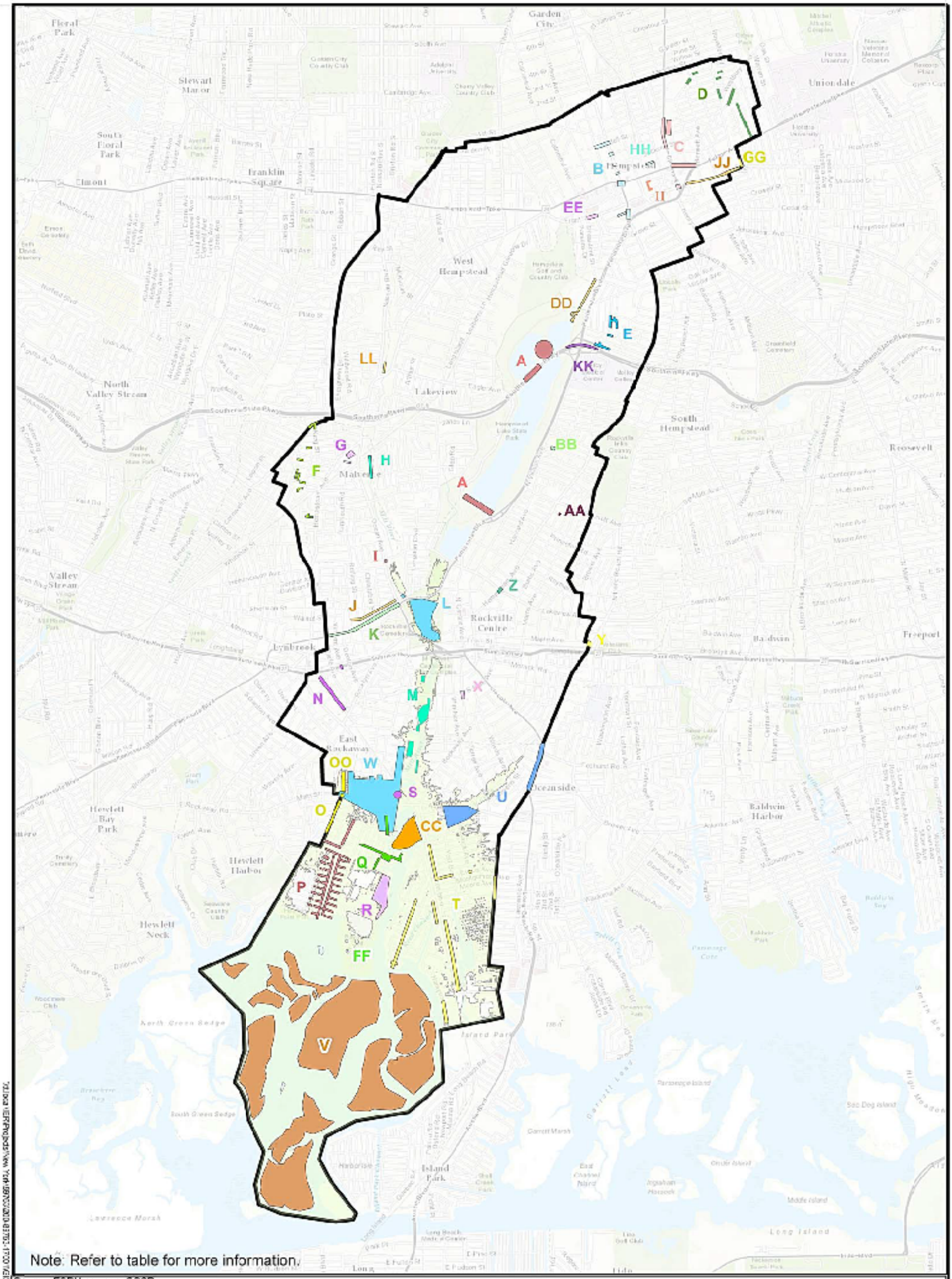
Appendix A

Living with the Bay Intervention Descriptions

Living with the Bay

LIVING WITH THE BAY
PROJECT PRIORITIZATION RESULTS SUMMARY
JUNE 2017

Project ID	Project Name	Cost	Benefits	Risk & Vulnerability	Synergies	Social Resiliency	Project Rating Score	Project Cost	Cumulative Cost	Overall Rank
V	Coastal Marsh Restoration Project	0.0	32.4	8.2	3.3	6.6	**50.5**	$ 30,800,000	$ 30,800,000	1
B	Horsebrook Drain West Branch Recharge Basin Project	7.0	24.2	11.4	1.9	0.8	**45.3**	$ 11,000,000	$ 41,800,000	2
DD	Hempstead High School Creek Restoration Project	23.9	7.4	2.2	5.7	5.8	**45.0**	$ 450,000	$ 42,250,000	3
HH	Nichols Court Stormwater Bump-Outs Project	24.7	1.3	2.4	6.1	8.7	**43.2**	$ 120,000	$ 42,370,000	4
II	Cooper Square Underground Detention Project	19.8	13.7	2.3	6.1	0.0	**41.9**	$ 2,100,000	$ 44,470,000	5
P	East Boulevard and West Boulevard Project	21.0	7.3	6.2	5.4	2.0	**41.9**	$ 1,600,000	$ 46,070,000	6
M	East Rockaway High School Project	10.3	13.4	5.1	4.9	7.8	**41.5**	$ 7,200,000	$ 53,270,000	7
D	Northeast Village of Hempstead Bioretention Green Streets Project	9.6	22.1	6.8	2.5	0.4	**41.4**	$ 7,900,000	$ 61,170,000	8
H	Malverne High School Project	18.0	9.2	2.1	4.8	6.2	**40.3**	$ 2,800,000	$ 63,970,000	9
C	Hempstead Housing Authority Project	19.3	9.5	7.6	3.6	0.2	**40.2**	$ 2,300,000	$ 66,270,000	10
L	Smith Pond Project	13.0	9.1	4.7	5.7	7.4	**39.9**	$ 4,800,000	$ 71,070,000	11
A	Hempstead Lake State Park Project	0.0	12.5	11.3	5.3	10.7	**39.8**	$ 34,500,000	$ 105,570,000	12
F	Malverne Bioretention Green Streets Project	12.1	17.5	3.8	5.3	0.4	**39.1**	$ 5,400,000	$ 110,970,000	13
N	Forest Avenue Project	22.8	4.9	4.8	6.1	0.4	**39.0**	$ 900,000	$ 111,870,000	14
X	S Centre Avenue Bioretention Green Street Project	24.5	1.6	2.7	6.1	3.5	**38.4**	$ 200,000	$ 112,070,000	15
EE	Covert Street Project	24.5	0.6	5.7	6.8	0.0	**37.6**	$ 200,000	$ 112,270,000	16
KK	Southern State Parkway Ramp Project	23.8	3.9	3.4	6.1	0.0	**37.2**	$ 500,000	$ 112,770,000	17
J	Lynbrook Bioretention Green Streets Project	24.7	4.2	3.9	3.6	0.8	**37.2**	$ 140,000	$ 112,910,000	18
E	Southwest Village of Hempstead Suspended Pavement Green Streets Project	5.0	20.0	6.1	5.3	0.0	**36.4**	$ 15,000,000	$ 127,910,000	19
GG	Hendrickson Avenue Project	24.3	1.9	3.0	4.8	0.2	**34.2**	$ 300,000	$ 128,210,000	20
I	Lakeview Avenue Project	24.9	0.0	2.4	4.9	1.6	**33.8**	$ 60,000	$ 128,270,000	21
AA	Beverly Road Project	24.5	1.6	2.9	3.6	0.0	**32.6**	$ 200,000	$ 128,470,000	22
K	Peninsula Boulevard Greenway Project	24.3	0.0	2.4	4.3	1.6	**32.6**	$ 300,000	$ 128,770,000	23
Y	Maple Avenue abd Long Beach Road Intersection Project	24.3	0.1	2.7	5.2	0.0	**32.3**	$ 280,000	$ 129,050,000	24
LL	Halls Pond Project	24.5	0.0	2.5	4.9	0.0	**31.9**	$ 200,000	$ 129,250,000	25
Q	Williamson Street Project	22.5	3.4	4.4	1.3	0.0	**31.6**	$ 1,000,000	$ 130,250,000	26
T	Lawson Boulevard Project	11.8	9.5	7.1	2.4	0.0	**30.8**	$ 5,680,000	$ 135,930,000	27
OO	Waldo Avenue Project	24.8	0.0	2.9	3.0	0.0	**30.7**	$ 100,000	$ 136,030,000	28
S	East Rockaway Long Island Railroad Station Project	23.5	1.2	1.7	3.6	0.4	**30.4**	$ 600,000	$ 136,630,000	29
R	Bay County Park Project	23.6	1.1	2.5	1.4	1.0	**29.6**	$ 570,000	$ 137,200,000	30
FF	Mill River Storm Surge Barrier Project	0.0	15.8	10.2	3.5	0.0	**29.5**	$ 723,000,000	$ 860,200,000	31
MM	Greenway	10.2	0.0	2.0	4.3	10.7	**27.2**	$ 7,350,000	$ 867,550,000	32
W	East Rockaway Downtown	24.5	0.0	0.0	0.0	0.0	**24.5**	$ 200,000	$ 867,750,000	33
CC	Marina Pointe Marsh Restoration Project	11.4	6.7	2.1	2.5	1.8	**24.5**	$ 6,100,000	$ 873,850,000	34
Z	Lakeview Avenue and Hempstead Avenue Intersection Project	15.0	0.8	2.6	5.4	0.0	**23.8**	$ 4,000,000	$ 877,850,000	35



Source: ESRI basemap; GOSR

LEGEND

A LWTB Project

Living with the Bay Program Area Limits

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TETRA TECH

0 3,500 Feet

GOVERNOR'S OFFICE OF STORM RECOVERY
LIVING WITH THE BAY

LWTB PROJECTS

FIGURE

PROJECT A

HEMPSTEAD LAKE STATE PARK PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE
SPACE FOR THE RIVER
BLUE-GREEN CORRIDOR

Living with the Bay

Site Location

SubWatershed	7, 19
Street Address	Eagle Avenue, West Hempstead, NY
Longitude	-73.64
Latitude	40.69
Landowner	New York State
Existing Use	Open Space, Open Water, Park, Street
O & M Responsibility	NYS Parks
Low Moderate Income Area	N/A
Existing Site Description:	Hempstead Lake Dam is an earthen dam located within Hempstead Lake State Park and features a gate house with multiple slide gates and overflow weirs. The Lake provides storage and treatment of runoff before discharging downstream to the Mill River. The outlet gates are no longer functional and openings were cut in the two upper gates which serve to maintain the water level of the lake. The North Ponds are subject to large amounts of floatables and heavy sediment loads and the ponds have elevated levels of pollutants. The Northwest Pond Spillway is breached and not functional.

Proposed Characteristics

Cost Estimate	$34,500,000
Level of Protection, yr	100
Project Life, yr	50
Focus	Habitat Restoration, Flood Defense, Water Quality, Social Resiliency
Problem Areas Addressed	27, 28, 29
Proposed Improvements Description	▪Hempstead Lake Dam Improvements ▪North Ponds Habitat Restoration ▪Northwest Pond Spillway Repair ▪Environmental Education and Resiliency Center ▪Blue-Green Pathway with Pedestrian Bridges to improve Public Access to the Waterfront and provide a substantial part of the overall Blue-Green Corridor. ▪Docks and Kayak launches to Improve the Public Access to the Waterfront. ▪Sediment Basin ▪Floatables catcher ▪Hiking, Cycling, and Bridle Path

LWTB Objectives Met By Project

Increase Community Resiliency | Preserve Quality of Life | Provide Educational Opportunities | Create and Improve Public Waterfront Access | Restore Environmental Health

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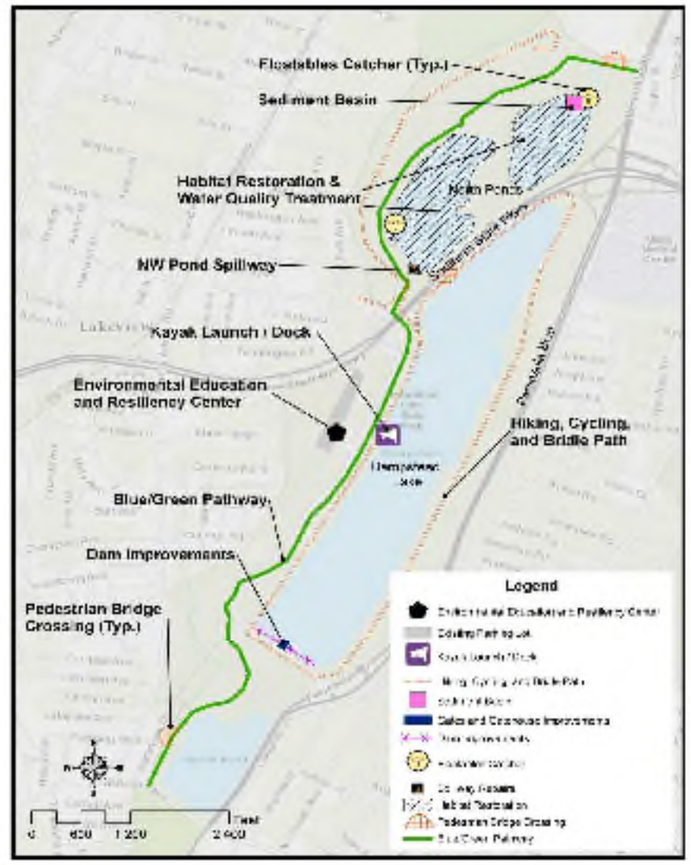
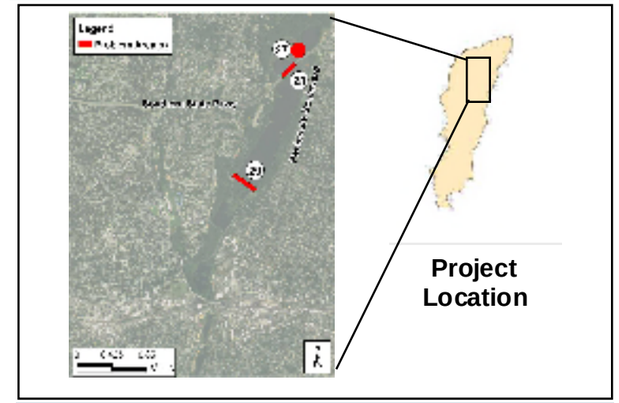
PROPOSED IMPROVEMENTS

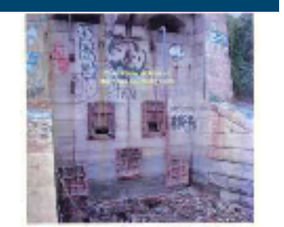


PROJECT AREA WITH PROBLEM AREA



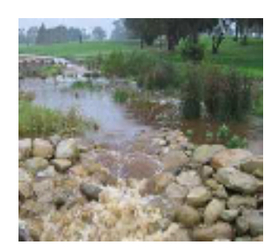
SAMPLE PHOTOS

Example Floatables Catcher



Existing Inoperable Hempstead Lake Dam Gatehouse

Environmental Education & Resiliency Center Rendering



North Ponds Restoration Example Images

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT AA
BEVERLY ROAD PROJECT DESCRIPTION

Theme(s): **N/A**

Living with the Bay

Site Location

SubWatershed	38
Street Address	14-98 Beverly Road, Rockville Centre, NY 11570
Longitude	-73.64
Latitude	40.67
Landowner	Village of Rockville Centre
Existing Use	Street
O & M Responsibility	Village of Rockville Centre
Low Moderate Income Area	N/A
Existing Site Description:	The intersection at Beverly Road and Lehigh Court currently floods during high intensity storm events. There is an existing pump system at the intersection with a capacity of 1200 GPM but additional overland sheet flow from Hempstead Avenue overwhelms the pump station and floods the intersection up to 18 inches routinely.

Proposed Characteristics

Cost Estimate	$200,000
Level of Protection, yr	5
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	30
Proposed Improvements Description	Refurbish the existing pump to be able to pump for additional flow coming from Hempstead Avenue and adjacent parcels.

LWTB Objectives Met By Project

Increase Community Resiliency

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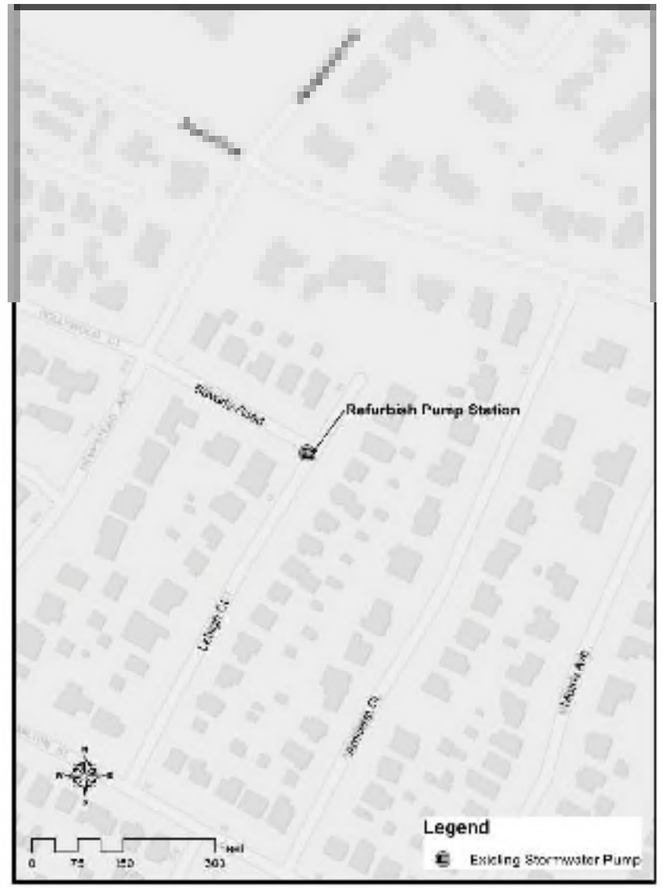
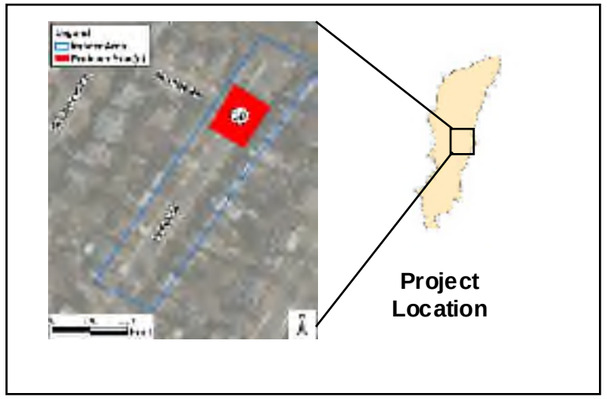
PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Street View of Beverly Road and Lehigh Court

Example Pump Station Under Street

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT B
HORSEBROOK DRAIN WEST BRANCH RECHARGE BASIN PROJECT DESCRIPTION

Theme(s): WATER STORAGE
BLUE-GREEN CORRIDOR

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	1
Street Address	90 Atlantic Avenue, Hempstead, NY
Longitude	-73.63
Latitude	40.71
Landowner	Nassau County, Village of Hempstead
Existing Use	Street
O & M Responsibility	Nassau County (Drainage System), Village of Hempstead (Park)
Low Moderate Income Area	>80%
Existing Site Description:	Six (6) intersections on North Franklin Street, from Bedell Street to Newmans Court, experience localized flooding due to poor conveyance capacity. The flooding areas are within the North Franklin Street drainage system and are connected to the existing stormwater pipe (Horsebrook Drain West Branch) originating from Old Country Road to the north and eventually discharging into Hempstead Lake to the south.

Proposed Characteristics

Cost Estimate	$11,000,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	15, 16, 17, 18, 19, 20, 21
Proposed Improvements Description	The proposed subgrade recharge basin utilizes Mirschel Community Park, located south of Atlantic Avenue, between Hilton Avenue and North Franklin Street in the Village of Hempstead as additional storage attenuation. The basin will be used to mitigate peak flows upstream of Atlantic Avenue and North Franklin Street to alleviate flooding in the problem areas. The proposed open recharge basin will provide storage, collect debris, and improve water quality. Stormwater first enters the open recharge basin and then overflows into the subgrade recharge basin. This project has the opportunity to help revitalize the community with park and recreation improvements desired by the community and become a north node for the Living with the Bay Blue-Green Corridor (see Project MM).

