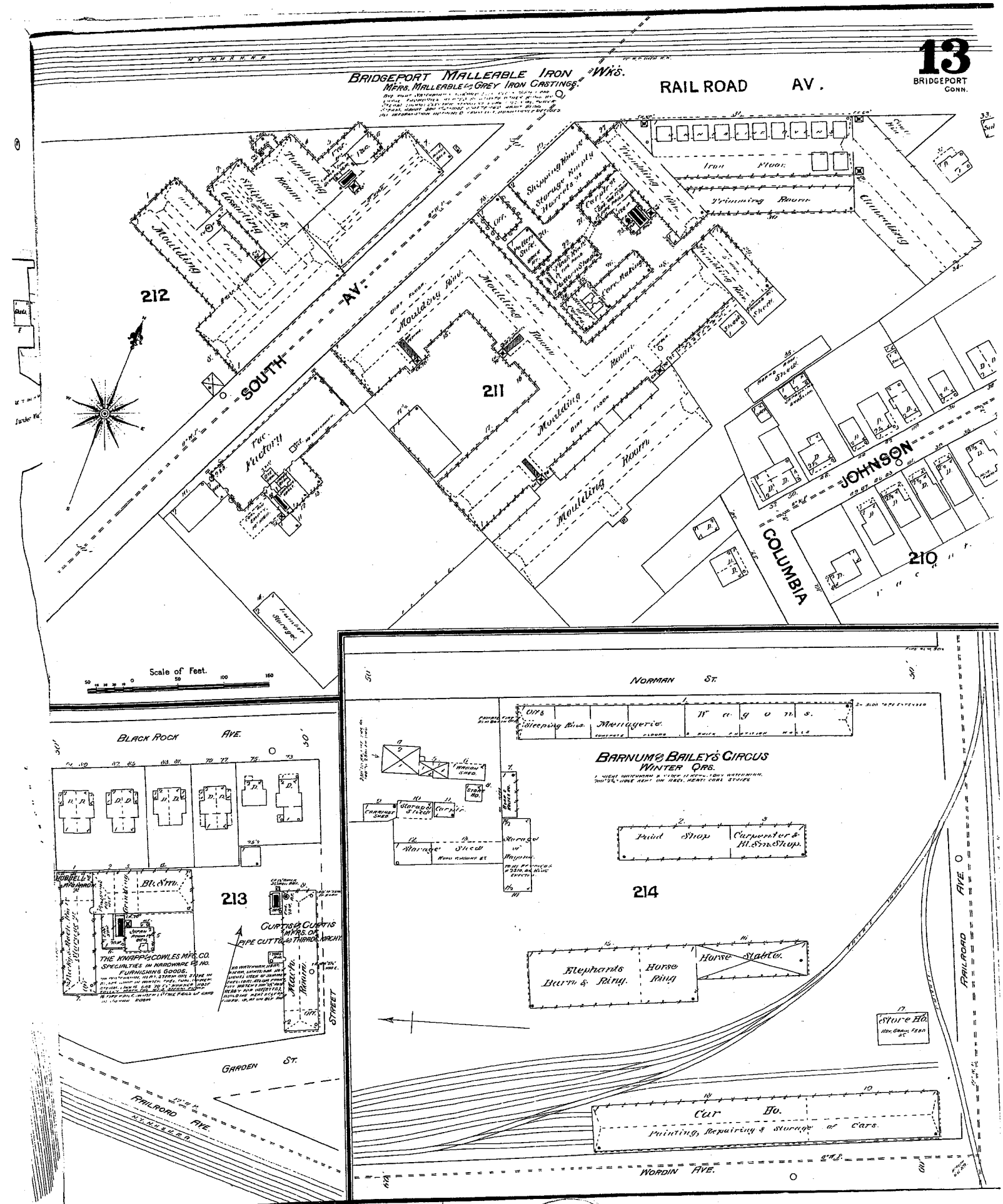
FUSS & O'NEILL

Appendix D

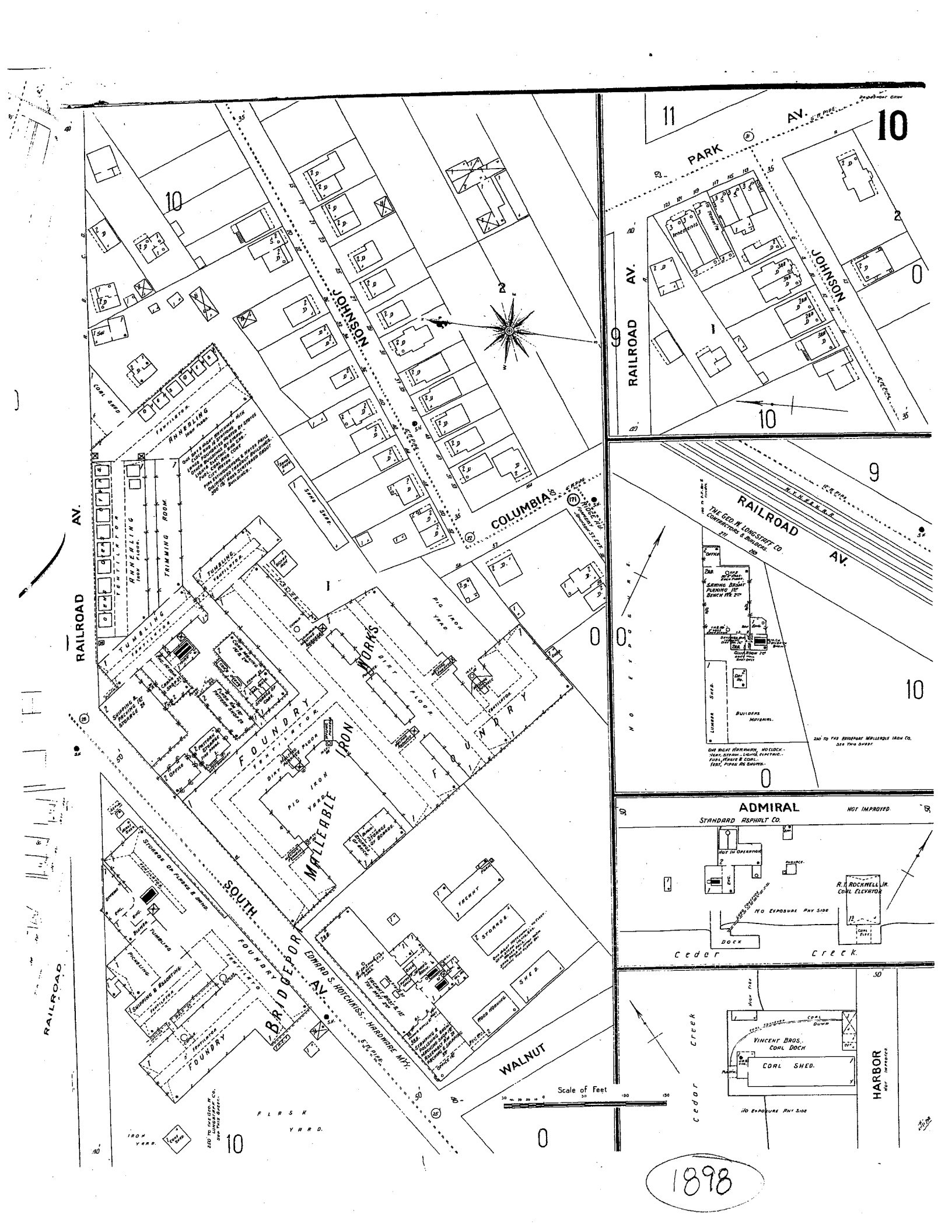
State File Information

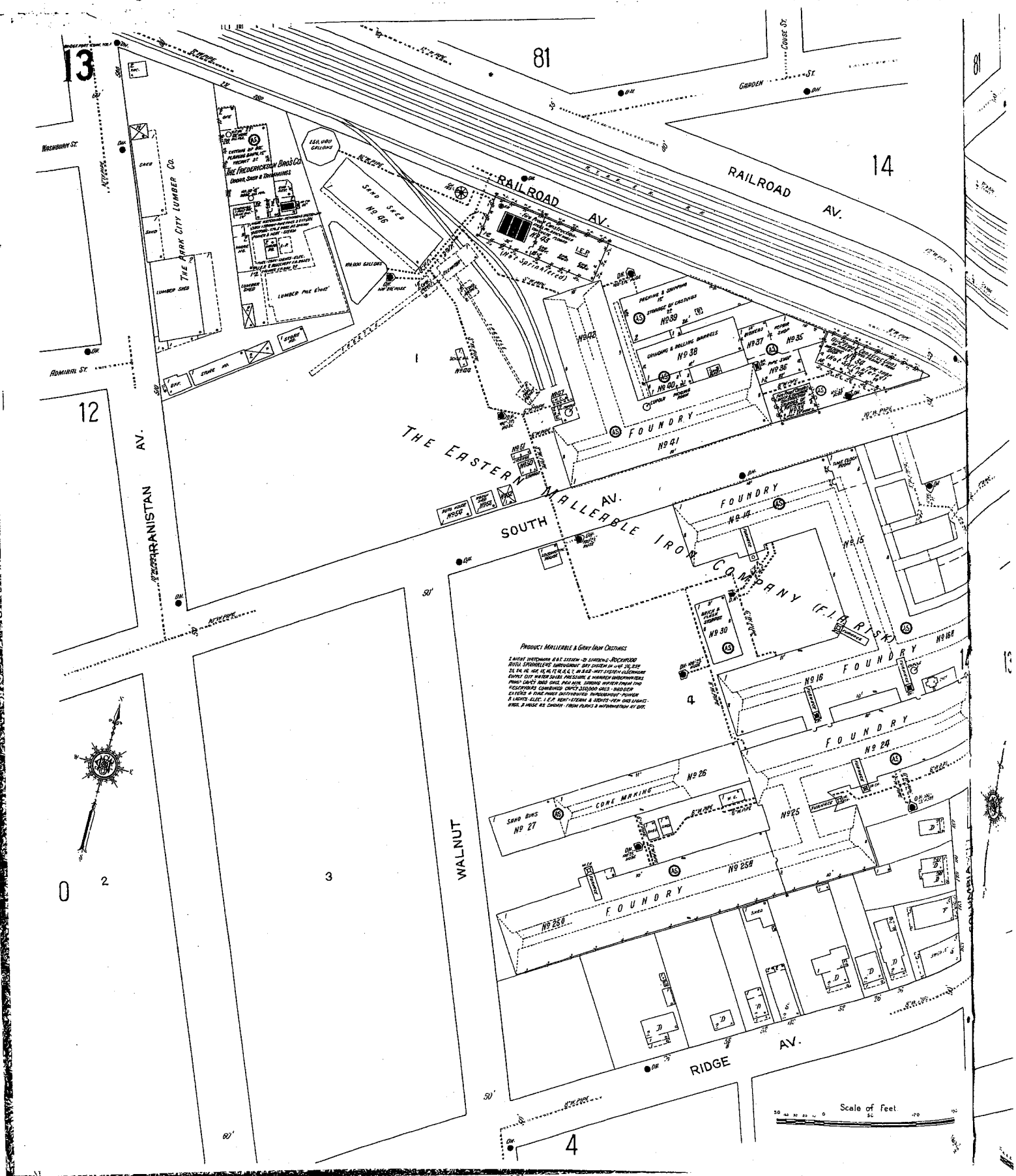

New York, New Haven & Hartford R. R. R.
RAIL ROAD
AV.
BRIDGEPORT MALLEABLE IRON WORKS. M'F'RS MALLEABLE & GREY IRON CASTINGS.
Trimming Room
Annealing
Moulding Room
Core Making
Dry Room
Trimming Rm.
Shipping Room
Storage
Blacksmith
Carpenter
Office
Engine
Boiler
Pattern Store
Smith Shop
Core Oven
Dry Room
SOUTH
HOTCHKISS SONS' M'F'RS CURRY COMBS &C.
Smelting & Sm. & Storage
Engine
Boiler
Shop
Office
Pattern Store
Core Oven
Dry Room
Moulding Room
Lumber Storage
MARCH 1884
BRIDGEPORT
CONN.
BRIDGEPORT FORGE CO. M'F'RS WROUGHT IRON & STEEL FORGINGS.
Coal Bins
B. Sm. Shop
Machine Shop
Carpt.
Dry
Trimming Shop
Engine
Boiler
Coal
Office
Lumber
Iron Pier
PIER.
Grant's
Creek
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NORMAN ST.
Carpt.
Dry
Wagons & Carriages.
Elec. Stock.
Wagons &c.
CAR SHED.
Paint Room.
Trans. Wagons, Hay &c. Storage.
BARNUM, BAILEY & HUTCHINSON'S CIRCUS
WINTER QUARTERS.
Painting
Wagon Storage
Ring Barn
Menagerie
Stock
Worden Ave.
R.R. Ave.
Road
R. H. WOLFF & CO. WIRE MF'RS.
Forging, Wire Drawing & Annealing
Spring & Spring Steel
Engine
Boiler
Shop
Office
Stock
SWAPPS RIFLE M'F'G CO'S. BUILDINGS.
SILVER PLATE CUTLERY CO.
Engine
Boiler
Forging, Grinding & Polishing
Scale of Feet.
Salt Water Pond.
Farmer's Bridgeport Siding
Ave.
Rail Road
N.Y. N.H. & H. R.R.

1884

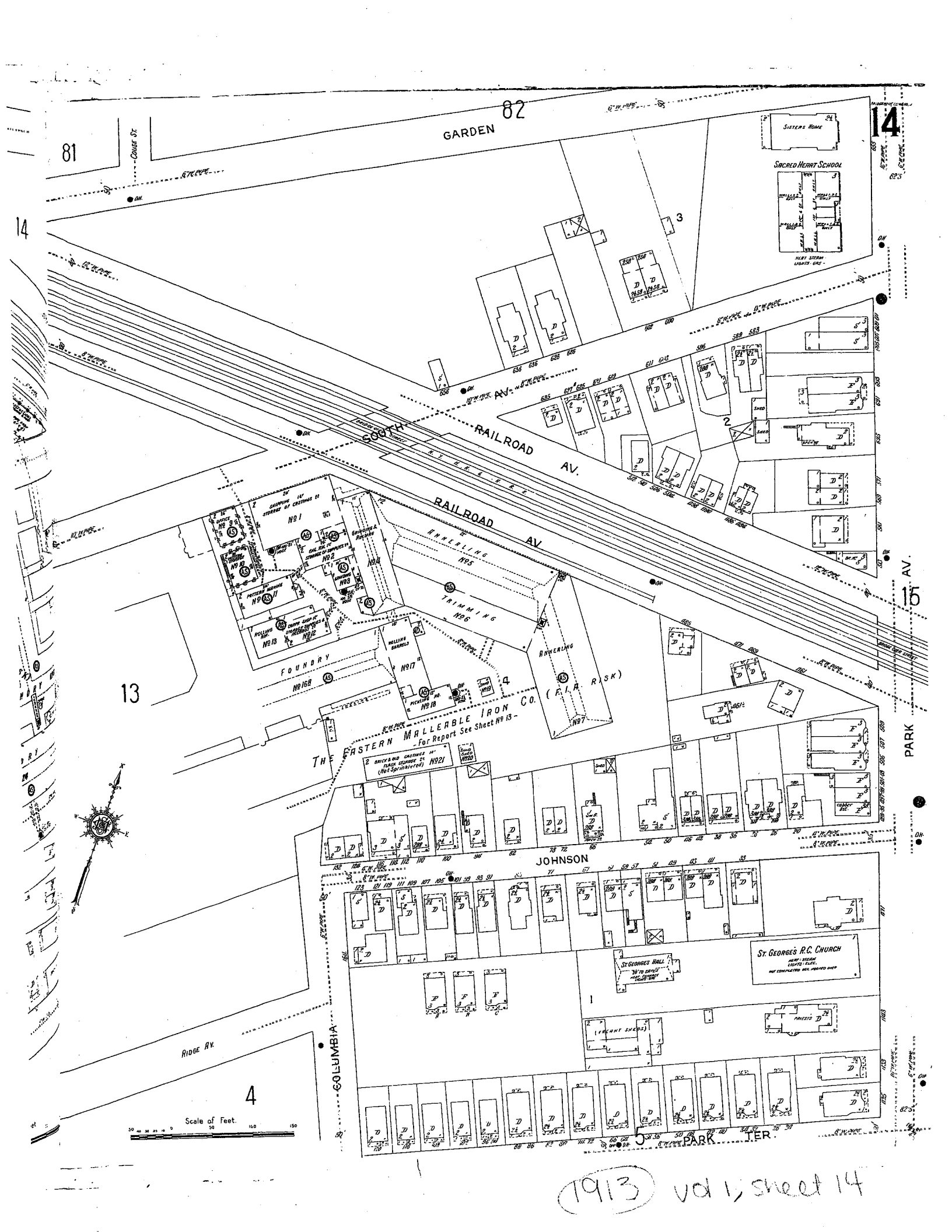

BRIDGEPORT MALLEABLE IRON Wks.
MFRS. MALLEABLE & GREY IRON CASTINGS.
RAIL ROAD AV.
212
SOUTH AV.
211
Moulding Room
Trimming Room
Iron Floor
Shipping Room
Storage Room
Moulding Floor
Tac. Factory
Blacksmith Shop
Tenement Storage
JOHNSON
COLUMBIA
210
Scale of Feet.
50 0 50 100 150
NORMAN ST.
Offs
Sleeping Rms.
Menagerie
Wagons
BARNUM & BAILEY'S CIRCUS
WINTER QRS.
Wagon Shed
Stock
Carriage Shed
Storage Shed
Paint Shop
Carpenter & Bl. Sm. Shop
214
Elephants Barn & Ring
Horse Ring
Horse Stables
Store Ho.
Car Ho.
Painting, Repairing & Storage of Cars.
WORDIN AVE.
RAILROAD AVE.
BLACK ROCK AVE.
213
HOBBELL'S MFG. HARDW.
Bl. Shop
THE KNAPP & COWLES MFG. CO.
SPECIALTIES IN HARDWARE & NO.
FURNISHING GOODS.
CURTIS & CURTIS
MFRS. OF
PIPE CUTTING & THREADING MACHY.
Machine Shop
Store
STREET
GARDEN ST.
RAILROAD AVE.
N.Y.N.H.&H.R.R.

1889

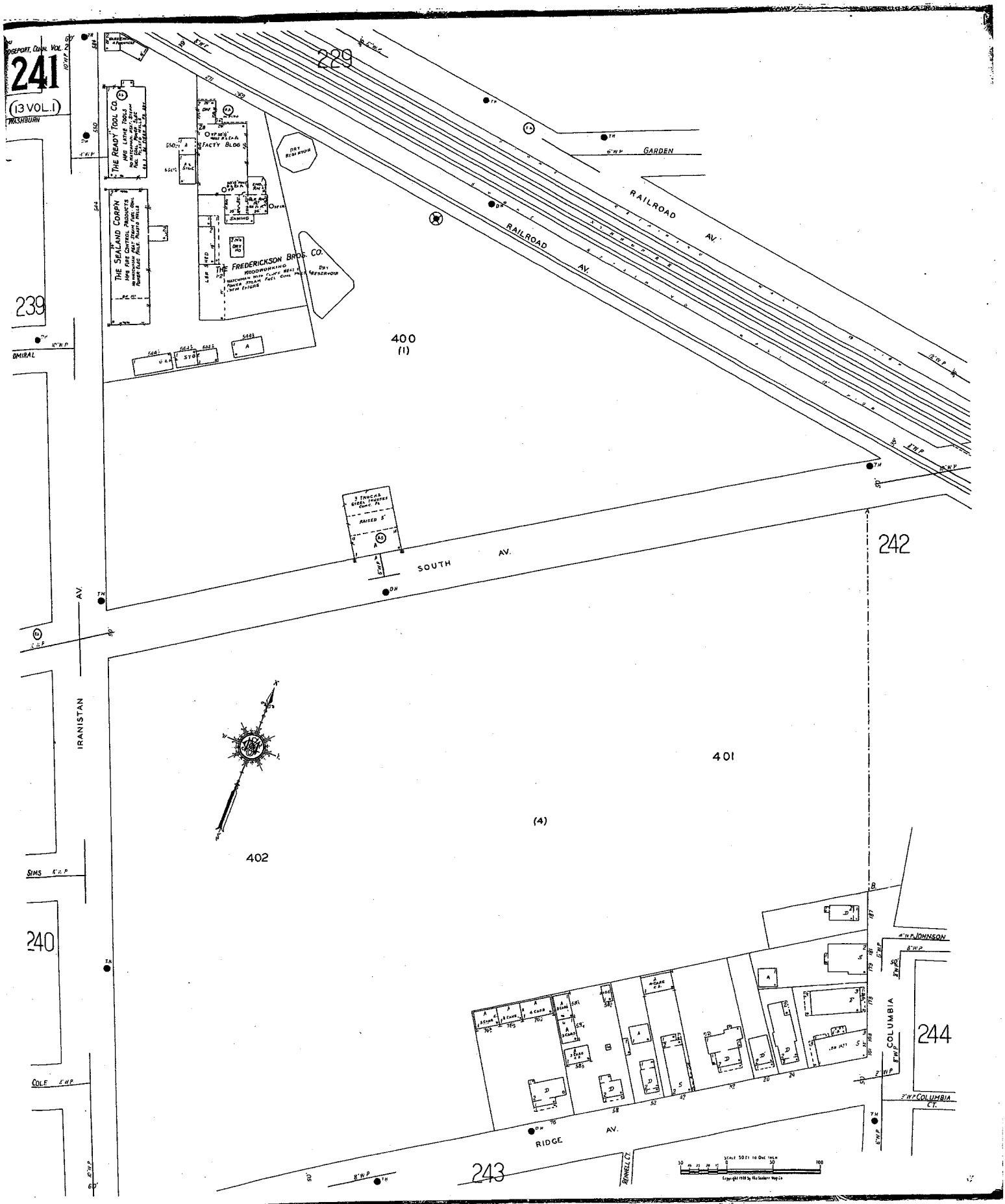

PARK AV.
JOHNSON
RAILROAD AV.
COLUMBIA
RAILROAD AV.
THE GEO. W. LONG STAFF CO.
CONTRACTORS & BUILDERS
ADMIRAL
STANDARD ASPHALT CO.
NOT IMPROVED
R. T. ROCKWELL JR. COAL ELEVATOR
NO EXPOSURE ANY SIDE
Cedar Creek
VINCENT BROS. COAL DOCK
COAL SHED.
HARBOR
NOT IMPROVED
SOUTH BRIDGE
EDWARD S. HOTCHKISS, HARDWARE MFR.
MALLEABLE IRON WORKS
FOUNDRY
PIG IRON YARD
DIRT FLOOR
TUMBLING
ANNEALING
TRIMMING ROOM
SHIPPING & RECEIVING
STORAGE
WALNUT
FLASK YARD
Scale of Feet
1898



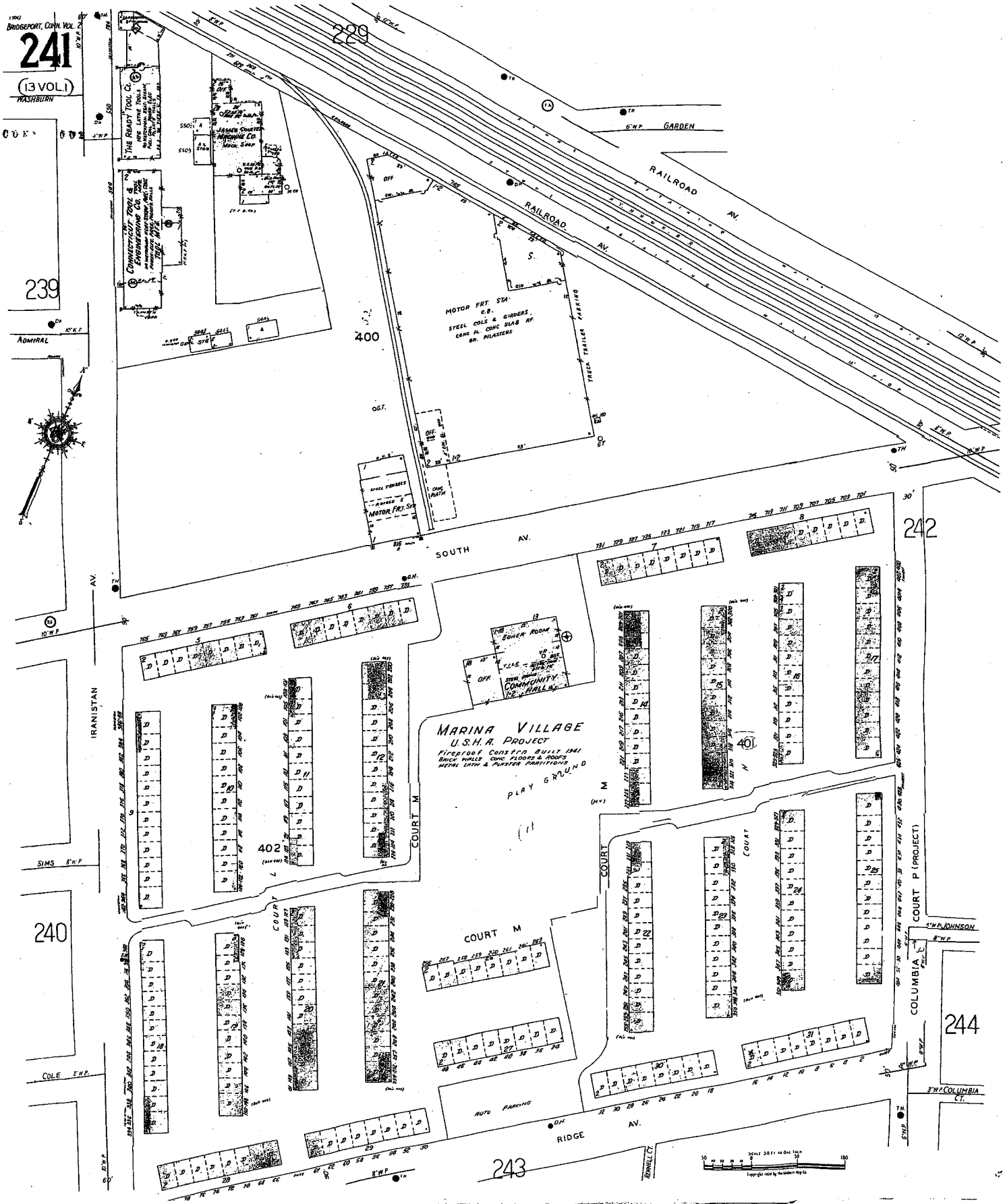
1913 Vol 1, Sheet 13



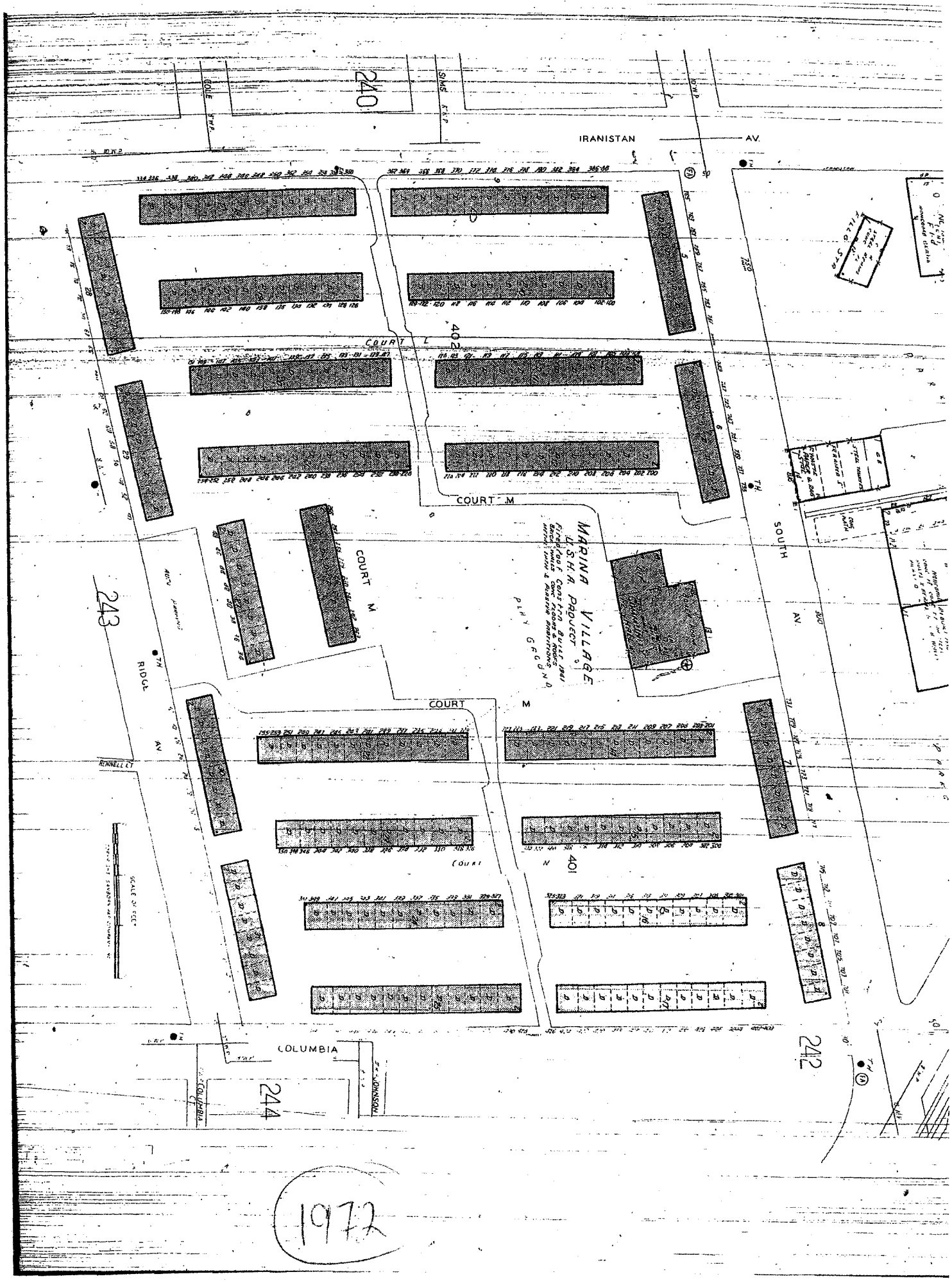
1913 vol 1, sheet 14



(1939) vol 2, sheet 241

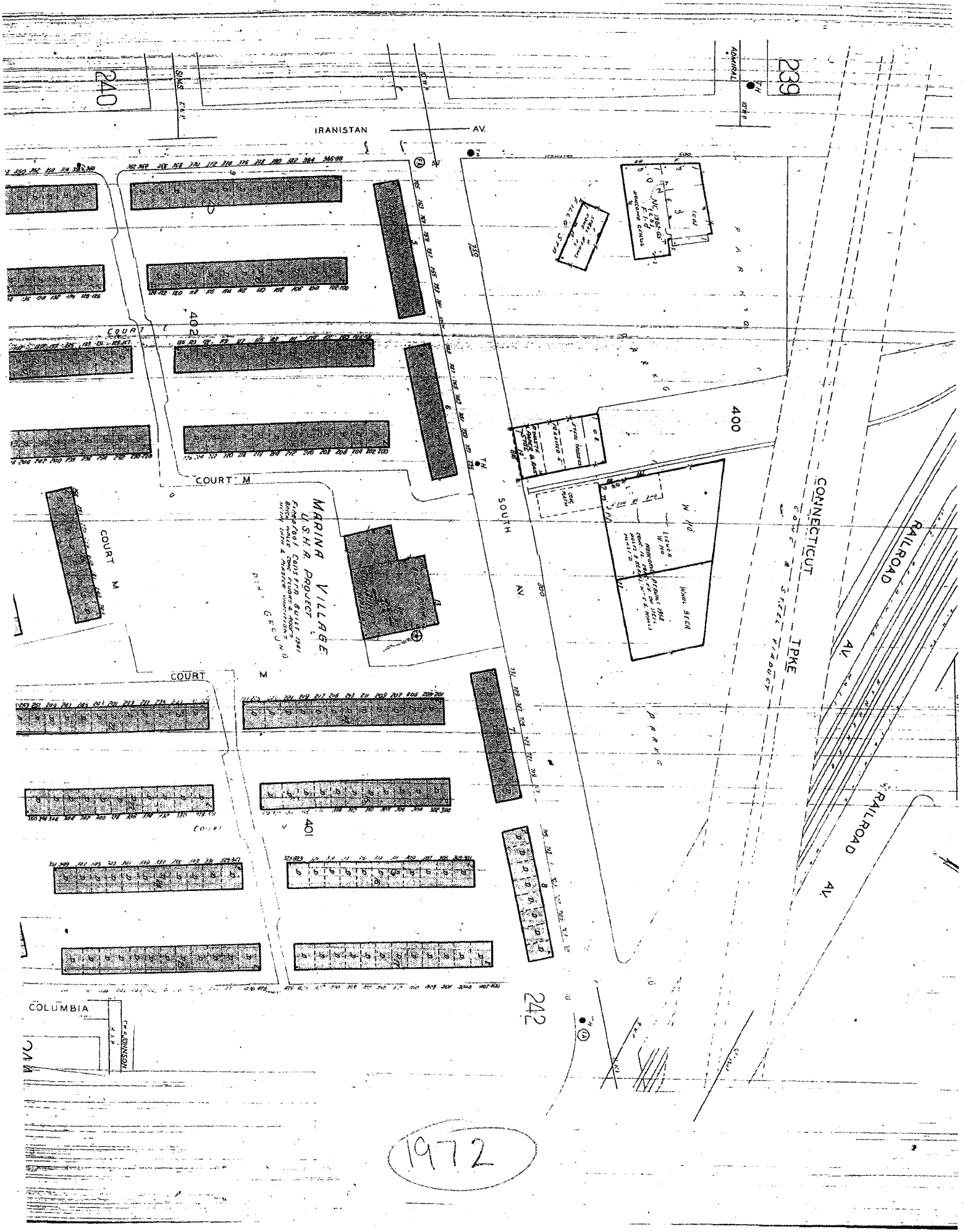


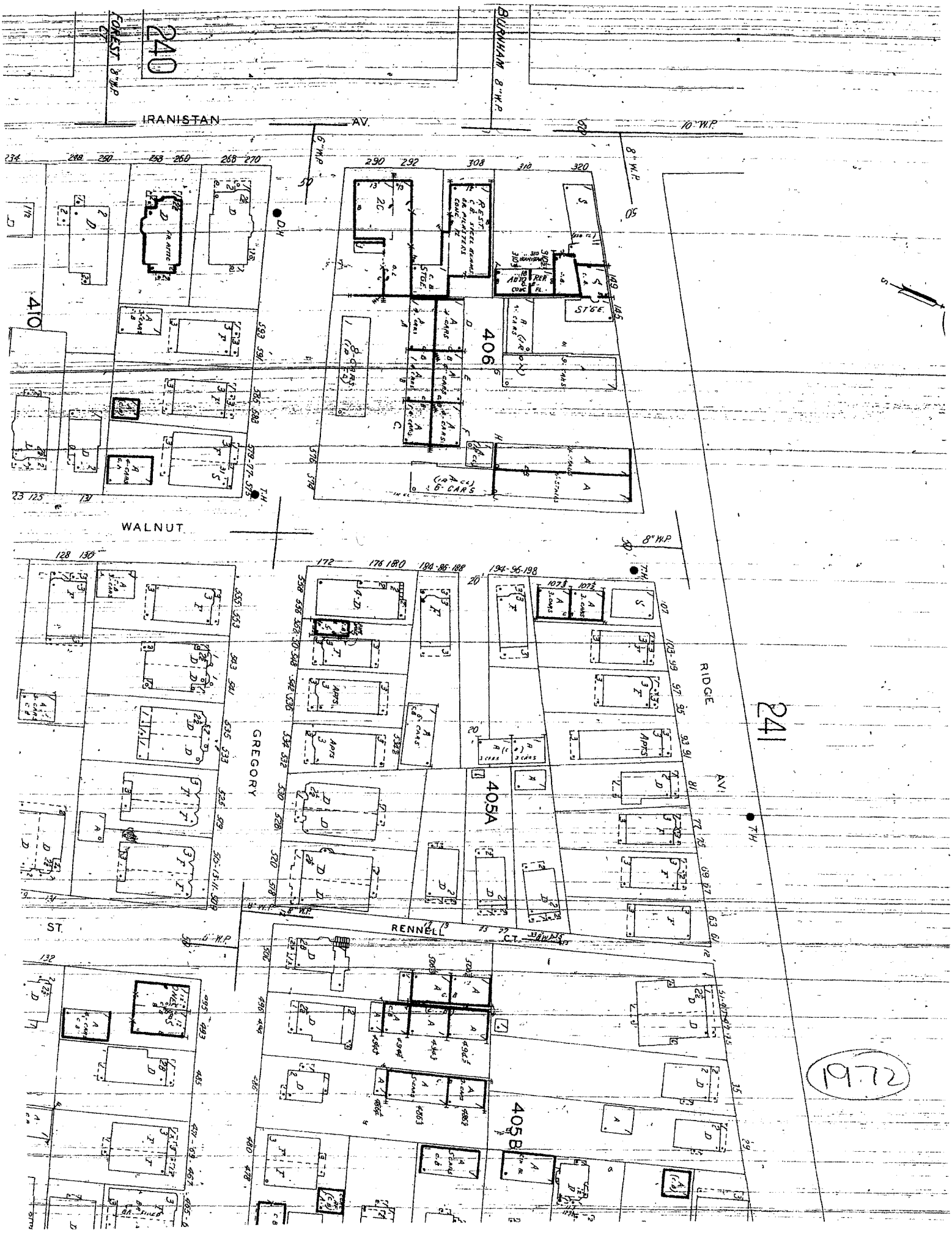
1939 - 1950 vol 2, sheet 241


IRANISTAN AV.
SIMS
GOULE
COURT L
COURT M
COURT N
MARINA VILLAGE
U.S.H.A. PROJECT
RIDGE AV
RENNELL CT
COLUMBIA
JOHNSON
SOUTH AV
240
241
242
243
244
401
402

1972


240
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239
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427
428
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432
SOUTH AV
SIMS
COLE
BURNHAM
FLANDERS
ALBERT SQ
ALSACE
LITTLE
IRANISTAN AV
RIDGE AV
1972


239
240
241
242
IRANISTAN AV.
ADMIRAL PL.
COURT M
COURT
SOUTH AV.
CONNECTICUT TPKE
RAILROAD AV.
MARINA VILLAGE
U.S.H.A. PROJECT
PARK
400
401
402
COLUMBIA
1972


240
FOREST
IRANISTAN
AV.
BURNHAM
8" W.P.
10" W.P.
6" W.P.
234 248 250 258 260 268 270
290 292 308 310 320
406
410
405A
405B
241
WALNUT
GREGORY
RIDGE
AV.
RENNELL
ST.
128 130
172 176 180 184-186-188 194-196-198
132
9-72

FUSS & O'NEILL

memorandum

To: Date:

From: Subject:

Project No: BRIDGEPORT

'12 Iran (Ridge-South) res, 459-Berkins Moving + Stor. no(400)
HH+P, Inc. RD all res, S. res, 713-Bluthmert Comm. Health Ctr., res, 810-Seaside Scrap metal Co, 840-Nunes Auto repair

'10 Iran (Ridge-S) res, 459-saa PMS Scrap Fuel Inc, 478-Nunes Auto rep. RD-saa. S 733-Earthcomm Systems, 743-saa, 840-saa

'05 Iran all res, 459-Connecell + Patterson Co, Europa Foods, 478-Nunes RD: res, S saa + 750-Regency Construction. 810-Seaside scrap metal Co 840-Nunes

00 saa

95 saa "Manna Village" res

90 saa Johnson 25 Oldermen Brass Mfg Corp Manna Village (Court L, M, N, P, Q, R, S) S 810+840-saa.

'85 Iran 459-CT Trane+PaperCo, Easton Beg + PaperCo 478-Nunes John 25-Oldermen Mfg. res "Courts-res (SRQ); S 800-Agency Beer Dist., Inc. 810-saa

'74 ~~'80~~ saa Iran 478-Family Shield Serv Ctr II John 25-saa. 40 Manna Village, res South 733 Manna Vlg office; 770-Beer Dist saa 810 saa

'74 Iran saa John saa. S saa

'70 saa

'65 John 40-114 M Vill. S saa

'61 saa

FUSS & O'NEILL

Appendix E

Completed Questionnaires

PHASE I ESA QUESTIONNAIRE-OWNER/KEY SITE MANAGER

SITE INFORMATION

***Site Name*:** **Marina Village – Buildings 26 & 27**

***Address*:** **50-80 Ridge Avenue, Bridgeport, CT 06604**

QUESTION	OWNER	OCCUPANT
1. Is or has the *property* been used industrially?	Unknown See Note Below	N/A
2. Is or has the *property* been used as a vehicle body repair facility, furniture stripping facility, dry cleaning facility, gasoline station, motor repair facility, commercial printing facility, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing or recycling facility (if applicable, identify which)?	Unknown See Note Below	N/A
3. Did you observe evidence or do you have any prior knowledge that any *adjoining property* has been used as a vehicle body repair facility, furniture stripping facility, dry cleaning facility, gasoline station, motor repair facility, commercial printing facility, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing or recycling facility (if applicable, identify which)?	Unknown See Note Below	N/A
4. Are there currently or have their previously been any damaged or discarded automotive or industrial batteries, pesticides, paints, or other chemicals in individual containers of greater than 5 gal (19 L) in volume or 50 gal (190 L) in the aggregate, stored on or used at the *property* or at the facility?	Unknown See Note Below	N/A
5. Are there currently or previously has there been any industrial *drums* (typically 55 gal (208L)) or sacks of chemicals located on the property or at the facility?	Unknown See Note Below	N/A
6. Did you observe evidence or do you have any prior knowledge that *fill material* has been brought onto the property that originated from a contaminated site or an See Note Below source.	Unknown See Note Below	N/A
7. Are there currently or has there previously been any *floor drains, septic systems, dry wells, pits, ponds, or lagoons* located on the *property* in connection with waste treatment or waste disposal?	Unknown See Note Below	N/A
8. Are there currently or has there previously been any registered or unregistered storage tanks (above or underground) located on the *property*?	Unknown See Note Below	N/A
9. Is there currently or has there previously been any evidence of leaks, spills or staining by substances other than water, or foul odors, associated with any flooring, drains, walls, ceilings, or exposed grounds on the property?	Unknown See Note Below	N/A
10. If the *property* is served by a private well or non-public water system, is there evidence or do you have prior knowledge that contaminants have been identified in the well or system?	Unknown See Note Below	N/A
11. Does that *owner* or *occupant* of the property have any knowledge of *environmental liens* or governmental notification relating to past or recurrent violations of environmental laws with respect to the *property* or any facility located on the *property*?	Unknown See Note Below	N/A

QUESTION	OWNER	OCCUPANT
12. Does the *owner* or *occupant* of the *property* have any knowledge of any *environmental site assessment* of the *property* or facility that indicated the presence of *hazardous substances* or *petroleum products* on, or contamination of, the *property* or recommended further assessment of the *property*?	**Unknown See Note Below**	**N/A**
13. Does the *owner* or *occupant* of the *property* know of any past, threatened, or pending lawsuits or administrative proceedings concerning a release or threatened release of any *hazardous substance* or *petroleum products* involving the *property* by any owner or occupant of the *property*?	**Unknown See Note Below**	**N/A**
14. Did you observe evidence, or do you have prior knowledge that any *hazardous substances* or *petroleum products*, unidentified waste materials, tires, automotive or industrial batteries or any other waste materials have been dumped above grade, buried and/or burned on the *property*?	**Unknown See Note Below**	**N/A**
15. Is there a transformer, capacitor, or any hydraulic equipment for which there are any records indicating the presence of PCBs?	**Unknown See Note Below**	**N/A**

NOTE: Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

In accordance with Standard Practice ASTME 1527-05 for Phase I Environmental Site Assessments (ESAs), we are required to ask you as the property owner or a person identified as a key site manager, the following questions:

1) Please place an "X" next to each if you have or know of the existence of any of the following reports relating to the site:

- Environmental site assessment reports — See Note Above
- Environmental compliance audit reports — See Note Above
- Environmental permits — See Note Above
- Underground storage tank notification forms — See Note Above
- Registrations for underground injection systems — See Note Above
- Material safety data sheets — See Note Above
- Community right to know plans — See Note Above
- Safety plans, preparedness and prevention plans, spill prevention, counter-measure and control plans — See Note Above
- Reports regarding hydro-geologic conditions on the property or surrounding area — See Note Above
- Notices or other correspondence form any governmental agency relating to past or current violations of environmental laws — See Note Above
- Hazardous waste generators notices or reports — See Note Above
- Geotechnical studies — See Note Above
- Risk assessments — See Note Above
- Activity and use restrictions — See Note Above

Please provide copies of each report to Fuss & O'Neill prior to or at the time of the site visit.

Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

2) Are you aware of any pending, threatened, or past litigation relevant to hazardous substances or petroleum products in, on, or from the property?

Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

3) Are you aware of any pending, threatened, or past administrative proceedings relevant to hazardous substances or petroleum products in, on, or from the property?

Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

4) Are you aware of any notices from any governmental entity regarding any possible violation of environmental laws or possible liability related to hazardous substances or petroleum products at the property?

Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

The ***Owner*** questionnaire was completed by:

Name: **Dulce Nieves / Peter Hance**
Title: **Chairperson / Deputy Executive Director**
Firm: **Housing Authority of the City of Bridgeport**
Address: **150 Highland Avenue, Bridgeport, CT 06604**
Phone: **(203) 337-8900**

Owner's Signature:_____ Date: **March 8, 2013**

The ***Occupant*** portion of the questionnaire is **N/A.**

PHASE I USER QUESTIONNAIRE

SITE NAME: Marina Village – Buildings 26 & 27
SITE ADDRESS: 50-80 Ridge Avenue, Bridgeport, CT 06604

Completed By: Dulce Nieves/Peter Hance (Please Print) **Date:** March 8, 2013

Signature: _____

Representing: Housing Authority of the City of Bridgeport **Phone No:** (203) 337-8900

ASTM Questions to Address User Responsibilities:
In order to qualify for one of the *Landowner Liability Protections (LLPs)* offered by the Small Business Liability Relief and Brownfield's Revitalization Act of 2001 (the "*Brownfields Amendments*") the *user* should provide the following information (if available) to the *environmental professional.* Failure to provide this information could result in a determination that "*all appropriate inquiry*" is not complete.

1) Environmental cleanup liens that are file or recorded against the site (40 CFR 312.25). Has a ***chain of title and title restriction*** review been conducted? **HACB is not aware of any restrictions etc. related to this issue.**

Based on the results of a ***chain of title and title restriction*** review, are there any environmental cleanup liens against the *property* that are filed or recorded under federal, tribal, state or local law?

2) Activity and land use limitation (AUL) that are in place on the site or that have been filed or recorded in a registry (40 CFR 312.26). Based on the results of a ***chain of title and title restriction review***, are there any activity and land use limitations, such as *engineering controls*, *land use restrictions* or *institutional controls* that are in place at the site and/or have been filed or recorded in a registry under federal, tribal, state or local law? **HACB is not aware of any limitations restrictions etc. related to this issue.**

If yes, explain:

3) Specialized knowledge or experience of the person seeking to qualify for the LLP (40 CFR 312.28). As the *user* of this *ESA* do you have any specialized knowledge or experience related to the *property* or nearby properties? **HACB is not aware of having any specialized knowledge or experience related to this issue.**

For example, are you involved in the same line of business as the current or former *occupants* of the *property* or an adjoining *property* so that you would have specialized knowledge of the chemicals and processes used by this type of business? **HACB is not aware of having any specialized knowledge related to this issue.**

If yes, please explain:

4) The relationship of the purchase price to the fair market value of the *property* if it were not contaminated (40 CFR 312.29). Does the purchase price being paid for this *property* reasonably reflect the fair market value of the *property*? **N/A**

If you conclude that there is a difference, have you considered whether the lower purchase price is because contamination is known or believed to be present at the *property*?

5) Commonly known or *reasonably* ascertainable information about the *property* (40 CFR 312.30). Are you aware of commonly known or *reasonably ascertainable* information about the *property* that would help the *environmental professional* to identify conditions indicative of releases or threatened releases?

If yes, please answer the following questions:

a) What were the past uses of the *property*?
b) What chemicals are present or once were present at the *property*?
c) What spills or other chemical releases that have taken place at the *property*?
d) Explain any environmental cleanups that have taken place at the *property*.

PHASE I USER QUESTIONNAIRE
PAGE 2 of 3

HACB is not aware of having any information related to this issue.

6) The degree of obviousness of the presence of likely presence of contamination at the property, and the ability to detect the contamination by appropriate investigation (40 CFR 312.31). As the *user* of this *ESA*, based on your knowledge and experience related to the *property* are there any *obvious* indicators that point to the presence or likely presence of contamination at the *property*? **HACB is not aware of having any information related to this issue.**

Other Questions:

ASTM Practice 1527-05 also requires that the *user* answer the following questions:

7) As the user of this ESA, are you aware of any pending, threatened, or past litigation relevant to hazardous substances or petroleum products in, on, or from the property? **HACB is not aware of having any information related to this issue.**
If so, explain:

8) As the user of this ESA, are you aware of any pending, threatened, or past administrative proceedings relevant to hazardous substances or petroleum products in, on, or from the property? **HACB is not aware of having any information related to this issue.**
If yes, explain:

9) As the user of this ESA, are you aware of any notices from any governmental entity regarding any possible violation of environmental laws or possible liability related to hazardous substances or petroleum products? **HACB is not aware of having any information related to this issue.**
If yes, explain:

10) We are required to ask you as the user if you have any of the following reports in your possession. Please place an "X" next to each report that is available:

_____ Environmental site assessment reports

_____ Environmental compliance audit reports

_____ Environmental permits

_____ Underground storage tank notification forms

_____ Registrations for underground injection systems

_____ Material safety data sheets

_____ Community right to know plans

_____ Safety plans, preparedness and prevention plans, spill prevention, countermeasure and control plans

_____ Reports regarding hydrogeologic conditions on the property or surrounding area

_____ Notices or other correspondence from any governmental agency relating to past or current violations of environmental laws

_____ Hazardous waste generator notices or reports

PHASE I USER QUESTIONNAIRE
PAGE 3of 3

_____ Geotechnical studies

_____ Risk assessments

_____ Activity and use restrictions

Please provide Fuss & O'Neill with copies of each report or make these reports available for inspection.

HACB is not aware of having any of the information listed above.

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Appendix F

Site Photographs



Photo 1: Courtyard area between buildings.



Photo 2: Sump pump in former boiler room in the Community/Maintenance Building.



Photo 3: Storage of oil, paint, and other chemicals in maintenance storage area.



Photo 4: Minor staining below lawn equipment in the maintenance garage.



Photo 5: Potential asbestos containing pipe insulation in crawl space of apartment building.



Photo 6: Furnace and hot water heater (both natural gas) in apartment unit.



Photo 7: View of area between buildings.



Photo 8: View of Columbia Street running through the site.



Photo 9: View of courtyard between buildings.



Photo 10: View of parking lot at the east end of the site.

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Appendix G

Qualifications of Environmental Professionals and Staff

FUSS & O'NEILL

Qualifications of Environmental Professionals and
Staff Scientists and Engineers

Environmental Professionals

Employee	Title	Education	Years of Applicable Experience	Licenses
Andy Zlotnick	Senior Vice President	BS Earth Science MS Hydrogeology	27	LEP, LEED AP
Dave Hurley	Vice President	BS Geology	32	LEP
Rob Danielson	Vice President	BS Geology MS Environmental Mgmt	26	CPG, LEP
John Carroll	Senior Project Manager	BA Geology	26	LEP
Dan Jahne	Senior Project Manager	BS Geology	18	LEP
Bob Bowden	Project Manager	BA Geology MS Geology	23	LEP
Jeremy Grant	Project Manager	BA Geology MS Geology	17	PG
Rick Kulzer	Project Manager	BA Geology	15	LEP

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Staff Scientists and Engineers

Employee	Title	Education	Years of Applicable Experience	Licenses
Kevin Vanderveer	Senior Hydrogeologist I	BS Geology	19	--
Greg Toothill	Engineer III	BS Civil Engineering	10	PE
Sara Rochelt	Hydrogeologist III	BS Geology	22	--
Caleb Scheetz	Hydrogeologist III	BS Geology MS Geology	8	--
Mike Kostiuk	Hydrogeologist II	BS Environmental Science	12	--
Drew Derrick	Environmental Technician III	BS Geophysics	3	--
Reginald Butler	Environmental Technician II		4	--
Steve Sarica	Environmental Engineer	BS Environmental Engineer	1	--

Licenses

CPG: Certified Professional Geologist
CPESC: Certified Professional in Erosion and Sediment Control
PE: Professional Engineer
PG: Professional Geologist
LEP: Licensed Environmental Professional
LEED AP: Leadership in Energy and Environmental Design Accredited Professional

Education

BA: Bachelor of Arts
BS: Bachelor of Science
MS: Master of Science

APPENDIX B

ENVIRONMENTAL EVALUATION AND MATERIALS MANAGEMENT REPORT- MAY 2015 – TRIANGLE PROPERTY

FREEMAN COMPANIES

LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Environmental Evaluation and Materials Management Report
Marina Village Housing Complex
Bridgeport, Connecticut

May 2015
Freeman File No.: 2015-0408

Prepared for:

Bridgeport Community Renewal Associates, LP
c/o JHM Group of Companies
1281 East Main St. Suite 201
Stamford, CT 06902

Prepared by:

Freeman Companies, LLC
36 John Street
Hartford, CT 06106

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1 INTRODUCTION

Freeman Companies has completed an Environmental Evaluation Assessment of the Marina Village Housing Complex located at 400 Iranistan Avenue in Bridgeport, CT. The site consists of two adjacent parcels totaling 15.9 acres, bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

Bridgeport Community Renewal Associates, LP ("BCRA") is working with Park City Communities on the redevelopment of the Marina Village housing development in Bridgeport, Connecticut. The initial Phase of this development will involve the demolition of the portion of the site bounded by Park Avenue, Railroad Avenue, Project Street (Columbia), and Johnson Street. (Buildings Numbered 32-43).

1.1 Purpose

The purpose of the assessment was to collect sufficient information in order to provide an evaluation of the environmental impacts, if present, to soil and groundwater at the site and how these impacts may affect the redevelopment of the site.

Preliminary environmental information regarding historical environmental impact on the property was obtained from the September 2013 Phase I Environmental Site Assessment (ESA) prepared by Fuss & O'Neill. Based on the information presented within the reports, the site has a long history of heavy industrial and manufacturing operations prior to its development as a residential housing complex in the late 1940s. Industrial activities at the site included the following industries:

- Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings and conducted operations such as annealing, trimming, core making, tumbling, grinding, rolling, and molding;
- Hotchkiss Sons' Manufacturers Curry Combs & Company which conducted scouring, tempering, and japanning of various metals; and
- Reliable Steel Drum Corporation which conducted the reconditioning of steel drums

1.2 Scope of Work

Based on the historical industrial activities that were conducted on the site, the following scope of work was developed:

- Oversight of the the advancement of up to 10 soil borings, three of which were completed as a groundwater monitoring well.
- The collection and analysis of a soil samples from each of the proposed soil borings. Select soil samples would be analyzed for the following parameters: volatile aromatic hydrocarbons (VOCs), extractable total petroleum hydrocarbons (ETPH), poly aromatic hydrocarbons (PAHs), total and leachable RSR listed metals and polychlorinated biphenyls (PCBs).
- The collection of a groundwater sample from each of the three newly installed monitoring wells. Groundwater samples would be analyzed for one or more of the following parameters: VOCs, PAHs, and total RSR listed metals.
- The preparation of a report documenting the findings of the investigation.

Investigation activities were conducted in general accordance with the guidelines for environmental site assessments established in the Connecticut Department of Energy and Environmental Protection (CTDEEP) Site Characterization Guidance Document (SCGD) September 2007 (updated December 2010).

1.3 Objectives

The primary objective of this investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions will affect the redevelopment of the Site.

2 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

2.1 General

The Site, located at 400 Iranistan Avenue, consists of a two adjacent parcels of land totaling 15.9 acres located in the City of Bridgeport. The Site is bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

2.2 Surrounding Land Use

The surrounding land use consists primarily of high-density housing to the southwest, southeast and northeast; and a mix of commercial and light industrial to the northwest.

2.3 Groundwater Classification

According to the CTDEEP water quality classification maps (November 2013), groundwater at the site is classified as GB. A GB classified groundwater is defined as groundwater within a historically highly urbanized area or an area of intense industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts.

2.4 Previous Environmental Assessment Activities

As previously identified a Phase I ESA was conducted on the site in 2013. Based on the information with the 2013 report no previous environmental sampling has been conducted at the site.

3 GEOLOGIC INFORMATION

The physical conditions of the Site, including hydrology characteristics, are described in the following sections.

3.1 Site Topography

The site slopes from north to south ranging with a difference in elevation of approximately 10 feet (10 feet to 20 feet) above mean sea level. A majority of the site is located between elevations 10-12 feet.

3.2 Site Soils

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS) for the State of Connecticut (NRCS Webpage), the site is identified as primarily containing Urban Land. Urban land if defined as areas those are in urban and built up areas. The characteristics of this unit are so variable that an onsite investigation is required to determine the suitability for proposed uses.

Based on field observations soil conditions were observed to consist of the following:

Topsoil/ Asphalt – Topsoil was described as light brown to brown silty SAND (SM). Up to 1.1 feet of topsoil was encountered in the borings conducted in grassy areas. Asphalt thickness ranged from 1 inch to 3 inches.

Fill – Fill was described as very loose to dense, dark brown to light brown, silty SAND with gravel (SM), asphalt, crushed brick, concrete, and other manmade material debris. Standard Penetration Test N-Values ranged from 2 to 47 blows per foot (bpf). The fill extended to depths below ground surface ranging from 0 feet (B-10) to greater than 17 feet (B-9/MW).

Natural Sand – Natural sand was encountered in each of the borings, except B-9/MW, and was described as loose to very dense, poorly graded sand with silt and gravel varying to silty sand with gravel (SM). Standard Penetration Test N-Values ranged from 6 to 69 blows per foot (bpf).

Silt – A silt layer was encountered in Borings B-2 and B-3 at a depth of approximately 16.5 feet. The silt is described as light brown, silt (ML) to clayey silt. The thickness of this deposit was not determined.

4 REMEDIATION STANDARD REGULATIONS

The analytical results reported in this report have been compared to remediation criteria listed in the CTDEEP's Remediation Standard Regulations (RSRs). The RSRs (Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies) form the basis for evaluation of site conditions in respect to environmental impacts and the impacts associated risk factors to human health and the environment. The CTDEEP uses the RSRs to determine whether sufficient remediation has been conducted at sites that are required by statute, regulation or administrative order to be remediated, or that are remediated through a formal voluntary remediation process.

The RSRs provide: (1) baseline specific criteria that may be used at any site to determine whether or not remediation is necessary, (2) self-implementing alternatives to the baseline criteria for specific circumstances, (3) self-implementing exceptions to the criteria for specific circumstances, and (4) an opportunity to request approval of site-specific alternatives to the self-implementing standards and the options for remediation from the CTDEEP Commissioner.

Although the Site is not currently under an order by the CTDEEP or subject to regulation and or statute to meet the risk based criteria within the RSRs, Freeman Companies will utilize the listed values within the RSRs as guidance in order to be protective of human health and the environment.

4.1 Soil Remediation Criteria

The CTDEEP soil remediation criteria integrate two risk-based goals: (1) Direct Exposure Criteria (DEC) to protect human health and the environment from risks associated with direct exposure (ingestion) to contaminated soil; and (2) Pollutant Mobility Criteria (PMC) to protect groundwater quality from contaminants that migrate or leach from the soil to groundwater. Soils to which both criteria apply must be remediated to a level which is equal to the more stringent criteria.

4.1.1 Direct Exposure Criteria

Specific numeric exposure criteria for a broad range of contaminants in soil have been established by the CTDEEP, based on exposure assumptions relative to incidental ingestion of contaminants in soils. The DEC applies to accessible soil to a depth of 15 feet. The DEC for substances other than PCBs does not apply to inaccessible soil at a release area provided that, if such inaccessible soil is less than 15 feet below the ground surface, an environmental land-use restriction (ELUR) is in effect with respect to the subject release area.

Inaccessible soil generally means polluted soil which is the following:

- More than four feet below the ground surface;

- More than two feet below a paved surface comprised of a minimum of three inches of bituminous pavement or concrete;
- Beneath an existing building; or
- Beneath another permanent structure(s) approved by the CTDEEP Commissioner. Buildings can be constructed and/or clean fill can be placed over contaminated soils rendering them inaccessible.

The CTDEEP has established two sets of DEC using exposure assumptions appropriate for residential land use (RES DEC) or for industrial and certain commercial land use (I/C DEC). In general, all sites are required to be remediated to the residential criteria. If the industrial/commercial land use criteria are applicable and used, an ELUR notification is required in accordance with the RSRs.

4.1.2 Pollutant Mobility Criteria

The PMC that are utilized for remediation determination of a site depends on the groundwater classification of the site. The Site is within in a GB groundwater classified area.

The PMC generally apply to all soil in the unsaturated zone, from the ground surface to the seasonal high water table in GB classified areas. The criteria do not apply to environmentally isolated soils that are polluted with substances other than VOCs provided that an ELUR is recorded for the release area which ensures that such soils will not be exposed (unless approved in writing by the CTDEEP Commissioner). Environmentally isolated soils are defined as certain contaminated soils which are below the seasonal low water table, beneath an existing building and not a source of ongoing contamination. An ELUR must be recorded for the site which ensures that such soils will not be exposed as a result of building demolition or other activities. Buildings can be constructed over contaminated soils rendering them environmentally isolated.

Remediation based upon the listed PMC requires that a substance, other than an inorganic substance or PCB, in soil be remediated to at least that concentration at which the results of a mass analysis of soil for such substances does not exceed the PMC applicable to the groundwater classification (i.e., GA or GB) of the area in which the soil is located. An inorganic substance or PCB in soil must be remediated to at least that concentration at which the analytical results of leachate produced from SPLP does not exceed the PMC applicable to the groundwater classification of the area in which the soil is located. As an alternative method for determining compliance with the PCM the analytical results of leachate produced from SPLP for most volatile, semi-volatile and petroleum compounds can be compared to the Groundwater Protection Criterion (GWPC) for such substance.

4.2 Groundwater Remediation Criteria

Groundwater remediation requirements are dependent upon the groundwater classification of the site. The objectives of these standards are the following:

- Protect existing use of groundwater regardless of the area's groundwater classification;
- Prevent further degradation of groundwater quality;
- Prevent degradation of surface water from discharges of contaminated groundwater; and
- Protect human health and the environment.

Portions of the RSRs governing groundwater regulate remediation of groundwater based on each substance present within the plume and by each distinct plume of contamination. Several factors influence the remediation goal at a given site, including: background water quality, the groundwater classification, the proximity of nearby surface water, existing groundwater uses, and the presence of buildings and their usage. When assessing general groundwater remediation requirements, all of these factors must be considered in conjunction with the major numeric components of the RSRs.

In general, remediation of a groundwater plume in a GB groundwater classified area shall result in the attainment of the following:

- The Surfacewater Protection Criteria;
- The Volatilization Criteria; and
- Not interfere with any existing usage of the groundwater.

5 SUBSURFACE INVESTIGATION ACTIVITIES

The primary objective of this investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions will affect the redevelopment of the Site. To achieve the stated objectives, the subsurface investigation activities were designed to include both environmental setting and contaminant identification investigations.

The approach, procedures and results of the site investigation activities are presented in the following sections.

5.1 Soil Sampling and Analysis

The primary purpose of the soils characterization portion of the assessment was to define the nature/presence of target contaminants in the unconsolidated materials in both the saturated and unsaturated zones associated with historical Site activities. In addition, the boring program also provided information on Site stratigraphy and physical properties of the unconsolidated materials in both the saturated and unsaturated zones with particular emphasis on the characteristics of those materials that affect contaminant migration pathways and transport mechanisms.

This section describes the specific soil borings and sampling performed in order to define Site stratigraphy, soil properties and soil contaminant profiles.

5.1.1 Soil Sampling

Soil sampling activities were conducted between the dates of May 12 through May 14, 2015. A total of ten soil borings were advanced at the Site as part of the investigation. New England Boring Contractors of Glastonbury, CT advanced the soil borings utilizing a hollow stemmed auger (HSA) drilling rig under the direct supervision of Freeman Companies field personnel. The location for each of the soil borings was chosen to maximize the information obtained based on Freeman Companies' understanding of existing site conditions. A figure depicting the locations of sampling activities is included in Appendix A. Boring and well completion logs are provided in Appendix B.

The following sections provide a summary of soil investigation drilling details.

5.1.2 Soil Sampling Via Hollow Stemmed Auger

All ten soil borings (B-1 through B-10) were advanced using a HSA drill rig spinning 4 ¼-inch inner diameter augers. Soil samples were collected with stainless steel, 2-inch diameter, two-foot split-spoon sampler advanced ahead of the augers in two-foot intervals using a weighted hammer. In general, sampling was conducted semi continuously at 2 foot intervals into the observed water table.

5.1.3 Soil Screening and Submittal

Upon retrieval of each soil sample, the supervising field personnel visually inspected each sample for staining, color, and moisture content and then characterized and logged each sample.

Following the completion of each soil boring and related soil sample collection activities, the resulting boreholes were backfilled with either the drill cuttings that were generated from the borehole and/or with virgin well materials.

Soil samples submitted for laboratory analysis were selected based on the groundwater interface zone and/or the identification of a contaminate migration pathways to the environment (HSA borings) and at predetermined depths for the manual soil borings. The selected soil samples were submitted to Phoenix Analytical laboratories of Manchester, CT and analyzed for those constituents that have the potential to be released to the subsurface due to current or historical activities related to the REC investigated. Based on the constituents of concern for each of the AOCs, the soil samples were analyzed for one or more of the following analysis:

- Volatile Organic Compounds (VOCs) in accordance with EPA Method 8260
- ETPH in accordance with CTDEEP extractable total petroleum hydrocarbons methodologies
- Poly-aromatic hydrocarbons (PAHs) via EPA Method 8270
- Total CT listed metals
- Leachable CT listed metals via the Synthetic Precipitation Leaching Procedure
- PCB's in accordance with EPA Method 8082

5.1.4 Sample Management

All soil and groundwater analytical samples were collected in laboratory-supplied containers and chilled immediately on ice for transit to the laboratory. Freeman Companies personnel maintained possession of the samples until transfer to a laboratory provided courier for transit to the laboratory. A chain-of-custody form accompanied the samples from their collection point to delivery at Phoenix. Complete chain-of-custody forms are included with the laboratory analytical data reports as provided in Appendix C.

5.2 Monitoring Well Installation Activities

The primary purpose of the groundwater characterization portion of the investigation was to determine the presence of contaminants of concern relative to historical site activities. In addition, the well installation program was designed to define groundwater elevations and aquifer characteristics across the Site in order to understand and evaluate potential contaminant fate and transport pathways/mechanisms.

Three overburden-monitoring wells (MW-1 through MW-3) were set to depths of approximately 12 to 16 feet below grade. The wells are constructed of approximately 10 feet of 2-inch diameter, 0.010-inch slotted PVC screen, with 2-inch PVC riser extending to grade. The annular space around the wells was filled with #2 sand extending up to approximately 1-2 feet above the screen. An approximate six inch layer of bentonite was placed above the sand pack to form a seal. Native fill and/or well sand was then used to fill the remaining borehole to grade. Each well was finished with an eight-inch diameter flush mounted road box set in concrete. A figure depicting monitoring well locations is included in Appendix A. Well construction logs are presented as Appendix B.

5.3 Groundwater Sampling

The primary purpose of the groundwater characterization portion of the site investigation was to attempt to identify the nature groundwater impacts from historic usage of the Site. In addition, the groundwater characterization portion of the site investigation was also used to define groundwater elevations and aquifer characteristics across the study area in order to understand and evaluate potential contaminant fate and transport pathways and mechanisms.

Freeman Companies personnel collected groundwater samples from the newly installed monitoring wells on May 18, 2015. Groundwater sampling was conducted using low flow procedures in general accordance with Region I EPA's Low Stress (low flow) Purging and Sampling Procedure (July 30, 1996, revised January 19, 2010). Purging and sampling were performed using an adjustable rate pneumatic bladder pump with dedicated polyethylene tubing for all sampled wells. Pump intake depths were selected to coincide with the center-of-saturated-screen elevations for the deep wells and the top of the saturated screens for the shallow water table wells.

Purged volumes were based on the rate of stabilization of field-measured water quality parameters, including: dissolved oxygen, specific conductance, temperature, pH, turbidity, and oxidation/reduction potential were obtained.

Field parameters were generally measured at five minute intervals; purging rates and water levels were also measured. Purged water from the wells did not exhibit any visual or olfactory evidence of impact such as odors and/or sheen. Due to the nature of the formation (urban fill) turbidity readings remained above the target of 5 NTUs, even after extended pumping.

Groundwater samples were collected from each well and submitted on ice to Phoenix for analysis. The following analyses were performed on all submitted groundwater samples:

- VOCs by EPA Method 8260
- PAHs via EPA Method 8270
- Total CT listed metals

Due to the turbid nature of the collected samples, ranging from 30 NTUs to 500 NTUs, the groundwater samples were also analyzed for total dissolved (filtered to remove turbidity) metals in order to evaluate interferences due to the turbidity.

5.4 Soil Sampling Results

Soil encountered during the advancement of the soil borings consisted primarily of brown, fine to medium sand. A layer of silt and clay was encountered at a depth of 11 feet below grade within boring FC-4. Bedrock was not encountered at any boring locations.

Based on non-restricted property use, guidance standards used for soil at the Site would be the Residential Direct Exposure Criteria (RDEC) and the Pollutant Mobility Criteria (PMC) for an area with a GB groundwater classification.

Laboratory analysis of the soil samples collected from sample locations B-5, B-7 and B-8, identified the presence of one or more of the following; poly aromatic hydrocarbons, total petroleum hydrocarbons, total arsenic and/or PCBs at concentrations exceeding the RDEC and/or the GB PMC.

A summary of the soil analytical results is presented in Table 1, within Appendix D and a copy of the laboratory analytical report is included as Appendix C.

5.5 Groundwater Sampling Results

Groundwater samples were collected from each monitoring well with dedicated sampling equipment in order to assess current water quality and to evaluate for the presence and distribution of contaminants in groundwater that may have originated from the Site or potentially from off-site locations. Samples were stored in laboratory provided glassware and submitted for analysis at for the suite of analytes identified based upon historic or current suspected potential sources of contamination. These parameters were used to indicate the presence of contaminants in groundwater and provided a basis for correlation with chemical data derived from the soil results.

Based on current land use and a GB groundwater classification, remediation guidance used for groundwater at the Site would be the Residential Volatilization Criteria (RES VC) and the Surface Water Protection Criteria (SWPC).

Analytical Results did not detect the presence of any volatile organic compounds at concentrations that exceeded the RES VC.

Analytical results of the poly aromatic hydrocarbons identified the presence of one or more of the following; benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and phenanthrene at concentration exceeding the default SWPC within the samples collected from MW-2 and MW-3.

Analytical results of the total metals analysis primarily detected the presence of one or more of the following metals; arsenic, copper, lead, mercury, and zinc at concentrations exceeding the default SWPC within the samples collected

from MW-1 and MW-3. Due to elevated turbidity levels that were encountered during sampling, the groundwater samples were filtered in order to remove suspended sediments and analyzed dissolved metals. Dissolved metals results did not indicate the presence of any metals exceeding the default SWPC.

A summary of the groundwater analytical results is presented as Table 2 in Appendix D, and a copy of the laboratory analytical report is included in Appendix C.

6 SOIL REUSE/DISPOSAL

Based on the findings of the assessment activities, the following general assumptions can be made regarding the soil at the site.

- Native soils may be managed as clean fill after confirmatory testing has been completed to ensure status as clean fill.
- Any urban fill material disturbed as part of proposed site activities shall be at a minimum be managed as a Regulated Soil.
- Urban fill material disturbed from the central portion of the site shall be classified as contaminated and must be removed from the site for proper disposal.
- Polluted soils may be reused on-site following site specific requirements

Further management/reuse discussions are provided in the following sections.

6.1 Soil Classifications

Based in the analytical results from the samples collected as part of the assessment activities the following soil types will be encountered as part of proposed site activities.

6.1.1 Clean Fill

Chemically clean fill that meets the definition of natural soil as defined in Sec. 22a-209-1 and Sec. 22a-133k-2(h) of the Regulations of Connecticut State Agencies (RCSA). Clean fill does not contain any substances above natural background levels. It is anticipated that a majority of native soils excavated from the project area will meet this definition of Clean Fill. Actual volumes will be determined by further analytical testing.

6.1.2 Polluted Soil

Soil affected by a release of a substance at a concentration above the analytical detection limit for such substance in accordance with RCSA 22a-133k-1(a)(45) and below the Residential Direct Exposure criteria and the GB Pollutant Mobility criteria as these terms are described in the Remediation Standard Regulations (RCSA 22a-133k-1 through 3). It is anticipated that a portion of the Urban Fill material will meet this definition. In most cases polluted soil may be reused at the project site with restriction.

6.1.3 Contaminated Soil

Soil affected by an identified or suspected release and determined, or reasonably expected to contain substances exceeding Residential Direct Exposure Criteria or GB Pollutant Mobility Criteria, as these terms are defined in the Remediation Standard Regulations (RCSA Section 22a-133k-1). It is anticipated that a majority of the Urban Fill located within the central portion of the project area will meet this soil type. In all cases contaminated soil disturbed as part of construction activities shall be removed from the site for proper disposal.

6.1.4 PCB Impacted Soil

Soil affected by a release of PCB at an as found concentration above 1 mg/Kg but <50 mg/kg for PCB. Soil will require special handling and management and will also require approvals for disposal at an approved disposal facility. It is anticipated that a small portion of the Urban Fill material, particularly located within the central portion of the site will meet this definition.

6.1.5 PCB Remediation Waste

Soil affected by a release of PCB at an as found concentration of >50 mg/kg. Soil remediation and management must be conducted under TSCA requirements within 40 CFR 761. It is not anticipated that any soil will meet the requirement of this criteria.

6.1.6 Hazardous Soil

Soil is classified as hazardous waste if it exhibits a hazardous waste characteristic or if it contains Resource Conservation and Recovery Act (RCRA) listed hazardous constituents above Connecticut's RCRA "Contained-In" Policy dated May 2002. It is not anticipated that any soil will meet the requirement of this criteria.

6.1.7 Regulated Soil

Regulated Soil includes Polluted Soil and Contaminated Soil. It is anticipated that almost all soil generated from site activities will be regulated

6.2 Soil Management

Based on the analytical results the testing conducted soil management activities for the handling and management of excavated material encountered during demolition/construction will be required. It is not intended that any soil remediation be conducted outside the limits of excavation anticipated for the project as designed.

All handling and management operations should be conducted in accordance with standard engineering practices applicable to such activity and in accordance with CTDEEP regulations including but not limited to the procedures contained in the CTDEEP General Permit for Contaminated Soil and/or Sediment Management.

Depending on the selected management approach, soils within the project area can be ether pre-classified, stockpiled and classified, or assumed to be contaminated.

All stockpiles of Regulated Soil should be constructed to isolate stored Regulated Soil from the environment. Stockpiles shall be constructed to include liners free of holes and other damage. The ground surface on which the liner is to be placed shall be free of rocks or and any other object which could damage the liner.

Regulated Soil cannot be stockpile off site unless a registration has been submitted to and approved by the CTDEEP under the General Permit for Contaminated Soil and/or Sediment Management.

6.3 Allowable Reuse Options

Polluted Soil may be reused in accordance with the following requirements:

- Reused on site as backfill in locations above the water table and not in areas subject to erosion in accordance with requirements of Section 22a-133K of the RCSA. The backfill location and depth shall be documented in a scaled drawing for any Polluted Soil that is reused on site. Any backfill material shall meet the structural/compaction geotechnical requirements.

- If the polluted soil is not suitable for reuse, the material shall be managed, disposed of, treated or recycled in accordance CTDEEP regulations

6.4 Health and Safety

All site health and safety controls shall be fully established and in operation prior to beginning any material handling activity. Site controls shall include but not be limited to the following: work zones properly barricaded, decontamination facilities established, air monitoring, and all support equipment and supplies including personal protective equipment.

7 WASTEWATER HANDLING

Based on the analytical testing conducted as part of this evaluation, it is anticipated that a majority of the dewatering wastewater generated from the project area will be contain some degree of contaminants, primarily metals and poly aromatic hydrocarbons, and therefore will likely require specific handling and management procedures to be implemented.

7.1 Allowable Disposal Options

Management of dewatered groundwater may be accomplished in accordance with CTDEEP General Permit for the Discharge of Groundwater Remediation Wastewater Directly to Surface Water (Storm sewers discharging to surface waters) and local regulations and ordinances or through the CTDEEP General Permit Groundwater Remediation Wastewater to a Sanitary Sewer and local regulations and ordinances.

7.2 Storage Options

If there is a need for storage of wastewater prior to discharge, fractionation tanks with a capacity of at least 20,000 gallons may be used. The tanks shall be equipped with a sample port to facilitate safe sampling of tank contents. Discharge valve shall be capable of controlling discharge flow rate.

7.3 Treatment Options

If it is necessary to treat the water in order to meet discharge limits, an activated carbon treatment and filtration system, sized to treat water with a minimum influent total volatile organic compound concentrations necessary to meet discharge goals, may be implemented. Systems of this type shall include one or more of the following components: pumps; piping; bag or cartridge filters; carbon treatment vessels; Influent, midpoint and effluent sampling ports and system flow meters.

7.4 Health and Safety

All site health and safety controls shall be fully established and in operation prior to beginning any material handling activity. Site controls shall include but not be limited to the following: work zones properly barricaded, decontamination facilities established, and all support equipment and supplies including personal protective equipment.

8 ENVIRONMENTAL REMEDIATION AND DISPOSAL COSTS

Freeman Companies conducted and environmental evaluation of the project area in order to obtain a better understanding of the subsurface conditions that may be encountered as part site demolition and construction activities.

Soil conditions encountered within soil borings consisted of sand (natural soil) overlain by various thicknesses of fill, which contained a variety of debris (asphalt, crushed brick, concrete), and other manmade material debris.

Analytical results identified that the fill material is generally impacted by a combination of poly aromatic hydrocarbons, metals and PCBs. Due to the presence of poly aromatic hydrocarbons, contaminated soils can be distinguished by both odor and discoloration.

In order to be protective of human health, Freeman Companies recommends that the following actions be taken for fill material encountered at the site:

- The removal of all contaminated fill to a depth of at least four feet below unpaved ground surfaces and two feet below paved surfaces; and
- The removal of all soil identified to be impacted by PCBs at concentrations of >1 mg/kg

The removed contaminated fill can either be removed from the site for disposal at a permitted disposal facility.

Due to the fact that the site will be re-graded following demolition activities, the Owner should attempt to reused polluted fill material to the maximum extent prudent upon the completion of demolition (i.e. within former building foundation excavations, within former tunnel excavations, as backfill within areas of remediation).

8.1 Remedial Costs

Based on the analytical results, the soil represented by the samples collected from borings B-5 and B-7 should be considered as contaminated and therefore Freeman Companies would recommend that any excavated material from within this area should be removed from the Site for proper disposal.

Based on initial estimates, approximately 2,000 – 5,000 tons of contaminated soil may need to be removed as part of the demolition activities. Freeman Companies estimates that the environmental costs associated with transportation and disposal of the Regulated soil to be approximately $50-70/ton for soils with PCB concentrations of <2 mg/kg and can be accepted at a Massachusetts landfill.

In addition, freeman companies would recommend that additional sampling be conducted during demolition activities in order to better define remedial areas and to continue the delineation/characterization of soils to remain on the site. Since the constituents of concern have been defined through evaluation testing, soil testing parameters may be limited to just PAHs, total arsenic and PCBs. Costs for analysis is estimated at $175/sample which will include all three parameters.

APPENDIX A

MAPS AND FIGURES



MAP REFERENCE
7.5 MINUTE SERIES TOPOGRAPHIC MAP
BRIDGEPORT, CONN. 1984

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

SITE LOCATION MAP

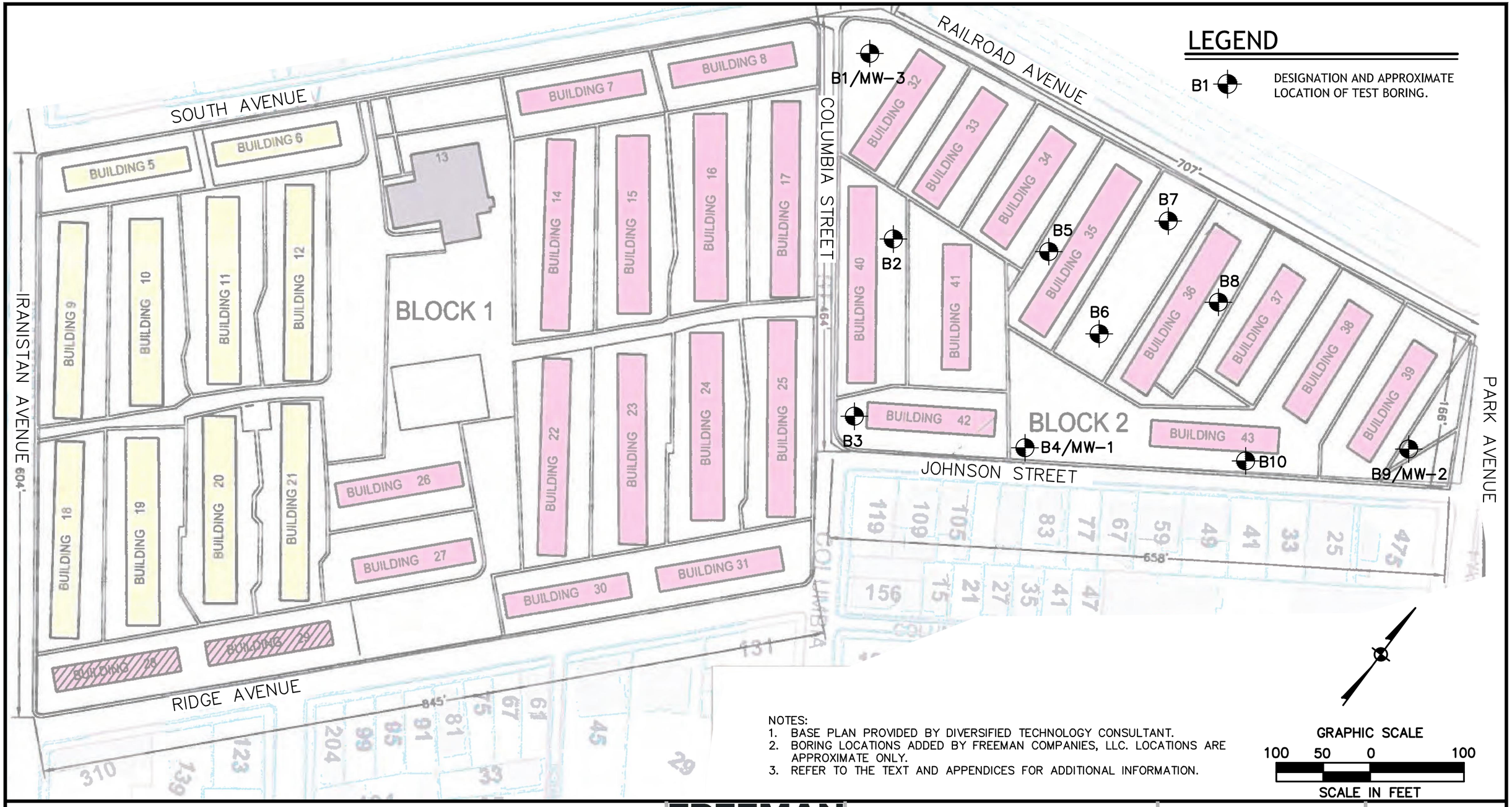
MARINA VILLAGE HOUSING COMPLEX
REDEVELOPMENT
BRIDGEPORT, CONNECTICUT

DRAFTED:	C.B.
CHECKED:	A.M.
APPROVED:	N.W.
SCALED:	1"=1000'
PROJECT NO.:	2015-0408
DATE:	05/29/15

FIG.

FIGURE 1

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Figure 1 and 2.dwg May 28, 2015-2:08pm Plotted By: cbarzola



NOTES:
1. BASE PLAN PROVIDED BY DIVERSIFIED TECHNOLOGY CONSULTANT.
2. BORING LOCATIONS ADDED BY FREEMAN COMPANIES, LLC. LOCATIONS ARE APPROXIMATE ONLY.
3. REFER TO THE TEXT AND APPENDICES FOR ADDITIONAL INFORMATION.

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET

SUBSURFACE EXPLORATION LOCATION PLAN

MARINA VILLAGE HOUSING COMPLEX REDEVELOPMENT
BRIDGEPORT, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

DESIGNED:	AM
DRAWN:	CB
CHECKED:	AM
APPROVED:	NW
SCALE:	1"=100'
PROJECT NO.:	2015-0408
DATE:	05/29/15

SHEET NO.

FIGURE 2

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Figure 1 and 2.dwg May 28, 2015-2:21pm Plotted By: cborzola

THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC

APPENDIX B

BORING AND WELL COMPLETION LOGS

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____

LOCATION: _____

EXPLORATION

B-1/MW-3

Drilling Information

DATE START / END: 5/14/2015 - 5/14/2015 **TOTAL DEPTH (FT):** 17.0

CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich

EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger

AUGER ID/OD: 4.25 in / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____

HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30

WATER LEVEL DEPTHS (ft): ▼ 8.00 5/14/2015 ▼ 6.40 5/18/2015

GENERAL NOTES: _____

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undistrubed Tube Sample	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Pen. = Penetration Length	S = Split Spoon	SC = Sonic Core	PID = Photoionization Detector	NA, NM = Not Applicable, Not Measured
Rec. = Recovery Length	DP = Direct Push Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength	

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			S-1		0.25 to 2.25	24/18	23-8-7-10			ASPHALT (1 in.)		backfill cuttings
										(0.1'- 0.3') POORLY GRADED GRAVEL (GP); ~100% gravel, coarse; dry, black, FILL.		6" bentonite seal. 1/4 bag
										(0.3'- 3') SILTY SAND (SM); ~75% sand, fine to coarse, ~15% fines, ~10% gravel, fine to medium; brown, FILL, with crushed brick.		
										(3'- 7') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to medium, ~35% gravel, coarse, ~15% fines; brown, FILL, with crushed brick, glass, black material (odor).		
			S-2		4 to 6	24/6	3-2-7-22				▼	
	5											#2 sand for sand pack. 3 bags.
			S-3		8 to 10	24/20	9-12-12-14			(7'- 16') POORLY GRADED SAND (SP); ~85% sand, medium to coarse, ~10% gravel, fine, ~5% fines; brown.	▼	2" diamter PVC Screen, 0.010 slot size
	10											
	15		S-4		15 to 17	24/18	5-8-14-20			(16'- 17') SANDY SILT (ML); ~60% fines, ~40% sand, fine to medium; brown.		17' bottom depth of boring, backfill cuttings, PVC plug
										Bottom of Exploration at 17 feet		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-2

Drilling Information

DATE START / END: 5/12/2015 - 5/12/2015 **TOTAL DEPTH (FT):** 17.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 8.00 5/12/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/19	2-6-13-6			TOPSOIL		
										(1'- 1.5') POORLY GRADED SAND WITH GRAVEL (SP); ~70% sand, fine to coarse, ~25% gravel, fine to coarse, ~5% fines; tan, FILL, asphalt pieces.		
										(1.5'- 3') POORLY GRADED SAND WITH GRAVEL (SP); ~50% sand, fine to coarse, ~45% gravel, fine to coarse, ~5% fines; brown, FILL, crushed concrete and asphalt.		
			S-2		4 to 6	24/23	2-1-1-3			(3'- 4.9') SILTY SAND (SM); ~70% sand, fine to coarse, ~30% fines; brown.		
	5									(4.9'- 16.3') POORLY GRADED SAND (SP); ~95% sand, medium to coarse, ~5% fines; tan.		
			S-3		8 to 10	24/24	8-10-10-11				▼	
	10											
	15		S-4		15 to 17	24/24	15-14-16-18					
										(16.3'- 17') SILT (ML); ~80% fines, ~20% sand; wet, light brown.		
										Bottom of Exploration at 17 feet		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-3

Drilling Information

DATE START / END: 5/12/2015 - 5/12/2015 **TOTAL DEPTH (FT):** 17.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 8.00 5/12/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0.2 to 2.2	24/13	8-8-5-9			ASPHALT (2 in.) (0.2'- 2.2') POORLY GRADED SAND WITH GRAVEL (SP); ~60% sand, medium to coarse, ~30% gravel, fine, ~10% fines; dry, tan, FILL, conrete, asphalt and brick pieces (fill).		
										(2.2'- 5') SILTY SAND (SM); ~60% sand, fine to coarse, ~25% gravel, fine, ~15% fines; dry, tan, FILL, conrete, asphalt and brick pieces (fill).		
			S-2		4 to 6	24/14	2-4-3-4					
	5									(5'- 12.5') POORLY GRADED SAND (SP); ~95% sand, coarse, ~5% fines; dry, tan, FILL.		
			S-3		8 to 10	24/24	6-5-7-8				▼	
	10											
										(12.5'- 16.4') POORLY GRADED SAND (SP); ~85% sand, medium to coarse, ~10% gravel, fine, ~5% fines; wet, brown.		
	15		S-4		15 to 17	24/24	22-24-27-28					
										(16.4'- 17') SILT (ML); ~60% fines, ~40% sand; wet, light brown.		
										Bottom of Exploration at 17 feet		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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Hartford, CT 06102
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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-4/MW-1

PAGE 1 of 1

Drilling Information

DATE START / END: 5/13/2015 - 5/13/2015 **TOTAL DEPTH (FT):** 17.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: 4.25 in / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 8.00 5/13/2015 ▼ 7.56 5/18/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			S-1		0.1 to 2.1	24/2	20-9-10-4			ASPHALT (1 in.) (0.1'- 0.4') POORLY GRADED GRAVEL (GP); ~60% gravel, medium to coarse, ~40% sand, fine; FILL.		backfill cuttings
			S-2		2 to 4	24/9	4-2-3-3			(0.4'- 2.1') POORLY GRADED GRAVEL WITH SAND (GP); ~60% gravel, medium to coarse, ~40% sand, fine; dry, black, FILL.		6" bentonite seal. 1/4 bag
			S-3		4 to 6	24/15	4-6-8-12			(2.1'- 2.5') SILTY SAND (SM); ~60% sand, fine, ~40% fines; dry, tan, FILL. (2.5'- 4') POORLY GRADED SAND WITH SILT AND GRAVEL (SM); ~70% sand, fine, ~20% fines, ~10% gravel, coarse, angular; dry, brown, FILL, asphalt pieces.		
5										(4'- 9') POORLY GRADED SAND WITH GRAVEL (SP); ~90% sand, fine to coarse, ~10% gravel, fine; wet, tan.	▼ ▼	# sand for sand pack
			S-4		8 to 10	24/24	4-9-14-43					2" diamter PVC Screen, 0.010 slot size
10										(9'- 12.5') SILTY SAND (SM); ~50% sand, fine to medium, ~40% fines, ~10% gravel, fine to coarse; wet, light brown.		
										(12.5'- 17') SILTY SAND WITH GRAVEL (SC); ~65% sand, medium to coarse, ~20% fines, ~15% gravel, fine to coarse; wet, gray.		
15			S-5		15 to 17	24/14	18-13-16-18					17' bottom depth of boring, backfill cuttings, PVC plug
										Bottom of Exploration at 17 feet		
20												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redevel
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

Freeman Companies, LLC
36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-5

Drilling Information

DATE START / END: 5/12/2015 - 5/12/2015 **TOTAL DEPTH (FT):** 8.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 6.50 5/12/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
			S-1		0 to 2	24/21	2-6-13-17			TOPSOIL (13 in.)		
			S-2		2 to 4	24/22	25-15-32-23			(1.1'- 2') SILTY SAND (SM); ~50% sand, ~50% fines, ~0% gravel; dry, dark brown, FILL, Pieces of brick and asphalt. (2'- 2.75') WELL GRADED SAND (SW); ~100% sand, fine to coarse; dry, light brown, FILL.		
			S-3		4 to 6	24/19	17-8-5-6			(2.75'- 4.8') SILTY SAND (SM); ~80% sand, fine, ~20% fines; dry, dark brown, FILL, with brick, asphalt, roof felt, and concrete. (4.8'- 5.4') SANDY SILT (ML); ~70% fines, ~30% sand, fine to coarse; moist, dark brown, FILL.		
	5		S-4		6 to 8	24/24	4-3-3-18			(5.4'- 6') SILTY SAND (SM); ~80% sand, fine to coarse, ~20% fines; moist, tan, FILL.	▼	
										(6'- 6.4') SANDY SILT (ML); ~70% fines, ~30% sand, fine to coarse; wet, dark brown, FILL. (6.4'- 6.7') SILTY SAND (SM); ~80% sand, medium to coarse, ~20% fines; wet, tan, FILL. (6.7'- 7.6') SILTY SAND WITH GRAVEL (SM); ~50% sand, medium to coarse, ~30% fines, ~20% gravel, fine; wet, tan, FILL.		
	10									(7.6'- 8') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; wet, tan.		
										Bottom of Exploration at 8 feet		
	15											
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redevel
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-6

Drilling Information

DATE START / END: 5/13/2015 - 5/13/2015 **TOTAL DEPTH (FT):** 10.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 7.00 5/13/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/19	13-17-11-14			ASPHALT (2 in.)		
										(0.2'- 4.7') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to coarse, ~20% fines, ~15% gravel, fine to coarse; dark brown, FILL, with concrete, brick, and black material.		
			S-2		2 to 4	24/19	13-22-105-30					
			S-3		4 to 6	24/21	15-2-2-2			(4.7'- 4.8') SILT WITH SAND (ML); ~50% sand, fine, ~50% fines; tan, FILL.		
	5									(4.8'- 6') SILT WITH SAND (ML); ~70% sand, fine to coarse, ~30% fines; gray, FILL, with concrete, brick, black material, unknown white material,.	▼	
			S-4		6 to 8	24/19	2-1-1-1					
			S-5		8 to 10	24/24	8-10-15-19			(6'- 7.6') SILTY SAND (SM); ~70% sand, fine to coarse, ~30% fines; tan, FILL.		
										(7.6'- 8.5') SILTY SAND (SM); ~85% sand, fine to coarse, ~15% fines; gray, FILL, with concrete, brick, black material, unknown white material,.		
	10									(8.5'- 10') POORLY GRADED SAND (SP); ~98% sand, fine to coarse, ~2% fines; tan.		
										Bottom of Exploration at 10 feet		
	15											
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-7

Drilling Information

DATE START / END: 5/12/2015 - 5/12/2015 **TOTAL DEPTH (FT):** 8.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 6.00 5/12/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/17	9-21-21-39			APHALT (3 in.)		
			S-2		2 to 4	24/24	11-8-4-5			(0.3'- 4.4') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to medium, ~20% gravel, fine to coarse, ~15% fines; brown, FILL, with asphalt, plastic, and black materials.		
	5		S-3		4 to 6	24/24	2-2-2-2			(4.4'- 6') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to medium, ~20% gravel, fine, ~20% fines; moist, tan.	▼	
			S-4		6 to 8	24/20	4-16-21-14			(6'- 6.5') SILTY SAND WITH GRAVEL (SM); ~70% sand, fine, ~20% fines, ~10% gravel, medium to coarse; wet.		
										(6.5'- 8') POORLY GRADED SAND (SP); ~95% sand, medium to coarse, ~5% fines; wet, tan.		
	10									Bottom of Exploration at 8 feet		
	15											
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-8

Drilling Information

DATE START / END: 5/13/2015 - 5/13/2015 **TOTAL DEPTH (FT):** 12.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 6.50 5/13/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24	9-12-8-16			TOPSOIL (6 in.)		
										(0.5'- 2') POORLY GRADED SAND WITH GRAVEL (SP); ~60% sand, fine to coarse, ~30% gravel, fine to coarse, ~10% fines; dry, FILL, with brick, concrete, and black material.		
			S-2		2 to 4	24	5-5-4-4			(2'- 4') POORLY GRADED SAND WITH GRAVEL (SP); ~70% sand, medium to coarse, ~30% gravel, fine to coarse; dry, tan, FILL, black material.		
			S-3		4 to 6	24	7-7-9-8			(4'- 7') POORLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, ~5% fines; moist, dark brown, FILL, with brick, black material, unknown white material.		
	5		S-4		6 to 8	24	5-5-4-3			(7'- 10') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~20% gravel, fine to coarse, ~20% fines; wet, dark brown, FILL, with brick, black material, unknown white material.	▼	
			S-5		8 to 10	24	100/2"					
	10		S-6		10 to 12	24	11-15-16-21			(10'- 12') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to coarse, ~30% gravel, fine to coarse, ~15% fines; wet, brown.		
										Bottom of Exploration at 12 feet		
	15											
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redevel
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PROJECT NUMBER: 2015-0408

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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-9/MW-2

Drilling Information

DATE START / END: 5/14/2015 - 5/14/2015 **TOTAL DEPTH (FT):** 17.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: 4.25 in / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 6.41 5/18/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			S-1		0 to 2	24/20	14-16-24-24			(0'- 9.5') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to coarse, ~30% fines, ~15% gravel, fine to medium; moist, brown.		backfill cuttings 6" bentonite seal. 1/4 bag.
			S-2		4 to 6	24/17	14-19-17-21				▼	
			S-3		8 to 10	24/18	21-30-39-33					#2 sand for sand pack.
	10									(9.5'- 10') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to coarse, ~30% fines, ~15% gravel, fine to medium; moist, black, odor. (10'- 17') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to coarse, ~30% fines, ~15% gravel, fine to medium; moist, brown.		2" diamter PVC Screen, 0.010 slot size.
	15		S-4		15 to 17	24/22	32-41-72-100					17' bottom depth of boring, backfill cuttings, PVC plug
										Bottom of Exploration at 17 feet		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-10

Drilling Information

DATE START / END: 5/13/2015 - 5/13/2015 **TOTAL DEPTH (FT):** 20.7
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 11.00 5/13/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
			S-1		0 to 2	24/10	11-6-6-5			(0'- 3.5') SILTY SAND WITH GRAVEL (SM); ~40% sand, fine to coarse, ~40% fines, ~20% gravel, fine to medium; dry, brown.		
	5		S-2		4 to 6	24/24	20-17-20-16			(3.5'- 8.5') SILTY SAND WITH GRAVEL (SM); ~40% sand, fine to medium, ~40% fines, ~20% gravel, fine to coarse; dry, brown.		
			S-3		8 to 10	24/20	16-32-30-40			(8.5'- 20.7') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~20% gravel, fine to medium, ~20% fines; wet, brown.	▼	
	10											
	15		S-4		15 to 17	24/24	57-77-59-129					
	20		S-5		20 to 20.7	8/8	30-140/2"			Bottom of Exploration at 20.67 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
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CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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APPENDIX C

LABORATORY ANALYTICAL DATA

AVAILABLE UPON REQUEST

APPENDIX D

SUMMARY TABLES OF RESULTS

Table 1
Summary of Soil Analytical Data
Marina Village Housing Complex
Bridgeport, CT

Parameter	GB PMC	RES DEC	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8	B-9	B-10
Matrix			Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Profile (feet)			15-17	8-10	4-6	8-10	4-6	5-6	3-5	4-6	8-10	10-12
Collection Date			5/14/15	5/12/15	5/12/15	5/13/15	5/12/15	5/13/15	5/12/15	5/13/15	5/14/15	5/13/15
Volatile Organic Compounds (VOCs) (ug/Kg)												
Naphthalene	NE	NE	12	< 6.1	< 5.9	< 5.9	< 5.1	<12	2,100	< 6.9	< 310	< 4.6
Toluene	67,000	500,000	< 6.0	< 6.1	< 5.9	< 5.9	< 5.1	<12	550	< 6.9	< 310	< 4.6
Total Xylenes	19,500	500,000	< 6.0	< 6.1	< 5.9	< 5.9	< 5.1	<12	1,560	< 6.9	< 310	< 4.6
Poly Aromatic Hydrocarbons (PAHs) (ug/Kg)												
Anthracene	400,000	1,000,000	< 300	< 290	< 270	< 300	6,700	<290	< 5,300	< 270	< 260	< 260
Benz(a)anthracene	1,000	1,000	< 300	< 290	560	< 300	**21,000**	<290	**11,000**	620	340	< 260
Benzo(a)pyrene	1,000	1,000	< 300	< 290	560	< 300	**15,000**	<290	**11,000**	480	290	< 260
Benzo(b)fluoranthene	1,000	1,000	< 300	< 290	750	< 300	**19,000**	<290	**11,000**	560	340	< 260
Benzo(ghi)perylene	NE	NE	< 300	< 290	460	< 300	11,000	290	16,000	460	< 260	< 260
Benzo(k)fluoranthene	1,000	8,400	< 300	< 290	< 270	< 300	5,900	<290	< 5,300	< 270	< 260	< 260
Chrysene	NE	NE	< 300	< 290	570	< 300	16,000	<290	10,000	540	310	< 260
Fluoranthene	56,000	1,000,000	< 300	< 290	1,300	< 300	26,000	<290	13,000	780	630	< 260
Indeno(1,2,3-cd)pyrene	NE	NE	< 300	< 290	350	< 300	8,000	<290	6,400	340	< 260	< 260
Naphthalene	56,000	1,000,000	< 300	< 290	< 270	< 300	< 5300	<290	< 5300	< 270	270	< 260
Phenanthrene	40,000	1,000,000	< 300	< 290	600	< 300	28,000	<290	22,000	980	1,100	< 260
Pyrene	40,000	1,000,000	< 300	< 290	1,100	< 300	29,000	<290	15,000	810	450	< 260
Total RSR Listed Metals (mg/Kg)												
Arsenic	-	10	2.2	1.0	3.3	2.4	**13.6**	3.3	**12.3**	**19.2**	1.5	< 0.8
Barium	-	4,700	40.2	13.2	104	36	623	26.1	188	48.2	40.9	24.9
Beryllium	-	2	0.41	< 0.33	0.49	0.62	0.31	0.53	0.61	< 0.32	0.45	< 0.31
Cadmium	-	34	< 0.44	< 0.42	< 0.38	< 0.44	1.5	<0.45	0.73	1.99	< 0.38	< 0.39
Chromium	-	100	11	7.03	13.1	13.9	43.7	13.5	26.2	21.7	13.5	15.1
Copper	-	2,500	18.9	7.36	27.5	19.2	49.7	23.2	69.4	80	17.8	22.2
Lead	-	400	7.7	3.35	130	10.3	190	8.66	124	28.9	6.28	7.44
Mercury	-	20	0.05	< 0.03	0.08	< 0.03	0.65	<0.03	2.94	0.03	< 0.03	< 0.03
Nickel	-	1,400	9.31	5.5	9.05	16.3	61.9	8.56	19.1	55.4	9.06	9.24
Silver	-	340	< 0.44	< 0.42	< 0.38	< 0.44	< 0.37	<0.45	1.54	< 0.40	< 0.38	< 0.39
Vanadium	-	470	20.5	10.8	23.6	21.4	35	27	34.9	23.4	32.1	38.3
Zinc	-	20,000	36.4	19.9	136	52.5	660	21.7	147	75.1	27.7	19.7
SPLP RSR Listed Metals (mg/L)												
SPLP Arsenic	0.5	-	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	<0.004	0.007	< 0.004	< 0.004	< 0.004
SPLP Barium	10	-	< 0.010	< 0.010	0.152	0.011	0.259	0.031	0.054	0.036	0.012	< 0.010
SPLP Chromium	0.5	-	< 0.010	< 0.010	< 0.010	< 0.010	0.087	<0.010	< 0.010	< 0.010	< 0.010	< 0.010
SPLP Copper	13	-	< 0.010	< 0.010	0.025	< 0.010	0.016	<0.010	< 0.010	< 0.010	< 0.010	< 0.010
SPLP Lead	0.15	-	< 0.010	< 0.010	0.128	< 0.010	0.069	<0.010	< 0.010	< 0.010	< 0.010	< 0.010
SPLP Nickel	1	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	<0.010	< 0.010	0.023	< 0.010	< 0.010
SPLP Vanadium	0.5	-	< 0.010	< 0.010	0.017	< 0.010	< 0.010	<0.010	< 0.010	< 0.010	< 0.010	< 0.010
SPLP Zinc	50	-	< 0.010	< 0.010	0.127	< 0.010	0.239	0.013	0.013	< 0.010	< 0.010	< 0.010
Extractable Total Petroleum Hydrocarbons (mg/Kg)												
ETPH	2,500	500	< 64	< 62	< 58	< 65	**570**	<62	**2,000**	< 58	< 55	< 56
PCBs By SW8082A (ug/kg)	Varies*	Varies*	-									
PCB-1254	-	1,000	< 430	< 410	< 390	< 430	< 380	<420	**1,400**	< 380	< 360	< 380
PCB-1260	-	1,000	< 430	< 410	< 390	< 430	890	<420	< 380	< 380	< 360	< 380

RES DEC - Residential Direct Exposure Criteria
GB PMC - Pollutant Mobility Criteria for a GB Classified Groundwater Area
* - Testing parameter(s) contains multiple constituents of concern with different detection limits; therefore no detection limits are provided within table
ND - Not Detected Above Laboratory Detection Limit
NA - Not Analyzed
NE - Criteria Not Established
ug/kg - micrograms per kilogram
mg/Kg - milligrams per kilogram

Table 2
Summary of Groundwater Analytical Data
Marina Village Housing Complex
Bridgeport, CT

Parameter	SWPC	RES VOL	MW-1	MW-2	MW-3
Matrix			Groundwater	Groundwater	Groundwater
Depth to Water (feet)			7.56	6.41	6.40
Collection Date			5/18/15	5/18/15	5/18/15
Volatile Organic Compounds (VOCs) (ug/l)					
1,2,4-Trimethylbenzene	NE	NE	< 1.0	42	< 1.0
1,3,5-Trimethylbenzene	NE	NE	< 1.0	26	< 1.0
2-Isopropyltoluene	NE	NE	< 1.0	2.6	< 1.0
Acetone	NE	50,000	< 25	130	< 25
Benzene	710	215	< 0.70	10	< 0.70
Bromodichloromethane	1,020	NE	1.4	< 0.50	1.6
Chloroform	14,100	287	12	< 1.0	8.1
Ethylbenzene	580,000	50,000	< 1.0	19	< 1.0
Isopropylbenzene	NE	NE	< 1.0	9.9	< 1.0
Methyl t-butyl ether (MTBE)	NE	50,000	< 1.0	1.6	< 1.0
Naphthalene	NE	NE	< 1.0	28	170
n-Butylbenzene	NE	NE	< 1.0	6.6	< 1.0
n-Propylbenzene	NE	NE	< 1.0	20	< 1.0
p-Isopropyltoluene	NE	NE	< 1.0	6.1	< 1.0
sec-Butylbenzene	NE	NE	< 1.0	10	< 1.0
Total Xylenes	NE	21,300	< 1.0	34.2	< 1.0
Poly Aromatic Hydrocarbons (PAHs) (ug/l)					
2-Methylnaphthalene	NE	-	< 0.10	4.2	< 50
Acenaphthene	NE	-	< 0.10	1.5	< 50
Anthracene	1,100,000	-	< 0.10	0.39	< 50
Benz(a)anthracene	0.3	-	0.03	0.12	**79**
Benzo(a)pyrene	0.3	-	< 0.02	0.1	**66**
Benzo(b)fluoranthene	0.3	-	< 0.02	0.14	**85**
Benzo(k)fluoranthene	0.3	-	< 0.02	0.04	< 50
Chrysene	NE	-	< 0.02	0.09	69
Fluoranthene	3,700	-	< 0.10	0.53	140
Fluorene	140,000	-	< 0.10	1.2	< 50
Indeno(1,2,3-cd)pyrene	NE	-	< 0.02	0.06	< 50
Naphthalene	NE	-	< 0.10	16	77
Phenanthrene	0.077	-	< 0.07	**2.1**	**200**
Pyrene	110,000	-	< 0.10	0.43	120
RSR Listed Metals (mg/l)					
Antimony	86	-	< 0.005	< 0.005	0.018
Antimony (Dissolved)	-	-	< 0.005	< 0.005	< 0.005
Arsenic	0.004	-	**0.006**	< 0.004	**0.015**
Arsenic (Dissolved)	-	-	< 0.004	< 0.004	< 0.004
Barium	NE	-	0.191	0.698	0.313
Barium (Dissolved)	-	-	0.068	0.661	0.096
Beryllium	0.004	-	0.001	< 0.001	0.002
Beryllium (Dissolved)	-	-	< 0.001	< 0.001	< 0.001
Cadmium	0.006	-	< 0.001	< 0.001	0.002
Cadmium (Dissolved)	-	-	< 0.001	< 0.001	< 0.001
Chromium	0.11	-	0.029	0.006	0.03
Chromium (Dissolved)	-	-	< 0.001	< 0.001	< 0.001
Copper	0.048	-	0.046	0.008	**0.309**
Copper (Dissolved)	-	-	< 0.005	< 0.005	< 0.005
Lead	0.013	-	**0.193**	0.011	**0.595**
Lead (Dissolved)	-	-	< 0.002	0.005	< 0.002
Mercury	0.0004	-	0.0002	< 0.0002	**0.0058**
Mercury (Dissolved)	-	-	< 0.0002	< 0.0002	< 0.0002
Nickel	0.88	-	0.033	0.016	0.027
Nickel (Dissolved)	-	-	0.006	0.011	0.002
Vanadium	NE	-	0.049	0.011	0.046
Vanadium (Dissolved)	-	-	< 0.002	< 0.002	< 0.002
Zinc	0.123	-	**0.131**	0.019	**0.482**
Zinc (Dissolved)	-	-	0.016	0.01	0.051

SWPC - Surfacewater Protection Criteria
RES VOL - Residential Volatilization Criteria
ND - Not Detected Above Laboratory Detection Limit
NA - Not Analyzed
NE - Criteria Not Established
mg/l - milligrams per liter
ug/l - micrograms per liter

APPENDIX C

ENVIRONMENTAL EVALUATION AND MATERIALS MANAGEMENT REPORT- JUNE 2016 - SECOND PHASE

FREEMAN COMPANIES

LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Environmental Evaluation and Materials Management Report
Marina Village Housing Complex
Bridgeport, Connecticut

June 2016
Freeman File No.: 2015-0408

Prepared for:

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1 INTRODUCTION

Freeman Companies has completed an Environmental Evaluation Assessment of what is referred to as Phase 2 of the redevelopment the Marina Village Housing Complex in Bridgeport, CT. Bridgeport Community Renewal Associates, LP ("BCRA") is working with Park City Communities on the redevelopment of the Marina Village housing complex. The second phase ("Phase 2") of this development will involve the demolition of the complex which is bounded by South Avenue, Columbia Street, Ridge Avenue, and Iranistan Avenue (Buildings Numbered 5-31).

1.1 Purpose

The purpose of the assessment was to collect sufficient information in order to provide an evaluation of the environmental impacts, if present, to soil and groundwater on the Phase 2 portion of the Site and how these impacts may affect the redevelopment of the site.

Preliminary environmental information regarding historical environmental impact on the property was obtained from the September 2013 Phase I Environmental Site Assessment (ESA) prepared by Fuss & O'Neill. Based on the information presented within the reports, the site has a long history of heavy industrial and manufacturing operations prior to its development as a residential housing complex in the late 1940s. Industrial activities at the site included the following industries:

- Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings and conducted operations such as annealing, trimming, core making, tumbling, grinding, rolling, and molding; and
- Hotchkiss Sons' Manufacturers Curry Combs & Company which conducted scouring, tempering, and japanning of various metals.

1.2 Scope of Work

Based on the historical industrial activities that were conducted on the site, the following scope of work was developed:

- Oversight of the advancement of 10 soil borings, four of which were completed as a groundwater monitoring well.
- The collection and analysis of soil samples from each of the proposed soil borings. Select soil samples were analyzed for the following parameters: volatile aromatic hydrocarbons (VOCs), extractable total petroleum hydrocarbons (ETPH), poly aromatic hydrocarbons (PAHs), total and leachable RSR listed metals, and polychlorinated biphenyls (PCBs).
- The collection of a groundwater sample from each of the four newly installed monitoring wells. Groundwater samples were analyzed for the following parameters: VOCs, PAHs, and total RSR listed metals.
- The preparation of a report documenting the findings of the investigation.

Investigation activities were conducted in general accordance with the guidelines for environmental site assessments established in the Connecticut Department of Energy and Environmental Protection (CTDEEP) Site Characterization Guidance Document (SCGD) September 2007 (updated December 2010).

1.3 Objectives

The primary objective of this investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions will affect proposed redevelopment activities.

2 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

2.1 General

The second phase ("Phase 2") of the Marina Village redevelopment will involve the demolition of the portion of the complex which is bounded by South Avenue, Columbia Street, Ridge Avenue, and Iranistan Avenue (Buildings Numbered 5-31).

Demolition of the Phase I portion of the complex was completed in 2015.

2.2 Surrounding Land Use

The surrounding land use consists primarily of high-density housing to the southwest, southeast and northeast; and a mix of commercial and light industrial to the northwest.

2.3 Groundwater Classification

According to the CTDEEP water quality classification maps (November 2013), groundwater at the site is classified as GB. A GB classified groundwater is defined as groundwater within a historically highly urbanized area or an area of intense industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts.

2.4 Previous Environmental Assessment Activities

As previously identified a Phase I ESA was conducted on the site in 2013. Based on the information with the 2013 report no previous environmental sampling has been conducted on the Phase 2 portion of the complex.

3 GEOLOGIC INFORMATION

The physical conditions of the Site, including hydrology characteristics, are described in the following sections.

3.1 Site Topography

The site slopes from north to south ranging with a difference in elevation of approximately 5 feet (8 feet to 13 feet) above mean sea level. A majority of the site is located between elevations 10-12 feet.

3.2 Site Soils

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS) for the State of Connecticut (NRCS Webpage), the site is identified as primarily containing Urban Land. Urban land if defined as areas those are in urban and built up areas. The characteristics of this unit are so variable that an onsite investigation is required to determine the suitability for proposed uses.

Based on field observations soil conditions were observed to consist of the following:

Topsoil/ Asphalt – Topsoil was described as a dark brown silt, and fine to coarse sand. Up to one foot of topsoil was encountered in the borings conducted in grassy areas. Asphalt thickness ranged from 1 inch to 5 inches.

Urban Fill – Urban Fill was described brown to dark brown, fine to coarse sand and silt, with asphalt, crushed brick, concrete, and other manmade material debris. Ash and pieces of coal were also found in fill in various borings. The fill extended to depths below ground surface ranging from 2 feet to greater than 12 feet. Fill was not observed in borings SB-5 or SB-6.

Natural Sand – Natural sand was encountered in each of the borings, except MW-4 which contained natural sand mixed with coal.

Silt – Silt layers were encountered in some borings (SB-1, SB-6, SB-4, and MW-3) at various depths throughout the borings. The silt layers ranged from half of a foot to two feet thick. The silt is described as being grey, tan, or brown.

4 REMEDIATION STANDARD REGULATIONS

The analytical results reported in this report have been compared to remediation criteria listed in the CTDEEP's Remediation Standard Regulations (RSRs). The RSRs (Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies) form the basis for evaluation of site conditions in respect to environmental impacts and the impacts associated risk factors to human health and the environment. The CTDEEP uses the RSRs to determine whether sufficient remediation has been conducted at sites that are required by statute, regulation or administrative order to be remediated, or that are remediated through a formal voluntary remediation process.

The RSRs provide: (1) baseline specific criteria that may be used at any site to determine whether or not remediation is necessary, (2) self-implementing alternatives to the baseline criteria for specific circumstances, (3) self-implementing exceptions to the criteria for specific circumstances, and (4) an opportunity to request approval of site-specific alternatives to the self-implementing standards and the options for remediation from the CTDEEP Commissioner.

Although the Site is not currently under an order by the CTDEEP or subject to regulation and or statute to meet the risk based criteria within the RSRs, Freeman Companies will utilize the listed values within the RSRs as guidance in order to be protective of human health and the environment.

4.1 Soil Remediation Criteria

The CTDEEP soil remediation criteria integrate two risk-based goals: (1) Direct Exposure Criteria (DEC) to protect human health and the environment from risks associated with direct exposure (ingestion) to contaminated soil; and (2) Pollutant Mobility Criteria (PMC) to protect groundwater quality from contaminants that migrate or leach from the soil to groundwater. Soils to which both criteria apply must be remediated to a level which is equal to the more stringent criteria.

4.1.1 Direct Exposure Criteria

Specific numeric exposure criteria for a broad range of contaminants in soil have been established by the CTDEEP, based on exposure assumptions relative to incidental ingestion of contaminants in soils. The DEC applies to accessible soil to a depth of 15 feet. The DEC for substances other than PCBs does not apply to inaccessible soil at a release area provided that, if such inaccessible soil is less than 15 feet below the ground surface, an environmental land-use restriction (ELUR) is in effect with respect to the subject release area.

Inaccessible soil generally means polluted soil which is the following:

- More than four feet below the ground surface;
- More than two feet below a paved surface comprised of a minimum of three inches of bituminous pavement or concrete;
- Beneath an existing building; or

- Beneath another permanent structure(s) approved by the CTDEEP Commissioner. Buildings can be constructed and/or clean fill can be placed over contaminated soils rendering them inaccessible.

The CTDEEP has established two sets of DEC using exposure assumptions appropriate for residential land use (RES DEC) or for industrial and certain commercial land use (I/C DEC). In general, all sites are required to be remediated to the residential criteria. If the industrial/commercial land use criteria are applicable and used, an ELUR notification is required in accordance with the RSRs.

4.1.2 Pollutant Mobility Criteria

The PMC that are utilized for remediation determination of a site depends on the groundwater classification of the site. The Site is within in a GB groundwater classified area.

The PMC generally apply to all soil in the unsaturated zone, from the ground surface to the seasonal high water table in GB classified areas. The criteria do not apply to environmentally isolated soils that are polluted with substances other than VOCs provided that an ELUR is recorded for the release area which ensures that such soils will not be exposed (unless approved in writing by the CTDEEP Commissioner). Environmentally isolated soils are defined as certain contaminated soils which are below the seasonal low water table, beneath an existing building and not a source of ongoing contamination. An ELUR must be recorded for the site which ensures that such soils will not be exposed as a result of building demolition or other activities. Buildings can be constructed over contaminated soils rendering them environmentally isolated.

Remediation based upon the listed PMC requires that a substance, other than an inorganic substance or PCB, in soil be remediated to at least that concentration at which the results of a mass analysis of soil for such substances does not exceed the PMC applicable to the groundwater classification (i.e., GA or GB) of the area in which the soil is located. An inorganic substance or PCB in soil must be remediated to at least that concentration at which the analytical results of leachate produced from SPLP does not exceed the PMC applicable to the groundwater classification of the area in which the soil is located. As an alternative method for determining compliance with the PCM the analytical results of leachate produced from SPLP for most volatile, semi-volatile and petroleum compounds can be compared to the Groundwater Protection Criterion (GWPC) for such substance.

4.2 Groundwater Remediation Criteria

Groundwater remediation requirements are dependent upon the groundwater classification of the site. The objectives of these standards are the following:

- Protect existing use of groundwater regardless of the area's groundwater classification;
- Prevent further degradation of groundwater quality;
- Prevent degradation of surface water from discharges of contaminated groundwater; and
- Protect human health and the environment.

Portions of the RSRs governing groundwater regulate remediation of groundwater based on each substance present within the plume and by each distinct plume of contamination. Several factors influence the remediation goal at a given site, including: background water quality, the groundwater classification, the proximity of nearby surface water, existing groundwater uses, and the presence of buildings and their usage. When assessing general groundwater remediation requirements, all of these factors must be considered in conjunction with the major numeric components of the RSRs.

In general, remediation of a groundwater plume in a GB groundwater classified area shall result in the attainment of the following:

- The Surfacewater Protection Criteria;

- The Volatilization Criteria; and
- Not interfere with any existing usage of the groundwater.

5 SUBSURFACE INVESTIGATION ACTIVITIES

The primary objective of this investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions will affect the redevelopment. To achieve the stated objectives, the subsurface investigation activities were designed to include both environmental setting and contaminant identification investigations.

The approach, procedures and results of the site investigation activities are presented in the following sections.

5.1 Soil Sampling and Analysis

The primary purpose of the soils characterization portion of the assessment was to define the nature/presence of target contaminants in the unconsolidated materials in both the saturated and unsaturated zones associated with historical Site activities. In addition, the boring program also provided information on Site stratigraphy and physical properties of the unconsolidated materials in both the saturated and unsaturated zones with particular emphasis on the characteristics of those materials that affect contaminant migration pathways and transport mechanisms.

This section describes the specific soil borings and sampling performed in order to define Site stratigraphy, soil properties and soil contaminant profiles.

5.1.1 Soil Sampling

Soil sampling activities were conducted between the dates of May 25 through May 26, 2016. A total of ten soil borings were advanced at the Site as part of the investigation. Seaboard Drilling Services Inc. of Springfield, MA advanced the soil borings utilizing a direct push drill rig, as well as a hollow stemmed auger (HSA) drilling rig under the direct supervision of Freeman Companies field personnel. The location for each of the soil borings was chosen to maximize the information obtained based on Freeman Companies' understanding of existing site conditions. A figure depicting the locations of sampling activities is included in Appendix A. Boring and well completion logs are provided in Appendix B.

The following sections provide a summary of soil investigation drilling details.

5.1.2 Soil Sampling Via Hollow Stemmed Auger

Six of the ten soil borings (SB-1 through SB-6) were advanced using a direct push drill rig that utilizes static force and dynamic percussion to drive steel boring rods into the ground. Soil samples were collected with a stainless steel, 2-inch diameter, five-foot spoon sampler interiorly lined within a single use acetate sleeve. Sampling was conducted continuously into the observed water table.

The remaining four soil borings (MW-1 through MW-4) were advanced using a HSA drill rig spinning a 4 ¼-inch inner diameter auger. Soil samples were collected with stainless steel, 2-inch diameter, two-foot split-spoon sampler advanced ahead of the augers in two-foot intervals using a weighted hammer. Sampling was conducted continuously at 2 foot intervals into the observed water table.

5.1.3 Soil Screening and Submittal

Upon retrieval of each soil sample, the supervising field personnel visually inspected each sample for staining, color, and moisture content and then characterized and logged each sample. None of the collected samples contained any noticeable odor or petroleum impact.

Following the completion of each soil boring and related soil sample collection activities, the resulting boreholes were backfilled with either the drill cuttings that were generated from the borehole and/or with virgin well materials.

Soil samples submitted for laboratory analysis were selected based on the groundwater interface zone and/or the identification of a contaminate migration pathways to the environment. The selected soil samples were submitted to Phoenix Analytical laboratories of Manchester, CT and analyzed for those constituents that have the potential to be released to the subsurface due to current or historical activities related to the Recognized Environmental Condition ("REC") investigated. Based on the constituents of concern for each of the Areas of Concern ("AOCs"), the soil samples were analyzed for one or more of the following analysis:

- Volatile Organic Compounds (VOCs) in accordance with EPA Method 8260
- ETPH in accordance with CTDEEP extractable total petroleum hydrocarbons methodologies
- Poly-aromatic hydrocarbons (PAHs) via EPA Method 8270
- Total CT listed metals
- Leachable CT listed metals via the Synthetic Precipitation Leaching Procedure
- PCB's in accordance with EPA Method 8082

5.1.4 Sample Management

All soil and groundwater analytical samples were collected in laboratory-supplied containers and chilled immediately on ice for transit to the laboratory. Freeman Companies personnel maintained possession of the samples until transfer to a laboratory provided courier for transit to the laboratory. A chain-of-custody form accompanied the samples from their collection point to delivery at Phoenix. Complete chain-of-custody forms are included with the laboratory analytical data reports as provided in Appendix C.

5.2 Monitoring Well Installation Activities

The primary purpose of the groundwater characterization portion of the investigation was to determine the presence of contaminants of concern relative to historical site activities.

Four overburden-monitoring wells (MW-1 through MW-4) were set to a depth of 15 feet below grade. The wells are constructed of 10 feet of 2-inch diameter, 0.010-inch slotted PVC screen, with 2-inch diameter PVC riser extending to grade. The annular space around the wells was filled with #2 sand extending up to approximately 1-2 feet above the screen. An approximate twelve inch layer of bentonite was placed above the sand pack to form a seal. Native fill and/or well sand was then used to fill the remaining borehole to grade. Each well was finished with an eight-inch diameter flush mounted road box set in concrete. A figure depicting monitoring well locations is included in Appendix A. Well construction logs are presented as Appendix B.

5.3 Groundwater Sampling

Freeman Companies personnel collected groundwater samples from the newly installed monitoring wells on June 3, 2016. Groundwater sampling was conducted using low flow procedures in general accordance with Region I EPA's Low Stress (low flow) Purging and Sampling Procedure (July 30, 1996, revised January 19, 2010). Purging and sampling were performed using an adjustable rate pneumatic bladder pump with dedicated polyethylene tubing for all sampled wells. Pump intake depths were selected to coincide with the center-of-saturated-screen elevations for the deep wells and the top of the saturated screens for the shallow water table wells.

Purged volumes were based on the rate of stabilization of field-measured water quality parameters, including: dissolved oxygen, specific conductance, temperature, pH, turbidity, and oxidation/reduction potential were obtained. Field parameters were generally measured at five minute intervals; purging rates and water levels were also measured. Purged water from the wells did not exhibit any visual or olfactory evidence of impact such as odors and/or sheen. Due to the nature of the formation (urban fill) turbidity readings remained above the target of 5 NTUs, even after extended pumping.

Groundwater samples were collected from each well and submitted on ice to Phoenix for analysis. The following analyses were performed on all submitted groundwater samples:

- VOCs by EPA Method 8260
- PAHs via EPA Method 8270
- Total CT listed metals

5.4 Soil Sampling Results

Soil encountered during the advancement of the soil borings consisted primarily of a mixture of Urban Fill and ash, followed by brown and tan, fine to coarse sand intermixed with silt at several locations. Bedrock was not encountered at any boring locations.

Based on non-restricted property use, guidance standards used for soil at the Site would be the Residential Direct Exposure Criteria (RDEC) and the Pollutant Mobility Criteria (PMC) for an area with a GB groundwater classification.

Laboratory analysis of the soil samples collected from sample locations SB-1, SB-4, and MW-2 identified the presence of one or more of the following; poly aromatic hydrocarbons and/or extractable total petroleum hydrocarbons, exceeding the RDEC and/or the GB PMC.

A summary of the soil analytical results is presented in Table 1, within Appendix D and a copy of the laboratory analytical report is included as Appendix C.

5.5 Groundwater Sampling Results

Groundwater samples were collected from each monitoring well with dedicated sampling equipment in order to assess current water quality and to evaluate for the presence and distribution of contaminants in groundwater that may have originated from the Site or potentially from off-site locations. Samples were stored in laboratory provided glassware and submitted for analysis at for the suite of analytes identified based upon historic or current suspected potential sources of contamination. These parameters were used to indicate the presence of contaminants in groundwater and provided a basis for correlation with chemical data derived from the soil results.

Based on current land use and a GB groundwater classification, remediation guidance used for groundwater at the Site would be the Residential Volatilization Criteria (RES VC) and the Surface Water Protection Criteria (SWPC).

Analytical Results did not detect the presence of any volatile organic compounds at concentrations that exceeded the RES VC.

Analytical results did identify the presence of one or more of the following poly aromatic hydrocarbobs; benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and phenanthrene at concentrations exceeding the default SWPC within the samples collected from MW-3 and MW-4.

Analytical results of the total metals analysis primarily detected the presence of one or more of the following metals; arsenic, copper, lead, and zinc at concentrations exceeding the default SWPC within the samples collected from MW-1, MW-3, and MW-4.

A summary of the groundwater analytical results is presented as Table 2 in Appendix D, and a copy of the laboratory analytical report is included in Appendix C.

6 SOIL REUSE/DISPOSAL

Based on the findings of the assessment activities, the following general assumptions can be made regarding the soil at the site.

- Native soils may be managed as clean fill after confirmatory testing has been completed to ensure status as clean fill.
- Any urban fill material disturbed as part of proposed site activities shall be at a minimum be managed as a Regulated Soil.
- Material disturbed from the northern portion of the project area, as characterized by samples collected from SB-1 and SB-4, shall be classified as contaminated and should be removed from the site for proper disposal.
- Polluted soils may be reused on-site following site specific requirements

Further management/reuse discussions are provided in the following sections.

6.1 Soil Classifications

Based in the analytical results from the samples collected as part of the assessment activities the following soil types will be encountered as part of proposed site activities.

6.1.1 Clean Fill

Chemically clean fill that meets the definition of natural soil as defined in Sec. 22a-209-1 and Sec. 22a-133k-2(h) of the Regulations of Connecticut State Agencies (RCSA). Clean fill does not contain any substances above natural background levels. It is anticipated that a majority of native soils excavated from the project area will meet this definition of Clean Fill. Actual volumes will be determined by further analytical testing.

6.1.2 Polluted Soil

Soil affected by a release of a substance at a concentration above the analytical detection limit for such substance in accordance with RCSA 22a-133k-1(a)(45) and below the Residential Direct Exposure criteria and the GB Pollutant Mobility criteria as these terms are described in the Remediation Standard Regulations (RCSA 22a-133k-1 through 3). It is anticipated that a portion of the Urban Fill material will meet this definition. In most cases polluted soil may be reused at the project site with restriction.

6.1.3 Contaminated Soil

Soil affected by an identified or suspected release and determined, or reasonably expected to contain substances exceeding Residential Direct Exposure Criteria or GB Pollutant Mobility Criteria, as these terms are defined in the Remediation Standard Regulations (RCSA Section 22a-133k-1). It is anticipated that a portion of the Urban Fill/ash material located within the northern portion of the project area will meet this soil type. In all cases contaminated soil disturbed as part of construction activities should be removed from the site for proper disposal.

6.1.4 Regulated Soil

Regulated Soil includes Polluted Soil and Contaminated Soil. It is anticipated that most of the Urban Fill material generated from site activities will be classified as regulated.

6.2 Soil Management

Based on the analytical results the testing conducted soil management activities for the handling and management of excavated material encountered during demolition/construction will be required. It is not intended that any soil remediation be conducted outside the limits of excavation anticipated for the project as designed.

All handling and management operations should be conducted in accordance with standard engineering practices applicable to such activity and in accordance with CTDEEP regulations including but not limited to the procedures contained in the CTDEEP General Permit for Contaminated Soil and/or Sediment Management.

Depending on the selected management approach, soils within the project area can be ether pre-classified, stockpiled and classified, or assumed to be contaminated.

All stockpiles of Regulated Soil should be constructed to isolate stored Regulated Soil from the environment. Stockpiles shall be constructed to include liners free of holes and other damage. The ground surface on which the liner is to be placed shall be free of rocks or and any other object which could damage the liner.

Regulated Soil cannot be stockpile off site unless a registration has been submitted to and approved by the CTDEEP under the General Permit for Contaminated Soil and/or Sediment Management.

6.3 Allowable Reuse Options

Polluted Soil may be reused in accordance with the following requirements:

- Reused on site as backfill in locations above the water table and not in areas subject to erosion in accordance with requirements of Section 22a-133K of the RCSA. The backfill location and depth shall be documented in a scaled drawing for any Polluted Soil that is reused on site. Any backfill material shall meet the structural/compaction geotechnical requirements.

- If the polluted soil is not suitable for reuse, the material shall be managed, disposed of, treated or recycled in accordance CTDEEP regulations

6.4 Health and Safety

All site health and safety controls shall be fully established and in operation prior to beginning any material handling activity. Site controls shall include but not be limited to the following: work zones properly barricaded, decontamination facilities established, air monitoring, and all support equipment and supplies including personal protective equipment.

7 WASTEWATER HANDLING

Based on the analytical testing conducted as part of this evaluation, it is anticipated that a majority of the dewatering wastewater generated from the project area will be contain some degree of impact, primarily metals and poly aromatic hydrocarbons, and therefore will likely require specific handling and management procedures to be implemented.

7.1 Allowable Disposal Options

Management of dewatered groundwater may be accomplished in accordance with CTDEEP General Permit for the Discharge of Groundwater Remediation Wastewater Directly to Surface Water (Storm sewers discharging to surface waters) and local regulations and ordinances or through the CTDEEP General Permit Groundwater Remediation Wastewater to a Sanitary Sewer and local regulations and ordinances.

7.2 Storage Options

If there is a need for storage of wastewater prior to discharge, fractionation tanks with a capacity of at least 20,000 gallons may be used. The tanks shall be equipped with a sample port to facilitate safe sampling of tank contents. Discharge valve shall be capable of controlling discharge flow rate.

7.3 Treatment Options

If it is necessary to treat the water in order to meet discharge limits, an activated carbon treatment and filtration system, sized to treat water with a minimum influent total volatile organic compound concentrations necessary to meet discharge goals, may be implemented. Systems of this type shall include one or more of the following components: pumps; piping; bag or cartridge filters; carbon treatment vessels; Influent, midpoint and effluent sampling ports and system flow meters.

7.4 Health and Safety

All site health and safety controls shall be fully established and in operation prior to beginning any material handling activity. Site controls shall include but not be limited to the following: work zones properly barricaded, decontamination facilities established, and all support equipment and supplies including personal protective equipment.

8 ENVIRONMENTAL REMEDIATION AND DISPOSAL COSTS

Freeman Companies conducted an environmental evaluation of the project area in order to obtain a better understanding of the subsurface conditions that may be encountered as part site demolition and construction activities.

Soil conditions encountered within soil borings consisted of sand (natural soil) overlain by various thicknesses of fill material, which contained a variety of debris (asphalt, crushed brick, concrete), ash, silt, and other manmade material.

Analytical results identified that the Urban Fill material is generally impacted by a combination of PAHs and ETPH. The area with the highest concentration of environmental impact was located under the former Hotchkiss Sons facility. Although the sample collected from this location contained elevated concentrations of PAHs, besides for the presence of ash and coal fragments, there was no clear indication of impact that would typically be found with this kind of impact. It is possible that the concentrations of PAHs are at least partially related to the burning of coke, formed by the destructive distillation of coal, within the furnaces as part of the malleable iron foundry process.

In order to be protective of for future residential reuse, Freeman Companies recommends the removal of the fill material containing elevated concentrations of PAHs. The removed fill material can be removed from the site for disposal at a permitted disposal facility.

Due to the fact that the site will be re-graded following demolition activities, the Owner should attempt to reuse polluted fill material to the maximum extent prudent upon the completion of demolition (i.e. within former building foundation excavations, within former tunnel excavations, as backfill within areas of remediation).

