Appendix D

Reference Documents

PREPARED FOR:

Township of Little Egg Harbor
665 Radio Road
Little Egg Harbor, NJ 08087

PREPARED BY:

T&M Associates
11 Tindall Road
Middletown, NJ 07748

ENVIRONMENTAL IMPACT STATEMENT

NJDEP COASTAL GENERAL PERMIT NO. 24 APPLICATION

SOUTH GREEN STREET SHORELINE RESTORATION – LIVING SHORELINE TUCKERTON BOROUGH OCEAN COUNTY, NJ

T&M PROJECT NO. LEHT-01730
May 2018

Ericka Naklicki, PWS
Principal Environmental Scientist

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LIST OF ATTACHMENTS

Attachment A – Site Location Maps

- USGS Topographic Map
- Site Location Map
- Shellfish Lease Map

Attachment B – Public Notice Documentation

- Mailing List for Certified Mail Notice
- Copy of Certified Mail Notice
- Certified Mail Receipts

Attachment C –Color Photographs

Attachment D - Qualifications of Preparers

Attachment E – Stevens Institute of Technology Living Shoreline and Conceptual Design, March 2016

State of New Jersey
Department of Environmental Protection
Division of Land Use Regulation
Application Form for Permit(s)/Authorization(s)

501 E. State Street Mail Code 501-02A P.O. Box 420
Trenton, NJ 08625-0420
Phone #: (609) 777-0454 Web: www.nj.gov/dep/landuse

Please print legibly or type the following: Complete all sections and pages unless otherwise noted. **Is this project Superstorm Sandy Related** Yes ☐ No ☐

1. **Applicant Name:** Mr./Ms./Mrs Borough of Tuckerton — E-Mail:
   Address: 420 East Main Street — Daytime Phone: 609-296-2701 Ext.
   City/State: Tuckerton, NJ — Zip Code 08087 Cell Phone:
2. **Agent Name:** Mr./Ms./Mrs Ericka Naklicki, PWS
   Firm Name: T&M Associates — E-Mail: enaklicki@tandmassociates.com
   Address: 11 Tindall Road — Daytime Phone: 732-671-6400 Ext. 9509
   City/State: Middletown, NJ — Zip Code 07748 Cell Phone:
3. **Property Owner:** Mr./Ms./Mrs Angelo Micalizzi (Block 45, Lot 8) and Ocean County (Right of Way) (Contact info. on Page 2) — E-mail:
   Address: 105 Mohican Lane — Daytime Phone: 239-331-3194 Ext.
   City/State: Little Egg Harbor, NJ — Zip Code 08087 Cell Phone:
4. **Project Name:** South Green Street Shoreline Protection Project — Address/Location: South Green Street
   Municipality: Borough of Tuckerton — County: Ocean — Zip Code 08087
   Block(s): 45 — Lot(s): 8
   N.A.D. 1983 State Plane Coordinates (feet) E (x): 539,177 N(y): 271,668 *Not Longitude/Latitude*
   Watershed: Little Egg Harbor Bay (Westecunk to Inlet) — Subwatershed: Lower LEH Bay Tributaries
   Nearest Waterway: Tuckerton Cove/Tuckerton Creek
5. **Project Description:** The proposed project involves the construction of stone breakwaters to provide stabilization and assist in the natural accretion of sand to enlarge the beach area. A Coastal General Permit No. 24 application is being submitted to authorize the enhancement activities.

Provide if applicable: Previous LUR File # (s): Waiver request ID # (s):

A. SIGNATURE OF APPLICANT (required):

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment. If the applicant is an organization such as a corporation, municipal entity, home-owners association etc., the party responsible for the application shall sign on behalf of the organization.

Susan R. Marshall
Signature of Applicant

Date

Mayor Susan Marshall, Tuckerton Borough
Print Name

Signature of Applicant

Date

Print Name

B. PROPERTY OWNER'S CERTIFICATION

I hereby certify that the undersigned is the **owner of the property** upon which the proposed work is to be done. This endorsement is certification that the owner/easement holder grants permission for the conduct of the proposed activity. In addition, written consent is hereby giver to allow access to the site by representatives or agents of the Department for the purpose of conducting a site inspection(s) or survey(s) of the property in question.

In addition, the undersigned property owner hereby certifies:

1. Whether any work is to be done within an easement? Yes ☐ No ☒
   (If answer is "Yes" – Signature/title of resonsible party is required below)
2. Whether any part of the entire project will be located within property belonging to the State of New Jersey? Tidal Waterbody Yes ☒ No ☐
3. Whether any work is to be done on any property owned by any public agency that would be encumbered by Green Acres? Yes ☐ No ☒
4. Whether this project requires a Section 106 (National Register of Historic Places) Determination as part of a federal approval? Yes ☐ No ☒

Signature of Owner

5/17-18
Date

Angelo Micalizzi, Owner of Block 45, Lot 8
Print Name

Signature of Owner/Easement Holder

Date

Ocean County Department of Engineering
Print Name/Title

John N. Ernst, County Engineer
129 Hooper Avenue, Toms River, N.J. 08754
Phone: (732) 929-2130
OCEngineering@co.ocean.nj.us

C. APPLICANT'S AGENT

I Mayor Susan Marshall, the Applicant/Owner and _____, co-Applicant/Owner authorize to act as my agent/representative in all matters pertaining to my application the following person:

Ericka Naklicki
Name of Agent

Principal Environmental Scientist, T&M Associates
Occupation/Profession of Agent

Susan R. Marshall
Signature of Applicant/Owner

Signature of co-Applicant/Owner

AGENT'S CERTIFICATION:

I agree to serve as agent for the above-referenced applicant:

Signature of Agent

T&M Associates
Name of Firm

D. STATEMENT OF PREPARER OF PLANS, SPECIFICATIONS, SURVEYOR'S OR ENGINEER'S REPORT

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

Signature

Jason Worth, P.E.
Print Name

Consulting Engineer, T&M Associates
Position & Name of Firm

GE49287
Professional License #

5/23/18
Date

E. STATEMENT OF PREPARER OF APPLICATION, REPORTS AND/OR SUPPORTING DOCUMENTS (other than engineering)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

Signature

Ericka Naklicki, PWS
Print Name

Principal Environmental Scientist, T&M Associates
Position & Name of Firm

2938
Professional License #
(If Applicable)

Date

B. PROPERTY OWNER'S CERTIFICATION

I hereby certify that the undersigned is the **owner of the property** upon which the proposed work is to be done. This endorsement is certification that the owner/easement holder grants permission for the conduct of the proposed activity. In addition, written consent is hereby giver to allow access to the site by representatives or agents of the Department for the purpose of conducting a site inspection(s) or survey(s) of the property in question.

In addition, the undersigned property owner hereby certifies:

1. Whether any work is to be done within an easement? Yes ☐ No ☒
   (If answer is "Yes" – Signature/title of resonsible party is required below)
2. Whether any part of the entire project will be located within property belonging to the State of New Jersey? **Tidal Waterbody** Yes ☒ No ☐
3. Whether any work is to be done on any property owned by any public agency that would be encumbered by Green Acres? Yes ☐ No ☒
4. Whether this project requires a Section 106 (National Register of Historic Places) Determination as part of a federal approval? Yes ☐ No ☒

Signature of Owner	Signature of Owner/Easement Holder
Date	Date 5/15/18
Angelo Micalizzi, Owner of Block 45, Lot 8	Ocean County Department of Engineering
Print Name	Print Name/Title John N. Ernst, County Engineer 129 Hooper Avenue, Toms River, N.J. 08754 Phone: (732) 929-2130 OCEngineering@co.ocean.nj.us

C. APPLICANT'S AGENT

I Mayor Susan Marshall , the Applicant/Owner and _____, co-Applicant/Owner authorize to act as my agent/representative in all matters pertaining to my application the following person:

Ericka Naklicki	
Name of Agent	Signature of Applicant/Owner
Principal Environmental Scientist, T&M Associates	
Occupation/Profession of Agent	Signature of co-Applicant/Owner

AGENT'S CERTIFICATION:

I agree to serve as agent for the above-referenced applicant:

	T&M Associates
Signature of Agent	Name of Firm

D. STATEMENT OF PREPARER OF PLANS, SPECIFICATIONS, SURVEYOR'S OR ENGINEER'S REPORT

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

Signature

Jason Worth, P.E.

Print Name

Consulting Engineer, T&M Associates

Position & Name of Firm

Professional License # Date

E. STATEMENT OF PREPARER OF APPLICATION, REPORTS AND/OR SUPPORTING DOCUMENTS (other than engineering)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

Signature

Ericka Naklicki, PWS

Print Name

Principal Environmental Scientist, T&M Associates

Position & Name of Firm

2938

Professional License # (If Applicable) Date

F. APPLICATION(S) FOR: (Check all that apply – Fee calculations and directions on pages 6, 7, & 8)

	Coastal General Permits	Fee Amount	Fee Paid
☐	**CZMGP1** Amusement Pier Expansion	$1,000.00	
☐	**CZMGP2** Beach/Dune Activities	$1,000.00	
☐	**CZMGP3** Voluntary Reconstruction Certain Residential/Commercial Dev.	$1,000.00	
☐	**CZMGP4** Development of one or two SFH or Duplexes	$1,000.00	
☐	**CZMGP5** Expansion or Reconstruction SFH/Duplex	$1,000.00	
☐	**CZMGP6** New Bulkhead/Fill Lagoon	$1,000.00	
☐	**CZMGP7** Revetment at SFH/Duplex	$1,000.00	
☐	**CZMGP8** Gabions at SFH/Duplex	$1,000.00	
☐	**CZMGP9** Support Facilities at a Marina	$1,000.00	
☐	**CZMGP10** Reconstruction of Existing Bulkhead	$1,000.00	
☐	**CZMGP11** Hazard Waste Clean-up	$1,000.00	
☐	**CZMGP12** Landfall of Utilities	$1,000.00	
☐	**CZMGP13** Recreation Facility at Public Park	$1,000.00	
☐	**CZMGP14** Bulkhead Construction & Fill Placement	$1,000.00	
☐	**CZMGP15** Construction of Piers/Docks/Ramps in Lagoons	$1,000.00	
☐	**CZMGP16** Minor Maintenance Dredging in Lagoons	$1,000.00	
☐	**CZMGP17** Eroded Shoreline Stabilization	$1,000.00	
☐	**CZMGP18** Avian Nesting Structures	$1,000.00	
☐	**CZMGP19** Modification of Electrical Substations	$1,000.00	
☐	**CZMGP20** Legalization of the Filling of Tidelands	$1,000.00	
☐	**CZMGP21** Construction of Telecommunication Towers	$1,000.00	
☐	**CZMGP22** Construction of Tourism Structures	$1,000.00	
☐	**CZMGP23** Geotechnical Survey Borings	$1,000.00	
☒	**CZMGP24** Habitat Creation/Restoration/Enhancement/Living Shorelines	No Fee	No Fee
☐	**CZMGP25** 1 to 3 Turbines < 200 Feet	$1,000.00	
☐	**CZMGP26** Wind Turbines < 250 Feet	$1,000.00	
☐	**CZMGP27** Dredge Lagoon (post storm event)	$1,000.00	
☐	**CZMGP28** Dredge post Bulkhead Failure	$1,000.00	
☐	**CZMGP29** Dredge Marina (post storm event)	$1,000.00	
☐	**CZMGP30** Aquaculture Activities	$1,000.00	
☐	**CZMGP31** Placement of Shell (shellfish areas)	$1,000.00	
☐	**CZMGP32** Application of Pesticides in Coastal Wetlands	$1,000.00	
☐	**CZM** General Permit Extension	$240.00	
☐	**CZM Permit-by-Certification** *(On-line application ONLY)*	$600.00	

	CAFRA and Waterfront Development Permits	Fee Amount	Fee Paid
☐	CAFRA Individual Permit		
☐	CAFRA Exemption Request	$500.00	
☐	Waterfront Development Individual Permit/Upland		
☐	Waterfront Development Individual Permit/In-water		
☐	Modification of a Coastal GP	$500.00	
☐	Minor Technical Modification of a CAFRA IP	$500.00	
☐	Minor Technical Modification of a Waterfront IP	$500.00	
☐	Major Technical Modification of a CAFRA IP		
☐	Major Technical Modification of a Waterfront IP		
☐	Zane Letter	$500.00	
☐	Waterfront Development Individual Permit - Extension		
☐	Individual Permit Equivalency/CERCLA	No Fee	No Fee

	Flood Hazard Area General Permits	Fee Amount	Fee Paid
☐	**FHAGP1** Channel Clean w/o Sediment Removal	No Fee	No Fee
☐	**FHAGP1** Channel Clean w/Sediment Removal	No Fee	No Fee
☐	**FHAGP2** Mosquito Control	$1,000.00	
☐	**FHAGP3** Scour Protection Bridges/Culverts	$1,000.00	
☐	**FHAGP4** Creation/Restoration/Enhancement of Habitat and Water Quality Values and Functions	No Fee	No Fee
☐	**FHAGP5** Reconstruction and/or Elevation of Building in a Floodway	No Fee	No Fee
☐	**FHAGP6** Construction of One SFH/Duplex and Driveway	$1,000.00	
☐	**FHAGP7** Relocation of Manmade Roadside Ditches for Public Roadway Improvements	$1,000.00	
☐	**FHAGP8** Placement of Storage Tanks	$1,000.00	
☐	**FHAGP9** Construction/Reconstruction of Bride/Culvert Across Water < 50 Acres	$1,000.00	
☐	**FHAGP10** Construction/Reconstruction of Bride/Culvert Across Water > 50 Acres	$1,000.00	
☐	**FHAGP11** Stormwater Outfall Along Regulated Water <50 Acres	$1,000.00	
☐	**FHAGP12** Construction of Footbridges	$1,000.00	
☐	**FHAGP13** Construction of Trails and Boardwalks	$1,000.00	
☐	**FHA** General Permit Extension	$240.00	
☐	**FHA Permit-by-Certification** (Except PBC 4 & 5) *(On-line application ONLY)*	$1,000.00	

	Flood Hazard Area		
☐	FHA Individual Permit		
☐	FHA Verification		
☐	FHA Hardship Exception (Must be submitted with a paid FHA IP)	$4,000.00	
☐	FHA Minor Technical Modification of a GP, IP or Verification		
☐	FHA Major Technical Modification of a GP, IP or Verification		
☐	FHA Extension of an IP or Verification		
☐	FHA Individual Permit Equivalency/CERCLA	No Fee	No Fee

	Stormwater Review Fees	Fee Amount	Fee Paid
☐	Fee for all Stormwater Reviews		

	Applicability Determination	Fee Amount	Fee Paid
☐	Coastal Applicability Determination	No Fee	No Fee
☐	Flood Hazard Applicability Determination	No Fee	No Fee
☐	Highlands Jurisdictional Determination	No Fee	No Fee
☐	Executive Order 215	No Fee	No Fee

	Highlands	Fee Amount	Fee Paid
☐	Emergency Permit		
☐	Pre-application Meeting	$500.00	
☐	Resource Area Determination >one acre		
☐	HPAAGP 1/ Habitat Creation/Enhance	No Fee	No Fee
☐	HPAAGP 2 Bank Stabilization	$500.00	
☐	Preservation Area Approval (PAA)		
☐	PAA with Waiver (Specify type below)		

	Coastal Wetlands	Fee Amount	Fee Paid
☐	Coastal/Tidal Wetlands Permit		
☐	Coastal Wetland Permit Modification		

	Freshwater Wetlands	Fee Amount	Fee Paid
☐	FWGP1 Main. & Repair Exist Feature	$1,000.00	
☐	FWGP2 Underground Utility Lines	$1,000.00	
☐	FWGP3 Discharge of Return Water	$1,000.00	
☐	FWGP4 Hazard Site Invest/Cleanup	$1,000.00	
☐	FWGP5 Landfill Closures	$1,000.00	
☐	FWGP6 Filling of Non-Tributary Wetlands	$1,000.00	
☐	FWGP6A TA Adj. to Non-Tributary Wetlands	$1,000.00	
☐	FWGP7 Human-made Ditches/Swales in Headwaters	$1,000.00	
☐	FWGP8 House Additions	$1,000.00	
☐	FWGP9 Airport Sight-line Clearing	$1,000.00	
☐	FWGP10A Very Minor Road Crossings	$1,000.00	
☐	FWGP10B Minor Road Crossings	$1,000.00	
☐	FWGP11 Outfalls / Intakes Structures	$1,000.00	
☐	FWGP12 Surveying and Investigating	$1,000.00	
☐	FWGP13 Lake Dredging	$1,000.00	
☐	FWGP14 Water Monitoring Devices	$1,000.00	
☐	FWGP15 Mosquito Control Activities	$1,000.00	
☐	FWGP16 Creation/Restoration/Enhancement Habitat	No Fee	No Fee
☐	FWGP17 Trails / Boardwalks	$1,000.00	
☐	FWGP17A Non-Motorized Multi-Use Paths	$1,000.00	
☐	FWGP18 Dam Repairs	$1,000.00	
☐	FWGP19 Docks and Piers	$1,000.00	
☐	FWGP20 Bank Stabilization	$1,000.00	
☐	FWGP21 Above Ground Utility Lines	$1,000.00	
☐	FWGP22 Expansion Cranberry Growing (Pinelands)	No Fee	No Fee
☐	FWGP23 Spring Developments	$1,000.00	
☐	FWGP24 Malfunctioning Individual Septic Systems	No Fee	No Fee
☐	FWGP25 Minor Channel / Stream Cleaning	$1,000.00	
☐	FWGP26 Redevelop Previously Disturbed Site	$1,000.00	
☐	FWGP Administrative Modification	No fee	No Fee
☐	FWGP Minor technical modification	$500.00	
☐	FWGP Major technical modification	$500.00	
☐	FWGP Extension	$500.00	

	Freshwater Wetlands	Fee Amount	Fee Paid
☐	Individual Wetlands Permit		
☐	Individual Open Water Permit		
☐	Individual Permit Administrative Modification	No Fee	No Fee
☐	Individual Permit Minor Technical Modification	$500.00	
☐	Individual Permit Major Technical Modification		
☐	Individual Permit Extension		
☐	Wetlands Exemption	$500.00	
☐	Permit Equivalency/CERCLA	No Fee	No Fee

	Transition Area Waiver	Fee Amount	Fee Paid
☐	Averaging Plan		
☐	Hardship Reduction		
☐	Special Activity Stormwater		
☐	Special Activity Linear Development		
☐	Special Activity Redevelopment		
☐	Special Activity Individual Permit		
☐	Exemption	$500.00	
☐	Administrative Modification	No Fee	No Fee
☐	Minor Technical Modification	$500.00	
☐	Major Technical Modification		
☐	Extension	$500.00	

	Letter of Interpretation	Fee Amount	Fee Paid
☐	Presence Absence	$1,000.00	
☐	Presence Absence Footprint	$1,000.00	
☐	Delineation ≤ 1.00 Acres	$1,000.00	
☐	Verification		
☐	Extension		

	Consistency Determination	Fee Amount	Fee Paid
☐	Water Quality Certificate		
☐	Federal Consistency	No Fee	No Fee
☐	HMC Water Quality Certificate		

Please note: If no fee amount is specified in the "Fee Amount" column, please refer to the Regulatory Fee Schedule which can be found at www.nj.gov/dep/landuse/forms.html. The following types of applications DO NOT require a fee submittal:

Coastal Permitting	• General Permit # 24 - Habitat creation, restoration, enhancement and living shoreline activities • Individual Permit Equivalency – CERCLA • Administrative Modifications
Applicability Determinations	• Coastal Applicability Determination • Highlands Jurisdictional Determination • Flood Hazard Area Applicability • Executive Order 215
Flood Hazard Area	• General Permit #1 – Channel cleaning under the Stream Cleaning Act • General Permit #4 – Creation, restoration, and enhancement of habitat and water quality values and functions • General Permit #5 – Reconstruction and/or elevation of a building in a floodway • Transfer of Approval • Administative Modifications • Individual Permit Equivalency – CERCLA
Federal Consistency	• Federal Consistency Determination
Highlands	• General Permit #1 - Habitat Creation, Restoration, Enhancement
Freshwater Wetlands	• General Permit #16 - Habitat creation and enhancement activities • General Permit #17 - Trails and Boardwalks (NO FEE when the activity is proposed on publicly owned lands) • General Permit #22 – Expansion of cranberry growing operations in the Pinelands • General Permit #24 – Malfunctioning individual subsurface sewage disposal (septic) systems • Individual Permit Equivalency – CERCLA

Also: In addition to the standard paper submission, an electronic copy of the entire application, including plans, may be submitted on CD-ROM to assist the Department in the review this application. Plans should be submitted as a CAD file or Shapefile, georeferenced in NJ state plane feet NAD83. Please do NOT send the electronic version via E-Mail.

Electronic permitting and/or application submittal is available for specific applications. Please see the Division website at www.nj.gov/dep/landuse/epermit.html for more information.

APPLICANT NAME: Tuckerton Borough FILE # (if known): _____

APPLICATION FORM - APPENDIX I

Section 1: Please provide the following information for the overall project site. All area measurements shall be recorded **in acres to the nearest thousandth** (0.001 acres).

PROPOSED:	*PRESERVED*	*UNDISTURBED*	*DISTURBED*
RIPARIAN ZONE			
CZMRA FORESTED *(CZMRA IP – Only)*			
E & T HABITAT *Endangered and/or Threatened*			
FRESHWATER WETLANDS			

Section 2: Please provide the following information for each permit/authorization requested pursuant to the Freshwater Wetlands Protection Act. All area measurements shall be recorded **in acres to the nearest thousandth** (0.001 acres). Use additional sheets if necessary

PERMIT TYPE _____ WETLAND TYPE *Emergent, Forest, Shrub, Etc.* _____ RESOURCE CLASSIFICATION *Ordinary, Intermediate, Exceptional, EPA, Etc.* _____

PROPOSED DISTURBANCE:	*WETLANDS*	*TRANSITION AREA*	*SOW*
FILLED			
EXCAVATED			
CLEARED			
TEMPORARY DISTURBANCE			

PERMIT TYPE _____ WETLAND TYPE *Emergent, Forest, Shrub, Etc.* _____ RESOURCE CLASSIFICATION *Ordinary, Intermediate, Exceptional, EPA, Etc.* _____

PROPOSED DISTURBANCE:	*WETLANDS*	*TRANSITION AREA*	*SOW*
FILLED			
EXCAVATED			
CLEARED			
TEMPORARY DISTURBANCE			

Appendix II - Fee Calculation Sheet (Re. .ed)

Directions:

The Fee Calculation sheet is broken down by the types of programs administered by the Division of Land Use Regulation: Coastal, Flood Hazard Area, Freshwater Wetlands, Stormwater Review.

Use the abbreviation key below in order to identify the type(s) of applications that you need to submit for your project. Once you find your application type(s) work through the **calculation column** and place the figure on the **fee amount** line. Do this for each application type and subtotal each section. In section 5 – enter the subtotals as indicated and add the fee figures to find your total fee.

- Whenever the calcuation requires an acreage figure, you will need to round UP to the nearest whole number, for example: 0.25 acres gets rounded up to one (1) acre or 2.61 acres gets rounded up to three (3) acres.
- The maximum fee for a CAFRA Individual permit, an Upland Waterfront Development permit, or an In-Water Waterfront Development permit is $30,000 per permit type. For example: if you are applying for both an upland and an in-water Waterfront Development the maximum fee is applied to each permit for a maximum total of $60,000 plus any applicable stromwater review fee.
- No matter how many types of applications are required, the stormwater review fee is applied only one time – maximum of $20,000.

Abbreviation KEY

CAFRA = CZM	General Permit = GP	Single Family Home = SFH
Coastal (Tidal) Wetlands = CSW	Individual Permit = IP	Transion Area Waiver = TAW
Extension = EXT	Letter of Interpretation = LOI	Verification = VER
Flood Hazard Area = FHA	Mean High Water Line = MHWL	Waterfront Development = WD
Freshwater Wetlands = FWW	Modification = MOD	Water Quality Certificate = WQC

Section 1 - Coastal Application Type	Calculation	Fee Amount
All General Permits (Except for Coastal GP #4)	$1,000 x 1 # of GPs requested	No Fee
CZM – IP SFH or Duplex	$2,000	
CZM – IP Residential other than SFH/duplex	$3,000 x _____ # of units	
CZM – IP Commercial, Industrial or Public	$3,000 x _____acres of the site	
CSW – IP SFH or Duplex	$2,000	
CSW – IP All Development other than SFH/duplex	$3,000 x _____acres of wetlands disturbed	
WD - IP SFH or Duplex (Landward of MHWL)	$2,000	
WD – IP Residential other than SFH/duplex (Landward of MHWL)	$3,000 x _____# of units	
WD – IP Commercial, Industrial or Public Development	$3,000 x _____acres of the site	
WD - IP SFH or Duplex (Waterward of MHWL)	$2,000	
WD – IP All Development other than SFH/duplex (Waterward of MHWL)	$3,000 x _____acres of water area impacted	
CZM, CSW, WD – Minor Technical Modification (GP/IP)	$500 x _____# of items to be revised	
CZM, CSW, WD – Major Technical Modification (GP/IP)	0.30 x _____original fee = Fee (Minimum $500)	
General Permit Extension	$240 x _____# of GPs to be extended	
WD – IP Permit Extension	0.25 x _____original fee = Fee (Maximum $3,000)	
CZM, CSW, WD – Exemption Request	$500 x _____# of exemptions requested	
	Subtotal for Coastal Applications	No Fee

Section 2 - Freshwater Wetlands Application Type	Calculation	Fee Amount
All General Permits (Except those listed in notes on Page 4)	$1,000 x _____# of GPs requested	
FWW – LOI Presence/Absence, Footprint, Delineation < 1 acre	$1,000	
FWW – LOI Line Verification	$1,000 + ($100 x _____# of acres of the site)	
FWW – TAW with valid LOI	$1,000 + ($100 x _____# acres FWW disturbed)	
FWW – TAW without valid LOI	$1000 + ($100 x _____acres TAW disturbed)+ LOI Fee	
FWW – IP or Open Water Fill SFH or Duplex	$2,000	
FWW – IP or Open Water Fill other than SFH or Duplex	$5,000 + ($2,500 x _____# acres FWW disturbed)	
FWW – GP, TAW, IP, Open Water Fill Minor Technical Modification	$500	
FWW – GP, TAW, IP, Open Water Fill Major Technical Modification	0.30 x _____original fee (Minimum $500)	
FWW – EXT LOI Presence/Absence, Footprint, Delineation < 1 acre	$500	
FWW – EXT LOI Line Verification	0.50 x _____original fee (Minimum $500)	
FWW – EXT GP or TAW	$500 x _____# of items to be extended	
FWW – EXT IP or Open Water Fill	0.50 x _____original fee (Minimum $500)	
	Subtotal for Freshwater Welands Applications	

Appendix II - Fee Calculation Sheet - Continued

Section 3 - Flood Hazard Area Application Type	Calculation	Fee Amount
All General Permits (Except for FHAGP 1, 4, 5)	$1,000 x _____# of GPs requested	
FHA – VER Methods 1, 2, 3, 5 (Fee not applicable to one (1) SFH)	$1,000	
FHA – VER Method 4 or 6	$4,000 + ($400 x _____per 100 linear feet)	
FHA – Delineation of Riparian Zone Only	$1,000	
FHA – IP SFH and/or Accessory Structures	$2,000	
FHA – IP * Fee not applicable to one (1) SFH	$3,000 base	
*Bank/Channel (stabilization, reestablishment, etc.) No Calculation Review --	+ $1,000	
*Bank/Channel (stabilization, reestablishment, etc.) With Calculation Review-	+ ($4,000 + ($400 x _____per 100 linear ft.))	
*Bridge, Culvert, Footbridge, Low Dam, etc. No Calculation Review--	+ $1,000 x _____ # of structures	
*Bridge, Culvert, Footbridge, Low Dam, etc. With Calculation Review-	+ $4,000 x _____ # of structures	
*Review of Flood Storage Displacement (net fill) Calculations----------	+ $4,000	
Review of Hardship Exception Request----------	+ $4,000	
*Utility Line----------	+ $1,000 x _____# of water crossings	
FHA – VER, IP, GP Minor Technical Modification	$500 x _____# of proejct elements to be revised	
FHA – VER, IP, GP Major Technical Modification	0.30 x _____original fee (Minimum $500)	
FHA – Extension of Verification - Method 1, 2, 3, 5, Riparian Zone	$240.00	
FHA - Extension of Verification - Method 4 or 6	0.25 x _____original fee	
FHA – Extension of a General Permit	$240.00 x _____# of GPs to be extended	
FHA – Extension of an Individual Permit	0.25 x _____original fee	
FHA – Department Delineation Minor Revision	$500	
FHA – Department Delineation Major Revision	$4,000 + ($400 x _____per 100 linear feet)	
	Subtotal for Flood Hazard Area Applications	

Section 4 – Individual Water Quality Certificate	Calculation	Fee Amount
WQC (NOTE: No fee required under the coastal program)	$5,000 + ($2,500 x _____ # acres regulated area disturbed)	

Section 5 - Additional Stormwater Review Fee	Calculation	Fee Amount
Stormwater Review	$3,000 base	
Review of Groundwater Recharge Calculations----------	+ $250 x _____# acres disturbed	
Review of Runoff Quantity Calculations----------	+ $250 x _____# acres disturbed	
Review of Water Quality Calculations----------	+ $250 x _____# acres impervious surface	
	Subtotal of Stormwater Review Fee	

Section 6 – Total of Application Fees

Subtotal of Section 1 - Coastal Applications	No Fee
Subtotal of Section 2 - Freshwater Wetlands Applications	
Subtotal of Section 3 - Flood Hazard Area Applications	
Subtotal of Section 4 – Individual Water Quality Certificate	
Subtotal of Section 5 - Additional Stormwater Review	
Total Application Fee	No Fee

Total Fee: No Fee _____ **Check #:** _____

General permit 24 - habitat creation, restoration, enhancement, and living shoreline activities

This general permit authorizes habitat creation, restoration, enhancement, and living shoreline activities necessary to implement a plan for the restoration, creation, enhancement, or protection of the habitat, water quality functions, and values of wetlands, wetland buffers, and open water areas, which is sponsored by a Federal or State agency or other entity. For the purposes of this general permit, a "sponsor" shall endorse the activities in writing. As per **N.J.A.C. - 7:7-6.24(b) 6,** A habitat creation, restoration or enhancement plan carried out by one of the Federal or State agencies at (b)1 through 5 above or by a government resource protection agency such as a parks commission. Since Tuckerton does not have a parks commission, the Tuckerton Waterways Commission is the Government Resource Agency that will sponsor the shoreline enhancement project. The Tuckerton Waterways Commission keeps in touch of lagoon and creek issues such as wake zone problems, dredging projects and marsh restoration projects within Tuckerton Borough.

I Nedean Maddox, Chairwoman of the Tuckerton Waterways Commission, hereby sponsor and support the restoration and enhancement at the shoreline at Tuckerton Cove located parallel to South Green Street.

Nedean Maddox

Nedean Maddox, Chairwoman
Tuckerton Waterways Commission

PROJECT DESCRIPTION

On behalf of the Borough of Tuckerton, T&M Associates is submitting a Coastal General Permit No. 24 application for the construction of a breakwater and shoreline enhancement at South Green Street. The shoreline of interest is a narrow beach parallel to South Green Street, located in Tuckerton Cove at the mouth of Tuckerton Creek. The northern boundary of the project area consists of a sheet pile bulkhead, and the southern boundary consists of a natural beach/wetland habitat consisting of a private residence and T-Shaped dock. There is a narrow sand/beach area that runs parallel to South Green Street. It is important to note that the property is private property and Ocean County Right of Way.

The proposed enhancement will consist of a stone breakwater that will allow for the natural accretion of sand to help restore area to the shoreline as identified in the 1970 Aerial Photograph. The shoreline from the 1970 tideland basemap was traced and converted into a CAD Shapefile to use as a basis for the design of the shoreline enhancement. The goal of the project is to protect the existing municipal infrastructure, reduce wave action for the nearby homes, and expand the shoreline for extra protection. The activities, in turn, will also create new habitat to a eroded shoreline. Stevens Institute prepared a "Living Shoreline Site Conditions and Conceptual Design Report" prepared for The Nature Conservancy, dated March 2016 (included in Attachment E). Based on the description in the report, "Due to a combination of sea level rise, land subsidence, and as much as 30 feet of erosion along the beach, more frequent flooding has occurred, resulting in the inundation of the adjacent road and nearby homes." The intended shoreline enhancement project would encompass approximately 224 linear feet, serving to stabilize and expand the eroding shoreline, with flood defense features to prevent flooding of the roadway due to wave runup/overwash.

The following information summarizes the areas of impact:

- The stone breakater will be 224.2 linear feet long and 28 feet wide.
- The top of the stone breakwater will be at elevation at 2.35' and the MHHWL is Elv. 1.35'.
- A layer of 43 CY of riprap is proposed parallel to the roadway for stabilization purposes.
- The total amount of stone below the MHWL will be 6,210 SF (0.142 Acres) 885 CY.
- The total amount of sand below the MHWL will be 3,765 SF (0.086 Acres) 140 CY.
- The total amount sand above the MHWL will be 3,613 SF (0.083 Acres) 78 CY.
- The total amount of restoration below the HTL for the sand placement will be 2,941 SF 454 CY

This area once completed will create habitat, protect South Green Street and will restore the loss of beach area that has been subject to wave run up and direct storm impact.

As discussed in the SIT report provided in Attachment E, "Based on the historic aerial photograph analysis as well as the bay geometry, it appears as though sediment is being pushed north along the cove until the point at which it leaves the system. During storm conditions, it seems likely that sediment is lost during overwash and through cross-shore currents carrying the material offshore. These currents are likely enhanced by the bulkhead to the north of the project site." To prevent this material from washing out, a stone groin is proposed adjacent to the bulkhead. According to the Restoration Explorer, as described in the SIT Report, beach restoration, an offshore semi-submerged breakwater or an ecologically enhanced revetment are potentially appropriate techniques for stabilizing the South Green Street beach shoreline. Each of the three techniques meet all seven of the environmental conditions used by the restoration explorer to determine a technique's suitability. The below table lists the environmental conditions used for the assessment and the respective results for

the Tuckerton site. Please refer to Attachment E for details on the existing conditions at Green Street and the required shoreline stabilization.

Erosion Shoreline Change: **Not Appilcable**
Tidal Range: **Yes - 2.8 feet**
Salinity: **Yes - 28.5 ppt**
Wave Height: **Yes - 1.1 feet**
Ice Cover: **Yes - Moderate**
Shoreline Slope: **Yes - 5%**
Nearshore Slope: **Yes - 6%**
Total Conditions Satisfied: **7**

The Stevens Institute design included a dune and stone groins at the shoreline. The Borough of Tuckerton wanted the shoreline to remain in a more natural state. The Stevens design also relies on sediment buildup via the stone groins in the future. T&M design is a similar but different approach wherein we would restore the beach area but build the stone breakwater to reduce erosion from waves and boat wakes.