LWTB Objectives Met By Project

Increase Community Resiliency | Preserve Quality of Life | Provide Educational Opportunities | Restore Environmental Health

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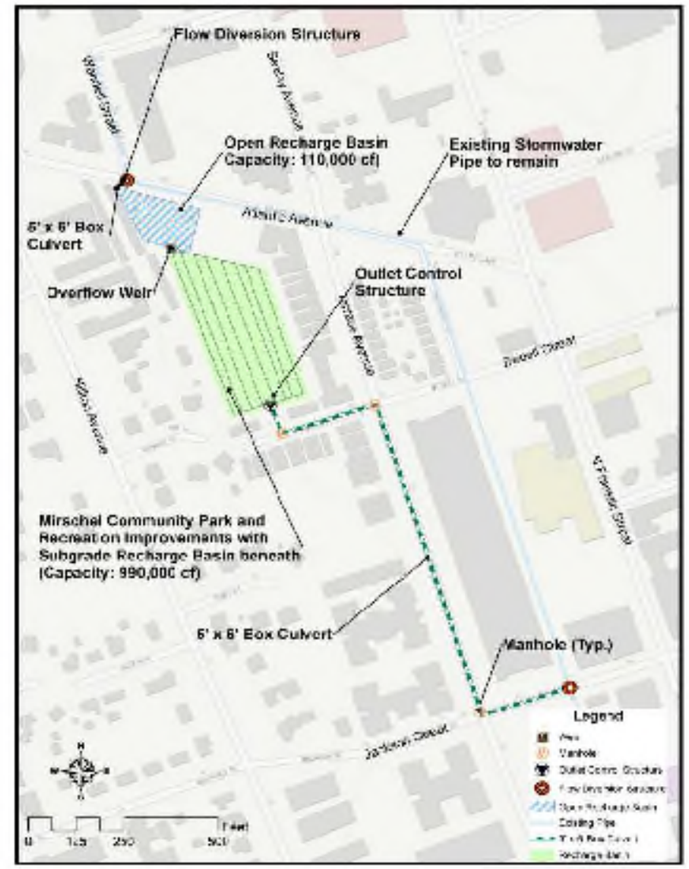
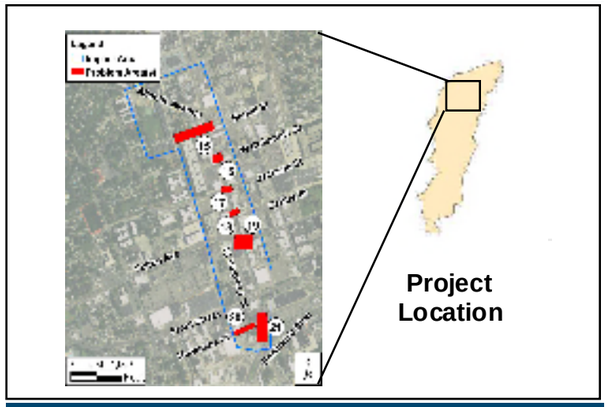
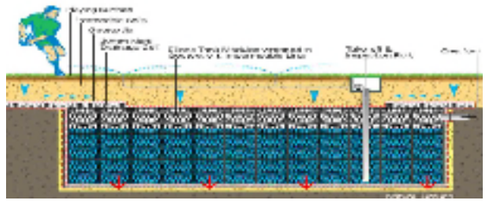
PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS



Example Cross-Section of Community Park with Subgrade Recharge Basin Beneath

Example Subgrade Recharge Basin

Example Community Park and Recreation Improvements on Top of Recharge Basin

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT C
HEMPSTEAD HOUSING AUTHORITY PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE
SPACE FOR THE RIVER

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	1
Street Address	260 Clinton St # 100, Hempstead, NY
Longitude	-73.62
Latitude	40.71
Landowner	Hempstead Housing Authority (HHA), Nassau County (Drain)
Existing Use	Open Water, Parking Lot, Street
O & M Responsibility	Nassau Co. DPW (Horsebrook Drain East Branch), HHA (On-site Drainage)
Low Moderate Income Area	>80%
Existing Site Description:	The Hempstead Housing Authority (HHA) along the east branch of Horsebrook Drain located between Yale Street and Jackson Street floods during a 5-year or greater rainfall event due to inadequate capacity of the open channel and downstream closed channel. The parking lot and ground floor are at low elevations and begin to flood from 2-year flood event, when the surface water profile exceeds the drain's banks according to the County's hydrologic and hydraulic model.

Proposed Characteristics

Cost Estimate	$2,600,000
Level of Protection, yr	25
Project Life, yr	50
Focus	Flood Defense, Water Quality
Problem Areas Addressed	9, 10
Proposed Improvements Description	Construct approx. 640 LF of new flood wall 4-5 ft above existing grade from Yale St to protect the HHA buildings west of Horsebrook Drain from flooding associated with a 25-yr 24-hr rainfall event or less. Floodbreak barriers installed at building access points will automatically deploy to prevent flooding. Green infrastructure (GI) in the form of bioswales and exfiltration systems will be incorporated on the HHA property so that runoff from 25-yr 24-hr storm event is captured and treated onsite. GI will include additional open space with new rain gardens and swales with 6:1 side slopes. Reconfigure existing parking lot to create GI and restripe parking with zero net difference in total number of parking spots. Redirect building's roof drains to ground surface so runoff will enter the new stormwater management system. Based on the County's modeling, the proposed improvements will protect HHA up to a 25-year storm event and provide on-site storage up to a 25-year rainfall event.

LWTB Objectives Met By Project

Increase Community Resiliency
Restore Environmental Health
Provide Educational Opportunities

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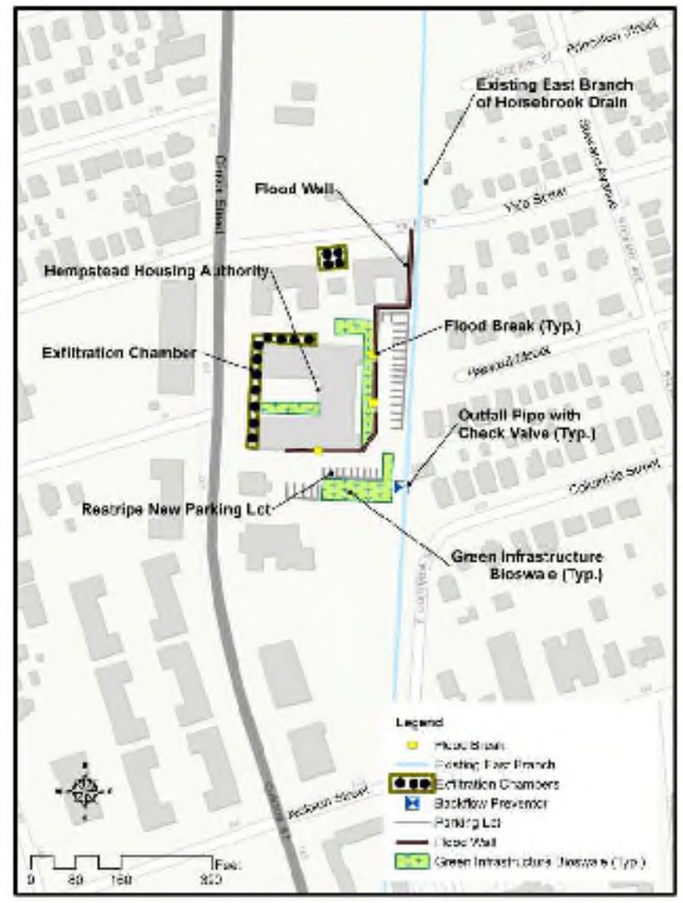
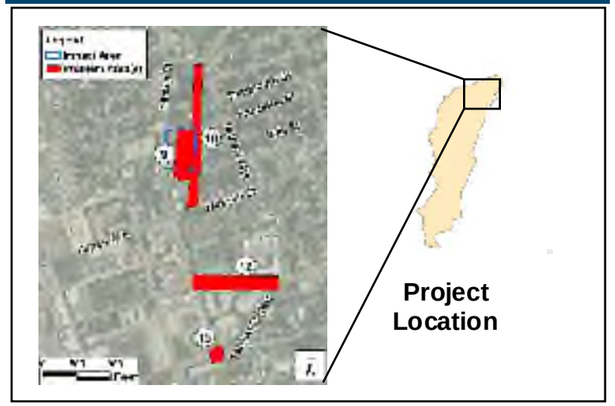
PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Existing HHA Parking Lot

Example Bioswale for HHA

Example Exfiltration Chamber for HHA On-site Drainage

Example Flood Wall on the Adjacent Property

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT CC

MARINA POINTE MARSH RESTORATION PROJECT DESCRIPTION

Theme(s): GREENER EDGE
SPACE FOR THE RIVER

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	29, 30
Street Address	Hempstead, NY
Longitude	-73.66
Latitude	40.64
Landowner	Town of Hempstead
Existing Use	Shoreline
O & M Responsibility	Town of Hempstead
Low Moderate Income Area	>80%
Existing Site Description:	The existing marshlands off the shore of Marina Pointe East Rockaway experience continual loss of habitat due to shoreline erosion.

Proposed Characteristics

Cost Estimate	$6,100,000
Level of Protection, yr	100
Project Life, yr	50
Focus	Water Quality, Habitat Restoration, Social Resiliency
Problem Areas Addressed	92
Proposed Improvements Description	▪Rock sill protection of marsh shoreline that experiences direct erosive impact of storm and surge flows and boat wake. ▪Floating marsh protection to provide wave attenuation and fish shelter while facilitating nutrient uptake. ▪Cutoff rock sills to prevent migration of flow into low marshland channels to minimize sediment erosion in the channels.

LWTB Objectives Met By Project

Increase Community Resiliency | Restore Environmental Health | Preserve Quality of Life | Provide Educational Opportunities

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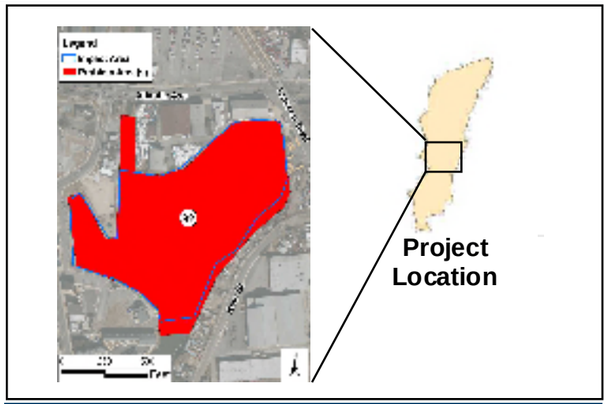
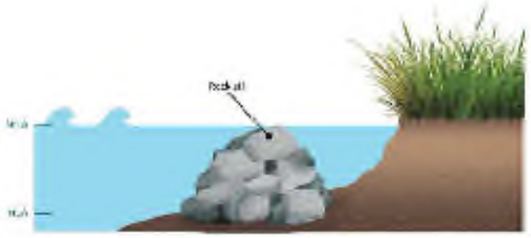
PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Existing Conditions



Example Rock/Cutoff Sill

Example Floating Marsh

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT D
NORTHEAST VILLAGE OF HEMPSTEAD BIORETENTION GREEN STREETS PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	1
Street Address	Cornell St., Amherst St., Stewart Ave., Remsen Ave., Harriet Ave., Syrrey La., Rhodes Ave., Westbury Blvd., Gertrude St., Fairview Blvd., Commander Ave., Byrd St., Chamberlain St., Pilot St., Myrtle Ave., Manor Ave., Warner Ave., Boylston St., James Burrell Ave., Dartmouth St., Wellesley St., Princeton St., Yale St., and Harvard St. , Hempstead, NY
Longitude	-73.61
Latitude	40.71
Landowner	Village of Hempstead
Existing Use	Street
O & M Responsibility	Village of Hempstead
Low Moderate Income Area	60% - 80%
Existing Site Description:	The existing project area includes seven sites in The Village of Hempstead that experience localized flooding caused by a lack of or undersized storm drainage infrastructure, microtopography, and/or substantial upstream contributing areas. The affected intersections are Cornell St. and Boylston St.; Amherst St. and Boylston St.; Stewart Ave. and James LL Burrell Ave.; and Cornell St. and Stewart Ave. Sections of Remsen Ave. north of Westbury Blvd.; Harriet Ave. off of Westbury Blvd.; and Surrey Ln. between Harvard St. and Fulton Ave. are also affected.

Proposed Characteristics

Cost Estimate	$7,900,000
Level of Protection, yr	0.4
Project Life, yr	30
Focus	Water Quality, Social Resiliency, Flood Defense
Problem Areas Addressed	1, 2, 3, 4, 5, 6, 7
Proposed Improvements Description	The proposed improvements include installation of green streets with incorporated bioretention area. Green streets are a linear network of distributed BMPs located in the street right-of-way that are designed to reduce runoff volume and improve water quality of the runoff both from the street and the adjacent parcels. 1.6 miles of street will be implemented with green streets for this project.

LWTB Objectives Met By Project

Increase Community Resiliency
Restore Environmental Health
Provide Educational Opportunities

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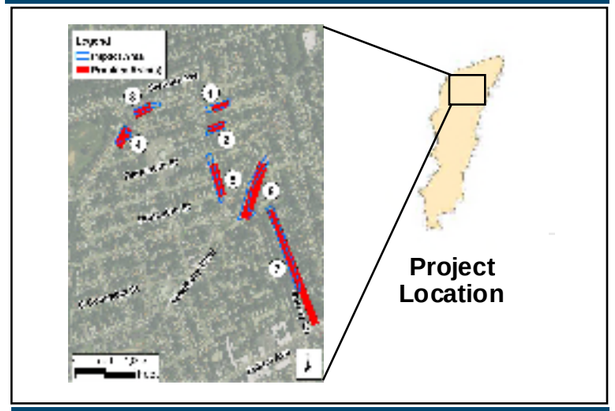
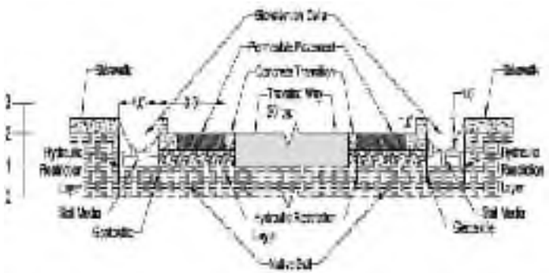
PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Typical Green Street Layout



Typical Green Street with Bioretention cross-section

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT DD
HEMPSTEAD HIGH SCHOOL CREEK RESTORATION PROJECT DESCRIPTION

Theme(s): GREENER EDGE
SPACE FOR THE RIVER
BLUE-GREEN CORRIDOR

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	7
Street Address	646-662 Peninsula Blvd., Hempstead, NY
Longitude	-73.63
Latitude	40.70
Landowner	Hempstead High School
Existing Use	Open Water, Shoreline
O & M Responsibility	Town of Hempstead
Low Moderate Income Area	40% - 60%
Existing Site Description:	The Creek entering North Ponds extends through a wooden parcel from Tyler Avenue and through Hempstead High School property. The Creek experiences major bank erosion, exposed tree roots and trees which have collapsed over the creek. The Creek is also subject to high amounts of bacteria exceeding the limits and increased nitrogen nutrients.

Proposed Characteristics

Cost Estimate	$450,000
Level of Protection, yr	N/A
Project Life, yr	50
Focus	Habitat Restoration, Water Quality
Problem Areas Addressed	23
Proposed Improvements Description	The proposed improvements consist of restoration of the creek bottom and side slopes to ameliorate the erosion, overgrowth, and debris within the creek. Geotextile will be installed to provide additional bank stabilization. Sodding will provide cover over the geotextile and additional stabilization. In the vicinity of the school building on the creek, a more robust geotextile will be installed to prevent erosion near the building. The proposed improvements will help mitigate damage caused by flooding in future storm events, while stabilizing creek banks, reducing erosion and decreasing sediment deposit downstream.

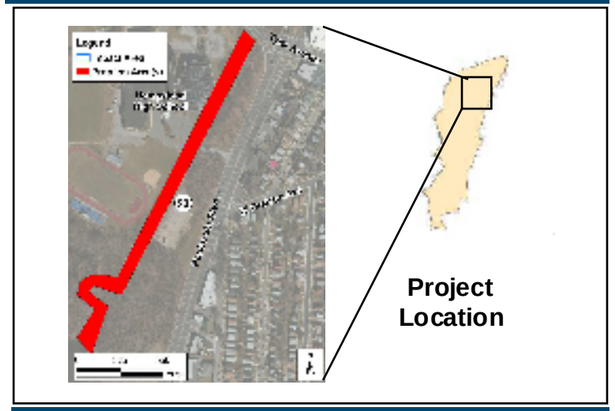
LWTB Objectives Met By Project

Increase Community Resiliency
Restore Environmental Health
Provide Educational Opportunities

DRAFT

PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Existing Conditions of Erosion on West Bank of Creek

Example Stream Restoration

Example for Creek after Stream Restoration

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT E

SOUTHWEST VILLAGE OF HEMPSTEAD SUSPENDED PAVEMENT GREEN STREETS PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	10
Street Address	Green Ave., Grant St., Rose Ave., W Marshall St., Carolina Ave., W Graham Ave., Marton Luther King Dr., Circle Dr., Alabama Ave., Virginia Ave., Mason St., Sutton St., and Flower St., Hempstead, NY
Longitude	-73.63
Latitude	40.69
Landowner	Village of Hempstead
Existing Use	Street
O & M Responsibility	Village of Hempstead
Low Moderate Income Area	40% - 60%
Existing Site Description:	The existing project area includes three sites in The Village of Hempstead that experience localized flooding caused by a lack of or undersized storm drainage infrastructure, microtopography, and substantial upstream contributing areas. The affected areas are near the intersection of Green Ave., Rose Ave., and Grant St.; the intersection of Green Ave. and Marshall St.; and a section of Carolina Ave. off of Virginia Ave.

Proposed Characteristics

Cost Estimate	$15,000,000
Level of Protection, yr	0.5
Project Life, yr	30
Focus	Water Quality, Flood Defense
Problem Areas Addressed	24, 25, 26
Proposed Improvements Description	The proposed improvements include installation of suspended pavement green streets. Green streets are a linear network of distributed BMPs located in the street right-of-way that are designed to reduce runoff volume and improve water quality of the runoff both from the street and the adjacent parcels. In this instance, water storage and treatment is integrated under the sidewalk using a suspended pavement system. 1.18 miles of street will be implemented with green streets for this project.

LWTB Objectives Met By Project

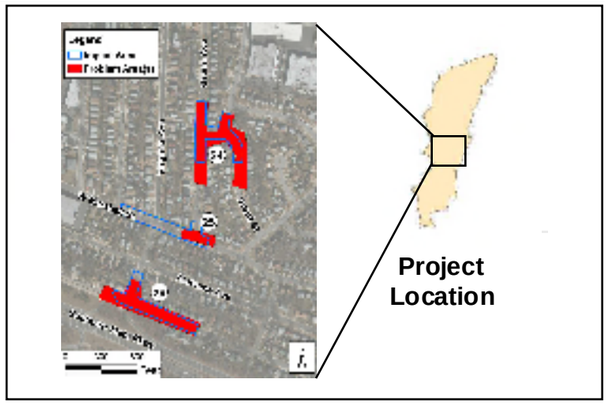
Increase Community Resiliency

Restore Environmental Health

DRAFT

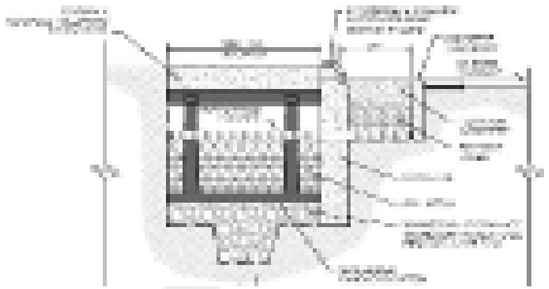
PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Typical Suspended Sidewalk Layout



Typical Green Street with Suspended Sidewalk Cross-Section

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT EE
COVERT STREET PROJECT DESCRIPTION

Theme(s): **N/A**

Site Location

SubWatershed	1
Street Address	5 Covert Street, Hempstead, NY
Longitude	-73.63
Latitude	40.70
Landowner	Village of Hempstead
Existing Use	Street
O & M Responsibility	Village of Hempstead
Low Moderate Income Area	40% - 60%
Existing Site Description:	The Covert Street/ Front Street intersection floods frequently in heavy rainfall events due to a high point south of the intersection. The lack of inlets at the intersection combined with the ridge on Covert Street causes flooding.