8.1 Remedial Costs

Based on the analytical results, the soil represented by the samples collected from borings SB-1 and SB-4 should be considered as contaminated and therefore Freeman Companies would recommend that any excavated material from within these areas should be removed from the Site for proper disposal.

Due to the limited testing conducted, initial estimates for soil removal quantities would be conservatively high (at least 5,000 tons). In order to provide a better definition of impacted fill material present within the project area, Freeman companies would recommend that additional sampling be conducted in order to better define remedial areas and to continue the delineation/characterization of soils to remain on the site. Since the constituents of concern have been defined through evaluation testing, soil testing parameters may be limited to just PAHs and ETPH. A cost for analysis is estimated at $175/sample which will include both parameters.

APPENDIX A

MAPS AND FIGURES



LEGEND:

SB-1	SOIL BORING
MW-1	MONITORING WELL

NOTE:

1. BASE PLAN PREPARED BY JULIANO ASSOCIATES, LLC.

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET

BORING LOCATION PLAN

MARINA VILLAGE
400 IRANISTAN AVENUE
BRIDGEPORT, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

DRAWN:	M.K.
CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=100'
PROJECT NO.:	2015-0408
DATE:	06/14/2016

SHEET NO.

FIGURE 1

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan.dwg Jun 14, 2016-4:03pm Plotted By: mkwok

THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC

APPENDIX B

BORING AND WELL COMPLETION LOGS

Boring/Well No. SB-1 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 13.5'
Drilling Method: Geoprobe **Sample Method:** 5' Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	14"/60"			0-0.1' Asphalt
					0.1-3.2' Dark brown f-c sand, some silt; pieces of brick
1					3.2-5' Brown f-c sand and silt
2					
3					
4					
5					
	S2	50"/60"			5-5.5' Grey and tan silt
6					5.5-10' Beige f-c sand, little f gravel, trace silt
7					
8					
9					
10					
	S3	49"/60"			10-12.5' Tan and grey f-c sand
11					12.5-13.75' Grey silt, wet
12					13.75-15' Tan and grey f-c sand.
13					
14					
15					
					BOB 15'
					Sample 3.5-5.5'

Boring/Well No. SB-2 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 14'
Drilling Method: Geoprobe **Sample Method:** 5' Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	30"/60"			0-0.5' Asphalt
1					0.5-1' Dark brown f sand
					1-2' Black silt
2					2-2.5' Tan sand and silt with some black silt
					2.5-5' Brown f-c sand, some silt
3					
4					
5					
	S2	48"/60"			5-10' Tan f-c sand, some f-m gravel
6					
7					
8					
9					
10					
	S3	55"/60"			10-11' Tan f-c sand, some f-m gravel
					11-15' Brown f-m sand, some silt, wet
11					
12					
13					
14					
15					
					BOB 15'
					Sample 2-4'

Boring/Well No. SB-3 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 8'
Drilling Method: Geoprobe **Sample Method:** 5' Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	28"/60"			0-0.5' Asphalt
1					0.5-5' Brown silt and f-c sand, some f-m gravel; mixed with brick,
					concrete, and very small strips of black ash
2					
3					
4					
5					
	S2	48"/60"			5-6' Brown silt and f-c sand, some f-m gravel; mixed with brick,
6					concrete, and very small strips of black ash
7					6-10' Tan and brown f-c sand, little f gravel. Wet
8					
9					
10					
	S3	54"/60"			10-14' Tan and brown f-c sand, little f gravel
11					
					14-15' Brown silt and f sand
12					
13					
14					
15					
					BOB 15'
					Sample 4-6'

Boring/Well No. SB-4 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 7.5'
Drilling Method: Geoprobe **Sample Method: 5' Sleeve**
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	40"/60"			0-0.1' Asphalt
1					0.1-3' Dark brown f-c sand, some silt; pieces of brick;
					small black pieces, possibly coal
2					3-3.75' Brick
					3.75-5' Dark brown f-c sand, some silt;
3					small black pieces possibly coal; small amount of ash
4					
5					
	S2	55"/60"			6-6.3' Dark brown f-c sand, some silt;
6					small black pieces possibly coal; small amount of ash
					6.3-6.7' Brick
7					6.7-9' Tan f-c sand with striations of grey silt. Wet
					9-10' Tan f-c sand
8					
9					
10					
	S3	60"/60"			10-15' Tan f-c sand
11					
12					
13					
14					
15					
					BOB 15'
					Sample 4-6'

Boring/Well No. SB-5 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 8'
Drilling Method: Hand auger and Geoprobe **Sample Method: 5'** Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	60"/60"			0-0.5' Topsoil; Dark brown silt and f-c sand
1					0.5-2' Tan f-c sand, trace silt
					2-5' Tan and beige f-c sand, trace silt
2					
3					
4					
5					
	S2	60"/60"			5-10' Tan and beige f-c sand, trace silt
6					wet at 8'
7					
8					
9					
10					
	S3	60"/60"			10-15' Tan and beige f-c sand, trace silt
11					
12					
13					
14					
15					
					BOB 15'
					Sample 6-8'

Boring/Well No. SB-6 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 9'
Drilling Method: Hand auger and Geoprobe **Sample Method: 5'** Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	60"/60"			0-1' Topsoil; Dark brown silt and f-c sand, little f gravel
1					1-2' Tan f-c sand, little f gravel, trace silt
					2-5' Beige f-c sand, little f gravel, trace silt
2					
3					
4					
5					
	S2	60"/60"			5-6' Beige f-c sand, little f gravel, trace silt
6					6-7' Brown silt
					7-9.6' Brown f-c sand, trace silt. Wet
7					9.6-10' Brown silt
8					
9					
10					
	S3	60"/60"			10-14.5' Brown f-c sand, little silt
11					14.5-15' Brown silt
12					
13					
14					
15					
					BOB 15'
					Sample 5-7'

Boring/Well No. MW-1 **Date:** 5/26/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 12' **Water Level:** 9'
Drilling Method: Hollow Stem Auger **Sample Method: 2' Split Spoon**
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
1					
2	S1	12"/24"	17,56,12,6		2-2.5' Brown f-c sand and silt
3					2.5-3.5' Crushed concrete, gravel
					3.5-4' Ash
4	S2	24"/24"	3,1,1,2		4-4.1' Ash and coal
5					4.1-5' Brown silt and f-c sand
					5-6' Brown and tan silt and f-c sand
6	S3	10"/24"	3,3,2,1		6-8' Brown and tan silt and f-c sand
7					
8	S4	12"/24"	9,20,26,4		8-10' Brown f-c sand and f-c gravel, little silt. Wet
9					
10	S5	17"/24"	3,4,16,20		10-11' Brown f-c sand, little silt
11					11-12' Brown f sand, some silt
12					
13					
14					
15					BOB 12'
					Sample 3-5'

Boring/Well No. MW-2 **Date:** 5/26/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 12' **Water Level: 10'**
Drilling Method: Hollow Stem Auger **Sample Method: 2' Split Spoon**
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
1					
2	S1	15"/24"	5,5,5,6		2-3' Tan/orange silt and f-c sand
3					3-4' Beige f-c sand, some f-m gravel
4	S2	17"/24"	9,12,15,14		4-6' Beige and tan f-c sand, some f-m gravel
5					
6	S3	14"/24"	11,12,12,12		6-8' Beige and tan f-c sand, little f gravel
7					
8	S4	19"/24"	4,5,6,14		8-10' Beige f-c sand with layers of grey silt and tan silt
9					
10	S5	18"/24"	10,12,12,17		10-12' Brown f sand and silt. Wet
11					
12					
13					
14					
15					BOB 12'
					Sample 2-4'

Boring/Well No. MW-3 **Date:** 5/26/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 10' **Water Level:** 8'
Drilling Method: Hollow Stem Auger **Sample Method: 2' Split Spoon**
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
1					
2	S1	18"/24"	1,1,3,3		2-3' Dark brown silt and f-c sand; brick, concrete, black rock possibly coal
3					3-4' Tan silt and f-c sand
4	S2	20"/24"	8,11,12,12		4-6' Tan silt and f-c sand
5					
6	S3	20"/24"	7,8,10,11		6-6.5' Tan silt and f-c sand
7					6.5-8' Beige f-c sand, some silt. Wet
8	S4	11"/24"	10,6,5,10		8-8.3' Beige f-c sand, some silt
9					8.3'-10' Grey silt layered with brown f-m sand
10					
11					
12					
13					
14					
15					BOB 10'
					Sample 2-4'

Boring/Well No. MW-4 **Date:** 5/26/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 12' **Water Level:** 8'
Drilling Method: Hollow Stem Auger **Sample Method: 2' Split Spoon**
Driller: Seaboard **Log By:** JHerpich

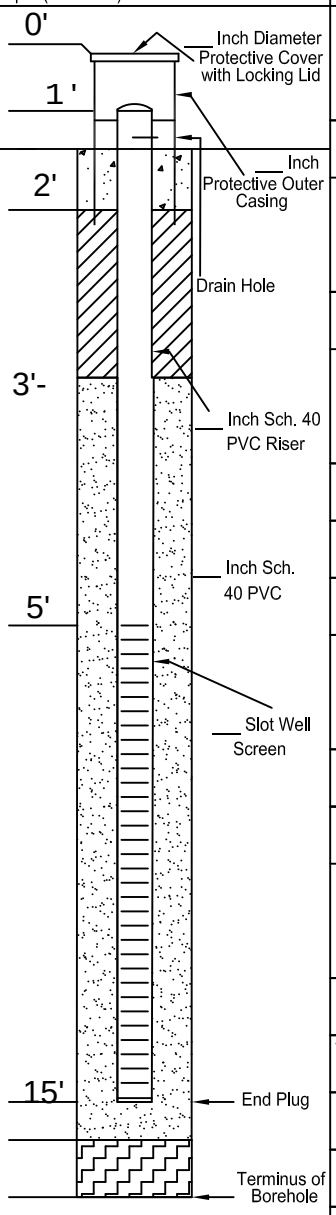
Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
1					
2	S1	12"/24"	19,12,13,12		2-4' Brick mixed with coal pieces and black powdered coal / ash
3					
4	S2	7"/24"	7,10,16,6		4-6' Brick mixed with coal pieces and black powdered coal / ash
5					
6	S3	5"/24"	5,5,6,4		6-8' Black powdered coal and ash, chunks of coal. Wet 7-8'
7					
8	S4	3"/24"	3,1,1,1		8-10' F-c sand and silt mixed with black powdered coal and ash,
9					chunks of coal.
10	S5	3"/24"	1, 0,1,0		10-12' Tan f-c sand with few chunks of coal
11					
12					
13					
14					
15					Note: Building foundation at 6.5'
					BOB 12'
					Sample 5-7'

MONITORING WELL INSTALLATION FIELD LOG

FACILITY NAME: Marina Village/2nd Phase	FACILITY ID: 400 Iranistan Ave, Bridgeport	WELL NO.: MW-1
GEOLOGIST: JHerpich	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES:
WEATHER:	DRILLING COMPANY: Seabaord	DATE/TIME 5/26/16
TEMPERATURE:	DRILL RIG: DRILLER:	STARTED: COMPLETED:

LITHOLOGIC DESCRIPTION | ELEVATION/ DEPTH | PID (ppm) | BLOWS/ft.

WELL CONSTRUCTION



MATERIALS INVENTORY

BENTONITE SEAL: TOP: 2' BOTTOM: 3'	
FILTER PACK GRAINSIZE: #2 sand	
FILTER PACK : TOP: 3' BOTTOM: 15'	
GROUT QUANTITY:	
GROUT : TOP: 0' BOTTOM: 1'	
GROUT TYPE: 1'-2' native fill	
SCREEN TYPE:	
WELL SCREEN: in. 5-15' l.f.	
SLOT SIZE:	
WELL CASING: Inches in Diameter 2" PVC l.f.	
CASING TYPE:	
TOP OF CASING (AGS):	
BOREHOLE (IN. DIAMETER):	
BOTTOM OF BOREHOLE (FT BGS): 15'	
TOP OF CASING ELEVATION (FT ABOVE MSL):	

CAVE IN (SLOUGH) | COARSE SAND | FINE FILTER SAND | BENTONITE GROUT | CEMENT PAD

TVA

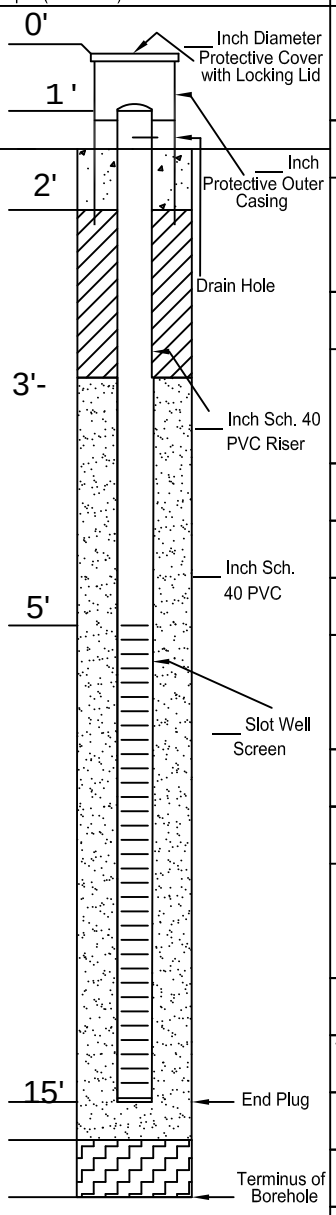
2/19/2010 3:35:08 PM c:\documents and settings\mfilipovits\desktop\borelog stuff\mwinstallationfieldlog.dwg

MONITORING WELL INSTALLATION FIELD LOG

FACILITY NAME: Marina Village/2nd Phase	FACILITY ID: 400 Iranistan Ave, Bridgeport	WELL NO.: MW-2
GEOLOGIST: JHerpich	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES:
WEATHER:	DRILLING COMPANY: Seabaord	DATE/TIME 5/26/16
TEMPERATURE:	DRILL RIG: DRILLER:	STARTED: COMPLETED:

LITHOLOGIC DESCRIPTION | ELEVATION/ DEPTH | PID (ppm) | BLOWS/ft.

WELL CONSTRUCTION



MATERIALS INVENTORY

BENTONITE SEAL: TOP: 2' BOTTOM: 3'

FILTER PACK GRAINSIZE: #2 sand

FILTER PACK : TOP: 3' BOTTOM: 15'

GROUT QUANTITY:

GROUT : TOP: 0' BOTTOM: 1'

GROUT TYPE: 1'-2' native fill

SCREEN TYPE:

WELL SCREEN: in. l.f. 5-15'

SLOT SIZE:

WELL CASING: Inches in Diameter l.f. 2" PVC

CASING TYPE:

TOP OF CASING (AGS):

BOREHOLE (IN. DIAMETER):

BOTTOM OF BOREHOLE (FT BGS): 15'

TOP OF CASING ELEVATION (FT ABOVE MSL):

CAVE IN (SLOUGH) | COARSE SAND | FINE FILTER SAND | BENTONITE GROUT | CEMENT PAD

TVA

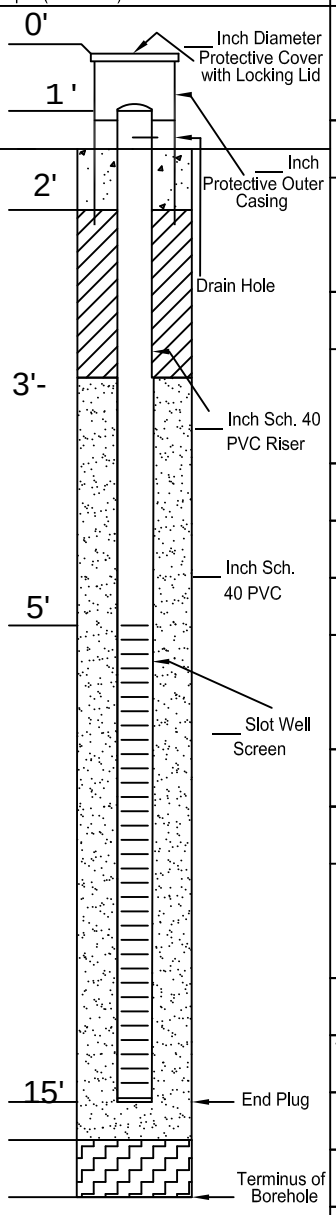
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MONITORING WELL INSTALLATION FIELD LOG

FACILITY NAME: Marina Village/2nd Phase	FACILITY ID: 400 Iranistan Ave, Bridgeport	WELL NO.: MW-3
GEOLOGIST: JHerpich	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES:
WEATHER:	DRILLING COMPANY: Seabaord	DATE/TIME 5/26/16
TEMPERATURE:	DRILL RIG: DRILLER:	STARTED: COMPLETED:

LITHOLOGIC DESCRIPTION | ELEVATION/ DEPTH | PID (ppm) | BLOWS/ft.

WELL CONSTRUCTION



MATERIALS INVENTORY

BENTONITE SEAL: TOP: 2' BOTTOM: 3'	
FILTER PACK GRAINSIZE: #2 sand	
FILTER PACK : TOP: 3' BOTTOM: 15'	
GROUT QUANTITY:	
GROUT : TOP: 0' BOTTOM: 1'	
GROUT TYPE: 1'-2' native fill	
SCREEN TYPE:	
WELL SCREEN: in. 5-15' l.f.	
SLOT SIZE:	
WELL CASING: Inches in Diameter 2" PVC l.f.	
CASING TYPE:	
TOP OF CASING (AGS):	
BOREHOLE (IN. DIAMETER):	
BOTTOM OF BOREHOLE (FT BGS): 15'	
TOP OF CASING ELEVATION (FT ABOVE MSL):	

CAVE IN (SLOUGH) | COARSE SAND | FINE FILTER SAND | BENTONITE GROUT | CEMENT PAD

TVA

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MONITORING WELL INSTALLATION FIELD LOG

FACILITY NAME: Marina Village/2nd Phase	FACILITY ID: 400 Iranistan Ave, Bridgeport	WELL NO.: MW-4
GEOLOGIST: JHerpich	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES:
WEATHER:	DRILLING COMPANY: Seabaord	DATE/TIME 5/26/16
TEMPERATURE:	DRILL RIG: DRILLER:	STARTED: COMPLETED:

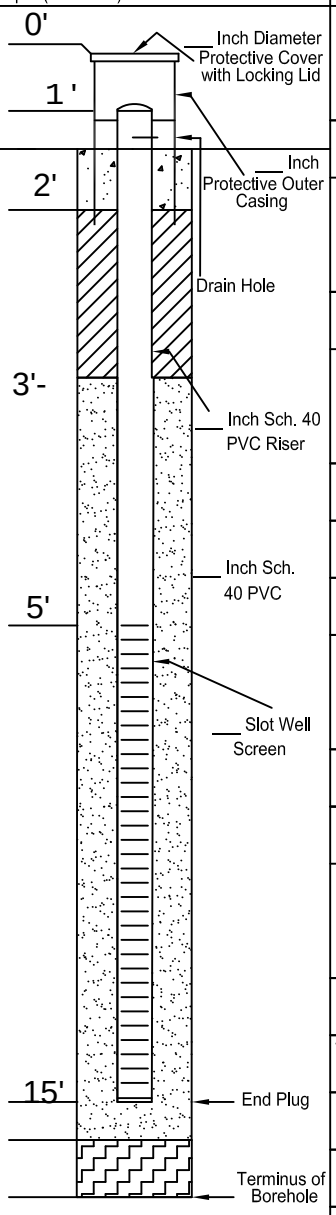
LITHOLOGIC DESCRIPTION

ELEVATION/ DEPTH

PID (ppm)

BLOWS/ft.

WELL CONSTRUCTION



MATERIALS INVENTORY

BENTONITE SEAL: TOP: 2' BOTTOM: 3'

FILTER PACK GRAINSIZE: #2 sand

FILTER PACK : TOP: 3' BOTTOM: 15'

GROUT QUANTITY:

GROUT : TOP: 0' BOTTOM: 1'

GROUT TYPE: 1'-2' native fill

SCREEN TYPE:

WELL SCREEN: in. l.f. 5-15'

SLOT SIZE:

WELL CASING: Inches in Diameter l.f. 2" PVC

CASING TYPE:

TOP OF CASING (AGS):

BOREHOLE (IN. DIAMETER):

BOTTOM OF BOREHOLE (FT BGS): 15'

TOP OF CASING ELEVATION (FT ABOVE MSL):

CAVE IN (SLOUGH) COARSE SAND FINE FILTER SAND BENTONITE GROUT CEMENT PAD

TVA

APPENDIX C

LABORATORY ANALYTICAL DATA

AVAILABLE UPON REQUEST

APPENDIX D

SUMMARY TABLES OF RESULTS

Table 1
Summary of Soil Analytical Data
Marina Village Housing Complex
Bridgeport, CT

Parameter	GB PMC	RES DEC	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	MW-1	MW-2	MW-3	MW-4
Matrix			Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Profile (feet)			3.5-5.5	2-4	4-6	4-6	6-8	5-7	3-5	2-4	2-4	5-7
Collection Date			5/26/16	5/26/16	5/26/16	5/26/16	5/26/16	5/26/16	5/27/16	5/27/16	5/27/16	5/27/16
Volatile Organic Compounds (VOCs) (ug/Kg)												
Naphthalene	NE	NE	300	ND< 320	ND< 5.1	ND< 440	ND< 5.2	ND< 6.1	ND< 4.4	18	ND< 4.8	ND< 7.0
Poly Aromatic Hydrocarbons (PAHs) (ug/Kg)												
2-Methylnaphthalene	NE	NE	1,100	ND< 270	ND< 270	ND< 2700	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Acenaphthene	NE	NE	2,800	ND< 270	ND< 270	ND< 2700	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Acenaphthylene	84,000	1,000,000	400	ND< 270	ND< 270	8,800	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Anthracene	400,000	1,000,000	6,400	ND< 270	ND< 270	10,000	ND< 250	ND< 270	ND< 280	760	ND< 260	ND< 250
Benz(a)anthracene	1,000	1,000	**14,000**	430	ND< 270	**44,000**	ND< 250	ND< 270	ND< 280	**1,300**	560	ND< 250
Benzo(a)pyrene	1,000	1,000	**13,000**	340	ND< 270	**49,000**	450	ND< 270	ND< 280	**1,200**	510	ND< 250
Benzo(b)fluoranthene	1,000	1,000	**12,000**	280	ND< 270	**44,000**	250	ND< 270	ND< 280	**1,100**	410	ND< 250
Benzo(ghi)perylene	NE	NE	6,000	ND< 270	ND< 270	29,000	300	ND< 270	ND< 280	850	350	ND< 250
Benzo(k)fluoranthene	1,000	8,400	**7,200**	310	ND< 270	**30,000**	270	ND< 270	ND< 280	930	410	ND< 250
Chrysene	NE	NE	15,000	420	ND< 270	45,000	ND< 250	ND< 270	290	1,300	630	ND< 250
Dibenz(a,h)anthracene	NE	NE	2,300	ND< 270	ND< 270	3,300	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Fluoranthene	56,000	1,000,000	29,000	1,000	390	**89,000**	ND< 250	ND< 270	590	3,700	1,200	270
Fluorene	56,000	1,000,000	2,900	ND< 270	ND< 270	4,200	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Indeno(1,2,3-cd)pyrene	NE	NE	9,000	ND< 270	ND< 270	33,000	340	ND< 270	ND< 280	890	350	ND< 250
Naphthalene	56,000	1,000,000	3,500	ND< 270	ND< 270	2,900	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Phenanthrene	40,000	1,000,000	25,000	770	300	**49,000**	ND< 250	ND< 270	560	3,800	1,000	ND< 250
Pyrene	40,000	1,000,000	24,000	870	350	**88,000**	ND< 250	ND< 270	510	3,300	1,200	ND< 250
Total RSR Listed Metals (mg/Kg)												
Antimony	-	27	ND< 3.5	ND< 3.8	ND< 3.8	3.5	ND< 3.2	ND< 3.9	ND< 3.7	ND< 3.2	ND< 3.5	ND< 3.4
Arsenic	-	10	4.3	3.7	3.6	6.2	2	3.3	5.1	3.7	4.5	3.8
Barium	-	4,700	60.8	36.6	32.8	67.7	16.2	24.2	108	16.9	47.4	27.1
Beryllium	-	2	0.71	0.67	0.68	0.4	0.27	0.54	0.72	0.31	0.62	0.35
Cadmium	-	34	ND< 0.35	ND< 0.38	ND< 0.38	0.36	ND< 0.32	ND< 0.39	ND< 0.37	ND< 0.32	ND< 0.35	0.63
Chromium	-	100	15	13.6	12.2	12	5.77	10.4	14.6	10.2	15	14.7
Copper	-	2,500	24.4	8.44	10.4	156	6.45	12.7	68.5	8.92	14.7	11.8
Lead	-	400	21.2	8.41	57.6	176	3.48	4.98	263	5.25	9.1	10.7
Mercury	-	20	0.04	0.04	0.05	0.08	ND< 0.03	ND< 0.03	0.66	ND< 0.03	ND< 0.03	0.03
Nickel	-	1,400	9.87	10.8	9.51	10.9	4.35	8.63	10.2	6.26	13.1	10.4
Vanadium	-	470	26	27.3	24	20.3	10.5	17.5	27.9	19.8	29.1	19
Zinc	-	20,000	60.3	139	31.5	259	28.3	37.1	132	26.7	34.1	33.7
SPLP RSR Listed Metals (mg/L)												
SPLP Antimony	0.06	-	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005
SPLP Arsenic	0.5	-	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004
SPLP Barium	10	-	0.015	0.016	0.011	0.015	ND< 0.010	ND< 0.010	0.037	0.01	ND< 0.010	0.015
SPLP Beryllium	0.04	-	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001
SPLP Cadmium	0.05	-	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005
SPLP Chromium	0.5	-	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010
SPLP Copper	13	-	ND< 0.010	ND< 0.010	ND< 0.010	0.015	ND< 0.010	ND< 0.010	0.021	ND< 0.010	ND< 0.010	ND< 0.010
SPLP Lead	0.15	-	ND< 0.010	ND< 0.010	ND< 0.010	0.02	ND< 0.010	ND< 0.010	0.084	ND< 0.010	ND< 0.010	ND< 0.010
SPLP Mercury	0.02	-	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005
SPLP Nickel	1	-	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	0.011	ND< 0.010
SPLP Vanadium	0.5	-	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010
SPLP Zinc	50	-	0.015	0.045	ND< 0.010	0.029	ND< 0.010	ND< 0.010	0.052	0.04	ND< 0.010	0.014
Extractable Total Petroleum Hydrocarbons (mg/Kg)												
ETPH	2,500	500	**840**	ND< 56	ND< 290	**550**	ND< 53	ND< 57	ND< 60	ND< 52	ND< 56	ND< 54
PCBs By SW8082A (ug/kg)	Varies*	Varies*	ND< 380	ND< 370	ND< 380	ND< 380	NA	NA	ND< 400	ND< 350	ND< 370	ND< 360

RES DEC - Residential Direct Exposure Criteria
GB PMC - Pollutant Mobility Criteria for a GB Classified Groundwater Area
* - Testing parameter(s) contains multiple constituents of concern with different detection limits; therefore no detection limits are provided within table

ND - Not Detected Above Laboratory Detection Limit
NA - Not Analyzed
NE - Criteria Not Established

ug/kg - micrograms per kilogram
mg/Kg - milligrams per kilogram

Table 2
Summary of Groundwater Analytical Data
Marina Village Housing Complex
Bridgeport, CT

Parameter	SWPC	RES VOL	MW-1	MW-2	MW-3	MW-4
Matrix			Groundwater	Groundwater	Groundwater	Groundwater
Depth to Water (feet)			7.81	7.25	6.71	7.20
Collection Date			6/3/16	6/3/16	6/3/16	6/3/16
Volatile Organic Compounds (VOCs) (ug/l)						
Bromodichloromethane	NE	NE	3.5	<ND 0.50	<ND 0.50	<ND 0.50
Chloroform	14,100	287	19	2.0	4.0	<ND 1.0
Poly Aromatic Hydrocarbons (PAHs) (ug/l)						
2-Methylnaphthalene	NE	-	<ND 0.05	<ND 0.05	0.18	<ND 0.05
Acenaphthene	NE	-	<ND 0.05	<ND 0.05	0.31	<ND 0.05
Acenaphthylene	0.3	-	<ND 0.05	<ND 0.05	0.14	<ND 0.05
Anthracene	1,100,000	-	0.06	<ND 0.05	0.77	<ND 0.05
Benz(a)anthracene	0.3	-	0.2	0.1	**1.8**	0.22
Benzo(a)pyrene	0.3	-	0.17	0.09	**0.7**	0.14
Benzo(b)fluoranthene	0.3	-	0.16	0.08	**1.4**	**0.23**
Benzo(ghi)perylene	NE	-	0.13	0.07	0.65	0.15
Benzo(k)fluoranthene	0.3	-	0.13	0.06	**1.2**	0.22
Chrysene	NE	-	0.19	0.09	2.1	0.26
Dibenz(a,h)anthracene	NE	-	<ND 0.01	<ND 0.01	0.28	0.05
Fluoranthene	3,700	-	0.53	0.33	5.3	0.42
Fluorene	140,000	-	<ND 0.05	<ND 0.05	0.3	<ND 0.05
Indeno(1,2,3-cd)pyrene	NE	-	0.12	0.06	0.77	0.18
Naphthalene	NE	-	<ND 0.10	<ND 0.10	0.3	<ND 0.10
Phenanthrene	0.077	-	0.26	0.2	**3.7**	0.2
Pyrene	110,000	-	0.45	0.29	3.2	0.31
RSR Listed Metals (mg/l)						
Antimony	86	-	<ND 0.005	<ND 0.005	<ND 0.005	<ND 0.005
Arsenic	0.004	-	<ND 0.004	<ND 0.004	**0.01**	**0.005**
Barium	NE	-	0.049	0.049	0.254	0.157
Beryllium	0.004	-	<ND 0.001	<ND 0.001	0.003	0.001
Cadmium	0.006	-	<ND 0.001	<ND 0.001	<ND 0.001	0.001
Chromium	0.11	-	0.008	0.001	0.047	0.017
Copper	0.048	-	0.012	<ND 0.005	**0.084**	0.042
Lead	0.013	-	**0.021**	0.002	**0.062**	**0.062**
Mercury	0.0004	-	<ND 0.0002	<ND 0.0002	<ND 0.0002	0.0003
Nickel	0.88	-	0.007	0.002	0.046	0.015
Vanadium	NE	-	0.012	<ND 0.002	0.088	0.03
Zinc	0.123	-	0.037	0.006	**0.298**	0.121

SWPC - Surfacewater Protection Criteria
RES VOL - Residential Volatilization Criteria
ND - Not Detected Above Laboratory Detection Limit
NA - Not Analyzed
NE - Criteria Not Established
mg/l - milligrams per liter
ug/l - micrograms per liter

APPENDIX D

CLOSE OUT REPORT

FREEMAN
COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Close-out Report
Marina Village Redevelopment – Phase I
Bridgeport, Connecticut

August 2016
Freeman File No.: 2015-0408

Prepared for:

Bridgeport Community Renewal Associates, LP
c/o JHM Group of Companies
Attn: Dan Montanaro / Anthony T. Rowan
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Stamford, CT

Prepared by:

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36 John Street
Hartford, CT 06106

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A Figures

B Soil Weight Tickets

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D Summary of Analytical Results

1 INTRODUCTION

Bridgeport Community Renewal Associates, LP ("BCRA") is working with Park City Communities on the redevelopment of the Marina Village housing development in Bridgeport, Connecticut. Phase I of the redevelopment consists of the 4.77-acre triangular portion of the Marina Village complex which is bounded by Park Avenue, Railroad Avenue, Columbia Street, and Johnson Street. A site plan depicting the Phase I project area is include within Appendix A.

2 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

2.1 General

The Marina Village Complex, located at 400 Iranistan Avenue, consists of two adjacent parcels of land totaling approximately 15.9 acres located in the City of Bridgeport, Connecticut. The Site is bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

2.2 Historical Usage

The existing Marina Village housing complex was constructed during the late 1940s. Prior to its construction, the Site was occupied by the Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings, Hotchkiss Sons' Manufacturers Curry Combs & Company and by a number of residential structures.

The foundry used coal to fuel their operations, which included annealing, trimming, core making, tumbling, and molding. Hotchkiss Sons Manufacturers Curry Combs & Company was located southwest of the Bridgeport Malleable Iron Works along South Avenue. The Hotchkiss Sons Manufacturers Curry Combs & Company property included a manufacturing building, a wood shop, coal storage, and lumber storage. Operations included scouring, tempering, and japanning. A number of residential homes were located along the north side of Johnson Street, the west side of Columbia Street, the west side of Park Avenue, and the south side of Railroad Avenue at the east end of the site.

2.3 Groundwater Classification

According to the CTDEEP water quality classification maps (November 2013), groundwater at the site is classified as GB. A GB classified groundwater is defined as groundwater within a historically highly urbanized area or an area of intense industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts.

2.4 Environmental Assessment Activities

Based on the historical industrial activities that had been conducted on the site, an environmental assessment was performed in May 2015. The scope of work of the assessment included the following:

- Oversight of the advancement of up to 10 soil borings, three of which completed as a groundwater monitoring well.
- The collection and analysis of a soil samples from each of the proposed soil borings. Select soil samples would be analyzed for the following parameters: volatile aromatic hydrocarbons (VOCs), extractable total petroleum hydrocarbons (ETPH), poly aromatic hydrocarbons (PAHs), total and leachable RSR listed metals and polychlorinated biphenyls (PCBs).
- The collection of a groundwater sample from each of the three newly installed monitoring wells. Groundwater samples would be analyzed for one or more of the following parameters: VOCs, PAHs, and total RSR listed metals.

- The preparation of a report documenting the findings of the investigation.

The primary objective of the investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions would affect the redevelopment of the Site.

2.5 Soil Conditions

Based on field observations the following soil conditions were generally observed:

- Topsoil/ Asphalt – Topsoil was described as light brown to brown silty SAND (SM). Up to 1.1 feet of topsoil was encountered in the borings conducted in grassy areas. Asphalt thickness ranged from 1 inch to 3 inches.

- Fill (Urban Fill) – Fill was described as very loose to dense, dark brown to light brown, silty SAND with gravel (SM), asphalt, crushed brick, concrete, and other manmade material debris. In addition, pockets of ash material were also encountered throughout the site. The fill extended to depths below ground surface ranging from 0 feet (B-10) to greater than 17 feet (B-9/MW).

- Natural Sand – Natural sand was encountered in each of the borings, except B-9/MW, and was described as loose to very dense, poorly graded sand with silt and gravel varying to silty sand with gravel (SM).

2.6 Soil Sampling Results

Results from the soil sampling activities identified the presence of PAHs, TPH, total arsenic and low concentrations of PCBs primarily located between former buildings 35 and 36. This area was once the location of the annealing and trimming area for Eastern Malleable Iron Company.

2.7 Groundwater Sampling Results

Analytical results from groundwater sampling activities did not detect the presence of any volatile organic compounds at concentrations that exceeded the residential volatilization criteria. Analytical results did detect the presence of (PAHs) including; benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and phenanthrene.

Based on the findings of the subsurface investigation, the following soil management recommendations were made

- Native soils can be managed as clean fill material;
- Any urban fill material disturbed as part of proposed site activities shall be at a minimum be managed as a Regulated Soil, but may remain on site for beneficial reuse; and
- Ash and oil stained soils are to be removed for disposal as contaminated soil

3 SPECIFIC INFORMATION

The following section provides specific information regarding the soil excavation activities conducted at the Site.

3.1 Construction Company

Standard Demolition Services, Inc.
30 Nutmeg Drive
Trumbull, CT 06611

Pro-Teck
85 Willow Street
New Haven, CT 06511

3.2 Oversight Firm

Freeman Companies
36 John Street
Hartford, CT 06106

3.3 Analytical Company

Phoenix Environmental (Soil and Water)
587 East Middle Turnpike
Manchester, CT 06040

3.4 Soil Disposal Facilities

Coventry Landfill
451 Arnold Road
Coventry, RI 02816

Chicopee Landfill
161 New Lombard Road
Chicopee, MA 01020

4 PERSONAL PROTECTION EQUIPMENT

Level D protection was the minimum protection required for the project. Appropriate PPE was chosen based on the physical and chemical properties of the product involved, a risk assessment of the situation, the work to be done, and the capabilities of the wearer. Level D protection is sufficient when work operations preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of chemicals. Appropriate Level D protective equipment included

- Work cloths;
- Disposable gloves;
- Boots/shoes, chemical-resistant steel toe and shank;
- Safety glasses or chemical splash goggles; and
- Hard hat

5 WORK PRACTICES

Freeman Company monitors observed the following general work practices during excavation activities:

1. Workers generally followed the procedures outlined in the project specifications
2. Waste profile forms were managed by Pro-Teck
3. Facility acceptance for the generated soil
4. Weight slips from the disposal facility were provided
5. Fencing was installed and maintained around the perimeter of the project area
6. Work areas were generally kept clean and free of debris

6 SOIL REMOVAL ACTIVITIES

The primary purpose of the soil removal activities was to excavate and disposal of contaminated soil/fill material that was encountered during the subsurface assessment activities. Based on the sol profile created during the assessment activities, the contractor, Standard Demolition Services (SDS), identified soil disposal locations as identified in Section 4.4.

Soil excavation and removal activities, conducted over an approximately eight week period, were initiated on April 21, 2016 and completed on June 16, 2016. A figure depicting excavation areas is included as Appendix A.

6.1 Previous Building Slab

During initial excavation activities it was identified that the floor slab from the former Eastern Malleable Iron Company was still present on the property. The slab was generally encountered at a depth of approximately 1-2 feet below the existing surface. Only within areas where the Marina Village buildings were constructed was the original

slab removed. Inspection of the slab revealed that the slab consisted of approximately 4-6" of non-reinforced concrete.

The slab appeared to be in good condition with no signs of staining. A small section of the slab was removed at a location to the southwest of building 35 in order to identify soil conditions under the slab. Soil conditions under the slab consisted of native sand. In order to confirm he initial findings Freeman Companies directed the contractor to remove small areas of slab at several additional locations. In all instances native sand was identified to be present under the slab.

Since the slab did not appear to be stained and that native sand was located under the slab, the decision was made to leave the slab in place.

6.2 Ash Fill Areas

During the soil removal activities serval areas of ash material were encountered and removed. The ash was identified to contain small pieces of ceramic debris and glass. One of the larger areas of ash material was located to the west of building 36, which is located just south of the former annealing area of the Eastern Malleable Company. The ash area measured approximately 30 feet long by 20 feet wide and extended to a depth of approximately 10-12 feet.

6.3 Demolition Debris

Various amounts of brick, asphalt, and broken concrete were encountered throughout the excavation area. The larger amounts of these materials were encountered primarily at locations on top of the former building slab. It appeared that the former building was crushed in place and filled with urban fill material to allow of the shaping of the property for construction of Marina Village.

6.4 Impacted Soil

Soil material identified to be impacted by PAHs and low concentration of PCBs was selected for removal from the site. The target areas for removal were primarily located to the northwest of building 36 and to the south and southwest of building 35. The largest of the impacted areas was located to the northwest of building 36, which was located within the former coal storage area for the former Eastern Malleable Iron Company. Soil within this area was primarily impacted from 1-4 feet in depth and encompassed almost the entire area north of the former building slab extending to Railroad Avenue. Other smaller pockets of impact generally consisted of areas measuring approximately 10 feet by 10 feet by 5 feet in depth.

7 SOIL DISPOSAL

Impacted soil and ash material excavated for removal from the site was brought to one of two locations for disposal. The soil and ash material located to the east of building 35 was brought to the Chicopee Landfill, in Chicopee Massachusetts. The remaining impacted material was brought to the Coventry Landfill in Coventry Rhode Island.

Based on weight tickets generated from the landfills, approximately 731.92 tons of impacted material were excavated and removed from the site for reuse at the Chicopee Landfill and approximately 3,503.11 tons of impacted material were excavated and removed from the site for reuse at the Coventry landfill. Copies of the weight tickets are included as Appendix B. Photos of the excavation activities are included as Appendix C.

8 CLOSURE SAMPLING

As identified, impacted material related to the historical operations of the Eastern Malleable Iron Company primarily consisted of discolored fill material and ash which contained moderate concentrations of PAHs and low concentrations of PCBs. This impacted material was visually identifiable due to its composition and color as compared to the native sands located at depth. Removal of impacted material was generally conducted until the native sand material was encountered.

Upon completion of the removal of the impacted material soil removal, soil samples were collected from the floor of excavation areas in order to demonstrate removal of the impacted material. Since PAHs were the primary driver for

removal activities and were present at the greatest concentrations, the closure samples were submitted for the analysis of PAHs. No PAHs were detected within the samples submitted. A figure depicting the endpoint sampling locations is provided in Appendix A. A summary of the analytical results is included as Appendix D.

9 BENEFICIAL REUSE OF URBAN FILL

Residual urban fill material, soil containing building debris and/or surficial soils that was located throughout the former Marina Village complex, will be beneficially reused on-site as part of redevelopment.

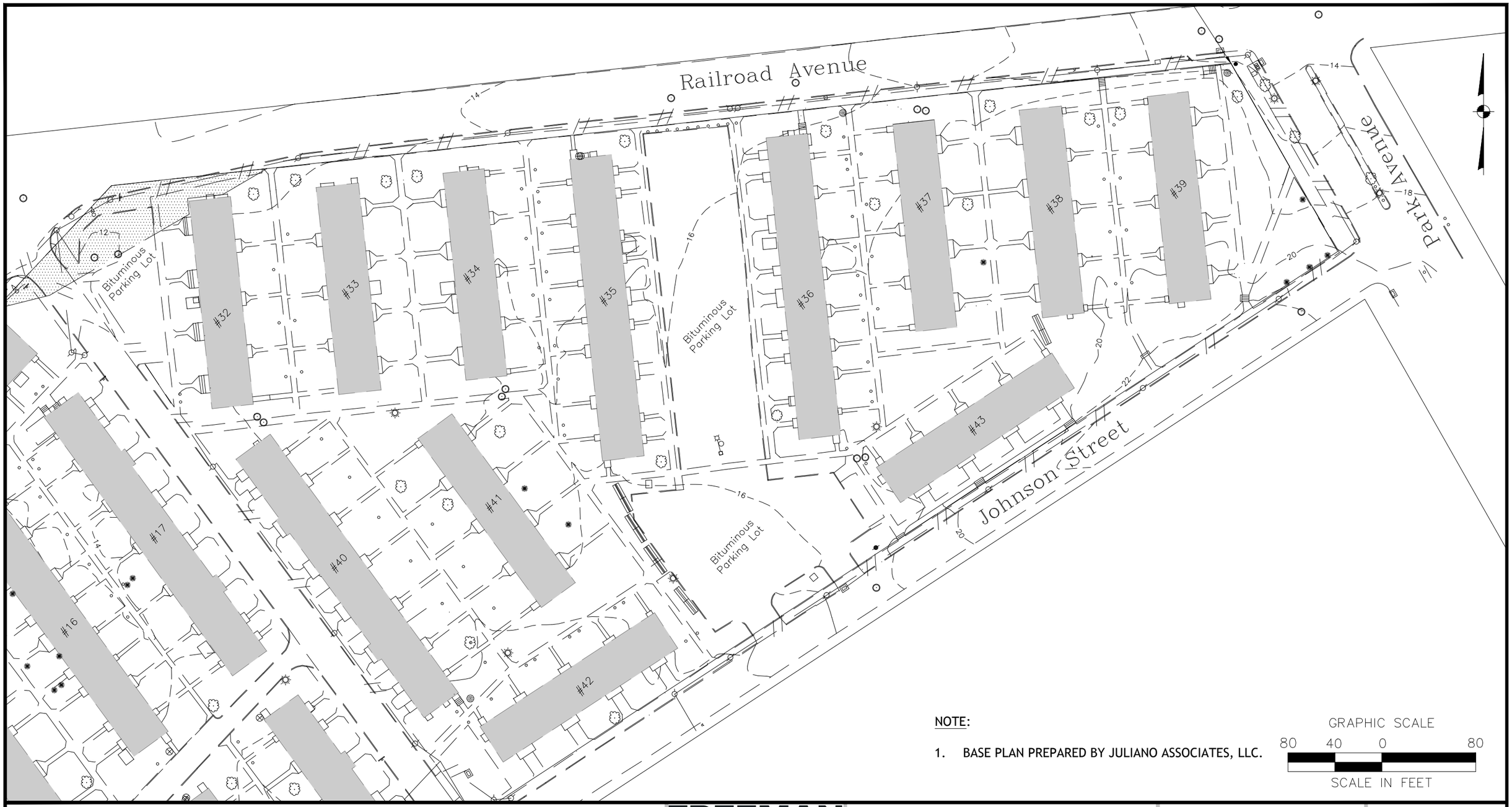
Urban fill is defined as non-native disturbed material within urban areas that typically contains a mixture of soil demolition debris, asphalt, brick, concrete, glass, ceramics, wood ash, coal and/or coal ash and is widespread within an urban environment. As a result of its composition it is common that urban fill typically contains low concentrations of PAHs and metals.

Urban fill was routinely encountered within the surficial soils on site during the demolition of site structures. Existing urban fill material remaining on-site will be beneficially reused either by being placed within the former building foundation excavations and covered with a new building structure or 2 feet of clean fill or will be placed under proposed parking areas and covered with at least 3 inches of asphalt.

Native sands located on the property, which were determined to be analytically free of historical impacts, will also be utilized in a non-restrictive manner as part of the redevelopment of the property.

APPENDIX A

FIGURES



NOTE:

1. BASE PLAN PREPARED BY JULIANO ASSOCIATES, LLC.

GRAPHIC SCALE
80 40 0 80
SCALE IN FEET

PLAN

MARINA VILLAGE
400 IRANISTAN AVENUE
BRIDGEPORT, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

DRAWN:	M.K.
CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=80'
PROJECT NO.:	2015-0408
DATE:	08/11/2016

SHEET NO.

FIGURE 1

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan 2.dwg Nov 07, 2016-11:31am Plotted By: mkwok

THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC



NOTE:

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No.	Date	Description
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REVISIONS

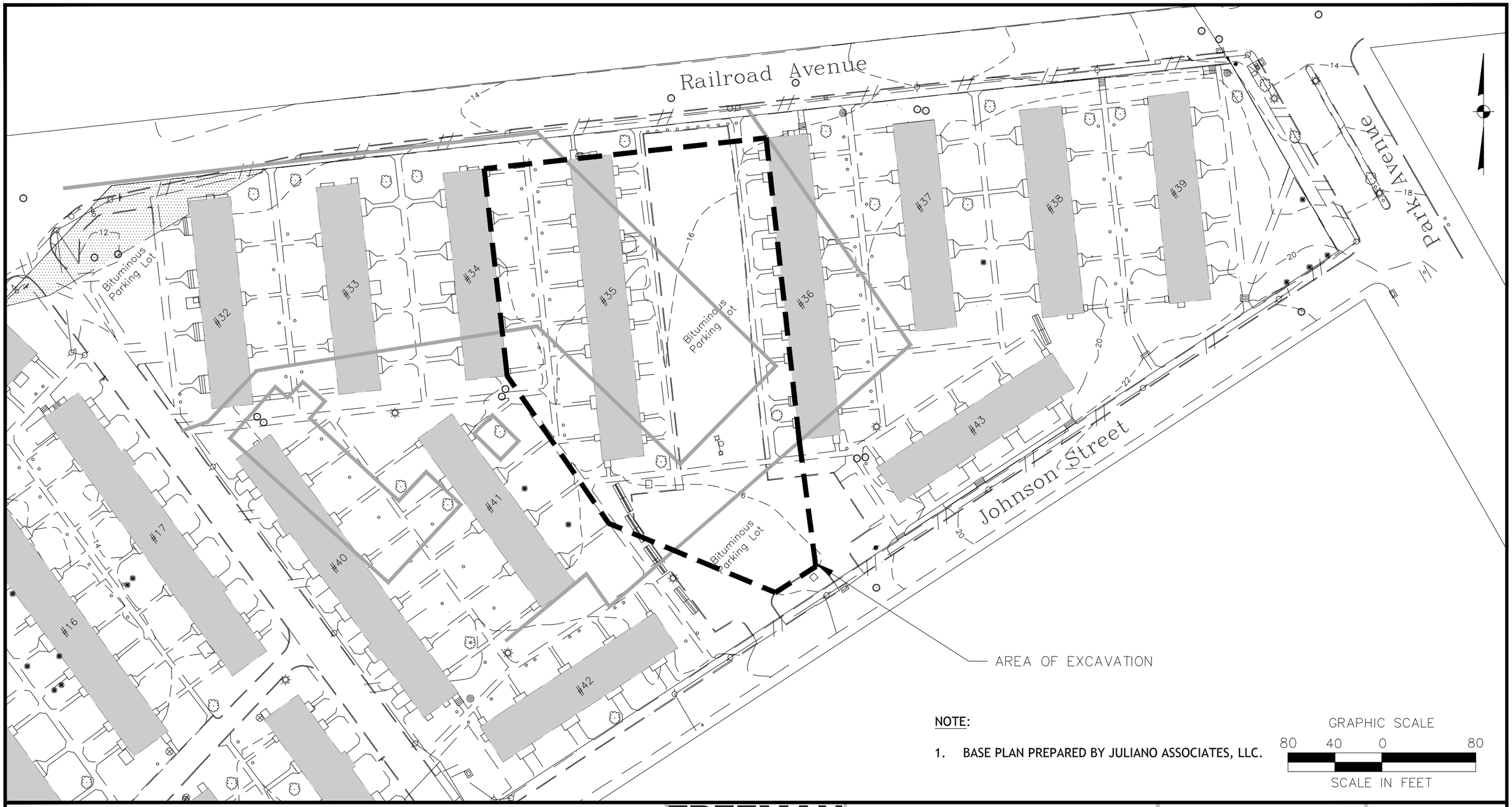
DRAWN:	M.K.
CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=80'
PROJECT NO.:	2015-0408
DATE:	08/11/2016

SHEET NO.

FIGURE 2

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan 2.dwg Nov 07, 2016-11:31am Plotted By: mkwok

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NOTE:

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No.	Date	Description
–	–	–

REVISIONS

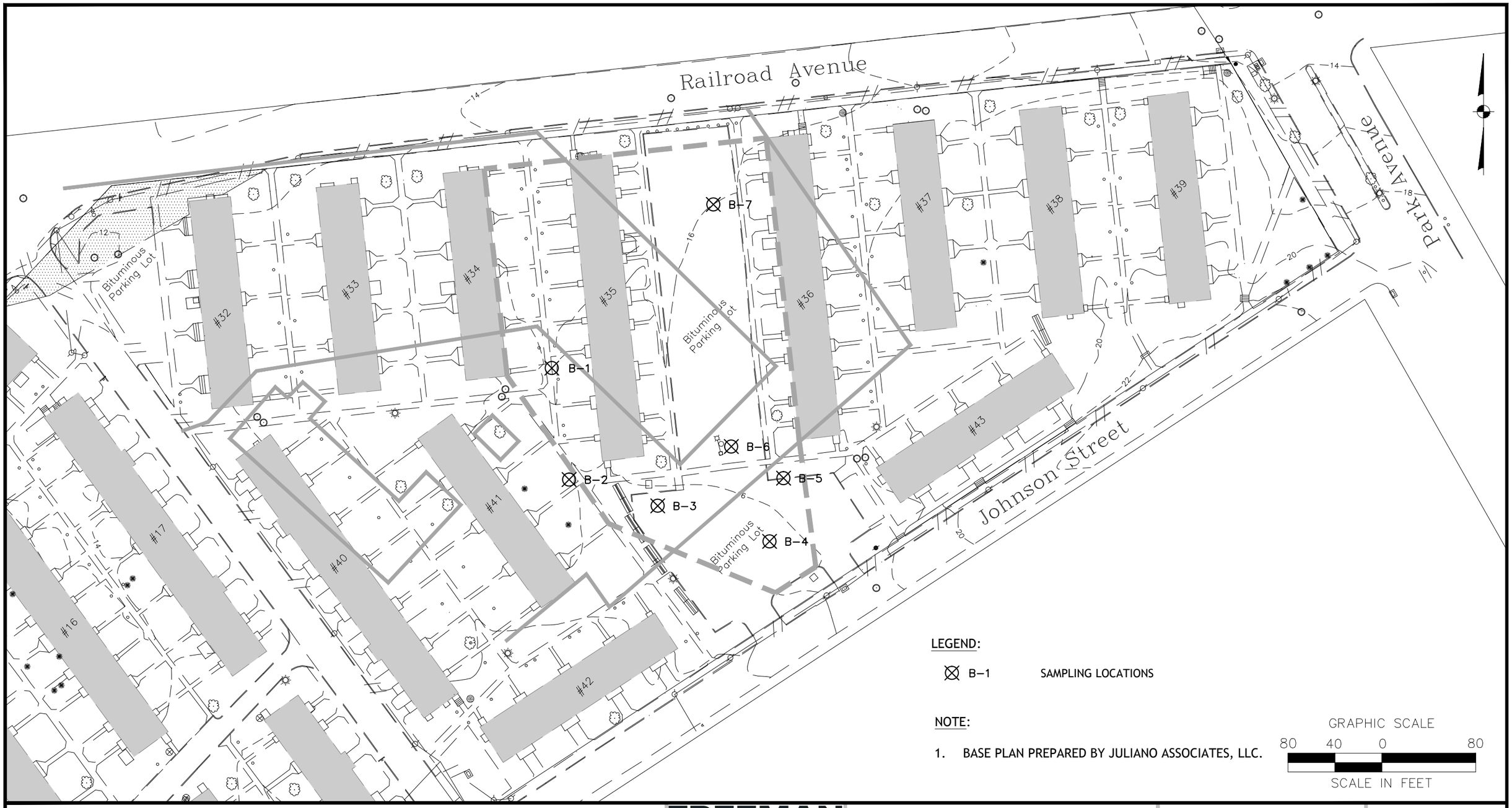
DRAWN:	M.K.
CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=80'
PROJECT NO.:	2015-0408
DATE:	08/11/2016

SHEET NO.

FIGURE 3

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan 2.dwg Nov 07, 2016-11:32am Plotted By: mkwok

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LEGEND:

⊗ B-1 SAMPLING LOCATIONS

NOTE:

1. BASE PLAN PREPARED BY JULIANO ASSOCIATES, LLC.

GRAPHIC SCALE
80 40 0 80
SCALE IN FEET

PLAN

MARINA VILLAGE
400 IRANISTAN AVENUE
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–	–	–

REVISIONS

DRAWN:	M.K.
CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=80'
PROJECT NO.:	2015-0408
DATE:	08/11/2016

SHEET NO.

FIGURE 4

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan 2.dwg Nov 07, 2016-11:32am Plotted By: mkwok

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FREEMAN COMPANIES

APPENDIX B

SOIL WEIGHT TICKETS

AVAILABLE UPON REQUEST

APPENDIX C

SITE PHOTOS



Photo 1: Excavation activities



Photo 2: Removal of ash material



Photo 3: Removal of material from coal storage area



Photo 4: Clean sand remaining after removal of impacted material

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APPENDIX D

SUMMARY OF ANALYTICAL RESULTS

AVAILABLE UPON REQUEST

APPENDIX E

ENVIRONMENTAL DATA RESOURCES REPORT

AVAILABLE UPON REQUEST

APPENDIX IV
Database Report

(Available Upon Request)

APPENDIX V
Site Photographs

CONNECTICUT DEPARTMENT OF HOUSING
RBD PILOT AREA
BRIDGEPORT, CONNECTICUT

Site Photographs – December 4, 2018



View looking down Johnson Street to the east from the corner of Columbia and Johnson Streets.



View of Columbia Street in the vicinity of Ridge Avenue (to the left) looking to the northwest towards Interstate 95.



Northwest corner of Ridge Avenue and Columbia Street with an active construction site from building demolition within the RBD Pilot area beyond.



Zoom view of previous photo showing soil covered grounds, building demolition piles and buildings 15, 16 and 17 of the Marina Village Housing Complex beyond to the northwest.



View of Ridge Street looking to the southeast



View of gated construction area entrance within the RBD Pilot area located along the approximate center of the north side of Ridge Avenue.



View of Buildings18-21 (left to right) at the southern portion of the RBD Pilot area from Ridge Avenue.


View of Buildings 20 and 21 located at the southern portion of the RBD Pilot Area looking to the northwest.

APPENDIX VI
Qualifications of Environmental Professionals

MICHAEL MANOLAKAS, LEP, CPG

Area Manager



Years with the firm

23

Years total

23

Professional qualifications

Licensed Environmental Professional: Connecticut,

Certified Professional Geologist, American Institute of Professional Geologists

Areas of practice

Hydrogeology, Environmental Investigation, Remediation and Estimating

Languages

English

CAREER SUMMARY

Michael Manolakas' 20 years of experience includes completion of numerous Phase I through Phase III environmental site investigations, delineation and full characterization of contaminated soils and groundwater, feasibility studies, remedial system design, remedial cost estimates, water treatment system design, and remediation of soils and groundwater. His remedial experience includes in-situ abiotic and biotic treatments, in-situ stabilization, soil-vapor extraction, air sparge, pump and treat, excavation, product removal, and encapsulation. He currently manages sites undergoing investigations and remediation as part of RCRA Corrective Action, CT Transfer Act, CT and NY Voluntary Remediation/Clean-Up/Brownfield Programs and under CT Consent Order. His experience also includes investigation and remediation of releases in accordance with 40 CFR 761 (TSCA).

Michael's experience includes performing comprehensive environmental liability assessments at industrial facilities, preparing detailed lifecycle construction/ remediation project cost estimates, preparing feasibility studies as well as project management, construction contract administration, preparation of project manuals, bidding documents, specifications, and management of remedial investigations. Additional experience includes assisting clients in administering construction bidding process and evaluating bids. Michael also has corporate experience in determining potential environmental financial liability related to the acquisition, leasing or sale of properties and businesses.

EDUCATION

B.S., Geological Sciences, Ohio State University, Columbus, Ohio 1994

PROFESSIONAL MEMBERSHIPS

American Institute of Professional Geologists (AIPG)

Environmental Professionals Organization of Connecticut (EPOC)

PROFESSIONAL EXPERIENCE

Environmental Site Investigation and Remediation

— Bridgeport, Connecticut: project management of investigations and remediation of a 76.5 acre former industrial site. This RCRA TSD facility included an approximate 1.5 million square foot manufacturing building, an inactive industrial landfill, 55 former USTs and two former metal hydroxide sludge beds. Investigations included the drilling of over ~1500 soil borings, installation of ~300 monitoring wells and ~350 soil-vapor point, collection of ~200 sediment samples, electromagnetic geophysics, ground penetrating radar, down-hole geophysics, aquifer test, groundwater flow modeling, collection and analyses of numerous soil and groundwater samples for various constituents of concern (COCs). COCs included PCBs, VOCs, SVOCs, metals, and pesticides. Remedial actions have included the removal and offsite disposal of thousands of tons of PCB remediation waste in accordance with 40 CFR 761, in-situ stabilization of over 3,000 tons of characteristically hazardous waste and disposal of this waste containing PCBs and non-aqueous phase liquids as PCB remediation waste, closure of multiple greater than 90-day RCRA waste storage areas, and remediation of four areas containing light non-aqueous phase liquids (LNAPL). Remediation also included the screening

and removal of solid waste from 40,000 cubic yards of landfilled materials. Remediation of this site is ongoing. Client: Name. Project Value: USD

- East Haven, Connecticut: characterization and remediation of PCB bulk product waste and PCB remediation waste at water-supply sedimentation basin in accordance with the self-implementing option for cleanup and disposal of PCB remediation waste (40 CFR 761.61(a)). The investigation and remediation were completed with the corporation of the CTDEEP and EPA Region 1 Administrator.
- Hamden, Connecticut: project management of investigation and remediation of an approximately 19-acre industrial waste landfill site located on residential and public school parcels. Tasks included development of chronological historical filling activities, a detailed investigation work plan, oversight of offsite investigations, implementation of extensive onsite soil and groundwater investigation, and remedial options and costs. Thus far, the field investigations have included the drilling of 70 soil borings, excavation of 8 test pits, collection and analysis of 105 soil samples, installation of 24 monitor wells and collection and analysis of 32 groundwater samples. In addition, tasks included monitor of communications, attend and report on CTDEEP, EPA and other primary responsible party public meetings and review of technical submittals of government agencies and primary responsible parties. Remediation underway includes the removal of PCB "hot spot" to be disposed as PCB remediation waste in accordance with 40 CFR 761.
- Fairfield, Connecticut: contracted for approximately four months to work at a large international conglomerate corporation. Tasks included review of over one hundred environmental site assessments and remedial closure reports to determine potential environmental risks with respect to acquiring, leasing or selling properties or businesses, and working with environmental health and safety managers to reduce risks associated with these types of transactions. Property and businesses reviewed were located throughout the world and ranged from leasing of office space to acquisition of $500 million corporations. Review of larger acquisitions often included development of work plans and determination of potential environmental liability.
- Danbury, Connecticut: identified offsite source of contamination through environmental file review and review of regional hydrogeologic setting. Designed and coordinated installation of potable water treatment system. Coordinated repairs of onsite well and distribution system to the satisfaction of the Connecticut Department of Public Health.
- Manhattan, New York: completed Phase I environmental site assessment for signature property assessed at approximately $250 million.
- Chester, Connecticut: project management of a RCRA ground-water quality assessment for a plume from metal hydroxide seepage lagoons. The project involved quarterly sampling and evaluation. Developed and implemented CTDEP approved work plan for closure investigation of waste lagoons. Receipt of CTDEP clean closure approval for former waste lagoons. Tasks also included characterization and monitoring of halogenated volatile organic plume and assessment of remedial performance. Remedial operations consisted of both a multi-phase extraction and pump and treat system.
- Norwalk, Connecticut: research and identification of inexpensive new technology (jet cavitation) for treatment of contaminated groundwater. Technology is

proposed to be used in conjunction with a pump and treat system to remove halogenated volatile organic compounds from bedrock and overburden aquifers.

- Winsted, Connecticut: project management of investigations and remediation at a former thread manufacturing facility. Tasks included identification and characterization of 22 potential release areas, and successful remediation of all identified release areas.
- Sag Harbor, New York: full characterization of halogenated VOC plume. Tasks included response to technical comments concerning hydrogeology, chemical transport, remedial effectiveness and SPDES discharge technical requirements.
- Detroit, Michigan: acted as the onsite supervisor for environmental investigations and remediation activities at three automotive plants. Tasks included operation and maintenance of phytoremediation berm, supervising closure of hazardous waste storage areas, excavation of petroleum, VOC and metal impacted soils and supervision of site investigations.
- Portland, Connecticut: supervision and development of monitor wells and evaluation of soil volatile organic levels.
- Stratford, Connecticut: supervision of test borings and monitor well installation, while sampling for PCB's and asbestos, to determine soil and groundwater quality.
- Illinois, New Jersey, New Hampshire, Pennsylvania, Rhode Island and Vermont: conducted several Phase I environmental site assessments for use of property transfer.
- Farmington, Connecticut: completion and submittal of the Environmental Condition Assessment Form and Form III to the CTDEP to satisfy requirements of the Connecticut Property Transfer Program.
- Yonkers, New York: supervision and development of monitor wells on periphery of landfill. Entailed collection of groundwater and surface water samples.
- Thomaston, Connecticut: characterization of MTBE and BTEX plume in the groundwater.
- Patterson, New York: project management of Phase II investigations. Project included sampling of groundwater, soils and paint and the evaluation of the laboratory results.
- Glastonbury, Connecticut: project management of subsurface investigation to determine the impact to the soil and groundwater from a former tannery operation. The project included the installation of monitor wells, sampling and evaluation.
- Cheshire, Connecticut: annual and quarterly reporting on efficiency and optimization of soil-vapor extraction (SVE) and sparge system (IAS) operation. SVE/IAS system orients hydraulic gradient so that halogenated solvents remain in localized area.
- Dutchess County, New York: completed numerous requirements of the hydrogeologic reporting section of the 6 NYCRR Part 360 Solid Waste Management Facilities rules and regulations for a proposed C&D landfill as a closure plan for a mining operation.
- Stratford, Connecticut: project management of subsurface investigation to determine the impact from former site operations to the soil and groundwater. Project included drilling of test borings, sampling, environmental database review

and evaluation. Completion of final remediation report and submittal of Form II Connecticut Property Transfer form.

- Orangetown, New York: project management of subsurface investigation to determine the impact of former site operations to the soil and groundwater. Development and implementation of final work plan to investigate the site under the NYSDEC voluntary remediation program.
- Cromwell, Connecticut: project management of bioremediation system, and monitoring program for petroleum release. Tasks also included fulfilling CTDEP reporting requirements.
- Hamden, Connecticut: project management of characterization, removal and disposal of mercury-impacted soils.
- Wallingford, Connecticut: project management of characterizing pesticide soil and groundwater contamination with respect to the Connecticut Remediation Standard Regulations. Identified concentrations of contaminant in soils posing a potential health threat for various uses of the property.
- Connecticut and New York: conducted numerous Phase I and Phase II environmental site assessments for use in a property transfer and financing.
- North Haven, Connecticut: supervised steam cleaning of impacted industrial sumps. Investigation and delineation of impacted soils and wetlands.

Groundwater Supply

- Suffolk County, New York: completed detailed salt-water and iron investigation as they responded to pumpage of eleven pumping wells in the Montauk Area. The study included pumpage recommendations intended to maximize potable water while limiting seasonal and long-term chloride and iron impacts. The study also provided alternative management approaches for rehabilitating impacted well fields and maximizing existing well fields.
- New Haven County, Connecticut: analysis and evaluation of groundwater levels, stream flows, precipitation and wetland conditions to determine the impact of groundwater withdrawals on the aquifers and surface-water systems in four well fields.
- Southington, Connecticut: conducted pumping and induced infiltration tests of municipal water supply wells.
- Town of Wappinger Falls, New York: conducted several geophysical investigations. Analyzed pump test to determine aquifer parameters and stream infiltration rates. Calculated optimal placement of an additional production well.
- New Haven County, Connecticut: evaluation of pumping test data and development of water table maps.
- Suffolk County, New York: conducted numerous geophysical investigations. Investigations required determination of optimal screen setting and size for design of production wells.
- Dutchess County, New York: completed numerous requirements of the hydrogeologic reporting section of the 6 NYCRR Part 360 Solid Waste Management Facilities rules and regulations for a proposed C&D landfill as a closure plan for a mining operation.

- Suffolk County, New York: development of numerous groundwater flow and salt-water intrusion models for locations in Suffolk County to determine optimal well field withdrawal rates in order to avoid potential adverse impacts to the Upper Glacial Aquifer, Magothy Aquifers and surrounding wetlands. Specifically, the models were utilized to determine pumping rates that would avoid salt-water upcoming or lateral encroachment or dewater of wetlands. Projects included management and analysis of pumping tests, design of monitoring well networks and response to concerns of the NYSDEC.
- Southold, New York: hydrogeologic assessment for proposed well field. Evaluated potential impacts from salt water upcoming. Project included a 72-hour pump test, collection of samples and evaluation.
- Carlin, Nevada: calibration of ground-water flow model (MODFLOW) to evaluate optimal use of pumpage for dewatering of gold mine.
- New Haven County, Connecticut: modification and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during drought conditions for four existing well fields. The modification involved updating three separate 2-dimensional models to 3 dimensional models to better evaluate the effects of the surface-water bodies.
- Town of Thomaston, Connecticut: use of groundwater flow model (MODFLOW) and particle tracking program (PATH3D) to determine most efficient and economical remedial design for the characterized MTBE and BTEX plume in the groundwater.
- Sag Harbor, New York: modification and calibration of groundwater flow model (MODFLOW), particle tracking program (PATH3D) and solute transport program (MT3D) to determine, optimal remedial design for historical DNAPL Plume.
- Town of Wappinger Falls, New York: use of 2 dimensional groundwater flow model (Capzone) and particle tracking program (GWPATH) to determine safe and maximum yield of well field. Model output helped determine capture zone and optimum discharge rate of future production well.
- Litchfield County, Connecticut: development and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during drought conditions for four existing well fields. Use of particle tracking program (PATH3D) to determine area of contribution for existing well field.
- Westchester County, New York: development and calibration of groundwater flow model (MODFLOW) to determine extent of mounding from proposed septic discharge.

Specific Experience in Groundwater Modeling

- Fairfield County, Connecticut: development and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during average conditions of existing well fields. Use of particle tracking software (PATH3D) for determination of area of contribution. Model was used to evaluate safe yield for southern well field with respect to salt water intrusion.
- Orange County, New York: development and calibration of several groundwater flow models (MODFLOW) to determine zone of influence in drought conditions of existing well fields. Use of particle tracking software (PATH3D) for determination of area of contribution for travel times.
- Carlin, Nevada: calibration of groundwater flow model (MODFLOW) to evaluate optimal use of pumpage for dewatering of gold mine.

- New Haven County, Connecticut: modification and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during drought conditions for four existing well fields. The modification involved updating three separate 2-dimensional models to 3 dimensional models to better evaluate the effects of the surface-water bodies.
- Thomaston, Connecticut: use of groundwater flow model (MODFLOW) and particle tracking program (PATH3D) to determine most efficient and economical remedial design for the characterized MTBE and BTEX plume.
- Suffolk County, New York: development of numerous (more than 20) groundwater flow (MODFLOW), particle tracking (PATH3d and MODPATH) and salt-water intrusion (SHARP) models for locations in Suffolk County which were utilized to determine optimal well field withdrawal rates to avoid potential adverse impacts to the Upper Glacial Aquifer, Magothy Aquifers and surrounding wetlands. Specifically, the models were utilized to determine pumping rates that would avoid salt-water upcoming or lateral encroachment or dewater of wetlands.
- Sag Harbor, New York: modification and calibration of groundwater flow model (MODFLOW), particle tracking program (PATH3D) and solute transport program (MT3D) to determine optimal remedial design for historical DNAPL plume. Through modeling determined contaminant removal times and optimum pumping locations and rates for focused source/contaminant removal actions.
- Wappinger Falls, New York: use of 2-dimensional groundwater flow model (Capzone) and particle tracking program (GWPATH) to determine safe and maximum yield of well field. Model output helped determine capture zone and optimum discharge rate of future production well.
- Litchfield County, Connecticut: development and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during drought conditions for four existing well fields. Use of particle tracking program (PATH3D) to determine area of contribution for existing well field.
- Westchester County, New York: development and calibration of groundwater flow model (MODFLOW) to determine extent of mounding from proposed septic discharge.

PUBLICATIONS AND PRESENTATIONS

Publications

- Manolakas, Michael. “Achieving Compliance through Development of Alternative Soil Criteria,” *Monitor*, Spring 2004.
- Manolakas, Michael. “Guidance for EPA Technical Impracticability of Ground Water Restoration,” *LBG Short Notes*, Spring 1999.
- Manolakas, Michael. “Aquifer Mapping Integral to Well Field Protection Efforts”, *Land and Water*, July/August 1998.
- Manolakas, Michael. “The Use of Computer Models in Well Field Protection delineations,” *CE News*, April 1999.

Presentations

- Manolakas, Michael. “Stabilization of Characteristically Hazardous Volatile Organic Compounds and Metals Using Rice Hull Ash and Lime Kiln Dust.” Battelle Eighth

International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 2012.

— Manolakas, Michael. "Effectiveness of a Metal Stabilizer when Treating Hazardous Waste with Modified Fenton's Reagent and Sodium Persulfate: A Laboratory Treatability Study." Battelle Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 2010.

— Manolakas, Michael. "Investigation of Site Specific Mobility and Leaching Characteristics of Dieldrin in Soils." Battelle Fourth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 2004.

MELANIE R. SHEPERD

Project Hydrogeologist

Years with the firm

12

Years total

18

Professional Qualifications

Professional Geologist, New York, 2018

Areas of practice

Geology, Hydrogeology, Environmental Investigation and Remediation

Languages

English

CAREER SUMMARY

Melanie has over eighteen years of experience conducting Phase I, II and III Environmental Site Assessments including completing all facets of field investigations, data tabulation and reporting. These investigations include a variety of drilling, well completion, soil and water sampling, environmental screening tasks associated with impacted soil and groundwater and remediation system monitoring and maintenance. Melanie's experience includes investigations of sites regulated by RCRA, Connecticut's Remediation Standard Regulations and other state regulations. Her experience also includes managing staff and subcontractors, communication with client and associated town and state representatives, project data compilation and reporting. Melanie is trained in all aspects of health and safety precautions related to environmental and geotechnical projects.

EDUCATION

B.S., Geology and Geophysics, University of Connecticut, Storrs, Connecticut	2000

ADDITIONAL TRAINING

Health and Safety Operations at Hazardous Waste Sites (HAZWOPER) 29 CFR 1910.120(e)(3), 40 hours with annual 8-hour refreshers	2000-2018
8-hour HAZWOPER Supervisor Training required by OSHA 29 CFR 1910.120(e)(4)	2012
Radiation Safety, 29 CFR 1910.1096	2015
EPOC Remediation Standard Regulations Course	2006

PROFESSIONAL EXPERIENCE

— Former Manufacturing Facility, Bridgeport, Connecticut: Monitored over 150 soil borings, monitoring wells and test pit excavations during extensive Phase II and Phase III investigations of a 77-acre property including a landfill area. Completed continuous soil sampling and geologic logging of site strata including identification of various historical fill materials, mapping a former stream bed and mapping and logging over 50 soil borings to identify deeper areas of industrial fill. Other tasks included completing a large soil vapor survey of the sub-slab soils beneath the Site building which totaled 240 survey points and performed several groundwater sampling rounds using EPA low flow techniques. Coordinated, setup and operated three dedicated, data-logging pressure transducers calibrated to existing stream staff gauges which collected surface water samples from three Site locations following significant storm events. Additional responsibilities included summarizing soil, groundwater and soil vapor data into formatted tables compared to regulatory criteria, creating site figures and assistance in report completion.

— Commercial Property, Stamford, Connecticut: Completed a Phase I ESA of a 60-acre commercial property where several areas of concern were identified and investigated in a widespread Phase II/Phase III investigation of over 250 soil borings/monitoring wells with several hundred soil samples analyzed. Responsibilities included locating, overseeing and logging soil borings/monitoring wells; completing quarterly groundwater monitoring; sediment sample collection and later tabulation of the soil

and groundwater analytical results in comparison to regulatory criteria. Remedial efforts of the property included mass excavation and off-site transport of impacted fill materials. Completed daily data tabulation to assess and determine the limits and extent of the impacts at the property to direct the excavation. Completed data quality assessment and data usability evaluation tables and associated reporting of the analytical laboratory reports.

— U.S. Army Corporation of Engineers, Hop Brook Dam, Naugatuck, Connecticut: Project Manager and lead geologist for installation monitoring of a grout curtain designed to remediate seepage and stabilize an earthen filled dam constructed in the late-1960s. Completed geologic logging and monitoring of the tightly-spaced, grout curtain boreholes in the unconsolidated dam soils and underlying fractured bedrock across the topography of the dam. Daily activities included overseeing two drill rigs using various techniques (sonic drilling, roller-bit advancing, rock coring) and logging of the soil and rock encountered per specifications of the U. S. Army Corporation of Engineers. Also, monitored the groundwater conditions and relative permeability of the fractured bedrock to provide subsurface details for creating a properly structured grout curtain. Developed written scope of work for geologic rock core logging including the project specifications required by the U.S. Army Corporation of Engineers to evaluate the integrity of the earthen dam.

— Former Research Facility, Rockland County, New York: Monitored an in-situ chemical oxidation (ISCO) pilot test which involved injecting sodium permanganate into a monitoring well network to remediate groundwater impacted with halogenated volatile organic compounds. Based on groundwater flow, fine-grained sand and silty surficial soils, a calculated sodium permanganate solution was injected into the saturated soils while water was extracted using a vacuum truck to radially disperse the remedy. My activities during the injection/extraction process included groundwater level monitoring to calculate a radius of influence of drawdown, measurement of water quality parameters using a multi-parameter water quality meter and monitoring downgradient monitoring wells to visually identify when and where the pink sodium permanganate was mobilized in the aquifer. As per specifications of the Site, additional field responsibilities including constant up- and down-gradient dust monitoring. Completed data tabulation of all field monitoring activities in summarized tables and field calculations were modified in the field during the test based on the behavior of the sodium permanganate in the aquifer and the measured groundwater table. Performed post-injection groundwater monitoring and associated data tabulation to evaluate the effectiveness of the chemical dispersion of the ISCO over designated time intervals.

— Over 30 Condominium & Apartment Complexes, Hartford, Connecticut: Completed individual Phase I ESAs of over 30 properties including a site inspection of each parcel and associated city and state research conducted at various city offices. Assessments of historical resources included topographic, aerial and Sanborn fire insurance maps and city directories evaluated to obtain the history of each parcel. Numerous environmental databases were researched and conclusions regarding potential groundwater flow, state groundwater classification, surficial materials and bedrock geology in conjunction with site history were determined in order to identify and potential liabilities. Following the completion of these Phase I assessments, several potential underground storage tanks (USTs) were identified. Monitored ground penetrating radar surveys to locate any subsurface anomalies, and completed Phase II soil boring investigations where USTs were suspected to evaluate if any releases from a UST had occurred. Several USTs, including No.2 and No. 6 oil of up to 10,000-gallon size tanks were found. My responsibilities included identifying impacted soils in the

field, monitoring the UST excavation, collecting tank closure samples and soil characterization samples for off-site removal of the impacted materials. Completed an individual report for each UST removal which summarized all field activities, including detailed site plans with pertinent site features, tank locations and confirmation soil sample locations. Lastly, completed the reporting and analytical data tabulation in comparison to applicable criteria to confirm all prudent actions had been completed to remove the tank and associated impacted soils.

— Various Commercial and Industrial Properties, Hartford/New Haven/Fairfield and Middlesex Counties, Connecticut: Completed over 45 Phase II and/or Phase III investigations at various properties in Connecticut. My responsibilities included monitoring drilling activities, geologic logging and field screening of all borings and monitoring wells; identifying groundwater depth; understanding the lithology of the surficial materials at each Site to determine the migration and distribution of contaminants; identifying fill materials and soil sample collection. Supplementary tasks included well development, groundwater sampling using US EPA low-flow methodology, completion of a groundwater elevation survey to determine inferred groundwater flow direction and created associated figures with soil boring/monitoring well locations and groundwater flow direction. Following completion of field work, tabulated analytical laboratory data and evaluated compliance with clean-up criteria and completed the necessary reporting.

APPENDIX D
Hazardous Materials Documentation

Task 110 Corridor Land Use Evaluation for the National Disaster Resilience Project

RESILIENCY PROJECT

Connecticut Department of Housing
Bridgeport, Connecticut

FINAL

PROJECT NO.: 52829NDR 6.08.02
DATE: DECEMBER 2018

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I Photographic Locations
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III Topographic Maps Tax
IV Assessor Records (available upon request)
V Sanborn Fire Maps (available upon request)
VI EDR Report (available upon request)

1.0 INTRODUCTION

WSP USA (WSP) has completed a Task 110 Corridor Land Use Evaluation for the National Disaster Resilience (NDR) project located in the South End area of Bridgeport, Connecticut (Figure 1). The objective of the Corridor Land Use Evaluation is to assess the relative environmental risk associated with current and former land use in the study area and to determine the potential need for further evaluation.

1.1 Project Description

In 2014, the U.S. Department of Housing and Urban Development (HUD) selected the City of Bridgeport and a multidisciplinary design team to prepare an integrated resilience framework for Bridgeport for the federal Rebuild by Design Competition. A HUD grant, which was received by the State of Connecticut, is being used to develop a plan for reducing flood risk and improving resilience for the South End and Black Rock Harbor areas, and to build a pilot project in the South End that serves as a catalyst for full implementation of broader flood protection and resilience strategies. This Task 110 Corridor Land Use Evaluation focuses on the pilot study area in the South End (Figure 2), which contemplates the installation of a sea wall in this area. Three potential alignments of the sea wall are being considered, and the Task 110 study area focuses on the properties adjacent to three potential sea wall alignments (Figure 2).

1.2 Scope of Services

The scope of work included: a survey of the study area, identification of the current land uses within the study area, a search of federal and state regulatory databases, a review of aerial photographs, topographic maps, and Sanborn fire insurance maps. Future land uses or situations within the study area are outside the scope of work. The following report summarizes present and former land use information to provide a professional opinion regarding the relative environmental risk associated with each parcel abutting the various alignments.

All proposed alignments for the sea wall are located within areas that likely contain urban fill that typically are comprised of constituents of concern (COCs) at concentrations near or above the Connecticut Department of Energy and Environmental Protection (CTDEEP) Remediation Standard Regulation (RSR) soil criteria. In addition, the environmental media within the alignments may also have been impacted by operations occurring on the parcels in the immediate vicinity of the alignments. This evaluation will provide baseline data to develop a scope necessary to assess environmental media in the various proposed alignments.

2.0 PHYSICAL SETTING

2.1 Regional Physiology

The study area is located on the U.S. Geological Survey (USGS) Bridgeport, Connecticut quadrangle. The elevation of the Site is approximately 20 feet above mean sea level (ft amsl) on the western portion of the study area, and 10 ft asml along the northwestern portion of the study area. The elevation slopes downward to sea level at the Bridgeport Harbor located on the east and south side of the study area.

2.2 Geologic Conditions

The property is located within the Southwest Coastal Major Drainage Basin. The surficial materials at the Site are mapped primarily as sand overlying fines with thin till in the west. A large portion of the eastern side of the study area is also mapped as Artificial fill (Stone, et al., 1985). Artificial fill includes any materials, natural or manmade, that have been artificially placed. Bedrock beneath the Site is mapped as the Derby Hill Member of the Orange Formation (Crowley, 1968), a thin-bedded, fine- to medium-grained schist and gneiss interlayered with a medium- to coarse-grained gneiss.

2.3 Hydrologic Characteristics and Known Uses

The nearest surface water is the Bridgeport Harbor to the east and south, which abuts the study area. The Bridgeport Harbor is mapped as a Class SB surface water (CTDEEP, 2015). A Class SB designation indicates a best usage for habitat for marine fish and other aquatic life and wildlife, commercial shellfish harvesting, recreation, industrial water supply, and navigation.

Groundwater at the study area is classified by the CTDEEP as "GB". A "GB" classification applies to groundwater within highly urbanized areas or areas of intense industrial activity and where public water-supply service is available rather than private water-supply wells. Groundwater with a GB classification may be impaired and the State's goal is to prevent further degradation of the aquifer.

Based on local topography, groundwater at the site is presumed to flow generally to the south and east. Once groundwater exits the Site, it is presumed to discharge to the Bridgeport Harbor. Groundwater flow would be influenced by the tides. Depth to groundwater is anticipated to be shallowest near the shoreline, and increase in depth as the elevation of land increases westward away from the shoreline.

3.0 LAND USE EVALUATION

3.1 Initial Site Survey

An initial survey of the study area was conducted on June 7, 2018 by Patrick Staub of WSP and June 27, 2018 by Timothy McBride of WSP. The initial survey involved a visual assessment of the study area from publicly accessible thoroughfares. Several properties in the eastern portion of the study area were not directly accessible at the time of the survey. Construction activity associated with what appeared to be active redevelopment of the 60 Main Street complex prevented access to nearly all of Henry Street (except the area adjacent to parcel Map ID 27). Separate road construction activity prevented access to all of Russell Street. Atlantic Street was inaccessible east of the intersection with Russell Street due to security measures surrounding the PSEG power plant and the Bridgeport Energy parcel (parcel Map IDs 40 and 12, respectively). Likewise, the entirety of the PSEG power plant parcel was inaccessible, preventing direct visual access to the majority of the Eastern and Central Alignments.

During the initial site survey, no chemical storage or indications of releases of hazardous substances were noted in the area west of Main Street. In the eastern portion of the study area, large quantities of petroleum (in est. 500,000 to 5,000,000-gallon silos) and coal (in an approximately 5-acre pile) were visible from public streets and from publicly available satellite imagery, presumably associated with power generation on these parcels. Because of the lack of access to these areas, specific identification of the storage of other chemical substances was not directly observed, though it is reasonable to infer additional

chemical use and storage based on the current use of the parcels as power generation and associated facilities.

As it is located in a highly urbanized area, a significant portion of the study area is comprised of buildings or other impermeable surface cover. No significant staining of pavement was noted in areas visible during the initial site survey. A slight solvent odor in the ambient air was noted during the initial site survey on June 7 while walking along Singer Avenue; it was unclear whether the odor was emanating from the eastern or western side of the street. Bare patches in grassy areas were noted throughout the study area, though these were likely the result of neglected maintenance rather than an indication of a release to the environment. No other stressed vegetation was observed in the study area. The inspection also identified that, as proposed, the Central Alignment may be located through a portion of the existing former Remington Products factory and loading dock area (parcel Map ID 10). A photographic log of observations made during the initial site survey is provided in Appendix I.

3.2 Current Land Use

The study area (Figure 2) consists of 73 individual parcels totaling approximately 107-acres. The current land use of parcels within the study area was determined based on information gathered during the initial site survey and from municipal land records.

Land use within the study area consists of heavy industrial, light industrial, commercial, educational, residential, and recreational, as well as vacant parcels. A total of 73 parcels are located within the study area, though in many cases multiple adjacent parcels are part of the same development, or owned by the same entity. A list of the parcels contained within the study area and their current land use designation and ownership is provided in Table 1. Locations of the individual parcels are shown on Figure 2.

3.3 Historical Land Use

Bridgeport has history rich in industry, dating back to the 19th century. The study area has been home to a variety of industries including clothing manufacturing, rail and sea shipping, electrical manufacturing, and power generation. These industrial activities have been focused primarily in the eastern portion of the study area. Seaside Park, which lies in the south-central portion of the study area and extends well beyond the study area limits, was established in the late 19th century. The remainder of the study area is composed primarily of the University of Bridgeport and residential homes. Historical land use within the study area was compiled from aerial photographs, United States Geological Survey (USGS) topographic maps, Sanborn Fire Insurance Maps, the City of Bridgeport Tax Assessor's records, and Sanborn Fire Insurance Maps.

3.3.1 Aerial Photographs

Aerial photographs of the study area were reviewed for the years 1934, 1951, 1965, 1970, 1985, 1995, and 2006. These aerial images illustrate the development of the eastern portion of the study area and corresponding progression of the shoreline. The 1934 and 1951 images indicate the shoreline was much further west than it is today, with a railyard and harbor along the coast. Industrial development, including the former Remington Products factory, is also visible in the southeastern portion of the study area, with

the western portion of the study area appearing to be either undeveloped or residential. The development of Seaside Park, located in the south-central portion of the study area and expanding beyond the limits of the study area, predates the first available aerial photograph and is observed in all reviewed aerial photographs, separating the industrial harbor in the east from the more residential area to the west. A power plant is first visible along the eastern edge of the study area in the 1965 aerial image with expansions appearing in the 1970 image. Industrial development extended eastward and is at its approximate current extent in the 1995 and 2006 aerial images. It should be noted that there is no railyard evident in these later images.

In addition to the development of the eastern shoreline, the development of the University of Bridgeport in the southwestern portion of the project area is first visible in the 1951 aerial image. The University Campus expanded northward and eastward through the 1965 aerial image, reaching its approximate current extent by the 1970 image. Concurrent with the expansion of the University of Bridgeport is the loss of residential housing, as this land was purchased and developed for other uses by the University.

Filling of the eastern and southern portions of the study area are first evident in the 1965 image. The filling appears to be completed in the 1970 image, and matches the current shoreline configuration.

Reviewed aerial photographs are provided in Appendix II.

3.3.2 Topographic Maps

WSP reviewed USGS topographic maps from 1889, 1943, 1951, 1960, 1970, and 1984. Copies of the maps are included in Appendix III. Reviewed maps illustrate the changing shoreline over time. Topographic maps from 1889 and 1943 indicate the shoreline was considerably further west than today, with the eastern portion of the study area under water. The shoreline configuration begins to change gradually in the 1951 topographic map, with development progressively moving eastward and approximately matching the current shoreline in 1970. Along with the changing shoreline, additional development in the study area is identified in the 1951 topographic maps, including the University of Bridgeport in the west as well as the railyard and the former Remington Products factory along the eastern shoreline. The power plant along the shoreline is first visible in 1960 with the expansions visible on the 1970 topographic map. Seaside Park is identified in all reviewed topographic maps. The railyard located in the eastern portion of the site is visible in the 1951, 1960, and 1970 topographic maps.

3.3.3 Tax Assessor Records

WSP reviewed records from the City of Bridgeport Tax Assessor's Office for the 73 parcels within the study area. Tax cards are available in Appendix IV and were used to identify current ownership and land use designation of the parcels. In some cases, historical ownership was also available from these records. Information obtained from the tax assessor's office is summarized in Table 1. Below is a summary of parcels where historical use may have included the use and/or storage of petroleum or other hazardous products.

Map ID 1-2 – From at least 1968 until 2002, these parcels were owned by a bag and canvas manufacturer who maintained a factory on the property.

Map ID 3-11: Records for these properties identify ownership by Remington Products Company from at least 1992 to 2006.

Map ID 12: Records indicate this property is designated as a public utility and is owned by Bridgeport Energy LLC.

Map ID 15: Records for this property identify United Illuminating as an owner in 1996.

Map ID 40-41: Records identify PSEG Power Connecticut as the owner of these properties beginning in 2003.

Map ID 49-50: Records identify United Illuminating Company as the current owner of these properties.

3.3.4 Sanborn Fire Maps

Sanborn Fire Maps were reviewed and portions of the study area were identified in the years 1884, 1889, 1904, 1913, and 1939 and are available in Appendix V. Below is a summary of parcels where historical use may have included the use and/or storage of petroleum or other hazardous products.

Map ID 1-2: Sanborn maps indicate these properties contained a bag and canvas manufacturer beginning in at least 1939.

Map ID 3-11 – Portions of this parcel were identified in the 1913 Sanborn map indicate historical use of this parcel included the Bridgeport Sewer Basin in the northern portion and as part of the rail yard that occupied the 1 Atlantic Avenue parcel to the east. Additionally, the southern portion of the parcel was identified in the 1939 Sanborn map and contained a Remington Products factory and a printing company, which consisted of various warehouses, machine shops, auto shops, and coal storage facilities.

Map ID 40: Railroad related structures are identified on the western portion of this property beginning in 1884 with the harbor located to the east. Railroad activities are identified on this parcel on all reviewed Sanborn maps and include a coal storage shed, a mechanic shop, and an oil storage area. Sanborn maps from 1884 and 1889 also identify a furniture manufacturing company on the northeastern area of the parcel.

Map ID 41: The 1913 Sanborn map identifies multiple storage boxes on the northern portion of the parcel. The use of these storage containers is not specified.

Map ID 21: The 1939 Sanborn map identifies a warehouse on this parcel which included an oxygen storage area and an acetylene storage area.

Map ID 50: The 1939 Sanborn map indicated that a portion of this parcel was used for storage of plumbing and heating supplies.

Map ID 51 and 64-66: Multiple auto houses or garages were identified on the 1913 Sanborn map in the general area of these parcels.

4.0 ENVIRONMENTAL RECORDS REVIEW

Federal, state and tribal environmental databases were reviewed for parcels within the study area in an effort to identify potential hazards. A search of U.S. Environmental Protection Agency (U.S. EPA) and Connecticut Department of Energy and Environmental Protection (CTDEEP) databases was completed by an independent firm, Environmental Data Resources Inc. (EDR).

The databases reviewed include:

- National Priorities List (NPL), Proposed NPL and Delisted NPL database
- Federal Superfund Liens (NPL LIENS)
- Federal Facility Site Information Listing (FEDERAL FACILITY)
- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and CERCLIS - No Further Remedial Action Planned (CERCLIS-NFRAP) database of potentially hazardous waste sites.
- Resource Conservation and Recovery Act Hazardous Waste Treatment, Storage or Disposal Facility (RCRA-TSD).
- Corrective Action Reports (CORRACTS) for Hazardous Waste handlers.
- RCRA Large, Small and Conditionally Exempt Small Quantity Generators (RCRA-LQG, RCRA-SQG & RCRA-CESQG) of Hazardous Waste
- Federal Institutional Control/Engineering Control Registries (US ENG CONTROLS & US INST CONTROL)
- Federal Emergency Response Notification System list (ERNS)
- Facility Index System/Facility Registry System (FINDS)
- State Hazardous Waste Sites (SHWS) database of hazardous waste disposal sites.
- Site Discovery and Assessment Database (SDADB) database of facilities suspected of hazardous waste disposal.
- State Solid Waste Facility/Landfills (SWF/LF) database of solid waste disposal facilities, landfills and transfer stations.
- State Leaking Underground Storage Tank (LUST) and Leaking Underground Storage Tanks on Indian Land (INDIAN LUST) databases.
- Connecticut Leachate and Wastewater Discharge Sites (LWDS) includes discharges, waste disposal sites and spills historically mapped by the Connecticut Department of Environmental Protection.
- State Registered Underground Storage Tanks (USTs)
- State Registered Aboveground Storage Tank (AST) database of bulk petroleum facilities that receive petroleum by marine vessels. Underground Storage Tanks on Indian Land (INDIAN UST) and Underground Storage Tank Listing (FEMA UST).
- ELUR Sites (AUL) database of state and tribal institutional control and engineering control registries.
- State Voluntary Cleanup Program Sites (VCP) and voluntary cleanup sites on Indian land (INDIAN VCP).
- Brownfield Sites

A full list of databases included in the EDR report are available in Appendix VI. Twenty-two (22) parcels within the study area were identified in these databases, including CT MANIFEST, CT SPILLS, CT UST, and RCRA NonGen/NLR. Appearance in these databases suggests a property is at risk of environmental contamination. Properties identified in the EDR report are summarized in Table 1.

5.0 EVALUATION AND SUMMARY

Current land use, historical land use, and environmental records were used to determine the relative risk of environmental contamination associated with each parcel within the study area (Table 1 and shown on Figure 2). Parcels where records identified no environmental concerns, such as residential properties, were designated low risk. A moderate risk designation was assigned to those parcels where records suggest the potential use or storage of potential contaminants, but where there is no indication of a release or direct environmental impact. A high-risk designation was assigned to parcels with records of contaminant release or where such a release is likely based on current or past land use.

While parcels are designated as a low, moderate and high risk designations, the likelihood exists that urban fill is present in surficial materials throughout the subject areas, and contain COCs at concentrations which are near or above soil criteria DD identified in the CTDEEP RSRs. Typical COCs identified in urban fill in Bridgeport include metals, polynuclear aromatic hydrocarbons (PAHs) and petroleum hydrocarbons. In addition, if part of the alignment were constructed through an existing building, a hazardous building materials inspection would be required to determine appropriate disposal of the building material (i.e. asbestos, lead-based paint, PCBs).

Within the study area, (27) parcels were designated low risk, (23) moderate risk, and (23) high risk. The relative risk designation of each parcel is identified in Table 1 and Figure 2. Table 1 also includes COCs potentially associated with each of the parcels. As noted above, because of the potential of urban fill underlying the study area, all parcels would include metals, PAHs and petroleum hydrocarbons as COCs. Low risk parcels account for the smallest portion of the study area and consist primarily of residential or commercial parcels located along Main Street. Moderate risk parcels are concentrated primarily west of Main Street. High risk parcels are concentrated east of Main Street and account for largest portion of the study area. However, each of the three proposed Alignments intersect a significant number of high risk parcels.

6.0 CONCLUSIONS

Based upon the information gathered during the Corridor Land Use Evaluation, it is recommended that a Task 210 – Subsurface Site Investigation be performed in all areas of anticipated intrusive construction activities and/or right-of-way activities. Because of the likely presence of urban fill, WSP recommends that the investigation include low to high risk parcels, with a greater density of sampling occurring in the right-of-way's adjacent to the moderate to high risk parcels identified in this report.

7.0 LIMITATIONS

The purpose of this Corridor Land Use Evaluation is to identify potential impacts to the environment status of the physical conditions (i.e., soil, ground water, structure, etc.) in the study area, due

to the use, storage or disposal of hazardous or toxic materials or wastes. As such, any other property conditions or characteristics are not addressed in the scope of work for this report. The scope of work does not include, nor should the report be considered as, an audit of compliance with environmental permits, management practices, or federal, state or local laws and regulations, even though in the course of work such information may be obtained and noted in the report.

The conclusions stated above have been developed from what is considered to be a reasonable investigation based on the present and past land use of the study area. The conclusions, to some degree, are based upon information provided by others as referenced or noted in the report. Reasonable efforts have been made to confirm the information with other sources; however, WSP is not responsible for missing or incomplete information if such information is not available at the source or provided at WSP's request, or if such information cannot be obtained within the time constraints of the work or within a level of effort reasonable for the work being completed.

The conclusions and/or recommendations are applicable to areas of the study area that were accessible at the time of inspection and represent the conditions observed in those areas. Areas that were hidden, covered or otherwise inaccessible to inspection are not covered by the conclusions and recommendations. The conclusions and recommendations are based in part on conditions observed within the study area at the time of the inspection. The conclusions do not include subsequent changes to or use of properties, which could alter the environmental status from its present condition.

WSP asserts that the data are complete and appropriate at the time and for the work conducted, but is not responsible for the use of the information for purposes for which it was not intended.

cmm
December 19, 2018
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TABLE

TABLE 1
RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

Summary of Corridor Land Use Evaluation

Map ID	Address	Current Owner	Current Land Use Designation	Previous Owners	EDR Database Review	COCs	Risk
1	388 MAIN ST	388 MAIN STREET LLC	Industrial	Josephson Bag & Canvas Company	EDR Historical Cleaner	ETPH, PAHs, Metals, VOCs	High
2	394 MAIN ST		Industrial	Josephson Bag & Canvas Company		ETPH, PAHs, Metals, VOCs	
3	37 HENRY ST #41	60 MAIN STREET LLC ET AL	Industrial	Adelman Hiram et al. Remington Products Company	CT MANIFEST, CT SDADB, RCRA NonGen/NLR, ICIS, US AIRS, FINDS, ECHO, CT CPCS, RI MANIFEST, NY MANIFEST, CT NPDES, CT BROWNFIELDS, CT ENF	ETPH, PAHs, Metals, PCBs,VOCs	High
4	51 HENRY ST		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
5	57 HENRY ST #65		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
6	97 HENRY ST		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
7	12 MAIN ST		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
8	50 MAIN ST.		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
9	110 MAIN ST		Industrial			ETPH, PAHs, Metals, PCBs,VOCs	
10	76 MAIN ST		Industrial	H & B CT LLC Adelman Hiram et al. Remington Products Company		ETPH, PAHs, Metals, PCBs,VOCs	
11	122 MAIN ST		Commercial	Adelman Hiram et al. Remington Products Company		ETPH, PAHs, Metals, PCBs,VOCs	
12	10 ATLANTIC ST	BRIDGEPORT ENERGY LLC	Pub Util	Main Atlantic Associates	CT SDADB, CT PROPERTY, CT CPCS, CT SPILLS, CT MANIFEST	ETPH, PAHs, Metals	High
13	149 MAIN ST #153	BRIDGEPORT OCEAN VIEW LLC	Residential	Taffee Place LLC Seaside Waterview LLC	--	ETPH, PAHs, Metals	Low
14	30 UNIVERSITY AV		Commercial	Taffee Place LLC Seaside Waterview LLC		ETPH, PAHs, Metals	Low
15	330 WATER ST	BRIDGEPORT PORT AUTHORITY	Industrial	United Illuminating City of Bridgeport	--	ETPH, PAHs, Metals	High
16	154 MAIN ST #156	BUSH CHRYSTAL	Residential	--	--	ETPH, PAHs, Metals	Low
17	350 WALDEMERE AV	CITY OF BRIDGEPORT PARK DEPT	Tax Exempt	--	CT LWDS	ETPH, PAHs, Metals	Moderate
18	211 MAIN ST #213	CONNECTICUT LIGHT & POWER	Vacant Land	--	--	ETPH, PAHs, Metals	Low
19	264 BROAD ST	DE TUYA III OSCAR C	Residential	--	--	ETPH, PAHs, Metals	Low
20	181 MAIN ST	DEWITT-SMITH WILLIAM S & JANET	Residential	--	--	ETPH, PAHs, Metals	Low
21	376 MAIN ST	ESM HOLDINGS LLC	Industrial	PJ Murphy Mov & Stor Co	CT LWDS	ETPH, PAHs, Metals	High
22	28 WHITING ST #30		Industrial	--	--	ETPH, PAHs, Metals	Moderate
23	183 MAIN ST	HOUSING AUTHORITY OF CITY OF BRIDGEPORT	Residential	--	--	ETPH, PAHs, Metals	Low
24	258 BROAD ST	HYER CHARLES W	Residential	--	--	ETPH, PAHs, Metals	Low
25	418 MAIN ST	KIEFER MAIN INCORPORATED	Commercial	--	--	ETPH, PAHs, Metals	Low
26	203 MAIN ST	KONG SIMON TATCHEE	Residential	Secretary of Housing and Urban	--	ETPH, PAHs, Metals	Low
27	160 MAIN ST #162	MALINOWSKI JOANN L	Commercial	--	--	ETPH, PAHs, Metals	Low
28	146 MAIN ST #148	MARTIN ROBERT F & FLORENCE	Residential	--	--	ETPH, PAHs, Metals	Low
29	354 MAIN ST	MARY & ELIZA FREEMAN CNTR FOR	Commercial	City of Bridgeport	--	ETPH, PAHs, Metals	Low
30	360 MAIN ST #366	HISTORY &	Residential	ABCD Inc	--	ETPH, PAHs, Metals	Low
31	107 HENRY ST #109	MASON CHARLES J & JOSEPH L	Industrial	--	--	ETPH, PAHs, Metals	High
32	113 HENRY ST	MASON JOSEPH L JR & LOUISE	Vacant Land	--	--	ETPH, PAHs, Metals	Low

TABLE 1
RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

Summary of Corridor Land Use Evaluation

Map ID	Address	Current Owner	Current Land Use Designation	Previous Owners	EDR Database Review	COCs	Risk
33	21 HENRY ST	MAUZERALL MICHAEL	Industrial	--	--	ETPH, PAHs, Metals	High
34	27 HENRY ST		Industrial	--	--	ETPH, PAHs, Metals	High
35	30 KIEFER ST	O'HARA'S LLC	Industrial	Cavalleri Marie R	--	ETPH, PAHs, Metals	High
36	38 KIEFER ST		Commercial		--	ETPH, PAHs, Metals	Moderate
37	54 KIEFER ST		Industrial		--	ETPH, PAHs, Metals	High
38	340 MAIN ST #350	PARKSIDE PROPERTIES LLC	Commercial	Polanco Rene & Margarita Mechanics & Farmers Savings Burr Jonathan	--	ETPH, PAHs, Metals	Low
39	268 BROAD ST	PLOTKIN NATHANIEL W	Residential	--	--	ETPH, PAHs, Metals	Low
40	1 ATLANTIC ST	PSEG POWER CONNECTICUT LLC	Pub Util	--	CT SPILLS, CT NPDES, CT ASBESTOS, ERNS, CT CPCS, CT AST, CT PROPERTY, TSCA, CT UST, ICIS, MLTS, FINDS, ECHO, US AIRS, SEMS-ARCHIVE, CORRACTS, RCRA-TSDF, RCRA-SQG	ETPH, PAHs, Metals, PCBs, VOCs	High
41	280 MAIN ST		Commercial	United Illuminating Company Main Atlantic Associates	--	ETPH, PAHs, Metals, PCBs	
42	TONGUE POINT LIGHT	FEDERAL GOVERNMENT	National Register of Historic Places	--	--	ETPH, PAHs, Metals, PCBs	Moderate
43	256 BROAD ST	SILJKOVIC SABAN	Residential	Alleyne Wayne A Sanjo Realy LLC Celli Joseph et al Meyers Richard J A/K/A	--	ETPH, PAHs, Metals	Low
44	167 MAIN ST	SEASIDE WATERVIEW LLC	Vacant Land	Lacont Laurence J Laconte Clara	--	ETPH, PAHs, Metals	Low
45	262 BROAD ST	STEPANOVA TATYANA	Residential	--	--	ETPH, PAHs, Metals	Low
46	270 BROAD ST		Residential	--	--	ETPH, PAHs, Metals	Low
47	195 MAIN ST #199	TENG WAN LING ETAL	Residential	St Raymond Stephen C St Raymond Raymond Murphy William S Murphy Vernon S Est	--	ETPH, PAHs, Metals	Low
48	274 BROAD ST	TEO PUAY LAM ET AL	Residential	Davis Thomas S Davis Carolyn H Estate	--	ETPH, PAHs, Metals	Low
49	282 BROAD ST #288	THE CONNECTICUT LIGHT & POWER	Vacant Land	Davis Carloyn H Trustee et al Davis Carolyn Murphy William S & Murphy Vernon S Est	--	ETPH, PAHs, Metals, PCBs	Low
50	3 ATLANTIC ST	UNITED ILLUMINATING COMPANY	Industrial	--	--	ETPH, PAHs, Metals, PCBs, VOCs	High
51	120 HENRY ST		Pub Util	PSEG Power Development LLC United Illuminating Co	NY MANIFEST, CT SPILLS, CT MANIFEST	ETPH, PAHs, Metals, PCBs, VOCs	High

TABLE 1
RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

Summary of Corridor Land Use Evaluation

Map ID	Address	Current Owner	Current Land Use Designation	Previous Owners	EDR Database Review	COCs	Risk
52	115 BROAD ST	UNIVERSITY OF BRIDGEPORT	Single Fam	Lee Jung Sook Noh	--	ETPH, PAHs, Metals	Moderate
53	136 LAFAYETTE ST #170		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
54	239 LAFAYETTE ST		Commercial	--	--	ETPH, PAHs, Metals	
55	245 LAFAYETTE ST #247		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
56	253 LAFAYETTE ST #255		2 Family	--	--	ETPH, PAHs, Metals	
57	262 LAFAYETTE ST #264		Commercial	--	--	ETPH, PAHs, Metals	
58	269 LAFAYETTE ST		Tax Exempt	--	--	ETPH, PAHs, Metals	
59	274 LAFAYETTE ST		Commercial	--	--	ETPH, PAHs, Metals	
60	320 LINDEN AV		Tax Exempt	--	--	ETPH, PAHs, Metals	
61	68 UNIVERSITY AV		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
62	114 UNIVERSITY AV		Commercial	--	--	ETPH, PAHs, Metals	
63	128 UNIVERSITY AV		Commercial	--	--	ETPH, PAHs, Metals	
64	152 UNIVERSITY AV		Tax Exempt	--	--	ETPH, PAHs, Metals	
65	169 UNIVERSITY AV		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
66	174 UNIVERSITY AV		Tax Exempt	--	--	ETPH, PAHs, Metals	
67	225 UNIVERSITY AV		Tax Exempt	--	--	ETPH, PAHs, Metals	
68	244 UNIVERSITY AV		Tax Exempt	--	CT UST	ETPH, PAHs, Metals,VOCs	
69	(UB Football Field)		--	--	--	ETPH, PAHs, Metals	
70	420 MAIN ST #422	VUKAJ ALEKSANDER	Commercial	--	--	ETPH, PAHs, Metals	Low
71	271 BROAD ST	ZAMBON KARL L & KATHARINA T	Residential	Wells Fargo Bank NA Choi Chung Woo Yasutake Yohio Paul et al	--	ETPH, PAHs, Metals	Moderate
72	189 MAIN ST #191	ZAMBON MICHAEL ET AL	Residential	Song Zhitao	--	ETPH, PAHs, Metals	Low
73	(Henry/Russell/Atlantic)	--	--	--	CT UST	ETPH, PAHs, Metals, PCBs, VOCs	Moderate

COC: Contaminant of concern

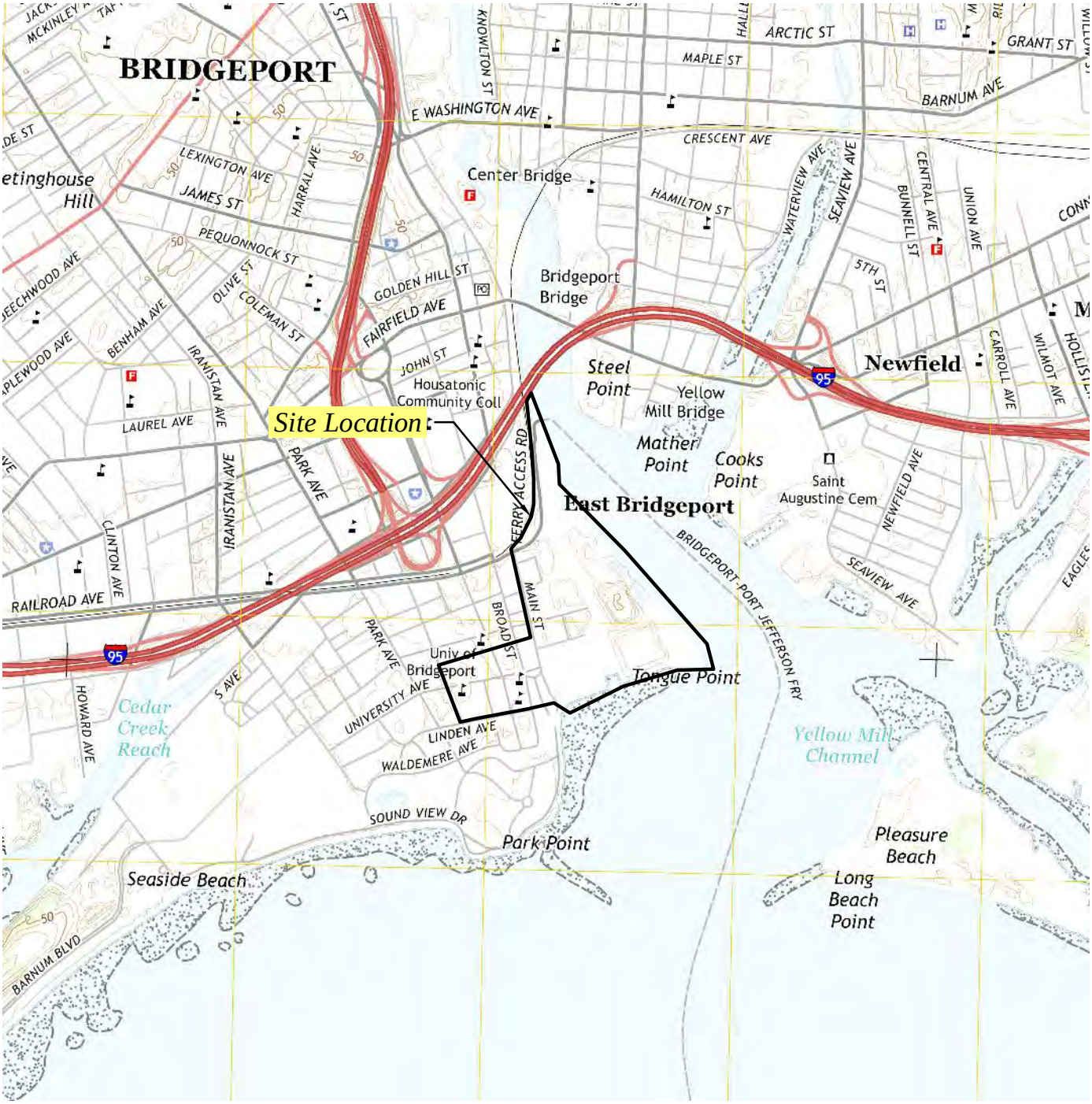
ETPH: Extractable total petroleum hydrocarbons

PAHs: Polynuclear aromatic hydrocarbons

PCBs: Polychlorinated biphenyls

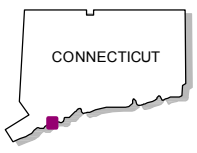
VOCs: Volatile organic compounds

FIGURES



SOURCE: USGS TOPOGRAPHIC QUADRANGLE BRIDGEPORT, CONNECTICUT (2015).





QUADRANGLE LOCATION

0 2000

SCALE IN FEET

RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

SITE LOCATION MAP

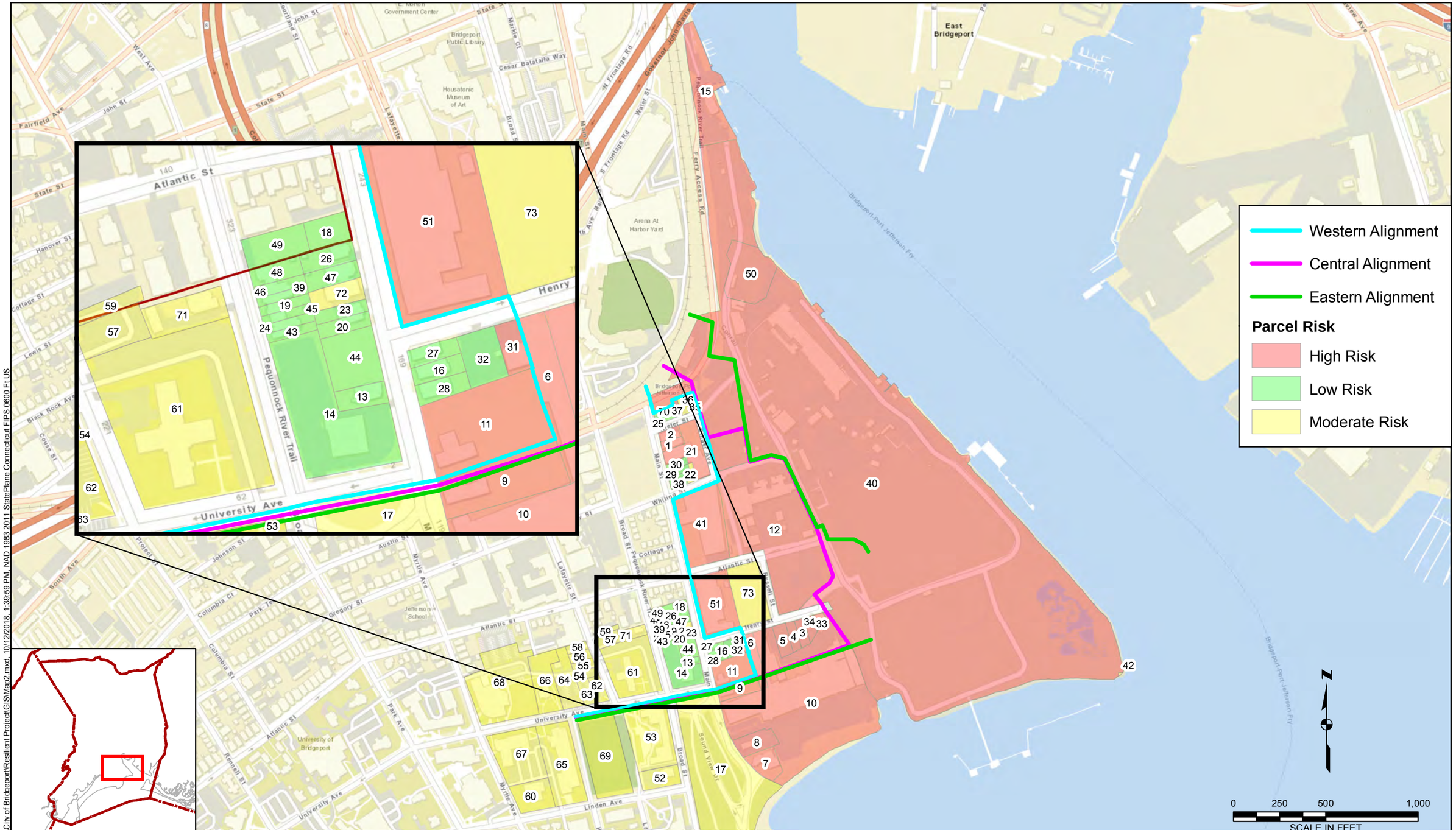
DATE	REVISED

PREPARED BY:

WSP USA
4 Research Drive
Suite 204
Shelton, Connecticut 06484
(203) 929-8555

DRAWN:	RAC	CHECKED:	SQ	DATE:	06/28/18	FIGURE:	1

O:\DWG\City of Bridgeport\Resilienct Project\F1_SLM.dwg, Layout1, 6/28/2018 7:33:17 AM, PDF-XChange for AcroPlot Pro



Drawn: 10/12/2018

Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

WSP Office: Shelton, CT | Source: K:\Jobs\City of Bridgeport\Resilient Project\GIS\Map2.mxd, 10/12/2018, 1:39:59 PM, NAD 1983 2011 StatePlane Connecticut FIPS 0600 Ft US

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WSP USA Inc.
4 RESEARCH DRIVE
SUITE 204
SHELTON, CT 06484
TEL: (203) 929-8555

RESILIENCY PROJECT
BRIDGEPORT, CONNECTICUT

PREPARED FOR

The City of Bridgeport

FIGURE 2

PARCEL RISK ASSESSMENT
OCTOBER 2018

APPENDIX I

PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
1	June 7, 2018

University of Bridgeport campus near southernmost terminus of proposed alignments



Photo No.	**Date**
2	June 7, 2018

University of Bridgeport campus – University avenue



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
3	June 7, 2018

University of Bridgeport campus residence hall



Photo No.	**Date**
4	June 7, 2018

Derelict building at 30 University Avenue



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
5	June 7, 2018

Construction activity at the 60 Main Street site



Photo No.	**Date**
6	June 7, 2018

View north on Main Street, from entrance of 60 Main Site



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
7	June 7, 2018

Several residential/mixed use buildings located at the corner of Henry and Main Streets



Photo No.	**Date**
8	June 7, 2018

Residences and a UI facility on Main Street, facing North



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
9	June 7, 2018

280 Main Street from Main and Atlantic Streets



Photo No.	**Date**
10	June 7, 2018

Unpaved parking area located at the corner of Russell and Henry Streets



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
11	June 7, 2018

10 Atlantic Street



Photo No.	**Date**
12	June 7, 2018

Light industrial style building at the corner of Main St and Cottage Pl



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
13	June 7, 2018

Loading docks at 280 Main Street and mixed use building located at Whiting and Main Streets



Photo No.	**Date**
14	June 7, 2018

Rear of PJ Murphy Self Storage (376 Main Street) and view north on Singer Avenue



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
15	June 7, 2018

Rear loading docks at PJ Murphy Self Storage



Photo No.	Date
16	June 7, 2018

1 Atlantic Avenue viewed from Singer Avenue



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
17	June 7, 2018

Commercial property storing excavators and triaxle dump trucks on Kiefer Street



Photo No.	**Date**
18	June 7, 2018

View west on Kiefer Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
19	June 7, 2018

WM Evans Painting, LLC located at the corner of Kiefer/Main



Photo No.	**Date**
20	June 7, 2018

Vacant lot located at the corner of Ferry Access Road and Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
21	June 27, 2018

Bridgeport Harbor Generating Station



Photo No.	Date
22	June 27, 2018

Commercial Property on Singer Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
23	June 27, 2018

Commercial Property on Singer Street



Photo No.	**Date**
24	June 27, 2018

Storage facility at corner of Whiting Street and Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
25	June 27, 2018

Several residential buildings on Main Street



Photo No.	Date
26	June 27, 2018

Commercial Property at 280 Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
27	June 27, 2018

Bridgeport Energy LLC on Atlantic Street



Photo No.	Date
28	June 27, 2018

Commercial Buildings on Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
29	June 27, 2018

Commercial Buildings at 340 Main Street



Photo No.	**Date**
30	June 27, 2018

Construction along Russell Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
31	June 27, 2018

Construction along Henry Street



Photo No.	Date
32	June 27, 2018

Construction along Henry Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
33	June 27, 2018

Residential Property along Henry Street



Photo No.	**Date**
34	June 27, 2018

Construction site along Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
35	June 27, 2018

University of Bridgeport property along Myrtle Ave



Photo No.	Date
36	June 27, 2018

Residential Properties along Lafayette Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
37	June 27, 2018

Parking lot for a commercial building at University of Bridgeport



Photo No.	Date
38	June 27, 2018

Commercial buildings associated with University of Bridgeport



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
39	June 27, 2018

Administrative buildings associated with University of Bridgeport



Photo No.	Date
40	June 27, 2018

Administrative buildings associated with University of Bridgeport



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
41	June 27, 2018

Administrative buildings associated with University of Bridgeport



Photo No.	Date
42	June 27, 2018

Park between Main Street and Harbor



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
43	June 27, 2018

Park between Main Street and Harbor



Photo No.	**Date**
44	June 27, 2018

Construction between Park and Harbor



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
45	June 27, 2018

Residential building at corner of Linden Ave and Broad Street



Photo No.	**Date**
46	June 27, 2018

Administrative Buildings for the University of Bridgeport



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	RESILIENCY PROJECT BRIDGEPORT, CONNECTICUT	52829NDR 6.08.02

Photo No.	Date
47	June 27, 2018

Construction between Park and Harbor



Photo No.	Date
48	June 27, 2018

Atlantic Street entrance to PSEG Power Property



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
49	June 27, 2018

Ferry Access Road Entrance to PSEG Power Property



Photo No.	**Date**
50	June 27, 2018

Industrial building located at 280 Main Street



PHOTOGRAPHIC LOG		
CITY OF BRIDGEPORT	**RESILIENCY PROJECT** **BRIDGEPORT, CONNECTICUT**	**52829NDR 6.08.02**

Photo No.	**Date**
51	June 27, 2018

View from Atlantic Avenue of 120 Henry Street.



APPENDIX II



CITY OF BRIDGEPORT
RESILIENT PROJECT

1934 Aerial Photograph

DATE	REVISED

PREPARED BY:

WSP USA Inc.
4 Research Drive
Suite 204
Shelton, CT 06484
Tel: (203) 944-5000

DRAWN: | CHECKED: | DATE: 1/4/18 | FIGURE: 1



CITY OF BRIDGEPORT
RESILIENT PROJECT

1951 Aerial Photograph

DATE	REVISED

PREPARED BY:

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4 Research Drive
Suite 204
Shelton, CT 06484
Tel: (203) 944-5000

DRAWN: | CHECKED: | DATE: 1/4/18 | FIGURE: 2



CITY OF BRIDGEPORT
RESILIENT PROJECT

1965 Aerial Photograph

DATE	REVISED	PREPARED BY:
		WSP USA Inc. 4 Research Drive Suite 204 Shelton, CT 06484 Tel: (203) 944-5000

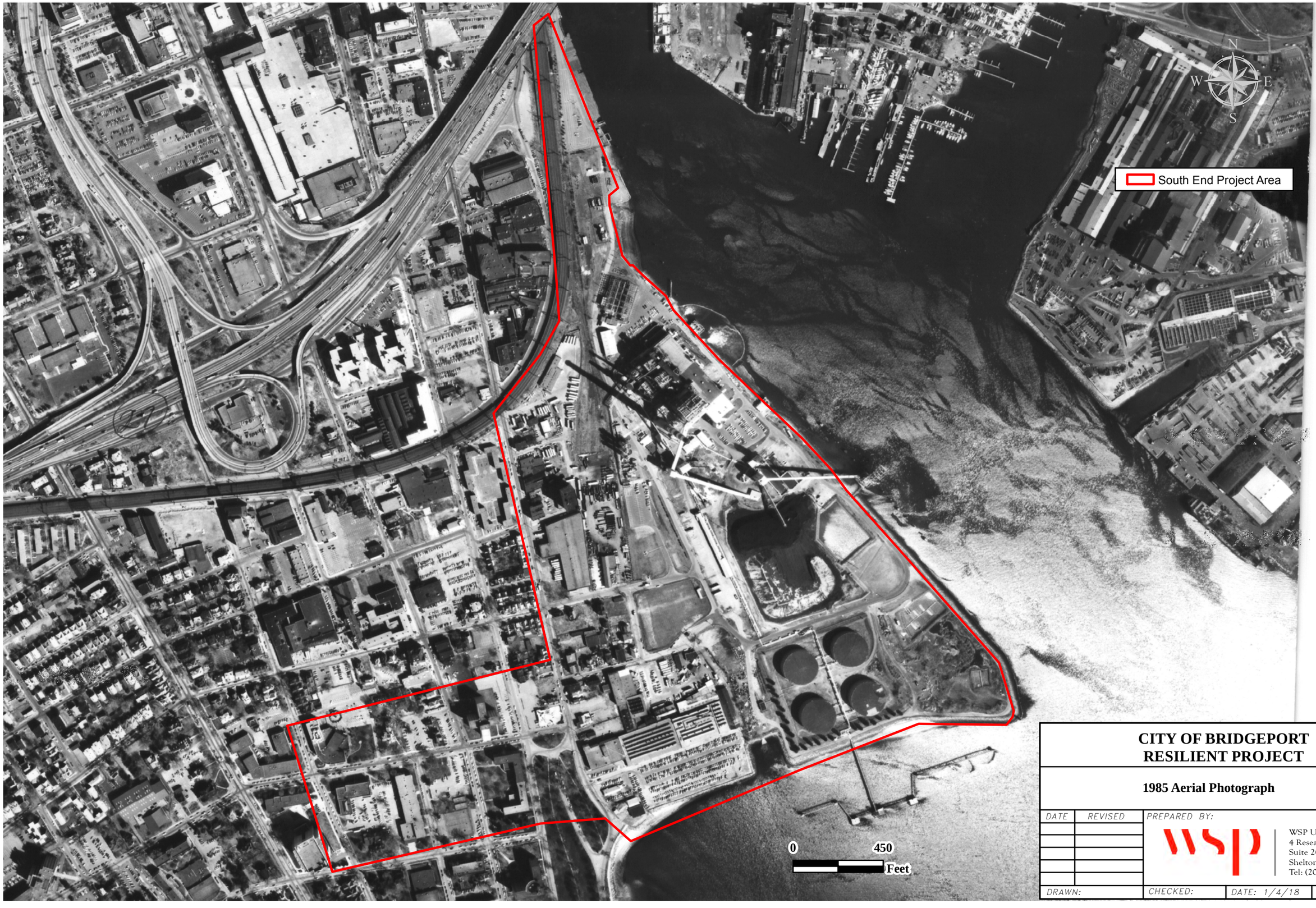
DRAWN:	CHECKED:	DATE: 1/4/18	FIGURE: 3



CITY OF BRIDGEPORT
RESILIENT PROJECT

1970 Aerial Photograph

DATE	REVISED	PREPARED BY:
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DRAWN:	CHECKED:	DATE: 1/4/18 — FIGURE: 4



CITY OF BRIDGEPORT
RESILIENT PROJECT

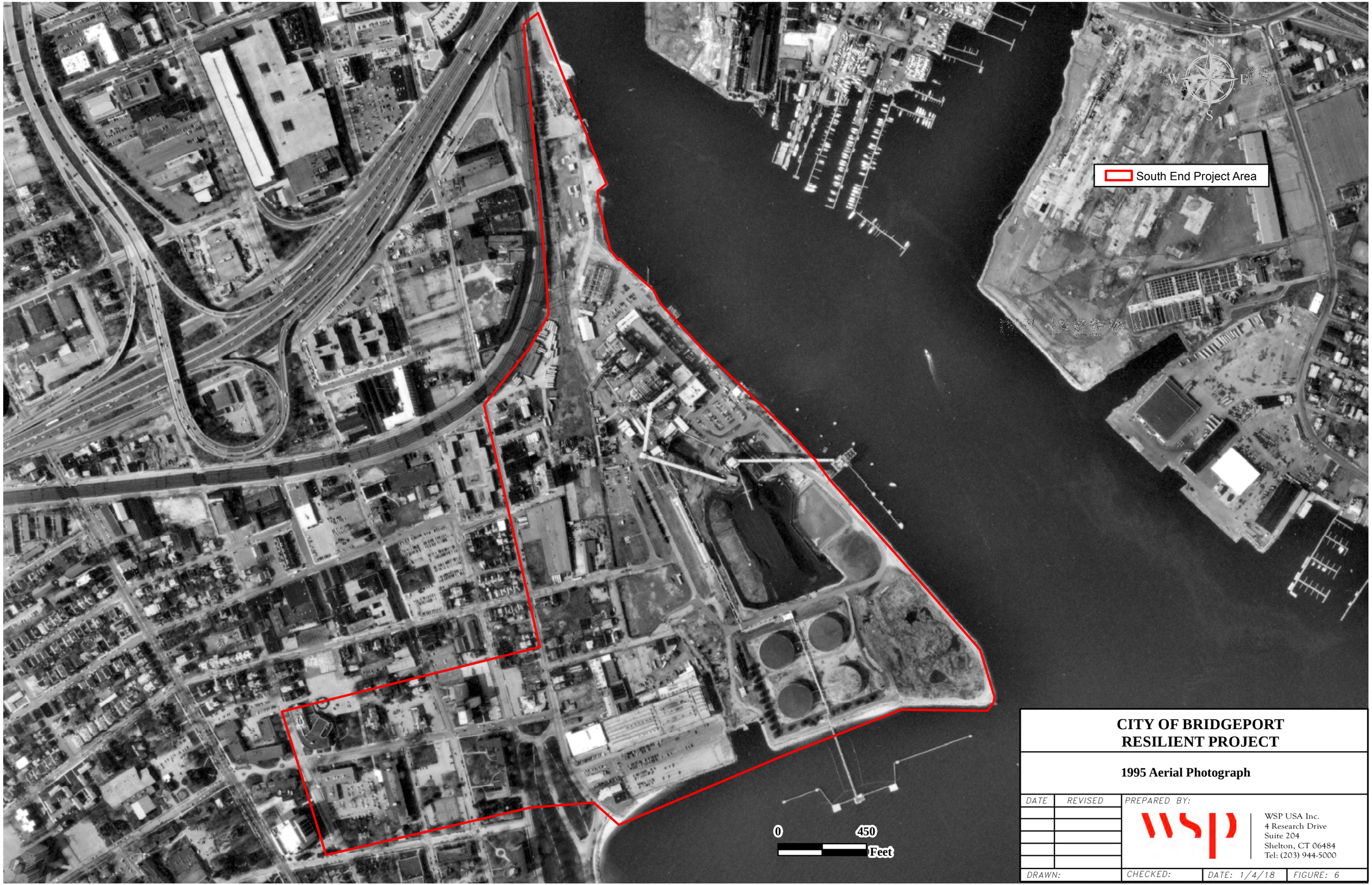
1985 Aerial Photograph

DATE	REVISED

PREPARED BY:

WSP USA Inc.
4 Research Drive
Suite 204
Shelton, CT 06484
Tel: (203) 944-5000

DRAWN:	CHECKED:	DATE: 1/4/18	FIGURE: 5



CITY OF BRIDGEPORT
RESILIENT PROJECT

1995 Aerial Photograph

DATE	REVISED	PREPARED BY:
		WSP USA Inc. 4 Research Drive Suite 204 Shelton, CT 06484 Tel: (203) 944-5000
DRAWN:	CHECKED:	DATE: 1/4/18 FIGURE: 6



CITY OF BRIDGEPORT
RESILIENT PROJECT

2006 Aerial Photograph

DATE	REVISED	PREPARED BY:
		WSP USA Inc. 4 Research Drive Suite 204 Shelton, CT 06484 Tel: (203) 944-5000

DRAWN:	CHECKED:	DATE: 1/4/18	FIGURE: 7

APPENDIX III

U.S. GEOLOGICAL SURVEY
J.W. POWELL,
DIRECTOR.

№ 33
CONNECTICUT
BRIDGEPORT SHEET
(Derby)

STATE OF CONNECTICUT
WM H. BREWER.
JAMES H. CHAPIN. } COMMISSIONERS
JOHN W. BACON.

73°15' 41°15' 10' 5' 73° 41°15'

Trumbull
Nichols Farms
Baldwin
Fowlers Island
Wepawaug River
Indian River
RAILROAD
Horse Tavern Reservoir
Ox Stream Reservoir
Island Brook Reservoir
Stratford Hill
Popes Flat
Long Island
Milford
Success Hill
Beardsley Park
North Bridgeport
Naugatuck Junction
Welches Point
Pond Point
Berkshire Mill Pond
Stillman Pond
Pembroke Lake
East Bridgeport
Stratford
Meadows End
Charles Island
Nells Island
BRIDGEPORT
Moody's Mill Pond
East End
Milford Point
BEACON
Pleasure Beach
Seaside Park
THE GUT
LIGHT
Stratford Point
Black Rock
Cedar Creek
Ash Creek
Long Beach
Point no Point
Fayerweather Island
Grover Hill
BLACK ROCK HARBOR
Fairfield Beach
(Norwalk)

BOUNDARY LINE
CONNECTICUT
NEW YORK

Henry Gannett. Chief Topographer.
Marcus Baker. Topographer in charge.
Triangulation by the U.S. Coast and Geodetic Survey.
Topography by E.B. Clark.
Surveyed in 1889.

Scale 1/62,500
0 1/2 1 2 3 4 5 Miles

Contour Interval 20 feet
Datum is mean Sea level

CONNECTICUT-NEW YORK

BRIDGEPORT QUADRANGLE

GRID ZONE "A"

WAR DEPARTMENT
CORPS OF ENGINEERS, U. S. ARMY

FIRST EDITION - AMS 1

(POUGHKEEPSIE)

(FARMINGTON)

73°30' — 73°00' — 41°30' — 41°00'

15° 14° 13° 12° 11° 10° 0°

400000 Conn. 6 MI. SHERMAN — U S HY NO 7 2.4 MI. — LANESVILLE 2.4 MI. — BRIDGEWATER 2 MI. — (LITCHFIELD) — STATE HY NO 67 0.7 MI. — STATE HWY NO 172 1.5 MI. — WHITE OAKS 0.5 MI. — MIDDLEBURY 2.9 MI. — STATE HY. NO 135 0.6 MI. — UNION CITY 0.1 MI.

240000 Conn.

2120 — 2110 — 2100 — 2090 — 2080 — 2070000

STATE HIGHWAY NO 37A 0.9 MI. — STATE HIGHWAY NO 37A 1 MI. — STATE HIGHWAY NO 39 1.5 MI. — DEFOREST CORNERS 4.1 MI. — MILL PLAIN 1 MI. — RIDGEFIELD 1.1 MI. — STATE HY NO 33 2 MI. — NORTH SALEM 5.3 MI. — STATE HY NO 123 4.3 — STATE H NO 123 1.8 MI. — (WEST POINT) — STATE HY NO 123 0.4 MI. — VISTA 1.5 MI. — STATE HY NO 29 0.6 MI. — POUNDRIDGE 6.2 MI. — STATE HY NO 137 2.3 MI. — SPRINGDALE 2.8 MI. — STAMFORD GLENBROOK 2.2 MI. — 1.2 MI.

STATE HY NO 68 2.2 MI. — BETHANY 3.5 MI. — BETHANY 0.7 MI. — STATE HY NO 69 3 MI. — NEW HAVEN 4 MI. — WESTVILLE 1.5 MI. — (NEW HAVEN) — NEW HAVEN 4.5 MI. — STATE HY. NO 122 1.4 MI. — WOODMOUNT 0.3 MI.

