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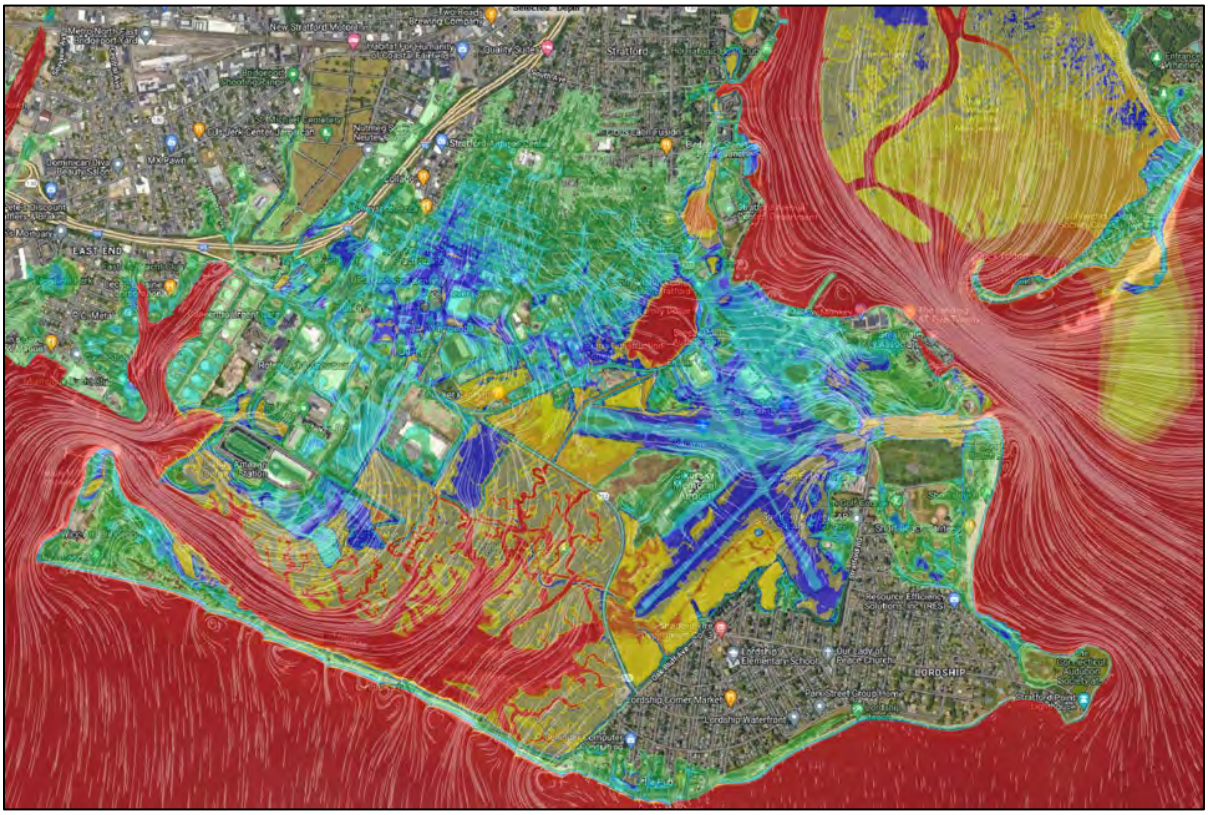
CIRCA RESILIENT CONNECTICUT PHASE III
RESILIENT STRATFORD SOUTH END PLAN

November 30, 2023
File No. 18.0175731.00



PREPARED FOR:

The Connecticut Institute of Resilience and Climate Adaptation (CIRCA) and The Town of Stratford, Connecticut

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VIA EMAIL

November 30, 2023
GZA File No. File No. 18.0175731.00

Mr. John Truscinski, CFM
Director of Resilience Planning
Connecticut Institute for Resilience and Climate Adaptation
University of Connecticut, Avery Point Campus
1080 Shennecossett Rd. Groton, CT 06340

Re: **Resilient Connecticut Phase III Plan - Resilient Stratford South End Plan**

Dear John:

GZA GeoEnvironmental, Inc. (GZA), with planning and stakeholder engagement support from Dodson & Flinker and translation services from American Translation Partners, is pleased to present this final Plan to the Connecticut Institute of Resilience and Climate Adaptation (CIRCA) and the Town of Stratford, Connecticut (Stratford). This Plan builds upon the extensive planning efforts and progress by CIRCA and Stratford. The goal of this Plan is to advance community-driven and conceptual design projects that will improve resilience of the community to natural hazards in Stratford's South End.

Recommendations for Stratford are provided to pursue grant funding for advancing projects that when built will improve the resilience of residents, businesses, natural resources and infrastructure to flooding. We enjoyed collaborating with CIRCA, Stratford, the Technical Advisory Committee, residents and business owners. Please contact Wayne Cobleigh at wayne.cobleigh@gza.com or 781-278-3848 as needed regarding this Plan.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

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cc: Susmitha Attota, Town of Stratford
John Casey, Town of Stratford

ACKNOWLEDGEMENTS

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Laura R. Hoydick, Mayor, Town or Stratford
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Chris Pia, Council Chair, Stratford Town Council
Mary Dean, Director, Economic & Community Development (or staff person), Town of Stratford
Joseph P. Gresko (D-Stratford), Connecticut State Representative, House Chair of the Environment Committee
State Senator Kevin C. Kelly, (R- Stratford) Senate Republican Ranking Member of the Children's Committee and the Legislative Management Committee, Regulations Review Committee Member
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This publication does not express the views of the Department of Housing or the State of Connecticut. The views and opinions expressed are those of the authors. Funding for this project was provided by the United States Department of Housing and Urban Development through the Community Development Block Grant National Disaster Recovery Program, as administered by the State of Connecticut, Department of Housing. More information can be found at https://resilientconnecticut.uconn.edu

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November 30, 2023

EXECUTIVE SUMMARY

Location: The geographic boundaries for this planning effort include Lordship Boulevard Commercial/Industrial Area and the South End Neighborhood, from the intersection of Surf Avenue and Lordship Boulevard to Access Road; Access Road from the intersection of Lordship Blvd. to Main Street; Main Street north to the intersection of Stratford Avenue; Stratford Avenue to Route 95; and Route 95 from the Stratford Avenue underpass south to the Surf Avenue exit ramp. More detailed maps of the project area can be found at Stratford-South-End_ROAR-Map-Portfolio.pdf (uconn.edu) (**See Figure 1**).

Figure 1: Stratford South End Resilience Study Area

Resilient Connecticut Phase III Plan: This project was led by GZA with subconsultant Dodson & Flinker in collaboration with CIRCA, the Town of Stratford, the Technical Advisory Committee and members of the community attending community outreach events and corresponding with the planning team. The Technical Advisory Committee played a critical role in the project's planning and public engagement process. Members of this committee were familiar with the South End and represented a broad cross section of community stakeholders. This committee directed and reviewed the planning team's work and assisted in building consensus among community stakeholders. This committee worked with the project team by participating in four virtual and in-person meetings from September 2022 to July 2023, facilitating project completion in November 2023.

This planning and conceptual design effort included:

1. A detailed review of the proposed South End and Lordship Boulevard Commercial/Industrial Area flood mitigation strategies from the 2016 Town of Stratford Community Coastal Resilience Plan (the 2016 Plan);
2. An assessment of project feasibility and implementation challenges; and
3. Recommendations for strategies that can be developed as feasible projects with flood loss avoidance benefits that satisfy federal and state funding eligibility and that achieve the Town's coastal resilience goals for the South End community and Lordship Boulevard Commercial/Industrial Area.

Climate adaptation alternatives and implementation planning were carried forward to conceptual design incorporated the Resilient Connecticut PERSISTS criteria. Alternative strategies were community driven and informed by stakeholder engagement and included revisions or alternative alignments of three critical levee segments from the 2016 Plan:

- **Project A Commercial Industrial Area Levee Segment/Reach,** which protects the commercial and industrial properties west of the Great Meadows Marsh and connects to either Project A or B at Lordship Boulevard (State Route 113). Refer to **Appendix I** for Project A Commercial Industrial Area Levee Segment accompanying site photos, rendering drawings, conceptual site plans, opinion of probable costs, and a list of adjacent properties.
- **Project B Lordship Boulevard (State Route 113) and Marine Basin Levee Segment/Reach**, which has been included in an USDOT PROTECT Planning Grant Application August 18, 2023, by the Town of Stratford. This project involves road and infrastructure elevations and a levee segment at the perimeter of the marine basin of the Sikorski Airport property owned by the City of Bridgeport. Both levee segments are needed to protect the airport, commercial businesses along Access Road and the South End residential neighborhoods north of Access Road. Refer to **Appendix II** for Project B Lordship Boulevard (State Route 113) and Marine Basin Levee Segment accompanying site photos, rendering drawings, conceptual site plans, and opinions of probable costs.

- **Project C Access Road Levee Segment/Reach,** which has been included in an USDOT PROTECT Planning Grant Application submitted on August 18, 2023, by the Town of Stratford. The project includes a levee consisting of earthen berm, road and infrastructure elevations and green infrastructure in the area connecting to Lordship Boulevard. This levee reach would protect commercial businesses along the north side of Access Road and the South End residential neighborhoods north of Access Road, which includes areas mapped and identified by FEMA and CIRCA as socially vulnerable and eligible for federal funding benefits to advance environmental justice under the Justice40 Initiative per Executive Order 14008. Refer to **Appendix III** Project C Access Road Levee Segment/Reach accompanying site photos, rendering drawings, conceptual site plans, opinion of probable costs, and a list of abutting properties.
- **Project D Orange Street Stormwater Flooding Area:** This proposed project includes development of a surface water feature, open space and adjacent land development. The proposed project is located within an existing low elevation floodplain, identified based on historic aerial photographs and FEMA flood mapping, and would be integrated into South End neighborhood stormwater management and infrastructure. The proposed project would require modifications to existing Orange Street and voluntary, pre-disaster buyouts from interested single family property owners in the vicinity of Orange Street to enable daylighting the former stream and the creation of natural and nature-based features for stormwater management. Site-scale stormwater flooding accommodation strategies for the Orange Street residential neighborhood were evaluated and included green infrastructure and nature-based strategies to improve open space for increased permeable surface area, mitigation of stormwater runoff and tidal flooding impacts, improved stormwater storage and flood management; and combinations of these strategies were evaluated to create flood resilience for the continued long-term viability of the South End Area. See **Appendix IV** for Project D details.

Town-wide Perimeter Coastal Flood Protection System: The 2016 Plan identified specific mitigation measures in the context of Managed Retreat, Protect and Accommodate. These measures included both non-structural policy and regulatory recommendations and structural flood protection projects. The structural flood protection projects included: 1) a series of 19 discrete flood protection projects that, when all are constructed, collectively provide Town-wide perimeter coastal flood protection; 2) two beach nourishment and dune restoration projects; and 3) one area-wide retreat. The total capital costs estimated by GZA in 2016 for the 19 flood protection projects and the beach nourishment projects was nearly $230 million. The projects were prioritized, with the Town's Water Pollution Control Authority (WPCA) Facility as the highest priority due to its high vulnerability to coastal flooding and severe failure consequences. Stratford has moved forward implementing many recommendations in the 2016 Plan.

The South End neighborhood and Lordship Boulevard Commercial/Industrial Area of Stratford were determined to have high current and future flood risks and identified as critical priorities for the Town of Stratford in the 2016 Plan. This study builds on the 2016 Plan and concludes that a coastal flood protection system necessary to create a Resilient Stratford South End will require:

1. Several levee segments or reaches within the Town-wide Coastal Flood Protection System, designed to varying Design Flood Elevations (DFEs) based on practical construction constraints and technical feasibility, regulatory compliance and achieving benefit-cost analyses favorable for federal grant funding criteria;
2. Incorporation of coastal flood protection with stormwater infrastructure improvements, including hard infrastructure and green infrastructure, pump stations, etc.;
3. Incorporation of coastal flood protection with infrastructure to maintain tidal flow with adjacent wetlands and ponds, including tide gates, gate valves, etc.;
4. Incorporation of coastal flood protection with other project initiatives planned by the Town, in particular the Town's existing and preliminary designed Stratford Greenway Extension Project;

5. Connection and integration of the proposed projects with other proposed levee segments, properties with high existing grade elevation and property planned for significant real estate development with grade elevation increases (in particular, the redevelopment of the former Stratford Army Engine Plant property [SAEP]); and
6. Minimizing adverse impacts to adjacent properties and infrastructure, including natural resources like the Great Meadows Marsh, a habitat for wildlife, fauna and the salt marsh sparrow.

Overcoming Barriers and Impediments to Project Advancement

Economic, technical, regulatory, environmental and infrastructure challenges converge as barriers to progress on the flood protection projects identified in the 2016 Plan. Barriers include federal ownership of the recently restored Great Meadows Marsh, Route 113 state highway and evacuation route owned by CT DOT, Sikorski Airport property ownership by the City of Bridgeport and a cancelled property transfer by the Connecticut Aviation Authority, Federal Aviation Administration guidance for runway safety zones limiting the elevation of structures beyond the property boundary of the airport.

These barriers to progress collectively increase the complexity of designing a levee system due to state and federal permitting requirements and in reaching consensus among diverse stakeholders on critical flood protection segments that need to connect as a levee system composed of several levee segments to ensure protection from the design flood to the leveed area, while minimizing negative impacts to neighboring land uses in the South End.

Project Benefit Costs Ratios (BCRs) Analysis

Benefit Cost Ratio analysis by GZA is summarized in **Section 4 and Table 1**, which indicates favorable results for the primary levee system and with alternative levee segments. The federal government prefers to fund infrastructure with a benefit cost ratio (BCR) greater than 1.0, which our analysis indicates may be achievable, as even the unlikely scenario of building both Projects B and C resulted in an estimated BCR greater than 1.0 when accounting for the State of Connecticut's sea level rise criteria for constructing projects funded with federal and/or state funding. Refer to Engineer Opinions of Probable Cost corresponding to the Primary Levee System Alternatives in **Appendix V**.

Recommendations

We recommend that the Town of Stratford analyze the levee system segments separately and collectively to assess the performance of the flood protection system with the 2D Hydrodynamic Overland Flood Model recently completed for the Town by GZA. The modeling could be completed with Town funding or as part of a CT DEEP Climate Resilience Fund Track 2 Project Development grant. This modeling may be used to confirm if each segment is dependent upon the performance of the other segments in the levee system—meaning if one segment fails the entire levee system fails. If any discrete segments are determined to perform well independently with favorable BCRs, state and federal grant funding should be pursued for those segments with these flood modeling results included in the grant application. The interdependence of the levee segments for coastal flood protection is a disadvantage for the Town when pursuing federal funding because FEMA's and USDOT's competitive coastal resiliency grant applications (FEMA FMA, FEMA BRIC, USDOT PROTECT) require a Benefit Cost Ratio greater than 1.0 for individual projects. Recently, U.S. Army Corps of Engineers (USACE) has been considering funding a major flood mitigation project estimated at $1.6 billion with a BCR value marginally below 1.0 for elevating 3300 private buildings in Louisiana for the Amite River Basin Commission. The estimated non-federal cost share for this project is 35% or $560 million. Federal funding of the estimated costs needed for the entire levee system in Stratford would need to be approved by Congress as an appropriation under the Water Resources Development Act or Connecticut Coastal Storm Risk Management (CSRM) feasibility study, similar to the system of flood walls, flood gates and pump stations to be constructed by USACE along Interstate 95 in the Long Wharf area of New Haven resulting from Coastal Storm Risk Management Feasibility Study that builds on the city's Long Wharf Responsible Growth Plan adopted in 2018, as well as GZA's Flood Protection Study undertaken in 2016. **Table 2** in **Section 5** includes a Summary of State and Federal Funding Programs for Resilient Stratford South End Projects.

November 30, 2023

SECTION 1 - PROJECT OVERVIEW

The purpose of the "Resilient Connecticut Phase III Plan" project is to help the Town of Stratford identify the challenges and impediments that exist to advancing the resilience projects identified in the 2016 "Town of Stratford Coastal Community Resilience Plan" (the 2016 Plan), specifically for project segments that protect the South End neighborhood and adjacent Lordship Commercial-Industrial District (see **Figure 1**). The 2016 Plan was funded by a HUD Community Development Block Grant Disaster Recovery (CDBG-DR).

The Resilient Connecticut Phase III Plan was led by GZA with subconsultant Dodson & Flinker in collaboration with CIRCA, the Town of Stratford, the Technical Advisory Committee (TAC) and members of the community attending community outreach events and corresponding with the planning team. The TAC served a critical role in the project's planning and public engagement process. Members of this committee were familiar with the South End and represented a broad cross section of community stakeholders. This committee directed and reviewed the planning team's work and assisted in building consensus among community stakeholders. This committee worked with the project team by participating in four virtual and in-person meetings from September 2022 to July 2023, facilitating project completion in November 2023.

This planning and conceptual design effort included:

(1) A detailed review of the proposed South End and Lordship Boulevard Commercial/Industrial Area flood mitigation strategies from Stratford's community resilience plan,

(2) An assessment of feasibility and implementation challenges, and

(3 Recommendations for strategies that can be developed as feasible projects with flood loss avoidance benefits that satisfy federal and state funding eligibility and that achieve the Town's coastal resilience goals for the South End community and Lordship Boulevard Commercial/Industrial Area.

Climate adaptation alternatives and implementation planning were carried forward to conceptual design incorporated the Resilient Connecticut PERSISTS criteria. Alternative strategies were community driven and informed by stakeholder engagement and included revisions or alternative alignments of three critical levee segments from the 2016 Plan.

2016 Town of Stratford Coastal Community Resilience Plan (2016 Plan) and Completed Resilience Projects

The 2016 Plan presented science-based vulnerability analyses, including numerical modeling of coastal flooding, waves and erosion and estimation of flood-related losses. Based on the vulnerability assessment conducted in 2016, coastal flooding in Stratford is highly complex, with factors including multiple flood entry points and culverts that hydraulically connect low-lying inland areas to the coast. Identifying, at high resolution, the flood hydrodynamics is essential for selection of flood protection measures as well as understanding their benefits. This was done in 2016 and is on-going with additional Town coastal flooding and stormwater modeling efforts.

The 2016 Plan identified specific mitigation measures in the context of Managed Retreat, Protect and Accommodate. These measures included both non-structural policy and regulatory recommendations and structural flood protection projects. The structural flood protection projects included: 1) a series of 19 discrete flood protection projects that, when all are constructed, collectively provide Town-wide perimeter coastal flood protection; 2) two beach nourishment and dune restoration projects; and 3) one area-wide retreat. The total capital costs estimated by GZA in 2016 for the 19 flood protection projects and the beach nourishment projects was nearly $230 million. The projects were prioritized, with the Town's Water Pollution Control Authority (WPCA) Facility as the highest priority due to its high vulnerability to coastal flooding and severe failure consequences.