Proposed Characteristics

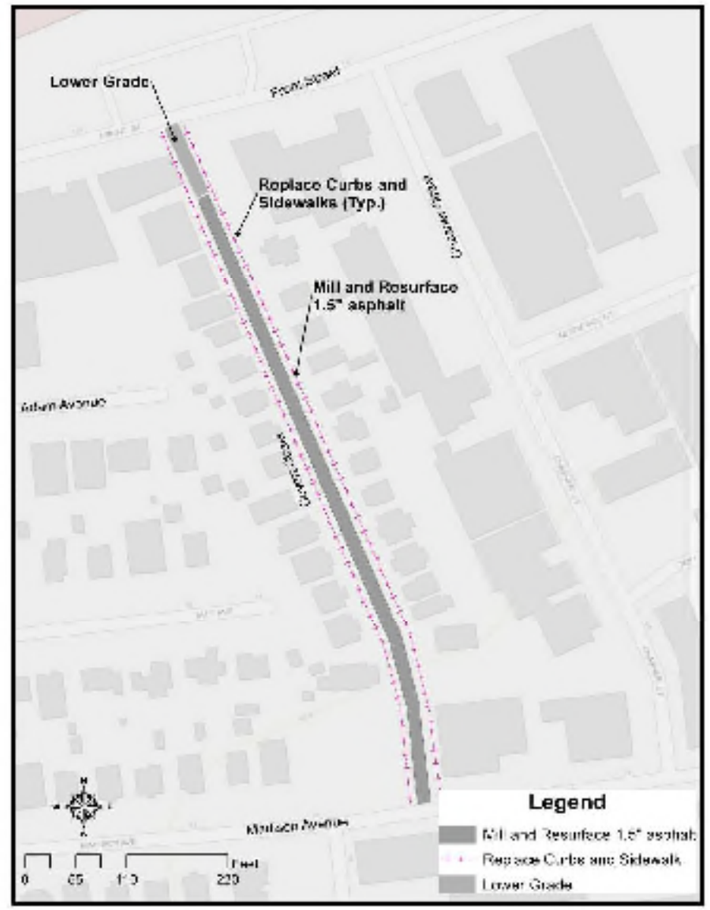
Cost Estimate	$200,000
Level of Protection, yr	10
Project Life, yr	25
Focus	Flood Defense
Problem Areas Addressed	22
Proposed Improvements Description	The elevated ridge at the entrance of Covert Street shall be lowered to allow sheetflow down Covert Street so that the stormwater drains south naturally. Replace curbs and sidewalks along the proposed improvement. Mill and resurface 1.5 inches of asphalt on the rest of the street for the proper drainage of sheetflow.

LWTB Objectives Met By Project

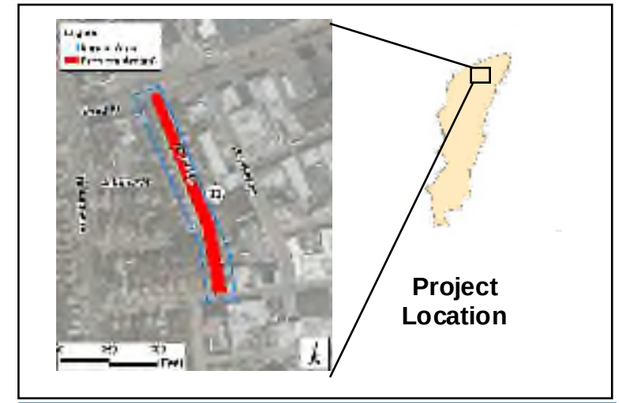
Increase Community Resiliency

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Existing View of Covert Street

Example Resurface Asphalt for Covert Street

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

PROJECT F

MALVERNE ST BIORETENTION GREEN STREETS PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuilt by Design

Site Location

SubWatershed	16
Street Address	Cornwell Ave., Sydney Ave., Nassau Ave., Nottingham Rd., Alnwick Rd., Rider Ave., Charles St., Parkview Pl., Gold Pl., N. King St., Atlas Ave., Lawrence Ave., Malverne Ave., Norwood Ave., Johnson Ave., Wagg Ave., Eimer Ave., William St., Roosevelt Ave., Morris Ave., Ogston Terr., Carrolton Pl., and Burton St., Malverne, NY
Longitude	-73.67
Latitude	40.68
Landowner	Village of Malverne
Existing Use	Street
O & M Responsibility	Village of Malverne
Low Moderate Income Area	N/A
Existing Site Description:	The existing project area includes five sites in The Village of Malverne that experience localized flooding caused by a lack of or undersized storm infrastructure and microtopography. The affected areas are near the intersections of Kenilworth St. and Nottingham Rd.; Eimer Ave. and Alnwick Rd.; Cornwell Ave. and N. King St.; and Sydney Ave. and Burton St.

Proposed Characteristics

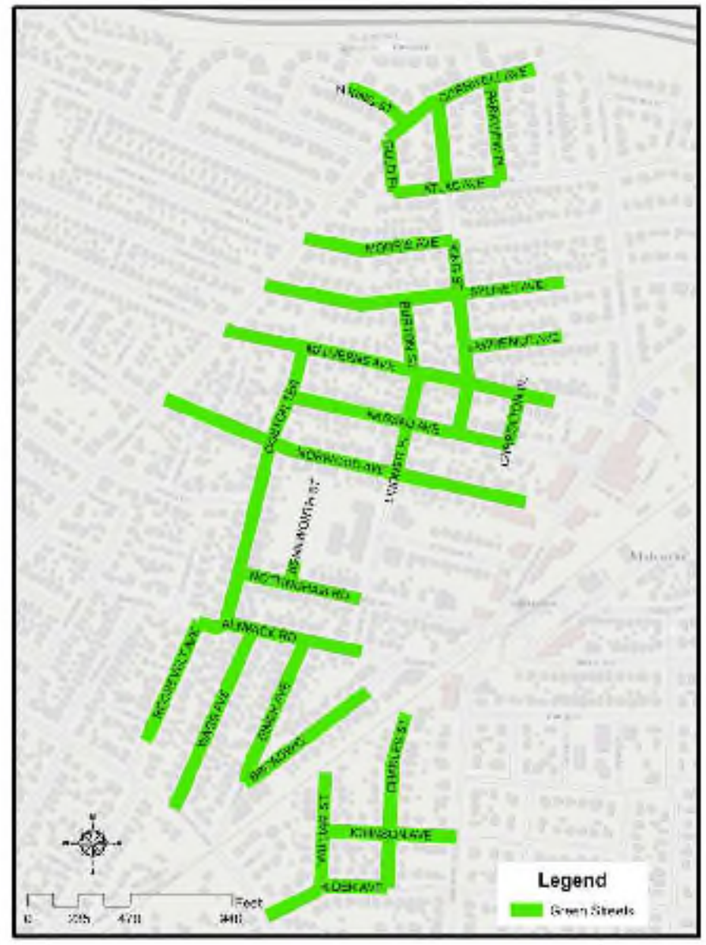
Cost Estimate	$5,400,000
Level of Protection, yr	0.3
Project Life, yr	30
Focus	Water Quality, Social Resiliency, Flood Defense
Problem Areas Addressed	74, 75, 76, 77, 78, 81, 82
Proposed Improvements Description	The proposed improvements include installation of green streets with incorporated bioretention area. Green streets are a linear network of distributed BMPs located in the street right-of-way that are designed to reduce runoff volume and improve water quality of the runoff both from the street and the adjacent parcels. 1.1 miles of street will be implemented with green streets for this project.

LWTB Objectives Met By Project

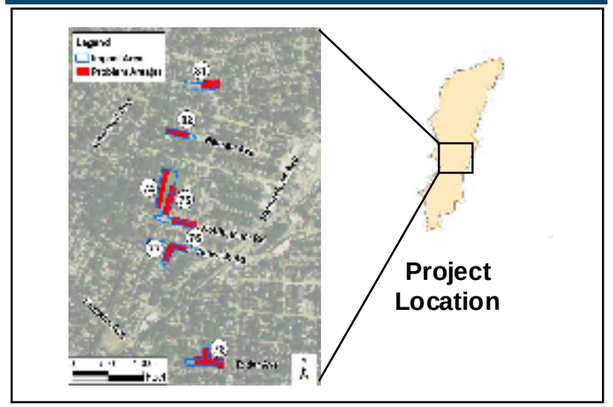
Increase Community Resiliency | Restore Environmental Health | Provide Educational Opportunities

DRAFT

PROPOSED IMPROVEMENTS

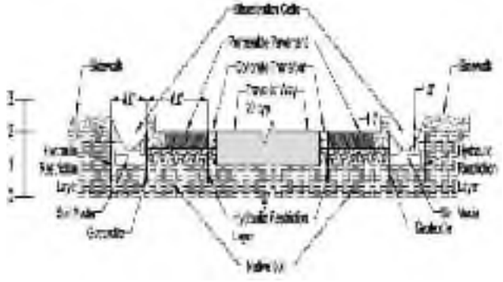


PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Typical Green Street Layout



Typical Green Street with Bioretention Cross-Section

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT FF
MILL RIVER STORM SURGE BARRIER PROJECT DESCRIPTION

Theme(s): **SPACE FOR THE RIVER**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	37
Street Address	N/A
Longitude	-73.66
Latitude	40.62
Landowner	Town of Hempstead, Nassau County, Private Landowners
Existing Use	Open Space
O & M Responsibility	Town of Hempstead, Nassau County
Low Moderate Income Area	N/A
Existing Site Description:	Storm and tidal surges caused by hurricanes and tropical storms bring water up the Mill River causing it to overflow its banks and cause flooding in the low lying adjacent areas.

Proposed Characteristics

Cost Estimate	$723,000,000
Level of Protection, yr	100
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	Multiple
Proposed Improvements Description	▪ The proposed improvements include a storm surge barrier spanning the width of the Mill River watershed. The barrier will run across the marshlands to the south. ▪ The barrier will have 1 large gate and multiple small gates at inlets to keep the inlets navigable in normal conditions, while providing the ability to seal the barrier in case of surge events. ▪ A rail gate will be installed at the railway tracks to continue the use of the track in normal conditions.

LWTB Objectives Met By Project

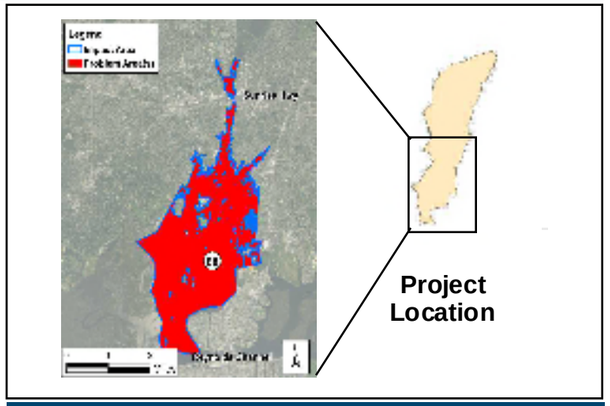
Increase Community Resiliency

Preserve Quality of Life

DRAFT

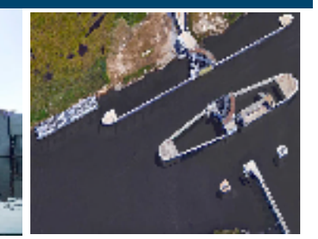
PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Example Open BB Flood Gate



Example Open Sector Gates

Example Closeup Sector Gates

Example Surge Barrier

Installation of a BB Flood Gate

Governor's Office of Storm Recovery

TETRA TECH

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

PROJECT GG

HENDRICKSON AVENUE PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	1
Street Address	37-99 Hendrickson Avenue, Hempstead, NY
Longitude	-73.61
Latitude	40.71
Landowner	Village of Hempstead
Existing Use	Street
O & M Responsibility	Village of Hempstead
Low Moderate Income Area	60% - 80%
Existing Site Description:	Hendrickson Avenue between Devon Road and Front Street floods during heavy rainfall events.

Proposed Characteristics

Cost Estimate	$400,000
Level of Protection, yr	0.3
Project Life, yr	30
Focus	Flood Defense, Water Quality
Problem Areas Addressed	8
Proposed Improvements Description	The proposed improvements include installation of 400 LF green infrastructure bioswales, 600 LF of pervious pavement on the east side of existing street. GI bioswales are vegetated channels that provide treatment and storage while moving stormwater from one place to other. Pervious pavements are proposed on the existing street to infiltrate and filter the stormwater runoff.

LWTB Objectives Met By Project

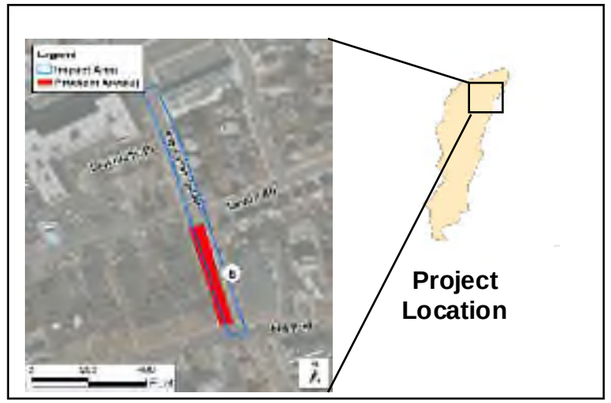
Increase Community Resiliency

Restore Environmental Health

DRAFT

PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Proposed Cross-Section on Hendrickson Avenue

Example Street with Pervious Pavement

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT H

MALVERNE HIGH SCHOOL PROJECT DESCRIPTION

Theme(s): SPACE FOR THE RIVER
BLUE-GREEN CORRIDOR

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	17
Street Address	80 Ocean Ave., Malverne, NY 11565
Longitude	-73.66
Latitude	40.68
Landowner	Malverne High School
Existing Use	Landscape Area
O & M Responsibility	Village of Malverne
Low Moderate Income Area	N/A
Existing Site Description:	The project area is at Malverne High School. There is a stream piped underneath the athletic fields that causes wet areas behind the high school. A yard waste site upstream of the school encroaches on the floodplain and significant impervious parking area runoff remains untreated before draining to the athletic fields. The ballfields on the southwest side of the school are constantly wet.

Proposed Characteristics

Cost Estimate	$2,800,000
Level of Protection, yr	1
Project Life, yr	30
Focus	Water Quality, Social Resiliency, Habitat Restoration
Problem Areas Addressed	71
Proposed Improvements Description	A stormwater wetland is proposed upstream of Malverne High School, at the corner of Ocean Avenue and Pinebrook Avenue. The wetland will restore floodplain functionality and provide stormwater runoff peak flow attenuation benefits, reducing moisture retention behind the high school and in the athletic fields, as well as water quality benefits downstream. The wetland would function as a living laboratory for the school.

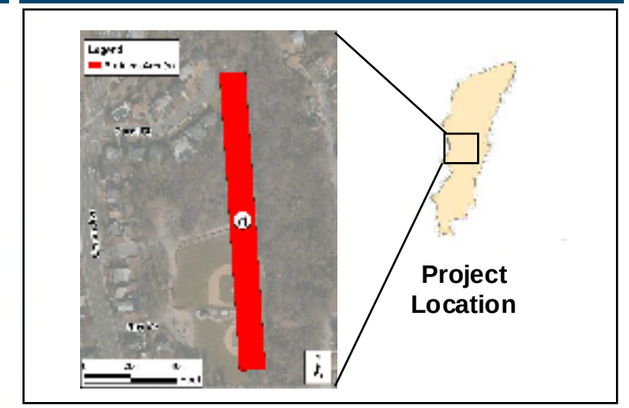
LWTB Objectives Met By Project

Increase Community Resiliency | Restore Environmental Health | Provide Educational Opportunities

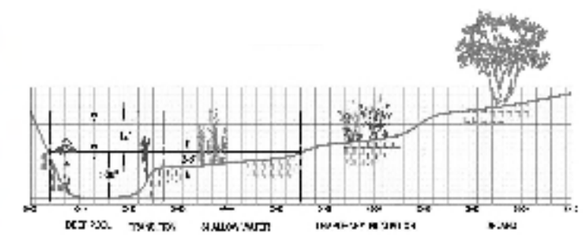
DRAFT

PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA



SAMPLE PHOTOS



Typical Wetland Cross-Section

Example Wetland

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT HH
NICHOLS COURT STORMWATER BUMP-OUTS PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	1
Street Address	115-198 Nichols Court, Hempstead, NY 11550
Longitude	-73.62
Latitude	40.71
Landowner	Village of Hempstead
Existing Use	Street
O & M Responsibility	Village of Hempstead
Low Moderate Income Area	>80%
Existing Site Description:	The intersection at Nichols Court and Washington Street in Hempstead, NY experiences localized flooding due to inadequate collection, poor conveyance, and microtopography. A portion of the intersection drains away from the intended drainage path, towards an area with no nearby inlets.

Proposed Characteristics

Cost Estimate	$170,000
Level of Protection, yr	0.7
Project Life, yr	30
Focus	Water Quality, Social Resiliency
Problem Areas Addressed	11
Proposed Improvements Description	Bioretention bump-outs are proposed along the northern and southern edges of Nichols Court, adjacent to the Hempstead Public Library and Christ's First Presbyterian Church, respectively. The bioretention areas will capture and treat excess stormwater from the intersection, which will then infiltrate into and through the subsurface soil.

LWTB Objectives Met By Project

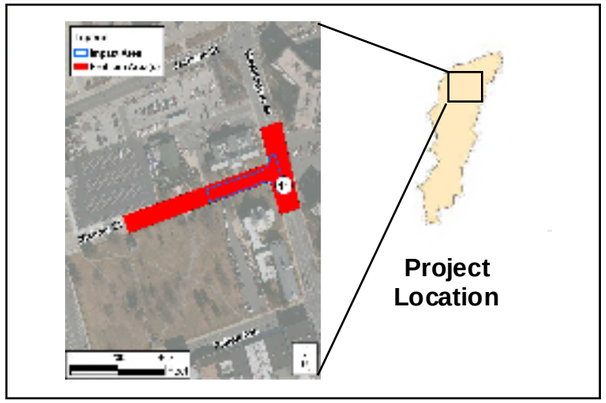
Increase Community Resiliency

Restore Environmental Health

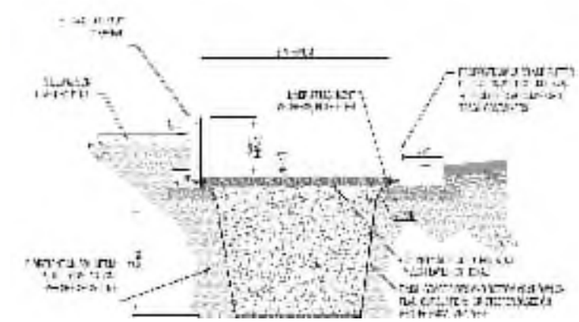
DRAFT

PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS



Typical Bioretention Bump-Out Cross-Section

Example Bioretention Bump-Out

Example Bioretention Bump-Out

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT I
LAKEVIEW AVENUE PROJECT DESCRIPTION

Theme(s): **N/A**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	17
Street Address	4 Ocean Avenue, Lynbrook, NY
Longitude	-73.66
Latitude	40.67
Landowner	Nassau County, Village of Lynbrook
Existing Use	Open Space
O & M Responsibility	Village of Lynbrook
Low Moderate Income Area	N/A
Existing Site Description:	The existing site is a sports field with no lighting and no restroom facilities and is located adjacent to Tanglewood Preserve that has recreational amenities such as a pond for fishing and a nature center offering educational activities and exhibits.