GRID DECLINATION 0°20' OR 6 MILS W — GRID DECLINATION 0°00' OR 0 MILS

20 Miles — 19 — 18 — 17 — 16 — 15 — 14 — 13 — 12 — 11 — 10 — 9 — 8 — 7 — 6 — 5 — 4 — 3 — 2 — 1 — 0 — 1/2

960000 — 970 — (ISLIP) — P — 990 — 520000 Conn. — 1000 — 80000 Conn.

(NEW YORK) — (RIVERHEAD)

Danbury, Danbury Airport, Bethel, Brookfield, Brookfield Center, Brookfield Junction, New Fairfield, Southville, Shepaug, Lake Candlewood, Lake Lillinonah, Still R., Broadbrook, Kohanza Lake, Upper Kohanza Lake, East Lake, Margerie Reservoir, Pump Sta, Beaver Brook Mt., Hawleyville, Newtown, Taunton Road, Shelter Rock, Taunton Hill, Dodgingtown, Bennett Pds, Town Hill, Thomas Mt, Moses Mt, Wooster Mt, Eureka Lake, Spruce Mt, Pine Mt, Sugar Hollow Pd, Bethel Reservoir, State Park, State Forest, Hattertown, West Redding, Redding Ridge, Redding, Umpawaug Pond, Topstone, Ridgefield, Georgetown, Branchville, Valley Forge, Devils Den, Hovey Hill, Bald Hill Street, Bald Hill, North Wilton, Turner Ridge, Cannondale, Wilton, South Wilton, Belden Hill, Norwalk Reservoir, South Norwalk Res, Silvermine, New Canaan, Four Corners, Five Corners, Winnipauk, Norwalk Airport, Cranbury, Saugatuck, Talmadge Hill Sta, West Norwalk, NORWALK, East Norwalk, South Norwalk, Darien, Rowayton, Noroton Sta, Noroton, Scott Cove, Pine Pt, Noroton Pt, Fish Islands, Long Neck Pt, Bell I, Sheffield I, Manrissa I, Betts I, Grassy I, Chimon I, Copp I, Ram I, Keyser Pt, Wilson Pt, NORWALK ISLANDS, Cockenoe I, Calfpasture I, Calfpasture Pt, Seymour Pt, Sprite I, Cedar Pt, Alvord Beach, Sherwood Pt, Frost Pt, Greens Farm, Greens Farm Sta, Southport, Fairfield, Pine Creek Pt, Fayerweather I, Black Rock, BRIDGEPORT, Greenfield Hill, Prospect Hill, Mill Plain, Westport, Saugatuck R., Sasco Br., Mill R., Aspetuck R., Aspetuck, Aspetuck Reservoir, Hemlock Reservoir, Plattsville, Lyon Plain, Easton, Long Hill, Tashua Hill, Tashua Knob, Easton Lake, Trumbull, Nichols, Oronoque, Beaver Dam Lake, Fowlers Island, Pipes Flat, Long Hill, Milford, Devon, Stratford, East Bridgeport, Bridgeport Airport, Milford Pt, Chimbo Pt, Myrtle Beach, Walnut Beach, Charles Island, Laurel Beach, Welch Pt, Pond Pt, Stratford Pt, Lordship, Long Beach, Point No Point, Gul, Port Jefferson Ferry, Sound, Long Island, Connecticut / New York

Southbury, Strongtown, Walnut Tree Hill, Preston Hill, Woodruff Hill, Long Meadow Pond, French Mt, Flat Hill, South Britain, Southbury Sta, Horse Hill, George Hill, Southford, Towantic, Towantic Hill, State Forest, Tobys Rock Mt, Andrews Hill, Millville, Huntington Hill, Spring, Naugatuck, Mulberry Hill, Straitsville, Hopkins Hill, Beacon Hill, High Rock Grove, Beacon Falls, Rock Rimmon, Rimmon Hill, Skokorat Hill, Mt Pisgah, Red City, Oxford, Quaker Farms, Nichols Rd, Hulls Hill, Good Hill, Moose Hill, Rocky Glen, Sandy Hook Sta, Sandy Hook, Hawleyville, Housatonic River, Stevenson, Riverside, Rockhouse Hill, Botsford, Huntington, Great Hill, Seymour, Peet Swamp Reservoir, Prospect Hill, Woodbridge, East Village, Upper White Hills, Lower White Hill, Monroe, Ansonia, Derby, Shelton, Walnut Tree Hill, Huntington, Stepney, Upper Stepney, Long Hill, Booth Hill, Trap Falls, Corum Hill, Grassy Hill, Georges Cellar Hill, Orange, Turkey Hill, Rock Rimmon, Round Hill, Terrmill River, Eightmile River, Housatonic River, Naugatuck River, Pootatuck R., Still R., Lake Lillinonah, Lake Zoar, Zoar Br., Zoar Tunnel, Zoar Gap, Zoar Dam, Zoar Sta, Lovers Leap, Indian Wells, Indian Wells Sta, Indian Wells Tunnel, Paugussett, Paugussett Sta, Paugussett Tunnel, Paugussett Br., Paugussett Trail, Pootatuck Trail, Housatonic Trail, Appalachian Trail, Housatonic Ridge, Housatonic Valley, Housatonic Hills, Housatonic Br., Housatonic Br. 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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF CONNECTICUT
HIGHWAY DEPARTMENT

BRIDGEPORT QUADRANGLE

CONNECTICUT-FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NW/4 BRIDGEPORT 15' QUADRANGLE

(BOTSFORD) (ANSONIA) (MONROE) (WESTPORT) (MILFORD) (SHERWOOD POINT)

73°15' 12'30" 10' 490 000 FEET 73°07'30"
41°15' 150 000 FEET 12'30" 10' 110 000 FEET 41°07'30"

NEWTOWN 13 MI.
STEPNEY DEPOT 3.9 MI.
0.8 MI. TO CONN. 25
SHELTON 6.9 MI.
HUNTINGTON 3.4 MI.
0.9 MI. TO CONN. 8
WATERBURY 24 MI.
SHELTON 5.6 MI.
GEORGE WASHINGTON BRIDGE, N.Y. 53 MI.
0.4 MI. TO CONN. 59
1.9 MI. TO CONN. 110
HARTFORD 46 MI.
UPPER STEPNEY 8.8 MI.
0.5 MI. TO CONN. 15
2.4 MI. TO CONN. 15
SHELTON 7.9 MI.
0.4 MI. TO U.S. 1
MILFORD 4.4 MI.
NEW HAVEN 14 MI.
DANBURY 23 MI.
2 MI. TO CONN. 15
NORWALK 9.7 MI.
WESTPORT 6.1 MI.

EASTON
Chestnut Hill
Long Hill
Ehrsham Pond
Canoe Brook Lake
Trumbull
Brinsmade Cem
Center Sch
Poquonock
Riverside Cem
Long Hill Cem
Frog Pond
Nichols Farm Cem
Nichols (BM 257)
Beaver Dam Lake
Pumpkin Ground
Cooks Pond
Ox Hill
Mill River
Lake Forest
Woodrow Wilson Sch
Ninety Acres Park
Fairchild Wheeler Park
Ireland Brook Lagoon
Englewood Hospital
Stratfield
Childrens Home
Toilsome Hill
Madison Sch
St Vincents Hospital
Seeleys Pond
Park Cemetery
Lincoln Sch
Melville Village
Read Sch
Shelton Sch
Columbus Sch
Nathan Hale Sch
County Jail
Beechwood Park
Brooklawn Country Club
Webster Sch
Golden Hill
Courthouse
Post Office
City Hall
Maplewood Jr High Sch
Mc Kinley Sch
Tunxis Hill Park
Old Stratfield Cem
Washington Sch
Tunxis Hill
Bryant Sch
Bassick High School
Mount Grove Cemetery
Lovejoy Cem
Holland Hill Sch
Whittier Sch
Longfellow Sch
Gas
Oil
Sewage Disposal
St Anns Sch
Black Rock
Black Rock Sch
Burr Creek
Cedar Creek
Ash Creek
Grover Hill
Fairfield
Jennings Beach
Shoal Pt
Fairfield Beach
Penfield Reef
Fayerweather Island
Light
Black Rock Harbor
Bunnells Pond
Success Lake
Success Hill
Second Hill
Hooker Sch
Hallen Sch
Ireland Brook
Television Relay Sta
Hill-Side Home
Bullard-Haven Sch
Beardsley Sch
Stillman Pond
Lakeview Cem
Seaside Park
Mill Hill
Harding High Sch
Garfield Sch
East Bridgeport
St Augustine Cem
Hall Sch
Bridgeport Hospital
East End Freight Yards
Bruce Pond
Waltersville Sch
Newfield
Lincoln Sch
Mc Kinley Sch
Sherman Sch
Steel Pt
Cooks Pt
Radio Tower (WNAB)
Tongue Pt
Radio Tower (WLIZ)
Light
Pleasure Beach
Radio Towers (WICC)
Great Meadows
Lewis Gut
Long Beach
Lordship
Point No Point
Eli Whitney Sch
Sunnyside Hospital
Stonybrook Sch
Garden Sch
Brewster Pond
Long Brook Park
Nichols Sch
Stratford
Union Cem
High Sch
Post Office
Franklin Sch
Center Sch
Academy Hill
Selby Pond
Birdseye Sch
Sedgwick Sch
Housatonic River
Frash Pond
Sewage Disposal
Johnsons Ct
Oil
BRIDGEPORT MUNICIPAL AIRPORT
BRIDGEPORT HARBOR
LONG ISLAND SOUND

INTERIOR-GEOLOGICAL SURVEY, WASHINGTON, D. C.-1953

Mapped, edited, and published by the Geological Survey

Control by USC&GS, USGS, USCE, and Connecticut Geodetic Survey

Topography from aerial photographs by multiplex methods
Aerial photographs taken 1949. Field check 1951
Hydrography from USC&GS charts

Polyconic projection. 1927 North American datum
10,000-foot grid based on Connecticut coordinate system

Red tint indicates areas in which only landmark buildings are shown

12° MAGNETIC NORTH TRUE NORTH
APPROXIMATE MEAN DECLINATION, 1951

SCALE 1:31680

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS 7 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CONNECTICUT
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty 4 LANE | 6 LANE Light-duty
Medium-duty 4 LANE | 6 LANE Unimproved dirt
U. S. Route State Route

BRIDGEPORT, CONN.
NW/4 BRIDGEPORT 15' QUADRANGLE
N4107.5—W7307.5/7.5

1951

10

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF CONNECTICUT
HIGHWAY DEPARTMENT

BRIDGEPORT QUADRANGLE
CONNECTICUT–FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

(BOTSFORD) (LONG HILL) (ANSONIA) (SHERWOOD POINT) (WESTPORT) (MILFORD)

73°15′ 41°15′ 647000m.E. 4567000m.N. NEWTOWN 13 MI. STEPNEY DEPOT 3.9 MI. 0.8 MI. TO CONN. 25 12′30″ HUNTINGTON 3.4 MI. 10′ 0.9 MI. TO CONN. 8 WATERBURY 24 MI. SHELTON 5.6 MI. 490 000 FEET 73°07′30″ 41°15′ 150 000 FEET

GEORGE WASHINGTON BRIDGE, N.Y. 53 MI. 0.4 MI. TO INTERCHANGE 45
UPPER STEPNEY 8.8 MI. 0.5 MI. TO CONN. 15
DANBURY 23 MI. 2 MI. TO CONN. 15
NORWALK 8 MI. 1 MI. TO INTERCHANGE 21
NORWALK 9.7 MI. WESTPORT 6.1 MI.
1.2 MI. TO INTERCHANGE 53 HARTFORD 46 MI.
2.4 MI. TO CONN. 15 SHELTON 7.9 MI.
0.2 MI. TO INTERCHANGE 33 MILFORD 4.4 MI. NEW HAVEN 14 MI.

12′30″ 10′ 110 000 FEET 4555000m.N. 41°07′30″ 73°15′ 470 000 FEET 12′30″ 10′ 41°07′30″ 657000m.E. 73°07′30″

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1963

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, USCE, and Connecticut Geodetic Survey

Topography by photogrammetric methods from aerial photographs taken 1949. Field checked 1951. Revised 1960

Selected hydrographic data compiled from USC&GS Chart 220 (1959)
This information is not intended for navigational purposes

Polyconic projection. 1927 North American datum
10,000-foot grid based on Connecticut coordinate system
1000-meter Universal Transverse Mercator grid ticks,
zone 18, shown in blue

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

Red tint indicates areas in which only landmark buildings are shown

12½° MAGNETIC NORTH TRUE NORTH
APPROXIMATE MEAN DECLINATION, 1960

SCALE 1:24000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 6.8 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CONNECTICUT
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route U. S. Route State Route

BRIDGEPORT, CONN.
N4107.5—W7307.5/7.5

1960

10

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF CONNECTICUT
HIGHWAY DEPARTMENT

BRIDGEPORT QUADRANGLE
CONNECTICUT—FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

6366 IV SE (BOTSFORD)
6366 I SW (LONG HILL)
6366 SE (ANSONIA)
6366 III NE (WESTPORT)
6366 II NE (MILFORD)
6366 III SE (SHERWOOD POINT)

73°15′ 41°15′ 73°07′30″ 41°15′
12′30″ 10′
647000m E. 648 649 650 651 653 656 657000m E.
4567000m N. 4565 4564 4563 4562 4560 4559 4558 4557 4556 4555000m N.
490 000 FEET 470 000 FEET
150 000 FEET 110 000 FEET

UPPER STEPNEY 6 MI.
HUNTINGTON 3.4 MI.
DERBY 6 MI.
GEORGE WASHINGTON BRIDGE, N.Y. 53 MI.
0.5 MI. TO INTERCHANGE 48
0.5 MI. TO CONN. 15
2 MI. TO CONN. 15
NORWALK 9 MI.
1.1 MI. TO INTERCHANGE 21
STAMFORD 19 MI.
WESTPORT 16 MI.
1.2 MI. TO INTERCHANGE 53
HARTFORD 46 MI.
0.4 MI. TO CONN. 110
0.2 MI. TO INTERCHANGE 33
NEW HAVEN 13 MI.

EASTON
TRUMBULL
STRATFORD
FAIRFIELD
BRIDGEPORT
LONG ISLAND SOUND
BRIDGEPORT HARBOR

Canoe Brook Lake
Long Hill
Ehrsam Pond
Trumbull
Pequonnock River
Beaver Dam Lake
Pumpkin Ground Brook
Cranberry Brook
Twin Brooks Park
Nichols
Cooks Pond
Chestnut Hill
Ox Hill
Lake Forest
Fairchild Memorial Park
Second Hill
Success Hill
Success Lake
Nichols Farm Cem
Trop Pond
Unity Park
Unity Cem
Spring Pond
North End Park
Ninety Acres Park
Fairchild-Wheeler Park
Island Brook Lagoon
Burnells Pond
Chamberland Pond
Seeleys Pd
Stillman Pond
Lakeview Cem
Toilsome Hill
Stratfield
Tunxis Hill
Mount Grove Cemetery
Melville Village
Mill Hill
East Bridgeport
Newfield
Stratford
Academy Hill
Brewsters Pond
Frash Pond
Housatonic River
Great Meadows
Lewis Gut
Long Beach
Lordship
Point No Point
Black Rock Harbor
Grover Hill
Fayerweather Island
Jennings Beach
Fairfield Beach
Shoal Pt
Tidal Flat
Penfield Reef
Tongue Pt
Steel Pt
Cooks Pt
Pleasure Beach
Bridgeport Municipal Airport

Interchange 47 · 48 · 49 · 50 · 51 · 52 · 53 · 54 · 24 · 25 · 26 · 27 · 28 · 29 · 30 · 31 · 32 · 33

Merritt Parkway · Toll Road · Connecticut Turnpike · Penn Central · Railroad

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, USCE, and Connecticut Geodetic Survey

Topography by photogrammetric methods from aerial photographs taken 1949. Field checked 1951. Revised from aerial photographs taken 1969. Field checked 1970

Selected hydrographic data compiled from USC&GS Chart 220 (1969)
This information is not intended for navigational purposes

Polyconic projection. 1927 North American datum
10,000-foot grid based on Connecticut coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue

Red tint indicates areas in which only landmark buildings are shown

MN GN
12½° 222 MILS
1°12′ 21 MILS
UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 6.8 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

CONNECTICUT
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route · U. S. Route · State Route

BRIDGEPORT, CONN.
N4107.5—W7307.5/7.5

1970

AMS 6366 II NW—SERIES V816

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1972

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF CONNECTICUT
HIGHWAY DEPARTMENT

BRIDGEPORT QUADRANGLE
CONNECTICUT—FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

6366 IV SE (BOTSFORD)
6366 I SE (ANSONIA)
6366 I SW (LONG HILL)
6366 II NE (WESTPORT)
6366 II NW (SHERWOOD POINT)
6366 I NE (MILFORD)

73°15′ 41°15′ 73°07′30″ 41°15′
10′ 12′30″ 10′ 12′30″
647000m E. 648 650 651 653 656 490 000 FEET
4567000m N. 4565 4563 4562 4559 4558 4555 110 000 FEET 4554
150 000 FEET 4567 4564 4563 4560 4559 4558 4557 4556 4555000m N.
648 649 470 000 FEET 650 651 652 653 654 655 656 657000m E.

UPPER STEPNEY 6 MI.
HUNTINGTON 3.4 MI. DERBY 6 MI.
0.4 MI. TO INTERCHANGE 46
0.5 MI. TO CONN. 15
2 MI. TO CONN. 15
NORWALK 9 MI. 1 MI. TO INTERCHANGE 21
STAMFORD 19 MI. WESTPORT 6 MI.
1.2 MI. TO INTERCHANGE 53 HARTFORD 46 MI.
0.4 MI. TO CONN. 110
0.2 MI. TO INTERCHANGE 33 NEW HAVEN 13 MI.

EASTON
TRUMBULL
STRATFORD
FAIRFIELD
BRIDGEPORT
LONG ISLAND SOUND
BRIDGEPORT HARBOR

Canoe Brook Lake
Canoe Brk.
Long Hill
Long Hill Cem
Middlebrook Sch
Riverside Cem
Pequonnock
Ehrsam Pond
Beaver Dam Lake
Pumpkin Ground Brook
Cemetery Pond Brk.
Chestnut Hill
Water Tank
St Theresas Sch
Edison Sch
Brinsmade Cem
Center Sch
TWIN BROOKS PARK
St Catherines Ch
BM 289
Frog Pond
Nichols Farm Cem
Nichols
Cooks Pond
INTERCHANGE 50
INTERCHANGE 51
INTERCHANGE 52
INTERCHANGE 49
INTERCHANGE 48
INTERCHANGE 47
Unity Cem
Unity Park
Pequonnock River
Ox Hill
Ox Hill Brook
St Nicholas Ch
Notre Dame High Sch
Substation
Cross Sch
FAIRCHILD MEMORIAL PARK
Lake Forest
Johnson Sch
Fire Sta
Hallen Sch
Woodrow Wilson Sch
NINETY ACRES PARK
St Andrews Sch
Island Brook Lagoon
Sheridan Sch
Water Tank
FAIRCHILD WHEELER PARK
Londons Brk.
Dunigan Sch
Holy Trinity Ch
Notre Dame High Sch
Radio Tower (WNAB)
Fire Sta
Police Sta
Bunnells Pond
Success Lake
Success Hill
Stratford
Brewsters Pond
Garden Sch
Nichols Avenue Sch
Stonybrook Sch
Brook
East Side Sch
Hill Side Homes
Bollard-Haven Sch
Bethany Ch
High Sch
Union Cem
Tollgate
Stratfield
Stratfield Sch
Unquowa Sch
Our Lady of the Assumption Sch
Tollsome Hill
Salem Ch
Park
Fire Sta
Madison Sch
Blackham Sch
Read Sch
Park Cemetery
St Vincents Hospital
Svihra Park
St Pauls Ch
Beardsley Sch
Drive-in Theaters
Stillman Pond
Lakeview Cem
Old Mill Green
Edison Sch
Clover Field
Holy Name of Jesus Sch
Frank Franklin Sch
St Johns Ch
Center Sch
Melville Village
Warde High Sch
Jennings Sch
Fairfield Woods Sch
Brooklawn Country Club
Nathan Hale Sch
Central High Sch
Wetstone Sch
Columbus Sch
St Josephs Sch
Shelton Sch
Library
Fire Sta
Police Sta
Holy Rosary Sch
East Bridgeport
Library
St Augustine Cem
Barnum Sch
St Charles Sch
Garfield Sch
Fire Sta
Harding High Sch
St Amrose Sch
Bridgeport Hospital
Hall Sch
Mill Hill
East End Freight Yards
Bruce Pond
Second Hill
Second Hill Lane Sch
Our Lady of Grace Sch
Hooker Sch
Wooster Park
Wooster Jr High Sch
Eli Whitney Sch
Bunnell High Sch
St Marks Sch
North End Park
Spring Pond Park
Armory
St Johns Cem
St John the Baptist Ch
Beaver Dam Lake
Pumpkin Ground
Cemetery Pond
Brk.
Ranney Stream
Success Hill
Success Lake
Newfield
Library
Lincoln Sch
McKinley Sch
Blessed Sacrament Sch
Honeyspot Sch
Birdseye Sch
Johnson Jr High Sch
Sewage Disposal
Housatonic River
U.S. MIL RES Frash Pond
Cooks Pt
Steel Pt
Tongue Pt Lt
Light
Light
Light
Light
Fayerweather Island
Black Rock Harbor
Grover Hill
Jennings Beach
Fairfield
Veterans Park
Shoal Pt
Penfield Reef
Tidal Flat
Tidal Flat
Tidal Flat
Tidal Flat
Pleasure Beach
Great Meadows
Lewis Gut
Long Beach
Point No Point
Lordship
IGOR SIKORSKY MEMORIAL AIRPORT
Housatonic River
Academy Hill
Christ Ch
St James Sch
Selby Pond
Tunxis Hill
Tunxis Hill Park
Old Stratfield Cem
Loyalty Cem
Holy Family Sch
Holland Hill Sch
Fire Sta
MOUNT GROVE CEMETERY
Nathan Hale Sch
Clinton Park
Maplewood Jr High Sch
Maplewood Sch
St Peters Sch
Bryant Sch
Bassick High Sch
Howe Sch
Roosevelt Sch
Klein Memorial Auditorium
Federal Courthouse
Park City Hospital
St Anthonys Sch
Sacred Heart Sch
Playground
Library
Police Sta
City Hall
St Augustine Cathedral
St Michaels Sch
St Marys Sch
Franklin Sch
Waltersville Sch
St Michaels Cemetery
McKinley Sch
Lincoln Sch
Blessed Sacrament Sch
Newfield Sch
Marina
Convent
Jefferson Sch
UNIVERSITY OF BRIDGEPORT
Whittier Sch
St Stephens Sch
Longfellow Sch
Sewage Disposal
Police and Fire Sta
Library
Black Rock
St Anns Sch
Grasmere Sch
Heliport
Navy Reserve Center
Burr Creek
Cedar Creek
Ash Creek
Mill Creek
Rooster River
Pequonnock River
Yellow Mill Channel
Bunnells Pond
Success Lake
Stillman Pond
Bruce Pond
Brook
Marina
Mill Hill
Edison Sch
St Amrose Sch
Harding High Sch
Bridgeport Hospital
Hall Sch
Police Sta
Fire Sta
Garfield Sch
St Charles Sch
Fire Sta
Putnam
Arctic
Park
Barnum Sch
Holy Rosary Sch
Koltbe High Sch
Wetstone Sch
Columbus Sch
St Josephs Sch
Fire Sta
Police Sta
City Hall
St Augustine Cathedral
Wheeler Sch
Maplewood Jr High Sch
Maplewood Sch
Fire Sta
Clinton Park
Old Stratfield Cem
Tunxis Hill Park
Loyalty Cem
Holy Family Sch
Holland Hill Sch
Fire Sta
MOUNT GROVE CEMETERY
Nathan Hale Sch
St Peters Sch
Bryant Sch
Bassick High Sch
Howe Sch
Roosevelt Sch
Park City Hospital
St Anthonys Sch
Sacred Heart Sch
Playground
Library
Federal Courthouse
Klein Memorial Auditorium
Cem
Fire Sta
Maplewood Sch

APPENDIX D
Hazardous Materials Documentation

Phase I Environmental Site Assessment Update for the RBD Pilot Project

PHASE I ENVIRONMENTAL SITE ASSESSMENT UPDATE

RBD PILOT AREA

CONNECTICUT DEPARTMENT OF HOUSING/BRIDGEPORT, CT

DRAFT

PROJECT NO.: 52829NDR
DATE: DECEMBER 2018

WSP USA
4 RESEARCH DRIVE, SUITE 204
SHELTON, CT 06484

PHONE: +1 (203) 929-8555
FAX: +1 (203) 926-9140
wsp.com

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FIGURES

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I Tax Cards and Tax Maps (Available Upon Request)
II Historical Resources (Available Upon Request)
III Previous Environmental Reports
IV Database Report (Available Upon Request)
V Site Photographs
VI Qualifications of Environmental Professionals

1.0 SUMMARY

WSP USA (WSP) completed a Phase I Environmental Site Assessment (ESA) Update for the property identified as the Rebuild by Design (RBD) Pilot Area in Bridgeport, Connecticut (the "Site"). This Phase I ESA was conducted in general conformance with the American Society for Testing Materials (ASTM) Standard E 1527-13. The purpose of this Phase I ESA update was to investigate and identify land uses that may have the potential to impact the environmental conditions at the Site.

The Site consists of approximately 4.44 acres of land. Approximately 3.29 acres of the Site is part of the western parcel, known as Block 1 of the Marina Village Housing Complex. The southern portions of four, two-story brick apartment buildings extend onto the Site. Adjacent areas to the northeast and south, also within the complex and part of the Site are vacant. The vacant areas are an active construction site, as former Marina Village Housing Complex apartment buildings have been recently demolished. The remaining 1.15 acres of the Site include portions of adjacent concrete sidewalks and paved roadways along South Street, Iranistan Avenue, Ridge Avenue, Columbia Street and Johnson Street. Currently, the four Site apartment buildings appear to be occupied by tenants. The Site buildings are heated by natural gas and serviced by municipal sewer services.

The Site is located in an area identified by the Connecticut Department of Energy and Environmental Protection (CTDEEP) as Class "GB", indicating that the groundwater is presumed to be unsuitable for direct human consumption without pretreatment. Public water service is available at the Site and surrounding properties. Based on topography at the Site and surrounding area, groundwater flow is presumed to flow to the west. Previous environmental reports inferred groundwater flow in a westerly direction. Observed groundwater from monitoring wells installed in the vicinity of the Site were reported at depths of approximately 8 and 9 ft bg (feet below grade).

Historical resources indicate the Site, aside from the roadway portions which appear to have remained constant, was originally occupied by several residential dwellings prior to the construction of the Marina Village Housing Complex in the late-1940s to 1950. However, early Sanborn Fire Insurance Maps indicate a thin strip of the Site, the approximate northern perimeter parallel to Ridge Avenue, may have been occupied by buildings associated with former foundry operations of the Bridgeport Malleable Iron Works/Eastern Malleable Iron Company. Site operations associated with the metal foundry reportedly included the manufacturing of malleable and grey iron castings. Additionally, coal was utilized to fuel the foundry operations which were listed as annealing, trimming, core making, tumbling and molding. As such, historical material use likely involved use of coal, metals, oils and solvents.

Previous environmental investigations have been completed for the entire Marina Village Housing Complex in preparation for redevelopment of the neighborhood. Results of these investigations identified recognized environmental concerns (RECs) across the complex, generally as result of historical manufacturing and industrial operations conducted by Bridgeport Malleable Iron Works/Eastern Malleable Iron Works, Hotchkiss Sons Manufacturers Curry Combs & Company and Reliable Steel Drum Corporation, as well as tanks associated with former Site heating systems and a #2 fuel oil release at the complex. A total of nine RECs were identified as follows: 1) historical foundry operations; 2) historical metal pickling operations; 3) historical manufacturing operations; 4) historical japanning operations; 5) historical steel drum reconditioning; 6) historical coal storage; 7) historical urban fill; 8) #2 fuel oil release; and 9) underground storage tanks.

Two previous subsurface investigations completed across the entire housing complex, and included the advancement of 20 soil borings, the installation of 7 monitoring wells, and the sampling and collection of 20 soil samples and 7 groundwater samples. Two monitoring wells and one soil boring were completed near the Site boundary, however, without a survey of the area, it appears that only one monitoring well maybe located within the RBD Pilot Area. Urban fill materials and elevated concentrations of polyaromatic hydrocarbons (PAHs) and select total and leachable metals were detected in the nearby soil samples. Elevated PAHs and select metals were also

identified in the two nearby groundwater samples above CTDEEP Remediation Standard Regulation (RSR) groundwater criteria. Remedial efforts completed in 2016 by Freeman Companies included the excavation, removal and offsite transport and disposal of over 4,235 tons of impacted soils on Block 2/eastern parcel of the Marina Village Housing Complex. Impacted soils included elevated concentrations of PAHs, extractable total petroleum hydrocarbons (ETPH), arsenic and polychlorinated biphenyls (PCBs) above CTDEEP RSR soil criteria. The remedial excavation was complete offsite to the northeast of the Site.

The Site appears to be identified in researched environmental databases, including the Voluntary Cleanup Program, and Asbestos and National Pollutant Discharge Elimination Database as a result of recent redevelopment and construction activities at the Site. Several area properties were identified on the ASTM database, which could have an impact on the environmental quality of the Site; however, most were located in an area where a potential offsite release would not be expected to have a significant impact on the Site. One possible exception is 401 Park Avenue, located approximately 487 feet east/northeast of the Site. This Site was identified on the Connecticut Leaking Underground Storage Tank database with releases of motor fuel, gasoline and waste oil from an underground storage tank. The LUST status is listed as complete and the database indicates soil was excavated and monitoring wells were sampled however additional details were not provided.

Previous environmental investigations completed for the Marina Village Housing Complex indicated a release of #2 fuel oil was reported in December 1999 in the basement of Community Building located adjacent to the north of the Site. Eighteen (18) inches of #2 fuel oil (estimated as 4,500-gallons) was observed covering the 400-square foot basement floor. Two days later when the spill was reported, only 4 inches of oil covered the basement floor. The release was attributed to the boiler room associated tanks for the complex. No additional documentation of any cleanup, tank removals or remediation has been located, and based on its proximity to the Site, it may have impacted the environmental quality of the Site.

Section 22a-134 of the Connecticut General Statutes (CGS), known as the Connecticut Transfer Act, requires environmental investigation and potentially remediation of hazardous waste "establishments" after a qualifying "transfer of establishment". Based on the information obtained in the course of this investigation, the RBD Pilot Area does not appear to qualify as an "establishment" based upon its use as a dry cleaner, furniture stripper or vehicle body repair facility. Additionally, no documentation of any hazardous wastes was located for the Site.

This assessment has revealed evidence of recognized environmental condition (RECs) in connection with the Site as follows:

1. Historic Urban Fill: Previous subsurface investigations of the Marina Village Housing Complex have identified urban fill containing asphalt, concrete, red brick, coal, ash, etc. from previous industrial and manufacturing site operations including the demolition of associated former factory structures. These materials were observed in shallow soils up to approximately 12 ft bg in areas investigated across the Marina Village Housing Complex and were identified in soil samples collected on or directly adjacent to the Site. Laboratory results of the urban fill materials identified elevated concentrations including PAHs and select total and leachable metals above CTDEEP RSR soil criteria. Similarly, these constituents of concern were also detected in groundwater samples collected from monitoring wells installed across the complex.
2. Several residential dwellings were formerly located along the north side of Ridge Avenue at the Site prior to the construction of the Marina Village Housing Complex. Based on the age of these structures, it is likely potential fuel oil USTs associated with former heating systems of the residences were utilized and may still be in place.

3. Previous investigations of the Site vicinity identified a spill report for a #2 fuel oil release within the basement of the Marina Village Housing Complex Community building which is located adjacent to the north of the Site. On December 7, 1999 18 inches of #2 fuel oil was observed covering the 400-square foot basement and estimated to be a 4,500-gallon spill. However, the release was reported on December 9, 1999, and at that time only 4 inches of oil remained on the floor. The spill status is reported as closed, however no additional information was located in the file search. Based on the quantity and proximity of the release, it may have impacted the soil and groundwater at the Site.

Without a survey of the Site boundaries previous soil boring/monitoring well locations, and approximate boundaries of former industrial/manufacturing occupants, it is unclear if site operations associated with former industrial processes with Bridgeport Malleable Iron Works/Eastern Malleable Iron Works were conducted at the RBD Pilot Area. Regardless, site operations including a historic foundry and metal pickling operations are also considered RECs for the Site based on the long history of site usage and the proximity to the Site. These former operations involved the use of petroleum products/oils, solvents, heavy metals and hazardous materials from the metal foundry, manufacturing and metal pickling operations, including coal ash, other foundry by-products.

2.0 INTRODUCTION

WSP USA (WSP) has completed a Phase I Environmental Site Assessment (ESA) for the property identified as the Rebuild by Design (RBD) Pilot Area in Bridgeport, Connecticut. This Phase I ESA was conducted in general conformance with the American Society for Testing Materials (ASTM) Standard E 1527, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment".

2.1 Purpose

Connecticut Department of Housing requested that WSP conduct a Phase I ESA update to evaluate the current environmental condition of the Site. The purpose of this Phase I ESA update was to investigate and identify current and past uses of the Site and the practices that may have led to situations referred to as recognized environmental conditions (REC). REC means the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater or surface water of the property. The term is not intended to include de minimis conditions that generally do not represent a material risk of harm and that generally would not be the subject of an enforcement action. Historical recognized environmental conditions (HREC), a term defined as closed releases that have been cleaned up to the satisfaction of the applicable regulatory authority or an unrestricted use criteria and controlled recognized environmental conditions (CREC) defined as a closed release that has been cleaned up but not to unrestricted use criteria such as industrial or commercial standards. Finally, significant data gaps are identified and commented upon when they affect the ability of the environmental professional to identify RECs.

2.2 Scope-of-Services

The scope of work included: a Site inspection, identification of the current land uses on the Site and adjacent properties, a search of federal and state regulatory databases, a review of aerial photographs, city directories, and Sanborn fire insurance maps; and inquiries of persons knowledgeable of the property and local agencies, including the Fire Marshal and Health Department. Future land uses or situations on either the Site or adjacent properties are outside the scope of work.

2.3 Significant Assumption

Based on topography of the Site and surrounding area, it is assumed the groundwater flow for the Site is generally to the west. Additionally, information provided by others is assumed to be fair and accurate.

2.4 User Reliance

This Phase I ESA update was conducted for the use and reliance by the Connecticut Department of Housing. No use of the information contained in this report by others is permissible without receiving prior written authorization to do so from WSP.

3.0 SITE DESCRIPTION

3.1 Location and Legal Description

The Site generally consists of the southern portion of the 400 Iranistan Avenue parcel (the western parcel or Block 1 of the Marina Village Housing Complex) and adjacent sections of South Street, Iranistan Avenue, Columbia and Johnson Streets in Bridgeport, Connecticut (Figure 1). In total, the Site consists of approximately 4.4 acres of land of which 3.29-acres are within the 400 Iranistan Avenue parcel. The remaining approximate 1.15 acres consist of adjacent paved sections of the abovementioned roadways. The portion of the Site that lies within the 400 Iranistan Avenue parcel is listed on the Bridgeport Tax Assessor's property records as Map 21, Block 401, Lot 1. The remainder of the Site consists of portions of city streets and avenues which are not included in tax assessor property records. A copy of an online map that include the Site and the property tax cards for the Site, including the entire Block 1 of the Marina Village Housing Complex are attached as Appendix I.

3.2 Current Use of Property

The Site consists of approximately 4.4-acres of land, which is currently occupied by the southern portions of four residential apartment buildings totaling approximately 21,492 square feet. A summary of the Site parcel information is presented in the following table.

Address	Description	Construction Date
400 Iranistan Avenue	Bldg 18 (5,508 square foot 2-story building)	1950
	Bldg 19 (5,238 square foot 2-story building)	1950
	Bldg 20 (5,238 square foot 2-story building)	1950
	Bldg 21 (5,508 square foot 2-story building)	1950

The Site buildings are residential. The western portion/Block 1 of the Marina Village Housing Complex formerly consisted of 26 apartment buildings and 1 community building/boiler room. Since 2016, 10 of the apartment buildings have been demolished (#22 to 31) and the majority of these former building footprints appear to be within the boundaries of the Site RBD Pilot Area. A Site Map depicting the relative locations of pertinent Site features is presented as Figure 2.

3.3 Site Vicinity General Characteristics

The Site is zoned R-C indicating a multi-family residential zone. The general vicinity of the Site is developed with residential uses or vacant land that was previously occupied by residential buildings. The Site area is served by public water and sewer services.

3.4 Description of Structures, Roads & Other Improvements on the Site

The Site buildings consist of two-story brick buildings reportedly constructed with crawl space basements. The areas surrounding the buildings are grassed/landscaped areas with concrete sidewalks. Vacant land, which is an active construction site, is located adjacent to the south and northeast of the Site buildings. This portion of the property is surrounded by chain-link fencing with locked gates. Former Marina Village Housing Complex residential apartment buildings have been demolished and the ground cover consists of soil and rubble piles. The remaining portions of the Site include concrete sidewalks along the adjacent streets and/or portions of paved roads including South Street, Iranistan Avenue, Ridge Avenue, Columbia Street and Johnson Street.

3.5 Current Uses of the Adjoining Properties

The Site abuts by the additional Marina Village Housing Complex apartment buildings to the north with South Avenue beyond; by residential properties to the east; by Ridge Avenue to the south with residential properties beyond and by residential properties to the west.

4.0 USER PROVIDED INFORMATION

WSP requested information from Connecticut Department of Housing, the User, including items identified within the User Questionnaire as specified in ASTM E1527-13. Information provided by the User is included in the section below.

4.1 Title Records

Chain of Title research documents were not provided.

4.2 Environmental Liens or Activity and Use Limitations

Information identifying the presence of environmental liens or activity and use limitations was not provided. We note that limited title research completed at the Bridgeport Town Clerk's office did not identify any evidence of environmental liens or activity and use limitations (Section 5.2.1). Furthermore, such instruments were not identified within the environmental database research (Section 5.4) or by regulatory agency file reviews (Section 5.5).

4.3 Specialized Knowledge

Connecticut Department of Housing does not have any specialized knowledge or experience related to the property or nearby properties.

4.4 Commonly Known or Reasonably Ascertainable Information

Connecticut Department of Housing was not aware of any commonly known or reasonably ascertainable information, which would assist the environmental professional in identifying conditions indicative of a release or threatened release of hazardous or toxic substances except as presented in previous environmental reports (Section 5.3).

4.5 Valuation Reduction for Environmental Issues

Connecticut Department of Housing did not provide information that would indicate that the property value was reduced for environmental issues.

4.6 Reason for Phase I ESA

This Phase I ESA update was completed to determine current or past uses may have impaired soil and/or groundwater on the Site.

5.0 RECORDS REVIEW

5.1 Physical Setting Sources

5.1.1 Regional Physiology

The Site is located on the U.S. Geological Survey (USGS), Bridgeport, Connecticut topographical quadrangle. Topography at the Site generally slopes down to the south and southwest from an approximate elevation of 15 feet above mean sea level (ft amsl) along Johnson Avenue to approximately 6 ft amsl at the northern corner of Iranistan and Ridge Avenues. Locally, the area topography is similar to the Site topography and slopes gently to the southwest.

5.1.2 Geologic Conditions

The surficial geology at the Site is mapped on the Surficial Material Map of Connecticut (1992) as two units. The majority of the Site is mapped as sands overlying finer materials. A small portion of the western end of the Site is mapped as artificial fill which indicates the area was filled with material from an unknown source. Previous subsurface investigations completed in the vicinity of the Site encountered fill materials (including concrete, brick and ash) over sand and silty soils. Fill materials were noted in soils located between the Site and South Avenue to the north at depths ranging up to 6 ft with deeper fill materials, including an old building foundation in the vicinity of the Marina Village Community building.

The Bedrock Geologic Map of Connecticut (1985) does not provide a determination of the bedrock underlying the Site. Surrounding bedrock types are metamorphic in nature.

5.1.3 Hydrologic Characteristics and Known Uses

The Site is located in an area identified by the Connecticut Department of Energy and Environmental Protection (CTDEEP) as Class "GB" indicating that the groundwater is presumed to be unsuitable for direct human consumption without pretreatment. Based on the topography at the Site and surrounding area, groundwater flow is presumed to flow to the west. Groundwater was observed in the vicinity of the Site in previous investigations at depths approximately 8 to 9 ft bg.

The closest water body is the Cedar Creek, which is located approximately 350 feet west of the Site. The water body is mapped as Class SC/SB (CTDEEP, 2006). This designation indicates that it is known or presumed to not meet the water quality criteria for one or more of the designated uses, which may include habitat for marine fish, other aquatic lift and wildlife; commercial shellfish harvesting; recreation; industrial water supply and navigation.

The State of Connecticut Department of Public Health (DPH) GIS mapping does not identify any regulated public water supply sources, reservoirs or watershed areas within one-half mile radius of the Site. The DPH mapping indicates that public water service is available to the Site and surrounding area by the Aquarion Water Company.

The CTDEEP Aquifer Protection Program web-based mapping does not identify aquifer protection areas in Bridgeport.

5.2 HISTORICAL USE INFORMATION

5.2.1 Aerial Photographs

WSP reviewed aerial photographs of the Site at online resources for the years 1934, 1951, 1965, 1970, 1985, 1996 and 2004. The following is a summary of the aerial photographs.

The 1934 aerial photograph is difficult to distinguish however several small structures appear visible adjacent to the north of Ridge Avenue. Larger rectangular buildings are depicted to the north of the Site. The 1951 and subsequent photographs illustrate the Site parcel and areas beyond as developed with the Marina Village Housing Complex. Adjacent roadways including South Street, Iranistan and Ridge Avenues, Columbia and Johnson Streets appear similar as they do today.

5.2.2 City Directories

WSP reviewed City Directories at the State Library in Hartford, Connecticut to supplement our understanding of historical Site occupancy. Bridgeport Directories were reviewed as approximately 10-year intervals for the available years spanning 1961 through 2018. WSP reviewed addresses for the Marina Village Housing Complex which were listed on Iranistan Avenue, Ridge Avenue, Columbia and Johnson Streets. Residential listings were identified for the occupied apartments located at the Site. A copy of the reviewed city directories are included in Appendix II.

5.2.3 Historical Topographic Maps

WSP reviewed historical topographic maps for the years 1951, 1960, 1970 and 1984 on on-line resources. Each of the reviewed topographic maps illustrate the Site and vicinity as shaded pink indicating a heavy developed area with only landmarks shown. Interstate 95 is illustrated to the north and the University of Bridgeport is shown to the southeast of the Site.

5.2.4 Sanborn Fire Insurance Maps

Sanborn Fire Insurance Maps included coverage for the Site vicinity for the years 1884, 1889, 1898, 1913, 1939, 1950 and 1972. The 1884 Sanborn map did not provide coverage for the Site, however areas to the west along South Avenue were illustrated with several buildings associated with Hotchkiss Sons Mfrs. Curry Combs & Co. and Bridgeport Malleable Iron Works. By the 1889 Sanborn, Bridgeport Malleable Iron Works appears to have expanded to the southeast, and beyond several residential dwellings are depicted at the northwest corner of Columbia Street and Ridge Avenue. The 1898 Sanborn appears similar to the 1889 Sanborn with additional building development at Bridgeport Malleable. Additional residential dwellings are visible to the southwest corner of Columbia Street and Ridge Avenue intersection. By the 1913 Sanborn residential dwellings are depicted to the north of Ridge Avenue between Iranistan Avenue and Columbia Street and north of Johnson Street at the eastern

end of the Site. Additionally, the Sanborn map appears to show Johnson Street, Columbia Street, Ridge Avenue, Iranistan Avenue and South Avenue in similar configurations as they are today. By the 1939 Sanborn, residential dwellings are shown at the northwest corner of Ridge Avenue and Columbia Street to approximately halfway down Ridge Avenue. Residential dwellings are also shown along the north side of Johnson Avenue. Areas west and north of the Site appear vacant as the former industrial buildings have been razed. The 1950 and 1972 Sanborn map illustrate a total of 27 buildings at the western, Block 1 parcel of the Marina Village Housing Complex. Twenty-six (26) of the buildings are two-story brick apartment buildings and one building is labeled as Community Hall with an associated boiler room and office.

5.2.5 Municipal Sources

The City of Bridgeport's Assessor records indicate the Site buildings were constructed in 1950.

5.3 Previous Environmental Investigations

WSP was provided with several previous environmental reports that were prepared for the Marina Village Housing Complex. These reports included the following:

1. September 2013 Phase I Environmental Assessment of Marina Village, 400 Iranistan Avenue in Bridgeport, Connecticut by Fuss & O'Neill (p. 13)
2. May 2015 Environmental Evaluation and Materials Management Report, Marina Village Housing Complex, Bridgeport, Connecticut by Freeman Companies, LLC. (p. 766)
3. June 2016 Environmental Evaluation and Materials Management Report, Marina Village Housing Complex, Bridgeport, Connecticut by Freeman Companies, LLC. (p. 945)
4. August 2016 Close-Out Report, Marina Village Redevelopment – Phase I, Bridgeport, Connecticut by Freeman Companies, LLC (p. 1062)
5. November 7, 2016 Phase I Environmental Site Assessment Update of Marina Village Housing Complex in Bridgeport, Connecticut by Freeman Companies, LLC.

Copies of these reports are included electronically on the flash drive included as Appendix III. Details from these reports are distributed throughout this report and a summary of the key findings of the various investigations follows.

Fuss & O'Neill 2013 Phase I ESA

Fuss & O'Neill (F & O) completed a Phase I ESA for the Marina Village Housing Complex which consists of thirty-nine buildings, a 389 unit apartment complex with a community/maintenance building with a former heating plant. The complex includes two parcels bound by Iranistan Avenue to the west, South Avenue to the northwest, Railroad Avenue to the north, Park Avenue to the east, Johnson Street to the southeast and Ridge Avenue to the south. Columbia Street bisects the village complex. F&O indicates the buildings were constructed in the late-1940s to 1950. The Site buildings were reportedly heated by steam from a central boiler room located in the Community Building located at the north end of the western parcel along South Street. F&O indicated the switch

from steam to natural gas was sometime in the 1990s, likely around the time the oil tanks were removed from the Community Building basement in 1999. These oil tanks fueled a former oil-fired boiler system.

F&O indicated a leaking underground storage tank (LUST) was reported on December 9, 1999 at 733 South Avenue, the Marina Village Community building located along South Street at the northern end of the parcel (west of Columbia Street). A total of eighteen inches of #2 fuel oil from an underground tank failure covered the floor of a 400-square foot room on December 7, 1999. By December 9, 1999 four inches of oil covered the floor, however it was unclear as to where/why the thickness of oil had decreased, how many associated tanks were buried outside, and the quantities of these supposed tanks. F&O indicated the EDR report noted that the local fire department, fire marshal and CTDEEP (formerly the Connecticut Department of Environmental Protection (CTDEP)) were notified, however no other pertinent information was located. F&O concluded that the oil release was likely from an aboveground storage tank in the basement rather than underground storage tanks following their site inspection.

F&O did not identify any activities that would qualify the Marina Village parcel as an "establishment" however they recommended the use of legal counsel to determine the regulatory status with respect to the Connecticut Transfer Act. F&O identified nine RECs, including: 1) historical foundry operations; 2) historical metal pickling operations; 3) historical manufacturing operations; 4) historical japanning operations; 5) historical steel drum reconditioning; 6) historical coal storage; 7) historical urban fill; 8) #2 fuel oil release and 9) underground storage tanks.

Freeman Companies May 2015 Environmental Evaluation and Materials Management Report

Freeman Companies (Freeman) completed a subsurface investigation of the eastern parcel (east of Columbia Street), known as Block 2 of the Marina Village housing complex based on the long history of industrial activities and manufacturing operations at the property identified in the 2013 F&O Phase I ESA. Bridgeport Malleable Iron Works (a/k/a Eastern Malleable Iron Company) manufactured malleable and grey iron castings. This property is the northeastern abutting property. Site operations included annealing, trimming, core making, tumbling, grinding, rolling and molding. Additional former occupants included the Hotchkiss Sons' Manufacturers Curry Combs & Company which included japanning, tempering and scouring various metals and the former Reliable Steel Drum Corporation reconditioned steel drums.

Freeman completed a total of ten soil borings (B-1 to B-10) across the eastern parcel. These borings were advanced up to 20 feet below grade. Materials encountered included fill (containing concrete, brick, asphalt, glass, brick and unknown white and black materials) up to ten feet below grade over sandy and silty soils. Groundwater was measured from approximately 6 to 11 feet below grade. One soil sample from each boring was collected from a discrete two foot interval (ranging between 2 and 12 feet below grade) and analyzed for volatile organic compounds (VOCs) by EPA Method 8260, extractable total petroleum hydrocarbons by Connecticut methodologies (CT ETPH), polyaromatic hydrocarbons (PAHs) by EPA Method 8270, polychlorinated biphenyls (PCBs) by EPA Method 8082, Total CT listed metals and/or selected leachable CT metals using the synthetic precipitation leaching procedures (SPLP). Concentrations of PAHs and ETPH were reported above CTDEEP Remediation Standard Regulations (RSR) soil criteria in the fill materials detected in borings B5 and B7. Total arsenic was also detected in these two soil samples, and in boring B8, above CTDEEP RSR soil criteria. PCBs were detected in boring B7 above CTDEEP RSR soil criteria. Additional select total metals were detected in each of the soil samples, however none were above CTDEEP RSR soil criteria. These locations are generally centrally located at the northern end of the parcel.

Three monitoring wells were completed (MW-1 to MW-3) at Block 2 and groundwater samples were collected for analyses for VOCs, PAHs and CT listed total metals. Freeman indicated that VOCs were not detected in any of the wells above the CTDEEP RSR Residential Volatilization Criteria. Concentrations of PAHs were

identified in wells MW-2 and MW-3 above the Surface Water Protection Criteria (SWPC) and total metals were reported above the SWPC in wells MW-1 and MW-3.

Based on their investigation, Freeman identified three distinct soil types and included recommendations for soil management and remediation. In general, they concluded the contaminated soils detected from borings B5 and B7 should be excavated and transported offsite for proper disposal. Freeman recommended further analytical testing during future demolition activities to define, delineate and characterize site soils, and the report included an estimate of 2,000 to 5,000 tons of material that may need to be transported offsite for disposal.

Freeman Companies June 2016 Environmental Evaluation and Materials Management Report

Freeman completed a subsurface investigation of the western parcel (a/k/a Block 1) of the Marina Village Housing Complex that included the advancement of ten soil borings, completion of four groundwater monitoring wells and the sampling and collection of ten soil and four groundwater samples. The soil borings and wells were installed to the north/northwest of the Site (Figure 2). Select soil samples were analyzed for VOCs, ETPH, PAHs, PCBs and total and leachable RSR listed metals whereas groundwater samples were analyzed for VOCs, PAHs and total RSR listed metals. Soils encountered included "urban fill" which contained asphalt, concrete, red brick, coal and ash over sand and silty soils. One soil sample from each of the ten locations was collected from depths ranging from 2 to 8 feet below grade. Laboratory results identified PAHs and ETPH at concentrations above CTDEEP RSR soil criteria in borings SB-1 and SB-4. PAHs were also reported above CTDEEP RSR soil criteria in soil from boring MW-2. These three soil samples were collected from the northern portion of the parcel, in the vicinity of the South Avenue and Columbia Street intersection. Other detections including naphthalene and select total and leachable metals were detected in other soil samples at the parcel, however reported below CTDEEP RSR soil criteria. VOCs were not detected above CTDEEP RSR groundwater criteria in the groundwater samples collected from the four site wells. PAHs and select total metals were identified above the SWPC in wells MW-3 and MW-4; select total metals were also reported above the SWPC in well MW-1.

Freeman Companies Close-Out Report August 2016

Based on the May 2015 subsurface investigation of the eastern parcel of the Marina Village Housing Complex, also known as Block 2, Freeman monitored the excavation, removal and offsite disposal of contaminated soil and fill materials. Freeman indicated three types of soil/fill materials were removed from the parcel including ash filled areas, demolition debris and soils impacted with PAHs and PCBs. In total, approximately 4,235 tons of material was excavated, removed and transported offsite to the Chicopee Landfill in Chicopee, Massachusetts (~732 tons) and the Coventry Landfill in Coventry Rhode Island (~3,503 tons) for reuse. The remedial excavation is generally located across the central portion of the eastern parcel.

The impacted materials were reportedly the result of historical site operations from the Eastern Malleable Iron Company which included fill materials and ash. Freeman reported these materials were removed to depths of native sand encountered below. Freeman indicated closure soil samples were collected from the bottom of the remedial excavation areas for analyses of PAHs. PAHs were not detected in the analyzed closure samples.

Lastly, Freeman described reusing the urban fill materials as part of the redevelopment. Freeman indicated urban fill material that contains soil demolition debris, asphalt, brick, concrete, glass, ceramics, wood ash, coal and or coal ash with typical low level concentrations of PAHs and metals will be reused under new building foundations, below 2 feet of clean fill or below paved parking areas with three-inches of asphalt.

Freeman Companies November 2016 Phase I ESA

Freeman Companies (Freeman) completed a Phase I ESA update (of the 2013 F&O Phase I) for the entire Marina Village Housing Complex. Freeman indicated the Site is located at 400 Iranistan Avenue in Bridgeport, Connecticut and includes two adjacent parcels of land that total 15.9 acres. The Site is bound to the north by South Street and Railroad Avenue, Park Street to the east, Johnson Street and Ridge Avenue to the south and Iranistan Avenue to the west. Columbia Street is located between the two Site lots. Freeman indicated the Site has a long history of industrial and manufacturing operations prior to the construction of the Marina Village in the late-1940s. Nine RECs, the same identified in the 2013 F&O Phase I ESA were listed and include: 1) historical foundry operations; 2) historical metal pickling operations; 3) historical manufacturing operations; 4) historical japanning operations; 5) historical steel drum reconditioning; 6) historical coal storage; 7) historical urban fill; 8) #2 fuel oil release; and 9) underground storage tanks.

This 2016 ESA update also summarized the previous 2015 and 2016 Freeman investigations and remedial efforts conducted at the Site.

5.4 Standard Environmental Record Sources

Federal, state and tribal environmental databases were reviewed for the Site in an effort to determine the regulatory status of the Site and to establish the location of surrounding properties with environmental records. A search of U.S. Environmental Protection Agency (U.S. EPA) and Connecticut Department of Energy and Environmental Protection (CTDEEP) databases was completed by an independent firm, Environmental Data Resources Inc. (EDR).

Based on the topography of the area and the inferred groundwater flow direction, releases within approximately 500 feet to the east of the Site were considered to have the potential to impact the environmental condition of the Site. The facilities identified by the EDR database search were evaluated to determine if they are within this potential area of concern. Search Radii, Geographic Information Systems (GIS) maps of the appropriate databases, and a copy of the database report are included in Appendix IV.

5.4.1 Federal Environmental Record Sources

Information from ASTM E 1527-13 specified Federal databases for the Site area as provided by EDR was reviewed by WSP. The databases reviewed, and the approximate search distances used are presented in the table below.

Federal Database	Radius Searched
National Priorities List (NPL), Proposed NPL and Delisted NPL database.	1 mile
Federal Superfund Liens (NPL LIENS)	Target Property (TP)
Federal Facility Site Information Listing (FEDERAL FACILITY)	1 mile
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and CERCLIS - No Further Remedial Action Planned (CERCLIS-NFRAP) database of potentially hazardous waste sites.	0.5-mile
Resource Conservation and Recovery Act Hazardous Waste Treatment, Storage or Disposal Facility (RCRA-TSD).	0.5-mile
Corrective Action Reports (CORRACTS) for Hazardous Waste handlers.	1 mile
RCRA Large, Small and Conditionally Exempt Small Quantity Generators (RCRA-LQG, RCRA-SQG & RCRA-CESQG) of Hazardous Waste	0.25-mile
Federal Institutional Control/Engineering Control Registries (US ENG CONTROLS & US INST CONTROL)	0.5-mile
Federal Emergency Response Notification System list (ERNS)	TP
Facility Index System/Facility Registry System (FINDS)	TP

The Site was not identified in the Federal environmental databases.

Several properties within the ASTM search distances were listed in federal agency databases facilities within the EDR report; however, none were located in an area where a potential off-site release would be expected to have a significant impact on the environmental condition of the Site.

5.4.2 State and Tribal Environmental Record Sources

Information from ASTM E 1527-13 specified State and Tribal databases for the Site area as provided by EDR was reviewed by WSP. The databases reviewed, and the approximate search distances used are presented in the table below.

State Database	Radius Searched
State Hazardous Waste Sites (SHWS) database of hazardous waste disposal sites.	1 mile
Site Discovery and Assessment Database (SDADB) database of facilities suspected of hazardous waste disposal.	0.5-mile
State Solid Waste Facility/Landfills (SWF/LF) database of solid waste disposal facilities, landfills and transfer stations.	0.5-mile
State Leaking Underground Storage Tank (LUST) and Leaking Underground Storage Tanks on Indian Land (INDIAN LUST) databases.	0.5-mile

State Database	Radius Searched
Connecticut Leachate and Wastewater Discharge Sites (LWDS) includes discharges, waste disposal sites and spills historically mapped by the Connecticut Department of Environmental Protection.	1 mile
State Registered Underground Storage Tanks (USTs)	0.25-mile
State Registered Aboveground Storage Tank (AST) database of bulk petroleum facilities that receive petroleum by marine vessels. Underground Storage Tanks on Indian Land (INDIAN UST) and Underground Storage Tank Listing (FEMA UST).	0.25-mile
ELUR Sites (AUL) database of state and tribal institutional control and engineering control registries.	0.5-mile
State Voluntary Cleanup Program Sites (VCP) and voluntary cleanup sites on Indian land (INDIAN VCP).	0.5-mile
Brownfield Sites	0.5-mile

The Site was listed in one of the State environmental databases. Bridgeport Community Renewal Associates LLP c/o JHM FIN of 400 Iranistan Avenue Bldg 28 was listed in the State Voluntary Cleanup Program Sites (VCP) database. The certifying party is listed as the Housing Authority of the City of Bridgeport and the database indicates the property entered the program in July 2018. No other pertinent information was provided.

Several properties within the ASTM search distances were listed in the State agency database facilities within the EDR report; however, most were located in an area where a potential off-site release would not be expected to have a significant impact on the Site. One possible exception includes the parcel listed as the White Property of 401 Park Avenue located approximately 487 feet east/northeast of the Site. The White Property is identified in the CT UST and LUST databases. A total of five former underground storage tanks (USTs) are associated with the property and include one 4,000-gallon tank, three 3,000-gallon tanks and one 550-gallon used oil tank. The contents of the larger USTs were not reported however all five tanks were listed as installed circa 1950 and permanently removed from the ground (dates not reported). The LUST database indicates an incident was reported on July 22, 2010. The database indicates release(s) include motor fuel, gasoline and waste oil. The LUST status is listed as complete and the database indicates soil was excavated and monitoring wells were sampled however additional details were not provided.

5.4.3 Additional Environmental Record Sources

The CTDEEP maintains a database of Hazardous Waste Manifests that have been returned to the State following the shipment of a hazardous waste. The database spans from 1984 through 2008 and 2012 through 2014 and reportedly includes hazardous waste disposal from registered U.S. EPA generators and waste shipped under temporary one-time identification numbers. The CTDEEP indicates that manifest data prior to 1984, between 2008 and 2012 and after 2014 are currently unavailable. No hazardous waste shipments were located for the Site in the file search.

The CTDEEP Oil & Chemical Spills (OCS) database includes releases which were reported to the CTDEEP between 1990 and the present. No spill files were located for the Site in the file search.

Additional database records were provided in the EDR report, presented in Appendix IV. WSP reviewed these non-ASTM scope databases for listings for the Site. The Site, listed as Bridgeport Community Renewal Associates LLP c/o JHM FIN located at 400 Iranistan Avenue, Bldg 28 was listed in the Asbestos and NPDES databases. The property was listed in the Asbestos database on August 18, 2016. The listing indicates asbestos was removed by October 19, 2016 by A. Vets Demo LLC and transported offsite by Red. No additional information was given. The National Pollutant Elimination System (NPDES) database identifies an active permit for the "portion of the former Marina Village development" was issued by the CTDEEP. The general permit for stormwater construction activities (#GSN003365) was issued on October 9, 2018 and expires on September 30, 2019.

5.5 Regulatory Agency File Review

The following sections summarize relevant information obtained from State and Municipal Regulatory Agency files.

5.5.1 City of Bridgeport Assessor's Office

WSP reviewed records at the City of Bridgeport Tax Assessor's Office. Relevant information is included in the appropriate sections of the report. The City of Bridgeport Assessor's cards are not currently up to date. Each of the property cards located for Block 1 of the Marina Village Housing Complex, which includes a portion of the Site are included in Appendix I. No property cards were identified for Buildings 5 and 29. Building 29 was located within the Site boundaries prior to its recent demolition. Additionally, some of the attached cards do not indicate former Site buildings have been demolished (Buildings 22 to 31). Copies of the Assessor's cards and a portion of an online map for the Site are included in Appendix I.

5.5.2 City of Bridgeport Building Department

The Bridgeport Building Department identified ten demolition permits for ten former apartment buildings located within or partially within the Site. These permits were dated between October 2016 and September 2018 for buildings along Ridge Avenue (former buildings 26 to 31) and the corner of Columbia Street and Ridge Avenue (former Buildings 22 to 25).

5.5.3 City of Bridgeport Fire Marshal

WSP requested copies of files for the Site from the City of Bridgeport Fire Marshal's office. A response has not yet been received from the Fire Marshal, however pertinent information will be sent as an addendum letter to this report.

5.5.4 City of Bridgeport Health Department

WSP requested copies of files for the Site from the City of Bridgeport Health Department office. A response has not yet been received from the Health Department, however pertinent information will be sent as an addendum letter to this report.

5.5.5 Connecticut Department of Energy and Environmental Protection (CTDEEP)

WSP reviewed available public files for the Site at the CTDEEP public file room. A request was made for files associated with the Site addresses with Remediation, Oil and Chemical Spills Reports, Oil and Chemical Spills Correspondences, Solid Waste, Hazardous Waste, Underground Storage Tanks, Tank Closure Report and Sub-Surface Disposal Permits. No files were located for the Site.

6.0 SITE RECONNAISSANCE

6.1 Methodology and Limiting Conditions

A drive-by Site inspection was completed by Melanie Sheperd of WSP in December 2018. The inspection was completed to obtain information regarding RECs and to evaluate potential environmental concerns on or adjacent to the Site. Interior inspections of the existing Site buildings were not completed. Photographs from the drive-by inspection are included in Appendix V.

6.2 Exterior Observations

The majority of the Site exterior consists of paved roadways (South Street, Iranistan and Ridge Avenues and Johnson and Columbia Streets) and a vacant construction site inaccessible within locked chain-link fencing located north of Ridge Avenue and west of Columbia Street. The remaining southern end of the Site is developed with four, two-story residential brick buildings, part of the remaining Marina Village Housing Complex. A southern portion of these buildings are located within the Site and the structures are known as buildings 21, 20, 19 and 18 (from east to west). Each of these buildings appear to have tenants. Grassed and landscaped areas and concrete sidewalks are located surrounding the apartment buildings.

6.3 Interior Observations

As stated earlier, the interior portions of the four residential apartment buildings that extend to the Site were not observed during the time of the Site inspection.

6.4 Hazardous Substances or Petroleum Products

Hazardous substances and petroleum products were not observed during the time of the drive-by inspection. However, track-mounted excavators were parked within chain-link fenced areas just northwest of Ridge Avenue. The diesel-fuel powered heavy machinery is associated with the recent demolition of the former Marina Village apartment buildings. Evidence of a significant release in the vicinity of the construction machinery was not noted; however, past investigations has identified constituents of concern (COCs) above CTDEEP RSR soil criteria on abutting properties.

6.5 Aboveground and Underground Storage Tanks

At least two excavators with diesel fuel tanks were located in the construction site portion of the Site during the time of the drive-by inspection. Evidence of a release from the machinery was not observed.

No documentation of any current or historic aboveground or underground storage tanks was located in the file review for the Site. Previous environmental reports indicated the Site buildings, including the other Marina Village Housing Complex buildings were heated by steam until natural gas was connected sometime in the 1990s.

F&O indicated oil tanks were removed from the Community building basement in 1999 and these tanks reportedly fueled the former boiler steam heating system. Also, as stated previously in Section 5.3, a release of #2 fuel oil was reported on December 7, 1999 that described 18-inches of oil covering the basement floor of the Community Building as a result from an underground tank failure. Local fire department, fire marshal and DEP were notified and two days later approximately 4-inches of #2 oil was reportedly covering the floor. No other documentation of this incident was identified by others or during our file research. The source of the #2 fuel oil, the amount released, the associated cleanup activities are all unknown. However, F&O concluded the oil release was likely from aboveground tank(s) in the basement rather than underground tank(s) following an inspection of the building exterior. It is noteworthy to mention the Community building is located offsite but adjacent to the north of the Site.

Based on the age of the Site buildings and the uncertainty of former heating system(s) of the Marina Village apartment buildings, it is possible that historic oil-fired systems with associated heating oil underground storage tanks (USTs) were utilized.

7.0 INTERVIEWS

WSP interviewed several employees of the City of Bridgeport for our Phase I ESA update. Our interviews were generally conducted to obtain knowledge of current and former Site operations, petroleum storage practices and usage, and usage and management of hazardous materials at the Site. Information gathered during interviews is generally incorporated throughout this report.

8.0 FINDINGS

The findings below are based on the work conducted as part of this assessment:

- The Site consists of a southern portion of the Block 1 parcel associated with the Marina Village Housing Complex and adjacent concrete sidewalks and sections of paved roadways along South Street, Iranistan Avenue, Ridge Avenue, Columbia and Johnson Streets. The Site, known as the RBD Pilot Area is encompasses approximately 4.44-acres. The paved roadway areas and adjacent sidewalks total approximately 1.15-acres and the remaining approximate 3.29-acres are part of the Marina Village Block 1 apartment complex. Southern ends of four Marina Village Housing Complex buildings (18-21) are located at the southern end of the Site. These buildings consist of two-story brick structures reportedly constructed on crawl space basement areas. Grassed/landscapes and concrete sidewalks are located surrounding the Site buildings. To the south and northeast of the Site buildings, the rest of the complex area is vacant and an active construction site as former apartment buildings have been recently demolished.
- The Site is located in an area identified by the CTDEEP as Class "GB", indicating that the groundwater is presumed to be unsuitable for direct human consumption without pretreatment. Public water service is available at the Site and surrounding properties. Based on topography at the Site and surrounding area, groundwater flow is presumed to flow to the west. Previous environmental investigations identified groundwater approximately 8 to 9 feet below grade at areas adjacent to the northwest of the Site.
- Historical resources indicate the Site, aside from the roadway portions which appear to have remained constant, was mainly occupied by residential dwellings prior to the construction of the Marina Village Housing Complex in the late-1940s to 1950. However, early Sanborn Fire Insurance Maps indicate a thin strip of the Site, the approximate northern perimeter of the Site parallel to Ridge Avenue may have been occupied by foundry buildings associated with Bridgeport Malleable Iron Works/Eastern Malleable Iron Company. Site operations associated with the metal foundry reportedly included the manufacturing of malleable and grey iron castings. Additionally, coal was utilized to fuel the foundry operations which were listed as annealing, trimming, core making, tumbling and molding. As such, material use historically involved extensive amounts of coal, metals, oils and solvents.
- Previous environmental investigations have been completed for the entire Marina Village Housing Complex in preparation for redevelopment of the neighborhood. Results of these investigations identified recognized environmental concerns (RECs) across the complex generally as result of historical manufacturing and industrial operations conducted by Bridgeport Malleable Iron Works/Eastern Malleable Iron Works, Hotchkiss Sons Manufacturers Curry Combs & Company and Reliable Steel Drum Corporation. These RECs were listed as 1.) historical foundry operations; 2.)

historical metal pickling operations; 3.) historical manufacturing operations; 4.) historical japanning operations; 5.) historical steel drum reconditioning; 6.) historical coal storage; 7.) historical urban fill; 8.) #2 fuel oil release and 9) underground storage tanks.

- Two previous subsurface investigations completed across the entire housing complex and included the advancement of twenty soil borings, the installation of seven monitoring wells and the sampling and collection of twenty soil samples and seven groundwater samples. Two monitoring wells and one soil boring were completed near the Site, however without a survey of the Site boundaries and these three locations, it is unclear if the subsurface investigation extended to the RBD Pilot Area. Urban fill material and elevated concentrations of PAHs and select total and leachable metals were detected in the nearby soil samples. Elevated PAHs and select metals were also identified in the two nearby groundwater samples above CTDEEP RSR soil criteria.
- The Site appears to be identified in researched environmental databases, including the Voluntary Cleanup Program, and Asbestos and National Pollutant Discharge Elimination Database as a result of recent redevelopment and construction activities at the Site.
- Previous environmental investigations completed for the Marina Village Housing Complex indicated a release of #2 fuel oil was reported in December 1999 at the Community Building basement. A total of eighteen inches of oil was noted in the basement, yet no additional documentation of any cleanup, tank removals or remediation has been located and based on its proximity to the Site; this release may have impacted the soil and groundwater of the Site.
- Several area properties were identified on the ASTM database, which could have an impact on the environmental quality of the Site; however, most were located in an area where a potential off-site release would not be expected to have a significant impact on the Site. One possible exception is 401 Park Avenue, located approximately 487 feet east/northeast of the Site. This Site was identified on the Connecticut Leaking Underground Storage Tank database with releases of motor fuel, gasoline and waste oil from an underground storage tank. The LUST status is listed as complete and the database indicates soil was excavated and monitoring wells were sampled however additional details were not provided.
- Eastern portions of the Site, within the Marina Village Housing Complex, is currently an active construction site and within locked chain-link fenced areas. Former apartment buildings were recently demolished (Buildings 22 to 31) and the ground surface conditions of these areas were observed as soil covered with piles of construction rubble and vegetation. Construction equipment, such as track-mounted excavators were stored in the construction site area of the property.
- The western portion of the Site, within the Marina Village apartment complex, generally consists of the southern end of four, two-story brick apartment buildings and surrounding grassed/landscaped areas with concrete sidewalks.

9.0 APPLICABILITY OF THE CONNECTICUT TRANSFER ACT

Section 22a-134 of the Connecticut General Statutes (CGS), known as the Connecticut Transfer Act, requires environmental investigation and potentially remediation of "establishments" after a qualifying "transfer of establishment". An "establishment" is defined as "any real property at which or any business operation from which (A) on or after November 19, 1980, there was generated, except as the result of remediation of polluted soil, groundwater or sediment, more than one hundred kilograms of hazardous waste in any one month, (B) hazardous waste generated at a different location was recycled, reclaimed, reused, stored, handled, treated, transported or disposed of, (C) the process of dry-cleaning was conducted on or after May 1, 1967, (D) furniture stripping was conducted on or after May 1, 1967, or (E) a vehicle body repair facility was located on or after May 1, 1967." Our research has not identified any uses that would automatically qualify the Site as an "establishment" under the Transfer Act based upon its use as a dry cleaner, furniture stripper or vehicle body repair facility. Additionally, no documentation of any hazardous wastes are located for the Site.

10.0 OPINIONS AND CONCLUSIONS

We have completed a Phase I ESA in conformance with the scope and limitations of ASTM Practice E1527-2013 for the property identified as the RBD Pilot Area in Bridgeport, Connecticut. This assessment has revealed evidence of recognized environmental conditions (RECs) in connection with the Site as follows:

1. Historic Urban Fill: Previous subsurface investigations of the Marina Village Housing Complex have identified urban fill containing asphalt, concrete, red brick, coal, ash, etc. from previous industrial and manufacturing site operations including the demolition of associated former factory structures. These materials were observed in shallow soils up to approximately 12 feet below grade in areas investigated across the Marina Village Housing Complex and likely extend to the Site. Laboratory results of such fill materials identified elevated concentrations including PAHs and select total and leachable metals above CTDEEP RSR soil criteria. Similarly, these constituents of concern were also detected in groundwater samples collected from monitoring wells installed across the complex.
2. Several residential dwellings were formerly located along the north side of Ridge Avenue at the Site prior to the construction of the Marina Village Housing Complex. Based on the age of these structures, it is likely potential fuel oil USTs associated with former heating systems of the residences were utilized and may still be in place.
3. Previous investigations of the Site vicinity identified a spill report for a #2 fuel oil release within the basement of the Marina Village Housing Complex Community building which is located adjacent to the north of the Site. On December 7, 1999 eighteen-inches of #2 fuel oil was observed covering the 400-square foot basement and estimated to be a 4,500-gallon spill. However, the release was reported on December 9, 1999 and at that time only four inches of oil remained on the floor. The spill status of the reported is closed however no additional information was located in the file search. Based on the quantity and proximity of the release, it may have impacted the soil and groundwater at the Site.

As noted earlier, without a survey of the Site boundaries, previous soil boring/monitoring well locations and approximate boundaries of former industrial/manufacturing occupants, it is unclear if site operations associated with former industrial processes with Bridgeport Malleable Iron Works/Eastern Malleable Iron Works were conducted at the RBD Pilot Area. Regardless, site operations including a historic foundry and metal pickling operations are also considered RECs for the Site based on the long history of site usage and the proximity to the Site. These former operations involved the use of petroleum products/oils, solvents, heavy metals and hazardous materials from the metal foundry, manufacturing and metal pickling operations including coal ash, other foundry by-products.

11.0 DEVIATIONS/DATA GAPS

Data gaps identified by the ASTM standard include:

- Chain of Title documentation for the Site was not provided. A limited review of property deeds filed at the Bridgeport Clerk's office was performed and evidence of an environmental related deed encumbrance was not noted. Further, the EDR research included a search of State and Federal environmental deed restriction databases and none were identified for the Site.
- Significant portions of the Site were not accessible at the time of our inspection as a result of gated chain-link fencing (construction site). We note that interior inspections of the Site buildings were not completed. Our investigation included drive-by inspections of the Site. Previous investigations of the Site did involve more comprehensive inspections.

It is our opinion that the identified data gaps are not significant. However, it is our understanding that portions of the Superfund protection offered by the All Appropriate Inquiry Phase I Environmental Site Assessment process may not be afforded the User in the event that resolution of these data gap would have resulted in the identification of significant environmental issues at the Site.

12.0 QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

Resumes for WSP personnel involved in the ESA are presented in Appendix VI.

13.0 LIMITATIONS

The purpose of this Phase I Environmental Site Assessment is to identify potential impacts to the environment status of the physical conditions (i.e., soil, ground water, structure, etc.) at the Site, due to the use, storage or disposal of hazardous or toxic materials or wastes. As such, any other property conditions or characteristics are not addressed in the scope of work for this report. The scope of work does not include, nor should the report be considered as, an audit of compliance with environmental permits, management practices, or

federal, state or local laws and regulations, even though in the course of work such information may be obtained and noted in the report.

The conclusions stated above have been developed from what is considered to be a reasonable investigation based on the present and past land use of the Site and the property's location with respect to adjacent land uses. The conclusions, to some degree, are based upon information provided by others as referenced or noted in the report. Reasonable efforts have been made to confirm the information with other sources; however, WSP is not responsible for missing or incomplete information if such information is not available at the source or provided at WSP's request, or if such information cannot be obtained within the time constraints of the work or within a level of effort reasonable for the work being completed.

The conclusions and/or recommends are applicable to areas of the Site that were accessible at the time of inspection and represent the conditions observed in those areas. Areas that were hidden, covered or otherwise inaccessible to inspection are not covered by the conclusions and recommendations. The conclusions and recommendations are based in part on conditions observed on the Site at the time of the inspection. The conclusions do not include subsequent changes to the Site, or use of the Site, which could alter the environmental status of the property from its present condition.

This report, and all work associated with it, has been completed solely for the use of the Connecticut Department of Housing. Use of the report by others, or conclusions drawn from the information contained herein without confirmation by WSP, is done at the users risk. WSP asserts that the data are complete and appropriate at the time and for the work conducted, but is not responsible for the use of the information for purposes for which it was not intended.

14.0 SIGNATURES OF ENVIRONMENTAL PROFESSIONALS

We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental Professional as defined in 312.10 CFR 312. We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the Site. We have developed and completed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

cmm

December 14, 2018

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Rodger, John, 1985. Bedrock Geological Map of Connecticut, CTDEEP/United States Geological Survey.

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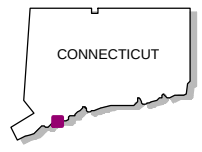
USGS 1984. Bridgeport, Connecticut Quadrangle Map.

FIGURES



SOURCE: USGS TOPOGRAPHIC QUADRANGLE BRIDGEPORT, CONNECTICUT (2015).





QUADRANGLE LOCATION

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SCALE IN FEET

CONNECTICUT DEPARTMENT OF HOUSING
RBD PILOT AREA
BRIDGEPORT, CONNECTICUT

SITE LOCATION MAP

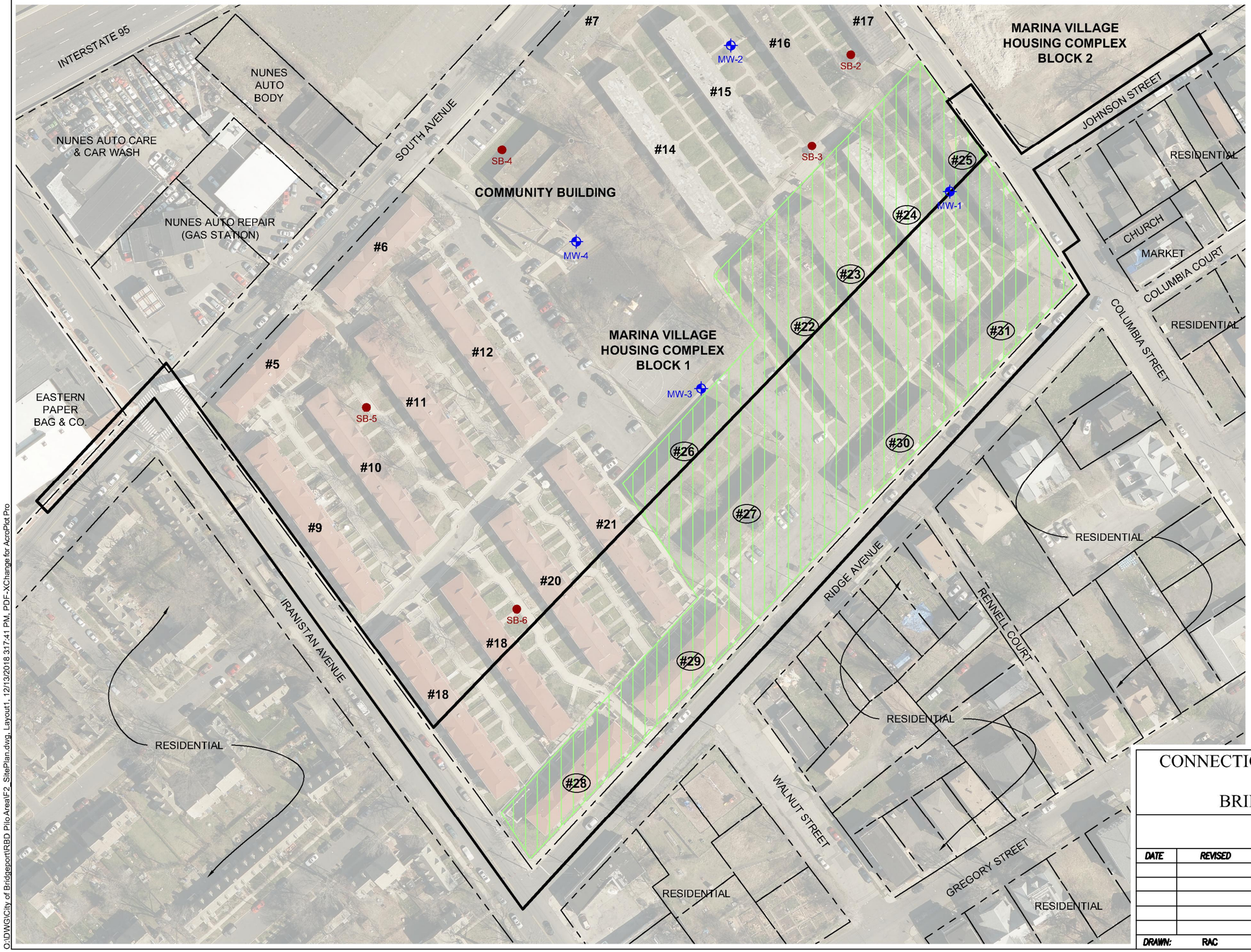
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DRAWN:	RAC	CHECKED:	MS	DATE:	12/11/18	FIGURE:	1

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LEGEND

- RBD PILOT AREA
- PROPERTY BOUNDARY
- #5 — MARINA VILLAGE HOUSING COMPLEX APARTMENT BUILDING
- #28 — DEMOLISHED APARTMENT BUILDING (CONSTRUCTION SITE)
- APPROXIMATE SOIL BORING LOCATION COMPLETED BY FREEMAN COMPANIES (2016)
- APPROXIMATE MONITOR WELL LOCATION COMPLETED BY FREEMAN COMPANIES (2016)

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SCALE IN FEET

CONNECTICUT DEPARTMENT OF HOUSING
RBD PILOT AREA
BRIDGEPORT, CONNECTICUT

SITE PLAN

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APPENDIX I
Tax Cards and Tax Maps

(Available Upon Request)

APPENDIX II
Historical Resources

(Available Upon Request)

APPENDIX III
Previous Environmental Reports

FREEMAN
COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Phase I Environmental Site Assessment Update
Marina Village Marina Village Housing Complex
Bridgeport, Connecticut

November 7, 2016

Prepared for:

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Appendices

A Fuss & O'Neill Phase I ESA

B Environmental Evaluation and Materials Management Report- May 2015

C Environmental Evaluation and Materials Management Report- June 2016

D Close Out Report – August 2016

E Environmental Data Resources Report

1 INTRODUCTION

1.1 Summary

This report provides an update to the September 2013 Phase I Environmental Site Assessment (ESA) performed for JHM Group by Fuss & O'Neill of Manchester, CT. A copy of the Phase I is attached as Appendix A. The subject property is currently utilized for residential housing.

The Site, located at 400 Iranistan Avenue, consists of a two adjacent parcels of land totaling 15.9 acres located in the City of Bridgeport. The Site is bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

1.2 Phase I Findings

Based on the information presented within the Phase I report, the Site has a long history of heavy industrial and manufacturing operations prior to its development as a residential housing complex in the late 1940s. Based on Section 8.2 of the Phase I report, the following recognized environmental conditions were identified:

- REC-1: Historic Foundry Operations - The Bridgeport Malleable Iron Works / Eastern Malleable Iron Company was present at the Site from prior to 1884 to the mid-1930s.
- REC-2: Historic Metal Pickling Operations - Historic metal pickling operations associated with the former foundry operations likely generated waste sludge that would currently be classified as hazardous.
- REC-3: Historic Manufacturing Operations - Hotchkiss Sons Manufacturers Curry Combs & Company / Edward S. Hotchkiss Hardware Manufacturing were present at the Site from prior to 1884 and were gone by 1913.
- REC-4: Historic Japanning Operations - Japanning operations associated with the Hotchkiss Sons Manufacturers Curry Combs & Company / Edward S. Hotchkiss Hardware Manufacturing have the potential to generate a release of petroleum based materials at the Site.
- REC-5: Historic Steel Drum Reconditioning - Following the closure of the Bridgeport Malleable Iron Works / Eastern Malleable Iron Company one of the former annealing buildings at the east end of the foundry was occupied by the Reliable Steel Drum Corporation for reconditioning steel drums and the area to the east of the former annealing building was used for the storage of steel drums.
- REC-6: Historic Coal Storage - Two historic coal storage areas were identified on the site. A coal storage shed was located along Railroad Avenue on the Bridgeport malleable Iron Works property and a coal bin associated with the Hotchkiss Sons Manufacturers Curry Combs & Company was located behind their manufacturing facility.
- REC-7: Historic Urban Fill - As with any site located in heavily urbanized area where former structures have been razed or with multiple generations of development, the potential for the presence of urban fill containing ash, coal, asphalt fragments, or manufacturing by-products exists.
- REC-8: #2 Fuel Oil Release - On December 9, 1999, release of 4,500 gallons of #2 fuel was reported to DEEP which occurred within the basement of the HACB's Marina Village office building (733 South Ave).
- REC-9: USTs - Approximately 30 former homes, storefronts, and apartment buildings were previously located on the Site along Ridge Avenue, Columbia Street, Johnson Street, Park Avenue and Railroad Avenue. There is potential for fuel oil USTs associated with these structures to have been abandoned in place.

1.3 Scope of Work

This Phase I ESA Update was conducted to identify Recognized Environmental Conditions (RECs) resulting from past or present activities on the site and to determine if any of the surrounding properties have the potential to impact the environmental integrity of the site. The assessment update consisted of a reconnaissance of accessible site areas and adjoining properties, a review of State and Federal environmental databases as they pertain to the site and an interview with the site owner/operator.

This ESA was conducted in a manner consistent with industry standard and practice and in general accordance with the Standards of the American Society for Testing and Materials (ASTM) E1527-13 Standard Practice for Environmental Site Assessment Updates.

2 SITE DESCRIPTION

2.1 Location

The Site, located at 400 Iranistan Avenue, consists of a two adjacent parcels of land totaling 15.9 acres located in the City of Bridgeport. The Site is bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

2.2 Current Usage

The Site is currently used for residential housing.

2.3 Historical Land Usage

Marina Village was originally constructed during the late 1940s. Prior to its construction, the Site was occupied by the Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings, Hotchkiss Sons' Manufacturers Curry Combs & Company and by a number of homes.

The foundry used coal to fuel their operations, which included operations such as annealing, trimming, core making, tumbling, and molding. Hotchkiss Sons Manufacturers Curry Combs & Company was located southwest of the Bridgeport Malleable Iron Works along South Avenue. The Hotchkiss Sons Manufacturers Curry Combs & Company property included a manufacturing building, a wood shop, coal storage, and lumber storage. Operations included scouring, tempering, and japanning. A number of homes were located along the north side of Johnson Street, the west side of Columbia Street, the west side of Park Avenue, and the south side of Railroad Avenue at the east end of the site.

2.4 Surrounding Land Use

The surrounding land use consists primarily of high-density housing to the southwest, southeast and northeast; and a mix of commercial and light industrial to the northwest.

2.5 Utilities

Marina Village is currently served by municipal sewer and water.

The Site's buildings were once heated by steam from the central boiler room of the Community Building, located on the northern side of Marina Village along South Avenue. The buildings made a switch from steam heat to natural gas sometime in the late 1990s. Electric, cable, and telephone services enter the Site via overhead wires.

2.6 Groundwater Classification

According to the CTDEEP water quality classification maps groundwater at the site is classified as GB. A GB classified groundwater is defined as groundwater within a historically highly urbanized area or an area of intense

industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts.

2.7 Environmental Assessment Activities

Several rounds of subsurface investigation activities have been conducted on the Site since the date of the original Phase I ESA. The initial round of sampling was conducted between the dates of May 12 through May 14, 2015. This investigation was conducted entirely within the "triangle" section of the Site. A total of ten soil borings were advanced at the Site as part of this investigation. The second subsurface investigation was conducted between the dates of May 25 through May 26, 2016. A total of ten soil borings were advanced at the Site as part of the second investigation.

2.7.1 Initial Subsurface Assessment "Triangle Property"

The initial assessment was conducted between the dates of May 12 through May 14, 2015. On the western section of the property. The primary purpose of the assessment was to define the nature/presence of target contaminants in the unconsolidated materials in both the saturated and unsaturated zones associated with historical Site activities. In addition, the boring program also provided information on Site stratigraphy and physical properties of the unconsolidated materials in both the saturated and unsaturated zones with particular emphasis on the characteristics of those materials that affect contaminant migration pathways and transport mechanisms.

New England Boring Contractors of Glastonbury, CT advanced the soil borings utilizing a hollow stemmed auger (HSA) drilling rig under the direct supervision of Freeman Companies field personnel. The location for each of the soil borings was chosen to maximize the information obtained based on Freeman Companies' understanding of existing site conditions.

All ten soil borings (B-1 through B-10) were advanced using a HSA drill rig spinning 4 ¼-inch inner diameter augers. Soil samples were collected with stainless steel, 2-inch diameter, two-foot split-spoon sampler advanced ahead of the augers in two-foot intervals using a weighted hammer. In general, sampling was conducted semi continuously at 2 foot intervals into the observed water table. Bedrock was not encountered at any boring locations.

Three of the soil borings were completed as overburden-monitoring wells (MW-1 through MW-3). The wells were set to depths of approximately 12 to 16 feet below grade. The wells are constructed of approximately 10 feet of 2-inch diameter, 0.010-inch slotted PVC screen, with 2-inch PVC riser extending to grade.

Laboratory analysis of the soil samples collected from sample locations B-5, B-7 and B-8, identified the presence of one or more of the following; poly aromatic hydrocarbons, total petroleum hydrocarbons, total arsenic and/or PCBs at concentrations exceeding default remediation criteria.

Laboratory analysis of groundwater samples did not detect the presence of any volatile organic compounds at concentrations that exceeded the RES VC within any of the monitoring wells. Analytical results of the groundwater samples identified the following poly aromatic hydrocarbons; benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and phenanthrene and the following metals; arsenic, copper, lead, mercury, and zinc at concentration exceeding the default SWPC in one or more of the monitoring wells. A copy of the assessment report is included as Appendix B.

2.7.2 Additional Assessment "Second Phase"

The second phase of the Marina Village redevelopment project involves the demolition of the portion of the complex that is bounded by South Avenue, Columbia Street, Ridge Avenue, and Iranistan Avenue (Buildings Numbered 5-31). The Second Phase Assessment activities were conducted between the dates of May 25 through May 26, 2016. A total of ten soil borings were advanced at the Site as part of the investigation.

Six of the ten soil borings proposed as part of the second phase (SB-1 through SB-6) were advanced using a direct push drill rig utilizing static force and dynamic percussion to drive steel boring rods into the ground. Soil samples were collected with a stainless steel, 2-inch diameter, five-foot spoon sampler interiorly lined within a single use acetate sleeve. Sampling was conducted continuously into the observed water table.

The remaining four soil borings (MW-1 through MW-4) were advanced using a HSA drill rig spinning a 4 ¼-inch inner diameter auger. Soil samples were collected with stainless steel, 2-inch diameter, two-foot split-spoon sampler advanced ahead of the augers in two-foot intervals using a weighted hammer. Sampling was conducted continuously at 2 foot intervals into the observed water table.

Soil encountered during the advancement of the second phase soil borings consisted primarily of a mixture of Urban Fill and ash, followed by brown and tan, fine to coarse sand intermixed with silt at several locations. Bedrock was not encountered at any boring locations.

Laboratory analysis of the soil samples collected from sample locations SB-1, SB-4, and MW-2 identified the presence of one or more of the following; poly-aromatic hydrocarbons and/or extractable total petroleum hydrocarbons, exceeding the RDEC and/or the GB PMC.

Although analytical results from groundwater samples collected as part of the did not detect the presence of any volatile organic compounds at concentrations that exceeded the RES VC; results did identify the presence of one or more poly aromatic hydrocarbons and or metals at concentrations exceeding the default SWPC within the samples collected from MW-1, MW-3 and MW-4.

2.8 Remedial Activities

The primary purpose of the soil removal activities was to excavate and disposal of contaminated soil/fill material that was encountered during the subsurface assessment activities of the "triangle property". Soil excavation and removal activities, conducted over an approximately eight week period, were initiated on April 21, 2016 and completed on June 16, 2016. A copy of the Close Out Report is included as Appendix D.

2.8.1 Previous Building Slab

During initial excavation activities it was identified that the floor slab from the former Eastern Malleable Iron Company was still present on the property. The slab was generally encountered at a depth of approximately 1-2 feet below the existing surface. Only within areas where the Marina Village buildings were constructed was the original slab removed. Inspection of the slab revealed that the slab consisted of approximately 4-6" of non-reinforced concrete. The slab appeared to be in good condition with no signs of staining. A small section of the slab was removed at a location to the southwest of building 35 in order to identify soil conditions under the slab. Soil conditions under the slab consisted of native sand. In order to confirm he initial findings Freeman Companies directed the contractor to remove small areas of slab at several additional locations. In all instances native sand was identified to be present under the slab. Since the slab did not appear to be stained and that native sand was located under the slab, the decision was made to leave the slab in place.

2.8.2 Ash Fill Areas

During the soil removal activities serval areas of ash material were encountered and removed. The ash was identified to contain small pieces of ceramic debris and glass. One of the larger areas of ash material was located to

the west of building 36, which is located just south of the former annealing area of the Eastern Malleable Company. The ash area measured approximately 30 feet long by 20 feet wide and extended to a depth of approximately 10-12 feet.

2.8.3 Demolition Debris

Various amounts of brick, asphalt, and broken concrete were encountered throughout the excavation area. The larger amounts of these materials were encountered primarily at locations on top of the former building slab. It appeared that the former building was crushed in place and filled with urban fill material to allow of the shaping of the property for construction of Marina Village.

2.8.4 Impacted Soil

Soil material identified to be impacted by PAHs and low concentration of PCBs was selected for removal from the site. The target areas for removal were primarily located to the northwest of building 36 and to the south and southwest of building 35. The largest of the impacted areas was located to the northwest of building 36, which was located within the former coal storage area for the former Eastern Malleable Iron Company. Soil within this area was primarily impacted from 1-4 feet in depth and encompassed almost the entire area north of the former building slab extending to Railroad Avenue. Other smaller pockets of impact generally consisted of areas measuring approximately 10 feet by 10 feet by 5 feet in depth.

2.8.5 Soil Disposal

Impacted soil and ash material excavated for removal from the site was brought to one of two locations for disposal. The soil and ash material located to the east of building 35 was brought to the Chicopee Landfill, in Chicopee Massachusetts. The remaining impacted material was brought to the Coventry Landfill in Coventry Rhode Island.

Based on weight tickets generated from the landfills, approximately 731.92 tons of impacted material were excavated and removed from the site for reuse at the Chicopee Landfill and approximately 3,503.11 tons of impacted material were excavated and removed from the site for reuse at the Coventry landfill.

2.8.6 Closure Sampling

As identified, impacted material related to the historical operations of the Eastern Malleable Iron Company primarily consisted of discolored fill material and ash which contained moderate concentrations of PAHs and low concentrations of PCBs. This impacted material was visually identifiable due to its composition and color as compared to the native sands located at depth. Removal of impacted material was generally conducted until the native sand material was encountered.

Upon completion of the removal of the impacted material soil removal, soil samples were collected from the floor of excavation areas in order to demonstrate removal of the impacted material. Since PAHs were the primary driver for removal activities and were present at the greatest concentrations, the closure samples were submitted for the analysis of PAHs. No PAHs were detected within the samples submitted.

3 RECORDS REVIEW

3.1 Standard Environmental Records Search

A database search report that identifies sites listed on state and federal databases within the ASTM-required radii was obtained for the property from Environmental Data Resources, Inc (EDR). A copy of EDR's complete report is provided as Appendix E.

The report included the following databases specified by the ASTM Phase I protocol as well as non-ASTM databases (not listed):

Database*	Search Radius
National Priorities List (NPL)	1 mile
Comprehensive Environmental Response, Compensation and Liability Information System	0.5 mile
Resource Conservation and Recovery Information System (RECRIS) Treatment, Storage, and Disposal Facilities (RCRA TSD)	0.5 mile
Resource Conservation and Recovery Corrective Action Sites (RCRA COR)	1 mile
RCRA Large and Small Quantity Generators (RCRA GEN)	0.25 mile
Emergency Response Notification System (ERNS)	Target Property
The Facility Index System (FINDS)	Target Property
State Hazardous Waste Sites	Target Property
Regulated State Underground Storage Tank (UST) and Aboveground Storage Tank database (AST)	0.25 mile
State Leaking Underground Storage Tank (LUST)	0.5 mile
Brownfield Site Database	0.5 mile
Engineering Controls Sites	0.5 mile
Institutional Controls Sites	0.5 mile
Indian Reservation Database	1 mile

*A description of these databases and additional sources searched is provided in the EDR report. A complete listing of sites identified on the above-referenced databases is provided in the EDR report.

Freeman Companies evaluated the following to determine whether additional environmental records with respect to these facilities, including the orphan sites, should be reviewed.

- Case status (i.e., whether a No Further Action letter has been issued or a case has been closed);
- Type of database and whether the presence of soil or groundwater contamination is known;
- Distance of the site from the subject property; and,
- Whether the site is upgradient or downgradient of the subject property based on local topography and the anticipated easterly groundwater flow direction.

Freeman Companies reviewed the information provided using the above criteria and the findings are discussed in the following Sections.

3.1.1 Subject Site

The subject Site was not listed within the any of the databases

3.1.2 Surrounding Properties

Based on the review of the database search, no new information regarding potential environmental impact to the Site was identified.

4 SITE RECONNAISSANCE

4.1 Methodology

As part of on-going abatement/demolition activities, Freeman Companies has conducted numerous site visits since the date of the original Phase I ESA. The latest visual inspection of the Site occurred on November 3, 2016. The inspection included a walk-through of the site for the purpose of identifying RECs.

A visual inspection of adjoining properties from the subject property line, public rights-of-way or other vantage points (e.g. aerial photography) including a visual inspection where hazardous substances may be or may have been stored, treated, handled or disposed was also conducted.

4.2 Observations

At the time of the initial Phase I ESA, the property contained 38 multi-family buildings and one community building which was the former boiler house. From 2015-2016, 12 of the 38 buildings (all within the "triangle" parcel) were demolished. As of November 3rd, 2016 two of the remaining 26 building are in the process of being demolished.

5 INTERVIEWS

5.1 Owner

An interview with was conducted with Site Manager Mike Cundiff on November 3, 2016. According to Mr. Cundiff, there have been no changes to the Site since the date of the original Phase I ESA.

6 FINDINGS AND CONCLUSIONS

Freeman Companies has performed a Phase I Environmental Site Assessment Update in conformance with the scope and limitations of ASTM Practice E 1527-13 Limitations of this assessment are described in Section 7.

6.1 Recognized Environmental Conditions

An REC is the presence or likely presence of any hazardous substance or petroleum products in, on, or at a property due to the release to the environment, under conditions indicative for a release to the environment, or under conditions that pose a material threat of a future release to the environment.

The following RECs were identified at the Site as part of the 2013 Phase I:

- REC-1: Historic Foundry Operations
- REC-2: Historic Metal Pickling Operations
- REC-3: Historic Manufacturing Operations
- REC-4: Historic Japanning Operations
- REC-5: Historic Steel Drum Reconditioning
- REC-6: Historic Coal Storage

- REC-7: Historic Urban Fill
- REC-8: #2 Fuel Oil Release
- REC-9: USTs

Based on assessment and remedial activities that have been conducted since the original Phase I was conducted, REC#5 has been closed. In addition, one of the coal storage areas identified as REC#6 has also been closed. Lastly, no USTs (REC#9) have yet been identified on the site.

7 ENVIRONMENTAL CERTIFICATION

7.1 Limitations

This report is prepared on behalf of and for the exclusive use of JHM Group (Client) and is subject to and issued in accordance with the Agreement and the provisions thereof. This report and any findings contained therein shall not, in whole or in part, be provided to or used by any other person, firm, entity or governmental agency in whole or in part, without the prior written consent of Client and Freeman Companies. However, Freeman Companies acknowledges and agrees that, subject to the Limitations set forth herein and prior written approval by Freeman Companies, this report may be provided to specific financial institutions, attorneys, title insurers, lessees and/or governmental agencies identified by Client at or about the time of issuance of the report in connection with the conveyance, mortgaging, leasing, or similar transaction involving the real property which is the subject matter of a report and any work product. Use of this report for any purpose by any persons, firm, entity, or governmental agency shall be deemed acceptance of the restrictions and conditions contained therein, these Limitations and the provisions of Freeman Companies' Agreement with Client. No warranty, express or implied, is made by way of Freeman Companies' performance of services or providing an environmental site assessment, including but not limited to any warranty with the contents of a report or with any and all work product.

In preparing a report, Freeman Companies may rely on certain information provided by governmental agencies or personnel as well as information and/or representations provided by other persons, firms, or entities, and on information in the files of governmental agencies made available to Freeman Companies at the time of the site assessment. To the extent that such information, representations, or files may be inaccurate, missing, incomplete or not provided to Freeman Companies, Freeman Companies is not responsible. Although there may be some degree of overlap in the information provided by these various sources, Freeman Companies does not assume responsibility for independently verifying the accuracy, authenticity, or completeness of any and all information reviewed by or received from others during the course of the site assessment.

Unless otherwise noted, a survey (which includes observations, sampling and analysis) for the presence of polychlorinated biphenyls (PCBs) and asbestos contained in building materials, mold and/or lead-based paint is not conducted as part of an assessment.

Unless otherwise noted, an evaluation (which includes observation, sampling and analysis) for Vapor Intrusion Conditions (VIC) is not conducted as part of an assessment.

No attempt is made to assess the compliance status of any past or present Owner or Operator of a site with any Federal, state, or local laws or regulations, unless specifically indicated otherwise in writing.

Findings, observations, and conclusions presented in this report, including but not limited to the extent of any subsurface explorations or other tests performed by Freeman Companies, are limited by the scope of services outlined in the Agreement, which may establish schedule and/or budgetary constraints for an environmental assessment or phase thereof. Furthermore, while it is anticipated that each assessment will be performed in accordance with generally accepted professional practices and applicable standards (such as ASTM, etc.) and then applicable state and Federal regulations, as may be further described in the report and/or the Agreement, Freeman Companies does not assume responsibility for

the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of its services.

The assessment presented in each report is based solely upon information obtained or received prior to issuance of the report, including a limited number of subsurface explorations (if performed) made on the dates indicated. If additional environmental or other relevant information is developed at a later date, Client agrees to bring such information to the attention of Freeman Companies promptly. Upon evaluation of such information, Freeman Companies reserves the right to recommend modification of this report and its conclusions.

If groundwater samples are collected for analysis or water level measurements are made in monitoring wells, such results/observations are provided as representative of conditions at the times stated in this report. Fluctuations in groundwater elevation may occur due to variations in precipitation cycle and multiple other factors, which may influence the concentrations of constituents present in the groundwater. Should additional data become available in the future, such data should be provided to Freeman Companies for review and Freeman Companies reserves the right to recommend modification of this report and its conclusions.

Except as may be noted specifically within the text of this report, no laboratory testing is performed as part of a site assessment. If such analyses have been conducted by an outside laboratory, Freeman Companies may rely upon the analyses or data provided, and makes no representation that an independent evaluation of the reliability of such testing has been conducted, with the exception of reviewing standard quality assurance/quality control data that may have been provided with the test results.

Although chemical analyses may be performed for specific parameters at specific locations during the course of a site assessment, as described in a report, the results are not definitive regarding the presence of the parameters at other concentrations or the absence of the parameters at other locations on the site. Additional chemical constituents not included in the list of analyzed parameters for a study may be present in soil and/or ground water at a site, and Freeman Companies assumes no responsibility for chemical constituents or parameters not analyzed.

If included, any database search is conducted under the Notice of Disclaimer/Waiver of Liability included in the database search report.

7.2 Reliance

The Environmental Professional hereby states that this Phase I ESA Update has been conducted in accordance ASTM E 1527-13, or the most current ASTM standard, and the EPA Rules. This Phase I ESA Update has been prepared for the sole use of JHM Group. This Phase I ESA Update should not be relied upon by other parties without the express written consent of Freeman Companies and JHM Group.

7.3 Environmental Professional Signature

The author of this report declares that, to the best of our professional knowledge and belief, I meet the definition of Environmental Professional as defined in §312.10 of 40 CFR 312. The author of this report has the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. The author has developed and performed the all appropriate inquiries in the conformance with the standards and practices set for the in 40 CFR 312.



Charles D. Brink, LEP
Manager of Environmental Services

APPENDIX A

FUSS AND O'NEILL PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT – SEPTEMBER 2013

Phase I Environmental Site Assessment

Marina Village

400 Iranistan Avenue
Bridgeport, CT

September 2013

FUSS & O'NEILL

56 Quarry Road
Trumbull, Connecticut 06611

20121111.A12

FUSS & O'NEILL

September 24, 2013

Ms. Sharon Lee, Associate AIA, PM
Planning Development & Modernization
Housing Authority of the City of Bridgeport
150 Highland Avenue
Bridgeport, CT 06604

RE: Phase I Environmental Site Assessment
Marina Village
400 Iranistan Avenue, Bridgeport, CT

Dear Ms. Lee:

We are pleased to submit the enclosed report of the Phase I Environmental Site Assessment (Phase I ESA) for the above-referenced site. The assessment was conducted in conformance with Standard Practice E 1527-05 for Environmental Site Assessments published by the American Society for Testing and Materials.

ASTM 1527-05 requires that certain elements of a Phase I ESA be updated if the data for the report are more than six months old. Therefore, if this report is to be relied on after March 24, 2014, we recommend you contact us to discuss options for such an update.

We have identified nine recognized environmental conditions associated with the site. This is discussed in the conclusion of our report (*Section 8.0*).

In accordance with the requirements of the ASTM 1527-05 Standard, we declare that to the best of our professional knowledge and belief, we meet the definition of an environmental professional as defined in §312.10 of 40 CFR 312 and we have the specific qualifications based on education, training, and experience to assess the nature, history, and setting of the subject property. We have developed and performed all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Thank you for the opportunity to conduct this work. Please contact us if we can be of further assistance.

Sincerely,

Richard S. Kulzer, LEP
Project Manager

Andrew R. Zlotnick, LEP, LEEP AP
Senior Vice President

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400 Iranistan Avenue

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1 Introduction

Fuss & O'Neill, Inc. has been retained by the Housing Authority of the City of Bridgeport (HACB) to conduct a Phase I Environmental Site Assessment (Phase I ESA) of the Marina Village located at 400 Iranistan Avenue in Bridgeport, Connecticut (the "Site"). Marina Village is a thirty-nine building, 389 unit apartment complex owned by HACB. We understand that HACB requested this Phase I ESA in anticipation of obtaining financing from Housing and Urban Development (HUD) for demolition of the buildings.

1.1 Objective

The objective of this Phase I ESA was to identify recognized environmental conditions (RECs) present at the Site. As defined by Standard Practice for Environmental Site Assessments E 1527-05 developed by the American Society for Testing and Materials (ASTM, 2005), REC means:

> *…the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimis conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.*

In portions of this report we refer to the Connecticut Department of Energy and Environmental Protection (DEEP). The Connecticut Department of Environmental Protection (CTDEP) was re-named the Department of Energy and Environmental Protection (DEEP) in July 2011. For convenience and consistency, we refer to the agency as the DEEP throughout this report, including the timeframe prior to July 2011.

1.2 Scope of Services

Our Phase I ESA was performed in conformance with Standard Practice E 1527-05 for Environmental Site Assessments by the American Society for Testing and Materials (ASTM, 2005).

Unless otherwise stated in this report, assessments for asbestos-containing materials, PCB-containing building materials, lead-based paint or plumbing materials, radon gas, and mold were not conducted as part of this Phase I ESA. Furthermore, we did not investigate the potential for the Site to contain wetlands, endangered species, ecological resources or historic/cultural resources. Additionally, environmental compliance or permitting issues were not considered during this investigation.

It is our understanding that this work is not being conducted under a United States Environmental Protection Agency (USEPA) Brownfield Assessment and Characterization Program grant awarded under CERCLA 9604(k)(2)(b); therefore, our investigation did not include an assessment of controlled

substances. Refer to *Appendix A* for the scope of work and restrictions of this ESA and to *Section 10.0* of this report for limitations on this work product.

2 Site Overview

2.1 Site Information

2.1.1 Property Location, Size of Parcel, and Site Plan

The Site, Marina Village, is located on the east side of Iranistan Avenue in a residential/commercial zone of Bridgeport, Connecticut (Fairfield County). A portion of a United States Geological Survey (USGS) topographic map showing the Site location is provided as *Figure 1* (USGS, 1970).

According to City of Bridgeport records, the Site is located on an 11.80-acre irregular-shaped parcel owned by HACB. The site is bound by South Avenue to the northwest, Railroad Avenue to the north, Park Avenue to the northeast, Johnson Street to the southeast, Ridge Avenue to the south, and Iranistan Avenue to the west. The site is bisected by Columbia Street which runs through the site. The Site includes 39 buildings constructed in the late 1940s to 1950. Seven of the buildings are currently vacant. A Site plan is provided as *Figure 2*. A copy of the online property description card available through the Bridgeport Assessor's Office website is attached in *Appendix B*. A description of the Site developed during the site inspection is presented in *Section 6.2*.

2.1.2 Utilities

According to the facility manager, Marina Village is served by municipal sewer and water. The City of Bridgeport Public Works Department, Building Department, and Aquarion, the public water supply company for the City of Bridgeport, did not have any information regarding the 400 Iranistan Avenue parcel hook-up dates. The public works department noted the buildings were built in the late 1940s to 1950 and the Water Pollution Control Authority for the City of Bridgeport was not established until 1989. Sanborn mapping indicates that municipal water was available in the vicinity of the site by 1889.

The Site's buildings were once heated by steam from the central boiler room of the Community Building, located on the northern side of Marina Village along South Avenue. According to the facility manager, the buildings made a switch from steam heat to natural gas. Although the exact date of the switch over to natural gas was not known by the site contact and not identified in our site research, we believe the switch over occurred in the late 1990s coinciding with removal of the oil supply tanks in 1999 which were formally located in the basement of the Community Building.

Electric, cable, and telephone services enter the Site via overhead wires.

2.1.3 Adjoining Land Use

Based on observations made during the site inspection and available mapping, properties adjoining the Site include the following:

Address	Description	Direction from Site
800 South Avenue	Industrial	NW
816 South Avenue	Warehouse	NW
824 South Avenue	Parking Lot	NW
840 South Avenue	Auto Repair	NW
478 Iranistan Avenue	Gas Station	NW
255 Iranistan Avenue #445	Residential	SW
310 Iranistan Avenue #320	Retail Store	S
139 Ridge Avenue	Vacant	S
123 Ridge Avenue #125	Playground	S
204 Walnut Street	Commercial	SE
99 Ridge Avenue #103	Vacant	SE
95 Ridge Avenue #97	Vacant	SE
91 Ridge Avenue #93	Vacant	SE
81 Ridge Avenue	Residential	SE
75 Ridge Avenue #77	Vacant	SE
67 Ridge Avenue #69	Vacant	SE
61 Ridge Avenue #63	Residential	SE
45 Ridge Avenue #51	Residential	SE
29 Ridge Avenue #35	Residential	SE
131 Columbia Street #137	Vacant	SE
160 Columbia Street	Commercial	SE
119 Johnson Street #123	Vacant	SE
109 Johnson Street #111	Residential	SE
105 Johnson Street #107	Residential	SE
99 Johnson Street #101	Vacant	SE
91 Johnson Street	Residential	SE
83 Johnson Street	Residential	SE
77 Johnson Street	Vacant	SE
67 Johnson Street	Residential	SE
59 Johnson Street	Residential	SE
49 Johnson Street #51	Residential	SE
41 Johnson Street #43	Vacant	SE
33 Johnson Street #35	Vacant	SE
25 Johnson Street	Church Property	SE

475 Park Avenue	Car Wash	SE
500 Park Avenue	Retail Stores	E
513 Park Avenue	Retail/Residential	N (Across Railroad Tracks)
561 Park Avenue	Retail/Residential	N (Across Railroad Tracks)
569 Park Avenue #571	Vacant	N (Across Railroad Tracks)

2.2 Environmental Setting

2.2.1 Physical Setting

Topography and Geology

The topography of the Site is flat (USGS, 1970). The regional topography generally slopes down gradually to the south, towards the Long Island Sound.

The University of Connecticut's Connecticut Environmental Conditions Online (CTECO) Advanced Map Viewer describes surficial material at the Site as sands overlying fines. Bedrock is not mapped underneath the Site.

Hydrology and Hydrogeology

The quality of groundwater beneath the Site is classified by the Connecticut Department of Energy and Environmental Protection as GB (DEEP, 2011). Such groundwater is presumed not to be suitable for human consumption without treatment and is used for industrial process water and cooling waters (DEEP, 2011).

The direction of groundwater flow within the surficial geological unit is influenced by a number of factors, including the physical characteristics of the geological unit (such as particle size), the local topography, the presence of surface water bodies, the depth to bedrock, and the type of aquifer. For an unconsolidated, unconfined aquifer, groundwater generally flows in the direction of the greatest topographic gradient. Based on USGS mapping and field observations of the local topography and surface water hydrology, the inferred groundwater flow direction is to the west. Depth to groundwater is estimated to be 10 feet.

The nearest surface water body, Cedar Creek, is located approximately 920 feet west of the Site (USGS, 1970). Cedar Creek is a tidally influenced river that discharges into the Long Island Sound and is classified by the State of Connecticut as SB (DEEP, 2011). Designated uses of such coastal and marine surface waters are for marine fish, shellfish and wildlife habitat, shellfish harvesting for transfer to approved areas for purification prior to human consumption, recreation, industrial and other legitimate uses including navigation (DEEP, 2011).

2.2.2 Location of Public Water Supply Sources

The DEEP's 2011 Connecticut Environmental Conditions Online (DEEP, 2011) and the Atlas of Public Water Supply Sources and Drainage Basins of Connecticut (CTDEP, 1982) show no public water-supply wells or aquifer protection areas within a one-half mile radius of the Site.

2.3 Previous Environmental Investigations

Key site manager, Sharon Lee of the HACB, is unaware of any previous environmental investigations having been performed on the Site.

3 Site History

The following sources were used to develop the history of the Site and, to the extent required by ASTM Practice E 1527-05, the nearby sites:

- City street directories (available at the Connecticut State Library) reviewed at approximately five-year intervals dating back to the year 1960
- Sanborn Fire Insurance Maps (available at the Connecticut State Library) for the years 1884, 1889, 1898, 1913, 1939, 1950 and 1972
- Aerial photographs (available at the State Archives of the Connecticut State Library) for the years 1975 and 1980
- Aerial photographs (obtained electronically from the State Archives of the Connecticut State Library) for the years 1934 and 1965
- Aerial photographs (obtained electronically from the University of Connecticut Map and Geographic Information Center) for the years 1951, 1970, 1986, 1990 and 1995
- Aerial photographs (obtained electronically from the DEEP's 2011 Connecticut Environmental Conditions Online (DEEP, 2011) for the years 2004 and 2010
- Historical USGS Topographic Maps for the years 1893 and 1951, available on-line from the Documents Department and Data Center of the University of New Hampshire (http://docs.unh.edu/nhtopos/nhtopos.htm)
- Sharon Lee, Associate AIA, PM, for the Planning Development & Modernization division at the Housing Authority of the City of Bridgeport

- Files and personnel at the City of Bridgeport offices of the City Clerk, Building Department, Engineering Department, Planning and Zoning Department, Health Department, and Fire Marshal.

The past uses of the Site and nearby properties based on the sources above are summarized below.

Site
The Marina Village was constructed during the late 1940s and is shown in its current location on the 1950 Sanborn fire insurance map. Prior to the 1930s, the Site was occupied by the Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings, Hotchkiss Sons' Manufacturers Curry Combs & Company and by a number of homes. The 1884 Sanborn map shows the foundry buildings located predominantly along both the northern and southern sides of South Avenue. The foundry used coal to fuel their operations, which included operations such as annealing, trimming, core making, tumbling, and molding. Hotchkiss Sons Manufacturers Curry Combs & Company was located southwest of the Bridgeport Malleable Iron Works along South Avenue. The Hotchkiss Sons Manufacturers Curry Combs & Company property included a manufacturing building, a wood shop, coal storage, and lumber storage. Operations included scouring, tempering, and japanning. A number of homes were located along the north side of Johnson Street, the west side of Columbia Street, the west side of Park Avenue, and the south side of Railroad Avenue at the east end of the site.

The 1889 Sanborn map shows that several residential dwellings were located on the Site along the north side of Johnson Street and near the corner of Railroad Avenue and Park Avenue. The Hotchkiss Sons Manufacturers and Curry Combs & Company site was vacant and the Bridgeport Malleable Iron Works had expanded its operations to the east.

The 1898 Sanborn Map shows the former Hotchkiss Sons Manufacturers Curry Combs & Company property was occupied by Edward S. Hotchkiss Hardware Manufacturing. Operations at the property included stamping, polishing, a machine shop, wood working, and japanning.

The 1913 Sanborn Map shows the Edward S. Hotchkiss Hardware Manufacturing buildings were no longer present at the Site and the Bridgeport Malleable Iron Works became the Eastern Malleable Iron Company. The Eastern Malleable Iron Company had expanded to the south toward Walnut Street adding additional foundry, core making, and sand bins. According to the 1913 Sanborn map, core making (or molding) buildings, foundry buildings, annealing, trimming, pickling, brick and old casting storage, carpentry shop, grinding, rolling, furnaces, shipping and storage, offices, a locomotive house, and storage sheds were present at the Site. The 1913 Sanborn map shows that the area between Walnut Street and Iranistan Avenue and between Ridge Avenue and South Avenue was vacant. The 1913 Sanborn map also shows that homes and stores were located along the north side of Ridge Avenue.

By 1939, the Sanborn maps show that the majority of the Eastern Malleable Iron Company had been razed and was no longer present at the Site or surrounding areas. One of the former annealing buildings located at the eastern end of the Site remained and was being utilized by The Reliable Steel Drum Corporation for reconditioning steel drums. A number of homes, apartments, and stores remained along Ridge Avenue, Columbia Street, Johnson Street, Railroad Avenue, and Park Avenue. As with any

site located in a heavily urbanized area where former structures have been razed, the potential exists for the presence of urban fill containing ash, coal, and asphalt fragments.

The 1950 Sanborn map shows the Marina Village was complete in its current layout.

Nearby Properties
Properties located to the south and east along Ridge Avenue, Columbia Street, and Johnson Street have historically been used for residential and retail store uses going back to the 1890s. Properties to the north were historically part of the Bridgeport Malleable Iron Works foundry going back to the 1880s. The Connecticut Clasp Company which manufactured metal corset parts was located to the east of the Site across Park Avenue from the early 1900s until after 1950. By 1972 the Connecticut Clasp Company buildings were razed and a retail store was located at the Site. The Bridgeport Deoxidized Bronze & Metal Company was historically located to the west of the site at the west corner of Iranistan Avenue and South Avenue. By 1950, the property along the northern side of South Avenue was occupied by a motor freight station. Outdoor parking areas are visible from aerial photographs and a gas tank was located outside the southeastern corner of the building. From approximately 1960 to 1980, this property was occupied by a beer distributor warehouse. The property located at 816 South Avenue, located northeast of the Site, has been occupied by a scrap metal yard since the 1960s. The property located at 840 South Avenue/478 Iranistan Avenue, located northwest of the Site has been occupied by Nunes Auto Repair, an auto body shop and gasoline station, since the 1960s.

4 Federal, State, and Local File Review

Files of Federal, State and local agencies were reviewed for environmentally-related issues pertinent to the Site and nearby parcels, such as permits, inspection reports, enforcement history or documented releases of hazardous materials. The sources of information listed in the following table were researched to identify properties of concern within distances of the Site specified by ASTM Practice E 1527-05.

Information Source*	Search Distance
Federal Files	
National Priorities List (NPL)	1 mile
Delisted NPL Sites	0.5 mile
Resource Conservation and Recovery Act (RCRA) CORRACTS list (RCRA Site Subject to Corrective Action)	1 mile
Resource Conservation and Recovery Act (RCRA) Treatment, Storage or Disposal Facility (TSDF) List	0.5 mile
Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) List, including No Further Remedial Action Planned (NFRAP) sites	0.5 mile
RCRA Generators List	property and adjoining
RCRA No Longer Regulated (NLR) List	property and adjoining
Federal Institutional / Engineered Control List	property only

Information Source*	Search Distance
Emergency Response and Notification (ERNS) List	property only
State Files	
Hazardous Waste Site List (State sites equivalent to NPL)	1 mile
Hazardous Waste Site List (State sites equivalent to CERCLIS)	0.5 mile
Landfill and Solid Waste Site	0.5 mile
Leaking Underground Storage Tank (LUST) List	0.5 mile
State Voluntary Clean-up or Brownfield Sites	0.5 mile
Oil & Chemical Spills Database	property and adjoining
Registered Underground Storage Tank (UST) List	property and adjoining
State Institutional / Engineered Control List	property only

*Fuss & O'Neill used Environmental Data Resources, Inc. (EDR), an environmental database search service, to obtain the information referenced in the above table. EDR provides access to publicly available environmental databases maintained by various Federal, State, and local agencies. A copy of the information provided by EDR relative to the Site and nearby properties is included in *Appendix C*. The listed information sources are defined and described in detail in the EDR report.

4.1 Summary of Regulatory Database Information

Site

As reported in the EDR Report in *Appendix C*, one environmental concerns was identified for the Site in the environmental databases searched.

- 733 South Avenue: On December 9, 1999, a LUST was reported at HACB's Marina Village office building. Eighteen inches of #2 fuel oil from an underground tank failure covered the floor of a 400 square-foot room on December 7, 1999. The local fire department, fire marshal, and DEP dispatch was notified. When recorded on December 9, 1999 only four inches of oil remained on the floor. According to the EDR Report, it was unknown where oil was going, how many tanks were buried outside, and of what volume they were. Groundwater and surface water was affected. The status for this event is closed. Upon completion of the site walk, we believe this was more likely a release from the above ground storage tank in the basement, not underground storage tanks.

Nearby Properties

As reported in the EDR Report in *Appendix C*, several properties were identified in the environmental databases within the minimum search radii required by ASTM Practice 1527-05. Based on distance from the Site and the local hydrogeology, these parcels are not anticipated to have a negative effect on the subject property, with the following exceptions:

- 478 Iranistan Avenue: Nunes Auto Repair Inc. is a general automotive repair shop and gasoline station located adjacent to the site on the opposite side of South Avenue. It is currently in use and includes three underground storage tanks installed in 2009. Two 3,000 gallon tanks and one 8,000 gallon tank store gasoline. Three underground storage tanks installed in 1992, two 8,000 and one 3,000 gallon, have been closed and removed.

- 800 South Avenue: A waste oil spill was reported on September 13, 1996. Current status is closed. The City of Bridgeport WPCA was listed as the discharger.

- 750 South Avenue: According to an emergency incident field report by John Aceto (CTDEEP), the Department of Transportation (DOT) discovered a 550-gallon leaking underground storage tank (LUST) during an I-95 highway project on April 23, 1997. The DOT wanted to remove the tank and address the impacted soils at a later date. Soil samples collected indicated high levels of total petroleum hydrocarbon (TPH) in surrounding soils. The LUST was removed, #2 fuel oil originally stored within the tank was pumped out and contained. Contaminated soil was removed and the status is closed.

- 720 South Avenue: The DOT closed and removed a 1,000-gallon underground storage tank located at the Former Westek Corporation. The former UST stored gasoline/motor fuel. On March 1, 1997 the tank was closed. Removal occurred March 26, 1997. The status for this event is closed. A LUST with an incident date of March 26, 1997 was also recorded for this address, but the EDR report does not include any release information other than the material was motor fuel and the status is completed.

Due to the inferred groundwater flow direction and/or the proximity of these properties to the Site, the potential exists for releases that occur at these sites to have an adverse impact on groundwater quality at the Site. However, the DEEP's policy on upgradient sources of contamination is that a downgradient property owner is not responsible for remediating groundwater contamination flowing onto his or her property from another site, as long as the contamination is present solely as a result of the off-site sources (Policy on Upgradient Contamination, Michael Harder, Director of Permitting, Enforcement, and Remediation Division, August 28, 1997).

4.2 State File Review

As part of our records review, correspondence files for the following were requested on November 13, 2012 from the DEEP Records Center and PCB Programs Department:

- 400 Iranistan Avenue
- Marina Village
- Miscellaneous Town Files

Files requested include the following:

- Property Transfer Program filings
- UST files
- Leaking UST files

- P-5 Inspection Reports
- Water Industrial/Remediation files
- Pre-1990 Spill files
- PCB files
- Hazardous Waste/RCRA files
- Environmental Land Use Restrictions

No correspondence files for the Site were available at the DEEP Records Center or the PCB Programs Department.

In addition, the DEEP Hazardous Waste Manifests Database, which summarizes manifests submitted from 1984 through 2007, was reviewed. No hazardous waste manifests were listed for the Site.

4.3 Wastewater and Leachate Discharge Sources

The Connecticut Leachate and Wastewater Discharge Sources Map (CTDEP, 1997) was reviewed to determine if any historical discharges to the ground in the area of the Site have been reported. The historical discharges listed below are located within a one half-mile radius of the Site.

Facility-Discharge	Distance / Direction from Site
Industrial wastewater	2,400' W
Miscellaneous	3,000' W
Cooling water	3,000' W
Cooling water	3,000' W
Oil/chemical spill	2,600' N
Oil/chemical spill	2,600' N
Oil/chemical spill	2,300' E
Leaking Underground Storage Tank	1,800' E

Due to distance from the Site and/or the inferred groundwater flow direction, none of these discharges are inferred to have a significant potential to adversely impact the Site.

4.4 Local File Review

The City of Bridgeport Assessor's office provided a record of ownership of the Site. Note that this review does not constitute a full title search.

According to the Tax Assessor and City Clerk, the Housing Authority of the City of Bridgeport has been the owner of the 400 Iranistan Avenue parcel since 1963. No ownership information dating further back than 1963 was available. The site plan, *Figure 2*, with a revision date of August 23, 1940 and titled, *South*

End Housing Project for the Housing Authority of the City of Bridgeport, Conn. under Loan Contract with the United States Housing Authority provides evidence of HACB ownership prior to 1963.

Files and personnel at the Bridgeport offices of the City Clerk, Tax Assessor, Building Department, Planning and Zoning Department, Health Department, and Fire Marshal were queried regarding environmental concerns at the Site and surrounding sites. No environmental concerns were identified for the Site.

As part of this assessment, staff members at the Office of the Fire Marshal were queried for any information pertinent to the Site. They stated they have no knowledge of releases or threatened releases of hazardous substance at the Site.

5 User-Provided Information

ASTM Practice 1527-05 describes certain tasks to be performed by the user of this assessment that will help to identify RECs at the parcel if they exist. ASTM Practice 1527-05 defines the user as "the party seeking to use Practice E 1527 to complete an environmental site assessment of the property." Users can include a potential purchaser or tenant of the property, a lender, a property manager, or a property owner.

As part of our agreement to conduct this work, we provided Sharon Lee, Associate AIA, PM for the Planning Development & Modernization division of HACB, with a User Questionnaire. A copy of this questionnaire and responses is provided in *Appendix E*.

The responses to this questionnaire were used to address the items in the subsections below.

5.1 Record of Environmental Liens or Activity and Use Limitations

Chain of title and title restriction records filed under federal, tribal, state or local law contain records of environmental liens or activity and use limitations (AULs), such as environmental land use restrictions in the State of Connecticut.

Ms. Lee reported, on behalf of HACB, that they are unaware of a chain of title and title restrictions records review having been performed for the Site. In addition, Ms. Lee reported that they have no actual knowledge of an environmental lien or ELURs recorded against the property.

Fuss & O'Neill reviewed the Connecticut database of recorded environmental land use restrictions on file at the DEEP. No environmental land use restrictions were identified for the Site.

5.2 Specialized Knowledge or Experience of the User

Ms. Lee, on behalf of HACB**,** reported that they have no specialized knowledge with respect to the Site or activities conducted at the Site.

5.3 Commonly Known or Reasonably Ascertainable Knowledge

Ms. Lee, on behalf of the HACB, reported that they are not aware of any commonly known or reasonably ascertainable knowledge within the local community that could assist the environmental professional with the identification of RECs.

5.4 Property Valuation, Reduction for Environmental Issues

Ms. Lee, on behalf of HACB did not provide information pertaining to the valuation of the Site as the Site is not subject to a property transaction. The HACB currently owns the property.

6 Site Reconnaissance and Interviews

6.1 Interviews

Owner/Key Site Manager

This assessment included an interview with the key site contact, Sharon Lee of the HACB. Prior to conducting the interview, Fuss & O'Neill forwarded a Phase I ESA Questionnaire to Ms. Lee. The completed questionnaires are included in *Appendix E*. Information provided by her is presented below and in previous sections of this report.

Ms. Lee of the Housing Authority of the City of Bridgeport, responded with, "No" to the each of the questions including:

> *4. Are there currently or have their previously been any damaged or discarded automotive or industrial batteries, pesticides, paints, or other chemicals in individual containers of greater than 5 gal (19 L) in volume or 50 gal (190 L) in the aggregate, stored on or used at the property or at the facility?*
>
> *5. Are there currently or previously has there been any industrial drums (typically 55 gal (208L)) or sacks of chemicals located on the property or at the facility?*
>
> *7. Are there currently or has there previously been any floor drains, septic systems, dry wells, pits, ponds, or lagoons located on the property in connection with waste treatment or waste disposal?*

12. Does the owner or occupant of the property have any knowledge of any environmental site assessment of the property or facility that indicated the presence of hazardous substances or petroleum products on, or contamination of, the property or recommended further assessment of the property?

6.2 Site Reconnaissance

The site reconnaissance was conducted on September 18, 2013 by Gregory Toothill, PE accompanied by a member of the facility maintenance team. The inspection included the physical observation of the exterior of the entire Site, the interior of the Community/Maintenance building, the interior of several vacant apartments, and the crawlspaces below 31 of the apartment buildings. Photographs taken during the inspection are presented in *Appendix F*.

Site Description

The Site consists of 39 buildings, including 38 apartment buildings and one community/maintenance building with a former heating plant. A playground is located on the Site as well as several parking areas. Refer to *Figure 2* for a site plan.

Building

According to the property card there are 39 building located at the site. Two are 7,028 square-feet, 19 are 7,236 square-feet, ten are 10,476 square-feet, and eight are 11,016 square feet. The buildings were built in 1950 and are constructed of a brick exterior. Twelve of the buildings are constructed with gable roofs with asphalt shingles while the remainder are flat, tar and gravel roofs. The apartment buildings consist of a first floor, a finished upper story, and an unfinished crawlspace below the buildings. A natural gas hot water heater and furnace are located in each unit. Suspect asbestos containing material was used as pipe insulation in many of the basement crawl spaces. An electric box and a natural gas meter hookup with associated piping are attached to each unit.

Seven of the buildings are currently vacant (Building #s 7, 25, 26, 27, 28, 29, and 34).

The Community/Maintenance Building consists of offices and a large community meeting room on the first floor and a maintenance area and a former boiler and fuel oil storage tank area in the basement. The Maintenance Area consisted of a carpentry shop, a storage area, an office, bathrooms, and a break room. Small quantities of paint, PVC cement, motor oil, and other chemicals were stored in the storage areas and the carpentry shop. All stored chemicals appeared to be properly stored in original sealed containers. The former boiler and fuel oil storage tank had been removed. A sump pump was located in the former boiler room.

A maintenance garage is located off the south side of the community building that is used for storage of lawn and maintenance equipment. Minor staining was observed on the concrete floor in the area where the lawn equipment was stored. The concrete floor in the maintenance garage appeared to be in good condition and the stains are believed to be a de minimis condition.

A shed located on the east side of the Community/Maintenance Building was inaccessible at the time of the inspection.

Grounds

The surrounding grounds are flat and landscaped with grass, trees, and sidewalks leading to individual units of the buildings.

6.3 Non-ASTM Scope Considerations

Housing and Urban Development requires a Phase I to include a discussion of available wetland, flood zone, and radon mapping for the Site. The University of Connecticut's CTECO Advanced Map Viewer shows no wetlands for the Site. The FEMA Flood Insurance Rate Map shows that a large portion of the south end of the Site, including all or portions of Buildings 5-14, 18-23, and 26-31 are located within the 100-year flood plain. Radon mapping is available online through CTDEEP. The indoor radon potential rating for the Site is low to medium.

7 Connecticut Transfer Law Status

The State of Connecticut Property Transfer Law, described in Sections 22a-134a through 22a-134e of the Connecticut General Statutes, requires the disclosure of environmental conditions when certain real properties and/or businesses are transferred. The law applies only to those properties that are deemed to be "establishments" as defined under the law. As defined by the Transfer Act (Sections 22a-134a et seq. of the Connecticut General Statutes, as amended), an establishment is:

> *…any real property at which or any business operation from which (A) on or after November 19, 1980, there was generated, except as the result of remediation of polluted soil, groundwater or sediment, more than one hundred kilograms of hazardous waste in any one month, (B) hazardous waste generated at a different location by another person or municipality was recycled, reclaimed, reused, stored, handled, treated, transported or disposed of, (C) the process of dry cleaning was conducted on or after May 1, 1967, (D) furniture stripping was conducted on or after May 1, 1967, or (E) a vehicle body repair facility is or was located on or after May 1, 1967.*

If the Site is determined to be an establishment, DEEP reporting and involvement may be required in order to transfer the property, and DEEP will require identification, delineation, and remediation of all environmental concerns in accordance with Connecticut's Remediation Standard Regulations.

Activities that would qualify the facility as an "establishment" have not been identified. However, should a determination as to the regulatory status of the Site with regard to the Connecticut Transfer Law be desired, legal counsel should be consulted.

8 Data Gaps, Findings and Conclusions

8.1 Data Gaps

Standard Practice 1527-05 requires the identification and evaluation of data gaps or data failures, which are defined as a lack of or inability to obtain information required by the practice despite good faith

efforts by the environmental professional to gather such information. The following data gaps were identified during this investigation:

- It was not possible to identify past uses of the Site back to its first known development. Past uses were identified back to 1889, at which time the parcel was used for industrial purposes. The potential for the presence of RECs resulting from activities conducted prior to 1889 is mitigated by the less common use of hazardous substances or petroleum products in the United States prior to the mid-1800s.

8.2 Findings and Conclusions

Fuss & O'Neill, Inc. prepared this Phase I ESA report in general conformance with the scope and limitations of ASTM Practice E 1527-05. Any exceptions to, or deletions from, this practice are described in *Appendix A* of this report.

This assessment has revealed several RECs in connection with the subject property that warrants additional investigation or action at this time.

REC-1: Historic Foundry Operations
The Bridgeport Malleable Iron Works / Eastern Malleable Iron Company was present at the Site from prior to 1884 to the mid-1930s. Releases of petroleum products or hazardous materials resulting from the historic metal foundry and manufacturing operations and/or deposition of coal ash or other foundry by-products used as fill at the Site may have occurred.

REC-2: Historic Metal Pickling Operations
Historic metal pickling operations associated with the former foundry operations likely generated waste sludge that would currently be classified as hazardous. A release of release of hazardous materials resulting from the historic pickling operations at the Site may have occurred.