COASTAL GENERAL PERMIT 24 COMPLIANCE STATEMENT

This Compliance Statement has been conducted utilizing the *Rules on Coastal Zone Management* N.J.A.C. 7:7 (last amended July 17, 2017):

7:7-6.24 General permit 24 - habitat creation, restoration, enhancement, and living shoreline activities

1. *This general permit authorizes habitat creation, restoration, enhancement, and living shoreline activities necessary to implement a plan for the restoration, creation, enhancement, or protection of the habitat, water quality functions, and values of wetlands, wetland buffers, and open water areas, which is sponsored by a Federal or State agency or other entity described in (b) below. For the purposes of this general permit, a "sponsor" shall endorse the activities in writing.*

2. *The following habitat creation, restoration, enhancement, and living shoreline plans are acceptable provided they demonstrate compliance with (c) through (g) below:*
    1. *A fish and/or wildlife management plan created or approved by the Department's Division of Fish and Wildlife;*
    2. *A project plan approved under the Partners for Fish and Wildlife program, Coastal Program, or a similar program administered by the USFWS;*
    3. *A project plan created by the U.S. Department of Agriculture's Natural Resources Conservation Service under the Wetlands Reserve program, the Conservation Reserve program, the Conservation Reserve Enhancement program, the Wildlife Habitat Incentive program (WHIP), or a similar program, and approved by the local Soil Conservation District;*
    4. *A plan approved by the Department's Office of Natural Resource Damages for the restoration, creation or enhancement of natural resources injured as the result of an oil spill or release of a hazardous substance;*
    5. *A mitigation project required or approved by a government agency, such as the USACE;*

6. ***A habitat creation, restoration or enhancement plan carried out by one of the Federal or State agencies at (b)1 through 5 above or by a government resource protection agency such as a parks commission; The Municipal Government Resource Agency that is sponsoring the proposed project is the Waterways Commission. Included with the DLUR Form is the sponsorship letter signed by the councilwoman of the Tuckerton Waterways Commission.***
7. *A habitat creation, restoration, or enhancement plan carried out by a charitable conservancy provided that the plan is part of a program listed at (b)2 through 5 above;*
8. *A living shoreline plan designed and/or sponsored by the Department, the USFWS, the Natural Resource Conservation Services, the USACE, the USEPA, or NOAA's Restoration Center;*
9. *A living shoreline plan implemented by a college or university for the purpose of research.*

(c) *Habitat creation, restoration, enhancement, and living shoreline activities that are authorized by this general permit include, but are not limited to, the following:*

1. *Altering hydrology to restore or create wetlands conditions, such as by blocking, removing, or disabling a human-made drainage ditch or other drainage structure such as a tile, culvert or pipe;* Not applicable.
2. *Breaching a structure such as a dike or berm in order to allow water into an area;* Not Applicable.
3. *Placing habitat improvement structures such as:*
   i. Nesting islands;
   ii. Fencing to contain, or to prevent intrusion by, livestock or other animals; and
   iii. Fish habitat enhancement devices or fish habitat improvement structures such as placed boulders, stream deflectors, or brush piles;
   Not applicable

4. *Regrading to provide proper elevation or topography for wetlands restoration, creation, or enhancement;*

   The shoreline will be enhanced with additional sand that will be graded down slope below the MLLWL. There are no wetlands within the project limits. The shoreline consists of a sand beach area and is void of vegetation. As such, the project would not consist of wetland enhancement.

5. *Cutting, burning or otherwise managing vegetation in order to increase habitat diversity or control nuisance flora;* or **Not applicable.**

6. *Establishing a living shoreline to protect, restore, or enhance a habitat.*

The proposed project is not identified as a living shoreline, however, the breakwater will enhance the narrow beach area by providing a barrier to protect the shoreline from erosion. Maximizing the size of the new shoreline provides increased intertidal and subaqueous environments for a variety of aquatic organisms, birds and fish. The new breakwater will act as an artificial reef structure which can provide wave attenuation and natural accretion of sand for shoreline erosion control plus habitat enhancement.

(d) *To be eligible for authorization under this general permit, an applicant shall demonstrate that the proposed project:*

1. *Is part of a plan for the restoration, creation or enhancement of the habitat and water quality functions and values of wetlands, wetland buffers, and/or State open waters;*

One goal of the shoreline enhancement project is to increase the width of the shoreline to protect municipal infrastructure and add the breakwater to help alleviate wave energy. The shoreline will be improved by providing a wider shoreline graded with sand and protection structures. The goal is to allow the natural accretion of sand over time so the shoreline and beach area will be restored to the 1970 shoreline as shown on historic aerial maps. A few of the main goals are as follows:

- Recreate or enhance shoreline conditions;
- Create or enhance natural habitat;
- Reverse otherwise erosional conditions;
- Enhance access to the shoreline, especially to public shorelines.

The new shoreline will ultimately provide habitat for a variety of animal communities including crabs, snails, mussels, fish, mammals and birds. The breakwater will protect and help improve the function and value of the shoreline. The proposed stone will help strengthen the structure to withstand erosion forces and will provide habitat for a variety of clams, mussels, oysters, and other sessile organisms. Once the beach is established, the habitat will attract common birds of the tidal marsh/beach including osprey, herons, egrets, shorebirds and ducks.

As such, the design of the breakwater and beach is intended to re-create the former shoreline that existed approximately four decades ago. The project will enhance the shoreline which will increase the value of the beach and provide shoreline protection from currents and other erosion factors.

2. *Is consistent with the requirements of the Wetlands Act of 1970, the Waterfront Development Law, the Coastal Area Facility Review Act and this chapter.*

The proposed shoreline enhancement has been designed to comply with the various laws and regulations to the greatest extent possible. This compliance statement addresses the Coastal Zone Management Rules that apply to the proposed habitat enhancement. The goal of the project is to restore and repair a severely eroded shoreline and restore the beach that once existed to match the shoreline from the 1977 tidelands base map.

3. *Will improve or maintain the values and functions of the ecosystem; and*

Once the breakwater is constructed, the shoreline will naturally accrete, and the habitat values and functions will be improved. The proposed project will improve the value of the ecosystem by providing a wider beach area to provide habitat for coastal community species. The shoreline will be protected with the structure to protect the habitat from further erosion.

4. *Will have a reasonable likelihood of success, or, if performed by a college or university, in accordance with (b)9 above, will advance the level of knowledge regarding living shorelines in the State.*

The breakwater design is based on criteria defined in the Stevens Institute of Technology guidelines. T&M Associates coastal engineer has conducted extensive research to assess the area for exposure to wave action and currents as detailed in the Steven's Guideline and to the SIT report that is included in Attachment E. The breakwater was selected in order to address the anticipated and historically observed relatively high erosion forces in this area of Tuckerton Cove. Accordingly, based on analysis of potential wave action, a stone breakwater structure was designed to resist erosion and dissipate wave energy along the edge of the shoreline and to allow the natural accretion of sand at the shore. In order to access the long-term stability of the breakwater, geotechnical soil borings were performed along the shoreline. The rsults of the borings revealed silty sand substrate. Based on the SIT and engineer surveys and background research, the proposed project has been designed with a strong likelihood of being successful.

The Stevens Institute design included a dune and stone groins at the shoreline. The Borough of Tuckerton wanted the shoreline to remain in a more natural state. The Stevens design also relies on sediment buildup via the stone groins in the future. T&M design is a similar but different approach wherein we would restore the beach area but build the stone breakwater to reduce erosion from waves and boat wakes.

(e) *Activities under this general permit, except for living shoreline activities, which are subject to the requirements of (f) below, shall comply with the following:*

1. *If the proposed habitat creation, restoration, or enhancement activity is to take place in special areas, as defined at N.J.A.C 7:7-9, the general permit authorization shall be issued only if the Department finds that there are no practicable alternatives that would involve less or no disturbance or destruction of special areas;* Subchapter 9 is addressed below.

2. The activities shall disturb the minimum amount of special areas as defined at N.J.A.C. 7:7-9 necessary to successfully implement the project plan;

3. The activities shall not decrease the total combined area of special areas on a site. However, the Department may approve a decrease if the Department determines that the activities causing the decrease are sufficiently environmentally beneficial to outweigh the negative environmental effects of the decrease. In addition, the Department may approve conversion of one special area to another spec al area if the Department determines that such conversion is environmentally beneficial;

(g) Public access shall be provided in accordance with the lands and waters subject to public trust rights rule, N.J.A.C. 7:7-9.48, and the public access rule, N.J.A.C. 7:7-16.9. The shoreline is private property; however the waterbody is public property. As such, the water will continue to be accessible to the public for a variety of fishing, swimming, seining, or snorkeling activities. The public can access the area via the public park located at the terminus of South Green Street.

(h) This general permit does not authorize an activity unless the sole purpose of the activity is habitat creation, restoration, enhancement, or a living shoreline. For example, this general permit does not authorize construction of a detention basin in wetlands for stormwater management, even if the detention basin or the project of which the basin is a part will also result in habitat creation or enhancement. The sole purpose of the proposed project is to enlarge/enhance the beach habitat located along the roadway. The stone will provide habitat to a variety of shellfish and other sessile organisms and the enlarged beach will provide habitat to a variety of coastal species.

SPECIAL AREAS (N.J.A.C. 7:7 – SUBCHAPTER 9)

Our assessment concludes that given the nature and location of this project and the environmental inventory of the area, the following special areas exist and are applicable for comment.

N.J.A.C. 7:7 –9.2 – Shellfish Habitat

According to NJDEP GIS Data, Little Egg Harbor and Great Bay contain shellfish harvesting beds near the project area. However, the open water within the immediate vicinity of the saltmarsh is identified as having moderate, occurrence, and high shellfish distribution. There is one area mapped as aquaculture lease areas. However, the proposed project will not impact the shellfish lease area (Shellfish map is included in Attachment A)

According to the NJ Division of Fish and Wildlife the commercially harvested northern quahog (*Mercenaria mercenaria*) is the most valuable of the food species harvested in the bays. The densities of hard clams are highest in the open water and sandflats areas at the southern end of Barnegat Bay and in Little Egg Harbor. Other species supporting commercial fisheries activities include blue crab, white perch, winter flounder, and American eel. The bay is an important spawning and nursery area for blue crab. Crabbing has always been important to this area; one hundred years ago, more crabbing was done in this bay than in any other area on the East Coast. Because blue crab is sensitive to several environmental alarms, including recreational and commercial harvest and anthropogenic effects on the environment its population is likely to continue to vary widely in the future.

Based on the NJ Divisions of Fish and Wildlife "Shellfish Aquaculture Leasing Policy of the Atlantic Coast Section of the NJ Shellfisheries Council" a small portion of Tuckerton Cove is mapped as having hard clam bed leasing areas. The Shellfish lease map is included in Attachment A. Specifically, the leasing area is described as follows:

- Jeremy and Gaunt Point – Little Egg Harbor Bay- There are 46 leases, that total 203.42 acres of hard clams grow in this area. This area is near the proposed breakwater location but will not be impacted by the construction,

Impacts to the shellfish habitats will be minimized through best management practices including a silt fences and floating turbidity barrier to reduce turbidity during construction.

N.J.A.C. 7:7 –9.3 – Surf Clam Areas

As described above, based on the shellfish distribution maps from the Division of Fish and Wildlife Little Egg Harbor and Great Bay are identified as having an occurrence of hard clam density. The contractor will use the appropriate turbidity measures (floating turbidity barrier) during construction in order to decrease the siltation and other disturbances that could result in the surrounding shellfish habitat.

N.J.A.C. 7:7 –9.4 – Prime Fishing Areas

Prime fishing areas include tidal water areas and water's edge areas which have a demonstrable history of supporting a significant local intensity of recreational or commercial fishing activity. These areas include all coastal jetties, groins, public fishing piers or docks, and artificial reefs.

There are numerous docks and piers and marinas within the close proximity of the proposed project that provide areas for access to the water for fishing. The proposed breakwater is not anticipated to adversely impact any of the existing prime fishing areas.

N.J.A.C. 7:7-9.6 – Submerged Vegetation Habitat

Based on the NJDEP New Jersey Submersed Aquatic Vegetation (SAV) Distribution Map, dated 1979, the project area is mapped as having SAV. The project area is void of submerged vegetation. The substrate consists of sand and small stones. The existing conditions of the shoreline do not provide habitat for SAV. The only submerged aquatic vegetation (SAV) is algae (green and others on the bottom) and some brown algae around the periphery. This applies to all of Great Bay. There are no vascular plants in Tuckerton Cove. The breakwater and shoreline improvements will improve the eroded and degraded shoreline by stabilizing the shoreline with stone. Although there are is no SAV habitat, the breakwater will improve a degraded shoreline which may help re-introduce eelgrass or other submerged aquatic vegetation over time.

N.J.A.C. 7:7-9.15 – Intertidal and Subtidal Shallows

The stone breakwater will incur some limited impacts (e.g., placement of stone) to inter-tidal and sub-tidal shallows. The goal of the project is to improve the intertidal and subtidal shallows by improving the narrow shoreline and allow the natural accretion of sand to restore the beach habitat. The improved shoreline will provide potential areas for colonial water birds and coastal species to breed and thrive. This project is intended to improve a severely eroded shoreline and to prevent the loss of this irreplaceable habitat.

The shoreline along South Green Street, been subject to long-term erosion and is considered previously disturbed. The goal of the project is to improve the narrow beach habitat and to prevent the loss of the roadway. The stone revetment will allow for the tide to flush into and out of the stones to provide habitat for shellfish and/or other aquatic species.

The implementation of the stone breakwater will aid in stabilizing the shoreline while also providing habitat for aquatic vegetation and animals. The proposed project will comply with the following rules:

a) Intertidal and subtidal shallows means all permanently or temporarily submerged areas from the spring high water line to a depth of four feet below mean low water.

b) Development, filling, new dredging, or other disturbance is discouraged but may be permitted in accordance with (c), (d), (e), (f), (g), and (h) below and with N.J.A.C. 7:7-12.2through 12.24. Maintenance dredging of intertidal and subtidal shallows is acceptable to maintain adequate water depths in accordance with N.J.A.C. 7:7-12.6.

Although the inertial/subtidal shallows will be impacted by the filling activities associated with the stone, the tides will continue to reach the habitat. Once the stones

settle, sessile organisms and other aquatic flora and fauna will naturally return to the area.

c) *New dredging, as defined in N.J.A.C. 7:7-12.7, in intertidal and subtidal shallows is discouraged, unless it complies with the following conditions.* This rule is not applicable to the proposed project since the project does not involve dredging activities.

d) The installation of submerged infrastructure within intertidal and subtidal shallows is conditionally acceptable, provided: **Not applicable**

1. Directional drilling is used unless it can be demonstrated that the use of directional drilling is not feasible;
2. Where directional drilling is not feasible, there is no feasible alternative route that would not disturb intertidal and subtidal shallows;
3. The infrastructure is located deeply enough to avoid exposure or hazard; and
4. All trenches are backfilled to the preconstruction depth with naturally occurring sediment.

e) *The filling of intertidal and subtidal shallows for beach nourishment is conditionally acceptable provided it meets the requirements of the filling rule at N.J.A.C. 7:7-12.11(f) and the coastal engineering rule at N.J.A.C. 7:7-15.11(f).* **These rules are addressed further in this compliance statement.**

f) *The establishment of a living shoreline in intertidal and subtidal shallows to address the loss of vegetated shorelines and habitat in the littoral zone is conditionally acceptable provided the living shoreline complies with N.J.A.C. 7:7-12.23.* **This rule is addressed further in this compliance statement.**

g) *The construction and/or replacement of a bulkhead within intertidal and subtidal shallows is conditionally acceptable provided the bulkhead meets the requirements of the filling rule at N.J.A.C. 7:7-12.11(f) and the coastal engineering rule at N.J.A.C. 7:7-15.11(d).* **This rule is not applicable to the proposed project.**

N.J.A.C. 7:7E – 9.19 Erosion Hazard Areas

The project area can be considered erosion hazard areas due to the lack of beach and eroded nature of the shoreline. This area is considered to be highly susceptible to further erosion unless corrective action is taken. There are numerous houses that are located along South Green Street that could be impacted by the eroded nature of shoreline. To this extent, eroding shoreline will be stabilized by installing the breakwater to allow for the natural accretion of sand thus improving shoreline erosion. Installation of the breakwater will restore the shoreline to the limits of the shoreline from the aerials from the 1970's and as such, meets the criteria of this policy. The breakwater will also help stabilize and protect the shoreline from boat wakes or other erosion forces.

N.J.A.C. 7:7-9.27 – Wetlands

The proposed project will not result in the adverse impacts to any wetlands near the project area. As such, this rule is not addressed further.

N.J.A.C. 7:7-9.36 – Endangered or Threatened Wildlife or Vegetation Species Habitat

Based on NJDEP Landscape Project Data (Version 3.3) Tuckerton Cove is mapped as containing habitat for a variety of bird species including Black crowned night heron (State Threatened), Black skimmer (State endangered), Osprey (ST), Least tern (SE), Caspian tern (Special concern), Little blue heron (SC), Common tern (SC), Glossy ibis (SC), Snowy Egret (SC), tricolored heron (SC), Bald eagle (SE), Northern harrier (SE), and Gull billed tern (SC),

The breakwater will improve the value of the ecosystem by providing a wider beach area to allow for oysters to colonize and birds to forage and rest. The breakwater will protect the habitat from further erosion.

N.J.A.C. 7:7E-9.37 – Critical Wildlife Area

As described in the above section, Tuckerton Cove and the surrounding marsh habitat contain suitable habitat for a variety of State threatened and endangered bird species. In addition, the marsh habitat provides habitat for diamondback terrapin and a variety of shellfish.

As such, the marsh and cove provide a unique habitat to a variety of critical wildlife. The proposed project will be designed and implemented carefully so as to not impact the sensitive ecosystem. A designated ecologist can be onsite during the construction activities if required by the Department to ensure the contractor is addressing Best Management Practices. The goal of the project is to improve the habitat and protect it from impacts associated with storms and sea level rise. This critical wildlife habitat will be protected to the greatest extent possible. The project will also restore an eroded beach and increase the shoreline to protect municipal infrastructure. For additional protection measures, the breakwater will help alleviate the wave energy.

N.J.A.C. 7:7E-9.38 - Public Open Space

The shoreline is private property; however the waterbody is public property. As such, the water will continue to be accessible to the public for a variety of fishing, swimming, seining, or snorkeling activities. The public can access the area via the public park located at the terminus of South Green Street.

N.J.A.C. 7:7-9.48 – Lands and Waters Subject to Public Trust Rights

This project will not adversely impact or otherwise affect lands and waters subject to the Public Trust Rights. Although the beach area is private property, the water is public and can be accessed by the public park at the terminus of South Green Street.

GENERAL WATER AREAS (N.J.A.C. 7:7 – SUBCHAPTER 12)

N.J.A.C. 7:7-12.11 Filling

The proposed project involves the placement of material which is considered filling. The total amount of stone below the MHWL will be 12,960 SF (0.298 Acres) 885 CY. The total amount of sand below the MHWL will be 4,792 SF (288 Acres) 289 CY. This area once completed will create habitat, protect South Green Street and will restore the loss of beach area that has been subject to wave run up and direct storm impact.

Based on this rule, filling is conditionally acceptable provided:

1. *The use that requires the fill is water dependent; improving the shoreline for impending sea level rise and potential storms the overall project is a water dependent activity.*

2. *There is a demonstrated need that cannot be satisfied by existing facilities; as described in this report.*

3. *There is no feasible or practicable alternative site on an existing water's edge; This rule is not applicable to the project.*

4. *The minimum practicable area is filled;*

   The overall project will stabilize the increase the width of the shoreline and protect the adjacent residential properties and shoreline from future erosion and degradation. The project is designed to match the shoreline from the 1977 tidelands Arial shoreline. As such, the project aims to restore the shoreline to the previous location. The new stone revetment and beach area will provide habitat for a variety of aquatic plant and animal species. Best Management Practices will be utilized during construction to protect the shoreline habitat to the greatest extent possible.

5. *The adverse environmental impacts are minimized, for example, by compensating for the loss of aquatic habitat by creation of an area of equivalent or greater environmental value elsewhere in the same estuary.* The stone revetment will allow for the tide to flush into and out of the stones to provide habitat for shellfish and/or other aquatic species.

6. *Minimal feasible interference is caused to special areas, as defined at N.J.A.C. 7:7-9*; The overall project will have little to no impact to special areas. There are no wetlands in the area and SAV is not growing in the project area. The project may result in temporary impacts to subtidal shallows during construction, however BMP's will be followed to minimize impacts. Upon project completion the wider beach and stone will provide habitat to a variety of aquatic bird species and other flora and fauna. During the construction activities, a certified ecologist can be onsite if required by the NJDEP to observe the activities and ensure the project is completed as required by the regulatory agencies.

CAFRA Section 10 Compliance Statement (N.J.S.A. 13:19-10)

a) The proposed project conforms to all applicable water, radiation emission and effluent standards as well as all applicable water quality criteria and air quality standards.

b) In order to meet applicable water quality criteria, all activities will take place using proper soil erosion and sediment control measures. Such methods include, but are not limited to sediment control fences and hay bale protection.

c) The proposed project will not produce air emissions and water effluent in excess of the existing dilution, assimilative, and recovery capacities of the air and water environments at the site and within the surrounding region. The proposed project will not produce harmful air emissions or effluents during construction activities or future operation.

d) The project does not incorporate any development that would incur the need for the collection and disposal of litter, recyclable material and solid waste.

e) The proposed project will not impact the regenerative capacity of water supply aquifers or other ground or surface water supplies. In addition, the proposed project will not create an additional demand on shallow or deep sub-surface aquifer systems.

f) The proposed project is not anticipated to interfere with local or regional plant, animal, fish and human life processes within, or in close proximity to the project area. The main goal of the project is to improve the eroded shoreline which will enhance the habitat. The Compliance Statement for Coastal GP 24 provide details on the project impacts to the plant and wildlife habitats within the project area. Overall, the proposed project complies with NJDEP Water Quality and Stormwater Management criteria.

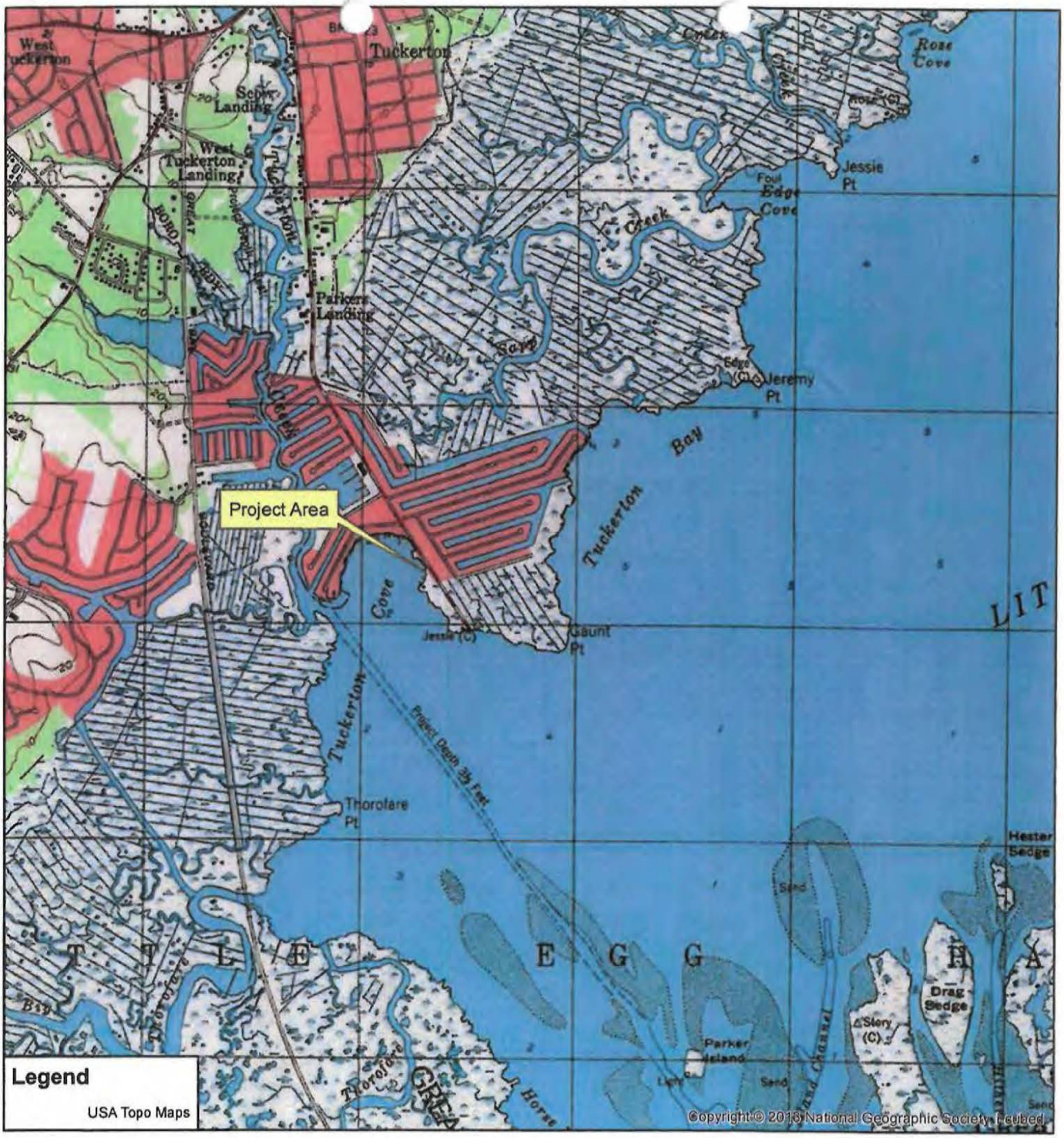
g) The proposed project will not endanger human life or property. In addition, it will not impair the public health, safety, or welfare of residents or visitors to the region. The goal of the project is to improve human life and property by restoring a degraded shoreline for storm protection while also enhancing the shoreline habitat.

h) The project will not result in degradation of unique or irreplaceable land types, historical or archaeological areas, and/or existing public scenic attributes at the site or within the surrounding region. The breakwater and sand replenishment will improve the eroded shoreline as further addressed in the Coastal GP 24 application.

CONCLUSION:

Based on a review of the Coastal Zone Management Rules, the proposed project complies with regulations pertaining to development in the CAFRA region. As with any form of development, however, certain irreversible and unavoidable impacts occur. The project team identified these impacts in order to prevent unnecessary environmental impacts where feasible.

Attachment A – Site Location Maps
USGS Topographic Map
Site location Map
Shellfish Maps



11 Tindall Road
Middletown, NJ 07748-2792
Phone: 732-671-6400
Fax: 732-671-7365

N

2,000 1,000 0 2,000 Feet

USGS Topographic Map
South Green Shoreline Restoration
Living Shoreline
Tuckerton Borough
Ocean County, New Jersey

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

Prepared by: EJN 5/1/18
Source: USGS topographic Maps
File Path:G:\Projects\LEHT\01730\Permits\NJDEP\Green Street Coastal GP 24\USGS Topographic Map.mxd

11 Tindall Road
Middletown, NJ 07748-2792
Phone: 732-671-6400
Fax: 732-671-7365

300 150 0 300 Feet

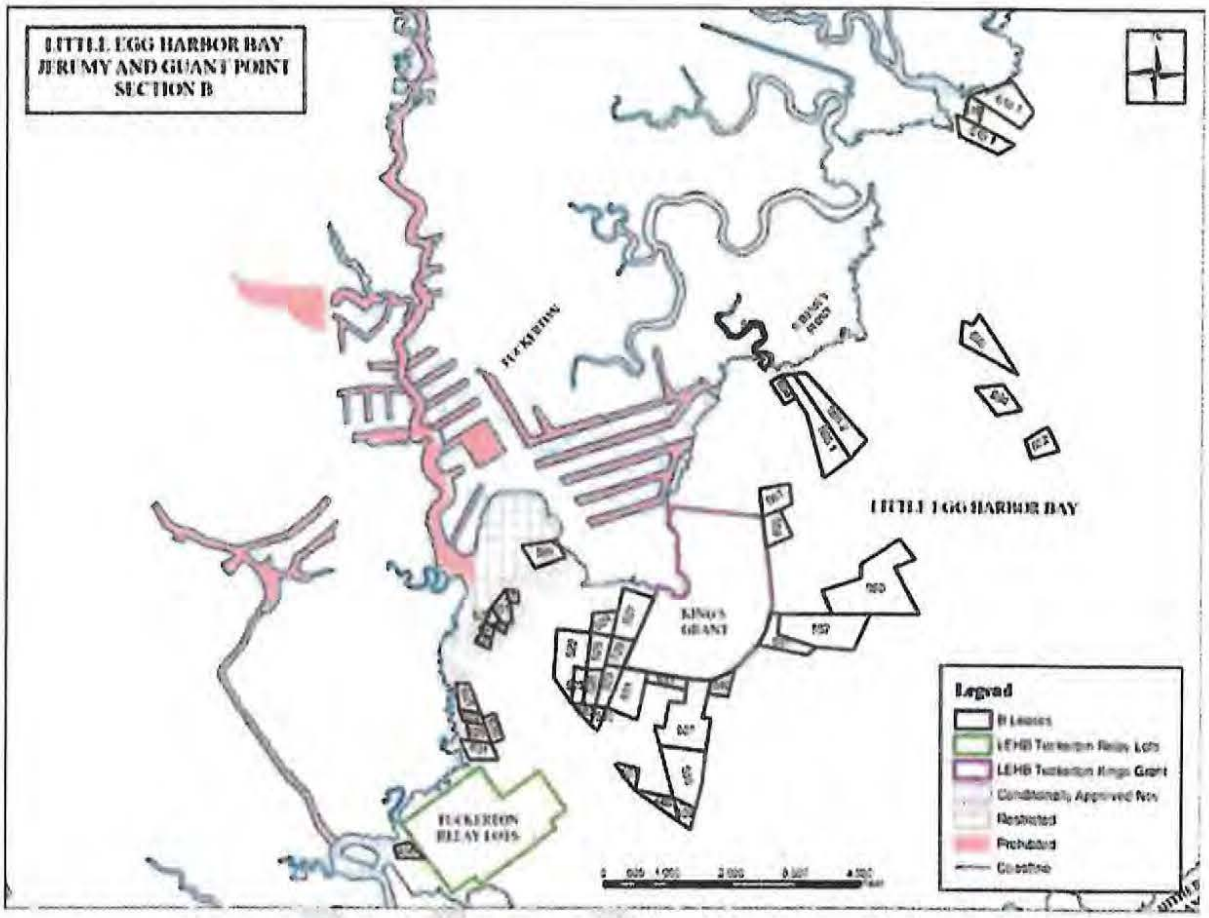
N

Site Location Map
South Green Street Shoreline Restoration
Living Shoreline
Tuckerton Borough
Ocean County, New Jersey

Prepared by: EJN 5/1/18
Source: World Imagery Aerial Maps, 1977 Tidelands Basemaps, Ocean County GIS Data
File Path:G:\Projects\LEHT\01730\Permits\NJDEP\Green Street Coastal GP 24\Site Location Map.mxd

NOTE: This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not State-authorized.

Figure B18: Jeremy and Gaunt Point (Little Egg Harbor Bay)



Location: Tuckerton and Little Egg Harbor Township, Ocean County

Existing Leases: 46 leases, 203.42 acres, 2 relay leases, 3.0 acres

Primary Shellfish Grow Out: Hard Clams

Shellfish Growing Waters Classification: Approved, Conditionally Approved and Restricted

Known Concerns: The existing traditional oyster and hard clam leases are only a fraction of what previously existed, due to changes in the substrate and other physical characteristics of the area.

Council Action: Expansion of existing leases encouraged. Potential expansion of leases in this section of Little Egg Harbor Bay shall be developed as a block of leases rather than as individual applications for new ground. Expansion limited to Approved waters. New proposed lease blocks shall need Committee recommendation and Council action for Bureau to investigate and/or accept applications. Designated hard clam relay lease area is regulated under Clam Relay Program at N.J.A.C.7:25-15.