Proposed Characteristics

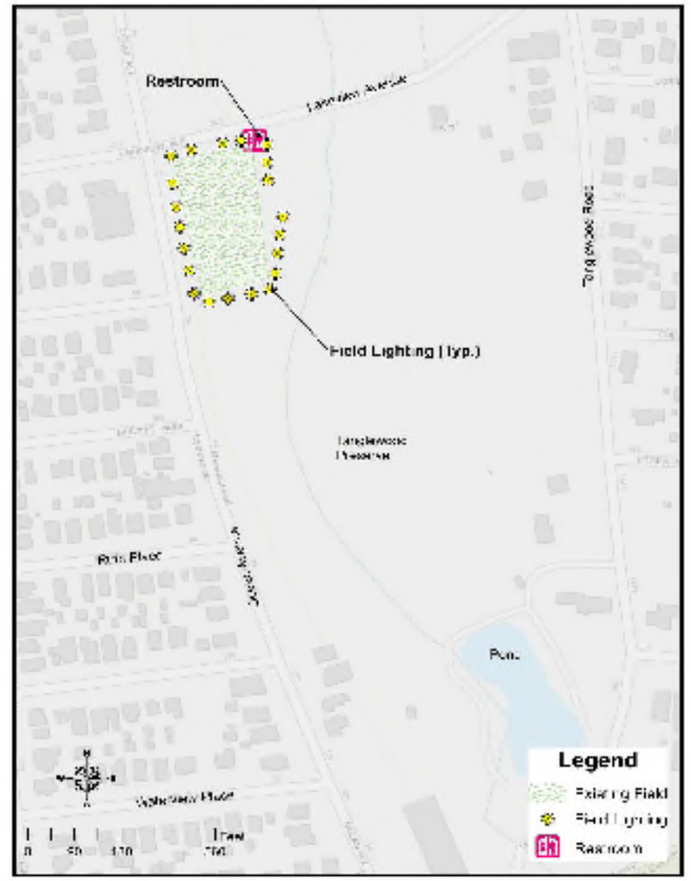
Cost Estimate	$400,000
Level of Protection, yr	N/A
Project Life, yr	50
Focus	Social Resiliency
Problem Areas Addressed	69
Proposed Improvements Description	Installation of restroom and lighting around the sports field to provide public access and recreation activities, thereby improving the quality of life for the community.

LWTB Objectives Met By Project

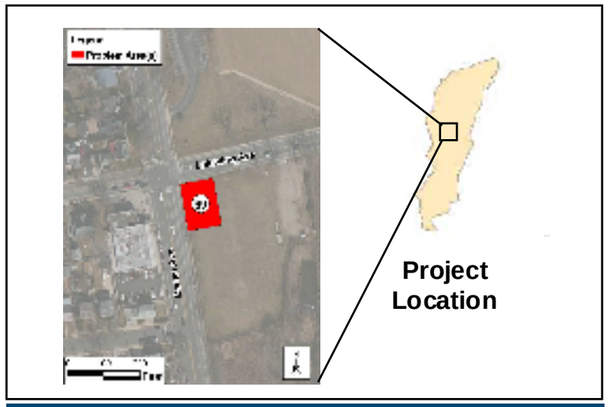
Preserve Quality of Life

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA



SAMPLE PHOTOS

Example Rest Stop

Example Field Lighting

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT II
COOPER SQUARE UNDERGROUND DETENTION PROJECT DESCRIPTION

Theme(s): **WATER STORAGE**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	1
Street Address	Cooper Square, Hempstead, NY 11550
Longitude	-73.62
Latitude	40.71
Landowner	Village of Hempstead
Existing Use	Street
O & M Responsibility	Village of Hempstead
Low Moderate Income Area	60% - 80%
Existing Site Description:	A highly impervious drainage area combined with inadequate collection infrastructure and poor conveyance infrastructure causes localized flooding at the downstream end of Cooper Square in Hempstead, NY. A number of dry wells appear to have been installed to alleviate the problem, but flooding still occurs.

Proposed Characteristics

Cost Estimate	$2,100,000
Level of Protection, yr	2
Project Life, yr	30
Focus	Water Quality, Flood Defense
Problem Areas Addressed	14
Proposed Improvements Description	A subsurface retention basin is proposed underneath the parking lot along Cooper Square North, adjacent and to the north of a multistory parking deck. The basin will be used to mitigate stormwater runoff volume and peak flows from the highly impervious drainage area upstream of Cooper Square to alleviate flooding in the problem areas.

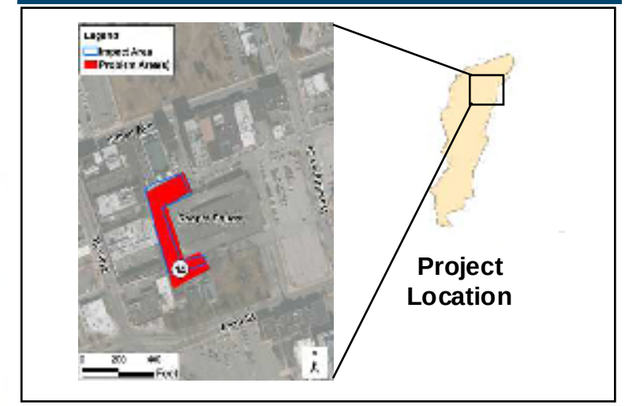
LWTB Objectives Met By Project

Increase Community Resiliency

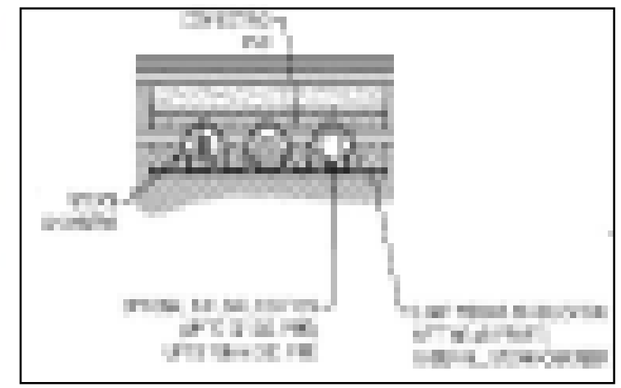
Restore Environmental Health

DRAFT

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS



Typical Subsurface Retention cross-section

Construction of Subsurface Retention

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT J

LYNBROOK RECHARGE BASIN PROJECT DESCRIPTION

Theme(s): **WATER STORAGE**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	19, 26
Street Address	118 Oak St, Lynbrook, NY
Longitude	-73.66
Latitude	40.66
Landowner	Village of Lynbrook
Existing Use	Street
O & M Responsibility	Village of Lynbrook
Low Moderate Income Area	N/A
Existing Site Description:	The existing site is in the right of way between Oak Street and Buckingham Place in The Village of Lynbrook. Localized flooding is ocurring on Buckingham Place caused by lack of or undersized storm drainage infrastructure and flat microtopography.

Proposed Characteristics

Cost Estimate	$140,000
Level of Protection, yr	0.2
Project Life, yr	30
Focus	Flood Defense, Water Quality
Problem Areas Addressed	37
Proposed Improvements Description	The proposed improvement include construction of new open recharge basin to capture the runoff and alleviate flooding for 0.2 year storm event for Buckingham place. The recharge basin is located at the north east corner of Buckingham Pl. and Oak St. and pops off into existing drianage system after maximum storage. This project helps to reduce runoff and improve water quality for the runoff collected from upstream drainage area.

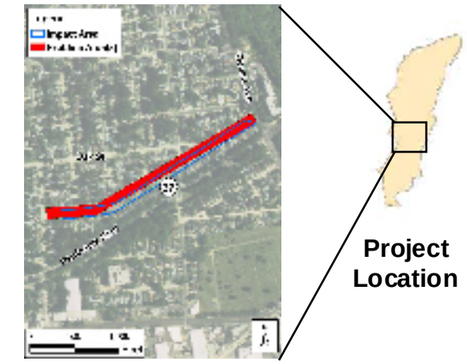
LWTB Objectives Met By Project

Increase Community Resiliency

DRAFT

PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Existing Street View at Buckingham Pl and Oak St.

Example Open Recharge Basin

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT K
PENINSULA BOULEVARD GREENWAY PROJECT DESCRIPTION

Theme(s): **BLUE-GREEN CORRIDOR**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	19, 26
Street Address	Peninsula Blvd., Lynbrook, NY
Longitude	-73.66
Latitude	40.66
Landowner	Nassau County, Village of Lynbrook
Existing Use	Landscape Area, Sidewalk
O & M Responsibility	Nassau County
Low Moderate Income Area	N/A
Existing Site Description:	Peninsula Boulevard located in Village of Lynbrook has an existing 60 ft Right of Way with narrow pathway used for walking.

Proposed Characteristics

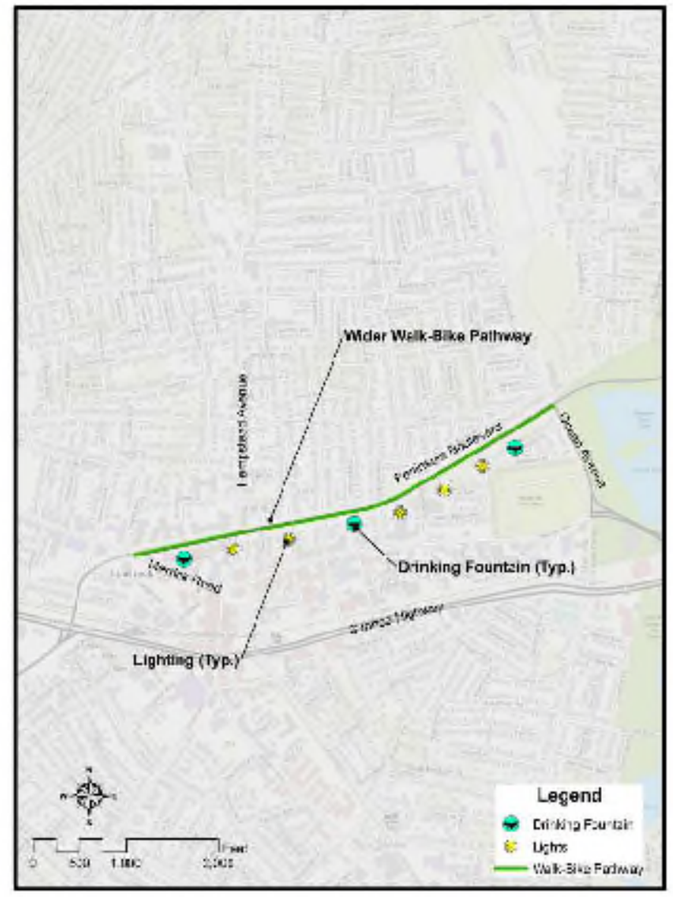
Cost Estimate	$300,000
Level of Protection, yr	N/A
Project Life, yr	25
Focus	Social Resiliency
Problem Areas Addressed	70
Proposed Improvements Description	Replacing existing asphalt path with wider pathway, lighting, drinking fountains, and landscaping between Ocean Avenue and Merrick Road will improve recreational and health benefits for the community.

LWTB Objectives Met By Project

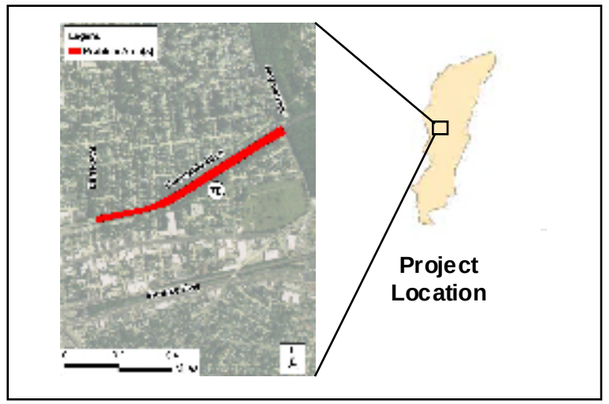
Preserve Quality of Life

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA



SAMPLE PHOTOS

Existing Peninsula Boulevard

Example Walk-Bike Pathway

Rendering Walk-Bike Pathway

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT KK
SOUTHERN STATE PARKWAY RAMP PROJECT DESCRIPTION

Theme(s): **N/A**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	10
Street Address	Southern State Parkway & Carolina Avenue, Hempstead, NY
Longitude	-73.63
Latitude	40.69
Landowner	NYSDOT
Existing Use	Street
O & M Responsibility	NYSDOT
Low Moderate Income Area	40% - 60%
Existing Site Description:	The Southern State Parkway westbound off ramp to Peninsula Boulevard has an existing inlet and has minor flooding. Due to missing or collapsed catch basin inlet, minor flooding occurs on the road.

Proposed Characteristics

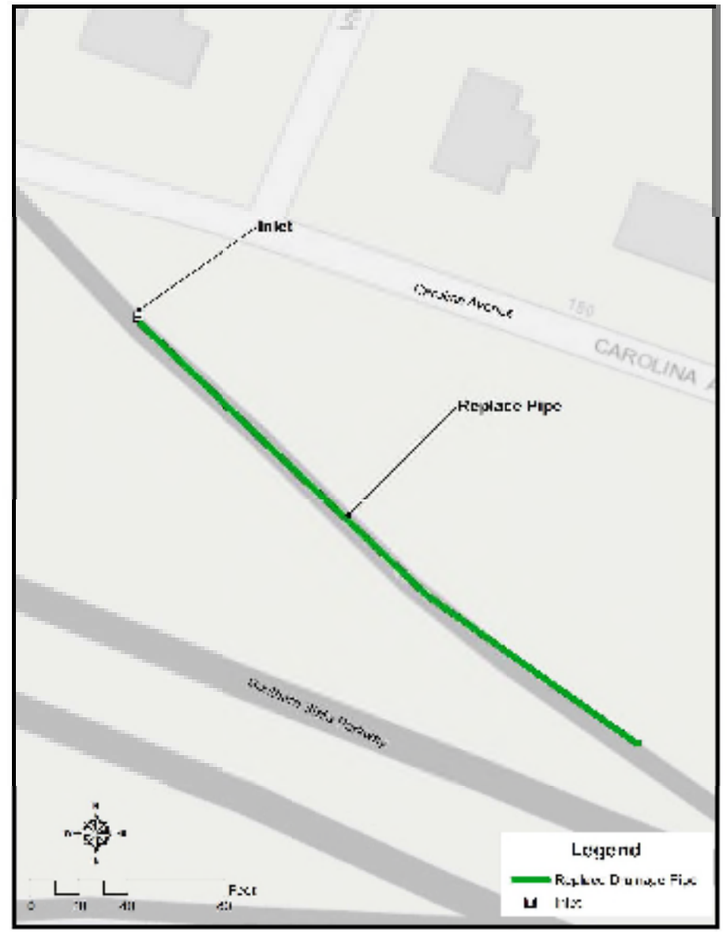
Cost Estimate	$500,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	91
Proposed Improvements Description	Add a new inlet and new pipe to improve the collection system for proper drainage and prevent flooding during heavy rainfall events.

LWTB Objectives Met By Project

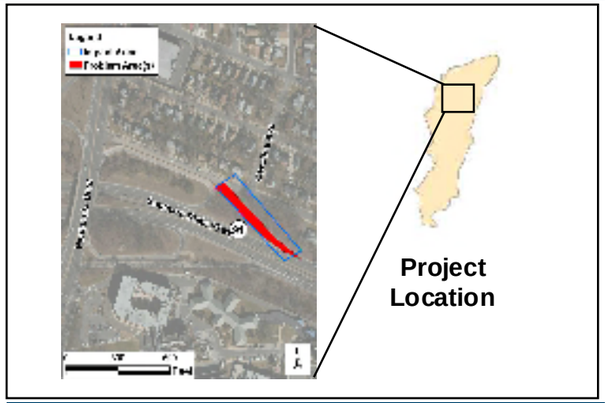
Increase Community Resiliency

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Existing Southern State Parkway Off Ramp

Example Installation of Storm Pipe

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT L
SMITH POND PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	19
Street Address	Smith Pond, Rockville Centre, NY
Longitude	-73.65
Latitude	40.66
Landowner	Village of Rockville Centre
Existing Use	Open Water, Park Space
O & M Responsibility	Nassau County (Weir), Village of Rockville Centre (Smith Pond)
Low Moderate Income Area	60% - 80%
Existing Site Description:	The Smith Pond is the confluence point of the two primary drainage branches (Pines Brook and Mill River). The Pond also connects upstream freshwater system to the downstream tidal and salt water system. The Pond collects flow and nutrient loads for the entire watershed. The Pond's high nutrient loads, silt, sedimentation, and excessive weed growth affect aquatic life support and recreational uses.

Proposed Characteristics

Cost Estimate	$4,900,000
Level of Protection, yr	100
Project Life, yr	50
Focus	Flood Defense, Water Quality, Habitat Restoration, Social Resiliency
Problem Areas Addressed	32
Proposed Improvements Description	Dredging approximately 33,000 cubic yards from the pond bottom at average dredge depths of 12 -24 inches helps to increase water depths and attain more volume for storage attenuation and creates an opportunity to eliminate invasive plant growth. Replacing weir and installing a fish ladder passage improves the pond habitat for fish. Blue/Green pathway is proposed on the east of Smith Pond along the shoreline and starts at existing parking lot and continues around the pond with a new overlook on north. The pathway creates public access and improves community recreation activities. A new access drive is proposed to access Smith Pond spillway in order for the spillway to be maintained.

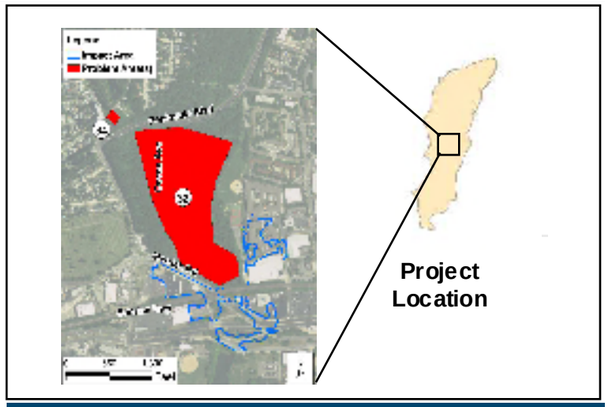
LWTB Objectives Met By Project

Increase Community Resiliency
Create and Improve Public Waterfront Access
Restore Environmental Health

DRAFT

PROPOSED IMPROVEMENTS

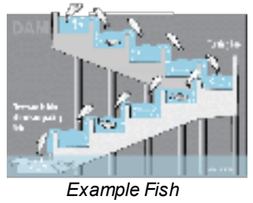
PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Existing Smith Pond Weir

Example Pond Overlook



Example Fish Ladder Mechanism

Example Fish Ladder for Smith Pond

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT LL
HALLS POND PROJECT DESCRIPTION

Theme(s): **N/A**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	5
Street Address	671 Nassau Blvd., West Hempstead, NY
Longitude	-73.66
Latitude	40.68
Landowner	Nassau County
Existing Use	Open Water
O & M Responsibility	Nassau County
Low Moderate Income Area	N/A
Existing Site Description:	The 5.5 acre Halls Pond is located on the north west corner of Nassau Blvd and Hempstead Avenue in West Hempstead. During heavy rainfall events the pond overtops and floods adjacent homes and overtops Hempstead Avenue. The pond is controlled by a weir and followed by a 2-barrel 4x10 box culvert under Hempstead Avenue. One barrel is currently blocked and restricts the increased impervious runoff from upstream. This causes flooding within the pond proximity and overtops Hempstead Avenue and floods nearby businesses downstream.

Proposed Characteristics

Cost Estimate	$200,000
Level of Protection, yr	25
Project Life, yr	50
Focus	Flood Defense, Water Quality
Problem Areas Addressed	83
Proposed Improvements Description	A detailed study needs to be done to evaluate the alternatives to alleviate the flooding at Halls Pond. The options to be considered will be lowering the weir to a certain percentage and determination of height of the box culvert to be opened to alleviate the flooding upstream and accounting for downstream conditions.