REC-3: Historic Manufacturing Operations
Hotchkiss Sons Manufacturers Curry Combs & Company / Edward S. Hotchkiss Hardware Manufacturing were present at the Site from prior to 1884 and were gone by 1913. Releases of petroleum or hazardous materials from the manufacturing operations may have occurred.

REC-4: Historic Japanning Operations
Japanning operations associated with the Hotchkiss Sons Manufacturers Curry Combs & Company / Edward S. Hotchkiss Hardware Manufacturing have the potential to generate a release of petroleum based materials at the Site.

REC-5: Historic Steel Drum Reconditioning
Following the closure of the Bridgeport Malleable Iron Works / Eastern Malleable Iron Company one of the former annealing buildings at the east end of the foundry was occupied by the Reliable Steel Drum Corporation for reconditioning steel drums and the area to the east of the former annealing building was used for the storage of steel drums. Releases of petroleum products or hazardous materials resulting from the historic steel drum reconditioning operations may have occurred.

REC-6: Historic Coal Storage
Two historic coal storage areas were identified on the site. A coal storage shed was located along Railroad Avenue on the Bridgeport malleable Iron Works property and a coal bin associated with the Hotchkiss Sons Manufacturers Curry Combs & Company was located behind their manufacturing facility.

REC-7: Historic Urban Fill
As with any site located in heavily urbanized area where former structures have been razed or with multiple generations of development, the potential for the presence of urban fill containing ash, coal, asphalt fragments, or manufacturing by-products exists.

REC-8: #2 Fuel Oil Release
On December 9, 1999, release of #2 fuel was reported to DEEP which occurred within the basement of the HACB's Marina Village office building (733 South Ave). The spill report indicated that eighteen inches of #2 fuel oil was released to the basement the floor of a 400 square-foot room on December 7, 1999. The release was estimated at 4,500 gallons. When the spill was reported on December 9, 1999 only four inches of oil remained on the floor. The status of the spill report is closed; however, no confirmatory samples were available for review. There is a potential that the release has impacted soil and groundwater at the Site.

REC-9: USTs
Approximately 30 former homes, storefronts, and apartment buildings were previously located on the Site along Ridge Avenue, Columbia Street, Johnson Street, Park Avenue and Railroad Avenue. There is potential for fuel oil USTs associated with these structures to have been abandoned in place.

Potential off-site concerns:

- Petroleum releases were identified in areas nearby and inferred to be upgradient of the Site. These releases were generally small and appear to have been adequately addressed. Therefore, we believe that little risk of impact from these releases to groundwater at the Site exists, and no additional action is recommended.

Fuss & O'Neill has followed the guidelines described in ASTM E1527-05 to identify the RECs at the Site in a manner consistent with standard practice in the industry. However, as indicated in the ASTM standard, "No environmental site assessment can wholly eliminate uncertainty regarding the potential for RECs in connection with a property. Performance of this practice is intended to reduce, but not eliminate, uncertainty regarding the potential for RECs in connection with a property, and the practice recognizes reasonable limits of time and cost."

9 References

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10 Limitations of Work Product

This document was prepared for the sole use of the Housing Authority of the City of Bridgeport, the only intended beneficiaries of our work. Those who may use or rely upon the report and the services (hereafter "work product") performed by Fuss & O'Neill, Inc. and/or its subsidiaries or independent professional associates, subconsultants and subcontractors (collectively the "Consultant") expressly accept the work product upon the following specific conditions.

1. Consultant represents that it prepared the work product in accordance with the professional and industry standards prevailing at the time such services were rendered.

2. The work product may contain information that is time sensitive. The work product was prepared by Consultant subject to the particular scope limitations, budgetary and time constraints and business objectives of the Client which are detailed therein or in the contract between Consultant and Client. Changes in use, tenants, work practices, storage, Federal, state or local laws, rules or regulations may affect the work product.

3. The observations described and upon which the work product was based were made under the conditions stated therein. Any conclusions presented in the work product were based solely upon the services described therein, and not on scientific or engineering tasks or procedures beyond the scope of described services.

4. In preparing its work product, Consultant may have relied on certain information provided by state and local officials and information and representations made by other parties referenced therein, and on information contained in the files of state and/or local agencies made available at the time of the project. To the extent that such files which may affect the conclusions of the work product are missing, incomplete, inaccurate or not provided, Consultant is not responsible. Although there may have been some degree of overlap in the information provided by these various sources, Consultant did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this project. Consultant assumes no responsibility or liability to discover or determine any defects in such information which could result in failure to identify contamination or other defect in, at or near the site. Unless specifically stated in the work product, Consultant assumes no responsibility or liability for the accuracy of drawings and reports obtained, received or reviewed.

5. If the purpose of this project was to assess the physical characteristics of the subject site with respect to the presence in the environment of hazardous substances, waste or petroleum and chemical products and wastes as defined in the work product, unless otherwise noted, no specific attempt was made to check the compliance of present or past owners or operators of the subject site with Federal, state, or local laws and regulations, environmental or otherwise.

6. If water level readings have been made, these observations were made at the times and under the conditions stated in the report. However, it must be noted that fluctuations in water levels may occur due to variations in rainfall, passage of time and other factors and such fluctuations may affect the conclusions and recommendations presented herein.

7. Except as noted in the work product, no quantitative laboratory testing was performed as part of the project. Where such analyses have been conducted by an outside laboratory, Consultant has relied upon the data provided, and unless otherwise described in the work product has not conducted an independent evaluation of the reliability of these tests.

8. If the conclusions and recommendations contained in the work product are based, in part, upon various types of chemical data, then the conclusions and recommendations are contingent upon the validity of such data. These data (if obtained) have been reviewed and interpretations made by Consultant. If indicated in the work product, some of these data may be preliminary or screening-level data and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time and other factors.

9. Chemical analyses may have been performed for specific parameters during the course of this project, as described in the work product. However, it should be noted that additional chemical constituents not included in the analyses conducted for the project may be present in soil, groundwater, surface water, sediments or building materials at the subject site.

10. Ownership and property interests of all documents, including reports, electronic media, drawings and specifications, prepared or furnished by Consultant pursuant to this project are subject to the terms and conditions specified in the contract between the Consultant and Client, whether or not the project is completed.

11. Unless otherwise specifically noted in the work product or a requirement of the contract between the Consultant and Client, any reuse, modification or disbursement of documents to third parties will be at the sole risk of the third party and without liability or legal exposure to Consultant.

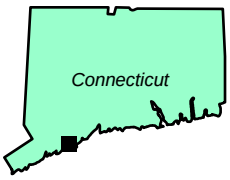
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13. Any use of or reliance on the work product shall constitute acceptance of the terms hereof.

Figures



MAP REFERENCE:
THIS MAP WAS PREPARED FROM THE FOLLOWING
7.5 MINUTE SERIES TOPOGRAPHIC MAP:
BRIDGEPORT, CONN. 1970 REVISED 1984



Quadrangle Location

0 1000 2000
GRAPHIC SCALE

SCALE: 1"=2000'

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PHASE I ESA

SITE LOCATION MAP

400 IRANASTAN AVENUE – MARINA VILLAGE

BRIDGEPORT CONNECTICUT

PROJ. No: 20121111.A12
DATE: SEPTEMBER 2013

FIGURE 1



FIGURE 2

NOTES:

BASE MAP OBTAINED AT HTTP://POI.PICTOMETRY.COM LOCATION OF ANNOTATED FEATURES ARE APPROXIMATE AND BASED ON FIELD OBSERVATIONS, AERIAL PHOTOGRAPHS, AND SANBORN MAPS.

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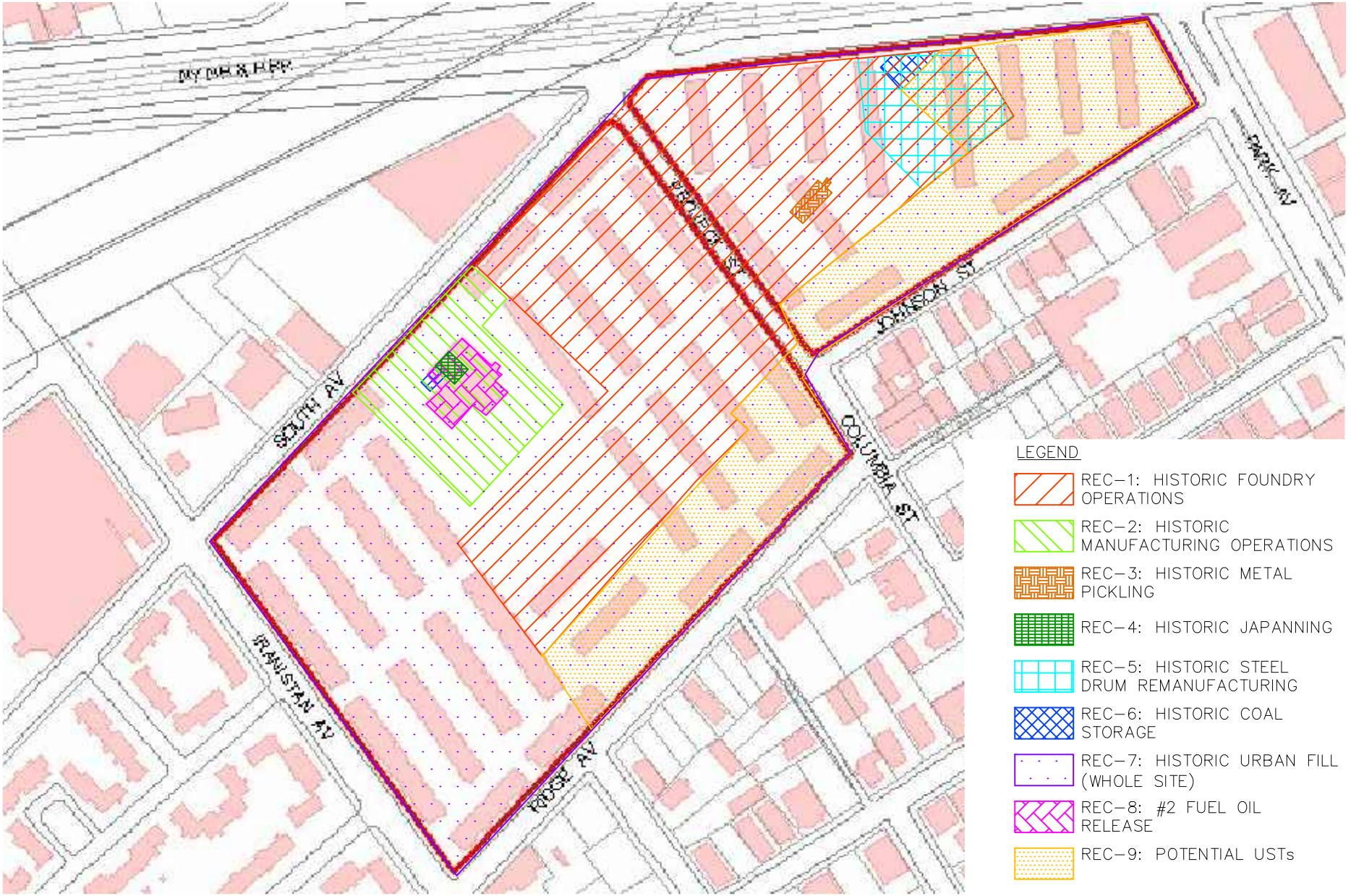
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SITE PLAN
MARINA VILLAGE

400 IRANISTAN AVENUE **BRIDGEPORT, CT**

PROJ NO. 20121111.A12 **DATED: AUGUST 2013** **SCALE = GRAPHIC**



File Path: J:\DWG\P2012\1111\A12\Environmental\Plan\20121111A12_STP01.dwg Layout: 08.5X11-L_DWG TO PDF Plotted: Wed, September 18, 2013 - 5:48 PM User: gtoothill
MS VIEW: LAYER STATE: Plotter: DWG TO PDF.PC3 CTB File: FO HALF.STB

SCALE:	
HORZ.: 1" = 200'	
VERT.:	
DATUM:	
HORZ.:	
VERT.:	

0 100 200
GRAPHIC SCALE

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BRIDGEPORT HOUSING AUTHORITY

RECOGNIZED ENVIRONMENTAL CONDITIONS PLAN

MARINA VILLAGE
400 IRANISTAN AVENUE

BRIDGEPORT CONNECTICUT

PROJ. No.: 20121111.A12
DATE: SEPTEMBER 2013

FIG. 3

FUSS & O'NEILL

Appendix A

Scope of Work and Restrictions

FUSS & O'NEILL

All Appropriate Inquiry Phase I ESA Scope of Work

Fuss & O'Neill uses Standard Practice E 1527-05 as the general standard for conducting Phase I ESAs. For consistency, this scope of work is generally presented based on the outline of our standard Phase I ESA report. The descriptions of the procedures and sources for obtaining the information for each section follow the section headings. As specified by Standard Practice E 1527-05, the scope of work described below allows for use of professional judgment to determine the extent to which specific sources are reviewed.

Unless otherwise specified, the following items are not considered in the course of completing an ASTM E 1527-05 Phase I ESA:

- Asbestos, Lead (paint/plumbing), Radon, Mold, Fluorescent Light Ballasts
- Wetlands, Ecological Resources, Historical/Cultural Resources
- Regulatory and Health & Safety Compliance
- Endangered species

These items typically present little environmental risk to the grounds of a site; however, these items may be liabilities during property transfer, regulatory audits, construction, renovation, or demolition projects.

1.0 Introduction

The objective of the ESA and the party that this ESA was conducted for are identified in this section.

2.0 Site Overview

2.1 Site Information

2.1.1 Property Location, Size of Parcel, and Site Plan
Review of USGS topographic maps, local assessor and zoning maps and property description cards, field observations and sketches, and, if available, plans provided by a contact for the Site. A site plan is included that is derived from these sources.

2.1.2 Potable Water Supply and Sewage Disposal
Query the local Department of Public Works, local Engineering Department, appropriate local utilities, and/or other local municipal sources and/or a knowledgeable site contact.

2.1.3 Adjoining Land Use
Site reconnaissance and assessor's mapping.

2.2 Physical Setting of Site

2.2.1 Geologic and Physiographic Setting
Site reconnaissance, USGS topographic maps, and available geological maps.

2.2.2 Groundwater
Site reconnaissance, USGS topographic maps, and DEEP water quality maps and water quality standards.

2.2.3 Surface Water
Site reconnaissance, USGS topographic maps, and DEEP water quality maps and water quality standards.

2.2.4 Location of Public Water Supply Sources
Site reconnaissance, DEEP water supply source mapping, and mapping available in local departments queried as part of the ESA.

2.3 Previous Environmental Investigations
Provided by the appropriate site contact or identified by other means during the course of conducting the ESA.

3.0 Site History

Site reconnaissance, knowledgeable site contacts, aerial photographs available at the State Archives and DEEP, Sanborn fire insurance maps available at the State Library, street directories

available at the State Library (note that street directories are reviewed at approximately five-year intervals, but may be reviewed at smaller intervals for multi-tenant properties), and local municipal sources (local municipal Building Department, Engineering Department, Planning and Zoning Department, Health Department,
and Fire Marshal).

4.0 Federal, State, and Local File Review

4.1 Summary of Regulatory Database Information
Regulatory databases specified by Standard Practice E 1527-05 are reviewed using Environmental Data Resources, Inc. (EDR) or a different environmental database search service.

The report provided by the environmental database search service is reviewed in detail. Sites that are inferred to present a significant risk to adversely impact the Site are identified and explained within the ESA report. However, sites inferred to pose little risk to adversely impact the Site are disclaimed within the attached environmental database search service report.

4.2 State File Review

DEEP Orders, Notices of Violation, and Connecticut Transfer Act Forms are provided for the Site using environmental database search service.

Correspondence files for the Site are requested from the DEEP solid waste and water management bureaus. If available, these files are reviewed for pertinent information, which is either copied or noted.

CTDEEP Connecticut Leachate and Wastewater Discharge Source maps are reviewed to identify any sites within one-half mile of the Site that may adversely impact the Site.

4.3 Local File Review
Files for the local municipal Tax Assessor, Building Department, Planning and Zoning Department, Health Department, and Fire Marshal are reviewed.

5.0 User Provided Information
Information provided by the user as required by the practice is discussed in this section

6.0 Site Reconnaissance, Interviews and Non-ASTM Scope Considerations

Field observations the results of required interviews are discussed in this section. In addition, surveys conducted to identify non-scope considerations are addressed.

7.0 Connecticut Transfer Act Status

Based on information obtained as part of the ESA, our opinion regarding the site's status with respect to the Connecticut Transfer Act is provided.

Hazardous waste manifests may be requested from DEEP or appropriate site contact to help resolve questions regarding the quantity of hazardous waste generated at the site.

8.0 Data Gaps, Findings and Conclusions

Data gaps relevant to the identification of recognized environmental conditions are discussed. In addition, recognized environmental conditions are summarized in this section as well as recommendations for further investigation, if appropriate.

9.0 References

References used as part of the ESA are presented here.

Restrictions: Exceptions to or Deletions from the Scope of Work

- Access to a shed located adjacent to the Community/Maintenance Building was not possible because a key could not be located.

- Access to the crawl spaces in seven buildings at the site was not possible because the entrances had either been welded shut or keys for the locks could not be located.
- Limited accessibility within the crawlspaces below the buildings limited inspection to the areas closest to the entrances.
- Equipment stored in the maintenance garage limited visibility of the floor surface.
- Due to the size of the Site and the large number of occupied units, only three representative vacant apartment units were inspected.

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Appendix B

Town File Information

AVAILABLE UPON REQUEST

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Appendix C

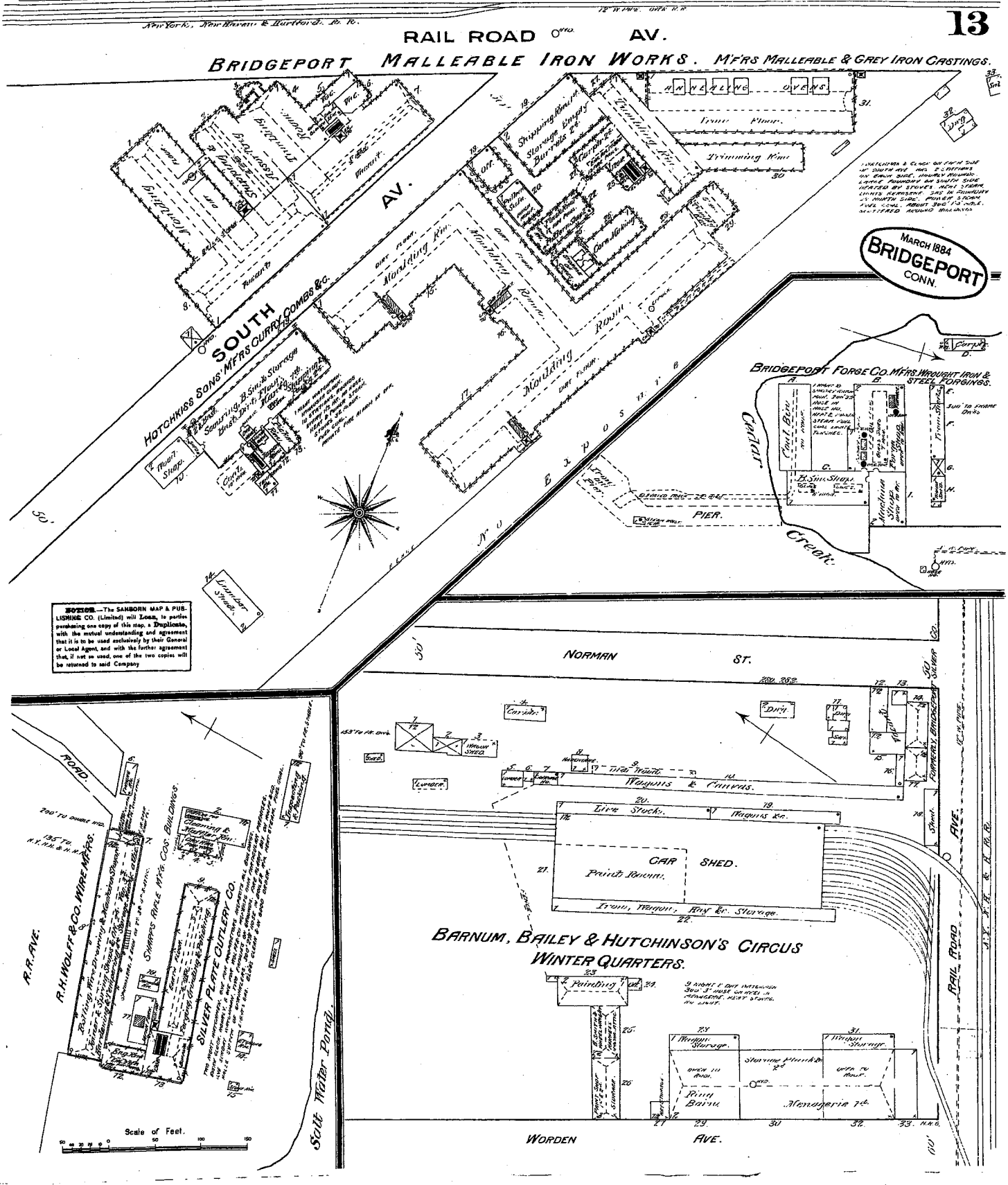
Environmental Database Search
Environmental Data Resources, Inc.

AVAILABLE UPON REQUEST

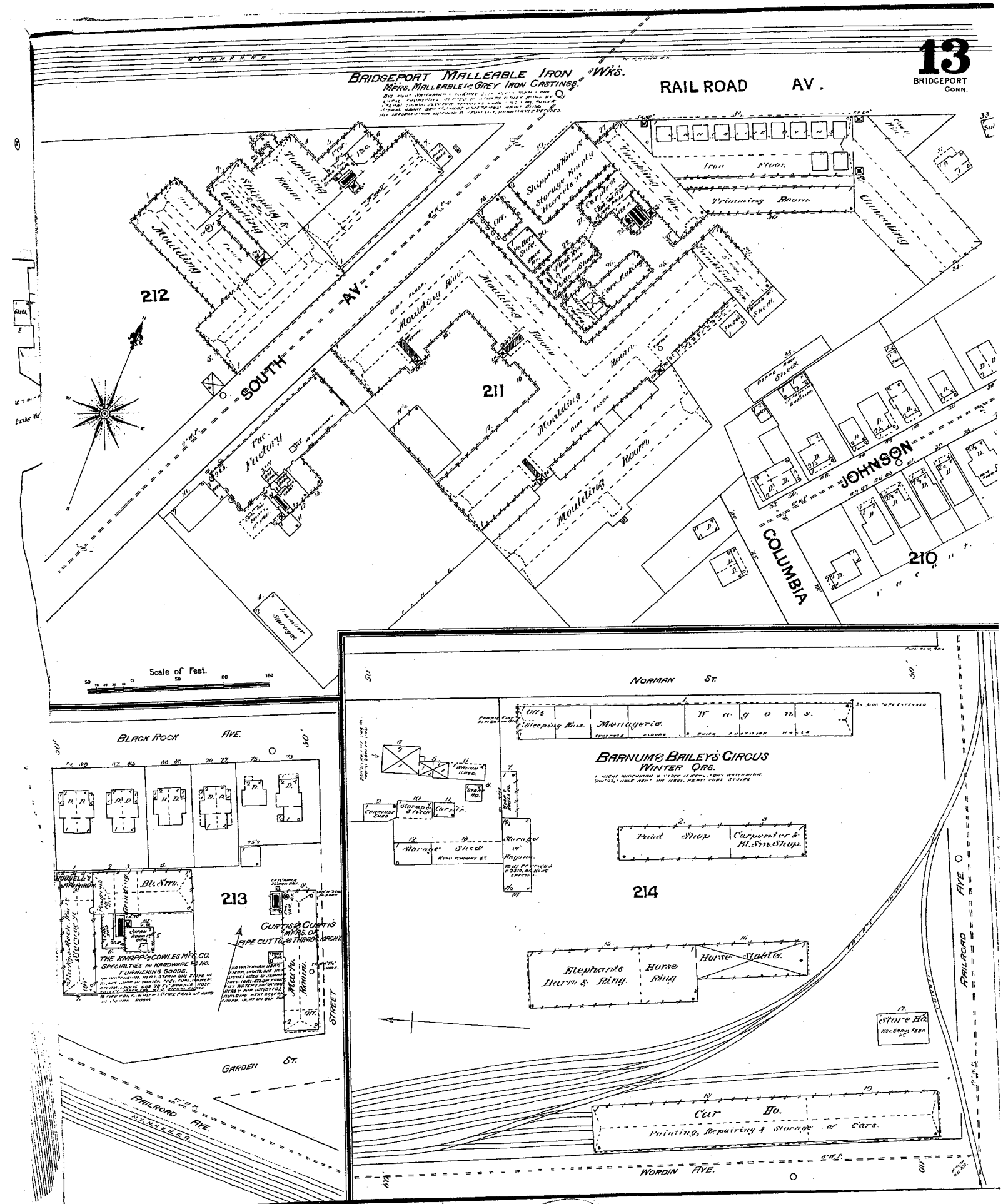
FUSS & O'NEILL

Appendix D

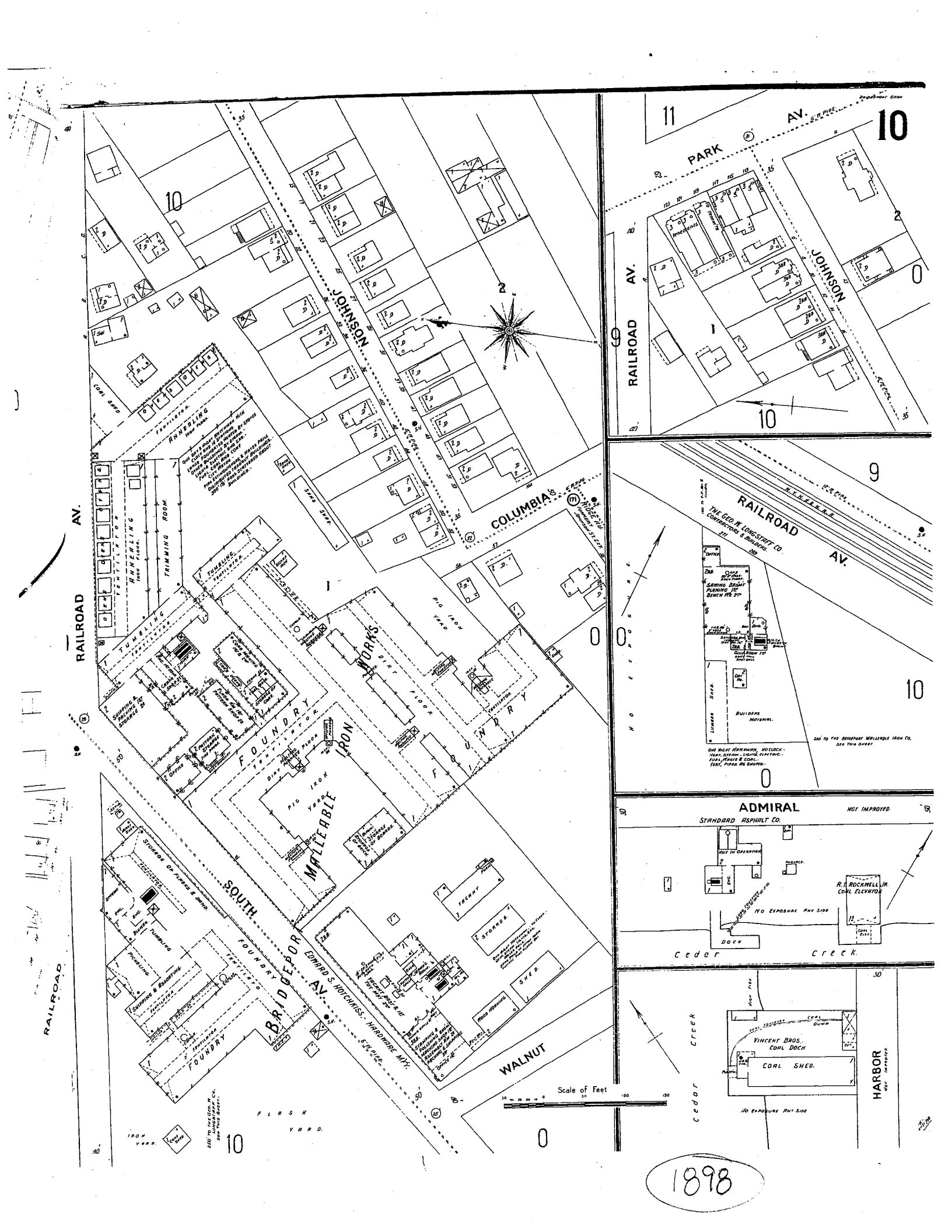
State File Information

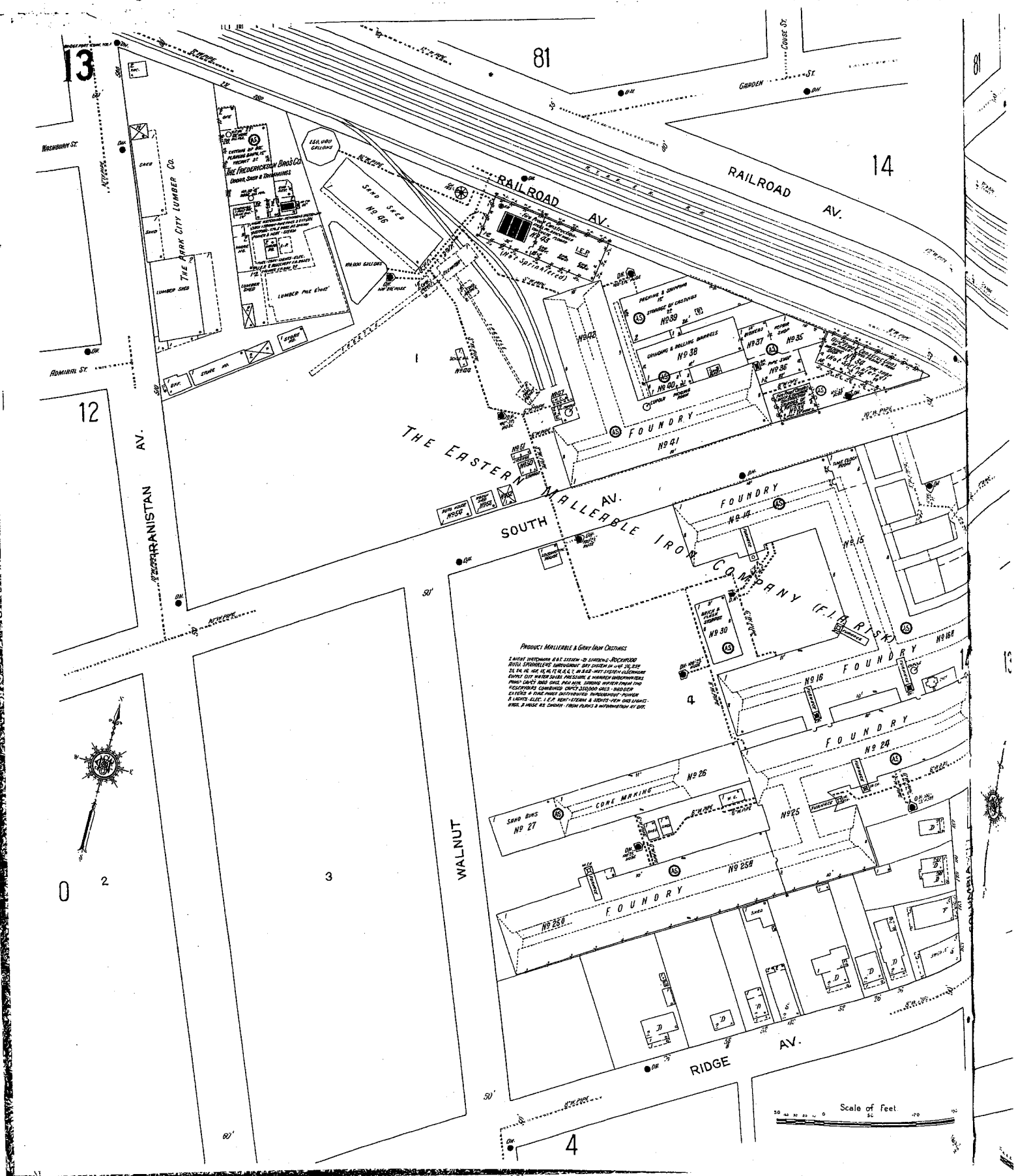

New York, New Haven & Hartford R. R. R.
RAIL ROAD
AV.
BRIDGEPORT MALLEABLE IRON WORKS. M'F'RS MALLEABLE & GREY IRON CASTINGS.
Trimming Room
Annealing
Moulding Room
Core Making
Dry Room
Trimming Rm.
Shipping Room
Storage
Blacksmith
Carpenter
Office
Engine
Boiler
Pattern Store
Smith Shop
Core Oven
Dry Room
SOUTH
HOTCHKISS SONS' M'F'RS CURRY COMBS &C.
Smelting & Sm. & Storage
Engine
Boiler
Shop
Office
Pattern Store
Core Oven
Dry Room
Moulding Room
Lumber Storage
MARCH 1884
BRIDGEPORT
CONN.
BRIDGEPORT FORGE CO. M'F'RS WROUGHT IRON & STEEL FORGINGS.
Coal Bins
B. Sm. Shop
Machine Shop
Carpt.
Dry
Trimming Shop
Engine
Boiler
Coal
Office
Lumber
Iron Pier
PIER.
Grant's
Creek
NOTICE.—The SANBORN MAP & PUBLISHING CO. (Limited) will Loan, to parties purchasing one copy of this map, a Duplicate, with the mutual understanding and agreement that it is to be used exclusively by their General or Local Agent, and with the further agreement that, if not so used, one of the two copies will be returned to said Company
NORMAN ST.
Carpt.
Dry
Wagons & Carriages.
Elec. Stock.
Wagons &c.
CAR SHED.
Paint Room.
Trans. Wagons, Hay &c. Storage.
BARNUM, BAILEY & HUTCHINSON'S CIRCUS
WINTER QUARTERS.
Painting
Wagon Storage
Ring Barn
Menagerie
Stock
Worden Ave.
R.R. Ave.
Road
R. H. WOLFF & CO. WIRE MF'RS.
Forging, Wire Drawing & Annealing
Spring & Spring Steel
Engine
Boiler
Shop
Office
Stock
SWAPPS RIFLE M'F'G CO'S. BUILDINGS.
SILVER PLATE CUTLERY CO.
Engine
Boiler
Forging, Grinding & Polishing
Scale of Feet.
Salt Water Pond.
Farmer's Bridgeport Siding
Ave.
Rail Road
N.Y. N.H. & H. R.R.

1884

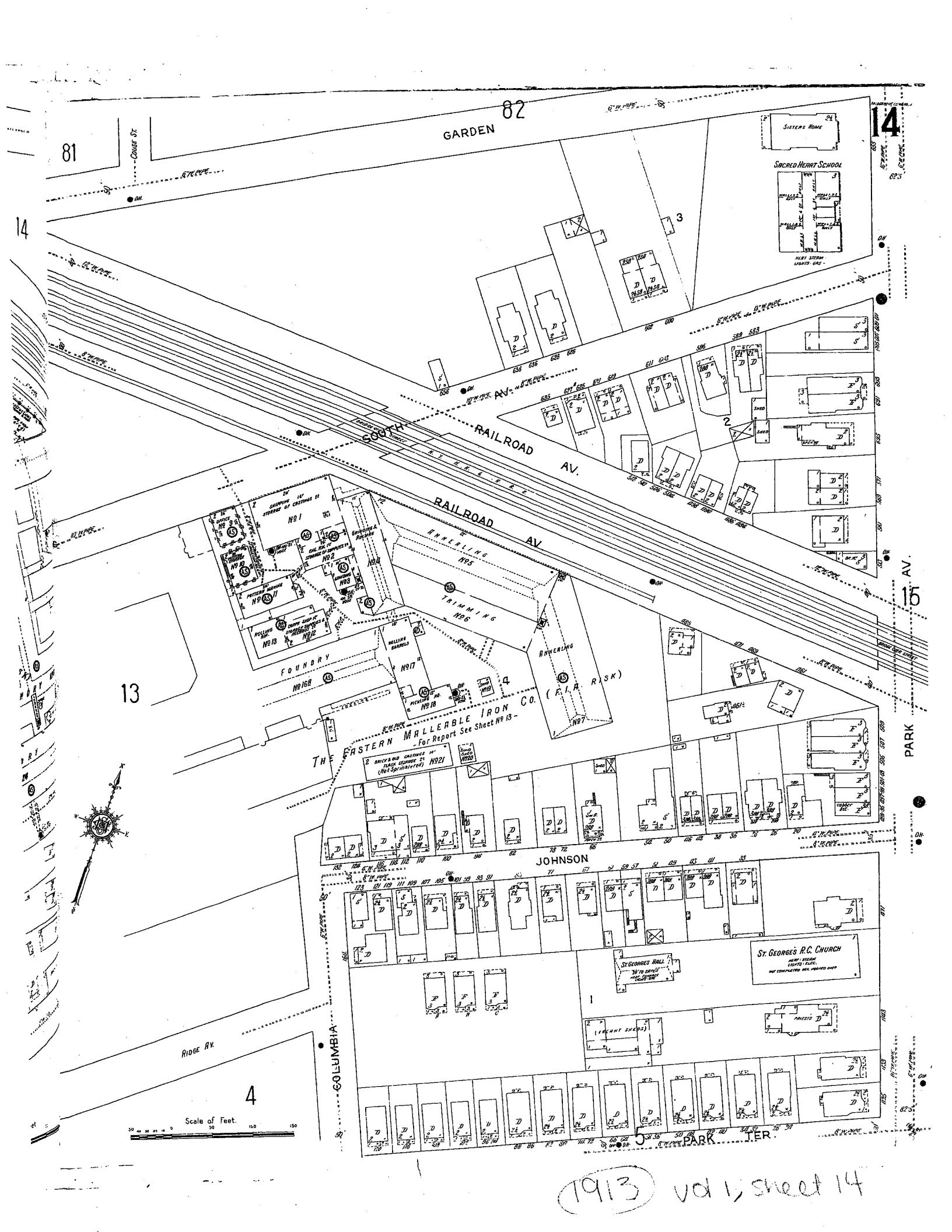

BRIDGEPORT MALLEABLE IRON Wks.
MFRS. MALLEABLE & GREY IRON CASTINGS.
RAIL ROAD AV.
212
SOUTH AV.
211
Moulding Room
Trimming Room
Iron Floor
Shipping Room
Storage Room
Moulding Floor
Tac. Factory
Blacksmith Shop
Tenement Storage
JOHNSON
COLUMBIA
210
Scale of Feet.
50 0 50 100 150
NORMAN ST.
Offs
Sleeping Rms.
Menagerie
Wagons
BARNUM & BAILEY'S CIRCUS
WINTER QRS.
Wagon Shed
Stock
Carriage Shed
Storage Shed
Paint Shop
Carpenter & Bl. Sm. Shop
214
Elephants Barn & Ring
Horse Ring
Horse Stables
Store Ho.
Car Ho.
Painting, Repairing & Storage of Cars.
WORDIN AVE.
RAILROAD AVE.
BLACK ROCK AVE.
213
HOBBELL'S MFG. HARDW.
Bl. Shop
THE KNAPP & COWLES MFG. CO.
SPECIALTIES IN HARDWARE & NO.
FURNISHING GOODS.
CURTIS & CURTIS
MFRS. OF
PIPE CUTTING & THREADING MACHY.
Machine Shop
Store
STREET
GARDEN ST.
RAILROAD AVE.
N.Y.N.H.&H.R.R.

1889

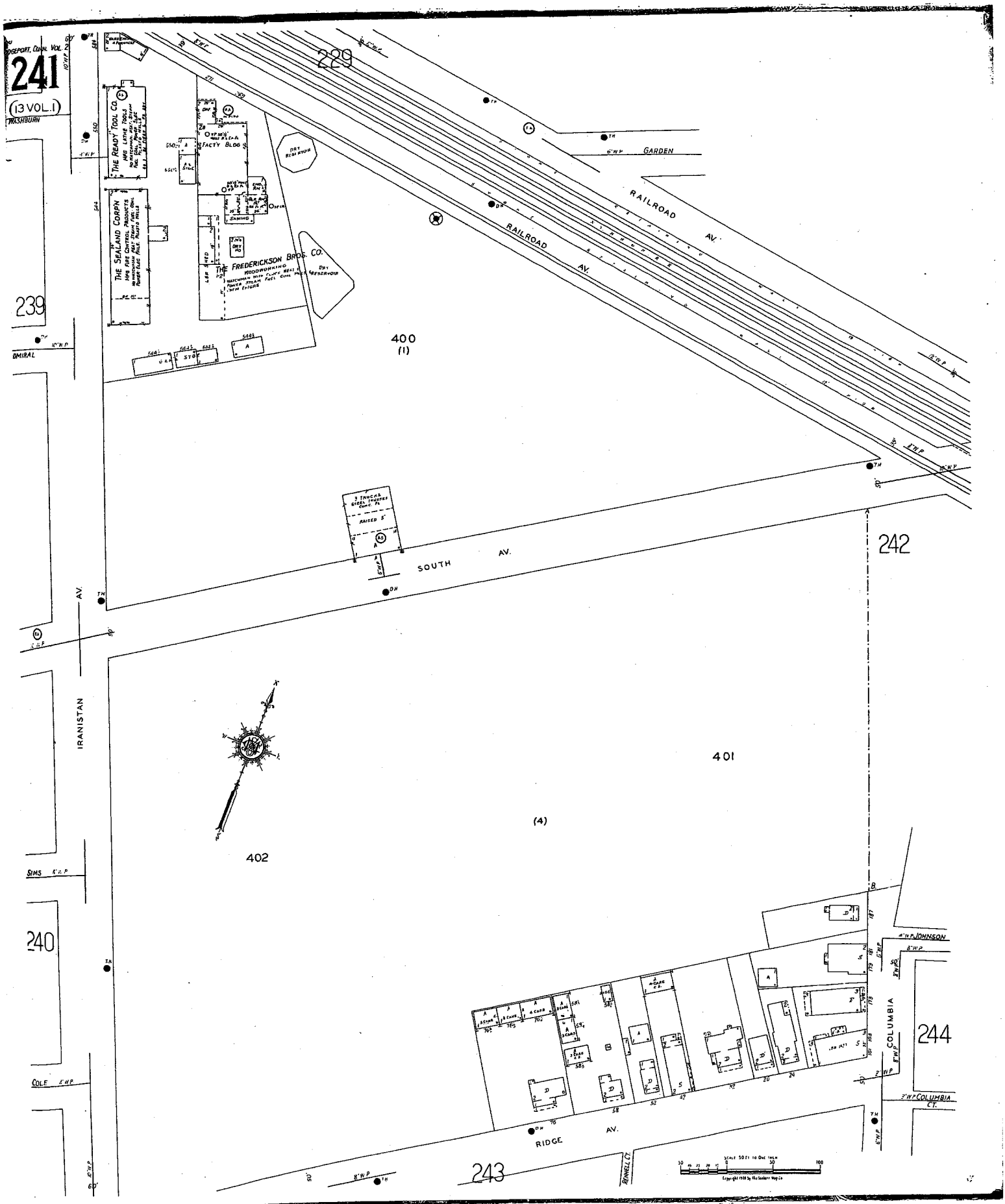

PARK AV.
JOHNSON
RAILROAD AV.
COLUMBIA
RAILROAD AV.
THE GEO. W. LONG STAFF CO.
CONTRACTORS & BUILDERS
ADMIRAL
STANDARD ASPHALT CO.
NOT IMPROVED
R. T. ROCKWELL JR. COAL ELEVATOR
NO EXPOSURE ANY SIDE
Cedar Creek
VINCENT BROS. COAL DOCK
COAL SHED.
HARBOR
NOT IMPROVED
SOUTH BRIDGE
EDWARD S. HOTCHKISS, HARDWARE MFR.
MALLEABLE IRON WORKS
FOUNDRY
PIG IRON YARD
DIRT FLOOR
TUMBLING
ANNEALING
TRIMMING ROOM
SHIPPING & RECEIVING
STORAGE
WALNUT
FLASK YARD
Scale of Feet
1898



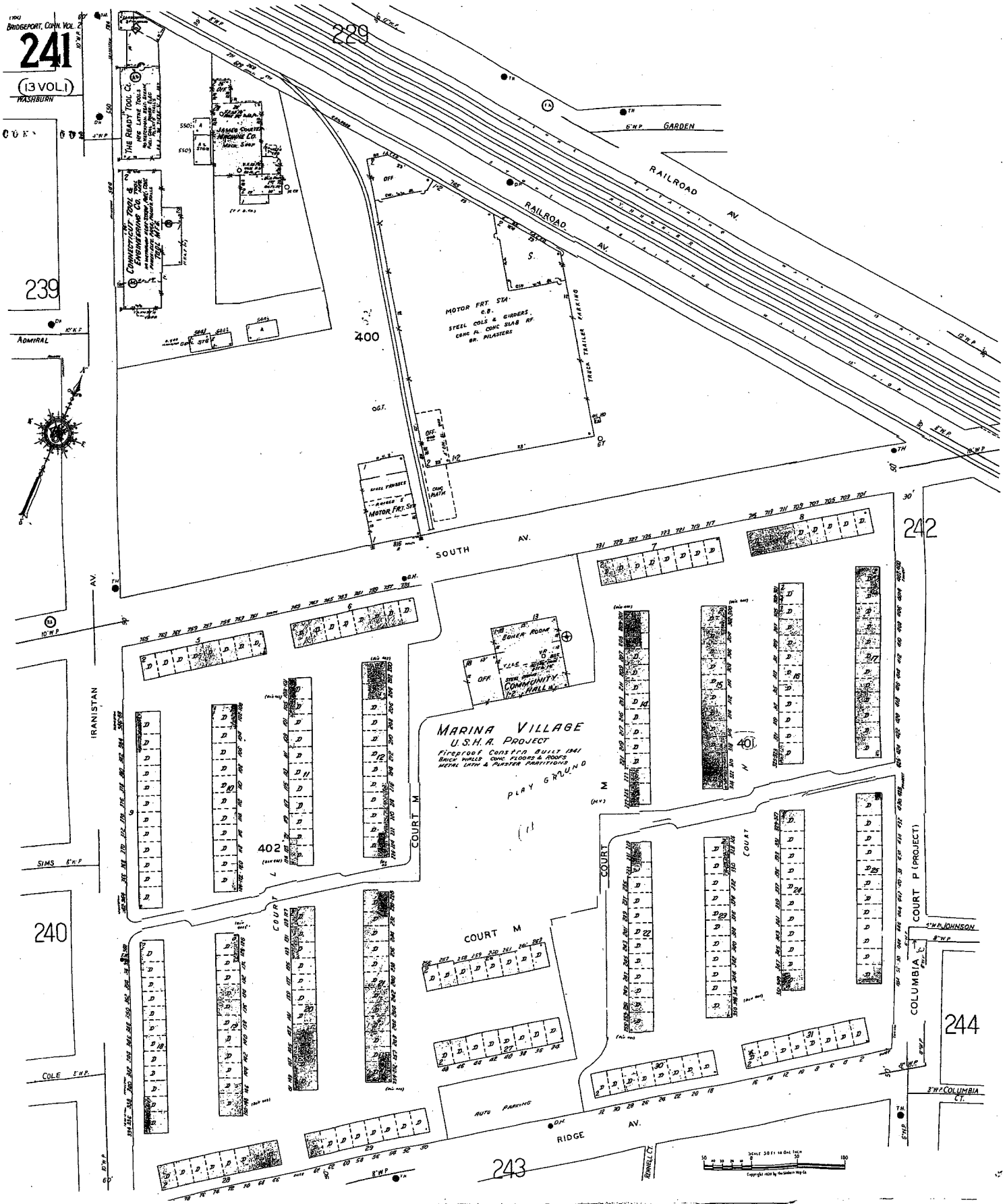
1913 Vol 1, Sheet 13



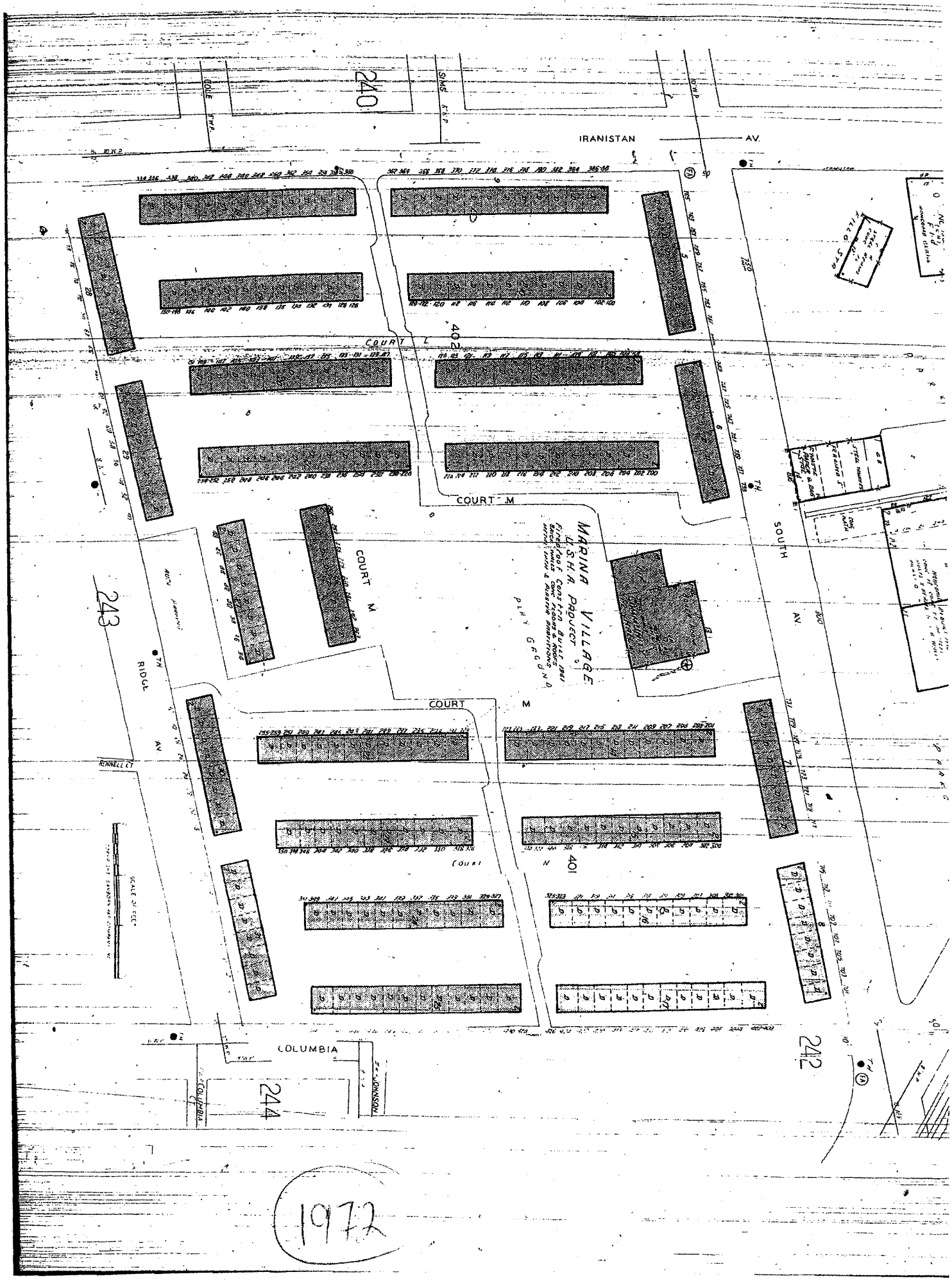
1913 vol 1, sheet 14



(1939) vol 2, sheet 241

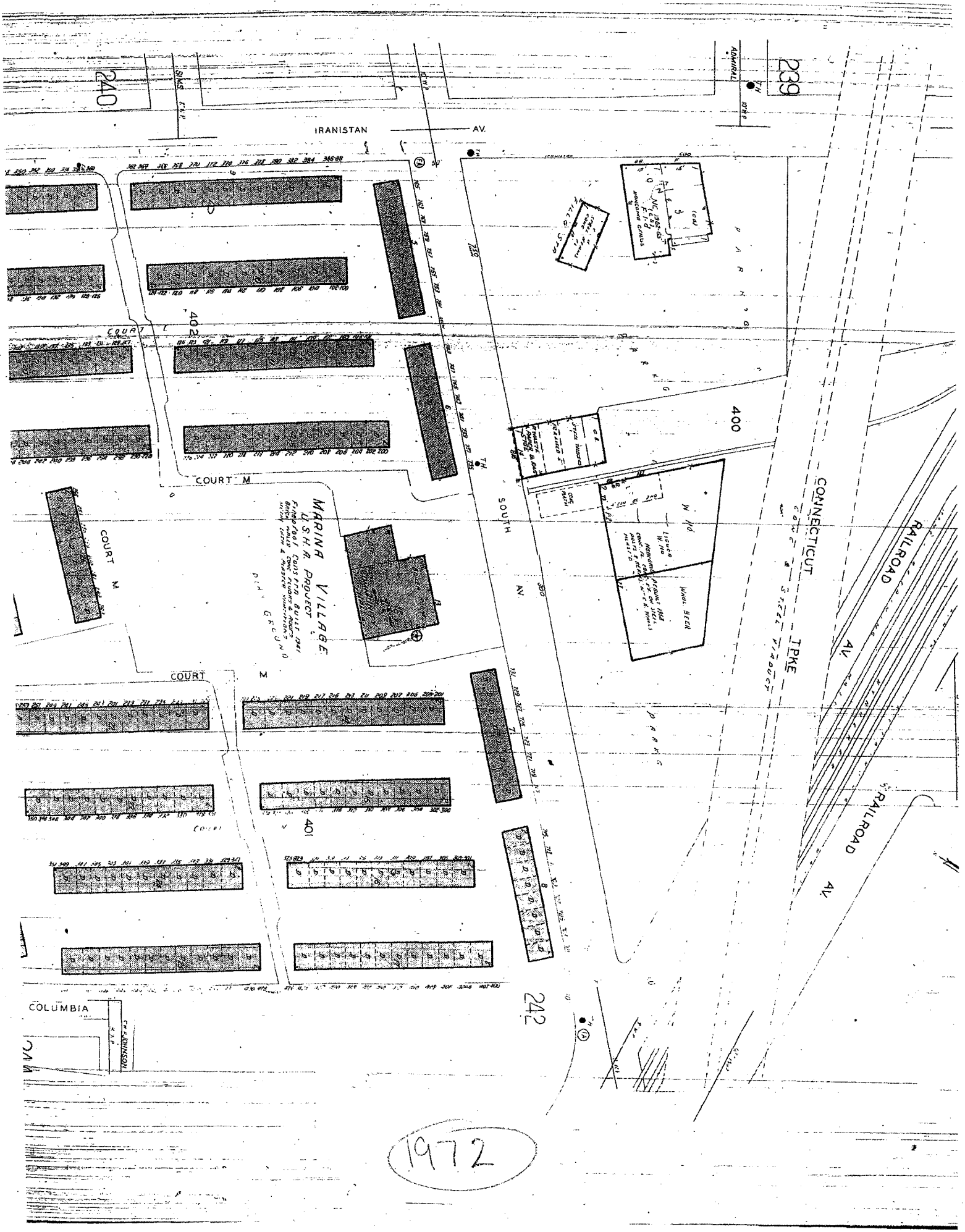


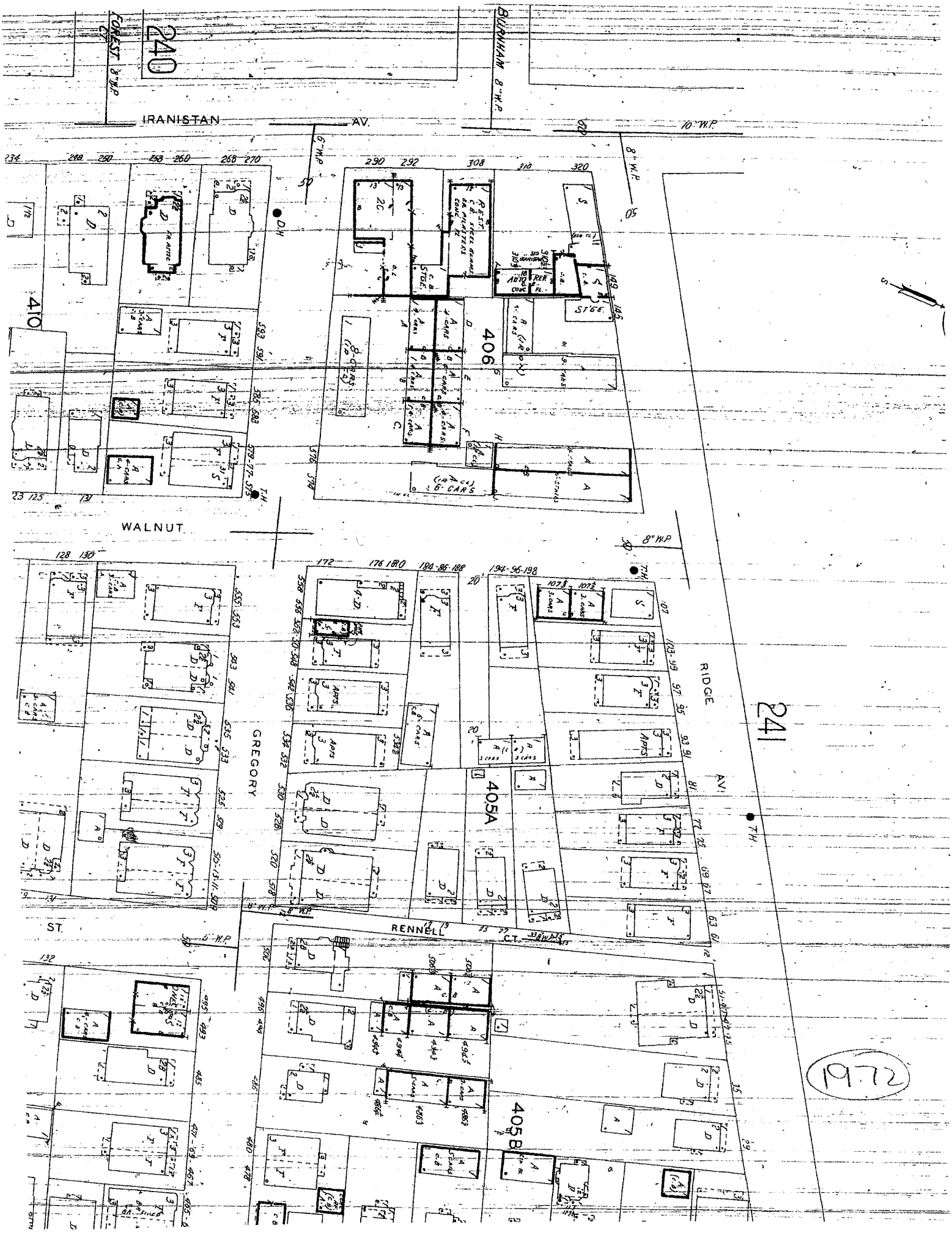
1939 - 1950 vol 2, sheet 241


IRANISTAN AV.
SIMS
GOULE
COURT L
COURT M
COURT N
MARINA VILLAGE
U.S.H.A. PROJECT
RIDGE AV
RENNELL CT
COLUMBIA
JOHNSON
SOUTH AV
240
241
242
243
244
401
402

1972


240
241
239
246
427
428
429
430
431
432
SOUTH AV
SIMS
COLE
BURNHAM
FLANDERS
ALBERT SQ
ALSACE
LITTLE
IRANISTAN AV
RIDGE AV
1972


239
240
241
242
IRANISTAN AV.
ADMIRAL PL.
COURT M
COURT
SOUTH AV.
CONNECTICUT TPKE
RAILROAD AV.
MARINA VILLAGE
U.S.H.A. PROJECT
PARK
400
401
402
COLUMBIA
1972


240
FOREST
IRANISTAN
AV.
BURNHAM
8" W.P.
10" W.P.
6" W.P.
234 248 250 258 260 268 270
290 292 308 310 320
406
410
405A
405B
241
WALNUT
GREGORY
RIDGE
AV.
RENNELL
ST.
128 130
172 176 180 184-186-188 194-196-198
132
9-72

FUSS & O'NEILL

memorandum

To: Date:

From: Subject:

Project No: BRIDGEPORT

'12 Iran (Ridge-South) res, 459-Berkins Moving + Stor. no(400)
HH+P, Inc. RD all res, S. res, 713-Bluthmert Comm. Health Ctr., res, 810-Seaside Scrap metal Co, 840-Nunes Auto repair

'10 Iran (Ridge-S) res, 459-saa PMS Scrap Fuel Inc, 478-Nunes Auto rep. RD-saa. S 733-Earthcomm Systems, 743-saa, 840-saa

'05 Iran all res, 459-Connecell + Patterson Co, Europa Foods, 478-Nunes RD: res, S saa + 750-Regency Construction. 810-Seaside scrap metal Co 840-Nunes

00 saa

95 saa "Manna Village" res

90 saa Johnson 25 Oldermen Brass Mfg Corp Manna Village (Court L, M, N, P, Q, R, S) S 810+840-saa.

'85 Iran 459-CT Trane+PaperCo, Easton Beg + PaperCo 478-Nunes John 25-Oldermen Mfg. res "Courts-res (SRQ); S 800-Agency Beer Dist., Inc. 810-saa

'74 ~~'80~~ saa Iran 478-Family Shield Serv Ctr II John 25-saa. 40 Manna Village, res South 733 Manna Vlg office; 770-Beer Dist saa 810 saa

'74 Iran saa John saa. S saa

'70 saa

'65 John 40-114 M Vill. S saa

'61 saa

FUSS & O'NEILL

Appendix E

Completed Questionnaires

PHASE I ESA QUESTIONNAIRE-OWNER/KEY SITE MANAGER

SITE INFORMATION

***Site Name*:** **Marina Village – Buildings 26 & 27**

***Address*:** **50-80 Ridge Avenue, Bridgeport, CT 06604**

QUESTION	OWNER	OCCUPANT
1. Is or has the *property* been used industrially?	Unknown See Note Below	N/A
2. Is or has the *property* been used as a vehicle body repair facility, furniture stripping facility, dry cleaning facility, gasoline station, motor repair facility, commercial printing facility, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing or recycling facility (if applicable, identify which)?	Unknown See Note Below	N/A
3. Did you observe evidence or do you have any prior knowledge that any *adjoining property* has been used as a vehicle body repair facility, furniture stripping facility, dry cleaning facility, gasoline station, motor repair facility, commercial printing facility, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing or recycling facility (if applicable, identify which)?	Unknown See Note Below	N/A
4. Are there currently or have their previously been any damaged or discarded automotive or industrial batteries, pesticides, paints, or other chemicals in individual containers of greater than 5 gal (19 L) in volume or 50 gal (190 L) in the aggregate, stored on or used at the *property* or at the facility?	Unknown See Note Below	N/A
5. Are there currently or previously has there been any industrial *drums* (typically 55 gal (208L)) or sacks of chemicals located on the property or at the facility?	Unknown See Note Below	N/A
6. Did you observe evidence or do you have any prior knowledge that *fill material* has been brought onto the property that originated from a contaminated site or an See Note Below source.	Unknown See Note Below	N/A
7. Are there currently or has there previously been any *floor drains, septic systems, dry wells, pits, ponds, or lagoons* located on the *property* in connection with waste treatment or waste disposal?	Unknown See Note Below	N/A
8. Are there currently or has there previously been any registered or unregistered storage tanks (above or underground) located on the *property*?	Unknown See Note Below	N/A
9. Is there currently or has there previously been any evidence of leaks, spills or staining by substances other than water, or foul odors, associated with any flooring, drains, walls, ceilings, or exposed grounds on the property?	Unknown See Note Below	N/A
10. If the *property* is served by a private well or non-public water system, is there evidence or do you have prior knowledge that contaminants have been identified in the well or system?	Unknown See Note Below	N/A
11. Does that *owner* or *occupant* of the property have any knowledge of *environmental liens* or governmental notification relating to past or recurrent violations of environmental laws with respect to the *property* or any facility located on the *property*?	Unknown See Note Below	N/A

QUESTION	OWNER	OCCUPANT
12. Does the *owner* or *occupant* of the *property* have any knowledge of any *environmental site assessment* of the *property* or facility that indicated the presence of *hazardous substances* or *petroleum products* on, or contamination of, the *property* or recommended further assessment of the *property*?	**Unknown See Note Below**	**N/A**
13. Does the *owner* or *occupant* of the *property* know of any past, threatened, or pending lawsuits or administrative proceedings concerning a release or threatened release of any *hazardous substance* or *petroleum products* involving the *property* by any owner or occupant of the *property*?	**Unknown See Note Below**	**N/A**
14. Did you observe evidence, or do you have prior knowledge that any *hazardous substances* or *petroleum products*, unidentified waste materials, tires, automotive or industrial batteries or any other waste materials have been dumped above grade, buried and/or burned on the *property*?	**Unknown See Note Below**	**N/A**
15. Is there a transformer, capacitor, or any hydraulic equipment for which there are any records indicating the presence of PCBs?	**Unknown See Note Below**	**N/A**

NOTE: Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

In accordance with Standard Practice ASTME 1527-05 for Phase I Environmental Site Assessments (ESAs), we are required to ask you as the property owner or a person identified as a key site manager, the following questions:

1) Please place an "X" next to each if you have or know of the existence of any of the following reports relating to the site:

- Environmental site assessment reports — See Note Above
- Environmental compliance audit reports — See Note Above
- Environmental permits — See Note Above
- Underground storage tank notification forms — See Note Above
- Registrations for underground injection systems — See Note Above
- Material safety data sheets — See Note Above
- Community right to know plans — See Note Above
- Safety plans, preparedness and prevention plans, spill prevention, counter-measure and control plans — See Note Above
- Reports regarding hydro-geologic conditions on the property or surrounding area — See Note Above
- Notices or other correspondence form any governmental agency relating to past or current violations of environmental laws — See Note Above
- Hazardous waste generators notices or reports — See Note Above
- Geotechnical studies — See Note Above
- Risk assessments — See Note Above
- Activity and use restrictions — See Note Above

Please provide copies of each report to Fuss & O'Neill prior to or at the time of the site visit.

Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

2) Are you aware of any pending, threatened, or past litigation relevant to hazardous substances or petroleum products in, on, or from the property?

Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

3) Are you aware of any pending, threatened, or past administrative proceedings relevant to hazardous substances or petroleum products in, on, or from the property?

Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

4) Are you aware of any notices from any governmental entity regarding any possible violation of environmental laws or possible liability related to hazardous substances or petroleum products at the property?

Fuss & O'Neill has been given a copy all reports that HACB has for this property. Please refer to these documents, reports etc. To the best of the knowledge of the organization, this is all the information that the Housing Authority of the City of Bridgeport (HACB) has regarding the property.

The ***Owner*** questionnaire was completed by:

Name: **Dulce Nieves / Peter Hance**
Title: **Chairperson / Deputy Executive Director**
Firm: **Housing Authority of the City of Bridgeport**
Address: **150 Highland Avenue, Bridgeport, CT 06604**
Phone: **(203) 337-8900**

Owner's Signature:_____ Date: **March 8, 2013**

The ***Occupant*** portion of the questionnaire is **N/A.**

PHASE I USER QUESTIONNAIRE

SITE NAME: Marina Village – Buildings 26 & 27
SITE ADDRESS: 50-80 Ridge Avenue, Bridgeport, CT 06604

Completed By: Dulce Nieves/Peter Hance (Please Print) **Date:** March 8, 2013

Signature: _____

Representing: Housing Authority of the City of Bridgeport **Phone No:** (203) 337-8900

ASTM Questions to Address User Responsibilities:
In order to qualify for one of the *Landowner Liability Protections (LLPs)* offered by the Small Business Liability Relief and Brownfield's Revitalization Act of 2001 (the "*Brownfields Amendments*") the *user* should provide the following information (if available) to the *environmental professional.* Failure to provide this information could result in a determination that "*all appropriate inquiry*" is not complete.

1) Environmental cleanup liens that are file or recorded against the site (40 CFR 312.25). Has a ***chain of title and title restriction*** review been conducted? **HACB is not aware of any restrictions etc. related to this issue.**

Based on the results of a ***chain of title and title restriction*** review, are there any environmental cleanup liens against the *property* that are filed or recorded under federal, tribal, state or local law?

2) Activity and land use limitation (AUL) that are in place on the site or that have been filed or recorded in a registry (40 CFR 312.26). Based on the results of a ***chain of title and title restriction review***, are there any activity and land use limitations, such as *engineering controls*, *land use restrictions* or *institutional controls* that are in place at the site and/or have been filed or recorded in a registry under federal, tribal, state or local law? **HACB is not aware of any limitations restrictions etc. related to this issue.**

If yes, explain:

3) Specialized knowledge or experience of the person seeking to qualify for the LLP (40 CFR 312.28). As the *user* of this *ESA* do you have any specialized knowledge or experience related to the *property* or nearby properties? **HACB is not aware of having any specialized knowledge or experience related to this issue.**

For example, are you involved in the same line of business as the current or former *occupants* of the *property* or an adjoining *property* so that you would have specialized knowledge of the chemicals and processes used by this type of business? **HACB is not aware of having any specialized knowledge related to this issue.**

If yes, please explain:

4) The relationship of the purchase price to the fair market value of the *property* if it were not contaminated (40 CFR 312.29). Does the purchase price being paid for this *property* reasonably reflect the fair market value of the *property*? **N/A**

If you conclude that there is a difference, have you considered whether the lower purchase price is because contamination is known or believed to be present at the *property*?

5) Commonly known or *reasonably* ascertainable information about the *property* (40 CFR 312.30). Are you aware of commonly known or *reasonably ascertainable* information about the *property* that would help the *environmental professional* to identify conditions indicative of releases or threatened releases?

If yes, please answer the following questions:

a) What were the past uses of the *property*?
b) What chemicals are present or once were present at the *property*?
c) What spills or other chemical releases that have taken place at the *property*?
d) Explain any environmental cleanups that have taken place at the *property*.

PHASE I USER QUESTIONNAIRE
PAGE 2 of 3

HACB is not aware of having any information related to this issue.

6) The degree of obviousness of the presence of likely presence of contamination at the property, and the ability to detect the contamination by appropriate investigation (40 CFR 312.31). As the *user* of this *ESA*, based on your knowledge and experience related to the *property* are there any *obvious* indicators that point to the presence or likely presence of contamination at the *property*? **HACB is not aware of having any information related to this issue.**

Other Questions:

ASTM Practice 1527-05 also requires that the *user* answer the following questions:

7) As the user of this ESA, are you aware of any pending, threatened, or past litigation relevant to hazardous substances or petroleum products in, on, or from the property? **HACB is not aware of having any information related to this issue.**
If so, explain:

8) As the user of this ESA, are you aware of any pending, threatened, or past administrative proceedings relevant to hazardous substances or petroleum products in, on, or from the property? **HACB is not aware of having any information related to this issue.**
If yes, explain:

9) As the user of this ESA, are you aware of any notices from any governmental entity regarding any possible violation of environmental laws or possible liability related to hazardous substances or petroleum products? **HACB is not aware of having any information related to this issue.**
If yes, explain:

10) We are required to ask you as the user if you have any of the following reports in your possession. Please place an "X" next to each report that is available:

_____ Environmental site assessment reports

_____ Environmental compliance audit reports

_____ Environmental permits

_____ Underground storage tank notification forms

_____ Registrations for underground injection systems

_____ Material safety data sheets

_____ Community right to know plans

_____ Safety plans, preparedness and prevention plans, spill prevention, countermeasure and control plans

_____ Reports regarding hydrogeologic conditions on the property or surrounding area

_____ Notices or other correspondence from any governmental agency relating to past or current violations of environmental laws

_____ Hazardous waste generator notices or reports

PHASE I USER QUESTIONNAIRE
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_____ Geotechnical studies

_____ Risk assessments

_____ Activity and use restrictions

Please provide Fuss & O'Neill with copies of each report or make these reports available for inspection.

HACB is not aware of having any of the information listed above.

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Appendix F

Site Photographs



Photo 1: Courtyard area between buildings.



Photo 2: Sump pump in former boiler room in the Community/Maintenance Building.



Photo 3: Storage of oil, paint, and other chemicals in maintenance storage area.



Photo 4: Minor staining below lawn equipment in the maintenance garage.



Photo 5: Potential asbestos containing pipe insulation in crawl space of apartment building.



Photo 6: Furnace and hot water heater (both natural gas) in apartment unit.



Photo 7: View of area between buildings.



Photo 8: View of Columbia Street running through the site.



Photo 9: View of courtyard between buildings.



Photo 10: View of parking lot at the east end of the site.

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Appendix G

Qualifications of Environmental Professionals and Staff

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Qualifications of Environmental Professionals and
Staff Scientists and Engineers

Environmental Professionals

Employee	Title	Education	Years of Applicable Experience	Licenses
Andy Zlotnick	Senior Vice President	BS Earth Science MS Hydrogeology	27	LEP, LEED AP
Dave Hurley	Vice President	BS Geology	32	LEP
Rob Danielson	Vice President	BS Geology MS Environmental Mgmt	26	CPG, LEP
John Carroll	Senior Project Manager	BA Geology	26	LEP
Dan Jahne	Senior Project Manager	BS Geology	18	LEP
Bob Bowden	Project Manager	BA Geology MS Geology	23	LEP
Jeremy Grant	Project Manager	BA Geology MS Geology	17	PG
Rick Kulzer	Project Manager	BA Geology	15	LEP

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Staff Scientists and Engineers

Employee	Title	Education	Years of Applicable Experience	Licenses
Kevin Vanderveer	Senior Hydrogeologist I	BS Geology	19	--
Greg Toothill	Engineer III	BS Civil Engineering	10	PE
Sara Rochelt	Hydrogeologist III	BS Geology	22	--
Caleb Scheetz	Hydrogeologist III	BS Geology MS Geology	8	--
Mike Kostiuk	Hydrogeologist II	BS Environmental Science	12	--
Drew Derrick	Environmental Technician III	BS Geophysics	3	--
Reginald Butler	Environmental Technician II		4	--
Steve Sarica	Environmental Engineer	BS Environmental Engineer	1	--

Licenses

CPG: Certified Professional Geologist
CPESC: Certified Professional in Erosion and Sediment Control
PE: Professional Engineer
PG: Professional Geologist
LEP: Licensed Environmental Professional
LEED AP: Leadership in Energy and Environmental Design Accredited Professional

Education

BA: Bachelor of Arts
BS: Bachelor of Science
MS: Master of Science

APPENDIX B

ENVIRONMENTAL EVALUATION AND MATERIALS MANAGEMENT REPORT- MAY 2015 – TRIANGLE PROPERTY

FREEMAN COMPANIES

LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Environmental Evaluation and Materials Management Report
Marina Village Housing Complex
Bridgeport, Connecticut

May 2015
Freeman File No.: 2015-0408

Prepared for:

Bridgeport Community Renewal Associates, LP
c/o JHM Group of Companies
1281 East Main St. Suite 201
Stamford, CT 06902

Prepared by:

Freeman Companies, LLC
36 John Street
Hartford, CT 06106

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1 INTRODUCTION

Freeman Companies has completed an Environmental Evaluation Assessment of the Marina Village Housing Complex located at 400 Iranistan Avenue in Bridgeport, CT. The site consists of two adjacent parcels totaling 15.9 acres, bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

Bridgeport Community Renewal Associates, LP ("BCRA") is working with Park City Communities on the redevelopment of the Marina Village housing development in Bridgeport, Connecticut. The initial Phase of this development will involve the demolition of the portion of the site bounded by Park Avenue, Railroad Avenue, Project Street (Columbia), and Johnson Street. (Buildings Numbered 32-43).

1.1 Purpose

The purpose of the assessment was to collect sufficient information in order to provide an evaluation of the environmental impacts, if present, to soil and groundwater at the site and how these impacts may affect the redevelopment of the site.

Preliminary environmental information regarding historical environmental impact on the property was obtained from the September 2013 Phase I Environmental Site Assessment (ESA) prepared by Fuss & O'Neill. Based on the information presented within the reports, the site has a long history of heavy industrial and manufacturing operations prior to its development as a residential housing complex in the late 1940s. Industrial activities at the site included the following industries:

- Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings and conducted operations such as annealing, trimming, core making, tumbling, grinding, rolling, and molding;
- Hotchkiss Sons' Manufacturers Curry Combs & Company which conducted scouring, tempering, and japanning of various metals; and
- Reliable Steel Drum Corporation which conducted the reconditioning of steel drums

1.2 Scope of Work

Based on the historical industrial activities that were conducted on the site, the following scope of work was developed:

- Oversight of the the advancement of up to 10 soil borings, three of which were completed as a groundwater monitoring well.
- The collection and analysis of a soil samples from each of the proposed soil borings. Select soil samples would be analyzed for the following parameters: volatile aromatic hydrocarbons (VOCs), extractable total petroleum hydrocarbons (ETPH), poly aromatic hydrocarbons (PAHs), total and leachable RSR listed metals and polychlorinated biphenyls (PCBs).
- The collection of a groundwater sample from each of the three newly installed monitoring wells. Groundwater samples would be analyzed for one or more of the following parameters: VOCs, PAHs, and total RSR listed metals.
- The preparation of a report documenting the findings of the investigation.

Investigation activities were conducted in general accordance with the guidelines for environmental site assessments established in the Connecticut Department of Energy and Environmental Protection (CTDEEP) Site Characterization Guidance Document (SCGD) September 2007 (updated December 2010).

1.3 Objectives

The primary objective of this investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions will affect the redevelopment of the Site.

2 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

2.1 General

The Site, located at 400 Iranistan Avenue, consists of a two adjacent parcels of land totaling 15.9 acres located in the City of Bridgeport. The Site is bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

2.2 Surrounding Land Use

The surrounding land use consists primarily of high-density housing to the southwest, southeast and northeast; and a mix of commercial and light industrial to the northwest.

2.3 Groundwater Classification

According to the CTDEEP water quality classification maps (November 2013), groundwater at the site is classified as GB. A GB classified groundwater is defined as groundwater within a historically highly urbanized area or an area of intense industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts.

2.4 Previous Environmental Assessment Activities

As previously identified a Phase I ESA was conducted on the site in 2013. Based on the information with the 2013 report no previous environmental sampling has been conducted at the site.

3 GEOLOGIC INFORMATION

The physical conditions of the Site, including hydrology characteristics, are described in the following sections.

3.1 Site Topography

The site slopes from north to south ranging with a difference in elevation of approximately 10 feet (10 feet to 20 feet) above mean sea level. A majority of the site is located between elevations 10-12 feet.

3.2 Site Soils

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS) for the State of Connecticut (NRCS Webpage), the site is identified as primarily containing Urban Land. Urban land if defined as areas those are in urban and built up areas. The characteristics of this unit are so variable that an onsite investigation is required to determine the suitability for proposed uses.

Based on field observations soil conditions were observed to consist of the following:

Topsoil/ Asphalt – Topsoil was described as light brown to brown silty SAND (SM). Up to 1.1 feet of topsoil was encountered in the borings conducted in grassy areas. Asphalt thickness ranged from 1 inch to 3 inches.

Fill – Fill was described as very loose to dense, dark brown to light brown, silty SAND with gravel (SM), asphalt, crushed brick, concrete, and other manmade material debris. Standard Penetration Test N-Values ranged from 2 to 47 blows per foot (bpf). The fill extended to depths below ground surface ranging from 0 feet (B-10) to greater than 17 feet (B-9/MW).

Natural Sand – Natural sand was encountered in each of the borings, except B-9/MW, and was described as loose to very dense, poorly graded sand with silt and gravel varying to silty sand with gravel (SM). Standard Penetration Test N-Values ranged from 6 to 69 blows per foot (bpf).

Silt – A silt layer was encountered in Borings B-2 and B-3 at a depth of approximately 16.5 feet. The silt is described as light brown, silt (ML) to clayey silt. The thickness of this deposit was not determined.

4 REMEDIATION STANDARD REGULATIONS

The analytical results reported in this report have been compared to remediation criteria listed in the CTDEEP's Remediation Standard Regulations (RSRs). The RSRs (Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies) form the basis for evaluation of site conditions in respect to environmental impacts and the impacts associated risk factors to human health and the environment. The CTDEEP uses the RSRs to determine whether sufficient remediation has been conducted at sites that are required by statute, regulation or administrative order to be remediated, or that are remediated through a formal voluntary remediation process.

The RSRs provide: (1) baseline specific criteria that may be used at any site to determine whether or not remediation is necessary, (2) self-implementing alternatives to the baseline criteria for specific circumstances, (3) self-implementing exceptions to the criteria for specific circumstances, and (4) an opportunity to request approval of site-specific alternatives to the self-implementing standards and the options for remediation from the CTDEEP Commissioner.

Although the Site is not currently under an order by the CTDEEP or subject to regulation and or statute to meet the risk based criteria within the RSRs, Freeman Companies will utilize the listed values within the RSRs as guidance in order to be protective of human health and the environment.

4.1 Soil Remediation Criteria

The CTDEEP soil remediation criteria integrate two risk-based goals: (1) Direct Exposure Criteria (DEC) to protect human health and the environment from risks associated with direct exposure (ingestion) to contaminated soil; and (2) Pollutant Mobility Criteria (PMC) to protect groundwater quality from contaminants that migrate or leach from the soil to groundwater. Soils to which both criteria apply must be remediated to a level which is equal to the more stringent criteria.

4.1.1 Direct Exposure Criteria

Specific numeric exposure criteria for a broad range of contaminants in soil have been established by the CTDEEP, based on exposure assumptions relative to incidental ingestion of contaminants in soils. The DEC applies to accessible soil to a depth of 15 feet. The DEC for substances other than PCBs does not apply to inaccessible soil at a release area provided that, if such inaccessible soil is less than 15 feet below the ground surface, an environmental land-use restriction (ELUR) is in effect with respect to the subject release area.

Inaccessible soil generally means polluted soil which is the following:

- More than four feet below the ground surface;

- More than two feet below a paved surface comprised of a minimum of three inches of bituminous pavement or concrete;
- Beneath an existing building; or
- Beneath another permanent structure(s) approved by the CTDEEP Commissioner. Buildings can be constructed and/or clean fill can be placed over contaminated soils rendering them inaccessible.

The CTDEEP has established two sets of DEC using exposure assumptions appropriate for residential land use (RES DEC) or for industrial and certain commercial land use (I/C DEC). In general, all sites are required to be remediated to the residential criteria. If the industrial/commercial land use criteria are applicable and used, an ELUR notification is required in accordance with the RSRs.

4.1.2 Pollutant Mobility Criteria

The PMC that are utilized for remediation determination of a site depends on the groundwater classification of the site. The Site is within in a GB groundwater classified area.

The PMC generally apply to all soil in the unsaturated zone, from the ground surface to the seasonal high water table in GB classified areas. The criteria do not apply to environmentally isolated soils that are polluted with substances other than VOCs provided that an ELUR is recorded for the release area which ensures that such soils will not be exposed (unless approved in writing by the CTDEEP Commissioner). Environmentally isolated soils are defined as certain contaminated soils which are below the seasonal low water table, beneath an existing building and not a source of ongoing contamination. An ELUR must be recorded for the site which ensures that such soils will not be exposed as a result of building demolition or other activities. Buildings can be constructed over contaminated soils rendering them environmentally isolated.

Remediation based upon the listed PMC requires that a substance, other than an inorganic substance or PCB, in soil be remediated to at least that concentration at which the results of a mass analysis of soil for such substances does not exceed the PMC applicable to the groundwater classification (i.e., GA or GB) of the area in which the soil is located. An inorganic substance or PCB in soil must be remediated to at least that concentration at which the analytical results of leachate produced from SPLP does not exceed the PMC applicable to the groundwater classification of the area in which the soil is located. As an alternative method for determining compliance with the PCM the analytical results of leachate produced from SPLP for most volatile, semi-volatile and petroleum compounds can be compared to the Groundwater Protection Criterion (GWPC) for such substance.

4.2 Groundwater Remediation Criteria

Groundwater remediation requirements are dependent upon the groundwater classification of the site. The objectives of these standards are the following:

- Protect existing use of groundwater regardless of the area's groundwater classification;
- Prevent further degradation of groundwater quality;
- Prevent degradation of surface water from discharges of contaminated groundwater; and
- Protect human health and the environment.

Portions of the RSRs governing groundwater regulate remediation of groundwater based on each substance present within the plume and by each distinct plume of contamination. Several factors influence the remediation goal at a given site, including: background water quality, the groundwater classification, the proximity of nearby surface water, existing groundwater uses, and the presence of buildings and their usage. When assessing general groundwater remediation requirements, all of these factors must be considered in conjunction with the major numeric components of the RSRs.

In general, remediation of a groundwater plume in a GB groundwater classified area shall result in the attainment of the following:

- The Surfacewater Protection Criteria;
- The Volatilization Criteria; and
- Not interfere with any existing usage of the groundwater.

5 SUBSURFACE INVESTIGATION ACTIVITIES

The primary objective of this investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions will affect the redevelopment of the Site. To achieve the stated objectives, the subsurface investigation activities were designed to include both environmental setting and contaminant identification investigations.

The approach, procedures and results of the site investigation activities are presented in the following sections.

5.1 Soil Sampling and Analysis

The primary purpose of the soils characterization portion of the assessment was to define the nature/presence of target contaminants in the unconsolidated materials in both the saturated and unsaturated zones associated with historical Site activities. In addition, the boring program also provided information on Site stratigraphy and physical properties of the unconsolidated materials in both the saturated and unsaturated zones with particular emphasis on the characteristics of those materials that affect contaminant migration pathways and transport mechanisms.

This section describes the specific soil borings and sampling performed in order to define Site stratigraphy, soil properties and soil contaminant profiles.

5.1.1 Soil Sampling

Soil sampling activities were conducted between the dates of May 12 through May 14, 2015. A total of ten soil borings were advanced at the Site as part of the investigation. New England Boring Contractors of Glastonbury, CT advanced the soil borings utilizing a hollow stemmed auger (HSA) drilling rig under the direct supervision of Freeman Companies field personnel. The location for each of the soil borings was chosen to maximize the information obtained based on Freeman Companies' understanding of existing site conditions. A figure depicting the locations of sampling activities is included in Appendix A. Boring and well completion logs are provided in Appendix B.

The following sections provide a summary of soil investigation drilling details.

5.1.2 Soil Sampling Via Hollow Stemmed Auger

All ten soil borings (B-1 through B-10) were advanced using a HSA drill rig spinning 4 ¼-inch inner diameter augers. Soil samples were collected with stainless steel, 2-inch diameter, two-foot split-spoon sampler advanced ahead of the augers in two-foot intervals using a weighted hammer. In general, sampling was conducted semi continuously at 2 foot intervals into the observed water table.

5.1.3 Soil Screening and Submittal

Upon retrieval of each soil sample, the supervising field personnel visually inspected each sample for staining, color, and moisture content and then characterized and logged each sample.

Following the completion of each soil boring and related soil sample collection activities, the resulting boreholes were backfilled with either the drill cuttings that were generated from the borehole and/or with virgin well materials.

Soil samples submitted for laboratory analysis were selected based on the groundwater interface zone and/or the identification of a contaminate migration pathways to the environment (HSA borings) and at predetermined depths for the manual soil borings. The selected soil samples were submitted to Phoenix Analytical laboratories of Manchester, CT and analyzed for those constituents that have the potential to be released to the subsurface due to current or historical activities related to the REC investigated. Based on the constituents of concern for each of the AOCs, the soil samples were analyzed for one or more of the following analysis:

- Volatile Organic Compounds (VOCs) in accordance with EPA Method 8260
- ETPH in accordance with CTDEEP extractable total petroleum hydrocarbons methodologies
- Poly-aromatic hydrocarbons (PAHs) via EPA Method 8270
- Total CT listed metals
- Leachable CT listed metals via the Synthetic Precipitation Leaching Procedure
- PCB's in accordance with EPA Method 8082

5.1.4 Sample Management

All soil and groundwater analytical samples were collected in laboratory-supplied containers and chilled immediately on ice for transit to the laboratory. Freeman Companies personnel maintained possession of the samples until transfer to a laboratory provided courier for transit to the laboratory. A chain-of-custody form accompanied the samples from their collection point to delivery at Phoenix. Complete chain-of-custody forms are included with the laboratory analytical data reports as provided in Appendix C.

5.2 Monitoring Well Installation Activities

The primary purpose of the groundwater characterization portion of the investigation was to determine the presence of contaminants of concern relative to historical site activities. In addition, the well installation program was designed to define groundwater elevations and aquifer characteristics across the Site in order to understand and evaluate potential contaminant fate and transport pathways/mechanisms.

Three overburden-monitoring wells (MW-1 through MW-3) were set to depths of approximately 12 to 16 feet below grade. The wells are constructed of approximately 10 feet of 2-inch diameter, 0.010-inch slotted PVC screen, with 2-inch PVC riser extending to grade. The annular space around the wells was filled with #2 sand extending up to approximately 1-2 feet above the screen. An approximate six inch layer of bentonite was placed above the sand pack to form a seal. Native fill and/or well sand was then used to fill the remaining borehole to grade. Each well was finished with an eight-inch diameter flush mounted road box set in concrete. A figure depicting monitoring well locations is included in Appendix A. Well construction logs are presented as Appendix B.

5.3 Groundwater Sampling

The primary purpose of the groundwater characterization portion of the site investigation was to attempt to identify the nature groundwater impacts from historic usage of the Site. In addition, the groundwater characterization portion of the site investigation was also used to define groundwater elevations and aquifer characteristics across the study area in order to understand and evaluate potential contaminant fate and transport pathways and mechanisms.

Freeman Companies personnel collected groundwater samples from the newly installed monitoring wells on May 18, 2015. Groundwater sampling was conducted using low flow procedures in general accordance with Region I EPA's Low Stress (low flow) Purging and Sampling Procedure (July 30, 1996, revised January 19, 2010). Purging and sampling were performed using an adjustable rate pneumatic bladder pump with dedicated polyethylene tubing for all sampled wells. Pump intake depths were selected to coincide with the center-of-saturated-screen elevations for the deep wells and the top of the saturated screens for the shallow water table wells.

Purged volumes were based on the rate of stabilization of field-measured water quality parameters, including: dissolved oxygen, specific conductance, temperature, pH, turbidity, and oxidation/reduction potential were obtained.

Field parameters were generally measured at five minute intervals; purging rates and water levels were also measured. Purged water from the wells did not exhibit any visual or olfactory evidence of impact such as odors and/or sheen. Due to the nature of the formation (urban fill) turbidity readings remained above the target of 5 NTUs, even after extended pumping.

Groundwater samples were collected from each well and submitted on ice to Phoenix for analysis. The following analyses were performed on all submitted groundwater samples:

- VOCs by EPA Method 8260
- PAHs via EPA Method 8270
- Total CT listed metals

Due to the turbid nature of the collected samples, ranging from 30 NTUs to 500 NTUs, the groundwater samples were also analyzed for total dissolved (filtered to remove turbidity) metals in order to evaluate interferences due to the turbidity.

5.4 Soil Sampling Results

Soil encountered during the advancement of the soil borings consisted primarily of brown, fine to medium sand. A layer of silt and clay was encountered at a depth of 11 feet below grade within boring FC-4. Bedrock was not encountered at any boring locations.

Based on non-restricted property use, guidance standards used for soil at the Site would be the Residential Direct Exposure Criteria (RDEC) and the Pollutant Mobility Criteria (PMC) for an area with a GB groundwater classification.

Laboratory analysis of the soil samples collected from sample locations B-5, B-7 and B-8, identified the presence of one or more of the following; poly aromatic hydrocarbons, total petroleum hydrocarbons, total arsenic and/or PCBs at concentrations exceeding the RDEC and/or the GB PMC.

A summary of the soil analytical results is presented in Table 1, within Appendix D and a copy of the laboratory analytical report is included as Appendix C.

5.5 Groundwater Sampling Results

Groundwater samples were collected from each monitoring well with dedicated sampling equipment in order to assess current water quality and to evaluate for the presence and distribution of contaminants in groundwater that may have originated from the Site or potentially from off-site locations. Samples were stored in laboratory provided glassware and submitted for analysis at for the suite of analytes identified based upon historic or current suspected potential sources of contamination. These parameters were used to indicate the presence of contaminants in groundwater and provided a basis for correlation with chemical data derived from the soil results.

Based on current land use and a GB groundwater classification, remediation guidance used for groundwater at the Site would be the Residential Volatilization Criteria (RES VC) and the Surface Water Protection Criteria (SWPC).

Analytical Results did not detect the presence of any volatile organic compounds at concentrations that exceeded the RES VC.

Analytical results of the poly aromatic hydrocarbons identified the presence of one or more of the following; benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and phenanthrene at concentration exceeding the default SWPC within the samples collected from MW-2 and MW-3.

Analytical results of the total metals analysis primarily detected the presence of one or more of the following metals; arsenic, copper, lead, mercury, and zinc at concentrations exceeding the default SWPC within the samples collected

from MW-1 and MW-3. Due to elevated turbidity levels that were encountered during sampling, the groundwater samples were filtered in order to remove suspended sediments and analyzed dissolved metals. Dissolved metals results did not indicate the presence of any metals exceeding the default SWPC.

A summary of the groundwater analytical results is presented as Table 2 in Appendix D, and a copy of the laboratory analytical report is included in Appendix C.

6 SOIL REUSE/DISPOSAL

Based on the findings of the assessment activities, the following general assumptions can be made regarding the soil at the site.

- Native soils may be managed as clean fill after confirmatory testing has been completed to ensure status as clean fill.
- Any urban fill material disturbed as part of proposed site activities shall be at a minimum be managed as a Regulated Soil.
- Urban fill material disturbed from the central portion of the site shall be classified as contaminated and must be removed from the site for proper disposal.
- Polluted soils may be reused on-site following site specific requirements

Further management/reuse discussions are provided in the following sections.

6.1 Soil Classifications

Based in the analytical results from the samples collected as part of the assessment activities the following soil types will be encountered as part of proposed site activities.

6.1.1 Clean Fill

Chemically clean fill that meets the definition of natural soil as defined in Sec. 22a-209-1 and Sec. 22a-133k-2(h) of the Regulations of Connecticut State Agencies (RCSA). Clean fill does not contain any substances above natural background levels. It is anticipated that a majority of native soils excavated from the project area will meet this definition of Clean Fill. Actual volumes will be determined by further analytical testing.

6.1.2 Polluted Soil

Soil affected by a release of a substance at a concentration above the analytical detection limit for such substance in accordance with RCSA 22a-133k-1(a)(45) and below the Residential Direct Exposure criteria and the GB Pollutant Mobility criteria as these terms are described in the Remediation Standard Regulations (RCSA 22a-133k-1 through 3). It is anticipated that a portion of the Urban Fill material will meet this definition. In most cases polluted soil may be reused at the project site with restriction.

6.1.3 Contaminated Soil

Soil affected by an identified or suspected release and determined, or reasonably expected to contain substances exceeding Residential Direct Exposure Criteria or GB Pollutant Mobility Criteria, as these terms are defined in the Remediation Standard Regulations (RCSA Section 22a-133k-1). It is anticipated that a majority of the Urban Fill located within the central portion of the project area will meet this soil type. In all cases contaminated soil disturbed as part of construction activities shall be removed from the site for proper disposal.

6.1.4 PCB Impacted Soil

Soil affected by a release of PCB at an as found concentration above 1 mg/Kg but <50 mg/kg for PCB. Soil will require special handling and management and will also require approvals for disposal at an approved disposal facility. It is anticipated that a small portion of the Urban Fill material, particularly located within the central portion of the site will meet this definition.

6.1.5 PCB Remediation Waste

Soil affected by a release of PCB at an as found concentration of >50 mg/kg. Soil remediation and management must be conducted under TSCA requirements within 40 CFR 761. It is not anticipated that any soil will meet the requirement of this criteria.

6.1.6 Hazardous Soil

Soil is classified as hazardous waste if it exhibits a hazardous waste characteristic or if it contains Resource Conservation and Recovery Act (RCRA) listed hazardous constituents above Connecticut's RCRA "Contained-In" Policy dated May 2002. It is not anticipated that any soil will meet the requirement of this criteria.

6.1.7 Regulated Soil

Regulated Soil includes Polluted Soil and Contaminated Soil. It is anticipated that almost all soil generated from site activities will be regulated

6.2 Soil Management

Based on the analytical results the testing conducted soil management activities for the handling and management of excavated material encountered during demolition/construction will be required. It is not intended that any soil remediation be conducted outside the limits of excavation anticipated for the project as designed.

All handling and management operations should be conducted in accordance with standard engineering practices applicable to such activity and in accordance with CTDEEP regulations including but not limited to the procedures contained in the CTDEEP General Permit for Contaminated Soil and/or Sediment Management.

Depending on the selected management approach, soils within the project area can be ether pre-classified, stockpiled and classified, or assumed to be contaminated.

All stockpiles of Regulated Soil should be constructed to isolate stored Regulated Soil from the environment. Stockpiles shall be constructed to include liners free of holes and other damage. The ground surface on which the liner is to be placed shall be free of rocks or and any other object which could damage the liner.

Regulated Soil cannot be stockpile off site unless a registration has been submitted to and approved by the CTDEEP under the General Permit for Contaminated Soil and/or Sediment Management.

6.3 Allowable Reuse Options

Polluted Soil may be reused in accordance with the following requirements:

- Reused on site as backfill in locations above the water table and not in areas subject to erosion in accordance with requirements of Section 22a-133K of the RCSA. The backfill location and depth shall be documented in a scaled drawing for any Polluted Soil that is reused on site. Any backfill material shall meet the structural/compaction geotechnical requirements.

- If the polluted soil is not suitable for reuse, the material shall be managed, disposed of, treated or recycled in accordance CTDEEP regulations

6.4 Health and Safety

All site health and safety controls shall be fully established and in operation prior to beginning any material handling activity. Site controls shall include but not be limited to the following: work zones properly barricaded, decontamination facilities established, air monitoring, and all support equipment and supplies including personal protective equipment.

7 WASTEWATER HANDLING

Based on the analytical testing conducted as part of this evaluation, it is anticipated that a majority of the dewatering wastewater generated from the project area will be contain some degree of contaminants, primarily metals and poly aromatic hydrocarbons, and therefore will likely require specific handling and management procedures to be implemented.

7.1 Allowable Disposal Options

Management of dewatered groundwater may be accomplished in accordance with CTDEEP General Permit for the Discharge of Groundwater Remediation Wastewater Directly to Surface Water (Storm sewers discharging to surface waters) and local regulations and ordinances or through the CTDEEP General Permit Groundwater Remediation Wastewater to a Sanitary Sewer and local regulations and ordinances.

7.2 Storage Options

If there is a need for storage of wastewater prior to discharge, fractionation tanks with a capacity of at least 20,000 gallons may be used. The tanks shall be equipped with a sample port to facilitate safe sampling of tank contents. Discharge valve shall be capable of controlling discharge flow rate.

7.3 Treatment Options

If it is necessary to treat the water in order to meet discharge limits, an activated carbon treatment and filtration system, sized to treat water with a minimum influent total volatile organic compound concentrations necessary to meet discharge goals, may be implemented. Systems of this type shall include one or more of the following components: pumps; piping; bag or cartridge filters; carbon treatment vessels; Influent, midpoint and effluent sampling ports and system flow meters.

7.4 Health and Safety

All site health and safety controls shall be fully established and in operation prior to beginning any material handling activity. Site controls shall include but not be limited to the following: work zones properly barricaded, decontamination facilities established, and all support equipment and supplies including personal protective equipment.

8 ENVIRONMENTAL REMEDIATION AND DISPOSAL COSTS

Freeman Companies conducted and environmental evaluation of the project area in order to obtain a better understanding of the subsurface conditions that may be encountered as part site demolition and construction activities.

Soil conditions encountered within soil borings consisted of sand (natural soil) overlain by various thicknesses of fill, which contained a variety of debris (asphalt, crushed brick, concrete), and other manmade material debris.

Analytical results identified that the fill material is generally impacted by a combination of poly aromatic hydrocarbons, metals and PCBs. Due to the presence of poly aromatic hydrocarbons, contaminated soils can be distinguished by both odor and discoloration.

In order to be protective of human health, Freeman Companies recommends that the following actions be taken for fill material encountered at the site:

- The removal of all contaminated fill to a depth of at least four feet below unpaved ground surfaces and two feet below paved surfaces; and
- The removal of all soil identified to be impacted by PCBs at concentrations of >1 mg/kg

The removed contaminated fill can either be removed from the site for disposal at a permitted disposal facility.

Due to the fact that the site will be re-graded following demolition activities, the Owner should attempt to reused polluted fill material to the maximum extent prudent upon the completion of demolition (i.e. within former building foundation excavations, within former tunnel excavations, as backfill within areas of remediation).

8.1 Remedial Costs

Based on the analytical results, the soil represented by the samples collected from borings B-5 and B-7 should be considered as contaminated and therefore Freeman Companies would recommend that any excavated material from within this area should be removed from the Site for proper disposal.

Based on initial estimates, approximately 2,000 – 5,000 tons of contaminated soil may need to be removed as part of the demolition activities. Freeman Companies estimates that the environmental costs associated with transportation and disposal of the Regulated soil to be approximately $50-70/ton for soils with PCB concentrations of <2 mg/kg and can be accepted at a Massachusetts landfill.

In addition, freeman companies would recommend that additional sampling be conducted during demolition activities in order to better define remedial areas and to continue the delineation/characterization of soils to remain on the site. Since the constituents of concern have been defined through evaluation testing, soil testing parameters may be limited to just PAHs, total arsenic and PCBs. Costs for analysis is estimated at $175/sample which will include all three parameters.

APPENDIX A

MAPS AND FIGURES



MAP REFERENCE
7.5 MINUTE SERIES TOPOGRAPHIC MAP
BRIDGEPORT, CONN. 1984

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
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36 JOHN STREET
HARTFORD, CT 06106
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(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

SITE LOCATION MAP

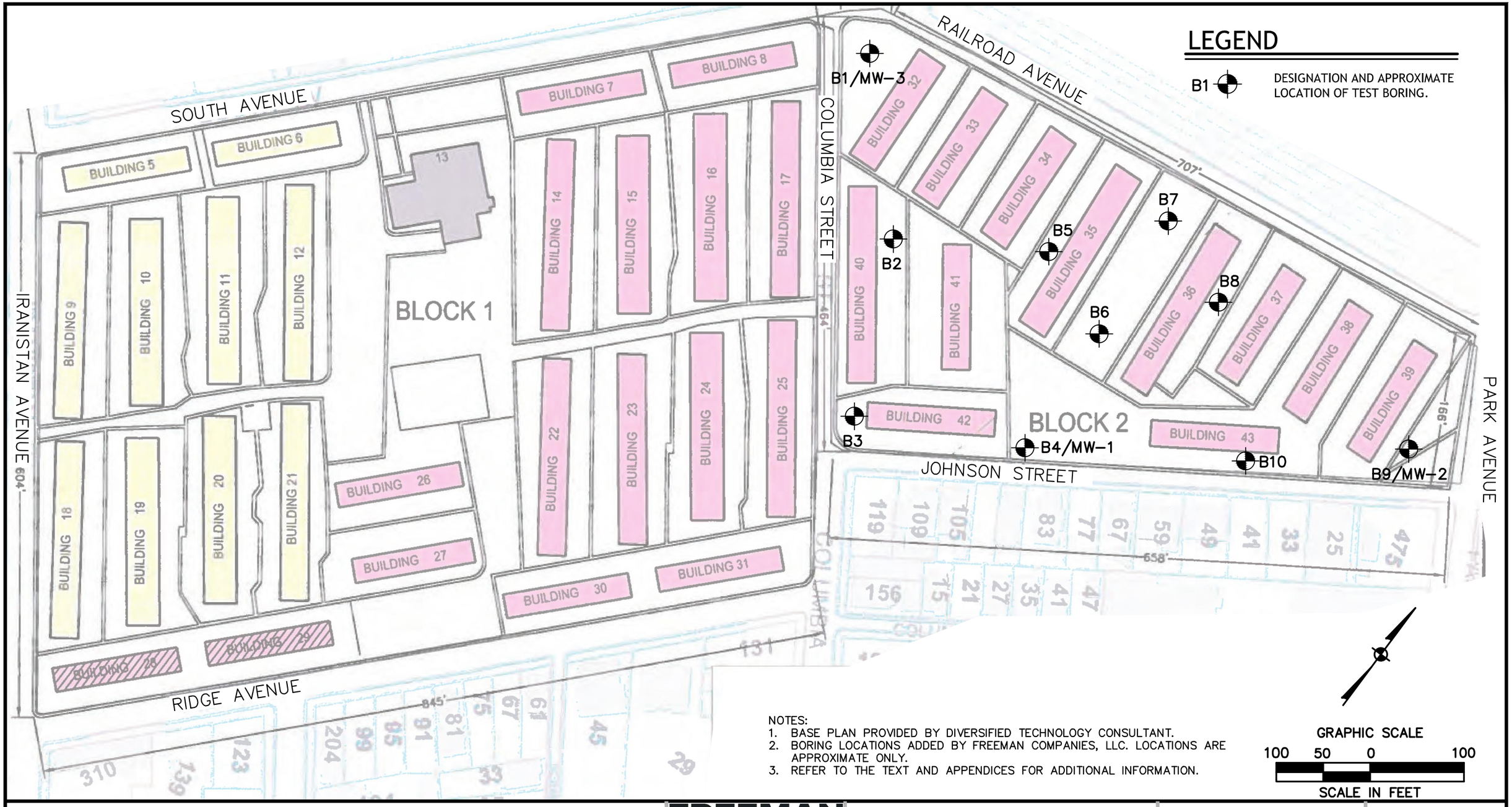
MARINA VILLAGE HOUSING COMPLEX
REDEVELOPMENT
BRIDGEPORT, CONNECTICUT

DRAFTED:	C.B.
CHECKED:	A.M.
APPROVED:	N.W.
SCALED:	1"=1000'
PROJECT NO.:	2015-0408
DATE:	05/29/15

FIG.

FIGURE 1

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Figure 1 and 2.dwg May 28, 2015-2:08pm Plotted By: cbarzola



NOTES:
1. BASE PLAN PROVIDED BY DIVERSIFIED TECHNOLOGY CONSULTANT.
2. BORING LOCATIONS ADDED BY FREEMAN COMPANIES, LLC. LOCATIONS ARE APPROXIMATE ONLY.
3. REFER TO THE TEXT AND APPENDICES FOR ADDITIONAL INFORMATION.

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET

SUBSURFACE EXPLORATION LOCATION PLAN

MARINA VILLAGE HOUSING COMPLEX REDEVELOPMENT
BRIDGEPORT, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES
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HARTFORD, CT 06106
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(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

DESIGNED:	AM
DRAWN:	CB
CHECKED:	AM
APPROVED:	NW
SCALE:	1"=100'
PROJECT NO.:	2015-0408
DATE:	05/29/15

SHEET NO.

FIGURE 2

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Figure 1 and 2.dwg May 28, 2015-2:21pm Plotted By: cborzola

THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC

APPENDIX B

BORING AND WELL COMPLETION LOGS

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____

HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____

VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____

LOCATION: _____

EXPLORATION

B-1/MW-3

Drilling Information

DATE START / END: 5/14/2015 - 5/14/2015 **TOTAL DEPTH (FT):** 17.0

CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich

EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger

AUGER ID/OD: 4.25 in / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____

HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30

WATER LEVEL DEPTHS (ft): ▼ 8.00 5/14/2015 ▼ 6.40 5/18/2015

GENERAL NOTES: _____

ABBREVIATIONS:

ID = Inside Diameter	bpf = Blows per Foot	U = Undistrubed Tube Sample	WOH = Weight of Hammer	S_v = Pocket Torvane Shear Strength
OD = Outside Diameter	mpf = Minute per Foot	C = Rock Core	RQD = Rock Quality Designation	F_v = Field Vane Shear Strength
Pen. = Penetration Length	S = Split Spoon	SC = Sonic Core	PID = Photoionization Detector	NA, NM = Not Applicable, Not Measured
Rec. = Recovery Length	DP = Direct Push Sample	WOR = Weight of Rods	Q_v = Pocket Penetrometer Strength	

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			S-1		0.25 to 2.25	24/18	23-8-7-10			ASPHALT (1 in.)		backfill cuttings
										(0.1'- 0.3') POORLY GRADED GRAVEL (GP); ~100% gravel, coarse; dry, black, FILL.		6" bentonite seal. 1/4 bag
										(0.3'- 3') SILTY SAND (SM); ~75% sand, fine to coarse, ~15% fines, ~10% gravel, fine to medium; brown, FILL, with crushed brick.		
										(3'- 7') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to medium, ~35% gravel, coarse, ~15% fines; brown, FILL, with crushed brick, glass, black material (odor).		
			S-2		4 to 6	24/6	3-2-7-22				▼	
	5											#2 sand for sand pack. 3 bags.
			S-3		8 to 10	24/20	9-12-12-14			(7'- 16') POORLY GRADED SAND (SP); ~85% sand, medium to coarse, ~10% gravel, fine, ~5% fines; brown.	▼	2" diamter PVC Screen, 0.010 slot size
	10											
	15		S-4		15 to 17	24/18	5-8-14-20			(16'- 17') SANDY SILT (ML); ~60% fines, ~40% sand, fine to medium; brown.		17' bottom depth of boring, backfill cuttings, PVC plug
										Bottom of Exploration at 17 feet		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-2

Drilling Information

DATE START / END: 5/12/2015 - 5/12/2015 **TOTAL DEPTH (FT):** 17.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 8.00 5/12/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/19	2-6-13-6			TOPSOIL		
										(1'- 1.5') POORLY GRADED SAND WITH GRAVEL (SP); ~70% sand, fine to coarse, ~25% gravel, fine to coarse, ~5% fines; tan, FILL, asphalt pieces.		
										(1.5'- 3') POORLY GRADED SAND WITH GRAVEL (SP); ~50% sand, fine to coarse, ~45% gravel, fine to coarse, ~5% fines; brown, FILL, crushed concrete and asphalt.		
			S-2		4 to 6	24/23	2-1-1-3			(3'- 4.9') SILTY SAND (SM); ~70% sand, fine to coarse, ~30% fines; brown.		
	5									(4.9'- 16.3') POORLY GRADED SAND (SP); ~95% sand, medium to coarse, ~5% fines; tan.		
			S-3		8 to 10	24/24	8-10-10-11				▼	
	10											
	15		S-4		15 to 17	24/24	15-14-16-18					
										(16.3'- 17') SILT (ML); ~80% fines, ~20% sand; wet, light brown.		
										Bottom of Exploration at 17 feet		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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www.freemancos.com

FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-3

Drilling Information

DATE START / END: 5/12/2015 - 5/12/2015 **TOTAL DEPTH (FT):** 17.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 8.00 5/12/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0.2 to 2.2	24/13	8-8-5-9			ASPHALT (2 in.) (0.2'- 2.2') POORLY GRADED SAND WITH GRAVEL (SP); ~60% sand, medium to coarse, ~30% gravel, fine, ~10% fines; dry, tan, FILL, conrete, asphalt and brick pieces (fill).		
										(2.2'- 5') SILTY SAND (SM); ~60% sand, fine to coarse, ~25% gravel, fine, ~15% fines; dry, tan, FILL, conrete, asphalt and brick pieces (fill).		
			S-2		4 to 6	24/14	2-4-3-4					
	5									(5'- 12.5') POORLY GRADED SAND (SP); ~95% sand, coarse, ~5% fines; dry, tan, FILL.		
			S-3		8 to 10	24/24	6-5-7-8				▼	
	10											
										(12.5'- 16.4') POORLY GRADED SAND (SP); ~85% sand, medium to coarse, ~10% gravel, fine, ~5% fines; wet, brown.		
	15		S-4		15 to 17	24/24	22-24-27-28					
										(16.4'- 17') SILT (ML); ~60% fines, ~40% sand; wet, light brown.		
										Bottom of Exploration at 17 feet		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-4/MW-1

PAGE 1 of 1

Drilling Information

DATE START / END: 5/13/2015 - 5/13/2015 **TOTAL DEPTH (FT):** 17.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: 4.25 in / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 8.00 5/13/2015 ▼ 7.56 5/18/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			S-1		0.1 to 2.1	24/2	20-9-10-4			ASPHALT (1 in.) (0.1'- 0.4') POORLY GRADED GRAVEL (GP); ~60% gravel, medium to coarse, ~40% sand, fine; FILL.		backfill cuttings
			S-2		2 to 4	24/9	4-2-3-3			(0.4'- 2.1') POORLY GRADED GRAVEL WITH SAND (GP); ~60% gravel, medium to coarse, ~40% sand, fine; dry, black, FILL.		6" bentonite seal. 1/4 bag
			S-3		4 to 6	24/15	4-6-8-12			(2.1'- 2.5') SILTY SAND (SM); ~60% sand, fine, ~40% fines; dry, tan, FILL. (2.5'- 4') POORLY GRADED SAND WITH SILT AND GRAVEL (SM); ~70% sand, fine, ~20% fines, ~10% gravel, coarse, angular; dry, brown, FILL, asphalt pieces.		
5										(4'- 9') POORLY GRADED SAND WITH GRAVEL (SP); ~90% sand, fine to coarse, ~10% gravel, fine; wet, tan.	▼ ▼	# sand for sand pack
			S-4		8 to 10	24/24	4-9-14-43					2" diamter PVC Screen, 0.010 slot size
10										(9'- 12.5') SILTY SAND (SM); ~50% sand, fine to medium, ~40% fines, ~10% gravel, fine to coarse; wet, light brown.		
										(12.5'- 17') SILTY SAND WITH GRAVEL (SC); ~65% sand, medium to coarse, ~20% fines, ~15% gravel, fine to coarse; wet, gray.		
15			S-5		15 to 17	24/14	18-13-16-18					17' bottom depth of boring, backfill cuttings, PVC plug
										Bottom of Exploration at 17 feet		
20												

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redevel
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-5

Drilling Information

DATE START / END: 5/12/2015 - 5/12/2015 **TOTAL DEPTH (FT):** 8.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 6.50 5/12/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
			S-1		0 to 2	24/21	2-6-13-17			TOPSOIL (13 in.)		
			S-2		2 to 4	24/22	25-15-32-23			(1.1'- 2') SILTY SAND (SM); ~50% sand, ~50% fines, ~0% gravel; dry, dark brown, FILL, Pieces of brick and asphalt. (2'- 2.75') WELL GRADED SAND (SW); ~100% sand, fine to coarse; dry, light brown, FILL.		
			S-3		4 to 6	24/19	17-8-5-6			(2.75'- 4.8') SILTY SAND (SM); ~80% sand, fine, ~20% fines; dry, dark brown, FILL, with brick, asphalt, roof felt, and concrete. (4.8'- 5.4') SANDY SILT (ML); ~70% fines, ~30% sand, fine to coarse; moist, dark brown, FILL.		
	5		S-4		6 to 8	24/24	4-3-3-18			(5.4'- 6') SILTY SAND (SM); ~80% sand, fine to coarse, ~20% fines; moist, tan, FILL.	▼	
										(6'- 6.4') SANDY SILT (ML); ~70% fines, ~30% sand, fine to coarse; wet, dark brown, FILL. (6.4'- 6.7') SILTY SAND (SM); ~80% sand, medium to coarse, ~20% fines; wet, tan, FILL. (6.7'- 7.6') SILTY SAND WITH GRAVEL (SM); ~50% sand, medium to coarse, ~30% fines, ~20% gravel, fine; wet, tan, FILL.		
	10									(7.6'- 8') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; wet, tan.		
										Bottom of Exploration at 8 feet		
	15											
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redevel
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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36 John Street
Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-6

Drilling Information

DATE START / END: 5/13/2015 - 5/13/2015 **TOTAL DEPTH (FT):** 10.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 7.00 5/13/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/19	13-17-11-14			ASPHALT (2 in.)		
										(0.2'- 4.7') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to coarse, ~20% fines, ~15% gravel, fine to coarse; dark brown, FILL, with concrete, brick, and black material.		
			S-2		2 to 4	24/19	13-22-105-30					
			S-3		4 to 6	24/21	15-2-2-2			(4.7'- 4.8') SILT WITH SAND (ML); ~50% sand, fine, ~50% fines; tan, FILL.		
	5									(4.8'- 6') SILT WITH SAND (ML); ~70% sand, fine to coarse, ~30% fines; gray, FILL, with concrete, brick, black material, unknown white material,.	▼	
			S-4		6 to 8	24/19	2-1-1-1					
			S-5		8 to 10	24/24	8-10-15-19			(6'- 7.6') SILTY SAND (SM); ~70% sand, fine to coarse, ~30% fines; tan, FILL.		
										(7.6'- 8.5') SILTY SAND (SM); ~85% sand, fine to coarse, ~15% fines; gray, FILL, with concrete, brick, black material, unknown white material,.		
	10									(8.5'- 10') POORLY GRADED SAND (SP); ~98% sand, fine to coarse, ~2% fines; tan.		
										Bottom of Exploration at 10 feet		
	15											
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

Freeman Companies, LLC
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Hartford, CT 06102
(860) 251-9550
www.freemancos.com

FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-7

Drilling Information

DATE START / END: 5/12/2015 - 5/12/2015 **TOTAL DEPTH (FT):** 8.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 6.00 5/12/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24/17	9-21-21-39			APHALT (3 in.)		
			S-2		2 to 4	24/24	11-8-4-5			(0.3'- 4.4') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to medium, ~20% gravel, fine to coarse, ~15% fines; brown, FILL, with asphalt, plastic, and black materials.		
	5		S-3		4 to 6	24/24	2-2-2-2			(4.4'- 6') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to medium, ~20% gravel, fine, ~20% fines; moist, tan.	▼	
			S-4		6 to 8	24/20	4-16-21-14			(6'- 6.5') SILTY SAND WITH GRAVEL (SM); ~70% sand, fine, ~20% fines, ~10% gravel, medium to coarse; wet.		
										(6.5'- 8') POORLY GRADED SAND (SP); ~95% sand, medium to coarse, ~5% fines; wet, tan.		
	10									Bottom of Exploration at 8 feet		
	15											
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
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PROJECT NUMBER: 2015-0408

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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-8

Drilling Information

DATE START / END: 5/13/2015 - 5/13/2015 **TOTAL DEPTH (FT):** 12.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 6.50 5/13/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	Remarks
			S-1		0 to 2	24	9-12-8-16			TOPSOIL (6 in.)		
										(0.5'- 2') POORLY GRADED SAND WITH GRAVEL (SP); ~60% sand, fine to coarse, ~30% gravel, fine to coarse, ~10% fines; dry, FILL, with brick, concrete, and black material.		
			S-2		2 to 4	24	5-5-4-4			(2'- 4') POORLY GRADED SAND WITH GRAVEL (SP); ~70% sand, medium to coarse, ~30% gravel, fine to coarse; dry, tan, FILL, black material.		
			S-3		4 to 6	24	7-7-9-8			(4'- 7') POORLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, ~5% fines; moist, dark brown, FILL, with brick, black material, unknown white material.		
	5		S-4		6 to 8	24	5-5-4-3			(7'- 10') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~20% gravel, fine to coarse, ~20% fines; wet, dark brown, FILL, with brick, black material, unknown white material.	▼	
			S-5		8 to 10	24	100/2"					
	10		S-6		10 to 12	24	11-15-16-21			(10'- 12') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to coarse, ~30% gravel, fine to coarse, ~15% fines; wet, brown.		
										Bottom of Exploration at 12 feet		
	15											
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
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CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-9/MW-2

Drilling Information

DATE START / END: 5/14/2015 - 5/14/2015 **TOTAL DEPTH (FT):** 17.0
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: 4.25 in / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 6.41 5/18/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_20 Depth	WELL CONSTRUCTION DETAILS
			S-1		0 to 2	24/20	14-16-24-24			(0'- 9.5') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to coarse, ~30% fines, ~15% gravel, fine to medium; moist, brown.		backfill cuttings 6" bentonite seal. 1/4 bag.
			S-2		4 to 6	24/17	14-19-17-21				▼	
			S-3		8 to 10	24/18	21-30-39-33					#2 sand for sand pack.
	10									(9.5'- 10') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to coarse, ~30% fines, ~15% gravel, fine to medium; moist, black, odor. (10'- 17') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to coarse, ~30% fines, ~15% gravel, fine to medium; moist, brown.		2" diamter PVC Screen, 0.010 slot size.
	15		S-4		15 to 17	24/22	32-41-72-100					17' bottom depth of boring, backfill cuttings, PVC plug
										Bottom of Exploration at 17 feet		
	20											

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
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CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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FREEMAN COMPANIES PROJECT 2015-0408 - MARINA VILLAGE.GPJ GINT STD US LAB.GDT 5/29/15

Exploration Location

NORTHING: _____ **EASTING:** _____ **STATION:** _____ **OFFSET:** _____
HORIZONTAL DATUM: _____ **STATION CENTERLINE:** _____
VERTICAL DATUM: _____ **ESTIMATED GROUND SURFACE ELEV. (FT):** _____
LOCATION: _____

EXPLORATION

B-10

Drilling Information

DATE START / END: 5/13/2015 - 5/13/2015 **TOTAL DEPTH (FT):** 20.7
CONTRACTOR: New England Boring **DRILLER:** Mike St. John **LOGGED BY (Person):** J. Herpich
EQUIPMENT: _____ **EXPLORATION TYPE/METHOD:** Hollow Stem Auger
AUGER ID/OD: N/A / N/A **CASING ID/OD:** N/A / N/A **CORE INFO:** _____
HAMMER TYPE: Safety Hammer **HAMMER WEIGHT (lbs):** 140 **HAMMER DROP (inch):** 30
WATER LEVEL DEPTHS (ft): ▼ 11.00 5/13/2015
GENERAL NOTES: _____

ABBREVIATIONS:
ID = Inside Diameter; OD = Outside Diameter; Pen. = Penetration Length; Rec. = Recovery Length
bpf = Blows per Foot; mpf = Minute per Foot; S = Split Spoon; DP = Direct Push Sample
U = Undistrubed Tube Sample; C = Rock Core; SC = Sonic Core; WOR = Weight of Rods
WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; Q_v = Pocket Penetrometer Strength
S_v = Pocket Torvane Shear Strength; F_v = Field Vane Shear Strength; NA, NM = Not Applicable, Not Measured

Elev. (ft)	Depth (ft)	Casing Pen. (bpf) or Core Rate (mpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blows Count or RQD	Test Data	GRAPHIC LOG	Sample Description & Classification	H_2O Depth	Remarks
			S-1		0 to 2	24/10	11-6-6-5			(0'- 3.5') SILTY SAND WITH GRAVEL (SM); ~40% sand, fine to coarse, ~40% fines, ~20% gravel, fine to medium; dry, brown.		
	5		S-2		4 to 6	24/24	20-17-20-16			(3.5'- 8.5') SILTY SAND WITH GRAVEL (SM); ~40% sand, fine to medium, ~40% fines, ~20% gravel, fine to coarse; dry, brown.		
			S-3		8 to 10	24/20	16-32-30-40			(8.5'- 20.7') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~20% gravel, fine to medium, ~20% fines; wet, brown.	▼	
	10											
	15		S-4		15 to 17	24/24	57-77-59-129					
	20		S-5		20 to 20.7	8/8	30-140/2"			Bottom of Exploration at 20.67 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

LOGGED BY (Consultant): Freeman Companies, LLC
PROJECT NAME: Marina Village Housing Complex Redeve
CITY/STATE: Bridgeport, CT
PROJECT NUMBER: 2015-0408

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APPENDIX C

LABORATORY ANALYTICAL DATA

AVAILABLE UPON REQUEST

APPENDIX D

SUMMARY TABLES OF RESULTS

Table 1
Summary of Soil Analytical Data
Marina Village Housing Complex
Bridgeport, CT

Parameter	GB PMC	RES DEC	B-1	B-2	B-3	B-4	B-5	B-6	B-7	B-8	B-9	B-10
Matrix			Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Profile (feet)			15-17	8-10	4-6	8-10	4-6	5-6	3-5	4-6	8-10	10-12
Collection Date			5/14/15	5/12/15	5/12/15	5/13/15	5/12/15	5/13/15	5/12/15	5/13/15	5/14/15	5/13/15
Volatile Organic Compounds (VOCs) (ug/Kg)												
Naphthalene	NE	NE	12	< 6.1	< 5.9	< 5.9	< 5.1	<12	2,100	< 6.9	< 310	< 4.6
Toluene	67,000	500,000	< 6.0	< 6.1	< 5.9	< 5.9	< 5.1	<12	550	< 6.9	< 310	< 4.6
Total Xylenes	19,500	500,000	< 6.0	< 6.1	< 5.9	< 5.9	< 5.1	<12	1,560	< 6.9	< 310	< 4.6
Poly Aromatic Hydrocarbons (PAHs) (ug/Kg)												
Anthracene	400,000	1,000,000	< 300	< 290	< 270	< 300	6,700	<290	< 5,300	< 270	< 260	< 260
Benz(a)anthracene	1,000	1,000	< 300	< 290	560	< 300	**21,000**	<290	**11,000**	620	340	< 260
Benzo(a)pyrene	1,000	1,000	< 300	< 290	560	< 300	**15,000**	<290	**11,000**	480	290	< 260
Benzo(b)fluoranthene	1,000	1,000	< 300	< 290	750	< 300	**19,000**	<290	**11,000**	560	340	< 260
Benzo(ghi)perylene	NE	NE	< 300	< 290	460	< 300	11,000	290	16,000	460	< 260	< 260
Benzo(k)fluoranthene	1,000	8,400	< 300	< 290	< 270	< 300	5,900	<290	< 5,300	< 270	< 260	< 260
Chrysene	NE	NE	< 300	< 290	570	< 300	16,000	<290	10,000	540	310	< 260
Fluoranthene	56,000	1,000,000	< 300	< 290	1,300	< 300	26,000	<290	13,000	780	630	< 260
Indeno(1,2,3-cd)pyrene	NE	NE	< 300	< 290	350	< 300	8,000	<290	6,400	340	< 260	< 260
Naphthalene	56,000	1,000,000	< 300	< 290	< 270	< 300	< 5300	<290	< 5300	< 270	270	< 260
Phenanthrene	40,000	1,000,000	< 300	< 290	600	< 300	28,000	<290	22,000	980	1,100	< 260
Pyrene	40,000	1,000,000	< 300	< 290	1,100	< 300	29,000	<290	15,000	810	450	< 260
Total RSR Listed Metals (mg/Kg)												
Arsenic	-	10	2.2	1.0	3.3	2.4	**13.6**	3.3	**12.3**	**19.2**	1.5	< 0.8
Barium	-	4,700	40.2	13.2	104	36	623	26.1	188	48.2	40.9	24.9
Beryllium	-	2	0.41	< 0.33	0.49	0.62	0.31	0.53	0.61	< 0.32	0.45	< 0.31
Cadmium	-	34	< 0.44	< 0.42	< 0.38	< 0.44	1.5	<0.45	0.73	1.99	< 0.38	< 0.39
Chromium	-	100	11	7.03	13.1	13.9	43.7	13.5	26.2	21.7	13.5	15.1
Copper	-	2,500	18.9	7.36	27.5	19.2	49.7	23.2	69.4	80	17.8	22.2
Lead	-	400	7.7	3.35	130	10.3	190	8.66	124	28.9	6.28	7.44
Mercury	-	20	0.05	< 0.03	0.08	< 0.03	0.65	<0.03	2.94	0.03	< 0.03	< 0.03
Nickel	-	1,400	9.31	5.5	9.05	16.3	61.9	8.56	19.1	55.4	9.06	9.24
Silver	-	340	< 0.44	< 0.42	< 0.38	< 0.44	< 0.37	<0.45	1.54	< 0.40	< 0.38	< 0.39
Vanadium	-	470	20.5	10.8	23.6	21.4	35	27	34.9	23.4	32.1	38.3
Zinc	-	20,000	36.4	19.9	136	52.5	660	21.7	147	75.1	27.7	19.7
SPLP RSR Listed Metals (mg/L)												
SPLP Arsenic	0.5	-	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	<0.004	0.007	< 0.004	< 0.004	< 0.004
SPLP Barium	10	-	< 0.010	< 0.010	0.152	0.011	0.259	0.031	0.054	0.036	0.012	< 0.010
SPLP Chromium	0.5	-	< 0.010	< 0.010	< 0.010	< 0.010	0.087	<0.010	< 0.010	< 0.010	< 0.010	< 0.010
SPLP Copper	13	-	< 0.010	< 0.010	0.025	< 0.010	0.016	<0.010	< 0.010	< 0.010	< 0.010	< 0.010
SPLP Lead	0.15	-	< 0.010	< 0.010	0.128	< 0.010	0.069	<0.010	< 0.010	< 0.010	< 0.010	< 0.010
SPLP Nickel	1	-	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	<0.010	< 0.010	0.023	< 0.010	< 0.010
SPLP Vanadium	0.5	-	< 0.010	< 0.010	0.017	< 0.010	< 0.010	<0.010	< 0.010	< 0.010	< 0.010	< 0.010
SPLP Zinc	50	-	< 0.010	< 0.010	0.127	< 0.010	0.239	0.013	0.013	< 0.010	< 0.010	< 0.010
Extractable Total Petroleum Hydrocarbons (mg/Kg)												
ETPH	2,500	500	< 64	< 62	< 58	< 65	**570**	<62	**2,000**	< 58	< 55	< 56
PCBs By SW8082A (ug/kg)	Varies*	Varies*	-									
PCB-1254	-	1,000	< 430	< 410	< 390	< 430	< 380	<420	**1,400**	< 380	< 360	< 380
PCB-1260	-	1,000	< 430	< 410	< 390	< 430	890	<420	< 380	< 380	< 360	< 380

RES DEC - Residential Direct Exposure Criteria
GB PMC - Pollutant Mobility Criteria for a GB Classified Groundwater Area
* - Testing parameter(s) contains multiple constituents of concern with different detection limits; therefore no detection limits are provided within table
ND - Not Detected Above Laboratory Detection Limit
NA - Not Analyzed
NE - Criteria Not Established
ug/kg - micrograms per kilogram
mg/Kg - milligrams per kilogram

Table 2
Summary of Groundwater Analytical Data
Marina Village Housing Complex
Bridgeport, CT

Parameter	SWPC	RES VOL	MW-1	MW-2	MW-3
Matrix			Groundwater	Groundwater	Groundwater
Depth to Water (feet)			7.56	6.41	6.40
Collection Date			5/18/15	5/18/15	5/18/15
Volatile Organic Compounds (VOCs) (ug/l)					
1,2,4-Trimethylbenzene	NE	NE	< 1.0	42	< 1.0
1,3,5-Trimethylbenzene	NE	NE	< 1.0	26	< 1.0
2-Isopropyltoluene	NE	NE	< 1.0	2.6	< 1.0
Acetone	NE	50,000	< 25	130	< 25
Benzene	710	215	< 0.70	10	< 0.70
Bromodichloromethane	1,020	NE	1.4	< 0.50	1.6
Chloroform	14,100	287	12	< 1.0	8.1
Ethylbenzene	580,000	50,000	< 1.0	19	< 1.0
Isopropylbenzene	NE	NE	< 1.0	9.9	< 1.0
Methyl t-butyl ether (MTBE)	NE	50,000	< 1.0	1.6	< 1.0
Naphthalene	NE	NE	< 1.0	28	170
n-Butylbenzene	NE	NE	< 1.0	6.6	< 1.0
n-Propylbenzene	NE	NE	< 1.0	20	< 1.0
p-Isopropyltoluene	NE	NE	< 1.0	6.1	< 1.0
sec-Butylbenzene	NE	NE	< 1.0	10	< 1.0
Total Xylenes	NE	21,300	< 1.0	34.2	< 1.0
Poly Aromatic Hydrocarbons (PAHs) (ug/l)					
2-Methylnaphthalene	NE	-	< 0.10	4.2	< 50
Acenaphthene	NE	-	< 0.10	1.5	< 50
Anthracene	1,100,000	-	< 0.10	0.39	< 50
Benz(a)anthracene	0.3	-	0.03	0.12	**79**
Benzo(a)pyrene	0.3	-	< 0.02	0.1	**66**
Benzo(b)fluoranthene	0.3	-	< 0.02	0.14	**85**
Benzo(k)fluoranthene	0.3	-	< 0.02	0.04	< 50
Chrysene	NE	-	< 0.02	0.09	69
Fluoranthene	3,700	-	< 0.10	0.53	140
Fluorene	140,000	-	< 0.10	1.2	< 50
Indeno(1,2,3-cd)pyrene	NE	-	< 0.02	0.06	< 50
Naphthalene	NE	-	< 0.10	16	77
Phenanthrene	0.077	-	< 0.07	**2.1**	**200**
Pyrene	110,000	-	< 0.10	0.43	120
RSR Listed Metals (mg/l)					
Antimony	86	-	< 0.005	< 0.005	0.018
Antimony (Dissolved)	-	-	< 0.005	< 0.005	< 0.005
Arsenic	0.004	-	**0.006**	< 0.004	**0.015**
Arsenic (Dissolved)	-	-	< 0.004	< 0.004	< 0.004
Barium	NE	-	0.191	0.698	0.313
Barium (Dissolved)	-	-	0.068	0.661	0.096
Beryllium	0.004	-	0.001	< 0.001	0.002
Beryllium (Dissolved)	-	-	< 0.001	< 0.001	< 0.001
Cadmium	0.006	-	< 0.001	< 0.001	0.002
Cadmium (Dissolved)	-	-	< 0.001	< 0.001	< 0.001
Chromium	0.11	-	0.029	0.006	0.03
Chromium (Dissolved)	-	-	< 0.001	< 0.001	< 0.001
Copper	0.048	-	0.046	0.008	**0.309**
Copper (Dissolved)	-	-	< 0.005	< 0.005	< 0.005
Lead	0.013	-	**0.193**	0.011	**0.595**
Lead (Dissolved)	-	-	< 0.002	0.005	< 0.002
Mercury	0.0004	-	0.0002	< 0.0002	**0.0058**
Mercury (Dissolved)	-	-	< 0.0002	< 0.0002	< 0.0002
Nickel	0.88	-	0.033	0.016	0.027
Nickel (Dissolved)	-	-	0.006	0.011	0.002
Vanadium	NE	-	0.049	0.011	0.046
Vanadium (Dissolved)	-	-	< 0.002	< 0.002	< 0.002
Zinc	0.123	-	**0.131**	0.019	**0.482**
Zinc (Dissolved)	-	-	0.016	0.01	0.051

SWPC - Surfacewater Protection Criteria
RES VOL - Residential Volatilization Criteria
ND - Not Detected Above Laboratory Detection Limit
NA - Not Analyzed
NE - Criteria Not Established
mg/l - milligrams per liter
ug/l - micrograms per liter

APPENDIX C

ENVIRONMENTAL EVALUATION AND MATERIALS MANAGEMENT REPORT- JUNE 2016 - SECOND PHASE

FREEMAN COMPANIES

LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Environmental Evaluation and Materials Management Report
Marina Village Housing Complex
Bridgeport, Connecticut

June 2016
Freeman File No.: 2015-0408

Prepared for:

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1 INTRODUCTION

Freeman Companies has completed an Environmental Evaluation Assessment of what is referred to as Phase 2 of the redevelopment the Marina Village Housing Complex in Bridgeport, CT. Bridgeport Community Renewal Associates, LP ("BCRA") is working with Park City Communities on the redevelopment of the Marina Village housing complex. The second phase ("Phase 2") of this development will involve the demolition of the complex which is bounded by South Avenue, Columbia Street, Ridge Avenue, and Iranistan Avenue (Buildings Numbered 5-31).