Attachment B – Public Notice Documentation

- Jenny Gleghorn, Clerk
  Tuckerton Borough
  420 East Main St.
  Tuckerton, NJ, 08087

- Planning Board Chair
  Tuckerton Borough
  420 East Main St.
  Tuckerton, NJ, 08087

- Environmental Commission
  Tuckerton Borough
  420 East Main St.
  Tuckerton, NJ, 08087

- Construction Official
  Tuckerton Borough
  420 East Main St.
  Tuckerton, NJ, 08087

- Ocean County Planning Board
  Mr. David McKean
  PO Box 2191
  Toms River, NJ 08754

- Ocean County Environmental Agency
  Karen Greene, Chairperson
  Att: John Protonentis
  175 Sunset Ave.
  P.O. Box 2191
  Toms River, N.J. 08754

- Ocean County Soil Conservation District
  714 Lacey Road
  Forked River, NJ 08731

  Certified Property owners located within 200 feet

ADJACENT PROPERTY LISTING APPLICANT: Block: 45 Lot: 8

TAXING DISTRICT 33 TUCKERTON BORO COUNTY 15 OCEAN

PROPERTY ID	PROPERTY LOCATION	CLASS	OWNERS NAME & ADDRESS
45	SOUTH GREEN STREET	1	MARINI, NAZZARENO, III
2			749 BRIDGEWATER RD
			BENSALEM PA 19020
45	1120 SOUTH GREEN STREET	2	ZHOU, MEILING
3	4		1120 S GREEN ST
			TUCKERTON NJ 08087
45	1122 SOUTH GREEN STREET	1	CAPONE, ANTHONY
5			1150 SOUTH GREEN STREET
			TUCKERTON NJ 08087
45	1150 S. GREEN ST.	2	CAPONE, ANTHONY
7	6		1150 SOUTH GREEN ST
			TUCKERTON NJ 08087
45	1200 SOUTH GREEN STREET	1	TRUEX, LEROY E & DOLORES
9			126 MAYETTA LANDING RD
			MAYETTA NJ 08092
45	1220 S. GREEN ST.	2	TRUEX, LEROY E & DOLORES
10			126 MAYETTA LANDING RD
			MAYETTA NJ 08092
45	S GREEN STREET	15C	BOROUGH OF TUCKERTON
11	11.01,14.01		420 EAST MAIN STREET
			TUCKERTON NJ 08087
118	1128 L.E. HARBOR BLVD.	15C	BOROUGH OF TUCKERTON
6			420 EAST MAIN STREET
			TUCKERTON NJ 08087
118	1130 L E HARBOR BVD	2	BRENNAN, FILOMENA R
7	20		1130 LITTLE EGG HBR BLVD
			TUCKERTON NJ 08087
118	1129 S. GREEN ST.	2	VODOPIJA, STANLEY
9	10		1129 SOUTH GREEN ST.
			TUCKERTON NJ 08087
118	S. GREEN ST.	2	ZHOU, MEILING
11			113 RIDGEDALE AVE
			CEDAR KNOLLS NJ 07927
118	S GREEN ST	1	ZHOU, MEILING
12			1120 S GREEN ST
			TUCKERTON NJ 08087
118	1125 S GREEN ST	2	MARINI, NAZZARENO III
13	14		749 BRIDGEWATER RD
			BENSALEM PA 19020
118	1132 L E HARBOR BVD	2	GRAHAM, DONNA L & CARVES, C
21			2405 NASSAU RD
			CINNAMINSON NJ 08077
118	1134 L E HARBOR BVD	2	MCDEVITT, BERNARD & MELISSA
22			914 S LEWIS RD
			ROYERSFORD PA 19468
118	1136 L.E. HARBOR BLVD	2	STEMPLE, JESSE R & BEVERLEE A
23			1208 FAYETTE ST
			CONSHOHOCKEN PA 19428
118	1138 L E HARBOR BVD	2	SALABRITAS, JEFFREY JR
24			1138 LITTLE EGG HARBOR BD
			LITTLE EGG HARBOR NJ 08087
118	1140 L E HARBOR BVD	1	TUCKERTON ESTATES, INC
25			8 NANTUCKET LANE
			DEER PARK NY 11729

ADJACENT PROPERTY LISTING APPLICANT: Block: 45 Lot: 8

TAXING DISTRICT 33 TUCKERTON BORO COUNTY 15 OCEAN

PROPERTY ID	PROPERTY LOCATION	CLASS	OWNERS NAME & ADDRESS	
118	1142 L E HARBOR BVD	1	TUCKERTON ESTATES, INC	
26			8 NANTUCKET LANE	
			DEER PARK NY	11729
118	1144 L E HARBOR BVD	1	TUCKERTON ESTATES, INC	
27			8 NANTUCKET LANE	
			DEER PARK NY	11729
118	1145 SO GREEN ST	1	TUCKERTON ESTATES, INC	
29			8 NANTUCKET LANE	
			DEER PARK NY	11729
118	1143 SO GREEN ST	1	TUCKERTON ESTATES, INC	
30			8 NANTUCKET LANE	
			DEER PARK NY	11729
118	1141 SO GREEN ST	2	DILORENZO, MICHAEL & PATRICE	
31			21 HIGH TOR RD	
			NEW CITY NY	10956
118	SO GREEN ST	1	DILORENZO, MICHAEL & PATRICE	
32			21 HIGH TOR RD	
			NEW CITY NY	10956
118	1137 SO GREEN ST	1	STEMPLE, BEVERLEE A & JESSE R	
33			1208 FAYETTE ST	
			CONSHOHOCKIN PA	19428
118	1135 SO GREEN ST	2	CLIFFORD, ELIZABETH C	
34			1135 SO GREEN ST	
			TUCKERTON NJ	08087
118	1133 SO GREEN ST	2	DAUGHENBAUGH, SCOTT	
35			1133 SOUTH GREEN ST	
			TUCKERTON NJ	08087
118	SO. GREEN ST.	1	HENIEN, SAMIR & NAGLAA	
36			15 BARRON HILL RD	
			EASTON PA	18042
118	1131 SOUTH GREEN STREET	2	JANY, RUSSELL C	
37			775 WHITE SCHOOL RD	
			HONEY BROOK PA	19344
118	1147 SO GREEN ST	1	DE SIPIO, PETER	
38			26449 OLD STATE RD	
			CRISFIELD MD	21817

YOUR GOALS. OUR MISSION.

LEHT-01730

May 24, 2018

Re: **Public Notice Letter**
Coastal GP 24 Application
South Green Street Shoreline Protection Project
Borough of Tuckerton, Ocean County, New Jersey

Applicant: **Tuckerton Borough**
420 East Main Street
Tuckerton, NJ 08087

Dear Interested Party:

This letter is being sent to inform you that Coastal General Permit No. 24 Application will be submitted to the New Jersey Department of Environmental Protection (NJDEP) Division of Land Use Regulation. application for the construction of a breakwater and shoreline enhancement at South Green Street. The shoreline of interest is a narrow beach parallel to South Green Street, located in Tuckerton Cove at the mouth of Tuckerton Creek. The attached DLUR Application form and reduced site plan provide additional information.

If you would like to inspect a copy of the application, it is on file at the Tuckerton Borough Clerk's Office, or you can call the NJDEP at (609) 777-0456 to make an appointment to see the application at the NJDEP offices in Trenton during normal business hours. The NJDEP welcomes any comments you may have on the application. If you wish to comment on the application, comments should be submitted to the NJDEP *in writing* within 15 days after you receive this letter. Please submit any comments you may have *in writing, along with a copy of this letter,* to:

Mail Code 501-02A
Department of Environmental Protection
Division of Land Use Regulation
P.O. Box 420
Trenton, New Jersey 08625-0420
ATTN: Ocean County Section Chief

Sincerely,

Ericka Naklicki, PWS
Principal Environmental Scientist

G:\Projects\LEHT\01730\Permits\NJDEP\Green Street Coastal GP 24\Public Notice Letter.docx

State of New Jersey
Department of Environmental Protection
Division of Land Use Regulation
Application Form for Permit(s)/Authorization(s)

501 E. State Street Mail Code 501-02A P.O. Box 420
Trenton, NJ 08625-0420
Phone #: (609) 777-0454 Web: www.nj.gov/dep/landuse

Please print legibly or type the following: Complete all sections and pages unless otherwise noted. **Is this project Superstorm Sandy Related** Yes ☐ No ☐

1. **Applicant Name:** Mr./Ms./Mrs Borough of Tuckerton — E-Mail:
   Address: 420 East Main Street — Daytime Phone: 609-296-2701 Ext.
   City/State: Tuckerton, NJ — Zip Code 08087 Cell Phone:
2. **Agent Name:** Mr./Ms./Mrs Ericka Naklicki, PWS
   Firm Name: T&M Associates — E-Mail: enaklicki@tandmassociates.com
   Address: 11 Tindall Road — Daytime Phone: 732-671-6400 Ext. 9509
   City/State: Middletown, NJ — Zip Code 07748 Cell Phone:
3. **Property Owner:** Mr./Ms./Mrs Angelo Micalizzi (Block 45, Lot 8) and Ocean County (Right of Way) (Contact info. on Page 2) — E-mail:
   Address: 105 Mohican Lane — Daytime Phone: 239-331-3194 Ext.
   City/State: Little Egg Harbor, NJ — Zip Code 08087 Cell Phone:
4. **Project Name:** South Green Street Shoreline Protection Project — Address/Location: South Green Street
   Municipality: Borough of Tuckerton — County: Ocean — Zip Code 08087
   Block(s): 45 — Lot(s): 8
   N.A.D. 1983 State Plane Coordinates (feet) E (x): 539,177 N(y): 271,668 *Not Longitude/Latitude*
   Watershed: Little Egg Harbor Bay (Westecunk to Inlet) — Subwatershed: Lower LEH Bay Tributaries
   Nearest Waterway: Tuckerton Cove/Tuckerton Creek
5. **Project Description:** The proposed project involves the construction of stone breakwaters to provide stabilization and assist in the natural accretion of sand to enlarge the beach area. A Coastal General Permit No. 24 application is being submitted to authorize the enhancement activities.

Provide if applicable: Previous LUR File # (s): — Waiver request ID # (s):

A. SIGNATURE OF APPLICANT (required):

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment. If the applicant is an organization such as a corporation, municipal entity, home-owners association etc., the party responsible for the application shall sign on behalf of the organization.

Susan R. Marshall
Signature of Applicant

Date

Mayor Susan Marshall, Tuckerton Borough
Print Name

Signature of Applicant

Date

Print Name

B. PROPERTY OWNER'S CERTIFICATION

I hereby certify that the undersigned is the **owner of the property** upon which the proposed work is to be done. This endorsement is certification that the owner/easement holder grants permission for the conduct of the proposed activity. In addition, written consent is hereby giver to allow access to the site by representatives or agents of the Department for the purpose of conducting a site inspection(s) or survey(s) of the property in question.

In addition, the undersigned property owner hereby certifies:

1. Whether any work is to be done within an easement? Yes ☐ No ☒
   (If answer is "Yes" – Signature/title of resonsible party is required below)
2. Whether any part of the entire project will be located within property belonging to the State of New Jersey? Tidal Waterbody Yes ☒ No ☐
3. Whether any work is to be done on any property owned by any public agency that would be encumbered by Green Acres? Yes ☐ No ☒
4. Whether this project requires a Section 106 (National Register of Historic Places) Determination as part of a federal approval? Yes ☐ No ☒

Signature of Owner

5/17-18
Date

Angelo Micalizzi, Owner of Block 45, Lot 8
Print Name

Signature of Owner/Easement Holder

Date

Ocean County Department of Engineering
Print Name/Title

John N. Ernst, County Engineer
129 Hooper Avenue, Toms River, N.J. 08754
Phone: (732) 929-2130
OCEngineering@co.ocean.nj.us

C. APPLICANT'S AGENT

I Mayor Susan Marshall, the Applicant/Owner and _____, co-Applicant/Owner authorize to act as my agent/representative in all matters pertaining to my application the following person:

Ericka Naklicki
Name of Agent

Principal Environmental Scientist, T&M Associates
Occupation/Profession of Agent

Susan R. Marshall
Signature of Applicant/Owner

Signature of co-Applicant/Owner

AGENT'S CERTIFICATION:

I agree to serve as agent for the above-referenced applicant:

Signature of Agent

T&M Associates
Name of Firm

D. STATEMENT OF PREPARER OF PLANS, SPECIFICATIONS, SURVEYOR'S OR ENGINEER'S REPORT

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

Signature

Jason Worth, P.E.
Print Name

Consulting Engineer, T&M Associates
Position & Name of Firm

GE49287
Professional License #

5/23/18
Date

E. STATEMENT OF PREPARER OF APPLICATION, REPORTS AND/OR SUPPORTING DOCUMENTS (other than engineering)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

Signature

Ericka Naklicki, PWS
Print Name

Principal Environmental Scientist, T&M Associates
Position & Name of Firm

2938
Professional License # (If Applicable)

Date

B. PROPERTY OWNER'S CERTIFICATION

I hereby certify that the undersigned is the **owner of the property** upon which the proposed work is to be done. This endorsement is certification that the owner/easement holder grants permission for the conduct of the proposed activity. In addition, written consent is hereby giver to allow access to the site by representatives or agents of the Department for the purpose of conducting a site inspection(s) or survey(s) of the property in question.

In addition, the undersigned property owner hereby certifies:

1. Whether any work is to be done within an easement? Yes ☐ No ☒
   (If answer is "Yes" – Signature/title of resonsible party is required below)
2. Whether any part of the entire project will be located within property belonging to the State of New Jersey? Tidal Waterbody Yes ☒ No ☐
3. Whether any work is to be done on any property owned by any public agency that would be encumbered by Green Acres? Yes ☐ No ☒
4. Whether this project requires a Section 106 (National Register of Historic Places) Determination as part of a federal approval? Yes ☐ No ☒

Signature of Owner	Signature of Owner/Easement Holder
Date	Date 5/15/18
Angelo Micalizzi, Owner of Block 45, Lot 8	Ocean County Department of Engineering
Print Name	Print Name/Title John N. Ernst, County Engineer 129 Hooper Avenue, Toms River, N.J. 08754 Phone: (732) 929-2130 OCEngineering@co.ocean.nj.us

C. APPLICANT'S AGENT

I Mayor Susan Marshall , the Applicant/Owner and _____, co-Applicant/Owner authorize to act as my agent/representative in all matters pertaining to my application the following person:

Ericka Naklicki	
Name of Agent	Signature of Applicant/Owner
Principal Environmental Scientist, T&M Associates	
Occupation/Profession of Agent	Signature of co-Applicant/Owner

AGENT'S CERTIFICATION:

I agree to serve as agent for the above-referenced applicant:

	T&M Associates
Signature of Agent	Name of Firm

D. STATEMENT OF PREPARER OF PLANS, SPECIFICATIONS, SURVEYOR'S OR ENGINEER'S REPORT

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

Signature

Jason Worth, P.E.

Print Name

Consulting Engineer, T&M Associates

Position & Name of Firm

Professional License # Date

E. STATEMENT OF PREPARER OF APPLICATION, REPORTS AND/OR SUPPORTING DOCUMENTS (other than engineering)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining and preparing the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for knowingly submitting false information, including the possibility of fine and imprisonment.

Signature

Ericka Naklicki, PWS

Print Name

Principal Environmental Scientist, T&M Associates

Position & Name of Firm

2938

Professional License # (If Applicable) Date

DATUM INFORMATION

TIDAL DATUMS DETERMINE BY NJDEP BUREAU OF COASTAL ENGINEERING USING NOAA VDATUM 3.4 SOFTWARE. ALSO USED AS A REFERENCE WAS TIDAL DATUM 853-4050 TUCKERTON CREEK, NJ BENCHMARK CONTROL STATION 855-7380 LEWES, FORT MILES, DE

ALL PLAN ELEVATIONS ARE IN NAVD 88.

DATUM	MLLW	NAVD 88
HTL	2.52	1.45
MHHW	2.52	1.35
MHW	2.25	1.08
NAVD 88	1.17	0.00
MTL	0.23	-0.94
MLW	0.09	-1.08
MLLW	0.00	-1.17

LEGEND

-0.05 CUT (FEET BELOW EXISTING GRADE)

1.25 FILL (FEET ABOVE EXISTING GRADE)

CUT ZONE (0.50' MAXIMUM CUT)

FILL ZONE (2.50' MAXIMUM FILL)

PERMANENTRIP-RAP STONE STABILIZATION

PERMANENT STONE BREAKWATER

PROPOSED TIMBER PILE (RENDERED NON-POLLUTING)

MHWL (NAVD 1988) EXISTING GRADING

MHHW (NAVD 1988) EXISTING GRADING

MLWL (NAVD 1988) EXISTING GRADING

MLLWL (NAVD 1988) EXISTING GRADING

HTL (NAVD 1988) EXISTING GRADING HIGHEST OBSERVED TIDE LINE DURING 2017

1977 TIDELANDS HISTORIC SHORELINE

BEACH SAND REPLENISHMENT EARTHWORK TABLE FOR NJDEP PERMITS (UNADJUSTED)

STRATUM	CUT	FILL	NET	METHOD	AREA
TOTAL PROPSOED EARTHWORK FROM: EXISTING SURFACE TO: PROPOSED SURFACE	±4 C.Y.	±510 C.Y.	506 C.Y. (F)	GRID	12,170 S.F. (0.279 AC.)
PROPOSED EARTHWORK BELOW THE MLWL	±1 C.Y.	±141 C.Y.	140 C.Y.(F)	GRID	3,765 S.F. (0.086 AC.)
PROPOSED EARTHWORK ABOVE THE MHWL	±2 C.Y.	±80 C.Y.	78 C.Y.(F)	GRID	3,613 S.F. (0.083 AC.)
PROPOSED EARTHWORK BETWEEN MLWL AND MHWL	±1 C.Y.	±289 C.Y.	288 C.Y.(F)	GRID	4,792 S.F. (0.110 AC.)

BEACH SAND REPLENISHMENT EARTHWORK TABLE FOR USACE PERMITS (UNADJUSTED)

STRATUM	CUT	FILL	NET	METHOD	AREA
PROPOSED EARTHWORK BELOW THE HTL	±2 C.Y.	±456 C.Y.	454 C.Y.(F)	GRID	2,941 S.F. (0.068 AC.)
PROPOSED EARTHWORK ABOVE THE HTL	±2 C.Y.	±54 C.Y.	52 C.Y.(F)	GRID	9,229 S.F. (0.211 AC.)

RIP-RAP STONE STABILIZATION EARTHWORK TABLE FOR NJDEP & USACE PERMITS (UNADJUSTED)

STRATUM	CUT	FILL	NET	METHOD	AREA
PROPOSED EARTHWORK ABOVE THE MHWL	±43 C.Y.	±43 C.Y.	0 C.Y.(F)	GRID	763 S.F. (0.018 AC.)
PROPOSED EARTHWORK ABOVE THE HTL	±43 C.Y.	±43 C.Y.	0 C.Y.(F)	GRID	763 S.F. (0.018 AC.)

NOTE: THERE IS NO RIP-RAP STONE STABILIZATION PROPOSED BELOW THE MHWL OR HTL

CONSTRUCT STONE BREAKWATER, TOP ELEV. ±2.35 (TYP.)
- 6,210 S.F. - STONE BREAKWATER (885 C.Y.)
(SEE CONSTRUCTION DETAILS)

CONSTRUCT TIMBER PILE WITH WARNING SIGN (TYP. OF 3)

IMPORT CLEAN BEACH SAND & REGRADE SAND AREAS WITHIN LIMIT OF DISTURBANCE (TYP.)
- 550 C.Y. - BEACH SAND REPLENISHMENT
- 12,960 S.F. (0.298 ACRES) - BEACH GRADING

CONSTRUCT TIMBER PILE WITH WARNING SIGN (TYP. OF 3)

FLOATING TURBIDITY BARRIER (TYP.)
(TO BE PAID UNDER SESC BID ITEM)

LIMIT OF DISTURBANCE ±0.298 ACRES
MARK/SECURE WITH CONSTRUCTION FENCE ON UPLAND AREAS (TYP.)
(TO BE PAID UNDER SESC BID ITEM)

CONSTRUCT RIP-RAP STONE SLOPE STABILIZATION.
3-4" WIDE BY 18" THICK (TYP.)
- 44 C.Y. - RIPRAP STONE SLOPE PROTECTION, 18" THICK (D50=6")

TEMPORARY DISTURBANCE = ±85 S.Y. (0.018 AC.)

SOUTH GREEN STREET

0+00 1+00 2+00 3+00 4+00 4+50

CONSTRUCTION PLAN
SOUTH GREEN STREET

SCALE: 1"=20'

20' 10' 0 20' 40'

1" = 20'

JASON A. WORTH
CONSULTING ENGINEER

LICENSED PROFESSIONAL ENGINEER
STATE OF NJ LICENSE No. 6549287

05-18-2018

BOROUGH OF TUCKERTON

SOUTH GREEN STREET LIVING SHORELINE

BOROUGH OF TUCKERTON, OCEAN COUNTY, NEW JERSEY

I - CONSTRUCTION PLAN

YOUR GOALS. OUR MISSION.

1144 HOOPER AVENUE, SUITE 202
TOMS RIVER, NJ 08753
TEL 732-473-3400
FAX 732-473-3408

NEW JERSEY BOARD OF PROFESSIONAL ENGINEERS AND LAND SURVEYORS
CERTIFICATE OF AUTHORIZATION #24GA27996100

OFFICES LOCATED IN:
CALIFORNIA, INDIANA, KENTUCKY, MASSACHUSETTS, MICHIGAN, NEW JERSEY, OHIO AND PENNSYLVANIA

DESIGNED BY	CPC
CHECKED BY	JAW
DRAWN BY	CPC
DATE	05-18-2018
SCALE	1"=20'
PROJ. NO.	LBH-01730

DRAWING CSP-1

SHEET 3 OF 7

NO.	DATE	REVISIONS	BY	CHKD

PROJECT INFORMATION:
FILE PATH: G:\Projects\LBH\01730\Word\SOUTH GREEN STREET_CSP.dwg
PLOT DATE: 21 May 2018, 10:14:44
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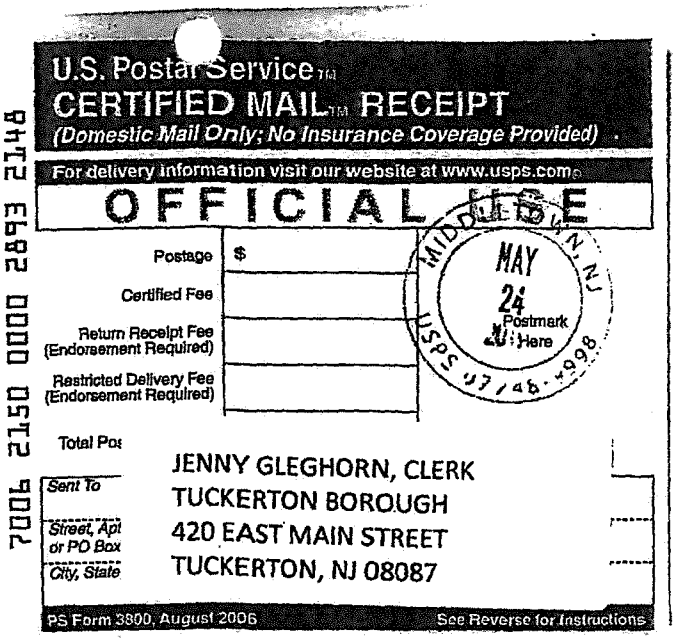

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SALABRITAS, JEFFREY, JR.
1138 LITTLE EGG HARBOR RD.
LITTLE EGG HARBOR, NJ 08087

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21 HIGH TOR ROAD
NEW CITY, NY 10956

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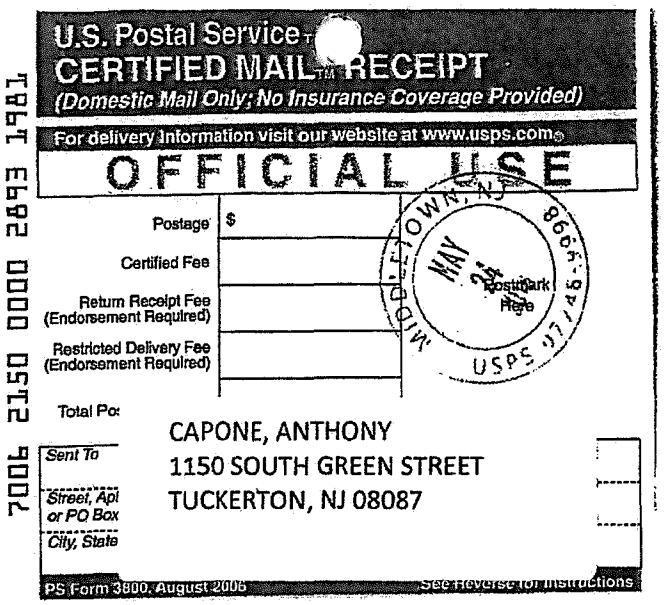
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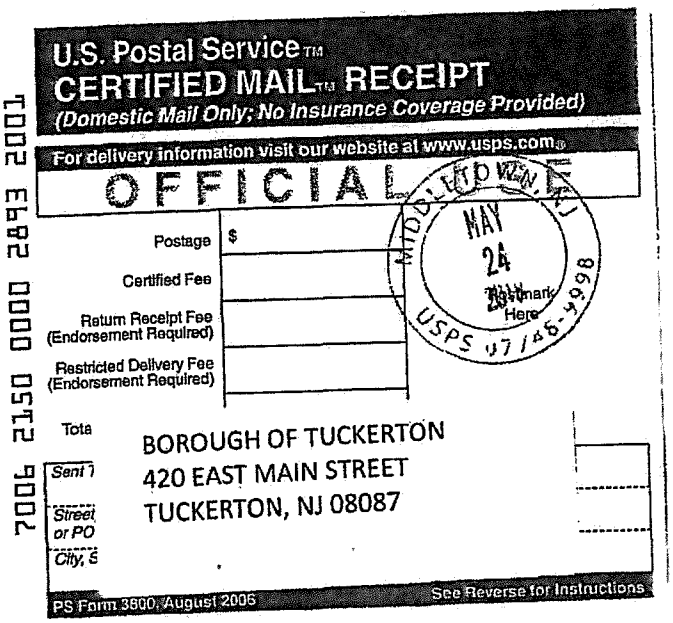
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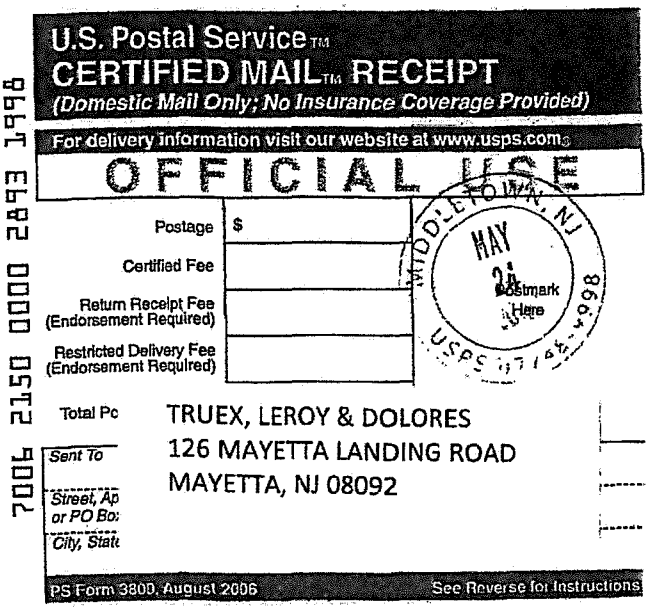
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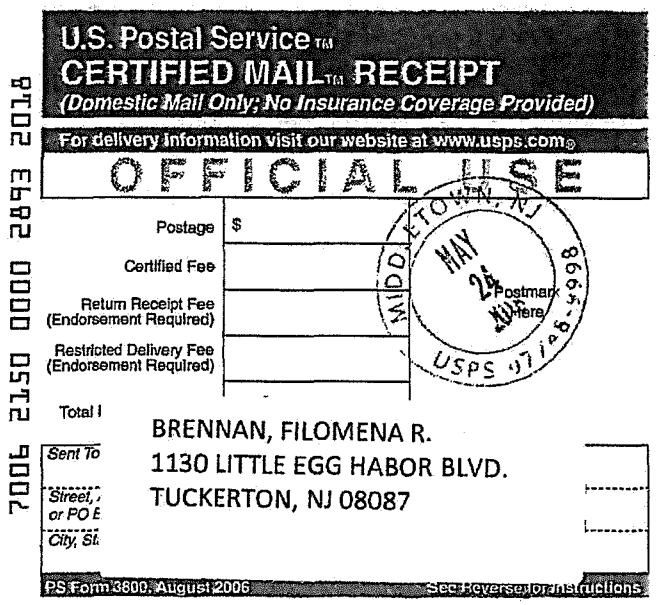
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City, St TUCKERTON, NJ 08087
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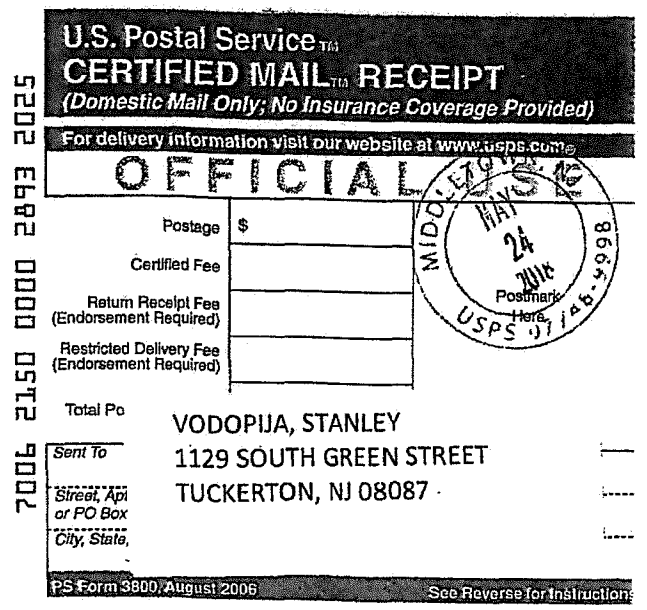
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OCEAN COUNTY ENV. AGENCY
175 SUNSET AVENUE, POX BOX 2191
TOMS RIVER, NJ 08754
ATTN: JOHN PROTONENTIS

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OCEAN COUNTY PLANNING BOARD
PO BOX 2191
TOMS RIVER, NJ 08754
ATTN: MR. DAVID MCKEAN

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CONSERVATION DISTRICT
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MARINI, NAZZARENO, III
749 BRIDGEWATER ROAD
BENSALEM, PA 19020

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NJ NATURAL GAS
C/O J. PURCARO – R.O.W. REP
1415 WYCKOFF ROAD
PO BOX 1464
WALL, NJ 07719

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TUCKERTON BOROUGH
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TUCKERTON, NJ 08087
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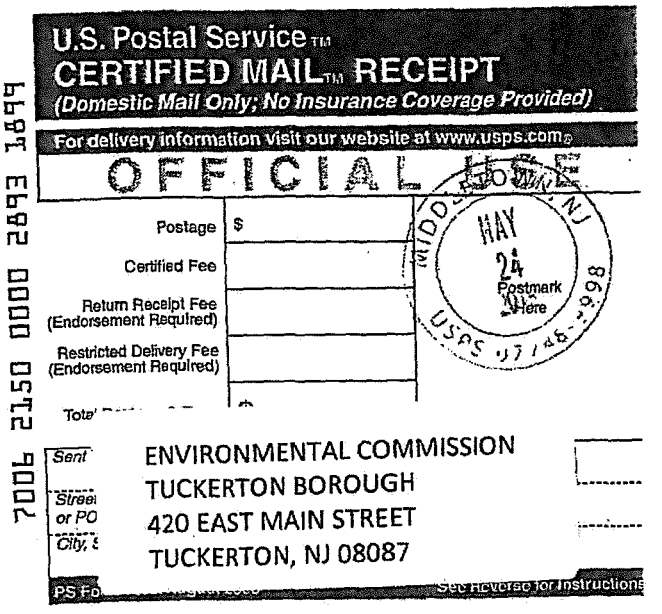
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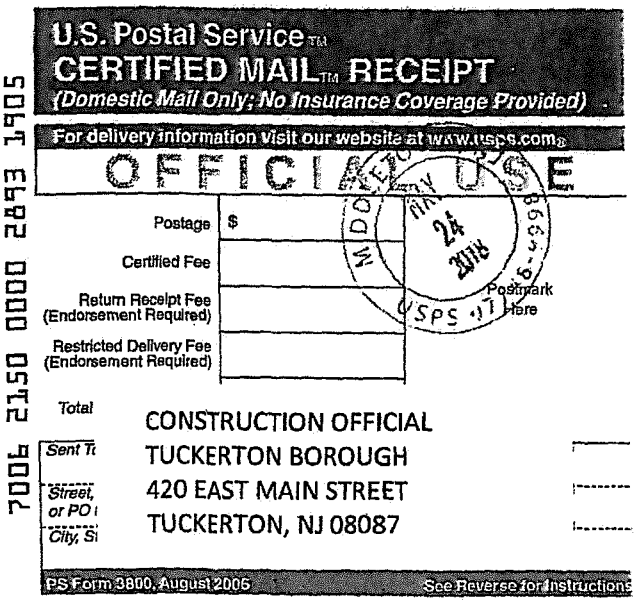
420 EAST MAIN STREET
TUCKERTON, NJ 08087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Attachment C –Color Photographs

Photo 1 – Looking south along narrow shoreline at project area.

Photo 2: Looking south along shoreline.

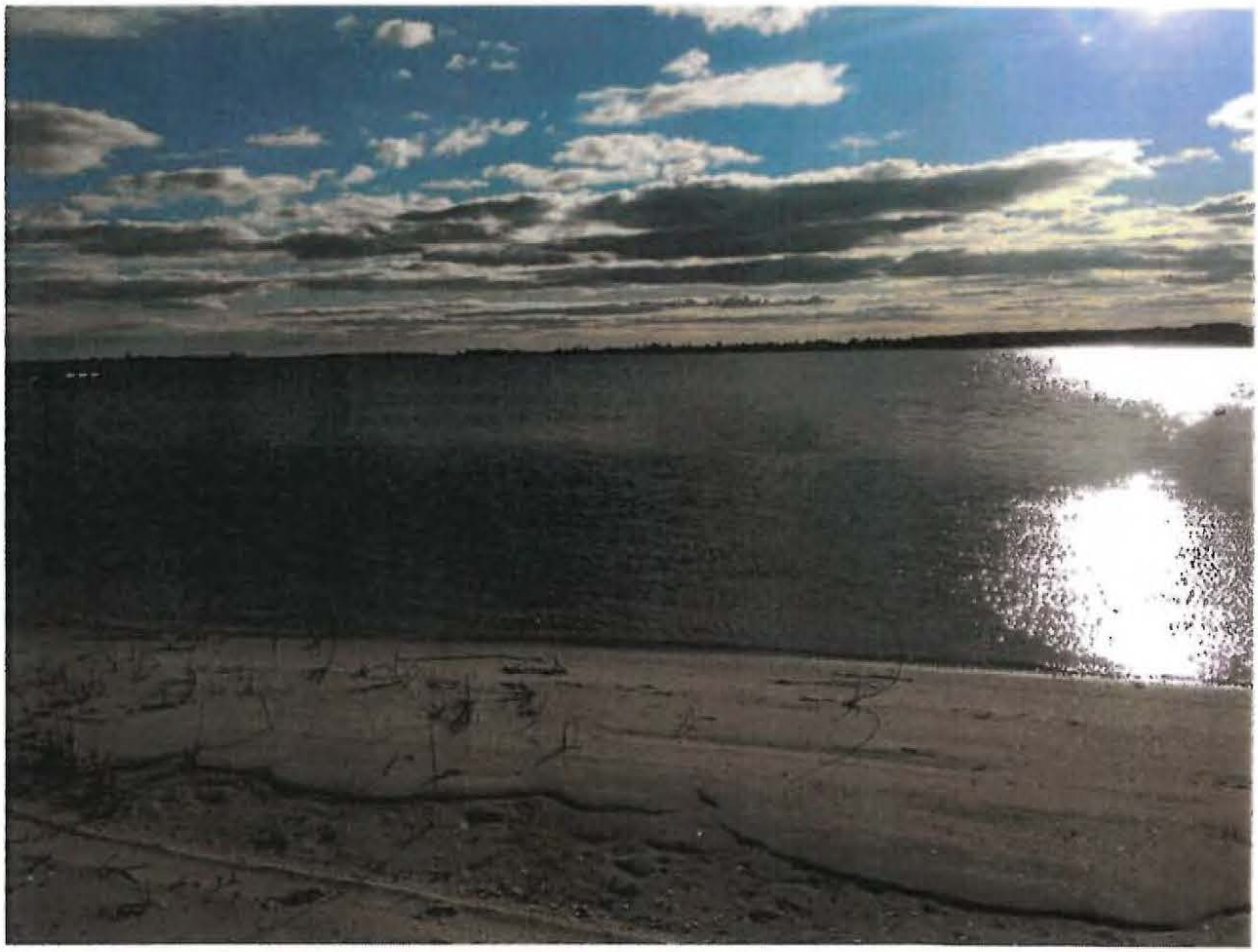

Photo 3: Looking west toward Tuckerton Cove.