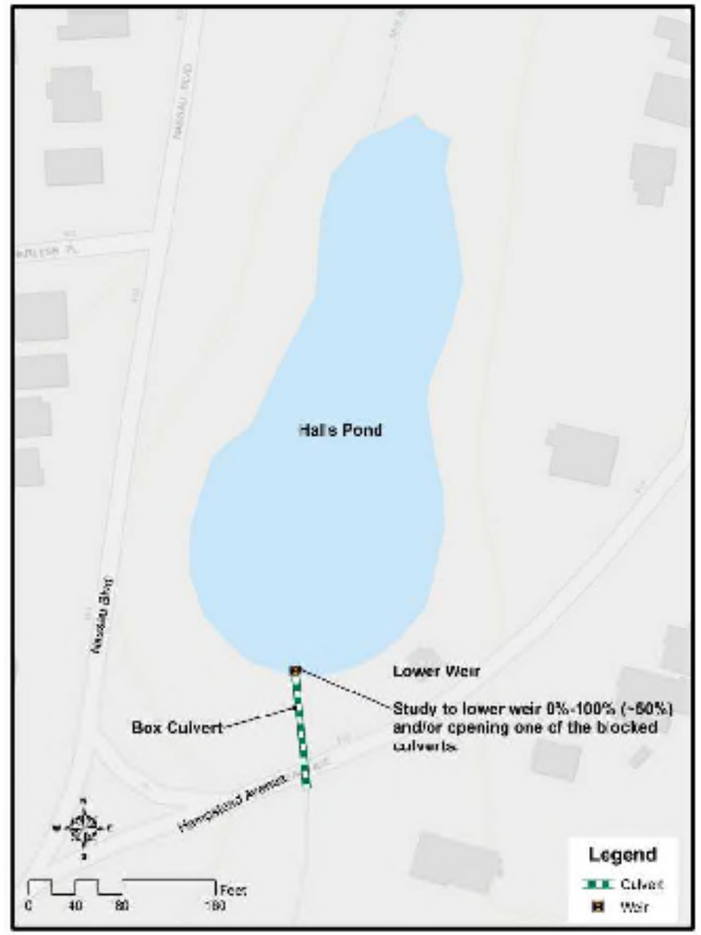
LWTB Objectives Met By Project

Increase Community Resiliency

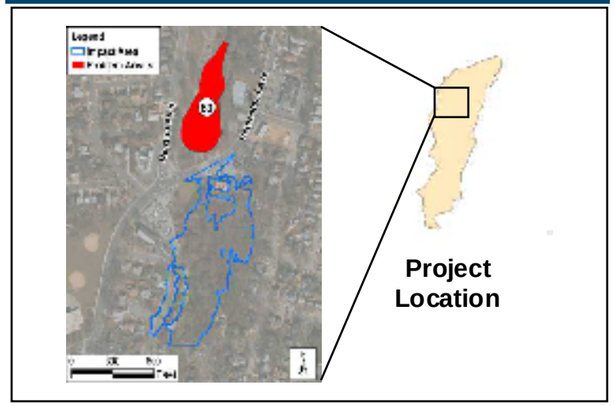
Restore Environmental Health

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA



SAMPLE PHOTOS

Existing Halls Pond View

Existing Weir and Blocked Box Culvert at Halls Pond

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT M

EAST ROCKAWAY HIGH SCHOOL/LISTER PARK PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE
SPACE FOR THE RIVER
BLUE-GREEN CORRIDOR

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	22, 23, 40
Street Address	443 Ocean Ave, East Rockaway, NY
Longitude	-73.66
Latitude	40.65
Landowner	Town of Hempstead, East Rockaway, Rockville Centre, ERSD
Existing Use	Open Space, Parking Lot, Shoreline, Street
O & M Responsibility	East Rockaway (River Ave.), ERSD (School), Town of Hempstead (Waterview Rd.), ToH Waterways & Conservation (Living Shoreline), Rockville Centre (Parks)
Low Moderate Income Area	40% - 60%
Existing Site Description:	East Rockaway High School is affected by shoreline erosion, tailwater flooding, and Superstorm Sandy flood damage. The bleachers, two story storage, and press box at the sports field are on the verge of falling into the Mill River due to ongoing shoreline erosion. Lister Park's parking lot and the intersection of River Avenue and Waterview Road flood due to tidal and storm surge influences. Areas along the Mill River banks experience shoreline erosion due to high river velocities and tides. Several residential properties along Mill River are affected by Superstorm Sandy inundation.

Proposed Characteristics

Cost Estimate	$7,200,000
Level of Protection, yr	100
Project Life, yr	50
Focus	Flood Defense, Water Quality, Habitat Restoration, Social Resiliency
Problem Areas Addressed	33, 34, 39, 43, 53, 68
Proposed Improvements Description	Approximately 1800 LF of bulkhead improvements and installing six (6) - backflow prevention devices to protect the school's parking lots and sports field from storm surge and tidal flooding. Living shoreline improvements to mitigate shoreline erosion and enhance habitat restoration and creation. A proposed Blue-Green Corridor multi-use pathway with a pedestrian bridge to bring communities on west bank of the Mill River to the waterfront and to protect 34 homes flooded during Sandy. Raising the bulkhead to the same elevation as adjacent properties and installing check valves protects the River Ave and Waterview Road intersection from tidal flooding. The runoff from the parking lots of Lister Park, Centennial Park and Tighe Field will be treated and reduced by Green Infrastructure Bioswales. Install self-regulating tide gates to protect the wetland behind ERHS from tidal flooding.

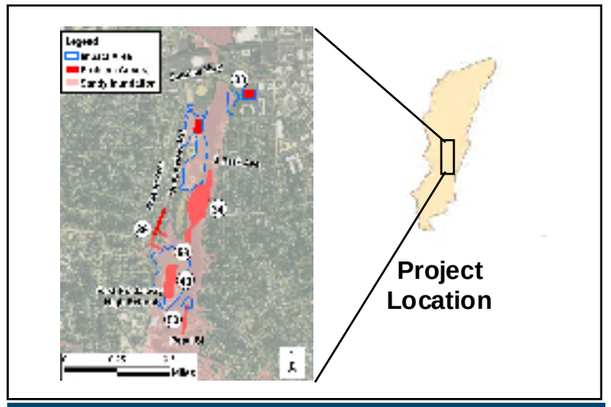
LWTB Objectives Met By Project

Increase Community Resilience | Preserve Quality of Life | Provide Educational Opportunities | Create and Improve Public Waterfront Access | Restore Environmental Health

DRAFT

PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Example Pathway Berm for Flood Protection

Example Sports Field

Example Bulkheads

Governor's Office of Storm Recovery

TETRA TECH

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

PROJECT MM
BLUE GREEN PATHWAY PROJECT DESCRIPTION

Theme(s): **BLUE-GREEN CORRIDOR**

Living with the Bay

Site Location

SubWatershed	1, 17, 19, 29, 31, 32, 37, 40
Street Address	Hempstead, Malverne, Rockville Centre, Bay Park
Longitude	-73.65
Latitude	40.66
Landowner	Village of Hempstead, Rockville Centre, Town of Hempstead, Malverne
Existing Use	Shoreline, Street, Pathway
O & M Responsibility	Village of Hempstead, Rockville Centre, Town of Hempstead, Malverne
Low Moderate Income Area	Percentage per Pathway Section from N to S (>80%, 60% - 80%, 40% - 60%)
Existing Site Description:	The overall area along Mill River in Nassau County is ideal for biking, walking, and boating but the existing pathway or routes towards or along the river are discontinuous or concentrated within an area. Much of the river's edge has been privatized and the public places that remain are disconnected from pathway network. The riverbanks have degraded as a result of lack of visibility and connectivity. More transportation with automobiles has evolved than by foot, boat or bicycle. Some issues in the Mill River area are dangerous road crossings for pedestrians and bicycles, lack of public access continuous walking and bicycle paths, reduction in use of public parks and play grounds, poor public access to waterways, and loss of natural resources.

Proposed Characteristics

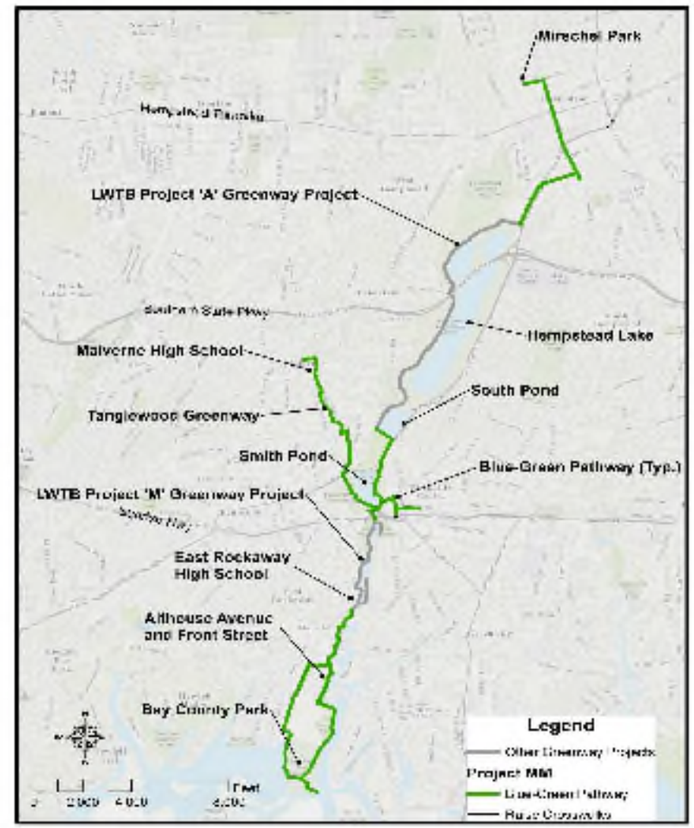
Cost Estimate	$7,350,000
Level of Protection, yr	N/A
Project Life, yr	25
Focus	Social Resiliency
Problem Areas Addressed	97
Proposed Improvements Description	Construct a new multi-use blue green pavement pathway, typically 10 feet wide with bioswales, to connect existing pathways along Mill River. The proposed pathway beings at Mirschel Park, Hempstead and connects South Pond to Smith Pond through Tanglewood Greenway, and connects Smith Pond to Living with the Bay Greenway Project along Mill River, and continues from East Rockaway High School, splitting into two branches at Althouse Ave and Front St. which together complete a loop around Bay County Park, and extends towards Malverne High School on the west. Improving public accesibility to Mill River will increase safety, ecological value, and recreational opportunities from communties around the river.

LWTB Objectives Met By Project

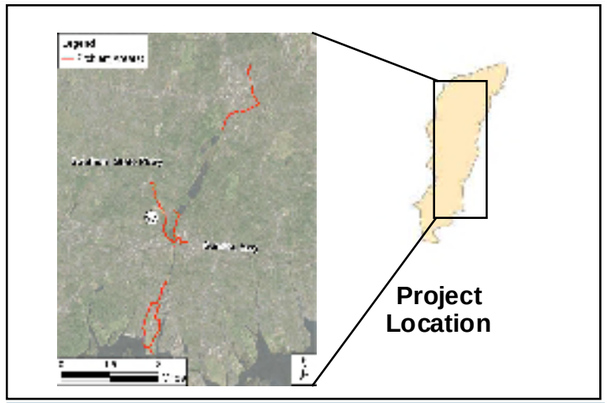
Increase Community Resiliency | Preserve Quality of Life | Provide Educational Opportunities

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA



SAMPLE PHOTOS

Example Pathway

Example Pathway Along Street

Example Pathway Education Sign

Example Pathway

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT N
FOREST AVENUE PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	26
Street Address	174-210 Forest Ave, Lynbrook, NY
Longitude	-73.67
Latitude	40.65
Landowner	Village of Lynbrook
Existing Use	Street
O & M Responsibility	Village of Lynbrook
Low Moderate Income Area	N/A
Existing Site Description:	The area along Forest Avenue between Sunrise Highway and Howard Place floods during heavy rainfall as it is located in a landlocked basin.

Proposed Characteristics

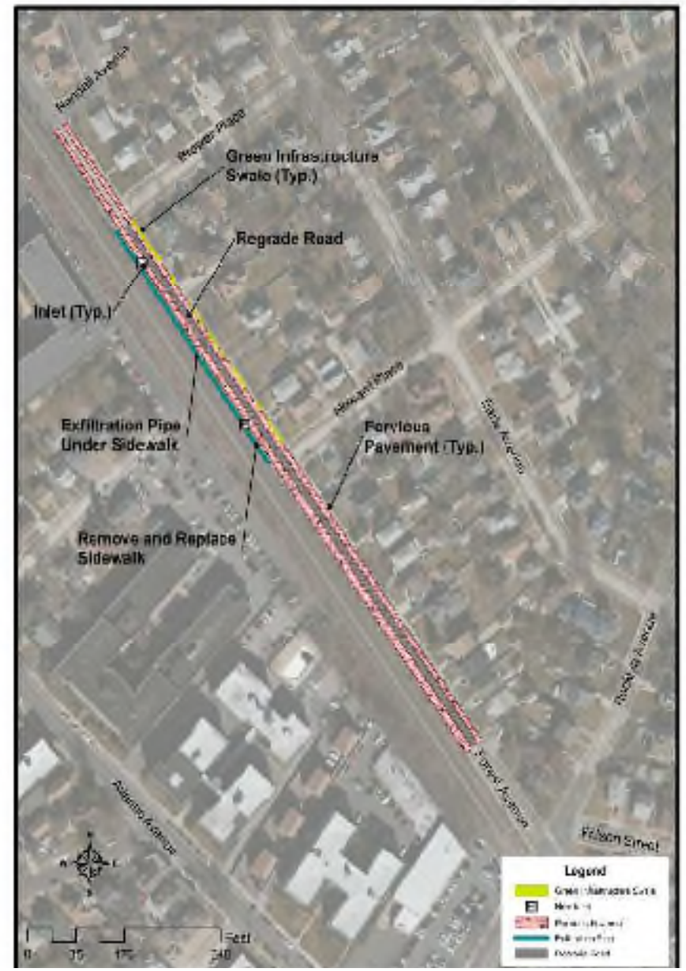
Cost Estimate	$1,000,000
Level of Protection, yr	0.5
Project Life, yr	30
Focus	Flood Defense, Water Quality
Problem Areas Addressed	38
Proposed Improvements Description	The proposed improvements include installation of 300 LF green infrastructure bioswales, 1300 LF of pervious pavement and 450 LF of exfiltration pipe. GI bioswales are vegetated channels that provide treatment and storage while moving stormwater from one place to other. Pervious pavements are proposed on the existing street to infiltrate and filter the stormwater runoff. Exfiltration pipe is proposed under sidewalk to provide additional storage and alleviate flooding from the landlocked basin. Regrade the road to provide positive slope and outfall towards Rocklyn Ave during the construction of street to allow stormwater to drain properly.

LWTB Objectives Met By Project

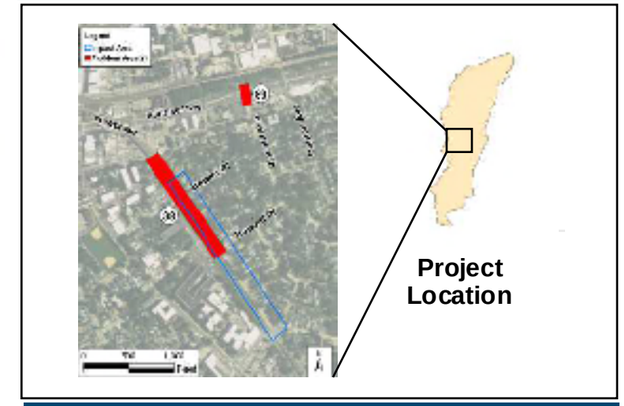
Increase Community Resiliency

Restore Environmental Health

DRAFT



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Flooding During Heavy Rainfall on Forest Avenue

Example Forest Ave Proposed Cross Section

Example Street with Pervious Pavement

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT OO
WALDO AVENUE PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	41
Street Address	36-42 Waldo Avenue, East Rockaway, NY
Longitude	-73.66
Latitude	40.64
Landowner	Village of East Rockaway
Existing Use	Street
O & M Responsibility	Village of East Rockaway
Low Moderate Income Area	N/A
Existing Site Description:	Stormwater backs up into the existing drainage system and floods the north end of Waldo Avenue and Maxwell Street intersection due to driving hydraulic head from Atlantic Avenue. A basement of a home floods frequently during heavy rainfall events because of its low-lying elevation.

Proposed Characteristics

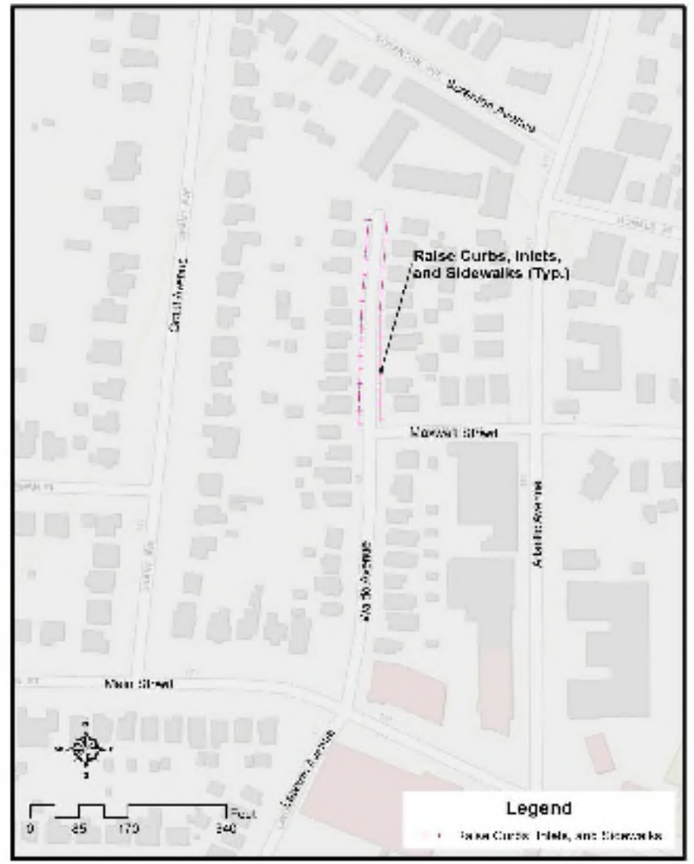
Cost Estimate	$100,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	41, 42
Proposed Improvements Description	To protect the basement flooding and allow stormwater to drain into Atlantic Ave drainage system raise sidewalks, curbs, and inlets to increase the head difference to drain the stormwater towards Atlantic Avenue.