1.1 Purpose

The purpose of the assessment was to collect sufficient information in order to provide an evaluation of the environmental impacts, if present, to soil and groundwater on the Phase 2 portion of the Site and how these impacts may affect the redevelopment of the site.

Preliminary environmental information regarding historical environmental impact on the property was obtained from the September 2013 Phase I Environmental Site Assessment (ESA) prepared by Fuss & O'Neill. Based on the information presented within the reports, the site has a long history of heavy industrial and manufacturing operations prior to its development as a residential housing complex in the late 1940s. Industrial activities at the site included the following industries:

- Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings and conducted operations such as annealing, trimming, core making, tumbling, grinding, rolling, and molding; and
- Hotchkiss Sons' Manufacturers Curry Combs & Company which conducted scouring, tempering, and japanning of various metals.

1.2 Scope of Work

Based on the historical industrial activities that were conducted on the site, the following scope of work was developed:

- Oversight of the advancement of 10 soil borings, four of which were completed as a groundwater monitoring well.
- The collection and analysis of soil samples from each of the proposed soil borings. Select soil samples were analyzed for the following parameters: volatile aromatic hydrocarbons (VOCs), extractable total petroleum hydrocarbons (ETPH), poly aromatic hydrocarbons (PAHs), total and leachable RSR listed metals, and polychlorinated biphenyls (PCBs).
- The collection of a groundwater sample from each of the four newly installed monitoring wells. Groundwater samples were analyzed for the following parameters: VOCs, PAHs, and total RSR listed metals.
- The preparation of a report documenting the findings of the investigation.

Investigation activities were conducted in general accordance with the guidelines for environmental site assessments established in the Connecticut Department of Energy and Environmental Protection (CTDEEP) Site Characterization Guidance Document (SCGD) September 2007 (updated December 2010).

1.3 Objectives

The primary objective of this investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions will affect proposed redevelopment activities.

2 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

2.1 General

The second phase ("Phase 2") of the Marina Village redevelopment will involve the demolition of the portion of the complex which is bounded by South Avenue, Columbia Street, Ridge Avenue, and Iranistan Avenue (Buildings Numbered 5-31).

Demolition of the Phase I portion of the complex was completed in 2015.

2.2 Surrounding Land Use

The surrounding land use consists primarily of high-density housing to the southwest, southeast and northeast; and a mix of commercial and light industrial to the northwest.

2.3 Groundwater Classification

According to the CTDEEP water quality classification maps (November 2013), groundwater at the site is classified as GB. A GB classified groundwater is defined as groundwater within a historically highly urbanized area or an area of intense industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts.

2.4 Previous Environmental Assessment Activities

As previously identified a Phase I ESA was conducted on the site in 2013. Based on the information with the 2013 report no previous environmental sampling has been conducted on the Phase 2 portion of the complex.

3 GEOLOGIC INFORMATION

The physical conditions of the Site, including hydrology characteristics, are described in the following sections.

3.1 Site Topography

The site slopes from north to south ranging with a difference in elevation of approximately 5 feet (8 feet to 13 feet) above mean sea level. A majority of the site is located between elevations 10-12 feet.

3.2 Site Soils

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS) for the State of Connecticut (NRCS Webpage), the site is identified as primarily containing Urban Land. Urban land if defined as areas those are in urban and built up areas. The characteristics of this unit are so variable that an onsite investigation is required to determine the suitability for proposed uses.

Based on field observations soil conditions were observed to consist of the following:

Topsoil/ Asphalt – Topsoil was described as a dark brown silt, and fine to coarse sand. Up to one foot of topsoil was encountered in the borings conducted in grassy areas. Asphalt thickness ranged from 1 inch to 5 inches.

Urban Fill – Urban Fill was described brown to dark brown, fine to coarse sand and silt, with asphalt, crushed brick, concrete, and other manmade material debris. Ash and pieces of coal were also found in fill in various borings. The fill extended to depths below ground surface ranging from 2 feet to greater than 12 feet. Fill was not observed in borings SB-5 or SB-6.

Natural Sand – Natural sand was encountered in each of the borings, except MW-4 which contained natural sand mixed with coal.

Silt – Silt layers were encountered in some borings (SB-1, SB-6, SB-4, and MW-3) at various depths throughout the borings. The silt layers ranged from half of a foot to two feet thick. The silt is described as being grey, tan, or brown.

4 REMEDIATION STANDARD REGULATIONS

The analytical results reported in this report have been compared to remediation criteria listed in the CTDEEP's Remediation Standard Regulations (RSRs). The RSRs (Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies) form the basis for evaluation of site conditions in respect to environmental impacts and the impacts associated risk factors to human health and the environment. The CTDEEP uses the RSRs to determine whether sufficient remediation has been conducted at sites that are required by statute, regulation or administrative order to be remediated, or that are remediated through a formal voluntary remediation process.

The RSRs provide: (1) baseline specific criteria that may be used at any site to determine whether or not remediation is necessary, (2) self-implementing alternatives to the baseline criteria for specific circumstances, (3) self-implementing exceptions to the criteria for specific circumstances, and (4) an opportunity to request approval of site-specific alternatives to the self-implementing standards and the options for remediation from the CTDEEP Commissioner.

Although the Site is not currently under an order by the CTDEEP or subject to regulation and or statute to meet the risk based criteria within the RSRs, Freeman Companies will utilize the listed values within the RSRs as guidance in order to be protective of human health and the environment.

4.1 Soil Remediation Criteria

The CTDEEP soil remediation criteria integrate two risk-based goals: (1) Direct Exposure Criteria (DEC) to protect human health and the environment from risks associated with direct exposure (ingestion) to contaminated soil; and (2) Pollutant Mobility Criteria (PMC) to protect groundwater quality from contaminants that migrate or leach from the soil to groundwater. Soils to which both criteria apply must be remediated to a level which is equal to the more stringent criteria.

4.1.1 Direct Exposure Criteria

Specific numeric exposure criteria for a broad range of contaminants in soil have been established by the CTDEEP, based on exposure assumptions relative to incidental ingestion of contaminants in soils. The DEC applies to accessible soil to a depth of 15 feet. The DEC for substances other than PCBs does not apply to inaccessible soil at a release area provided that, if such inaccessible soil is less than 15 feet below the ground surface, an environmental land-use restriction (ELUR) is in effect with respect to the subject release area.

Inaccessible soil generally means polluted soil which is the following:

- More than four feet below the ground surface;
- More than two feet below a paved surface comprised of a minimum of three inches of bituminous pavement or concrete;
- Beneath an existing building; or

- Beneath another permanent structure(s) approved by the CTDEEP Commissioner. Buildings can be constructed and/or clean fill can be placed over contaminated soils rendering them inaccessible.

The CTDEEP has established two sets of DEC using exposure assumptions appropriate for residential land use (RES DEC) or for industrial and certain commercial land use (I/C DEC). In general, all sites are required to be remediated to the residential criteria. If the industrial/commercial land use criteria are applicable and used, an ELUR notification is required in accordance with the RSRs.

4.1.2 Pollutant Mobility Criteria

The PMC that are utilized for remediation determination of a site depends on the groundwater classification of the site. The Site is within in a GB groundwater classified area.

The PMC generally apply to all soil in the unsaturated zone, from the ground surface to the seasonal high water table in GB classified areas. The criteria do not apply to environmentally isolated soils that are polluted with substances other than VOCs provided that an ELUR is recorded for the release area which ensures that such soils will not be exposed (unless approved in writing by the CTDEEP Commissioner). Environmentally isolated soils are defined as certain contaminated soils which are below the seasonal low water table, beneath an existing building and not a source of ongoing contamination. An ELUR must be recorded for the site which ensures that such soils will not be exposed as a result of building demolition or other activities. Buildings can be constructed over contaminated soils rendering them environmentally isolated.

Remediation based upon the listed PMC requires that a substance, other than an inorganic substance or PCB, in soil be remediated to at least that concentration at which the results of a mass analysis of soil for such substances does not exceed the PMC applicable to the groundwater classification (i.e., GA or GB) of the area in which the soil is located. An inorganic substance or PCB in soil must be remediated to at least that concentration at which the analytical results of leachate produced from SPLP does not exceed the PMC applicable to the groundwater classification of the area in which the soil is located. As an alternative method for determining compliance with the PCM the analytical results of leachate produced from SPLP for most volatile, semi-volatile and petroleum compounds can be compared to the Groundwater Protection Criterion (GWPC) for such substance.

4.2 Groundwater Remediation Criteria

Groundwater remediation requirements are dependent upon the groundwater classification of the site. The objectives of these standards are the following:

- Protect existing use of groundwater regardless of the area's groundwater classification;
- Prevent further degradation of groundwater quality;
- Prevent degradation of surface water from discharges of contaminated groundwater; and
- Protect human health and the environment.

Portions of the RSRs governing groundwater regulate remediation of groundwater based on each substance present within the plume and by each distinct plume of contamination. Several factors influence the remediation goal at a given site, including: background water quality, the groundwater classification, the proximity of nearby surface water, existing groundwater uses, and the presence of buildings and their usage. When assessing general groundwater remediation requirements, all of these factors must be considered in conjunction with the major numeric components of the RSRs.

In general, remediation of a groundwater plume in a GB groundwater classified area shall result in the attainment of the following:

- The Surfacewater Protection Criteria;

- The Volatilization Criteria; and
- Not interfere with any existing usage of the groundwater.

5 SUBSURFACE INVESTIGATION ACTIVITIES

The primary objective of this investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions will affect the redevelopment. To achieve the stated objectives, the subsurface investigation activities were designed to include both environmental setting and contaminant identification investigations.

The approach, procedures and results of the site investigation activities are presented in the following sections.

5.1 Soil Sampling and Analysis

The primary purpose of the soils characterization portion of the assessment was to define the nature/presence of target contaminants in the unconsolidated materials in both the saturated and unsaturated zones associated with historical Site activities. In addition, the boring program also provided information on Site stratigraphy and physical properties of the unconsolidated materials in both the saturated and unsaturated zones with particular emphasis on the characteristics of those materials that affect contaminant migration pathways and transport mechanisms.

This section describes the specific soil borings and sampling performed in order to define Site stratigraphy, soil properties and soil contaminant profiles.

5.1.1 Soil Sampling

Soil sampling activities were conducted between the dates of May 25 through May 26, 2016. A total of ten soil borings were advanced at the Site as part of the investigation. Seaboard Drilling Services Inc. of Springfield, MA advanced the soil borings utilizing a direct push drill rig, as well as a hollow stemmed auger (HSA) drilling rig under the direct supervision of Freeman Companies field personnel. The location for each of the soil borings was chosen to maximize the information obtained based on Freeman Companies' understanding of existing site conditions. A figure depicting the locations of sampling activities is included in Appendix A. Boring and well completion logs are provided in Appendix B.

The following sections provide a summary of soil investigation drilling details.

5.1.2 Soil Sampling Via Hollow Stemmed Auger

Six of the ten soil borings (SB-1 through SB-6) were advanced using a direct push drill rig that utilizes static force and dynamic percussion to drive steel boring rods into the ground. Soil samples were collected with a stainless steel, 2-inch diameter, five-foot spoon sampler interiorly lined within a single use acetate sleeve. Sampling was conducted continuously into the observed water table.

The remaining four soil borings (MW-1 through MW-4) were advanced using a HSA drill rig spinning a 4 ¼-inch inner diameter auger. Soil samples were collected with stainless steel, 2-inch diameter, two-foot split-spoon sampler advanced ahead of the augers in two-foot intervals using a weighted hammer. Sampling was conducted continuously at 2 foot intervals into the observed water table.

5.1.3 Soil Screening and Submittal

Upon retrieval of each soil sample, the supervising field personnel visually inspected each sample for staining, color, and moisture content and then characterized and logged each sample. None of the collected samples contained any noticeable odor or petroleum impact.

Following the completion of each soil boring and related soil sample collection activities, the resulting boreholes were backfilled with either the drill cuttings that were generated from the borehole and/or with virgin well materials.

Soil samples submitted for laboratory analysis were selected based on the groundwater interface zone and/or the identification of a contaminate migration pathways to the environment. The selected soil samples were submitted to Phoenix Analytical laboratories of Manchester, CT and analyzed for those constituents that have the potential to be released to the subsurface due to current or historical activities related to the Recognized Environmental Condition ("REC") investigated. Based on the constituents of concern for each of the Areas of Concern ("AOCs"), the soil samples were analyzed for one or more of the following analysis:

- Volatile Organic Compounds (VOCs) in accordance with EPA Method 8260
- ETPH in accordance with CTDEEP extractable total petroleum hydrocarbons methodologies
- Poly-aromatic hydrocarbons (PAHs) via EPA Method 8270
- Total CT listed metals
- Leachable CT listed metals via the Synthetic Precipitation Leaching Procedure
- PCB's in accordance with EPA Method 8082

5.1.4 Sample Management

All soil and groundwater analytical samples were collected in laboratory-supplied containers and chilled immediately on ice for transit to the laboratory. Freeman Companies personnel maintained possession of the samples until transfer to a laboratory provided courier for transit to the laboratory. A chain-of-custody form accompanied the samples from their collection point to delivery at Phoenix. Complete chain-of-custody forms are included with the laboratory analytical data reports as provided in Appendix C.

5.2 Monitoring Well Installation Activities

The primary purpose of the groundwater characterization portion of the investigation was to determine the presence of contaminants of concern relative to historical site activities.

Four overburden-monitoring wells (MW-1 through MW-4) were set to a depth of 15 feet below grade. The wells are constructed of 10 feet of 2-inch diameter, 0.010-inch slotted PVC screen, with 2-inch diameter PVC riser extending to grade. The annular space around the wells was filled with #2 sand extending up to approximately 1-2 feet above the screen. An approximate twelve inch layer of bentonite was placed above the sand pack to form a seal. Native fill and/or well sand was then used to fill the remaining borehole to grade. Each well was finished with an eight-inch diameter flush mounted road box set in concrete. A figure depicting monitoring well locations is included in Appendix A. Well construction logs are presented as Appendix B.

5.3 Groundwater Sampling

Freeman Companies personnel collected groundwater samples from the newly installed monitoring wells on June 3, 2016. Groundwater sampling was conducted using low flow procedures in general accordance with Region I EPA's Low Stress (low flow) Purging and Sampling Procedure (July 30, 1996, revised January 19, 2010). Purging and sampling were performed using an adjustable rate pneumatic bladder pump with dedicated polyethylene tubing for all sampled wells. Pump intake depths were selected to coincide with the center-of-saturated-screen elevations for the deep wells and the top of the saturated screens for the shallow water table wells.

Purged volumes were based on the rate of stabilization of field-measured water quality parameters, including: dissolved oxygen, specific conductance, temperature, pH, turbidity, and oxidation/reduction potential were obtained. Field parameters were generally measured at five minute intervals; purging rates and water levels were also measured. Purged water from the wells did not exhibit any visual or olfactory evidence of impact such as odors and/or sheen. Due to the nature of the formation (urban fill) turbidity readings remained above the target of 5 NTUs, even after extended pumping.

Groundwater samples were collected from each well and submitted on ice to Phoenix for analysis. The following analyses were performed on all submitted groundwater samples:

- VOCs by EPA Method 8260
- PAHs via EPA Method 8270
- Total CT listed metals

5.4 Soil Sampling Results

Soil encountered during the advancement of the soil borings consisted primarily of a mixture of Urban Fill and ash, followed by brown and tan, fine to coarse sand intermixed with silt at several locations. Bedrock was not encountered at any boring locations.

Based on non-restricted property use, guidance standards used for soil at the Site would be the Residential Direct Exposure Criteria (RDEC) and the Pollutant Mobility Criteria (PMC) for an area with a GB groundwater classification.

Laboratory analysis of the soil samples collected from sample locations SB-1, SB-4, and MW-2 identified the presence of one or more of the following; poly aromatic hydrocarbons and/or extractable total petroleum hydrocarbons, exceeding the RDEC and/or the GB PMC.

A summary of the soil analytical results is presented in Table 1, within Appendix D and a copy of the laboratory analytical report is included as Appendix C.

5.5 Groundwater Sampling Results

Groundwater samples were collected from each monitoring well with dedicated sampling equipment in order to assess current water quality and to evaluate for the presence and distribution of contaminants in groundwater that may have originated from the Site or potentially from off-site locations. Samples were stored in laboratory provided glassware and submitted for analysis at for the suite of analytes identified based upon historic or current suspected potential sources of contamination. These parameters were used to indicate the presence of contaminants in groundwater and provided a basis for correlation with chemical data derived from the soil results.

Based on current land use and a GB groundwater classification, remediation guidance used for groundwater at the Site would be the Residential Volatilization Criteria (RES VC) and the Surface Water Protection Criteria (SWPC).

Analytical Results did not detect the presence of any volatile organic compounds at concentrations that exceeded the RES VC.

Analytical results did identify the presence of one or more of the following poly aromatic hydrocarbobs; benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and phenanthrene at concentrations exceeding the default SWPC within the samples collected from MW-3 and MW-4.

Analytical results of the total metals analysis primarily detected the presence of one or more of the following metals; arsenic, copper, lead, and zinc at concentrations exceeding the default SWPC within the samples collected from MW-1, MW-3, and MW-4.

A summary of the groundwater analytical results is presented as Table 2 in Appendix D, and a copy of the laboratory analytical report is included in Appendix C.

6 SOIL REUSE/DISPOSAL

Based on the findings of the assessment activities, the following general assumptions can be made regarding the soil at the site.

- Native soils may be managed as clean fill after confirmatory testing has been completed to ensure status as clean fill.
- Any urban fill material disturbed as part of proposed site activities shall be at a minimum be managed as a Regulated Soil.
- Material disturbed from the northern portion of the project area, as characterized by samples collected from SB-1 and SB-4, shall be classified as contaminated and should be removed from the site for proper disposal.
- Polluted soils may be reused on-site following site specific requirements

Further management/reuse discussions are provided in the following sections.

6.1 Soil Classifications

Based in the analytical results from the samples collected as part of the assessment activities the following soil types will be encountered as part of proposed site activities.

6.1.1 Clean Fill

Chemically clean fill that meets the definition of natural soil as defined in Sec. 22a-209-1 and Sec. 22a-133k-2(h) of the Regulations of Connecticut State Agencies (RCSA). Clean fill does not contain any substances above natural background levels. It is anticipated that a majority of native soils excavated from the project area will meet this definition of Clean Fill. Actual volumes will be determined by further analytical testing.

6.1.2 Polluted Soil

Soil affected by a release of a substance at a concentration above the analytical detection limit for such substance in accordance with RCSA 22a-133k-1(a)(45) and below the Residential Direct Exposure criteria and the GB Pollutant Mobility criteria as these terms are described in the Remediation Standard Regulations (RCSA 22a-133k-1 through 3). It is anticipated that a portion of the Urban Fill material will meet this definition. In most cases polluted soil may be reused at the project site with restriction.

6.1.3 Contaminated Soil

Soil affected by an identified or suspected release and determined, or reasonably expected to contain substances exceeding Residential Direct Exposure Criteria or GB Pollutant Mobility Criteria, as these terms are defined in the Remediation Standard Regulations (RCSA Section 22a-133k-1). It is anticipated that a portion of the Urban Fill/ash material located within the northern portion of the project area will meet this soil type. In all cases contaminated soil disturbed as part of construction activities should be removed from the site for proper disposal.

6.1.4 Regulated Soil

Regulated Soil includes Polluted Soil and Contaminated Soil. It is anticipated that most of the Urban Fill material generated from site activities will be classified as regulated.

6.2 Soil Management

Based on the analytical results the testing conducted soil management activities for the handling and management of excavated material encountered during demolition/construction will be required. It is not intended that any soil remediation be conducted outside the limits of excavation anticipated for the project as designed.

All handling and management operations should be conducted in accordance with standard engineering practices applicable to such activity and in accordance with CTDEEP regulations including but not limited to the procedures contained in the CTDEEP General Permit for Contaminated Soil and/or Sediment Management.

Depending on the selected management approach, soils within the project area can be ether pre-classified, stockpiled and classified, or assumed to be contaminated.

All stockpiles of Regulated Soil should be constructed to isolate stored Regulated Soil from the environment. Stockpiles shall be constructed to include liners free of holes and other damage. The ground surface on which the liner is to be placed shall be free of rocks or and any other object which could damage the liner.

Regulated Soil cannot be stockpile off site unless a registration has been submitted to and approved by the CTDEEP under the General Permit for Contaminated Soil and/or Sediment Management.

6.3 Allowable Reuse Options

Polluted Soil may be reused in accordance with the following requirements:

- Reused on site as backfill in locations above the water table and not in areas subject to erosion in accordance with requirements of Section 22a-133K of the RCSA. The backfill location and depth shall be documented in a scaled drawing for any Polluted Soil that is reused on site. Any backfill material shall meet the structural/compaction geotechnical requirements.

- If the polluted soil is not suitable for reuse, the material shall be managed, disposed of, treated or recycled in accordance CTDEEP regulations

6.4 Health and Safety

All site health and safety controls shall be fully established and in operation prior to beginning any material handling activity. Site controls shall include but not be limited to the following: work zones properly barricaded, decontamination facilities established, air monitoring, and all support equipment and supplies including personal protective equipment.

7 WASTEWATER HANDLING

Based on the analytical testing conducted as part of this evaluation, it is anticipated that a majority of the dewatering wastewater generated from the project area will be contain some degree of impact, primarily metals and poly aromatic hydrocarbons, and therefore will likely require specific handling and management procedures to be implemented.

7.1 Allowable Disposal Options

Management of dewatered groundwater may be accomplished in accordance with CTDEEP General Permit for the Discharge of Groundwater Remediation Wastewater Directly to Surface Water (Storm sewers discharging to surface waters) and local regulations and ordinances or through the CTDEEP General Permit Groundwater Remediation Wastewater to a Sanitary Sewer and local regulations and ordinances.

7.2 Storage Options

If there is a need for storage of wastewater prior to discharge, fractionation tanks with a capacity of at least 20,000 gallons may be used. The tanks shall be equipped with a sample port to facilitate safe sampling of tank contents. Discharge valve shall be capable of controlling discharge flow rate.

7.3 Treatment Options

If it is necessary to treat the water in order to meet discharge limits, an activated carbon treatment and filtration system, sized to treat water with a minimum influent total volatile organic compound concentrations necessary to meet discharge goals, may be implemented. Systems of this type shall include one or more of the following components: pumps; piping; bag or cartridge filters; carbon treatment vessels; Influent, midpoint and effluent sampling ports and system flow meters.

7.4 Health and Safety

All site health and safety controls shall be fully established and in operation prior to beginning any material handling activity. Site controls shall include but not be limited to the following: work zones properly barricaded, decontamination facilities established, and all support equipment and supplies including personal protective equipment.

8 ENVIRONMENTAL REMEDIATION AND DISPOSAL COSTS

Freeman Companies conducted an environmental evaluation of the project area in order to obtain a better understanding of the subsurface conditions that may be encountered as part site demolition and construction activities.

Soil conditions encountered within soil borings consisted of sand (natural soil) overlain by various thicknesses of fill material, which contained a variety of debris (asphalt, crushed brick, concrete), ash, silt, and other manmade material.

Analytical results identified that the Urban Fill material is generally impacted by a combination of PAHs and ETPH. The area with the highest concentration of environmental impact was located under the former Hotchkiss Sons facility. Although the sample collected from this location contained elevated concentrations of PAHs, besides for the presence of ash and coal fragments, there was no clear indication of impact that would typically be found with this kind of impact. It is possible that the concentrations of PAHs are at least partially related to the burning of coke, formed by the destructive distillation of coal, within the furnaces as part of the malleable iron foundry process.

In order to be protective of for future residential reuse, Freeman Companies recommends the removal of the fill material containing elevated concentrations of PAHs. The removed fill material can be removed from the site for disposal at a permitted disposal facility.

Due to the fact that the site will be re-graded following demolition activities, the Owner should attempt to reuse polluted fill material to the maximum extent prudent upon the completion of demolition (i.e. within former building foundation excavations, within former tunnel excavations, as backfill within areas of remediation).

8.1 Remedial Costs

Based on the analytical results, the soil represented by the samples collected from borings SB-1 and SB-4 should be considered as contaminated and therefore Freeman Companies would recommend that any excavated material from within these areas should be removed from the Site for proper disposal.

Due to the limited testing conducted, initial estimates for soil removal quantities would be conservatively high (at least 5,000 tons). In order to provide a better definition of impacted fill material present within the project area, Freeman companies would recommend that additional sampling be conducted in order to better define remedial areas and to continue the delineation/characterization of soils to remain on the site. Since the constituents of concern have been defined through evaluation testing, soil testing parameters may be limited to just PAHs and ETPH. A cost for analysis is estimated at $175/sample which will include both parameters.

APPENDIX A

MAPS AND FIGURES



LEGEND:

SB-1	SOIL BORING
MW-1	MONITORING WELL

NOTE:

1. BASE PLAN PREPARED BY JULIANO ASSOCIATES, LLC.

GRAPHIC SCALE
100 50 0 100
SCALE IN FEET

BORING LOCATION PLAN

MARINA VILLAGE
400 IRANISTAN AVENUE
BRIDGEPORT, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

DRAWN:	M.K.
CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=100'
PROJECT NO.:	2015-0408
DATE:	06/14/2016

SHEET NO.

FIGURE 1

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan.dwg Jun 14, 2016-4:03pm Plotted By: mkwok

THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC

APPENDIX B

BORING AND WELL COMPLETION LOGS

Boring/Well No. SB-1 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 13.5'
Drilling Method: Geoprobe **Sample Method:** 5' Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	14"/60"			0-0.1' Asphalt
					0.1-3.2' Dark brown f-c sand, some silt; pieces of brick
1					3.2-5' Brown f-c sand and silt
2					
3					
4					
5					
	S2	50"/60"			5-5.5' Grey and tan silt
6					5.5-10' Beige f-c sand, little f gravel, trace silt
7					
8					
9					
10					
	S3	49"/60"			10-12.5' Tan and grey f-c sand
11					12.5-13.75' Grey silt, wet
12					13.75-15' Tan and grey f-c sand.
13					
14					
15					
					BOB 15'
					Sample 3.5-5.5'

Boring/Well No. SB-2 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 14'
Drilling Method: Geoprobe **Sample Method:** 5' Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	30"/60"			0-0.5' Asphalt
1					0.5-1' Dark brown f sand
					1-2' Black silt
2					2-2.5' Tan sand and silt with some black silt
					2.5-5' Brown f-c sand, some silt
3					
4					
5					
	S2	48"/60"			5-10' Tan f-c sand, some f-m gravel
6					
7					
8					
9					
10					
	S3	55"/60"			10-11' Tan f-c sand, some f-m gravel
					11-15' Brown f-m sand, some silt, wet
11					
12					
13					
14					
15					
					BOB 15'
					Sample 2-4'

Boring/Well No. SB-3 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 8'
Drilling Method: Geoprobe **Sample Method:** 5' Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	28"/60"			0-0.5' Asphalt
1					0.5-5' Brown silt and f-c sand, some f-m gravel; mixed with brick,
					concrete, and very small strips of black ash
2					
3					
4					
5					
	S2	48"/60"			5-6' Brown silt and f-c sand, some f-m gravel; mixed with brick,
6					concrete, and very small strips of black ash
7					6-10' Tan and brown f-c sand, little f gravel. Wet
8					
9					
10					
	S3	54"/60"			10-14' Tan and brown f-c sand, little f gravel
11					
					14-15' Brown silt and f sand
12					
13					
14					
15					
					BOB 15'
					Sample 4-6'

Boring/Well No. SB-4 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 7.5'
Drilling Method: Geoprobe **Sample Method: 5' Sleeve**
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	40"/60"			0-0.1' Asphalt
1					0.1-3' Dark brown f-c sand, some silt; pieces of brick;
					small black pieces, possibly coal
2					3-3.75' Brick
					3.75-5' Dark brown f-c sand, some silt;
3					small black pieces possibly coal; small amount of ash
4					
5					
	S2	55"/60"			6-6.3' Dark brown f-c sand, some silt;
6					small black pieces possibly coal; small amount of ash
					6.3-6.7' Brick
7					6.7-9' Tan f-c sand with striations of grey silt. Wet
					9-10' Tan f-c sand
8					
9					
10					
	S3	60"/60"			10-15' Tan f-c sand
11					
12					
13					
14					
15					
					BOB 15'
					Sample 4-6'

Boring/Well No. SB-5 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 8'
Drilling Method: Hand auger and Geoprobe **Sample Method: 5'** Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	60"/60"			0-0.5' Topsoil; Dark brown silt and f-c sand
1					0.5-2' Tan f-c sand, trace silt
					2-5' Tan and beige f-c sand, trace silt
2					
3					
4					
5					
	S2	60"/60"			5-10' Tan and beige f-c sand, trace silt
6					wet at 8'
7					
8					
9					
10					
	S3	60"/60"			10-15' Tan and beige f-c sand, trace silt
11					
12					
13					
14					
15					
					BOB 15'
					Sample 6-8'

Boring/Well No. SB-6 **Date:** 5/25/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 15' **Water Level:** 9'
Drilling Method: Hand auger and Geoprobe **Sample Method: 5'** Sleeve
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
	S1	60"/60"			0-1' Topsoil; Dark brown silt and f-c sand, little f gravel
1					1-2' Tan f-c sand, little f gravel, trace silt
					2-5' Beige f-c sand, little f gravel, trace silt
2					
3					
4					
5					
	S2	60"/60"			5-6' Beige f-c sand, little f gravel, trace silt
6					6-7' Brown silt
					7-9.6' Brown f-c sand, trace silt. Wet
7					9.6-10' Brown silt
8					
9					
10					
	S3	60"/60"			10-14.5' Brown f-c sand, little silt
11					14.5-15' Brown silt
12					
13					
14					
15					
					BOB 15'
					Sample 5-7'

Boring/Well No. MW-1 **Date:** 5/26/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 12' **Water Level:** 9'
Drilling Method: Hollow Stem Auger **Sample Method: 2' Split Spoon**
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
1					
2	S1	12"/24"	17,56,12,6		2-2.5' Brown f-c sand and silt
3					2.5-3.5' Crushed concrete, gravel
					3.5-4' Ash
4	S2	24"/24"	3,1,1,2		4-4.1' Ash and coal
5					4.1-5' Brown silt and f-c sand
					5-6' Brown and tan silt and f-c sand
6	S3	10"/24"	3,3,2,1		6-8' Brown and tan silt and f-c sand
7					
8	S4	12"/24"	9,20,26,4		8-10' Brown f-c sand and f-c gravel, little silt. Wet
9					
10	S5	17"/24"	3,4,16,20		10-11' Brown f-c sand, little silt
11					11-12' Brown f sand, some silt
12					
13					
14					
15					BOB 12'
					Sample 3-5'

Boring/Well No. MW-2 **Date:** 5/26/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 12' **Water Level: 10'**
Drilling Method: Hollow Stem Auger **Sample Method: 2' Split Spoon**
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
1					
2	S1	15"/24"	5,5,5,6		2-3' Tan/orange silt and f-c sand
3					3-4' Beige f-c sand, some f-m gravel
4	S2	17"/24"	9,12,15,14		4-6' Beige and tan f-c sand, some f-m gravel
5					
6	S3	14"/24"	11,12,12,12		6-8' Beige and tan f-c sand, little f gravel
7					
8	S4	19"/24"	4,5,6,14		8-10' Beige f-c sand with layers of grey silt and tan silt
9					
10	S5	18"/24"	10,12,12,17		10-12' Brown f sand and silt. Wet
11					
12					
13					
14					
15					BOB 12'
					Sample 2-4'

Boring/Well No. MW-3 **Date:** 5/26/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 10' **Water Level:** 8'
Drilling Method: Hollow Stem Auger **Sample Method: 2' Split Spoon**
Driller: Seaboard **Log By:** JHerpich

Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
1					
2	S1	18"/24"	1,1,3,3		2-3' Dark brown silt and f-c sand; brick, concrete, black rock possibly coal
3					3-4' Tan silt and f-c sand
4	S2	20"/24"	8,11,12,12		4-6' Tan silt and f-c sand
5					
6	S3	20"/24"	7,8,10,11		6-6.5' Tan silt and f-c sand
7					6.5-8' Beige f-c sand, some silt. Wet
8	S4	11"/24"	10,6,5,10		8-8.3' Beige f-c sand, some silt
9					8.3'-10' Grey silt layered with brown f-m sand
10					
11					
12					
13					
14					
15					BOB 10'
					Sample 2-4'

Boring/Well No. MW-4 **Date:** 5/26/2016
Project: Marina Village **Client:**
Location: 400 Iranistan Ave., Bridgeport
Total Depth: 12' **Water Level:** 8'
Drilling Method: Hollow Stem Auger **Sample Method: 2' Split Spoon**
Driller: Seaboard **Log By:** JHerpich

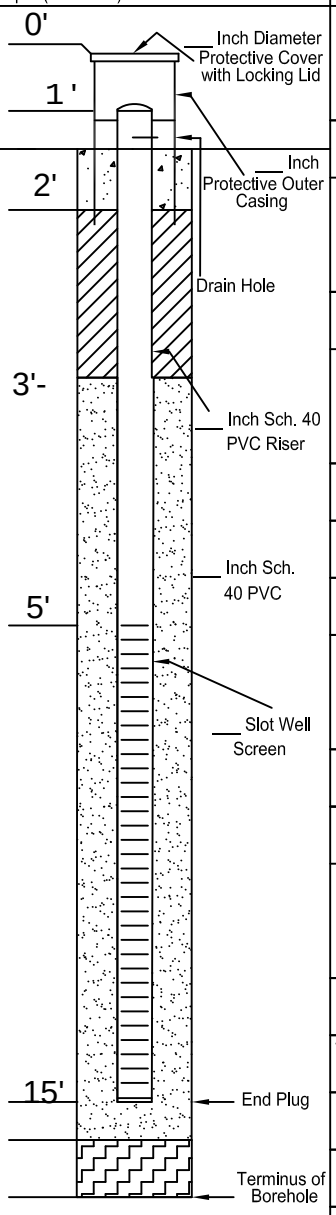
Depth (feet)	Sample Number	Recovery	Blow Counts (blows/6")	PID	Lithology
1					
2	S1	12"/24"	19,12,13,12		2-4' Brick mixed with coal pieces and black powdered coal / ash
3					
4	S2	7"/24"	7,10,16,6		4-6' Brick mixed with coal pieces and black powdered coal / ash
5					
6	S3	5"/24"	5,5,6,4		6-8' Black powdered coal and ash, chunks of coal. Wet 7-8'
7					
8	S4	3"/24"	3,1,1,1		8-10' F-c sand and silt mixed with black powdered coal and ash,
9					chunks of coal.
10	S5	3"/24"	1, 0,1,0		10-12' Tan f-c sand with few chunks of coal
11					
12					
13					
14					
15					Note: Building foundation at 6.5'
					BOB 12'
					Sample 5-7'

MONITORING WELL INSTALLATION FIELD LOG

FACILITY NAME: Marina Village/2nd Phase	FACILITY ID: 400 Iranistan Ave, Bridgeport	WELL NO.: MW-1
GEOLOGIST: JHerpich	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES:
WEATHER:	DRILLING COMPANY: Seabaord	DATE/TIME 5/26/16
TEMPERATURE:	DRILL RIG: DRILLER:	STARTED: COMPLETED:

LITHOLOGIC DESCRIPTION | ELEVATION/ DEPTH | PID (ppm) | BLOWS/ft.

WELL CONSTRUCTION



MATERIALS INVENTORY

BENTONITE SEAL: TOP: 2' BOTTOM: 3'	
FILTER PACK GRAINSIZE: #2 sand	
FILTER PACK : TOP: 3' BOTTOM: 15'	
GROUT QUANTITY:	
GROUT : TOP: 0' BOTTOM: 1'	
GROUT TYPE: 1'-2' native fill	
SCREEN TYPE:	
WELL SCREEN: in. 5-15' l.f.	
SLOT SIZE:	
WELL CASING: Inches in Diameter 2" PVC l.f.	
CASING TYPE:	
TOP OF CASING (AGS):	
BOREHOLE (IN. DIAMETER):	
BOTTOM OF BOREHOLE (FT BGS): 15'	
TOP OF CASING ELEVATION (FT ABOVE MSL):	

CAVE IN (SLOUGH) | COARSE SAND | FINE FILTER SAND | BENTONITE GROUT | CEMENT PAD

TVA

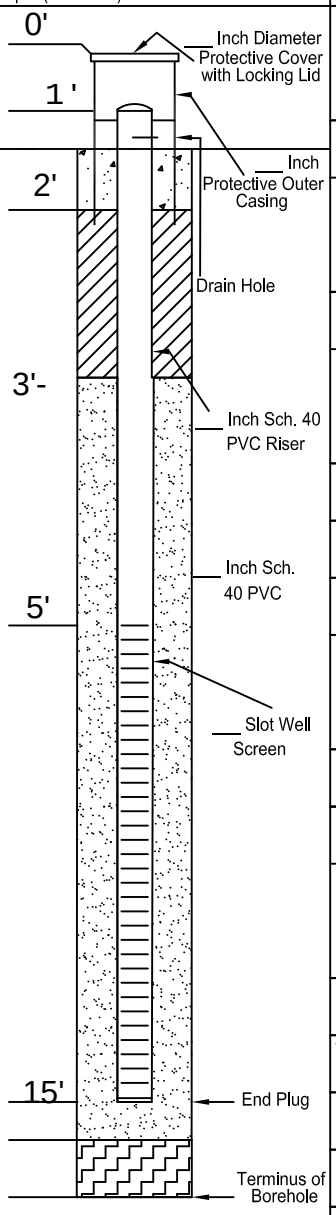
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MONITORING WELL INSTALLATION FIELD LOG

FACILITY NAME: Marina Village/2nd Phase	FACILITY ID: 400 Iranistan Ave, Bridgeport	WELL NO.: MW-2
GEOLOGIST: JHerpich	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES:
WEATHER:	DRILLING COMPANY: Seabaord	DATE/TIME 5/26/16
TEMPERATURE:	DRILL RIG: DRILLER:	STARTED: COMPLETED:

LITHOLOGIC DESCRIPTION | ELEVATION/ DEPTH | PID (ppm) | BLOWS/ft.

WELL CONSTRUCTION



MATERIALS INVENTORY

BENTONITE SEAL: TOP: 2' BOTTOM: 3'

FILTER PACK GRAINSIZE: #2 sand

FILTER PACK : TOP: 3' BOTTOM: 15'

GROUT QUANTITY:

GROUT : TOP: 0' BOTTOM: 1'

GROUT TYPE: 1'-2' native fill

SCREEN TYPE:

WELL SCREEN: in. l.f. 5-15'

SLOT SIZE:

WELL CASING: Inches in Diameter l.f. 2" PVC

CASING TYPE:

TOP OF CASING (AGS):

BOREHOLE (IN. DIAMETER):

BOTTOM OF BOREHOLE (FT BGS): 15'

TOP OF CASING ELEVATION (FT ABOVE MSL):

CAVE IN (SLOUGH) | COARSE SAND | FINE FILTER SAND | BENTONITE GROUT | CEMENT PAD

TVA

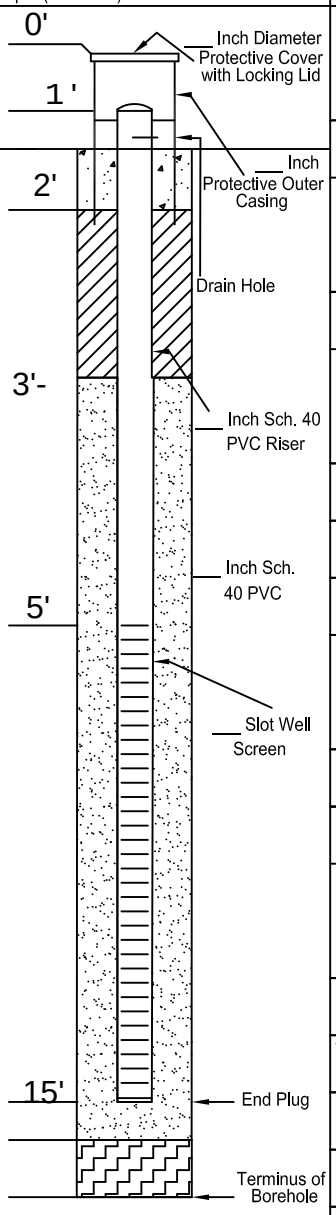
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MONITORING WELL INSTALLATION FIELD LOG

FACILITY NAME: Marina Village/2nd Phase	FACILITY ID: 400 Iranistan Ave, Bridgeport	WELL NO.: MW-3
GEOLOGIST: JHerpich	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES:
WEATHER:	DRILLING COMPANY: Seabaord	DATE/TIME 5/26/16
TEMPERATURE:	DRILL RIG: DRILLER:	STARTED: COMPLETED:

LITHOLOGIC DESCRIPTION | ELEVATION/ DEPTH | PID (ppm) | BLOWS/ft.

WELL CONSTRUCTION



MATERIALS INVENTORY

BENTONITE SEAL: TOP: 2' BOTTOM: 3'	
FILTER PACK GRAINSIZE: #2 sand	
FILTER PACK : TOP: 3' BOTTOM: 15'	
GROUT QUANTITY:	
GROUT : TOP: 0' BOTTOM: 1'	
GROUT TYPE: 1'-2' native fill	
SCREEN TYPE:	
WELL SCREEN: in. 5-15' l.f.	
SLOT SIZE:	
WELL CASING: Inches in Diameter 2" PVC l.f.	
CASING TYPE:	
TOP OF CASING (AGS):	
BOREHOLE (IN. DIAMETER):	
BOTTOM OF BOREHOLE (FT BGS): 15'	
TOP OF CASING ELEVATION (FT ABOVE MSL):	

CAVE IN (SLOUGH) | COARSE SAND | FINE FILTER SAND | BENTONITE GROUT | CEMENT PAD

TVA

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MONITORING WELL INSTALLATION FIELD LOG

FACILITY NAME: Marina Village/2nd Phase	FACILITY ID: 400 Iranistan Ave, Bridgeport	WELL NO.: MW-4
GEOLOGIST: JHerpich	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES:
WEATHER:	DRILLING COMPANY: Seabaord	DATE/TIME 5/26/16
TEMPERATURE:	DRILL RIG: DRILLER:	STARTED: COMPLETED:

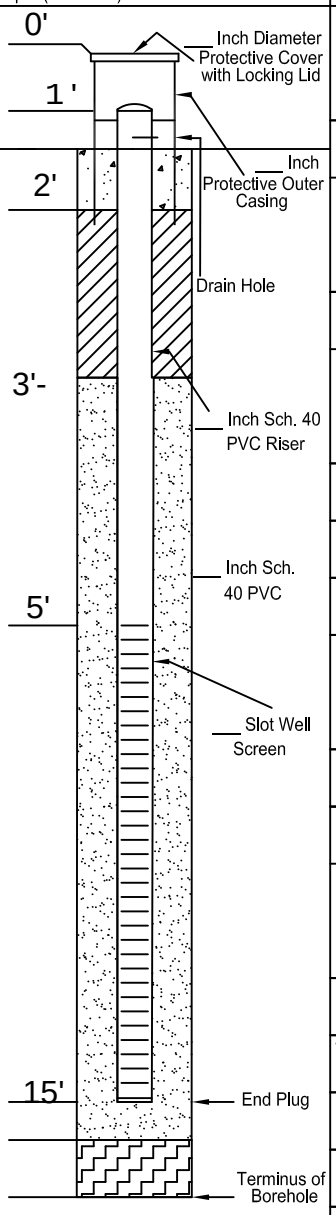
LITHOLOGIC DESCRIPTION

ELEVATION/ DEPTH

PID (ppm)

BLOWS/ft.

WELL CONSTRUCTION



MATERIALS INVENTORY

BENTONITE SEAL: TOP: 2' BOTTOM: 3'

FILTER PACK GRAINSIZE: #2 sand

FILTER PACK : TOP: 3' BOTTOM: 15'

GROUT QUANTITY:

GROUT : TOP: 0' BOTTOM: 1'

GROUT TYPE: 1'-2' native fill

SCREEN TYPE:

WELL SCREEN: in. l.f. 5-15'

SLOT SIZE:

WELL CASING: Inches in Diameter l.f. 2" PVC

CASING TYPE:

TOP OF CASING (AGS):

BOREHOLE (IN. DIAMETER):

BOTTOM OF BOREHOLE (FT BGS): 15'

TOP OF CASING ELEVATION (FT ABOVE MSL):

CAVE IN (SLOUGH) COARSE SAND FINE FILTER SAND BENTONITE GROUT CEMENT PAD

TVA

APPENDIX C

LABORATORY ANALYTICAL DATA

AVAILABLE UPON REQUEST

APPENDIX D

SUMMARY TABLES OF RESULTS

Table 1
Summary of Soil Analytical Data
Marina Village Housing Complex
Bridgeport, CT

Parameter	GB PMC	RES DEC	SB-1	SB-2	SB-3	SB-4	SB-5	SB-6	MW-1	MW-2	MW-3	MW-4
Matrix			Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Sample Profile (feet)			3.5-5.5	2-4	4-6	4-6	6-8	5-7	3-5	2-4	2-4	5-7
Collection Date			5/26/16	5/26/16	5/26/16	5/26/16	5/26/16	5/26/16	5/27/16	5/27/16	5/27/16	5/27/16
Volatile Organic Compounds (VOCs) (ug/Kg)												
Naphthalene	NE	NE	300	ND< 320	ND< 5.1	ND< 440	ND< 5.2	ND< 6.1	ND< 4.4	18	ND< 4.8	ND< 7.0
Poly Aromatic Hydrocarbons (PAHs) (ug/Kg)												
2-Methylnaphthalene	NE	NE	1,100	ND< 270	ND< 270	ND< 2700	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Acenaphthene	NE	NE	2,800	ND< 270	ND< 270	ND< 2700	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Acenaphthylene	84,000	1,000,000	400	ND< 270	ND< 270	8,800	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Anthracene	400,000	1,000,000	6,400	ND< 270	ND< 270	10,000	ND< 250	ND< 270	ND< 280	760	ND< 260	ND< 250
Benz(a)anthracene	1,000	1,000	**14,000**	430	ND< 270	**44,000**	ND< 250	ND< 270	ND< 280	**1,300**	560	ND< 250
Benzo(a)pyrene	1,000	1,000	**13,000**	340	ND< 270	**49,000**	450	ND< 270	ND< 280	**1,200**	510	ND< 250
Benzo(b)fluoranthene	1,000	1,000	**12,000**	280	ND< 270	**44,000**	250	ND< 270	ND< 280	**1,100**	410	ND< 250
Benzo(ghi)perylene	NE	NE	6,000	ND< 270	ND< 270	29,000	300	ND< 270	ND< 280	850	350	ND< 250
Benzo(k)fluoranthene	1,000	8,400	**7,200**	310	ND< 270	**30,000**	270	ND< 270	ND< 280	930	410	ND< 250
Chrysene	NE	NE	15,000	420	ND< 270	45,000	ND< 250	ND< 270	290	1,300	630	ND< 250
Dibenz(a,h)anthracene	NE	NE	2,300	ND< 270	ND< 270	3,300	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Fluoranthene	56,000	1,000,000	29,000	1,000	390	**89,000**	ND< 250	ND< 270	590	3,700	1,200	270
Fluorene	56,000	1,000,000	2,900	ND< 270	ND< 270	4,200	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Indeno(1,2,3-cd)pyrene	NE	NE	9,000	ND< 270	ND< 270	33,000	340	ND< 270	ND< 280	890	350	ND< 250
Naphthalene	56,000	1,000,000	3,500	ND< 270	ND< 270	2,900	ND< 250	ND< 270	ND< 280	ND< 250	ND< 260	ND< 250
Phenanthrene	40,000	1,000,000	25,000	770	300	**49,000**	ND< 250	ND< 270	560	3,800	1,000	ND< 250
Pyrene	40,000	1,000,000	24,000	870	350	**88,000**	ND< 250	ND< 270	510	3,300	1,200	ND< 250
Total RSR Listed Metals (mg/Kg)												
Antimony	-	27	ND< 3.5	ND< 3.8	ND< 3.8	3.5	ND< 3.2	ND< 3.9	ND< 3.7	ND< 3.2	ND< 3.5	ND< 3.4
Arsenic	-	10	4.3	3.7	3.6	6.2	2	3.3	5.1	3.7	4.5	3.8
Barium	-	4,700	60.8	36.6	32.8	67.7	16.2	24.2	108	16.9	47.4	27.1
Beryllium	-	2	0.71	0.67	0.68	0.4	0.27	0.54	0.72	0.31	0.62	0.35
Cadmium	-	34	ND< 0.35	ND< 0.38	ND< 0.38	0.36	ND< 0.32	ND< 0.39	ND< 0.37	ND< 0.32	ND< 0.35	0.63
Chromium	-	100	15	13.6	12.2	12	5.77	10.4	14.6	10.2	15	14.7
Copper	-	2,500	24.4	8.44	10.4	156	6.45	12.7	68.5	8.92	14.7	11.8
Lead	-	400	21.2	8.41	57.6	176	3.48	4.98	263	5.25	9.1	10.7
Mercury	-	20	0.04	0.04	0.05	0.08	ND< 0.03	ND< 0.03	0.66	ND< 0.03	ND< 0.03	0.03
Nickel	-	1,400	9.87	10.8	9.51	10.9	4.35	8.63	10.2	6.26	13.1	10.4
Vanadium	-	470	26	27.3	24	20.3	10.5	17.5	27.9	19.8	29.1	19
Zinc	-	20,000	60.3	139	31.5	259	28.3	37.1	132	26.7	34.1	33.7
SPLP RSR Listed Metals (mg/L)												
SPLP Antimony	0.06	-	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005
SPLP Arsenic	0.5	-	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004	ND< 0.004
SPLP Barium	10	-	0.015	0.016	0.011	0.015	ND< 0.010	ND< 0.010	0.037	0.01	ND< 0.010	0.015
SPLP Beryllium	0.04	-	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001	ND< 0.001
SPLP Cadmium	0.05	-	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005	ND< 0.005
SPLP Chromium	0.5	-	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010
SPLP Copper	13	-	ND< 0.010	ND< 0.010	ND< 0.010	0.015	ND< 0.010	ND< 0.010	0.021	ND< 0.010	ND< 0.010	ND< 0.010
SPLP Lead	0.15	-	ND< 0.010	ND< 0.010	ND< 0.010	0.02	ND< 0.010	ND< 0.010	0.084	ND< 0.010	ND< 0.010	ND< 0.010
SPLP Mercury	0.02	-	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005	ND< 0.0005
SPLP Nickel	1	-	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	0.011	ND< 0.010
SPLP Vanadium	0.5	-	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010	ND< 0.010
SPLP Zinc	50	-	0.015	0.045	ND< 0.010	0.029	ND< 0.010	ND< 0.010	0.052	0.04	ND< 0.010	0.014
Extractable Total Petroleum Hydrocarbons (mg/Kg)												
ETPH	2,500	500	**840**	ND< 56	ND< 290	**550**	ND< 53	ND< 57	ND< 60	ND< 52	ND< 56	ND< 54
PCBs By SW8082A (ug/kg)	Varies*	Varies*	ND< 380	ND< 370	ND< 380	ND< 380	NA	NA	ND< 400	ND< 350	ND< 370	ND< 360

RES DEC - Residential Direct Exposure Criteria
GB PMC - Pollutant Mobility Criteria for a GB Classified Groundwater Area
* - Testing parameter(s) contains multiple constituents of concern with different detection limits; therefore no detection limits are provided within table

ND - Not Detected Above Laboratory Detection Limit
NA - Not Analyzed
NE - Criteria Not Established

ug/kg - micrograms per kilogram
mg/Kg - milligrams per kilogram

Table 2
Summary of Groundwater Analytical Data
Marina Village Housing Complex
Bridgeport, CT

Parameter	SWPC	RES VOL	MW-1	MW-2	MW-3	MW-4
Matrix			Groundwater	Groundwater	Groundwater	Groundwater
Depth to Water (feet)			7.81	7.25	6.71	7.20
Collection Date			6/3/16	6/3/16	6/3/16	6/3/16
Volatile Organic Compounds (VOCs) (ug/l)						
Bromodichloromethane	NE	NE	3.5	<ND 0.50	<ND 0.50	<ND 0.50
Chloroform	14,100	287	19	2.0	4.0	<ND 1.0
Poly Aromatic Hydrocarbons (PAHs) (ug/l)						
2-Methylnaphthalene	NE	-	<ND 0.05	<ND 0.05	0.18	<ND 0.05
Acenaphthene	NE	-	<ND 0.05	<ND 0.05	0.31	<ND 0.05
Acenaphthylene	0.3	-	<ND 0.05	<ND 0.05	0.14	<ND 0.05
Anthracene	1,100,000	-	0.06	<ND 0.05	0.77	<ND 0.05
Benz(a)anthracene	0.3	-	0.2	0.1	**1.8**	0.22
Benzo(a)pyrene	0.3	-	0.17	0.09	**0.7**	0.14
Benzo(b)fluoranthene	0.3	-	0.16	0.08	**1.4**	**0.23**
Benzo(ghi)perylene	NE	-	0.13	0.07	0.65	0.15
Benzo(k)fluoranthene	0.3	-	0.13	0.06	**1.2**	0.22
Chrysene	NE	-	0.19	0.09	2.1	0.26
Dibenz(a,h)anthracene	NE	-	<ND 0.01	<ND 0.01	0.28	0.05
Fluoranthene	3,700	-	0.53	0.33	5.3	0.42
Fluorene	140,000	-	<ND 0.05	<ND 0.05	0.3	<ND 0.05
Indeno(1,2,3-cd)pyrene	NE	-	0.12	0.06	0.77	0.18
Naphthalene	NE	-	<ND 0.10	<ND 0.10	0.3	<ND 0.10
Phenanthrene	0.077	-	0.26	0.2	**3.7**	0.2
Pyrene	110,000	-	0.45	0.29	3.2	0.31
RSR Listed Metals (mg/l)						
Antimony	86	-	<ND 0.005	<ND 0.005	<ND 0.005	<ND 0.005
Arsenic	0.004	-	<ND 0.004	<ND 0.004	**0.01**	**0.005**
Barium	NE	-	0.049	0.049	0.254	0.157
Beryllium	0.004	-	<ND 0.001	<ND 0.001	0.003	0.001
Cadmium	0.006	-	<ND 0.001	<ND 0.001	<ND 0.001	0.001
Chromium	0.11	-	0.008	0.001	0.047	0.017
Copper	0.048	-	0.012	<ND 0.005	**0.084**	0.042
Lead	0.013	-	**0.021**	0.002	**0.062**	**0.062**
Mercury	0.0004	-	<ND 0.0002	<ND 0.0002	<ND 0.0002	0.0003
Nickel	0.88	-	0.007	0.002	0.046	0.015
Vanadium	NE	-	0.012	<ND 0.002	0.088	0.03
Zinc	0.123	-	0.037	0.006	**0.298**	0.121

SWPC - Surfacewater Protection Criteria
RES VOL - Residential Volatilization Criteria
ND - Not Detected Above Laboratory Detection Limit
NA - Not Analyzed
NE - Criteria Not Established
mg/l - milligrams per liter
ug/l - micrograms per liter

APPENDIX D

CLOSE OUT REPORT

FREEMAN
COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Close-out Report
Marina Village Redevelopment – Phase I
Bridgeport, Connecticut

August 2016
Freeman File No.: 2015-0408

Prepared for:

Bridgeport Community Renewal Associates, LP
c/o JHM Group of Companies
Attn: Dan Montanaro / Anthony T. Rowan
1281 East Main St. Suite 201
Stamford, CT

Prepared by:

Freeman Companies, LLC
36 John Street
Hartford, CT 06106

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1 INTRODUCTION

Bridgeport Community Renewal Associates, LP ("BCRA") is working with Park City Communities on the redevelopment of the Marina Village housing development in Bridgeport, Connecticut. Phase I of the redevelopment consists of the 4.77-acre triangular portion of the Marina Village complex which is bounded by Park Avenue, Railroad Avenue, Columbia Street, and Johnson Street. A site plan depicting the Phase I project area is include within Appendix A.

2 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

2.1 General

The Marina Village Complex, located at 400 Iranistan Avenue, consists of two adjacent parcels of land totaling approximately 15.9 acres located in the City of Bridgeport, Connecticut. The Site is bounded on the north by South Avenue and Railroad Avenue, on the east by Park Avenue, on the south by Johnson Street and Ridge Avenue, and on the west by Iranistan Avenue. Columbia Street runs between the two parcels through the middle of the site.

2.2 Historical Usage

The existing Marina Village housing complex was constructed during the late 1940s. Prior to its construction, the Site was occupied by the Bridgeport Malleable Iron Works (later known as the Eastern Malleable Iron Company), a metal foundry that manufactured malleable and grey iron castings, Hotchkiss Sons' Manufacturers Curry Combs & Company and by a number of residential structures.

The foundry used coal to fuel their operations, which included annealing, trimming, core making, tumbling, and molding. Hotchkiss Sons Manufacturers Curry Combs & Company was located southwest of the Bridgeport Malleable Iron Works along South Avenue. The Hotchkiss Sons Manufacturers Curry Combs & Company property included a manufacturing building, a wood shop, coal storage, and lumber storage. Operations included scouring, tempering, and japanning. A number of residential homes were located along the north side of Johnson Street, the west side of Columbia Street, the west side of Park Avenue, and the south side of Railroad Avenue at the east end of the site.

2.3 Groundwater Classification

According to the CTDEEP water quality classification maps (November 2013), groundwater at the site is classified as GB. A GB classified groundwater is defined as groundwater within a historically highly urbanized area or an area of intense industrial activity and where public water supply service is available. Such groundwater may not be suitable for human consumption without treatment due to waste discharges, spills or leaks of chemicals or land use impacts.

2.4 Environmental Assessment Activities

Based on the historical industrial activities that had been conducted on the site, an environmental assessment was performed in May 2015. The scope of work of the assessment included the following:

- Oversight of the advancement of up to 10 soil borings, three of which completed as a groundwater monitoring well.
- The collection and analysis of a soil samples from each of the proposed soil borings. Select soil samples would be analyzed for the following parameters: volatile aromatic hydrocarbons (VOCs), extractable total petroleum hydrocarbons (ETPH), poly aromatic hydrocarbons (PAHs), total and leachable RSR listed metals and polychlorinated biphenyls (PCBs).
- The collection of a groundwater sample from each of the three newly installed monitoring wells. Groundwater samples would be analyzed for one or more of the following parameters: VOCs, PAHs, and total RSR listed metals.

- The preparation of a report documenting the findings of the investigation.

The primary objective of the investigation was to obtain sufficient information on subsurface conditions in order to provide an understanding on how these conditions would affect the redevelopment of the Site.

2.5 Soil Conditions

Based on field observations the following soil conditions were generally observed:

- Topsoil/ Asphalt – Topsoil was described as light brown to brown silty SAND (SM). Up to 1.1 feet of topsoil was encountered in the borings conducted in grassy areas. Asphalt thickness ranged from 1 inch to 3 inches.

- Fill (Urban Fill) – Fill was described as very loose to dense, dark brown to light brown, silty SAND with gravel (SM), asphalt, crushed brick, concrete, and other manmade material debris. In addition, pockets of ash material were also encountered throughout the site. The fill extended to depths below ground surface ranging from 0 feet (B-10) to greater than 17 feet (B-9/MW).

- Natural Sand – Natural sand was encountered in each of the borings, except B-9/MW, and was described as loose to very dense, poorly graded sand with silt and gravel varying to silty sand with gravel (SM).

2.6 Soil Sampling Results

Results from the soil sampling activities identified the presence of PAHs, TPH, total arsenic and low concentrations of PCBs primarily located between former buildings 35 and 36. This area was once the location of the annealing and trimming area for Eastern Malleable Iron Company.

2.7 Groundwater Sampling Results

Analytical results from groundwater sampling activities did not detect the presence of any volatile organic compounds at concentrations that exceeded the residential volatilization criteria. Analytical results did detect the presence of (PAHs) including; benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and phenanthrene.

Based on the findings of the subsurface investigation, the following soil management recommendations were made

- Native soils can be managed as clean fill material;
- Any urban fill material disturbed as part of proposed site activities shall be at a minimum be managed as a Regulated Soil, but may remain on site for beneficial reuse; and
- Ash and oil stained soils are to be removed for disposal as contaminated soil

3 SPECIFIC INFORMATION

The following section provides specific information regarding the soil excavation activities conducted at the Site.

3.1 Construction Company

Standard Demolition Services, Inc.
30 Nutmeg Drive
Trumbull, CT 06611

Pro-Teck
85 Willow Street
New Haven, CT 06511

3.2 Oversight Firm

Freeman Companies
36 John Street
Hartford, CT 06106

3.3 Analytical Company

Phoenix Environmental (Soil and Water)
587 East Middle Turnpike
Manchester, CT 06040

3.4 Soil Disposal Facilities

Coventry Landfill
451 Arnold Road
Coventry, RI 02816

Chicopee Landfill
161 New Lombard Road
Chicopee, MA 01020

4 PERSONAL PROTECTION EQUIPMENT

Level D protection was the minimum protection required for the project. Appropriate PPE was chosen based on the physical and chemical properties of the product involved, a risk assessment of the situation, the work to be done, and the capabilities of the wearer. Level D protection is sufficient when work operations preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of chemicals. Appropriate Level D protective equipment included

- Work cloths;
- Disposable gloves;
- Boots/shoes, chemical-resistant steel toe and shank;
- Safety glasses or chemical splash goggles; and
- Hard hat

5 WORK PRACTICES

Freeman Company monitors observed the following general work practices during excavation activities:

1. Workers generally followed the procedures outlined in the project specifications
2. Waste profile forms were managed by Pro-Teck
3. Facility acceptance for the generated soil
4. Weight slips from the disposal facility were provided
5. Fencing was installed and maintained around the perimeter of the project area
6. Work areas were generally kept clean and free of debris

6 SOIL REMOVAL ACTIVITIES

The primary purpose of the soil removal activities was to excavate and disposal of contaminated soil/fill material that was encountered during the subsurface assessment activities. Based on the sol profile created during the assessment activities, the contractor, Standard Demolition Services (SDS), identified soil disposal locations as identified in Section 4.4.

Soil excavation and removal activities, conducted over an approximately eight week period, were initiated on April 21, 2016 and completed on June 16, 2016. A figure depicting excavation areas is included as Appendix A.

6.1 Previous Building Slab

During initial excavation activities it was identified that the floor slab from the former Eastern Malleable Iron Company was still present on the property. The slab was generally encountered at a depth of approximately 1-2 feet below the existing surface. Only within areas where the Marina Village buildings were constructed was the original

slab removed. Inspection of the slab revealed that the slab consisted of approximately 4-6" of non-reinforced concrete.

The slab appeared to be in good condition with no signs of staining. A small section of the slab was removed at a location to the southwest of building 35 in order to identify soil conditions under the slab. Soil conditions under the slab consisted of native sand. In order to confirm he initial findings Freeman Companies directed the contractor to remove small areas of slab at several additional locations. In all instances native sand was identified to be present under the slab.

Since the slab did not appear to be stained and that native sand was located under the slab, the decision was made to leave the slab in place.

6.2 Ash Fill Areas

During the soil removal activities serval areas of ash material were encountered and removed. The ash was identified to contain small pieces of ceramic debris and glass. One of the larger areas of ash material was located to the west of building 36, which is located just south of the former annealing area of the Eastern Malleable Company. The ash area measured approximately 30 feet long by 20 feet wide and extended to a depth of approximately 10-12 feet.

6.3 Demolition Debris

Various amounts of brick, asphalt, and broken concrete were encountered throughout the excavation area. The larger amounts of these materials were encountered primarily at locations on top of the former building slab. It appeared that the former building was crushed in place and filled with urban fill material to allow of the shaping of the property for construction of Marina Village.

6.4 Impacted Soil

Soil material identified to be impacted by PAHs and low concentration of PCBs was selected for removal from the site. The target areas for removal were primarily located to the northwest of building 36 and to the south and southwest of building 35. The largest of the impacted areas was located to the northwest of building 36, which was located within the former coal storage area for the former Eastern Malleable Iron Company. Soil within this area was primarily impacted from 1-4 feet in depth and encompassed almost the entire area north of the former building slab extending to Railroad Avenue. Other smaller pockets of impact generally consisted of areas measuring approximately 10 feet by 10 feet by 5 feet in depth.

7 SOIL DISPOSAL

Impacted soil and ash material excavated for removal from the site was brought to one of two locations for disposal. The soil and ash material located to the east of building 35 was brought to the Chicopee Landfill, in Chicopee Massachusetts. The remaining impacted material was brought to the Coventry Landfill in Coventry Rhode Island.

Based on weight tickets generated from the landfills, approximately 731.92 tons of impacted material were excavated and removed from the site for reuse at the Chicopee Landfill and approximately 3,503.11 tons of impacted material were excavated and removed from the site for reuse at the Coventry landfill. Copies of the weight tickets are included as Appendix B. Photos of the excavation activities are included as Appendix C.

8 CLOSURE SAMPLING

As identified, impacted material related to the historical operations of the Eastern Malleable Iron Company primarily consisted of discolored fill material and ash which contained moderate concentrations of PAHs and low concentrations of PCBs. This impacted material was visually identifiable due to its composition and color as compared to the native sands located at depth. Removal of impacted material was generally conducted until the native sand material was encountered.

Upon completion of the removal of the impacted material soil removal, soil samples were collected from the floor of excavation areas in order to demonstrate removal of the impacted material. Since PAHs were the primary driver for

removal activities and were present at the greatest concentrations, the closure samples were submitted for the analysis of PAHs. No PAHs were detected within the samples submitted. A figure depicting the endpoint sampling locations is provided in Appendix A. A summary of the analytical results is included as Appendix D.

9 BENEFICIAL REUSE OF URBAN FILL

Residual urban fill material, soil containing building debris and/or surficial soils that was located throughout the former Marina Village complex, will be beneficially reused on-site as part of redevelopment.

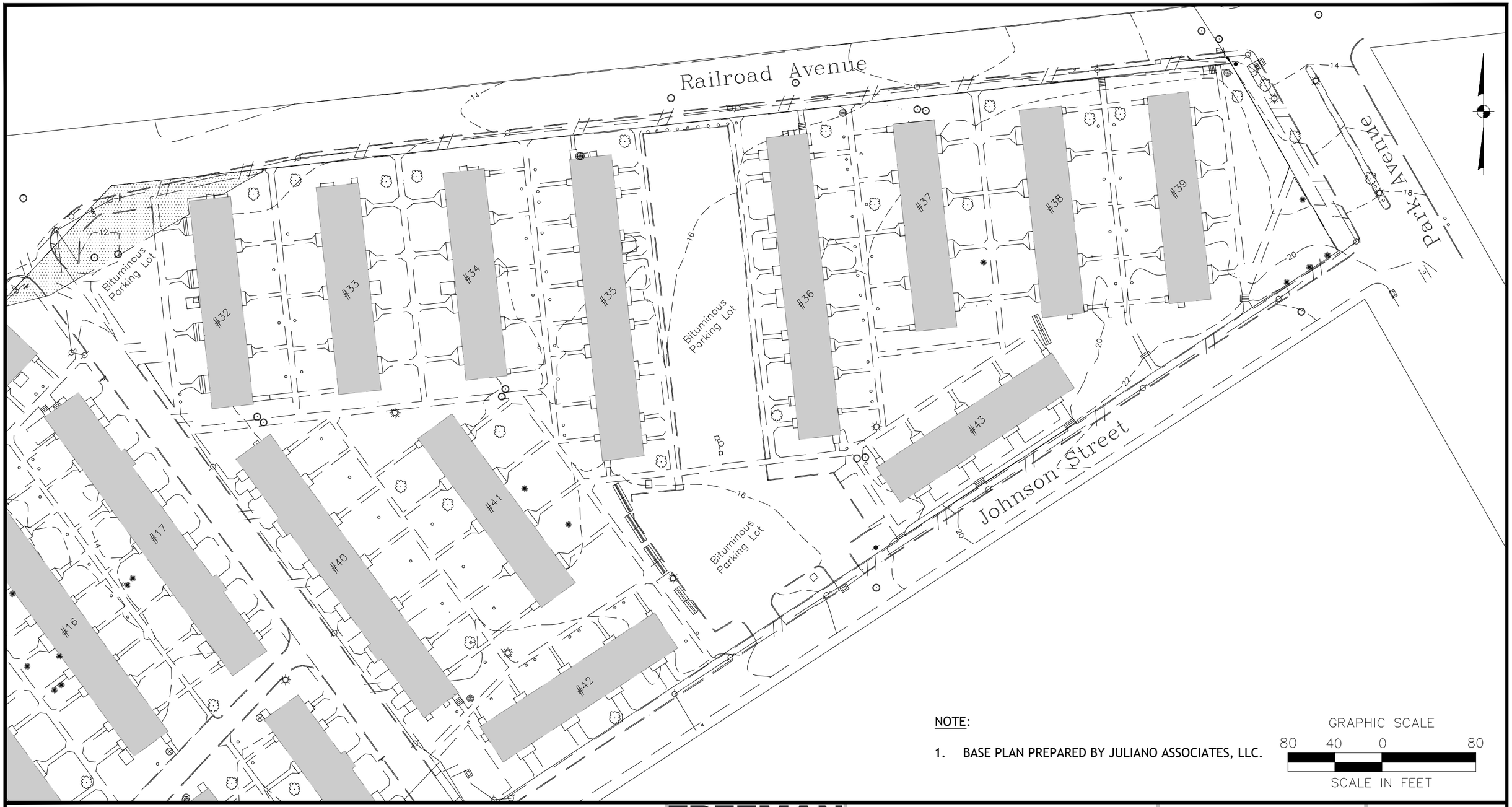
Urban fill is defined as non-native disturbed material within urban areas that typically contains a mixture of soil demolition debris, asphalt, brick, concrete, glass, ceramics, wood ash, coal and/or coal ash and is widespread within an urban environment. As a result of its composition it is common that urban fill typically contains low concentrations of PAHs and metals.

Urban fill was routinely encountered within the surficial soils on site during the demolition of site structures. Existing urban fill material remaining on-site will be beneficially reused either by being placed within the former building foundation excavations and covered with a new building structure or 2 feet of clean fill or will be placed under proposed parking areas and covered with at least 3 inches of asphalt.

Native sands located on the property, which were determined to be analytically free of historical impacts, will also be utilized in a non-restrictive manner as part of the redevelopment of the property.

APPENDIX A

FIGURES



NOTE:

1. BASE PLAN PREPARED BY JULIANO ASSOCIATES, LLC.

GRAPHIC SCALE
80 40 0 80
SCALE IN FEET

PLAN

MARINA VILLAGE
400 IRANISTAN AVENUE
BRIDGEPORT, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

FREEMAN COMPANIES, LLC
36 JOHN STREET
HARTFORD, CT 06106
WWW.FREEMANCOS.COM
TEL:(860)251-9550
TOLL FREE:(800)604-5141
FAX:(860)986-7161
ELEVATE YOUR EXPECTATIONS

No.	Date	Description
–	–	–

REVISIONS

DRAWN:	M.K.
CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=80'
PROJECT NO.:	2015-0408
DATE:	08/11/2016

SHEET NO.

FIGURE 1

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan 2.dwg Nov 07, 2016-11:31am Plotted By: mkwok

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NOTE:

1. BASE PLAN PREPARED BY JULIANO ASSOCIATES, LLC.

GRAPHIC SCALE
80 40 0 80
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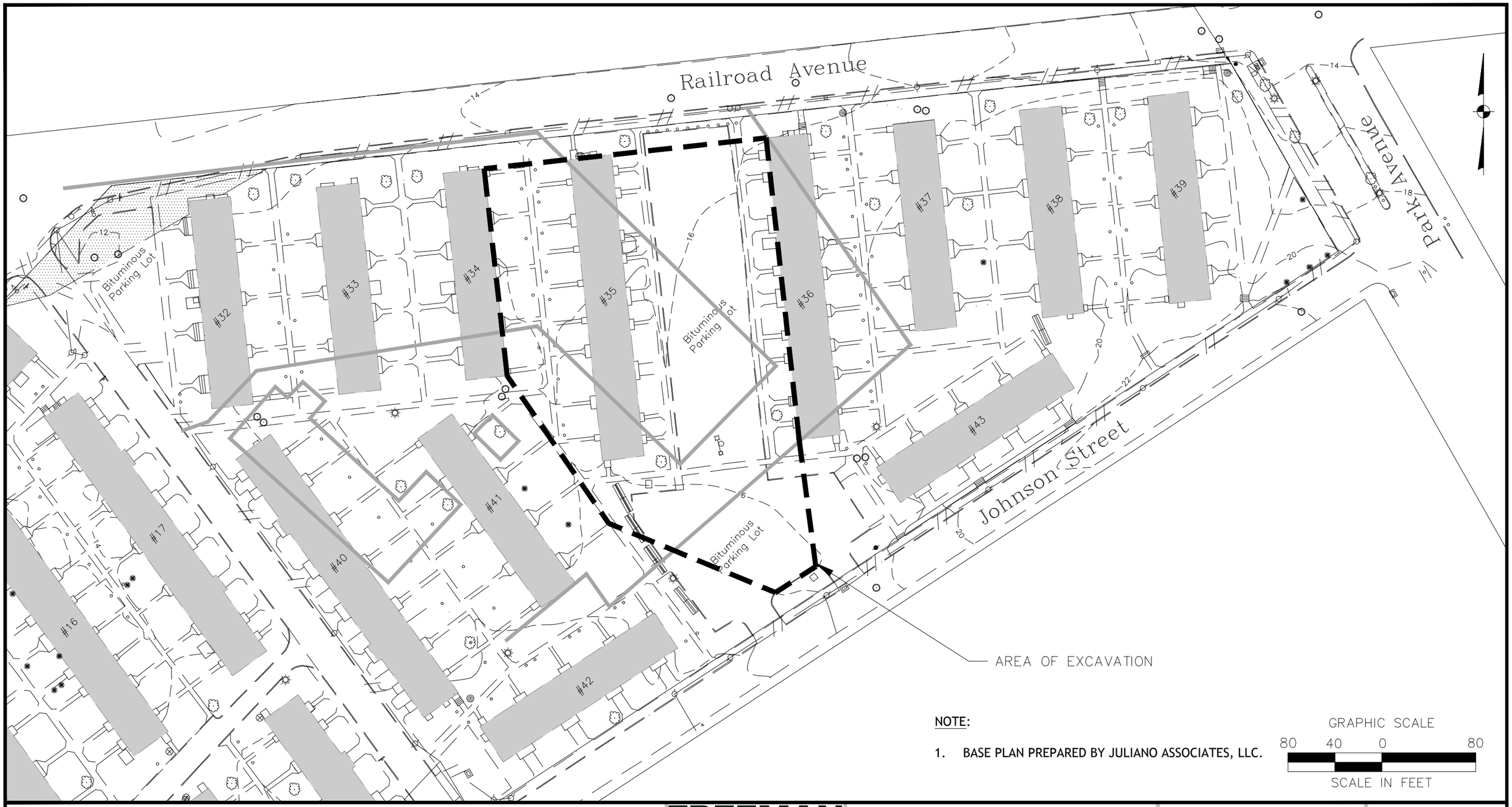
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APPROVED:	C.D.B.
SCALE:	1"=80'
PROJECT NO.:	2015-0408
DATE:	08/11/2016

SHEET NO.

FIGURE 2

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan 2.dwg Nov 07, 2016-11:31am Plotted By: mkwok

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NOTE:

1. BASE PLAN PREPARED BY JULIANO ASSOCIATES, LLC.

GRAPHIC SCALE
80 40 0 80
SCALE IN FEET

PLAN

MARINA VILLAGE
400 IRANISTAN AVENUE
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No.	Date	Description
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REVISIONS

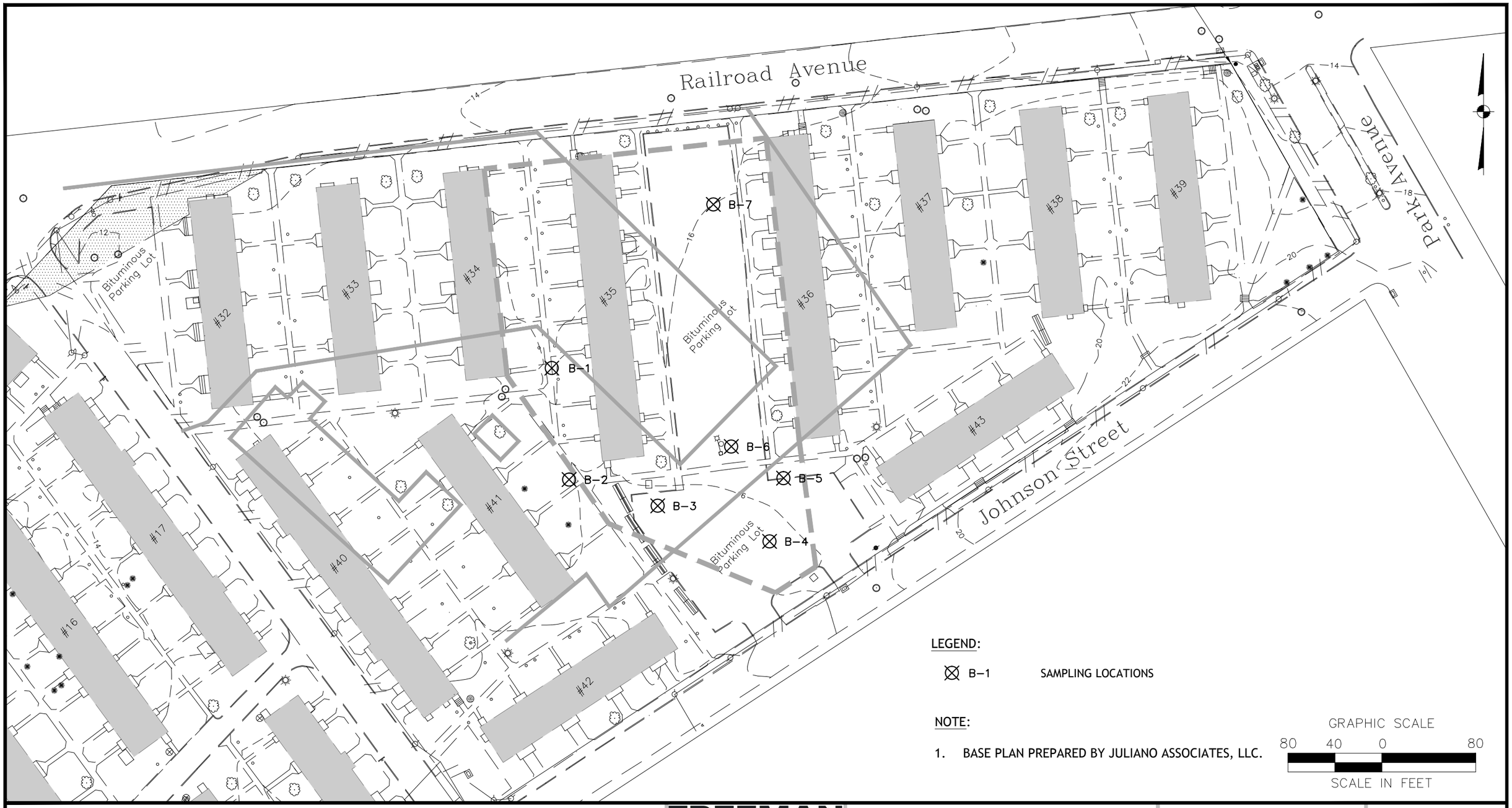
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CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=80'
PROJECT NO.:	2015-0408
DATE:	08/11/2016

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FIGURE 3

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan 2.dwg Nov 07, 2016-11:32am Plotted By: mkwok

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LEGEND:

⊗ B-1 SAMPLING LOCATIONS

NOTE:

1. BASE PLAN PREPARED BY JULIANO ASSOCIATES, LLC.

GRAPHIC SCALE
80 40 0 80
SCALE IN FEET

PLAN

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REVISIONS

DRAWN:	M.K.
CHECKED:	C.D.B.
APPROVED:	C.D.B.
SCALE:	1"=80'
PROJECT NO.:	2015-0408
DATE:	08/11/2016

SHEET NO.

FIGURE 4

Freeman Companies, LLC . Y:\2015\2015-0408 - Marina Village\DWG\Plan 2.dwg Nov 07, 2016-11:32am Plotted By: mkwok

THESE DRAWINGS SHALL NOT BE UTILIZED BY ANY PERSON, FIRM OR CORPORATION WITHOUT THE SPECIFIC WRITTEN PERMISSION OF FREEMAN COMPANIES, LLC

FREEMAN COMPANIES

APPENDIX B

SOIL WEIGHT TICKETS

AVAILABLE UPON REQUEST

APPENDIX C

SITE PHOTOS



Photo 1: Excavation activities



Photo 2: Removal of ash material



Photo 3: Removal of material from coal storage area



Photo 4: Clean sand remaining after removal of impacted material

FREEMAN COMPANIES

APPENDIX D

SUMMARY OF ANALYTICAL RESULTS

AVAILABLE UPON REQUEST

APPENDIX E

ENVIRONMENTAL DATA RESOURCES REPORT

AVAILABLE UPON REQUEST

APPENDIX IV
Database Report

(Available Upon Request)

APPENDIX V
Site Photographs

CONNECTICUT DEPARTMENT OF HOUSING
RBD PILOT AREA
BRIDGEPORT, CONNECTICUT

Site Photographs – December 4, 2018



View looking down Johnson Street to the east from the corner of Columbia and Johnson Streets.



View of Columbia Street in the vicinity of Ridge Avenue (to the left) looking to the northwest towards Interstate 95.



Northwest corner of Ridge Avenue and Columbia Street with an active construction site from building demolition within the RBD Pilot area beyond.



Zoom view of previous photo showing soil covered grounds, building demolition piles and buildings 15, 16 and 17 of the Marina Village Housing Complex beyond to the northwest.



View of Ridge Street looking to the southeast



View of gated construction area entrance within the RBD Pilot area located along the approximate center of the north side of Ridge Avenue.



View of Buildings18-21 (left to right) at the southern portion of the RBD Pilot area from Ridge Avenue.


View of Buildings 20 and 21 located at the southern portion of the RBD Pilot Area looking to the northwest.

APPENDIX VI
Qualifications of Environmental Professionals

MICHAEL MANOLAKAS, LEP, CPG

Area Manager



Years with the firm

23

Years total

23

Professional qualifications

Licensed Environmental Professional: Connecticut,

Certified Professional Geologist, American Institute of Professional Geologists

Areas of practice

Hydrogeology, Environmental Investigation, Remediation and Estimating

Languages

English

CAREER SUMMARY

Michael Manolakas' 20 years of experience includes completion of numerous Phase I through Phase III environmental site investigations, delineation and full characterization of contaminated soils and groundwater, feasibility studies, remedial system design, remedial cost estimates, water treatment system design, and remediation of soils and groundwater. His remedial experience includes in-situ abiotic and biotic treatments, in-situ stabilization, soil-vapor extraction, air sparge, pump and treat, excavation, product removal, and encapsulation. He currently manages sites undergoing investigations and remediation as part of RCRA Corrective Action, CT Transfer Act, CT and NY Voluntary Remediation/Clean-Up/Brownfield Programs and under CT Consent Order. His experience also includes investigation and remediation of releases in accordance with 40 CFR 761 (TSCA).

Michael's experience includes performing comprehensive environmental liability assessments at industrial facilities, preparing detailed lifecycle construction/ remediation project cost estimates, preparing feasibility studies as well as project management, construction contract administration, preparation of project manuals, bidding documents, specifications, and management of remedial investigations. Additional experience includes assisting clients in administering construction bidding process and evaluating bids. Michael also has corporate experience in determining potential environmental financial liability related to the acquisition, leasing or sale of properties and businesses.

EDUCATION

B.S., Geological Sciences, Ohio State University, Columbus, Ohio 1994

PROFESSIONAL MEMBERSHIPS

American Institute of Professional Geologists (AIPG)

Environmental Professionals Organization of Connecticut (EPOC)

PROFESSIONAL EXPERIENCE

Environmental Site Investigation and Remediation

— Bridgeport, Connecticut: project management of investigations and remediation of a 76.5 acre former industrial site. This RCRA TSD facility included an approximate 1.5 million square foot manufacturing building, an inactive industrial landfill, 55 former USTs and two former metal hydroxide sludge beds. Investigations included the drilling of over ~1500 soil borings, installation of ~300 monitoring wells and ~350 soil-vapor point, collection of ~200 sediment samples, electromagnetic geophysics, ground penetrating radar, down-hole geophysics, aquifer test, groundwater flow modeling, collection and analyses of numerous soil and groundwater samples for various constituents of concern (COCs). COCs included PCBs, VOCs, SVOCs, metals, and pesticides. Remedial actions have included the removal and offsite disposal of thousands of tons of PCB remediation waste in accordance with 40 CFR 761, in-situ stabilization of over 3,000 tons of characteristically hazardous waste and disposal of this waste containing PCBs and non-aqueous phase liquids as PCB remediation waste, closure of multiple greater than 90-day RCRA waste storage areas, and remediation of four areas containing light non-aqueous phase liquids (LNAPL). Remediation also included the screening

and removal of solid waste from 40,000 cubic yards of landfilled materials. Remediation of this site is ongoing. Client: Name. Project Value: USD

- East Haven, Connecticut: characterization and remediation of PCB bulk product waste and PCB remediation waste at water-supply sedimentation basin in accordance with the self-implementing option for cleanup and disposal of PCB remediation waste (40 CFR 761.61(a)). The investigation and remediation were completed with the corporation of the CTDEEP and EPA Region 1 Administrator.
- Hamden, Connecticut: project management of investigation and remediation of an approximately 19-acre industrial waste landfill site located on residential and public school parcels. Tasks included development of chronological historical filling activities, a detailed investigation work plan, oversight of offsite investigations, implementation of extensive onsite soil and groundwater investigation, and remedial options and costs. Thus far, the field investigations have included the drilling of 70 soil borings, excavation of 8 test pits, collection and analysis of 105 soil samples, installation of 24 monitor wells and collection and analysis of 32 groundwater samples. In addition, tasks included monitor of communications, attend and report on CTDEEP, EPA and other primary responsible party public meetings and review of technical submittals of government agencies and primary responsible parties. Remediation underway includes the removal of PCB "hot spot" to be disposed as PCB remediation waste in accordance with 40 CFR 761.
- Fairfield, Connecticut: contracted for approximately four months to work at a large international conglomerate corporation. Tasks included review of over one hundred environmental site assessments and remedial closure reports to determine potential environmental risks with respect to acquiring, leasing or selling properties or businesses, and working with environmental health and safety managers to reduce risks associated with these types of transactions. Property and businesses reviewed were located throughout the world and ranged from leasing of office space to acquisition of $500 million corporations. Review of larger acquisitions often included development of work plans and determination of potential environmental liability.
- Danbury, Connecticut: identified offsite source of contamination through environmental file review and review of regional hydrogeologic setting. Designed and coordinated installation of potable water treatment system. Coordinated repairs of onsite well and distribution system to the satisfaction of the Connecticut Department of Public Health.
- Manhattan, New York: completed Phase I environmental site assessment for signature property assessed at approximately $250 million.
- Chester, Connecticut: project management of a RCRA ground-water quality assessment for a plume from metal hydroxide seepage lagoons. The project involved quarterly sampling and evaluation. Developed and implemented CTDEP approved work plan for closure investigation of waste lagoons. Receipt of CTDEP clean closure approval for former waste lagoons. Tasks also included characterization and monitoring of halogenated volatile organic plume and assessment of remedial performance. Remedial operations consisted of both a multi-phase extraction and pump and treat system.
- Norwalk, Connecticut: research and identification of inexpensive new technology (jet cavitation) for treatment of contaminated groundwater. Technology is

proposed to be used in conjunction with a pump and treat system to remove halogenated volatile organic compounds from bedrock and overburden aquifers.

- Winsted, Connecticut: project management of investigations and remediation at a former thread manufacturing facility. Tasks included identification and characterization of 22 potential release areas, and successful remediation of all identified release areas.
- Sag Harbor, New York: full characterization of halogenated VOC plume. Tasks included response to technical comments concerning hydrogeology, chemical transport, remedial effectiveness and SPDES discharge technical requirements.
- Detroit, Michigan: acted as the onsite supervisor for environmental investigations and remediation activities at three automotive plants. Tasks included operation and maintenance of phytoremediation berm, supervising closure of hazardous waste storage areas, excavation of petroleum, VOC and metal impacted soils and supervision of site investigations.
- Portland, Connecticut: supervision and development of monitor wells and evaluation of soil volatile organic levels.
- Stratford, Connecticut: supervision of test borings and monitor well installation, while sampling for PCB's and asbestos, to determine soil and groundwater quality.
- Illinois, New Jersey, New Hampshire, Pennsylvania, Rhode Island and Vermont: conducted several Phase I environmental site assessments for use of property transfer.
- Farmington, Connecticut: completion and submittal of the Environmental Condition Assessment Form and Form III to the CTDEP to satisfy requirements of the Connecticut Property Transfer Program.
- Yonkers, New York: supervision and development of monitor wells on periphery of landfill. Entailed collection of groundwater and surface water samples.
- Thomaston, Connecticut: characterization of MTBE and BTEX plume in the groundwater.
- Patterson, New York: project management of Phase II investigations. Project included sampling of groundwater, soils and paint and the evaluation of the laboratory results.
- Glastonbury, Connecticut: project management of subsurface investigation to determine the impact to the soil and groundwater from a former tannery operation. The project included the installation of monitor wells, sampling and evaluation.
- Cheshire, Connecticut: annual and quarterly reporting on efficiency and optimization of soil-vapor extraction (SVE) and sparge system (IAS) operation. SVE/IAS system orients hydraulic gradient so that halogenated solvents remain in localized area.
- Dutchess County, New York: completed numerous requirements of the hydrogeologic reporting section of the 6 NYCRR Part 360 Solid Waste Management Facilities rules and regulations for a proposed C&D landfill as a closure plan for a mining operation.
- Stratford, Connecticut: project management of subsurface investigation to determine the impact from former site operations to the soil and groundwater. Project included drilling of test borings, sampling, environmental database review

and evaluation. Completion of final remediation report and submittal of Form II Connecticut Property Transfer form.

- Orangetown, New York: project management of subsurface investigation to determine the impact of former site operations to the soil and groundwater. Development and implementation of final work plan to investigate the site under the NYSDEC voluntary remediation program.
- Cromwell, Connecticut: project management of bioremediation system, and monitoring program for petroleum release. Tasks also included fulfilling CTDEP reporting requirements.
- Hamden, Connecticut: project management of characterization, removal and disposal of mercury-impacted soils.
- Wallingford, Connecticut: project management of characterizing pesticide soil and groundwater contamination with respect to the Connecticut Remediation Standard Regulations. Identified concentrations of contaminant in soils posing a potential health threat for various uses of the property.
- Connecticut and New York: conducted numerous Phase I and Phase II environmental site assessments for use in a property transfer and financing.
- North Haven, Connecticut: supervised steam cleaning of impacted industrial sumps. Investigation and delineation of impacted soils and wetlands.

Groundwater Supply

- Suffolk County, New York: completed detailed salt-water and iron investigation as they responded to pumpage of eleven pumping wells in the Montauk Area. The study included pumpage recommendations intended to maximize potable water while limiting seasonal and long-term chloride and iron impacts. The study also provided alternative management approaches for rehabilitating impacted well fields and maximizing existing well fields.
- New Haven County, Connecticut: analysis and evaluation of groundwater levels, stream flows, precipitation and wetland conditions to determine the impact of groundwater withdrawals on the aquifers and surface-water systems in four well fields.
- Southington, Connecticut: conducted pumping and induced infiltration tests of municipal water supply wells.
- Town of Wappinger Falls, New York: conducted several geophysical investigations. Analyzed pump test to determine aquifer parameters and stream infiltration rates. Calculated optimal placement of an additional production well.
- New Haven County, Connecticut: evaluation of pumping test data and development of water table maps.
- Suffolk County, New York: conducted numerous geophysical investigations. Investigations required determination of optimal screen setting and size for design of production wells.
- Dutchess County, New York: completed numerous requirements of the hydrogeologic reporting section of the 6 NYCRR Part 360 Solid Waste Management Facilities rules and regulations for a proposed C&D landfill as a closure plan for a mining operation.

- Suffolk County, New York: development of numerous groundwater flow and salt-water intrusion models for locations in Suffolk County to determine optimal well field withdrawal rates in order to avoid potential adverse impacts to the Upper Glacial Aquifer, Magothy Aquifers and surrounding wetlands. Specifically, the models were utilized to determine pumping rates that would avoid salt-water upcoming or lateral encroachment or dewater of wetlands. Projects included management and analysis of pumping tests, design of monitoring well networks and response to concerns of the NYSDEC.
- Southold, New York: hydrogeologic assessment for proposed well field. Evaluated potential impacts from salt water upcoming. Project included a 72-hour pump test, collection of samples and evaluation.
- Carlin, Nevada: calibration of ground-water flow model (MODFLOW) to evaluate optimal use of pumpage for dewatering of gold mine.
- New Haven County, Connecticut: modification and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during drought conditions for four existing well fields. The modification involved updating three separate 2-dimensional models to 3 dimensional models to better evaluate the effects of the surface-water bodies.
- Town of Thomaston, Connecticut: use of groundwater flow model (MODFLOW) and particle tracking program (PATH3D) to determine most efficient and economical remedial design for the characterized MTBE and BTEX plume in the groundwater.
- Sag Harbor, New York: modification and calibration of groundwater flow model (MODFLOW), particle tracking program (PATH3D) and solute transport program (MT3D) to determine, optimal remedial design for historical DNAPL Plume.
- Town of Wappinger Falls, New York: use of 2 dimensional groundwater flow model (Capzone) and particle tracking program (GWPATH) to determine safe and maximum yield of well field. Model output helped determine capture zone and optimum discharge rate of future production well.
- Litchfield County, Connecticut: development and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during drought conditions for four existing well fields. Use of particle tracking program (PATH3D) to determine area of contribution for existing well field.
- Westchester County, New York: development and calibration of groundwater flow model (MODFLOW) to determine extent of mounding from proposed septic discharge.

Specific Experience in Groundwater Modeling

- Fairfield County, Connecticut: development and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during average conditions of existing well fields. Use of particle tracking software (PATH3D) for determination of area of contribution. Model was used to evaluate safe yield for southern well field with respect to salt water intrusion.
- Orange County, New York: development and calibration of several groundwater flow models (MODFLOW) to determine zone of influence in drought conditions of existing well fields. Use of particle tracking software (PATH3D) for determination of area of contribution for travel times.
- Carlin, Nevada: calibration of groundwater flow model (MODFLOW) to evaluate optimal use of pumpage for dewatering of gold mine.

- New Haven County, Connecticut: modification and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during drought conditions for four existing well fields. The modification involved updating three separate 2-dimensional models to 3 dimensional models to better evaluate the effects of the surface-water bodies.
- Thomaston, Connecticut: use of groundwater flow model (MODFLOW) and particle tracking program (PATH3D) to determine most efficient and economical remedial design for the characterized MTBE and BTEX plume.
- Suffolk County, New York: development of numerous (more than 20) groundwater flow (MODFLOW), particle tracking (PATH3d and MODPATH) and salt-water intrusion (SHARP) models for locations in Suffolk County which were utilized to determine optimal well field withdrawal rates to avoid potential adverse impacts to the Upper Glacial Aquifer, Magothy Aquifers and surrounding wetlands. Specifically, the models were utilized to determine pumping rates that would avoid salt-water upcoming or lateral encroachment or dewater of wetlands.
- Sag Harbor, New York: modification and calibration of groundwater flow model (MODFLOW), particle tracking program (PATH3D) and solute transport program (MT3D) to determine optimal remedial design for historical DNAPL plume. Through modeling determined contaminant removal times and optimum pumping locations and rates for focused source/contaminant removal actions.
- Wappinger Falls, New York: use of 2-dimensional groundwater flow model (Capzone) and particle tracking program (GWPATH) to determine safe and maximum yield of well field. Model output helped determine capture zone and optimum discharge rate of future production well.
- Litchfield County, Connecticut: development and calibration of groundwater flow model (MODFLOW) to determine the zone of influence during drought conditions for four existing well fields. Use of particle tracking program (PATH3D) to determine area of contribution for existing well field.
- Westchester County, New York: development and calibration of groundwater flow model (MODFLOW) to determine extent of mounding from proposed septic discharge.

PUBLICATIONS AND PRESENTATIONS

Publications

- Manolakas, Michael. “Achieving Compliance through Development of Alternative Soil Criteria,” *Monitor*, Spring 2004.
- Manolakas, Michael. “Guidance for EPA Technical Impracticability of Ground Water Restoration,” *LBG Short Notes*, Spring 1999.
- Manolakas, Michael. “Aquifer Mapping Integral to Well Field Protection Efforts”, *Land and Water*, July/August 1998.
- Manolakas, Michael. “The Use of Computer Models in Well Field Protection delineations,” *CE News*, April 1999.

Presentations

- Manolakas, Michael. “Stabilization of Characteristically Hazardous Volatile Organic Compounds and Metals Using Rice Hull Ash and Lime Kiln Dust.” Battelle Eighth

International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 2012.

— Manolakas, Michael. "Effectiveness of a Metal Stabilizer when Treating Hazardous Waste with Modified Fenton's Reagent and Sodium Persulfate: A Laboratory Treatability Study." Battelle Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 2010.

— Manolakas, Michael. "Investigation of Site Specific Mobility and Leaching Characteristics of Dieldrin in Soils." Battelle Fourth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 2004.

MELANIE R. SHEPERD

Project Hydrogeologist

Years with the firm

12

Years total

18

Professional Qualifications

Professional Geologist, New York, 2018

Areas of practice

Geology, Hydrogeology, Environmental Investigation and Remediation

Languages

English

CAREER SUMMARY

Melanie has over eighteen years of experience conducting Phase I, II and III Environmental Site Assessments including completing all facets of field investigations, data tabulation and reporting. These investigations include a variety of drilling, well completion, soil and water sampling, environmental screening tasks associated with impacted soil and groundwater and remediation system monitoring and maintenance. Melanie's experience includes investigations of sites regulated by RCRA, Connecticut's Remediation Standard Regulations and other state regulations. Her experience also includes managing staff and subcontractors, communication with client and associated town and state representatives, project data compilation and reporting. Melanie is trained in all aspects of health and safety precautions related to environmental and geotechnical projects.

EDUCATION

B.S., Geology and Geophysics, University of Connecticut, Storrs, Connecticut	2000

ADDITIONAL TRAINING

Health and Safety Operations at Hazardous Waste Sites (HAZWOPER) 29 CFR 1910.120(e)(3), 40 hours with annual 8-hour refreshers	2000-2018
8-hour HAZWOPER Supervisor Training required by OSHA 29 CFR 1910.120(e)(4)	2012
Radiation Safety, 29 CFR 1910.1096	2015
EPOC Remediation Standard Regulations Course	2006

PROFESSIONAL EXPERIENCE

— Former Manufacturing Facility, Bridgeport, Connecticut: Monitored over 150 soil borings, monitoring wells and test pit excavations during extensive Phase II and Phase III investigations of a 77-acre property including a landfill area. Completed continuous soil sampling and geologic logging of site strata including identification of various historical fill materials, mapping a former stream bed and mapping and logging over 50 soil borings to identify deeper areas of industrial fill. Other tasks included completing a large soil vapor survey of the sub-slab soils beneath the Site building which totaled 240 survey points and performed several groundwater sampling rounds using EPA low flow techniques. Coordinated, setup and operated three dedicated, data-logging pressure transducers calibrated to existing stream staff gauges which collected surface water samples from three Site locations following significant storm events. Additional responsibilities included summarizing soil, groundwater and soil vapor data into formatted tables compared to regulatory criteria, creating site figures and assistance in report completion.

— Commercial Property, Stamford, Connecticut: Completed a Phase I ESA of a 60-acre commercial property where several areas of concern were identified and investigated in a widespread Phase II/Phase III investigation of over 250 soil borings/monitoring wells with several hundred soil samples analyzed. Responsibilities included locating, overseeing and logging soil borings/monitoring wells; completing quarterly groundwater monitoring; sediment sample collection and later tabulation of the soil

and groundwater analytical results in comparison to regulatory criteria. Remedial efforts of the property included mass excavation and off-site transport of impacted fill materials. Completed daily data tabulation to assess and determine the limits and extent of the impacts at the property to direct the excavation. Completed data quality assessment and data usability evaluation tables and associated reporting of the analytical laboratory reports.

— U.S. Army Corporation of Engineers, Hop Brook Dam, Naugatuck, Connecticut: Project Manager and lead geologist for installation monitoring of a grout curtain designed to remediate seepage and stabilize an earthen filled dam constructed in the late-1960s. Completed geologic logging and monitoring of the tightly-spaced, grout curtain boreholes in the unconsolidated dam soils and underlying fractured bedrock across the topography of the dam. Daily activities included overseeing two drill rigs using various techniques (sonic drilling, roller-bit advancing, rock coring) and logging of the soil and rock encountered per specifications of the U. S. Army Corporation of Engineers. Also, monitored the groundwater conditions and relative permeability of the fractured bedrock to provide subsurface details for creating a properly structured grout curtain. Developed written scope of work for geologic rock core logging including the project specifications required by the U.S. Army Corporation of Engineers to evaluate the integrity of the earthen dam.

— Former Research Facility, Rockland County, New York: Monitored an in-situ chemical oxidation (ISCO) pilot test which involved injecting sodium permanganate into a monitoring well network to remediate groundwater impacted with halogenated volatile organic compounds. Based on groundwater flow, fine-grained sand and silty surficial soils, a calculated sodium permanganate solution was injected into the saturated soils while water was extracted using a vacuum truck to radially disperse the remedy. My activities during the injection/extraction process included groundwater level monitoring to calculate a radius of influence of drawdown, measurement of water quality parameters using a multi-parameter water quality meter and monitoring downgradient monitoring wells to visually identify when and where the pink sodium permanganate was mobilized in the aquifer. As per specifications of the Site, additional field responsibilities including constant up- and down-gradient dust monitoring. Completed data tabulation of all field monitoring activities in summarized tables and field calculations were modified in the field during the test based on the behavior of the sodium permanganate in the aquifer and the measured groundwater table. Performed post-injection groundwater monitoring and associated data tabulation to evaluate the effectiveness of the chemical dispersion of the ISCO over designated time intervals.

— Over 30 Condominium & Apartment Complexes, Hartford, Connecticut: Completed individual Phase I ESAs of over 30 properties including a site inspection of each parcel and associated city and state research conducted at various city offices. Assessments of historical resources included topographic, aerial and Sanborn fire insurance maps and city directories evaluated to obtain the history of each parcel. Numerous environmental databases were researched and conclusions regarding potential groundwater flow, state groundwater classification, surficial materials and bedrock geology in conjunction with site history were determined in order to identify and potential liabilities. Following the completion of these Phase I assessments, several potential underground storage tanks (USTs) were identified. Monitored ground penetrating radar surveys to locate any subsurface anomalies, and completed Phase II soil boring investigations where USTs were suspected to evaluate if any releases from a UST had occurred. Several USTs, including No.2 and No. 6 oil of up to 10,000-gallon size tanks were found. My responsibilities included identifying impacted soils in the

field, monitoring the UST excavation, collecting tank closure samples and soil characterization samples for off-site removal of the impacted materials. Completed an individual report for each UST removal which summarized all field activities, including detailed site plans with pertinent site features, tank locations and confirmation soil sample locations. Lastly, completed the reporting and analytical data tabulation in comparison to applicable criteria to confirm all prudent actions had been completed to remove the tank and associated impacted soils.

— Various Commercial and Industrial Properties, Hartford/New Haven/Fairfield and Middlesex Counties, Connecticut: Completed over 45 Phase II and/or Phase III investigations at various properties in Connecticut. My responsibilities included monitoring drilling activities, geologic logging and field screening of all borings and monitoring wells; identifying groundwater depth; understanding the lithology of the surficial materials at each Site to determine the migration and distribution of contaminants; identifying fill materials and soil sample collection. Supplementary tasks included well development, groundwater sampling using US EPA low-flow methodology, completion of a groundwater elevation survey to determine inferred groundwater flow direction and created associated figures with soil boring/monitoring well locations and groundwater flow direction. Following completion of field work, tabulated analytical laboratory data and evaluated compliance with clean-up criteria and completed the necessary reporting.

APPENDIX E
Supplemental Natural Resources Information

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Appendix E. Supplemental Natural Resources Information

E.1 ECOLOGICAL COMMUNITIES

A comprehensive field survey performed by certified ecologists identified nine distinct habitat types within the waterfront and inland portions of the study area. These nine habitat types are ruderal uplands, urban forest, freshwater wetlands, beaches and dunes, hardened shoreline, intertidal wetlands, intertidal flats, oyster reefs/shellfish beds, and subtidal bottom (Waggonner & Ball and Arcadis, 2018).

E.1.1 Ruderal Uplands

Within the study area, many upland spaces that have not been converted to impervious surface have been otherwise modified through extensive anthropogenic activity. This includes (1) spaces dominated by invasive plant communities; (2) spaces managed as grass lawns or landscape features; and (3) spaces comprised of disturbed soil, rock, or gravel. Such spaces, collectively referred to as ruderal uplands, possess little ecological value and primarily support urban wildlife (Waggonner & Ball and Arcadis, 2018). Brownfields, areas where significant contamination is known or expected, represent a ruderal upland habitat that is common throughout Bridgeport.

E.1.2 Urban Forest

Recreational parks, such as Seaside Park, and portions of residential neighborhoods harbor a diversity of plant life that is absent from much of the upland study area. These zones of relatively diverse vegetation comprise an urban forest habitat that is characterized by native trees, cultivars, maintained shrubs, and herbaceous plants. Tree species such as northern red oak (*Quercus rubra*), red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), American sycamore (*Platanus occidentalis*), eastern hemlock (*Tsuga canadensis*), American linden (*Tilia Americana*), and black birch (*Betula lenta*) can be found within Seaside Park, as well as along public roadways and within private yards. Several shrubs (e.g., sumacs (*Rhus* spp.), roses (*Rosa* spp.), etc.) and herbaceous plants (e.g., wildflowers) also populate these spaces. Ecosystem services provided by the study area's urban forest network include wave attenuation and habitat opportunity for an assemblage of wildlife – namely opportunistic mammals and resident birds (Waggonner & Ball and Arcadis, 2018).

E.1.3 Freshwater Wetlands

Many freshwater features within the South End of Bridgeport have been filled to support existing development. Two man-made, freshwater bodies are present along the eastern shoreline of the study area, north of Tongue Point. These waterbodies are located on PSEG property and may function to support industrial operations. Additionally, a small section of freshwater emergent wetland is present at the southeastern corner of the study area – also on PSEG property (USFWS, 2018). Freshwater emergent wetlands are typically dominated by rooted, herbaceous hydrophytes that remain present for the majority of the growing season. Within the state of Connecticut, hydrophytes of this nature include tussock sedge (*Carex stricta*), rice cutgrass (*Leersia oryzoides*),

bluejoint grass (*Calamagrostis canadensis*), sensitive fern (*Onoclea sensibilis*), Virginia chain fern (*Woodwardia virginica*), goldenrod (*Solidago spp.*), pickerelweed (*Pontederia cordata*), and others (Metzler and Tiner, 1992).

Freshwater wetlands offer a variety of recognized benefits, including water quality maintenance, nutrient cycling, flooding and erosion control, fishing area, and habitat opportunity for sensitive species (Waggonner & Ball and Arcadis, 2018). However, anthropogenic disturbances – vegetation removal, pollution, etc. – can restrict the scope of possible benefits. Given the location of the study area's remaining freshwater wetlands in an industrial zone, they may be impacted by contamination and characterized by reduced ecological and economic potential.

E.1.4 Beaches and Dunes

CT DEEP, through the CT Coastal Management Manual (2000), defines beaches as "dynamic areas abutting coastal waters that are characterized by sand, gravel, or cobbles." Dunes are generally defined as mounds of unconsolidated sediment that form along the inland edge of a beach. Together, beaches and dunes comprise a complex habitat that provides ecosystem services such as wave attenuation, shoreline stabilization, floodwater and erosion control, recreation, and wildlife support (Waggonner & Ball and Arcadis, 2018). Characteristic vegetation of this habitat includes beachgrass (*Ammophila breviligulata*), dusty miller (*Artemisia stelleriana*), beach pea (*Lathyrus japonicus*), sedge (*Carex spp.*), and seaside goldenrod (*Solidago sempervirens*). Other species, such as beach heather (*Hudsonia tomentosa*), bearberry (*Arctostaphylos uva-ursi*), beach pinweed (*Lechea maritime*), jointweed (*Polygonella articulate*), bayberry (*Myrica pensylvanica*), and beach-plum (*Prunus maritima*), commonly populate stabilized dunes (Waggonner & Ball and Arcadis, 2018).

The southern coast of the study area is characterized by a heavily utilized beach with a sparsely vegetated, fragmented dune community. Limited flora diversity remains, and the habitat is frequently encroached upon by bulkheads, riprap, revetments, and other hardened structures. The image below depicts the current state of the shoreline along Seaside Park.

E.1.5 Hardened Shoreline

As mentioned above, Bridgeport's shoreline has been extensively modified through the addition of hardened structures to curb flooding and aid in erosion control. Riprap has been constructed along much of the study area, creating an unnatural continuum between the land and adjacent coastal waterbodies. In some places, hardened features have entirely replaced historic ecological communities (e.g., beaches, intertidal flats, etc.), causing an abrupt transition to open water. Shoreline hardening has had significant consequences, including habitat loss and degradation, loss of recreational space, and disruption of visual resources. However, existing riprap does function as a viable substrate for plant and animal colonizers, including oysters, mussels, barnacles, and other macroinvertebrates (Waggonner & Ball and Arcadis, 2018).

E.1.6 Intertidal Wetlands

Intertidal wetlands are a type of tidally-influenced ecological community that is inundated by surface water or groundwater frequently enough to support vegetation adapted to wet soil conditions. Distinct zones can be identified within an intertidal wetland, including low salt marsh and high salt marsh. Low salt marsh generally occurs between mean low water (MLW) and mean high water (MHW) and is inundated twice daily by normal

high tides. Within Connecticut, areas of low salt marsh are usually dominated by saltmarsh cordgrass (*Spartina alterniflora*). High salt marsh occurs between mean high water (MHW) and mean higher high water (MHHW) and is only inundated under extreme circumstances, such as during major storms or spring tides. Typical vegetation of this zone includes salt marsh hay (*Spartina patens*), saltgrass (*Distichlis spicata*), and marsh elder (*Iva frutescens*). (Waggonner & Ball and Arcadis, 2018)

Along Long Island Sound, many intertidal wetlands have been filled to support development or have been otherwise harmed through anthropogenic activity. Invasive plant species – namely the disturbance-tolerant common reed (*Phragmites australis*) – have outcompeted vulnerable native vegetation in wetlands across coastal Connecticut (Waggonner & Ball and Arcadis, 2018). Establishment of common reed produces expansive, monotypic communities characterized by reduced hydrological complexity and wildlife diversity. Due to these factors, very few native salt marshes offering a healthy range of ecosystem services remain in close proximity to the study area.

E.1.7 Intertidal Flats

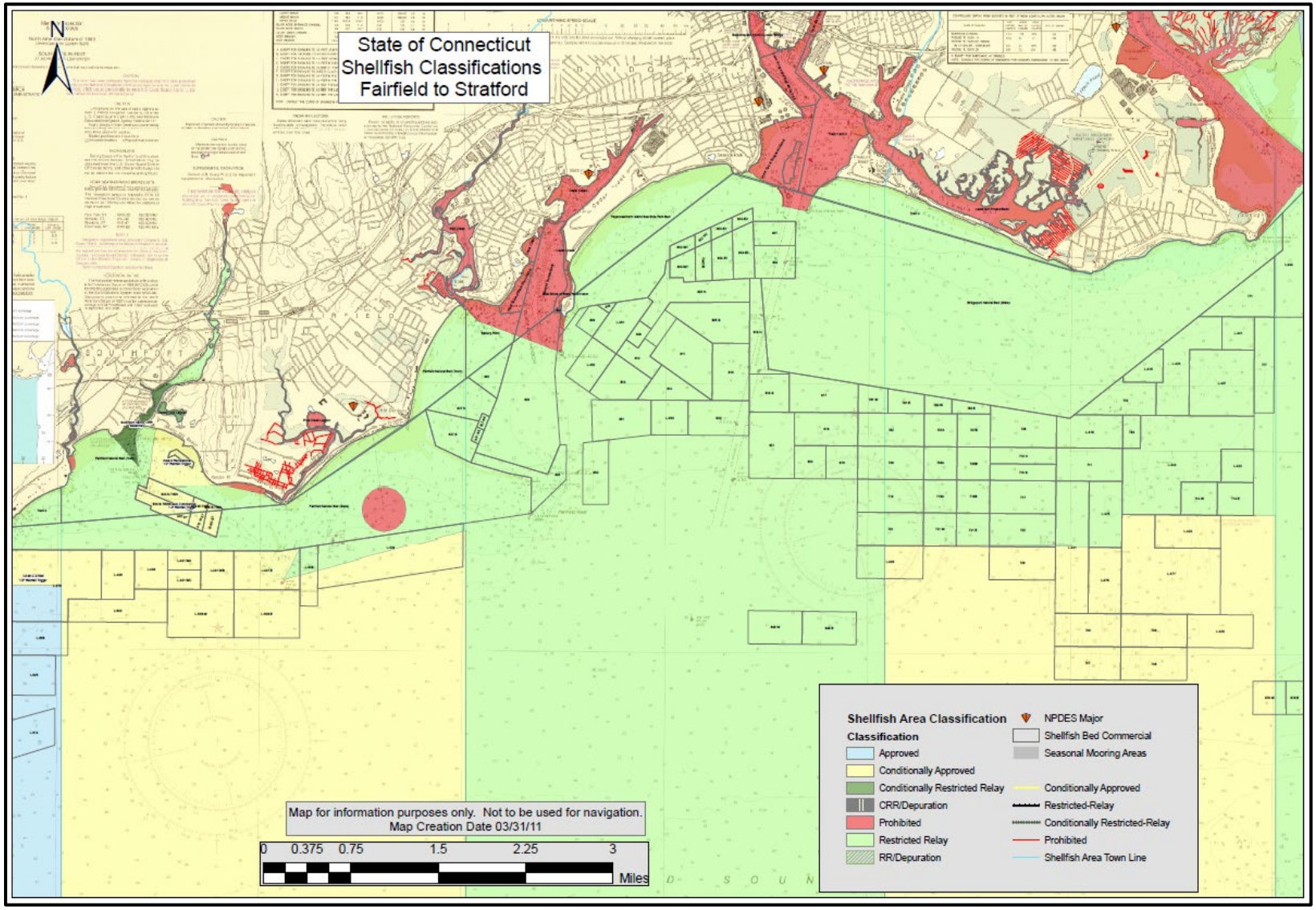
CT DEEP, through the CT Coastal Management Manual (2000), defines intertidal flats as "very gently sloping or flat areas located between high and low tides composed of muddy, silty, and fine sandy sediments and generally devoid of vegetation." This ecological community accounts for much of the South End's existing natural shoreline, primarily due to historic wetland loss and modified sediment transport. Intertidal flats stretch from the southwestern corner of the study area along the coast to Fayweather Island. Benefits provided by intertidal flats include shoreline protection, water quality enhancement, and habitat opportunity for benthic macro- and micro-invertebrates (Waggonner & Ball and Arcadis, 2018). Avian and fish species that feed on benthic invertebrates also frequent intertidal flats.

E.1.8 Oyster Reefs/Shellfish Beds

Oyster reefs and shellfish beds are valuable ecological communities that occur throughout the Bridgeport Estuary. These communities provide structural complexity to subtidal bottom environments and help to improve water quality via physical and biological filtration. Moreover, they function as natural substrate for small, encrusting invertebrates (e.g., barnacles, sea squirts, etc.); provide refuge, feeding, breeding, and nursery opportunity to a range of aquatic organisms (e.g., finfish, crustaceans, etc.); and serve as foraging habitat for various water-dependent birds (e.g., shorebirds, wading birds, etc.). Where environmental and regulatory conditions permit, oyster reefs/shellfish beds also support recreational fishing and commercial harvesting for sale or consumption. (Waggonner & Ball and Arcadis, 2018)

Unfortunately, shellfish communities have been degraded by poor water quality in many areas of the Bridgeport Estuary. CT DOAG's Bureau of Aquaculture has forbidden shellfish harvesting along Bridgeport's shoreline, with coastal waters in the vicinity of the study area mapped as either "prohibited" or "restricted-relay". Generally, the prohibited designation indicates that shellfish quality is severely compromised by pollution – often microbial contamination from sewage treatment plants or combined sewer outfalls. The restricted-relay designation applies when sanitary surveys have revealed moderate pollution, and shellfish must be transported (relayed) to cleaner waters for natural purification prior to harvesting. Figure E-1, developed by the Connecticut Bureau of Aquaculture, depicts shellfish classifications along Fairfield County as of March 2011.

Figure E-1. State of Connecticut Shellfish Classifications (Fairfield to Stratford)



Source: CT DOAG Bureau of Aquaculture Website (2011)

E.1.9 Subtidal Bottom

Subtidal bottom is defined as all open water spaces situated below the mean lower low water (MLLW) level (i.e., -3.1' North American Vertical Datum of 1988 [NAVD 88]). This area represents a significant portion of the Bridgeport Estuary and encompasses a variety of naturally-occurring and anthropogenically-modified water depths. Natural subtidal bottom communities contribute to water filtration and support a variety of resources, both terrestrial and aquatic. For example, the littoral zone – the nearshore zone that remains inundated by shallow water at low tide – facilitates the growth of submerged aquatic vegetation, such as eelgrass (*Zostera marina*). In turn, SAV acts as shelter, feeding, and breeding habitat for a diversity of wildlife, including crustaceans and small finfish. Deeper subtidal bottom habitats are utilized by additional resident and migratory fish species, as well as sea turtles. (Waggonner & Ball and Arcadis, 2018)

Along the coast of the study area, shoreline hardening has eliminated portions of the littoral zone by creating a sudden shift to deep water. Subtidal bottom areas further offshore have also been impaired by anthropogenic disturbances (e.g., pollution, trawling, etc.).

The study area lacks certain coastal habitats, such as maritime forests and maritime shrubland, that can be found elsewhere along the Long Island Sound.

E.2 BIRD SPECIES

The state of Connecticut conducted a bird atlas from 1982 to 1986, with results published in 1994 as the Atlas of Breeding Birds of Connecticut. The state was divided into 596 census blocks, and each block was surveyed to document avian species present during the breeding season and record evidence of breeding. Birds were classified as possible, probable, or confirmed breeders based on behavioral and physiological indicators. Indicators of confirmed breeding included distraction displays, nest incubation, feeding of young, and presence of a brood patch (among others). Table E-1 lists avian species identified by the atlas as confirmed breeders within the census blocks that intersect with the study area (i.e., blocks 109C, 109D, 109E, and 109F).

Table E-1. Confirmed Avian Breeders

COMMON NAME	SCIENTIFIC NAME
American Black Duck	*Anas rubripes*
American Crow	*Corvus brachyrhynchos*
American Goldfinch	*Spinus tristis*
American Kestrel	*Falco sparverius*
American Robin	*Turdus migratorius*
Baltimore Oriole	*Icterus galbula*
Barn Swallow	*Hirundo rustica*
Black-capped Chickadee	*Poecile atricapillus*
Blue Jay	*Cyanocitta cristata*
Brown Thrasher	*Toxostoma rufum*
Canada Goose	*Branta canadensis*
Chimney Swift	*Chaetura pelagica*
Chipping Sparrow	*Spizella passerina*
Common Grackle	*Quiscalus quiscula*
Common Nighthawk	*Chordeiles minor*
Common Tern	*Sterna hirundo*
Common Yellowthroat	*Geothlypis trichas*
Downy Woodpecker	*Picoides pubescens*
Eastern Kingbird	*Tyrannus*
European Starling	*Sturnus vulgaris*
Fish Crow	*Corvus ossifragus*
Gadwall	*Anas strepera*
Gray Catbird	*Dumetella carolinensis*
Green Heron	*Butorides virescens*
Horned Lark	*Eremophila alpestris*
House Finch	*Carpodacus mexicanus*
House Sparrow	*Passer domesticus*
House Wren	*Troglodytes aedon*
Indigo Bunting	*Passerina cyanea*
Killdeer	*Charadrius vociferus*
Least Bittern	*Ixobrychus exilis*
Least Tern	*Sternula antillarum*
Mallard	*Anas platyrhynchos*
Marsh Wren	*Cistothorus palustris*
Mourning Dove	*Zenaida macroura*
Mute Swan	*Cygnus olor*
Nelson's Sparrow	*Ammodramus nelsoni*
Northern Cardinal	*Cardinalis*
Northern Flicker	*Colaptes auratus*
Northern Mockingbird	*Mimus polyglottos*
Pied-billed Grebe	*Podilymbus podiceps*
Piping Plover	*Charadrius melodus*
Red-winged Blackbird	*Agelaius phoeniceus*
Rock Pigeon	*Columba livia*
Song Sparrow	*Melospiza melodia*
Spotted Sandpiper	*Actitis macularius*
Tufted Titmouse	*Baeolophus bicolor*
Willet	*Tringa semipalmata*
Wood Thrush	*Hylocichla mustelina*
Yellow Warbler	*Dendroica petechia*

Source: 1994 Atlas of Breeding Birds of Connecticut: blocks 109C, 109D, 109E & 109F; Breeding Bird Atlas Explorer (online resource). U.S. Geological Survey Patuxent Wildlife Research Center. (2018);

E.3 THREATENED AND ENDANGERED SPECIES

E.3.1 Roseate Tern

The breeding range of the roseate tern spans the Atlantic coast from Novia Scotia south to Long Island; nesting colonies also occur along the southern tip of Florida. Preferred nesting habitat is sand/gravel beaches and pebbly/rocky offshore islands. (CT DEEP "Roseate Tern Fact Sheet," 1999)

In Connecticut, roseate terns are almost strictly observed along saltwater coastlines, and inland sightings are rare. The third largest roseate tern colony in North America exists at Falkner Island, with approximately 175 to 200 breeding pairs reported annually. Historic colony sites include Tuxis Island (observed 1989), Duck Island (observed 1989), and small islands in the vicinity of New London (observed 1970s). The terns arrive in Connecticut in late April and early May, and the first eggs are laid by the third week of May. In the case of nest or offspring loss, the birds will produce new nests later in the breeding season (usually into late July). Roseates that nest in the northeastern United States overwinter in the southern hemisphere, primarily along the coast of South America from Colombia to eastern Brazil. (CT DEEP "Roseate Tern Fact Sheet," 1999)

The Falkner Island roseate colony is located approximately thirty (30) miles east of the study area. Given this distance, it is unlikely that any nesting roseate terns would be disrupted by project activities. It is anticipated that any observations of roseates within the study area would be due to brief stopovers by migrants heading to their breeding or wintering grounds.

E.3.2 Red Knot

The red knot is a long-distance migrator, with some individuals completing a south-to-north journey of over nine-thousand (9,000) miles each spring and an equally extensive return trip each autumn. The species breeds in the tundra of the central Canadian Artic and overwinters primarily in the Caribbean and along the coasts of South America and the southeastern US. Small groups of red knots overwinter further north along the Atlantic, into New England and southern Canada. (USFWS "Rufa Red Knot," 2013)

According to the publication "Common Shorebirds of Connecticut" (2018), CT DEEP classifies the red knot as an uncommon migrant. Only a limited number of red knots visit the Connecticut coastline on an annual basis, typically between the months of April and September. These individuals utilize beaches and intertidal mudflats as stopover sites during their lengthy migration. They seek out spaces with abundant, easily accessible sources of nutrition – concentrations of aquatic snails, bivalves, horseshoe crab eggs, etc. – to refuel before resuming their flight. Given the ecological degradation that characterizes Bridgeport's waterfront habitats, it is unlikely that transient red knots congregate in or immediately proximate to the study area.

E.3.3 Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) has an extensive range; it is found in major waterbodies across the world, including the North and South Atlantic Ocean, the Mediterranean Sea, coastal portions of the Indian Ocean, and nearshore waters off the eastern coasts of Asia, Australia, and South America. Loggerheads nest along beaches from North Carolina to Florida, with some additional nesting along beach and bay communities of the Caribbean. (CT DEEP "Loggerhead Sea Turtle Fact Sheet," 1999).

NMFS correspondence (2018) indicates that the federally threatened Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead may occur in Long Island Sound. Juvenile turtles have been documented in eastern Long Island Sound and its associated bays, where they feed on crustaceans, mollusks, and other macroinvertebrates. Adult loggerheads are rarely observed in Connecticut waters, and those reported in nearby areas (e.g., the north shore of Long Island) are often cold-stunned. All life stages of the loggerhead are sensitive to anthropogenic disturbances, including industrial development, oil releases, beachfront construction, beach traffic, commercial fishing, boating, litter accumulation, and light pollution (CT DEEP "Loggerhead Turtle Fact Sheet," 1999). Overall, loggerhead sea turtles are considered to have the potential to occur in the study area on rare occasions. However, given the above vulnerabilities, long-term occupation for breeding, wintering, growth, or development is highly unlikely.

E.3.4 Green Sea Turtle

The green sea turtle (*Chelonia mydas*) has been observed along the coasts of North America from Massachusetts to Mexico and from British Columbia to California. Major nesting grounds are located in Mexico, Costa Rica, Guyana, Suriname, and Ares Island in the West Indies. Only small nesting populations occur in the United States, most commonly on the eastern coast of Florida. (CT DEEP "Atlantic Green Sea Turtle Fact Sheet," 1999)

NMFS correspondence (2018) indicates that the federally threatened North Atlantic DPS of green sea turtle may occur in the vicinity of the study area. Green sea turtles prefer shallow water habitats in reefs, bays, and inlets and may be found in nearshore portions of Long Island Sound. However, they generally favor subtropical and tropical waters where their primary food source, turtle grass (*Thalassia testudinum*), grows in abundance. According to CT DEEP, a green sea turtle has never been reported along the Connecticut shoreline, although they may occasionally migrate through nearby waters during the warmer months (CT DEEP "Atlantic Green Sea Turtle Fact Sheet," 1999). Given the rarity of green sea turtle observations in Connecticut, it is unlikely that this species would be significantly impacted by project activities.

E.3.5 Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coriacea*) is a highly migratory species; it can be found in the tropical Atlantic, Pacific, and other areas of the world. In the United States, nesting leatherbacks have been documented along the Atlantic coast from Florida to North Carolina. Leatherbacks also move into the cooler waters of New England's sounds and bays as they follow jellyfish migratory patterns. (CT DEEP "Leatherback Sea Turtle Fact Sheet," 1999)

NMFS correspondence (2018) indicates that the leatherback sea turtle, federally classified as endangered, may occur near the study area. During the summer months, turtles have been observed in Long Island Sound's offshore waters where they frequently bask or rest at the surface. CT DEEP reports that leatherbacks can be spotted off the coasts of both Stonington and Block Island throughout the summer (CT DEEP "Leatherback Sea Turtle Fact Sheet," 1999). Like other sea turtle species, the leatherback is sensitive to various recreational, commercial, and industrial activities: boating, beachfront development, etc. Overall, it is anticipated that leatherbacks may occur in the vicinity of the study area during the warmer months, namely May through October. However, given the nature and limited scope of in-water activities associated with the proposed project, little-to-no adverse impacts to the species are anticipated.

E.3.6 Kemp's Ridley Sea Turtle

The Kemp's Ridley sea turtle (*Lepidochelys kempii*) has been observed from Newfoundland south to Bermuda and west through the Gulf of Mexico. These turtles nest between the months of April and June on the beaches of Tamaulipas, Mexico and Padres Island, Texas. (CT DEEP "Kemp's (Atlantic) Ridley Sea Turtle Fact Sheet," 1999)

NMFS correspondence (2018) indicates that the Kemp's Ridley sea turtle, federally listed as endangered, may occur in waterbodies near the study area. Although adults of the species tend to remain in tropical waters, juveniles have been reported along much of the Atlantic coast of the United States. According to CT DEEP, juvenile turtles inhabit shallow coastal and estuarine habitats across Connecticut during the summer months, typically beginning in July (CT DEEP "Kemp's (Atlantic) Ridley Sea Turtle Fact Sheet," 1999). Consequently, the Kemp's Ridley may be seasonally present offshore of the study area and has the potential to be affected by the proposed project. However, given the nature and limited scope of possible in-water activities, little-to-no adverse impacts are anticipated.

E.3.7 Atlantic Sturgeon

The range of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) spans the east coast of North America from New Brunswick, Canada to the St. Johns River in Florida. The species is anadromous; in the spring, adult fish migrate from saltwater bodies to large freshwater river systems to spawn. The Hudson River in New York holds the only remaining spawning population in New England. (CT DEEP "Atlantic Sturgeon Fact Sheet," 1999)

E.3.8 Shortnose Sturgeon

The shortnose sturgeon (*Acipenser brevirostrum*) is found along the east coast of North America from New Brunswick, Canada to the Indian River in Florida. This species has very specific spawning requirements; all spawning occurs in freshwater systems within a period of one-to-two weeks, from the end of April to the first week of May. (CT DEEP "Shortnose Sturgeon Fact Sheet," 1999)

Consultation with NMFS (2018) indicates that the shortnose sturgeon, federally classified as endangered, may occur in Long Island Sound and its adjacent bays and tributaries. Adults of the species have been observed in the lower Connecticut River from the Holyoke Dam to the waters of Long Island Sound (CT DEEP "Shortnose Sturgeon Fact Sheet," 1999). Early life stages – eggs, larvae, and juveniles – cannot tolerate saline conditions and, thus, are not anticipated to be present in the vicinity of the study area. Given the nature and limited scope of in-water activities associated with the proposed project, adverse impacts to adult shortnose sturgeon near the study area are highly unlikely.

E.4 SURFACE WATERS

Water quality standards for Class SA and SB waterbodies are provided in Table E-2.

As required by permit, Bridgeport has conducted monitoring of targeted pollutants of stormwater discharges once a year since 2004 (CTDEEP 2015). Based on the available water quality sampling results, the following information has been observed from outfalls around Bridgeport (CTDEEP 2015) (CTWPCA 2017):

- Wide range of *E. coli* observed, results ranged from 0 (the Minimal Detection Limit [MDL]) during the annual data presented by CT DEEP (2015). The WPCA results indicated several outfalls had over 200,000 CFU/100ml for the sampling undertaken on September 19, 2017 (2017). CTDEEP results indicated concentrations of *Escherichia coli* (*E. coli*), as high as 800,000 CFU/100ml in 2010 and 2011 (2015). The mean *E. coli* concentrations from 2004 to 2011 ranged from 53.5 CFU/100ml to 667,280 CFU/100ml.
- High variation in Total Suspended Sediments (TSS) concentration seen in sampling results (2015). Values of TSS observed ranged from below the MDL of 5mg/l to 400mg/l with a mean range of 11.67mg/l to 109.67mg/l.
- WPCA sampling from September 19, 2017 ranged from 8.10mg/l to 12.3mg/l for oil and grease at MS4 outfalls in Bridgeport (2017).
- Total Nitrogen (TN) has high variability; CT DEEP results ranged from a low of 0.63mg/l in 2007 to 38.35mg/l 2008 (2015). Yearly mean TN obtained from the six MS4 outfalls ranged from 1.06mg/l to 8.46mg/l from 2004 to 2011. The 2017 results average for TN was approximately 6.42mg/l (2017).
- Total Phosphorus (TP) ranged from no detection to 1.83mg/l from the CT DEEP study (2015). The mean ranged from 0.182mg/l to 0.782mg/l.

It is noted that water quality data is limited for the City of Bridgeport's MS4 outfalls and that the parameters have a wide range of results and are based from one annual sample at six separate MS4 outfalls; as such, results may not be indicative of actual wet and dry weather events at the MS4 outfalls.

Table E-2. Ambient Water Quality Standards for Classes SA and SB Waterbodies

PARAMETER	CLASS SA CRITERIA	CLASS SB/SC CRITERIA*
Aesthetics	Uniformly excellent	Good to excellent
Dissolved Oxygen	Acute: Not less than 3.0 mg/l	
	4.8> DO (mg/l) ≤ 4.5 [No. Of Days Allowed: 30] 4.5> DO (mg/l) ≤ 4.0 [No. Of Days Allowed: 14] 4.0> DO (mg/l) ≤ 3.5 [No. Of Days Allowed: 7] 3.5> DO (mg/l) ≤ 3.0 [No. Of Days Allowed:2]	
Sludge Deposits/Solid Refuse/Floating Solids/Oils and Grease/Scum	None other than of natural origin	None except for small amounts that may result from the discharge from a grease waste treatment facility providing appropriate treatment and none exceeding levels necessary to protect and maintain all designated uses
Color	None other than of natural origin	None resulting in obvious discoloration of the surface water outside of any designated zone of influence
Suspended and Settleable Solids	None other than of natural origin	None in concentrations or combinations which would impair the designated uses; none aesthetically objectionable; none which would significantly alter the physical or chemical composition of bottom sediments; none which would adversely impact organisms living in or on the bottom sediment
Silt or Sand Deposits	None other than of natural origin except as may result from normal agricultural, road maintenance, construction activity, dredging activity or the discharge of dredged or fill materials provided all reasonable controls or BMP are used in such activities and all designated uses are protected and maintained	
Turbidity	None other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity, dredging activity or discharge of dredged or fill materials provided all reasonable controls BMP are used to control turbidity and none exceeding levels necessary to protect and maintain all designated uses	None other than of natural origin except as may result from normal agricultural, road maintenance, or construction activity, or discharge from a waste treatment facility providing appropriate treatment, dredging activity or discharge of dredged or fill materials provided all reasonable controls and BMP are used to control turbidity and none exceeding levels necessary to protect and maintain all designated uses
Indicator Bacteria	See Table 4.42	See Table 4.42
Taste and Odor	As naturally occurs	As naturally occurs. None that would impair any uses specifically assigned to this Class
pH	6.8 – 8.5	
Temperature Increase	There shall be no changes from natural conditions that would impair any existing or designated uses assigned to this Class and, in no case exceed 83F, or in any case raise the temperature of the receiving water more than 4°F. During the period including July, August and September, the temperature of the receiving water shall not be raised more than 1.5°F unless it can be shown that spawning and growth of indigenous organism will not be significantly affected	
Nutrients	The loading of nutrients, principally phosphorus and nitrogen, to any surface waterbody shall not exceed that which supports maintenance or attainment of designated uses	
Biological Conditions	Sustainable, diverse biological communities of indigenous taxa shall be present. Moderate changes, from natural conditions, in the structure of the biological communities, and minimal changes in ecosystem function may be evident; however, water quality shall be sufficient to sustain a healthy, diverse biological community	

Table E-3. Relevant Indicator Bacteria Standards for Ambient Saltwater Water Quality

DESIGNATED USE	CLASS	INDICATOR	CRITERIA
Shellfishing – Direct Consumption	SA	Fecal coliform	Geometric Mean < 14/100ml 90% of Samples < 31/100ml
Shellfishing – Indirect Consumption	SB	Fecal coliform	Geometric Mean < 88/100ml 90% of Samples < 260/100ml
Recreation – Designated Swimming	SA, SB	*Enterococci*	Geometric Mean < 35/100ml Single Sample Max < 104/100ml
All Other Recreational Uses	SA, SB	*Enterococci*	Geometric Mean < 35/100ml Single Sample Max < 500/100ml

APPENDIX F
Wetlands Letter Report

July 16, 2018

WSP USA Inc.
Attn: Nicole Weymouth
500 Winding Brook Drive,
Glastonbury, CT 06033

Re: HUD NDRC Bridgeport Resilience Design Project
BL Project No. 17C6199

Dear Ms. Weymouth,

At your request, BL Companies inspected the four proposed outfall locations labeled A, B, C, and D, and a fifth which will be referred to as E, between June 5, 2018 and July 9, 2018, and determined the presence or absence of coastal resources, specifically tidal wetland vegetation, at each location. All observations were completed at low tide. Any tidal wetland vegetation observed was horizontally located utilizing a handheld Trimble GeoExplorer 6000 Series. The coastal jurisdiction line (CJL) for Bridgeport is at 5.0' elevation. The Connecticut Department of Energy and Environmental Protection (CT DEEP) regulates everything below this elevation as well as tidal vegetation up to 1.0' above the CJL; therefore, tidal vegetation observed above elevation 6.0' is not considered to be within CT DEEP's jurisdiction[1].