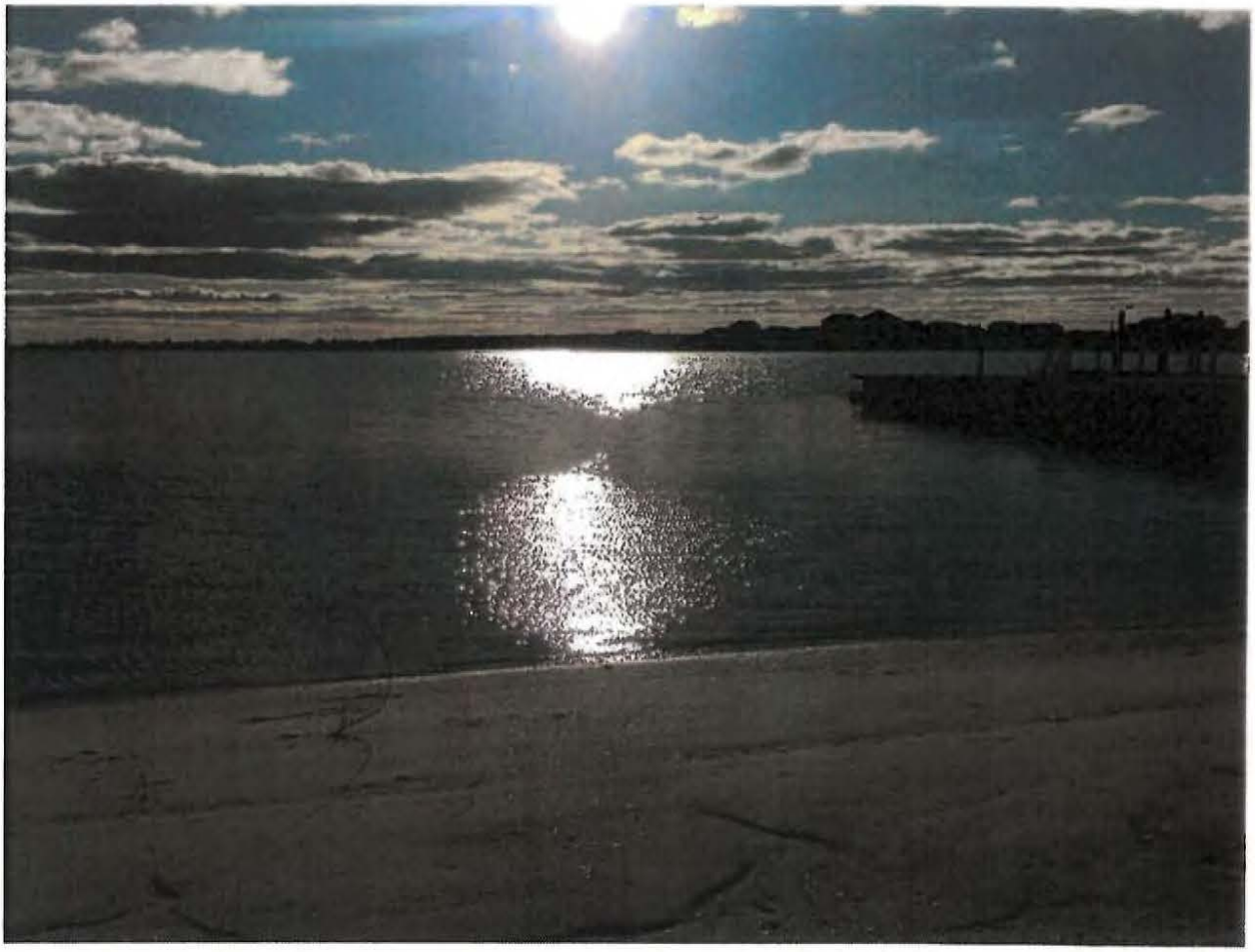

Photo 4: Looking northwest toward Tuckerton Cove.

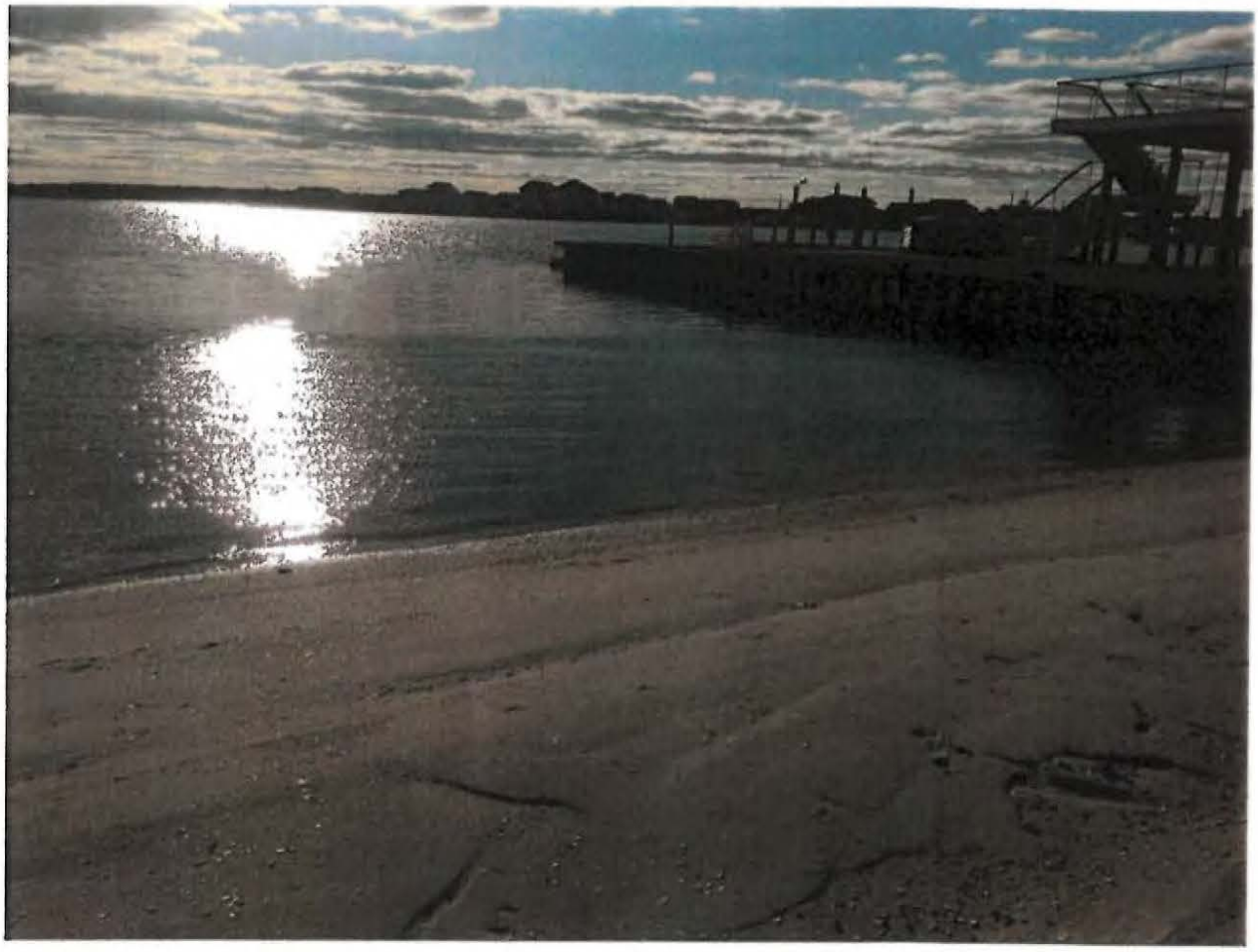

Photo 5: Looking north toward adjacent property and bulkhead.

Attachment D - Qualifications of Preparers

Erick**NAKLICKI**, PWS

Principal Environmental Scientist

Education

University of Vermont, BS Environmental Studies, 2001

Rutgers University, Wetlands Delineator Certification

Rutgers University, Threatened and Endangered Species in NJ

Rutgers University, Winter Vegetation Identification

Rutgers University, NJDEP Freshwater Wetlands Regulations Short Course

Rutgers University, NJDEP Coastal Wetlands Regulations Short Course

Professional Registrations / Affiliations

Professional Wetland Scientist (PWS) Certification number 2938

Society of Women Environmental Professionals, NJ/Philadelphia Chapter

Society of Wetland Scientists (SWS)

40-Hour OSHA Hazwoper Certification

8-Hour OSHA Permit Required Confined Spaces

Years in the Industry

17

Areas of Expertise

Wetland Delineations, Geographic Information Systems (GIS), NJDEP Land Use Regulations, PADEP Wetland Regulations, USACE Permit Requirements, Pinelands Regulations

Summary of Qualifications

Ms. Naklicki has 17 years of experience in the field of environmental consulting. She is certified as a Professional Wetland Scientist (PWS) by the Society of Wetland Scientists. Her areas of expertise include wetland delineations as well as the preparation of applications and final reports to the regulatory agencies. Her project duties include obtaining Freshwater and Coastal Wetland Permits, Letters of Interpretation, CAFRA and Waterfront Development Permits, Pinelands approvals and US Army Corps of Engineers permits. Ms. Naklicki also has experience with the Pennsylvania Department of Environmental Protection (PADEP) wetland permits. Additionally, she has written numerous Environmental Impact Statements and Baseline Ecological Evaluations that relate to a variety of projects.

In addition, she is experienced in the preparation of Geographical Information Systems (GIS) maps for various project types including wetlands, floodplains, threatened and endangered species, aquifer and land use maps. She also has experience using Global Positioning System (GPS) surveying equipment.

Ms. Naklicki has experience in vegetation analysis, habitat assessments and wetlands and stream analysis. She has performed numerous wetland delineations ranging from small to large properties up to 450 acres. She has conducted natural resource inventories and threatened and endangered species surveys for various projects. In addition, she has performed numerous tree surveys for various developments ranging from 2 to 300 acres. Ms. Naklicki uses Trimble® Global Positioning Services (GPS) while in the field to gather her data and locate the wetland flag locations. After the data is collected she works with the project engineers to prepare Permit Plans to demonstrate project compliance with the local, state, and federal land use regulations.

Ms. Naklicki has helped coordinate and attend numerous public information sessions and public hearings for several large projects including the NJTA's GSP Widening from Milepost 30 to 80 and the Carteret Ferry Terminal Project.

Key Projects

Drainage Improvements to Lincoln, Harrison, Ballantine and Pelican Roads, Middletown Township, NJ. Environmental Scientist responsible for conducting the wetland and State open water delineations at each site. Once delineations were complete, coordinated with the NJDEP to obtaining all required NJDEP land use permits to implement the proposed drainage improvement projects at these locations.

Overpeck Park Landfill, Teaneck, Bergen County, Teaneck, NJ. Environmental Scientist responsible to prepare and submit the interagency permit applications for the closure of the Overpeck park landfill and slope stabilization along Overpeck Creek. The permit applications included Army Corps of Engineers Permit Application and the NJDEP Freshwater Wetland General Permit No. 5, Coastal General Permit 15 and Waterfront Development Permit Application. The project also included the delineation of the wetlands located on the 51 acre parcel. Ms. Naklicki worked with the client and the NJDEP and ACOE to address the permit review comments and to revise the permit plans in accordance with the regulations.

Berkeley Island Park Improvement Project, Berkeley Township, NJ. Environmental Scientist responsible for organizing the major permitting efforts for the improvements of an existing Ocean County Park located on Barnegat Bay and Cedar Creek that was destroyed by Superstorm Sandy and closed to the public since the storm. Permit applications included CAFRA IP, Waterfront Development IP, Army Corps of Engineer and Tidelands License. There were numerous interagency meetings and conversations with the NJDEP and ACOE to design the project to be in compliance with the strict NJDEP Coastal Zone Management Rules and Army Corps of Engineers Rules. The project entailed the design of in-water structures to help with erosion control consisting of beach replenishment, two breakwaters, a stone revetment, a stone jetty, bulkhead replacement and living shoreline. T&M worked with Stevens Institute of Technology and the NJDEP Division of Coastal Engineering to design the stone revetments and living shoreline. The upland work consisted of the construction of a 1,500 SF comfort station that included restrooms, locker rooms, first aid station and storage, the replacement of two gazebos and picnic pavilion, playground and splash pad, horseshoe pits, bocce courts, site lighting, walkways, low level landscaping, benches, parking area, bike racks, split rail fencing, bait cutting stations, flag pole area and entrance gate.

Roundabout Design at CR 8A (Locust Avenue/Valley Drive), CR 8B (Navesink Avenue) & Monmouth Avenue, Middletown Township, Monmouth County, NJ. Environmental Scientist for intersection and safety improvements associated with converting an existing stop-controlled intersection to a new roundabout. Performed wetland delineation for the project area. Work performed in conformance with MUTCD, TRB's Highway Capacity Manual (including LOS analysis), and Monmouth County standards.

Monmouth County Landfill, Tinton Falls, NJ. Environmental Scientist for the delineation of 300 acres of wooded wetlands. Prepared and submitted Letter of Interpretation (LOI) application to NJDEP. Worked with the client and NJDEP case manager to review the site and overall wetland delineation.

Intersection Improvements at Bordentown Road, Mansfield, Burlington County, NJ. Environmental Scientist for the final design of roadway improvements to Bordentown Road at intersections with Georgetown Road, Chesterfield Road and Schoolhouse Road. Conducted land surveys and environmental assessments related to the road improvements. Responsible for the design and layout of a single lane roundabout at the intersection of Bordentown Road with Georgetown Road, assisted by the TORUS roundabout design software.

Cloverdale Park, Barnegat Township, NJ. Prepared the Pinelands Public Development Permit Application for the redevelopment of an existing Ocean County park and cranberry bogs. Worked with the design engineers to design the project to meet the needs of the Pinelands Commission and the Ocean County Department of Parks and Recreation. The proposed project involved the redevelopment of an existing residence to be converted to a public restroom, construction of a visitor center, parking lots and other site improvements. Ericka coordinated all pre-application meetings, field work, onsite meetings with the client, permit preparation, permit submission and regulatory agency communication.

Red Bank Library Bulkhead Replacement and North Prospect Avenue Bulkhead Replacement, Red Bank, NJ. Environmental Scientist responsible to obtain the NJDEP Coastal General Permit No 14, ACOE SPGP19 and NJDEP Tidelands License for the replacement of the bulkheads along the Navesink River. Coordinated with the Borough and structural engineers to design the bulkheads on two different properties to maintain compliance with the NJDEP Coastal Zone Management Rules.

Red Bank Bellhaven Park, Borough of Red Bank, NJ. Worked with the Borough Engineer, Landscape Architects and LSRP to prepare and submit a combined NJDEP Permit application for Coastal GP 17, Freshwater Wetlands GP 17 and 4 and a Transition Area Waiver D Clause for the improvements to an underutilized public park located on the Swimming River in Red Bank. Improvements to the park included resurfacing an existing six-foot wide, 3,755 LF long gravel trail, a tot-lot with new playground equipment, 314 SF spray pad encircled by a six-foot wide concrete sidewalk, re-grading and elevation increase by 2-3 feet to meet the existing topography. New landscaping was provided throughout the project area and removal of the existing invasive vegetation. The project remained compliant with strict Coastal Zone Management Rules and Freshwater Wetland Rules. Conference calls with the NJDEP, pre-application meetings and

emails were organized to meet the Division of Land Use Regulations. Assisted the LSRP with additional permits required for the remediation activities needed for a portion of the site.

Sea Bright Beach Pavilion, Borough of Sea Bright, NJ. Organized efforts to obtain the CAFRA Individual Permit for the construction of a proposed two-story 76' by 70' beach pavilion on a portion of the public beach and parking lot. The new facility will be accessible by the boardwalk and ADA compliant ramps from both the beach and parking lot. Facility amenities will include a public library, beach office, community room, restrooms and outdoor showers, public gathering facility and lifeguard station headquarters for equipment and observation. The project will require close coordination with the NJDEP to remain in compliance with the Coastal Zone Management Rules that apply to impervious surface, parking, scenic resources and beaches.

Beach Access Plan, Monmouth Beach Borough, NJ. Worked with the Borough Engineer to design a Public Beach Access Plan to assure that the beach access was in compliance with the NJDEP Coastal Zone Management Rules. The access plan included researching the size of the beach during high tide and assessing the amount of people using the beach. In addition, the amount of parking spaces and the amount of access points to the beach had to be assessed. The report and all maps and plans had to be compiled into a report and submitted to the NJDEP for review and approval.

Teaneck Nature Preserve, Teaneck, NJ. Wetland Delineation and NJDEP Letter of Interpretation. Conducted wetland delineation at a disturbed site that is 55 acres in size. The site was a previously disturbed landfill that has been converted to a nature preserve. The site has been disturbed from past site activities which provided rough terrain and made the delineation more difficult. Subsequent to the delineation, the Freshwater Wetland Letter of Interpretation was prepared and submitted.

Geographic Information Systems (GIS). Environmental Constraints Analyses prepares Environmental Constraints Maps for a variety of projects for different departments at T&M. The GIS Maps are prepared using Arc GIS version 10.1. The GIS program contains NJDEP State GIS Data along with County and Municipal GIS Data. The data can be used when preparing proposals to get background information on a site. The data can be used for preliminary background work prior to conducting a site visit. In addition, the maps can be used in Environmental Assessment Reports and NJDEP Permit Applications.

Sanderson Parcel, Preliminary Assessment and Wetlands Delineation, Edison Township, NJ. Environmental Scientist for environmental investigation and consulting services for the Middlesex County Improvement Authority. Work included the oversite of staff which included a thorough onsite investigation and assessment of the environmental conditions in conformance with accepted ASTM Standard Practice for Environmental Site Assessment.

Tamarack Hollow Expansion, Phase I Site Assessment and Wetlands Delineation, East Brunswick/South Brunswick, NJ. Environmental Scientist for environmental investigation, wetland delineation and lot yield analysis for the Middlesex County Improvement Authority. Work included the oversite of staff which included a thorough onsite investigation and assessment of the environmental conditions in conformance with accepted ASTM Standard Practice for Environmental Site Assessment, Freshwater Wetlands Protection Act and East Brunswick and South Brunswick Land Use and Zoning Ordinances.

Ocean County Midstream Road Bridge Replacement, NJ. Prepared all of the combined interagency permits for the replacement of an Ocean County Bridge Spanning Beaverdam Creek in Brick Township. The permits included NJDEP CAFRA, Waterfront Development and Freshwater Wetlands General Permit No. 10. In addition the project involved obtaining US Coast Guard Bridge Permit and USACE Nationwide Permit.

Noe Street Drainage Improvement Project, Carteret, NJ. Prepared NJDEP Waterfront Development Permit, Freshwater Wetlands Permit and Army Corps Nationwide Permit for the drainage improvements and proposed tide gate at Noes Creek in Carteret. Also worked with the landscape architects to prepare the Intertidal and Subtidal shallow and Riparian Buffer Mitigation and restoration plan. Worked closely with the NJDEP Division of Land Use Regulation in order to assure the project was designed in compliance with the NJDEP rules and also meet the goals of the project.

Monmouth County/County Route 3 Between County Road 527 and Kensington Drive/Woodland Circle, Manalapan, NJ. Environmental Scientist assisting with the permit applications for the concept development, preliminary engineering and roadway design alternative analyses for roadway improvements for CR3 (Main Street-Tennent Road) between CR527 (Millhurst Road) and Kensington/Woodland Circle. The project addresses traffic safety issues, capacity improvements, system linkage, geometric deficiencies, project transportation demands, environmental considerations for permitting, and traffic signal improvements and optimization along CR3. The project included environmental assessment and studies including cultural resource analysis; wetland delineation; and regulatory assessment.

Reconstruction of Readington Road (CR 637), Townships of Branchburg and Readington, NJ. Environmental Scientist for the final design efforts of approximately 5,500 feet of roadway widening and reconstruction including the replacement of two county bridge structures. Effort associated with the project includes preliminary and final roadway, structural and hydraulics and hydrology design, including an alternatives analysis. Conducted the wetland delineation and prepared the freshwater Wetlands Letter of Interpretation Application and worked with the NJDEP to obtain the approvals.

Carnegie Center West, Building 804, Boston Properties/NRG Energy, Princeton, NJ. Environmental Wetland Permitting for a project involving site plan design of a state-of-the-art office building site using a multitude of sustainable elements including 800kW solar arrays consisting of 13 solar ground-mounted parking canopies, 2 solar roof-mounted canopies, and 2 solar ground-mounted pergolas; 400kW natural-gas-fired CHP unit; Two 30,000 gallon underground rainwater storage system; 2 windmills; pedestrian sidewalks and bicycle paths; 4 bio-swales and a 0.70-acre wet pond; green roof; and electric vehicle charging stations. Scope includes surveying, General Development Plan (GPD) design, wetland delineations, Phase 1 investigations, environmental permitting, landscape architecture design, traffic engineering, site lighting design, LEED® consulting services, and construction management.

Solar Array, Southampton Township, NJ. Delineated 450 acres of agriculture wetlands. Prepared and submitted Letter of Interpretation (LOI) Application to the NJDEP. Worked with the NJDEP to obtain the LOI and conducted site meetings to discuss with the NJDEP Case Manager.

Monmouth County Landfill, Tinton Falls, NJ. Delineated 300 acres of wooded wetlands. Prepared and submitted Letter of Interpretation (LOI) Application to the NJDEP. Met with Client and NJDEP Case Manager to review the site and overall wetland delineation.

Sand Replenishment, Union Beach, NJ. Prepared NJDEP CAFRA and waterfront development permits for the placement of 6,000 CY of sand replenishment. In addition, prepared Army Corps of Engineers (ACOE) Permit Applications.

Benjamin Terry Bulkhead Replacement, Borough of Keyport, NJ. Prepared coastal general permit No.14 and ACOE permit for the replacement of 413 LF of timber bulkhead with new fiberglass bulkhead within 21-inches of the existing bulkhead.

Six Bulkhead Replacements and Pump Station, Sea Bright, NJ. Prepared the NJDEP CAFRA Individual Permit and Waterfront Development Permit for the replacement of 5 bulkheads, the construction of a new bulkhead and walkover access ramp and construction of a new pump station to aid in the restoration of a Town that was greatly impacted by flood waters during Superstorm Sandy. The project also involved obtaining an USACOE Nationwide Permit.

Beachwood Beach Groin, Beachwood Borough, NJ. Prepared the NJDEP Waterfront Development Permit and Coastal General Permit No. 6 and Army Corps of Engineers Permit. Worked with the Municipal engineers to design the project to meet the needs of the NJDEP and the Borough of Beachwood. The Borough of Beachwood proposed the construction of a groin to reduce erosion along the eastern shoreline of Beachwood Beach located along the Toms River. In addition, the project involved minor sand transfer from the lower portion of the beach to the eastern shoreline to provide additional beach area and to improve the eroded conditions of the beach. Ericka Coordinated all field work, permit preparation, permit submission and regulatory agency communication.

Attachment E – Stevens Institute of Technology Living Shoreline and Conceptual Design, March 2016

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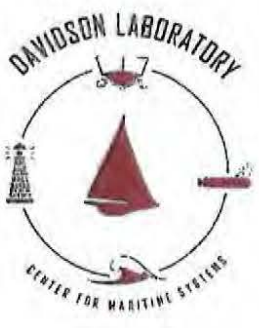


Living Shoreline Site Conditions and Conceptual Design for Green Street Beach, Tuckerton, NJ

Prepared for:

The Nature Conservancy and
Borough of Tuckerton, NJ

Prepared by:

Andrew Rella, Jon K. Miller, and Amy Williams

SIT-DL-16-9-draft

March 2016

Introduction

"Living shorelines" refers to a suite of shoreline stabilization and habitat restoration alternatives that enhance coastal resilience through protecting both the built and natural environment. The lower energy found along the shorelines where living shorelines projects are typically proposed, allows for greater flexibility in selecting the size, shape, orientation, and materials used to stabilize the shoreline. These projects include measures specifically designed to enhance or promote habitat for native flora and fauna, and typically incorporate one of several of the following living shorelines design principles:

- Preference for sinuosity over straight coastlines
- Preference for sloping over vertical surfaces
- Preference for roughened over smooth surfaces
- Preference for natural over man-made materials
- Preference for heterogeneous over homogenous surfaces

In 2013, the State of New Jersey officially adopted Coastal General Permit 24 (N.J.A.C. 7:7-6.24) (originally Coastal General Permit 29), in an effort to reduce some of the regulatory hurdles and encourage the adoption of habitat restoration and living shorelines projects. The General Permit, commonly referred to as Coastal GP 24, authorizes living shorelines projects designed to protect, restore, or enhance habitat, provided certain criteria are met. Under Coastal GP 24, projects must:

- Comply with all applicable coastal statutes and Coastal Zone Management rules including the provision of public access.
- Maintain or improve the value and function of the local ecosystem and must disturb the minimum amount of NJDEP defined special areas (shellfish habitat, SAV, intertidal and subtidal shallows, and wetlands, for example) as defined in N.J.A.C. 7:7-9.

In addition, projects constructed seaward of mean high water are limited in size to one acre or less, unless the applicant is a federal or state agency that can demonstrate the need for a larger project. Associated with this is the requirement that restoration activities must take place within an area bounded by the shoreline as indicated on the 1977 state tidelands map. An exception is provided for structural components designed to reduce the wave energy which can be placed outside of the tidelands boundary.

In 2015, the New Jersey Department of Environmental Protection (NJDEP) commissioned Stevens Institute of Technology to write a set of engineering guidelines (Miller et al., 2015) for living shorelines projects. The guidelines identify the parameters critical to the success of living shorelines projects, outline the level of analysis required to understand those parameters, and provide guidance on how to incorporate this knowledge into the design of a successful project. The methodology employed here utilizes these guidelines as the framework for the data collection and analysis, and concept development. The final conceptual design is intended to represent a reasonable alternative based on the site conditions and community preferences; however it is not intended to be used for construction. As with all living shorelines projects, it is recommended that an engineer and a biologist/ecologist be consulted to finalize the design and associated details.

Site Description

The shoreline of interest is a thin beach adjacent to South Green Street, located in Tuckerton Cove at the mouth of Tuckerton Creek. Due to a combination of sea level rise, land subsidence, and as much as 30 feet of erosion along the beach, more frequent flooding has occurred, resulting in the inundation of the adjacent road and nearby homes. The northern end of the project site is bordered by a sheet pile bulkhead, with a naturally stable headland (private property) making up the southern boundary. A layer of small rip rap (< 1ft.) lies on the upland shoreline just prior to the roadway. The intended living shoreline project would encompass approximately 200 linear feet, serving to stabilize the eroding shoreline, with flood defense features constructed in the upland to prevent flooding of the roadway due to wave runup/overwash. Tuckerton Borough, NJ is primarily marsh shoreline with nearly 62% of the approximately 35 miles of coastline being marsh habitat. Across the borough, approximately 4% of the coastline has been experiencing moderate to high rates of erosion. (Doyle, 2006).

Figure 1 – Tuckerton Beach Site Photos (Rella, 2015)

Restoration Explorer Analysis

The Restoration Explorer Tool (http://www.maps.coastalresilience.org/newjersey/) was created through the NJ Resilient Coastlines Initiative to provide communities with a means of visualizing the most appropriate locations for beneficial coastal restoration and enhancements projects based on ecological and engineering criteria. The tool compares environmental data in the form of GIS layers, with the criteria specified in the *New Jersey Living Shorelines Engineering Design Guidelines*, to identify potentially appropriate restoration techniques for specified areas. The Restoration Explorer tool is considered a valuable first step towards a design, but does not eliminate the need for higher resolution data collection and analysis later in the design process. In terms of the tiers of analysis defined in the Stevens design guidelines, the Restoration Explorer would be considered a Tier 0 or Tier 1a representing an initial cursory analysis from which more detailed plans can be developed.

Erosion Shoreline Change: **Not Appilcable**
Tidal Range: **Yes - 2.8 feet**
Salinity: **Yes - 28.5 ppt**
Wave Height: **Yes - 1.1 feet**
Ice Cover: **Yes - Moderate**
Shoreline Slope: **Yes - 5%**
Nearshore Slope: **Yes - 6%**
Total Conditions Satisfied: **7**

Figure 2 - RE Site Condition Summary

According to the Restoration Explorer, beach restoration, an offshore semi-submerged breakwater or an ecologically enhanced revetment are potentially appropriate techniques

for stabilizing the South Green Street beach shoreline. Each of the three techniques meet all seven of the environmental conditions used by the restoration explorer to determine a technique's suitability. The adjacent table lists the environmental conditions used for the assessment and the respective results for the Tuckerton site.

Parameter Evaluation

Each of the parameters described in the *New Jersey Living Shorelines Engineering Design Guidelines* is discussed below. Data relevant to the potential design and performance of a living shorelines project at Tuckerton, NJ are collated.

Erosion History

The erosion history of a site can be established through the use of aerial photographs. Historic aerials often give indications as to the potential causes of erosion at a site and are used to calculate an annual rate of erosion. Both are critical pieces of information which can be used to help identify an appropriate solution. Using the imagery available on http://www.historicaerials.com/ (and presented below as Set A), a potential cause of the erosion was determined. At some point between 1956 and 1963, a bulkhead was added at the foot of South Green Street to create a public parking lot. In the series of images that follow, the shorelines within the Cove undergo their most significant transformation. A larger quantity of more recent imagery is available from *Google Earth* (https://www.google.com/earth/). The images presented below identified as "Set B" are *Google Earth* images from 1995, 2007 and 2013, and show approximately 30 feet of shoreline change over the 18 year period. No shoreline change information was available from Restoration Explorer to validate the results.

Erosion Rate: 0.6 ft. / year

Figure 3 – Aerial Photos (Set A - Historic Aerials-1931, 1963, 1986) (Set B – Google Earth-1995, 2007, 2013)

Sea Level Rise

Living shorelines projects are particularly sensitive to sea level rise due to the living elements of the projects, therefore it is particularly critical to take this information into account during project design. Currently no official state guidance exists on the incorporation of sea level change into the design of living shorelines projects. Until official guidance is developed, the simplest approach is to assume that the existing regional sea level trend will persist into the future. NOAA maintains information on sea level trends on its *Tides and Currents* website (http://tidesandcurrents.noaa.gov/). The mean sea level trend for New Jersey's Atlantic City Tide gage is 4.08 per year (with a 95% confidence interval of plus or minus 0.16 millimeters per year based on monthly mean sea level data from 1911 to 2014 which is equivalent to a change of 1.34 feet in 100 years (NOAA). A first order estimate of the potential sea level rise at a living shoreline project site can be made by simply applying these values.

Sea Level Rise Rate: 0.16 inches/year

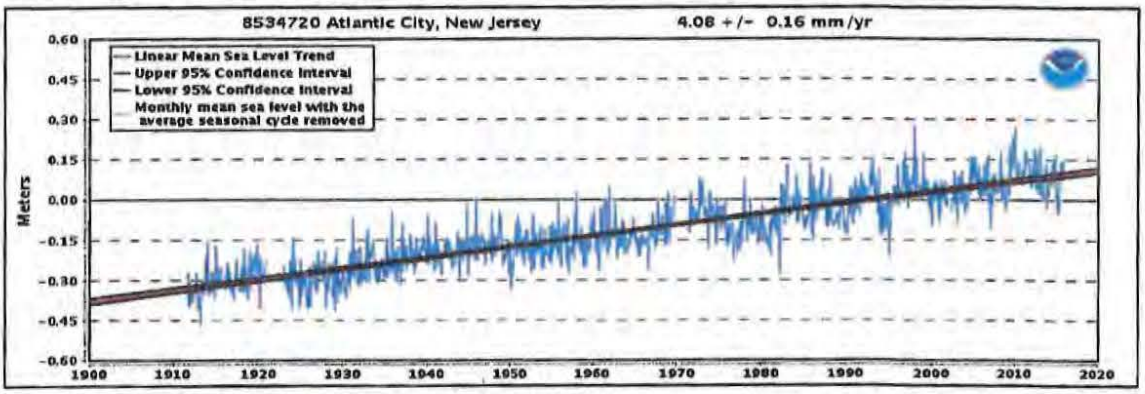


Figure 4 – Sea Level Rise Trend from Sandy Hook Tide Gauge

Tide Range

Tidal range is a critical factor in the design of living shorelines projects for the selection and placement of appropriate vegetation. Two sources of tidal range data were identified for the Tuckerton site. The Restoration Explorer utilizes NOAA's VDatum tool to determine the tide range. NOAA's printed tide tables represent a second source of information. The mean and spring tidal range given in the tide charts for "Tuckerton Creek Entrance" which is directly adjacent to the site are provided below.

RE Tidal Range: 2.8 ft.
NOAA Tide Chart Mean Tidal Range: 2.11 ft.
NOAA Tide Chart Spring Tidal Range: 2.53 ft.

Waves

Waves generated by local winds and meteorological conditions tend to be one of the dominant forces impacting shorelines, and are typically considered in all engineered shoreline projects. As the wind blows over the surface of a body of water its energy is transferred to the water. The wind speed, the duration of the wind, and the open water distance over which it acts (fetch) will determine how large the waves

grow. At most inland sites wave growth will be limited by the available fetch, and as a result wave heights and periods are generally much less than those observed on open ocean coastlines. When designing a living shoreline project, there are generally two design waves which may be important. The first is the maximum expected or extreme wave; however for living shorelines this wave may not represent the critical condition, as during an extreme storm the entire project may be submerged. The second relevant wave height should represent a more frequently encountered, daily or operational condition.

Figure 5 – Fetch Distance Determination

Several wave estimates for the Tuckerton site were obtained. The figure and table below show the fetch analysis and results for the site for determining the longest uninterrupted distance over which the wind can act. The maximum fetch distance (0.56 mile) was combined with the ASCE 25 year event wind speed for estimating the expected wave heights. The results are shown in the two tables below.

Table 1 – Fetch Analysis Results

Fetch Direction	Degrees (true)	Method	Effective Fetch (ft)	Θ (angle of wave approach to beach normal)
Southwest	216	SPM	2990	18°

Table 2 – Wind Driven Wave Analysis Results

Fetch Direction	Hs	Tp	H(1/10)
Southwest	2.20	3.00	2.80
Units	ft	seconds	ft

FEMA's coastal flood risk analysis was used as a secondary source to validate the findings. FEMA's recently completed reanalysis of the coastal flood risk in New Jersey included an evaluation of the wave height expected during the 1% annual chance of occurrence (commonly referred to as the 1 in 100 year) storm. The Tuckerton site lies between transects 141 and 142, on which the wave heights during the 1% annual chance storm are 3.85 ft. (Tp = 3.21 sec) and 4.56 ft. (Tp = 3.42 sec), respectively. Interpolating between the two, an FIS wave height of 4.2 ft. is obtained.