LWTB Objectives Met By Project

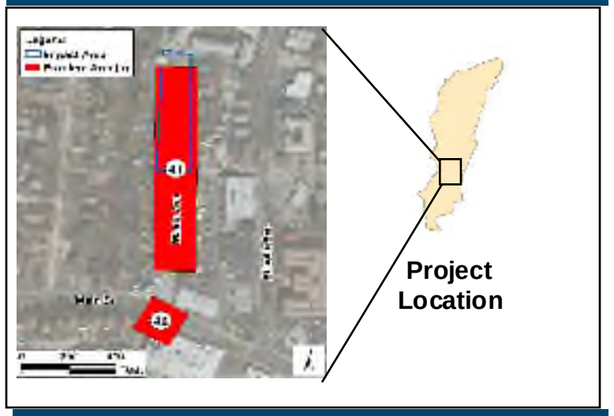
Increase Community Resiliency

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Example Waldo Ave and Maxwell St Intersection

Example Raised Sidewalk for Waldo Avenue

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT P
EAST BOULEVARD AND WEST BOULEVARD PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

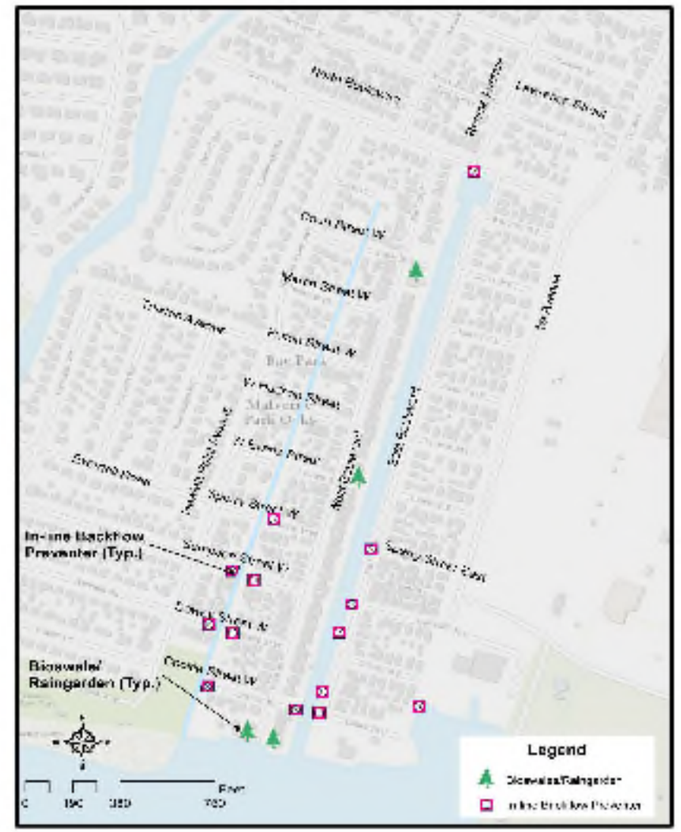
Site Location

SubWatershed	32
Street Address	104-106 West Blvd., East Rockaway, NY.
Longitude	-73.67
Latitude	40.63
Landowner	Town of Hempstead
Existing Use	Street
O & M Responsibility	Town of Hempstead
Low Moderate Income Area	N/A
Existing Site Description:	West Blvd., East Blvd., and cross streets of East Blvd., West Blvd., and Hewlett Point Ave. frequently flood due to tidal backup. The drainage systems in Sperry, Dewey, Sampson, Martin, and Fulton Streets are inadequately designed to convey stormwater for a 10-yr event. Most of the outfalls on West Blvd. are subject to water quality issues and Bay Park Area is subjected to public safety access issues from the tidal and storm surge.

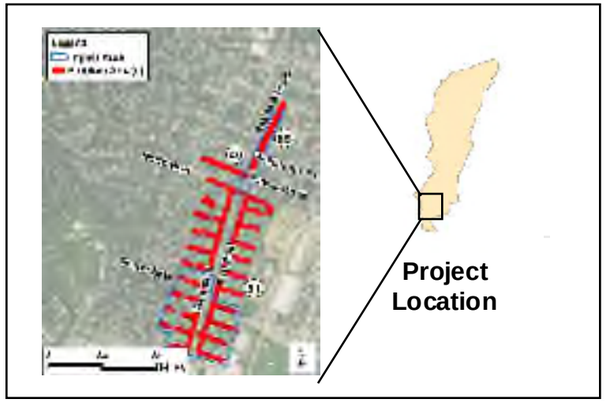
Proposed Characteristics

Cost Estimate	$1,600,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	49, 51, 85
Proposed Improvements Description	Install green infrastructure bioswales at end of West Blvd., East Evans St., and East Court St. to improve water quality and mitigate flooding. Install 14 in-line backflow preventers in outfall structures south of Sperry St. on W. Blvd., E. Blvd., Hewlett Point Ave., and Rhame Ave. to prevent tidal water from entering drainage system.

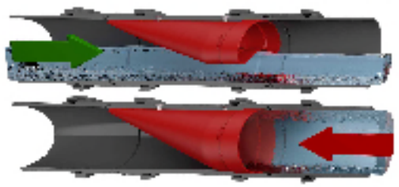
PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS



There are a variety of backflow prevention valves available intended to allow water to flow to open water but preventing tidal water from surcharging the system

Increase Community Resiliency
Improve Environmental Health

DRAFT

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT Q
WILLIAMSON STREET PROJECT DESCRIPTION

Theme(s): **N/A**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	31
Street Address	70-84 Williamson Street, East Rockaway, NY
Longitude	-73.66
Latitude	40.64
Landowner	Village of East Rockaway, Town of Hempstead
Existing Use	Street
O & M Responsibility	Village of East Rockaway (W. of 6th Ave), Town of Hempstead (E. of 6th Ave)
Low Moderate Income Area	40% - 60%
Existing Site Description:	The low points along Williamson Street and adjacent streets flood during high tides, especially during moon tides when the high tailwater condition fills up the stormwater pipes.

Proposed Characteristics

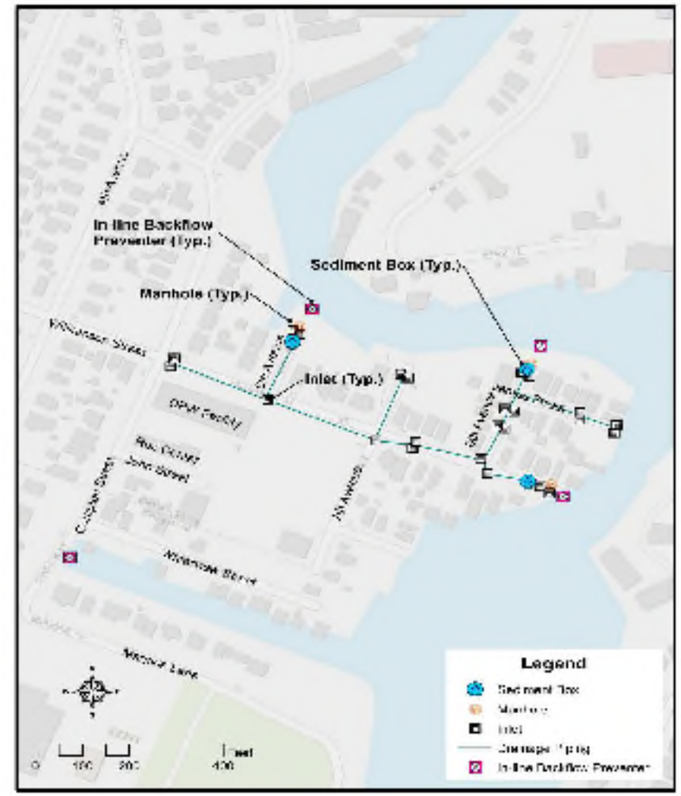
Cost Estimate	$1,000,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	47, 48, 50
Proposed Improvements Description	Install in-line backflow preventers with sediment basins at 6th Avenue and James Street. Combine existing drainage system at 7th Avenue, James Street, and Williamson Street to reduce the risk of allowing tidal backup and lower the cost to install separate check valves. Install in-line backflow preventer at Compton Street. The in-line backflow preventer will prevent tidal water from backing up into the existing drainage system. Floodproofing of DPW facilities will be addressed by the Community Reconstruction program.

LWTB Objectives Met By Project

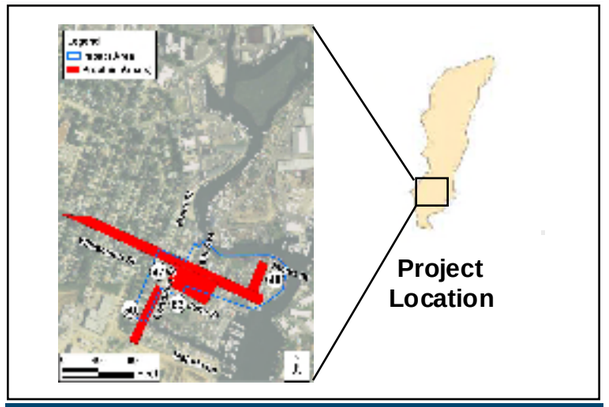
Increase Community Resiliency

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

There are a variety of backflow prevention valves available intended to allow water to flow to open water but preventing tidal surge from surcharging the system

Governor's Office of Storm Recovery

Note: Characteristics are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT R
BAY COUNTY PARK PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay

Site Location

SubWatershed	31
Street Address	2 Marjorie Lane, East Rockaway, NY
Longitude	-73.66
Latitude	40.63
Landowner	Nassau County
Existing Use	Park
O & M Responsibility	Nassau County DPW
Low Moderate Income Area	N/A
Existing Site Description:	The boat ramp parking lot at Bay County Park floods frequently during tidal conditions as the tidal water enters the drainage system.

Proposed Characteristics

Cost Estimate	$570,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense, Water Quality
Problem Areas Addressed	52
Proposed Improvements Description	Install four (4) check valves at the outfalls of parking lot drainage system to prevent tidal water from entering the drainage pipes and install green infrastructure for treatment of stormwater runoff from the boat ramp parking lot.

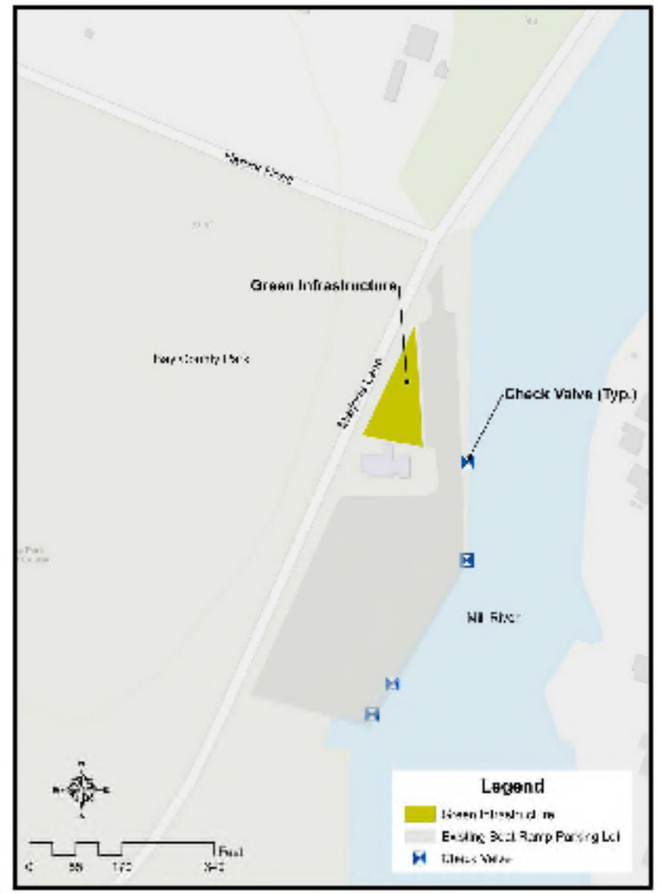
LWTB Objectives Met By Project

Increase Community Resiliency

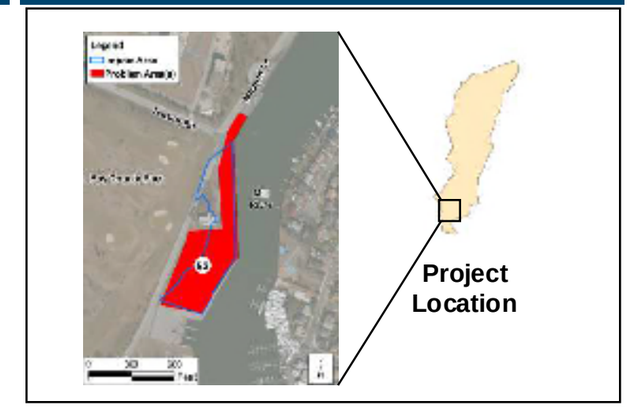
Restore Environmental Health

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Example Bioswale Green Infrastructure for Parking Lot

Example Check Valve for Parking Lot

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT S
EAST ROCKAWAY LONG ISLAND RAILROAD STATION PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	29
Street Address	1-31 Ocean Ave, East Rockaway, NY
Longitude	-73.66
Latitude	40.64
Landowner	Town of Hempstead, Village of East Rockaway
Existing Use	Parking Lot
O & M Responsibility	Town of Hempstead (SE parking lot), Village of East Rockaway (NE parking lot)
Low Moderate Income Area	N/A
Existing Site Description:	The parking lots located at the southeast and northwest corner of Ocean Avenue and Long Island Railroad (LIRR) intersection at East Rockaway LIRR station frequently floods during high tide conditions.

Proposed Characteristics

Cost Estimate	$600,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense, Water Quality
Problem Areas Addressed	44
Proposed Improvements Description	Install three (3) check valves on parking lot outfalls to prevent tidal waters from entering the drainage systems. Install green infrastructure bioswales for treatment and storage of stormwater before discharging into the Mill River on the parking lots.

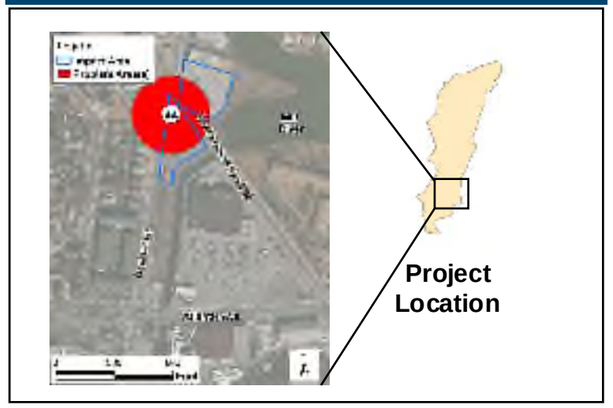
LWTB Objectives Met By Project

Increase Community Resiliency
Restore Environmental Health
Preserve Quality of Life

DRAFT

PROPOSED IMPROVEMENTS

PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Example Bioswale Green Infrastructure Project for LIRR Parking Lot

Example Check Valve for LIRR Parking Lot

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT T
LAWSON BOULEVARD PROJECT DESCRIPTION

Theme(s): **WATER STORAGE**

Living with the Bay

Site Location

SubWatershed	35, 34
Street Address	3057 Lawson Blvd, Oceanside, NY
Longitude	-73.65
Latitude	40.62
Landowner	Nassau County, Town of Hempstead
Existing Use	Street
O & M Responsibility	Nassau County DPW (Lawson Blvd), Town of Hempstead (Weidner Ave & Hampton Rd)
Low Moderate Income Area	N/A
Existing Site Description:	The problem areas listed along Lawson Blvd. between Weidner Avenue and Powell Creek, Weidner Avenue, and Evans Avenue and Messick Avenue, flood due to high tides. The areas along Hampton Road off Daly Blvd. and the intersection of Moore Avenue and Fulton Avenue flood due to inadequate drainage systems.

Proposed Characteristics

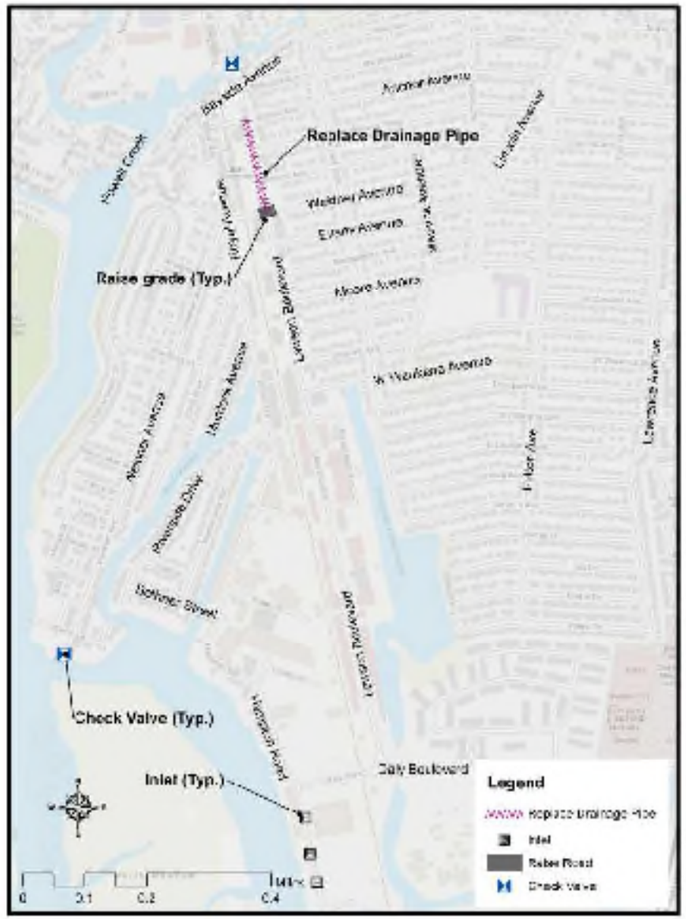
Cost Estimate	$5,680,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	54, 56, 58
Proposed Improvements Description	Install a 36 inch inline check valve at Lawson Blvd. drainage system outfall to prevent tidal water entering from Powell Creek, replace 900 LF of drainage pipe between Weidner Avenue and Anchor Avenue, and raise intersection of Weidner Avenue by 6 inches to avoid flooding. Install a 24 inch check valve on Weidner Avenue outfall, and install three (3) additional inlets at low points along Hampton Road to avoid ponding of storm water. Problem areas 55, 57, and 60 are being addressed through the Community Reconstruction Program.

LWTB Objectives Met By Project

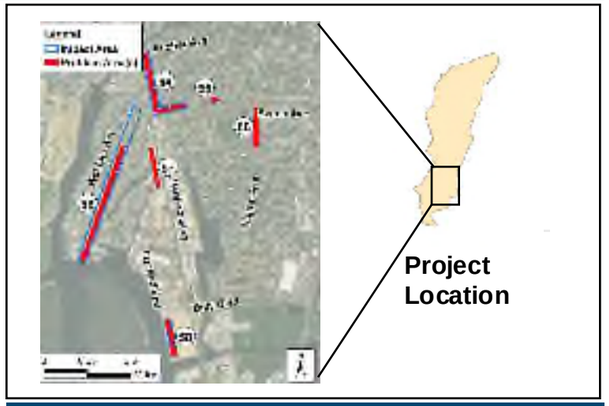
Increase Community Resiliency

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREA AND IMPACT AREA



SAMPLE PHOTOS

Example Replacing Drainage Pipe for Lawson Blvd.

Example Check Valve for Lawson Blvd.

Example Raised Intersection for Weidner Ave. and Lawson Blvd.

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT V

COASTAL MARSH RESTORATION PROJECT DESCRIPTION

Theme(s): GREENER EDGE
SPACE FOR THE RIVER
BLUE-GREEN CORRIDOR

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	33, 37
Street Address	Hempstead, NY
Longitude	-73.67
Latitude	40.62
Landowner	Town of Hempstead
Existing Use	Shoreline
O & M Responsibility	Town of Hempstead
Low Moderate Income Area	N/A
Existing Site Description:	The existing marshlands including North Meadow, East Meadow, West Meadow, Pearsalls Hassock, Black Banks Hassock, Simmons Hassock, Hewlett Hassock, Nums Marsh and Cedar Island continue to experience continual loss of marshland habitat due to shoreline erosion.

Proposed Characteristics

Cost Estimate	$30,800,000.00
Level of Protection, yr	100
Project Life, yr	50
Focus	Water Quality, Habitat Restoration, Social Resiliency
Problem Areas Addressed	67
Proposed Improvements Description	▪ Rock sill protection of marsh shoreline that experiences direct erosive impact of storm and surge flows and boat wakes. ▪ Application of enhanced marsh alternative in lower areas to raise level of marsh and provide rock dike on shore face for protection against erosive flows. ▪ Floating marsh protection to provide wave attenuation and fish shelter while facilitating nutrient uptake. ▪ Cutoff rock sills to prevent migration of flow into low marshland channels to minimize sediment erosion in the channels. ▪ Construct coastal field center and improve kayak launching area.