Since the formal adoption of the 2016 Plan by the Town (during 2016), GZA has worked closely and continuously with the Town professionals to advance federal grant application and project design and construction and other resilience and climate adaptation measures including:

- GZA completed a 30% design of POTW flood protection measures during 2016. Building on this design, GZA assisted the Town in achieving a $7.6 million (not including Town match) FEMA (PDMC) Pre-Disaster Mitigation Competitive Grant, for final design and construction. GZA was awarded a competitive procurement in 2021 and is completing final design, construction documents and permitting in 2023.
- GZA supported the Town with integration of supplemental resilience measures in the design of the (previously planned) replacement of the Broad Street over Ferry Brook bridge and tide gate, including an area-wide loss estimation study and detailed benefit-cost analysis resulting in design modifications for resilience and additional bridge funding.
- Incorporation of specific climate resilience requirements into the land development agreement for the former SAEP redevelopment project.
- GZA has completed 30% design of flood protection at 255 Long Beach Boulevard adjacent to Great Meadows Marsh.
- 30% design is underway by GZA for two Stratford Greenway segments, including the Park Path greenway segment between the WPCA Facility and the SAEP and the Birdseye flood berm located north of the WPCA Facility.
- GZA has also utilized the Plan for enabling projects to support several State and Federal grant applications by the Town.
- GZA is completing supplemental flood analysis and numerical modeling (Town of Stratford 2D Hydrodynamic Overland Coastal Flood Model), including evaluating the potential for a Town-wide FEMA Letter of Map Revision (LOMR).

In addition, the Town is currently performing a detailed assessment of stormwater infrastructure within the South End neighborhood, including numerical modeling of stormwater run-off and infrastructure.

Since 2016, the Town has successfully advanced additional resilience recommendations identified in the 2016 Plan, including: 1) achieving a FEMA Community Rating CRS Class 8; 2) increasing community awareness and buy-in; 3) integrating the Plan findings and recommendations into updates of the FEMA Natural Hazard Mitigation Plan and the Plan of Conservation and Development; 4) using the Flood Mitigation Assistance program for several building elevation projects; and 5) evaluating WPCA Facility pump station hardening.

Resilient Connecticut Phase III Plan Development

The goal of Resilient Connecticut Phase III is to further evaluate specific resilience projects (flood protection segments) that are supportive of flood protection for the South End neighborhood and the Lordship Boulevard Industrial and Commercial Area, including Sikorsky Airport. These projects affect key Town roads like Access Road and a State roadway Rt. 113 (Lordship Boulevard and Main Street) and border on the former SAEP to the east and Great Meadows Marsh to the south. The geographic boundaries for this planning effort are from the intersection of Surf Avenue and Lordship Boulevard to Access Road; Access Road from the intersection of Lordship Blvd. to Main Street; Main Street north to the intersection of Stratford Avenue; Stratford Avenue to Route 95; and Route 95 from the Stratford Avenue underpass south to the Surf Avenue exit ramp (see **Figure 1**).

The development of the Resilient Connecticut Phase III Plan included identification and conceptual design of select projects from the 2016 Plan (as well as additional, alternative concepts) that are suitable to be advanced further to final design and funding. The process included public and private stakeholder outreach (led by Dodson & Flinker with support from GZA), and close collaboration with CIRCA staff, a Town Technical Advisory Committee (TAC), Town of Stratford professionals (in particular, Engineering and Planning, Zoning, Conservation, Public Works, and the Planning Commission) and members of the public. Key Town professionals included Susmitha Attota, AICP (Town Planner) and John Casey, PE (Town Engineer). The past successes in advancing coastal resilience within Stratford have been largely due to their continuous commitment to advancing the plans into action and understanding the risks and barriers affecting advancing projects identified in the 2016 plan.

The Resilient Connecticut Phase III Plan project selection and evaluation criteria developed and used by GZA, Dodson & Flinker and the TAC included the following: 1) are proposed projects eligible for State and Federal funding with a social equity lens and Justice 40 benefits to residents in environmental justice areas that are disproportionately impacted by climate change; 2) are the projects permittable relative to local, State and Federal regulations; 3) do the projects use practical and transferable technologies; 4) are the projects with opportunistic development, meaning that they can be implemented as enabling circumstances arise such as land development of the former SAEP, planned property transfer of the Sikorski Airport from the City of Bridgeport to the Connecticut Airport Authority, etc.; and 5) are the projects aligned with Town planning and community resiliency initiatives, in particular the Town's public greenway system and Plan of Conservation and Development (POCD).

As part of the Resilient Connecticut Phase III, Dodson & Flinker also conducted an independent review of the 2016 Plan, focused on issues and resilience measures and recommendations affecting the Lordship Boulevard Industrial and Commercial Area and the South End neighborhood. Alternatives to the projects presented in the 2016 Plan, that may be more appropriate, were also identified.

GZA, Dodson & Flinker and the TAC also evaluated the barriers to advancing the projects and the evaluation is documented in the TAC meeting notes. Key barriers include:

- Project cost and funding are key barrier and like many municipalities in New England, project capital funding and an overreliance and dependence on State and Federal grants versus other competitive and discretionary funding sources are key barriers to implementing projects.
- Potential property tax loss due to property acquisitions associated with construction of the projects.
- Practical constraints to construction including available land area, existing topography, working within a highly developed urban environment, ground surface elevation, etc. These practical constraints affect the project Design Flood Elevations (DFEs) that can practically be achieved.
- The existing, aging stormwater infrastructure and ability to manage stormwater including increased rainfall intensities and existing outfalls at low elevations enabling tidal influence or experiencing restricted flow without pumping.
- Property owner resistance to managed retreat as a Town resilience strategy.
- On-going commercial real estate redevelopment within flood zones.

Updated resilience strategies include: 1) revisions or alternative alignments of critical coastal flood protection segments proposed in the 2016 Plan; 2) accommodation strategies for critical community assets; 3) the use of high resolution coastal flooding and stormwater hydrological and hydraulic modeling study by the Town to inform planning and design decisions; 4) the creation of resilient corridors; 5) the integration of green infrastructure or nature-based features, in particular for stormwater management; 6) the use of open space for mitigating extreme heat, flood management and ecological restoration; 7) consideration for improving environmental justice and social equity in the South End, including the opportunity for incorporating affordable housing; 8) change in zoning policy and regulation to increase low impact development, stormwater management, building height relief and district-scale resiliency measures to address stormwater flooding and exposure to extreme heat; and 9) a combination of these strategies to create buffers and multiple layers of resilience for the continued long-term resilience of and affordability of single and multi-family housing in the South End Neighborhood.

Based on the project evaluations and stakeholder outreach, several projects from the 2016 Plan were selected for advancement to conceptual design and new, alternative projects were identified. Three (3) projects were advanced to concept design (10% design), including plan view, cross sections, and photo-rendered perspectives (before and after) images. Engineer's Opinion of Probable Costs inclusive of design, permitting and construction costs, were developed for these projects. Evaluations of prevented losses (i.e., project benefits) and FEMA Benefit– Cost Analyses (BCAs) (utilizing

knowledge of inputs required for the FEMA BCA Toolkit 6.0 and the Framework for Benefit Cost Analysis (BCA) Approach were performed.

Figure 2: Project Study Area Map

SECTION 2. STAKEHOLDER ENGAGEMENT

Stakeholder engagement was a key part of the project selection process. A focused, differentiated approach to stakeholder engagement was used. In addition to the Town (including the Planning Zoning and Conservations Commissions) and MetroCOG, several specific categories of stakeholders were involved in this Resilient Connecticut Phase III Plan:

- Business and residential stakeholders associated with the portion of the Lordship Boulevard Industrial and Commercial Area that is dedicated to commercial and industrial activities and construction in the South End.
- Stakeholders associated with the January 2021 Airport Master Plan Final Report by CHA Consulting, Inc. (CHA) for the Igor I Sikorsky Memorial Airport, owned by the City of Bridgeport. This airport was undergoing property transfer and sale negotiations during 2022 that were terminated in 2023 by the prospective purchaser, Connecticut Airport Authority. The City of Bridgeport issued a letter of support for the Town of Stratford's Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program Planning Grant Application for evaluation of the Resilient Stratford South End and Route 113 Project in August 2023. The grant application status is pending.
- CT DOT which controls State roads, including a critical roadway Route 113 (Lordship Boulevard) providing evacuation routes for access/ingress in these areas. The CT DOT issued a letter of support for the Town of Stratford's PROTECT Planning Grant Application in August 2023.
- CT DEEP which oversees project permitting and interpretation of Connecticut statutes and regulations affecting state-funded projects and recent interpretations for Coastal AE zones.
- State representatives (Congressional District 3; Senate District 21 and 23; House Districts 120 and 121 and 122).
- Audubon Connecticut, which completed a $4.1M restoration project at the Great Meadows Marsh involving the U.S. Fish and Wildlife Service, the EPA, The Nature Conservancy, the Robert F. Schumann Foundation, the Jeniam Foundation, NOAA, and CT DEEP. Audubon Connecticut provided a poster of the project which was shared with the TAC and with the attendees of the first Stakeholder Engagement Workshop.

Outreach Approach:

Dodson & Flinker, GZA and CIRCA focused the stakeholder engagement outreach topics with input from the Technical Advisory Committee at four (4) TAC virtual and in-person meetings (September 20, 2022; February 26, 2023; June 6, 2023; and July 6, 2023) and two public workshops (November 15, 2022 and October 17, 2023) focused on understanding coastal and stormwater flooding experienced by the stakeholders in the South End community; and 2) a pre-permit virtual meeting with members of CT DEEP on October 26, 2023 to review the three coastal flood protection segments for understanding DEEP's permitting requirements and points of contact for the Town when advancing the projects for grant applications, design and permitting.

South End Neighborhood and Town Officials Outreach: Phase 1 of the outreach included collaborating with elected officials, State Representatives, Stratford Community Services to identify how best to involve neighborhood leadership and community organizations such as Citizens Addressing Racial Equity (CARE), Stratford Clergy Association, the South End Community Center and South End schools, Stratford Housing Authority. Informed by TAC meetings in Phase 1, outreach materials and workshop notifications were developed. The second phase included an public workshops in the Commercial Industrial Area, and a public meeting with the Planning, Zoning and Conservation Commissions at Town Hall. The November 2022 and October 2023 Public Meeting materials are available at the CIRCA Resilient Connecticut Phase III project Website at https://resilientconnecticut.uconn.edu/stratford-south-end-project-public-meetings/ with portions of the materials translated in Spanish.

Sikorsky Airport Outreach: Airport resilience and flood protection includes a combination of Town projects (external to the airport property) and deployable and permanent facility and building flood protection measures. Flooding of the airport area also contributes to flooding the South End, making the airport part of a comprehensive flood protection strategy. Federal aviation regulations restrict aspects of flood protection projects within flyover zones. The status of property transaction negotiations made determination of the outreach details uncertain (Sikorsky Memorial Airport Special Airport Commission Meetings are attended by the Town of Stratford's Mayor, who provided status updates on the Airport). Federal Aviation Administration Guidance that may restrict the height of roads, buildings, structures withing runway safety areas and runway safety zones were determined from January 2021 Airport Master Plan Final Report by CHA and presented at the TAC meetings.

CT DOT Outreach: CT DOT is a key stakeholder since Route 113 is an evacuation route and major transportation route and has been identified in the 2016 Plan as a conceptual flood protection project. Past surface improvements to Route 113 have been made with limited consideration of coastal flood protection or resilient design. The CT DOT outreach was made by GZA and the Town of Stratford in August 2023 in the context of the Statewide Resilience Improvement Plan (RIP) the CT DOT is planning to undertake in 2023-2024 with PROTECT formula funding. Any specific resilient transportation infrastructure projects identified in the RIP reduce the non-federal match for PROTECT grants by 7-10%. CT DOT was advised to review Resilient CT Phase III Pilot Plan projects involving road and culvert improvement projects as projects to consider for including in the RIP. Emily Pysh, PMP, Transportation Supervising Planner, Sustainability & Resiliency, CT DOT indicated concept designs of the proposed road elevation projects on Access Road and Route 113 should be reviewed with the DOT District 3 Engineer, John Antonucci, P.E. who is responsible for state highways in the Town of Stratford.

Lordship Boulevard Commercial/Industrial Area: Although the 2016 Plan also encouraged a long-term relocation of commercial and industrial businesses in the area, the Airport is likely to remain due to the difficulty in siting and permitting a comparable new Airport elsewhere and easy access to Route 95 enables commercial and warehouse distribution land use to remain in the area. The 2016 Plan promoted municipal flood protection projects; however, a non-structural, regulatory and technical guidance approach is also promoted to encourage or require design for coastal flood resilience at the property scale within the area in the event flood mitigation measures cannot be funded with competitive grants (e.g., City of Boston Flood Resilience Zoning Overlay; Coastal Flood Resilience Overlay District and Flood Resiliency Design Guidelines). GZA outreach to business owners was completed as part of the November 15, 2022, Workshop. The November 15, 2022 Public Meeting materials are available at the CIRCA Resilient Connecticut Phase III project Website at https://resilientconnecticut.uconn.edu/stratford-south-end-project-public-meetings/ with portions of the materials translated in Spanish.

Great Meadows: Separate from the Resilient Connecticut Phase III Plan, the GZA completed 30% design for the Town Engineer for a vegetated flood levee at the Meyer property at 255 Long Beach Boulevard that borders the Great Meadows Marsh; however, it came at a time when the marsh restoration design and permitting by Audubon Connecticut were already completed. RA representative from Meyer indicated at and subsequent to the November 15, 2022, Stakeholder Engagement Workshop that Meyer is interested in enabling flood protection at their property. The Town Engineer reported at a TAC meeting that the Town was informed by a U.S. Fish and Wildlife Service representative that the levee construction should not be proposed on the federal property. Representatives from Meyer were visited by GZA in October 2023 to determine if a property boundary map was available from the company records. A map was not available. Several portions of the asphalt parking lot adjacent to the marsh are currently used for storing moving vehicles and trailers. A map of the stormwater system for the parking lot was not available. More comprehensive discussions between the Town, DEEP, US Fish and Wildlife, commercial and industrial property owners relative to integrating future marsh restoration, maintenance and flood protection, and review the feasibility of a floodwall on the Meyer property will be needed to advance the projects to a grant application.

CT DEEP: Once the three project concepts were developed, a virtual permit pre-application meeting was conducted to solicit regulatory feedback and identify permits and points of contact to facilitate permitting with the Town.

A summary of the Resilient Stratford South End Concept projects (depicting flood barriers, levees, specific geographic areas for flood protection needed and feedback on proposed flood mitigation concept projects) were provided to CT DEEP ahead of the meeting and the presentation materials are provided on CIRCA's Resilient Connecticut Phase III website. CT DEEP discussed the project during a virtual meeting with CIRCA and GZA on October 26, 2023. CT DEEP also provided a detailed written response in two emails to GZA and CIRCA regarding the pre-permitting meeting, which included guidance on the specific types of permits required by the design of the proposed segments of the Coastal Flood Levee System, the process for GZA to conduct site-specific modeling of the 500-year flood zone consistent with FEMA flood mapping requirements, related guidance provided by CT DEEP in 2019 for the design flood elevation of similar levee system associated with the Resilient Bridgeport project, and specific points of contact at CT DEEP for the various permits issued by CT DEEP. This information provided by CT DEEP in response to the meeting was provided the Town of Stratford for use in advancing the concept designs.

The October 17, 2023 "Summary of Special Public Meeting with Town of Stratford Planning, Zoning and Conservation Commissions on Resilient Stratford South End Plan - Review of Flood Mitigation Projects" public meeting included the following agenda:

1. Overview of the ongoing Phase III Resilient Connecticut Planning Projects;
2. Progress made by the Town since the 2016 Coastal Community Resilience Plan;
3. Summary of how a Resilient Stratford South End benefits the Town of Stratford and how other planning and design efforts and the hydrologic and hydraulic (H&H) study funded by the Town and provided by Weston & Sampson, along with other plans will be integrated with this study funded by CIRCA;
4. High resolution coastal flood model visualization of the coastal flooding hazards in the South End area; and
5. An overview of the Resilient Stratford South End projects as protect and accommodate climate adaptation strategies by GZA and Dodson & Flinker. The coastal flood protection projects are intended to connect as several flood mitigation segments or reaches of a levee system in the Stratford South End. A concept project to address stormwater flooding hazards north of Access Road along a low topographic area of Orange Street was also presented.

Three conceptual design projects were presented with aerial views, renderings, and a summary of the length of the projects and number of properties involved. The three coastal flood mitigation projects included:

- "Project A Commercial Industrial Area Levee Segment/Reach" (See **Appendix I**);
- "Project B Lordship Boulevard (State Route 113) Levee Segment/Reach" (See **Appendix II**); and
- "Project C Access Road Levee Segment/Reach" (See **Appendix III**).

Projects B and C represent alternative flood protection segments.

A fourth project, Project D Orange Street Stormwater Flooding Area was developed in conjunction with proposed South End neighborhood stormwater improvements.

These projects are described in **Section 3** and details are presented in the **Appendices**.

While Projects A, B and C are distinct flood protection projects, Project D includes potential property acquisition by the Town and neighborhood redevelopment. Project D would require modification of Orange Street and voluntary, pre-disaster buyouts from interested single family property owners in the vicinity of Orange Street. Redevelopment opportunities were summarized with the existing roadway becoming green infrastructure for stormwater storage with options for flood resilient single or multi-family housing was presented. This concept design would need to be enabled by iterative and longer-term land use changes such as land acquisition, zoning for increased building height, one way street traffic, temporary relocation of residents and options for new housing development of comparable priced homes (single family residential, condominium townhouses or apartments) in the flood prone residential area on Orange Street caused by tidal conditions, precipitation and street runoff into the aging stormwater infrastructure. Options were presented that

minimized displacement of residents that decided to remain in the neighborhood. The intent of the proposed concept is not to compel anyone to live in multi-family or apartment dwellings rather than single family housing. Rather, the intent is to convey a conceptual project that explores how to:

- allow for interested residents to have a means by which their flood-vulnerable homes could be sold so that new development could support the overall ability to accommodate flooding from intense precipitation or coastal flooding.
- incentivize redevelopment of flood-resilient housing but comparably priced homes (of various sizes—for townhouses or apartments).
- minimize displacement of residents that wished to remain in the neighborhood.

A summary of the community stakeholder comments provided by the Stakeholder Engagement process completed on October 17, 2023, are provided below**:**

- Flooding on Orange Street is primarily due to stormwater that cannot discharge from the neighborhood because the stormwater infrastructure is undersized, or the discharge elevation is below tidal and storm surface water levels.
- Even if homes were elevated, the stormwater drainage problems would still need to be addressed. Improvements to stormwater infrastructure should be the first step taken to alleviate flooding in the Orange Street area. The priority for addressing stormwater flooding should include the installation of gate valves to prevent tidal flooding. GZA commented that the Hydrologic & Hydraulic Study conducted by the Town's Consultant will help to address the stormwater system improvements needed. (**See Section 3**)
- The first step for Orange Street stormwater flooding should include the installation of rain gardens.
- Honeyspot Road and Orange Street are the two main through streets for the South End residents and commuters. Comments included questions about the conceptual plans, including: Will transition of Orange Street to a one-way road to enable more green infrastructure, also create a source of traffic congestion in this part of the South End?
- Expecting residents to voluntarily accept property buyouts and move is unlikely to be welcomed by the residents until repetitive flooding and the associated property damages become intolerable. One commenter, regarding the Orange Street concept project, asked whether managed retreat could be phased (e.g., could residents sell when they are ready to downsize). After the meeting the following considerations for opting for a voluntary buyout were developed and include:
    - low lying houses are vulnerable to flooding without future investments in flood mitigation by an owner will be more difficult to sell at a profit in the future as the intensity and frequency of stormwater flooding continues.
    - we heard from residents in the December 2022 open house, who after hearing the presentation on flooding, indicated that they would consider moving or selling (how serious they were, however, is uncertain).
    - there are non-flood related reasons to sell a home - one of the most common being downsizing after retirement.
    - A concern for the flood barriers on Access Road or other road segments near the Great Meadows will restrict wildlife migration and negatively impact habitats of sensitive species. One sensitive bird species nests at higher elevations than the marsh which could become a concern for the roadway berm areas. GZA responded that the projects will require permitting which will require that environmental impacts are not significant, and any disturbance of wetlands, culverts or watercourses will need to be balanced by offsetting projects called wetland mitigation projects that create new wetlands, improve water quality or enhance the ecological and habitat functions of these regulated areas. Standards have been developed for the design of culverts that improve habitat, wildlife migration and ecological functions.
- One commenter thought getting a permit from the US Fish and Wildlife Service to relocate Lordship Boulevard (Route 113) in the Great Meadows may not be possible and would need further investigation. Could the design include a

causeway or bridge over the Great Meadows to limit the impact to these natural resources? GZA responded that due to the presence of runway safety areas from the Airport operation that are recommended by the Federal Aviation Administration (FAA), elevating the existing area of Lordship Boulevard may cause non-compliance with this FAA guidance for pilot and public safety for landing or takeoff emergency events.