Finally, the Restoration Explorer utilizes a wave height data set created for the Natural Capital Project (http://www.naturalcapitalproject.org/). The wave heights correspond to a weighted average of waves generated by the strongest 10% of winds.

FIS Wave Height: 4.2 ft.
SMB Wave Height: 2.8 ft.
RE Wave Height: 1.1 ft.

Wakes

Wakes or ship-generated waves can be one of the most significant sources of wave energy within sheltered water bodies. Once generated, wakes will propagate away from the point of generation where they will be modified by the local conditions including the wind and bathymetry. While a detailed wake study was not performed as a part of the conceptual designed, a typical wake was estimated on the basis of past studies, and an empirical formula. Moffat and Nicol (2003) conducted a wake analysis in support of a channel deepening project in the Arthur Kill. In their analysis, they measured 151 secondary wakes over a seven day period, and came up with an average wake height and period of 15 cm (0.49 ft.) and 2.7 sec. The largest wake measured during the study was 33 cm (1.08 ft). LaPann-Johannessen et al. (2015) conducted a shorter two day study at 32 locations in the Hudson River and found an average wake height of 0.35 ft. with periods on the order of 2-4 sec. Wakes as large as 3.5 ft. were measured during that study; however these were mostly associated with large barges in restricted channels, and are not expected to be representative of the wakes at Tuckerton. As a final check, the formula developed by Bhowmik et al. (1991) for wakes generated by recreational vessels was used to estimate the wake heights for both a small and large vessel moving at a variety of speeds. The results are presented in the table below. Based on these observations and calculations, a conservative estimate of a 3 ft. maximum wake with a 3 sec period is assumed. A more typical wake is expected to be on the order of 1.5 ft.

Table 3 – Wake Height Analysis Results

Length (ft.)	Beam (ft.)	Draft (ft.)	Speed (ft.)	Wake (ft.)
50	15	4	5	3.05
50	15	4	10	2.39
50	15	4	15	2.10
50	15	4	20	1.90
25	8	2.5	5	1.77
25	8	2.5	10	1.41
25	8	2.5	15	1.21
25	8	2.5	20	1.08

Maximum Wake Height: 3 ft.
Typical Wake Height: 1.5 ft.

Currents

Although waves are generally considered to be the primary force impacting the design of coastal structures, currents also play an important role, particularly for living shorelines sites located near tidal inlets or along riverbanks. Currents have the capacity to uproot vegetation, erode the bank, and transport debris during storms which increases the scour potential. In areas subject to freezing, currents can also transport sheets or clusters of ice, which similar to debris can scour the shoreline. At the Tuckerton site, the major concern with respect to currents is that the longshore currents generated by waves from the

south are large enough to push sediment to the north along the shoreline. In such a scenario, it is possible that strong currents moving along the bulkhead bordering the site to the north may sweep this sediment offshore where it is "lost" from the beach. No current data was identified during the conceptual design work.

Maximum Current Speed: Not available

Ice

Ice is known to have a significant impact on the shoreline and the stability of coastal structures, but our knowledge on the process of ice-structure interaction is lacking. This is particularly true for living shorelines projects, which thus far have predominantly been constructed in locations such as the Chesapeake Bay and Gulf of Mexico where ice is not a concern. In some locations records of ice are collected by organizations such as the United States Coast Guard; however these records are sparse. For the purpose of this report, the information regarding ice available through the Restoration Explorer was utilized. In the Restoration Explorer, the absence/presence of ice was determined based on the USGS EarthExplorer Landsat archive for winter months.

Probability of Ice: Moderate
Ice Thickness: Moderate ice cover (2.1-4" thick)

Storm Surge

Determination of storm surge has always played a critical role in the design of traditional coastal structures for stability. For living shorelines however, the storm surge takes on less significance because most of the approaches are low lying and will be overtopped during extreme storms. Wave forces diminish as depth from the surface increases, minimizing the impact on low-crested structures.

FEMA's recently completed reanalysis of the coastal flood risk in New Jersey included an evaluation of the water level (base flood elevation or BFE) expected during the 1% annual chance of occurrence (commonly referred to as the 1 in 100 year) storm. The BFE differs from the storm surge or storm tide in that it includes a contribution from the waves. The Tuckerton site lies in a VE zone with a BFE of 12 ft. NAVD88. Still water elevations are reported in the *Ocean County Flood Information Study Report* at the wave model transect locations. The Tuckerton site lies between transects 141 and 142, on which the following data is reported. The 25yr still water level is estimated from a best fit of the data.

Table 4 – Results from the Ocean County Flood Information Study

	10% Annual Chance (ft. NAVD)	2% Annual Chance (ft. NAVD)	1% Annual Chance (ft. NAVD)	0.2% Annual Chance (ft. NAVD)
Transect 141	5.3	7.2	7.9	9.4
Transect 142	5.4	7.4	8.1	9.7

FEMA BFE: 12 ft. NAVD88
FIS 25-yr SWL: 6.43 ft. NAVD88

Upland Slope

The upland slope is defined as the slope of the land from approximately the spring high water elevation to the point at which the upland levels off. The upland slope is critical for determining the type of vegetation that can be supported and the likelihood of scarping during storms. In general, gentler slopes are more susceptible to inundation and less susceptible to erosion. Using ArcGIS, slopes were derived from LIDAR images of the site. The slopes for specific locations were extracted from the digital elevation model and an average slope was calculated. The upland slope was found to be a mild 4 percent (1V: 25H).

Upland Slope: 1 ft. V / 25 ft. H

Shoreline Slope

The shoreline or intertidal slope is important in determining the appropriate shoreline stabilization for a particular site. Here the shoreline slope is defined as the slope from approximately Mean Lower Low Water (MLLW) to the Spring High Water line. Most living shorelines projects require gentle shoreline slopes so that marsh vegetation can be established. A recent analysis of the performance of several stabilized shorelines in New York State during Hurricanes Irene, Lee, and Sandy determined that over steepened slopes contributed to the loss of vegetation and subsequently to the development of erosion at the site (Miller, et al., 2015). Using ArcGIS, slopes were derived from LIDAR images of the site. The slopes for specific locations were extracted from the digital elevation model and an average slope was calculated. The shoreline slope at the Tuckerton location was found to be a mild 10 percent (1V: 10H).

Shoreline Slope: 1 ft. V / 10 ft. H

Nearshore Slope

The nearshore slope plays a critical role in determining the characteristics of the waves and currents interacting with the site. Steeper slopes generally reflect energy, while milder slopes tend to absorb and dissipate energy. Steeper sloping nearshore areas make structures less stable and may require more fill if fill is a requirement of the project. Using ArcGIS, slopes were derived from LIDAR images of the site. The slopes for specific locations were extracted from the digital elevation model and an average slope was calculated. The nearshore slope at the Tuckerton Site was found to be a mild 3.5 percent (1V: 28H).

Nearshore Slope: 1 ft. V / 28 ft. H

Offshore Depth

Understanding the bathymetry or underwater conditions is crucial for structure selection and design of living shorelines projects for several reasons. The offshore contours will dictate the maximum size of the waves impacting the shore, where the waves will break, and the amount of scour or sedimentation that should be expected. In addition, deeper offshore water allow for larger ships capable of generating larger wakes. Depending on the living shoreline approach selected, water depth will also impact the amount of fill material, the size of the structure, and ultimately its cost. As shown in the NOAA nautical chart included below, the immediate offshore depth is limited to 1 to 2 feet, slowly increasing further offshore to 3 to 4 feet. The deepest depths border the mouth of the nearby Tuckerton Creek system.

Offshore Depth: 2-3 ft. (Soundings in feet below MLLW, referenced to North American Datum 1983)

Figure 6 – Bathymetric Data for Tuckerton Site

Soil Bearing Capacity

Soil bearing capacity is an important, often overlooked factor in the design of living shorelines projects. Although the size of the materials used in living shorelines projects is typically small compared to traditional engineered approaches, the additional load imposed by structural elements consisting of stone, concrete, or even natural reefs needs to be taken into consideration. If not accounted for properly in the design phase, these additional loadings can cause undesirable settlement which can compromise the performance of the project. During the site visit, fine sand was observed at the site. Typically, sand is assumed to have a presumptive bearing capacity of between 3 and 6 tons/ft^2; however the presence of silt/clay or organic material can reduce this significantly. It is recommended that if necessary, additional geotechnical analyses be performed to further characterize the sediments at the site.

Soil Bearing Capacity: 3-6 tons per square foot

Soil Type

Soil type plays an important role in determining the rate of vegetation growth and the penetration and heartiness of the root system. A strong root system is essential for providing erosion resistance during large storms; therefore selecting the right type of soil for use in living shorelines projects is critical. The sediment type was classified as fine sand during the initial site visit. It is assumed that this material is also found immediately offshore. At a minimum, it is recommended that this assumption be confirmed and if necessary additional geotechnical analyses be performed to further characterize the sediments at the site. The grain size of the material for proposed beach fill should match the native grain size found on site to optimize the design and increase the life span of the nourishment.

Soil Type: Fine Sand

Water Quality

Habitat development is extremely dependent upon water quality. Dissolved oxygen concentrations, water temperature, salinity, PH and turbidity are significant factors that must be considered when planning any habitat preservation or restoration. Specific habitat types (i.e marsh plantings, oysters, fish) each have optimal conditions under which they can survive flourish. Considering the proposed structure type is a beach nourishment, the importance of water quality will be diminished in the design process. However, salinity will be important for choosing appropriate vegetation for the dune to be planted in the upland.

Water Quality: Not Determined

Parameter Summary

Table 5 – Tuckerton Site Condition Summary

System Parameters	
Erosion History	0.6 ft./year
Sea Level Rise	0.16 ft./year
Tidal Range	4.0 – 4.6 ft.
Hydrodynamic Parameters	
Waves	2.8 ft.
Wakes	3 ft.
Currents	Not Determined
Ice	Yes-Moderate (2.1-4" thick)
Storm Surge (25 yr. Event)	6.43 ft. (NAVD88)

Terrestrial Parameters	
Upland Slope	4 %
Shoreline Slope	10 %
Nearshore Slope	3.5 %
Offshore Depth	2 – 3 feet
Soil Bearing Capacity	3-6 tons per square foot
Ecological Parameters	
Water Quality	Not Determined
Soil Type	Fine Sand
Sunlight Exposure	Fully Exposed

Conceptual Design

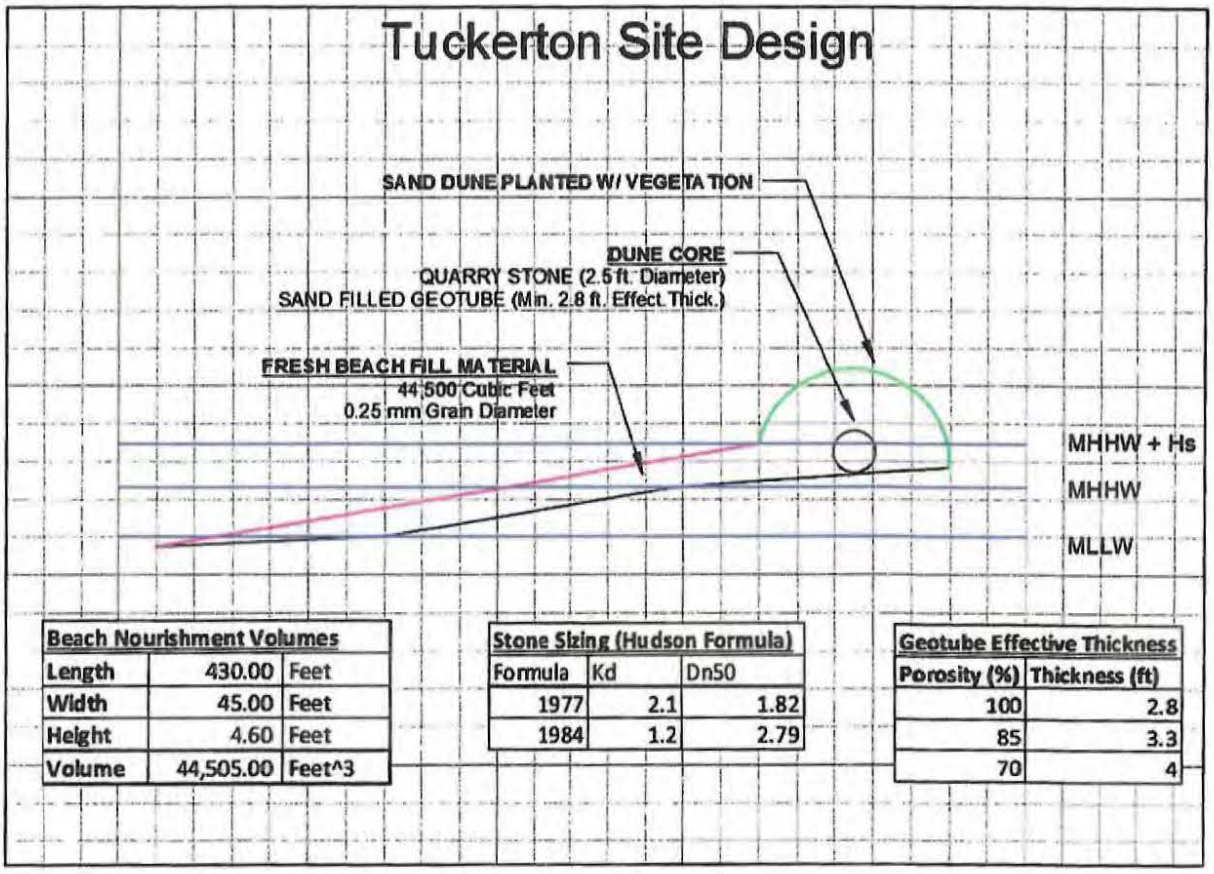
Based on the information described above, a conceptual design was developed for the Tuckerton site. The conceptual design represents a reasonable alternative in light of the site conditions and the needs and desires of the local community, and not necessarily an optimal design. The design represents a preliminary concept intended to help the community visualize the project being proposed, and to guide the community moving forward. While every attempt has been made to make the conceptual design as a realistic as possible, optimization of the proposed designs and finalization of many of the details should be performed as outlined in Miller et al. (2015).

The primary recommendation for South Green Street is to address the sediment deficit along the project shoreline with a small beach fill. An estimated total of 44,500 cf. of material is required to restore the shoreline to the position defined on the 1977 tidelands map (regulatory limit for GP 24). This quantity is based on the assumption that material similar to the native is used and that the nourished slope matches

the existing slope. The grain size shown on the cross-section is an estimate based on visual observation during the site visit and should be confirmed.

In order to increase the effectiveness of the proposed beach fill, two potential enhancements are recommended. The first is the creation of a small dune with or without an engineered core. The dune would serve to limit overwash and reduce the potential for undermining of the road during large storms. A crest elevation of at least 2.8 ft. above MHHW (MHHW+H_s) is recommended to prevent overwash during moderate storms with strong southwesterly winds. It should be kept in mind that during storms with significant storm surge, the South Green Street peninsula will flood from the backside; therefore increasing the crest elevation will only be effective at reducing overwash during small to moderate storms. Depending on budget/labor constraints, quarry stone, coir rolls, geotubes, or gabion baskets may be used to anchor the dune. The stone reinforcement depicted on the cross-section is based on the stable stone size calculated using the Hudson formula with consideration of the wave and ice forces described above. All other core enhancement dimensions should be considered "stone diameter equivalents", and should be confirmed before finalizing the design. Fill should be placed over the dune core, and planted with the appropriate native vegetation (http://plants.usda.gov/java/)

The second potential enhancement is the addition of two rubble mound structures to help retain the placed sand. Based on the historic aerial photograph analysis as well as the bay geometry, it appears as though sediment is being pushed north along the cove until the point at which it leaves the system. During storm conditions, it seems likely that sediment is lost during overwash and through cross-shore currents carrying the material offshore. These currents are likely enhanced by the bulkhead to the north of the project site. To prevent this material from washing out, a hooked groin adjacent to the bulkhead is proposed. To further reduce potential losses, a T-head groin is recommended near the critically narrow section of the beach. The lengths and arrangement of the structures should be confirmed with a more detailed analysis which includes wave direction. A typical 2-layer cross-section is provided, where the stone size is based on application of the Hudson Formula. It is expected that the shoreline will attempt to align itself to the angle of the incoming waves, resulting in a crenulate or parabolic bay shaped shoreline.



Beach Nourishment Volumes		
Length	430.00	Feet
Width	45.00	Feet
Height	4.60	Feet
Volume	44,505.00	Feet^3

Stone Sizing (Hudson Formula)		
Formula	Kd	Dn50
1977	2.1	1.82
1984	1.2	2.79

Geotube Effective Thickness	
Porosity (%)	Thickness (ft)
100	2.8
85	3.3
70	4

Figure 7 – Tuckerton Preliminary Cross-Section Design

Figure 8 – Tuckerton Overhead View

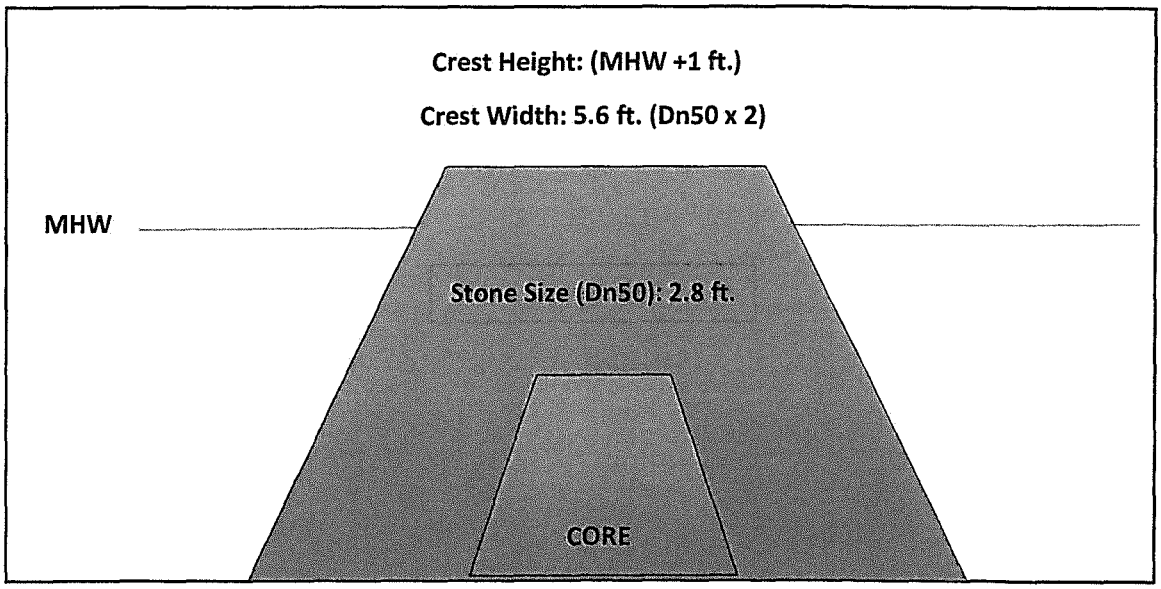


Figure 9 – Groin Cross-Section Design

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8-Hour Ozone (2008) Designated Area Area/State/County Report

Data is current as of June 30, 2018

Allentown-Bethlehem-Easton, PA (Marginal - Nonattainment)
- PENNSYLVANIA (Region III)
  - Carbon County
  - Lehigh County
  - Northampton County

Atlanta, GA (Moderate - Maintenance)
- GEORGIA (Region IV)
  - Bartow County
  - Cherokee County
  - Clayton County
  - Cobb County
  - Coweta County
  - DeKalb County
  - Douglas County
  - Fayette County
  - Forsyth County
  - Fulton County
  - Gwinnett County
  - Henry County
  - Newton County
  - Paulding County
  - Rockdale County

Baltimore, MD (Moderate - Nonattainment)
- MARYLAND (Region III)
  - Anne Arundel County
  - Baltimore County
  - Baltimore city
  - Carroll County
  - Harford County
  - Howard County

Baton Rouge, LA (Marginal - Maintenance)
LOUISIANA (Region VI)
Ascension Parish
East Baton Rouge Parish
Iberville Parish
Livingston Parish
West Baton Rouge Parish

Calaveras County, CA (Marginal - Nonattainment)
CALIFORNIA (Region IX)
Calaveras County

Charlotte-Rock Hill, NC-SC (Marginal - Maintenance)
NORTH CAROLINA (Region IV)
Cabarrus County (P)
Gaston County (P)
Iredell County (P)
Lincoln County (P)
Mecklenburg County
Rowan County (P)
Union County (P)
SOUTH CAROLINA (Region IV)
York County (P)

Chicago-Naperville, IL-IN-WI (Moderate - Nonattainment)
ILLINOIS (Region V)
Cook County
DuPage County
Grundy County (P)
Kane County
Kendall County (P)
Lake County
McHenry County
Will County
INDIANA (Region V)
Lake County
Porter County
WISCONSIN (Region V)
Kenosha County (P)

Chico (Butte County), CA (Marginal - Nonattainment)
CALIFORNIA (Region IX)
Butte County

Cincinnati, OH-KY-IN (Marginal - Maintenance)
INDIANA (Region V)

Dearborn County (P)

Lawrenceburg Township

KENTUCKY (Region IV)
Boone County (P)
Campbell County (P)
Kenton County (P)
OHIO (Region V)
Butler County
Clermont County
Clinton County
Hamilton County
Warren County

Cleveland-Akron-Lorain, OH (Marginal - Maintenance)
OHIO (Region V)
Ashtabula County
Cuyahoga County
Geauga County
Lake County
Lorain County
Medina County
Portage County
Summit County

Columbus, OH (Marginal - Maintenance)
OHIO (Region V)
Delaware County
Fairfield County
Franklin County
Knox County
Licking County
Madison County

Dallas-Fort Worth, TX (Moderate - Nonattainment)
TEXAS (Region VI)
Collin County
Dallas County
Denton County
Ellis County
Johnson County
Kaufman County
Parker County
Rockwall County
Tarrant County

Wise County

Denver-Boulder-Greeley-Ft. Collins-Loveland, CO (Moderate - Nonattainment)
COLORADO (Region VIII)
Adams County
Arapahoe County
Boulder County
Broomfield County
Denver County
Douglas County
Jefferson County
Larimer County (P)
Weld County (P)

Dukes County, MA (Marginal - Nonattainment)
MASSACHUSETTS (Region I)
Dukes County

Greater Connecticut, CT (Moderate - Nonattainment)
CONNECTICUT (Region I)
Hartford County
Litchfield County
New London County
Tolland County
Windham County

Houston-Galveston-Brazoria, TX (Moderate - Nonattainment)
TEXAS (Region VI)
Brazoria County
Chambers County
Fort Bend County
Galveston County
Harris County
Liberty County
Montgomery County
Waller County

Imperial County, CA (Moderate - Nonattainment)
CALIFORNIA (Region IX)
Imperial County

Jamestown, NY (Marginal - Nonattainment)
NEW YORK (Region II)
Chautauqua County

Kern Co (Eastern Kern), CA (Moderate - Nonattainment)

CALIFORNIA (Region IX)
Kern County (P)

Knoxville, TN (Marginal - Maintenance)
TENNESSEE (Region IV)
Anderson County (P)
Blount County
Knox County

Lancaster, PA (Marginal - Nonattainment)
PENNSYLVANIA (Region III)
Lancaster County

Los Angeles-San Bernardino Counties (West Mojave Desert), CA (Severe 15 - Nonattainment)
CALIFORNIA (Region IX)
Los Angeles County (P)
San Bernardino County (P)

Los Angeles-South Coast Air Basin, CA (Extreme - Nonattainment)
CALIFORNIA (Region IX)
Los Angeles County (P)
Orange County
Riverside County (P)
San Bernardino County (P)

Mariposa County, CA (Moderate - Nonattainment)
CALIFORNIA (Region IX)
Mariposa County

Memphis, TN-MS-AR (Marginal - Maintenance)
ARKANSAS (Region VI)
Crittenden County
MISSISSIPPI (Region IV)
DeSoto County (P)

Portion along MPO Lines

TENNESSEE (Region IV)
Shelby County

Morongo Band of Mission Indians (Serious - Nonattainment)
CALIFORNIA (Region IX)
Riverside County (P)

Nevada Co. (Western part), CA (Moderate - Nonattainment)
CALIFORNIA (Region IX)

Nevada County (P)

New York-N. New Jersey-Long Island, NY-NJ-CT (Moderate - Nonattainment)
CONNECTICUT (Region I)
Fairfield County
Middlesex County
New Haven County
NEW JERSEY (Region II)
Bergen County
Essex County
Hudson County
Hunterdon County
Middlesex County
Monmouth County
Morris County
Passaic County
Somerset County
Sussex County
Union County
Warren County
NEW YORK (Region II)
Bronx County
Kings County
Nassau County
New York County
Queens County
Richmond County
Rockland County
Suffolk County
Westchester County

Pechanga Band of Luiseno Mission Indians of the Pechanga Reservation (Moderate - Nonattainment)
CALIFORNIA (Region IX)
Riverside County (P)
San Diego County (P)

Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE (Marginal - Nonattainment)
DELAWARE (Region III)
New Castle County
MARYLAND (Region III)
Cecil County
NEW JERSEY (Region II)
Atlantic County
Burlington County
Camden County
Cape May County

Cumberland County
Gloucester County
Mercer County
Ocean County
Salem County
PENNSYLVANIA (Region III)
Bucks County
Chester County
Delaware County
Montgomery County
Philadelphia County

Phoenix-Mesa, AZ (Moderate - Nonattainment)
ARIZONA (Region IX)
Maricopa County (P)
Pinal County (P)

Pittsburgh-Beaver Valley, PA (Marginal - Nonattainment)
PENNSYLVANIA (Region III)
Allegheny County
Armstrong County
Beaver County
Butler County
Fayette County
Washington County
Westmoreland County

Reading, PA (Marginal - Nonattainment)
PENNSYLVANIA (Region III)
Berks County

Riverside Co, (Coachella Valley), CA (Severe 15 - Nonattainment)
CALIFORNIA (Region IX)
Riverside County (P)

Sacramento Metro, CA (Severe 15 - Nonattainment)
CALIFORNIA (Region IX)
El Dorado County (P)
Placer County (P)
Sacramento County
Solano County (P)
Sutter County (P)
Yolo County

San Diego County, CA (Moderate - Nonattainment)
CALIFORNIA (Region IX)

San Diego County (P)

San Francisco Bay Area, CA (Marginal - Nonattainment)
CALIFORNIA (Region IX)
Alameda County
Contra Costa County
Marin County
Napa County
San Francisco County
San Mateo County
Santa Clara County
Solano County (P)
Sonoma County (P)

San Joaquin Valley, CA (Extreme - Nonattainment)
CALIFORNIA (Region IX)
Fresno County
Kern County (P)
Kings County
Madera County
Merced County
San Joaquin County
Stanislaus County
Tulare County

San Luis Obispo (Eastern San Luis Obispo), CA (Marginal - Nonattainment)
CALIFORNIA (Region IX)
San Luis Obispo County (P)

Seaford, DE (Marginal - Nonattainment)
DELAWARE (Region III)
Sussex County

Sheboygan County, WI (Moderate - Nonattainment)
WISCONSIN (Region V)
Sheboygan County

St. Louis-St. Charles-Farmington, MO-IL (Marginal - Maintenance)
ILLINOIS (Region V)
Madison County
Monroe County
St. Clair County
MISSOURI (Region VII)
Franklin County
Jefferson County
St. Charles County

St. Louis County
St. Louis city

Tuscan Buttes, CA (Marginal - Nonattainment)
CALIFORNIA (Region IX)
Tehama County (P)

Upper Green River Basin Area, WY (Marginal - Nonattainment)
WYOMING (Region VIII)
Lincoln County (P)
Sublette County
Sweetwater County (P)

Ventura County, CA (Serious - Nonattainment)
CALIFORNIA (Region IX)
Ventura County (P)

Washington, DC-MD-VA (Marginal - Nonattainment)
DISTRICT OF COLUMBIA (Region III)
District of Columbia
MARYLAND (Region III)
Calvert County
Charles County
Frederick County
Montgomery County
Prince George's County
VIRGINIA (Region III)
Alexandria city
Arlington County
Fairfax County
Fairfax city
Falls Church city
Loudoun County
Manassas Park city
Manassas city
Prince William County

FEMA (/) Flood Zones

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The purpose of this page is to define flood zones, a commonly used term in floodplain management.

Expand All Sections

Definition/Description

Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. The 1-percent annual chance flood is also referred to as the base flood or 100-year flood. SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30. Moderate flood hazard areas, labeled Zone B or Zone X (shaded) are also shown on the FIRM, and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood. The areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled Zone C or Zone X (unshaded).

To see flood maps for a specific address, visit FEMA's Flood Map Service Center (http://msc.fema.gov/portal).

Learn more about what how FEMA defines each flood zone in Appendix D, page D-11 of the below document.

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DAMAGE ASSESSMENT REPORT ON THE EFFECTS OF HURRICANE SANDY ON THE STATE OF NEW JERSEY'S NATURAL RESOURCES

FINAL REPORT

PREPARED BY: OFFICE OF SCIENCE
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

FOR:
HURRICANE SANDY
NATURAL & CULTURAL RESOURCE WORKGROUP

May 2015

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IMAGE Credits:

Credit: NASA Goddard MODIS Rapid Response Team. NASA's Aqua satellite captured a visible image of Sandy's massive circulation on Oct. 29 at 2:20 p.m. EDT. Sandy covers 1.8 million square miles, from the Mid-Atlantic to the Ohio Valley, into Canada and New England.

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Executive Summary

Hurricane Sandy (October 28, 2012) was the most destructive hurricane of the 2012 Atlantic hurricane season, as well as the second-costliest hurricane in United States history, and the most destructive natural disaster ever to hit the State of New Jersey. Sandy's devastation included:

- 346,000 homes damaged;
- 1,400 vessels sunken or abandoned;
- 70 drinking water systems affected by power loss and damages;
- 80 wastewater treatment plants affected by power loss and damages;
- The entire coastline of beaches experienced significant erosion.

Persistent northeasterly winds over coastal waters, compounded by the astronomically high tidal cycles that coincided with and followed Sandy's landfall, caused water to accumulate and become trapped for a prolonged period along the coast in the bays, harbors, rivers, etc. (NOAA 2013). Coastal damage to human development and natural areas along tidally influenced waterways was immense immediately after landfall. Inland, the effects of strong sustained winds and unseasonably wet conditions caused tremendous tree damage and blow-down, generating widespread damage to infrastructure, buildings, and disruption of public services. Although the impacts to human communities were well documented, comprehensive assessment of damages to natural communities were not thoroughly evaluated.

In coordination with efforts to restore coastal and lowland communities, and to rebuild New Jersey's infrastructure following Hurricane Sandy, damage to specific natural resources was inventoried and rapidly assessed for degree of impact by the New Jersey Department of Environmental Protection (NJDEP). Feedback provided by the NJ State Park Service (SPS), Division of Fish and Wildlife Endangered and Nongame Species Program (DFWENSP), Division of Parks and Forestry - Office of Natural Lands Management (DPF- ONLM), New Jersey Forestry Service (NJFS), Land Use Regulation (LUR), and Bureau of Dam Safety & Flood Control indicated that although significant impacts were reported by field staff, the resources to conduct scientific site assessments, or to adequately evaluate the pre- vs. post-storm viability of these natural areas within the Park System were insufficient. In order to estimate the full extent of natural resource damages, the Department's Natural and Cultural Resources (NCR) Working Group assembled a Damage Assessment Team (DAT) to assess the qualitative and/or quantitative extent of damages to natural resources via surveys of riparian habitat, wetlands, forests and open waters.

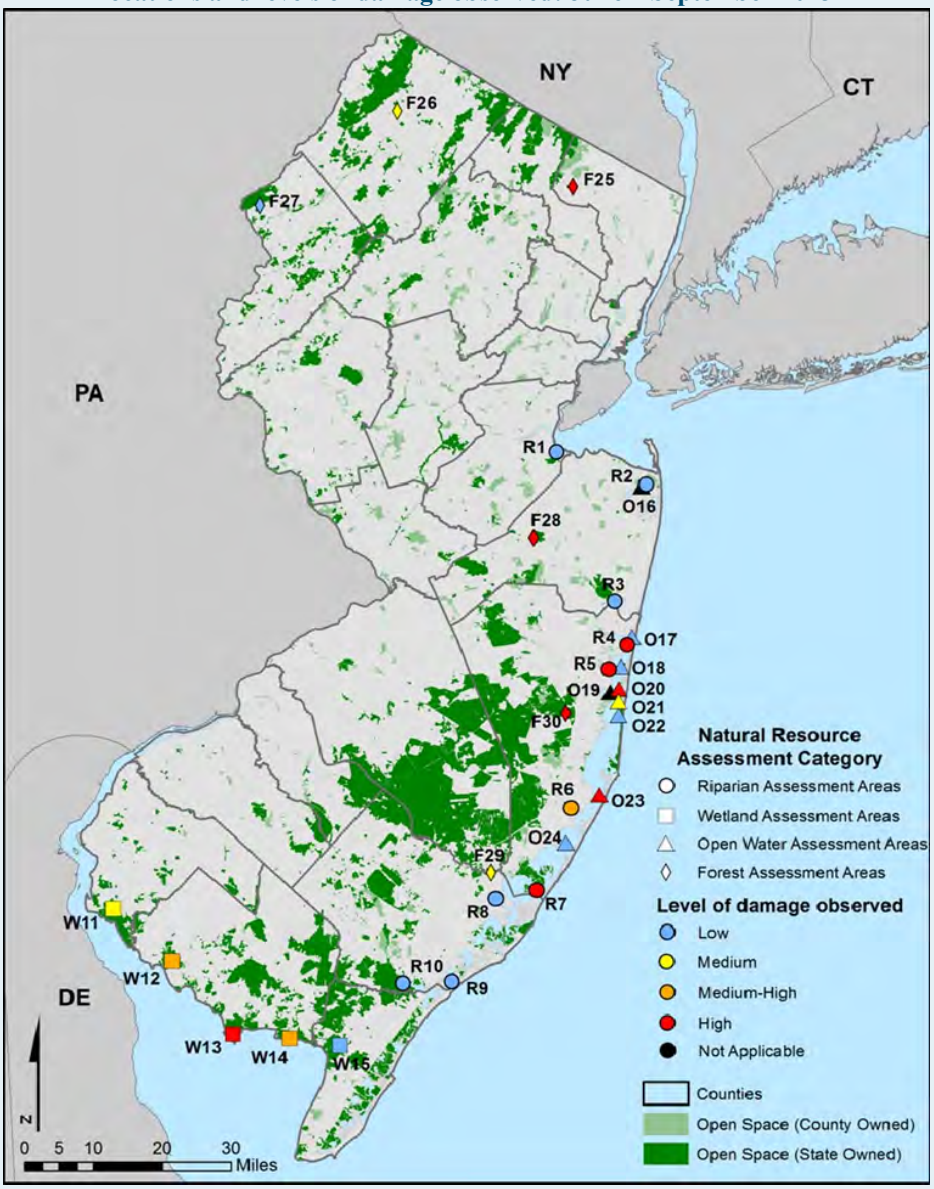
The objective of the natural resource damage assessment surveys as stated above was to investigate realized impacts to "natural areas", those that are undeveloped, maintained as County, State, and Federal lands or natural areas (managed and/or conserved), or otherwise considered environmentally sensitive areas. The DAT determined which resources and areas were the most heavily impacted, and provided recommendations to inform future research and investigation. Additionally, if warranted by the DAT findings, habitat restoration could be contemplated with measured consideration of the estimated cost of rehabilitation, overall benefit to habitat, and other environmental factors, as well as the simple fact that habitat lost for some species may represent additional habitat opportunities for others.