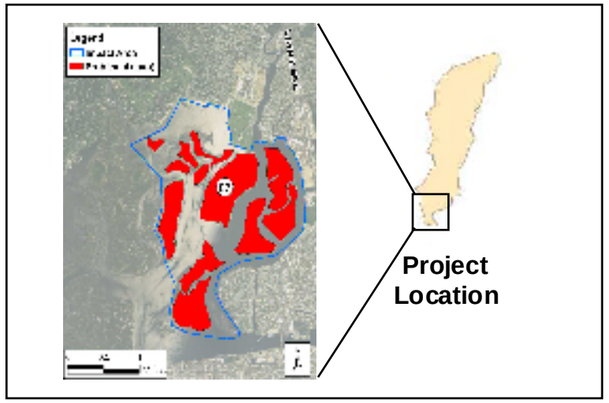
LWTB Objectives Met By Project

Increase Community Resiliency | Restore Environmental Health | Create and Improve Public Waterfront Access | Provide Educational Opportunities

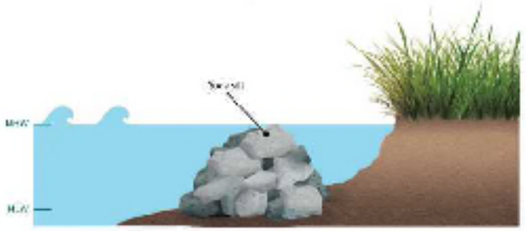
DRAFT

PROPOSED IMPROVEMENTS

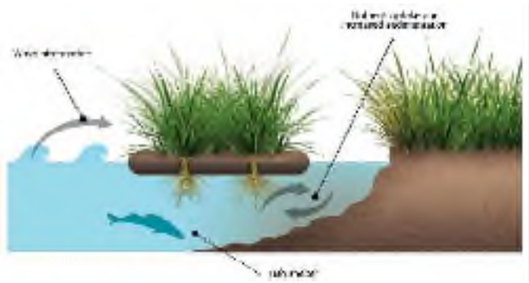
PROJECT AREA WITH PROBLEM AREAS AND IMPACT AREA



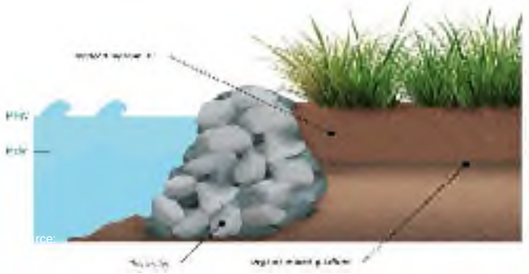
SAMPLE PHOTOS



Example Rock/Cutoff Sill



Example Floating Marsh



Example Enhanced Marsh

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT W
EAST ROCKAWAY DOWNTOWN PROJECT DESCRIPTION

Theme(s): **N/A**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	29, 40
Street Address	15-25 Main St, East Rockaway, NY
Longitude	-73.66
Latitude	40.64
Landowner	East Rockaway, Nassau County
Existing Use	Shoreline, Street
O & M Responsibility	TBD
Low Moderate Income Area	N/A
Existing Site Description:	The area of Downtown East Rockaway along the Main Street Corridor extending to Lawson Avenue was severely damaged during Superstorm Sandy. This is one of East Rockaway's two commercial corridors, encompassing retail services that the Village of East Rockaway and the community of Bay Park depend on for daily services. The focus area includes US Post Office, The Fishery and other businesses along Main Street.

Proposed Characteristics

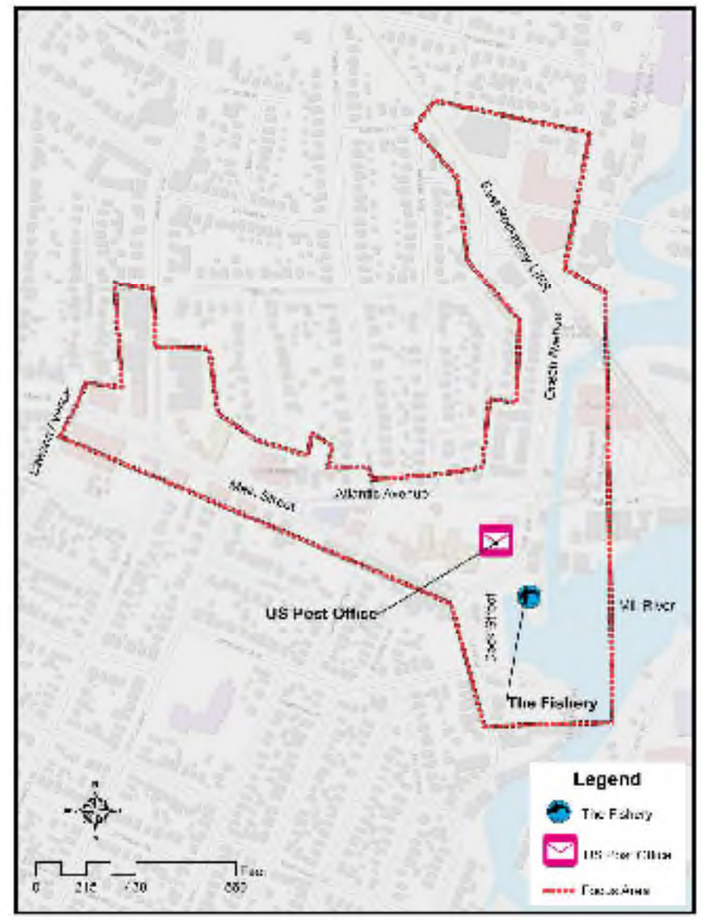
Cost Estimate	$200,000
Level of Protection, yr	TBD
Project Life, yr	TBD
Focus	Flood Defense, Social Resiliency
Problem Areas Addressed	N/A
Proposed Improvements Description	Downtown Resiliency and Redevelopment Plan was proposed to increase the resiliency of the Main Street corridor by: identifying new measures for leveraging publicly-owned land along the Mill River's edge to accommodate tidal surge and establish a larger open space and trail system; identifying opportunities for new redevelopment that can renew downtown as a destination; reestablishing civic pride in downtown. Adopting zoning requirements to protect businesses from flooding. Implement new shoreline improvements along the Mill River's edge redevelopment. A comprehensive stategy for improvement of the Mill River waterfront, open space plan, and implementation and funding recommendations.

LWTB Objectives Met By Project

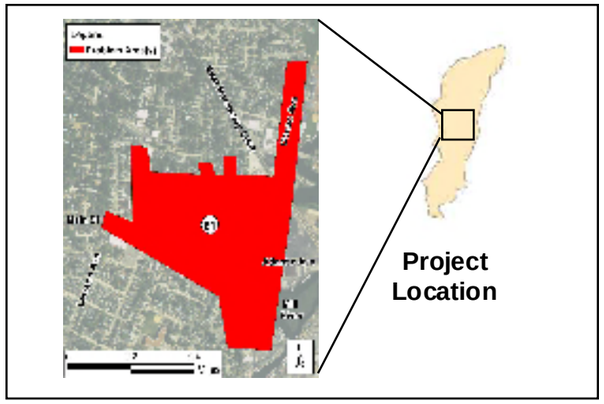
Increase Community Resiliency | Preserve Quality of Life | Provide Educational Opportunities | Create and Improve Public Waterfront Access

DRAFT

PROPOSED IMPROVEMENTS

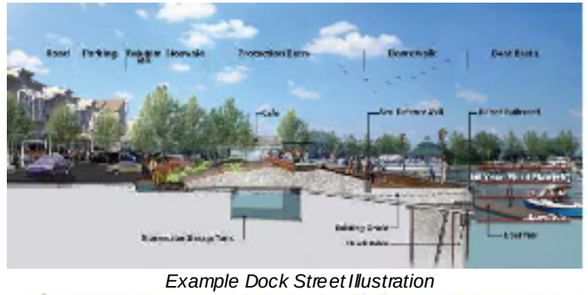


PROJECT AREA WITH PROBLEM AREAS



SAMPLE PHOTOS

Example Boardwalk



Example Dock Street Illustration

Rendering Waterfront Access

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT X

S CENTRE AVENUE BIORETENSION GREEN STREET PROJECT DESCRIPTION

Theme(s): WATER STORAGE
GREENER EDGE

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	21
Street Address	S Centre Avenue, Rockville Centre, NY 11570
Longitude	-73.65
Latitude	40.65
Landowner	Village of Rockville Centre
Existing Use	Street
O & M Responsibility	Village of Rockville Centre
Low Moderate Income Area	40% - 60%
Existing Site Description:	The existing site is at the intersection of South Park Avenue and South Centre Avenue in the Village of Rockville Centre. Localized flooding is ocurring near the intersection caused by a lack of or undersized storm drainage infrastructure and flat microtopography.

Proposed Characteristics

Cost Estimate	$200,000.00
Level of Protection, yr	0.5
Project Life, yr	30
Focus	Water Quality, Social Resiliency
Problem Areas Addressed	35
Proposed Improvements Description	The proposed improvements include installation of green streets with incorporated bioretention area. Green streets are a linear network of distributed BMPs located in the street right-of-way that are designed to reduce runoff volume and improve water quality of the runoff both from the street and the adjacent parcels. 150 feet of street will be implemented with green streets for this project.

LWTB Objectives Met By Project

Increase Community Resiliency | Restore Environmental Health | Preserve Quality of Life | Provide Educational Opportunities

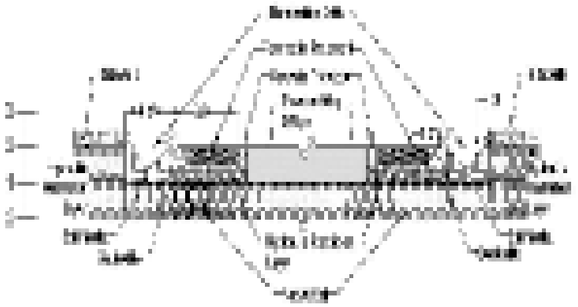
DRAFT

PROPOSED IMPROVEMENTS

Project Prioritization Results

PROJECT AREA WITH PROBLEM AREA

SAMPLE PHOTOS



Typical Green Street with Bioretention Cross-Section

Example Green Street with Bioretention

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT Y

MAPLE AVENUE AND LONG BEACH ROAD INTERSECTION PROJECT DESCRIPTION

Theme(s): **N/A**

Living with the Bay
Rebuild by Design

Site Location

Sub Watershed	20
Street Address	285-303 Maple Avenue, Rockville Centre, NY
Longitude	-73.63
Latitude	40.66
Landowner	Nassau County
Existing Use	Street
O & M Responsibility	Nassau County
Low Moderate Income Area	N/A
Existing Site Description:	During heavy rainfall events the runoff from Long Beach Road enters Maple Avenue and floods the intersection.

Proposed Characteristics

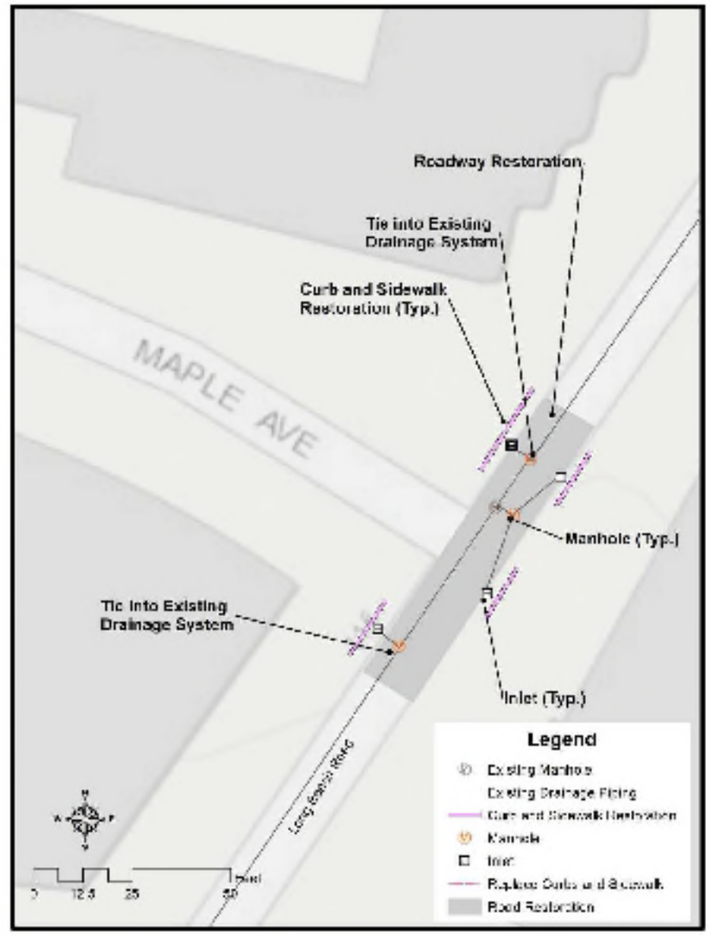
Cost Estimate	$280,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	88
Proposed Improvements Description	Install **four** (4) drainage inlets and **three** (3) drainage manholes in vicinity of intersection to provide collection of runoff and 150 LF of 18-inch diameter stormwater pipe. Roadway, curb, and sidewalk shall be removed and replaced. The proposed improvements will provide better runoff collection within the roadway and prevents Maple Avenue flooding from Long Beach Road runoff. The proposed inlets are connected to existing storm-drainage system.

LWTB Objectives Met By Project

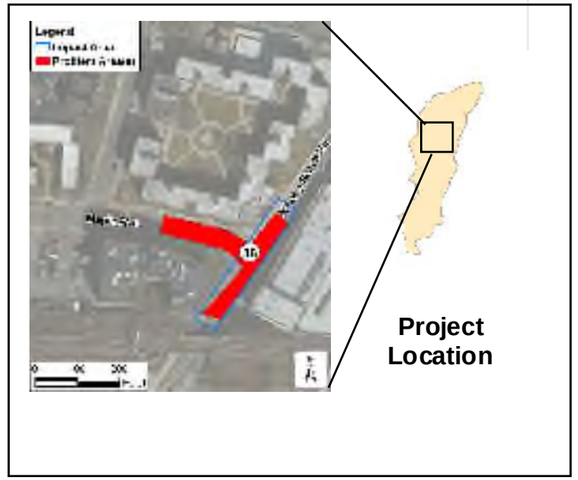
Increase Community Resiliency

DRAFT

PROPOSED IMPROVEMENTS

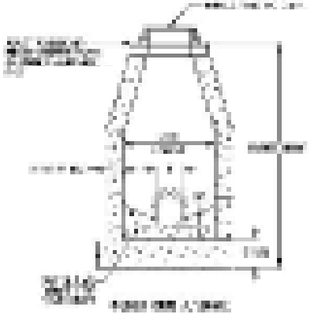


PROJECT AREA WITH PROBLEM AREAS AND IMPACT AREA



SAMPLE PHOTOS

Existing Maple Avenue and Long Beach Road Intersection



Existing Manhole for Maple Avenue and Long Beach Road Intersection

Governor's Office of Storm Recovery

Note: Characteristics are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

PROJECT Z

LAKEVIEW AVENUE AND HEMPSTEAD AVENUE INTERSECTION PROJECT DESCRIPTION

Theme(s): **SPACE FOR THE RIVER**

Living with the Bay
Rebuild by Design

Site Location

SubWatershed	38
Street Address	120 Hempstead Ave, Rockville Centre, NY
Longitude	-73.64
Latitude	40.66
Landowner	Nassau County, Village of Rockville Centre
Existing Use	Street
O & M Responsibility	Nassau County (Hempstead Ave.), Village of Rockville Centre
Low Moderate Income Area	N/A
Existing Site Description:	The intersection of Hempstead Avenue and Lakeview Avenue is located within the Village of Rockville Centre. A sub-surface drainage system is located along Hempstead Avenue and outfalls into Smith Pond downstream of the existing weir. The intersection floods during heavy rainfall due to inadequate conveyance.

Proposed Characteristics

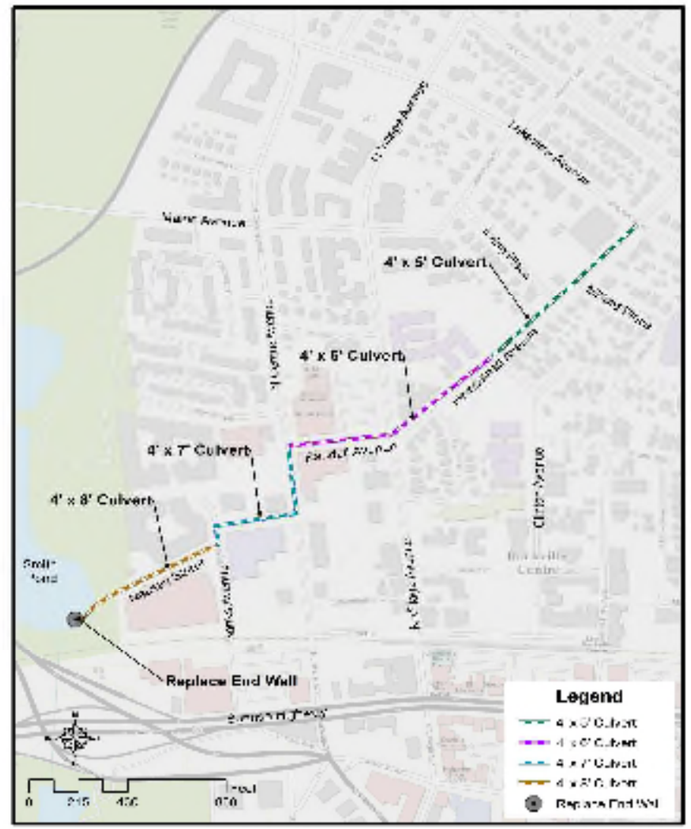
Cost Estimate	$4,000,000
Level of Protection, yr	10
Project Life, yr	50
Focus	Flood Defense
Problem Areas Addressed	87
Proposed Improvements Description	Remove and replace existing 48-inch storm pipe with box culverts of increasing size (4'x5 to 4'x8'). Reconstruct endwall at outfall to Smith Pond. Flooding is mitigated by increasing the pipe capacity downstream to the intersection.

LWTB Objectives Met By Project

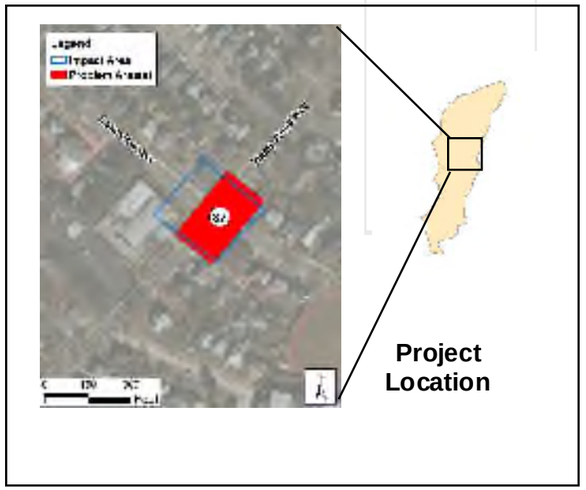
Increase Community Resiliency

DRAFT

PROPOSED IMPROVEMENTS



PROJECT AREA WITH PROBLEM AREAS AND IMPACT AREA



SAMPLE PHOTOS

Existing Lakeview Avenue and Hempstead Avenue Intersection

Example Endwall for Hempstead Avenue Drainage System

Governor's Office of Storm Recovery

Note: Characteristic are based on field observations and GIS data resources available at the time of conceptual design analysis. Note that final design characteristics will be dependent on a detailed site survey and could vary from conceptual design characteristics.

TETRA TECH

HUD Action Plan Amendment
East Rockaway High School and Blue-Green Park Narrative
Tetra Tech

The East Rockaway High School (School) is situated along the west bank of the Mill River in Nassau County. Superstorm Sandy caused heavy rains and storm surge resulting in flood waters flooding the School's northern and eastern property and entering the School's buildings and facilities. The boiler room, auditorium and gymnasium wings, teacher parking lot, and sports fields received the most pronounced damage. The building's floor crawl space typically has flooding associated with normal tidal cycles due to porous soil conditions, however the high level of water from Sandy caused scour below the pile caps and left pools of sewage & fuel oil polluted water. Lack of sufficient backwater valves also created water infiltration of the sanitary outfalls. The site for the School is on the west bank of Mill River just north of Pearl Street as shown in Figure 3.

Figure 3. East Rockaway High School.

The School's buildings and grounds were repaired after Sandy and a recently approved FEMA project is intended to mitigate the flooding of the School's buildings. The teacher parking lot routinely floods at an approximate 1-year storm event frequency and, along with the sport fields, remain vulnerable to frequent tidal flooding and shoreline erosion. The bleachers and two story storage and press box at the sports field are on the verge of falling into the Mill River due to ongoing shoreline erosion.