- One commenter asked if the above ground electric power transmission lines could be installed underground while the road improvements and stormwater lines were being replaced. GZA responded that placing electric transmission power lines underground is the responsibility of the electric utility, costs can be significant, and the utility will request to include these project related costs in the electric rates statewide, which requires permits.
- A commenter questioned why each of the proposed solutions are flood barriers and levees instead of natural and nature-based features enabling habitat protection? GZA responded that the solutions needed to protect the residents and businesses from coastal flooding will need to be a system of levees and flood barriers. Nature based solutions and the Great Meadows can accommodate stormwater storage but cannot stop the physical damage to buildings from severe coastal flood events and storm surge.
- A commenter questioned how long into the future will these proposed flood protection solutions protect the residents and businesses. GZA responded that the design will be based on models which include sea level rise predictions published and accepted by the State of Connecticut. The climate conditions until 2050 in Stratford can be planned and designed for. How much additional protection is needed beyond 2050 depends on how effective the global efforts are to reduce carbon emissions from the burning of fossil fuels from our current emission levels.

SECTION 3 – RESILIENT CONNECTICUT PHASE III FLOOD PROTECTION STRATEGIES AND ALTERNATIVES

The South End neighborhood and Lordship Boulevard Commercial/Industrial Area of Stratford were both assessed to have high current and future flood risks and identified as critical priorities for the Town of Stratford in the 2016 Plan (link to community resilience plan). Stratford has moved forward implementing many recommendations in the plan. Several separate flood mitigation projects were proposed as a series of levee segments or reaches connecting to create a levee system for protection from the design flood event. Progress has been made in funding and designing the Water Pollution Control Facility levee, which was the highest community resilience priority. This Plan further builds on the 2016 Plan in concluding coastal flood protection to create a Resilient Stratford South End requires:

1) a levee system composed of several levee segments or reaches designed to varying elevations based on cost benefit analysis, technically feasibility and compliance with applicable regulations,
2) including other components and features such as flood walls, a stormwater system with functioning gate valves, check valves, culverts, green infrastructure for storage, greenway berms for recreation, and pump stations,
3) which are interconnected with other levee segments and existing areas of high elevation and are necessary to operate as a coastal flood levee system to ensure protection from the design flood event for the leveed area,
4) while also minimizing adverse impacts to adjacent properties and infrastructure, and to natural resources like the Great Meadows Marsh, a habitat for wildlife, fauna, and the salt marsh sparrow.

Three coastal flood mitigation projects were advanced for further evaluation and conceptual design. These included:

- "Project A Commercial Industrial Area Levee Segment/Reach";
- "Project B Lordship Boulevard (State Route 113) Levee Segment/Reach"; and
- "Project C Access Road Levee Segment/Reach".

These proposed projects represent segments of a Town-wide perimeter flood protection system. Projects B and C represent alternative flood protection segments. **Figure 3** presents the proposed project reaches.

A fourth project, Project D Orange Street Stormwater Flooding Area, aligns with proposed stormwater infrastructure improvements within the South End neighborhood.

Project A Commercial Industrial Area Levee Segment/Reach:

This proposed project protects the commercial and industrial properties west of the Great Meadows Marsh and connects to either Project B or C at Lordship Boulevard (State Route 113). **Appendix I** presents Project A details, including site photos, conceptual site plans, concept renderings and Opinion of Probable Costs. A list of properties that would potentially be impacted by the project is also provided.

Project B Lordship Boulevard (State Route 113) and Marine Basin Levee Segment/Reach:

This proposed project involves road and infrastructure elevations and a levee segment at the perimeter of the marine basin of the Sikorski Airport property owned by the City of Bridgeport. Both levee segments are needed to protect the airport, commercial businesses along Access Road and the South End residential neighborhoods north of Access Road. **Appendix II** presents Project B details, including site photos, conceptual site plans, concept renderings and Opinion of Probable Costs. This proposed project was included in an USDOT PROTECT Planning Grant Application August 18, 2023, submitted by the Town of Stratford.

Project C Access Road Levee Segment/Reach:

The proposed project includes a levee consisting of earthen berm, road and infrastructure elevations and green infrastructure in the area connecting to Lordship Boulevard. This levee reach would protect commercial businesses along the north side of Access Road and the South End residential neighborhoods north of Access Road, which includes areas mapped and identified by FEMA and CIRCA as socially vulnerable and eligible for federal funding benefits to advance environmental justice under the Justice40 Initiative per Executive Order 14008. **Appendix III** presents Project C details, including site photos, conceptual site plans, concept renderings and Opinion of Probable Costs. This proposed project was included in an USDOT PROTECT Planning Grant Application August 18, 2023, submitted by the Town of Stratford.

Project D Orange Street Stormwater Flooding Area:

This proposed project includes development of a surface water feature, open space, and adjacent land development. The proposed project is located within an existing low elevation floodplain, identified based on historic aerial photographs and FEMA flood mapping, and would be integrated into South End neighborhood stormwater management and infrastructure. The proposed project would require modifications to existing Orange Street and voluntary, pre-disaster buyouts from interested single family property owners in the vicinity of Orange Street to enable daylighting the former stream and the creation of natural and nature-based features for stormwater management. Site-scale stormwater flooding accommodation strategies for the Orange Street residential neighborhood were evaluated and included green infrastructure and nature-based strategies to improve open space for increased permeable surface area, mitigation of stormwater runoff and tidal flooding impacts, improved stormwater storage and flood management; and combinations of these strategies were evaluated to create flood resilience for the continued long-term viability of the South End Area.

Project D was also evaluated by Weston & Sampson (W&S), who were completing a Hydrologic & Hydraulic (H&H) Study of the South End neighborhoods, which was funded by the Town of Stratford. The H&H Study , which was draft at the time of this report, confirmed that the stormwater drainage system within the low elevation floodplain areas of Orange Street is unable to convey stormwater from the area during high tide conditions. Draft results include a summary and schematics of flooding from for various storm event scenarios. All pipe sizes and inverts indicated in the study are based on either 40–50-year-old as-built drawings available from the Town records or based on estimates by W&S. Field verifications of pipe sizes and inverts were not conducted by W&S in the Access Road and Orange Street areas. Portions of Access Road were not included as part of the H&H study area limits. The PCSWMM model does not directly report stormwater system capacities. Maximum (Max Flow) data is reported below:

Max Flow within pipes during a 10yr flood event (10% annual chance storm) over 24hr period:

- Frash Pond Culvert under Access Road: 172 cf
- Southern End of Orange Street: 68 cfs
- Hathaway Culvert: 158 cfs
- Dodge Avenue Area under Access Road: 19 cfs
- Proposed Orange Street Open Channel Southern End of Orange Street: 89 cfs

Appendix IV presents details for proposed Project D, including proposed pre-disaster voluntary buyouts, green infrastructure, and flood resilient zoning concept project with accompanying site photos, rendering drawings and conceptual site plans, cost estimates, abutting property owners. Note this conceptual project does not include an opinion of probable cost.

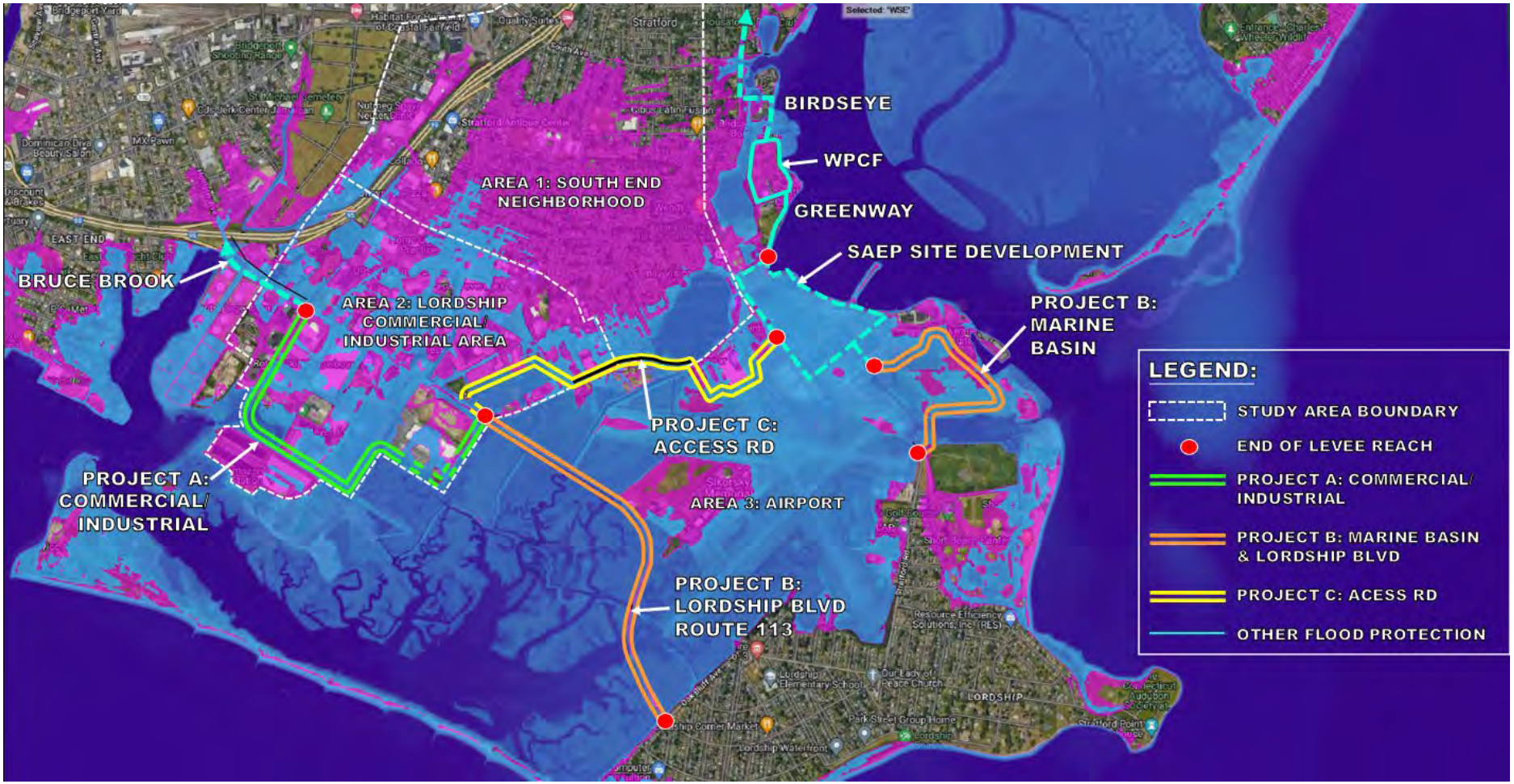


Figure 3: 2D Hydrodynamic Overland Flood Model – Comparison of inundation limits during Sandy 2012 (blue shading) and a 100-yr flood condition (blue + pink shading) with flood protection segments overlaid.

SECTION 4 – ESTIMATE OF FLOOD MITIGATION PROJECT COSTS AND BENEFITS

An initial calculation of costs and benefits for preferred project concepts and strategies for several of the levee segments was completed by GZA. For levee project components, the methodology applied for benefit/cost analysis (BCA) is aligned with potential federal grant funding sources. GZA prepared an "Engineer's Opinion of Probable Cost" for proposed project concepts in support of BCAs that are required by FEMA or other federal agencies to pursue grant funding, including probable costs for final design and bidding (along with additional studies anticipated to support further design, such as environmental assessment and geotechnical investigations), construction staging and preparation, site preparation, demolition of existing structure, traffic control, water control, earthwork, materials, labor, paving restoration, landscaping necessary for restoration, stormwater system repairs or replacement, and other project-specific considerations.

The Construction Base Costs for Projects A, B, and C are based on the corresponding conceptual flood protection designs presented in this report; and cost data was sourced from RSMeans2023, CTDOT, and GZA's experience with similar types of construction. In addition to the flood protection segments developed for this report (Projects A, B, and C), the costs associated with five additional levee system segments are included in the Engineer Opinions of Probable Costs to account for the coastal flood protection system components that, once completed, will correspond to the calculated benefit. The five additional levee system segments are the Stratford Army Engine Plant (SAEP), Greenway, Water Pollution Control Facility (WPCF), Birdseye, and Bruce Brook. The Construction Base Cost for the five additional segments are based on updating the corresponding cost estimates for inflation from the values described in the "Town of Stratford Coastal Community Resilience Plan," prepared by GZA, and dated December 2016.

Additional cost factors include Contractor's overhead, profit, insurance, and bond; additional engineering and site investigations; construction administration; cost escalation; and contingency budgets were applied to the Construction Base Costs to calculate the total estimated opinion of probable costs for the individual Projects A, B, and C, and the total levee system alternatives considered for the BCA. Note that constructing both Projects A and B has the additional benefit of protecting the Sikorski Airport but may not be needed to protect the commercial, industrial, and residential areas north of Access Road. Engineer Opinions of Probable Cost summary tables for Projects A, B, and C are presented in **Appendices I, II, and III**, respectively. Engineer Opinions of Probable Cost corresponding to the Primary Levee System Alternatives considered for the BCA are presented in **Appendix V**.

Benefits were developed and expressed as costs for avoided losses. GZA used the 2019 state-wide parcel data organized by Regional Councils of Governments (COG). The Town of Stratford parcel information was part of the Metropolitan COG. The GIS data was downloaded via the state website. The parcel data layer included key information on each parcel such as street address, building area, lot size, assessed value, etc. Note that per Town's assessment website, the assessed value is taken as 70% of the appraisal. Environmental Justice (EJ) parcels were identified based on the Connecticut Environmental Justice Blocks (2022) downloaded from a web-based viewer authored by DEEP. Approximately 695 parcels were identified as EJ parcels. Refer to **Figure 4** for the locations of the EJ parcels.

GZA's analysis of benefits was performed based on representative building and content replacement values ($ per square foot) for building structures. It is a simplified approach to obtain an approximate estimate of benefits for a project. Although FEMA's BCA Toolkit was not used at this stage of the project planning, the methodology used by GZA is consistent with the algorithms used in the FEMA BCA Toolkit.

Four stillwater flood elevations were considered in the analysis, with recurrence intervals at 10-, 50-, 100- and 500-years, which represent an annual probability of 10%, 2%, 1% and 0.2%, respectively. Water level information was based on the FEMA FIS data (coastal transect #48). Representative Depth-Damage Functions (DDFs) for residential, commercial, and industrial properties were used to determine approximate percentage of damages under each flood scenario. Average Annual Loss (AAL) for each parcel was also calculated.

A typical CPI value of 1.223 was applied to adjust dollar values from 2019 to 2023. All calculations were based on net present values in 2023. Two different discount rates were used, 7% and 3%, consistent with FEMA's methodology.

GZA analyzed three sea level conditions: present day conditions and two future sea level scenarios, 1.7 feet and 3.3 feet, consistent with the Connecticut Sea Level Rise (SLR) guidance, corresponding to the planning and alert levels, respectively. The estimated Benefit Cost Ratios (BCRs) increase with SLR values used, as percent of damages increases with stillwater flood depths. Note that the cost of designing and constructing the proposed flood protection system was assumed to remain the same for the 3 different sea level scenarios. **Table 1** presents the BCR results, for three different project alternatives (consisting of various combinations of individual structures/flood mitigation measures). Engineer's Opinion of Probable Costs corresponding to the entire Primary Coastal Levee System is presented in **Appendix V.** The Engineer's Opinion of Probable Costs, the BCA and the BCR values are subject to the Limitations presented in **Appendix VI.**

Table 1: Summary of Preliminary Loss and BCR Estimates (Project Life 75 Years)

Area ID	Neighborhood	No. of Parcels Analyzed	No. of EJ Parcels	Assessed Bldg Value ($ M)	Appraised Bldg Value ($ M)	EJ (%) of Assessed/ Appraised	Replacement Bldg+Cont Value ($ M)	EJ (%) of Replacement Value	EJ (%) of 1% Flood Damage	Approximate AAL ($ M) No SLR (Present)	1.7-ft SLR (Planning)	3.3-ft SLR (Alert)
1	South End	2133	522	$ 242	$ 346	32%	$ 1,838	22%	41%	$ 14.4	$ 19.9	$ 28.1
2	Lordship	233	115	$ 146	$ 209	32%	$ 1,399	33%	55%	$ 1.9	$ 7.5	$ 17.3
3	Airport	255	0	$ 47	$ 67	0%	$ 282	0%	0%	$ 1.1	$ 2.5	$ 4.7
	Sum (2019 PV)	2621	637	$ 435	$ 622	--	$ 3,519	--	--	$ 17.4	$ 29.9	$ 50.1
	Sum (2023 PV)	2621	637	$ 532	$ 761	--	$ 4,303	--	--	$ 21.3	$ 36.6	$ 61.3
									7% BCR	***1.3***	***2.2***	***3.7***
Alternative A [Access Rd. w/o Lordship and Marine Basin; Airport unprotected]: Construction Cost = $215 M									***3% BCR***	***2.8***	***4.7***	***7.7***
									7% BCR	***1.8***	***3.0***	***5.1***
Alternative B [Lordship and Marine Basin w/o Access Rd.; Airport protected]: Construction Cost = $171 M									***3% BCR***	***3.7***	***6.4***	***10.7***
									7% BCR	***1.0***	***1.8***	***2.9***
Alternative C [All segments combined]: Construction Cost = $297 M									***3% BCR***	***2.1***	***3.7***	***6.2***

Figure 4: Environmental Justice Parcel Locations

SECTION 5 - RECOMMENDATIONS

The proposed projects represent segments of the Town-wide perimeter flood protection system and based on coastal flood modeling, specific project segments (described herein) need to be constructed to provide flood protection to the South End neighborhood and Lordship Boulevard Commercial/Industrial Area of Stratford. The BCRs presented in Section 4 indicate the relative benefits within the protected areas.