Desktop damage assessments were initiated in April 2013 as a precursor to field investigations and natural resources surveys. Using NOAA post-Sandy aerial photography, NJDEP 2007 aerial photography, NJDEP 2012 GIS land use/land cover data, and Pictometry® Connect for Hurricane Sandy, qualitative comparisons were made to determine areas that exhibited signs of impact.

Areas identified as having sustained natural resources damage (specifically New Jersey's coastal areas and Delaware Bay), were selected for further investigation via ground truthing and field assessment. Information (e.g. blow-down areas, impacted marsh, erosion, etc.) from the various NCR programs, county and local park officials, and partnerships were used to corroborate appropriate selection of field sites and survey locations.

Field investigations commenced in June 2013 and continued through September 2013. Four teams were deployed to survey areas reported as the most heavily impacted, with concerted efforts focused in riparian habitat/ floodplains (coastal), wetlands (coastal), forests, and open waters (bays and estuarine systems).[1]

Figure ES-1. Natural resource damage assessment field investigation locations and levels of damage observed: June – September 2013



Overall results from the field investigations indicate that riparian habitat and **wetland systems** performed well, with the most severe impacts (e.g. shoreline failure, erosion, and/or undercutting) observed in the central and northern coastal region (i.e. Barnegat Bay) and in southern Delaware Bay (Figure ES-1). These are consistent with damage inflicted on infrastructure and development observed in the vicinities of northern and central Barnegat Bay, and the Maurice River (Delaware Bay). Since baseline data immediately prior to the storm were unavailable for coastal wetland/ riparian habitats, accurate estimates of shoreline loss could not be quantified.

Based on field surveys, it is estimated that less than 1% of shoreline was eroded during Hurricane Sandy. However, impacts to **wetlands** (especially to coastal marshes) did occur, where impacts up to 5% were estimated. Accumulation of natural (e.g. wrack, trees, etc.) and manmade debris, prolonged periods of inundation, as well as loss of vegetation were all issues of concern and observed at numerous locations to

[1] *It is important to note that surveys of NJ's barrier islands and coastal beaches were excluded from this assessment, since most of the information on these impacts was reported from other DEP programs and municipalities (see Appendix C for NJSPS information on the impacts to Liberty State Park and Island Beach State Park).*

the farthest extent of the storm surge (although some recovery had occurred by the time the field investigations were initiated). Comparison of recent NOAA aerial photography for 2012 (post—Sandy) and State land use/land cover for 2007 show remarkable shoreline changes (both loss and gain) for bay and coastal estuarine/marsh shorelines. Caution must be taken in interpretation of the coverage review, since many of the changes observed from 2007 to present occurred due to multiple storm events prior to Hurricane Sandy's influence.

In **forests**, especially along the salt marsh/maritime forest interface, salt marsh – upland ecotone (e.g. Manahawkin WMA/Edwin B. Forsythe NWR), central Pinelands forests (e.g. Bass River State Forest), and in the northwestern ridge line forests (e.g. Stokes State Forest), blow-down and breakage of trees in isolated areas were observed in most state forests, however overall forest damage is estimated at no more than 5% of all state and natural lands.

Field investigation of **submerged aquatic vegetation (SAV)** beds in open water habitats revealed variable amounts of loss. Some locations in Lower Barnegat Bay and Little Egg Harbor (e.g. Loveladies to Beach Haven), appear to have lost significant seagrass beds.[2] Similarly, SAV losses were observed in the central section of the bay and a significant portion east of Conklin Island (Barnegat, NJ) as well.

All four habitats examined in this study sustained damage from Hurricane Sandy, with the level of damage ranging from minimal to moderate. The investigation highlighted the fact that tidal wetlands were especially impacted, with observed losses of forest and riparian habitat, as well as aquatic vegetation. However, the assessment was made more difficult by the limited baseline data available pre-storm for these important natural resources and some losses likely occurred pre-storm. It is recommended that monitoring be continued, which will provide for a baseline characterization and allow a much more concise assessment of damages sustained from storms in the future. Generally, the State's natural resources endured the effects of the storm better than the built environment (e.g., homes) and protected these areas from more severe damage. However, these results strongly imply that these habitats, especially coastal and tidal, and the valuable functions they provide will continue to be at risk from the effects of sea level rise and severe storms.

Table ES-1. Natural resource assessment areas surveyed by OS and the level of assessed damage associated with the effects of Hurricane Sandy. Map Code refers to the mapped area locations in Figure ES-1.

Map Code	Area Description	Damage Assessment
Riparian Assessment Areas		
R1	Cheesequake S. P.	Low
R2	Navesink/Shrewsbury Rivers	Low
R3	Manasquan River WMA	Low
R4	Mantaloking/Edwin B. Forsythe NWR	High
R5	Cattus Island	High
R6	Manahawkin WMA/Edwin B. Forsythe NWR	Medium-High
R7	Great Bay WMA	High
R8	Leeds Point/ Edwin B. Forsythe NWR	Low
R9	Pork Island WMA	Low
R10	Tuckahoe WMA	Low
Wetland Assessment Areas		
W11	Alloways Creek	Medium
W12	Cohansey River	Medium-High
W13	Maurice River	High
W14	Thompson's Beach	Medium-High
W15	Dennis Creek	Low
Open Water Assessment Areas		
O16	Navesink	Low
O17	Bay Head	Low
O18	Lavallette	Low
O19	Toms River	Low
O20	Seaside	High
O21	Seaside Park	Medium
O22	Island Beach SP	Low
O23	Manahawkin	High
O24	Long Beach TWP	Low
Forest Assessment Areas		
F25	Abraham Hewitt SF	High
F26	Stokes SF	Medium
F27	Worthington SF	Low
F28	Battlefield SP	High
F29	near Great Bay	Medium
F30	Double Trouble SP	High

[2] *It is important to note that the cause or causes of such divergent seagrass bed conditions and losses can be attributed to multiple factors. Therefore, these impacts cannot be solely attributed to the effects of Hurricane Sandy, since beach sand overwash and consequent buildup from other storm events, including Hurricane Irene, can negatively impact sea grass survival (Kennish 2012).*

Introduction

Hurricane Sandy was a late-season hurricane in the southwestern Caribbean Sea, first making landfall as a category 1 hurricane in Jamaica, and as a 100-knot (kt) category 3 hurricane in eastern Cuba before quickly weakening to a category 1 hurricane while moving through the central and northwestern Bahamas (Blake et al, 2013). After undergoing a complex transformation, the hurricane grew considerably in size while over the Bahamas, and continued to grow despite weakening into a tropical storm north of those islands. The system then intensified once again into a hurricane while moving northeast and parallel to the coast of the southeastern United States, and finally reached a secondary peak intensity of 85 kt while moving toward the mid-Atlantic states (Blake et al, 2013). Sandy came ashore near Brigantine, NJ around 7:30 p.m. on Monday October 29, 2012 with an estimated wind speed near 80 mph (70 kt) (NOAA, 2013b) and a minimum central pressure of 945 mb. At landfall, Sandy broke all-time low pressure records for Philadelphia, Harrisburg, and Baltimore. Tropical storm force winds extended across approximately 1,000 miles, making Sandy one of the largest Atlantic tropical storms ever recorded. Shortly after landfall, NOAA satellite imagery showed Sandy covering 1.8 million square miles.

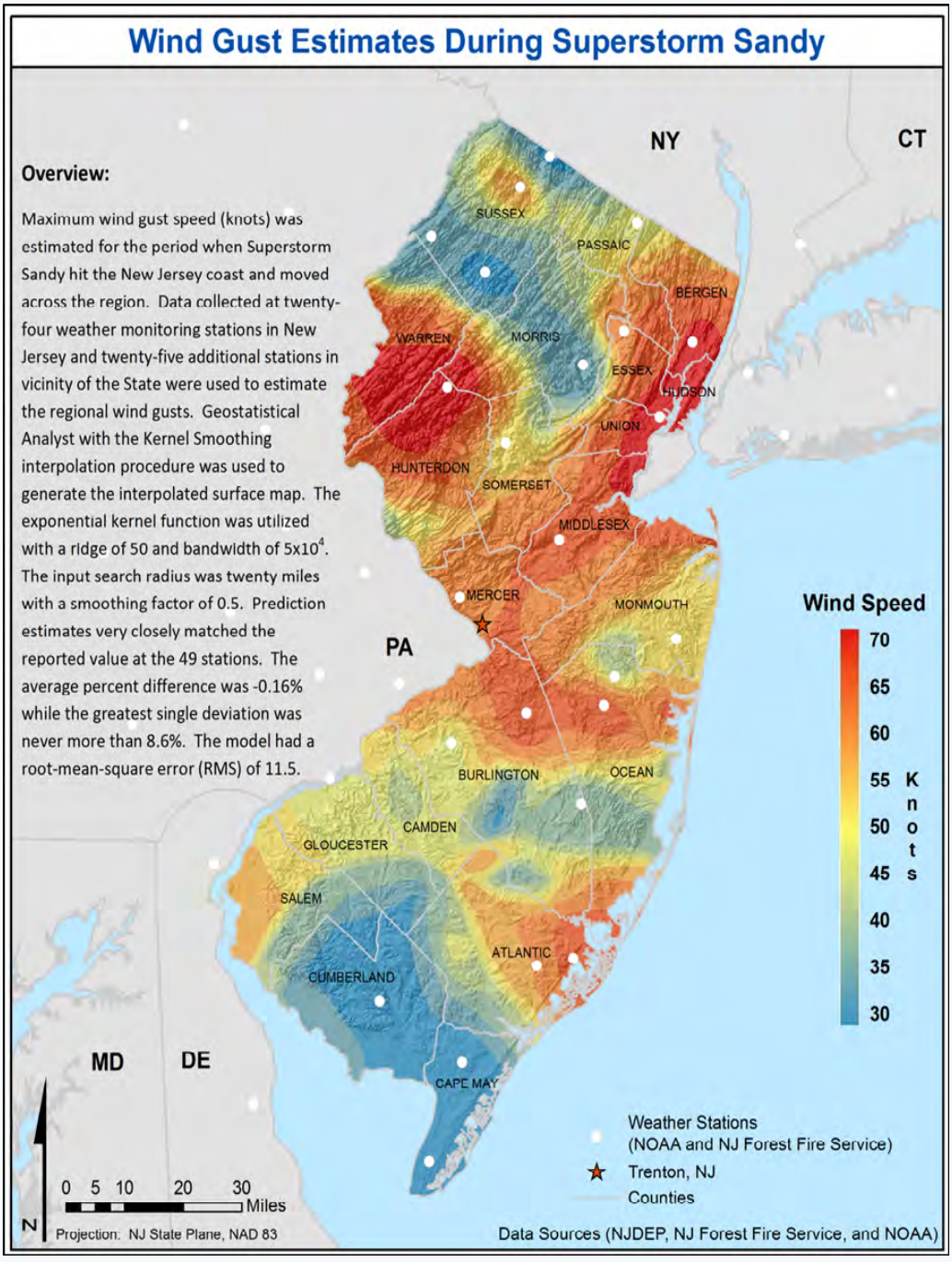


Figure 1-1. Maximum sustained wind gusts (kt) observed for New Jersey during Hurricane Sandy, October 29 – 30, 2012 (NJDEP-OS 2012).

General information on the impact of the storm

New Jersey's natural resources were affected by multiple aspects of the storm. Sustained and gusting winds caused significant damage to widespread areas of the state (Figures 1-1 and 1-2). In addition to the more than 100,000 downed trees in urban, suburban and rural communities of the state (48,000 trees cut/removed in the PSEG service area - PSEG, 2013; 65,000 trees cut/removed in JCPL service area, First Energy Corp., 2013), the winds damaged forests along the coast and well inland. Areas impacted included state parks, wildlife management areas and state forests.

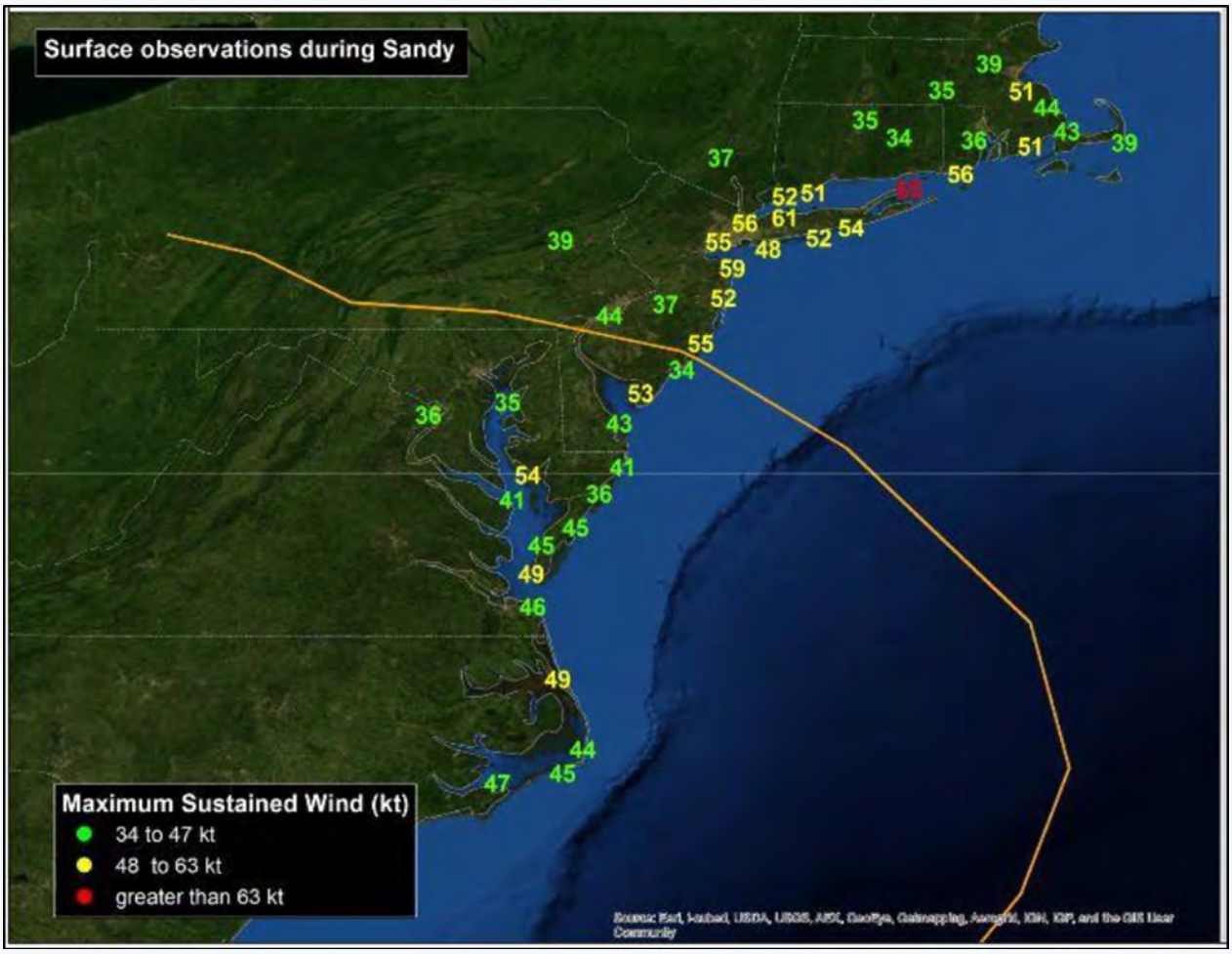


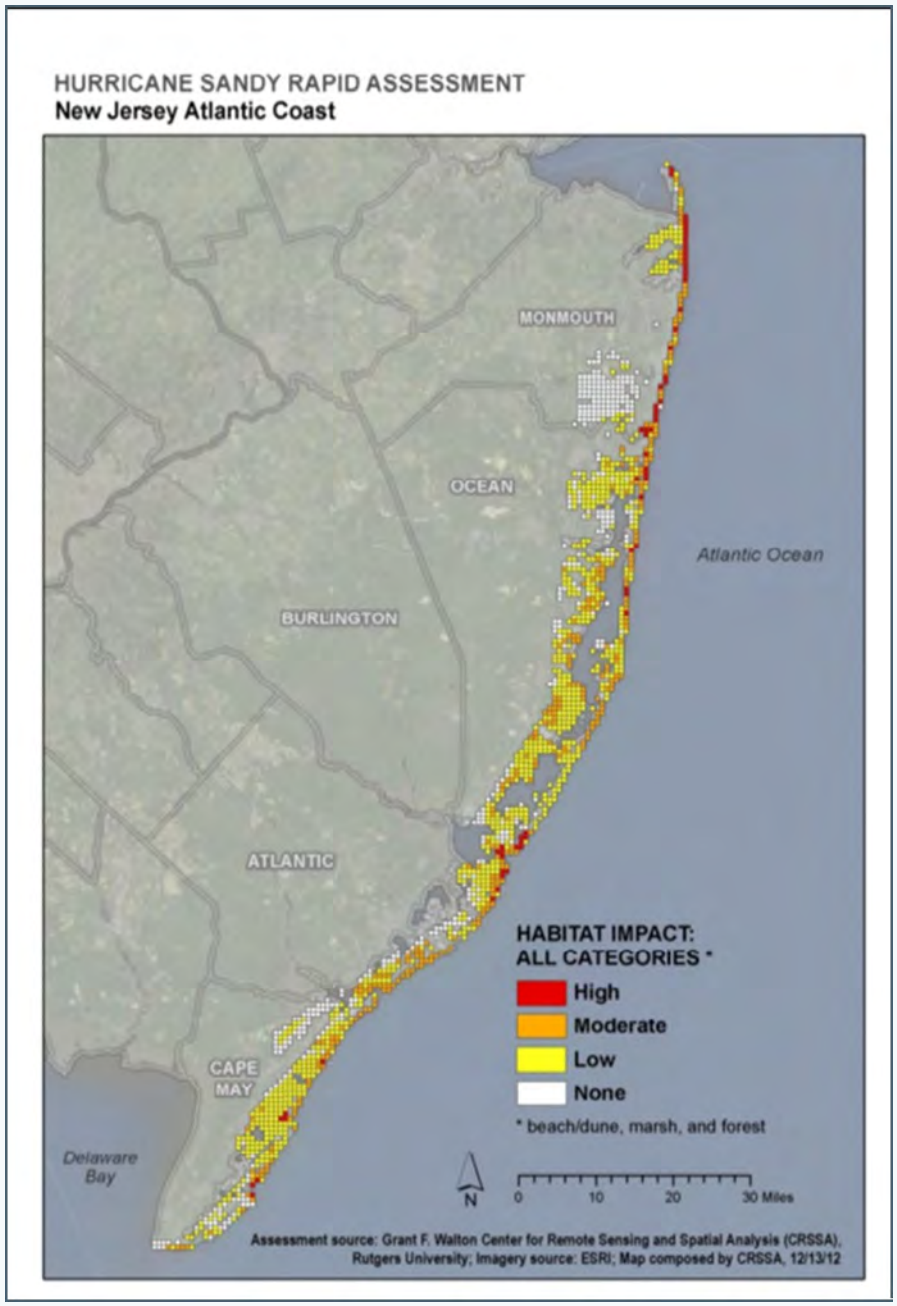
Figure 1-2. Maximum Sustained Wind Observations (34 knots; 38 mph or greater) along the Mid-Atlantic and New England coasts associated with Hurricane Sandy. Storm track is the orange line. (Source: NOAA, 2013a).

Prior to the Department's comprehensive efforts in evaluating the full impacts of Hurricane Sandy on its natural resources, federal agencies (e.g. FEMA, USGS, NFWF, NOAA) coordinated efforts to rapidly and qualitatively assess damage and its scope. The American Littoral Society (ALS) was tasked by the National Fish and Wildlife Foundation (NFWF) with coordinating a regional assessment to rapidly evaluate the quantitative and qualitative environmental impacts associated with Hurricane Sandy. The project was presented in two parts: an Interim Assessment Report (November 21, 2012) and the Final Assessment Report was submitted on December 17, 2012 (ALS 2012). The initial qualitative rapid assessment conducted by ALS concluded that the most severe impacts to natural resources occurred to the barrier islands, and to a lesser extent coastal marshes of Barnegat, Raritan and Delaware Bays (Figure 1-3). The report also stresses that secondary and tertiary impacts associated with storm surge[1] and wind damage would include disruptions in species

breeding and foraging, wetland function, changes in species distribution, vegetation composition, etc.

Storm surge affected large areas of the coast and inland areas via tidal bays and rivers including freshwater marshes and salt marshes (Figures 1-4 and 1-5). The worst flooding occurred over Staten Island and to the south along the New Jersey shore (Middlesex, Monmouth, and Ocean Counties). In coastal Monmouth and Ocean Counties, post-storm surveys confirmed entire communities were flooded, with houses washed off foundations, and cars and boats carried well inland by the surge. The storm surge caused significant flooding in parts of the Hudson River Valley, with record flooding at Poughkeepsie, and minor flooding as far north as Albany (NOAA 2013). Damages included deposition ofdebris, inundation of vegetation and trees leading to physical damage, as well as erosion, changes in water and soil chemistry (e.g., fresh to saline).

Figure 1-3: Initial rapid damage assessment of natural resources impacts following Hurricane Sandy (Source: ALS, 2012).



A major example of the ancillary effects of storm surge occurred following Hurricane Sandy's landfall on October 29, 2012, where approximately 255,180 gallons of low sulfur diesel fuel was released from the Sewaren, NJ, Motiva Facility into Woodbridge Creek (a tributary of the Arthur Kill) (NOAA and NJDEP, 2013). Although localized, oil was distributed into the tidal headwaters of Woodbridge and Smith Creeks, and along both banks of the Arthur Kill. Following the spill response and subsequent cleanup efforts, field investigations revealed minimal impacts to wildlife short

[1]Storm surge is defined as the abnormal rise of water generated by a storm, over and above the predicted astronomical tide, and is expressed in terms of height above normal tide levels. Since storm surge represents the deviation from normal water levels, it is not referenced to a vertical datum. Storm tide is defined as the water level due to the combination of storm surge and the astronomical tide, and is expressed in terms of height above a vertical datum, e.g. the North American Vertical Datum of 1988 (NAVD88) or Mean Lower Low Water (MLLW). Inundation is the total water level that occurs on normally dry ground as a result of the storm tide, and is expressed in terms of height above ground level. At the coast, normally dry land is roughly defined as areas higher than the normal high tide line, or Mean Higher High Water (MHHW). (Source: NOAA, 2013a)

term, however impacts to habitat and vegetation due to varying degrees of oiling would necessitate the need for limited wetland restoration (1.23 acres) and continued environmental monitoring.

As noted in the ALS (2012) report assessment, storm surge also deposited large volumes of sand, sediment and debris in open waters in bay and tidal rivers. This deposition resulted in the burying of ecological habitat including submerged aquatic vegetation, filled in deeper waters (e.g., channels, open marsh water management areas [OMWMs], depressions/seeps, etc.) and impacted marsh surfaces by blocking channels and/or covering large areas of marsh vegetation.

The following is a summary from NOAA (2013a) on the Sandy storm surge in New Jersey (see Figure 1 -4 and Table 1-1):

> *The highest storm surge measured by an NOS tide gauge in New Jersey was 8.57 ft. above normal tide levels at the northern end of Sandy Hook in the Gateway National Recreation Area. Since the station failed and stopped reporting during the storm, it is likely that the actual storm surge was higher. Farther south, the NOS tide gauges in Atlantic City and Cape May measured storm surges of 5.82 ft. and 5.16 ft., respectively.*
>
> *The deepest water occurred in areas that border Lower New York Bay, Raritan Bay, and the Raritan River. The highest high-water mark measured by the USGS was 8.9 ft. above ground level at the U.S. Coast Guard Station on Sandy Hook. This high-water mark agrees well with data from the nearby NOS tide gauge, which reported 8.01 ft. above MHHW before it failed. Elsewhere, a high-water mark of 7.9 ft. above ground level was measured in Keyport on the southern side of Raritan Bay and a mark of 7.7 ft. was measured in Sayreville near the Raritan River.*
>
> *As storm surge from Sandy was pushed into New York and Raritan Bays, sea water piled up within the Hudson River and the coastal waterways and wetlands of northeastern New Jersey, including Newark Bay, the Passaic and Hackensack Rivers, Kill Van Kull, and Arthur Kill. Significant inundations occurred along the Hudson River in Weehawken, Hoboken, and Jersey City, where many high-water marks indicated that inundations were between 4 and 6.5 ft. above ground level. Inundations of 4 to 6 ft. were also measured across Newark Bay in Elizabeth and the area around Newark Liberty International Airport.*
>
> *Water levels were highest along the northern portion of the Jersey Shore in Monmouth and Ocean Counties, north of where Sandy made landfall. Barrier islands were almost completely inundated in some areas, and breached in some cases, due to storm surge and large waves from the Atlantic Ocean meeting up with rising waters from back bays such as Barnegat Bay and Little Egg Harbor. The USGS surveyed high- water marks as high as 4 to 5 ft. above ground level in locations such as Sea Bright in Monmouth County and Tuckerton, Seaside Park, and Long Beach Island in Ocean County. Farther south, measured inundations were as high as 2 to 4 ft. in areas near Atlantic City and Cape May.*

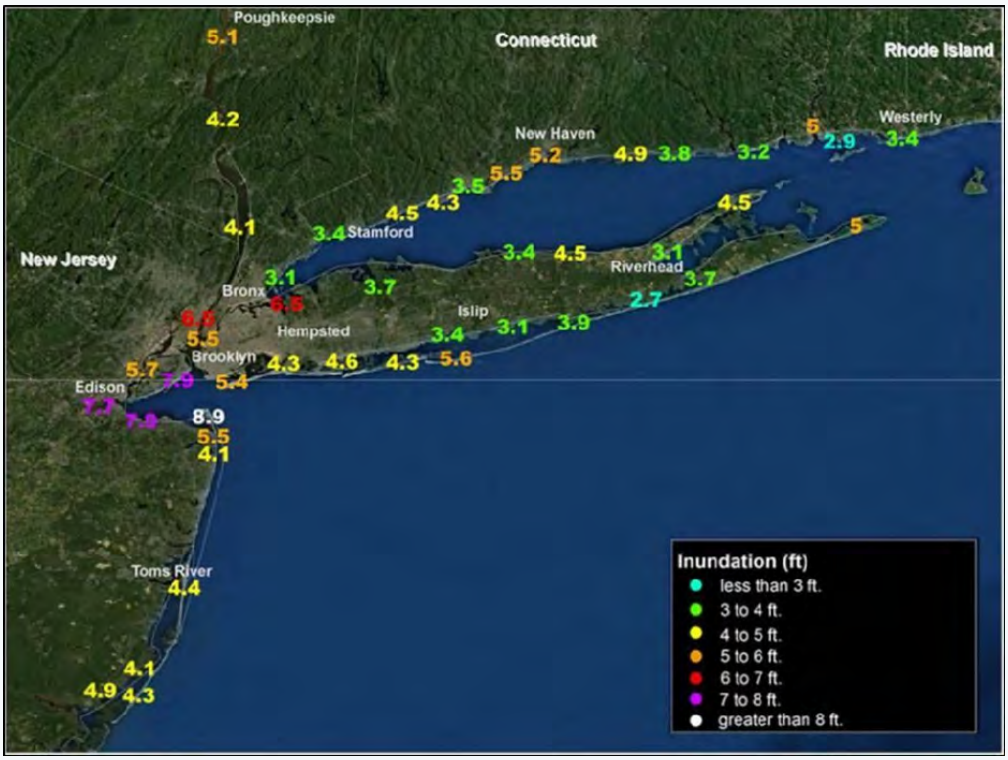


Figure 1-4. Estimated Sandy storm inundation (feet, above ground level; AGL) calculated from USGS high-water marks and National Ocean Survey tide gages in Connecticut, NewYork, and northern New Jersey, (Source: NOAA, 2013a)

As indicated by NOAA, large sections of the New Jersey coast were impacted by Sandy's storm surge (Figure 1-5). This qualitative assessment examined key areas in more detail to help define the actual impacts to natural resources.

Figure 1-5. Affected coastal and wetland areas of New Jersey following storm surge inundation due to Hurricane Sandy (NJDEP, OS 2014).

Response by federal agencies

A preliminary assessment has been conducted by the National Oceanic and Atmospheric Administration (NOAA) and other federal agencies for the 'NJ Natural Areas Impact Assessment'. The assessment identified natural resources potentially impacted by using the FEMA Interim High Resolution Surge Area data and by reviewing/comparing to state and federal agency data sets. In August (2013), FEMA released the "Superstorm Sandy (FEMA-4086-DR-NJ) Federal Recovery Support Strategy" report (RSS) in collaboration with the Recovery Support Functions (RSF), the Hurricane Sandy Rebuilding Task Force (HSRTF), the Governor's Office of Recovery and Rebuilding (GORR), and various state departments and agencies. The goal was to identify state priorities and initiatives within particular recovery areas, as well as to identify Federal support strategies for those initiatives, thereby assisting local recovery efforts within each identified programmatic area. The intent of the Federal RSS for New Jersey is to provide guidance for engaging recovery partners across all sectors and jurisdictions, while describing the various priorities as the State continues developing and implementing its recovery initiatives (FEMA 2013).

With respect to natural resource damages, the RSS (specifically the Natural and Cultural Resources RSF) has focused on assisting interested and affected parties with protecting natural and cultural resources and historic properties through numerous response and recovery actions. Particular areas of concern identified by State agencies include: beaches and dunes; wetlands; coastal lakes; residual debris; cultural and recreational resources; and natural habitats and wildlife, including marine life (FEMA 2013).

Federal agencies have contributed assessment data to the State, including pre- and post-Sandy light detection and ranging (LiDAR) survey information, as well as information about safe cleanup methods. Federal and State agencies continue to work together to provide information, environmental assessments, and other resources for beach restoration. Map projections of storm surge overlays (FEMA and NOAA data) and other information are available via the New Jersey Office of GIS - Hurricane Sandy GIS Resources website (http://njgin.state.nj.us/oit/gis/sandy/). USGS Hurricane Sandy Storm Tide mapper is also available at: http://water.usgs.gov/floods/events/2012/sandy/sandymapper.html, showing storm surge projections using tide gauge data. Additional information and resources, response information, and Federal agency links are available at: http://www.state.nj.us/dep/special/hurricane-sandy/.

The Federal government has also been developing strategies for assessing impacts to and restoring beach dunes, wetlands, coastal lakes, natural habitat and wildlife, and debris removal (DOI-USGS 2013). Strategies include:

- beneficial reuse of dredge material to create living shorelines and buffering wetlands for habitat and shore protection
- assisting the State in continuing to monitor water quality of impacted fresh and coastal water bodies

- assessing the impacts of changes to fish habitat in relation to sustainability of commercial and recreational fisheries
- collecting and periodically updating state-wide information for land as well as for water depth
- assisting with a targeted assessment of the impacts to wetlands, including edge loss and overall health
- assessing and enhancing ongoing monitoring and observation for storm events
- assisting the State in assessing the protective services provided by natural systems (e.g., beach dunes, salt marshes, and tidal wetlands) and hard structures (e.g., groins, jetties, and riprap)
- evaluating the suitability, costs, and benefits (socio-economic and ecological) of both hard structures and natural coastal systems
- establishing pilot natural sites that can be studied and monitored to improve our understanding of baseline conditions

Response by New Jersey

New Jersey's state Natural and Cultural Resources (NCR) Working Group was established to provide overall technical direction and oversight of the distribution of federal funding, established in a manner which corresponds to the overall Federal Recovery Framework in the aftermath of Sandy. The NCR serves as the focal point for projects and federal funding opportunities for those resources that have been impacted, as well as subject matter experts regarding all projects in New Jersey potentially impacting natural, cultural and historic resources. Natural features including coastal wetlands, beaches, aquatic and terrestrial habitats, farmland, marine fisheries and aquaculture, and urban rivers and streams were greatly impacted by the storm. Additionally, many public institutions, state forests and places of historic significance were also impacted. The mission of the NCR Working Group is to help restore, reestablish, and reconstruct these resources in an environmentally sound manner that is consistent with State and Federal policies and goals. In addition, the NCR will provide technical assistance to all of New Jersey's State agencies as part of the Sandy Recovery and Rebuilding Federal assistance process.

The NCR team consists of subject matter experts within New Jersey's Department of Environmental Protection, Department of Community Affairs, and the Department of Agriculture. In addition, a multi-disciplinary approach is being utilized in project implementation, and includes members of the Governor's office, the Attorney General's office, and team members possessing information technology (IT), communications and federal grant funding and processing expertise. The Department's Natural and Cultural Resources programs have been actively assessing impacts to natural resources immediately following Hurricane Sandy's landfall, and interpreting the continued effects to and recovery of these resources. For example, efforts to monitor observed impacts to nesting and breeding habitat for numerous species, both inland and coastal along various habitat types, have been exhaustive and ongoing.