The presence of the continuous stretch of publicly owned land along the western bank of the river at the School and to the north and east of the School offers a range of opportunities to implement several RBD Living with the Bay goals - protect and increase the resiliency of a critical community asset from flood damage and create and improve waterfront access for the public. Potential resiliency interventions for protection and social resiliency include linear flood risk mitigation and shoreline stabilization with design considerations to alleviate the tailwater and surge flooding occurring in the teacher parking lot and sports field. Living shoreline elements with stormwater outlet treatment systems to improve water quality in the area and improved connectivity for the public to the waterfront are also being incorporated.

As noted, the School's sports field bleachers are located at the river bank. Due to ongoing erosion of the bank, the structural stability of these stands is being compromised. The design proposal provides an integrated solution that stabilizes the river bank, raises its flood protection level, and enhances the

conditions for the grandstand. The proposed level of protection service for the design is the current 1/100y FEMA flood elevation of 9ft.

The goal for this area is to determine the feasibility of design options that help reduce the School's vulnerability to flooding and stabilize its eroding shoreline. The designed interventions also have the opportunity to facilitate a continuous north-south route along the water for pedestrians and cyclists in the form of the Blue-Green Park, and contribute to improving the quality and operations of the School and its sports fields by enhancing the connection between the School and the river.

DRAFT

HUD Action Plan Amendment
Greenway Narrative
Tetra Tech

Continuous safe pedestrian pathways from the residential areas to the waterfont in the Living with the Bay program area are rare and if they exist, they are fragmented with little connectivity for any significant lengths. The winning RBD, Living with the Bay project noted the overall scale and existing land use of the program area makes it ideal for biking, walking, and boating, but existing routes toward or along the river and bay are ad-hoc and discontinuous, and the adjacent neighborhoods' access to the river is poor. Combining this fact with the potential degradation of stormwater management and environmental habitat has created a concern for the sustainable resilience of the community.

The RBD Living with the Bay design called for the landscapes along Mill River to be interconnected into a strong "blue green" framework in order to improve public accessibility and visibility of the Mill River as a means to increase safety, and enhance the ecological and landscape value of this historic water course. It will also increase recreational opportunities for the densely populated communities around the river as an effort that will only be good for the community as a long-term positive benefit to the residents. The concept for the Greenway is shown in Figure 4.

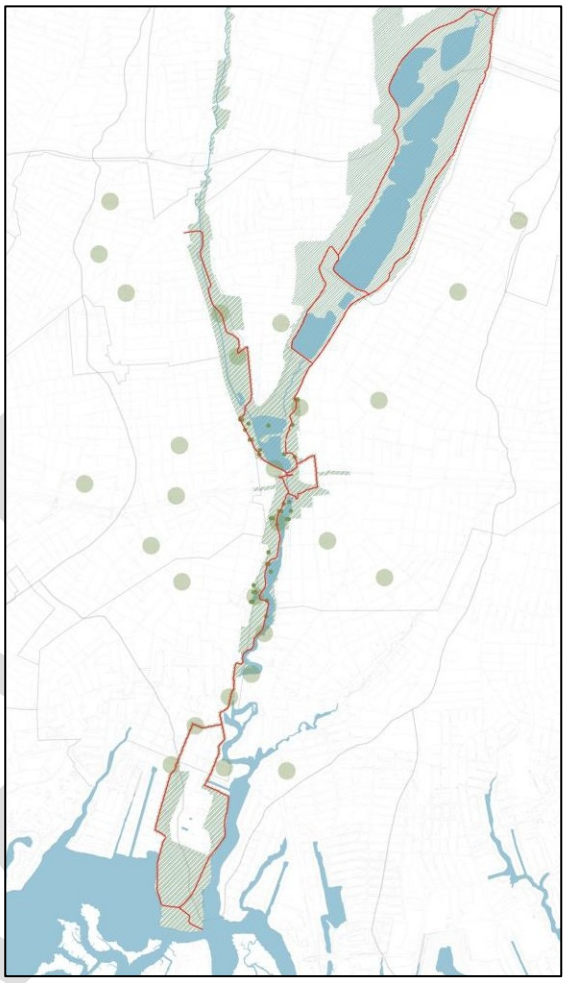


Figure 4. Greenway Concept Plan.

The development of a continuous Greenway is intended to be a strong feature for the suburban layout along and adjacent to the Mill River, thus transforming it into an attractive public amenity. The intent is to take the currently disconnected recreational and open resources in the LWTB program area, as well as schools, and link them into a coherent system of pedestrian and bike paths, resulting in the creation of a new blue green identity. Another goal of the Greenway component of the project is to adopt and develop new sites along the Mill River that are presently underutilized and / or not accessible, and make these sites productive towards the LWTB objectives.

The design level of service elements of the multi-use path will, where practical, typically include 10 feet wide permeable pavement with water storage and infiltration under the path. As a linear element and where space permits, the paths will serve as interceptors of surface stormwater runoff through parallel bioswales.

HUD Action Plan Amendment
Resiliency Strategy Narrative
Tetra Tech

Scope. The Living with the Bay design provides a comprehensive suite of potential resiliency interventions for Nassau County communities surrounding Mill River; an environmentally degraded north-south tributary flowing from Hempstead State Park into the South Shore of Long Island's Back Bay. Tetra Tech is preparing a Resiliency Strategy, developing this suite of potential interventions. This includes developing a program of specific projects and potential project locations, consistent with the winning Living with the Bay design, addressing storm surge, flooding caused by critical rainfall events, coastal habitat degradation, and water quality problems, as well as improving the public's access to the waterfront and educating the public on stormwater and environmental management. The Resiliency Strategy will seek to prioritize potential interventions, and provide an implementation schedule.

Plan. The final outcome of the Resiliency Strategy will be a program of thematically consistent and prioritized projects consistent with the goals set forth in the Rebuild by Design, Slow Streams (Living with the Bay) project. The suite of projects will be constructible and impactful.

Results. The types of documented flooding problems in the program area range from poor to inadequate drainage collection and conveyance capacity, to high tailwater conditions deeming the existing stormwater systems inadequate for critical storms, to overtopping surge events such as Superstorm Sandy that inundated more than 3,000 residential properties. Other documented problems include habitat and shoreline degradation and decreased water quality from the effects of untreated urban runoff. The Resiliency Strategy includes coordinated projects focused on addressing the problems with the anticipated sea level rise impacts accounted for in the analysis. This covers improved drainage collection and conveyance, tidal and storm surge prevention, water quality improvements, habitat restoration, improved public pathways to the waterfront, and public education components. The Strategy has projects strategically prioritized with program-specific timeframes and costs for planning, design, permitting, procurement, construction, and project closeout. The program area is shown in Figure 1.

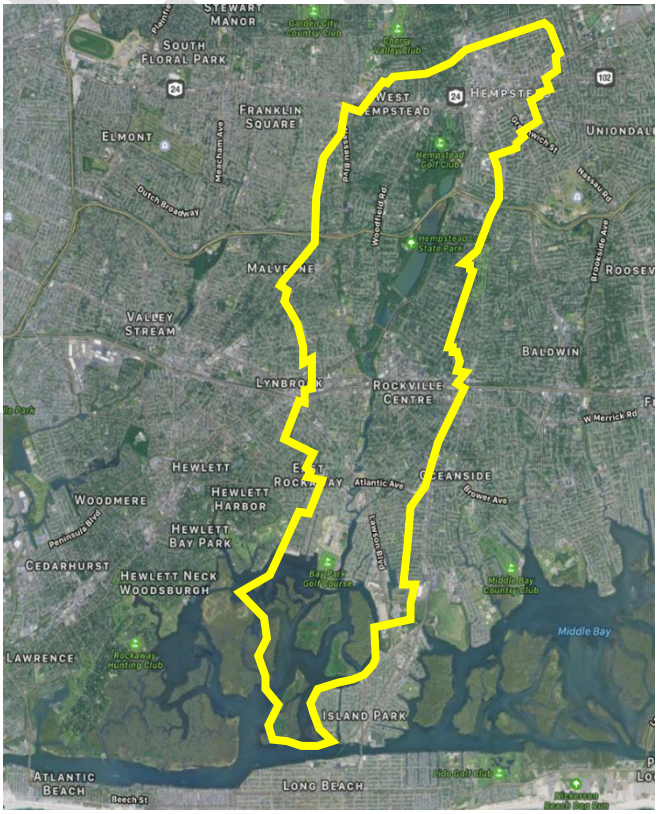


Figure 1. The Living with the Bay program area includes approximately 10,000 acres in Nassau County on Long Island in New York.

DRAFT

HUD Action Plan Amendment
Smith Pond Narrative
Tetra Tech

Smith Pond, shown in Figure 2, is a 22-acre freshwater pond located in the center of the LWTB Program Area just north of the Sunrise Highway in the Village of Rockville Centre. The pond is associated with Morgan Days Park and is managed by the Village of Rockville Centre. The watershed of the pond is largely developed in high density housing although the area immediately around Smith Pond and the area around Hempstead Lake are lightly forested.

Figure 2. Smith Pond.

The pond is the confluence point of the two primary drainage branches (Pines Brook and Mill River) conveying water from the north end of the Mill River watershed — one on the north eastern side coming from Hempstead Lake State Park, and the other on the north western side originating north in the Garden City area. The latter inlet flows through a few small impoundments, including Halls Pond, before reaching Smith Pond.

The pond receives both the flow (water quantity) and the nutrient loads (water quality) for the entire watershed. Smith Pond is also a unique location as the connecting water body between the upper freshwater system and the lower tidal and salt water system. The Pond's location provides an advantageous opportunity to incorporate RBD and Living with the Bay concepts of dynamic protection, ecological restoration, and social reactivation of the Mill River corridor.

The pond was included in the New York State Department of Environmental Conservation (DEC) Division of Water's 2009 intensive (monthly sampling) Lake Classification and Inventory (LCI) survey of the Atlantic Ocean/ Long Island Sound (AO/LIS) basin. Inclusion in the survey was based on an "Impacted Segment" listing in the 2000 AO/LIS Waterbody Inventory and Priority Waterbodies List (WIPWL):

> *Fish consumption in Smith Pond is impaired due to a specific NYS DOH health advisory that recommends eating no more than one meal per month of white perch because of elevated chlordane. (2000-01 NYS DOH Health Advisories).*
>
> *Aquatic life support and recreational uses (swimming, fishing, boating) in the pond are also affected by high nutrient loads, silt, sedimentation, excessive aquatic weed growth (spatterdock) and occasional algal blooms. Stormwater and urban nonpoint runoff are the sources of pollutants. The pond is included in the Nassau County Suburban Pond Management Plan. (Nassau County WQCC, 1998).*

Pond bathymetry and topography surrounding the pond was collected in October 2016 to begin assessing dredging and flood mitigation options. Additional environmental sampling is scheduled to begin in Spring 2017 such as pond bottom borings to document the soil characteristics and support the dredging management plan and environmental permitting. Biological assessments are also scheduled in Spring/Summer 2017 to document the current and historic types of vegetation in the pond and along the pond's shoreline so that the final pond elevations following dredging promote habitat restoration.

The proposed improvements at Smith Pond consist of a comprehensive suite of resiliency interventions such as dredging, habitat restoration, storm attenuation improvements, and improving public access. A key RBD benefit of this project will be the ability to monitor this work as an example of a successful scalable strategy that could be replicated elsewhere in other highly developed watersheds.

A dredging management plan will be prepared evaluating the opportunity to increase water depths to greater than eight (8) feet in depth to supplement storm runoff attenuation with the additional pond volume and to improve environmental conditions. The current shallow water depths in areas of the Pond combined with high nutrient loads from upstream runoff and warmer temperatures contribute to invasive plant growth in the Pond during certain months. Deeper water depths will help eliminate the opportunity for the invasive plants to thrive and appear to be able to be achieved with the dredging of approximately 33,000 cubic yards of pond bottom at average dredge depths of 12-24-inches. Part of the dredging plan will include opportunities for improving pond bottom habitat for fish so that with the inclusion of a fish ladder at the Pond weir, the fish will have appropriate habitat in the Pond.

Flood mitigation alternatives in areas around the pond at lower elevations are being evaluated from the standpoint of protecting the immediate surrounding area. Stormwater from part of Rockville Centre discharges directly into the basin downstream of the Smith Pond weir and options are being evaluated to improve conveyance and treatment of this runoff. There will likely be modifications to the existing weir at the south end of the Pond to improve flood stage elevations around the Pond. Options to modify the weir are being evaluated carefully considering the age of the existing weir and the opportunity to incorporate a fish ladder in the weir modifications.

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HUD Action Plan Amendment
Stormwater Retrofit Narrative
Tetra Tech

A critical piece of the Living with the Bay program is addressing flood mitigation. For the program area, this includes finding solutions to chronic drainage problems in the community that continue to worsen as a result of more frequent critical storm events and tidal surge similar to the problem area shown in Figure 5 and the problems experienced during and after Superstorm Sandy. The approach to address this is through a variety of retrofits incorporating stormwater best management practices (BMPs) with a complementary intent and underlying theme of the RBD Living with the Bay concept being that the projects can be duplicated elsewhere in the program area and on Long Island.

Figure 5. Chronic flooding problem in the Village of Lynbrook.

The RBD Living with the Bay design identified the desirability of green infrastructure retrofit projects which will improve stormwater collection and conveyance to mitigate flooding and incorporate water quality improvement components. Some of the project types which are being developed in the strategy are described in the following:

Parcel-Based Green Infrastructure. Green infrastructure typically incorporates multiple practices utilizing the natural features of the site in conjunction with the goal of the project. Multiple BMPs can be incorporated into a site to complement and enhance the current land use while also providing volume reduction and water quality treatment. Green infrastructure practices are those methods that provide control and/or treatment of stormwater runoff on or near locations where the runoff initiates. Typical parcel based practices include approaches such as vegetated infiltration basins, stormwater wetlands, and subsurface practices as shown in Figures 6 and 7. Publicly owned open spaced parcels will be evaluated throughout the watershed to identify potential opportunities to incorporate green infrastructure practices to reduce flooding in areas with limited or no drainage infrastructure.

Figure 6. Typical surface infiltration basins.

Figure 7. Stormwater wetland in a park.

Green Streets. Green streets are a dense network of distributed BMPs concentrated on a public right-of-way. Green streets are often referred to as BMPs, but actually employ multiple distributed BMPs in a linear (rather than parcel-based) fashion. The green street BMP configuration strategy implements BMPs within the street right-of-way with designs that reduce runoff volume and improve water quality of the runoff both from the street and adjacent parcels. Green Street features can include vegetated curb extensions incorporating bioretention, sidewalk planters, bump outs at intersections incorporating bioretention, permeable paving, and suspended pavement systems. Green streets could be implemented throughout the residential areas to reduce localized flooding where there are micro depressions and little or no drainage infrastructure.

The most common approaches include bioretention areas located between the edge of the pavement and the edge of the right-of-way and permeable pavement installed in the parking lanes. Permeable pavement in Long Island is less desirable due to the use of sand to treat roadways and the limitation of small municipalities to expand maintenance activities. An alternative option for integrating water quantity and water quality improvements is to integrate storage and treatment under the sidewalk using a suspended pavement system. Suspended pavement uses structural frames to support the weight generated by sidewalks and roadways while providing open void space for runoff storage and treatment underneath. The runoff is treated as it passes beneath the pavement and through an engineered soil media before exiting through infiltration or an underdrain. Suspended pavement systems allow for the integration of BMPs with little to no disturbance to the surface, and serve as an improved BMP over more traditional dry wells located throughout the program area.

The benefits of green streets will be evaluated using a multi-step process to (1) evaluate the typical green street configuration (2) quantify potential unit load reductions (3) and apply the unit load reductions to streets throughout the watersheds based on expected opportunity. The storage and treatment capacity of the green street can be significantly increased by utilizing available storage under the full width of the right of way. Substantial flood mitigation combined with water quality improvement may be possible. Figure 8 shows some of the potential components of a green street or right-of-way system, including suspended sidewalk and bioretention. Figure 9 shows a typical green street cross section.

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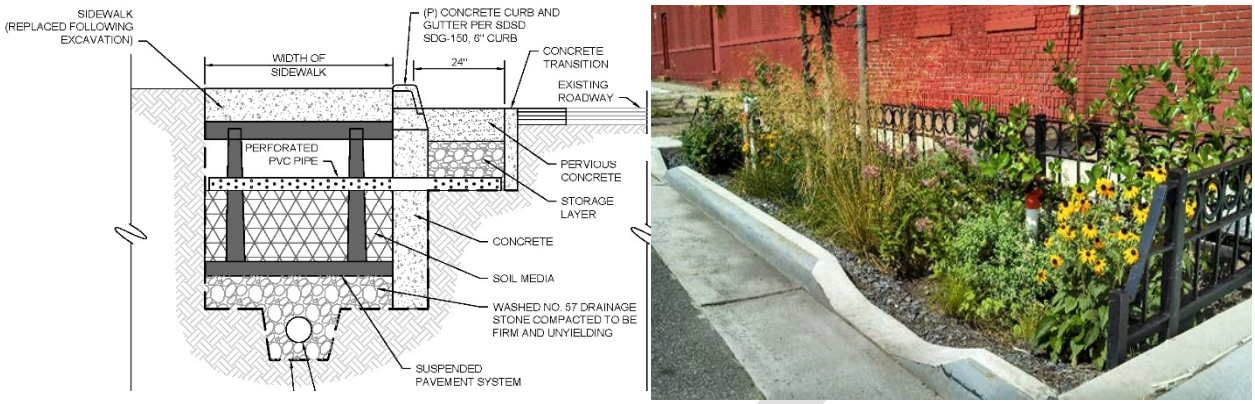

Figure 8. Suspended sidewalk system (left) and bioretention in the Right-of-Way (right).

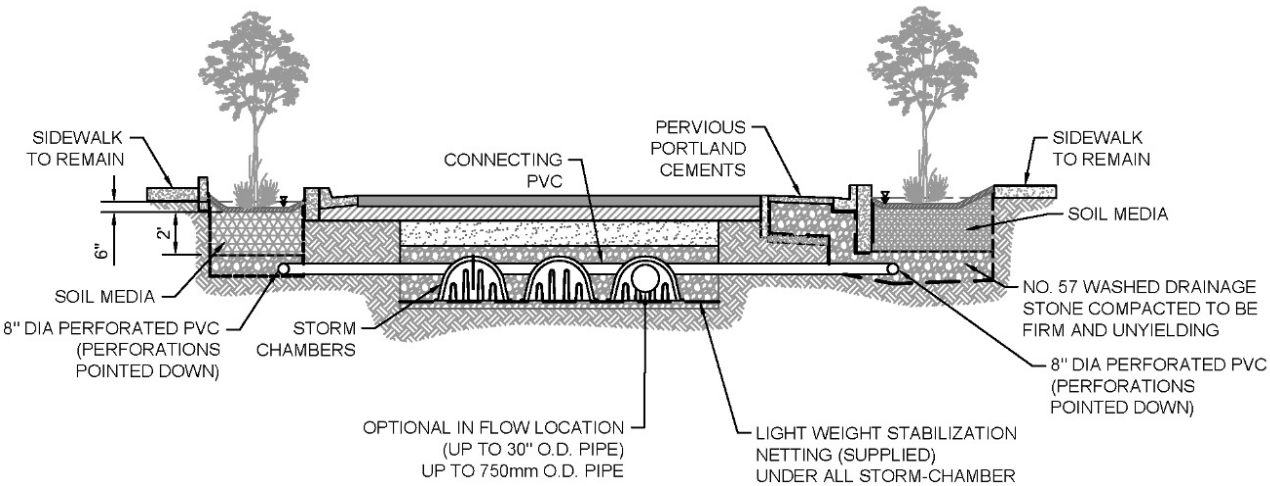

Figure 9. Typical green street cross section.

Green-Gray Infrastructure. In some cases, traditional structural or "gray" infrastructure in the form of additional inlets and stormwater pipe will be required to provide the necessary flood mitigation. At locations where this will occur, the design team will incorporate "green" infrastructure elements that will provide more ecological and environmental benefits where practical. For example, exfiltration beds and/or structures will be utilized to retain and treat the runoff rather than sending the collected water immediately downhill. In addition, minor design elements such as stormwater structures with sumps (two to three foot deep bottoms) to help collect sediment prior to being discharged to downstream surface waters. Typical types of green-gray infrastructure construction are shown in Figure 10.

Figure 10. Typical green-gray infrastructure construction.