We recommend that the Town of Stratford appropriate funding or pursue grant funding from the DEEP Climate Resilience Fund Track 2 Project Development program to further analyze the flood protection provided by each of the individual projects (i.e., levee system segments) using the "Town of Stratford 2D Hydrodynamic Overland Coastal Flood Model" recently completed for the Town by GZA. This modeling may be used to simulate the flood protection of each project individually and collectively. If any discrete segments are determined to perform well independently, grant funding should be pursued for those segments as individual projects. A summary of state and federal funding sources for advancing Projects A, B and C are provided in **Table 2.**

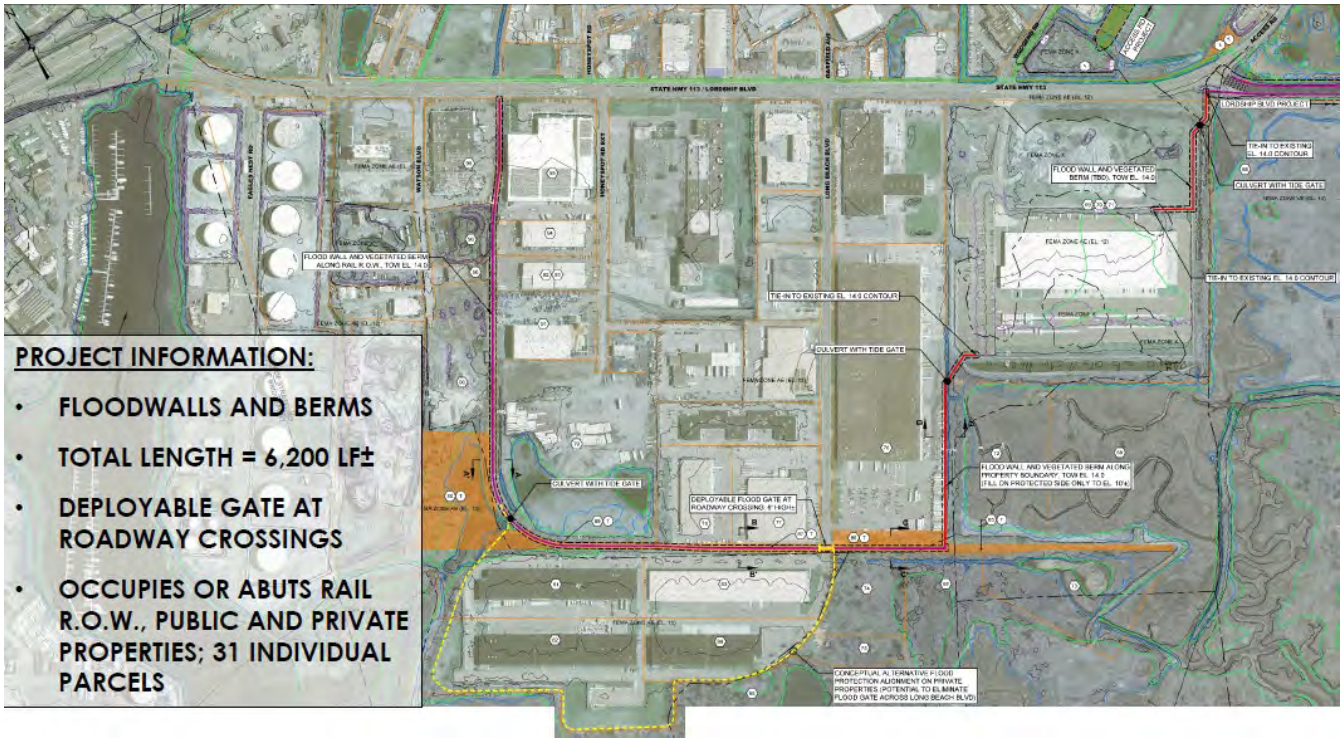
The interdependence of the levee segments for coastal flood protection may be a disadvantage for the Town when pursuing federal funding because FEMA's and USDOT's competitive coastal resiliency grants (FEMA FMA, FEMA BRIC, USDOT PROTECT) require a Benefit Cost Ratio greater than 1.0 for individual projects. Federal funding of the entire project based on the opinion of probable costs for the entire coastal levee system would need to be approved by an appropriation by Congress. Congress approved funding for Connecticut Coastal Storm Risk Management (CSRM) feasibility study which includes the Town of Stratford. In 2022, USACE was funded by Congress to design a system of flood walls, flood gates and pump stations to be constructed by U.S. Army Corps of Engineers along Interstate 95 in the Long Wharf area of New Haven, with an estimated budget of over $160 million. This funding appropriation resulted from extensive planning by the City of New Haven and by U.S. Army Corps of Engineers in response to Superstorm Sandy, including the Coastal Storm Risk Management Feasibility Study that builds on the City of New Haven's Long Wharf Responsible Growth Plan funded by the City and adopted in 2018, as well as GZA's Flood Protection Study undertaken in 2016 and funded by U.S. HUD Community Development Block Grant/Disaster Recovery funding. The Town of Stratford should leverage the extensive climate resiliency planning completed by the Town in 2016 and with CIRCA through 2023 to pursue the once in a generation level of federal climate resilience funding available through the Bipartisan Infrastructure Law.

Table 2: Summary of State and Federal Funding Programs for Resilient Stratford South End Projects

Resilient Stratford Project	Eligible State and Federal Funding Sources
Project A Commercial Industrial Area Levee Segment/Reach (See Appendix I)	DEEP Climate Resilience Fund for assessing the performance of the individual segments with a 2D Hydrodynamic Overland Flood Model and FEMA Building Resilient Infrastructure and Communities (BRIC) 25% non-federal match if BCA for Individual Segment is greater than 1.0.
Project B Lordship Boulevard (State Route 113) Levee Segment/Reach (See Appendix II), **Project C** Access Road Levee Segment/Reach (See Appendix III)	DEEP Climate Resilience Fund for assessing the performance of the individual segments with a 2D Hydrodynamic Overland Flood Model and Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Planning Grant (USDOT) for Access Road and Route 113 Feasibility Study (0% non-federal match) Design and Construction (10- 20% non-federal match depending on projects listing in CTDOT Resilience Improvement Plan) DEEP Climate Resilience Fund (Design) and National Coastal Resilience Fund (Design and Construction) for Marine Basin Natural and Nature Based Features (NCRF form NOAA and NFWF).
Complete Coastal Flood Levee System (See Section 4 and Appendix V)	DEEP Climate Resilience Fund for assessing the performance of the individual segments and the complete flood levee system with a 2D Hydrodynamic Overland Flood Model to determine if system fails if any one segment is not completed. U.S. Army Corps of Engineers' (USACE) Connecticut Coastal Storm Risk Management (CSRM) feasibility study and civil works program, Water Resources Development Act (WRDA), Feasibility Study 50% non-federal match. Construction 0-35% non-federal match depending on project's criteria.

Appendix I – Project A. Commercial Industrial Area Levee Segment

PROJECT A. COMMERCIAL INDUSTRIAL AREA LEVEE SEGMENT OVERVIEW



Lordship Commercial/ Industrial

Potential Multifunctional Landscape

A Temporary floodwall location at road crossing.
B Steel sheet pile wall
C Native, low-maintenance plantings
D 10' width multi-use path
E Connection to existing pedestrian network

Flood Protection & Greenway
Long Beach Boulevard
Protected Side

Lordship Commercial/ Industrial

Potential Multifunctional Landscape

A Temporary floodwall location at road crossing.
B Steel sheet pile wall
C Native, low-maintenance plantings

Flood Protection & Greenway
Long Beach Boulevard
Flood Side

Lordship Commercial/ Industrial

Potential Multifunctional Landscape

A Temporary floodwall at road crossing.
B Steel sheet pile wall
C Native, low-maintenance plantings

Flood Protection & Greenway
Long Beach Boulevard
Flood Side with High Water


Stewart B.
McKinney
NATIONAL WILDLIFE REFUGE


NATIONAL
WILDLIFE
REFUGE
BOUNDARY

TABLE 4.1

OPINION OF PROBABLE COST

GZA GeoEnvironmental, Inc.

Project No.: 18.0175731.00

Sheet No.: 1 OF 1

Estimate By: AJK (11/20/2023)

Checked By: RBC (11/29/2023)

Project Segment: Project A - Lordship Commercial Industrial Area

Project: Resilient Stratford South End

Client: CIRCA and Town of Stratford, Connecticut

Location: Stratford, Connecticut

Project A - Construction Cost Estimate

Item	Description	Quantity	Unit	Unit Estimate	Extension	Comment
1	Mobilization/Demobilization	1	LS	$ 130,000	$ 130,000	
2	Site Preparation, Access, Temp Controls & Temp. Facilities	1	LS	$ 250,000	$ 250,000	Assumes existing City property available for laydown area(s)
3	Site Sedimentation and Erosion Control	1	LS	$ 50,000	$ 50,000	
4	Sheet Pile Floodwall / Seepage Cut-Off Wall	6,190	LF	$ 2,000	$ 12,380,000	
5	Embankment (Fill)	20,300	CY	$ 55	$ 1,116,500	Includes borrow, placement, compaction and grading
6	Flood Barrier Gates (at grade crossings)	1	EA	$ 200,000	$ 200,000	
7	Roadway Restoration / Improvements (incl. Storwater Drain)	80	LF	$ 1,000	$ 80,000	Includes pavement restoration and raising structures in vicinity of crossing
8	Tide Gates and Culverts	3	EA	$ 150,000	$ 450,000	
9	Greenway and Recreational Access Improvements	1	Est.	$ 1,000,000	$ 1,000,000	Allowance assuming approximately 245,000 SF of improvements
10	Wetlands & Habitat Restoration / Replication / Mitigation	1	Est.	$ 150,000	$ 150,000	Allowance assuming 24,500 SF of wetland soil restoration, no off-site soil disposal
				Construction Base Estimate:	**$ 15,806,500**	

Project A - Total Estimate

Line	Description	Subtotal Amount
1	Construction Cost Estimate	$ 15,806,500
2	Contractor's Office Overhead (7.7% Line 1)	$ 1,217,101
3	Contractor's Insurance, Payment, & Performance Bonds (3.3% Line 1)	$ 521,615
4	Contractor's Profit (3.0% Line 1)	$ 474,195
5	Engineering, Permitting, and Design Development (13% Line 1)	$ 2,054,845
6	Owner's Construction Administration (6% Line 1)	$ 948,390
7	Cost Escalation (60 Mos. @ 0.237% =**14.2%** Sum Lines 1-6)	$ 2,985,216
8	Contingency Budget (25% Sum Lines 1-7)	$ 6,001,965
	Total Estimated Project Segment A Cost (Sum Lines 1-8):	**$ 30,009,826**

General Opinion of Probable Cost Assumptions:

- Prevailing union wage rates used for construction labor.
- Contracts are competitively bid.
- Estimated costs for traffic control or temporary route bypass are excluded.
- Environmental regulatory requirements, including protected habitat requirements, can be accommodated and managed within the proposed project footprints.
- Water-based construction methods are not required.
- Materials are readily available and sourced.
- Property ownership/easements/right-of-access necessary to enable the work are secured.
- Construction will not be substantially delayed due to factors beyond the Contractor's control.
- Projects are net fill with minimal permanent cut or requirement for replacement volume.
- Potential generation of existing soil unsuitable for reuse and off-site disposal of excess or unsuitable existing soil will be minimal.
- Potential costs associated with environmental remediation are excluded.
- Sufficient Staging and laydown areas will be provided by the Town.
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- Conceptual designs and associated costs are subject to change based on results of recommended higher resolution flood modeling analysis.
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Δ 2-yr:	708.00
%Δ 2-yr:	5.68%
Monthly Escalation Rate:	0.237%
Calculated 5-yr (60 Mos.) Escalation Rate:	14.2%

LEGEND:

- EXISTING MAJOR CONTOUR 5' INTERVAL
- EXISTING MINOR CONTOUR 1' INTERVAL
- EXISTING MEAN HIGH WATER (MHW) EL. 3.2'
- EXISTING EL. 14.0' CONTOUR
- FEMA NATIONAL FLOOD HAZARD BOUNDARY
- EXISTING PARCEL BOUNDARY LINES
- NATIONAL WETLANDS INVENTORY LINES
- PROPERTY REFERENCE ID (SEE PROPERTY INFORMATION TABLE)
- INDICATES TOWN-OWNED PROPERTY
- PROPOSED PROJECT AREA
- PROPOSED FLOOD BARRIER ON TOWN-OWNED PROPERTY
- PROPOSED FLOOD BARRIER ON PRIVATE PROPERTY
- PROPOSED ALTERNATIVE FLOOD PROTECTION ALIGNMENT
- PROPOSED RETAINING WALL
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- PROPOSED SLOPED EMBANKMENT / FILL
- PROPOSED ROADWAY GRADE TRANSITION

GENERAL NOTES:

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REPORT FIGURE
NOVEMBER 30, 2023
NOT FOR CONSTRUCTION

0 100 200 400
SCALE IN FEET 1" = 200'

NO.	ISSUE/DESCRIPTION	BY	DATE

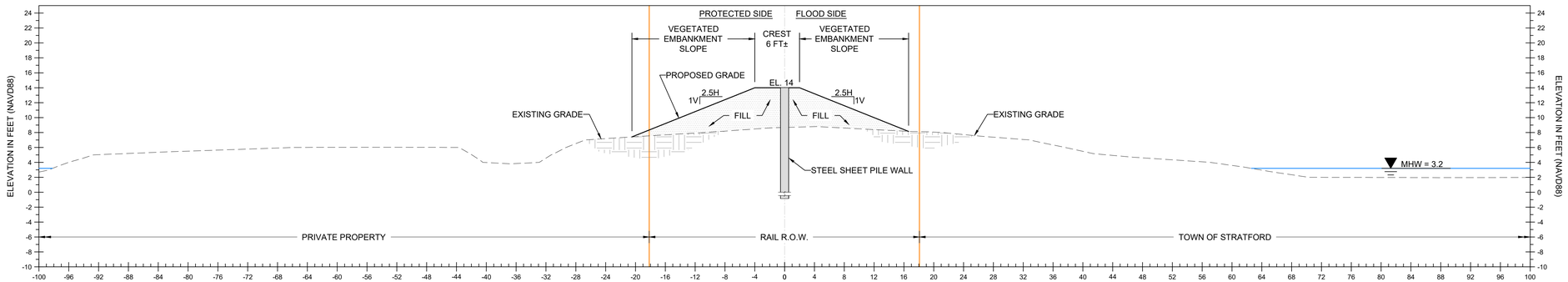
CIRCA RESILIENT CONNECTICUT PHASE III
RESILIENT STRATFORD SOUTH END
CONCEPTUAL FLOOD MITIGATION DESIGN

LORDSHIP COMMERCIAL INDUSTRIAL AREA CONCEPT SITE PLAN

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

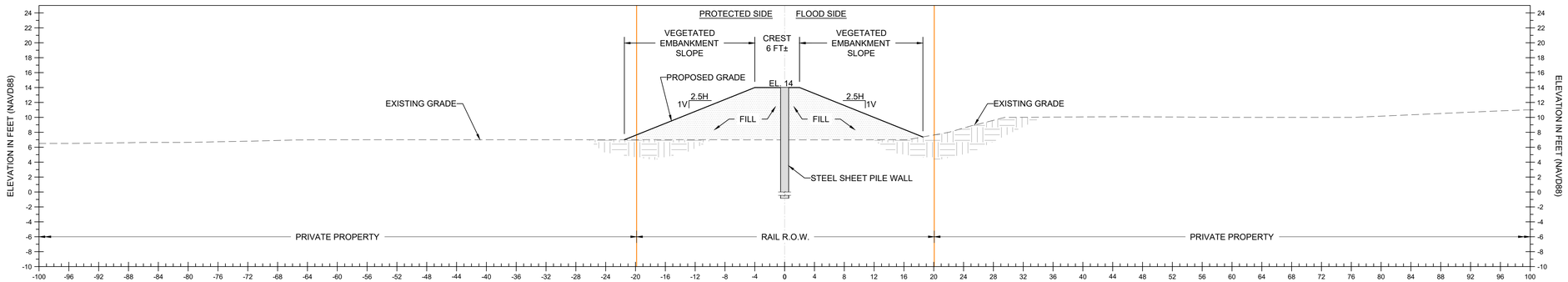
PREPARED FOR:
CONNECTICUT INSTITUTE FOR RESILIENCE AND CLIMATE ADAPTATION (CIRCA) - UCONN - AVERY POINT CAMPUS
1080 SHENNECOSSETT ROAD
GROTON, CONNECTICUT 06340

PROJ MGR: AJK	REVIEWED BY: WWC	CHECKED BY: -	DRAWING
DESIGNED BY: AJK	DRAWN BY: DCS	SCALE: AS SHOWN	1
DATE: NOVEMBER 2023	PROJECT NO. 18.0175731.00	REVISION NO. -	SHEET NO.



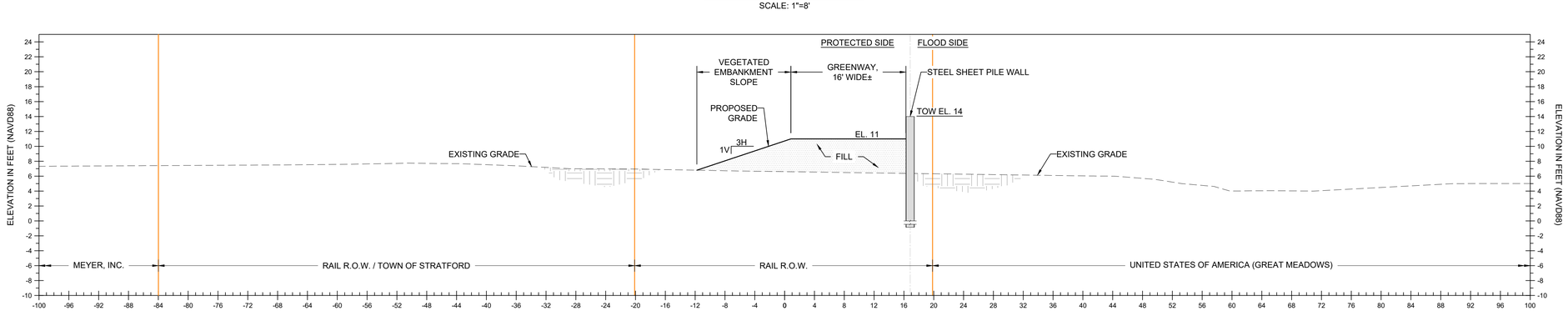
CONCEPTUAL SECTION A-A'

SCALE: 1"=8'



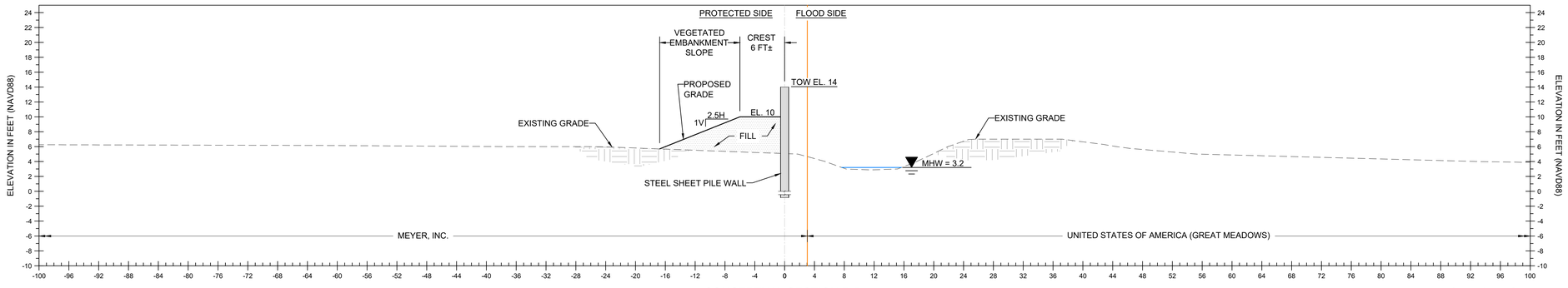
CONCEPTUAL SECTION B-B'

SCALE: 1"=8'



CONCEPTUAL SECTION C-C'

SCALE: 1"=8'



CONCEPTUAL SECTION D-D'

SCALE: 1"=8'

0 4 8 16

SCALE IN FEET 1" = 8'

REPORT FIGURE
NOVEMBER 30, 2023
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NO.	ISSUE/DESCRIPTION	BY	DATE

CIRCA RESILIENT CONNECTICUT PHASE III
RESILIENT STRATFORD SOUTH END
CONCEPTUAL FLOOD MITIGATION DESIGN

LORDSHIP COMMERCIAL INDUSTRIAL AREA CONCEPT CROSS-SECTIONS

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PROJ MGR: AJK	REVIEWED BY: WWC	CHECKED BY: DCS	DRAWING		
DESIGNED BY: AJK	DRAWN BY: AJK	SCALE: AS SHOWN	2		
DATE: NOVEMBER 2023	PROJECT NO. 18.0175731.00	REVISION NO. -	SHEET NO.		