The following is a brief summary of the statewide approximate acreage impacted by the storm by category based on a preliminary assessment conducted by the National Oceanic and Atmospheric Administration (NOAA) and other federal agencies for the 'NJ Natural Areas Impact Assessment' shortly after Hurricane Sandy (note some categories may overlap):

Natural Resources Preliminary Assessment – Acreage Inundated by Storm Surge:

642,000 acres of shellfish harvesting waters (adjacent to areas inundated)
380,000 acres of habitat inundated
292,000 acres contain state-endangered species
23,000 acres contain federally-listed endangered/threatened species
21,500 acres of Natural Heritage Priority Sites inundated

Specific Planning, Management or Federal Areas Impacted:

132,000 acres of Coastal Environmentally Sensitive Planning Areas
129,000 acres in NJ Pinelands Management Areas
36,000 acres of US Fish & Wildlife Service National Wildlife Refuges
12,000 acres of Critical Environmental and Historic Sites
1,600 acres of National Park Service land (Gateway National Recreation Area)

Land Use/Land Cover – Acreage Inundated by Storm Surge

Wetlands: 260,000 acres
Water: 81,000 acres
Urban: 74,000 acres
Forest: 16,000 acres
Agriculture: 8,000 acres
Barren Land: 3,300 acres

Shoreline Type- Total Length Impacted by Hurricane Sandy within the CAFRA Zone section covering from Keyport (Monmouth County) to Heislerville (Cape May County)

Marsh/Wetland: 678 miles
Beach: 194 miles
Bulkhead: 194 miles
Erodible shoreline: 70 miles
Earthen dike: 5.6 miles

Table 1-1. Storm Surge Levels in New Jersey Counties (Source: NOAA, 2103a

County	Storm Surge (feet above ground level)
Monmouth and Middlesex Counties	4 – 9 ft.
Union and Hudson Counties	3 – 7 ft.
Essex and Bergen Counties	2 – 4 ft.
Ocean County	3 – 5 ft.
Atlantic, Burlington, and Cape May Counties	2 – 4 ft.

Damage Assessment Team

The NCR Working Group assembled a team to examine and assess the damages from the storm with the NJDEP's Office of Science leading the effort. Multiple programs were involved in compiling information on impacts to state parks, wildlife management areas, beaches, estuaries, and ecologically sensitive habitats. Four primary assessment themes were selected for additional damage screening. These themes included wetlands, forests, riparian/floodplains and open waters. These habitats were identified as priorities and as having a nexus to ongoing research in affected areas (e.g. Barnegat Bay, Delaware Bayshore, etc.). NJDEP Programs providing support to the team included:

Division of Fish & Wildlife (ENSP)

State Park Service

State Forestry Service (DPF, NHP)

Green Acres & Ecological Restoration

Office of Science

Themes (Results & Discussion)

Wetlands

New Jersey's tidal wetlands are one of the State's most dynamic features providing a multitude of ecological and economic benefits. Fringing the perimeter of the state, these areas have been subject to natural and human induced perturbations and change. These include tidal inundation, subsidence, sea level rise, sediment supply, ditching, diking, filling, water withdrawal and the stressors of adjacent development.

As documented in the NJDEP Coastal Management Program's 2011-2015 Section 309 Assessment and Strategy, New Jersey has (according to the 2007 Land Use/Land Cover GDS Dataset) 198,773 acres of tidal wetlands in the CAFRA zone. This amount corresponds to a loss/change of approximately 9,997 acres of coastal/emergent wetland vegetation or conversion to open water from the 2002 Land Use/Land Cover data. It is important to note that this acreage does not include the tidal wetlands outside the CAFRA area in the Raritan Bay, Meadowlands and northern coast, or on the tidal Delaware River, and part of the loss may be attributed to differences in classification methodology as well as the physical changes that occurred between 2002 and 2007.

Regardless of the present distribution of tidal wetlands, these areas provide unquestionable ecological and economic values that New Jersey residents have come to rely upon. Hurricane Sandy demonstrated that these wetlands serve as a 'first line of defense', providing vital flood and storm surge protection to human assets and infrastructure. After Hurricane Sandy, it became evident that those communities buffered by coastal wetlands sustained less physical damage, and consequently less economic losses. Hurricane Sandy produced a record level of storm surge due to its wind strength, angle of approach and time of landfall coinciding with a lunar high tide. However, the tidal wetlands withstood this assault and proved to be resilient to Sandy's powerful effects.

Hurricane Sandy made landfall on the eastern coast of New Jersey, however, the wind strength and circulation pattern impacted all of New Jersey's coastal wetland areas. While it was to be expected that the tidal wetlands on the east coast of New Jersey (i.e. ocean-side) would sustain damage, the tidal wetlands fringing the Delaware Bay (not buffered by barrier islands) suffered severe damage. The vast area of the Bay and the extended periods of sustained wind speeds contributed to the impacts and to the severity of these effects.

It has been documented that the Delaware River Estuary has lost 2% of its wetlands between 1996 and 2006 (PDE 2012). This loss is attributed to increase in tidal water levels, subsidence, and to the lack of sediment enabling the wetlands to keep pace with sea level rise. It is estimated that an additional 25 – 75% loss of wetlands will occur with one meter of sea level rise (PDE 2012 – Application of the SLAMM6 Model). The decline in the integrity of the tidal wetland system of the Delaware Bayshore has resulted in decreased resiliency of these wetlands to storm impacts associated with severe storm events including Hurricane Sandy, Hurricane Irene, and seasonal Nor'easters.

Immediately following Hurricane Sandy (October and November 2012), aerial and field assessments of the State's built and natural resources were conducted by federal, state and non-governmental organizations (NGOs). There were numerous reports of adverse impacts inflicted by the storm on the state's wetlands. The Office of Science (OS) reviewed the various reports of impacts and followed with a qualitative survey of the State's tidal wetlands.

The qualitative damage assessment was intended to identify and estimate the 'observed' impacts of Hurricane Sandy on wetland and shoreline vegetation, substrate, integrity, and observed function. The following procedure was employed:

Step 1: Determine current knowledge and assessment information

- Contact DEP programs and determine:
  - Damage Assessment (DA) information specific to the resources they manage; Have the programs completed DA information summaries requested by OS.
  - What DA information did the program need or want checked and/or confirmed in the field.
  - Was the Program conducting any DA at the time (in the field, desk top); was any planned; where, when?
  - Had the Program reviewed and confirmed DA information provided by other sources (federal, state, NGO, etc.)?

Step 2: Desktop Damage Assessment – Remote sensing review and interpretation (aerial photography, reports)

- The Office of Science utilized the NJDEP Hurricane Sandy Waterway Debris Management Zone map (OIRM-BGIS 2012) as the basis to assign assessment areas for desktop and future field review. The Wetlands Damage Assessment areas included the entire tidal (salt marsh and freshwater) wetland area of the state and overlapped with the Damage Assessment being conducted for Floodplain and Riparian Habitats.

  The sources of information utilized for the desktop aerial review included:

  - 2012 NJDEP aerial photography (flown in March/April 2012 – Pre Sandy)
  - 2012 NOAA/USGS post-Sandy aerial photography – October/November (limited to coastal zone); east of the Garden State Pkwy; no coverage of the Delaware Bay or River
  - 2007 NJDEP aerial photography
  - County Road Maps
  - USGS Hurricane Sandy Storm Surge Line
  - LiDAR data sets
  - Pictometry® Connect for Hurricane Sandy– aerial photography with various dates pre- and post-Hurricane Sandy
  - Aerial and marsh-level photographs provided by NGO and academic sources

The objective of the Wetlands Damage Assessment was to identify areas showing changes to marshes/wetlands post Hurricane Sandy which includes (see Figures W-1 – W-5):

Figure W-1. Marsh edge – collapse, sloughing off, under-cutting, erosion (Edwin B. Forsythe NWR, Mantoloking Ocean County).

Figure W-2. Marsh scouring (Edwin B. Forsythe NWR, Mantoloking, Ocean County).

Figure W-3. Marsh edge overwash (Great Bay WMA, Ocean County) .

Figures W-4 and W-5. Marsh ponding, drowned (excessive water retention) (Great Bay WMA, Ocean County).

* Matting – areas where the marsh and underlying substrate have been lifted and rolled back on itself (i.e.: sod)
* Rafts of debris and marsh vegetation
* Marsh scour or deposition – areas where the marsh vegetation and substrate was scoured away and sediment /sand was deposited
* General assessment of the marsh – did it appear to sustain damage or remained relatively intact (as compared to the 2012 pre-Hurricane Sandy photography)
* High Marsh/Upland Edge – condition of the high marsh vegetation and along the upland edge
* Extent of the debris/rack line (vegetation) and associated ponding
* Condition of trees on upland edge of marsh – was there evidence of salt water stress/dieback (note: this might not be observed until next growing season), and uprooting of vegetation
* Development adjacent to marsh – observations of condition of bulkheads, docks, piers and condition of adjacent marsh
* Observed damage to residential and commercial development upland of marsh
* Stream Channel modifications – changes in width, sediment deposits, erosion, bank scouring, changes in meanders

Step 3: Prioritize Areas for Field Reconnaissance

- Based on the desktop assessment identify areas for ground-truthing and field assessment:
  - Identify which areas had the most damage
  - Identify areas having sensitive habitat – areal extent of impact, condition of habitat (inundated, scoured)
  - Investigate areas where there were data gaps, limited data and /or conflicting observations between sources

Step 4: Refining Desktop Assessment for Field Reconnaissance:

- The desktop assessment revealed several factors that required consideration and refinement prior to making determinations on impacts. These included discrepancies in the scale and stage of tide between the various aerial overflights. The timing of the NOAA/USGS October/November 2012 overflight immediately following the storm captured immediate impacts, but also captured standing water on the marsh and did not account for potential 'natural adjustment' that might occur between photo documentation and field assessment. In comparing the NJDEP aerial photography flown in 2007 to those for same area flown in 2012 there appeared to be considerable change to wetland areas that were being attributed to Hurricane Sandy but were in fact evident pre-storm. In some areas the storm exacerbated or highlighted the changes but was not responsible for the erosion/loss of wetland area. Additionally, there were significant data gaps depending on the region being observed, and the potential for exaggeration of impacts due to low resolution and report discrepancies.

Field Assessment

The OS Field Assessments were conducted in the spring and summer of 2013. These field reconnaissance investigations were conducted during the 2013 growing season, and after Hurricane Sandy and other winter storms. The individual desktop Wetlands Assessment Reports coinciding with the NJDEP Waterway Debris Management Zones are available on the Office of Science computer network (available upon request). These reports identify the aerial photographs viewed, observations, and areas identified for field observation. The field investigations for the Northern and Eastern coastal areas were conducted in coordination with the field investigation for Floodplain and Riparian Habitats. The summary of the findings and place specific photographs documenting field observations can be found in this report's Floodplain and Riparian Habitat section.

General Observations

The earliest aerial photographs taken post Hurricane Sandy revealed extensive flooding of tidal wetlands, debris from destroyed developments, areas of sediment deposit (sand wash-over) from barrier islands, broken dikes, edge loss and altered channel meanders. Details of the field assessments for each geographic region are presented below.

Atlantic Coast and northern coastal waterfront – The post-Sandy aerial photography showed large areas of standing water and some wetland edge loss.

- Areas of edge loss were not extensive or contiguous. As noted previously a comparison of 2007 and 2012 pre-Sandy aerial photography (same scale and orientation) showed significant changes in shoreline configuration and areas of loss. Hurricane Sandy may have contributed to under-cutting and additional loss to already compromised shorelines.
- Field investigations of areas identified on aerial photography as being flooded or having extensive areas of standing water showed that standing water had receded. However, there were areas where vegetation had not recovered leaving areas of bare ground in the interior marsh.
- Field surveys of areas identified on aerial photography as being managed for mosquito control [open marsh water management – OMWM] showed evidence of retaining water (ponding) and vegetation loss

with reduced recovery (Figure W-6). Edge loss was greatest in areas where OMWMs were constructed in lower marsh areas (closer to open water). In areas where OMWM ponds were present in greater abundance, the marsh also appeared slower to recover (e.g. greater prevalence of ponding/retention). There has been concern that the OMWM areas will not be as resilient (i.e. due to their influence on the diminished integrity of marsh vegetation composition and original surface structure) to future assaults from storm surge or wind damage.

Figure W-6. Open Marsh Water Management areas showing evidence of water retention (Cape May County).

- Wetlands areas previously compromised by ditching, OMWM, and diking appear to have sustained more damage and were slower to recover than other less impacted marsh areas.
- The communities that were upgradient of wetlands were buffered from storm surge and winds. These communities appeared to have sustained less damage. However, there was evidence of damage to docks, piers, and bulkheads, but these features were directly impacted by the storm's intensity.
- Based on the USGS mapping of the storm surge line, it was evident that the upland vegetation/ tree line bordering tidal wetlands was impacted by saltwater intrusion. These areas retained water and debris for longer periods of time than the open marsh. There is concern that this ponded water and debris would create or enhance breeding habitat for mosquitoes, insects and vermin. The impact of saltwater intrusion on the long-term viability of the trees and understory vegetation may require surveys during additional growing seasons to fully estimate long term effects.
- The field investigations conducted post storm documented that the tidal wetlands (with few exceptions) recovered from the assault of Hurricane Sandy as they would from other coastal storms. Unfortunately, post storm assessments are not conducted on a routine bases. As noted previously, there appears to be a significant change in wetland acreage and integrity (vegetation vs. mud flats) when comparing the 2007 and pre-Sandy 2012 aerial photography.
- The impact of ongoing recreational activities including boat traffic, wakes, and landings in the marsh, have had a greater adverse impact on shoreline stability, vegetation, and wildlife habitat than the impacts attributed to the storm in a number of areas where wetland vegetation recovered.

The following two photos (Figures W-7 and W-8) were taken on the same day (7/24/13) and illustrate how various marshes responded to the impacts of Hurricane Sandy

Figure W-7. Atlantic Coast Wetlands - Tuckahoe 1: Example of ponding post inundation (Atlantic and Cape May Counties).

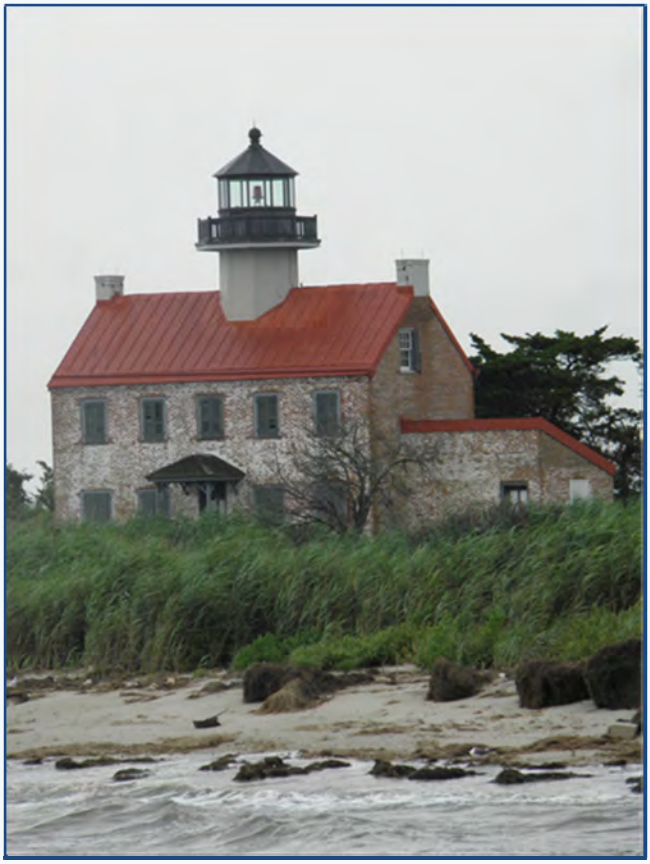
Figure W-8. Dennis Creek 1: No lasting impacts (Cape May County).

Delaware Bayshore Wetlands

A majority of the post Hurricane Sandy media reports indicated that Delaware Bayshore communities did not sustain significant economic damage to their residential and commercial businesses as compared to Atlantic coast communities. These reports failed to address any potential impact to natural communities (e.g. wetlands, forests, or sandy shorelines). In the absence of post Sandy aerial photography for the Delaware Bayshore and want of natural resource impact assessments, the OS conducted a qualitative review and assessment of storm impacts for this region. Areas potentially impacted by the storm were selected for field investigation utilizing 2007, 2010 and 2012 aerial photography, LiDAR, local NGO post storm reports and prior (2011) NJDEP Coastal Program Coastal Hazard Project information. The Delaware Bayshore wetlands investigated (Cape May, Cumberland County and Salem counties) showed significant storm impacts to tidal wetlands. Impacts to wetland edges (land water interface) appeared to be more significant than those on the Atlantic coast. Larger, contiguous areas of shoreline were compromised by erosion, undercuts, and sloughing. Furthermore, the storm surge extended further inland to the tree line, dikes were blown out, wetlands inundated, and a significant loss of wetland area was observed at the confluence of the Bay and rivers (i.e. Maurice and Cumberland Rivers). There were also forested areas showing downed trees. Another observation revealed that storm winds contributed to sand and sediment deposition along shorelines creating shallow embayments water ward of former wetland edges on the Delaware Bayshore. In discussion with property owners, it was confirmed that moorings and piers were unusable because of the additional sediment.

The following photos (Figures W-9 and W-10) were taken in June 2013 and illustrate the impacts to shoreline and coastal wetlands along the Delaware Bayshore .

Figure W-9. East Point Light House (Cumberland County).



Note: clumps of vegetation where substrate was scoured from root base. Vegetation appears free standing.

Scoured vegetation, wave run-up and undercutting of bulkhead are illustrated here (East Point Lighthouse)

Figure W-10a. View looking south to Thompson's Beach/Moore's Beach (Cumberland County).

Figure W-10b. East Point Lighthouse Beach.

Figure W-10c. Thompson's Beach - undercut vegetation

Figure W-10d. Heislerville WMA – Impoundment.

Figure W-10e. Mouth of the Maurice River Basket Flats.

Note: Historically, there was a vegetated oxbow where the remains of a railroad crossing are visible. With each storm the area erodes. Post Hurricane Sandy vegetation is no longer observable.

Riparian Habitats/Floodplains

Desktop damage assessments were initiated in April 2013 using NOAA Post-Sandy Aerial Photography at a resolution of 1:1000 and Pictometry® Connect for Hurricane Sandy for coastal riparian habitats and marshlands, and completed by June 2013. Special attention was given to Monmouth, Ocean (e.g. Barnegat Bay) and Atlantic Counties given the significant loss to human assets. Pre- and post- storm images and impact maps provided by the rapid damage assessment surveys conducted by the American Littoral Society (ALS, through the Rutgers University Grant F. Walton Center for Remote Sensing and Spatial Analysis - CRSSA project) (ALS 2012) were used as a background comparison for desktop survey observations. Based on the resolution of the NOAA aerial photography, few observable impacts could be ascertained from the review. Natural areas identified as having sustained some observable impact (e.g. change in shoreline, loss or gain, debris/wrack accumulation areas, blow-down areas, etc.) were noted and later investigated during field surveys (Table R-1).

Qualitative surveys were conducted for coastal riparian and riverine wetland habitats along the NJ Coast during the summer months of 2013 to assess impacts to natural areas (including Wildlife Management Areas [WMAs], State Parks, Municipal Parks, etc.) from Hurricane Sandy and post-Sandy storms. Natural resource damages were initially assessed by reviewing 2013 NOAA aerial photography compared to the Department's 2012 Land Use/Land Cover Imagery, 2007 GIS Land Use Data, and Pictometry® Connect for Hurricane Sandy imagery. Focus for the assessment centered on areas that were reported as sustaining the highest damage based on impacts to human habitation, and in natural areas managed by federal, state and/or local entities. Given information provided by various DEP programs including the Office of Natural Lands Management – Natural Heritage Program (ONLM – NHP), Division of Parks and Forestry (DPF), and Division of Fish and Wildlife – Endangered and Nongame Species Program (DFW – ENSP), coastal areas beginning north in the Raritan Bay region and south to Cape May were chosen as focal points for desktop review and field investigation; the Delaware Bay region is covered in the Wetlands Assessment section of this report. Damage assessments within State lands along the coast, as reported by other programs within the Department (see Niles et al. 2012 and NJDEP – ENSP 2013), were solely focused on T&E species and associated habitats, active species management programs (NJDEP and CWFNJ 2013a, 2013b, and 2013c), shore bird nesting (Niles et al. 2012, and physical damage to forestry and park resources (NJDEP-DFW 2013), infrastructure, and other resources.

Information provided by other State programs with respect to riparian habitat and wetland areas is limited, however impacts to resources such as Atlantic white cedar (AWC) (*Chamaecyparis thyoides*) stands and other imperiled species (e.g. 10-year assessment of 6 rare beach species prior to Sandy, including federally-listed Seabeach amaranth [*Amaranthus pumilus*]), have and are being assessed in great detail. Richard Stockton State College in collaboration with the NJDEP Division of Parks and Forestry (G. Zimmermann, pers. Comm.) has been quantifying AWC damage along the Mullica river in Cape May County, and in other areas of the state. According to Zimmermann, and supported by aerial photography provided by DPF (credit: J. Dunn, L. Flemming), large stands or sections of AWC stands show visible signs of stress in areas inundated by the storm surge.

Figure R-1. Aerial photograph illustrating stressed and dying Atlantic white cedar due to storm surge from Hurricane Sandy along the Mullica River, Atlantic County, NJ (Courtesy of DPF).

During the spring of 2013, aerial photography and field surveys conducted by DPF showed significant areas of dying and dieback (Figure R-1) of AWC (and other woody vegetation) observed along Barnegat Bay along and within the salt marsh-upland ecotone, maritime forest, and inland along tributaries entering Barnegat Bay and south to the extent of the storm surge. Some areas, specifically those along mid- and upper Barnegat Bay, were more heavily impacted than other areas of the State. The most severe impacts to vegetation, especially AWC, were observed in areas where water was impounded and trapped by physical barriers such as roads and blocked culverts. Studies conducted by the United States Geological Survey (2005) on coastal bald cypress forests in central Louisiana following Hurricane Rita show that in many locales, bald cypress has been in decline due to apparent saltwater intrusion. Study sites, including those many miles inland of the storm surge, have shown that inundation can elevate salinity levels twofold to threefold with long residence times, which can lead to delayed tree species mortality (Doyle et al, 2007). Increase in the duration of salt water retention in the back bay and riparian habitats surveyed by DPF and the Office of Science confirm that these areas are experiencing varying degrees of stress and dieback apparently due to elevated salinity. Studies are presently underway by Richard Stockton State College and DPF to further investigate these observations (G. Zimmermann and James Dunn, pers. Comm.)

With respect to wildlife, a number of assessments have been conducted to date (as of January 2014) regarding impacts to habitats on state lands, or elsewhere, other than for Delaware Bayshore, Atlantic coastal beaches, and vernal pools in southern Cape May County (ENSP 2013, D. Jenkins, pers. Comm. and ENSP 2014, G. Fowles, pers. Comm., respectively). However, ENSP (2013) reported that initial assessments of the habitat impacts for specific species in the above areas were conducted immediately following the storm, and surveys have been ongoing, with focus being on species and population. The impacts noted were more or less similar to what has been reported by the American Littoral Society (see ALS 2012), although more detailed work has since been done for Delaware Bay beaches (Niles et al., 2012). The ENSP also indicated that additional work was needed to assess impacts to species that use the back bay islands and coastal marshes, specifically colonial waterbirds. The ENSP received federal funding (not Sandy related) to perform that assessment for colonial waterbird surveys; these were initiated in late May 2013 to assess impacts to both the bird populations themselves and to nesting habitats.

The ENSP proposed plan is to continue assessment of avian populations for the next three years in order to evaluate the consequences of habitat changes. The three year colonial waterbird survey has completed its first year and 2013 results are available (ENSP 2014, C. Davis, pers. Comm). The results indicate that present populations of long-legged wading birds and associated habitat were fairly recovered,

whereas tern and gull habitat was most affected in areas where debris of anthropogenic origin (e.g. construction, household, trash, etc.) were still present. Surveys for other avian marsh species such as sparrows, bitterns, and rails has been and is presently being conducted by the University of Delaware, with conclusions yet to be determined. Surveys conducted for raptors in 2013 such as the peregrine falcon (*Falco peregrinus*), osprey (*Pandion haliaetus*), and bald eagle (*Haliaeetus leucocephalus*) concluded that all surveyed species were largely unaffected by Hurricane Sandy, although minor disruptions to nest sites did occur without long term detriment to the species (NJDEP and CWFNJ 2013a, 2013b, and 2013c, respectively). A more comprehensive set of population surveys are available for the above and other species of concern for 2013 (NJDEP – ENSP 2013). More general assessments with regard to broader wildlife resources or broader areas have not been completed.

Table R-1. Summary of qualitative impacts observed during June – September 2013. OS field survey assessments of natural resources impacts described by observations of damage type to habitat type.

Region (Debris Mngmt Zones)	Field Location	Habitat Type	Damage Category								
			P	ER	IN	DB	UND	COL	SD	VS	BD
Zones 1 - 3	Navesink & Shrews-bury Rivers	Wetlands/ Forest		x	x	x					x
Zones 4 - 9	Manasquan River	Wetlands		x	x						
	Stafford Ave/Turtle Cove (Manahawkin)	Forested edge of Marsh			x	x				x	
	Beach Ave (Manahawkin)	Forested edge of Marsh	x		x					x	
	Taylors Lane, EBF NWR (Manahawkin)	Forested Edge of Marsh	x		x					x	x
	Bay Side (Manahawkin)			x	x	x			x	x	
	Cattus Island	Wetlands/ Forest		x	x	x	x		x	x	x
	Mantaloking/Edwin B. Forsythe NWR	Wetlands		x	x	x	x	x	x	x	
	Turkey Swamp WMA	Forest									x
	Monmouth Battle-field State Park	Forest									x
	Allaire State Park	Forest								x	x
Zones 10 - 11	Great Bay North Side	Wetlands		x	x	x	x	x	x		
	Mystic Island	Wetlands		x	x			x		x	
Delaware Bay	Cumberland/Cape May Counties	Wetlands		x		x		x			

Zones:

Zones 1-3 – Bergen county south through Monmouth county

Zones 4-9 – Ocean County south to Atlantic county

Zones 10-11 – Atlantic County to Atlantic Ocean face of Cape May County

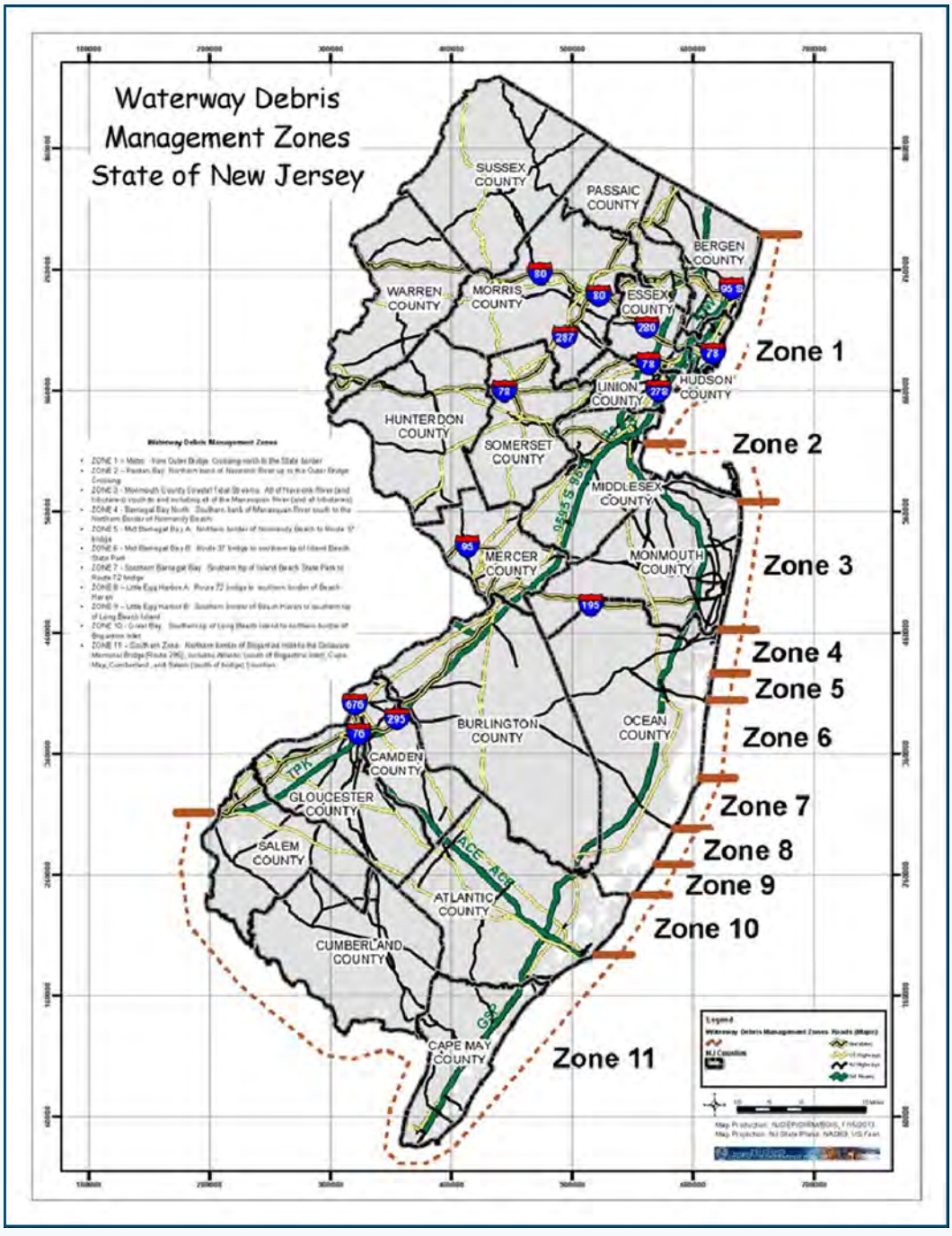
Delaware Bay – Delaware Bayshore from point of Cape May to Cumberland/Salem County Border

Impact Type:

P = Ponding; ER = Erosion; IN= Inundation; DB = Debris; UND = Undercut; COL = Collapse; SD = Sediment Deposition; VS = Vegetation Stress; BD = Blow-down

Field surveys were conducted via ground-truthing reports by NHR and other sources, on foot and by boat, and visual estimations made of impacted vegetation, shoreline loss, and other impacts. Ten locations were chosen starting from the north and continuing south: Cheesequake State Park, Navesink River, Manasquan WMA, Mantoloking/Edwin B. Forsythe NWR, Cattus Island, Manahawkin WMA, Great Bay WMA, Pork Island WMA, Leeds Point, and Tuckahoe-Corbin City WMA (see Figure ES-1). Field assessments were conducted using qualitative observations, based on the Rapid Storm Assessment protocols developed by Washington State (Roberts et al. 2009). The following parameters were observed during the 2013 surveys including: shoreline erosion, undercut, bank collapse, wrack/construction debris, sediment/sand deposition, and vegetation impacts (dieback due to salinity, inundation, blow-down erosion, etc.).

Figure R-2: Waterway Debris Management Zone Map (Source: NJDEP-BGIS, 2013).



Results

Field surveys along the Atlantic coast revealed that the greatest impacts to natural resources were sustained in areas consistent with those developed areas reporting the greatest damage (Zones 4 –9; see Figure R-2), from both wind and storm surge (i.e. Area roughly between the Metedeconk River and Great Bay. Results are presented below separated geographically (Northern, Central, and Southern Coast, respectively) and by waterway debris zones (Zones2 – 3; Zones 4 – 9; Zones 10 – 11).

Northern Coast - Zones 2 – 3:

1.) **Cheesequake State Park (Zone 2) -** Field surveys of western and northern riparian/ wetland areas revealed no major impacts to these areas. In the northern wetlands (near Blue Bell Is- land), some shoreline erosion was observed along creek channels in the north (above the Garden State Parkway), although adverse impacts appeared to be sparse compared with the total area surveyed. Major slope erosion was seen on the northeast side of Arrowsmith peninsula (area about 75' in length) facing Stump Creek, an area already identified by the Park Service as having experienced erosion in past. Very limited dieback of vegetation was observed (along Sandpit Picnic Area parking lot and surrounding area); most marsh vegetation was remarkably lush and well intact in all wetland areas and riparian edges. No major debris were observed along the wetland boundary (wrack line of reeds & limbs evident at 6' +/- above wetland at upland edges), although an overturned boardwalk was still visible near the crabbing bridge area (i.e. Hooks Creek). According to the NJSPS, Hooks Creek Lake sustained major impacts due to salt water intrusion and retention (NJSPS, pers. Comm. 2014). Evidence of salinity effects on vegetation (i.e. stress, die-back of coniferous tree species) was visible in June 2013 at the time of the OS Survey. The majority of debris (natural and anthropogenic) were removed by park personnel and volunteers in November/December of 2012, however some natural debris was still evident at the high water mark in most areas of the park.

2.) **Navesink River area (Hubbards Bridge to Shrewsbury River – Zone 3) -** Field surveys of the northern & southern banks of the Navesink River, and main riparian and wetland areas:

- Bank erosion, some increasingly significant on the steeper slopes, was observed on the northern banks of the Navesink River. T h e most significant bank failures observed could be seen along Rocky Point in Hartshorne Woods Park out to Shrewsbury River. Impacted areas are most obvious from Huber Woods (near Oceanic Bridge) east to Shrewsbury River on the north side. Large areas of downed trees were observed on these steep slopes as well, distributed from water level up to top of slope; areas of woody debris and some construction material were seen on both sides of river. Comparison to previous conditions will be necessary to determine the extent of damage due to the storm; some areas appear to have had historic bank stability issues. Significant damage was still noticeable to private docks along the entire area surveyed. Additionally, some impacts were observed along the banks of the Swimming River, especially along the wetland southeast of Hubbards Bridge (W Front St. – Red Bank). These include bank failure and sections of torn vegetation mats (estimated percent damage minimal, less than 5%). No major impacts to wetlands or concentrated debris areas were observed. Communication with marina personnel (Chris' River Plaza Marina) suggests that significant mud deposition had occurred in the channel due to the storm, which was estimated to be as much as 4' in depth (however, they suggested this may still be due in part to a dam failure that occurred a few years prior).

- **South side of Navesink R. -** No major impacts to wetlands detected, although human property damage appears to have been significant in low lying areas in the Rumson area (e.g. Barley Point). Debris (vegetation and construction) were still present in the wetlands and at the vertical limit of the storm surge from Barley Point and toward the south and east.

3.) **Manasquan River WMA (Zone 3)** - No major impacts noted to either riverine wetland vegetation or shoreline. Some shoreline erosion was evident, especially in the area of the public boat access (Northern area) and along the southwest shoreline. However, stretches of eroded banks were not more than 100' in length in the few sections observed (note that it was difficult to ascertain whether the erosion present occurred prior to Sandy or occurred due to/exacerbated by past storm events and changes in land use). Some debris were observed, albeit limited, and consisted mostly of vegetation/wrack, although some construction material was also present.