Proposed Outfalls A and B, which are located along the strip of public beach associated with Seaside Park, were investigated on June 5, 2018 and again on July 9, 2018. An existing reinforced concrete pipe (RCP) outfall that was partially buried by sand and shells was observed in the vicinity of the proposed Outfall A. The existing RCP outfall discharges to the sandy beach were a small channel has formed, conveying the flows from the beach to an intertidal flat that becomes inundated during high tide. No tidal vegetation was observed in the immediate vicinity of the pipe, and no submerged aquatic vegetation was observed in the water near the discharge location. A small patch of poison ivy (*Toxicodendron radicans*), which is considered tidal vegetation, was observed in the large boulder revetment approximately 45 feet north of the existing pipe (see Figure 1). Additionally, tidal vegetation, namely smooth cordgrass (*Spartina alterniflora*), was noted in portions of the public beach approximately 350 feet south of Outfall A. Photos 1-3 depict these features.

No existing outfall structure was observed in the vicinity of the proposed Outfall B. Vegetation including beach grass (*Ammophila breviligulata*), American sea-rocket (*Cakile edentula*), rough cocklebur (*Xanthium stumarium*), orache (*Atriplex sp.*), Japanese knotweed (*Fallopia japonica*), hedge false bindweed (*Calystegia sepium*), American elm (*Ulmus americana*), northern catalpa (*Catalpa speciosa*), and tree-of-heaven (*Ailanthus altissima*) was observed in the vicinity of the proposed Outfall B. While

[1] Unless there are also freshwater inland wetlands present

vegetation is present, none of the observed species are included on the Connecticut tidal vegetation list. No submerged aquatic vegetation was observed in the vicinity of the proposed outfall; however, intertidal flats were observed south of the sandy beach area. Figure 2 depicts the approximately proposed location of the outfall, and Photo 4 shows the general location including the existing vegetation and intertidal flats.

Proposed Outfalls C and D, which are located on or immediately adjacent to PSE&G property, were investigated on June 22, 2018. BL Companies was accompanied by PSE&G employee Karl Wintermeyer during the field investigation. Outfalls C and D are proposed at existing outfalls. Proposed Outfall C is adjacent to an existing RCP, which is located in a small alcove surrounded by riprap slopes. No tidal vegetation was noted along the slopes. The pipe is still partially submerged during low tide, and the water was especially turbid during the site visit due to discharge from an adjacent pipe, therefore the substrate could not be seen and assessed for submerged aquatic vegetation. However, given the velocity of the discharges and the interspersed turbidity, it appears unlikely that this area would support submerged aquatic vegetation. Figure 3 depicts the existing and proposed outfall, and Photo 5 shows the existing outfall during low tide.

Proposed Outfall D is located near a small sandy beach, but does not appear to be accessible to the public. The existing outfall consists of two RCPs within a concrete endwall which discharge directly to the water and are surrounded by riprap and concrete stabilization. Both pipes appeared to have once had gates attached to the ends to prevent backflow, however both were observed to have fallen off into the water. No tidal vegetation or submerged aquatic vegetation were observed in the vicinity of Proposed Outfall D. Figure 4 depicts the existing and proposed outfall, and Photo 6 shows the existing outfall during low tide.

A fifth proposed outfall (referred to as Outfall E in mapping) located between 1498 and 1048 South Ave, Bridgeport along Cedar Creek Harbor was also assessed for coastal resources on July 9, 2018. The property is owned by the City of Bridgeport and is surrounded by a locked chain link fence; a site visit was coordinated with Max Perez of the City of Bridgeport. The property consists of disturbed land that has previously been cleared; compacted gravel forms the main substrate and small herbaceous plants are present throughout the property. A timber retaining wall paralleling Cedar Creek Reach forms the northern boundary of the property. A portion of the timber retaining wall along the northernmost section of the property has failed, allowing for erosion of the bank. In this collapsed area, tidal vegetation including smooth cordgrass (*Spartina alterniflora*), hightide bush (*Iva frutescens*), and groundsel bush (*Baccharis halmifolia*) are present (see Figure 5). The channel appeared opaque brown, therefore it could not be visually assessed for submerged aquatic vegetation at the time of the investigation. Photos 7 and 8 show the timber retaining wall and tidal vegetation in the vicinity of the proposed outfall.

It should be noted that in addition to the small patches of tidal vegetation observed in the immediate vicinity of proposed Outfalls A and E, as well as the tidal vegetation found south of Outfall A, other coastal resources are mapped on Coastal Area Management (CAM) mapping, which is included as an attachment, and were observed in the vicinity

of the proposed outfalls. These coastal resources, which may be regulated by CT DEEP, include developed shorefront, coastal hazard area, estuarine embayment, intertidal flats, modified escarpment, beaches, and areas of water-dependent recreation. Publicly accessible sandy beach is present at Outfalls A and B. Sandy beach is also present at Outfall D, but does not appear to be accessible by the public. No natural rocky shorefront is present near any of the outfalls, but the riprap slopes west of Outfall C are utilized by locals for fishing. Additionally, while seaweed was noted at all the sites, no submerged aquatic vegetation was observed in any of the areas that could be visually assessed.

Mapping and pertinent photos of the proposed outfall locations are included as attachments. The attached mapping shows the limits of tidal vegetation, but does not include topographic survey. Therefore, survey information should be referenced to determine the location of the CJL as well as the 1.0' above the CJL in order to determine the true limits of CT DEEP's jurisdiction.

Sincerely,
BL Companies



Rachael Hyland, WPIT, Certified Associate Ecologist
Project Scientist I



Legend

- Tidal Vegetation Limits
- CAM Zone

N

0 20 40 80 Feet

BL Project 17C6199
Bridgeport Resiliency
Proposed Outfalls

Architecture Engineering Environmental Land Surveying
Companies

Figure 1: Proposed Outfall A



Legend

- Tidal Vegetation Limits
- CAM Zone

N

0 20 40 80 Feet

BL Project 17C6199
Bridgeport Resiliency
Proposed Outfalls

Architecture
Engineering
Environmental
Land Surveying
Companies

Figure 2: Proposed Outfall B



Legend

Tidal Vegetation Limits

CAM Zone

N

0 20 40 80 Feet

BL Project 17C6199
Bridgeport Resiliency
Proposed Outfalls

Architecture
Engineering
Environmental
Land Surveying
BL Companies

Figure 3: Proposed Outfall C



Legend

- Tidal Vegetation Limits
- CAM Zone

N

0 20 40 80 Feet

BL Project 17C6199
Bridgeport Resiliency
Proposed Outfalls

BL Companies
Architecture
Engineering
Environmental
Land Surveying

Figure 4: Proposed Outfall D



Legend

- Tidal Vegetation Limits
- CAM Zone

N

0 15 30 60 Feet

BL Project 17C6199
Bridgeport Resiliency
Proposed Outfall

BL Companies
Architecture
Engineering
Environmental
Land Surveying

Figure 5: Proposed Outfall E



PHOTO 1: Existing Outfall A, partially buried, looking west towards Seaside Park.



PHOTO 2: View of small patch of tidal vegetation (*Toxicodendron radicans*) in the vicinity of Outfall A, growing between the boulder revetment and the sidewalk.



PHOTO 3: View of existing tidal vegetation *(Spartina alterniflora*) approximately 350 feet south of Outfall A, looking north towards Outfall A.



PHOTO 4: View of approximate location of proposed Outfall B. Vegetation is present, but not considered tidal.

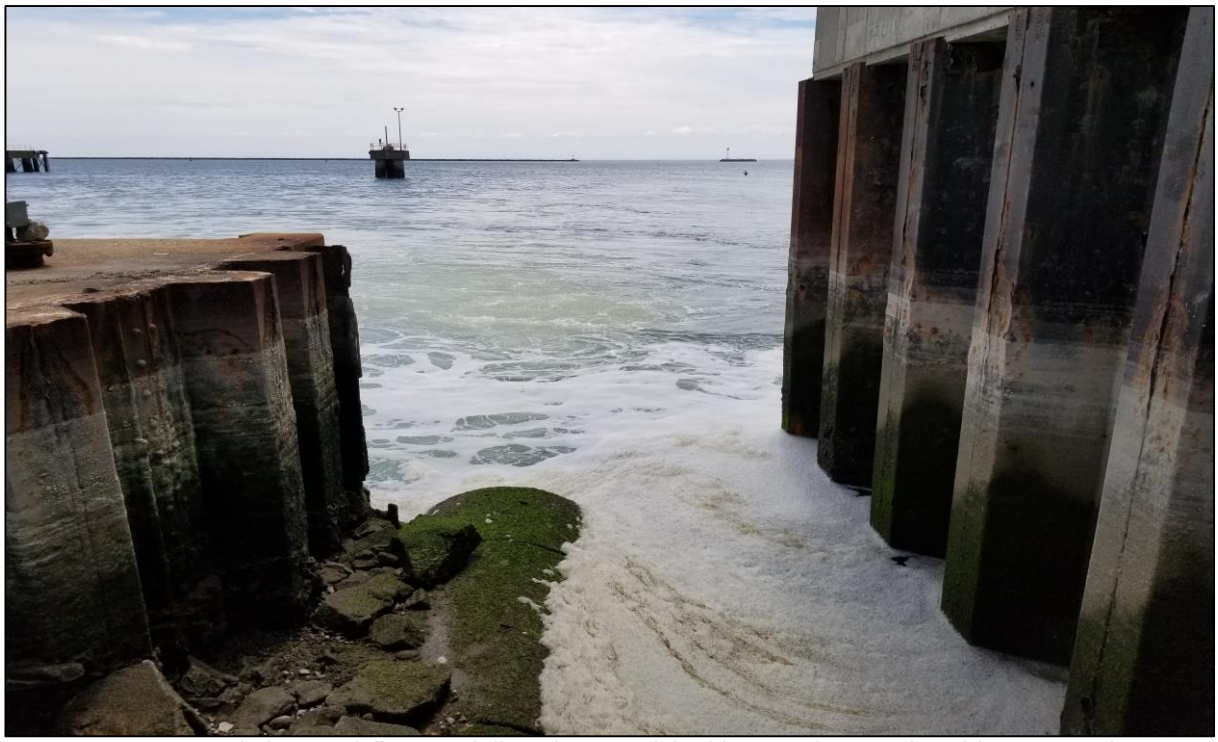


PHOTO 5: Existing Outfall C, partially submerged, looking south towards Bridgeport Harbor.



PHOTO 6: Existing Outfall D, looking east towards Bridgeport Harbor.



PHOTO 7: View of timber retaining wall along the approximate location of proposed Outfall E.

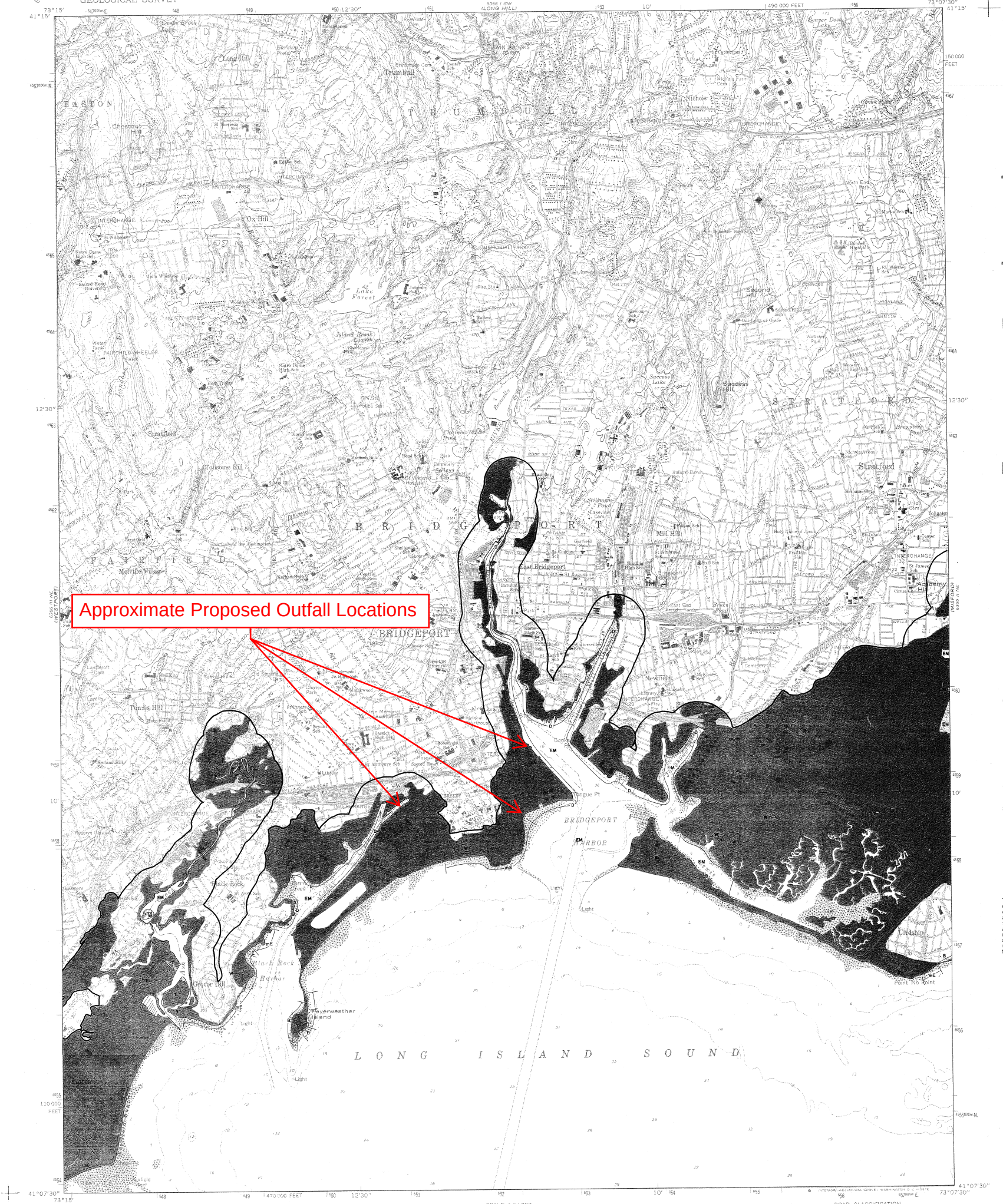


PHOTO 8: View of tidal vegetation (*S. alterniflora, Iva frutescens, Baccharis halmifolia*) along the collapsed portion of the timber retaining wall in the vicinity of proposed Outfall E.

GEOLOGICAL SURVEY

STATE OF CONNECTICUT

BRIDGEPORT QUADRANGLE
CONNECTICUT–FAIRFIELD CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



LEGEND

COASTAL LAND RESOURCES

E — COASTAL BLUFFS AND ESCARPMENTS: Steep, seaward sloping marine cliffs or escarpments composed of unconsolidated bouldery to stony or sandy to gravelly soils. The slopes are active and the shores retreating(eroding). The slopes may be mantled with a sparse shrub or herb cover of salt spray tolerant plants. (Sources: 1,2)

mE — modified BLUFFS AND ESCARPMENTS: Bluffs and escarpments which have been temporarily stabilized by erosion control structures (revetment, bulkhead or seawall) positioned seaward of the marine cliff or escarpment. (Source: 1)

B — BEACHES AND DUNES: Moderately sloping shores composed of water worked sand, gravel or cobble deposits(beach) and when present, wind deposited sands(dunes or sand flats). The beach (proper) is positioned between mean low water and coastal bluffs/escarpments or dunes or vegetation. The map designations include all areas of sandy beach fill. Dunes and sand flats positioned landward and elevated above the beach, support coastal grasslands dominated by beach grass (*Ammophila breviligulata*). (Sources: 1,2,3,4)

mB — modified BEACHES AND DUNES: Beach systems temporarily stabilized by an erosion control structure (revetment, seawall or bulkhead) positioned between the dune ridge and the beach. (Source: 1)

R — ROCKY SHOREFRONTS: Shorefront composed of bedrock or armored with a dense aggrega^e of boulder and stone. Includes rugged nearly vertical rock cliffs or gently seaward sloping rock and bouldery lands. (Source: 1)

COASTAL 'FLOOD' HAZARD AREA: 100 year coastal flood hazard area as identified by the Federal Emergency Management Agency (FEMA). On those coastal islands currently unmapped by FEMA, the flood hazard area is conservatively approximated by the 10' contour interval. (Sources: 2,5)

F — FRESHWATER WETLANDS AND UNDESIGNATED TIDAL WETLANDS: Areas defined in Section 22a-38 of the Connecticut General Statutes as "land, including submerged land, not regulated pursuant to sections 22a-28 to 22a-35('Tidal' Wetlands and Watercourses Act), inclusive, which consists of any of the soil types designated as poorly drained, very poorly drained, alluvial and floodplain...(Inland Wetlands and Watercourses Act)." Includes all freshwater wetland soils and any poorly to very poorly drained soils of the Pawcatuck and Westbrook series (tidal wetland soils) that are unmapped and unregulated by the state tidal wetland program. (Sources: 1,5)

I — ISLANDS: A land mass of bedrock or till encircled by coastal waters. (Note: All critical coastal resource components of the island such as bluffs and escarpments, beaches and dunes, rocky shorefront and wetlands should be managed accordingly whether or not these are displayed on this map) (Sources: 1,2)

SHORELANDS: Upland areas at elevations in excess of the 100 year still water flood level and located within the coastal boundary. (Sources: 2,5)

D — DEVELOPED SHOREFRONT: Port and harbor areas which have been highly engineered and developed resulting in the functional impairment or substantial alteration of their natural physiographic features or systems. (Sources: 1,3,4,7)

W — WATER: Open water bodies such as but not limited to lakes and ponds subject to regulation under Sections 22a-36 to 22a-45 of the Connecticut General Statutes. (Source: 2)

INTERTIDAL RESOURCES

T — REGULATED TIDAL WETLANDS: Official state designated and regulated tidal wetlands located within the coastal boundary. The areas depicted on this map shall in no way supersede the official state regulated tidal wetland maps at the scale of 1:2400. (Source: 6)

INTERTIDAL FLATS: Level to gently sloping areas subjected to alternating periods of tidal inundation and exposure. Sediment is variable ranging from mud to sand. (Source: 2)

COASTAL WATERS

EM — ESTUARINE EMBAYMENTS: Protected coastal water bodies with an open connection to the Sound including tidal rivers, bays, coves and lagoons. (Source: 2)

NW — NEARSHORE WATERS: Those waters and submerged lands between mean low water and a depth approximated by the 10 meter bathymetric contour. (Source: 2)

OW — OFFSHORE WATERS: Those waters and submerged lands seaward of a depth approximated by the 10 meter bathymetric contour. (Source: 2)

COASTAL BOUNDARY: As defined in Section 22a-94 of the Connecticut General Statutes as amended by Public Act 79-535. (Lands and waters seaward of the inside edge of this line are subject to the provisions of the Connecticut Coastal Management Act)

SOURCES:
1. False Color Infrared Aerial Photographs (1:12000), 1974
2. U.S.G.S. 7½ Minute Quadrangle
3. Surficial Geology Maps (U.S.G.S. or Connecticut Geological and Natural History Survey)
4. Soil Conservation Service, Coastal Soil Maps (1:24000), 1979
5. Flood Insurance Maps Prepared by the Federal Emergency Management Agency (hazard boundary maps, preliminary flood insurance rate maps or final flood insurance rate maps, whichever ones were most current at this printing)
6. State Regulated Tidal Wetland Maps (1:2400)
7. Coastal Area Management, Land Use Overlays (1:24000)

This map is intended as a guide to identify the approximate locations of coastal resources. Map designations conform to the resource definitions in Section 22a-93 of the Connecticut General Statutes as amended by Public Act 79-535. Boundary lines are as precise as this map and source information permit. This map shall not supersede any existing and more precise official tidal wetland map, state or municipal inland wetlands map or FEMA flood insurance map. Specific questions or comments relating to the map units or the application of this map, should be directed to the Connecticut Coastal Area Management Program.

SCALE 1:24000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 4.8 FEET

UTM GRID AND 1970 MAGNETIC NORTH
1214 MILS 222 MILS 1°12' 21 MILS

CONNECTICUT
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Primary highway, hard surface — Light-duty road, hard or improved surface
Secondary highway, hard surface — Unimproved road
Interstate Route — U. S. Route — State Route

BRIDGEPORT, CONN.
N4107.5—W7307.5/7.5
1970
AMS 6366 II NW—SERIES V816

Base Map U.S.G.S. 7½ minute quadrangle

109

coastal area management

COASTAL RESOURCES

1979. Prepared by Coastal Area Management Program,
Connecticut Department of Environmental Protection.

APPENDIX G
Traffic Reports

Preliminary Traffic Data Collection and Analysis RBD Pilot Project

DRAFT

1 TRAFFIC ASSESSMENT

1.1 INTRODUCTION

In response to the extensive damage to communities in Connecticut and throughout the Northeast, the Obama administration created the Superstorm Sandy Rebuilding Task Force, chaired by the U.S. Department of Housing and Urban Development (HUD). As an outgrowth of the task force, in June 2013 HUD launched the Rebuild by Design (RBD) Competition, a multi-stage planning and design competition to promote innovation by developing regionally-scalable but locally-contextual solutions that increase resilience in the region. In June 2014, HUD announced the award of $930 million to seven winning RBD ideas, one of which was *Resilient Bridgeport*. In September 2014, HUD announced an additional round of funding through the National Disaster Resilience (NDR) Competition, a targeted effort under its Community Development Block Grant (CDBG) Program to broaden federal support for resiliency efforts in Connecticut, New Jersey, New York State, and New York City. Connecticut received approximately $54 million to continue the implementation of *Resilient Bridgeport* and expand its success to the regional and state scales. The proposed projects are considered a "major federal action significantly affecting the quality of the human environment," therefore, must comply with the requirements of the National Environmental Policy Act (NEPA). CTDOH will prepare the EIS in accordance with the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508) and HUD's NEPA Regulations (24 CFR 58).

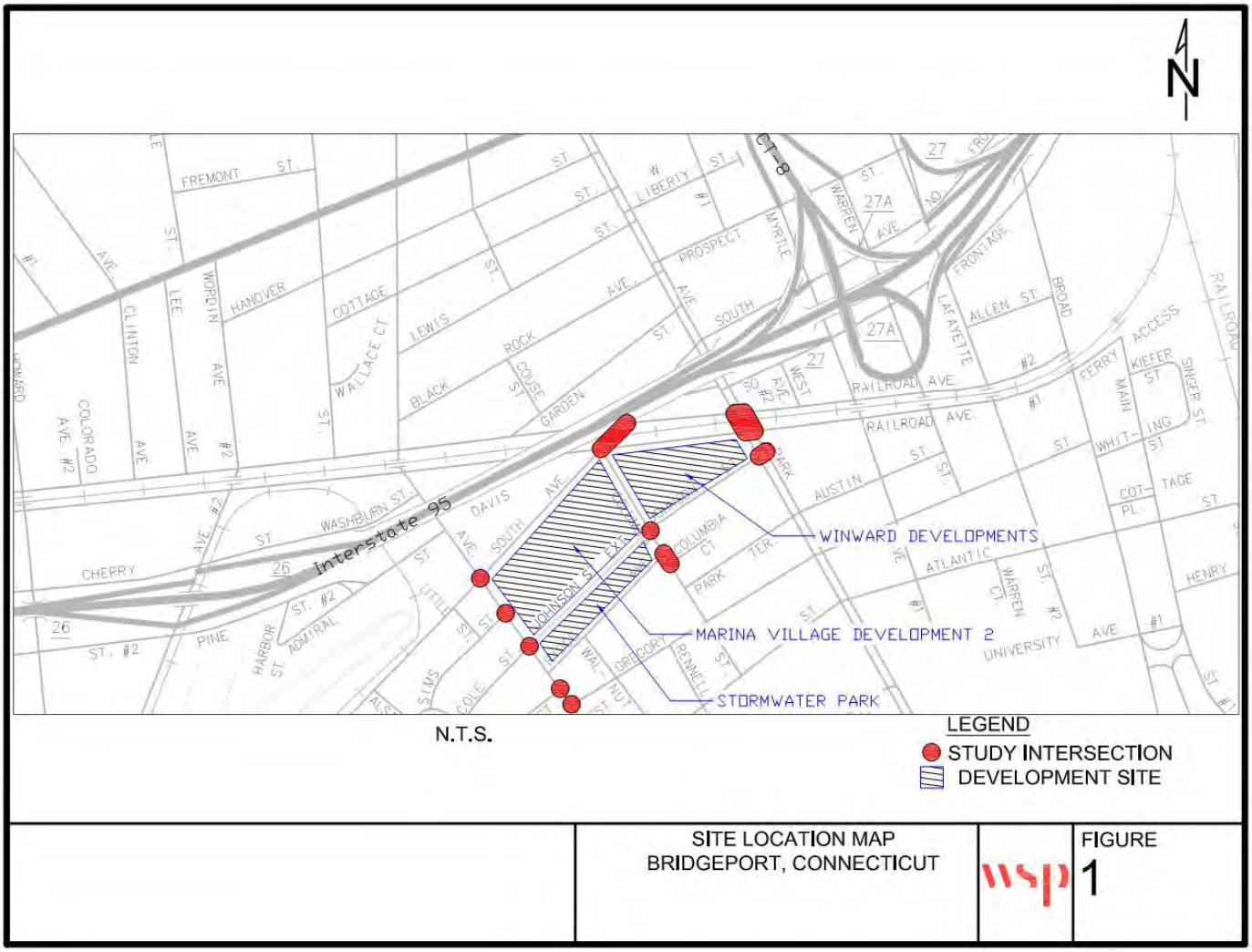
This traffic study evaluates the transportation impacts for the 2038 Build Year of the proposed Johnson Street reconfiguration, developments in the area bounded by Railroad Avenue to the north, Ridge Avenue and Johnson Street to the south, Iranistan Avenue to the west and Park Avenue to the east. Figure 1 depicts the study roadways and intersections including future development parcels for Marina Village and Windward Development.

1.2 PROJECT DESCRIPTION

The RBD project will convert Johnson Street from a one-way (northeast bound) to a two-way street from Park Avenue at the east terminus to Iranistan Avenue at the west. This involves extending Johnson Street across Columbia Street through a parcel to the north of Ridge Road. A 405-unit housing complex called Marina Village once occupied the study area. At the time of this report, a portion of Marina Village was vacant, and had been since 2012, with approximately 15 buildings already demolished. The proposed Johnson Street parcel (bounded by South Avenue, Railroad Avenue, Columbia Street, and the proposed Johnson Street Extension), is called the RBD Pilot Marina Village. At the time of preparing this report, the proposed development consisted of a 217-unit, 3-story, multibuilding, residential housing complex. A proposed storm water park will occupy the land south of the proposed Johnson Street Extension and north of Ridge Avenue, as shown on Figure 1. The proposed access to the Marina Village site is from Johnson Street Extension and Iranistan Avenue. A proposed mixed-use development will be located in the area bounded by Railroad Avenue to the north, Johnson Avenue to the south, Park Avenue to the east and Columbia Street to the west. On the adjacent parcel, east of Columbia Street, once part of Marina Village, is land now known as Windward Development.

This traffic assessment includes the collection and compilation of existing roadway and intersection geometry, the number and width of travel lanes, intersection controls, vehicle speed, pedestrian and bicycle facilities, transit, and other relevant transportation information. Additionally, local condition data were compiled for ten (10) intersections including: lane configuration, sight lines (turning and approach), turn restrictions, parking restrictions, bus stops, pedestrian controls, and signing by location and type (regulatory, warning, informational, school, other).

FIGURE 1 - STUDY AREA INTERSECTIONS AND ROADWAY NETWORK



Traffic impacts were evaluated in the study area for the following intersections:

1. Park Avenue at Railroad Avenue (East and West bound)- *signalized intersection*
2. Park Avenue at Johnson Road
3. Johnson Road at Columbia Street
4. South Avenue at Railroad Avenue / Columbia Street – *signalized intersection*
5. Iranistan Avenue at Sims Street
6. Iranistan Avenue at Coles Street
7. Iranistan Avenue at Burnham Street
8. Columbia Street at Ridge Avenue
9. Ridge Avenue at Iranistan Avenue
10. Iranistan Avenue at South Avenue – *signalized intersection*

Peak hour intersection turning movement counts, vehicle classifications, pedestrian and bicycle counts were collected at the above intersections for the analysis.

WSP compiled the crash data from the Connecticut Crash Data Repository for the ten (10) intersections based on the most recent three - year crash records and tabulated based on type, location, and severity.

1.3 STUDY METHODOLOGY

To determine the traffic impacts on the area roadway network by the proposed Johnson Street extension and developments associated with the future build condition, traffic operational performance measures at the study intersections were evaluated. WSP collected daily and peak hour traffic data to support the traffic operations analysis. When available, traffic data inventory from the City, Metropolitan Council of Governments (Metro COG), and Connecticut Department of Transportation (CTDOT) was also gathered. Crash data from the Connecticut Crash Data Repository website, maintained by the University of Connecticut (UCONN), was downloaded, compiled and analyzed for the most recent 3-year. The intersections in the study area were analyzed using the methodology described in the 2000 and 2010 Highway Capacity Manual (HCM), published by the Transportation Research Board and replicated in the Synchro® Version 9 software program. The following is a description of the Existing, Background and Build conditions:

1.4 2018 EXISTING CONDITION

The existing traffic conditions were established based on turning movement volume counts collected in January and February of 2018 together with the traffic and roadway data gathered at the study intersections. This information was inputted into the Synchro model to determine the existing traffic operations.

1.5 2038 BACKGROUND CONDITION

A background traffic growth rate of 0.5% per year for 20 years was used to develop the 2038 Background volumes. The growth rate was provided by CTDOT's Bureau of Policy and Planning on October 31, 2017. Added to the growth rate volumes were the potential trips generated by the proposed Windward Development. Based on the Fuss & O'Neill letter dated August 4, 2017, addressed to the City of Bridgeport Engineering Department, the Windward Apartments development will have a total of 128 residential units and 7,480 square feet of medical office space (a copy of Fuss &O'Neill letter addressed to the City is included in this report). Two full access driveways will be provided onto Railroad Avenue and Johnson Street will become two-way from Park Avenue to Columbia Street. Also, added to the Background volumes were the approximately 124 unoccupied and demolished units of the Marina Village

apartments. The sum of the growth rate, Windward Development and Marina Village apartment volumes determined the Background condition volumes. The background volumes were then distributed into the roadway network and inputted into the Synchro model to determine the background traffic operations.

1.6 2038 BUILD CONDITION

The 2038 build traffic conditions were developed by subtracting the prior existing 280 Marina Village apartment units and adding the RBD Pilot Marina Village proposed development. The RBD Pilot Marina Village proposed development consists of a 217-unit, 3-story, multibuilding, residential housing complex. This will slightly reduce the Build Site Generated traffic volumes from the Background condition. The roadway network will be modified with the extension of Johnson Street, as a two-way street, from Columbia Street to Iranistan Avenue. The build volumes were then distributed into the proposed roadway network and inputted into the Synchro model to determine the build traffic operations.

A review and comparison of the LOS and delays for the Existing, Background and Build conditions was then performed to identify improvements, if any, that were necessary to maintain acceptable traffic operations. Lastly, based on the information and analysis in this report, a conclusion was developed.

2 EXISTING ROADWAY CONDITIONS

The study area is a mix of residential housing (multi-family and single family), with a combination of commercial and retail property located on Park Avenue and Iranistan Avenue. The existing roadway network characteristics are shown in Table 1and intersection control inventory shown in Table 2.

2.1 ROADWAY GEOMETRY

Park Avenue is a two-lane, north-south, minor urban arterial with parallel, on-street parking on both sides of the road and a 6-foot median between travel ways. There are bicycle sharrows (shared-lane pavement marking depicting a bicycle) in both directions. The roadway width (curb-to-curb) is approximately 50 feet. Park Avenue runs from Route 15 (Merritt Parkway) in Fairfield, south to Waldemere Avenue by the parks and Long Island Sound. There is an existing signal at the intersection of Park Avenue and Railroad Avenue. The signal equipment is approximately 15 years old with mast arm mounted signal heads, pedestrian pushbuttons and hand/person pedestrian signal heads.

Railroad Avenue is an east-west road that has one lane in each direction on either side of the railroad tracks. Railroad Avenue runs in the eastbound direction south of the railroad tracks, and north of the tracks in the westbound direction. It is classified as major collector that runs from Fairfield Avenue to the west to Broad Street on the east. There is parallel, on-street parking on one side of the road in both directions for much of the roadway apart from the eastbound leg from Iranistan Avenue to Columbia Street (approximately 0.2 miles). In this section of Railroad Avenue there are bicycle sharrows and there is no on-street parking. The westbound leg from Park Avenue to Garden Street, approximately 0.25 miles, has a striped bike lane and no on-street parking. The roadway width is approximately 30 feet in each direction.

South Avenue is a two-lane minor arterial that runs east-west with parallel, on-street parking on both sides of the street except between Railroad Avenue and Park Avenue, where it runs under I-95. South Avenue has a roadway width of approximately 32 feet and sidewalks on both sides of the street. There is an existing signal at the intersection of South Avenue and Railroad Avenue that is approximately 20 years old. It has mast arm mounted signal heads, pedestrian pushbuttons and hand/person pedestrian signal heads.

Iranistan Avenue is a two-lane, north-south, major collector street that runs from U.S. Route 1 on the north end to Waldemere Avenue on the south end. The roadway width varies from approximately 40 - 48 feet with sidewalks on both sides of the street. There is parallel, on-street parking on both sides of the road. There are bar-type painted crosswalks across southbound and eastbound approaches. There is an existing signal at the intersection of Iranistan Avenue and South Avenue. The signal equipment is approximately 3 years' old and has mast arm mounted signal heads with backplates and countdown pedestrian heads. There is video detection installed for all approaches.

Johnson Street is one-way in the eastbound direction terminating at Park Avenue to the east and Columbia Street to the west. It is classified as a local road with parallel, on-street parking on the south side only. It has a roadway width of approximately 22 feet.

Columbia Street is one-way in the southbound direction from Railroad Avenue to Johnson Street with no on-street parking. From Johnson Street, it's two-way with parking on both sides of the street. It terminates at Atlantic Street in the south direction. It is classified as a local road and has a width of approximately 20 feet on the north end, and 32 feet south of Johnson Street.

Ridge Avenue is a two-way, east-west, local road that runs from Iranistan Avenue on the west end to Columbia Street on the east end. There is parallel parking allowed on both sides of the street. The roadway width is approximately 32 feet.

Sims Street, Coles Street and Burnham Street are all two-way, east-west, local roads that run off the west side of Iranistan Avenue. There is parallel parking only on the north side of these roads. The roadway widths are approximately 26 feet.

All roadways in the study area have speed limits of 25 miles per hour (mph). Many of the roadways do not have posted speed limits. In the City of Bridgeport, the speed limit is 25 mph if it is not posted. There are posted speed limit signs on Iranistan Avenue.

The sight lines all appear to be adequate with the roadways intersecting at, or near, 90 degrees and no vertical curvature. The exceptions are:

The signalized intersection of Railroad Avenue eastbound at South Avenue. The railroad bridge abutment blocks the driver's view to the north, looking left. The same condition is on the other side of the tracks, Railroad Avenue westbound at South Avenue looking left, to the south.

The signalized intersection of Railroad Avenue eastbound at Park Avenue. The railroad bridge abutment blocks the driver's view to the north, looking left. Again, the same condition is on the other side of the tracks, Railroad Avenue westbound at Park Avenue looking left, to the south.

TABLE 1 - ROADWAY INVENTORY

Thoroughfare	**Orientation**	**Lanes**	**On-Street Parking**	**Flow**	**Functional Classification**	**Approximate Width**	**Posted Limit**
Park Avenue	NB-SB	2	Yes	2-Way	Minor Arterial	50'	25 mph
Railroad Avenue	EB-WB	2	Yes	2-Way	Major Collector	30' + 30'	25 mph
South Avenue	EB-WB	2	Yes	2-Way	Minor Arterial	32'	25 mph
Iranistan Avenue	NB-SB	2	Yes	2-Way	Major Collector	40' to 48'	25 mph
Johnson Street	EB	1	South Side	1-Way	Local	22'	25 mph
Columbia Street	SB	1	No	1-Way	Local	20' to 32'	25 mph
Ridge Avenue	EB-WB	2	Yes	2-Way	Local	32'	25 mph
Sims Street	EB-WB	2	North Side	2-Way	Local	26'	25 mph
Cole Street	EB-WB	2	North Side	2-Way	Local	26'	25 mph
Burnham Street	EB-WB	2	North Side	2-Way	Local	26'	25 mph

Notes: NB: northbound, EB: eastbound, SB: southbound, and WB: westbound

TABLE 2- INTERSECTION INVENTORY

Intersection	Traffic Control	Crosswalk?
Park Avenue at Railroad Avenue (East and West bound)	Signal	Yes
Park Avenue at Johnson Road	TWSC	No
Johnson Road at Columbia Street	TWSC	No
South Avenue at Railroad Avenue / Columbia Street	Signal	Yes
Iranistan Avenue at Sims Street	TWSC	No
Iranistan Avenue at Cole Street	TWSC	No
Iranistan Avenue at Burnham Street	TWSC	No
Columbia Street at Ridge Avenue	TWSC	No
Ridge Avenue at Iranistan Avenue	TWSC	No
Iranistan Avenue at South Avenue	Signal	Yes

Notes: TWSC – Two Way Stop Control

2.2 EXISTING TRAFFIC VOLUMES

Turning movement volume/pedestrian and vehicle classification counts were collected at the study intersections. The counts were taken on Tuesday, January 9, 2018. on Tuesday, February 27, 2018 on the north side of Railroad Avenue at South Avenue and at Park Avenue. The commuter peak periods identified for weekdays are between 7:00 AM and 9:00 AM in the morning and 4:00 PM and 6:00 PM in the evening. The morning and evening peak hour traffic volumes are summarized and graphically depicted on Figure 2.

2.3 TRANSIT

Greater Bridgeport Transit (GBT) has Bus Route 1 that runs up Park Avenue and provides a stop at Railroad Avenue within the study area. GBT Route 9 runs up Iranistan Avenue with stops at Ridge Avenue, South Avenue and just north of Railroad Avenue within the study area.

2.4 BRIDGEPORT TO PORT JEFFERSON FERRY

The Long Island Ferry terminal is approximately 0.75 miles from Park Avenue at Railroad Avenue. The ferry, which operates from Bridgeport to Port Jefferson, NY, can be accessed from Railroad Avenue by heading east to Ferry Access Road. The ferry provides ten crossings per day, Monday through Thursday and Sundays, and eleven on Fridays and Saturdays.

2.5 PEDESTRIAN AND BICYCLE FACILITIES

The study area is located within the south end of Bridgeport. This is mainly a residential area with a mix of small retail shops. The pedestrian activity is accommodated by sidewalks and bar-type pedestrian crosswalks at the intersections. The signalized intersections provide pedestrian pushbuttons and faces. Iranistan Avenue at South Avenue has an exclusive pedestrian phase with countdown pedestrian signal heads. The intersection appears to be ADA compliant with sidewalk ramps and tactile warning strips. The signalized intersections of Park Avenue at Railroad Avenue and South Avenue at Railroad Avenue have concurrent pedestrian phasing. The pedestrian phases are pushbutton activated and turning traffic must yield to the pedestrians in the crosswalk. The pedestrian signal heads are hand/person type. There are no tactile warning strips at the sidewalk ramps at South Avenue and Railroad Avenue but there are tactile warning strips at Park Avenue. Also, there is no painted crosswalk across Railroad Avenue (south side) at South Avenue.

There are signed bicycle routes with sharrows in the study area. They run north-south on Park Avenue and east-west on Railroad Avenue.

2.6 CRASH ANALYSIS

A crash data analysis was performed for all the intersections within the study area. It was gathered from the University of Connecticut's (UCONN) Crash Data Repository (CTCDR). UCONN publishes the MMUCC or the 'Model Minimum Uniform Crash Criteria' Standard. WSP used the most current MMUCC recent 3-year data set from February 2015 to February 2018.

Table 3 lists the intersections within the project limits with at least 1 crash in during the 3-year study period. As evident, most of the crashes occur at the signalized intersections and are rear-end type crashes. The full crash data set is included in this report. A total of 38 crashes have been recorded at the study intersections over the three-year period. The crash analysis indicated that there are fewer than five crashes of a type within the past 12-month period susceptible to correction by a traffic control signal, or merit further investigation.

TABLE 3- THREE-YEAR CRASH DATA (FEB 2015-FEB 2018)

Intersection Name	**Total Number of Crashes**	**Crash Type**	**Maximum Crash Severity**
Park Avenue at Railroad Avenue	10	Front-to-Rear	Injury - Serious
Park Avenue at Johnson Street	4	Angle	Property Damage
Columbia Street at Johnson Street	1	Angle	Property Damage
South Avenue at Columbia Street and Railroad Avenue	9	Front-to Rear	Injury - Minor
Sims Street at Iranistan Avenue	1	Angle	Property Damage
Cole Street at Iranistan Avenue	1	Sideswipe (Same Direction)	Property Damage
South Avenue at Iranistan Avenue	12	Front-to-Rear	Injury - Serious
South Avenue at Burnham Street	*0*	*n/a*	*n/a*
Columbia Street at Ridge Avenue	*0*	*n/a*	*n/a*
Ridge Avenue at Iranistan Avenue	*0*	*n/a*	*n/a*

Notes: The following are the crash type definitions; Source: UCONN Connecticut Crash Data

Angle– A crash where two motor vehicles impact at an angle.

Front-to-Rear- A crash where the front end of one vehicle collides with the back of another vehicle, while the two vehicles are traveling in the same direction.

Sideswipe (Same Direction)- A crash where two vehicles traveling in the same direction impact one another where the initial engagement does not overlap the corner of either vehicle so that there is no significant involvement of the front or rear surface area.

3 FUTURE CONDITIONS

3.1 BACKGROUND TRAFFIC GROWTH

The CTDOT's Bureau of Policy and Planning was contacted on October, 2017 to determine the future growth. Their regional forecasting travel model shows very little growth in the study area and WSP was told to use between 0.2 – 0.5 percent growth per year. These rates do not include any future developments that may occur. To be conservative, this study considered using the high end, 0.5 percent annual growth rate over 20 years. This worked out to approximately ten (10) percent growth rate over the 20 years to arrive at the 2038 Future No-Build traffic volumes and are provided on Figure 3.

3.2 SITE-GENERATED TRAFFIC

Added to the growth rate volumes are the potential trips for approximately 124 units that are unoccupied on the Marina Village site, west of Columbia Street. Also, added to the growth rate volumes were the trips generated by the proposed Windward Development. This is a proposed 128 residential unit development with 7,485 square feet of Medical-Dental Office Building. The Institute of Transportation Engineer's Trip Generation Manual, 10th Edition, was used to determine the number of trips generated during the AM and PM Peak Hours by these uses. Land Use 221, Multifamily Housing (Mid-Rise) and Land Use 720, Medical-Dental Office Building, Peak Hour of Adjacent Street Traffic, was utilized to determine the volumes entering and exiting the proposed site. Table 4 shows the Windward Development Site-Generated Traffic. The traffic impact document by Fuss & O'Neill stated that two full access driveways will be provided onto Railroad Avenue. The Site Generated and distributed Traffic Background Conditions are shown on Figure 4 (Marina Village) and Figure 5 (Windward Development).

TABLE 4 - TRIP GENERATION – WINDWARD DEVELOPMENT (VEHICLES PER PEAK HOUR OF ADJACENT STREET TRAFFIC) – MORNING AND EVENING PEAK HOUR OF TRAFFIC

TRIP GENERATION CALCULATIONS **Morning Peak Hour of Traffic**					
LAND USE	AREA/UNIT	EQUATION	ENTER	EXIT	TOTAL
Residential Mid-Rise Apartments – Land Use Code 221	128 units	Ln(T) = 0.98 Ln(X) - 0.98	11	32	43
Medical – Dental Office Building – Land Use Code 720	7,480 sq.ft.	Ln(T) = 0.89 Ln(X) + 1.31	17	5	22
INCREASE IN TRAFFIC (Veh./hr.)		-	**28**	**37**	**65**
TRIP GENERATION CALCULATIONS **Evening Peak Hour of Traffic**					
LAND USE	AREA/UNIT	EQUATION	ENTER	EXIT	TOTAL
Residential Mid-Rise Apartments – Land Use Code 221	128 units	Ln(T) = 0.96 Ln(X) - 0.63	34	22	56
Medical – Dental Office Building – Land Use Code 720	7,480 sq.ft.	T = 3.39(X) + 2.02	8	20	28
INCREASE IN TRAFFIC (Veh./hr.)		-	**42**	**42**	**84**

3.3 BUILD CONDITION

The 2038 build traffic conditions were developed by subtracting the former existing 280 Marina Village apartment units and adding the RBD Pilot Marina Village proposed development. The proposed RBD Pilot Marina Village (Marina Village Phase 2) development consists of a 217-unit, 3-story, multibuilding, residential housing complex. As shown in Table 5, this would reduce the Build Site Generated traffic volumes from the Background condition. Because of this small net decrease from the Background to Build Condition, the Background volumes were also used for the Build Condition. They were distributed according to the proposed roadway network in the Build Condition with the extension of Johnson Street, as a two-way street, from Columbia Street to Iranistan Avenue. This will distribute volume to the proposed Johnson Street Extension which will serve as an access to Marina Village Phase 2. The build trips and distribution is shown on Figure 6. The volumes were inputted into the Synchro model to determine the 2038 Build traffic operations.

TABLE 5 – BUILD SITE GENERATED TRAFFIC

Existing/Approved Marina Village

	Mid-Rise Apt		Entering	Exiting	*Units*	*280*
Units	280	AM	24	69	*AM*	*93.88718*
		PM	73	46	*PM*	*119.0327*

Proposed Marina Village II

	Mid-Rise Apt		Entering	Exiting	*Units*	*217*
Units	217	AM	19	54	*AM*	*73.13444*
		PM	57	36	*PM*	*93.19569*

Total Volume		**Entering**	**Exiting**	**Total**
	AM	-5	-15	-20
	PM	-16	-10	-26

3.4 TRIP DISTRIBUTION

3.4.1 WINDWARD DEVELOPMENT

The following assumptions were made for distributing the Windward Development generated traffic volumes:

3.4.1.1 ENTERING THE SITE

50% of vehicles would come westbound on South Avenue (this includes I-95 SB, Route 8 SB and local traffic)

At the intersection of Park Avenue and South Avenue, 30% would continue west on South Avenue and 20% would turn left and go south on Park Avenue

50% would come from I-95 NB, exiting at Interchange 26, turning left on Wordin Avenue, right on Railroad Avenue and right into the main entrances to the development.

3.4.1.2 EXITING THE SITE

80% would go east on Railroad Avenue and north on Park Avenue

20% would go east on Johnson Street and north on Park Avenue

The Windward Development Site Generated Traffic is shown on Figure 5.

3.4.2 MARINA VILLAGE

The following assumptions were made for distributing Marina Village and Marina Village Phase 2 generated traffic volumes:

3.4.2.1 ENTERING THE SITE

50% of vehicles would come from the north and east, westbound on South Avenue (this includes I-95 SB, Route 8 SB and local traffic)

At intersection of South Avenue and Columbia Street, 25% would continue west on South Avenue to enter the site from the north and 25% would turn left and go south on Columbia Street.

In the Background Condition, vehicles would take a right onto Ridge Avenue to access Marina Village. In the Build Condition, vehicles would take right on Johnson Street Extension to access Marina Village Phase 2.

50% would come from south, on I-95 NB, exiting at Interchange 26, turning right on Wordin Avenue, an immediate left on Pine Street, left on Admiral Street and right on Iranistan Avenue.

At the intersection of Iranistan Avenue and South Avenue, 25% would turn left on South Avenue to enter Marina Village from the north, and 25% would continue straight on Iranistan Avenue. 15% of the vehicles would enter from Iranistan Avenue and 10% would continue and turn left on Ridge Avenue to enter the site from the south. In the Build Condition, the 10% would turn left on Johnson Street Extension.

3.4.2.2 EXITING THE SITE

25% would go east on South Avenue to South Frontage Road

25% would go east on Johnson Street, left on Park Avenue and right on South Frontage Road

25% would go west on South Avenue, right on Iranistan Avenue, left on Washburn Street to the Wordin Avenue I-95 SB On-Ramp

25% would go north on Iranistan Avenue and follow the same movements as above to the Wordin Avenue I-95 SB On-Ramp

The Marina Village Site Generated Traffic is shown on Figure 4. The Marina Village Phase 2 Site Generated Traffic is shown on Figure 6.

Figure 7 depicts 2023 background peak hour traffic volume, and figure 8 depicts 2023 build condition and Johnson Street proposed extension peak hour traffic volume.

4 TRAFFIC OPERATIONS

To ascertain this project's impacts on the area roadway network, an analysis of the key intersections in the study area was performed. The Existing, Background and Build AM and PM peak hour operating conditions were determined using the Synchro® Version 9 software program that closely replicates the 2000 and 2010 HCM.

LOS is a calculation of control delay for an intersection and an indication of driver discomfort, frustration, fuel consumption, and lost time. LOS is defined by a grading system similar to that in a school with A (free flow) being the best and F (breakdown in flow) the worst.

Signalized intersection analysis is based upon the capacity of each lane group and the correlating control delay associated with the intersection. Capacity is a measurement of the ability of an intersection design to accommodate all movements within the intersection. Delay is the measure of the user quality of service. Capacity is a function of physical geometry and signalization conditions.

For unsignalized intersections, delay values apply only to the controlled movements, since the main street movements are not restricted. Control delay is the elapsed time for deceleration, queue time, stopped delay, and final acceleration. For Two-Way Stop Controlled (TWSC) intersections, the LOS is characterized by the LOS of the movement with the greatest delay. This is typically the left turn movement from the minor approach to the intersection. If the intersection operates at LOS F a traffic signal warrant analysis may be done to justify installation of a signal. The minimum criteria as set forth in the U.S. Department of transportation, Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD) must be met before the installation of a traffic control signal. It should be noted that none of the unsignalized intersections in the study area have a LOS F or warrant a traffic control signal.

Table 6 and 7 summarize the results of the analysis conducted as part of this study. No changes were made to the signal timing nor phasing for the Background Condition. Timings were optimized at the signalized intersections for the Build Condition. All the stop controlled intersections operate at LOS B or better in the Existing, Background and Build scenarios. The intersection of South Avenue at Railroad Avenue operates at LOS D in the AM Peak Hour in the Existing, Background and Build Scenarios. It should be noted LOS D is considered acceptable in an urban environment. All the analysis from Synchro Reports are included in this report.

TABLE 6 - TRAFFIC OPERATIONAL ANALYSIS – SIGNALIZED INTERSECTIONS

Intersection		AM Peak Hour						PM Peak Hour					
		Existing Condition		Background Condition		20-Year Build Condition		Existing Condition		Background Condition		20-Year Build Condition	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
1	Park Av at Railroad Av	B	15.1	B	15.0	B	15.0	B	17.4	B	17.6	B	17.6
2	South Av at Railroad Av	D	37.2	D	52.3	D	52.3	C	25.7	C	32.1	C	32.1
3	South Av at Iranistan Av	B	11.0	B	12.3	B	12.3	B	10.9	B	11.3	B	11.3

Note: Delay values are in seconds per vehicle.

TABLE 7 - TRAFFIC OPERATIONAL ANALYSIS – UNSIGNALIZED INTERSECTIONS

Intersection		AM Peak Hour						PM Peak Hour					
		Existing Condition		Background Condition		20-Year Build Condition		Existing Condition		Background Condition		20-Year Build Condition	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
1	Park Ave. at Johnson St.	B	10.4	B	10.8	B	10.8	B	11.9	B	12.8	B	12.8
2	Columbia St at Ridge Ave	A	8.8	A	8.9	A	8.9	A	8.9	A	9	A	9
3	Iranistan Ave at Sims St	A	9.9	B	10.4	B	10.4	A	10	B	10.5	B	10.5
4	Iranistan Ave at Cole St	A	0.2	A	0.12			B	10.4	B	10.7		
5	Iranistan Ave at Ridge Ave	A	9.1	A	9.1	A	9.1	A	9.3	A	9.4	A	9.4
6	Iranistan Ave at Burnham	A	9.9	B	10.2	B	10.2	A	9.8	A	10	A	10
7	Johnson St at Columbia					A	9.6					A	9.7
8	Johnson St/Cole St at Iranistan Ave					A	9.1					B	11.2

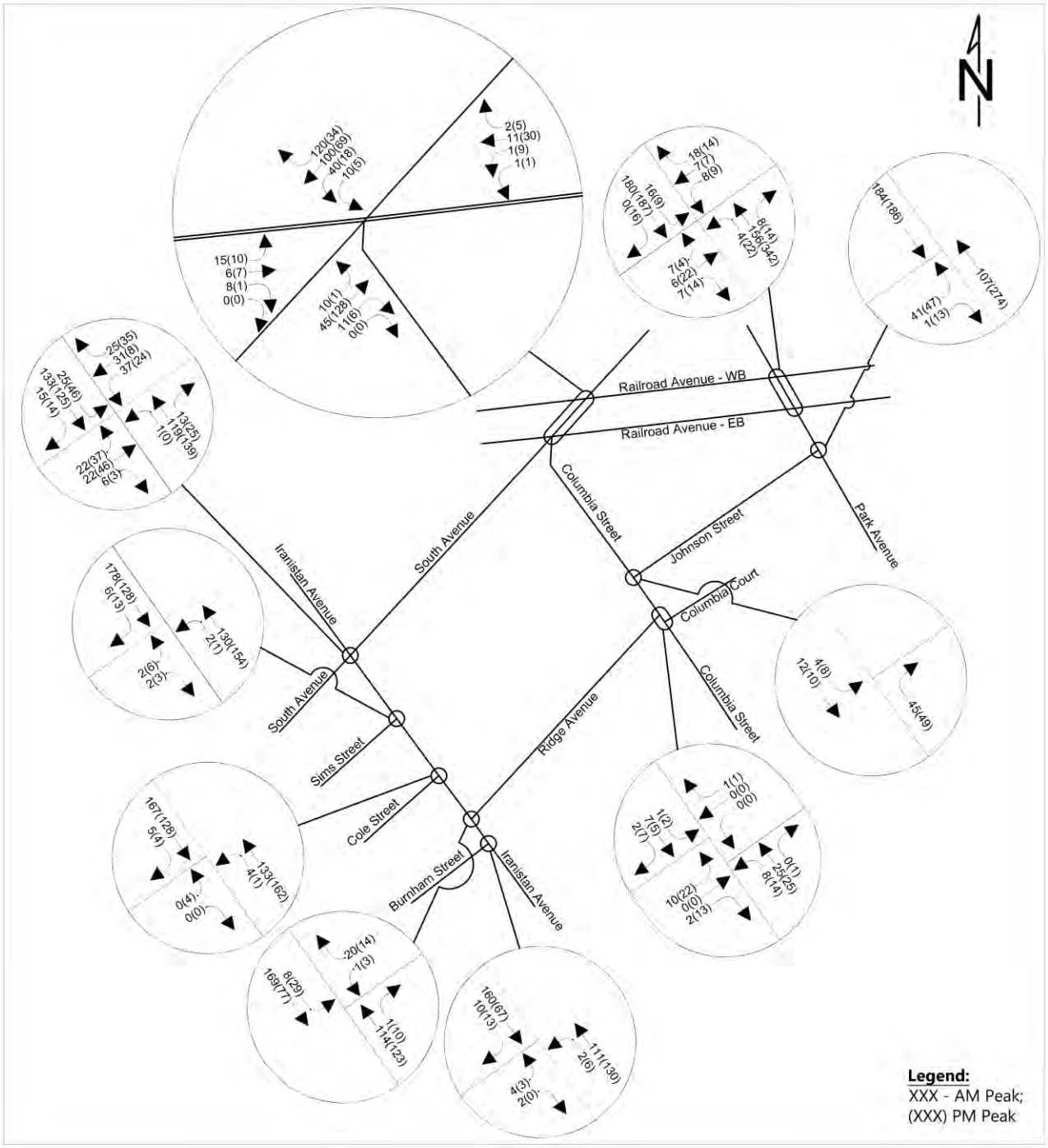
Note: Delay is based on side street movement. Delay values are in seconds per vehicle.

5 CONCLUSIONS

As shown in Table 6 and 7 above, for the 20-year Build Condition (2038 Build Year) the delays and LOS slightly improve over the 2038 Background Conditions. It is anticipated that the proposed Johnson Street extension (two-way; one lane each direction) will not have a negative impact on the surrounding roadway network. It will have capacity to accommodate approximately 1,000 peak hour vehicles. The vehicles that in the Background Condition used Ridge Avenue will use Johnson Street Extension in the Build Condition. Therefore, the proposed Johnson Street extension, and its conversion to a two-way roadway, will not have any negative impacts and will provide for the proposed future developments.

6 BIBLIOGRAPHY

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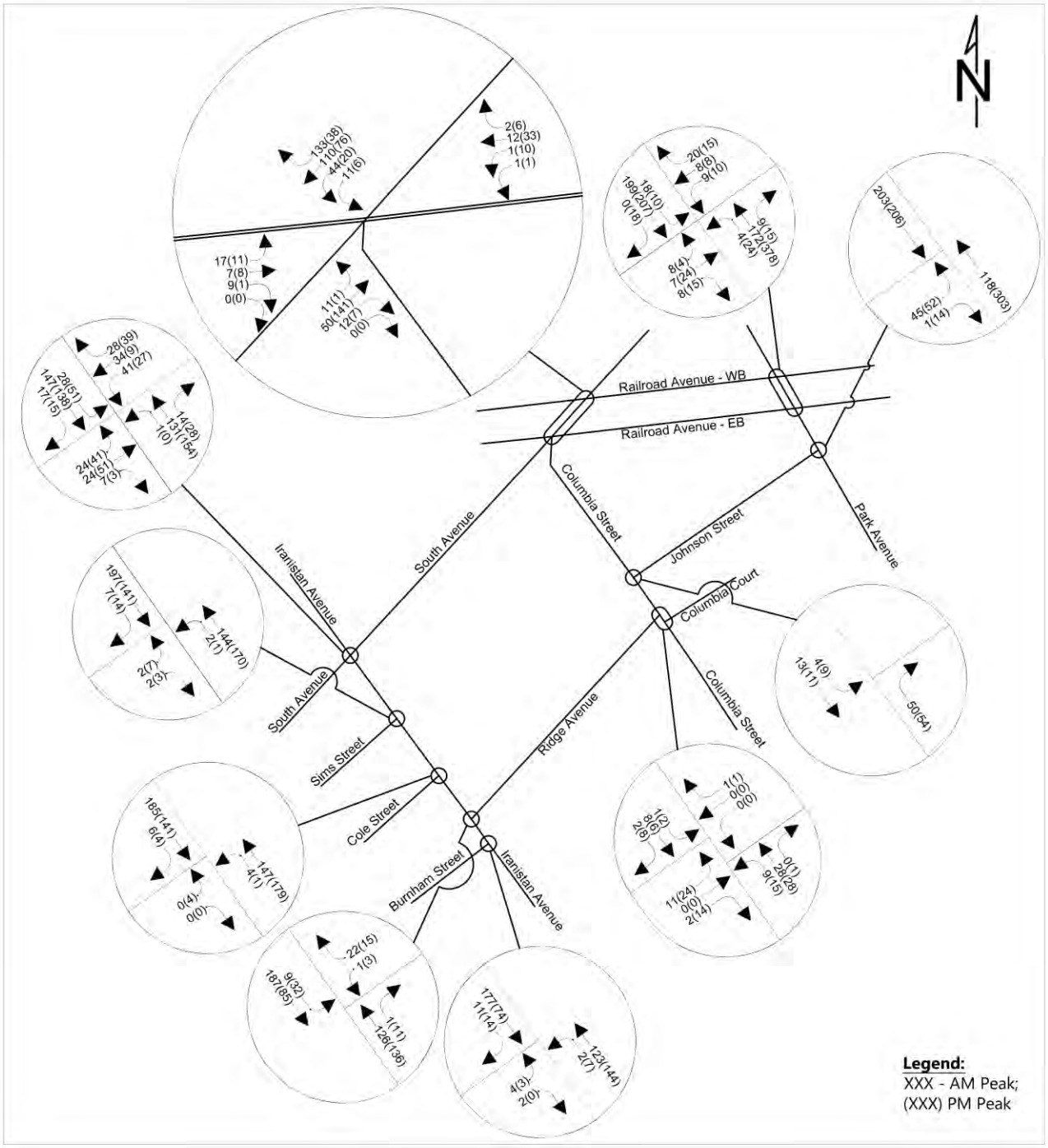
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Glastonbury, CT 06033

3/26/2018

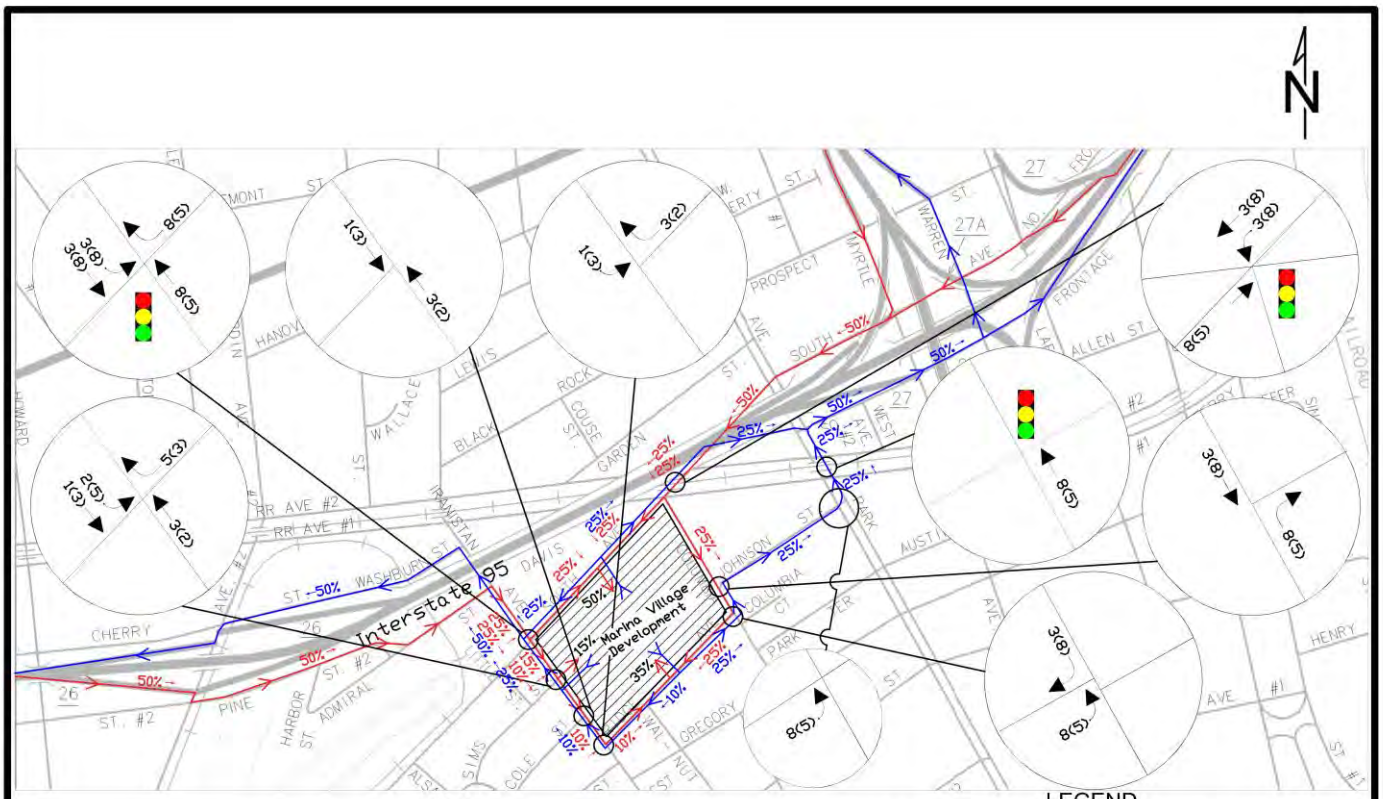
Not to Scale

RBD; Bridgeport, CT

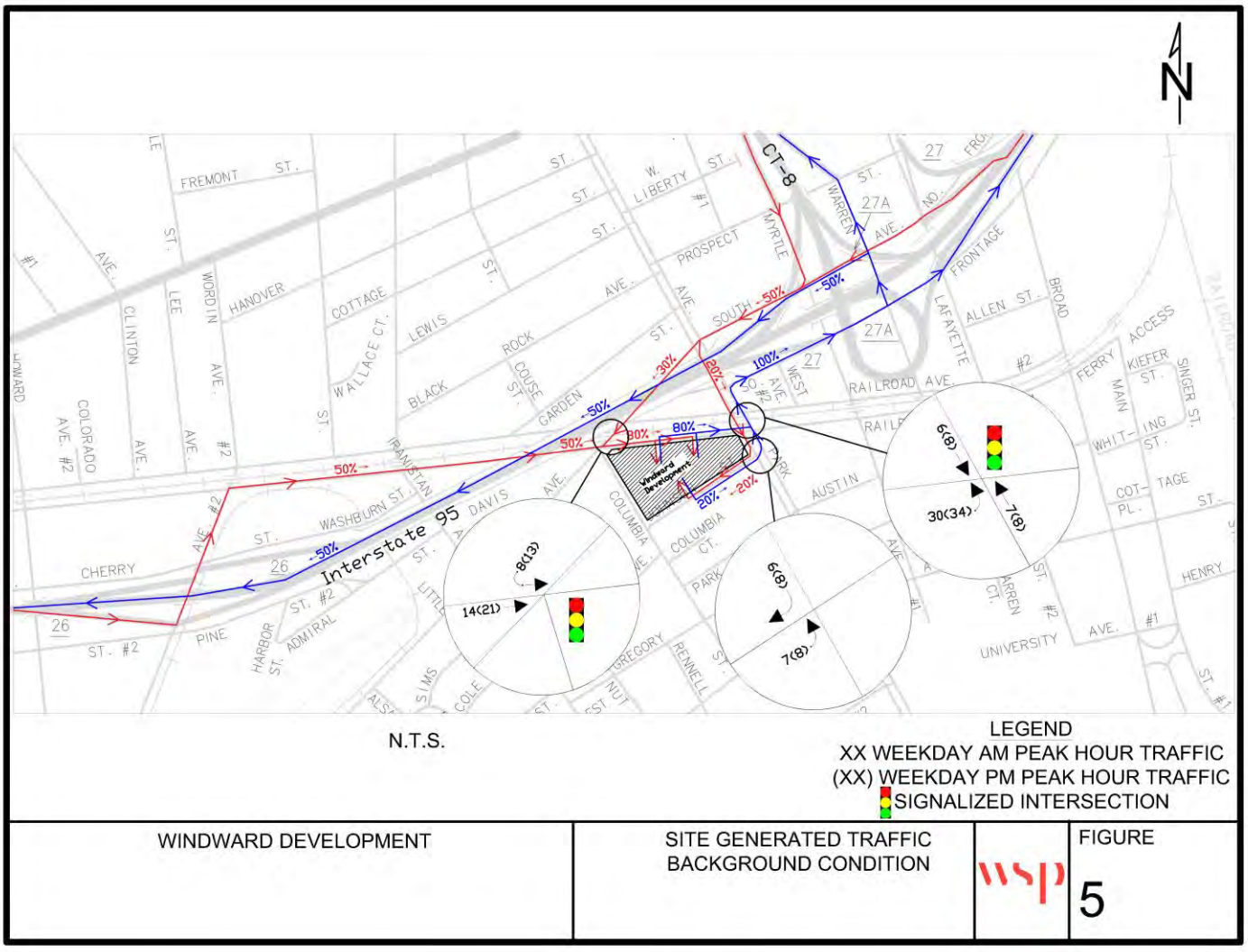
Figure 2
Existing Peak Hour Volumes



500 Winding Brook Dr. Glastonbury, CT 06033	3/26/2018 Not to Scale	**RBD; Bridgeport, CT** **Figure 3** **Future No-Build Peak Hour Volumes** **20 Year, 0.5% Growth/ Year**



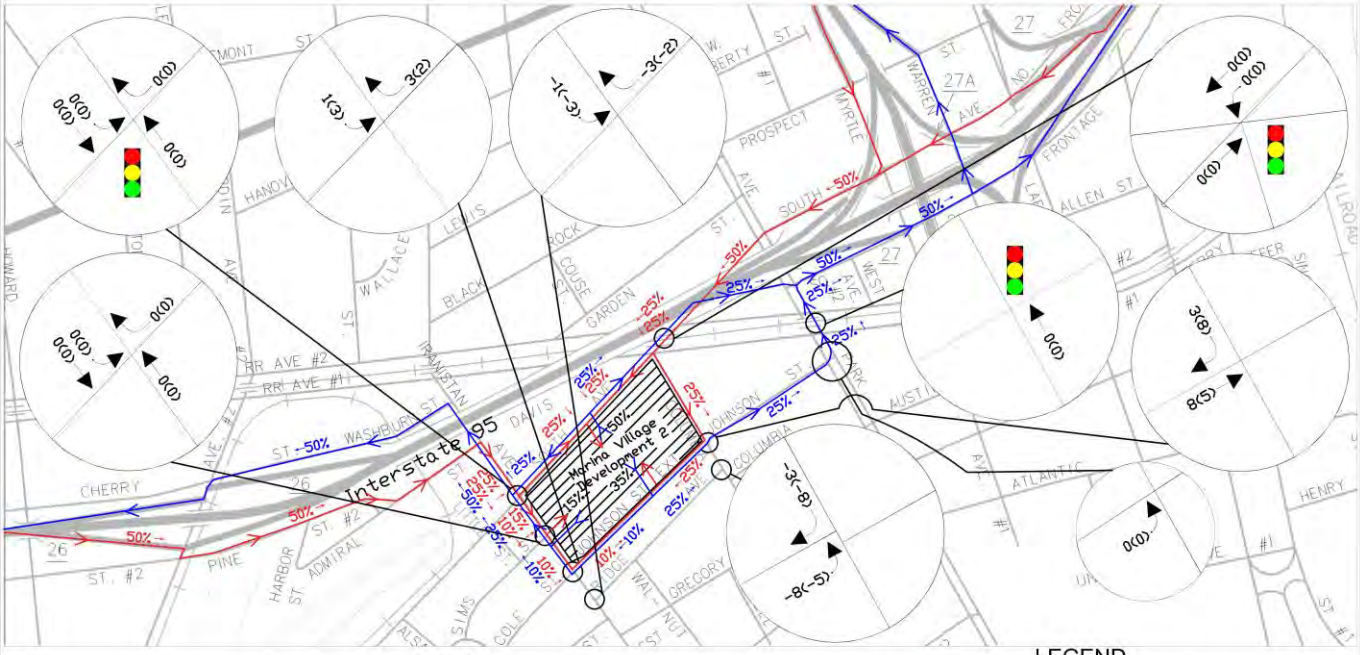
MARINA VILLAGE	SITE GENERATED TRAFFIC BACKGROUND CONDITION		FIGURE 4



N.T.S.

LEGEND
XX WEEKDAY AM PEAK HOUR TRAFFIC
(XX) WEEKDAY PM PEAK HOUR TRAFFIC
SIGNALIZED INTERSECTION

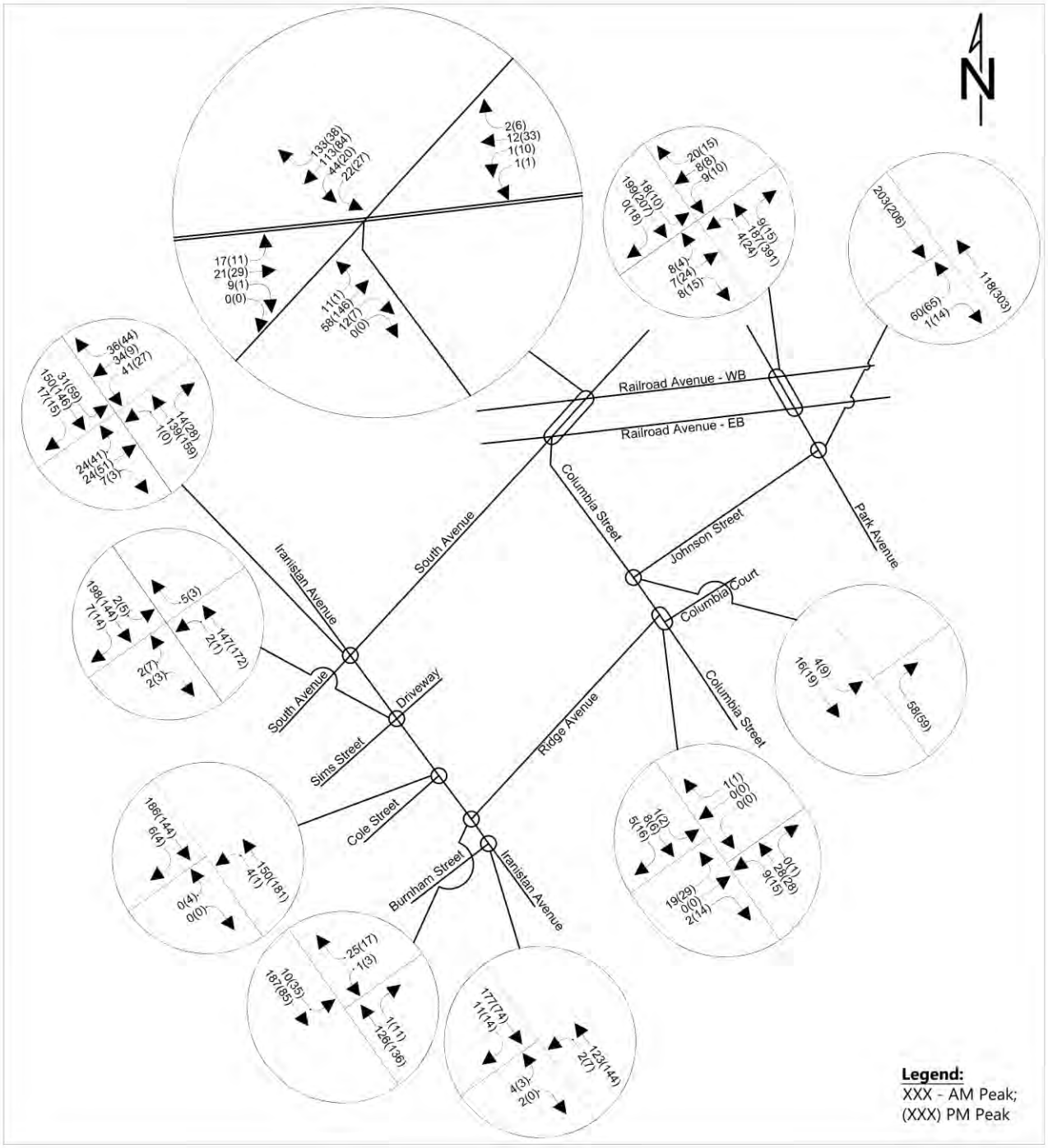
WINDWARD DEVELOPMENT	SITE GENERATED TRAFFIC BACKGROUND CONDITION		FIGURE 5



N.T.S.

LEGEND
XX WEEKDAY AM PEAK HOUR TRAFFIC
(XX) WEEKDAY PM PEAK HOUR TRAFFIC
SIGNALIZED INTERSECTION

MARINA VILLAGE PHASE 2	SITE GENERATED TRAFFIC BUILD CONDITION JOHNSON STREET EXTENSION	wsp	FIGURE 6



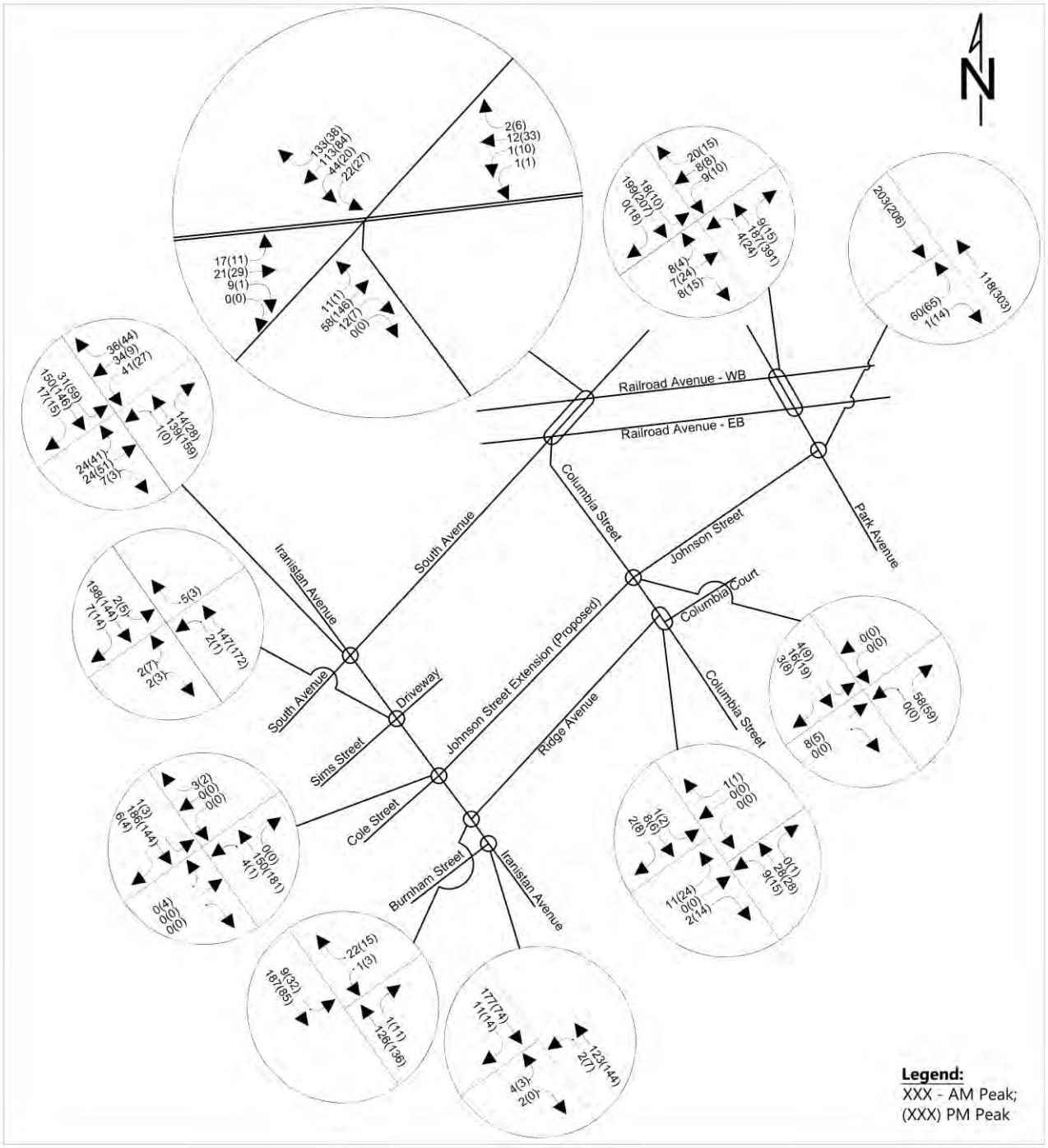
500 Winding Brook Dr.
Glastonbury, CT 06033

3/26/2018

Not to Scale

RBD; Bridgeport, CT

Figure 7
2038 Background Peak Hour Volumes



500 Winding Brook Dr.
Glastonbury, CT 06033

3/26/2018

Not to Scale

RBD; Bridgeport, CT

Figure 8
2038 Build Peak Hour Volumes

Preliminary Traffic Data Collection and Analysis NDR Project

DRAFT

STATE OF CONNECTICUT DEPARTMENT OF HOUSING

RESILIENT BRIDGEPORT NATIONAL DISASTER RESILIENCE

PRELIMINARY TRAFFIC DATA COLLECTION AND ANALYSIS

AUGUST 06, 2018

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RESILIENT BRIDGEPORT NATIONAL DISASTER RESILIENCE

PRELIMINARY TRAFFIC DATA COLLECTION AND ANALYSIS

STATE OF CONNECTICUT DEPARTMENT OF HOUSING

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Rebecca French – Director of Resilience
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Dear Dr. French:

Subject: Preliminary Traffic Data Collection and Analysis

Please find enclosed our Preliminary Traffic Data Collection and Analysis for the Resilient Bridgeport National Disaster Resilience Competition (NDRC) project. This document forms part of the deliverables under Task 2.6 of our contract scope of services.

If you have any questions, please do not hesitate to contact me at 1.617.960.4964 or Dan.J.Kennedy@wsp.com

Yours sincerely,



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Project Manager

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QUALITY MANAGEMENT

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Project number	Daniel Kennedy			
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1 TRAFFIC ASSESSMENT

1.1 INTRODUCTION

In response to the extensive damage to communities in Connecticut and throughout the Northeast, the Obama administration created the Superstorm Sandy Rebuilding Task Force, chaired by the U.S. Department of Housing and Urban Development (HUD). As an outgrowth of the task force, in June 2013 HUD launched the Rebuild by Design (RBD) Competition, a multi-stage planning and design competition to promote innovation by developing regionally-scalable but locally-contextual solutions that increase resilience in the region. In June 2014, HUD announced the award of $930 million to seven winning RBD ideas, one of which was Resilient Bridgeport. In September 2014, HUD announced an additional round of funding through the National Disaster Resilience (NDR) Competition, a targeted effort under its Community Development Block Grant (CDBG) Program to broaden federal support for resiliency efforts in Connecticut, New Jersey, New York State, and New York City. Connecticut received approximately $54 million to continue the implementation of Resilient Bridgeport and expand its success to the regional and state scales. Approximately $42 million of the funding was allocated to the CTDOH to oversee design and construction of additional pilot projects in Bridgeport's South End focused on the eastern portion of the neighborhood. The proposed projects are considered a "major federal action significantly affecting the quality of the human environment," therefore, must comply with the requirements of the National Environmental Policy Act (NEPA). CTDOH will prepare the EIS in accordance with the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500-1508) and HUD's NEPA Regulations (24 CFR 58).

The EIS includes both the Resilient Bridgeport NDR and RBD projects. This traffic assessment is developed to support the EIS and includes the NDR project only with RBD analyzed in a separate report. The NDR project includes a combination of measures in the eastern South End of Bridgeport, CT to reduce the flood risk within the project area from current and future coastal surge and chronic rainfall events. The measures would include constructing a coastal defense system (CDS) consisting of raising a portion of University Avenue, installing floodwalls connecting to high ground, and implementing stormwater and internal drainage management strategies (e.g., detention/retention features, drainage structures, and pump systems). The Project Team is currently evaluating alternatives for the location of the CDS, which is expected to include the eastern end of University Avenue, portions of the 60 Main Street Development and north-south corridor located somewhere between Main Street and the western edge of PSEG's property, terminating at the Metro North Rail Line north of Ferry Access Rd as shown in Figure 1.

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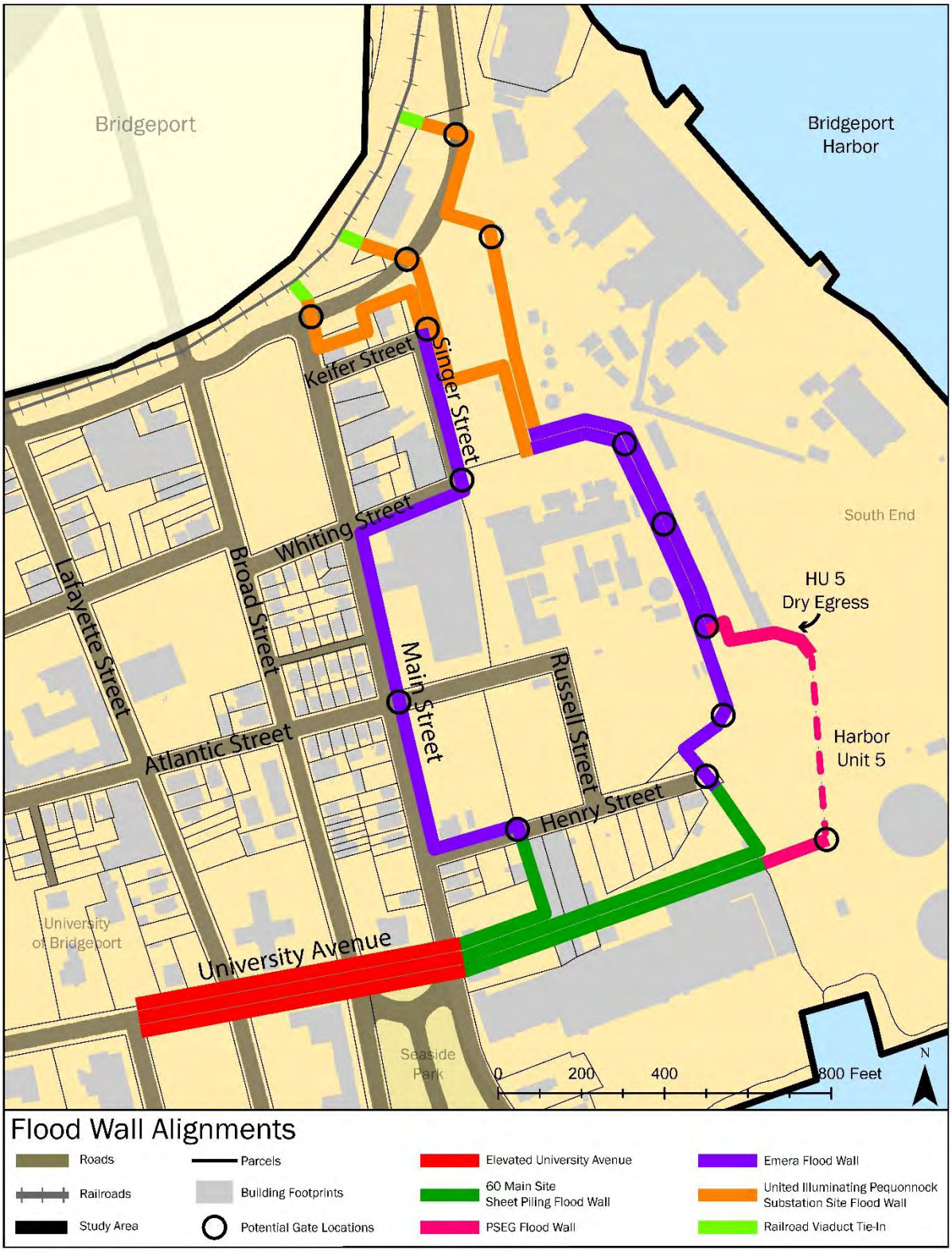


Figure 1 - Preliminary Coastal Defense System Alignments

This traffic study evaluates the transportation impacts for the 2038 Build Year of the proposed NDR Project.

1.2 PROJECT DESCRIPTION

This traffic report evaluates the transportation impacts associated with the modifications to University Avenue (i.e., elevating). University Avenue, within the study area, is a two-way road that runs east-west from Main Street two blocks to Lafayette Street where it meets a parking lot for the University of Bridgeport's (UB) stadium. From here it becomes a pedestrian way until it reaches Park Avenue to the west. All the properties along University Avenue in this area belong to UB. The NDR project considers elevating and closing University Avenue to vehicular traffic between Lafayette Street and Broad Street, elevating and closing Soundview Circle to vehicles, and dead-ending Main Street just north of University Avenue. Access to University Avenue would be from Broad Street. The analysis also assumes a future proposed mixed-use development referred to as 60 Main Street (located east of University Avenue, between Henry Street and the waterfront), although this project is independent of the NDR project. The study analyzes vehicular traffic, parking, pedestrians, bicycle, and transit services in this area that is part of the South End of Bridgeport. Other CDS street crossings shown on Figure 1 will be facilitated with movable gates, scheduled to remain open under normal operating conditions (non-storm events), and are expected to have no impact on traffic.

This traffic assessment includes the collection and compilation of existing roadway and intersection geometry, the number and width of travel lanes, intersection controls, vehicle speed, pedestrian and bicycle facilities, transit, and other relevant transportation information. Additionally, local condition data were compiled for six intersections including: lane configuration, sight lines, turn restrictions, parking restrictions, bus stops, pedestrian controls, and signing. The project study area includes Broad Street from Gregory Street to University Avenue; Lafayette Street from Atlantic Street to University Avenue; and University Avenue from Main Street to Lafayette Street, including Soundview Circle. The study locations are depicted on Figure 2. The study roadways and intersections inventoried are summarized in Table 1 and Table 2, respectively.

Traffic impacts were evaluated in the study area for the following intersections:

1. University Avenue at Lafayette Street
2. University Avenue at Broad Street
3. University Avenue at Main Street (including Soundview Circle at Main Street)
4. Atlantic Street at Lafayette Street
5. Atlantic Street at Broad Street
6. Gregory Street (Bishop JC White Boulevard) at Broad Street (including Whiting Street approach)

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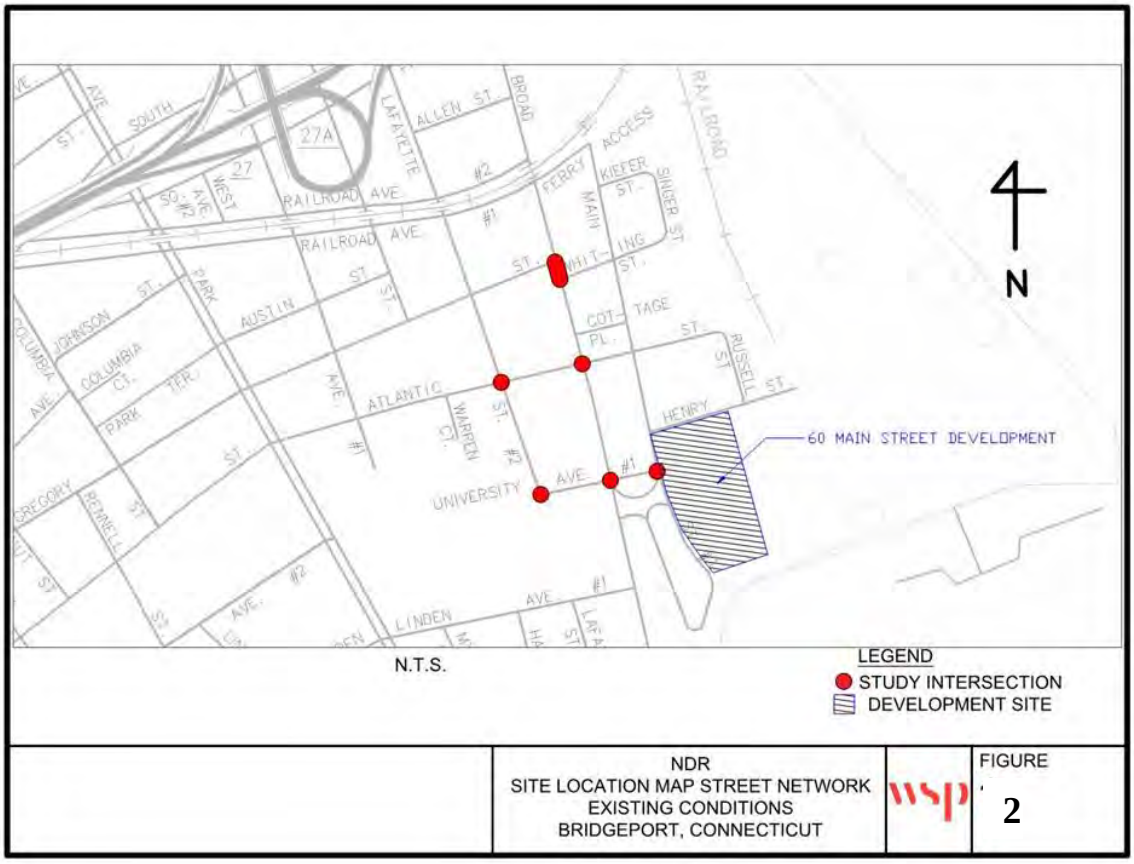


Figure 2 - Study Area Intersections and Roadway Network

Table 1 - Intersection Inventory

Thoroughfare	Orientation	Lanes	On-Street Parking	Flow	Functional Classification	Approximate Width	Posted Limit
Broad Street	NB-SB	2	Yes	2-Way	Collector	30'	25 mph
Lafayette Street	NB-SB	2	Yes	2-Way	Collector	30'	25 mph
Main Street	NB-SB	2	Yes	2-Way	Collector	36'	25 mph
University Avenue (W of Broad)	EB-WB	2	South Side Only	2-Way	Collector	32'	25 mph
Atlantic Street	EB	1	Yes	1-Way	Collector	31'	25 mph
University Avenue (E of Broad)	WB	1	No	1-Way	Collector	32'	25 mph
Gregory Street	WB	2	Yes	1-Way	Local	32'	25 mph
Whiting Street	EB-WB	2	No	2-Way	Local	31'	25 mph

Notes: NB: northbound, EB: eastbound, SB: southbound, and WB: westbound

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Table 2 - Roadway Inventory

Intersection	Traffic Control	Crosswalk
University Avenue at Lafayette Street	AWSC	Yes
University Avenue at Broad Street	AWSC	Yes
University Avenue at Main Street (Including Soundview Circle at Main Street)	Free	No
Atlantic Street at Lafayette Street	AWSC	No
Atlantic Street at Broad Street	AWSC	No
Gregory Street (Bishop JC White Boulevard) at Broad Street (including Whiting Street approach)	TWSC	No

Notes: AWSC – All Way Stop Control, TWSC – Two Way Stop Control

1.3 STUDY METHODOLOGY

Traffic operational performance measures were evaluated at the study intersections to determine future traffic impacts associated with the proposed roadway reconfiguration on University Avenue and site development at 60 Main Street. WSP collected daily and peak hour traffic data to support the traffic operations analysis. When available, traffic data inventory from the City, Connecticut Metropolitan Council of Governments (MetroCOG), and Connecticut Department of Transportation (CTDOT) was also gathered. Crash data from the Connecticut Crash Data Repository website, maintained by the University of Connecticut (UCONN), was downloaded, compiled, and analyzed for the most recent three-years. The intersections in the study area were analyzed using the methodology described in the 2000 and 2010 Highway Capacity Manual (HCM), published by the Transportation Research Board and replicated in the Synchro® Version 9 software program. The following is a description of the existing, background and Build conditions:

1.3.1 EXISTING CONDITION (2018)

The existing traffic conditions were determined based on turning movement counts collected in December 2017 (see Appendix A) together with the traffic and roadway data gathered at the six study area intersections. This information was inputted into the Synchro model to determine the existing traffic operations.

1.3.2 BACKGROUND CONDITION (2038)

A background traffic growth rate of 0.5 percent per year for 20 years was used to develop the Background traffic volumes. The growth rate was referenced from CTDOT's Bureau of Policy and Planning (October 31, 2017).

1.3.3 BUILD CONDITION (2038)

The 2038 Build Condition was developed using the background traffic volumes and including traffic generated by the proposed 60 Main Street development. It was assumed no additional traffic would generated by the NDR project itself. The Build volumes were then distributed into the proposed roadway network and inputted into the Synchro model to determine the Build traffic operations.

A review and comparison of the Level of Service (LOS) and delays for the Existing, Background and Build conditions was then performed to identify impacts and any mitigation measures to improve traffic operations. Lastly, a conclusion was developed for this study based on the proposed roadway circulation changes and traffic analysis.

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2 EXISTING CONDITIONS

2.1 EXISTING TRAFFIC VOLUMES

Intersection turning movement volume, pedestrian, and vehicle classification count data were recorded on December 7, 2017 from 7:00 AM to 9:00 AM (AM Peak Period) and from 4:00 PM to 6:00 PM (PM Peak Period). The count data was performed at the intersections of University Avenue at Lafayette Street, University Avenue at Broad Street, University Avenue at Main Street (including Soundview Circle at Main Street), Atlantic Street at Lafayette Street, Atlantic Street at Broad Street, and Gregory Street (Bishop JC White Boulevard) at Broad Street (including Whiting Street approach). Heavy Vehicle Percentages and Peak Hour Factors (PHFs) were also recorded and calculated at each intersection. The data is included in this report in Appendix A. These volumes and parameters were input into the existing conditions Synchro™ software model (Version 9). The morning and evening peak hour traffic volumes are summarized and illustrated on Figure 3.

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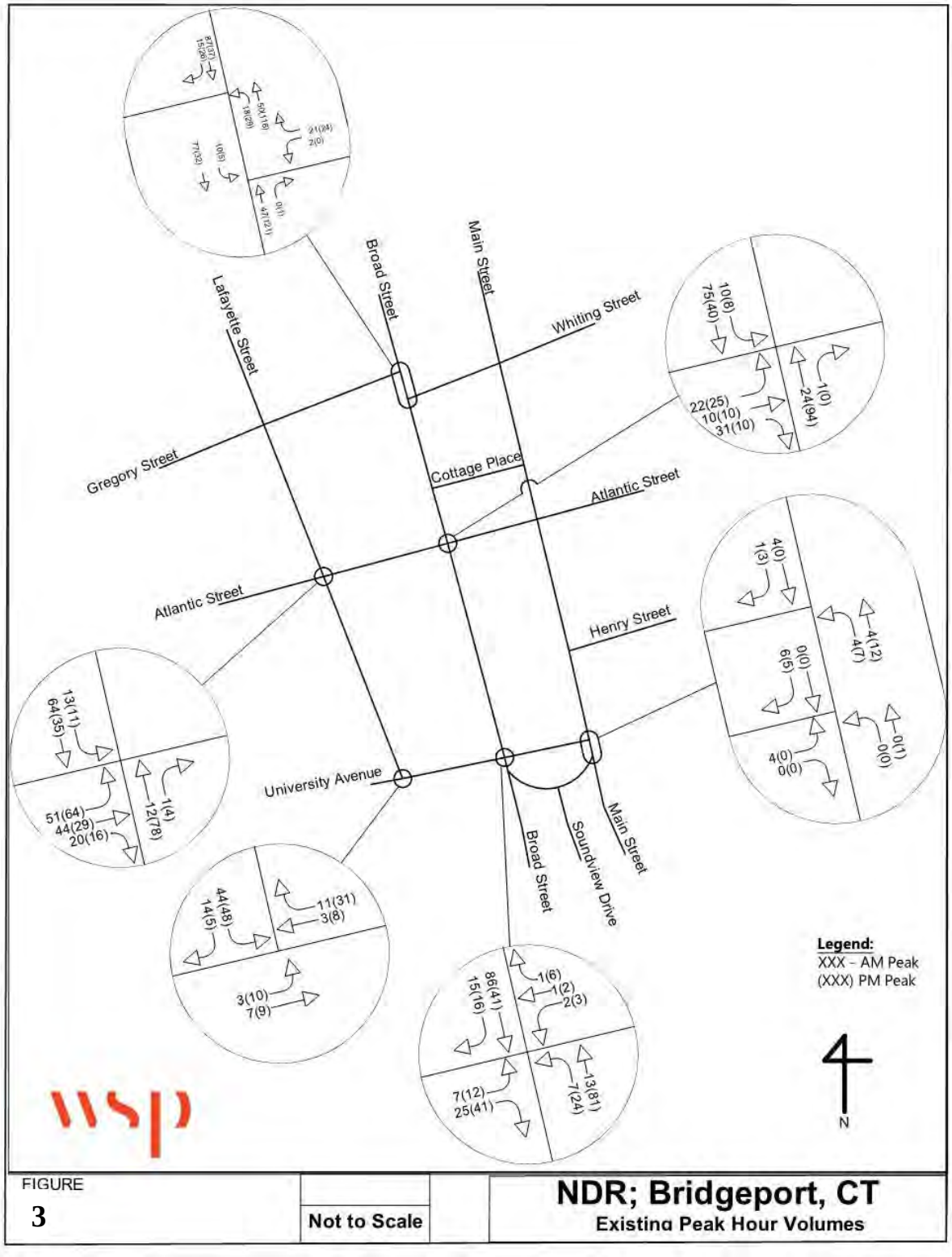


Figure 3 - Existing Conditions - AM and PM Peak Hour Volumes

2.2 TRANSIT

Greater Bridgeport Transit (GBT) provides local, regional and express bus service throughout the Bridgeport region with routes extending from Milford to Norwalk and from Bridgeport to the Naugatuck Valley[1]. Within the study area, Bus Route 1 provides a major stop (Stop 1) on Broad Street at University Avenue. This bus line makes 35 stops per day to this location, eastbound towards Stratford, and 36 stops per day westbound from Stratford. This bus line does not make stops on Saturday or Sunday.

2.3 PEDESTRIAN AND BICYCLE FACILITIES

The University of Bridgeport is located within the study area bringing increased pedestrian activity to the adjacent roadways. All study intersections are stop controlled. Sidewalks and handicap ramps exist with painted crosswalks. There currently are no bike lanes or markings on the roads in the study area. There are no pedestrian signals for crossing in the project area.

2.4 CRASH ANALYSIS

Analysis of the most recent three-year (January, 2015 to December, 2017) crash data was performed for all intersections within the project limit. The crash data from the UCONN Connecticut Crash Data Repository was compiled. UCONN publishes Crash Data from the MMUCC or the 'Model Minimum Uniform Crash Criteria' Standard.

Table 3 lists the intersections within the project limits with at least one crash in the most recent available three-year period. The full crash data set is included in this report. A total of four crashes have been recorded in the study area over the three-year period from January, 2015 to December, 2017. The crash analysis indicated that there are fewer than five crashes of a type within the past 12-month period susceptible to correction by a traffic control signal, or merit further investigation.

Table 3 - Three-Year Crash Data

Intersection Name	Total Number of Crashes	Crash Type	Maximum Crash Severity
University Avenue at Lafayette Street	1	Angle*	Property Damage
Broad Street at University Avenue	1	*Unknown*	Possible Injury
Main Street at University Avenue	*0*	*n/a*	*n/a*
Lafayette Street at Atlantic Street	*0*	*n/a*	*n/a*
Broad Street at Atlantic Street	1	Angle	Possible Injury
Gregory Street (Bishop JC White Boulevard) at Broad Street	*0*	*n/a*	*n/a*
Soundview Circle at Main Street	*0*	*n/a*	*n/a*
Broad Street at Whiting Street	1	*Unknown*	Property Damage

*Angle– A crash where two motor vehicles impact at an angle (UCONN Connecticut Crash Data).

[1] http://www.gogbt.com/

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3 FUTURE CONDITIONS

3.1 BACKGROUND TRAFFIC GROWTH AND FUTURE NO-BUILD CONDITION

The CTDOT's Bureau of Policy and Planning was contacted on October 31, 2017 to determine the future growth. Their regional forecasting travel model shows very little growth in the study area and a rate of 0.2 – 0.5 percent growth per year was recommended. These rates do not include any future developments that may occur. To be conservative, this study used the high end, 0.5 percent annual growth rate over 20 years. This resulted in approximately ten (10) percent growth rate over the 20 years to arrive at the 2038 Future No-Build traffic volumes that are provided on Figure 4.

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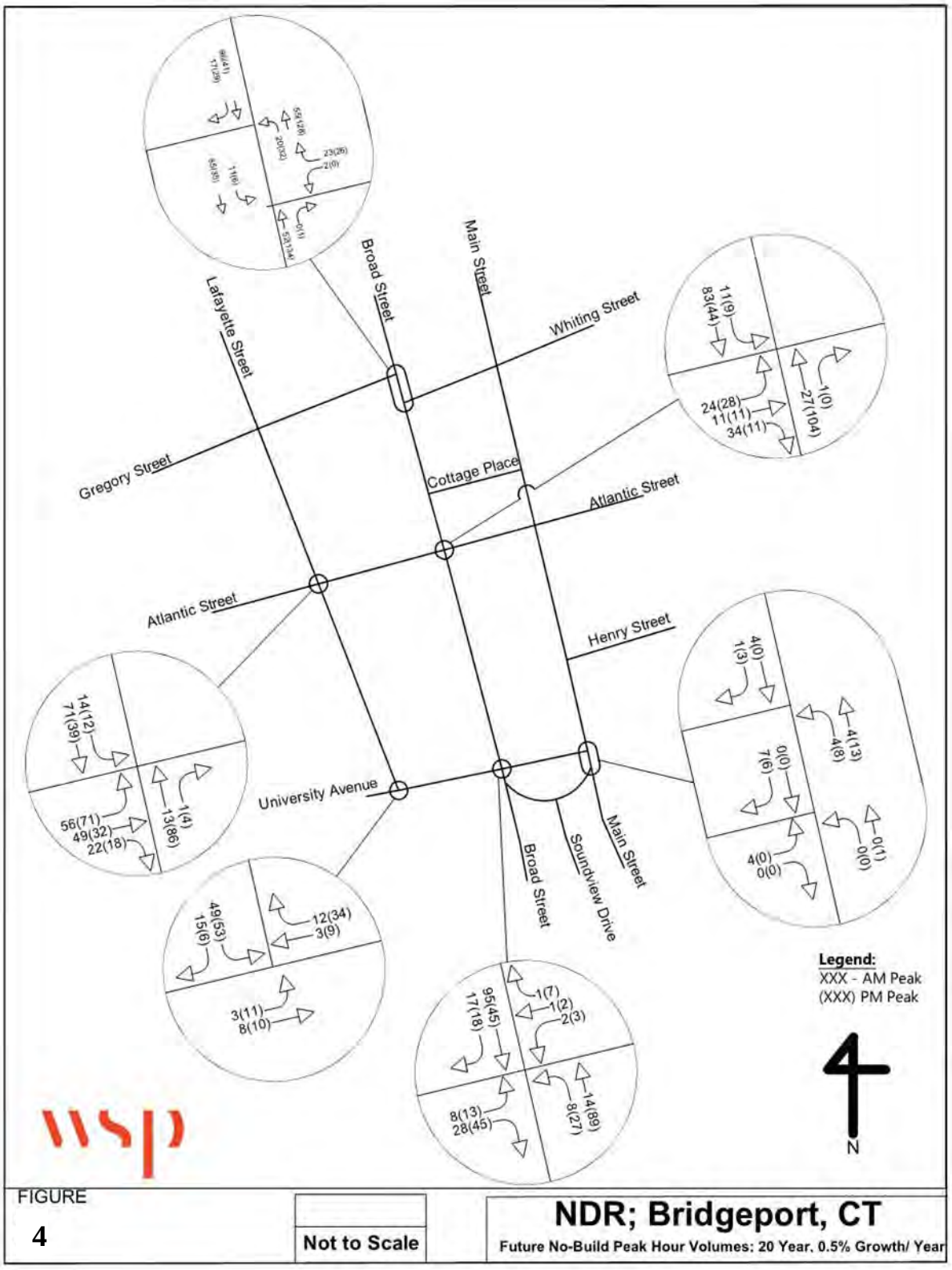


Figure 4 - Future No-Build Conditions - AM and PM Peak Hour Volumes

3.2 FUTURE BUILD CONDITION

The 2038 Build Condition was developed using the background traffic volume including traffic generated by the proposed 60 Main Street development. The volume was then distributed on the proposed roadway network that includes elevating and closing University Avenue between Lafayette Street and Broad Street, closing Soundview Circle to vehicles, and dead-ending Main Street just north of University Avenue. Figure 5 depicts the proposed roadway network and Figure 6 exhibits future build traffic volume for AM and PM peak periods. The volumes were inputted into the Synchro model to determine the 2038 Build traffic operations.

3.3 60 MAIN STREET MIX-USE DEVELOPMENT SITE-GENERATED TRAFFIC

The following traffic generation was calculated using the *Trip Generation Manual, 10th Edition, Volume 2: Data (2017).* The proposed 60 Main Street development is assumed to consist of two buildings, consisting of a shopping center (Trip Generation Manual Section 820) and mid-rise apartment buildings (Trip Generation Manual Section 221). One of the two apartment buildings would have 177 apartment units and the other building would have 45 apartment units and 12,000 square feet of retail. Table 4 presents the trip generation for the proposed uses and summarizes entering and exit trips for the peak hour of the adjacent street for both the AM and PM peak hour.

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Table 4 - Trip Generation - 60 Main Street Development - Morning and Evening Peak Hour of Traffic

TRIP GENERATION CALCULATIONS **Morning Peak Hour of Traffic**				
LAND USE	**AREA/UNIT**	**ENTER**	**EXIT**	**TOTAL**
Retail Shopping Center – Land Use Code 820	12,000 sq. ft.	98	60	158
Residential Mid-Rise Apartments – Land Use Code 221	45 units	4	11	15
Residential Mid-Rise Apartments – Land Use Code 221	177 units	16	44	60
INCREASE IN TRAFFIC (Veh./hr.)		**118**	**115**	**233**
TRIP GENERATION CALCULATIONS **Evening Peak Hour of Traffic**				
LAND USE	**AREA/UNIT**	**ENTER**	**EXIT**	**TOTAL**
Retail Shopping Center – Land Use Code 820	12,000 sq. ft.	54	59	113
Residential Mid-Rise Apartments – Land Use Code 221	45 units	13	8	21
Residential Mid-Rise Apartments – Land Use Code 221	177 units	47	30	77
INCREASE IN TRAFFIC (Veh./hr.)		**114**	**97**	**211**

The following proposed roadway network was assumed in the development of the future conditions traffic analysis:

- University Avenue will be closed between Lafayette Street and Broad Street;
- Soundview Circle will be closed to vehicles;
- University Avenue between Broad Street and Main Street will be modified to be two-way (it is currently only westbound);
- Main Street will be dead-ended just north of University Avenue. Access to Main Street south of University Avenue will be accessible from University Avenue and Main Street north of University Avenue will be not be accessible from University Avenue;
- Lafayette Street will retain access to the parking lot north of the University of Bridgeport soccer field;
- Main Street, just north of the intersection with Soundview Drive, will have an access point to 60 Main Street. Heading Northbound, it will be right-turn-only into the 60 Main Street development. Heading southbound on Main Street, it will be a left-through. Drivers exiting the development will have a right turn only, heading north;
- Between the intersection described in #6 and the intersection with University Avenue, there will be an access point to 60 Main Street. It will be a two-way, stop controlled entrance/exit;

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- The intersection of Main Street and University Avenue will be an access point to the 60 Main Street development. It will be a two-way, stop controlled entrance/exit;
- North of the intersection of Main Street at University Avenue, there will be an access point to 60 Main Street on Main Street. As described in #4, this entrance will not be accessible from University Avenue; and
- On the south side of Henry Street (a one-way eastbound roadway with access to Main Street) there will be a one-way inlet to 60 Main Street, Broad Street at University Avenue will have stop control on the westbound approach, and Main Street at University Avenue will have stop control on the eastbound and westbound approach.

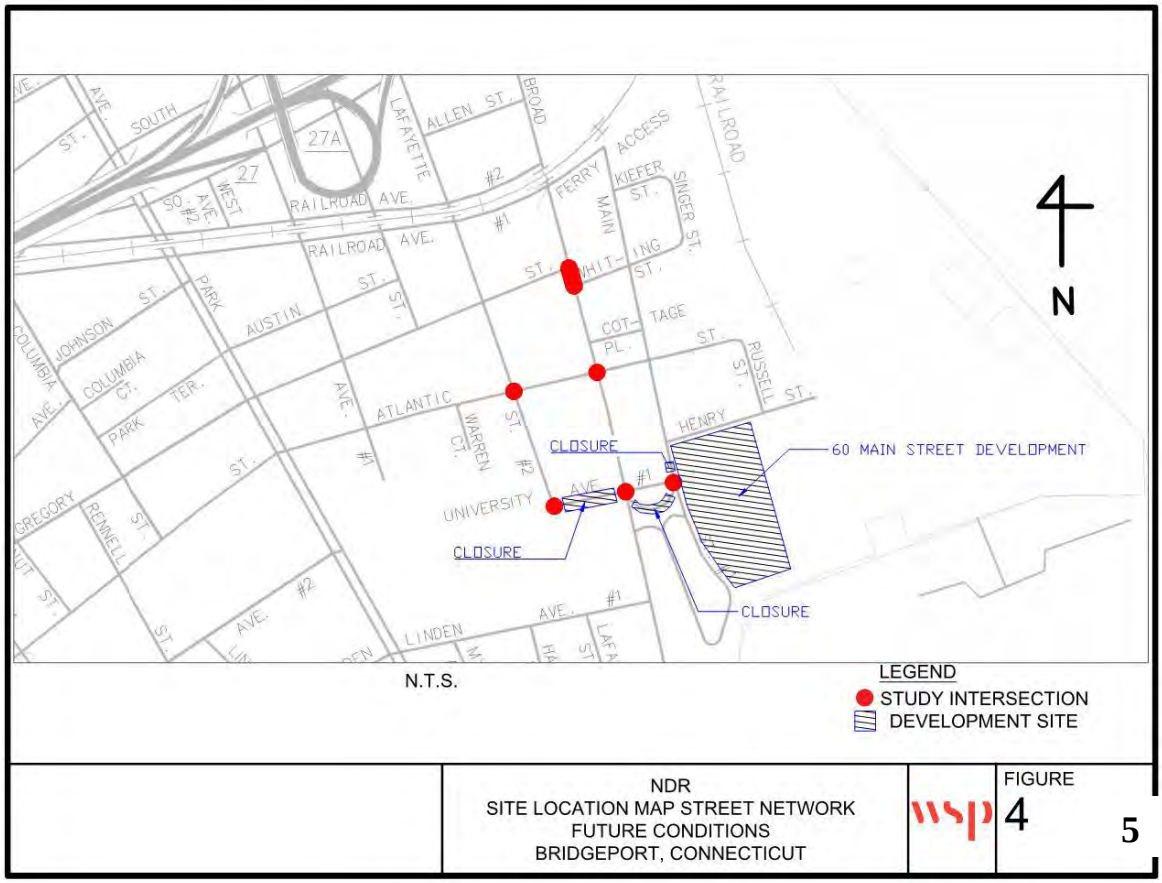


Figure 5 - Proposed Roadway Network - Build Future Condition

The following traffic assumptions were made in the development of the future conditions roadway volume network model:

- Figure 5 depicts the future condition traffic volume for AM and PM hours:
- Entering and exiting traffic will be evenly distributed through the network on Lafayette Street, Broad Street, and Main Street per existing proportionality;
- Entering traffic to 60 Main Street will be evenly distributed to all entrances to the development;
- Exiting traffic from 60 Main Street will be evenly distributed from all exits of the development;
- All impacted traffic due to the closure of Main Street north of University Avenue will be rerouted to Broad Street; and

- All impacted traffic due to the closure of University Avenue between Broad Street and Lafayette Street will be rerouted to Broad Street.
- Build Traffic Volumes distribution and assignment were calculated, and are included in this report.

3.4 FUTURE TRANSIT

GBT's Bus Route 1, that passes through the study area, will not be affected by the planned closing of roadways described above. Bus Route 1 will be able to maintain its route down Broad Street to Waldemere Avenue and up Park Avenue.

3.5 PEDESTRIAN AND BICYCLE FACILITIES

The University of Bridgeport's Campus Master Plan, Spring 2017, was reviewed. The vision for the campus shows a promenade running the length of University Avenue. A pedestrian way is also planned for Myrtle Avenue, a half block north and south of its intersection with University Avenue. The master plan states that an effort will be made to seamlessly connect campus with the downtown and the waterfront.

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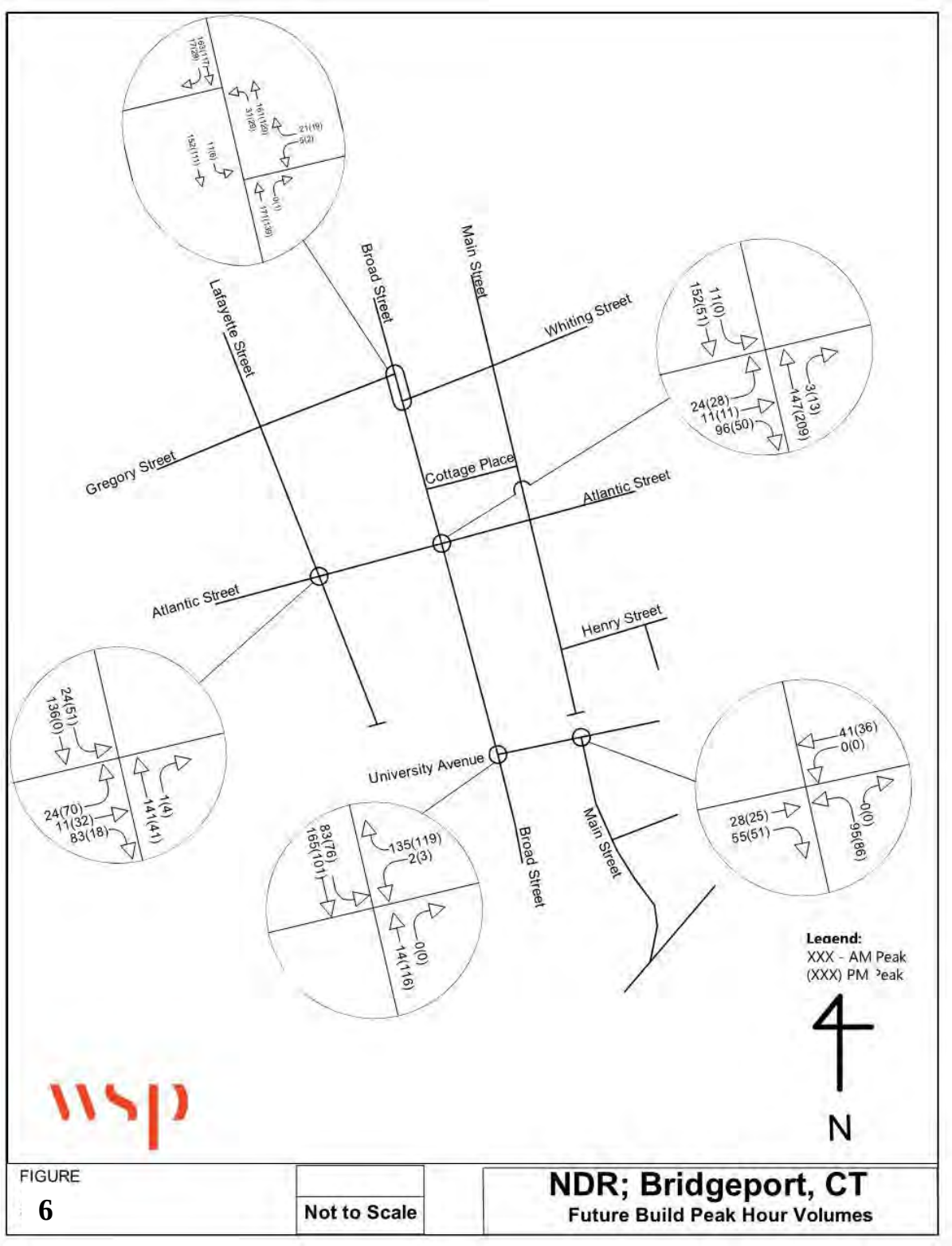


Figure 6 - Build Future Condition Roadway Volume Network

4 TRAFFIC OPERATIONS

To ascertain this project's impacts on the area roadway network, an analysis of the key intersections in the study area was performed. The existing, background and Build AM and PM peak hour operating conditions were determined using the Synchro® Version 9 software program that closely replicates the 2000 and 2010 HCM.

LOS is a calculation of control delay for an intersection and an indication of driver discomfort, frustration, fuel consumption, and lost time. LOS is defined by a grading system similar to that in a school with A (free flow) being the best and F (breakdown in flow) being the worst.

Signalized intersection analysis is based upon the capacity of each lane group and the correlating control delay associated with the intersection. Capacity is a measurement of the ability of an intersection design to accommodate all movements within the intersection. Delay is the measure of the user quality of service. Capacity is a function of physical geometry and signalization conditions.

For unsignalized intersections, delay values apply only to the controlled movements, since the main street movements are not restricted. Control delay is the elapsed time for deceleration, queue time, stopped delay, and final acceleration. For Two-Way Stop Controlled (TWSC) intersections, the LOS is characterized by the LOS of the movement with the greatest delay. This is typically the left turn movement from the minor approach to the intersection. If the intersection operates at LOS F, a traffic signal warrant analysis may be performed to justify installation of a signal. The minimum criteria as set forth in the U.S. Department of Transportation, Federal Highway Administration's Manual on Uniform Traffic Control Devices (MUTCD) must be met before the installation of a traffic control signal. It should be noted that none of the unsignalized intersections in the study area have a LOS F or warrant a traffic control signal.

Table 5 below summarizes the results of the analysis conducted as part of this study. All intersections operate at LOS B or better in the existing, background, and Build scenarios. In the Build condition, the delays increased at the intersection of Main Street and University Avenue with the closure of Soundview Circle. The Level of Service increased from LOS "A" to LOS "B" (delay increased to approximately 11 seconds per vehicle in the AM and PM Peak Hours). Synchro Reports are included in this report.

Table 5 - Traffic Operations Analysis

	Intersection	AM Peak Hour						PM Peak Hour					
		Existing Condition		20-Year No-Build Condition		20-Year Build Condition		Existing Condition		20-Year No-Build Condition		20-Year Build Condition	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
1	University Ave at Lafayette St	A	7.3	A	7.3			A	7.5	A	7.5		
2	Broad St at University Ave	A	7.5	A	7.6	A	9	A	7.8	A	7.9	A	9.6
3	Main St at University Ave	A	0.0	A	0.0	B	11	A	0.0	A	0.0	B	10.7
4	Lafayette St at Atlantic St	A	7.8	A	7.9	A	8.4	A	8.0	A	8.1	A	8.0
5	Broad St at Atlantic St	A	7.6	A	7.6	A	8.7	A	7.6	A	7.7	A	9.0
6	Gregory St at Broad St	Free Flow	Free Flow	Free Flow	Free Flow	Free Flow	Free Flow	Free Flow	Free Flow	Free Flow	Free Flow	Free Flow	Free Flow

Notes: All delays in seconds/ vehicle for highest delay of all approaches; LOS: Level of Service

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4.1 CONCLUSION

Based on the traffic analysis as described above, site access and circulation would be at a satisfactory level of service in the Build Condition. All movements would operate at LOS B or better during peak periods. Thus, following the elevation of University Avenue and rerouting of traffic to the proposed roadway network, traffic operating conditions at study intersections in the 2038 Build Condition would remain at a satisfactory level during peak periods.

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APPENDIX

A SYNCHRO REPORTS AND TURNING MOVEMENT COUNTS

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APPENDIX

A-1 SYNCHRO REPORTS: AM PEAK HOUR EXISTING CONDITION

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A-2 SYNCHRO REPORTS:
PM PEAK HOUR
EXISTING CONDITION

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APPENDIX

A-3 SYNCHRO REPORTS: AM PEAK HOUR 2038 BACKGROUND CONDITION

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A-4 SYNCHRO REPORTS: PM PEAK HOUR 2038 BACKGROUND CONDITION

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APPENDIX

A-5 SYNCHRO REPORTS: AM PEAK HOUR 2038 BUILD CONDITION

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A-6 SYNCHRO REPORTS: PM PEAK HOUR 2038 BUILD CONDITION

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APPENDIX

A-7 TURNING MOVEMENT COUNTS

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APPENDIX H
Public Involvement

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Appendix H. Public Involvement

H.1 CITIZIENS ADVISORY COMMITTEE LIST

Citizen Advisory Committee

First	Last	Title	Category	Affiliation	Email
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H.2 TECHNICAL ADVISORY COMMITTEE LIST

Technical Advisory Committee

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H.3 PUBLIC INFORMATION MEETING – OCTOBER 18, 2017

RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC INFORMATION MEETING

DATE: October 18, 2017; 6:00PM-8:00PM

LOCATION: Littlefield Recital Hall, Arnold Bernhard Arts & Humanities Center- 84 Iranistan Avenue, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
Richard Baldwin	Rensselaer, NY	rbaldwin@ramboll.com	631-987-6710	✓
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RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC INFORMATION MEETING

DATE: October 18, 2017; 6:00PM-8:00PM

LOCATION: Littlefield Recital Hall, Arnold Bernhard Arts & Humanities Center- 84 Iranistan Avenue, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
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John Santa				☐
~~TANAFF BURGDORF~~	BPT.			☐
				☐
				☐
				☐

RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC INFORMATION MEETING

DATE: October 18, 2017; 6:00PM-8:00PM

LOCATION: Littlefield Recital Hall, Arnold Bernhard Arts & Humanities Center- 84 Iranistan Avenue, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
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Rev Chen Fong	Bpt	chenfong2075@gmail	203 612-1246	☐
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				☐
				☐
				☐
				☐
				☐
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RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC INFORMATION MEETING

DATE: October 18, 2017; 6:00PM-8:00PM

LOCATION: Littlefield Recital Hall, Arnold Bernhard Arts & Humanities Center- 84 Iranistan Avenue, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
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Jim Lohr	Monroe	jlohrclm@gmail.com	203 650-5457	
P SPAIN	BPT	PeterDSPAIN@gmail.com		

Public Information Meeting
October 18, 2017 6-8 PM
Littlefield Recital Hall

Attendance:
41 signed in – note some did not choose to sign in

Public Comments:
Goals and Objectives:
Which of these is most important? What other objectives do you see for your neighborhood?

- "Local job creation"
- "#1 and #4"
- "How do you measure health? Are measures in place?"
- "Safe connections to downtown"
- "Divide between economic classes"
- "Retail not safe to and desirable to residents"
- "Concerned about raising streets on historic homes"
- "Effect of standing water on insect population"
- "Show the Seaside Village pilot at next meeting"
- "Transportation connections to downtown and train station"
- "Strategies used by other states to assist flood insurance cost"
- "Agree- especially on #1- protection from flooding. I think this area is becoming more resilient."

How did Hurricane Sandy Affect You?

- "6 feet of water in basement cracked floor foundation"
- "Basement flooded- 247 Atlantic Street"
- "IRENE 150k in flood damage. SANDY 1m in flood damage- 285 Lafayette Street"
- "Transportation to get to work, hospitals, nursing homes"
- "4 feet of basement water- Seaside Village"
- "Rev Clayton- Broad/Gregory out of building since Sandy. Also chronic flooding."
- "Basement filled with water. House is 150 years old. Destroyed pointing on field stone foundation. Underground water shift under basement floor. Damage going on to present day!"

Resilience Hub Types:

- "Satellite Phone Connection"
- "Emergency Response Brigade Center (neighborhood based)"
- "I'd like to see the design center/resilience center be focused on collecting the data for subsidence and groundwater as outlined by Roelof Stroman from Deltares in Netherlands. I'd like this center to be a community driven data collection center."

Advertising:

Only in Bridgeport Website- Ran online ads October 4-18th (unlimited impressions)
WTNH Website- Three online ads ran October 4-18th for 500k impressions (193 people clicked)
La Voz- ¼ page print ad October 13th
WPKN- PSAs running week before and week of meeting
Groundworks Bridgeport canvased homes and businesses in the South End with door hangers

H.4 PUBLIC INFORMATION MEETING – DECEMBER 12, 2017

RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC INFORMATION MEETING

DATE: December 12, 2017; 5:30PM-7:30PM

LOCATION: New Vision International Ministries - 130 Gregory Street, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
Vincent Aurelia	BPT	varella@snet.net		☑
Barbara Robinson	Bpt			☐
Carolyn Rogers		Kingrogers@sbcglobal.net		☐
King Rogers		" "		☐
Clopha Deshotel	Bpt	cdeshotel@hcc.commnet.edu	203-332 5019	☑
Greg Breland	B.A	cgbreland@gmail.com	203-260-1330	☐
Bishop Curtis	Bpt		203-384-9471	☐
Vincent Santilli	Bpt	Vsantilli@homesforthebrave.org	203-338-1669	☐
DAVID JONES	BPT	ddjs@cox.com	203-521-0296	☐
KYOUNG-SOOK	Fow BPT		(203)612-1246	☐
Mark Dudley	Bpt	Mark_Nixon_Dudley@yahoo.com	203-887-7311	☐
Brenda Collins	Bpt	Dcollins360@yahoo.com	475-202-0308	☐
Rebecca Alston	Bpt	nancy102108@gmail.com	508 543-5561	☐
TERRI Williams	BPT	TW11567@gmail.com	203-521-4742	☐
Barbara Kelly	Bridgeport	bklobos@gmail.com	203.258.3183	☐
Bishop Theodore T. Plummer	BpT	elderttp@gmail.com	203-520-1713	☐
DIEGO CRUZ	BRIDGEPORT, CT	Daisa61@gmail.com	212-470-8437	☐
FRANK BAGLER	" "	FRANK.BAGLER@GMAIL	203-345-5682	☐
				☐

RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC INFORMATION MEETING

DATE: December 12, 2017; 5:30PM-7:30PM

LOCATION: New Vision International Ministries - 130 Gregory Street, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
Allan Katz	Hobeken NJ.	allenkatz@rebuildbydesign.org	201-244-7476	☐
Frank LaGrottesia	Bridgeport	on file	203 334 3434	☐
CHRIS HEMYOWIN	Brt	chemyowin@aol.com	203 526 7394	☐
Doug Williams	Brgpt	dougwilliams444@gmail.com	425 530-1042	☐
JEFF OLSZEWSKI	ORANGE	JEFF.OLSZEWSKI@STANTEC.COM	203-495-1645	☐
REV. Elvin Clayton	Bridgeport	pastorecclayton25@sbcglobal.net	860 910-3194	☐
Sonya Huber	Stratford	indigomission@gmail.com	912-481-9554	☒
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RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC INFORMATION MEETING

DATE: December 12, 2017; 5:30PM-7:30PM

LOCATION: New Vision International Ministries - 130 Gregory Street, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
Bill Heiple	Trumbull	wheiple@fando.co	203 374 3748	☐
Bethany Gordon	Bridgeport	Bgordon@swchc.org	(203) 332.3543	☐
Alanna Kabel	HUD	alanna.c.kabel@hud.gov	860-240-9770	☐
Michon Bernard	Bridgeport	hisdaughter0205@gmail.com	(203) 912-1833	☐
David Bernard	"	jamaica517@gmail.com	(203) 482-2340	☐
Paul Yasutake	Bpt	py1800@hotmail.com	203-913 8888	☑
Pamela Soto	New Haven	pamela.soto@tpl.org	475 224 6349	☐
Peter Upshaw	Bridgeport	pastordexter@nvim.org	203-455-4259	☑
Vanessa Clayton	Trumbull	claytonvanessa1@gmail.com	860-930-8843	☑
Liz Swenson	Hartford	Elizabeth.Swenson@ct.gov	860.270.8034	☐
Chen Lawrence Fang	Bridgeport	chenfang2075@gmail	203-612 1246	☐
Lindsay Green-Upshaw	Bridgeport	lindsey@nvim.org	281-841-7725	☐
Lydia Silvas	Bpt	lydiasilvas@gmail.com	203 550-4208	☐
Betty Baldwin	Bpt CT	ugdreb757@yahoo.com	203-526-0563	☐
Richard Emery Baldwin	Bpt CT	ugdreb757@yahoo.com	203 449 9421	☐
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Resilient Bridgeport
Public Information Meeting & Workshop
December 12, 2017 5:30-7:30 PM
New Vision International Ministries
130 Gregory Street, Bridgeport, CT 06044

Meeting Attendance:
40 signed in

Public Comments:

How did you hear about this meeting?
- On email distribution list
- Facebook
- Door Hanger
- NRZ
- Church bulletin

Connections:
- Connection to Downtown, waterfront and multi-modal transportation system should be enhanced
    - Neighborhood too distinct from Downtown and from Seaside Park
    - Sidewalks are in disrepair
    - Did they say anything about bikes?
    - Too much congestion on local roads; exacerbated by on-street parking
    - Paths in Seaside Park and along waterfront should be integrated into the neighborhood pedestrian network and expanded by whatever flood risk reduction infrastructure is built
- South End needs a gateway
    - Entrances to neighborhood under highway and railroad are bleak
    - Land uses in transportation corridor zone not friendly to walking
- Public infrastructure could enhance community connectivity
    - More playgrounds needed
    - More services in the South End- Community and/or Emergency Center

Neighborhood Development:
- Significant opportunities to bring new businesses and residents to neighborhood without compromising neighborhood character and supporting local goals
    - Broad and Lafayette Streets provide greatest redevelopment sites
    - Reuse of abandoned factories would convert current non-productive and blighted eyesores into something providing value for neighborhood
    - Residential could be appropriate
        - Residential development should include efficiencies to support UB students
        - Residential development should take advantage of the high rents that could be achieved with water views
        - Another 1,000 housing units would bring vitality to the neighborhood and downtown
        - 60 Main Street is an early opportunity if flood risk can be reduced
    - Commercial could be appropriate
        - UB students currently have to go to Trumbull Mall for shopping
        - Restaurants would be perfect given University and waterfront

        - 30 University and sites like that near park would be great restaurant sites but that site is a cautionary tale since restaurants there keep failing
        - Boathouse in Seaside Park could be great destination restaurant
    - Development policy doesn't seem to be effectively enforced
    - Greater density is ok as long as the style and scale doesn't detract from neighborhood's historic character.
- Some land should be reserved for water management and leveraged as a community asset
    - Stormwater parks and retention areas could provide benefit during flood events and year round
    - Rain gardens integrated into development could bring park-like feel into neighborhood
    - Look to low-lying points in neighborhood for new pocket parks that could hold water during rain events

Public Realm Improvements:

- Seaside Park needs to be a bigger part of South End identity
    - Most travel through the arch to enter the park; all three entrances are important; Broad/Main and Iranistan entrances should be improved
    - If you hired a branding firm, the brand for Bridgeport would be "It's the Park City"
    - There's currently no public location that gives an elevated vantage point where you can see the breadth of the park; an elevated spot in the park could be great for stargazing and interacting with nature
    - Seaside should be the anchor of an outdoor recreation lifestyle in South End
- More and better managed street trees should permeate the South End, bringing the Park into the neighborhood
- Floodwalls or other flood risk reduction infrastructure should include public art and new public spaces
- Investment in public realm should be limited to those areas of the flood risk reduction infrastructure that touch the community
- More public activities and programming necessary for new public spaces

Resilience Hub:

- Could be used to bring energy to the area under I-95
- Stand-alone building
- Leveraged for broad community uses
    - Information
    - Learning
    - place to go for emergency
    - healthcare
    - engineering and design
- Engage students
    - Youth staffing
    - Volunteer/paid program for youth
    - Use students for data collection
    - STEM program with students
    - Afterschool program for children
- Senior Citizen's Center
- Urban Agriculture
    - Link to strong network of existing community gardens
    - Expand existing resources with a community farm

H.5 PUBLIC HEARING & DESIGN WORKSHOP– MARCH 14, 2018

CONNECTICUT DEPARTMENT OF HOUSING TO HOLD A SCOPING MEETING FOR THE RESILIENT BRIDGEPORT ENVIRONMENTAL IMPACT STATEMENT

Please join us for the EIS Public Scoping Meeting:

DATE: Wednesday, March 14, 2018
TIME: 6:00 – 9:00 PM (presentation to start at 6:30 PM)
LOCATION: Arnold Bernhard Arts & Humanities Center (first floor) located at 84 Iranistan Avenue, Bridgeport, CT 06601

The Connecticut Department of Housing (CTDOH) and U.S. Department of Housing and Urban Development (HUD) invite the public to a Public Scoping Meeting on the Resilient Bridgeport Environmental Impact Statement (EIS). The EIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) and the Connecticut Environmental Policy Act (CEPA) to analyze the potential environmental and social effects of alternatives being proposed to improve coastal and social resiliency and reduce flood risk to the south end of Bridgeport. The purpose of the meeting is to present information about the project and solicit comments on the project's purpose and need, preliminary alternatives, and areas of key environmental concern.