SOUTH END PROPERTY LIST - LORDSHIP COMMERCIAL INDUSTRIAL

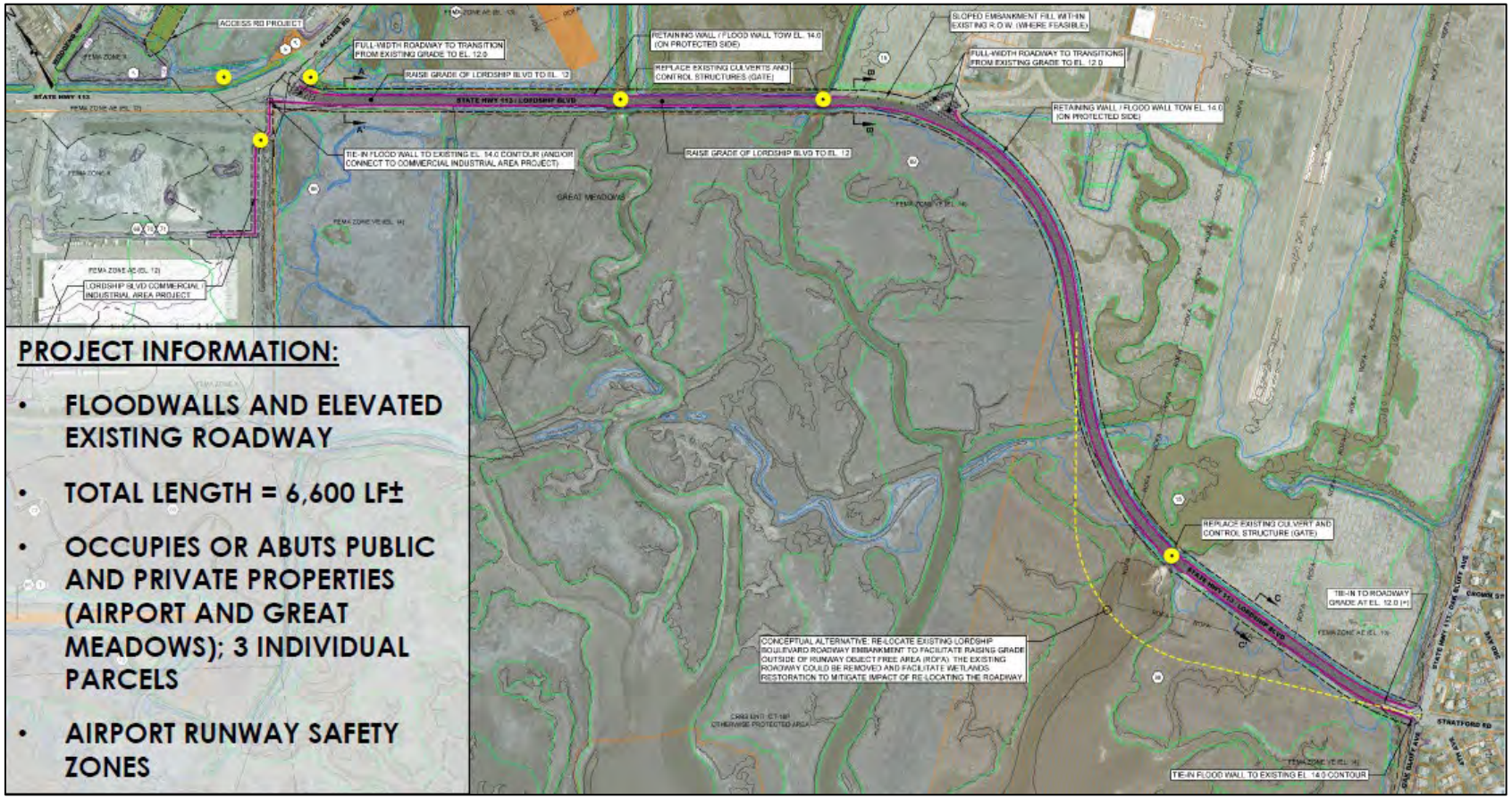
REFERENCE NUMBER	OWNERSHIP CATEGORY	SITE ADDRESS	AREA (AC.)	PARCEL NUMBER MBLU	PID	NOTES
15	CITY OF BRIDGEPORT	1600 LORDSHIP BLVD	445.94	4003010001	10390	2
68	FEDERAL	LORDSHIP BLVD	374.06	3004020001	20072	
69	CORPORATION	825 LORDSHIP BLVD	28.22	3004020002	10357	2
70	CORPORATION	775 LORDSHIP BLVD	28.22	3004020002	103542	2
71	CORPORATION	975 LORDSHIP BLVD	28.22	3004020002	103543	2
72	FEDERAL	LORDSHIP BLVD	9.36	2004030002	102553	
73	FEDERAL	LORDSHIP BLVD	7.37	2004010008	100480	
74	FEDERAL	LORDSHIP BLVD	3.83	2004010006	100482	
75	FEDERAL	LORDSHIP BLVD	1.90	2004010007	20075	
76	CORPORATION	255 LONG BEACH BLVD	18.54	2004030001	10226	
77	CORPORATION	400 LONG BEACH BLVD	4.88	2004020001	10227	
78	CORPORATION	350 LONG BEACH BLVD	4.25	2004020002	10228	
79	CORPORATION	HONEYSPOT RD-EXT	15.99	2004010001	8259	
80	TOWN OF STRATFORD	LORDSHIP BLVD	5.26	2004010002	102431	3
81	CORPORATION	550 LONG BEACH BLVD	8.76	2004010003	10366	
82	CORPORATION	650 LONG BEACH BLVD	12.33	2004010009	102091	
83	CORPORATION	500 LONG BEACH BLVD	7.21	2004010004	10365	
84	CORPORATION	600 LONG BEACH BLVD	5.41	2004010005	10364	
85	TOWN OF STRATFORD	LORDSHIP BLVD	1.43	2004030004	102552	3
86	TOWN OF STRATFORD	LONG BEACH BLVD	0.66	2004030003	102011	3
87	TOWN OF STRATFORD	LORDSHIP BLVD	0.76	2004010010	102551	3
89	TOWN OF STRATFORD	NONE	0.41	2004020011	NONE	
90	CORPORATION	200 WATSON BLVD	5.35	2005060009	18806	
91	CORPORATION	1410 HONEYSPOT RD-EXT	3.97	2005060001	8264	
92	CORPORATION	1370 HONEYSPOT RD-EXT	2.01	2005060002	8262	2
93	CORPORATION	1400 HONEYSPOT RD-EXT	2.01	2005060002	8263	2
94	CORPORATION	1330 HONEYSPOT RD-EXT	2.01	2005060003	8261	
95	CORPORATION	333 LORDSHIP BLVD	6.71	2005060004	10369	
96	CORPORATION	180 WATSON BLVD	0.68	2005060008	18811	
97	CORPORATION	140 WATSON BLVD	1.31	2005060006	18808	
98	CORPORATION	60 WATSON BLVD	4.39	2005060005	18807	

Notes:

1. Indicated property data was obtained from the Town of Stratford GIS accessed online between 9/1 and 9/28/2023 (https://metrocog.mapxpress.net/Stratford/).
2. Multiple property owners and/or field cards associated with parcel per Stratford GIS.
3. Indicates a Town-owned parcel.

Appendix II – Project B. Lordship Boulevard/Route 113 & Marine Basin Levee Segment

PROJECT B. LORDSHIP BOULEVARD/ROUTE 113 & MARINE BASIN SEGMENT OVERVIEW



PROJECT B. LORDSHIP BOULEVARD/ROUTE 113 & MARINE BASIN SEGMENT OVERVIEW

Lordship Boulevard

Elevated Roadway and Flood Barrier

Elevated Road and Flood Protection
Lordship Boulevard, west of airport

TABLE 4.2

OPINION OF PROBABLE COST

GZA GeoEnvironmental, Inc.

Project No.: 18.0175731.00

Sheet No.: 1 OF 1

Estimate By: AJK (11/20/2023)

Checked By: RBC (11/29/2023)

Project Segment: Project B - Lordship Boulevard (State Hwy 113) & Marine Basin

Project: Resilient Stratford South End

Client: CIRCA and Town of Stratford, Connecticut

Location: Stratford, Connecticut

Project B - Construction Cost Estimate

Item	Description	Quantity	Unit	Unit Estimate	Extension	Comment
1	Mobilization/Demobilization	1	LS	$ 350,000	$ 350,000	
2	Site Preparation, Access, Temp. Controls & Temp. Facilities	1	LS	$ 350,000	$ 350,000	Assumes existing City property available for laydown area(s)
3	Site Sedimentation and Erosion Control	1	LS	$ 100,000	$ 100,000	
4	Pile-Supported Reinforced Concrete Floodwall	325	LF	$ 4,500	$ 1,462,500	
5	Sheet Pile Floodwall / Retaining Wall / Seepage Cut-Off Wall	13,080	LF	$ 2,000	$ 26,160,000	
6	Elevated Boardwalk	325	LF	$ 2,500	$ 812,500	
7	Embankment (Fill)	56,100	CY	$ 55	$ 3,085,500	Includes borrow, placement, compaction and grading
8	Roadway Restoration / Improvements	6,600	LF	$ 1,000	$ 6,600,000	Includes pavement restoration and raising structures
9	Tide Gates and Culverts	4	EA	$ 500,000	$ 2,000,000	
10	Sluice Gates	2	EA	$ 75,000	$ 150,000	
11	Greenway and Recreational Access Improvements	1	Est.	$ 1,400,000	$ 1,400,000	Allowance assuming 345,000 SF of improved area
12	Wetlands & Habitat Restoration / Replication / Mitigation	1	Est.	$ 600,000	$ 600,000	Allowance assuming 94,000 SF of wetland improvements
				Construction Base Estimate:	**$ 43,070,500**	

Project B - Total Estimate

Line	Description	Subtotal Amount
1	Construction Base Estimate	$ 43,070,500
2	Contractor's Office Overhead (7.7% Line 1)	$ 3,316,429
3	Contractor's Insurance, Payment, & Performance Bonds (3.3% Line 1)	$ 1,421,327
4	Contractor's Profit (3.0% Line 1)	$ 1,292,115
5	Engineering, Permitting, and Design Development (13% Line 1)	$ 5,599,165
6	Owner's Construction Administration (6% Line 1)	$ 2,584,230
7	Cost Escalation (60 Mos. @ 0.237% =**14.2%** Sum Lines 1-6)	$ 8,134,295
8	Contingency Budget (25% Sum Lines 1-7)	$ 16,354,515
	Total Estimated Project B Cost (Sum Lines 1-8):	**$ 81,772,575**

General Opinion of Probable Cost Assumptions:

- Prevailing union wage rates used for construction labor.
- Contracts are competitively bid.
- Estimated costs for traffic control or temporary route bypass are excluded.
- Environmental regulatory requirements, including protected habitat requirements, can be accommodated and managed within the proposed project footprints.
- Water-based construction methods are not required.
- Materials are readily available and sourced.
- Property ownership/easements/right-of-access necessary to enable the work are secured.
- Construction will not be substantially delayed due to factors beyond the Contractor's control.
- Projects are net fill with minimal permanent cut or requirement for replacement volume.
- Potential generation of existing soil unsuitable for reuse and off-site disposal of excess or unsuitable existing soil will be minimal.
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ACCESS RD PROJECT
ACCESS RD
WOODEND RD
FEMA ZONE X
STATE HWY 113
FEMA ZONE AE (EL. 12)
FEMA ZONE AE (EL. 13)
FULL-WIDTH ROADWAY TO TRANSITION FROM EXISTING GRADE TO EL. 12.0
RAISE GRADE OF LORDSHIP BLVD TO EL. 12
RETAINING WALL / FLOOD WALL TOW EL. 14.0 (ON PROTECTED SIDE)
REPLACE EXISTING CULVERTS AND CONTROL STRUCTURES (GATE)
STATE HWY 113 / LORDSHIP BLVD
SLOPED EMBANKMENT FILL WITHIN EXISTING R.O.W. (WHERE FEASIBLE)
FULL-WIDTH ROADWAY TO TRANSITIONS FROM EXISTING GRADE TO EL. 12.0
RETAINING WALL / FLOOD WALL TOW EL. 14.0 (ON PROTECTED SIDE)
TIE-IN FLOOD WALL TO EXISTING EL. 14.0 CONTOUR (AND/OR CONNECT TO COMMERCIAL INDUSTRIAL AREA PROJECT)
RAISE GRADE OF LORDSHIP BLVD TO EL. 12
GREAT MEADOWS
FEMA ZONE VE (EL. 14)
FEMA ZONE AE (EL. 12)
LORDSHIP BLVD COMMERCIAL / INDUSTRIAL AREA PROJECT
FEMA ZONE X
FEMA ZONE VE (EL. 15)
ROFA
REPLACE EXISTING CULVERT AND CONTROL STRUCTURE (GATE)
TIE-IN TO ROADWAY GRADE AT EL. 12.0 (+)
CROWN ST
STATE HWY 113 / OAK BLUFF AVE
3RD AVE
CONCEPTUAL ALTERNATIVE: RE-LOCATE EXISTING LORDSHIP BOULEVARD ROADWAY EMBANKMENT TO FACILITATE RAISING GRADE OUTSIDE OF RUNWAY OBJECT FREE AREA (ROFA). THE EXISTING ROADWAY COULD BE REMOVED AND FACILITATE WETLANDS RESTORATION TO MITIGATE IMPACT OF RE-LOCATING THE ROADWAY.
CRBS UNIT: CT-18P OTHERWISE PROTECTED AREA
STRATFORD RD
4TH AVE
OAK BLUFF AVE
TIE-IN FLOOD WALL TO EXISTING EL. 14.0 CONTOUR
A
A'
B
B'
C
C'

LEGEND:

EXISTING MAJOR CONTOUR 5' INTERVAL	PROPOSED PROJECT AREA
EXISTING MINOR CONTOUR 1' INTERVAL	PROPOSED FLOOD WALL
EXISTING MEAN HIGH WATER (MHW) EL. 3.2'	PROPOSED ALTERNATIVE FLOOD PROTECTION ALIGNMENT
EXISTING EL. 14.0' CONTOUR	PROPOSED RETAINING WALL
FEMA NATIONAL FLOOD HAZARD BOUNDARY	PROPOSED ELEVATED ROADWAY
EXISTING PARCEL BOUNDARY LINES	PROPOSED EARTHEN BERM CREST
NATIONAL WETLANDS INVENTORY LINES	PROPOSED SLOPED EMBANKMENT / FILL
PROPERTY REFERENCE ID (SEE PROPERTY INFORMATION TABLE)	PROPOSED ROADWAY GRADE TRANSITION
INDICATES TOWN-OWNED PROPERTY	RUNWAY OBJECT FREE AREA (ROFA)

INDICATES PARCEL OWNED BY CITY OF BRIDGEPORT

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NOVEMBER 30, 2023
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RESILIENT STRATFORD SOUTH END
CONCEPTUAL FLOOD MITIGATION DESIGN

LORDSHIP BOULEVARD AREA CONCEPT SITE PLAN

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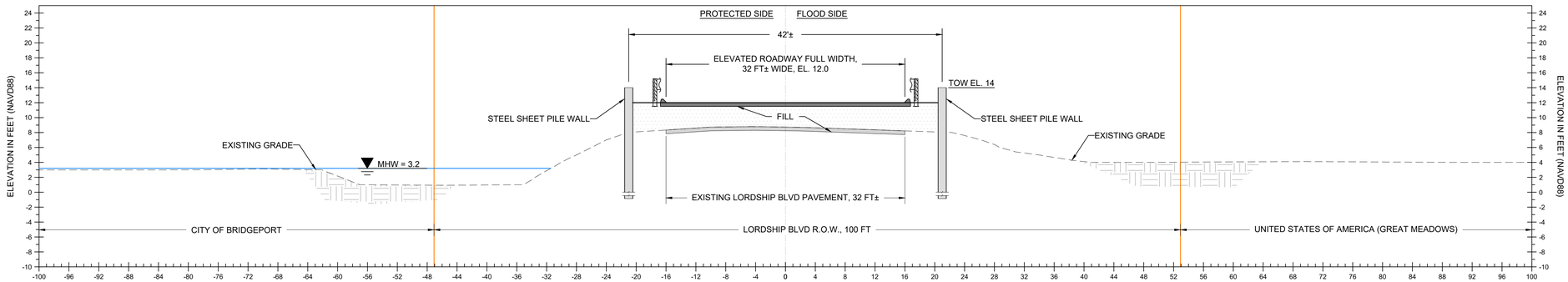
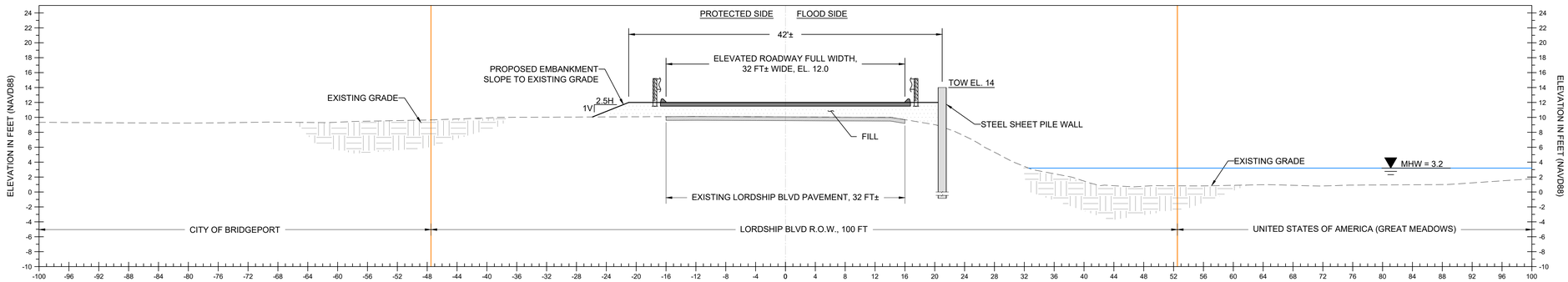
PROJ MGR: AJK	REVIEWED BY: WWC	CHECKED BY: DCS	DRAWING
DESIGNED BY: AJK	DRAWN BY: AJK	SCALE: AS SHOWN	1
DATE: NOVEMBER 2023	PROJECT NO. 18.0175731.00	REVISION NO. -	SHEET NO.



CONCEPTUAL SECTION A-A'

SCALE: 1"=8'



CONCEPTUAL SECTION B-B'

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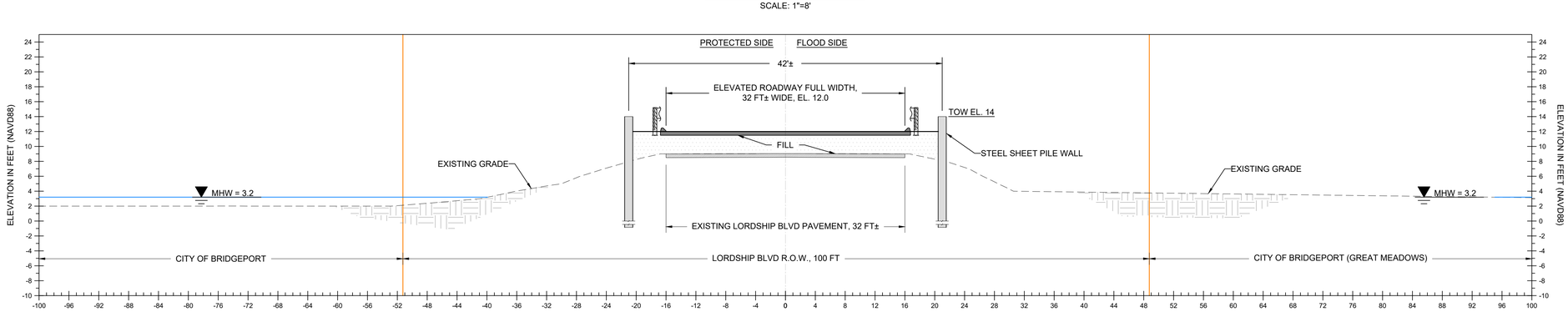

CONCEPTUAL SECTION C-C'

SCALE: 1"=8'

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DESIGNED BY: AJK	DRAWN BY: AJK	SCALE: AS SHOWN			
DATE: NOVEMBER 2023	PROJECT NO. 18.0175731.00	REVISION NO. -	SHEET NO. 2		

LEGEND:

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EXISTING MINOR CONTOUR 1' INTERVAL	PROPOSED FLOOD WALL
EXISTING MEAN HIGH WATER (MHW) EL. 3.2'	PROPOSED ALTERNATIVE FLOOD PROTECTION ALIGNMENT
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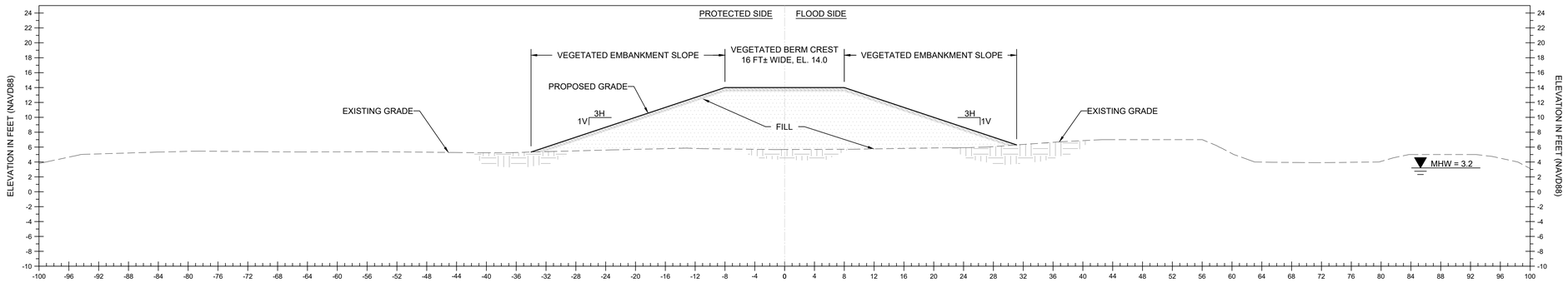
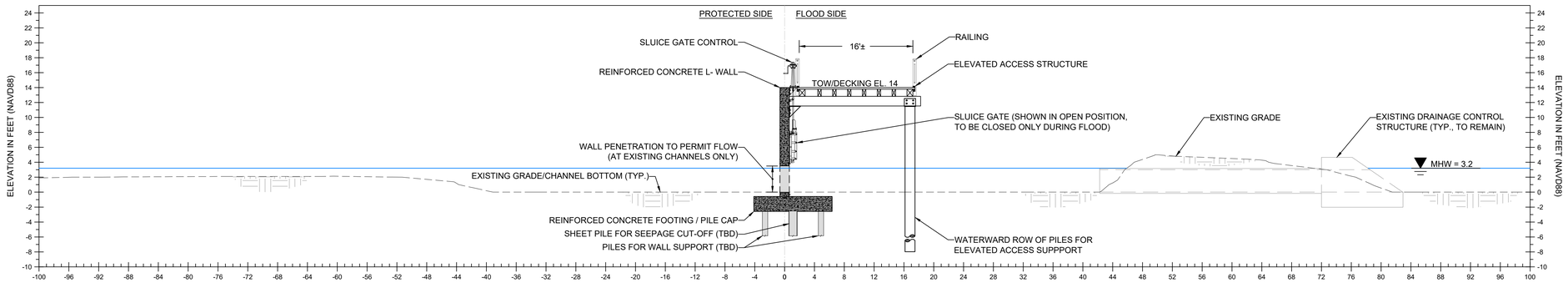
DATE: NOVEMBER 2023	PROJECT NO. 18.0175731.00	REVISION NO. -	SHEET NO.



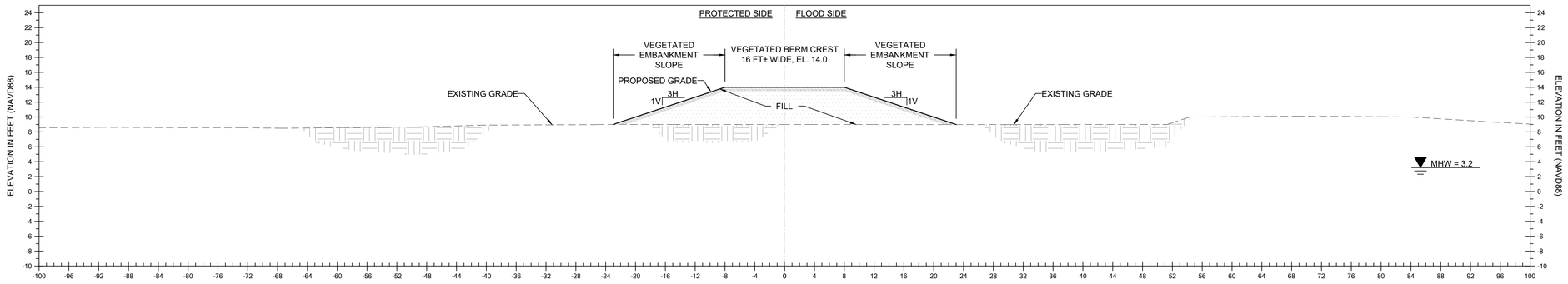
CONCEPTUAL SECTION A-A'

SCALE: 1"=8'



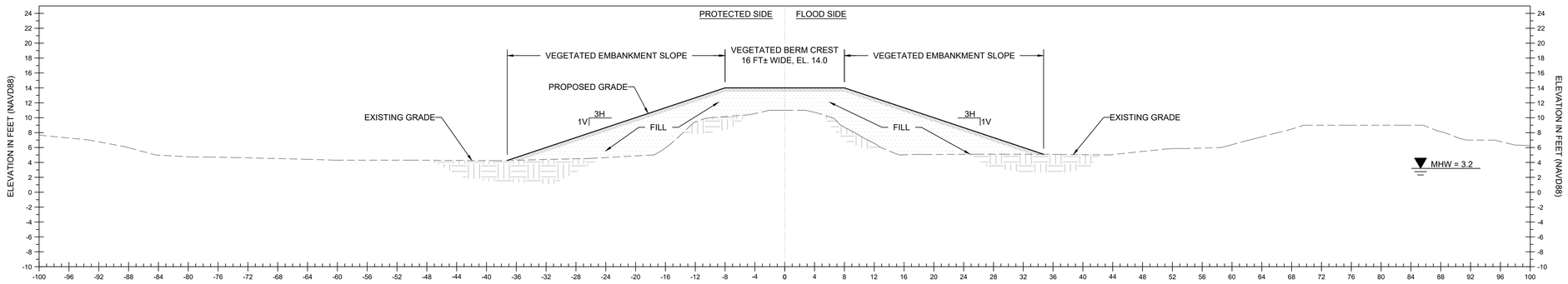
CONCEPTUAL SECTION B-B'

SCALE: 1"=8'



CONCEPTUAL SECTION C-C'

SCALE: 1"=8'



CONCEPTUAL SECTION D-D'

SCALE: 1"=8'

0 4 8 16

SCALE IN FEET 1" = 8'

REPORT FIGURE
NOVEMBER 30, 2023
NOT FOR CONSTRUCTION

NO.	ISSUE/DESCRIPTION	BY	DATE

CIRCA RESILIENT CONNECTICUT PHASE III
RESILIENT STRATFORD SOUTH END
CONCEPTUAL FLOOD MITIGATION DESIGN

MARINE BASIN AREA CONCEPT
CROSS-SECTIONS

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:
CONNECTICUT INSTITUTE FOR RESILIENCE AND CLIMATE ADAPTATION (CIRCA) - UCONN - AVERY POINT CAMPUS
1080 SHENNECOSSETT ROAD
GROTON, CONNECTICUT 06340

PROJ MGR: AJK	REVIEWED BY: WWC	CHECKED BY: DCS	DRAWING
DESIGNED BY: AJK	DRAWN BY: AJK	SCALE: AS SHOWN	2
DATE: NOVEMBER 2023	PROJECT NO. 18.0175731.00	REVISION NO. -	SHEET NO.

SOUTH END PROPERTY LIST - LORDSHIP BOULEVARD

REFERENCE NUMBER	OWNERSHIP CATEGORY	SITE ADDRESS	AREA (AC.)	PARCEL NUMBER MBLU	PID	NOTES
15	CITY OF BRIDGEPORT	1600 LORDSHIP BLVD	445.94	4003010001	10390	2
68	FEDERAL	LORDSHIP BLVD	374.06	3004020001	20072	
99	CITY OF BRIDGEPORT	LORDSHIP BLVD	87.32	4003020001	51	

Notes:

1. Indicated property data was obtained from the Town of Stratford GIS accessed online between 9/1 and 9/28/2023 (https://metrocog.mapxpress.net/Stratford/).
2. Multiple property owners and/or field cards associated with parcel per Stratford GIS.
3. Indicates a Town-owned parcel.

SOUTH END PROPERTY LIST - MARINE BASIN

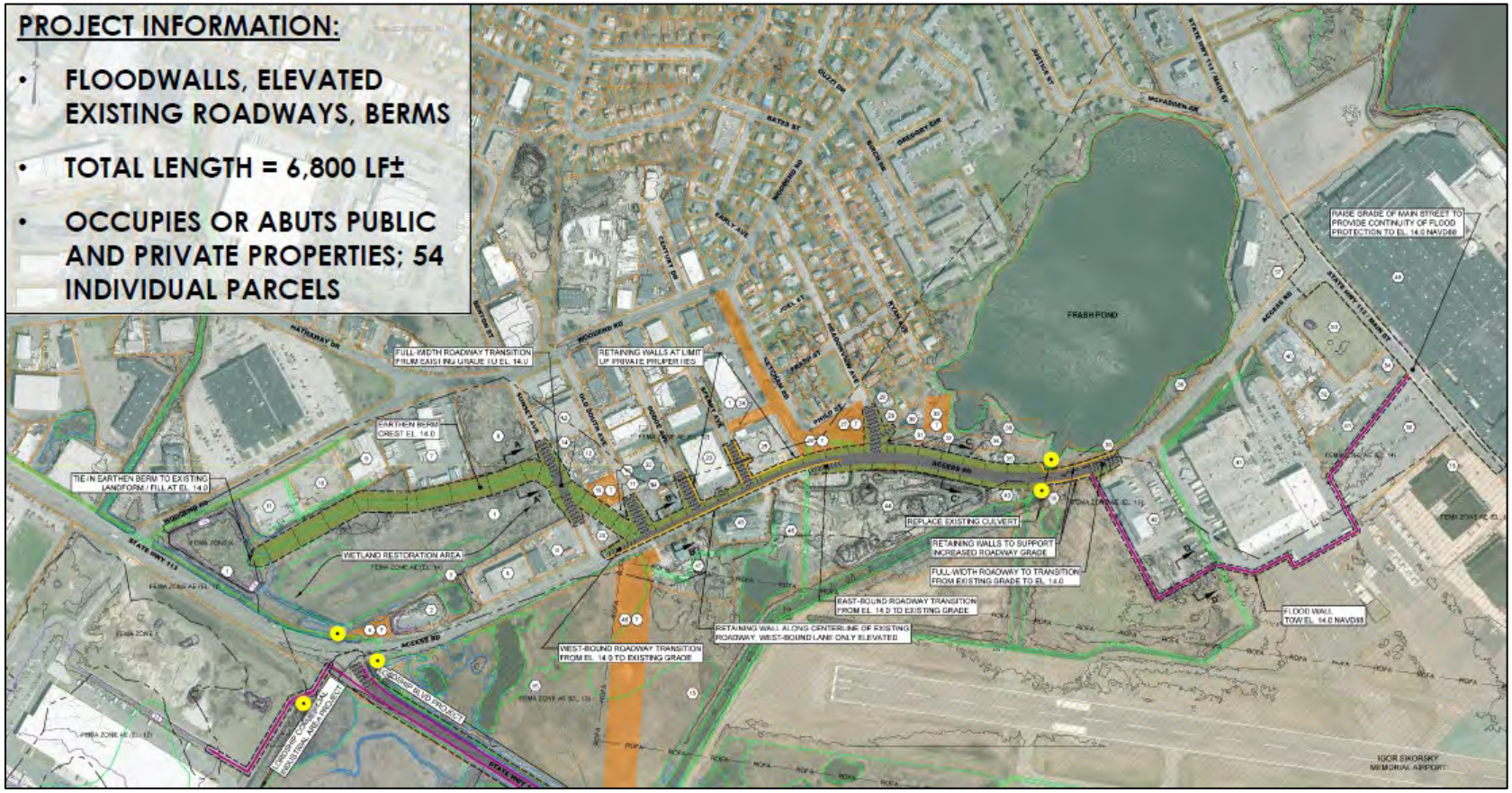
REFERENCE NUMBER	OWNERSHIP CATEGORY	SITE ADDRESS	AREA (AC.)	PARCEL NUMBER MBLU	PID	NOTES
15	CITY OF BRIDGEPORT	1600 LORDSHIP BLVD	445.94	4003010001	10390	2
55	CITY OF BRIDGEPORT	1445 STRATFORD RD	1.79	5004020001	17376	
56	CITY OF BRIDGEPORT	MAIN ST	69.55	5004030001	10580	
57	CORPORATION	365 SNIFFENS LN	2.42	5005020001	16565	
58	CORPORATION	335 SNIFFENS LN	3.51	5005020002	16566	
59	CORPORATION	305 SNIFFENS LN	0.51	5005020003	16564	
60	FEDERAL	MAIN ST	20.45	5005020004	10552	
61	TOWN OF STRATFORD	SHORT BEACH RD	107.28	6004020001	16199	3
62	PRIVATE	3 MAIN ST	1.61	6004020003	14593	
63	PRIVATE	18 MAIN ST	1.40	6005010001	10599	
64	PRIVATE	1 MAIN ST	1.86	6005010002	10596	
65	PRIVATE	101 BREAKERS LN	8.99	6005010003	16439	
67	CORPORATION	SNIFFENS LN	1.74	6005010009	16391	
66	PRIVATE	QUIMBYS NECK	0.96	6005010007	14589	

Notes:

1. Indicated property data was obtained from the Town of Stratford GIS accessed online between 9/1 and 9/28/2023 (https://metrocog.mapxpress.net/Stratford/).
2. Multiple property owners and/or field cards associated with parcel per Stratford GIS.
3. Indicates a Town-owned parcel.

Appendix III – Project C. Access Road Levee Segment

PROJECT C. ACCESS ROAD SEGMENT OVERVIEW



A Concrete floodwall between lower northbound and higher southbound lane
B Northbound and southbound lane both elevated to higher elevation
C Existing southbound lane elevation

Flood Protection & Elevated Road
Access Road
Flood Side

Flood Protection & Elevated Road
Access Road
Protected Side

TABLE 4.3
OPINION OF PROBABLE COST

GZA GeoEnvironmental, Inc.

Project No.: 18.0175731.00
Sheet No.: 1 OF 1
Estimate By: AJK (11/20/2023)
Checked By: RBC (11/29/2023)

Project Segment: Project C - Access Road
Project: Resilient Stratford South End
Client: CIRCA and Town of Stratford, Connecticut
Location: Stratford, Connecticut

Project C - Construction Cost Estimate

Item	Description	Quantity	Unit	Unit Estimate	Extension	Comment
1	Mobilization/Demobilization	1	LS	$ 150,000	$ 150,000	
2	Site Preparation, Access, Temp. Controls & Temp. Facilities	1	LS	$ 250,000	$ 250,000	Assumes existing City property available for laydown area(s), includes
3	Site Sedimentation and Erosion Control	1	LS	$ 750,000	$ 750,000	
4	Pile-Supported Reinforced Concrete Floodwall	2,500	LF	$ 4,500	$ 11,250,000	
5	Embankment Construction	70,000	CY	$ 55	$ 3,850,000	Includes borrow, placement, compaction and grading
6	Flood Barrier Gates (at grade crossings)	2	EA	$ 200,000	$ 400,000	
7	Roadway Restoration / Improvements	3,600	LF	$ 1,500	$ 5,400,000	
8	Stormwater Improvements (including Pump Station)	1	Est.	$ 12,200,000	$ 12,200,000	Includes stormwater riser upgrades and pump station
9	Retaining Walls	2,615	LF	$ 2,000	$ 5,230,000	
10	Tide Gates and Culverts	2	EA	$ 500,000	$ 1,000,000	
11	Greenway and Recreational Access Improvements	1	Est.	$ 610,000	$ 610,000	Allowance assuming 152,000 SF of improved area
12	Wetlands & Habitat Restoration / Replication / Mitigation	1	Est.	$ 2,400,000	$ 2,400,000	Allowance assuming restoration of 400,000 SF of existing wetland, no soil disposal
13	Private Property Buyout/Easements	1	Est.	$ 4,400,000	$ 4,400,000	
14	Existing Utility Coordination and Accommodation	1	Est.	$ 5,000,000	$ 5,000,000	
15	Existing Above-ground Transmission Relocation	1	Est.	$ 2,000,000	$ 2,000,000	
16	Stakeholder Coordination and Accommodation	50	EA	$ 10,000	$ 500,000	
	Construction Base Estimate:				**$ 55,390,000**	

Project C - Total Estimate

Line	Description	Subtotal Amount	Comment
1	Construction Base Estimate	$ 55,390,000	
2	Contractor's Office Overhead (7.7% Line 1)	$ 4,265,030	
3	Contractor's Insurance, Payment, & Performance Bonds (3.3% Line 1)	$ 1,827,870	
4	Contractor's Profit (3.0% Line 1)	$ 1,661,700	
5	Engineering, Permitting, and Design Development (13% Line 1)	$ 7,200,700	
6	Owner's Construction Administration (6% Line 1)	$ 3,323,400	
7	Cost Escalation (60 Mos. @ 0.237% =**14.2%** Sum Lines 1-6)	$ 10,460,955	
8	Contingency Budget (50% Sum Lines 1-7)	$ 42,064,828	50% Contingency applied for project complexity
	Total Estimated Project C Cost (Sum Lines 1-8):	**$ 126,194,483**	

General Opinion of Probable Cost Assumptions:

- Prevailing union wage rates used for construction labor.
- Contracts are competitively bid.
- Estimated costs for traffic control or temporary route bypass are excluded.
- Environmental regulatory requirements, including protected habitat requirements, can be accommodated and managed within the proposed project footprints.
- Water-based construction methods are not required.
- Materials are readily available and sourced.
- Property ownership/easements/right-of-access necessary to enable the work are secured.
- Construction will not be substantially delayed due to factors beyond the Contractor's control.
- Projects are net fill with minimal permanent cut or requirement for replacement volume.
- Potential generation of existing soil unsuitable for reuse and off-site disposal of excess or unsuitable existing soil will be minimal.
- Potential costs associated with environmental remediation are excluded.
- Sufficient Staging and laydown areas will be provided by the Town.
- Site preparation, access, temporary controls, and temporary facilities items include measures such as clearing and grubbing, stripping, and stockpiling existing materials, and restoration located outside the proposed completed work but necessary to enable the Contractor's construction access.
- Conceptual designs and associated costs are subject to change based on results of recommended higher resolution flood modeling analysis.
- Potential environmental remediation costs are excluded.
- The project component located along Lordship Blvd. (State Hwy 113) will be constructed within the existing roadway embankment. Roadway relocation is not included in this opinion.
- The private property buyout/easement item is based on 2019 Town of Stratford Assessors' appraisal data multiplied by a CPI of 1.22278 to represent September 2023 values.
- Contingency budgets of 25% are included for Project A – Lordship Commercial Industrial Area and Project B – Lordship Boulevard (State Hwy 113) & Marine Basin. A contingency budget of 50% is applied to Project C – Access Road for project complexity.
- Cost escalation factor calculated per FEMA's "CEF for Large Projects Instructional Guide V2.1," Part E: Cost Escalation Allowance, dated September 2009 and ENR's Construction Cost Index (CCI; accessed online at ENR.com 11/10/2023).