The Draft Scoping Document can be downloaded at https://resilientbridgeport.com.

To provide comments, please contact: David Kooris, Director of Resilience, Department of Housing, 505 Hudson Street, Hartford, CT 06106 or email info@resilientbridgeport.com.

Comments must be submitted by March 28, 2018 to be included in the Final Scoping Document. If you have special needs and require assistance at the meeting, please contact the project team by calling (860) 815-0299 no later than 5:00 PM on Friday, March 9, 2018.

Resilient Bridgeport
Public Hearing & Design Workshop
Wednesday, March 14, 2018 at 6 PM
Schelfhaudt Gallery, 84 Iranistan Avenue, Bridgeport

The Public Hearing will begin promptly at 6 PM with an open house and opportunity to speak one-on-one with project staff. A presentation on the Environmental Impact Statement (EIS) / Environmental Impact Evaluation (EIE) will begin promptly at 6:30 PM. Following the presentation, the public will have the opportunity to provide comments. After the hearing, attendees are encouraged to stay for a design update and public workshop.

Please feel free to spread the word of this Public Hearing & Design Workshop with your colleagues, friends and neighbors who share an interest in the future of Bridgeport's South End. All are welcome and encouraged to attend!

For more information about Resilient Bridgeport and to review the EIS Notice of Intent and Draft Scoping Document, please visit the project website www.resilientbridgeport.com.

If you have any special needs and require assistance at the meeting, please contact the project team by calling 860-815-0299 no later than 5 PM on Friday, March 9, 2018.

RESILIENT
BRIDGEPORT

Public Hearing & Design Workshop

March 14, 2018
6 PM - 9 PM

Schelfhaudt Gallery
84 Iranistan Avenue
Bridgeport, CT 06604

The Public Hearing will begin promptly at 6 PM with an open house and opportunity to speak one-on-one with project staff.

A presentation on the Environmental Impact Statement (EIS) / Environmental Impact Evaluation (EIE) will begin promptly at 6:30 PM. Following the presentation, the public will have the opportunity to provide comments.

After the hearing, attendees are encouraged to stay for a design update and public workshop.

www.ResilientBridgeport.com
info@resilientbridgeport.com



More Information >>

RESILIENT BRIDGEPORT

Public Hearing & Design Workshop

Wednesday, March 14, 2018
Scheelhaudt Gallery
84 Iranistan Avenue, Bridgeport, CT

6:00 PM Open House
6:30 PM EIS/EIE Presentation
6:50 PM Public Comments
Design Presentation & Workshop to Follow
(Approximately 7:30 PM)

Join us for a presentation on the Environmental Impact Statement (EIS) / Environmental Impact Evaluation (EIE). Following the presentation, the public will have the opportunity to provide comments. After the hearing, please join us for a design update and public workshop.

For more information and to review the EIS Notice of Intent and Draft Scoping Document, please visit

www.ResilientBridgeport.com

If you have any special needs and require assistance at the meeting, please contact the project team by calling (860) 815-0299 no later than 5 PM on Friday, March 9, 2018.

RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC HEARING & DESIGN WORKSHOP

DATE: March 14, 2018 6 PM

LOCATION: Schelfhaudt Gallery, 84 Iranistan Avenue, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
Kathleen Maher	Bridgeport	kmaher@barnum-museum.org	203-331-1104 x100	☑
William DeWitt Smith	Bridgeport	bdewitt@aol.com	203-366-3726	☑
Bill Hemple	Trumbull	wthemple@fando	203 374 7748	
Kai Starn	Bridgeport / Blacklock	kstarn@swinter.com		☑
Lydia Silvas	? / Seaside Village	lydiasilvas@gmail.com	203 550-4208	
Lynn Haig	Bridgeport	Lynn.haig@bridgeportct.gov	203-576-7317	
Andrew Cryan	Bridgeport	dangermouse1019@Gmail.com		
Alex Kelly	New Haven	Alex@RideDribble.com		
Liz Swenson	Hartford	Elizabeth.swenson@ct.gov	860.270.8054	
Marsa Tisdale	Bridgeport	mltcons.ltng@yahoo.com	203-895-2469	
Lindsey Greene-Upshaw	Bridgeport	lindsey@arim.org	281-841-7725	☑

RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC HEARING & DESIGN WORKSHOP

DATE: March 14, 2018 6 PM

LOCATION: Schelfhaudt Gallery, 84 Iranistan Avenue, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
STEVE TYLISZCZAK	BRIDGEPORT	STEVET@BLDSTEELPOINTE.COM	203.330.8200	X
Lawrence Fong	Bridgeport	chenfong2075@gmail	203 612 1246	
Pat Cochran	Bridgeport	JoyCo31vision@gmail	203 583 8931	
~~[illegible]~~				
Adam Tremallo	Stratford	atremallo@optimum.net	203-378-2437	
CHRIS WIGREN	NEW HAVEN	cwigren@cthmst.org	203.562.6312	
Jimmy Fera	Norwalk	jfera@winter.com	—	
Carmen Nieves	Bridgeport	Senrz@gmail.com	203-727-9229	
Tammy Monnin	New Haven	tmonnin@pcparch.com	—	
Rebecca French	Waterford/UConnCIRCA	rebecca.french@uconn.edu	860 405 9228	

RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC HEARING & DESIGN WORKSHOP

DATE: March 14, 2018 6 PM

LOCATION: Schelfhaudt Gallery, 84 Iranistan Avenue, Bridgeport, CT 06604

PRINT NAME	TOWN / CITY	EMAIL	TELEPHONE	CHECK TO RECEIVE EMAIL NOTICES
Donna Mahon	N/A	Donna.m.Mahon@hud.gov	973-776-7260	☐
Clopha Deshotel	Bridgeport CT	cdeshotel@bridgeport.edu	203-332-5019	☑
Angie Stallaro	Bridgeport, CT	Angie.Stallaro@bridgeportct.gov	203 6736345	☐
Allen Kratz	NA	[illegible]	201-214-7476	☐
David Bernard	Bridgeport	dnbernard@snet.net	(203) 374-3719	☐
Dean Mack	City of Bridgeport-OPED	Dean.Mack@BridgeportCT.gov	(203) 907-6698	☑
DICK DMOCHOWSKI	FAIRFIELD - FEGB	r.dmochowski@sbcglobal.net	203-256-9559	☒
Pamela Soto	New Haven	pamela.soto@tpl.org	4752246349	☐
Kerri J. Cryan	BRIDGEPORT	kjcryan@aol.com	203-209-6279	☐
Nora M. Sanchez	Bridgeport	norasanchez@yahoo.com	203-366-5799	☐
Scott Hughes	Bpt	liberatedlibraries@gmail.com	5784618688	☑
Alanna Kabel	Hartford	alanna.c.kabel@hud.gov	860-240-9770	☐
Lisa Maragno	Bpt.	lismaragno@gmail.com	2036680877	☐
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RESILIENT BRIDGEPORT

Public Hearing

March 14, 2018
Schelfhaudt Gallery, 84 Iranistan Avenue, Bridgeport, CT

SPEAKER SIGN-UP – PLEASE PRINT CLEARLY

Speakers will be called up in order during the comment period following the Environmental Impact Statement (EIS) / Environmental Impact Evaluation presentation. Speakers will be limited to three minutes each.

First Name	Last Name	Address	Affiliation
Carmen	Nieves		
Lydia	Silvas	seaside village	

Public Design Workshop Table Discussion Notes

March 14, 2018

University Avenue Table 1
Leader: Andrei Harwell
Notes: Jared Abraham

North Main St/University Avenue Termination

- "It's already blocked off [at the railroad], so won't make a difference."
- There was a general concern regarding traffic flow to 60 Main and the Broad/Main Street couplet.
- There was an acknowledgment that raising a street requires handrails, fences and lighting, and concern for what that might look like.

Olmstead Park

- There was a concern that a built out UB masterplan would result in less daylight in the park.
- "Will you be able to restore the grove in the [north side of the] park?"
- "University buildings would cast shadows on the park."

Curve Diagram ("Park City Scheme")

- "A continuity of the park is good."
- One community member expressed a want to incorporate public art in the re-design of University Avenue.
- There was little reaction to the proposed geometry of the University Avenue pedestrian walk.

Park Place

- The group preferred a gradual/sloped transition between a raised university Ave and the Park.
- "I'd rather see a slope up and a slope down."
- The group expressed a need for better programming in the park.
- "What draws people here, other than a walk in the Park?"
- The park and paths at the head of the park (former carriage gate) are used by residents for access to the park.
- "I go down the paths to the playground. I have a granddaughter."
- There were general questions about how the Conte site would interface with a raised University Avenue.

Other Questions

- "Are you separating the storm water and sewer system?"
- "What about utilities? Will electric, telephonic, etc. go underground?"
- The group sited existing flooding under the train tracks and asked how it might be addressed. "Will you add a pumping station?"
- General questions of funding and the scope of the work we were doing. Could it be used for park restoration? Utility upgrades? etc.
- "What do you think about the casino?"

- Questions about the storm-water Park. “How much water does the park manage?” “Where is the storm-water Park?”

University Avenue Table 2
Leader: David Waggoner
Notes: Daphne Agosin

North Main St/University Avenue Termination

- This table was inclined to terminate the vehicular access North of University Avenue in its intersection with Main St, understanding that this would allow for better access to the three houses located in the East sidewalk of Main, before Henry St.
- They were interested in a pedestrian access

Lafayette/Park

- This table was inclined to have some kind of vertical connection remain in Lafayette/Park, "at least pedestrian."

Curve Diagram ("Park City Scheme")

- People felt good about the curve diagram, as DW explained it allows for connections between important points of University Avenue and a perceptive connection to other parks north.

- Interest when this diagram is explained as a "Civic Gateway" making UB areas more approachable as connectors for pedestrians

Park Place

Questions:

- Public: Does the wall wrap around the arc of the park?
- DW: No, the elevation of the park towards the risk reduction barrier would respond to the historic plan of Olmsted—that is what the arc is about.

- A community member was interested in having a water feature in this area of the park.
- There was interest in integrating bike paths in this location.
- Henry Burke Statue: some concern on how to move it without losing its category of preservation.
- "the park is actually super used"
- "A way to maintain its relevance is to create virtual reality parks"
- "Enhance information system on the park"
- "Is there a possibility to relocate the trees that we take out?"

Comments on Resilience Hub:
Interest in using houses as info kiosks
Interest in the hub complementing health centers
*Some community members from this table took the survey to further think and respond from home.

Resilience Hub Table
Leader: Kelli Reinhardt
Notes: Megan Savage

Consensus: Physical space

Question:

- We have up to $1m- can you explain how the money works?

Kelli:
We have money to set it up, not to run programs forever. The money is one-time use. Need a partner to run/facilitate programs.

Comment:

- Physical building- place to get help, ask questions.
- Maybe we don't have programming now, but we could if a building was there.
- Don't see value in the virtual hub option.
- You need to use a space regularly to know where to go to get help in an emergency.
- Physical space to teach about resilience and human/environment relationship.
- The space needs to be a standalone from the University or Churches.
- When there is a disaster, people have this place to go to.
- Provide WIFI and phone services in case of emergency. Charging stations.
- Meeting place for people separated in times of emergency. Should be used so people know where to go prior to an emergency.
- Food, water, communication, get out.
- Cultural corridor, tourist spot, place to tell story.

Question:

- How long do we have?

Kelli: Construction completion by 2022.

Comment:

- Mixed use development.
- Cert training.
- Facility to house mobile hub.
- We need more signage for evacuation.
- Place for detour information during crisis.
- Innovation Center.
- A co-working space of resilience tech companies to test and work together could be valuable.
- This would be more valuable than a place for team designers.
- Rent out commercial/tech spaces- a way to fund building.
- Children's programs.
- Building needs to have generator.
- Mixed use space. Housatonic tried something like this.

Question:

- What is the next step?

Roni:
Next step for the Resilience Hub- need to have understand of needs/wants by early April.

Comment:

- Rent out for meetings and events.
- Swap out Housing Authority space across from Freeman Houses and use that space.
- Data monitoring program. Interested in getting the community involved in the monitoring efforts “citizen scientist”.
- Engage people directly- give people a voice to make change and not fear the water.
- Partnerships with people/agencies to use data.
- Need more resources than the University.

How to Comment

The Draft Scoping Document is available on:

https://resilientbridgeport.com



Comment During Tonight's Meeting



Submit Comments by Email:
info@resilientbridgeport.com



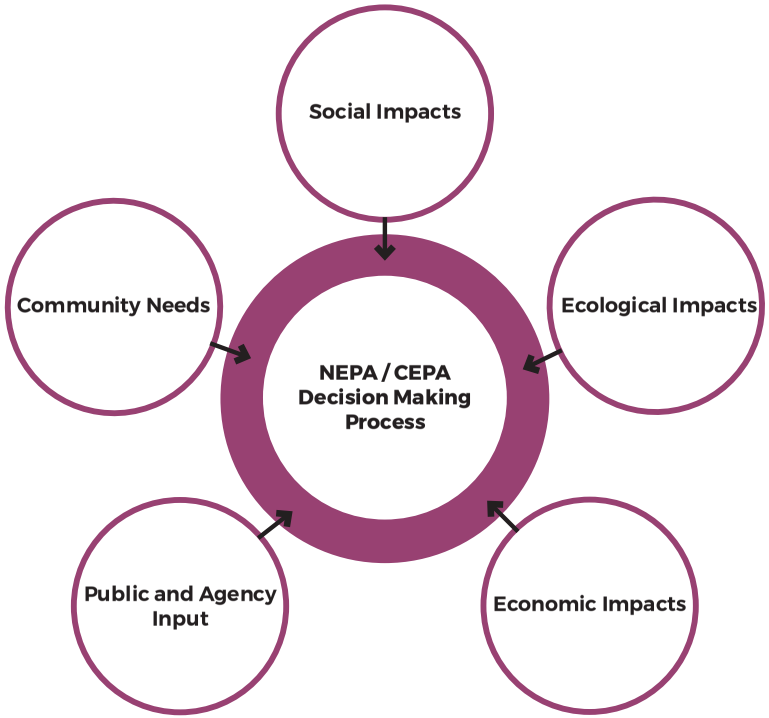
Fill Out Comment Card and Submit Tonight or by Mail to:

CT DOH
505 Hudson Street
Hartford, CT 06061-7106

Comments received by **March 28, 2018** will be considered and summarized in the Final Scoping Document, which will be posted on the project website https://resilientbridgeport.com/

NEPA / CEPA Process

National Environmental Policy Act / Connecticut Environmental Policy Act



We Are Here →

- **Notice of Intent**
- **Scoping / Public Hearing**
- **Prepare Draft EIS**
- **Release Draft EIS**
- **Public Comment/ Public Hearing**
- **Prepare and Issue Final EIS and Record of Decision**

Impact Categories

Natural Resources
- Ecology
- Floodplains
- Surface Waters
- Wetlands and Riparian Zones
- Coastal Resources

Cultural Resources
- Architectural Resources
- Archaeological Resources

Land Development
- Land Use and Zoning
- Noise and Vibrations
- Air Quality
- Visual and Aesthetic Resources
- Hazardous Materials
- Energy

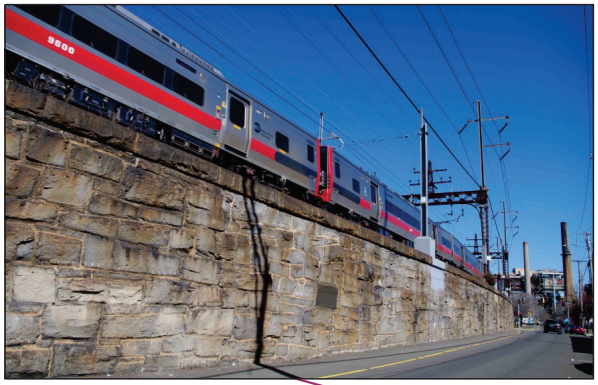
Socioeconomics
- Environmental Justice

Community Facilities and Services
- Stormwater
- Utilities
- Transportation
- Open Space and Recreation

Indirect Effects and Cumulative Impacts

Section 106 Process and Historic Properties

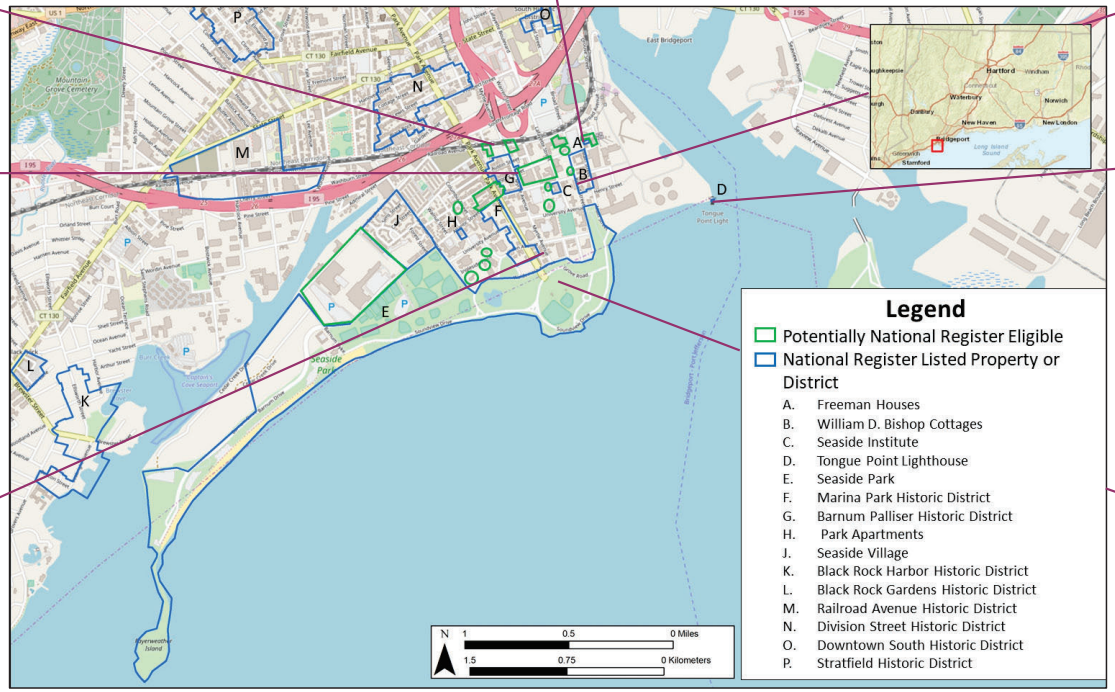
Section 106 of the National Historic Preservation Act of 1966 requires federal agencies to consider the effects of their actions on historic properties (including standing structures, bridges, landscapes, and archaeological resources) that are listed or eligible for listing in the National Register of Historic Places.









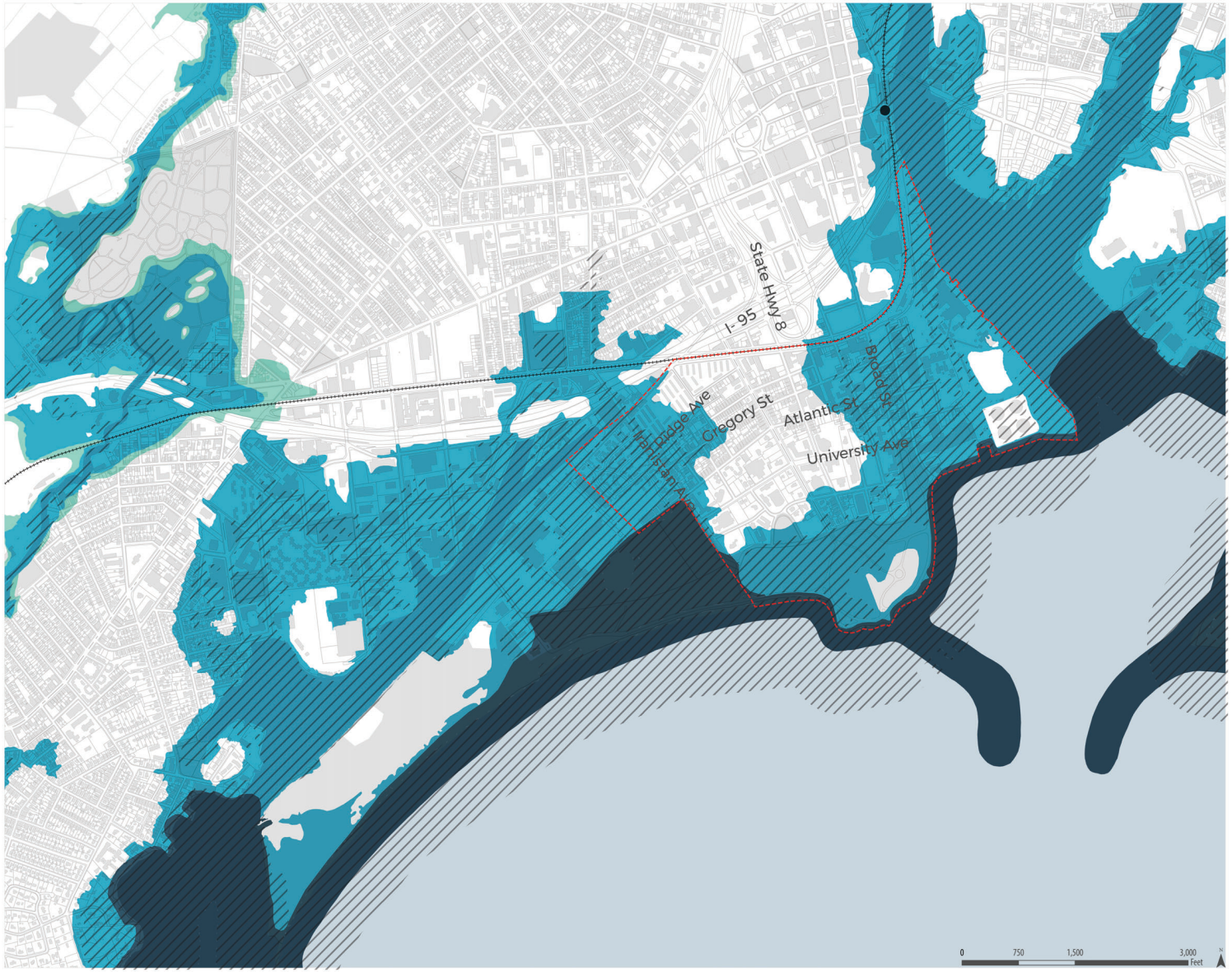








Project Needs



RESILIENT BRIDGEPORT

Study Area

FEMA FIRM FLOOD ZONE

- VE Zone (waves above 3')
- 100 Year Floodplain (1% annual chance)
- 500 Year Floodplain (.2% annual chance)

SUPERSTORM SANDY INUNDATION

- Superstorm Sandy Inundation



Project Purpose

Purpose

Create a more resilient South End community, support its long-term viability, and improve health and safety for the community's vulnerable populations.

Principal targeted outcomes:

- **Lower the risk of acute and chronic flooding**
- **Provide dry egress during emergencies**
- **Educate the public about flood risks and sea level rise**

Goals and Objectives

Minimize Coastal and Inland Flood Risk

Enhance Connectivity (Resilient TOD)

Create a More Socially + Economically Resilient Community

Implementable – Feasible and Constructible

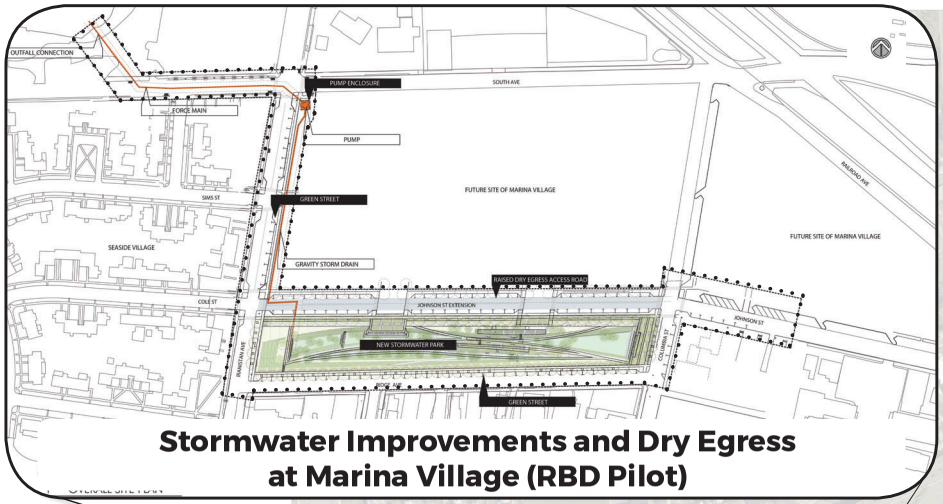
Co-Benefits

The proposed project could deliver additional benefits to the community:

- **Unlock development or public realm opportunities**
- **Enhance connectivity between the South End and Downtown Bridgeport**
- **Improve existing open space amenities**
- **Build up the resilience of local energy systems**
- **Leverage public investment in ongoing resiliency efforts through coordination with local stakeholders**



Proposed Action



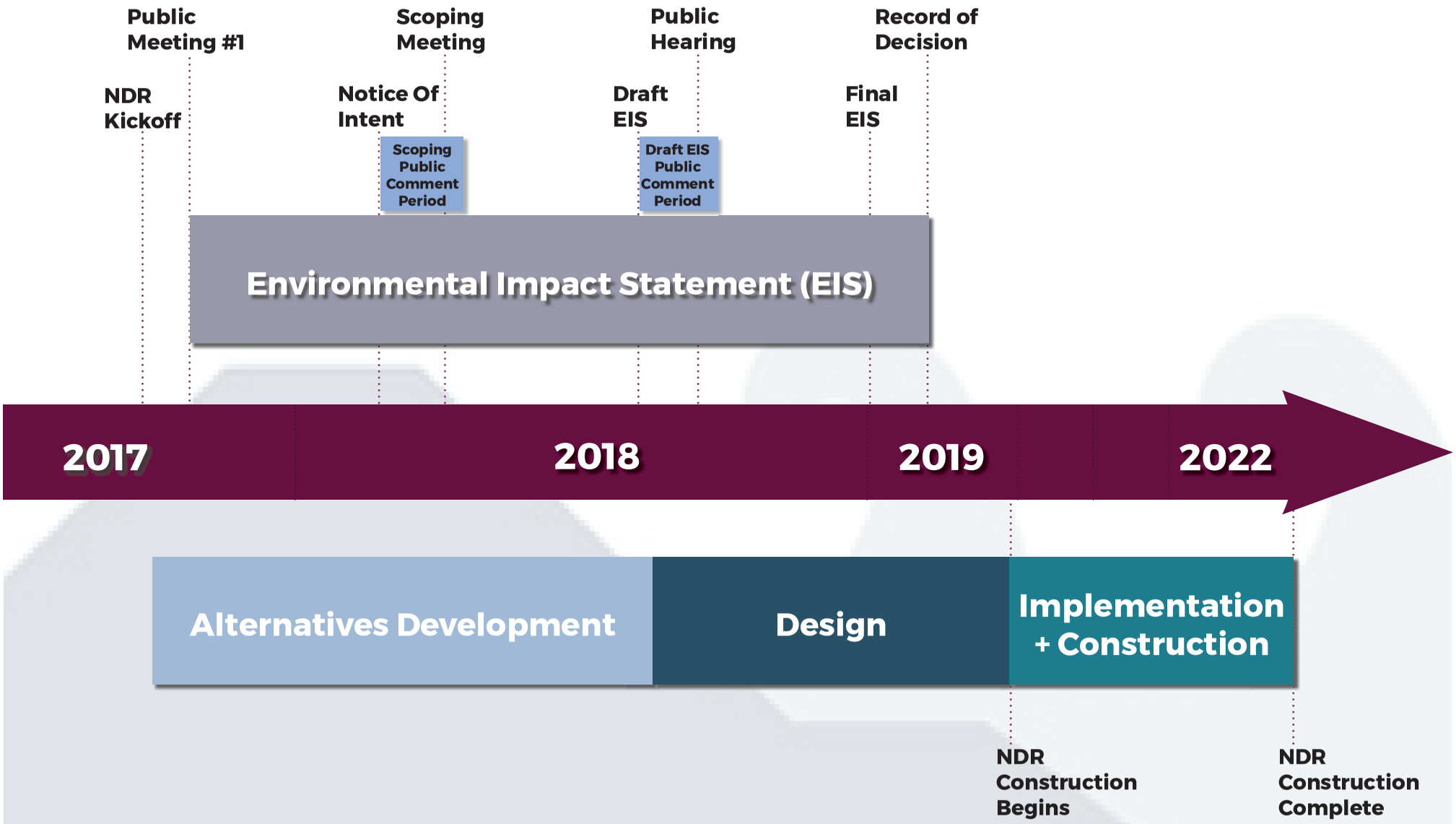
Stormwater Improvements and Dry Egress at Marina Village (RBD Pilot)

Flood Risk Reduction

- Study Area
- Edge Alignment
- Integrated Alignment
- Interior Alignment

I-95
I-95
Main St
Atlantic St
University Ave
Park Ave
Broad St
Iranistan Ave
Seaside Park

Schedule


Public Meeting #1
Scoping Meeting
Public Hearing
Record of Decision
NDR Kickoff
Notice Of Intent
Draft EIS
Final EIS
Scoping Public Comment Period
Draft EIS Public Comment Period
Environmental Impact Statement (EIS)
2017
2018
2019
2022
Alternatives Development
Design
Implementation + Construction
NDR Construction Begins
NDR Construction Complete

H.6 PUBLIC HEARING & DESIGN WORKSHOP– JUNE 6, 2018

+3

RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC HEARING & DESIGN WORKSHOP

DATE: ~~March 14, 2018 6 PM~~ DATE: June 6, 2018

LOCATION: Schelfhaudt Gallery, 84 Iranistan Avenue, Bridgeport, CT 06604

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RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC HEARING & DESIGN WORKSHOP

DATE: ~~March 14, 2018 6 PM~~ June 6, 2018

LOCATION: Schelfhaudt Gallery, 84 Iranistan Avenue, Bridgeport, CT 06604

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RESILIENT BRIDGEPORT

RESILIENT BRIDGEPORT

PUBLIC HEARING & DESIGN WORKSHOP

DATE: ~~March 14, 2018 6 PM~~ June 6, 2018

LOCATION: Schelfhaudt Gallery, 84 Iranistan Avenue, Bridgeport, CT 06604

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MEETING NOTES

JOB TITLE	Resilient Bridgeport – NDR Project
PROJECT NUMBER	52829
DATE	06 June 2018
TIME	6:00PM – 8:00 PM
VENUE	84 Iranistan Avenue, Bridgeport, CT
SUBJECT	Public Meeting #4
CLIENT	Connecticut Department of Housing
PRESENT	NDR Team: David Kooris (CTDOH), Hermia Delaire (CTDOH), Dan Kennedy (WSP), Megan Savage (WSP), Nicole Weymouth (WSP), Laura Toole (WSP), Jared Abraham (YUDW), Joseph Marrone (Arcadis), Roni Deitz (Arcadis), Ian Applegate (WSP), Daphne Agostin (YUDW), Katie Coleman (Arcadis), Christina Smith (Groundwork Bridgeport), Miranda Zhang (WSP), David Waggonner (WB), Kelli Reinhardt (WB), Tanner Burgdorf (Groundwork Bridgeport) Event was open to the public- see attached sign-in sheets.
DISTRIBUTION	NDR Team

1.0 QUESTIONS DURING PRESENTATION	**Action/comments**
• What level of rise in comparison with New Orleans? • 100 Year/500 Year difference? • Will gates be open? • What is the height of the wall? • What is a swale? • Will this project improve the sewer overflow in the sound? • Army core of Engineer involvement? • Price difference in alignments?	Record of Questions

WSP USA
500 Winding Brook Drive
Glastonbury, CT 06033

Tel.: +1 860 659-0444
Fax: +1 860 633-8117
www.wsp.com

• What's the impact on the West of South End? • Will Iranistan be raised?	
2.0 TABLE #1 DISCUSSION NOTES	
Development in front of UB North. Werner Gitt Projects. Bath house in Seaside Park is underutilized. More Art More Restaurants Example in Rome and Naples community projects. Fix critical points (park and train). Talk about the separation of the system. Maisa: We don't want the Western most alignment because we want to redevelop Main Street sidewalk into small markets. It's a perfect space for sidewalk/pedestrians, people with disabilities. UB students like to walk around there. The folks at the Cottages are concerned about a wall in front of them.	INFO
2.1 RECLAIM	
Wall BEHIND Main Street so we don't see so much industry Lights Churches: Downtown, "release of ancestors": walk through Main Street to the beach. (at 1AM) Sunset Ritual of passage	INFO
2.2 MAIN STREET/UNIVERSITY AVENUE	
As long as it's something that evokes the park, invites people to the park. Symbolic On top of superpower elastic tubes- pedestrian walkway Everyone would love a place to have a cup of coffee (PSEG at Main Street) Laurence Harvey Hubble- Little Liberia electrical power plug (and pull chain light sockets) inventor First woman landscape architect in Bridgeport- Elizabeth J Bullard (Lydia) A garden for her or small monument Little Liberia Event- pop-up (done before- murals) Inventors Rent to buy mechanism, DOH project to transition rent to ownership Historically, center of Little Liberia	INFO

MEETING NOTES

Pocket Neighborhoods- housing, 3 story max, playground We are hoping to see *again* something uplifting Development, especially a neighborhood that transfer socio-economic situation Also, burial site- somewhere Main Street- would you add a tree lane instead of parking? Art workshop/housing redevelopment	
2.3 HISTORY	
Crown (curser?) Factory demonstrations of 1915 History: • Cottages because tenements at NY wanted something better • Workers housing • Class consciousness • PT Barnum • "ecosystem" of factories • Seaside Park Conversation on # of units for new development on Main Street / in South End There are examples of ushering people out of poverty right here in the south end	INFO
3.0 TABLE #2 DISCUSSION NOTES	
Main Street least pleasing alignment Singer Substation is already a wall Further East seems like a no brainer What is happening with 60 Main Dead ending Main Street sounds good to resident Leo's owner- the farther out the better Prefer ramp because of commercial property, but is willing to accept either option, can see the disadvantages to local property owners (three sisters) Mark and Ronda would prefer the dead end- they own middle sister	INFO

NEXT MEETING

FALL 2018

APPENDIX I
CEPA Documentation

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Appendix I. CEPA Documentation I-1

Resilient Bridgeport Benefit Cost Analysis, Methodology Report (April 21, 2017)

Design Strategies Report 2B, Resilient Bridgeport: Benefits (February 28, 2018)

Resilient Bridgeport Benefits Summary (March 26, 2018)

Appendix I. CEPA Documentation

Table I-1. Cross-Reference Between CEPA Environmental Impact Evaluation Requirements and Resilient Bridgeport DEIS

CEPA EIE REQUIREMENT	RESILIENT BRIDGEPORT DEIS SECTION
Description of the Proposed Action	Section 1.3, Proposed Action Section 3.2.2, RBD Pilot Project Alternatives Section 3.3.5, Alternatives Carried Forward for Evaluation in this DEIS Section 3.3.6.2, Resilience Center, Project Alternatives
Purpose and Need	Chapter 2, Purpose and Need
Alternative Analysis	Chapter 3, Concept and Alternatives Development
Existing Environment and Impact Evaluations:	Chapter 4, Affected Environment and Environmental Consequences
Traffic	Section 4.13.3, Transportation
Air Quality	Sections 4.16, Air Quality & Greenhouse Gas Emissions
Noise	Section 4.7, Noise and Vibration
Water Resources	Sections 4.11, Water Resources and Water Quality
Wetlands	Section 4.8, Natural Resources
Water Quality	Sections 4.11, Water Resources and Water Quality
Groundwater Quality	Sections 4.11, Water Resources and Water Quality
Coastal Resources	Section 4.12, Coastal Zone Management
Endangered, Threatened, or Special Concern Species or Habitat	Section 4.8, Natural Resources
Fish and Wildlife, Habitats, and Ecosystems	Section 4.8, Natural Resources
Historic Sites, Districts, and Archeologically Sensitive Areas	Section 4.5, Cultural Resources
Visual Resources (aesthetic and scenic resources)	Section 4.4, Urban Design and Visual Resources
Agricultural Lands and Soils	Section 4.9, Geology and Soils
Pesticides, Toxic or Hazardous Materials	Section 4.6, Hazardous Materials
Energy (Use and Conservation)	Section 4.13.2, Utilities Section 4.13.3, Transportation Section 4.16, Air Quality & Greenhouse Gas Emissions
Public Health and Safety	Section 4.14, Community Facilities and Public Services
Consistency with State Environmental Equity Policy	Section 4.3, Environmental Justice
Consistency with Adopted Municipal and Regional Plans	Section 4.1, Land Use, Zoning and Public Policy
Consistency with State Plan of Conservation and Development	Section 4.1, Land Use, Zoning and Public Policy
Consistency with Connecticut Coastal Management Act	Section 4.12, Coastal Zone Management
Cumulative Impacts	Chapter 5, Cumulative Impacts
Construction Related Impacts	Section 4.7, Noise and Vibration Section 4.13.3, Transportation Section 4.16, Air Quality & Greenhouse Gas Emissions
Unavoidable Adverse Environmental Impacts	Section 4.17, Summary of Environmental Consequences
Irreversible and Irretrievable Commitment of Resources	Section 4.17, Summary of Environmental Consequences
Summary of Mitigation Measures	Section 4.17, Summary of Environmental Consequences
Cost Benefit Analysis	Appendix I
Potential Certificates, Permits, and Approvals	Section 4.17, Summary of Environmental Consequences
Conclusions	Section 4.17, Summary of Environmental Consequences
References	Chapter 7, References

Resilient Bridgeport Benefit Cost Analysis, Methodology Report

(April 21, 2017)

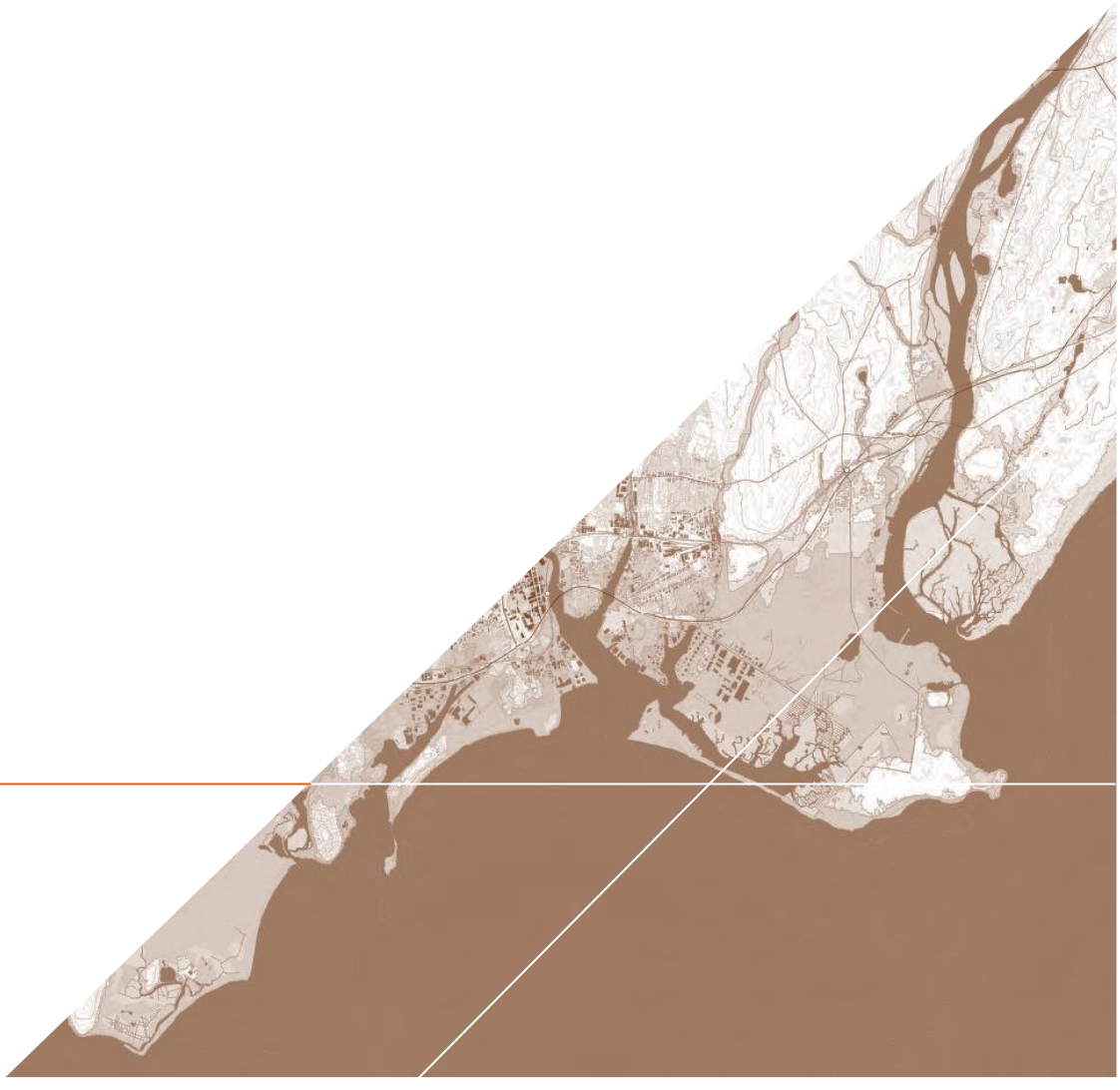
ARCADIS Design & Consultancy for natural and built assets

RESILIENT BRIDGEPORT

BENEFIT COST ANALYSIS

METHODOLOGY REPORT

April 21, 2017



BENEFIT COST ANALYSIS

Methodology Report

Macy Fricke, CFM
Management Consultant

Edward Fernandez, CFM
Senior Management Consultant

Hugh Roberts, PE
Associate Vice President

Prepared for:

Connecticut Department of Housing

Prepared by:

Arcadis U.S., Inc.

Our Ref.:

LA003323.0000

Date:

April 21, 2017

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VERSION CONTROL

Issue	Revision No	Date Issued	Page No	Description	Reviewed by
001	Rev. 1			Draft	E. Fernandez
002	Rev. 2			Draft	H. Roberts
003	Rev. 3			Final Draft	E. Fernandez

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Appendix B: Benefit Cost Analysis Crosswalk

Appendix C: Depth Damage Functions

Appendix D: Rebuild by Design Pilot Project Cost Estimates

Appendix E: Occupancy Mapping

Appendix F: Additional Benefit Cost Analysis Resources

ACRONYMS AND ABBREVIATIONS

ARC: American Red Cross

BCA: Benefit Cost Analysis

BCAR: BCA Re-Engineering Report

BCR: Benefit Cost Ratio

BEA: Bureau of Economic Analysis

BLS: Bureau of Labor Statistics

BRV: Building Replacement Value

CDC: Centers for Disease Control

CRV: Contents Replacement Value

CSRV: Contents-to-Structure Ratio Value

CSO: Combined sewer overflow

CSS: Combined sewer system

DDF: Depth-Damage Function

DEEP: Connecticut Department of Energy and Environment

DEM: Digital Elevation Model

DOH: Connecticut Department of Housing

EPA: U.S. Environmental Protection Agency

EIS: Environmental Impact Statement

FAA: Federal Aviation Administration

FEMA: Federal Emergency Management Agency

FIS: Flood Insurance Study

FIRM: Flood Insurance Rate Map

FFE: First Floor Elevation

GCP: Gross city product

GDP: Gross domestic product

GIS: Geographic Information System

HUD: United States Department of Housing and Urban Development

LiDAR: Light Detection and Ranging

MEP: Mechanical/Engineering/Plumbing

NACCS: North Atlantic Coast Comprehensive Study

NAICS: North American Industry Classification System

NAVD88: North American Vertical Datum of 1988

NDR: National Disaster Resilience

NOAA: National Oceanic and Atmospheric Administration

NPV: Net present value

NRCS: Natural Resources Conservation Service

OMB: United States Office of Management and Budget

PTSD: Post-traumatic stress disorder

RBD: Rebuild by Design

SAM: Social Accounting Matrix

SF: Square Feet

SLR: Sea Level Rise

TM: Technical Manual

UDV: Unit Day Value

USACE: U.S. Army Corps of Engineers

WTP: Willingness to Pay

1 INTRODUCTION

During Tropical Storm Irene (Federal Emergency Management Agency [FEMA] Major Disaster Declaration [DR] -4023) and Hurricane Sandy (DR-4087), floodwaters from Long Island Sound inundated roadways, critical infrastructure, businesses, and homes in low-lying areas, directly affecting the South End's residents and businesses. Following the devastation from Hurricane Sandy, the U.S. Department of Housing and Urban Development (HUD) launched Rebuild by Design (RBD) to inspire innovative community and policy-based resilience solutions to protect cities most vulnerable to intense weather events.

HUD awarded the Connecticut Department of Housing (DOH) $10 million to reduce flood risk for the most vulnerable public housing stock in Bridgeport through continued planning and evaluation of long-term resiliency strategies, as well as designing a RBD pilot project aimed at alleviating acute and chronic flooding in the South End neighborhood. To this end, the Resilient Bridgeport Team, led by Waggonner & Ball with Arcadis, Yale Urban Design Workshop and Reed Hilderbrand Landscape Architects, has developed an innovative and multifaceted RBD project in the South End to provide benefits to the neighborhood by means of dry egress and stormwater management.

The Resilient Bridgeport Team completed a benefit cost analysis (BCA) to evaluate the RBD project at its current level of design as part of the design process. The BCA assesses resiliency, social, environmental, and economic benefits that will result from the implementation of the RBD project. In accordance with HUD Notice: CPD-16-06, the BCA uses federally accepted standard figures and methods to assess project benefits.

This appendix serves to provide a detailed description of the BCA methods summarized in the BCA Report, and includes the following principle sections:

- **Section 1 Introduction** includes a BCA overview.
- **Section 2 RBD Project Description** summarizes the RBD project and project costs.
- **Section 3 Resiliency Benefits** includes detailed methodologies used to determine resilient redevelopment and dry egress benefits.
- **Section 4 Value Added** describes in detail the methods used to evaluate social, environmental, and economic benefits.
- **Section 5 Sensitivity Analysis** includes a describes how analysts approached BCA assumptions and the discount rate.
- **Section 6 Double Counting** describes how analysts approached potentially overlapping benefits in the BCA.
- **Section 7 Benefit Cost Analysis Results** presents BCA findings.
- **Section 8 Economic Impact Analysis** is a detailed description of the methodology used to evaluate economic impacts of project implementation.

To facilitate HUD's review of the BCA Summary Report and BCA Methodology Report, analysts completed two crosswalks:

1. **Appendix A: HUD Crosswalk** summarizes the pilot project's benefits, costs, and BCA methods.
2. **Appendix B: BCA Crosswalk** relates CPD Notice 16-06 requirements to report sections.

1.1 Benefit Cost Analysis Overview

A benefit cost analysis (BCA) helps inform sound decision making related to public infrastructure investment. BCA benefits represent the present value of the total expected annual losses avoided and value added over the RBD project's useful life. The BCA accounts for:

- Probabilities of flood events and losses
- Project useful life
- Time value of money (discount rate)

Resiliency benefits are future losses prevented or reduced by the RBD project. Analysts estimate losses avoided for certain modeled flood scenarios, then apply the annual probability of occurrence to losses at each flood scenario to determine expected annual losses avoided. Probability of occurrence refers to the percent chance of an expected flood event being met or exceeded in any given year.

$$Annual\ Resiliency\ Benefits = \sum_{s=1}^{s=4} Expected\ Losses\ Avoided \times Annual\ Probability\ of\ Occurence$$

Where:

S = annual flood event scenario

Analysts project and discount annual benefits and project life-cycle costs[1] over the RBD project's useful life (50 years) using a 7 percent discount rate to find the present value of project benefits. The project useful life is the estimated amount of time the project will be effective. The discount rate determines the time value of money; in other words, the discount rate accounts for the fact that monetary value tomorrow will not be as much as it is in the present. The Office of Management and Budget (OMB) mandates the discount rate to be 7 percent, but HUD also considers a 3 percent discount rate for review per HUD Notice: CPD-16-06.

The BCR is the project's total present value of benefits divided by the project's total present value of life-cycle costs. NPV is the difference between the present value of a project's total benefits and the present value of a project's total life-cycle costs. Both the NPV and BCR inform the RBD project's cost effectiveness and ensure the project is fiscally beneficial.

$$Net\ Present\ Value = Present\ Value\ of\ Project\ Benefits - Present\ Value\ of\ Project\ Costs$$

$$Benefit\ Cost\ Ratio = \frac{Present\ Value\ of\ Project\ Benefits}{Present\ Value\ of\ Project\ Costs}$$

This BCA presents benefits and costs in 2016 dollars. The sections below describe the RBD project and the detailed methods analysts used to determine annual resiliency benefits and value added benefits that Bridgeport will realize once it implements the pilot project.

[1] Project life cycle costs include direct capital costs and operations and maintenance cost over the life of the project.

2 REBUILD BY DESIGN PILOT PROJECT

Through stakeholder meetings, community engagement, mapping, and modeling, the RBD project team has come to understand the different impacts that chronic and acute flooding have on the community, and the risks posed by climate change and sea level rise (SLR). Though the primary intent of the RBD project is to reduce these impacts on the project area, the project team has also designed the project to serve as a proof of concept for broader resilience principles within Bridgeport and the region. The project and the collaboration that it requires will result in the demonstration of best practices for agencies and private entities. It is intended to provide a precedent for future development, as well as encourage the adoption and implementation of updated local policies, zoning regulations, and building code standards by the City of Bridgeport.

Further, the State of Connecticut has committed to developing and implementing a set of resilience performance standards for the RBD project. The State will coordinate the standards developed or the project with those that are being developed for the National Disaster Resilience (NDR)-funded infrastructure of similar nature being implemented in the South End of Bridgeport. Overtime, these performance standards will be refined based on the outcomes of the RBD project and South End NDR project so that they can continually be applied to any future development projects throughout the State.

The RBD project will extend Johnson Street to provide dry egress for future Mariana Village residents out of the FEMA 500-year flood zone, as well as future SLR conditions of 3 feet. The Johnson Street Extension will incorporate green infrastructure, such as bioswales, to divert surface runoff away from the combined sewer system and into a multifunctional stormwater park. Stormwater park components such as terraced basins and underground storage features will retain, delay, and improve the quality of stormwater runoff. Community gathering spaces, play equipment and courts, and walkways in the stormwater park will provide space for community programs, environmental education, and passive and active recreation. The park component will also include new flora and fauna.

The stormwater park will collect surface water, which will be gravity drained to a new pump station located at the southeast corner of South Avenue and Iranistan Avenue. A new underground force main will pump the flow to an existing outfall at Cedar Creek, the Little Regulator Outfall. By removing stormwater from the combined sewer system, a reduced load will be routed to the wastewater treatment plant on the west side of Bridgeport. Similarly, bringing additional stormwater to the head end of Cedar Creek will improve flushing and overall ecological function of the creek. RBD project costs include direct capital costs, as well as operation and maintenance (O&M) costs over the project useful life. **Table 1** summarizes the total value of each cost category. Refer to **Appendix D: Rebuild by Design Pilot Project Cost Estimates** for a detailed description of project costs.

Table 1. Summary of RBD Project Costs

Cost Category	Costs (7 Percent Discount Rate)	Costs (3 Percent Discount Rate)
Capital Costs	$ 8,200,000	$ 8,200,000
Annual O&M Costs	$ 75,000	$ 75,000
Present Value O&M Costs	$ 1,035,060	$ 1,912,620
Total Project Costs	**$ 9,235,060**	**$ 10,112,620**

2.1 Project Timeline

It is anticipated that the RBD project will be completed by the end of 2021. The project has not yet been permitted, but preliminary permitting requirements have been identified and additional permit requirements may be identified during the development of an Environmental Impact Statement (EIS). An aggregated EIS to include both the RBD project and the Bridgeport resilience projects is being funded through the State of Connecticut's National Disaster Resilience Grant award. The State is currently concluding a public procurement process that will result in a consultant team being engaged under contract to complete the Environmental Impact Statement and other tasks designed to move forward the projects funded by both RBD and NDR.

Concurrent to this procurement process, the State's existing consultant team is also advancing the project to a 30% design stage. It is expected that environmental review, preliminary design, and permitting will continue into the last quarter of 2018 and construction will commence in early 2019 and continue into the middle of 2021. A Notice of Intent to Prepare an EIS as required under 24 CFR Part 58.55 is anticipated to be published in the Federal Register in September 2017 thereby launching the public scoping process. **Table 2** below delineates the major milestones for project completion including remaining design and engineering work, permitting, bidding, and construction.

Table 2. RBD Project Milestone Timeline

Activity Milestone	Start Date	End Date
CDBG-DR Action Plan Substantial Amendment	February 2017	June 2017
30 Percent Design Completion	February 2017	June 2017
Resilience Strategies Finalization	December 2016	June 2017
Environmental Impact Statement	June 2017	July 2018
Final Design Documents	July 2017	November 2018
Project Permitting	October 2017	November 2018
RBD Project Construction	November 2018	September 2021

3 RESILIENCY BENEFITS

Resiliency benefits are the result of the RBD project's expected effectiveness at protecting against future flooding impacts. Resiliency benefits are related to resilient redevelopment or dry egress. These benefits are the largest category of benefits quantified for the RBD project. Resilient redevelopment benefits include direct physical damages, displacement costs, mental stress and anxiety, and lost productivity. Dry egress benefits include loss of road service, injuries and fatalities (**Table 3**). The BCA estimates these losses as probabilistic outcomes of flood risk from acute and chronic flood events. This BCA evaluates losses at the 10-precent, 2-percent, 1-percent, and 0.2-percent annual chance flood event, sourced from the Fairfield County Flood Insurance Study (FIS). Analysts calculate resiliency benefits for current or future Marina Village buildings.

Table 3. Resiliency Benefits Matrix

Benefit Category	Measurable Benefit/Metric	Stormwater Park	Johnson Street Extension		Marina Village Redevelopment
			Green Infrastructure	Raised Road	
Resilient Redevelopment	Physical Damages				X
	Displacement Costs				X
	Mental Stress and Anxiety				X
	Lost Productivity				X
Dry Egress	Fatalities			X	
	Injuries			X	
	Loss of Roadway Service			X	

The stormwater park and John Street Extension's green infrastructure contribute to reduced flood risk during chronic flood events, resulting in resiliency benefits. Acute flood events are more severe and result in greater flood impacts; therefore, resiliency benefits for acute flood events inherently capture benefits of lesser magnitude events. As such, analysts have not conducted a separate analysis.

3.1 Resilient Redevelopment

Marina Village, the site of a former public housing development and the future home of a mixed income residential development, is the focal point of the RBD project. The Resilient Bridgeport Team designed project components to benefit the future mixed income redevelopment by reducing stormwater flooding impacts and providing dry egress out of the FEMA 500-year flood zone plus SLR. Because Connecticut building code requires dry egress from the 500-year flood zone for critical developments (e.g., public housing developments), the Johnson Street Extension of the RBD project serves as a catalyst for the resilient redevelopment of the site.

The BCA captures the benefits of the resilient redevelopment by evaluating the flood impacts that would otherwise occur within Marina Village, as well as the economic benefits realized after the redevelopment of the site. The following section describe the methods used to evaluate losses avoided due to resilient

redevelopment. Section **5.2.3 Economic Revitalization** describes the economic revitalization methodology.

3.1.1 Direct Physical Damages – Buildings and Contents

Resilient redevelopment will reduce the risk of direct physical damage to the future development on the Marina Village site by reconstructing buildings to the 500-year flood elevation. Direct physical damages include the degradation and destruction of property and are quantified through monetary losses. The BCA categorizes property loss as both structural damage (i.e., damage that applies to real property) and content damage (i.e., damage to personal property or inventory).

Analysts evaluate property losses using Depth Damage Functions (DDFs) developed by the United States Army Corps of Engineers (USACE); DDFs relate the flood depth at a structure to an expected percent damage for structures and contents. This percent damage is applied to a building or contents replacement value to estimate monetary loss. Analysts calculate property damage results using building data as of 2015 and RS Means 2016 replacement cost values.

3.1.1.1 Depth Damage Functions

Analysts calculated expected property losses associated with the Fairfield County FIS flood scenarios using standardized depth-damage functions (DDFs) specific to the characteristics and occupancy of a structure. A DDF correlates the depth, duration, and type of flooding to a percentage of expected damage to a structure and its contents, including inventory. The USACE produces DDFs that analysts can use to model direct physical damages. Following Hurricane Sandy, the USACE developed DDFs specific to the Northeast for coastal flooding in a report titled the North Atlantic Coast Comprehensive Study (NACCS). As this information contains the most current and best available data, analysts used these functions to evaluate direct physical damages. **Figure 1** provides a sample depth damage relationship from the USACE NACCS.

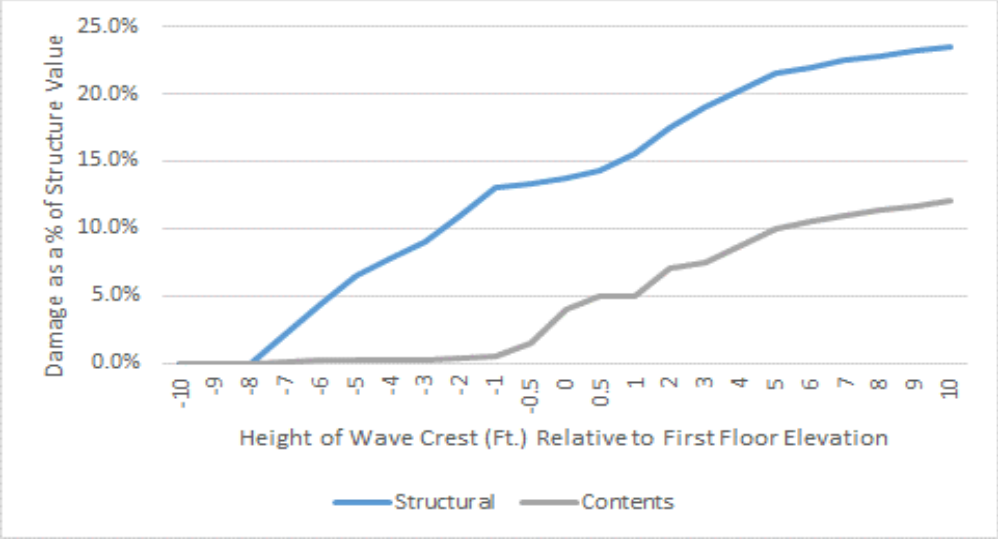


Figure 1. Expected Structural and Contents Damage from Inundation, NACCS Urban High Rise Prototype. Damage at negative flood depths accounts for impacts to mechanical, electrical, and plumbing systems that may be located at or below grade.

3.1.1.2 Data Sources

BCA analysts utilized the following data sources to calculate expected structure, contents, and inventory losses avoided:

- **City of Bridgeport Tax Assessor Data (2015):** Attributes from this dataset used in the direct physical damage analysis include: square footage, number of stories, building elevation, and building use. This dataset also provided building footprints.
- **RS Means Building Construction Cost Data (2016):** This publication provides location-specific building replacement square foot costs for 160 building occupancy types. Using RS Means, analysts calculated building replacement square foot costs for the various structure types in Bridgeport.
- **USACE North Atlantic Coast Comprehensive Study (NACCS) Physical Depth Damage Function Summary Report (2015):** Following Hurricane Sandy, the USACE collected empirical data to estimate the damages that would occur from future events. This report produced damage functions for residential, non-residential, and public property. Analysts used DDFs from this study to estimate direct physical damages.
- **USACE West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study (2014):** This study conducted by the USACE produced contents-to-structure ratio values (CSRVs) for residential and non-residential structures. CSRVs are a percentage of the total building replacement values, and analysts used CSVR's determine total contents replacement values for structures in the project area. While produced for a separate region, analysts determined this study to be the best and most recent data available for use with the DDFs.
- **Connecticut Department of Energy and Environmental Protection Digital Elevation Model (2011):** A Department of Energy and Environmental Protection (DEEP) digital elevation model (DEM) is a model of the ground surface, and provides the ground elevation for structures. The DEM is a raster layer of high-resolution ground elevation data based on information from bare-earth LiDAR elevation data collected and compiled during December 2006 and Spring/Summer 2004.
- **Fairfield County Flood Insurance Study (2013):** provides flood elevations for the 10 percent, 2 percent, 1 percent, and 0.2 percent flood events. Analysts use flood elevations to approximate flood depths inside structures.

3.1.1.3 Approach

Analysts completed the following six steps to conduct the direct physical damages analysis.

1. Develop Asset Inventory

Analysts identified benefitting structures (e.g., the redevelopment of Marina Village) and gathered building attributes necessary for analysis, such as number of stories, area, and building use, from Bridgeport's tax assessor data (**Table 4**). Analysts used the attributes of the Marina Village building stock prior to demolition as it is the best available data at the time of analysis; analysts assumed the redevelopment of Marina Village will be a similar style and density multi-family housing complex. Analysts merged building footprints and parcel level data using the unique identification number.

Table 4. Building Attributes

Attribute	Analysis Use
Parcel ID	Key location identifier specific to a parcel
Unique ID	Key location identifier specific to a building
Address	Key location identifier
Living Area	Used in square footage analysis and replacement value calculation
Land Occupancy Description	Building use
Land Use Description	Secondary identifier of building use
Number of Stories	Used in square footage analysis

Ground Elevation

Structure grade elevation is an essential field used to estimate the approximate flood depth within structures. To determine the structure grade elevation, analysts extracted the average elevation within a structure footprint from the DEEP DEM.

2. Map Building Use to Depth Damage Functions, Replacement Values, and Hazus Occupancy Types

Buildings may be classified according to both construction features (type) and use (occupancy); analysts use these classifications to determine further information about the structure. For example, BCA analysts mapped land occupancy descriptions to classifications used by RS means to estimate replacement value for a structure. Analysts completed the following mappings based on land occupancy descriptions:

- Land occupancy description to USACE NACCS DDFs. Refer to **Appendix C: Depth Damage Functions** for a listing of land occupancies and damage functions.
- Land occupancy description to contents/inventory value shares described in the USACE Lake Pontchartrain Study to assign the appropriate CSRV's. Refer to **Appendix E: Occupancy Mapping** for the full mapping scheme
- Land occupancy description to Hazus occupancy classes to estimate a replacement value for structures, as well as apply the appropriate business interruption time multipliers, one-time disruption costs, and for certain uses, the percent owner occupancy. Refer to **Appendix E: Occupancy Mapping** for the full mapping scheme.

3. Conduct Square Footage Analysis

Damages must be assessed based on the square footage within a certain number of stories NACCS identifies for each DDF.[2] The number of stories analysed by the DDF is related to the structure type and the expected location and value of mechanical, electrical, and plumbing (MEP) in buildings. A significant portion of a building's value is captured in such assets; damage costs to these assets can therefore be disproportionate to those of other assets. Urban high rise damage functions, for example, analyse damages as a percent of the square footage of the first ten floors given the NACCS assumption that MEP assets are located within the basement or first floor of the structure.

[2] U.S. Army Corps of Engineers. North Atlantic Coast Comprehensive Study (NAACS). http://www.nad.usace.army.mil/CompStudy

To calculate the structure square footage for the analysis, analysts multiplied the square footage per floor by the DDF's number of stories identified by NACCS (**Table 5**) or the total number of stories, whichever is less, for each structure. Analysts use the analysis square footage to calculate the building and contents replacement value, as described in the next steps.

Table 5. USACE NACCS, Number of Stories per Depth Damage Function

DDF No.	Building Types	Stories (for Analysis)
1A-1	Apartment 1-Story, No Basement	1
1A-3	Apartment 3-Story, No Basement	3
2	Commercial Engineered	2
3	Commercial Non-Engineered	1
4A	Urban High Rise	10
4B	Beach High Rise	10
5A	Residential 1-Story, No Basement	1
5B	Residential 2-Story, No Basement	2
6A	Residential 1-Story, With Basement	1
6B	Residential 2-Story, With Basement	2
7A	Building on Open Pile Foundation	1
7B	Building on Pile Foundation with Enclosures	1

Source: North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk. Physical Depth Damage Function Summary Report. January 2015.

4. Determine Building and Contents Replacement Value

Building replacement values (BRVs) and Contents Replacement Values (CRVs) are necessary to place a value on expected damage to buildings. Analysts used RS Means 2016 Square Foot Costs to estimate the BRV.

Building Replacement Value

The BCA Re-engineering Guide defines the BRV as, "the building replacement value for a specific component of the building, expressed in dollars".[3] Analyst used RS Means square foot costs to estimate building replacement values for each Hazus occupancy class[4]. RS Means is a construction cost estimating resource published each year often used by engineers to evaluate different construction cost possibilities. RS Means square foot costs capture labor and material costs, and other information such as city cost

[3] Federal Emergency Management Agency. Benefit Cost Analysis Re-engineering Guide. Full Flood Data. 2009. Located at: http://www.fema.gov/media-library-data/20130726-1738-25045-2254/floodfulldata.pdf
[4] Hazus occupancy classes represent a certain building type based on use, and the FEMA Hazus-MH Flood Technical Manual applies an average square footage to each occupancy class. This average square footage was used to choose the appropriate replacement value per square foot from the RS Means cost data book.

indexes, productivity rates, crew composition, and contractors overhead and profit rates are also available. Analysts used the appropriate RS Means city cost indices of 1.12 for residential uses and 1.09 for commercial uses to accommodate construction conditions in Bridgeport. **Table 6** shows the BRV values determined from RS Means with the city cost index increase for Fairfield County. The building replacement value represents the cost to repair or rebuild damaged buildings in current dollars.

Contents Replacement Value

The USACE NACCS does not include content replacement ratios, therefore analysts used the next best available data. The CRV is based on the contents-to-structure ratio values (CSRV) for residential and non-residential structures from data obtained through surveys in the *West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study (***Table 6***).*[5] To calculate the CRV, analysts multiplied the total BRV by the appropriate CSRV, mapped to the Hazus occupancy class. Because the contents values are based on percentages, they increase coincident with an increase in the BRV and do not need to be updated to Bridgeport specific values.

Table 6. Replacement Values

Hazus Occupancy Code	Occupancy Code Description	BRV	CSVR	CRV
RES1	Single Family Dwelling	$130.34	0.69	$89.93
RES2	Mobile Home	$125.17	1.14	$142.70
RES3A	Multi Family Dwelling - Duplex	$107.23	0.69	$73.99
RES3B	Multi Family Dwelling – 3-4 Units	$206.99	0.69	$142.82
RES3C	Multi Family Dwelling – 5-9 Units	$206.99	0.69	$142.82
RES3D	Multi Family Dwelling – 10-19 Units	$197.06	0.69	$135.97
RES3E	Multi Family Dwelling – 20-49 Units	$191.07	0.69	$131.84
RES3F	Multi Family Dwelling – 50+ Units	$184.55	0.69	$127.34
RES4	Temporary Lodging	$192.14	0.69	$132.57
RES5	Institutional Dormitory	$220.99	0.69	$152.49
RES6	Nursing Home	$224.80	0.69	$155.11
COM1	Retail Trade	$127.17	1.19	$151.33
COM2	Wholesale Trade	$123.23	2.07	$255.09
COM3	Personal and Repair Services	$148.21	2.36	$349.78
COM4	Business/Professional/Technical Services	$183.48	0.54	$99.08
COM5	Depository Institutions	$276.60	0.54	$149.36
COM6	Hospital	$394.26	0.54	$212.90
COM7	Medical Office/Clinic	$223.50	0.54	$120.69
COM8	Entertainment & Recreation	$233.01	1.70	$396.13
COM9	Theaters	$195.78	0.54	$105.72

[5] USACE. 2014. West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study – Final Integrated Feasibility Study Report and Environmental Impact Statement. November.

Hazus Occupancy Code	Occupancy Code Description	BRV	CSVR	CRV
COM10	Parking	$82.52	0.54	$44.56
IND1	Heavy	$140.17	2.07	$290.16
IND2	Light	$123.23	2.07	$255.09
IND3	Food/Drugs/Chemicals	$189.91	2.07	$393.10
IND4	Metals/Minerals Processing	$189.91	2.07	$393.10
IND5	High Technology	$189.91	2.07	$393.10
IND6	Construction	$123.23	2.07	$255.09
AGR1	Agriculture	$123.23	N/A	N/A
REL1	Church/Membership Organizations	$197.03	0.55	$108.36
GOV1	General Services	$157.02	0.55	$86.36
GOV2	Emergency Response	$262.05	1.50	$393.07
EDU1	Schools/Libraries	$210.99	1.00	$210.99
EDU2	Colleges/Universities	$185.28	1.00	$185.28

5. Determine Flood Depth

Analysts subtracted grade elevations from the FEMA defined 10 percent, 2 percent, 1 percent, and 0.2 percent flood elevations to determine the expected flood depths in structures. The USACE NACCS DDFs account for expected first floor elevation (FFE) by occupancy type and age, as well as the presence of mechanical, electrical, and plumbing (MEP) located in the basement. Since the DDFs incorporate these building attributes, it is not necessary to account for FFE in the asset inventory. To determine the flood depths, analysts obtained the flood elevation within a building footprint for each flood scenario, and subtracted the average grade elevation from the respective flood elevations to obtain a flood depth for each flood scenario.

6. Estimate Percent Damage and Monetary Losses

As previously mentioned, DDFs are a relationship between the depth of floodwater in a structure and the percent of flood damage. Once BCA analysts established the expected flood depth for each flood scenario, they applied the DDF to estimate the percent of structural or contents damage; this percentage is applied to a structure's BRV or CRV to produce a physical loss value in dollars. Analysts applied the annual probability of each flood scenario to expected flood impacts to calculate annual benefits (**Table 7**). Ultimately, benefits represent the present value of the sum of expected annual avoided damages over the project useful life.

Table 7. Direct Physical Damage Results

Flood Scenario (Percent Annual Chance Event)	Loss Category		Total Direct Physical Damages
	Building Losses	Contents Losses	
10 Percent	$2,007,510	$2,326,120	$4,333,630
2 Percent	$3,285,290	$4,620,570	$7,905,860
1 Percent	$4,003,460	$5,792,100	$9,795,560
0.2 Percent	$6,171,770	$9,453,250	$15,625,020
Annualized Losses Avoided	*$318,840*	*$401,850*	*$16,772,570*

3.1.1.4 Assumptions

BCA analysts made the following assumptions to account for uncertainties and limitation of the analysis:

- The USACE NACCS DDFs account for underground vulnerabilities by applying a percent damage for negative flood depths.
- The NACCS DDFs did not provide percent loss for all flood depth intervals for all occupancies, and provided no percent loss above ten feet of flood depth. As such, analysts developed trend interpolations based on the preceding three available flood depths for missing DDFs. A similar approach was used for flood depth gaps below zero flood depth, using averages between flood depths, where available.
- The DDFs do not assume complete loss beyond 50 percent damage, as is often assumed for use with benefit cost analyses, as well as substantial damage determinations. Further, the analysis does not consider the impacts of codes and standards in restoration. As such, direct physical damage costs may be conservatively low.
- Benefits begin the year Marina Village redevelopment is complete, which is 2023.
- The RBD project life-cycle costs do not include the costs associated with the redevelopment of the Marina Village site. In Connecticut, activities such as the construction of public housing in the floodplain are considered a "critical activity." Critical activities are regulated to the 500-year flood elevation when applying to the Department of Energy and Environment Protection for a Flood Management Certification.[6] These costs are not included in the analysis, since they are activities associated with the minimum standards per the Regulations of Connecticut State Agencies and not an additional expense to develop to a higher standard.
- Analysts assume the redevelopment of Marina Village will be a similar style and density multi-family housing complex. As such, analysts consider the number of future population and units within the site to be similar. The analysis does not consider an increase in development or population density, resulting in a conservative analysis.

3.1.2 Displacement Costs

Residents of impacted structures may experience displacement costs during the time when a building becomes uninhabitable due to flood damage. Relocation costs are associated with moving a household or a business to a new location and resuming business in that new location. Relocation costs are derived from

[6] Sections 25-68h-1 through 25-68h-3, Regulations of Connecticut State Agencies

displacement time, which is derived from DDFs that relate a depth of flooding to an amount of time a structure is not usable. The overall approach taken to evaluate relocations costs is:

1. Identify flood depths and damage expected at the 10 percent, 2 percent, 1 percent, and 0.2 percent annual chance flood event
2. Determine expected displacement time based on flood depth and building use
3. Calculate relocation costs

3.1.2.1 Data Sources

BCA analysts used the following data sources when evaluating displacement costs:

- **Hazus-MH 3.2 One-time Disruption Cost Defaults:** Hazus provides national one-time relocation costs per square foot based on Hazus occupancy class. These costs are provided in 2006 dollars and have been normalized to 2016 dollars based on inflation. Refer to **Appendix F: Additional Benefit Cost Analysis Resources** for Hazus-MH 3.2 manual excerpts.
- **US Census Bureau American Community Survey 5-Year Estimates (2014):** provided the percent owner occupancy by census block for residential uses. Analysts used Hazus-MH 3.2 default values for commercial structures as local figures were not readily available.
- **Hazus-MH 3.2 Percent Owner Occupancy Defaults:** Hazus provides percent owner occupancy for non-residential uses by Hazus occupancy class (local value not available).
- **Direct Physical Damages:** Flood impacts were modeled for different flood scenarios to determine which structures are expected to flood and the depth of flooding within the structure (see **2.2.1 Direct Physical Damages – Buildings and Contents**).
- **FEMA BCA Toolkit 5.3:** Depth displacement tables were not provided with the USACE NACCS DDFs used in the direct physical damage analysis, therefore analysts extracted displacement tables from the BCA Toolkit to determine displacement time for structures based on flood depth.
- **Local Rental Rates:** Analysts researched local rent rates within the project area and applied these rates by occupancy. An online survey of varied sizes and types of residential spaces currently available for rent within the South End established local residential rental rates. Local commercial rental rates were obtained in the same manner as residential rental rates. Analysts used Loopnet to obtain commercial rental values, and Trulia, and Zillow to conduct the residential survey (all online real estate services).

3.1.2.2 Approach

1. Identify Impacted Structures: The direct physical damages analysis identified structures expected to be impacted at the 10 percent, 2 percent, 1 percent, and 0.2 percent annual chance flood events.

2. Identify Impacted Square Footage: For structures that are expected to experience less than ten feet of flooding, the total impacted square footage is the area of the first floor. Analysts use the total square footage of the first two floors when a structure experiences more than ten feet of flooding.

3. Identify and Apply Percent Owner Occupied by Occupancy: For residential uses, census block level data provided the percent owner occupied. Analysts assigned all non-residential uses default percent owner occupancy obtained from Hazus-MH 3.2.

4. Identify Rental Rates by Occupancy: Analysts categorized available rental units by commercial and residential uses for the project area, and then calculated an average rent price per square foot per year for each use. The results of this analysis indicate that the average annual price per square foot for commercial properties in 2016 is $10.05, and the average annual price per square foot for residential properties in 2016 is $13.13. Analysts converted these values to an average price per square foot per day for use in the relocation cost calculation outlined below.

5. Evaluate Displacement Time: The estimated flood depth within each structure is correlated to USACE depth displacement tables to estimate displacement time for each modeled flood scenario.

6. Process Relocation Costs: Analysts processed relocation costs to building occupants based on occupancy type.[7] Displacement costs, or relocation costs, are a product of percent damage, impacted square footage, disruption costs per occupancy, rental costs, displacement time, and percent owner occupied. Analysts applied the probability of each flood scenario to expected impacts to calculate annual benefits (**Table 8**).

$$Relocation\ costs = If\ percent\ damage\ is$$
$$> 10\ percent: Impacted\ floor\ area \times (1 - percent\ owner\ occupied) \times disruption\ cost$$
$$+ percent\ owner\ occupied \times (disruption\ cost + rental\ cost \times displacement\ time)]$$

Table 8. Relocation Costs Avoided

Flood Scenario (Percent Annual Chance Event)	Relocation Costs
10 Percent	-
2 Percent	$18,180
1 Percent	$53,770
0.2 Percent	$124,300
Annualized Losses Avoided	*$1,150*

3.1.2.3 Assumptions

- Relocation costs are only calculated for floors expected to be directly impacted by floodwaters. There are times when the entire structure will be displaced because of flood impacts. As a result, this approach produces conservative results.
- Depth displacement tables used in the analysis do not consider flooding below grade. Utilities and other critical assets may lie below grade. When these areas flood, occupants may be displaced, even if flood waters do not reach above the first floor. The analysis does not capture such displacement.
- The depth displacement tables do not extend beyond 16 feet of flood depth. As such, analysts assume displacement periods for flood depths above 16 feet match the time for displacement at 16 feet.

[7] It is important to note that this equation incorporates only owner-occupied structures when calculating displacement values. The reason for this is that a renter who has been displaced would likely cease to pay rent to the building owner of the damaged property, and instead would pay rent to a new landlord. As such, the renter could reasonably be expected to incur no new rental expenses. Conversely, if the damaged property is owner-occupied, then the owner will have to pay for new rental costs in addition to any existing costs while the building is being repaired. This model assumes that it is unlikely that an occupant will relocate if a building is slightly damaged (less than 10% structure damage).

3.1.3 Mental Stress and Anxiety

Natural disasters threaten or cause loss of health, social, and economic resources, which leads to psychological distress.[8] Research indicates that individuals who experience significant stressors, such as property damage or displacement, are more likely to experience symptoms of mental illness, Post-Traumatic Stress Disorder (PTSD), and higher levels of stress and anxiety after a disaster.[9] Post-Hurricane Sandy research demonstrates there was a measurable spike in mental stress disorders after the event, including PTSD, anxiety, and depression.[10] As mental health issues increase after a disaster, it is expected that mental health treatment costs will also increase. The pilot project is expected to reduce flood impacts to homes and public transportation, and thus reduce risk of mental stress and anxiety post-disaster.

FEMA developed standard values to estimate the treatment costs of mental stress in a post- disaster situation, if a person has personally experienced damage to their residence. The following section describes FEMA's method to evaluate mental stress and anxiety impacts after a flood event.

3.1.3.1 Data Sources

- **FEMA's Final Sustainability Benefits Methodology Report (2012):** This report provides a method to calculate the cost of mental stress and anxiety treatment.
- **Direct Physical Damages:** Analysts use flood depths from Section **2.1.1 Direct Physical Damages – Buildings and Contents** to identify impacted buildings and population.
- **US Census Bureau American Community Survey (ACS) (2014) 5-Year Estimates:** This source provided population by census block.

3.1.3.2 Approach

The principle resource used to conduct the analysis is FEMA's Final Sustainability Benefits Methodology Report that accompanies the FEMA BCA Toolkit. Mental health treatment costs are measured using three factors: cost, prevalence, and course. Prevalence is the percentage of people who experience mental health problems after a disaster event, and course is the rate at which mental health symptoms reduce or increase over time. Cost is the cost of treatment to those who seek it. Analysts completed the following steps to estimate the expect cost of mental health treatment for each flood scenario.

1. Population Analysis

To analyze human impacts for each building, analysts must distribute the total population in the project area to each residential building. To do so, analysts distributed the population (from the 2014 ACS) to each building based on the ratio of a residential building's total square footage to the total residential square footage in the census block that contains the building.

[8] Hobfoll, S.E. 1989. Conservation of resources: A new attempt at conceptualizing stress. American Psychologist. 44:513–524. [PubMed: 2648906].
[9] Rhodes, J., Chan, C.,Pacson, C., Rouse, C.E., Waters, M., and E. Fussell. 2010.. The Impact of Hurricane Katrina on the mental and physical health of low-income parents in New Orleans. Am J Orthopsychiatry. April; 80(2): 237-247.
10 Beth Israel Medical Center data indicate a 69% spike in psychiatric visits in November 2012. Healthcare Quality Strategies Inc. reviewed Medicare claims before and after Hurricane Sandy in select communities in New Jersey and found that PTSD was up 12.2%, anxiety disorders were up 7.8%, and depression or proxy disorders were up 2.8%.

2. Determine Prevalence Rate and Course

FEMA's Final Sustainability Benefits Methodology Report[11] uses prevalence percentages and mental health expenses from Schoenbaum (2009) to derive a standard value for mental stress and anxiety costs. Prevalence percentages are adjusted over different time periods: mild to moderate impacts will reduce over time as treatment is provided, while severe mental health problems may persist much longer, possibly never being fully resolved.[12] **Table 9** provides a summary of prevalence considering course over four different time periods.[13] The FEMA methodology only captures mental health impacts for the first 30 months because prevalence rates after this period are not available.

Table 9. Mental Health Prevalence Rates After a Disaster

Time after Disaster	Severe	Mild/Moderate
7-12 months	6%	26%
13-18 months	7%	19%
19-24 months	7%	14%
25-30 months	6%	9%

Source: FEMA Updated Social Sustainability Methodology Report

3. Establish Treatment Cost

Schoenbaum provides an estimate of treatment costs in an ideal scenario where all needs are met. FEMA contends that treatment costs from the study must be adjusted to consider only those with mental health problems who will actively seek out treatment (41 percent).[14] FEMA uses the following steps to adjust total treatment costs from Schoenbaum for a percentage of individuals who seek treatment and for prevalence.

$$Cost\ per\ person\ seeking\ treatment = Treatment\ cost\ per\ person^{15} \times 0.41 \times prevalence$$

This methodology is applied to each time period, adjusting for prevalence. Analysts normalized the values provided by FEMA's Final Sustainability Benefits Methodology Report (2012) using the Consumer Pricing Index (CPI) Inflation Calculator,[16] and the costs for both severe and mild/moderate mental health problems over each time period are added together to provide a total treatment cost of $ 2,707 for 30 months. **Table 10** provides a summary of treatment costs in current dollars.

11 FEMA. 2012. Final Sustainability Benefits Methodology Report. August 23.
12 Schoenbaum, Michael; Butler, Brittany; Kataoka, Sheryl; Norquist, Grayson; Springgate, Benjamin; Sullivan, Greer; Duan, Naihua; Kessler, Ronald; and Kenneth Wells. 2009. Promoting Mental Health Recovery After Hurricanes Katrina and Rita: What Can Be Done at What Cost. Archives of General Psychiatry, Vol. 66, #8, August.
13 FEMA. 2014. Updated Social Benefits Methodology Report. December 18.
14 Wang, Philip S., MD, DrPH; Lane, Michael, MS; Olfson, Mark, MD, MPH; Pincus, Harold A., MD; Wells, Kenneth B., MD, MPH; Kessler, Ronald C., PhD. 2005. Twelve-Month Use of Mental Health Services in the United States: Results from the National Comorbidity Survey Replication. Archives of General Psychiatry, v. 62, June.
A., MD; Wells, Kenneth B., MD, MPH; and Ronald C. Kessler, PhD. 2005. Twelve-Month Use of Mental Health Services in the United States: Results from the National Comorbidity Survey Replication. Archives of General Psychiatry, v. 62, June.
15 Schoenbaum, Michael; Butler, Brittany; Kataoka, Sheryl; Norquist, Grayson; Springgate, Benjamin; Sullivan, Greer; Duan, Naihua; Kessler, Ronald; Wells, Kenneth. 2009. Promoting Mental Health Recovery After Hurricanes Katrina and Rita: What Can Be Done at What Cost. Archives of General Psychiatry, Vol. 66, #8, August 2009.
16 U.S. Bureau of Labor Statistics. Undated. CPI Inflation Calculator. [web page] Located at: http://www.bls.gov/data/inflation_calculator.htm.

Table 10. Cost of Treatment[17] After a Disaster (30 Month Duration), Per Person Expected to Seek Treatment

Time after Disaster	Severe	Mild/Moderate	Total per person
7-12 months	$ 220.00	$ 691.27	$ 911.27
13-18 months	$ 256.66	$ 451.98	$ 708.64
19-24 months	$ 256.66	$ 372.22	$ 628.88
25-30 months	$ 218.89	$ 239.28	$ 458.17
Total			**$ 2,707**

Source: FEMA Updated Social Sustainability Methodology Report

4. Identify Impacted Population and Calculate Costs

Analysts consider the total number of residents in Marina Village projected post-development that experience flooding during a 0.2 percent annual chance event as impacted. The cost per person was applied to the total number of Marina Village residents expected to be impacted by flooding. Per FEMA methodology, analysts do not annualize benefits; rather, benefits at the design level of protection (the 0.2 percent annual chance flood event) are incorporated into the BCR as a one-time benefit: **$1,050,280**.

3.1.3.3 Assumptions

- Research is limited to 30 months after a disaster; therefore, estimated losses avoided are limited to this period. Mental health avoided losses beyond two and a half years after a disaster, though expected, are not valued in this analysis.
- Benefits are calculated for only 41 percent of the impacted population because research indicates that only that portion of the population with mental health issues can be expected to seek treatment. This significantly lowers the calculated treatment costs and does not consider the full costs to society.
- The analysis does not consider population growth.
- The value of treatment is a national figure and does not consider local costs.

3.1.4 Lost Productivity

FEMA's standard values for mental health impacts also include lost productivity due to mental stress and anxiety. Historical impacts indicate that mental health issues will increase after a disaster, and this, paired with research related to lost productivity due to mental illness, indicates that economic productivity can be impacted by an increase in mental health issues post-disaster.[18] A study of 19 countries by the World Health Organization showed a lifetime 32 percent reduction in earnings for respondents with mental illness.[19] Implementation of the RBD project will help reduce the number of stressors caused by natural disasters, thereby reducing mental health impacts. Fewer mental health impacts will reduce lost work productivity.

17 Costs normalized to 2015 dollars using the CPI calculator located at: http://data.bls.gov/cgi-bin/cpicalc.pl?cost1=623.63&year1=2008&year2=2015
[18] Insel, Thomas. Assessing the Economic Costs of Serious Mental Illness. American Journal of Psychiatry. 165:6 June 2008. / Kessler et al. Individual and Societal Effects of Mental Disorders on Earnings on the United States: Results from the National Comorbidity Survey Replication. American Journal of Psychiatry. 165:6. June 2008.
[19] Levinson, et al. 2010. Associations of Serious Mental Illness with Earnings: Results from the WHO World Mental Health Surveys. British Journal of Psychiatry. August; 197(2): 114–121. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2913273

3.1.4.1 Data Sources

- **FEMA's Final Sustainability Benefits Methodology Report (2012):** This report provides a method to calculate the cost of lost productivity after a flood event.
- **US Census Bureau American Community Survey (2014) 5-Year Estimates:** Analysts use the average number of workers per household and persons per household from this data source to determine the number of impacted workers.
- **Direct Physical Damages:** Analysts use flood depths from Section **2.1.1 Direct Physical Damages – Buildings and Contents** to identify impacted buildings and population.
- **Structure Population:** provides the number of people expected to reside in impacted buildings.

3.1.4.2 Approach

FEMA's Final Sustainability Benefits Methodology Report that accompanies the FEMA BCA Toolkit is the primary resource used to estimate lost productivity.

1. Determine the Value of Work Productivity

Analysts first established the value of work productivity per FEMA's methodology:

$$Loss\ of\ Work\ Productivity = (EC_{NA} \times H_{NA}) \times 25.5\%$$

Where:

EC_{NA}: Average Employment Compensation

H_{NA}: Average Number of Hours Worked per Day

FEMA references Levinson et al (2010)[20] in which research was conducted using the World Health Organization's Mental Health Surveys in 19 countries; the study found that individuals in the United States with mental health illnesses experience as much as a 25.5 percent reduction in earnings. The national average for employment compensation in March 2015 was $33.49 per hour.[21] This, multiplied by the average number of hours worked per day (6.9),[22] produces a daily U.S. value of $231.08. Thus, a 25.5 percent reduction in earnings would equal a loss of $58.90 daily, or $1,767 per capita, monthly.

2. Determine Prevalence Rates

Analysts apply $1,767 to the amount of time lost productivity is expected to occur, 30 months. Prevalence factors from Schoenbaum (2009) are used to adjust the value of productivity loss over 30 months, to account for the fact that only a portion of the population will experience mental health impacts post-disaster. The prevalence factor is based on severe mental health issues because there is insufficient literature to document the impacts of mild/moderate mental health issues on productivity.[23] Accounting for prevalence, the value of work productivity for 30 months is **$3,394** per capita, monthly.

20 Levinson, et al. 2010. Associations of Serious Mental Illness with Earnings: Results from the WHO World Mental Health Surveys. British Journal of Psychiatry. August; 197(2): 114–121. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2913273

21 Employer Costs for Employee Compensation. March 2015. United States Department of Labor, Bureau of Labor Statistics.

22 Average week hours of overtime of all employees. Web page. Located at: http://www.bls.gov/news.release/empsit.t18.htm

23 FEMA. 2014. Updated Social Benefits Methodology Report. December 18.

3. Identify Impacted Population

Analysts consider the total population in residential buildings that experience flooding during a 0.2 percent annual chance event as impacted. Population data and the average number of persons per household (2.72) determined the number of households projected to be in the Marina Village redevelopment. Analysts apply the average number of workers per household in Bridgeport (1.35 workers) to the number of households impacted to determine the number of wage earning residents who will experience flooding. The total lost productivity share per worker for 30 months ($3,394) is multiplied by to the number of wage-earning residents who will experience flooding to value productivity losses avoided. Analysis results are **$653,610**; analysts incorporate benefits into the BCR in the same fashion as mental stress and anxiety benefits.

3.1.4.3 Assumptions

- Analysts assumed that the average number of workers per household and the average number of persons per household for Bridgeport is applicable to the project area.
- Value is provided for the first 30 months only because there is insufficient literature available to analyze longer periods of time.
- Prevalence rates are based on severe mental issues because there is insufficient literature related the impacts of mild or moderate mental health problems on work productivity. Thus, analysts consider results as conservative.
- The analysis does not account for population growth.

3.2 Dry Egress

Dry egress is a development practice in Connecticut that requires critical developments, such as public housing, located within the 500-year floodplain, to have a means of evacuation, as well as route for emergency vehicles, constructed to the 500-year flood elevation plus 2 feet.[24] Elevated roads also prevent residents from being stranded during flood events, reduce flood damage, reduce the need for water rescues, and increase public safety. The RBD project will provide dry egress for the Marina Village redevelopment site, as well as a shorter route to access dry egress for Seaside Village residents and adjacent properties. Dry egress will be constructed to the 500-year flood elevation plus 3 feet to account for future SLR. The BCA captures the benefits of dry egress by evaluating the value of road service and avoided casualties.

3.2.1 Loss of Roadway Service

Transportation assets and systems in the South End may flood during both acute and chronic events. Loss of roadway service is a function of the per-hour value of time, detour route, and number of vehicles evacuating. Analysts focused on the future residents of the Marina Village redevelopment that will benefit from dry egress.

24 “A Guide for Higher Standards in Floodplain Management”. Association of State Floodplain Managers. October 2010.

3.2.1.1 Data Sources

- **FEMA Benefit-Cost Analysis Re-Engineering (BCAR) Development of Standard Economic Values:** provides a standard value of detour lost time per vehicle.
- **The New England Hurricane Evacuation Study (2016):** provides the average number of vehicles per household and Bridgeport specific evacuation rates.
- **Fairfield County FIS and Flood Insurance Rate Map:** This data is overlaid with buildings to determine potential evacuation routes.
- **Direct Physical Damages:** Analysts used flood depths for each structure to identify impacted buildings and residents.

3.2.1.2 Approach

This FEMA methodology is centered around the value of time, which is described in FEMA's Benefit Cost Analysis Re-Engineering Guide, Development of Standard Economic Values report. In summary, analysts evaluate additional travel time needed for an alternative travel route because floodwaters inundate a roadway. The following equation characterizes roadway loss of service:

$$Roadway\ Loss\ of\ Service = \left[\left((UpPD \times ER) \times VpH \times VT\right) \times DT\right] \times TV$$

Where:

UpPD: Number of Units per Property Description

ER: Expected Evacuation Rate

VpH: Average Number of Vehicles per Household

VT: Vehicle Trips to Evacuate

DT: Delay Time

TV: Hourly Value of Time per Vehicle

1. Evaluate Evacuation Routes and Determine Delay Time

Analysts reviewed the FEMA flood zones and found floodwaters would inundate future Marina Village resident's evacuation route during a 2 percent annual chance flood event. When no alternative route is available, FEMA uses a delay time of 12 hours as a standard value.[25]

2. Identify Impacted Population and Evacuating Vehicles

Analysts apply the average vehicles per household sourced from the New England Hurricane Evacuation Study (2016) to the total the number of households projected to be in Marina Village, determined in Section **2.1.4 Lost Productivity**. Analysts factor evacuation rates into the analysis to account for residents that choose to shelter in place. Analysts assumed vehicles trips during an evacuation scenario to be one.

[25] FEMA Supplement to the Benefit-Cost Analysis Reference Guide (2011). Page 5-14. http://www.fema.gov/media-library-data/1396549910018-c9a089b8a8dfdcf760edcea2ff55ca56/bca_guide_supplement__508_final.pdf

3. Determine the Value of Lost Time

To place a monetary value on lost roadway service, analysts normalized and applied FEMA's value of lost time to the total number of evacuating vehicles: $32.09 per hour.[26] **Table 11** summarizes flood impacts to road service by flood scenario.

Table 11. Loss of Road Service Results by Flood Scenario

10 Percent Annual Chance Event	2 Percent Annual Chance Event	1 Percent Annual Chance Event	0.2 Percent Annual Chance Event	Annual Losses Avoided
-	$82,650	$82,650	$82,650	$10,910

Losses remain consistent across each flood event because the once floodwaters inundate the roadway residents may no longer use the road, regardless of an increase in flood elevation.

3.2.1.3 Assumptions

- Analysts assume one person per each evacuating vehicle, therefore results are conservative.
- FEMA's Supplement to the Benefit-Cost Analysis Reference Guide states that "For road or bridge losses that do not have detours, the number of daily trips should be based on the number of one-way trips, and the delay time should be 12 hours per one-way trip."
- The analysis does not account for population growth.

3.2.2 Casualties

Casualties, which include loss of life and injuries, are an unfortunate risk inherent to hazard events. Flood events are considered some of the most frequently occurring natural hazards, contributing to 44 percent of natural hazard-related fatalities worldwide.

The approach chosen to estimate reduced fatalities within the future Marina Village redevelopment is based on a study completed by the Brno University of Technology in 2013.[27] Through this approach, analysts consider the number of fatalities expected at different flood scenarios. Additional data required to supplement the Brno approach include standard life safety values from the Federal Aviation Administration (FAA): the FAA's Willingness to Pay value for one fatality is $5.8 million.

Casualties also includes injuries related to identified flood events. In October 2014, the CDC published another report titled "Nonfatal Injuries 1 Week after Hurricane Sandy." The report suggests that 10.4 percent of residents in the inundation zone were injured within the first week after Hurricane Sandy, mostly during attempts to evacuate or navigate and clean up debris.

3.2.2.1 Data Sources

- **US Census Bureau ACS 5-Year Estimate:** provides the population expected to reside in the Marina Village redevelopment; estimates are based on building square footage and total population within a census block.
- **The New England Hurricane Evacuation Study (2016):** provides local evacuation rates.

[26] Normalization in this report refers to the process of converts past dollar values to current dollar values using the CPI inflation calculator.
[27] Brazdova, M. and J. Riha. 2014. A simple model for the estimation of the number of fatalities due to floods in central Europe. Nat Hazards Earth Syst Sci. 14. June 12.

- **Federal Aviation Administration (FAA) values:** The Federal Aviation Administration (FAA) categorizes injuries and fatalities as shown in **Table 12**. FEMA has acknowledged the validity of these life safety values and permits their use in benefit cost analyses.
- **CDC injury rates:** The CDC report from October 2014 titled "Nonfatal Injuries 1 Week after Hurricane Sandy" estimates 10.4 percent of residents in the inundation zone were injured within the first week of Hurricane Sandy.
- **Brno University of Technology fatality risk methodology:** the approach is based on three main factors: materials loss, population preparedness, and warning.

3.2.2.2 Injuries

To quantify the value of injuries, analysts developed the below equation based on the CDC study titled "Deaths Associated with Hurricane Sandy". Analysts assumed that all injuries reduced are FAA AIS1 minor injuries. This injury category is the lowest value within the FAA study ($13,590[28]) allowing for a conservative analysis of injuries associated with a flood event.

$$Value\ of\ Injuries = \left(Population \times (1 - Evacuation\ Rate)\right) \times 10.4\% \times \$13{,}590$$

Table 12. FAA Category Levels and Values[29]

Injury Category	Description of Injury	Fraction of WTP Value of Life (Percent)	WTP Value (2008 Dollars)
AIS 1	Superficial abrasion or laceration of skin; digit sprain; first-degree burn; head trauma with headache or dizziness (no other neurological signs).	0.20	$12,000
AIS 2	Major abrasion or laceration of skin; cerebral concussion (unconscious less than 15 minutes); finger or toe crush/amputation; closed pelvic fracture with or without dislocation.	1.55	$90,000
AIS 3	Major nerve laceration; multiple rib fracture (but without flail chest); abdominal organ contusion; hand, foot, or arm crush/amputation.	5.75	$334,000
AIS 4	Spleen rupture; leg crush; chest-wall perforation; cerebral concussion with other neurological signs (unconscious less than 24 hours).	18.75	$1,088,000
AIS 5	Spinal cord injury (with cord transection); extensive second- or third- degree burns; cerebral concussion with severe neurological signs (unconscious more than 24 hours).	76.25	$4,423,000
AIS 6	Injuries, which although not fatal within the first 30 days after an accident, ultimately result in death.	100	$5,800,000

[28] Normalized to current dollars using the Consumer Price Index inflation calculator.
[29] Revised Departmental Guidance: Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses. Located at: https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/media/Revised%20Value%20Of%20Life%20Guidance%20Feburary%202008.pdf

Source: Revised Departmental Guidance: Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses.

3.2.2.2.1 Approach

1. Identify Impacted Population

Analysts consider the number of residents in Marine Village that experience flooding during the 0.2 percent annual chance event and did not evacuate as the impacted population.

2. Estimate and Value Injuries

Analysts apply 10.4 percent to the total impacted population, then the value of injury to determine the monetary cost of injuries. The CDC report *Nonfatal Injuries 1 Week after Hurricane Sandy* found the rate of injuries among impacted persons to be 10.4 percent.[30] **Table 13** summarizes the results of the injury analysis.

Table 13. Injury Analysis Results

Percent Annual Chance Event	Value of Injuries
10 Percent	-
2 Percent	$146,990
1 Percent	$244,510
0.2 Percent	$548,380
Annual Injuries Avoided	*$6,480*

3.2.2.2.2 Assumptions

- The results are based on historical data from a CDC survey conducted 5 to 12 months after Hurricane Sandy. The timing of the evaluation, coupled with the fact that the data is only available for one event, increases uncertainty. Nevertheless, the study performed is in an area like the project area, which means that conditions under which the survey was completed are largely transferable. The survey is thus an appropriate source from which to transfer expected results.
- Injuries reported are only for a one-week period following Hurricane Sandy. The analysis does not account for injuries sustained while repairing damages from Sandy more than one week following the event.
- Estimated injuries are all considered minor; the BCA does not account for moderate or serious injuries.
- The BCA evaluates people with multiple injuries the same as people with only one injury.
- The analysis does not include people in buildings that do not experience flooding, and neither are injuries sustained because of road damage and closures.
- The BCA does not consider worker and transient populations.
- The BCA does not account for population growth.

[30] CDC report titled "Nonfatal Injuries 1 Week after Hurricane Sandy," October 2014, page 1. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6342a4.htm

3.2.2.3 Fatalities

Most existing methodologies that estimate fatalities use two groups of characteristics: hydraulic characteristics such as water depth, rate of water rising, flow velocities, wind, and temperature; and by area characteristics including factors such as population density, land use, warning systems, and vulnerability of the population.[31] Arcadis analysts considered material loss, population preparedness, rate of water rise, and warning capabilities. This approach is the most appropriate because it accounts both for event damage characteristics and the community's capacity to prepare for and react to flood events, both of which relate to vulnerability.

3.2.2.3.1 Approach

The Brno University of Technology approach is based on three main factors: material loss (in dollars), population preparedness, and warning. The equation presented below expresses the relationship of these factors. There are additional factors that are important to consider in estimating the loss of life in a natural hazard event. Nevertheless, factors such as debris, climatic conditions, water quality, and time of day, were not available for analysis due to a lack of data.

The equation for fatality estimates:

$$LOL = 0.075 \times D^{0.384} \times (P + 2)^{-3.207} \times (W + 2)^{-1.017}$$

Where:

LOL: Loss of Life

D: Material Loss ($)

P: Population Preparedness (aggregated population preparedness factors)

W: Warning (factor-based)

1. Determine D, W, and P Factor

(i) D Factor

The D factor (material loss) consists of building damage and contents loss, which analysts estimated in direct physical damages analysis. For the purposes of this analysis, analysts evaluated only structure and contents damage for residential structures for the appropriate flood scenarios. Analysts assumed these losses reflect both the destructive ability of the event and the number of endangered inhabitants. The analysis does not consider damage to constructed assets, such as roads or utility systems. The values used as D in the formula are listed in **Table 14.**

[31] Jonkman, S.N. and J.K. Vrijling. 2002. Loss of life models for sea and river floods. Flood Defence. Wu et al. (eds) Science Press, New York Ltd.

Table 14. Expected Material Loss (D) Values by Percent Annual Chance Flood Event

Percent Annual Chance Flood Event	Expected Material Loss
10 Percent	$4,333,630
2 Percent	$7,905,860
1 Percent	$9,795,560
0.2 Percent	$15,625,020

(ii) P Factor

The P Factor (population preparedness) expresses the preparedness of the community for flood management and resiliency, and it reflects the population's general awareness of flooding and required preparations. Analyst determined this value by rating eight sub-factors on a scale of -1 to 1 (**Table 16**).

The evaluation of the P sub-factors is based on existing conditions within the project area community. The flood knowledge held by the public in Bridgeport greatly increased after Hurricanes Sandy and Irene. Analysts evaluated the P sub-factors to determine the below ratings for P1 to P8. Because of the frequency and amount of flood prevention and awareness activities present in Bridgeport, analysts assumed that the same P subfactors apply for all four flood scenarios. Analysts found the final P Factor using the equation below, where P is the aggregated preparedness score presented in **Table 15**. **Table 16** describes P subfactors.

$$P = \frac{1}{8} * \sum_{i=1}^{8} Pi$$

Table 15. P Values

P Subfactor	Factor Description	Existing Conditions Evaluation
P_1	Flood awareness and general knowledge of hazards	1
P_2	Flood memory	1
P_3	Existing flood documentation	1
P_4	Understanding of activities and behavior during floods	0
P_5	Initiatives and activities of flood committees	0
P_6	Response to hydrological forecast	0.5
P_7	Response to flood warning	0
P_8	Evacuation and rescue activities	1
Aggregated Preparedness		**2.125**

Table 16. P Factor Descriptions

P_i	Score				
	-1.0	-0.5	0.0	0.5	1.0
P_1	No flood awareness or knowledge about flood hazard, sometimes ignorance	Poor awareness, underestimation of flood hazard	Common flood awareness	Fair knowledge about flood hazards obtained mostly from the media	Excellent knowledge about flood hazards via the media, education, training, etc.
P_2	Area never flooded, no experience with flooding	Area flooded decades ago, poor records concerning flood losses	Area flooded decades ago, good records concerning the risks	Flooding still in the memory of the population	Personal experience with flooding
P_3	Flood extent maps or flood management plans not available	Existing flood extent maps are outdated	Flood extent maps drawn up based on current hydrologic data, but only poor flood management plans exist	Flood extent maps drawn up, flood management and evacuation plans available	Flood extent maps drawn up, updated digital versions of flood management and evacuation plans available
P_4	Individuals have no idea about actions to take during floods	Limited (vague) understanding of what to do during floods	General understanding of what to do before and during a flood	Quite good knowledge of flood management plans and corresponding activities	Perfect knowledge of flood management plans and understand of what to do in the event of flooding, good preparedness
P_5	No flood committee established	Flood committee established but not trained, only equipped with flood fighting facilities	Flood committee established and generally trained, poorly equipped with flood-fighting facilities	Only moderately experienced but trained committee with standard flood fighting facilities	Experienced and well-trained flood committee equipped with flood-fighting facilities
P_6	No response to hydrological forecast, no understanding or belief	Poor understand of hydrological forecast and poor response	Approximate understanding of forecast and adequate response	Fair understanding of hydrological forecast and good response	Very good understanding of hydrological forecast and very good response
P_7	No response to warning, no idea about warning procedures and response	Only poor response to warning, warning system not trusted	Adequate response	Good response to warning	Immediate and fast response to warning
P_8	Rescue system does not exist, no staff or equipment available	Organized rescue system does not exist, volunteer basis, no trained staff available with randomly acquired equipment	Poorly organized but functioning rescue system, basic rescue equipment of adequate quality	Functioning rescue system, trained staff with equipment of fair quality	Efficiently functioning rescue system, well-trained, experienced and well-equipped personnel

(iii) W Factor

The W factor (warning) includes factors that influence warning of the community that an event is forecasted. The contributing factors include a hydrological forecast, the type of warning system employed, the speed of flooding, and the rate of water level rise; as these factors are somewhat based on the frequency and

extent of flooding, analysts evaluate the W Factor for each flood scenario. **Table 17** shows the scale of sub-factors.

Table 17. W Factor Descriptions

W_i	Score				
	-1.0	-0.5	0.0	0.5	1.0
W_1	No hydrologic forecast, forecast not possible (e.g. at small catchments)	Only vague and general forecast	General forecast for medium size catchment	Hydrologic forecast provided in a standard way by hydrologic services	Reliable hydrologic forecast based on contemporary technical and modelling techniques
W_2	Flood may arrive within several tens of minutes	Flood arrives faster than 45 min	Flood arrives within several hours	Flood arrives within 1 day	Flood arrives within several days
W_3	Warning system does not exist	Poorly designed and functioning warning system	Only moderately reliable warning system	Fully functioning traditional warning system	Sophisticated warning system including digital online alarm systems
W_4	Water rises at a rate of several meters per hour (floods in 1998, 2009)	Water level rise about 1 m per hour (small catchments in 2013)	Rate of several meters per day	About 1 m per day (floods in 1997, 2002)	Water level rise of several meters over several days

For factor W4, water rise rates are based on event data. **Table 18** provides evaluations for W_1 to W_4 values for each flood scenario. The aggregated effect of Factor W was evaluated using the equation below, here W is the sub-factor score.[32]

$$W = \frac{1}{4} * \sum_{i=1}^{4} Wi$$

Table 18. W Values

W Subfactor	Subfactor Description	Existing Conditions (10 Percent)	Existing Conditions (2 Percent)	Existing Conditions (1 Percent)	Existing Conditions (0.2 Percent)
W_1	Reliability of hydrological forecast	0.5	0.5	0.5	0.5
W_2	Speed of flood arrival	1.0	1.0	1.0	0.5
W_3	Warning system	1.0	1.0	1.0	0.5
W_4	Rate of water level rise	0.0	0.0	0.0	-0.5
Aggregated Warning Factor Score (W Factor for each flood scenario)		**1.38**	**1.38**	**1.38**	**0.25**

32 Brazdova, M. and J. Riha. 2014. A simple model for the estimation of the number of fatalities due to floods in central Europe. Nat Hazards Earth Syst Sci. 14. June 12.

2. Value Loss of Life

Loss of life is estimated for each flood scenario by placing all determined factor values (D, P, and W) into the previously mentioned equation.

For example, the calculation to determine the number of casualties in the 1 percent annual chance event scenario includes:

D Value = $1,608,409,580
P Value = 2.13
W Value = 1.38

$$0.79 = 0.075 * \$1{,}608{,}409{,}580^{0.384} * (2.13 + 2)^{-3.207} * (1.38 + 2)^{-1.017}$$

Analysts apply Federal Aviation Administration's (FAA) Willingness to Pay values for a fatality ($5.8 million) to value loss of life.

Table 19. Estimated Fatalities Avoided by Flood Scenario

Percent Annual Chance Event	Estimated Fatalities	Value of Lost Life
10 Percent	0.08	$564,290
2 Percent	0.10	$710,820
1 Percent	0.11	$771,800
0.2 Percent	0.13	$923,370
Annual Fatalities Avoided	-	*$80,210*

3.2.2.3.2 Assumptions

- The analysis does not account for road and non-structural asset damages.
- Loss of life post-disaster can be affected by many factors not considered in this methodology, including the financial and physical health of the population, mental stress and anxiety, and other factors.
- Fatalities may not be calculated on a per-structure basis due to the nature of P values, which consider the flood preparedness characteristics of the whole study area population.
- The analysis does not account for population growth.

4 VALUE ADDED BENEFITS

Beyond improving Bridgeport's flood resiliency by reducing acute and chronic flood impacts to public housing and residents, the RBD project intends to foster community cohesion, generate economic opportunities, improve the natural environment, and stimulate redevelopment through growth, prosperity, awareness, and beauty. Analysts consider added value benefits, in addition to resiliency benefits, when comprehensively analyzing increased community resilience: Investment in increased flood resilience may foster commercial and residential redevelopment, in turn, promoting a more diverse and healthy economy. A resilient environment can provide protective services that stabilize and contribute to improved air and water quality, and may also help improve resident's health. Community gathering space provides an opportunity for increased social interactions and cohesion, creating additional networks for support during and after disaster events.

Value added benefits include social, environmental, and economic revitalization benefits resulting from the RBD project. These benefits include:

- Social benefits in the form of recreational value;
- Aesthetic benefit generated from making the surroundings more desirable for businesses and residents;
- Environmental benefits in the form of reduced energy use, air pollution, water pollution, and carbon dioxide emissions; and,
- Economic revitalization benefits related to added commercial space.

Table 20 relates RBD project elements to value added benefit categories.

Table 20. Value Added Benefit Matrix

Benefit Category		Measurable Benefit/Metric	Stormwater Park						Johnson Street Extension				Marina Village Redevelopment
			Trees	Shrubs	Green Space	Sidewalks	Playground	Basketball Courts	Trees	Shrubs	Bio-Retention	Sidewalks	
Value Added Benefits	Social	Recreation			X	X	X	X					
		Aesthetic	X	X	X	X	X	X	X	X	X	X	
	Environmental	Water Quality (CSO)			X						X		
		Ecosystem Services	X	X	X				X	X	X		
	Economic	Revitalization											X

4.1 Social Benefits

Urban parks and green space help improve the quality of life and social sustainability of cities by providing recreation opportunities and aesthetic enjoyment, promoting physical health, contributing to psychological well-being, enhancing social ties, and providing opportunities for education.[33] The RBD project's multifunctional stormwater park will be a new public amenity in the neighborhood, and includes basketball courts, a playground, sidewalks, green open spaces, and passive seating areas. The new stormwater park will provide opportunity for residents to participate in recreation activities, environmental education, and community programs, thereby enhancing their health and well-being, increasing social capital[34] and improving the quality of life in the greater community.[35]

4.1.1 Recreation Benefits

Recreation benefits quantify the consumer value of increased outdoor recreation expected to occur after completion of the new stormwater park. There are federally approved methods to quantify the value of new outdoor recreation opportunities: the low value method is based on FEMA's Final Sustainability Benefits Methodology Report, and assigns a value per square foot of recreational space. The high value method uses United States Army Corps of Engineers (USACE) Unit Day Values to value an increase in recreation activity. The medium method is the average results of high and low estimated benefits.

4.1.1.1 Data Sources

- **FEMA's Final Sustainability Benefits Methodology Report (2012):** provides a recreational value per acre of space. Refer to **Appendix F: Additional Benefit Cost Analysis Resources** for a summary of FEMA's standard values.
- **USACE Economic Guidance Memorandum, 16-03, Unit Day Values for Recreation for Fiscal Year 2016 (2015):** provides a daily recreational value by type of recreation activity.
- **RBD Project Design Drawings:** provide the total area of park features.

4.1.1.2 Approach

Analysts implemented two federal methods to evaluate the stormwater parks recreation benefits. These methods are described in detail below.

4.1.1.2.1 FEMA: Low Value Method

FEMA generates an annual recreational value per unit area using nationwide, rural, and urban willingness to pay studies.[36] Analysts normalized[37] and converted FEMA's standard annual recreational value per acre to current dollars per square foot: $0.13. Analysts apply this value to the total area of new park amenities to estimate the annual recreational value. **Table 21** summarizes results of the low value method by park feature.

33 Zhou, X. and M.P. Rana. 2011. Social benefits of urban green space. A conceptual framework of valuation and accessibility measurements. Management of Environmental Quality: An International Journal.
34 Gomez, E., Baur, J.W.R., Hill, E., and S. Georgiev. 2015. Urban Parks and Psychological Sense of Community. Journal of Leisure Research.
35 Lestan, K.A., Erzen, I., and M. Golobic . 2014. The Role of Open Space in Urban Neighbourhoods for Health-Related Lifestyle. 2014. International Journal of Environmental Research and Public Health. June
[36] FEMA uses the benefit transfer methodology to apply the results of previously conducted primary studies to another geography.
[37] Normalization in this context refers to converting past dollar values to current dollar values using the Consumer Price Index (CPI) Inflation Calculator: http://www.bls.gov/data/inflation_calculator.htm.

Table 21. Stormwater Park Low Annual Recreation Benefit

Park Feature	Square Feet	Annual Recreation Benefit
Playground	11,613	$1,510
Basketball	9,152	$1,190
Sidewalks	6,334	$820
Green Open Space	38,069	$4,950
Total	**65,168**	**$8,470**

4.1.1.2.2 USACE: High Value Method

The USACE produces Unit Day Values (UDV)[38] based on expert or informed opinion and judgement to estimate the average willingness to pay for recreation resources. Analysts calculate recreation benefits by applying the UDV to a park feature's expected useful life. The Federal government generates standardized average estimated useful life values that analysts used for the analysis.[39] UDVs provide a range of possible recreation values based on activity type, general or specialized recreation. Analysts used the lowest value available for general recreation ($3.90) to produce conservative estimates. **Table 22** provides results of the high value method by park feature.

Table 22. Stormwater Park High Annual Recreation Benefit

Park Feature	Expected Useful Life (Years)	Annual Recreation Benefit
Playground	10	$14,240
Basketball	25	$35,590
Sidewalks	50	$71,180
Green Open Space	100	$142,350
Total	**185**	**$263,350**

4.1.1.2.3 Medium Value Method

Analysts found the medium recreation benefit value by averaging the results of the low and high value methods (**Table 23**).

Table 23. Stormwater Park Medium Annual Recreation Benefit

Park Feature	Low Benefit Value	High Benefit Value	Medium Benefit Value
Playground	$1,510	$14,240	$7,870
Basketball	$1,190	$35,590	$18,390
Sidewalks	$820	$71,180	$36,000
Green Open Space	$4,950	$142,350	$73,650
Total	**$8,470**	**$263,350**	**$135,910**

38 United States Army Corps of Engineers. 2016. Economic Guidance Memorandum, 16-03 Unit Day Values for Recreation for Fiscal Year 2016. Located at: http://planning.usace.army.mil/toolbox/library/EGMs/EGM16-03.pdf

39 Fannie Mae. Instructions for Performing A Multifamily Property Conditions Assessment. Appendix F. Estimated Useful Life Tables. Located at: https://www.fanniemae.com/content/guide_form/4099f.pdf

4.1.1.3 Assumptions

- The results of previously conducted studies are applicable to the project area. The FEMA annual recreation value relies on studies that are limited in scope, but FEMA considers these studies applicable nationwide. This approach does not consider location-specific factors known to impact the results of recreation studies, such as population density, age, and income distribution.[40]

4.1.2 Aesthetic Benefits

The RBD project will integrate concepts of green infrastructure into the Johnson Street Extension; thoughtful "green street" design coupled with the new stormwater park will create a more appealing project area to existing and future residents. This attention to aesthetic detail may create a positive effect for residential property and the local economy. One measurable example of an aesthetic benefit that can contribute to this positive effect is attractive views and willingness to pay for these views. The benefits of increased aesthetic amenities, including attractive views, may be quantified through hedonic pricing demonstrated in the housing market, and on a standard value-per-square foot basis.

4.1.2.1 Data Sources

- **FEMA's Final Sustainability Benefits Methodology Report (2012):** provides an aesthetic value per acre of space. Refer to **Appendix F: Additional Benefit Cost Analysis Resources** for a summary of FEMA's standard values.
- **United States Department of Agriculture (USDA) Northeast Community Tree Guide: Benefits, Costs, and Strategic Planting (2007):** provides annual aesthetic value per tree.
- **RBD Project Design Drawings:** provide the total area of park features and total number of new trees.

4.1.2.2 Approach

FEMA's Final Sustainability Benefits Methodology Report uses the benefit transfer methodology[41] to convert results of hedonic pricing studies to a nationwide annual aesthetic value per acre. Analysts normalized this value to 2016 dollars and converted it to square feet; this value is $0.04 per square foot annually. Analysts apply this value to the total area of the new multiuse stormwater park to value aesthetic benefits. **Table 24** summarizes aesthics benefits by project element and feature.

Table 24. Summary of Aesthetic Benefits by Project Element

Project Element	Feature	Square Feet	Annual Aesthetic Benefit
Stormwater Park	Playground	11,613	$470
	Basketball	9,152	$370
	Sidewalks	6,334	$250

[40] Brander, L.M. and M.J. Koetse. 2011. The Value of Urban Open Space: Meta-analyses of contingent valuation and hedonic pricing results. Journal of Environmental Management. 92 (2011) 2763-2773. October

41 The benefit transfer method applies the results of previously conducted primary studies to another geography.

Project Element	Feature	Square Feet	Annual Aesthetic Benefit
	Paving	26,645	$1,070
	Green Open Space	38,069	$1,520
	Shrubs	2,740	$110
Johnson Street Extension	Shrubs	4,720	$190
	Bio-retention	9,372	$380
	Sidewalks	9,334	$370
	Paving	10,286	$410
	Total	**128,265**	**$5,130**

New trees may also increase the aesthetic quality of the surrounding area. The U.S. Forest Service's Northeast Community Tree Guide (2007) provides an annual asethetic value per public tree ($32.84). Analysts normalized this value to 2016 dollars ($38.44), and applied it to the total number of added trees to generate annual benefits. **Table 25** summarizes the annual aesthetic benefit of new trees.

Table 25. Annual Aesthetic Benefits of New Trees

Project Element	Number of Trees	Annual Aesthetic Benefit
Stormwater Park	81	$3,110
Johnson Street Extension	66	$2,540
Total	**147**	**$5,650**

4.1.2.3 Assumptions

- Analysts assumed that the results of previously conducted studies, used by FEMA to determine standard values, are transferable to the project area. FEMA values are based on studies FEMA considers to be applicable nationwide. Research indicates that higher population density results in a considerable increase in the value of urban parks and open space.[42] The analysis does not capture increased value in urban areas due to the use of FEMA standard figures.
- The Northeast Community Tree Guide provides values for small, medium, and large tree. Analysts assumed that the added trees are fully developed medium-sized trees; therefore, the benefits calculated pertain to medium trees.
- The USDA's Northeast Community Tree Guide accounts for tree morbidity over time (33.95 percent); therefore, it is not included as a separate function in the calculation.

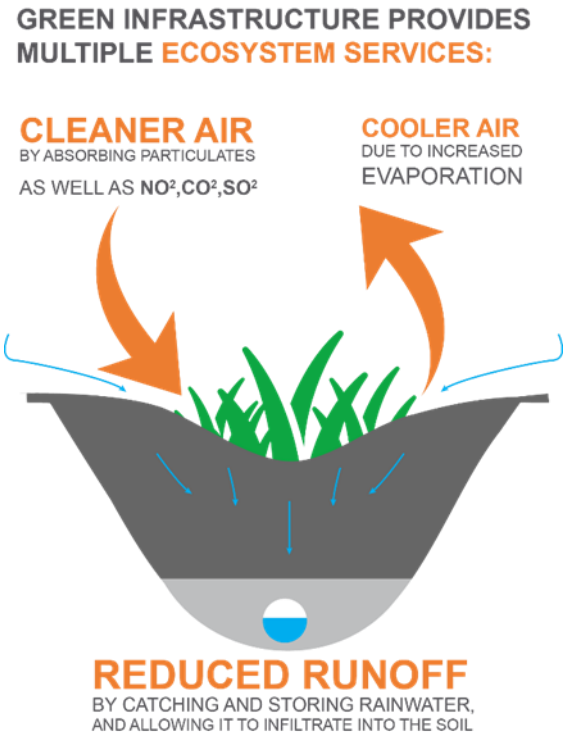
[42] Brander, L.M. and M.J. Koetse. 2011. The Value of Urban Open Space: Meta-analyses of contingent valuation and hedonic pricing results. Journal of Environmental Management. 92 (2011) 2763-2773. October

4.2 Environmental Benefits

The RBD project proposes to add new natural vegetation that will produce a range of environmental benefits, also known as ecosystem goods and services. Ecosystem goods and services provided by natural vegetation may be quantified to estimate their economic benefit to society. Such benefits can be categorized through measures such as carbon sequestration, air pollutant reduction, energy savings, increase in water quality, and pollination. The RBD also implements stormwater management measures that will reduce water treatment needs and environmental impact of CSO events. Environmental benefits are grouped into two categories based on valuation methods: those associated with the ecosystem goods and services and those associated with reduction CSO events.

4.2.1 Ecosystem Goods and Services

Natural capital is the world's stock of natural assets, such as soil, air, water, and all living things that provide a good or service that benefits society. For example, natural capital, such as forests and soils, provide the ecosystem service of filtering water independent of treatment plants.



Ecosystem services are grouped into four broad categories:[43]

- **Provisioning services:** produce physical materials that society uses such as minerals, gases, and living things;
- **Regulating services:** create and maintain a healthy environment such as climate stability and flood protection;
- **Supporting services:** maintain conditions for life such as habitat and genetic diversity; and,
- **Cultural services:** provide meaningful human interaction with nature including spiritual, recreational, aesthetic, educational, and scientific uses. Sections **3.1.1 Recreation Benefits** and **3.1.2 Aesthetic Benefits** describe the methods used to evaluate these benefits.

4.2.1.1 Data Sources

- **FEMA's Final Sustainability Benefits Methodology Report (2012):** provides an annual ecosystem service value per acre of green space. Refer to **Appendix F: Additional Benefit Cost Analysis Resources** for a summary of FEMA's standard values.
- **United States Department of Agriculture (USDA) Northeast Community Tree Guide: Benefits, Costs, and Strategic Planting (2007):** provides annual environmental benefit values per tree.
- **RBD Project Design Drawings:** provide the total area of green space and number of new trees.

[43] Earth Economics. 2015. Earth Economics Ecosystem Valuation Toolkit. [Web page] Located at: http://esvaluation.org/ecosystem-services/

4.2.1.2 Approach

Table 26 summarizes the approach taken to develop a benefit value per vegetative unit.

Table 26. Approach Summary by Vegetative Type

Vegetation Type	Approach
Tree	Annual benefits per tree are sourced from the USDA's Northeast Community Tree Guide (2007).
Vegetation	Annual benefits per vegetative square foot are sourced from FEMA's Final Sustainability Report (2012).

Analysts normalized benefits values to 2016 dollars and converted FEMA's values to square feet (**Table 27**). These values are applied to the area of new vegetation or total number of new trees to estimate environmental benefits (**Table 28** and

Table 29).

Table 27. FEMA's Annual Environmental Ecosystem Service Values

Ecosystem Service	Value per Square Foot	Value per Tree
Regulating Services		
Climate Regulation	$0.0003	$0.94
Water Retention/Flood Hazard Reduction	$0.0072	$10.57
Air Quality	$0.0050	$7.88
Energy Savings	-	32.72
Support Services		
Erosion Control	$0.0016	-
Pollination	$0.0072	-
Total Environmental Ecosystem Service Value	**$0.1937**	**$52.11**

Table 28. RBD Project Elements Contributing Ecosystem Services

Project Element	Vegetative Unit	Count / Area
Johnson Street Extension	Trees	66
	Shrubs	4720
	Bio-Retention	9,372
Stormwater Park	Trees	81
	Shrubs	2,740
	Green Space	38,069

Table 29. Annual Ecosystem Service Benefits provided by the RBD Project

Ecosystem Service	Johnson Street Extension			Stormwater Park			Total
	Street Trees	Shrubs	Bio-Retention	Trees	Shrubs	Green Space	
Climate Regulation	$62	$2	$3	$76	$1	$12	$160
Water Retention/Flood Hazard Reduction	$698	$34	$68	$856	$20	$275	$1,950
Air Quality	$520	$24	$47	$638	$14	$192	$1,440
Erosion Control	-	$8	$15	-	$4	$61	$90
Pollination	-	$34	$67	-	$20	$272	$390
Energy Savings	$2,160	-	-	$2,650	-	-	$4,810
Total	**$3,439**	**$101**	**$200**	**$4,221**	**$58**	**$813**	**$8,830**

4.2.1.3 Assumptions

- The Northeast Community Tree Guide provides values for small, medium, and large tree. Analysts assumed that the added trees are fully developed medium-sized trees; therefore, the benefits calculated pertain to medium trees.
- The USDA's Northeast Community Tree Guide accounts for tree morbidity over time (33.95 percent); therefore, it is not included as a separate function in the calculation.
- The results of previously conducted studies are applicable to the project area. FEMA values are based on studies FEMA considers to be applicable nationwide.

4.2.2 Combined Sewer Overflow Reduction

A significant added benefit of the RBD project is the ability to retain stormwater. The City of Bridgeport currently uses a combined sewer system. When rain events occur, the City's sewer system can become overwhelmed and untreated wastewater can spill into nearby waterways as a relief mechanism to avoid damaging property or treatment plants; this is commonly referred to as a CSO event. The RBD project proposes to implement a stormwater management features that will capture flow, preventing it from entering the combined sewer system and contributing to CSO events. This water quality benefit is not captured in ecosystems services benefits, therefore requiring a separate analysis.

4.2.2.1 Data Sources

- **Bridgeport Long Term Control Plan:** provided information needed to derive a damage cost.
- **RBD Project Modeling:** provided total CSO reduction volume.

4.2.2.2 Approach

CSOs have a major impact on water quality and pose significant health and safety risks. Bridgeport is acting to meet water quality requirements under the Clean Water Act. The City has developed a Long-Term Control Plan to reduce the frequency of CSO events. The Plan reveals it will cost the City $384,900,000

over 30 years to reduce CSO output by 43 million gallons. Given this information, analysts generated a damage cost for CSO abatement: $0.29 per gallon per year. Analysts modeled CSO reduction at the RBD design event (25-year Natural Resources Conservation Service [NRCS] rainfall event), and applied the damage cost to the total volume of CSO reduction to estimate water quality benefits (**Table 30**).

Table 30. Annual Water Quality Benefits

25 Year NRCS event	Volume (gallons)	Annual Water Quality Benefit
Volume Reduction in CSOs at Outfall	620,000	$3,300

4.2.2.3 Assumptions

- The assessment accounts for runoff that will be retained by the stormwater park and green street's bio-retention features, as well as additional system capacity to manage flow.

4.3 Economic Revitalization

The resilient redevelopment of Marina Village includes added commercial space that will generate economic revitalization benefits. These benefits can be measured through anticipated added economic output and employment compensation. Output is the value of industry production, and employment compensation includes wages and benefits for employees.

4.3.1 Data Sources

- **FEMA's Hazus-MH 3.2:** provides a method to estimate economic losses and gains and provides national output and employment compensation values per square foot.

4.3.2 Approach

Phase I of Marine Village redevelopment includes 10,000 square feet of new commercial space. Analysts normalized Hazus' output per square foot per day and employment compensation per square foot per day, and used the equation below calculate the economic benefits of added commercial space. **Table 31** summarizes annual economic revitalization benefits.

$$Added\ Output\ per\ Year = Added\ Annual\ Output\ or\ Employment\ Compensation\ per\ Square\ Foot \times Added\ Space\ (SF)$$

Table 31. Economic Revitalization Benefits

	Marina Village Phase 1	Annual Economic Output
Commercial (square feet)	10,000	$5,400

4.3.3 Assumptions

- The analysis does not account for inflation over time, nor does it consider business turnover, vacancy rates, and changes in future land use for the analysis area.
- Analysts assume revitalization efforts will be successful

5 SENSITIVITY ANALYSIS

The relationship between BCA inputs and outputs requires certain assumptions. To ensure the BCA captures and describes uncertainty related to inputs and outputs, analysts performed a sensitivity analysis. By evaluating a variety of different model inputs, BCA analysts could identify the most appropriate values for use in the analysis and understand how assumptions impact BCA results, and thereby any decisions that may be based on BCA findings. This section provides an understanding of how a change in an uncertain variable will impact the present value of project benefits or costs, and the resulting BCR.

5.1 Analysis Uncertainties, Assumptions, and Limitations

Analysts estimated low, medium, and high benefits when more than one Federal method or value was available to evaluate a project benefit, or when uncertainties result in an alternative assumption in methodology or the use of a different methodology. This BCA report illustrates the range of benefits as low, medium, and high benefit scenarios for the pilot project's recreation and direct physical damage benefits and provides an indication of the differing variables or approaches for these benefits. Analysts limited low, medium-, and high- benefit scenarios to varying Federally approved BCA methods or values; this BCA does not explore the use of values or methods that are not accepted by Federal agencies. **Table 32** presents variable approaches explored during analysis.

Table 32. Summary of Uncertain Variables and Alternative Approaches

Benefit	Variable Approaches	Solution
Direct Physical Benefits	The BRV and CRV can have a significant impact on the monetary value of property loss. Analysts generated low-, medium-, and high- replacement values using 2016 RS Means Square Foot Costs to understand how the replacement value may impact BCA results.	Low Estimate: Economy BRV per square foot: $110.10
		Medium Estimate: Average BRV per square foot: $130.34
		High Estimate: Custom BRV per square foot: $169.74
Recreation Benefits	Analysts can calculate recreational benefits using different methods, such as willingness to pay values related to a specific recreation activity or a value per square foot of recreation space.	Low Estimate: FEMA value per square foot
		Medium Estimate: Average of low and high estimate
		High Estimate: USACE Unit Day Values

5.2 Discount Rates

The discount rate captures social "opportunity costs" (the maximum worth of an input feature as assessed among practical alternative uses), and provides an interpretation of the present value of expected annual

benefits and costs. In other words, the discount rate attempts to measure the present value of future benefit, and always assumes that future benefit is of lower value than present benefit.

OMB Circular A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs requires a discount rate of 7 percent. The Federal government last updated this discount rate in the OMB Circular A-94 in 1992. Sources of literature, such as the article *Discount Rate* published by the Association of State Floodplain Managers, emphasize the uncertainty surrounding discount rates. It can also be useful to analyze discount rates used by other federal agencies. The Government Accountability Office (GAO) is a congressional agency that determines its own discount rate policy. The GAO uses the yield of United States Treasury debt with a maturity of the duration of the Project.[44] Appendix C of OMB Circular A-94 (Revised in January of 2015), states that the 30-year interest rate is 1.4 percent.[45] Furthermore it states that, "Programs with durations longer than 30 years may use the 30-year interest rate in calculating the discount rate."

To analyze the potential impact of assumptions surrounding discount rates, analysts compared the present value of project benefits and costs using two different discount rates recommended by OMB Circular A-94 (7 percent) and HUD Notice: CPD-16-06 (3 percent). **Table 33** summarizes the range of benefits individually using both discount rates, as well as the BCR for each benefit scenario.

Table 33. Summary of Benefit Range and Present Value

Benefit	Bound	Estimated Annual Benefit	Present Value of Benefits	BCR
Discount Rate: 7 Percent				
Direct Physical Damages	Low	$673,630	$8,667,050	1.32
	Medium	$720,690	$9,272,460	1.57
	High	$817,070	$10,512,500	1.91
Recreation	Low	$8,470	$119,240	1.32
	Medium	$135,910	$1,910,160	1.57
	High	$263,350	$3,701,080	1.91
Discount Rate: 3 Percent				
Direct Physical Damages	Low	$673,630	$16,678,350	2.16
	Medium	$720,690	$17,843,370	2.64
	High	$817,070	$20,229,640	3.24
Recreation	Low	$8,470	$247,030	2.16
	Medium	$135,910	$3,292,180	2.64
	High	$263,350	$7,611,340	3.24

[44] Page 4. Located at: http://www.floods.org/PDF/WhitePaper/ASFPM_Discount_%20Rate_Whitepaper_0508.pdf
[45] Web page. Located at: https://www.whitehouse.gov/sites/default/files/omb/memoranda/2015/m-15-05.pdf

6 DOUBLE COUNTING

Duplication of benefits, or "double-counting," may occur when two projects or methodologies of similar purpose have overlapping benefits. Analysts identified and removed double counting from the evaluation to maintain its integrity. Benefits may duplicate because:

1. Benefits calculated in the analysis may duplicate each other if there is overlap in the underlying values used to quantify losses avoided or value added.
2. Bridgeport has implemented or plans to implement a project in the same area with overlapping benefits.

Table 34 identifies potential double counting along with a description of how analysts managed or removed these duplications.

Table 34. Summary of Double-Counting Approach

Benefit	Potential Duplication	Resolution of Duplication
Resiliency Benefits		
Road Service and Casualties	The primary objective of dry egress is to provide residents with a means to evacuate before and after a flood event. There are two benefits associated with dry egress: continuity of road service, valued through lost time, and avoided casualties, valued using the FAA's WTP for life and injuries. In theory, residents that choose to evacuate would not be exposed to the risk of injury or loss of life. Similarly, residents that choose to shelter in place do not benefit from avoided time lost. Therefore, analysts must take care to identify the appropriate population for each analysis.	Analysts used local evacuation rates to address potential overlapping benefits: casualties were estimated for the population not expected to evacuate, and continuity of road service was estimated for the population expected to evacuate before a storm event.
Relocation	Relocation costs may be a double-counting with shelter needs. The relocation approach assumes that all displaced individuals will require alternative living quarters, thus capturing the costs of individuals that may opt or need to go to a shelter.	The BCR does not include costs associated the shelter needs to avoid any possible duplication. Instead, the BCA reports provides estimated population expecting to require public shelter in the case of an event for the benefit of the reader.
Social Benefits		
Recreation	In the future, Bridgeport may implement projects that improve the quality of Seaside Park. Such improvements may impact park visitation and may duplicate recreation benefits for different park sites.	The BCA calculates recreation benefits by unit of stormwater park elements to ensure that the benefits calculated are specific to RBD project only.
Health	Surveys used to determine consumer surplus values for recreation benefits may inherently include a health benefit component. Thus, recreation consumer surplus values may be duplicative with health benefits related to recreation.	The BCA report describes health benefits of recreation space in a quantitative manner, but analysts did not calculate monetary values to be included in the benefit-cost ratio to avoid any risk of double-counting benefits.

7 BENEFIT COST ANALYSIS RESULTS

The BCA finds the RBD project cost effective in each benefit scenario (**Table 36**), indicating the project is a sound investment of public resources.

*The NPV of the RBD project is **$5.4 million**, and the BCR using a 7 percent discount rate is **1.57**.*

The RBD project is expected to provide a range of resiliency, social, environmental, and economic benefits totaling to **$14.6 million** in today's dollars, compared to an overall investment of **$9.2 million**, both at a 7 percent discount rate (**Table 35** and **Table 1**). ***Resilient redevelopment benefits*** comprise 60 percent of the project's overall benefits, while ***social benefits*** comprise 13 percent of the project's overall benefits (**Figure 2**). The BCA reveals the RBD project will reduce acute and chronic flood impacts to future Marina Village development and residents, as well as provide a range of social, environmental, and economic benefits to the South End.

Table 35. Annual and Present Value Benefits for the Medium Benefit Scenario

Benefit	Annualized Benefit	Present Value (7 Percent Discount Rate)	Present Value (3 Percent Discount Rate)
Resiliency Benefits			
Resilient Redevelopment			
Direct Physical Damages	$ 720,690	$ 9,272,460	$ 17,843,370
Displacement	$ 1,150	$ 14,800	$ 28,470
Mental Stress and Anxiety	-	$ 1,050,280	$ 1,050,280
Lost Productivity	-	$ 653,610	$ 653,610
Dry Egress Value			
Evacuation / Roadway Loss of Service	$ 10,910	$ 149,370	$ 270,120
Casualties	$ 86,690	$ 1,115,390	$ 2,146,390
Value Added Benefits			
Social Value			
Recreation Benefits	$ 135,910	$ 1,910,160	$ 3,929,180
Aesthetic Benefits	$ 5,130	$ 71,660	$ 142,700
Environmental Value			
Ecosystem Goods and Services Benefits	$ 8,830	$ 126,030	$ 279,090
CSO Reduction Benefits	$ 3,300	$ 45,630	$ 85,070
Economic Value			
Economic Revitalization Benefits	$ 5,400	$ 69,480	$ 133,700
Total Project Benefits	**$978,010**	**$14,478,870**	**$26,561,980**

Table 36. Benefit Cost Ratio by Benefit Scenario

Scenario	Low Benefit Cost Ratio	Medium Benefit Cost Ratio	High Benefit Cost Ratio
7% Discount Rate			
RBD Project	1.32	1.57	1.91
3% Discount Rate			
RBD Project	2.16	2.64	3.24

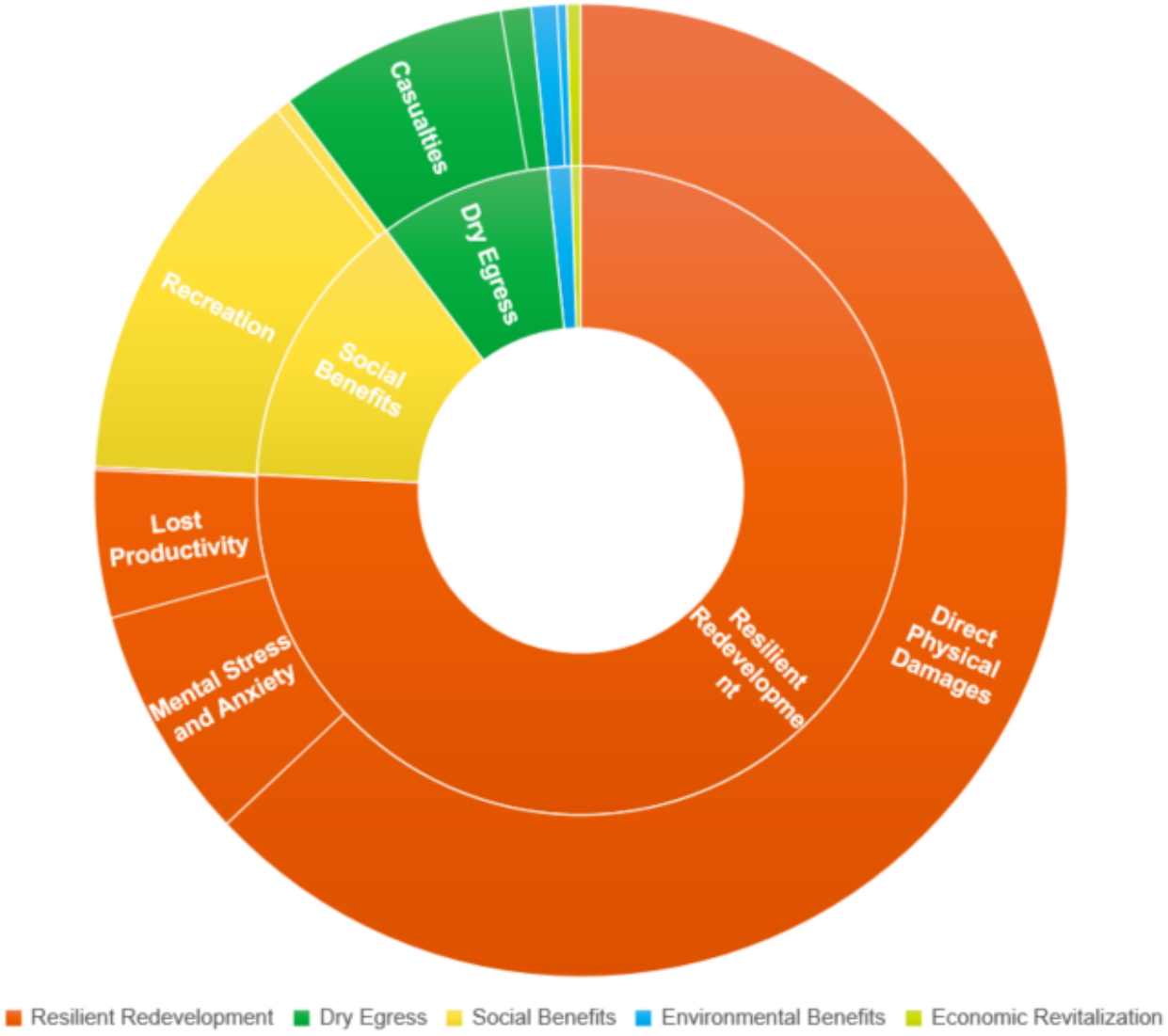


Figure 2. Distribution of RBD Project Benefits, Medium Benefit Scenario

Table 37. Annual and Present Value Benefits for the Low Benefit Scenario

Benefit	Annualized Benefit	Present Value (7 Percent Discount Rate)	Present Value (3 Percent Discount Rate)
Resiliency Benefits			
Resilient Redevelopment			
Direct Physical Damages	$ 673,630	$ 8,667,050	$16,678,350
Displacement	$ 1,150	$ 14,800	$ 28,470
Mental Stress and Anxiety	-	$1,150,430	$1,150,430
Lost Productivity	-	$715,940	$715,940
Dry Egress Value			
Evacuation / Roadway Loss of Service	$ 10,910	$ 149,370	$ 270,120
Casualties	$ 86,690	$ 1,115,390	$ 2,146,390
Value Added Benefits			
Social Value			
Recreation Benefits	$ 8,470	$ 119,240	$ 247,030
Aesthetic Benefits	$ 5,130	$ 71,660	$ 142,700
Environmental Value			
Ecosystem Goods and Services Benefits	$ 8,830	$ 126,030	$ 279,090
CSO Reduction Benefits	$ 3,300	$ 45,630	$ 85,070
Economic Value			
Economic Revitalization Benefits	$ 5,400	$ 69,480	$ 133,700
Total Project Benefits	**$803,510**	**$12,245,030**	**$21,877,300**

Table 38. Annual and Present Value Benefits for the High Benefit Scenario

Benefit	Annualized Benefit	Present Value (7 Percent Discount Rate)	Present Value (3 Percent Discount Rate)
Resiliency Benefits			
Resilient Redevelopment			
Direct Physical Damages	$ 817,070	$ 10,512,500	$ 20,229,640
Displacement	$ 1,150	$ 14,800	$ 28,470
Mental Stress and Anxiety	-	$1,150,430	$1,150,430
Lost Productivity	-	$715,940	$715,940
Dry Egress Value			
Evacuation / Roadway Loss of Service	$ 10,910	$ 149,370	$ 270,120
Casualties	$ 86,690	$ 1,115,390	$ 2,146,390
Value Added Benefits			
Social Value			
Recreation Benefits	$ 263,350	$ 3,701,080	$ 7,611,340
Aesthetic Benefits	$ 5,130	$ 71,660	$ 142,700
Environmental Value			
Ecosystem Goods and Services Benefits	$ 8,830	$ 126,030	$ 279,090
CSO Reduction Benefits	$ 3,300	$ 45,630	$ 85,070
Economic Value			
Economic Revitalization Benefits	$ 5,400	$ 69,480	$ 133,700
Total Project Benefits	**$1,201,830**	**$17,672,320**	**$32,792,900**

8 ECONOMIC IMPACT ANALYSIS

In addition to the benefits of increased resiliency from reduced future disaster loss, project expenditures for construction are expected to stimulate economic activity within Bridgeport and Fairfield County. This economic impact evaluation is accessory to the RBD project; the intent is to evaluate the expected economic benefits generated by project construction in the form of employment, labor income, value added, and sales and revenues (output).

8.1 Project Description

The RBD project includes two main elements: the Johnson Street Extension and a multiuse stormwater park. The Johnson Street Extension will provide dry egress and incorporate green infrastructure, such as bioswales, to divert surface runoff from the combined sewer system and into the multifunctional stormwater park. The 2.5 acre stormwater park will include terraced basins, underground storage features, community gathering space, and recreational features. Flow from the stormwater park will be pumped via a new force main to an existing outfall. Analysts used the cost estimates for the Johnson Street Extension and force main to conduct the economic impact analysis (EIA); detailed cost estimates for the stormwater park were not available at the time of analysis.

8.2 IMPLAN Software and Results

This methodology presents the approach used to model economic impacts for project expenditures. Generally, analysts evaluate the cost of each proposed project element using IMPLAN modeling software to determine the economic impacts that will result from the change in the local economy directly related to project expenditures. IMPLAN software provides economic data and modeling to users for assessing the economic impacts of project implementation in all industry sectors, with the intent of predicting how projects or policies interact with and shape the economy. Analysts used IMPLAN Version 3.1 software, an input-output system that uses a combination with social accounting matrices (SAMs) and economic multipliers to estimate the result of changes or activities in an economic region. SAMs provide a complete picture of the economy and generate multipliers to measure the impacts from one activity for a given sector throughout the entire economy. Analysts used the 2015 Fairfield County Package for the economic impact analysis, which includes the economic profile for each zip code. and **Table 40** below describes the IMPLAN analysis report outputs and types of relationships reported. Each result category presented in **Table 39** is reported in terms of relationships measured, displayed in **Table 40**.

Table 39. Economic Impact Analysis Result Outputs

Analysis Result	Definition
Output	The value of industry production, which varies by industry. For example, the output of the service sector is measured in sales, hospital output is measured in the total service package that a patient receives during their entire length of stay, and output for non-profit organizations is based on the cost of production or the expenses that the organization must incur to operate.
Labor Income	The expected combined income of employment in each industry sector generated by project implementation expenditures. Including wages and benefits for employees and proprietor income.
Value-Added	Measure of the project's contribution to Gross Domestic Product (GDP).
Employment	All jobs (full-time, part-time, and temporary) that are created or lost as a result of an economic activity in the year of the activity.

Table 40. Economic Impact Analysis Relationships Measured

Analysis Result	Definition
Direct Effects	Represents the initial impacts that occur as a result of an economic activity.
Indirect Effects	The impact of direct economic effects on supporting industries, such as those that provide equipment and materials.
Induced Effects	The response to a direct effect that occurs through re-spending of income.

8.3 Approach

Outlined below is the approach to estimate economic impacts of project.

1. Compare project estimates with IMPLAN industries

IMPLAN has a total of 440 economic industries, derived from the North American Industry Classification System (NAICS). To run IMPLAN, analysts must choose the economic industry expected to be impacted by a project related activity, and estimate how much that industry will change (in dollars). Evaluating the economic impact of mitigation measures requires analysts to choose economic industries necessary for project design, construction, and maintenance and divide project costs appropriately among those industries. **Table 41** displays the project elements and corresponding economic industries chosen by analysts.

Table 41. Expenditures used in the Economic Impact Analysis

IMPLAN Industry	Planning and Design	Johnson Street Extension	24" RCP	Force Main	Maintenance
30 Stone mining and quarrying	$-	$20,480	$-	$-	$-
31 Sand and gravel mining	$-	$-	$11,040	$-	$-
36 Other nonmetallic materials	$-	$45,080	$-	$-	$-
51 Water, sewage, and other systems	$-	$126,400	$-	$254,240	$-
58 Construction of other new nonresidential structures	$-	$-	$49,600	$-	$-
62 Maintenance and repair construction of nonresidential structures	$-	$42,960	$-	$-	$75,000
64 Maintenance and repair construction of highways, streets, and bridges	$-	$94,520	$-	$-	$-
58 Construction of other new nonresidential structures	$-	$116,880	$-	$106,960	$-
157 Asphalt paving and manufacturing	$-	$163,680	$-	$-	$-
208 Concrete pipe manufacturing	$-	$-	$54,320	$226,800	$-
213 Cut stone and stone product manufacturing	$-	$50,440	$-	$-	$-
326 Street lighting fixtures manufacturing	$-	$64,680	$-	$-	$-
445 Commercial and industrial machinery and equipment rental	$-	$276,560	$172,280	$-	$-
449 Architectural, engineering, and related services	$1,100,000	$-	$-	$-	$-
507 Commercial and industrial machinery and equipment	$-	$35,560	$-	$-	$-

2. Populate IMPLAN model

Analysts created an IMPLAN model and populated the software with appropriate project costs listed in Step 1.

3. Review IMPLAN outputs

Analysts reviewed outputs generated from IMPLAN software for appropriateness. The IMPLAN analysis software evaluates the relationships between employment, labor income, economic output, and value added to GDP three ways: 1) direct impacts, which include industries directly related to mitigation activities; 2) indirect impacts, which include industries that support directly impacted industries; and 3) induced impacts, or benefits created through employee spending.

8.4 Assumptions

Analysts made the below assumptions to run the IMPLAN model accurately.

- Project planning and design will take place from 2016 through 2018. The costs of planning and design are distributed across those three years as described in the project budget.
- Project expenditure inputs are assigned the year of activity completion, IMPLAN outputs are adjusted to 2017 dollars.
- Project construction will occur between 2018 and 2022. Analysts allocated the costs of project construction, including materials, labor, and equipment, equally across those four years to account for temporal differences in project expenditures.
- Analysts applied IMPLAN's Local Purchase Percentage, calculated from the study area's SAM, to all industry sectors. This assumes that a certain percentage of an industry will be purchased locally, discounting commodities or services that are imported from outside of the study area which therefore have no impact on the local economy.

The following caveats apply to the results of the economic impact analysis, and should be considered when evaluating results:

- These results display the expected economic effect of the proposed project on the entirety of Fairfield County.
- The project is in the first stages of planning; the analysis must be considered as preliminary and can be refined as more project details are realized.
- Employment generated by analyzed project expenditures include all full-time, part time, and temporary positions.
- IMPLAN does not account for price elasticities or changes in consumer/industry behavior based on a direct effect, such as changes in spending patterns within sectors not related to project expenditures directly.
- The results presented are those that are associated with the years the project is implemented, and are not projected into the future.

8.5 Results

Analysis results indicate that the Johnson Street Extension and force main, will result in:

- 10 JOBS DIRECTLY RELATED TO THE ACTIVITIES LISTED IN THE **APPROACH**.
- 4 JOBS CREATED IN SUPPORTING INDUSTRIES.
- 5 JOBS CREATED THROUGH EMPLOYEE SPENDING.
- 19 JOBS CREATED TOTAL, WITH $1.8 MILLION IN LABOR INCOME (THIS INCLUDES EMPLOYEE WAGES AND BENEFITS AND PROPRIETOR INCOME).

The top three industries expected to be impacted by project implementation include the ***construction industry, the engineering and architectural services industry, and the water system industry***. As a whole, the project is expected to generate ***$3.7 million in industry production***, creating ***$2.4 million in value added*** (GDP) for Fairfield County.

Figure 3 below offers the results of the economic impact analysis, organized by project activity. These results are presented in percentages to show the contributions that each makes to the whole impact.

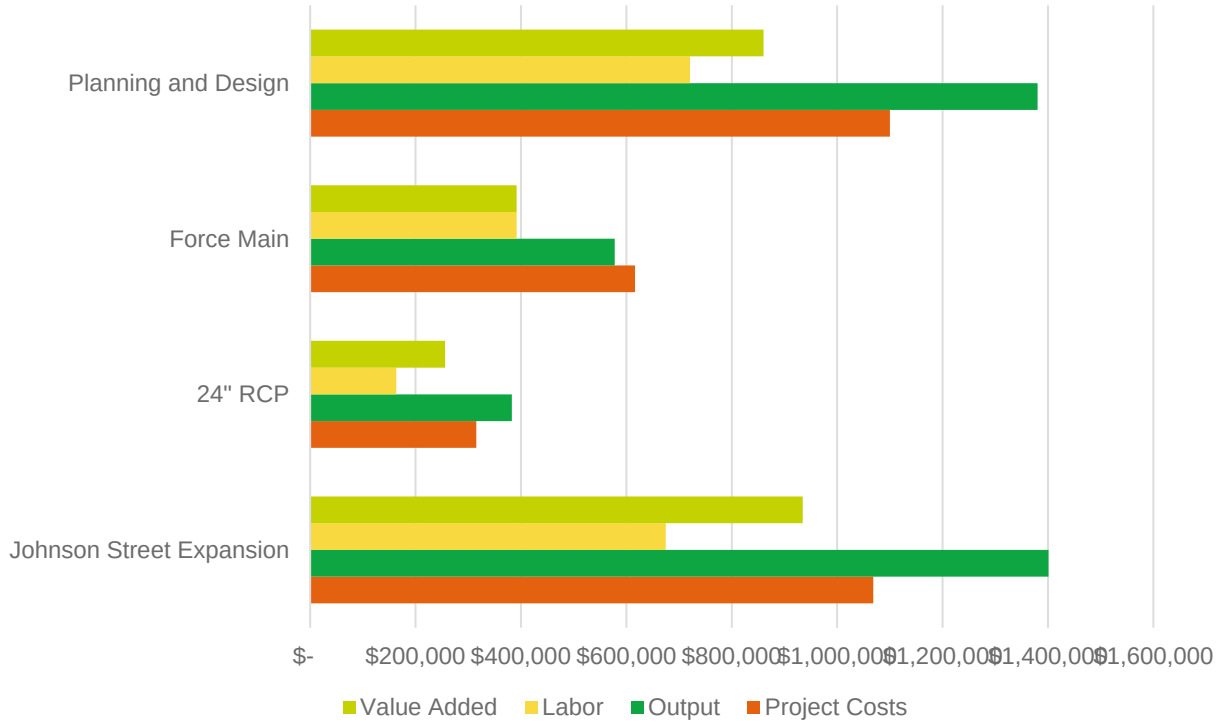


Figure 3. Economic Impact Results by Activity, Presented as Percentages

Design Strategies Report 2B, Resilient Bridgeport: Benefits

(February 28, 2018)

28 FEBRUARY 2018
DESIGN STRATEGIES REPORT 2B

Resilient Bridgeport: Benefits



Design Team

WAGGONNER & BALL

ARCADIS

Led by Waggonner & Ball Architecture/Environment, the design team brings together architects, landscape architects, urban designers, engineers, and ecologists to provide an integrated approach to the development of a resilience strategy for Bridgeport.

Waggonner & Ball Architecture / Environment is a design and planning practice based in New Orleans, close to the Mississippi River and the Gulf of Mexico. Waggonner & Ball designs environments and transformational strategies, from civic buildings to innovative district and regional plans across the United States. **Arcadis** is a global engineering and design consultancy that provides expertise in hydraulic modeling, ecology, economic analysis, civil engineering, and infrastructure design, with an office in New York City.

ALL IMAGES IN THIS REPORT ARE CREDITED TO THE RESILIENT BRIDGEPORT TEAM LED BY WAGGONNER & BALL ARCHITECTURE/ENVIRONMENT, UNLESS OTHERWISE NOTED.

COVER PHOTO: MAY 31, 2015, THE SEASIDES, MARCELLA KOVAC

DESIGN STRATEGIES REPORT 2B

Resilient Bridgeport: Benefits

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1 Introduction

Following the devastation from Hurricane Sandy, the United States Department of Housing and Urban Development (HUD) launched Rebuild by Design (RBD) to inspire innovative community and policy-based resilience solutions to protect cities most vulnerable to intense weather events. HUD awarded the Connecticut Department of Housing (DOH) $10 million through the Rebuild by Design (RBD) competition to reduce flood risk for the most vulnerable public housing stock in the City of Bridgeport's South End and Black Rock Harbor areas. This funding is for the planning and development of resilient strategies and implementation of a pilot project.

The resilient strategies are a comprehensive, multi-layered approach to reduce flood risk, enhance quality of life, and inspire economic revitalization. The five strategies work together, addressing distinct aspects of acute and chronic flood risk. The Restore the Edge strategy creates or enhances natural systems that provide natural flood protection, as well as habitat and resource production, among other ecosystem services. The Adapt to Rising Seas strategy is an integrated flood protection system that will protect against flooding from Long Island Sound and rising seas. The Delay and Convey Stormwater strategy addresses chronic flooding from normal to heavy rainfall events, and separates portions of Bridgeport's stormwater system from the combined sewer system. The Access and Egress strategy provides Bridgeport's residents with dry egress out of high risk flood areas, and is intended to spur redevelopment and economic activity by enhancing connections between people, businesses, and the coast. The Make Power Local strategy supports the creation of district scale microgrids to provide backup power for critical facilities and support sustainable energy production. The project team has designed the resilient strategies to be a proof of concept for broader resilience principles within Bridgeport and the region. The goal is to ultimately develop, prioritize, and implement a long-term flood protection strategy for Bridgeport through these five primary layers.

Following the development of the resilience strategies, the project team went through a design process to select a pilot project. The RBD pilot project will serve as a catalyst for resilience initiatives, and provide flood risk reduction for the future residents of the Marina Village housing complex. More specifically, the RBD pilot project is a system that integrates both green and grey water retention features that center on the Marina Village redevelopment site. In the upland portion of the project area, Johnson Street will be extended, providing dry egress for future Marina Village residents out of the current FEMA 500-year floodplain considering a future SLR condition of 3 feet. Additionally, a shorter route to access dry egress will be available to Seaside Village residents. Johnson Street Extension will also improve east-west

neighborhood connectivity from Park Avenue to Iranistan Avenue and will incorporate green infrastructure to divert surface runoff away from the combined sewer system and into a multiuse "stormwater park." Upland stormwater park from Marina Village development diverts 44,000 CF of water from the combined sewer system for a 1-year storm event; 56,000 CF for a 2-year storm event; 93,000 CF for a 10-year event; and 109,000 CF for a 25-year event.

To release funds, HUD requires a benefit cost analysis (BCA) for the pilot project as a condition to release project funds. As such, the Resilient Bridgeport Team developed a benefit analysis framework to analyze the resilient design strategies and pilot project. This framework considers a wide range of economic, social, and environmental factors to produce a comprehensive understanding of the benefits and impacts of the resilient strategies and RBD pilot project. The project team used the resilient strategies benefits analysis, contained herein, to inform the selection of a pilot project, and the RBD pilot project BCA informs sound public investment.

This document serves to provide a detailed description of resilient strategies benefits and summarize the benefit analysis framework implemented to evaluate the resilient strategies and RBD pilot project. This Benefits Report includes the following principle sections:

- **Introduction** includes an overview of Resilient Bridgeport strategies and the benefit analysis framework
- **Resilient Bridgeport Strategies Benefit Analysis** describes the current risk context and benefits associated with each resilient strategy. Subsections are categorized by benefitting community assets, and describe each strategy's benefits within the category.
- **Resilient Strategies Benefit Analysis Detailed Approach** summarizes the methodology used to evaluate resilient strategies.

Resilient Bridgeport Strategies

The Resilient Bridgeport Team formulated five strategies, working in harmony to address various aspects of resilience, that are comprehensive approaches to reduce flood risk and achieve a more resilient Bridgeport. **Restore the Edge** restores or enhances wetland habitats and coastlines to connect the natural systems of Long Island Sound, as well as preserves and enhances historic parks and creates new amenities that serve the City of Bridgeport and greater region. **Adapt to Rising Seas** is a flood protection system that is

integrated with the landscape to reduce flood risk and improve ecology. **Delay and Convey Stormwater** is a system of grey and green stormwater features to capture stormwater runoff to reduce flood risk and improve water quality. **Access and Egress** includes roadway improvements to provide dry egress, enhance access to the coast, and spur economic reinvestment. **Make Power Locally** implements thermal loops, microgrids, and sustainable energy sources to diversify power options within the City.

Resilient Bridgeport Benefit Analysis Framework

A benefit analysis helps inform sound decision making related to public infrastructure investment by identifying strategic areas for investment that maximize return on investment. Thus, analysts completed benefit analyses to inform resilient design strategies development, justify the implementation of the resilient strategies, and inform the Rebuild by Design (RBD) pilot project. The benefit analysis framework described herein is consistent between the resilient strategies and RBD pilot project, including the methods and figures used to complete the analyses. In accordance with HUD Notice: CPD-16-06, the framework uses federally accepted standard figures and methods to assess project benefits. Sources include Federal Emergency Management Administration (FEMA), the United States Army Corps of Engineers (USACE), the Federal Aviation Administration (FAA), the Environmental Protection Agency (EPA), and other published sources.

Within the framework, benefits fall into two broad categories: resiliency benefits and value added benefits. Resiliency benefits consist of estimated flood impacts to structures, roads, the economy, and residents that the resilient strategies or RBD pilot project will reduce. Value added benefits consists of additional benefits beyond flood protection, such as environmental, aesthetic, and recreational benefits.

As stated above, the resilient strategies benefit analysis informed the selection of a RBD pilot project. The analysis provides a broad understanding of the benefits of each strategy, which the project team used to bring to focus initiatives that provided the greatest benefit to the City of Bridgeport. Following the selection of a pilot project, analysts translated the resilient strategies benefit analysis to the RBD pilot project BCA through refinement of the pilot project's scope, design, schedule, and budget. Refer to the **Benefit Cost Analysis Summary Report** for the RBD pilot project BCA results, and the **Benefit Cost Analysis Methodology Report** for detailed descriptions of the methods and figures used to evaluate benefits. The following sections provide the outputs of the resilient strategies benefits analysis, as well as describes the approach taken to reach analysis outputs.

2 Resilient Bridgeport Strategies Benefit Analysis

The purpose of the resilient strategies benefit analysis is to explore the benefits of each strategy to inform the selection of a pilot project. To complete the resilient strategies benefits analysis, analysts first gained an understanding of the resilient strategies' goals and objectives, defined benefits, and identified benefitting community assets. To define benefits, analysts translated strategy goals and objectives to specific benefits, and grouped them with community assets. Community assets are categorized as:

- **People:** Bridgeport's residents benefitting from the resilient strategies
- **Environment:** Natural areas or systems benefitting from the resilient strategies
- **Economy:** Commercial structures and businesses that will benefit from the resilient strategies
- **Infrastructure/ Structures:** Built assets that will benefit from flood protection and increased connectivity

To evaluate the potential impact of the resilient strategies, analysts determined the number of benefitting community assets. Then, they described benefits to community assets for each resilient strategy. Following this step, analysts quantified certain benefits identified by the project team, making different analysis assumptions to quantify the monetary value of benefits. Quantifiable benefits are either: annualized flood impacts avoided (losses avoided) or annual value added (ecosystem services).

The following subsections provide analysis results, organized as follows:

- **Resilient Bridgeport Benefits Summary:** summarizes value added benefits for each strategy and the total number of community assets reaping resiliency benefits from the resilient strategies
- **Risk Context:** provides the reader context to the benefits described in detail following this section
- **People:** describes expected benefits to the residents of Bridgeport
- **Environment:** details expected environmental benefits
- **Economy:** provides a description of benefits to the local economy
- **Infrastructure/ Structures:** describes benefits to structures, critical facilities, and infrastructure

Resilient Bridgeport Strategies Benefit Summary

Each resilient design strategy contributes to resilience by protecting against acute or chronic flood risk, or by reducing social and economic vulnerability through value added benefits, such as increasing connectivity, providing opportunities to build social cohesion, or diversifying the local economy through revitalization. Table 1 summarizes the number of people, commercial structures, structures, and key infrastructure expected to experience resiliency benefits and lists the value added benefits expected to occur due to implementation of the resilient strategies. A subsection for People, Environment, Economy, Infrastructure/Structures follows this table, and each section describes the resilient strategies' benefits.

Table 1. Resilient Strategies Benefits Summary Table

Resilience Design Strategies		Resiliency Benefits (Vulnerable Assets Protected)				Value Added Benefits			
		People	Economy*	Structures**	Infrastructure***	People	Environment	Economy	Infrastructure
Restore the Edge: Strengthen and Provide Access to the Coast	Preserve and enhance historic parks, restore wetland habitats and coastlines, connect to systems of the Long Island Sound, and create a new set of accessible amenities and infrastructure that serves the city and the region.	3,176	13	362	9	• Improved health • Enhanced recreational and educational opportunities	• Improved water and sediment quality • Improved air quality • Climate regulation • Restored and enhanced ecological habitats; 270 acres of new or enhanced natural space generates $8.8 million in annual ecosystem services	• Revitalization • Increased property values • Cost savings • Poverty alleviation • Tourism and recreation	-
Adapt to Rising Seas: Provide Surge Protection	Create a line of defense that is integrated in the landscape, improves connections and ecology, and anchors redevelopment, phase implementation to provide both immediate and long-term value, and develop new mechanisms for funding and operations.	2,798	39	419	28	• Improved health • Enhanced recreational and educational opportunities	• Improved air quality • Climate regulation • Protecting inland vegetation and habitats from saltwater storm surge	• Revitalization • Increased property values • Poverty alleviation	-
Delay and Convey Stormwater: Enhance Stormwater Capture and Discharge	Integrate retention strategies into urban landscape, catching and holding where it falls, structure flows of water to nurture habitats, and improve flushing and estuarine conditions, improve groundwater management to stabilize soils, and reduce basement flooding and other	5,710	72	668	42	• Improved health	• Improved water and sediment quality • Improved air quality • Climate regulation • Reduction in existing CSO volume (37,437,000 gallons) by 95 percent (35,565,150 gallons) results in $10 million in annual benefits	• Revitalization • Increased property values • Cost savings	-

Resilience Design Strategies		Resiliency Benefits (Vulnerable Assets Protected)				Value Added Benefits			
		People	Economy*	Structures**	Infrastructure***	People	Environment	Economy	Infrastructure
	damage and risks associated with groundwater.								
Access and Egress: Improve Access and Development Opportunity	Enhance access between coastal neighborhoods, habitats, and coastline, ensure emergency access and egress, strengthen or create distinct identities that link to land and water resources, histories, people, and businesses that can enhance social cohesion and spur economic development with new and existing infrastructure.	3,632	33	516	45	• Improved health • Enhanced recreational and educational opportunities	• Restored and enhanced ecological environments generate ecosystem services	• Revitalization	• Improved transit system
Make Power Locally: Create Distributed Utility Networks	Support expansion of thermal loop to reuse waste heat, support development of district-scale microgrids to provide backup power for critical facilities, support development of sustainable energy production, and connect new energy systems with new forms of transport, including electric shuttles.	-	-	-	Assets benefitting have not yet identified	• Improved health	• Improved water and sediment quality • Improved air quality • Climate regulation	• Revitalization • Cost savings • Poverty alleviation	-

***Number of commercial structures protected**

****Number of structures protected out of the total number of structures in the study area, 1,490**

*****Refer to Table 8 for a full listing of assets protected**

Risk Context

Two sets of factors contribute to flood risk and vulnerability within Bridgeport: flood hazards and social/ economic vulnerability. Exposure of vulnerable assets to acute and chronic flooding creates a scenario where the City's most vulnerable populations and distressed economic assets are at risk of experiencing flood impacts during heavy rainfall and surge events. The below details existing flood hazards and the socioeconomic status in the South End.

Flood Risk Context

Bridgeport is uniquely vulnerable to the impacts of storms and flooding due to its low elevation, existing stormwater infrastructure, and population demographics in low-lying areas. The South End neighborhood was constructed on a peninsula and partly on former wetlands that were filled in during the 19th and 20th centuries. The historic development of the peninsula protruded south from the mainland towards Long Island Sound, and at its center, Park Avenue, an important street in the City, ran north from the coast along a higher ridge line. As regions west of the peninsula were filled to make more developable land, natural drainage patterns were disrupted, and filled land was constructed close to sea level.

Residential development constructed in these low-lying areas has long been prone to chronic flooding, from even modest storm events. In the last 6 years, two major storms have impacted Bridgeport – Tropical Storm Irene and Hurricane Sandy. Both caused massive damage and major flooding, and forced thousands of people to evacuate. It is estimated that Hurricane Sandy alone caused over $38 million worth of damage to buildings and contents within the project area. Storms of Sandy's caliber inundate low-lying areas with storm surge flooding at depths of 5 to 6 feet.[1] Bridgeport is not only affected by acute flooding caused by storms, but also by chronic stormwater flooding which occurs on an annual basis. The topography of the South End combined with a high groundwater table, low elevation, and inadequate stormwater drainage, causes sidewalks and roads to flood after even a minor rainfall event. Because Bridgeport has a combined sewer system, these floods can expose residents to untreated wastewater, creating a public health hazard. As sea levels rise, the chronic flooding problem is expected to worsen dramatically.

[1] FEMA MOTF Hurricane Sandy Impact Analysis. https://www.arcgis.com/home/item.html?id=307dd522499d4a44a33d7296a5da5ea0.

Social Vulnerability

The other set of factors affecting Bridgeport's vulnerability is the social demographics in the South End and the city. Bridgeport was founded as an industrial city, but in recent decades that industry has been declining, leading to a depressed local economy. The South End, especially, faces great economic hardship. The neighborhood has some of the highest unemployment rates and lowest median salaries in Connecticut, and there is a noticeable lack of economic development and job opportunities in the neighborhood.[2] Approximately 42 percent of the population of the South End is below the national poverty level, and the median household income is $24,304. Even within Bridgeport that level of poverty is disproportionate; an estimated 16 percent of the population is below the poverty level city-wide.[3] These factors contribute to making the South End extremely socially vulnerable in the event of a flood.

People

Though there are many intricacies to social dynamics in Bridgeport, the city's resident's share a heightened social vulnerability, which presents a significant opportunity to pursue resiliency solutions which benefit the entire community. Through the implementation of the resilience strategies, Bridgeport's residents will take advantage of mental and physical benefits in both personal and professional realms. Specifically, locals will experience a reduction in displacement time and costs, injuries and fatalities, mental stress and anxiety, and lost productivity, and an increase in health, recreational and educational opportunities and shelter.

Resiliency Benefits (Losses Avoided)

Reduction in Displacement Time and Costs

1. Displacement time and costs account for the damages people face when they are forced to evacuate their homes or businesses. Displacement time is the duration from the initial damage to the structure until it can be reoccupied, while displacement costs are comprised of a one-time displacement cost in addition to the accrual of monthly rent for the span of the displacement.[4] Through providing

ADAPT TO RISING SEAS ANNUAL BENEFIT: $105,000

[2] https://www.census.gov/programs-surveys/acs/
[3] http://www.city-data.com/city/Bridgeport-Connecticut.html
[4] FEMA, 2011. FEMA Benefit-Cost Analysis Re-engineering (BCAR). https://www.hudexchange.info/course-content/ndrc-nofa-benefit-cost-analysis-data-resources-and-expert-tips-webinar/FEMA-BCAR-Resource.pdf

direct protection and enhancing water conveyance systems in modeling and making use of the natural resilience of green infrastructure, the combined effects of the resilient design strategies including **Adapt to Rising Seas**, **Restore the Edge**, and **Delay and Convey Stormwater** will reduce the number of evacuations and help displaced households and businesses recover more expediently.

Reduction in Injuries and Fatalities

1. Fatalities and injuries are an unfortunate risk inherent to hazard events. One significant benefit offered by the project is the reduction in risk of injuries and fatalities during flood events. With an overall reduction in flooding frequency and intensity, there will also be a reduction in injuries and fatalities. Several of the resilience design strategies used in this project will work together to contribute to a reduction in flooding. The **Delay and Convey Stormwater**, **Restore the Edge**, and **Adapt to Rising Seas** strategies each play a role in reducing flood risk.

ADAPT TO RISING SEAS ANNUAL BENEFIT: INJURIES: $74,000; FATALITIES: $162,000

2. Easy access to dry egress is essential for the safety of any community. In the event of a flood, residents must be able to quickly and safely evacuate the neighborhood and get to higher ground. Emergency services such as ambulances and firetrucks also need a way into the neighborhood to help stranded or injured residents. The **Access and Egress** strategy will ensure that the neighborhood has dry egress and well-designed signage for easy navigation before, during, and after a flood event.

Reduction in Mental Stress and Anxiety

1. Natural disasters may threaten health, social, and economic wellbeing, which leads to psychological distress. Prevalence rates of mild and moderate mental illnesses tend to be higher in post-disaster periods.[5] This increases mental health care costs and burdens individuals and society. Additionally, living in a neighborhood with frequent flooding can be a source of constant stress to residents, who may worry about when the next flood will occur. The combined effects of the **Delay and Convey Stormwater**, **Adapt to Rising Seas**, and **Restore the Edge** strategies will reduce the frequency of

ADAPT TO RISING SEAS ANNUAL BENEFIT: $160,000

[5] FEMA, 2012. Final Sustainability Benefits Methodology Report.

floods in Bridgeport, and will reduce flooding intensity when they do occur. These reductions will improve stress levels and overall mental health in the community.

2. The **Access and Egress** strategy will improve wayfinding and urban design in the neighborhood which can help reduce day-to-day stress related to navigation and stress in the event of an emergency. During a flood or other event, improved urban design can make it easier for residents to evacuate and reach safety.

Reduction in Lost Productivity

1. Severe weather is a common detriment to productivity as it is the foremost cause of power outages nationwide.[6] Modernizing the grid and increasing grid resilience through the **Make Power Locally** strategy can help maintain and improve the local continuity of services even during extreme events for both critical and noncritical infrastructure.[7]

ADAPT TO RISING SEAS
ANNUAL BENEFIT: $99,000

2. There is a definite relationship between mental stress impacts and disasters, which takes a societal and economic toll through the costs of treatment and the cost of lost productivity. Green infrastructure measures implemented through the **Delay and Convey Stormwater**, **Restore the Edge** and **Adapt to Rising Seas** strategies help protect against flood damage and disasters and therefore reduce mental health impacts. Fewer mental health impacts will reduce lost work productivity, as quantified by FEMA's standard Value of Lost Time at $1,600 a month, which can also have a significant and long-lasting economic impact.[8]

Shelter Needs

1. During a flood event, residents may need to seek shelter if they cannot access their homes. Even though homes may not be damaged, people will be displaced if they are evacuated or cannot physically access their property by foot, vehicle, or transit due to flooded roadways and transit systems. The **Access and Egress** strategy will improve the accessibility of shelters in the neighborhood, and will ensure that there are safe routes to reach them.

[6] Executive Office of the President, 2013. https://energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf
[7] Crabtree, Misewich, Ambrosio, Clay, DeMartini, James, Lauby, Mohta, Moura, Sauer and Slakey, 2011. Integrating renewable electricity on the grid. https://www.aps.org/policy/reports/popa-reports/upload/integratingelec.pdf
[8] FEMA, 2012. Final Sustainability Benefits Methodology Report.

Value Added Benefits

Improved Health

1. Human health is related to the condition of the environment, and can derive benefits from well-functioning natural processes. As green infrastructure captures and treats rainwater where it falls, the **Restore the Edge** design strategy can help lessen the harmful effects of polluted urban runoff in rivers, lakes and coastal waters.[9] Furthermore, wetlands can help mitigate human health problems resulting from primarily nitrogen and phosphorus nutrient pollution due to unchecked algae growth.[10]

2. Implementing the **Make Power Locally** strategy through wind, solar, hydroelectric, geothermal, biomass, fuel cell, and combined heat and power (CHP) energy systems would lower the total air emissions associated with existing local generation mix dominated by coal-and natural gas-fired power plants.[11] The impact of the generation of fossil fuel electricity in the United States on health represents an estimated annual economic expenditure of $361.7 to $886.5 billion, or 2.5-6.0% of the national GDP.[12] The industry's associated air and water pollution from coal and natural gas plants is tied to breathing problems, neurological damage, heart attacks and cancer.[13] Through the direct reduction of emissions and related diseases, local and renewable power improves environmental quality and thus advances public health.

3. The **Delay and Convey Stormwater** design strategy will reduce human health risks related to combined sewer overflows (CSOs). CSOs cause untreated wastewater to be released to surface waters, and sometimes flood streets and sidewalks. This creates opportunities for humans to encounter harmful bacteria, which can cause serious illnesses. CSOs are especially dangerous in areas with public beaches; the US EPA estimates that CSOs, in combination with separate sewer overflows (SSOs) cause at least 5,576 illnesses every year at beaches across the country.[14] The total

[9] American Rivers, the Water Environment Federation, the American Society of Landscape Architects and ECONorthwest, 2012. Banking On Green: A Look at How Green Infrastructure Can Save Municipalities Money and Provide Economic Benefits Community-wide. https://www.asla.org/uploadedFiles/CMS/Government_Affairs/Federal_Government_Affairs/Banking%20on%20Green%20HighRes.pdf

[10] Conathan, Buchanan, and Polefka, 2014. The economic case for restoring coastal ecosystems. *Center for American Progress & Oxfam America, Washington, DC*. https://www.americanprogress.org/wp-content/uploads/2014/04/CoastalRestoration_report.pdf

[11] Benefits of Renewable Energy Use, 2013. http://www.ucsusa.org/clean-energy/renewable-energy/public-benefits-of-renewable-power#.WW5QjYjythE

[12] Machol and Rizk, 2013. Economic value of US fossil fuel electricity health impacts. *Environment international*. http://www.sciencedirect.com/science/article/pii/S0160412012000542

[13] Benefits of Renewable Energy Use, 2013.

[14] Banking on Green, 2012.

number of illnesses caused by exposure to bacteria from CSOs is likely much higher, since the above number does not consider inland areas or non-beaches.

4. The **Adapt to Rising Seas**, **Restore the Edge** and **Access and Egress** strategies will provide new outdoor recreation space to the neighborhood and improve access to facilitate biking and walking. Urban green space is associated with a variety of social benefits ranging from increased recreational and educational opportunities and aesthetic enjoyment, regulated psychological well-being, promoted physical health and enhanced social ties.[15] Regular exercise strongly influences an individual's health. Physical activity can reduce cardiovascular problems, diabetes and certain types of cancers, while blood pressure can be lowered in natural settings.[16] Equal access active-use green areas have been shown to substantially contribute to the overall quality of life.[17]

Enhanced Recreational and Educational Opportunities

1. Through the preservation, restoration and enhancement of historic parks, wetland habitats and coastlines, the **Restore the Edge** strategy improves accessibility and makes the resulting environments more conducive to recreational and educational activities. Schools and local organizations can play an active role in the stewardship of these native habitats, which can act as a stimulus for community involvement. Restoring these areas along the coast also provides habitat for fish, birds and other wildlife of commercial and recreational importance, which in turn supports nature-based opportunities for further engagement.[18] Additionally, properly managed green infrastructure and bioretention and infiltration practices can improve community livability through benefit local aesthetics across shoreline, parks and pathways.[19] Complementing this coastal restoration, the **Adapt to Rising Seas** strategy provides new and improved park space, bicycle, and pedestrian trails, as well as community gathering and recreational spaces that will give local populations and visitors a number of opportunities to participate in a variety of activities such as walking, jogging, bicycling, and playground use. The **Access and Egress** strategy will improve wayfinding through urban design elements and access to bike paths which will enhance recreational and educational opportunities. The strategy will also create opportunities for community

[15] Zhou, X. and M.P. Rana. 2011. Social benefits of urban green space. A conceptual framework of valuation and accessibility measurements. Management of Environmental Quality: An International Journal.
[16] Zhou, X. and M.P. Rana. 2011. Social benefits of urban green space.
[17] Lestan, K.A., Erzen, I., and M. Golobic . 2014. The Role of Open Space in Urban Neighbourhoods for Health-Related Lifestyle. 2014. International Journal of Environmental Research and Public Health. June
[18] Ruckelshaus, Guannel, Arkema, Verutes, Griffin, Guerry, Silver, Faries, Brenner and Rosenthal, 2016. Evaluating the benefits of green infrastructure for coastal areas: Location, location, location. Coastal Management. http://www.tandfonline.com/doi/pdf/10.1080/08920753.2016.1208882?needAccess=true&
[19] Gallet, 2011. The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Environmental and Social Benefits. Proceedings of the Water Environment Federation. http://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf

engagement through bike tours, such as a student bike ride through the watershed that the design team organized.

Environment

Due to the city's natural capital and industrial history, Bridgeport's environment plays a vital role in connecting the local population, economy and infrastructure, and therefore has a significant opportunity to act as a catalyst in achieving regional benefits. Implementing the resiliency strategies will improve water, sediment and air quality, regulate the climate and restore and enhance ecological habitats.

Value Added Benefits

Improved Water and Sediment Quality

1. The offshore and estuarial ecological habitats central to the **Restore the Edge** strategy support the establishment of species which directly improve water quality. Kelp thrives in acidic ocean waters though naturally lowering dissolved acid, nitrogen and phosphorus while giving off oxygen, creating a more habitable environment for a variety of organisms.[20] Oysters greatly benefit estuary ecology through filtering water containing algae as well as inert and polluting sediments.[21] Local Menhaden fish schools filter feed on phyto- and zooplankton in water treatment plant outfall, helping to clean the water further.[22] A greater number of species can prospectively benefit from Restoring the Edge, though these examples are representative of the cascade of benefits that can be derived through improved water quality.

DELAY AND CONVEY STORMWATER
ANNUAL BENEFIT: $10 MILLION

2. The **Make Power Locally** strategy represents an efficient and sustainable use of water resources. In contrast to fossil fuels, which substantially impact water resources, wind and solar energy require

[20] National Oceanic and Atmospheric Administration. *Seaweed in the Spotlight.* http://www.nmfs.noaa.gov/aquaculture/homepage_stories/paul_allen_grant.html
[21] South Carolina Department of Natural Resources. *Ecology of Oysters, Oyster Growth, and Water Quality.* http://score.dnr.sc.gov/ktmlpro10/files/uploads/riverlab.pdf
[22] Food and Agriculture Organization of the United States. *Brevoortia tyrannus Species Fact Sheet.* http://www.fao.org/fishery/species/2094/en

limited amounts of water and do not pollute or strain supplies in competition with other important water needs such as agriculture or drinking water systems.[23]

3. The **Delay and Convey Stormwater** and **Restore the Edge** strategies confront the significant challenge of stormwater runoff in urban areas. Water that falls on impervious surfaces picks up pollutants and enters the sewer system where it is then either treated or transferred into the environment. When a heavy rainfall event occurs, large volumes of stormwater can exceed the capacity of the system and result in overflows that release untreated wastewater into Long Island Sound. Green infrastructure features collect stormwater runoff and allow it to infiltrate the ground or evaporate. Not only do they reduce the need for stormwater treatment, but they also contribute to fewer and lesser overflow events and can filter land-based pollutants associated with contaminated soil on former industrial land.[24]

4. Through the establishment of wetlands, the **Restore the Edge** strategy helps mitigate the negative impact of nutrient pollution as it contaminates drinking water and contributes to eutrophication and the extent of coastal "dead zones". The absorption of anthropogenic nitrogen can help lessen the extent of its damage to ecosystem productivity, biodiversity, recreation and the availability of clean water.[25]

Improvement in Air Quality

1. Air pollution is a significant and expensive urban problem that reduces the health of urban residents. Criteria air pollutants (nitrogen dioxide, sulfur dioxide, particulate matter, and ozone) impose a variety of health impacts, such as increased risk of bronchitis, asthma, and emphysema.[26] Natural vegetation such as existing forests and wetlands, stormwater wetlands, stormwater tree trenches, bioswales and rain gardens can absorb these air pollutants and reduce health risks in the surrounding population. The green stormwater retention and conveyance features of the **Delay and Convey Stormwater** strategy, the living shoreline elements of the **Adapt to Rising Seas** strategy, the green infrastructure components of the **Restore the Edge** strategy and the renewable energies in the **Make**

[23] Benefits of Renewable Energy Use, 2013.
[24] Ruckelshaus, Guannel, Arkema, Verutes, Griffin, Guerry, Silver, Faries, Brenner and Rosenthal, 2016. Evaluating the benefits of green infrastructure for coastal areas: Location, location, location. *Coastal Management*. http://www.tandfonline.com/doi/pdf/10.1080/08920753.2016.1208882?needAccess=true&
[25] Conathan, Buchanan, and Polefka, 2014. The economic case for restoring coastal ecosystems.
[26] US Environmental Protection Agency. *Criteria Air Pollutants*. https://www.epa.gov/sites/production/files/2015-10/documents/ace3_criteria_air_pollutants.pdf

Power Locally strategy all improve air quality through the uptake and deposition of particulate matter or avoidance of pollutant emissions.[27]

Climate Regulation

1. Carbon dioxide emissions vary greatly by the source of electricity generation, which has significant repercussions on the climate. Natural gas emits between 0.6 and 2 pounds of carbon dioxide equivalent per kilowatt-hour (CO2E/kWh) while coal emits between 1.4 and 3.6 pounds of CO2E/kWh. The renewable energies produce fractions of these numbers; wind emits 0.02 to 0.04 pounds of CO2E/kWh, solar 0.07 to 0.2, geothermal 0.1 to 0.2, and hydroelectric 0.1 and 0.5.[28] Popular in Connecticut due to the local manufacturing base, fuel cells are a transitional alternative that utilize natural gas feedstock but emit between 0.9 and 1.0 CO2E/kWh or just over half that (0.5 to 0.7 CO2E/kWh) when used to anchor a CHP system. Taken altogether, electricity generation represents over a third of U.S. carbon dioxide emissions, of which 68 percent is attributed to coal-fired power plants, followed by natural gas-fired power plants, which contribute 30 percent of emissions.[29] The **Make Power Locally** strategy would utilize renewable energy sources which produce little to no global warming emissions.[30] Furthermore, the green infrastructure central to the **Adapt to Rising Seas** and **Restore the Edge** strategies helps lower ambient air temperatures, decrease the energy needed to warm and cool buildings, diverts stormwater from wastewater treatment, in turn reducing energy used to treat stormwater, all of which results in reduced carbon dioxide emissions.[31] Furthermore, coastal environments can contribute to climate regulation as they act as highly effective sinks increasing carbon sequestration.[32]

Restored and Enhanced Ecological Habitats

1. Coastal environments have an ability to self-sustain and adapt to changes in the climate with minimal human involvement.[33] Rebuilding the native coastal environment and the wetlands, beaches, dunes and low-lying coastal woodlands that

RESTORE THE EDGE ANNUAL BENEFIT: $8.8 MILLION

[27] Gallet, 2011. The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Environmental and Social Benefits. *Proceedings of the Water Environment Federation*. http://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf
[28] Benefits of Renewable Energy Use, 2013.
[29] U.S. Energy Information Administration, 2017. https://www.eia.gov/tools/faqs/faq.php?id=77&t=11
[30] Benefits of Renewable Energy Use, 2013.
[31] Center for Neighborhood Technology. *The Value of Green Infrastructure.* http://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf
[32] Conathan, Buchanan, and Polefka, 2014. The economic case for restoring coastal ecosystems.
[33] Ruckelshaus, Guannel, Arkema, Verutes, Griffin, Guerry, Silver, Faries, Brenner and Rosenthal, 2016. Evaluating the benefits of green infrastructure for coastal areas: Location, location, location. Coastal Management.

historically dominated the shoreline supports the establishment and maintenance of diverse terrestrial and aquatic ecosystems. The **Restore the Edge** strategy can attract historically displaced species, and in particular, four species that represent the great diversity and resilience of the Connecticut shorelines: Oysters, Bluefish, Horseshoe Crab and Red Knot. Restoring and enhancing the physical landscape can help increase species diversity in the process of supporting the entire community of organisms.[34] Furthermore, as the provision of ecosystem services provided by lower trophic level species is linearly dependent on habitat size and quality, new or enhanced natural space can generate ecosystem services (Table 2).[35]

Table 2. Summary of Ecosystem Services (2016 dollars)

Ecosystem Service	Wetland	Riparian
Provisioning Services		
Food	$131,300	$118,800
Fiber/Raw Materials	$55,000	-
Water Supply	$21,400	-
Regulating Services		
Hurricane Storm Hazard Risk Reduction	$390,700	
Waste Reduction and Filtration/Water Quality	$71,700	$828,600
Climate Regulation	$21,000	$39,800
Water Retention/Flood Hazard Reduction	$523,400	$780,900
Air Quality	-	$41,900
Support Services		
Nutrient Cycling	$51,800	-
Habitat	$16,100	$162,800
Biological Control	-	$31,900
Erosion Control	-	$2,230,800
Cultural Services		
Recreation/Tourism	$47,400	$2,957,900
Aesthetic Value	$168,800	$113,200
Biodiversity	$11,100	-
Total Ecosystem Service Value	**$1,509,700**	**$7,306,600**

2. The **Access and Egress** strategy will integrate built infrastructure with the natural environment through the sustainable redevelopment of existing sites for residential, commercial and eco-industrial purposes. Eco-industrial parks will facilitate the transfer of green technologies, use of

[34] Jordan, Peters and Allen, 1998. Ecological restoration as a strategy for conserving biological diversity. https://link.springer.com/article/10.1007/BF01867377
[35] Dobson, Lodge, Alder, Cumming, Keymer, McGlade, Mooney, Rusak, Sala, Wolters and Wall, 2006. Habitat loss, trophic collapse, and the decline of ecosystem services. *Ecology*.

resource-effective methods and reuse of waste energy and materials, which will lessen the impact on the surrounding environment and contribute to the restoration and enhancement of ecosystems.[36]

3. The **Adapt to Rising Seas** strategy will protect inland vegetation and habitats through buffering storm surge that might otherwise inflict extensive damage. Research indicates that each mile of vegetation that exists can reduce the height of storm surge by one foot.[37]

Economy

As a historically industrial city, Bridgeport presents a substantial opportunity to establish a more resilient future through its economy. The resiliency strategies will provide a benefit in the reduction in business interruption, while value-added benefits will include economic revitalization, increased property values, cost savings, poverty alleviation, and increased tourism and recreation.

Resiliency Benefits (Losses Avoided)

Reduction in Business Interruption

1. Business interruption costs are associated with revenue, sales, and jobs that are impacted because of a flood event which interrupts the operations of a business, or the temporary removal of a piece of real estate, from the market. Business interruption impacts are classified as direct, indirect, and induced, and model the effects of local business closures throughout a greater region. This analysis assumes that businesses which experience interruption because of flood impacts are eventually able to return to business as usual. Several resilience design strategies will work together to minimize business disruptions and prevent major revenue loss. The **Delay and Convey Stormwater** and **Adapt to Rising Seas** strategies will reduce the overall frequency and intensity of flooding, leading to fewer instances of service interruption. Installation of green infrastructure and flood barriers will



ADAPT TO RISING SEAS ANNUAL BENEFIT: $396,000

[36] UNIDO, 2017. Eco-industrial parks: creating shared prosperity and safeguarding the environment. https://www.unido.org/news/press/eco-industrial-parks.html

[37] NOAA. Understand – Conserving Coastal Wetlands for Sea Level Rise Adaptation. https://coast.noaa.gov/applyit/wetlands/understand.html

protect the neighborhood from stormwater flooding and coastal flooding, both day-to-day and during storm events.

2. Besides direct flooding effects that can damage inventory, power outages are a major threat to continuity of services. Costs associated with power outages for businesses can include lost output and wages, spoiled inventory, inconvenience, and startup costs after the outage ends. Renewable energies are typically less prone to large-scale failure as they are characteristically distributed and modular.[38] The **Make Power Locally** strategy distributes energy generation over a larger geographic area, therefore providing resilience to localized severe weather events that might threaten more centralized systems and cut off power at a large scale.

Value Added Benefits

Revitalization

1. The **Make Power Locally** strategy will involve transitioning to a microgrid energy distribution system, as well as utilizing more energy from renewable sources. Both of those factors will contribute to revitalizing the local economy. The community would be less reliant on imported fuels such as coal and natural gas.[39] Instead, utility fees would go back to local energy producers and distributors.

2. Installation of surge protection measures in the **Adapt to Rising Seas** strategy and green infrastructure measures through the **Delay and Convey Stormwater** strategy can act as a revitalizing aesthetic improvement to neighborhoods if the project includes urban design considerations. Redevelopment of grey infrastructure can transform the neighborhood, spurring economic growth. The economic benefits of revitalization efforts may be measured through the anticipated addition of economic output and the creation of labor income.

3. Increasing navigability and accessibility through the **Access and Egress** strategy can make neighborhoods more appealing to the establishment of businesses. Strategic and attractive urban design will draw consumers to the neighborhood and potentially increase revenue for businesses.

[38] Benefits of Renewable Energy Use, 2013.
[39] Benefits of Renewable Energy Use, 2013.

4. The redevelopment and restoration of Bridgeport's waterfront as described in the **Restore the Edge** strategy will realize immediate short-term economic impacts due to project spending. Broader, longer term economic stimulus can persist as areas rehabilitated with coastal and near-shore habitat infrastructure experience an increase in consumer spending, recreation and tourism.[40] Additionally, healthier coastal ecosystems could lead to the revitalization of Bridgeport's commercial fishing and aquaculture industries, such as oyster farming or kelp farming.

Increased Property Values

1. Several of the resilience design strategies for this project will work together to increase property values in Bridgeport. The **Delay and Convey Stormwater** and **Adapt to Rising Seas** strategies will reduce the frequency and intensity of floods in the neighborhood, which could increase the desirability of the neighborhood and therefore property values. Businesses may be more likely to move to the neighborhood while residents would be more likely to stay. The health of coastal ecosystems is also linked with property values. The **Restore the Edge** strategy will increase recreation space and make aesthetic improvements along the shoreline, making neighborhoods near the water more desirable.[41] The **Access and Egress** strategy will also contribute to property value increases. Through redevelopment of underutilized sites and increasing overall neighborhood safety, the South End will become a more attractive place to live. New transit options like bike paths, shuttles, and driverless vehicles will make the neighborhood more accessible and more convenient for commuters.

Cost Savings

1. Several resilience design strategies will result in major cost savings for the city and region. Research shows that restoring coastal ecosystems and wetlands leads to a reduction in nitrogen pollution in surface water, which has a huge cost saving impact. Across the country, wetlands remove approximately 5.8 million metric tons of nitrogen, resulting in a savings of over $12.76 billion.[42] The natural infrastructure elements that comprise the **Restore the Edge** strategy are associated with cost-effectiveness, not only through nitrogen pollution reduction, but also through a decrease in long term maintenance costs.[43] Healthy coastal wetlands drastically improve local sediment and water quality, which reduces pollution and management costs.

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[40] Edwards, P. E. T., A. E. Sutton-Grier, and G. E. Coyle. "Investing in nature: restoring coastal habitat blue infrastructure and green job creation." *Marine Policy* 38 (2013): 65-71.
[41] Conathan, Buchanan, and Polefka, 2014. The economic case for restoring coastal ecosystems.
[42] Conathan, Buchanan, and Polefka, 2014. The economic case for restoring coastal ecosystems.
[43] World Business Council for Sustainable Development, 2017. http://www.wbcsd.org/Clusters/Water/Natural-Infrastructure-for-Business/Resources/Incentives-for-Natural-Infrastructure

2. Green infrastructure implementation has potential for cost savings when compared with grey infrastructure. The **Delay and Convey Stormwater** strategy will implement green infrastructure in the community to tie into the existing grey infrastructure system. According to an EPA case study, implementing green infrastructure can save millions of dollars in capital costs over the lifetime of the project.[44]

3. The use of microgrids and renewable energy in the **Make Power Locally** strategy will result in large cost savings for Bridgeport residents and the city itself. After the initial capital investment required to install renewable energy systems and microgrid technology, there will be very little, if any, maintenance required.[45]

Poverty Alleviation

1. Coastal restoration projects in the **Restore the Edge** strategy create a range of job and career opportunities, including planning and design, implementation and construction, and operations and monitoring. According to a study by Oxfam and the Center for American Progress, projects to rehabilitate coastal wetlands can help residents out of poverty through job creation.[46] Ecosystem restoration work can create up to 39 jobs for every $1 million invested in the project.[47] In the South End of Bridgeport, where 42% of residents are below the national poverty level, those new jobs would be of huge importance. Beyond construction and maintenance jobs, there is also potential for the creation of jobs in revived industries, such as oyster and kelp farming, as well as tourism.

2. The **Make Power Locally** design strategy has the potential to create many new jobs in the region. Renewable energy sources generally require significant labor to construct and install, meaning more jobs are created. Compared with traditional energy sources like coal and natural gas, renewable energies create more jobs per unit of electricity generated.[48] Jobs will also be created for microgrid construction and maintenance.

3. Implementation of surge protection measures, such as those described in the **Adapt to Rising Seas** strategy, would require unskilled and skilled labor; labor that may be filled by otherwise unemployed

[44] US Environmental Protection Agency. The Economic Benefits of Green Infrastructure; A Case Study of Lancaster, PA. https://www.epa.gov/sites/production/files/2015-10/documents/cnt-lancaster-report-508_1.pdf
[45] Kwasinski, Weaver and Balog, 2016. Microgrids and other local area power and energy systems.
[46] The Center for American Progress and Oxfam America. *The Economic Benefits of Restoring Coastal Ecosystems.* https://www.oxfamamerica.org/static/media/files/CoastalRestoration-factsheet.pdf
[47] Conathan, Buchanan, and Polefka, 2014. The economic case for restoring coastal ecosystems.
[48] Union of Concerned Scientists, 2013. Benefits of Renewable Energy. http://www.ucsusa.org/clean-energy/renewable-energy/public-benefits-of-renewable-power#.WW_CG4QrKM8

laborers. Benefits captured in this section include the avoided cost of social services that the government would have to provide if the same people were unemployed.

Tourism and Recreation

1. The **Restore the Edge** design strategy has significant potential to create recreational spaces and attract tourism. Aside from the aesthetic value of healthy wetlands and rehabilitated public parks, birds and other animal species living on the shore can attract birdwatchers or other naturalists. Wildlife watching generates a positive economic impact in multiple ways, through entrance and permit fees, and wages earned by guides, drivers and staff, while also creating opportunities for engagement in other tourism activities.[49]

Infrastructure/Structures

Bridgeport's infrastructures and structures will gain greater resilience through direct and indirect benefits. The implementation of the resilience strategies will result in a reduction in direct physical damages and an increase in functional resilience, while value-added benefits will contribute to greater redundancy of complementary approaches, and an improved transit system.

Resiliency Benefits (Losses Avoided)

Reduction in Direct Physical Damages

1. Natural and built infrastructure can both contribute to a reduction in direct physical damages. Surge protection through the **Adapt to Rising Seas** strategy can reduce the risk of physical damage due to coastal flooding. In addition, the potential of coastal habitats to provide direct defense through reducing erosion and flooding is well documented in literature.[50] Through green infrastructure and stormwater improvements, the **Delay and Convey**

ADAPT TO RISING SEAS ANNUAL BENEFITS: $2.5 MILLION IN BUILDING LOSS PREVENTED AND $2.6 MILLION IN BUILDING CONTENTS LOSSES PREVENTED

[49] Tapper, 2006. Wildlife watching and tourism: a study on the benefits and risks of a fast growing tourism activity and its impacts on species.
[50] Ruckelshaus, Guannel, Arkema, Verutes, Griffin, Guerry, Silver, Faries, Brenner and Rosenthal, 2016. Evaluating the benefits of green infrastructure for coastal areas: Location, location, location.

Stormwater strategy reduces the risk of physical damage due to stormwater-related flooding. The **Restore the Edge** strategy will support coastal areas as an effective line of defense against storm surge as they provide protection from inundation for landward areas. These environments provide benefits to the U.S. economy which range from $250 and $51,000 per hectare per year, cumulatively worth approximately $23 billion in storm protection annually.[51]

Reduction in Loss of Critical Services

1. FEMA defines a critical, or essential, facility as one for which "even a slight chance of flooding is too great a threat."[52] Disaster events may disrupt **critical facilities** such as fire, EMS, and police stations, hospitals, public utilities, and storage of critical records, and **public services** such as electric, potable water, and wastewater services. Rising sea levels contribute to flooding risks from disaster events, increasing the likelihood that critical facilities will be inundated or damaged. The **Delay and Convey Stormwater** strategy aims at the avoidance of the loss of function of infrastructure and creates functional resilience for critical and non-critical facilities alike. The **Access and Egress** strategy will also help to ensure the continuity of emergency services by improving access to dry egress throughout the community.

Value Added Benefits

Provision of Power

1. Installing microgrid power distribution technology as described in the **Make Power Locally** strategy will have the benefit of adding redundancy to the neighborhoods power supply. Microgrids can be designed to remain functional even when the larger utility power supply is down.[53] In this way, a combination of microgrids and renewable energy can act as a back-up power supply during flooding events and other natural disasters. Furthermore, renewable energies, such as wind power, geothermal, solar, and hydroelectric can guarantee a steady energy supply to a community indefinitely.[54] Estimates of the technical potential of each renewable energy source are based on their overall availability given certain technological and environmental constraints. In 2012, NREL found that together, renewable energy sources have the technical potential to supply 482,247 billion kilowatt-hours of electricity annually. This amount is 118 times the amount of electricity the nation

[51] Conathan, Buchanan, and Polefka, 2014. The economic case for restoring coastal ecosystems. Center
[52] FEMA, Critical Facilities and Higher Standards Fact Sheet. https://www.fema.gov/media-library-data/1436818953164-4f8f6fc191d26a924f67911c5eaa6848/FPM_1_Page_CriticalFacilities.pdf
[53] NREL, 2012. Microgrids: So Much More Than Backup Energy https://www.nrel.gov/news/features/2012/1980.html
[54] Conserve Energy Future, 2017. What is Renewable Energy? http://www.conserve-energy-future.com/advantages-and-disadvantages-of-renewable-energy.php

currently consumes. In this way, the **Make Power Locally** strategy will ensure that Bridgeport has a reliable energy source in the long term.

Improved Transit System

1. An efficient and modern public transit system is invaluable to cities. New modes of transportation offered through the **Access and Egress** strategy, such as bike paths, shuttles, and driverless vehicles will make the neighborhood more accessible and convenient day-to-day. Residents will have more options for commuting, increasing the accessibility of a greater extent of possible job opportunities.

3 Resilient Strategies Benefit Analysis Detailed Approach

In harmony, the resilient design strategies will reduce flood risk and increase resilience in Bridgeport. Analysts completed a benefits analysis to understand the benefits expected to occur due to the implementation of the design strategies. The magnitude of these benefits is measured based on the number of people, structures, infrastructure, and businesses benefitting and the area of new or enhanced natural space created. Table 1 summarizes the results of this analysis. Analysts completed the analysis by evaluating the monetary value of certain benefits for three of the strategies. The **Benefit Analysis Results** section summarizes these results, and the methodology to complete the resilient strategies benefits analysis is available below.

Benefit Analysis Results

The resilient strategies are expected to provide a range of resiliency, economic, environmental, and social benefits as described in the **Resilient Bridgeport Strategies Benefit Analysis** section. Based on the three scenarios in which analysts calculated the monetary value of benefits, Table 3 demonstrates that the **Delay and Convey Stormwater** strategy generates the most annual benefits. However, these are solely water quality benefits. Similarly, the environment benefits the most from the **Restore the Edge** strategy, with a few ecosystem services benefitting residents. Even though **Adapt to Rising Seas** annual benefits are the least between the three scenarios, the built, social, and economic systems of the South End benefit, as made evident in Table 4. Table 4 demonstrates flood impacts expected to be avoided for three flood scenarios due to implementation of the recommended flood protection alignment.

Table 3. Quantified Benefits (2016 dollars)

Resilient Strategy	Annual Benefits
Restore the Edge	$8.8 million
Adapt to Rising Seas	$6.1 million
Delay and Convey Stormwater	$10 million

Adapt to Rising Seas Results

Table 4 summarizes flood impacts avoided due to the recommended flood protection alignment. Results are presented at one-time losses avoided per flood scenario and as annualized benefits. Analysts calculate annual benefits by applying the annual probability of occurrence to losses at each flood scenario, then

summing the results. Probability of occurrence refers to the percent chance of an expected flood event being met or exceeded in any given year.

Direct physical damages, or building and contents losses, are the largest benefit category, followed by human impacts, to include: mental stress and anxiety, lost productivity, injuries, fatalities, and relocation costs. This reveals that the built environment will benefit most from the flood protection system, followed by residents, then the local economy. Nevertheless, business interruption impacts are limited to lost income due to the business being closed for a period, and do not include reverberating impacts throughout the economy, such as direct, indirect, and induced effects;[55] therefore, business interruption impacts are likely a conservative estimate.

Table 4. Summary of Losses Avoided due to Adapt to Rising Seas (Results are presented in the thousands)

Flood Scenario	Loss Category (Results are presented in the thousands)								Total
	Building Losses	Contents Losses	Relocation Costs	Business Interruption	Mental Stress and Anxiety	Lost Productivity	Injuries	Fatalities	
10 percent	$11,923	$11,406	$517	$852	$690	$430	$318	$1,077	$27,213
2 percent	$36,735	$41,285	$1,407	$3,104	$2,620	$1,631	$1,208	$1,712	$89,702
1 percent	$58,151	$69,388	$2,498	$24,827	$3,830	$2,384	$1,766	$2,067	$164,911
Annualized Benefits	$2,508	$2,660	$105	$396	$160	$99	$74	$162	$6,164

Analysis Steps

This section details the approach taken to define resilient strategy benefits, measure benefitting community assets, and quantify certain benefit scenarios. Analysts implemented FEMA's approach to evaluating resiliency benefits and ecosystem services to determine the economic value of the following scenarios:

1. Ecosystem services to be provided by new or enhanced natural area created by the **Restore the Edge** strategy

[55] Direct effects represent the initial impacts that occur because of an economic activity. Indirect effects are the impact of direct economic effects on supporting industries, such as those that provide equipment and materials. Induced effects are the response to a direct effect that occurs through re-spending of income.

2. Water quality benefits to be realized by CSO reduction due to the **Delay and Convey Stormwater** strategy

3. Losses avoided due to the protection provided by the **Adapt to Rising Seas** strategy

Primary resources analysts utilized to complete the analysis include:

Methodology:

- **FEMA's Final Sustainability Benefits Methodology Report (2012):** provides an ecosystem service value per acre of space, as well as the method to evaluate Lost Productivity and Mental Stress and Anxiety.
- **FEMA Benefit-Cost Analysis Re-Engineering (BCAR) Development of Standard Economic Values (2011):** details the methodology to evaluate Direct Physical Damages, Displacement Costs, and Business Interruption.
- **Brno University of Technology fatality risk methodology:** the approach to evaluate fatalities is based on three main factors: materials loss, population preparedness, and warning.

Data:

- **US Census Bureau ACS 5-Year Estimate:** provides the population within the study area.
- **City of Bridgeport Tax Assessor Data (2015):** Attributes from this dataset used in the analysis include: square footage, number of stories, building elevation, and building use. This dataset also provided building footprints.
- **Connecticut Department of Energy and Environmental Protection Digital Elevation Model (2011):** A Department of Energy and Environmental Protection (DEEP) digital elevation model (DEM) is a model of the ground surface, and provides the ground elevation for structures. The DEM is a raster layer of high-resolution ground elevation data based on information from bare-earth LiDAR elevation data collected and compiled during December 2006 and Spring/Summer 2004.
- **Fairfield County Flood Insurance Study (2013):** provides flood elevations for the 10 percent, 2 percent, and 1 percent. Analysts use flood elevations to approximate flood depths inside structures.

- **CDC injury rates:** The CDC report from October 2014 titled "Nonfatal Injuries 1 Week after Hurricane Sandy" estimates 10.4 percent of residents in the inundation zone were injured within the first week of Hurricane Sandy.
- **Bridgeport Long Term Control Plan:** provided information needed to derive a combined sewer overflow event damage cost.

The steps of the benefits analysis are broken down as follows: define benefits, assess benefitting community assets, and evaluate quantifiable benefits.

Define Benefits

Analysts researched existing literature to gather information on the benefits of natural and hard flood protection measures, green infrastructure, and local power networks. Research informed the categorization and description of resilient strategy benefits. The matrix below summarizes benefits, and the **Resilient Bridgeport Strategies Benefits Summary** section describes benefits by community asset, then by benefit category and strategy.

Table 5. Resilient Strategies Benefits Matrix

Benefit	Restore the Edge	Adapt to Rising Seas	Delay and Convey Stormwater	Access and Egress	Make Power Locally
People					
Reduction in Displacement Time and Costs	X	X	X		X
Reduction in Injuries and Fatalities	X	X	X	X	
Reduction in Mental Stress and Anxiety	X	X	X	X	
Reduction in Lost Productivity	X	X	X		X
Improved Health	X	X	X	X	X
Enhanced Recreational and Educational Opportunities	X	X			
Shelter Needs		X			

Benefit	Restore the Edge	Adapt to Rising Seas	Delay and Convey Stormwater	Access and Egress	Make Power Locally
Environment					
Improved Water and Sediment Quality	X		X		X
Improvement in Air Quality	X		X		X
Climate Regulation	X	X			X
Restored and Enhanced Ecological Habitats	X				
Economy					
Reduction in Business Interruption		X	X		X
Revitalization	X	X	X	X	X
Increased Property Values	X	X	X	X	
Cost Savings					X
Poverty Alleviation	X	X			X
Tourism and Recreation	X				
Infrastructure/Structures					
Reduction in Direct Physical Damages	X	X	X		
Reduction in Loss of Critical Services			X		X
Improved Transit System				X	

Assess Benefitting Community Assets

To better understand the magnitude of benefits, analysts measured the number of community assets benefitting from each strategy. The following subsection describes the process to generate these numbers.

1. Develop Asset Inventory

The asset inventory is a GIS database of building, parcel, and population data per structure. Analysts gathered data listed in Table 6, and merged building footprints and parcel level data using the parcel identification number. Analysts distributed the total population in each census block group to each residential building to complete the inventory. To do so, analysts distributed the population (from the 2014

ACS) to each building based on the ratio of a residential building's total living area to the total residential living area in the census block that contains the building.

Table 6. Summary of Asset Inventory Data and Data Sources

Attribute	Analysis Use	Data Source
Parcel ID	Key location identifier specific to a parcel	City of Bridgeport Tax Assessor Data (2015)
Unique ID	Key location identifier specific to a building; used to manage data	Assigned by analyst
Address	Key location identifier	City of Bridgeport Tax Assessor Data (2015)
Living Area	Used in population analysis	City of Bridgeport Tax Assessor Data (2015)
Land Occupancy Description	Building use, used in population analysis	City of Bridgeport Tax Assessor Data (2015)
Land Use Description	Secondary identifier of building use	City of Bridgeport Tax Assessor Data (2015)
Census Block Group	Use in population analysis	US Census Bureau American Community Survey 5-Year Estimates (2014)

2. Define Benefitting Area

The project team identified appropriate benefitting areas for each strategy to determine the number of community assets benefitting from each strategy. Figure 1 provides an example benefitting area, and demonstrates the recommended alignment of the surge protection measures. Analysts used this alignment to estimate the number of structures, businesses, and residents that the recommended surge protection measures will protect. Table 7 summarizes the approach taken to define the benefitting area for each resilient strategy.

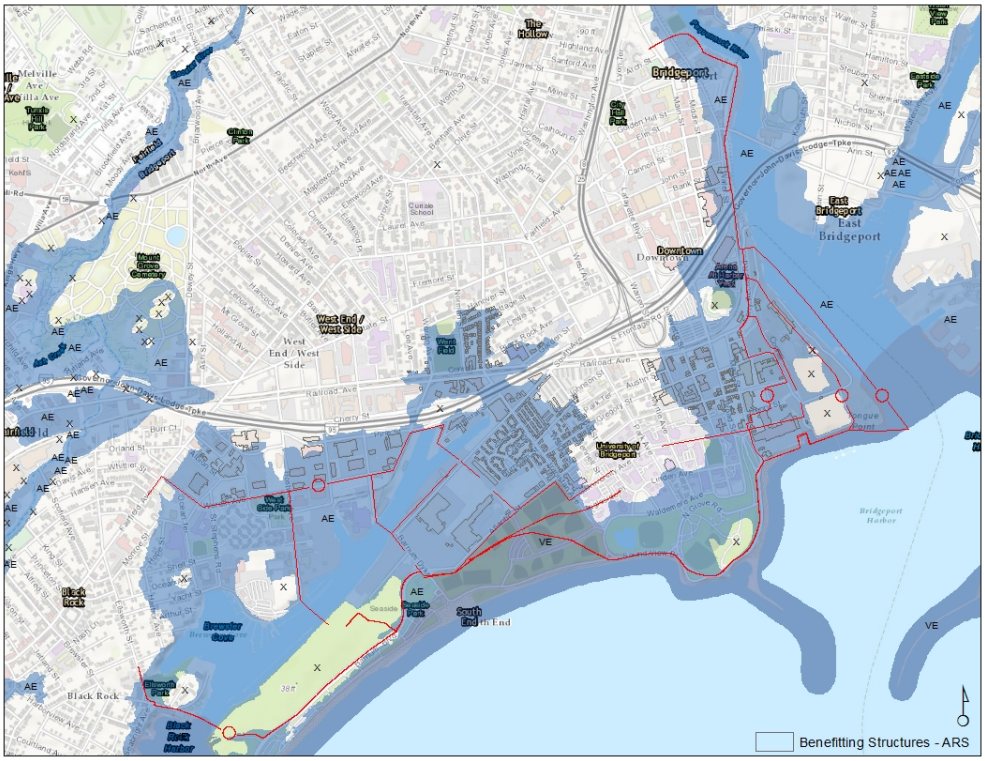


Figure 1. Recommended Alignment of Surge Protection

3. Measure Benefitting Assets

The last step was to identify the structures and residents within a benefitting area using the asset inventory (Table 7, Column 2 and 3). The building use code provided data to identify commercial structures within the asset inventory benefitting from a strategy (Table 7, Column 5). GIS layers of community assets, such as schools, medical facilities, fire stations, police stations, etc., enabled analysts to identify benefitting infrastructure (Table 7, Column 4, and detailed in Table 8). Analysts performed quality assurance and quality control of benefitting infrastructure using Google Earth. Table 7 and Table 8 summarize the outcome of this analysis, and demonstrates that the **Delay and Convey Stormwater** strategy benefits the most people, businesses, and structures, followed by the **Access and Egress** and **Adapt to Rising Seas** strategies.

Table 7. Summary of Benefitting Community Assets and Benefitting Area Methodology

Strategy	People	Structures	Infrastructure	Economy	Benefitting Area
Restore the Edge	3,176	362	9	13	The benefitting area is a 0.25-mile buffer around the proposed location of strategy elements.
Adapt to Rising Seas	2,798	419	28	39	The benefitting area is the A flood zones within the recommended alignment.
Delay and Convey Stormwater	5,710	668	42	72	The benefitting area is the A flood zones in the South End.
Access and Egress	3,632	516	45	33	The benefitting area is the South End because the strategy implements and connects measures throughout the project area.

Table 8. Summary of Benefitting Community Infrastructure

Category	Restore the Edge	Adapt to Rising Seas	Delay and Convey Stormwater	Access and Egress
National Register of Historic Places	Park Apartments	David Perry House	Park Apartments	Park Apartments
	Seaside Park	Seaside Institute	Seaside Park	Seaside Park
	Tongue Point Lighthouse	Mary and Eliza Freeman Houses	David Perry House	David Perry House
			Seaside Institute	Seaside Institute
			Mary and Eliza Freeman Houses	Mary and Eliza Freeman Houses
City of Bridgeport Historic Districts	Black Rock Harbor	Cottage Development	Black Rock Harbor	Cottage Development

Category	Restore the Edge	Adapt to Rising Seas	Delay and Convey Stormwater	Access and Egress
		Seaside Village	Cottage Development	Seaside Village
		Division Street	Seaside Village	Division Street
		Railroad Avenue	Division Street	Railroad Avenue
		Marina Park	Railroad Avenue	Marina Park
		Downtown South	Marina Park	Downtown North and South
			Downtown North and South	
Recreation	Wordin Park	Went Field	Ellsworth Park	West Side Park
	Seaside Park / Barnum Field		Went Field	Longfellow Park
	Ellsworth Park			Park City Plaza
	Seabright Park			Wordin Park
	St. Marys by the Sea			Went Field
				Waterfront Park
				Waterstreet Park
Religious		Walters Memorial Zion Church	Walters Memorial Zion Church	Walters Memorial Zion Church
		Cathedral of Praise	Cathedral of Praise	Cathedral of Praise
			Church of God	Church of God
Transportation		Bridgeport Train Station	Bridgeport Train Station	Bridgeport Train Station
		Jefferson Ferry	Jefferson Ferry	Jefferson Ferry
Critical and Essential Facilities		Bridgeport Port Authority	Bridgeport Port Authority	Bridgeport Port Authority
		Bridgeport Harbor	Bridgeport Harbor	Bridgeport Harbor

Category	Restore the Edge	Adapt to Rising Seas	Delay and Convey Stormwater	Access and Egress
		Generating Station	Generating Station	Generating Station
			Bridgeport Fire Department Engine Company 7 and Ladder 11	Bridgeport Fire Department Engine Company 7 and Ladder 11
			Division of Criminal Justice - Juvenile Matters & Detention Center	Division of Criminal Justice - Juvenile Matters & Detention Center
			Post Office: 120 Middle Street	Post Office: 120 Middle Street
Education		University of Bridgeport	University of Bridgeport	University of Bridgeport
		Columbus Elementary School	Columbus Elementary School	Columbus Elementary School
		New Beginnings Family Academy	New Beginnings Family Academy	New Beginnings Family Academy
		The University School	The University School	The University School
		Bridgeport Hope School	Bridgeport Hope School	Bridgeport Hope School
			Maplewood Elementary and High School	Maplewood Elementary and High School
			Longfellow Elementary School	Longfellow Elementary School
			Bridgeport Regional	Bridgeport Regional

Category	Restore the Edge	Adapt to Rising Seas	Delay and Convey Stormwater	Access and Egress
			Vocational Aquaculture Center	Vocational Aquaculture Center
Entertainment		Webster Bank Arena	Webster Bank Arena	Webster Bank Arena
		Harbor Yard Sports Complex	Harbor Yard Sports Complex	Harbor Yard Sports Complex
		Barnum Museum	Barnum Museum	Barnum Museum
			Fayerweather Yacht Club	
Industrial		Sikorsky Bridgeport Heliport	Sikorsky Bridgeport Heliport	Sikorsky Bridgeport Heliport
		Santa Energy	Santa Energy	Santa Energy
		Wheelabrator Bridgeport	Wheelabrator Bridgeport	Wheelabrator Bridgeport
			Captains Cove Heliport / Seaport	Captains Cove Heliport / Seaport
Community Center		Southwest Community Health Center	Southwest Community Health Center	Southwest Community Health Center
			Gary Cooks Memorial Center	Gary Cooks Memorial Center
Total	**9**	**28**	**42**	**45**

Evaluate Quantifiable Benefits

The project team identified three scenarios where adequate data was available to estimate the monetary benefits of specific elements for certain strategies. These three scenarios include:

1. Ecosystem services to be provided by new or enhanced natural area created by the **Restore the Edge** strategy
2. Water quality benefits to be realized by CSO reduction due to the **Delay and Convey Stormwater** strategy
3. Losses avoided due to the protection provided by the **Adapt to Rising Seas** strategy.

This section describes the approach taken to quantify benefits.

Restore the Edge

Restore the Edge proposes to create wetlands and riparian habitat that will produce a range of environmental benefits, also known as ecosystem goods and services. Ecosystem goods and services provided by natural vegetation may be quantified to estimate their economic benefit to society. To determine the monetary value of ecosystem services, analysts calculated the area of new or enhanced wetlands or riparian habitat, and applied FEMA's standard annual ecosystem service values to the total area. Analysts found that **270 acres** of new or enhanced natural areas will generate **$8.8 million in annual ecosystem service benefits**.

Delay and Convey Stormwater

CSOs have a major impact on water quality and pose significant health and safety risks. Bridgeport is acting to meet water quality requirements under the Clean Water Act. The City has developed a Long-Term Control Plan to reduce the frequency of CSO events. The Plan reveals it will cost the City $384,900,000 over 30 years to reduce CSO output by 43 million gallons. Given this information, analysts generated a damage cost for CSO abatement: $0.29 per gallon per year. Analysts modeled CSO output at the design event (25-year Natural Resources Conservation Service [NRCS] rainfall event) to generate CSO existing conditions: 37,437,000 gallons. It is expected the **Delay and Convey Stormwater** strategy will reduce CSO volume by 95 percent: 35,565,150 gallons. Analysts applied the damage cost to the total volume of CSO reduction to estimate water quality benefits. Results reveal the annual benefit of CSO abatement is **$10 million**.

Adapt to Rising Seas

The recommended flood protection alignment will reduce the risk of direct physical damage to structures and contents, business interruption, and negative impacts to residents caused by flooding from the Long Island Sound. As such, analysts used FEMA approved methods to estimate benefits of flood protection. Detailed methodologies are available in the **Benefit Cost Analysis Methodology Report**; therefore, methodologies are summarized below. Analysis parameters include:

- **Risk context:** The flood source is Long Island Sound, and the Fairfield County Flood Insurance Study provides flood elevations for the 10, 2, and 1 percent annual chance flood event. The analysis considers structures and residents located in the flood zones within the recommended alignment.
- **Project design:** It is assumed the flood protection system will protect against the 1 percent annual chance flood event.
- **Time horizon:** The analysis does not consider sea level rise or population growth over time.

The subsections below summarize the approach for each resiliency benefit, and Table 4 summarizes results.

Direct Physical Damages – Buildings and Contents

Direct physical damages include the degradation and destruction of property, and are quantified through monetary losses. The BCA categorizes property loss as both structural damage (i.e., damage that applies to real property) and content damage (i.e., damage to personal property or inventory). BCA analysts can predict flood impacts by modeling expected damages of hypothetical storms. Thus, analysts calculated expected losses avoided for the 10, 2, and 1 percent annual chance flood events, sourced from the Fairfield County Flood Insurance Study.

BCA analysts calculated direct physical damages using standardized depth-damage functions (DDFs) specific to the characteristics and occupancy of a structure. A DDF correlates the depth, duration, and type of flooding to a percentage of expected damage to a structure and its contents, including inventory. Following Hurricane Sandy, the USACE developed DDFs specific to the North Atlantic region in a report titled the North Atlantic Coast Comprehensive Study (NACCS); analysts used these functions to evaluate direct physical damages. Steps to complete the direct physical damage analysis are listed below.

1. Determine Replacement Value: BCA analysts assigned building replacement values (BRVs) and contents replacement values (CRVs) based on building use. BRV is based on RSMeans 2016 Square Foot

Costs, and CRV is based on a contents-to-structure ratio values (CSRV) from the West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study.[56]

2. Determine flood depth: BCA analysts compared flood elevations from the FIS to grade elevations to determine a flood depth at each structure. The NACCS DDFs consider first floor elevations, therefore analysts use ground elevation rather than first floor elevations when estimating flood depth.

3. Estimate Percent Damage and Monetary Losses: Once BCA analysts established the expected flood depth for each flood scenario, they applied the DDF to estimate the percent of structural or contents damage. The DDF relates 1-foot depth increments to a percent of structural or contents damage, which is applied to a structure's BRV or CRV to produce a physical loss value in dollars. Analysts applied the probability of each flood scenario to expected impacts to calculate annual benefits. Ultimately, benefits represent the present value of the sum of expected annual avoided damages over the project useful life.

Displacement Costs

Residents of impacted structures may experience displacement costs during the time when a building becomes uninhabitable due to flood damage. Relocation costs are associated with moving a household or a business to a new location and resuming business in that new location. Relocation costs are derived from displacement time, which is derived from DDFs that relate a depth of flooding to an amount of time a structure is not usable.

Displacement costs, or relocation costs, are a product of percent damage, impacted square footage, disruption costs per occupancy, rental costs, displacement time, and percent owner occupied.

$$\begin{aligned} Relocation\ costs = {} & If\ percent\ damage\ is \\ & > 10\ percent: Impacted\ floor\ area\ \times\ (1 - percent\ owner\ occupied) \\ & \times\ disruption\ cost \\ & + percent\ owner\ occupied \\ & \times\ (disruption\ cost + rental\ cost\ \times\ displacement\ time)] \end{aligned}$$

Analysts identified structures experiencing flood impacts at different flood scenarios and determined the total flooded floor area. Census block level data provided the percent owner occupied for residential structures and Hazus-MH 3.2 provided default owner-occupancies for non-residential uses. Analysts used Zillow and Loopnet to develop location specific rental costs for residential and non-residential structures. Flood depths estimated in the direct physical damage analysis are correlated to USACE displacement

[56] USACE. 2014. West Shore Lake Pontchartrain Hurricane and Storm Damage Risk Reduction Study – Final Integrated Feasibility Study Report and Environmental Impact Statement. November.

DDFs to estimate displacement time for each flood scenario. Analysts processed relocation costs to building occupants based on occupancy type.[57] Analysts applied the probability of each flood scenario to expected impacts to calculate annual benefits.

Business Interruption

Business interruption is lost business income because of an event that interrupts the operation of a business, or the removal of a piece of real estate from the market as a result of disaster impacts. Business interruption time is a proportion of the displacement time, which is based on the business type and extent of damage. Analysts use Business Interruption Multipliers found in the Hazus-MH Flood TM to determine business interruption time for impacted buildings. Lost business income is a product of the net income of commercial business per day or the daily rental rate and the number of days of business interruption.

Mental Stress and Anxiety

The principle resource used to conduct this analysis is FEMA's Final Sustainability Benefits Methodology Report that accompanies the FEMA BCA Toolkit. Mental health treatment costs can be measured using three factors: cost, prevalence, and course. Prevalence is the percentage of people who experience mental health problems after a disaster event, and course is the rate at which mental health symptoms reduce or increase over time. Cost is the cost of treatment to those who seek it.

FEMA's Final Sustainability Benefits Methodology Report[58] uses prevalence percentages and mental health expenses from Schoenbaum (2009) to derive a standard value for mental stress and anxiety costs. Schoenbaum provides an estimate of treatment costs in an ideal scenario where all needs are met. FEMA contends that treatment costs from the study must be adjusted to consider only those with mental health problems who will actively seek out treatment (41 percent).[59] FEMA uses the following steps to adjust total treatment costs from Schoenbaum for a percentage of individuals who seek treatment and for prevalence.

[57] It is important to note that this equation incorporates only owner-occupied structures when calculating displacement values. The reason for this is that a renter who has been displaced would likely cease to pay rent to the building owner of the damaged property, and instead would pay rent to a new landlord. As such, the renter could reasonably be expected to incur no new rental expenses. Conversely, if the damaged property is owner-occupied, then the owner will have to pay for new rental costs in addition to any existing costs while the building is being repaired. This model assumes that it is unlikely that an occupant will relocate if a building is slightly damaged (less than 10% structure damage).

[58] FEMA. 2012. Final Sustainability Benefits Methodology Report. August 23.

[59] Wang, Philip S., MD, DrPH; Lane, Michael, MS; Olfson, Mark, MD, MPH; Pincus, Harold A., MD; Wells, Kenneth B., MD, MPH; Kessler, Ronald C., PhD. 2005. Twelve-Month Use of Mental Health Services in the United States: Results from the National Comorbidity Survey Replication. Archives of General Psychiatry, v. 62, June.
A., MD; Wells, Kenneth B., MD, MPH; and Ronald C. Kessler, PhD. 2005. Twelve-Month Use of Mental Health Services in the United States: Results from the National Comorbidity Survey Replication. Archives of General Psychiatry, v. 62, June.

$$Cost\ per\ person\ seeking\ treatment = Treatment\ cost\ per\ person^{60} \times 0.41 \times prevalence$$

Once an appropriate treatment cost was determined, the cost per person was applied to the total number of residents that are expected to be impacted by flooding.

Lost Productivity

FEMA's standard values for mental health impacts also include lost productivity due to mental stress and anxiety. Historical impacts indicate that mental health issues will increase after a disaster, and this, paired with research related to lost productivity due to mental illness, indicates that economic productivity can be impacted by an increase in mental health issues post-disaster.[61] FEMA's Final Sustainability Benefits Methodology Report that accompanies the FEMA BCA Toolkit is the primary resource used to estimate lost productivity. Analysts first established the value of work productivity per FEMA's methodology:

$$Loss\ of\ Work\ Productivity = (EC_{NA} \times H_{NA}) \times 25.5\%$$

Where

EC_{NA}: Average Employment Compensation

H_{NA}: Average Number of Hours Worked per Day

FEMA references Levinson et al (2010)[62] in which research was conducted using the World Health Organization's Mental Health Surveys in 19 countries; the study found that individuals in the United States with mental health illnesses experience as much as a 25.5% reduction in earnings. Using the above equation, analysts found the value of work productivity to be $1,767 per capita, monthly.

Analysts apply $1,767 to the amount of time lost productivity is expected to occur, 30 months. Prevalence factors from Schoenbaum (2009) are used to adjust the value of productivity loss over 30 months, to account for the fact that only a portion of the population will experience mental health impacts post-disaster. The prevalence factor is based on severe mental health issues because there is insufficient literature to document the impacts of mild/moderate mental health issues on productivity.[63] Accounting for prevalence, the value

60 Schoenbaum, Michael; Butler, Brittany; Kataoka, Sheryl; Norquist, Grayson; Springgate, Benjamin; Sullivan, Greer; Duan, Naihua; Kessler, Ronald; Wells, Kenneth. 2009. Promoting Mental Health Recovery After Hurricanes Katrina and Rita: What Can Be Done at What Cost. Archives of General Psychiatry, Vol. 66, #8, August 2009.

61 Insel, Thomas. Assessing the Economic Costs of Serious Mental Illness. American Journal of Psychiatry. 165:6 June 2008. / Kessler et al. Individual and Societal Effects of Mental Disorders on Earnings on the United States: Results from the National Comorbidity Survey Replication. American Journal of Psychiatry. 165:6. June 2008.

62 Levinson, et al. 2010. Associations of Serious Mental Illness with Earnings: Results from the WHO World Mental Health Surveys. British Journal of Psychiatry. August; 197(2): 114–121. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2913273

63 FEMA. 2014. Updated Social Benefits Methodology Report. December 18.

of work productivity for 30 months is $3,394 per capita. This value is applied to the number of wage-earning residents who will experience flooding to value productivity losses avoided.

Casualties

Casualties, which include loss of life and injuries, are an unfortunate risk inherent to hazard events. Flood events are considered some of the most frequently occurring natural hazards, contributing to 44% of natural hazard-related fatalities worldwide. The approach chosen to estimate reduced fatalities within the project area is based on a study completed by the BRNO University of Technology in 2013.[64] Through this approach, analysts consider the number of fatalities expected at different flood scenarios. Additional data required to supplement the BRNO approach include standard life safety values from the Federal Aviation Administration (FAA): the FAA's Willingness to Pay value for one fatality is $5.8 million. Casualties also includes injuries related to identified flood events. In October 2014, the CDC published another report titled "Nonfatal Injuries 1 Week after Hurricane Sandy." The report suggests that 10.4% of residents in the inundation zone were injured within the first week after Hurricane Sandy, mostly during attempts to evacuate or navigate and clean up debris.

Injuries

To quantify the value of injuries, analysts developed the below equation based on the CDC study titled "Deaths Associated with Hurricane Sandy". It is assumed that all injuries reduced are categorized as FAA AIS1 minor injuries. This injury category is the lowest value within the FAA study ($13,590) allowing for a conservative analysis of injuries associated with a flood event.[65] The US Census Bureau American Community Survey provided the population in the study area. The impacted population is considered those that experience greater than one foot of flooding.

$$Value\ of\ Injuries = (Population) \times 10.4\% \times \$13{,}590$$

Fatalities

The BRNO University of Technology approach is based on three main factors: material loss (in dollars), population preparedness, and warning. The relationship of these factors is expressed in the equation presented below. There are additional factors that are important to consider in estimating the loss of life in a natural hazard event. Nevertheless, factors such as debris, climatic conditions, water quality, and time of day, were not available for analysis due to a lack of data.

[64] Brazdova, M. and J. Riha. 2014. A simple model for the estimation of the number of fatalities due to floods in central Europe. Nat Hazards Earth Syst Sci. 14. June 12.
[65] Value normalized to 2016 dollars.

The equation for fatality estimates is presented below:

$$LOL = 0.075 \times D^{0.384} \times (P + 2)^{-3.207} \times (W + 2)^{-1.017}$$

Where:

LOL: Loss of Life

D: Material Loss ($)

P: Population Preparedness (aggregated population preparedness factors)

W: Warning (factor-based)

D Factor: The D factor (material loss) consists of building damage and contents loss; both values are determined through the approach described in estimating direct physical damages. For the purposes of this analysis, only structure and contents damage for residential structures are evaluated for the appropriate flood scenarios. Analysts assumed these losses reflect both the destructive ability of the event and the number of endangered inhabitants. Damage to constructed assets, such as roads or utility systems, are not considered.

P Factor: The P Factor (population preparedness) expresses the preparedness of the community for flood management and resiliency, and is intended to reflect the population's general awareness of flooding and required preparations. This value is determined by rating eight sub-factors on a scale of -1 to 1. Because of the frequency and amount of flood prevention and awareness activities present in Bridgeport, analysts assumed that the same P sub-factors apply for all flood scenarios.

W Factor: The W factor (warning) includes factors that influence warning of the community that an event is forecasted. The contributing factors include a hydrological forecast, the type of warning system employed, the speed of flooding, and the rate of water level rise; as these factors are somewhat based on the frequency and extent of flooding, the W Factor is evaluated for the identified flood scenarios. For factor W4, water rise rates were determined based on event data.

Loss of life is then obtained by placing all determined factor values (D, P, and W) into the previously mentioned equation. The benefits associated with avoiding these fatalities can be calculated using Federal Aviation Administration (FAA) Willingness to Pay values for a fatality ($5.8 million).

RESILIENT
BRIDGEPORT

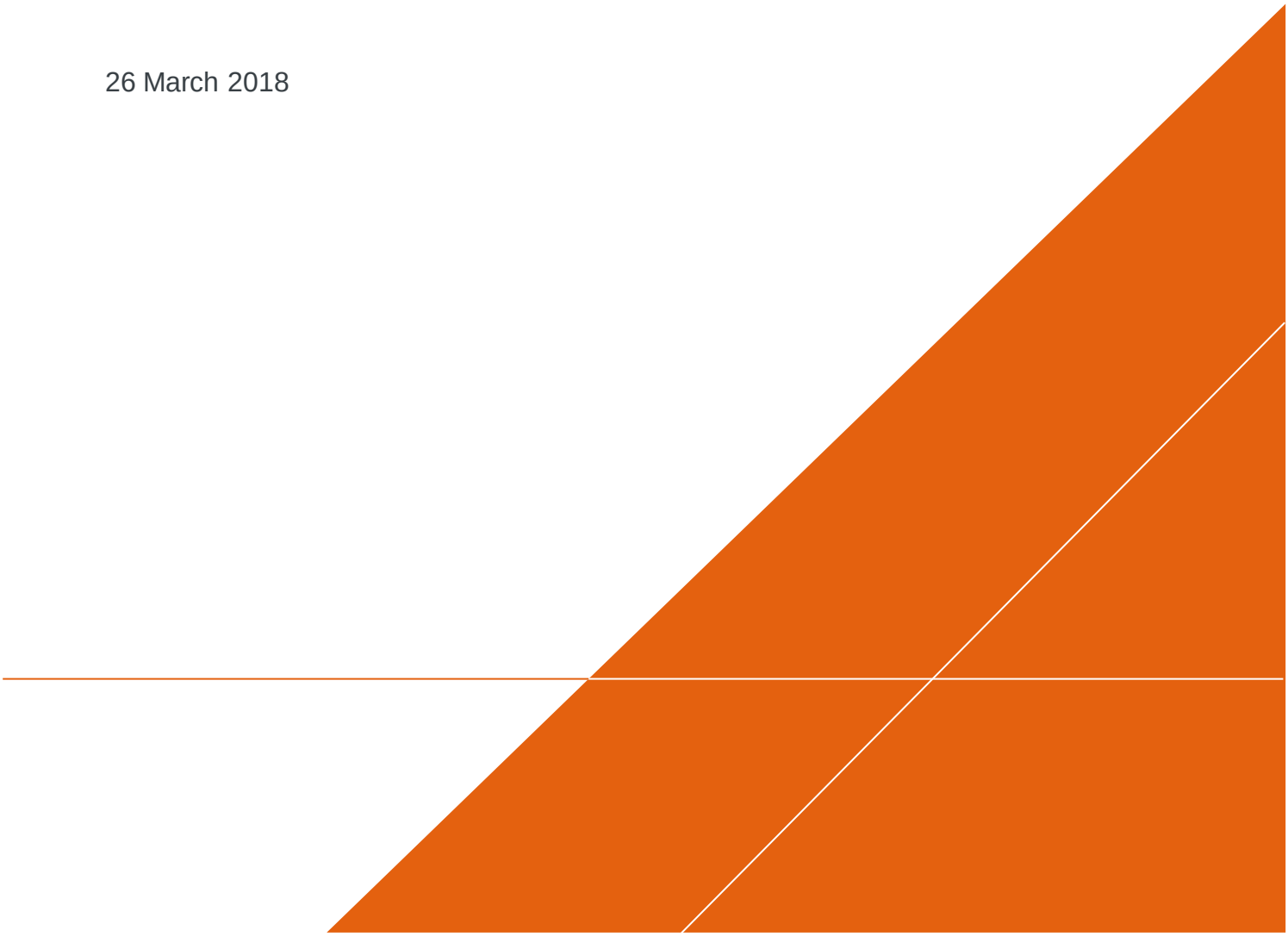
Resilient Bridgeport Benefits Summary
(March 26, 2018)

ARCADIS Design & Consultancy for natural and built assets

RESILIENT BRIDGEPORT

BENEFITS SUMMARY

26 March 2018



BENEFITS SUMMARY

Project Identification And Benefit Synopsis

Prepared for:
Connecticut Department of Housing

Prepared by:
Arcadis U.S., Inc.

Our Ref.:
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1 INTRODUCTION

The Connecticut Department of Housing (CT DOH) was awarded $10 million to Bridgeport, Connecticut to reduce flood risk for the most vulnerable public housing stock in Bridgeport – specifically to continue planning and evaluation of long-term resilience strategies, as well as to design a pilot project aimed at alleviating acute and chronic flooding in Bridgeport's South End. This document aims to quantify and qualify the benefits that can be realized in each neighborhood within the South End by implementing aspects of the long-term strategy, as presented in the Resilient Bridgeport Design Strategies document. This document serves also aims to synthesize the processes used in determining the benefits of the potential future projects and summarize the individual neighborhood benefits provided that would offer the greatest return on investment (ROI). This summary document supplements the **Benefits Report** and includes the following principal sections:

- **Section 2: Overall Strategy Objectives** includes a description of the overall strategy objectives and outcomes for the Resilient Bridgeport long-term strategy
- **Section 3: Benefit Analysis Summary and Overview** briefly identifies the project benefits captured, a description of the individual benefits, and the sources used to develop these methodologies.
- **Section 4: Neighborhood Targets and Benefits Analysis** provides a synopsis of project neighborhoods, strategy elements to be utilized, and the benefits gained from implementing the strategy layers in each neighborhood.
- **Section 5: Project Benefit Calculation Assumptions** describes the assumptions made by the benefits analyst and provides a first order benefit estimate.

It is important to note that this first order benefits summary is largely based on existing conditions, and all calculations documented herein are based on the alignments and conceptual drawings illustrated in the Resilient Bridgeport Design Strategies document. This document does not explore other potential project opportunities, and, if the strategies or sub-projects were to change, the benefits would need to be recalculated. Moreover, the analysis assumes that the entire risk reduction system (starting in Downtown, continuing south to South End East, heading west to South End West, and circling around Black Rock / West Side to tie into Fairfield Avenue) would be realized in order for the benefits of flood risk reduction to be realized. This not only includes the flood defense elements, such as floodwalls and levees, but also the necessary interior drainage improvements to manage any overtopping, seepage, and contributions from groundwater.

2 OVERALL STRATEGY OBJECTIVES

The resilient strategies are a comprehensive, multi-layered approach to reduce flood risk, enhance quality of life, and inspire economic revitalization. These five strategies work together, addressing distinct aspects of acute and chronic flood risk, and include:

- **Restore the Edge**, which aims to create or enhance natural systems that provide flood risk reduction and ecosystem services;
- **Adapt to Rising Seas**, which aims to develop an integrated flood risk reduction system that will reduce risk from coastal flooding from Long Island Sound and rising seas;
- **Delay and Convey Stormwater**, which aims to addresses chronic flooding from rainfall events, as well as separate portions of Bridgeport's stormwater system from the combined sewer system;
- **Access and Egress**, which aims to provide Bridgeport's residents with dry egress out of high risk coastal flood areas and is intended to spur redevelopment and economic activity by enhancing connections between people, businesses, and the coast;

- **Make Power Local**, which supports the creation of district scale microgrids to provide backup power for critical facilities and support sustainable energy production.

The Project Team has designed the resilient strategies to be a proof of concept for broader resilience principles within Bridgeport and the region. The goal is to ultimately develop, prioritize, and implement a comprehensive, long-term strategy for Bridgeport through these five primary layers that would result in substantial flood risk reduction for the South End and facilitate economic revitalization.

3 BENEFIT ANALYSIS SUMMARY

As part of the long-term strategy design process, the Project Team has completed a benefit analysis to evaluate the Resilient Bridgeport strategy at its current level of design in each neighborhood. The benefit analysis assesses resilience, social, environmental, and economic benefits that will result from the implementation of each neighborhood's project implementation.

The Project Team considered two broad categories in the benefit development: Resilience Benefits and Added Value Benefits. Resilience Benefits consist of estimated flood impacts to structures, roads, and the population. Value Added Benefits consist of additional benefits beyond flood protection, such as environmental, aesthetic and recreational benefits. **Table 1** below provides a breakdown of benefit categories, benefits calculated, and description of the benefit.

Table 1. Summary of Resilience and Added Value Benefits

Benefit Category	Benefits Captured	Description
Resilience Benefits		
Resilient Redevelopment		
Direct Physical Damages	- Structure Damage - Content Loss	Analysts applied USACE depth-damage functions (DDFs) to structures in the project area. DDFs consider the type of structure, replacement values, and expected flood depth within the structure to estimate the dollar value of contents loss or structure damage.
Displacement Costs	- Relocation Costs	Displacement occurs as a direct result of the threat and impact of flood events. Displacement within this BCA is a function of direct physical damage and flood depth and is based on FEMA and USACE source material.
Mental Stress and Anxiety	- Mental Health Costs	Natural disasters threaten or cause the loss of health, social, and economic resources, which can lead to psychological distress. Methodologies used to calculate expected benefits for mental stress are a product of expected flood depth and damage to people's homes.
Loss of Productivity	- Lost Work Productivity	Loss of productivity can occur during and after a storm event. Analysts expect that the long-term strategy will reduce the number of stressors caused by natural disasters, thereby reducing mental health impacts and lost work productivity.

Resilient Bridgeport, Benefits Summary – Rebuild by Design Analysis

Benefit Category	Benefits Captured	Description
Dry Egress		
Evacuation/ Roadway Loss of Service Impacts	- Additional Time Travelled in Miles	Analysts used a FEMA methodology to evaluate the loss of function of a roadway which serves as an evacuation route with no available detour. This methodology is based on the number of vehicles, additional travel time, and additional miles travelled, and is modified per FEMA guidance to reflect an evacuation scenario.
Casualties	- Loss of Life - Injuries	Casualties are an unfortunate risk inherent to hazard events. Methodologies to estimate avoided casualties are based on flood depth and damage to homes and are based on FEMA approved methods, as well as a study by the United States Center for Disease Control (CDC) post-Hurricane Sandy.
Value Added		
Social Value		
Recreation Benefits	- Increased Recreation Opportunity	Recreational benefits are based on added public amenities. There is willingness to pay values associated with these amenities for both recreational benefit and aesthetic values. Analysts used federally approved willingness to pay values to estimate recreation benefits.
Aesthetic Benefits	- Increased Willingness to Pay	Benefits are based on added public amenities and increased natural vegetation. Analysts used FEMA's Final Sustainability Benefits Methodology Report to value the aesthetic benefit of specific park improvements and USDA values to estimate aesthetic benefits of trees
Environmental Value		
Ecosystem Goods and Services Benefits	- Water Quality - Air Quality - Climate Regulation - Energy Savings	Green spaces, trees, and shrubs benefits include improved water and air quality, and support climate regulation. There are several ways to quantify environmental benefits provided by natural vegetation depending upon the good or service being evaluated.
Combined Sewer Overflow Reduction Benefits	- CSO Reduction	A benefit of this project is the ability to retain stormwater, preventing it from entering the combined sewer system, and ultimately entering Long Island Sound untreated. By increasing the ability to store and treat stormwater more systematically, Bridgeport will see an added benefit of lower frequency CSO events.
Economic Value		
Economic Revitalization Benefits	- New Employment - Economic Outcome	Economic gains are based on the estimated addition of commercial space. Analysts utilized methods based on FEMA's Hazus-MH 3.2 software and local economic data.

The first order benefits analysis presented herein focused primarily on the Resilience Benefits in each neighborhood, as these benefits can be captured without a fully designed project in mind. These benefits still provide a clear understanding of the potential losses and damages that could be prevented should the current strategy be pursued. While preliminary "Value Added" benefits were included in the analysis based on the generalized makeup of the five primary layers and the available preliminary conceptual information (e.g., amount of new wetlands that would be created), a thorough analysis requires a greater level of detail regarding specific square footages of measures to be implemented (i.e. number of new trees that would be planted, square footage of new sidewalk that would be added, amenities that could be incorporated into flood risk reduction structures, etc.). A more robust discussion about these benefits is presented in the **Benefits Report**, and a first order calculation is presented herein.

It also should be noted that though Value Added benefits are important to capture, as those benefits comprised approximately 15 percent of the overall benefits calculated within the RBD Pilot Project analysis. The initial analysis of Value Added Benefits described within is intended to principally represent their likely contribution to total benefits, but these benefits should be evaluated further as design of projects within the long-term strategy advance.

The benefits generated for this analysis are illustrated herein in two ways: annualized benefits and present value of benefits. To obtain annualized Resilience Benefits, the benefits analysis evaluates losses avoided for certain, expected flood events and normalizes those results to communicate risk, which is the product of flood-related loss and annual probability of exceedance.[1,2] Similarly, to calculate the present value of those benefits, the Project Team applied a discount rate to annual benefits expected over the life of the project (50 years). The benefits analysis for the Bridgeport Strategy includes a discount rate to account for the fact that investors and federal agencies value cost savings in several decades' time at a lower rate than cost savings today. The Federal Office of Management and Budget (OMB) requires a discount rate of 7 percent, but HUD also considers a 3 percent discount rate for review per HUD Notice: CPD-16-06. Accordingly, both 7 percent and 3 percent are considered.

4 COST OVERVIEW

To translate the benefits analysis into a benefit-cost analysis (BCA), a project cost is needed to compare to the benefits. Costs incorporated into the BCA would need to include all project life-cycle costs, or costs incurred over the life of the project. Such costs include capital costs and operations and maintenance (O&M) costs. In an effort to quantify a capital cost that could be justified in each region, net present value was calculated.[3] The same respective discount rate that was employed in calculating the benefits was used when calculating the justified cost (i.e., 3 and 7 percent). In addition, the project was assumed to have a capital expenditure in year 0, and then a consistent, annual O&M cost equal to 3 percent of the capital expenditure over the project useful life (i.e., in years 1-50). From there, the capital cost in year 0 and the O&M were annualized based upon the net present value of the benefits. It is important to note that, for the purposes of this first order calculation, it was assumed that all construction would take place in year 0 and escalation and inflation were not considered. In addition, this capital cost is intended to provide an overall range of the level of investment that could be justified in each neighborhood based upon the Resilience and Value Added Benefits calculated for the long-term strategy.

[1] Annual exceedance probability refers to the percent chance of an expected flood event being met or exceeded in any given year.

[2] It is important to note that anticipated sea level rise (SLR) projections were used only in the development of dry egress benefits as the design elevation of the roadway is at or above the 500-year flood elevation plus projected SLR.

[3] Justified, for the purposes of a benefit cost analysis (BCA), means that the benefit cost ratio (BCR) is equal to 1 and therefore the benefits are equal to the investment over the project's design life

Additional benefits could be realized based upon new additions to the scope of the long-term strategy, which, in turn, would justify higher capital expenditures.

A discussion of the adequacy of the anticipated capital cost per neighborhood to implement the long-term strategy is presented herein. However, it is important to note that this exercise did not attempt to cost the long-term strategy that is illustrated in the Resilient Bridgeport Design Strategies Report. At this current stage of conceptual design, there is limited information regarding existing conditions and technical analyses to produce a first cost estimate that could be confidently used for future planning and costing exercises. Rather, as design of the long-term strategy is advanced, cost estimates should be developed based upon updated information. For reference, parametric costs for program elements is shown in Table 2, and, for additional information on these elements please, see the **Costing Report.**

Table 2: Parametric Unit Costs Summary (numbers extracted from Costing Report)

Measure	Unit*	Low Estimate (USD)	High Estimate (USD)
Levee	LF	1,050	2,500
Floodwall	LF	3,500	9,500
Timber Bulkhead	LF	3,500	4,300
Steel Bulkhead	LF	6,000	10,000
Living Shoreline	LF	900	7,000
Street Raising	LF	2,050**	
Storm Surge Barrier	EA	55	150
Oyster Reef (100-ft wide)	LF	3,000	3,500
Wetlands	AC	30,000	84,000
Bioretention Plantings (soil and seed)	CY	25	30
Rain Gardens	SF	45	50
Permeable Pavement	SF	7	10
Engineered Soil	CY	45	50
Detention Pond	SF	6	7
Generic Plantings	SF	20	25
Generic Trees	EA	300	350

**Note: LF = Linear Foot, EA = Each, SF = Square Foot, AC = Acre, and CY = Cubic Yard.*

*** Only one estimate for street raising was employed*

5 NEIGHBORHOOD BENEFITS AND COST CALCULATIONS

To supplement the benefit analysis that was completed for the Bridgeport, Connecticut long-term strategy, the Project Team has also parsed out a first order benefits analysis for four neighborhoods contained within the strategy (Figure 1): 1) Black Rock / West Side; 2) South End East; 3) South End West; and, 4) Downtown.

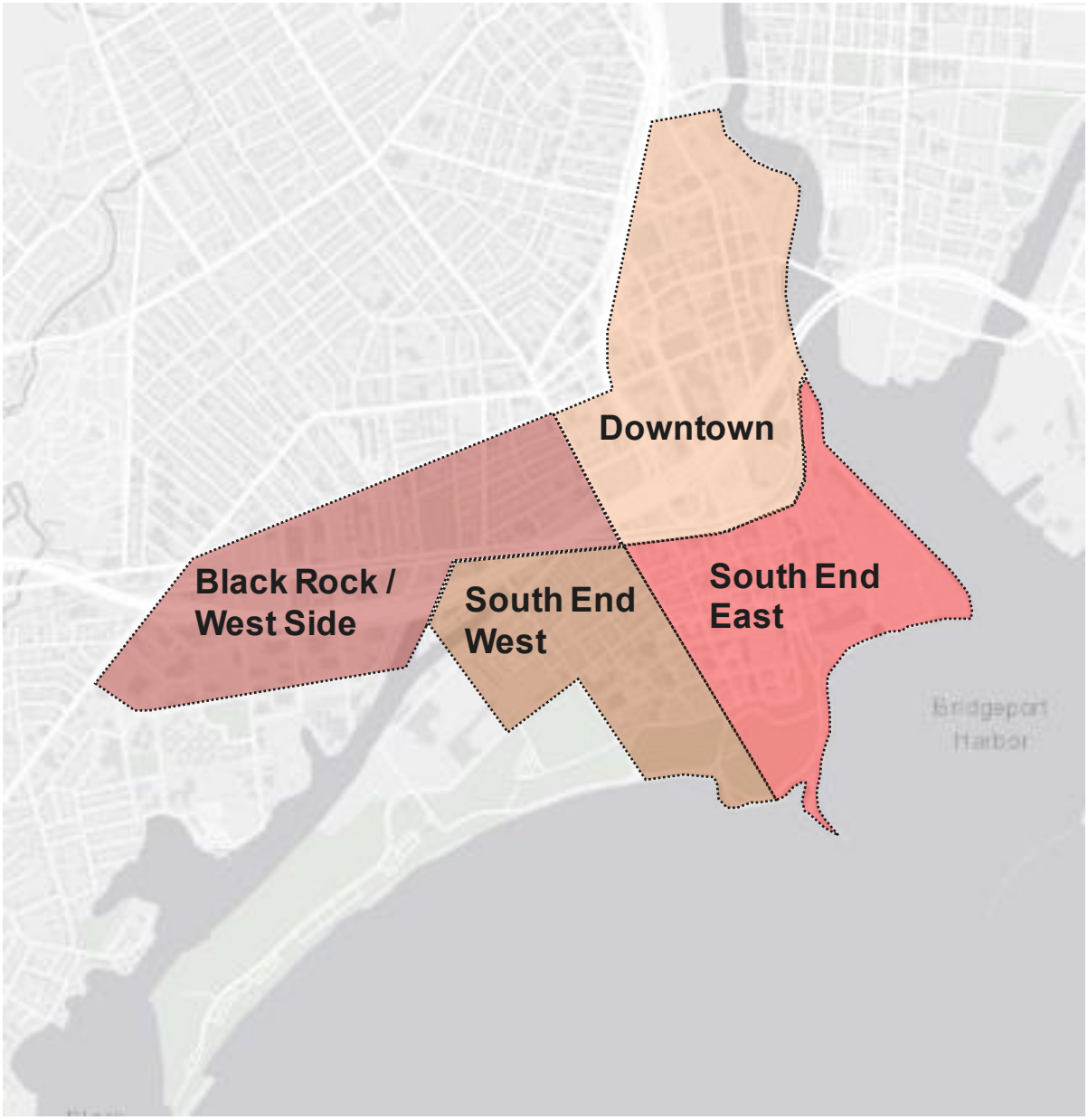


Figure 1: Neighborhood Boundaries for Benefits Analyses

Black Rock / West Side

A summary of the Resilience and Value Added Benefits are presented in Table 3. Based on the benefitting region and the first order benefits analysis, a project with a present value of approximately 3.6 – 6.6 million 2018 USD could be justified.[4] Using an annual O&M of 3% of the capital project and a 50-year project life, this equates to a first cost of approximately 2.5 to 3.7 million 2018 USD (for a discount rate of 7 and 3 percent, respectively).

The majority of the Resilience Benefits for Black Rock / West Side are based on an assumption that a series of measures, largely a raised road that would run from Cedar Creek to Fairfield Avenue, would be implemented. However, based upon the area plans in the Resilient Bridgeport Design Strategies document, as well as parametric costs from the Costing Report, the Project Team believes that projects, like those outlined in the long-term strategy, would not be cost beneficial at this time; a BCR less than 1.0 is expected in this area based on the current neighborhood conditions and general expected costs associated with the types of strategies proposed.

Table 3. Summary of Resilience and Value Added Benefits – Black Rock / West Side

Benefit	Annualized Benefit (USD)	Present Value (7% Discount Rate) (USD)	Present Value (3% Discount Rate) (USD)
Resilience Benefits			
Resilient Redevelopment			
Direct Physical Damages	150,900	2,083,100	3,883,700
Displacement	1,200	17,200	32,100
Mental Stress and Anxiety	2,500	36,500	65,800
Lost Productivity	1,500	22,700	41,000
Dry Egress Value			
Evacuation / Roadway Loss of Service	7,200	99,300	185,200
Casualties	1,100	15,700	29,200
Value Added Benefits			
Social Value			
Recreation Benefits	2,300	31,100	57,900
Aesthetic Benefits	1,100	14,600	27,200
Environmental Value			
Ecosystem Goods and Services Benefits	71,800	990,900	1,847,500
CSO Reduction Benefits	800	11,400	21,300
Economic Value			
Economic Revitalization Benefits	18,400	253,300	472,200
Total Project Benefits	**258,800**	**3,575,800**	**6,663,200**

[4] "Justified" means the project, as described in the Resilient Bridgeport long-term strategy, would have a BCR equal to 1. A BCR equal to 1 is necessary to justify the public expenditure.

South End West (RBD)

A summary of the Resilience and Value Added Benefits are presented in Table 4. Based on the benefitting region and the first order benefits analysis, a project with a present value of approximately 18 – 34 million 2018 USD could be justified.[5] Using an annual O&M of 3% of the capital project and a 50-year project life, this equates to a first cost of approximately 13 to 19 million 2018 USD (for a discount rate of 7 and 3 percent, respectively).

The majority of the Resilience Benefits for South End West are based on an assumption that a series of measures, largely comprising floodwalls near industrial areas and levees/berms in Seaside Park, would be implemented. Based upon the area plans in the Resilient Bridgeport Design Strategies document, parametric costs from the Costing Report, as well as the information the Project Team currently has about site conditions, it is possible that the project is justifiable from a benefit cost basis. However, the project in South End East (i.e., the NDRC grant funded portion of Resilient Bridgeport) should be tracked closely, as many of the key takeaways regarding subsurface conditions and constructability will be similar in the South End West and will impact both the technical and cost feasibility of implementing the long-term strategy.

Table 4. Summary of Resilience and Value Added Benefits – South End West (RBD)

Benefit	Annualized Benefit (USD)	Present Value (7% Discount Rate) (USD)	Present Value (3% Discount Rate) (USD)
Resilience Benefits			
Resilient Redevelopment			
Direct Physical Damages	1,100,200	15,183,100	28,306,900
Displacement	8,800	120,800	225,300
Mental Stress and Anxiety	36,800	544,100	982,600
Lost Productivity	22,900	338,600	611,500
Dry Egress Value			
Evacuation / Roadway Loss of Service	7,700	106,500	198,600
Casualties	16,900	233,900	436,100
Value Added Benefits			
Social Value			
Recreation Benefits	5,900	81,100	151,200
Aesthetic Benefits	1,000	13,700	25,500
Environmental Value			
Ecosystem Goods and Services Benefits	92,600	1,278,400	2,383,500
CSO Reduction Benefits	800	11,400	21,300
Economic Value			
Economic Revitalization Benefits	10,200	141,400	263,700
Total Project Benefits	**1,303,800**	**18,053,000**	**33,606,100**

[5] "Justified" means the project, as described in the Resilient Bridgeport long-term strategy, would have a BCR equal to 1. A BCR equal to 1 is necessary to justify the public expenditure.

South End East (NDRC)

A summary of the Resilience and Value Added Benefits are presented in Table 5. Based on the benefitting region and the first order benefits analysis, a project with a present value of approximately 44 – 81 million 2018 USD could be justified.[6] Using an annual O&M of 3% of the capital project and a 50-year project life, this equates to a first cost of approximately 31 to 46 million 2018 USD (for a discount rate of 7 and 3 percent, respectively).

The majority of the Resilience Benefits for South End East are based on an assumption that a series of measures, largely comprising floodwalls encompassing the Energy Corridor and a raised road along University Avenue, would be implemented.[7] Based upon the area plans in the Resilient Bridgeport Design Strategies document, as well as parametric costs from the Costing Report, the Project Team believes that, from a benefit cost basis, it is possible to justify the implementation of the risk reduction measures and drainage infrastructure improvements to realize the long-term strategy.

Table 5. Summary of Resilience and Value Added Benefits – South End East (NDRC)

Benefit	Annualized Benefit (USD)	Present Value (7% Discount Rate) (USD)	Present Value (3% Discount Rate) (USD)
Resilience Benefits			
Resilient Redevelopment			
Direct Physical Damages	2,778,500	38,344,900	71,489,200
Displacement	56,200	775,700	1,446,200
Mental Stress and Anxiety	120,500	1,783,700	3,221,200
Lost Productivity	75,000	1,110,000	2,004,700
Dry Egress Value			
Evacuation / Roadway Loss of Service	6,800	93,600	174,500
Casualties	55,600	766,800	1,429,600
Value Added Benefits			
Social Value			
Recreation Benefits	5,100	69,800	130,200
Aesthetic Benefits	1,000	14,400	26,900
Environmental Value			
Ecosystem Goods and Services Benefits	57,400	792,500	1,477,400
CSO Reduction Benefits	800	11,400	21,300
Economic Value			
Economic Revitalization Benefits	1,400	19,900	37,100
Total Project Benefits	**3,158,300**	**43,782,700**	**81,458,300**

[6] "Justified" means the project, as described in the Resilient Bridgeport long-term strategy, would have a BCR equal to 1. A BCR equal to 1 is necessary to justify the public expenditure.

[7] Benefits calculated include PSEG, Emera and United Illuminating Company ("UI")

Downtown

A summary of the Resilience and Value Added Benefits are presented in Table 6. Based on the benefitting region and the first order benefits analysis, a project with a present value of approximately 17 – 31 million 2018 USD could be justified.[8] Using an annual O&M of 3% of the capital project and a 50-year project life, this equates to a first cost of approximately 12 to 17 million 2018 USD (for a discount rate of 7 and 3 percent, respectively).

The majority of the Resilience Benefits for Downtown are based on an assumption that a series of measures, largely comprising surge risk reduction features to be determined at a later stage of design, would be implemented. Based upon the area plans in the Resilient Bridgeport Design Strategies document, parametric costs from the Costing Report, as well as the information the Project Team currently has about site conditions, it is possible that the project is justifiable from a benefit cost basis. However, the project in South End East (i.e., the NDRC grant funded portion of Resilient Bridgeport) should be tracked closely, as many of the key takeaways regarding subsurface conditions and constructability will be similar in Downtown and will impact both the technical and cost feasibility of implementing the long-term strategy.

Moreover, whether the project has a BCR greater than or equal to 1 is also dependent upon the flood risk reduction measures implemented – for example, a levee typically costs less to implement than a floodwall. These cost considerations versus site conditions should be evaluated as the design of the long-term strategy advances.

Table 6. Summary of Resilience and Value Added Benefits – Downtown

Benefit	Annualized Benefit (USD)	Present Value (7% Discount Rate) (USD)	Present Value (3% Discount Rate) (USD)
Resilience Benefits			
Resilient Redevelopment			
Direct Physical Damages	1,139,100	15,720,800	29,309,500
Displacement	38,600	532,400	992,600
Mental Stress and Anxiety	0	0	0
Lost Productivity	0	0	0
Dry Egress Value			
Evacuation / Roadway Loss of Service	200	2,200	4,000
Casualties	0	0	0
Value Added Benefits			
Social Value			
Recreation Benefits	1,100	15,800	29,500
Aesthetic Benefits	200	3,000	5,500
Environmental Value			
Ecosystem Goods and Services Benefits	18,500	255,100	475,500
CSO Reduction Benefits	800	11,400	21,300
Economic Value			
Economic Revitalization Benefits	6,500	89,800	167,400
Total Project Benefits	**1,205,000**	**16,630,400**	**31,005,300**

[8] "Justified" means the project, as described in the Resilient Bridgeport long-term strategy, would have a BCR equal to 1. A BCR equal to 1 is necessary to justify the public expenditure.

Summary

A summary table that documents the justified first cost and the present value of benefits is presented below. Overall, to implement the long-term strategy, a first cost of 59-86M USD could be justified to obtain benefits between 83-153M USD. Based upon the area plans in the Resilient Bridgeport Design Strategies document, as well as parametric costs from the Costing Report, the Project Team believes that it is best to prioritize investments in the South End West, South End East, and Downtown neighborhoods. While it may be possible to implement the risk reduction measures, drainage infrastructure improvements, and ecological enhancements, additional funds are likely needed to support the full build-out of the long-term strategy.

Table 7. Summary of Justified First Cost and Present Value of Benefits per Neighborhood

Neighborhood	Justified First Cost (M USD)		Present Value of Benefits (M USD)	
	7% Discount Rate	3% Discount Rate	7% Discount Rate	3% Discount Rate
Black Rock Harbor / West Side	3	4	3.6	6.6
South End West (RBD)	13	19	18	34
South End East (NDRC)	31	46	44	81
Downtown	12	17	17	31
Total	**59**	**86**	**83**	**153**

6 ASSUMPTIONS

The following assumptions have been made in order to determine the Study Area benefit calculations:

- **Resilience Benefits** are based on structures identified within the floodplain up to the 1% Annual Chance (100 Year) Event. The calculated losses avoided do not take into account any structures located within the 0.2% Annual Chance (500 Year) Event.
- **Value Added Benefits** are based on square footages and alignments of amenities identified within the Bridgeport, Connecticut Strategy document.
- **Resilience Benefit: Dry Egress -** This FEMA methodology is centered around the value of time, which is described in FEMA's Benefit Cost Analysis Re-engineering Guide, Development of Standard Economic Values report. In summary, analysts evaluate additional travel time needed for an alternative travel route because floodwaters inundate a roadway. Analysts reviewed the FEMA flood zones to determine whether the project area residents would have an evacuation route available that would not be inundated during a 100-year flood event. Analysts found there is no evacuation route in this scenario. When no alternative route is available, FEMA uses a delay time of 12 hours as a standard value.
- **Social Value: Recreation –** To calculate this value and remain conservative, analysts used the low value methodology described within the RBD Pilot Project Benefit Cost Analysis Methodology Report. This methodology uses a 0.13 per square foot multiplier to calculate recreational benefits. Additionally, recreational benefits were calculated using existing parks and stormwater parks only because projects have not yet been fully developed and estimates of square footages to be added per amenity have not yet been determined.
- **Social Value: Aesthetic –** To calculate this value and remain conservative, analysts used square footages of the properties contained within the floodplain and considered to be "impacted" should the Resilient Bridgeport floodwall alignment strategy be utilized. Furthermore, a value of 0.04 per square foot was used to determine an increase in property value for these impacted properties based on information contained within the FEMA Final Sustainability Report.
- **Environmental Value: CSO Reduction -** The City has developed a Long-Term Control Plan to reduce the frequency of CSO events. The Plan reveals it will cost the City 384,900,000 over 30 years to reduce CSO output by 43 million gallons. Given this information, analysts generated a damage cost for CSO abatement: 0.29 per gallon per year. Analysts modeled CSO reduction and applied the damage cost to the total volume of CSO reduction to estimate water quality benefits.
- **Environmental Value: CSO Reduction –** For the purposes of this analysis, the CSO reduction benefits have been evenly divided by the four neighborhoods to prevent duplication of benefits.
- **Environmental Value: Ecosystem Goods and Services –** To calculate this value, analysts assumed that all wetland and riparian areas surrounding the project area including Black Rock Harbor and Bridgeport Harbor area would be repaired and restructured. While Added Value Benefits can also be captured for certain additions (trees, parks, green spaces, etc.) and subtractions (reduction in impervious surfaces), analysts did not have the necessary information to complete this in-depth analysis as projects within the strategy have not yet been defined and scoped.
- **Economic Value: Economic Revitalization -** Waggonner & Ball assisted with the generation of building square footage calculations to support this benefits calculation. For each region, building

footprint square footage was pulled directly from the area plan drawings and represents only one potential build-out scenario. The values used are highly conceptual and based off very broad assumptions about redevelopment potential:

- South End West: assumes 2 stories of commercial on the current Sikorsky Site, 1 story elsewhere
- South End East: assume 1 story of commercial in mixed use buildings
- Downtown: assumes a mix of 1 story and 3 stories of commercial space. As there were no buildings added in the denser blocks of downtown, it was assumed no new building was taller than 3 stories.
- Black Rock / West Side: assumes 1 story of commercial; however, some of the new footprints are located on site where there is currently an active business or warehouse. The Project Team anticipates this zone transitioning to the eco-technology park.

Present Value – Present value calculations assume a first cost in year 0 and 50 identical periods for annual operation and maintenance costs over the assumed design life of the project.

ARCADIS Design & Consultancy for natural and built assets