CCI November 2023:	13175.00
CCI November 2021:	12467
Δ 2-yr:	708.00
%Δ 2-yr:	5.68%
Monthly Escalation Rate:	0.237%
Calculated 5-yr (60 Mos.) Escalation Rate:	14.2%

LEGEND:

EXISTING MAJOR CONTOUR 5' INTERVAL	PROPOSED PROJECT AREA	INDICATES PARCEL OWNED BY CITY OF BRIDGEPORT	
EXISTING MINOR CONTOUR 1' INTERVAL	PROPOSED FLOOD WALL		
EXISTING MEAN HIGH WATER (MHW) EL. 3.2'	PROPOSED ALTERNATIVE FLOOD PROTECTION ALIGNMENT		
EXISTING EL. 14.0' CONTOUR	PROPOSED RETAINING WALL		
FEMA NATIONAL FLOOD HAZARD BOUNDARY	PROPOSED ELEVATED ROADWAY		
EXISTING PARCEL BOUNDARY LINES	PROPOSED EARTHEN BERM CREST		
NATIONAL WETLANDS INVENTORY LINES	PROPOSED SLOPED EMBANKMENT / FILL		
PROPERTY REFERENCE ID (SEE PROPERTY INFORMATION TABLE)	PROPOSED ROADWAY GRADE TRANSITION		
INDICATES TOWN-OWNED PROPERTY	ROFA — RUNWAY OBJECT FREE AREA (ROFA)		

GENERAL NOTES:

1. ELEVATIONS INDICATED ON THIS DRAWING ARE IN FEET AND REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88), UNLESS NOTED OTHERWISE.
2. EXISTING ELEVATION CONTOURS OBTAINED FROM THE 2016 CONNECTICUT LIDAR PROJECT, ACCESSED ELECTRONICALLY VIA CTECO.UCONN.EDU. CONTOUR ELEVATIONS ARE IN FEET AND REFERENCED TO NAVD88.
3. PARCEL LINES ARE BASED ON CT OPM MUNICIPAL PARCEL FILES ACCESSED ELECTRONICALLY VIA MAPS.CTECO.UCONN.EDU/DATA/PARCELS/DOWNLOAD ON AUGUST 3, 2023.
4. AERIAL IMAGERY BASE MAP DEVELOPED FROM USGS CONNECTICUT ORTHOIMAGERY (2019), ACCESSED ELECTRONICALLY VIA CTECO.UCONN.EDU/DATA/DOWNLOAD BETWEEN AUGUST 3-5, 2023.
5. STATE OF CONNECTICUT NATIONAL WETLAND INVENTORY DATA OBTAINED FROM U.S. FISH & WILDLIFE SERVICE, ACCESSED ELECTRONICALLY VIA FWS.GOV ON AUGUST 11, 2023.

REPORT FIGURE
NOVEMBER 30, 2023
NOT FOR CONSTRUCTION

0 100 200 400
SCALE IN FEET 1" = 200'

NO.	ISSUE/DESCRIPTION	BY	DATE

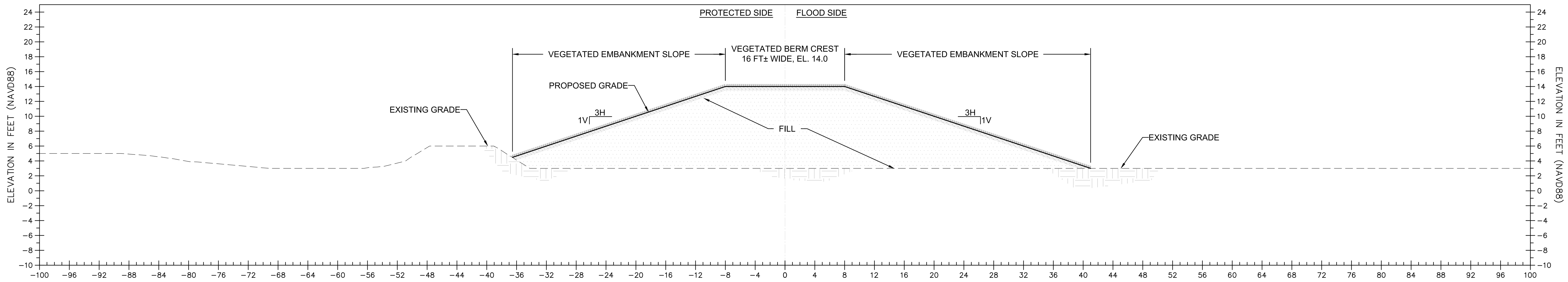
CIRCA RESILIENT CONNECTICUT PHASE III
RESILIENT STRATFORD SOUTH END
CONCEPTUAL FLOOD MITIGATION DESIGN

ACCESS ROAD AREA CONCEPT SITE PLAN

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

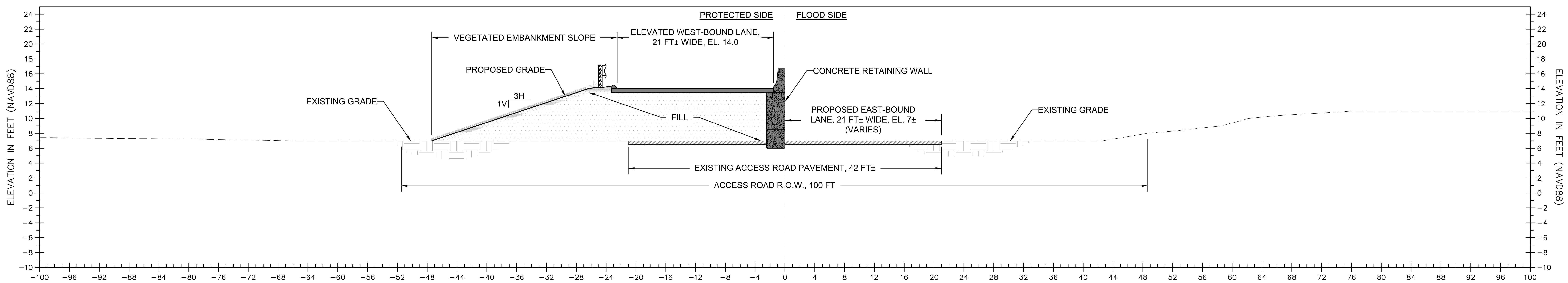
PREPARED FOR:
CONNECTICUT INSTITUTE FOR RESILIENCE AND CLIMATE ADAPTATION (CIRCA) - UCONN - AVERY POINT CAMPUS
1080 SHENNECOSSETT ROAD
GROTON, CONNECTICUT 06340

PROJ MGR: AJK	REVIEWED BY: WWC	CHECKED BY: DCS	DRAWING
DESIGNED BY: AJK	DRAWN BY: AJK	SCALE: AS SHOWN	1
DATE: NOVEMBER 2023	PROJECT NO. 18.0175731.00	REVISION NO. -	SHEET NO.



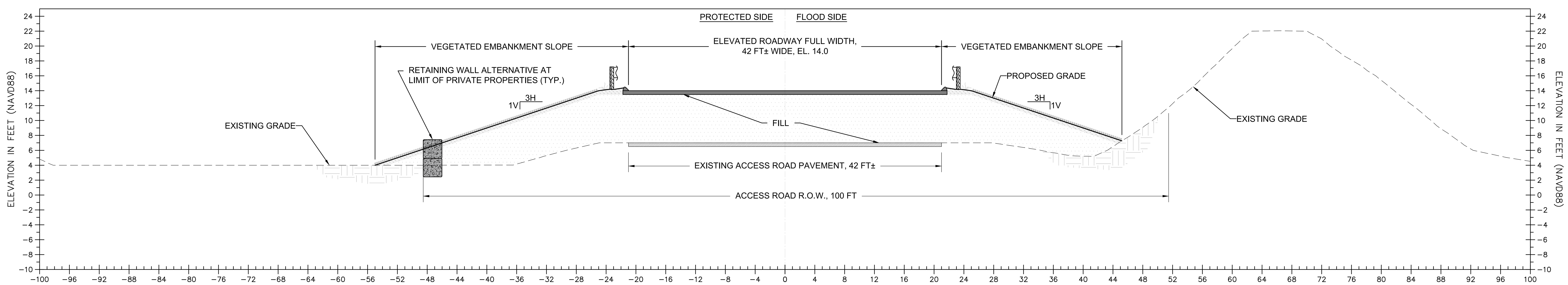
CONCEPTUAL SECTION A-A'

SCALE: 1"=8'



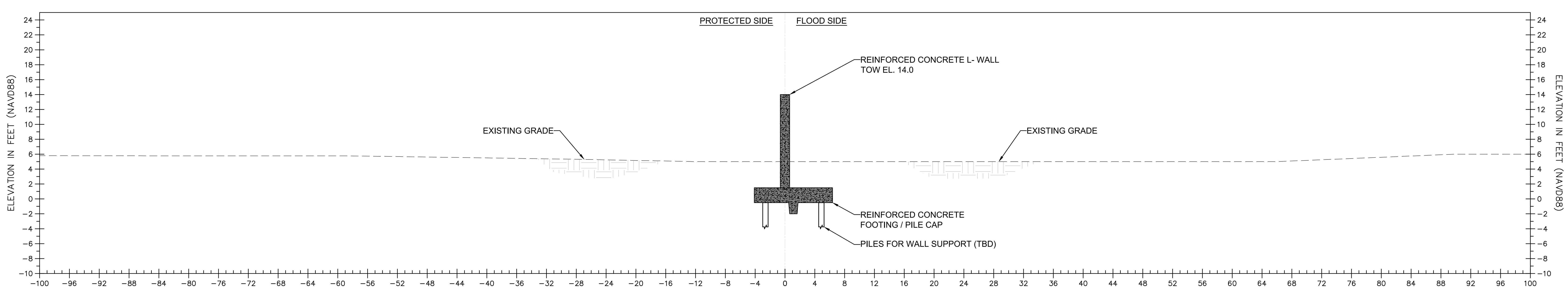
CONCEPTUAL SECTION B-B'

SCALE: 1"=8'



CONCEPTUAL SECTION C-C'

SCALE: 1"=8'



CONCEPTUAL SECTION D-D'

SCALE: 1"=8'

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SCALE IN FEET 1" = 8'

REPORT FIGURE
NOVEMBER 30, 2023
NOT FOR CONSTRUCTION

NO.	ISSUE/DESCRIPTION	BY	DATE

CIRCA RESILIENT CONNECTICUT PHASE III
RESILIENT STRATFORD SOUTH END
CONCEPTUAL FLOOD MITIGATION DESIGN

ACCESS ROAD AREA CONCEPT CROSS-SECTIONS

PREPARED BY:
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Engineers and Scientists
www.gza.com

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CONNECTICUT INSTITUTE FOR RESILIENCE AND CLIMATE ADAPTATION (CIRCA) - UCONN - AVERY POINT CAMPUS
1080 SHENNECOSSETT ROAD
GROTON, CONNECTICUT 06340

PROJ MGR: AJK	REVIEWED BY: WWC	CHECKED BY: DCS	DRAWING 2
DESIGNED BY: AJK	DRAWN BY: AJK	SCALE: AS SHOWN	
DATE: NOVEMBER 2023	PROJECT NO. 18.0175731.00	REVISION NO. -	SHEET NO.

SOUTH END PROPERTY LIST - ACCESS ROAD

REFERENCE NUMBER	OWNERSHIP CATEGORY	SITE ADDRESS	AREA (AC.)	PARCEL NUMBER MBLU	PID	NOTES
1	CORPORATION	LORDSHIP BLVD	17.14	3004010001	10351	2
1	STATE OF CONNECTICUT	GOOSE ISLAND	17.14	3004010001	6810	2
2	CORPORATION	900 ACCESS RD	1.36	3004010002	41	
3	CORPORATION	ACCESS RD	0.18	3004010003	56	
4	TOWN OF STRATFORD	ACCESS RD	0.27	3004010004	45	3
5	CORPORATION	840 ACCESS RD	0.96	3005070001	64	
6	CORPORATION	810 ACCESS RD	0.99	3005070002	63	
7	CORPORATION	1010 WOODEND RD	3.56	3005070004	19824	
8	CORPORATION	885 WOODEND RD	1.71	3005070005	19822	
9	CORPORATION	1050 WOODEND RD	0.92	3005070006	19825	
10	CORPORATION	WOODEND RD	1.35	3005070007	19698	
11	CORPORATION	WOODEND RD	1.43	3005070008	19697	
12	CORPORATION	300 OLD SOUTH AVE	0.68	3005080001	13149	
13	CORPORATION	45 OLD SOUTH AVE	0.89	3005080002	13143	
14	CORPORATION	SUNSET AVE	0.52	3005080004	17652	
15	CITY OF BRIDGEPORT	1600 LORDSHIP BLVD	445.94	4003010001	10390	2
16	CORPORATION	OLD SOUTH AVE	0.16	4005030001	13140	
17	CORPORATION	OLD SOUTH AVE	0.05	4005030002	13137	
18	CORPORATION	OLD SOUTH AVE	0.20	4005030003	13139	
19	TOWN OF STRATFORD	11 OLD SOUTH AVE	0.33	4005030004	13142	3
20	CORPORATION	10 SUNSET AVE	0.36	4005030005	40	
21	PRIVATE	165 DODGE AVE	0.27	4005040001	4746	
22	CORPORATION	120 OLD SOUTH AVE	1.19	4005040002	13146	
23	CORPORATION	640 ACCESS RD	1.44	4005050008	16845	
24	TOWN OF STRATFORD	SPERRY AVE	0.21	4005060005	102532	3
25	CORPORATION	300 SPERRY AVE	1.18	4005060006	16850	
26	TOWN OF STRATFORD	KETCHAM RD	1.41	4005060007	102533	3
27	TOWN OF STRATFORD	KETCHAM RD	0.44	4005060008	9295	3
28	PRIVATE	190 MEADOWVIEW AVE	0.40	4005120001	11763	
29	PRIVATE	MEADOWVIEW AVE	0.23	4005120002	11738	
30	PRIVATE	MEADOWVIEW AVE	0.29	4005120003	11739	
31	PRIVATE	190 MEADOWVIEW AVE	0.12	4005120005	11762	
32	PRIVATE	MEADOWVIEW AVE	0.04	4005120006	11764	
33	TOWN OF STRATFORD	ACCESS RD	0.35	4005120007	42	3
34	CORPORATION	ACCESS RD	0.24	4005120008	43	
35	PRIVATE	350 ACCESS RD	0.38	4005120010	62	
36	CITY OF BRIDGEPORT	ACCESS RD	0.41	4005120013	46	
37	CORPORATION	699 MAIN ST	3.09	4005120014	10547	
38	CORPORATION	MEADOWVIEW AVE	1.27	4005120048	11740	
39	CORPORATION	ACCESS RD	0.45	4005120049	48	
40	CORPORATION	55 ACCESS RD	1.45	4005130001	58	
41	CORPORATION	125 ACCESS RD	11.30	4005130002	59	
42	CORPORATION	245 ACCESS RD	3.95	4005130003	60	
43	PRIVATE	349 ACCESS RD	0.23	4005140001	61	

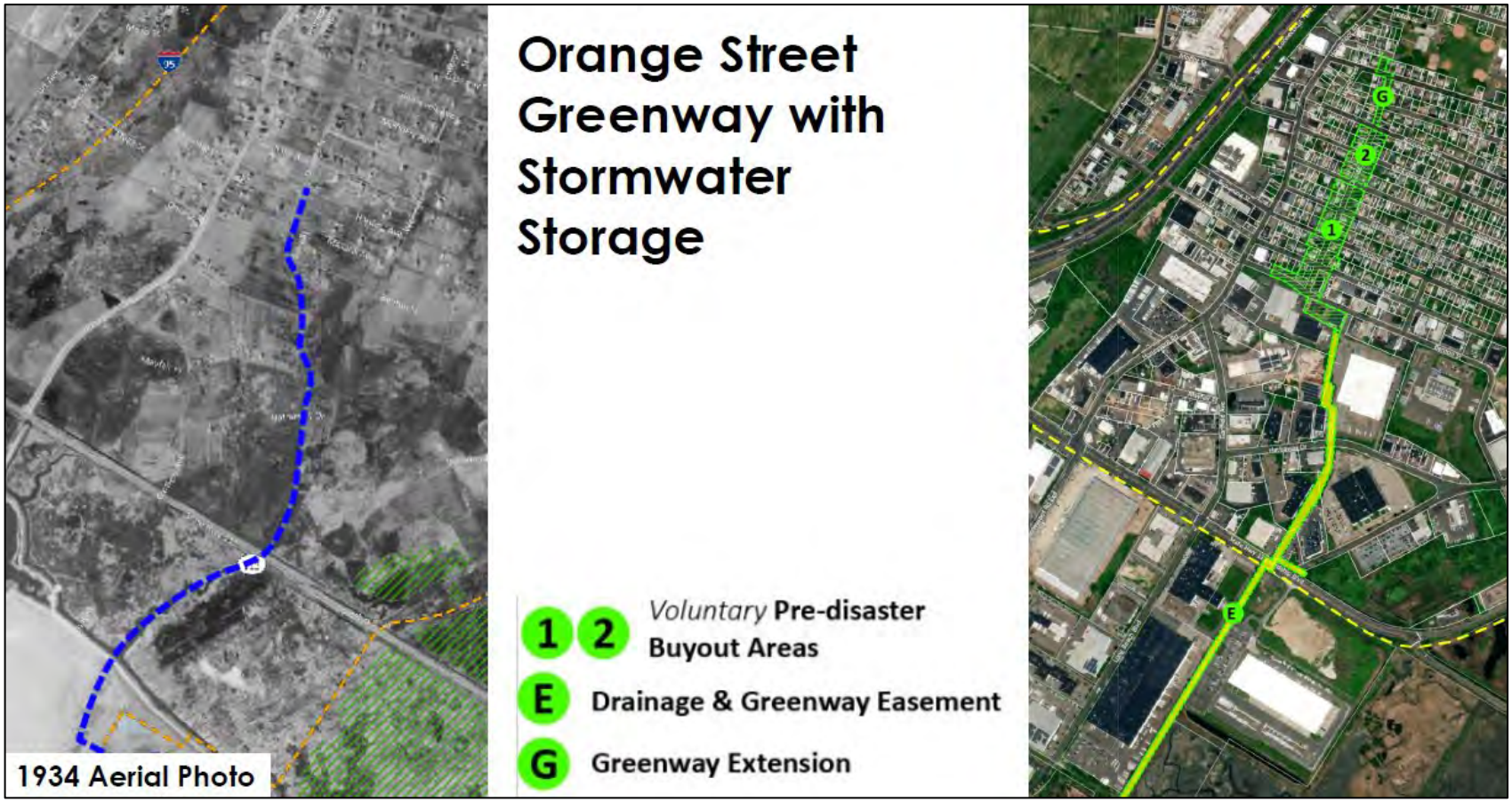
SOUTH END PROPERTY LIST - ACCESS ROAD

REFERENCE NUMBER	OWNERSHIP CATEGORY	SITE ADDRESS	AREA (AC.)	PARCEL NUMBER MBLU	PID	NOTES
44	CORPORATION	ACCESS RD	8.34	4005140002	57	
45	CORPORATION	511 ACCESS RD	2.44	4005140003	16851	
46	CORPORATION	611 ACCESS RD	0.85	4005140004	44	
47	CORPORATION	681 ACCESS RD	1.97	4005140006	52	
48	TOWN OF STRATFORD	ACCESS RD	3.51	4005140007	54	3
49	FEDERAL	550 MAIN ST	5.09	5005010003	10600	
50	FEDERAL	MAIN ST	3.55	5005030001	10534	
51	CORPORATION	595 MAIN ST	1.48	5005030002	10601	
52	CORPORATION	611 MAIN ST	1.35	5005030003	10603	
53	CORPORATION	685 MAIN ST	2.16	5005030004	10605	
54	CORPORATION	609 MAIN ST	0.26	5005030005	10602	

Notes:

1. Indicated property data was obtained from the Town of Stratford GIS accessed online between 9/1 and 9/28/2023 (https://metrocog.mapxpress.net/Stratford/).
2. Multiple property owners and/or field cards associated with parcel per Stratford GIS.
3. Indicates a Town-owned parcel.

Appendix IV – Project D. Orange Street Stormwater Flooding Area


Orange Street Greenway with Stormwater Storage
1934 Aerial Photo
1 2 Voluntary Pre-disaster Buyout Areas
E Drainage & Greenway Easement
G Greenway Extension
G
2
1
E

Orange Street Greenway with Stormwater Storage

- Separate study is exploring stormwater management challenges and potential improvements
- Project could add stormwater storage, but also improve pedestrian connectivity, habitat value, and add to larger Town-wide greenway network

1 2 *Voluntary* **Pre-disaster Buyout Areas**

E **Drainage & Greenway Easement**

G **Greenway Extension**

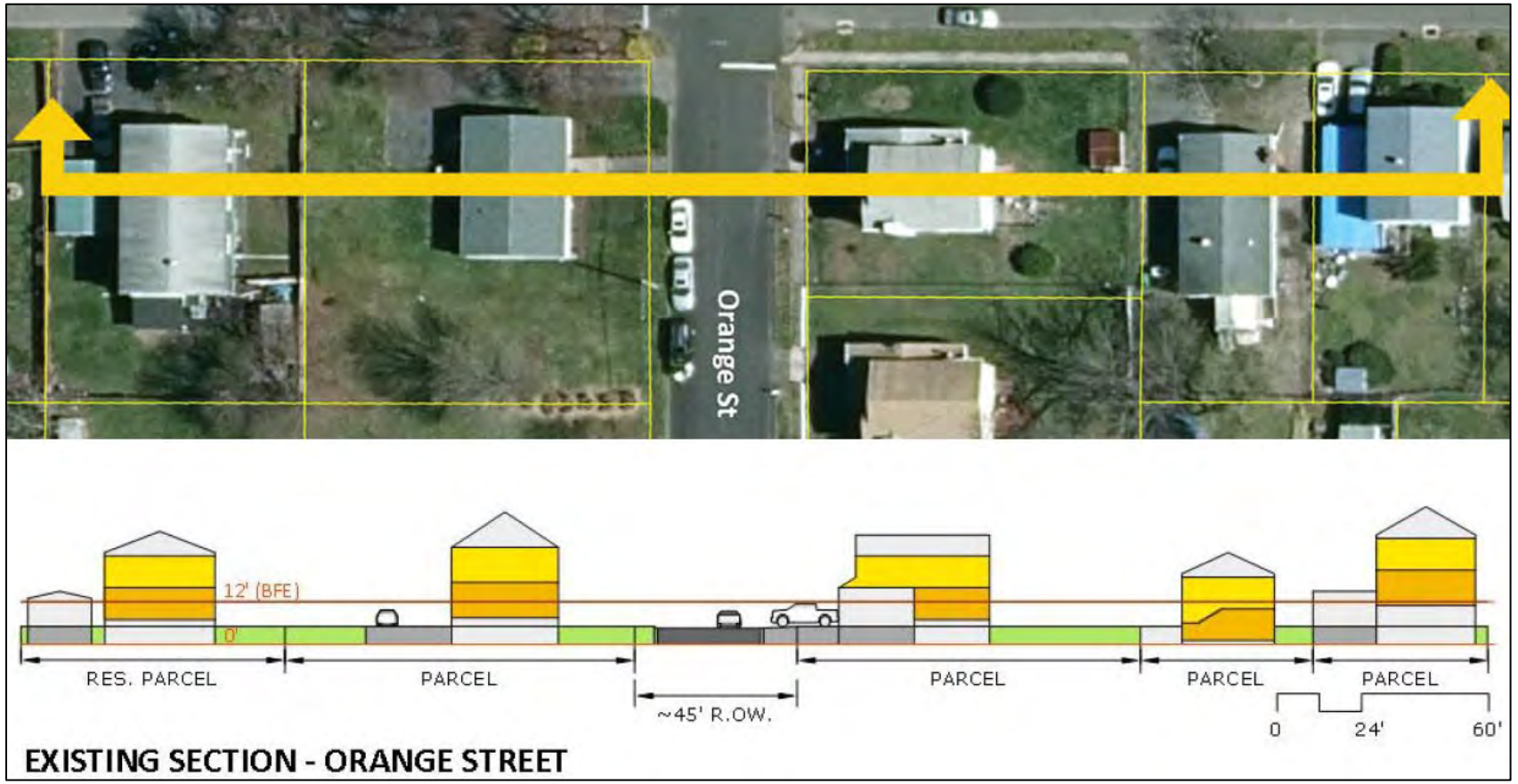
Orange Street Greenway with Stormwater Storage

- Separate study is exploring stormwater management challenges and potential improvements
- Project could add stormwater storage, but also improve pedestrian connectivity, habitat value, and add to larger Town-wide greenway network

1 2 *Voluntary* **Pre-disaster Buyout Areas**

E **Drainage & Greenway Easement**

G **Greenway Extension**



EXISTING SECTION - ORANGE STREET

Orange Street Greenway (narrow)

Multifunctional Landscape

- A One way shared vehicular and bike route
- B New sidewalks
- C Stormwater storage areas with native plantings
- D Crosswalk improvements
- E Driveways reoriented to perpendicular streets where feasible

Greenway with Stormwater Storage
Orange Street
within R.O.W. only

Orange Street Greenway (wider)

Multifunctional Landscape

A One vehicular route
B Multi-use path
C Stormwater storage areas with native plantings
D Crosswalk improvements

Greenway with Stormwater Storage
Orange Street
R.O.W + voluntary pre-disaster buyouts

Appendix V – Primary Levee System Opinion of Probable Cost

TABLE 5.0 - SUMMARY
OPINION OF PROBABLE COST

GZA GeoEnvironmental, Inc.

Project No.:	18.0175731.00
Sheet No.:	1 OF 1
Estimate By:	AJK (11/20/2023)
Checked By:	RBC (11/29/2023)

Project:	Resilient Stratford South End
Client:	CIRCA and Town of Stratford, Connecticut
Location:	Stratford, Connecticut

Summary of Total Cost by Segment

Project ID	Proposed Conceptual Flood Protection Segment Description		Segment Cost
A	Commercial Industrial Area		$ 30,009,826
B	Lordship Blvd. & Marine Basin		$ 81,772,575
C	Access Road		$ 126,194,483
SEGMENTS NOT INCLUDED IN CIRCA SCOPE		SAEP (Note 1.)	$ -
		Greenway	$ 17,186,101
		WPCF	$ 12,345,060
		Birdseye	$ 20,868,837
		Bruce Brook	$ 8,593,050

Summary of Total Cost by Flood Protection Alternative

Project ID	Proposed Conceptual Flood Protection Segment Description	Opinion of Probable Cost		
		Alternative A	Alternative B	Alternative C
A	Commercial Industrial Area	$ 30,009,826	$ 30,009,826	$ 30,009,826
B	Lordship Blvd. & Marine Basin		$ 81,772,575	$ 81,772,575
C	Access Road	$ 126,194,483		$ 126,194,483
SEGMENTS NOT INCLUDED IN CIRCA SCOPE		$ 58,993,048	$ 58,993,048	$ 58,993,048
Total Estimated Alternative Costs (Note 1.):		**$ 215,197,357**	**$ 170,775,448**	**$ 296,969,931**

Notes:

1. Private funding for anticipated resiliency improvements located at the Stratford Army Engine Plant (SAEP) site are not included in this opinion.
2. Opinion of Probable Costs for the Greenway, WPCF, Birdseye, and Bruce Brook segments are based on "Town of Stratford Coastal Community Resilience Plan," prepared by GZA, December 2016.
3. An inflation factor of 1.274 representing cost increase from December 2016 to October 2023 was calculated with the U.S. Bureau of Labor and Statistics' CPI Inflation Calculator, accessed online at bls.gov on 11/28/2023 and applied to the 2016 Base Construction Costs for segments not included in the CIRCA scope before applying cost estimating factors consistent with Projects A, B, and C.
4. Each Alternative (A, B, & C) includes the Commercial Industrial Area Segment (A) and segments not included in the CIRCA project scope.
5. Alternative A does not include the Lordship Blvd. & Marine Basin segment (Project B).
6. Alternative B does not include the Access Road segment (Project C).
7. Alternative C includes all identified segments.
8. Additional information regarding Engineer Opinion of Probable Cost for Projects A, B, and C are included in Appendices I, II, and III; respectively.

General Opinion of Probable Cost Assumptions:

- Prevailing union wage rates used for construction labor.
- Contracts are competitively bid.
- Estimated costs for traffic control or temporary route bypass are excluded.
- Environmental regulatory requirements, including protected habitat requirements, can be accommodated and managed within the proposed project footprints.
- Water-based construction methods are not required.
- Materials are readily available and sourced.
- Property ownership/easements/right-of-access necessary to enable the work are secured.
- Construction will not be substantially delayed due to factors beyond the Contractor's control.
- Projects are net fill with minimal permanent cut or requirement for replacement volume.
- Potential generation of existing soil unsuitable for reuse and off-site disposal of excess or unsuitable existing soil will be minimal.
- Potential costs associated with environmental remediation are excluded.
- Sufficient Staging and laydown areas will be provided by the Town.
- Site preparation, access, temporary controls, and temporary facilities items include measures such as clearing and grubbing, stripping, and stockpiling existing materials, and restoration located outside the proposed completed work but necessary to enable the Contractor's construction access.
- Conceptual designs and associated costs are subject to change based on results of recommended higher resolution flood modeling analysis.
- Potential environmental remediation costs are excluded.
- The project component located along Lordship Blvd. (State Hwy 113) will be constructed within the existing roadway embankment. Roadway relocation is not included in this opinion.
- The private property buyout/easement item is based on 2019 Town of Stratford Assessors' appraisal data multiplied by a CPI of 1.22278 to represent September 2023 values.
- Contingency budgets of 25% are included for Project A – Lordship Commercial Industrial Area and Project B – Lordship Boulevard (State Hwy 113) & Marine Basin. A contingency budget of 50% is applied to Project C – Access Road for project complexity.
- Cost escalation factor calculated per FEMA's "CEF for Large Projects Instructional Guide V2.1," Part E: Cost Escalation Allowance, dated September 2009 and ENR's Construction Cost Index (CCI; accessed online at ENR.com 11/10/2023).

CCI November 2023:	13175.00
CCI November 2021:	12467
Δ 2-yr:	708.00
%Δ 2-yr:	5.68%
Monthly Escalation Rate:	0.237%
Calculated 5-yr (60 Mos.) Escalation Rate:	14.2%

Appendix VI – Report Limitations

Use of Report

1. GZA GeoEnvironmental, Inc. (GZA) prepared this Report on behalf of, and for the exclusive use of the Connecticut Institute of Resilience and Climate Adaptation (Client) for the stated purpose(s) and location(s) identified in the Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

Standard of Care

2. Our findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Report and/or proposal, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).

3. Our services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

4. Note that the probabilities presented in this study are approximate and uncertain. They describe future potential conditions to support planning-level decision-making. The scenarios are appropriate for use in understanding the risk of different climate change scenarios and planning. For example, applying higher amounts of inland flooding may be appropriate when considering risk mitigation for high value lifeline assets, which would merit protection against events with a low probability of occurrence.

5. Unless specifically stated otherwise, the flood evaluations performed by GZA and associated results and conclusions are based upon evaluation of historic data, trends, references, and guidance with respect to the current climate and sea level conditions. Future climate change may result in alterations to inputs which influence flooding at the site (e.g. rainfall totals, storm intensities, mean sea level, etc.). Such changes may have implications on the estimated flood elevations, wave heights, flood frequencies and/or other parameters contained in this Report.

6. Basis of Opinion of Cost. Unless otherwise stated, our opinions of cost are only for comparative and general planning purposes. These opinions are based on the limited data and conditions and assumptions described in the Report. The cost estimates may involve approximate quantity evaluations and are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of the work addressed in the Report. Further, since we have no control over when the work will take place nor the labor and material costs required to plan and execute the anticipated work, our cost opinions were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs may vary over time and could be significantly more, or less, than stated in the Report.

7. Cost opinions presented in the Report are based on a combination of sources and may include published RS Means Cost Data; cost data from federal, state or local transportation agency web sites; and GZA's experience with costs for similar projects at similar locations. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation. In accordance with the project construction bid restrictions, GZA did not directly solicit cost estimates from contractors. Actual costs will likely vary depending on the quality of materials and installation; manufacturer of the materials or equipment; field conditions; geographic location; access restrictions; phasing of the work; subcontractors mark-ups; quality of the contractor(s); project management exercised; and the availability of time to thoroughly solicit competitive pricing. In view of these limitations, the costs presented in the Report should be considered "order of magnitude" and used for budgeting and comparison purposes only. Detailed quantity and cost estimating should be performed by experienced professional cost estimators to evaluate actual costs. The opinions of cost in the Report should not be interpreted as a bid or offer to perform the work. Unless stated otherwise, all costs are based on present value.
8. The opinion of costs are based only on the quantity and/or cost items identified in the Report, and should not be assumed to include other costs such as legal, administrative, permitting, or others. The estimate also does not include any costs with regard to third-party claims, fines, penalties, or other charges which may be assessed against any responsible party because of either the existence of present conditions or the future existence or discovery of any such conditions.

General

9. The observations described in this report were made under the conditions stated therein. The conclusions presented were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by the Client.
10. In preparing this report, GZA relied on certain information provided by the Client, state and local officials, and other parties referenced therein available to GZA at the time of the evaluation. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.
11. Observations were made of the site and of structures on the site as indicated within the report. Where access to portions of the structure or site, or to structures on the site was unavailable or limited, GZA renders no opinion as to the condition of that portion of the site or structure.
12. In reviewing this Report, it should be realized that the reported condition of any features discussed is based on observations of field conditions during the course of this study along with data made available to GZA. It is important to note that the conditions noted depend on numerous and constantly changing circumstances and are evolutionary in nature.

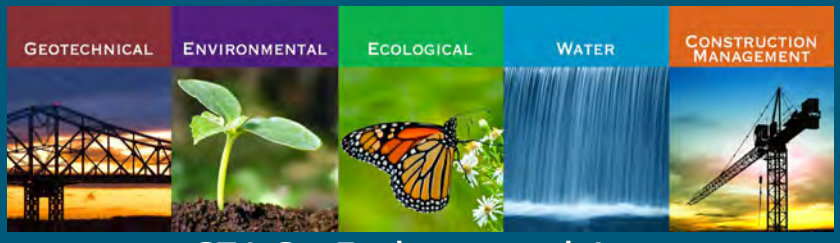
Compliance with Codes and Regulations

13. We used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

Appendix VII – References

REFERENCES

1. Resilient Connecticut Phase II Report, Stratford South End Resilience Opportunity Area (ROAR) Map https://resilientconnecticut.uconn.edu/phase-ii/
2. Resilient Connecticut Planning Framework, PERSISTS Criteria https://resilientconnecticut.uconn.edu/wp-content/uploads/sites/2761/2020/04/Resilient-Connecticut-Planning-Framework-Final-1-30-20.pdf
3. Justice40 Initiative per Executive Order 14008 M-21-28 (whitehouse.gov)
4. Town of Stratford Hydrologic & Hydraulic (H&H) Study Excerpts by Weston & Sampson (W&S) of the Stratford South End neighborhoods, email correspondence by Raju Vasamsetti, PE, CFM received by GZA November 21, 2021
5. Town of Stratford Coastal Community Resilience Plan by GZA dated December, 2016 https://www.stratfordct.gov/filestorage/39879/40866/Stratford_Coastal_Resiliency_Plan_-_Final_Report_12-21-2016_Electronic_-_optimized.pdf
6. Airport Master Plan, Igor I Sikorsky Memorial Airport, FINAL REPORT by CHA Consulting, Inc. dated January 2021 for the City of Bridgeport http://planbdrairport.com/resources/documents/BDR-Final-Master-Plan-Report.pdf
7. U.S. Army Corps of Engineers (USACE) considering funding a major flood mitigation project estimated at $1.6 billion with a BCR value marginally below 1.0 for elevating 3300 private buildings in Louisiana for the Amite River Basin Commission, email newsletter from Bob Jacobsen PE, LLC dated November 20, 2023 with link to Amite River Basin Commission Public Hearing of November 14, 2023 November 14, 2023 Regular Meeting (with audio) - YouTube
8. Town of Stratford South End Environmental Justice (EJ) parcels Connecticut Environmental Justice Blocks dated 2022 downloaded from a web-based viewer authored by DEEP.
9. 2019 parcel data for Town of Stratford organized by Metro Regional Councils of Governments.
10. A Climate Resilient Approach to Marsh Restoration, October 2022 CIRCA 10th Anniversary of Superstorm Sandy Poster Session, by Jack Matthias, Audubon Connecticut, https://resilientconnecticut.uconn.edu/wp-content/uploads/sites/2761/2022/10/Audubon-CT-Poster.pdf
11. CIRCA Resilient Connecticut Phase III Website, Stratford South End Plan Project https://resilientconnecticut.uconn.edu/stratford-south-end-project-public-meetings/
12. Connecticut Coastal Storm Risk Management (CSRM) Feasibility Study https://www.nae.usace.army.mil/Missions/Projects-Topics/Fairfield-and-New-Haven-Counties-Coastal-Storm-Risk-Management-Feasibility-Study/
13. City of New Haven Long Wharf Responsible Growth Plan https://www.newhavenct.gov/government/departments-divisions/city-plan/plans-projects/long-wharf
14. City of New Haven Flood Protection at Long Wharf Study by GZA https://storymaps.arcgis.com/stories/3194888f50584d019894f845a76fa54c



GZA GeoEnvironmental, Inc.