Central Coast – Zones 4 – 9:

1.) **Mantoloking area/Edwin B. Forsythe** - North (Zone 4): Edwin B. Forsythe NWR (EBF NWR) South of Mantoloking Bridge/Barnegat Bay shoreline/marsh: Surveys were conducted from canoe along and within the marshland south of the Mantoloking bridge. Significant impacts were observed along the entire shoreline interfacing with Barnegat Bay, with severe erosion spotted throughout (Figures R-4 and R-5). Depth of erosion/shoreline loss (perpendicular from shoreline/marsh edge) is estimated at 5' – 15' along the marsh/bay edge from Mantoloking bridge south to Reedy Creek, and about 2' from bank to water on either side of major channels moving inland. Mosquito ditches also show signs of significant mud and sand deposition. General shoreline impacts include collapse, undercutting, and scouring with areas of complete breakthrough/washout, with impacts extended to the OMWMs (e.g. filling in with mud/debris, or complete scouring). However, the marsh surface vegetation was largely intact, with herbaceous vegetation and wildlife abundant. Debris, mostly wrack, were observed along the marsh/forest interface and along the roadway; some debris was also

Figure R-3: Mantoloking/Edwin B. Forsythe NWR (July 2013). Severe shoreline erosion along marsh edge and inner channel.

Figure R-4: Mantoloking/Edwin B. Forsythe NWR (July 2013). Example of both marsh/shoreline loss and sand deposition along marsh edges.

still present on the marsh surface. Some construction debris were seen in the water along the outer marsh, where large areas of debris were observed from the desktop assessment (i.e. aerial photography) performed in March 2013. This debris was also observed inland along the forest edges and along Reedy Creek as far as Delmar Drive. Some stressed vegetation was detected along the forest margin of the EBF NWR.

Edwin B. Forsythe NWR North of Mantoloking Bridge/Barnegat Bay shoreline/marsh: Same as above; severe bank erosion was observed along the inland shore of the Bay, especially at F-Cove. Various types of debris, mostly anthropogenic, were still evident on and along the marsh with the greatest concentration along the wooded margin. Large amounts of debris remained in the water along the shoreline between the Metedeconk River and Herbert Island.

2.) **Cattus Island** (Ocean County; Zone 5) - As identified by park personnel (Chris Claus, Chief Naturalist Ocean County Parks Dept., Cattus Island), significant impacts were observed along the north-northeast shorelines and west shoreline of Scout Island. Impacts noted included: 1) severe bank erosion and under-cutting (NE portion of park on Silver Bay and OC boat launch area, sporadic stretches of marsh beginning in Crossway Creek and moving toward point of Scout Island/ Barnegat Bay proper); 2) inundation occurred throughout most of the park (to estimated depth of +/- 5 feet); 3) impacts to vegetation (browning and dieback), observed along Crossway Creek (estimated 40% of visible shoreline, coniferous tree spp.), around/on Scout Island (estimated 50% + coniferous tree spp.), areas of Applegate Cove, and American white cedar (AWC) stand in NE near Mizzen Road; 4) Tree blow-down, oriented to the WSW, seen especially along the south shores of Crossway Creek, Applegate Cove, and Barnegat Bay (observed to within 150' from shoreline); 5) and sand build up in two areas of Scout Island on the south side (area of 40' length, 25' width, and approx. 2' depth). Debris removal, comprised of both construction and natural debris in significant amounts, was almost complete as of June of 2013 due to the efforts of volunteers and contractors, as well as park personnel.

Figure R-5: Manahawkin WMA/Edwin B. Forsythe NWR – Tree blow-down within outer boundary and inner areas of maritime forest. Orientation of trees lying towards south and southeast.

3.) **Manahawkin WMA Area Field Survey** (Stafford Ave/Turtle Cove, Beach Ave, Taylors Lane/ Edwin B. Forsythe NWR – Barnegat; Zone 7):
Stafford Ave/Turtle Cove: Surveys were conducted along several points following Stafford

Ave. Significant impacts were observed along the entire forested edge of the marsh (inundation effects; debris line up to 6' + above water level), looking both south to Rt. 72 and north toward Barnegat. Stressed and dying vegetation (especially understory coniferous species, e.g. American holly – *Ilex opaca* and AWC) were observed, with an estimated 50% of damage/loss or greater consisting of large tree blow- down (mostly red maple – *Acer rubrum*, silver maple – *A. saccharinum*, and sweet gum – *Liquidamber styraciflua*) in some sections of the upland/marsh ecotone, and extending inland as much as 500' + (Figure R-5). Very little, if any, bank erosion was observed in the marsh channels, although some was observed along Cedar Creek on the western banks moving south toward Barnegat Bay. Debris, mostly wrack, was observed along the marsh/forest interface and along the roadway; some on the marsh surface as well.

Figure R-6: Manahawkin WMA/Edwin B. Forsythe NWR – Browning understory along outer edge of marsh/forest boundary. Stressed overstory (e.g. sparse and stunted foliage visible throughout).

Beach Ave: Stressed vegetation was observed along the forest margin (both tree and shrub species alike), estimated to reach in to the forest about 250'. Marsh surface vegetation and features appear largely intact, some wrack visible, although not in significant amounts.

Taylors Lane, EBF NWR: Severe impacts to forested edge of marsh observed, with impacts inward up to about ¼ mi. or greater. As stated above, extensive areas of blow-down was noted in the forested interior (Red maple - *A. rubrum* and *A. saccharinum*, especially) and dying understory, with effects observed out to outer 250' + of trees along the forest/marsh interface (Figure R-7). Atlantic white cedar and other conifer species (pitch pine – *Pinus rigida*, *I. opaca*, etc.) appear to be the most affected, although deciduous tree species such as black gum (*Nyssa sylvatica*) were intact in most areas surveyed.

Bay Side: Impacts evident to human structures, with evidence of heavy inundation in the immediate and surrounding area; some buildings still have not been removed or remediated. In addition, ponding effects were observed along the access roads and some erosion of shoreline; standing water was observed on and along all access roads. The forested margin along Rt. 72 and the surrounding wetland were observed to be showing significant vegetation dieback and stand blow-down, especially impacts to the understory as noted in the Manahawkin WMA and EBF NWR surveys. The estimated extent of damage appears to extend inland to about ¼ mile.

4.) **Great Bay Area Field Survey** (Great Bay WMA, Tuckerton Green Street Beach, Mystic Island, and Leeds Point area; Zones 9-10): Surveys were conducted at the above locations (at or near high tide), with significant impacts visible to dwellings and infrastructure due to inundation and wind shear from the northeast. Tuckerton Green Street Park appears to have

Figure R-7: Great Bay WMA – Severe marsh erosion along northeast- ern shoreline of peninsula. Various impacts visible, including erosion, overwash and separation of large mat areas visible.

significant shoreline erosion, with up to 5' + visibly missing or partially collapsed/submerged banks in some areas, as well as some severe undercutting. Sand and shell deposition was evident with wrack distributed throughout. Great Bay WMA: Observations were made along Seven Bridges Road, with no major impacts detected to interior channels on the peninsula proper, although wrack and other debris were visible throughout. The south side of Great Bay Blvd. appeared to be in good condition, although the north side was showing storm impacts, increasing SE toward RUMFS and the tip of peninsula. Severe impacts to the shoreline were observed on the SE and eastern shoreline of Great Bay WMA peninsula (Figures R-7 and R-8). The SE shoreline appeared severely eroded or collapsed along its entire length beginning from RUMFS and continuing NE to Point Creek. Sedge mat erosion/loss was estimated at as much as 30' from the water edge, with large areas collapsed, torn out, and/or submerged, with severe undercuts and subsidence evident. Mystic Island: Significant shoreline erosion was observed (estimated at 5' – 10') as above; wrack line measured at about 6'above water line. Uprooted and dying vegetation (mostly trees) were observed from the shoreline and inland along Radio Rd. Severe blow-down was seen in the forested parcel (Osborn Island), with the most visible blow-down oriented toward the NE and East. Leeds Point area (E Motts Creek and Oyster Creek Roads): No major impacts were observed at either location. Evidence of inundation was seen with wrack and other debris sporadically distributed. The shoreline and interior marsh areas appear to be healthy and in good shape. No large areas of vegetation impacts were observed.

Figure R-8: Great Bay WMA – Marshland looking Northwest. Erosion and large areas of collapse due to undercutting and wave action visible along northern and eastern shorelines.

Southern Coast – Zones 10 – 11:

Pork Island WMA, Great Egg Harbor Area Field Survey (Tuckahoe WMA).

Pork Island WMA/Scull Bay/Somers Point: No significant impacts observed. Large areas of wrack were seen along the north side of Rt. 152 (Somers Point); however no discernible erosion was evident. Some erosion was detected along the marsh shoreline at the terminus of Poplar road (Scull Bay), in addition to sporadic collapse of sedge mats (1' – 3' wide x 6' – 12' long in spots). However, at the time of this survey, it was difficult to ascertain whether these impacts were due to Hurricane Sandy or an ongoing issue. Shoreline damage was estimated at 2% along the western shoreline, and wrack was observed along all of the highest points along the roads and upland edges.

Great Egg/Jobs Point – Jeffries Landing: No significant impacts to wetlands observed. Evidence of inundation was measured up to 5'+ above the marsh surface, and various types of damage were observed to dwellings and structures at various points along the access roads to Jobs Point. Debris was still present and sporadically distributed, and some debris including stranded watercraft, construction material, and wrack were observed on the marsh. Additionally, stressed Atlantic white cedar individuals and/or stands were observed on the upland peninsulas/high marsh areas near Jeffries Landing.

2.) **Tuckahoe – Corbin City WMA**: No significant impacts were observed at the time of this survey. Severe damage to impoundments did occur during the storm and were reported, however these were repaired/replaced prior to the OS damage assessments. Evidence of inundation was seen along the tributaries and marshland, with sporadic areas of wrack piles and wrack lines observed. Major impacts to vegetation following inundation were not observed. However, some tree blow-down was detected in the forested areas due to high winds, and these effects appear to have been widespread, albeit sparsely distributed.

Forests

In summary, Hurricane Sandy caused mainly two types of effects on forested natural areas in New Jersey, tree blow-downs and toxicity to trees due to saltwater inundation. A qualitative examination of affected areas indicates that the overall effect of this storm is that less than 5 percent of trees were downed on State lands. Damage from seawater inundation supplied the most extensive effect of Hurricane Sandy, and has killed and/or stressed many stands of Atlantic white cedar.

Ground survey, aerial photography, and storm models have historically been used for forest damage assessments. Since the 1990s, remote sensing where satellite detection of light from forests can estimate chlorophyll content, leaf water content, and structural changes in a damaged forest have also been applied to damage assessment (Wang 2010). Damage classes as described by USDA have been categorized as follows: little to none (0 to 11%), moderate (11 to 25%), and severe (greater than 25%) (Nielsen 2006). These studies show that the less than 10% tree damage from Hurricane Sandy as being in the "little to none" classification for natural resource damage.

While the overall statewide extent of downed trees in natural areas is small, some areas covering tens of acres did experience almost complete tree toppling due to wind. This information is gleaned primarily from three sources: an overflight by the New Jersey State Forestry Services during late 2012, analysis of Pictometry® Connect images of state forests, and site visits to areas of known tree damage by the Damage Assessment Team.

Figure F-1 shows the results of a flight conducted on December 13, 2012 by the NJ State Forestry Service. The damage recorded is primarily in the northern part of the state along mountain ridgelines where there was exposure to hurricane force/high winds. Damage was observed at seven parks and consisted of 8% of the total area. Table F-1 shows these Parks and the number of damaged acres.

Table F-1. New Jersey State Parks and number of damaged acres (2012-2013). Please note that not all State forests reporting damages are included below (Source: NJSFS 2012).

State Park	Total Acres	Damaged Acres	Percent Damaged
Abram S. Hewitt State Forest	3,622	532	15
High Point State Park	13,866	450	3
Norvin Green State Forest	5,271	847	16
Stokes State Forest	15,453	1,139	7
Washington Crossing State Park	2,600	135	5
Wawayanda State Park	9,163	1,066	12
Worthington State Forest	5,075	337	7
Total Survey Area	55,050	4,506	8

Aerial photography (Figure F-2) obtained from Pictometry® Connect shows conifer dieback at Double Trouble State Park probably caused by salt water inundation. The brownish areas are evidence of the dead and/or dying trees. This is an example of the type of damage responsible for damaging large areas of Atlantic white cedar.

Numerous parks were visited in June 2013 where there had been reports of blow-downs. Only portions of the parks were evaluated as the survey was from roadside and limited walks into the affected areas. Areas were chosen which had the most evidence of damage with the results of the survey shown in Table F-2.

Table F-2. Evidence of damage and results (acres) following field survey assessment.

Location	Acres Examined	Acres Damaged	Percent Damaged
Allaire State Park	20	5	25
Monmouth Battlefield State Park	40	8	20
Colliers Mills Wildlife Management Area	20	2	10
Turkey Swamp Wildlife Management Area	30	2	7

On June 5, 2013 a field trip was conducted in the area inundated by the storm surge in the vicinity of Great Bay. Roadside observations on Hay Road and Lower Bank Road showed areas of Atlantic white cedar damage due to salt water toxicity. This was indicated by brown needles throughout the canopy. This location is about seven miles from the open water of Great Bay on the Mullica River. Observations in the Edwin B. Forsythe National Wildlife Refuge surrounding Great Bay showed blow-downs of Atlantic white cedar and pitch pine.

Figure F-1. Estimated forest damage in northern New Jersey Forests (NJSFS 2012).

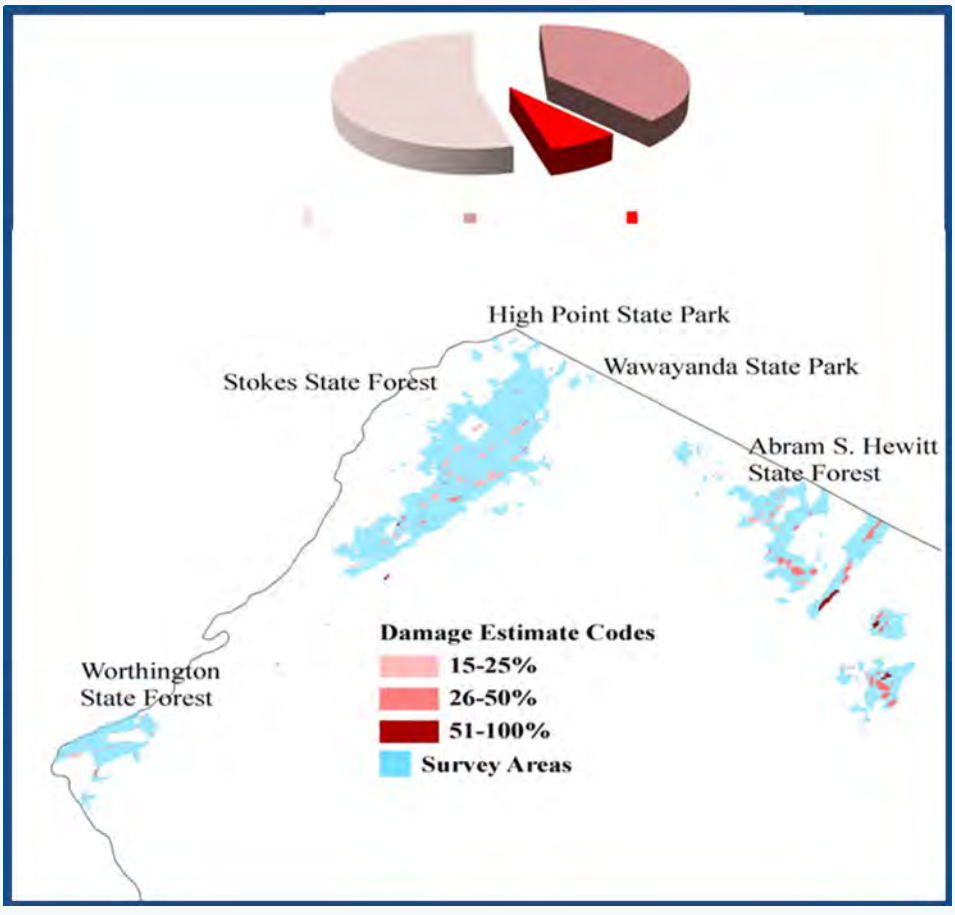


Figure F-2. Conifer dieback at Double Trouble State Park (Cedar Creek) probably caused by salt water inundation (Pictometry® International 2013).

SUMMARY OF FEBRUARY 14, 2013 NJ PARK SERVICE REPORT

The New Jersey State Park Service (NJSPS) of the Division of Parks and Forestry produced a report entitled "Hurricane Sandy Storm Impact on Natural Resources" (NJSPS, 2013). This report documents storm effects on approximately 40,000 acres of 12 state parks. Topics such as infrastructure damage, beach erosion, bird habitat, salt water intrusion and tree damage are covered. Salt water intrusion and tree damage data are the most relevant for this section of the report.

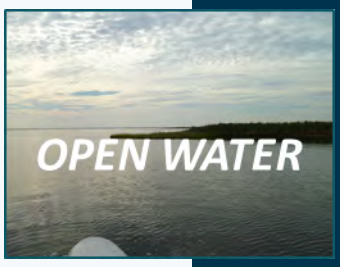
Stokes State Forest, Hacklebarney, Round Valley Recreation Area, and Cheesequake, Allamuchy, Voorhees, Wawayanda State Parks are noted as having significant damage to forest due to blow-downs with Tillman's Ravine, and the School of Conservation being particularly hard hit in Stokes State Forest. In Hunterdon County, the New Jersey State Forestry Service (NJSFS) also reported heavy tree damage to the Bull's Island and Cook Natural Areas (NJSFS, pers. Comm., 2014). Salt water inundation and resulting damage to Atlantic white cedar was documented for Bass River State Forest and Cheesequake State Park. Additionally, severe white pine (*Pinus alba*) and mixed hardwood damage in Washington Crossing State Parks was observed (D. Swaysland, NJSFS, pers. Comm., 2014).

Other programs within the Department focused on forest damage associated with park resources, infrastructure, and threatened and endangered species habitat.

SUMMARY OF SITE VISITS WHERE TREE PLOTS WERE COUNTED FOR BLOW-DOWNS

One quarter acre plots of visually damaged tree stands were examined on site for the number and diameter of downed trees. A total of 6 plots at three parks were counted. All trees over 3 inches in diameter were enumerated. After normalization to units of trees per acre (tpa) the plots ranged from 0 to 273 tpa with a mean of 53 tpa. The greatest damage of 273 tpa was recorded at Monmouth Battlefield State Park.

Open Water



Introduction

Damage assessment of open waters involved examination of multiple tidal waters along the coast for the presence/absence of submerged aquatic vegetation (SAV), critical habitat for a number of aquatic biota.

Since early 2013, several Department programs were contacted to provide information on what Hurricane Sandy damage assessments have already been conducted, are underway, and/or are being proposed to meet their specific program needs. Key personnel have been contacted and team members established with representatives of the Division of Fish and Wildlife (DFW), Bureau of Marine Fisheries, Bureau of Shellfisheries, and the Division of Water Monitoring & Standards (DWM&S). Currently, very little information is available to determine the degree to which marine fish or shellfish, as well as SAV habitat, have been impacted by or following Hurricane Sandy.

Bureau of Marine Fisheries:

According to the Bureau of Marine Fisheries, the fisheries resources themselves were not significantly impacted by Hurricane Sandy (BMF 2013, Pers. Comm., T. McCloy and B. Muffle). The distribution and movements of fish were likely changed right after the storm, but evidence is lacking of mass mortality or population level impacts. The Bureau believes that the greatest impact is likely to be habitat modifications - changes /covering/movement on the artificial reef network; sand impacts/covering hard bottom areas needed for winter flounder eggs to adhere; closing/opening of fish passage impediments; and impacts to nursery areas and SAV.

The only marine fisheries related assessments conducted to date have been directed at the various user groups (commercial and for-hire fishermen, bait and tackle shops, marinas, commercial docks, shell fishermen, shellfish hatcheries) that suffered physical (e.g., equipment and facility) and economic losses due to Hurricane Sandy.

Bureau of Shellfisheries:

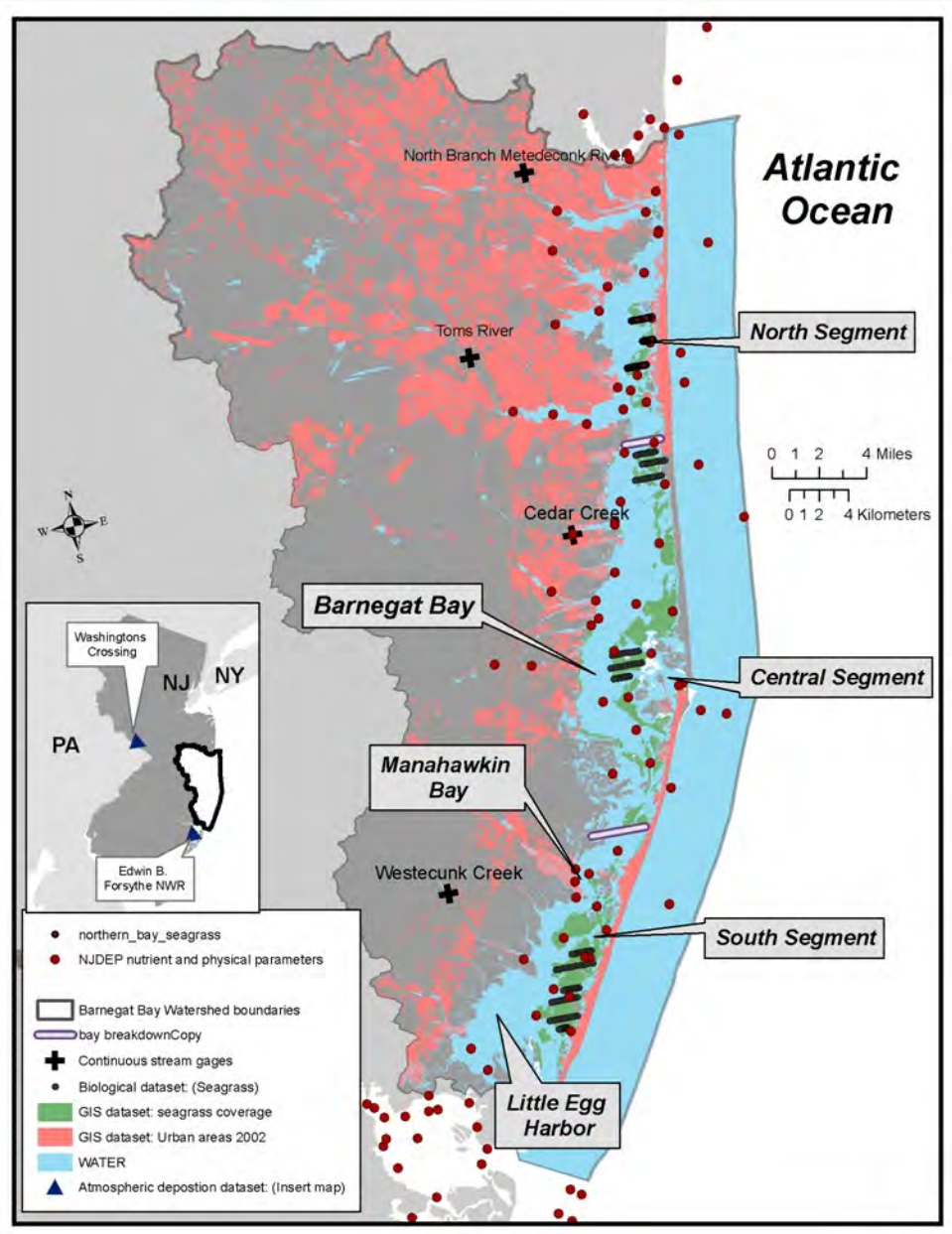
With respect to shellfish and SAV resources, the Bureau of Shellfisheries submitted a series of projects to the Aquatic Resources Workgroup for funding consideration in order to assess the present abundance of distribution of these resources in State waters (Personal Communication: Jeff Normant and Russell Babb). Beginning in 2011, the Bureau prioritized its comprehensive stock assessment program of shellfish and as a component of the program SAV throughout the State's waters. In 2011, an estuarine shellfish stock assessment was conducted in Little Egg Harbor, followed by an estuarine shellfish stock assessment survey of Barnegat Bay in 2012. The Little Egg Harbor survey was the first shellfish survey conducted since 2001 and the first for Barnegat Bay since 1985/1986. The presence or absence of SAV was also noted at each station sampled. These programs are essential for the management goals of the Bureau. Data obtained as part of this survey was instrumental in determining if any significant impacts from Hurricane Sandy could be ascertained.

In 2012, the Bureau sampled 356 stations using a hydraulic clam dredge and estimated the bay's standing stock and relative distribution of hard clams. Work was conducted between May 30, 2012 and October 25, 2012. The survey resampled stations that were sampled during the 1985/86 survey plus an additional 51

new stations to cover areas not previously sampled. The standing stock of hard clams in the bay for 2012 was estimated at 136.1 million clams. For the purpose of a direct comparison, the stock was also estimated using only those stations that were sampled during both surveys, which yielded an estimate of 134.6 million clams. That estimate represents an approximately 24% decrease in the standing stock compared with the 177.3 million clams estimated in 1985/86. Statistical analysis indicated a significant decrease in hard clam abundance when comparing stations sampled in 2012 to those same stations sampled in 1985/86.

Following Hurricane Sandy, the Bureau changed its survey schedule and revisited Barnegat and Little Egg Harbor bays in order to assess any population changes attributable to the storm event. Hurricane Superstorm Sandy officially made landfall on October 29, 2012 and survey work was conducted in the summer of 2013. Approximately 25% of all the stations in both bays were resampled. No significant difference was found in hard clam abundance or mortality when comparing stations sampled before and after the storm, and the survey showed little direct physical impact from Hurricane Sandy in the surveyed region. However, a significant decrease was found in the proportion of stations containing SAV that were sampled before and after the storm. Of the stations sampled prior to the storm, 60% contained SAV, whereas 45% of the same stations sampled after the storm contained SAV.

Figure O-1. Changes in Seagrass coverage for Barnegat Bay from2003 to 2009 (Lathrop 2011).



Methods: A desktop assessment of existing data and information gathered on SAV status and trends along the New Jersey Atlantic coast identified several studies that were used extensively in the field assessments and location determinations.

Lathrop (2011) employed high definition remote sensing overflights and spatial analysis to document the seagrass beds in Barnegat Bay for 2003 and

2009. According to Lathrop (2011), "The Barnegat Bay-Little Egg Harbor (BB-LEH) estuarine system contains about 75% of New Jersey's known seagrass habitat. Eelgrass (*Zostera marina*) is often the dominant species, while widgeongrass (*Ruppia maritima*) is also common in lower salinity and shallow regions of the BB-LEH. The remote sensing data generated for the 2003 and 2009 surveys of Barnegat Bay suggests that the area of mapped seagrass coverage was similar between the two time periods. While changes in seagrass locations and densities were evident at all locations surveyed, the overall assessment indicates that the seagrass beds for those areas surveyed were stable. The changes and direct impacts that were observed, were apparently enhanced by anthropogenic activities. Several direct impacts to seagrass habitat (including dredging, boat docks and scarring) were identified as contributors to diminishing seagrass habitat. However, these direct impacts overall have only contributed to a minor reduction in seagrass habitat (Lathrop, 2011).

Kennish (2013) conducted a comprehensive seagrass study in Barnegat Bay and Little Egg Harbor estuary in 2011 to determine seagrass demographics in the north segment of the estuary, and to document seagrass characteristics across the entire estuary in the same year as part of a separate study (Figure O-1) . The results of this study show that *R. maritima* dominates seagrass beds in the northern segment, while *Z. marina* dominates seagrass beds in the central and south segments of BB-LEH. Widgeongrass populations decreased between 2005 and 2010, and no *R. maritima* samples were found in the south segment during 2011. Total eelgrass biomass declined over the 2004-2006 and 2008-2010 periods, and more acutely during the 2004-2006 period. The 2010 eelgrass biomass values measured were the lowest levels ever recorded in the estuary.

Able (2013) examined how the macrofauna of Barnegat Bay respond to urbanization by comparing the temporal (annual, seasonal) and spatial (along the north-south gradient in urbanization) variation in the Bay. He found that seasonality dominated both abundance and diversity patterns in SAV habitat, as well as influenced the fishes associated with these habitats. Furthermore, a greater spatial effect was evident, specifically the relationship of sample site distance (i.e. SAV bed locations in relation to distance from the inlets). Able suggested "the effects of inlets on water quality, especially salinity and larval delivery, may also be substantial enough to mitigate urbanization effects for fishes in open bay SAV habitat, especially because these sites are along the eastern side of Barnegat Bay. Thus, they are not as closely tied to the land use patterns that define urbanization mostly through development of the western site of the bay".

Consequently, Able et al. (2013a) indicated:

> There are no clear negative responses to the hurricane (Sandy) in the fall of 2012, although the analysis of the data from 2013 is just beginning. The number of fish species collected in April (n = 18), June (n = 27) and August (n = 35) 2013 is similar to the number collected with the same otter trawl techniques and locations in April (n = 23), June (n =25) and August (n = 31) 2012 (Table 6). However, overall abundance (catch per unit effort, CPUE) is lower with number of individuals collected in April (n=322), June (n=1117) and August (n=2729) 2013 less than in April (n=1301), June (n=3103) and August (n=5175) 2012, prior to the storm.

The number of blue crabs captured (2,301) in 2013 is very similar to the number captured over the same time period and sampling sites in 2012 (2,295), suggesting that there are no obvious negative effects of Hurricane Sandy on blue crab abundance.

Celestino (2013) (Bureau of Shellfisheries) conducted a hard clam *Mercenaria mercenaria* stock assessment of Little Egg Harbor Bay (LEH) in 2011. As part of this survey, the Bureau determined that the LEH contains an estimated 4,720 acres of SAV, a noted decrease of approximately 1,600 acres from 2001 (see Attachment 2). The SAV in Little Egg Harbor Bay declined approximately 25% in total estimated acreage from 2001 to 2011. Some of the more prominent changes in SAV distribution include additional fragmentation of the extensive beds located in the northern and central portions of Barnegat Bay. Some of the reported losses may be attributed to the fact some of the surveys were completed during different times of the year. Other losses may be due to impacts from other major storm events (e.g. Tropical Storm Lee, August 2011) impacting this region during this period. Other potential influential factors affecting the results include SAV phenology (seasonality), and concerns have been raised about the potential for habitat change.

Post Storm Impact:

The hurricane landfall information identified that the Barnegat Bay, from Mantoloking/Bay Head to Little Egg Harbor, was one of the most severely impacted sections along the New Jersey coast. As for other habitat examined in this report, aerial photography, Pictometry, and LIDAR were examined for areas to conduct ground truthing of reported damage and field reconnaissance. Based upon the data gathered from pre-Sandy SAV studies, the field assessment locations were concentrated mainly in the Barnegat Bay- Little Egg Harbor region. An initial field assessment conducted in the Navesink River Estuary was selected to identify the existence of seagrass beds in this estuary, and to determine if the macro-alga *Ulva lactuca* beds were in any way impacted.

One major consequence or potential impact of the storm not examined in the field (due to scope) includes loss of aquatic biota due to the storm surge. Freshwater ponds and lakes in the surge area were adversely affected by the penetration of saltwater during the storm. Carteret Pond in Carteret was found to be brackish following Hurricane Sandy, and both pumps and aerators were damaged by the storm (MyCentralJersey.com, 2013). It was reported that no fish were found in the pond, ostensibly from being dislodged by the storm surge[2]. Recovery has already been completed due to the addition of freshwater and stocking by the NJDEP's Division of Fish & Wildlife Hackettstown State Fish Hatchery.

Impacts to submerged aquatic vegetation (SAV) and shoaling leading to loss of habitat are a major concern. The greatest effect is suspected to be on fish/crab nursery areas in back bay areas, however the realized effects may not be evident for one or more years.

<u>Open Waters Field Assessments</u>

The OS Damage Assessment Team conducted a series of qualitative surveys along the backbay region of the Atlantic coast of New Jersey. These surveys targeted areas moderately to severely impacted by Hurricane Sandy. Survey site selection was based upon the availability of pre- hurricane data on the

[2] In this case recovery has already been completed due to equipment repair, lake drainage and addition of freshwater, as well as stocking by the NJDEP's Division of Fish & Wildlife Hackettstown State Fish Hatchery at the request of municipal officials (MyCentralJersey.com, 2013).

existence of seagrass beds as described in 2009 by Lathrop (2011). Sampling occurred in areas where seagrass beds had been previously identified and in areas where seagrass beds may have been established during post-hurricane conditions.

In all cases where seagrass beds were not established in 2009, no newly established (post-hurricane) beds were discovered. An assessment of seagrass beds in the Navesink River/Estuary identified little in the way of seagrasses and only macro-alga *Ulva* in the eastern portion of the estuary.

In areas where seagrass beds were identified in 2009, the presence or absence interpretation is not as obvious. For example, in 2009 a seagrass bed existed in and around Herring Island (Bay Head-Mantoloking). The assessment of the seagrass beds in this vicinity identified a markedly degraded bed with only a limited survival within the interior of the cove on the western side of Herring Island. By contrast, the surveys also identified areas of seagrass beds from Lavallette to Island Beach State Park that appear to be intact and thriving. However, even in this region, a large area (~ 200 acres) south of the Rt.35 bridge at Seaside Park did not contain a significant amount of seagrass as previously identified in 2009. This patch work survival pattern was not as evident farthest south along the eastern side of Barnegat Bay. From Seaside Park and into Island Beach State Park, the assessment survey found that the seagrass beds still appeared to be extensive and flourishing. Other locations in Lower Barnegat Bay and Little Egg Harbor such as Loveladies to Beach Haven, appear to have lost significant SAV in the central section of the bay and a portion of the seagrass bed east of Conklin Island (Barnegat, NJ) as well.

The cause or causes of such divergent seagrass bed conditions cannot be solely attributed to effects of Hurricane Sandy. While beach sand buildup in Barnegat Bay from Hurricane Sandy can have an impact on seagrass survival, from prior studies it is apparent that seagrass losses can be attributed to multiple factors. For example, Kennish (2012) states:

"Since 2004, eutrophication has generally worsened in BB-LEH, and the condition of the seagrass habitat has markedly degraded in the central and south segments. Eelgrass biomass declined consistently over the 2004-2006 and 2008-2010 periods, and overall from 2004-2010. The 2010 eelgrass biomass values were the lowest levels recorded in the estuary. Data collected on demographic trends indicate that eelgrass beds in 2011 had yet to recover from the marked decline of plant biomass and areal cover observed in 2009 and 2010. The trend of eelgrass decline over the years has not been isolated to one bed but has been observed over extensive areas of the estuary, signaling a response to a broad-scale stressor that adversely affects plant condition across the system."

In addition, Lathrop (2011) suggests that for the submerged aquatic vegetation (SAV) in Little Egg Harbor Bay there was:

"a decline of approximately 25% in the total estimated acreage from 2001 to 2011. Some of the more prominent changes in SAV distribution include further fragmentation of the extensive beds located in the northern and central portions of the Bay. He further suggested that the loss of SAV in the Barnegat Bay has been occurring for a long time and that there are probably many contributing factors (i.e. Hurricane Irene made landfall at Beach Haven, NJ 28 August 2011). Observed differences and other potential influential factors affecting our results (including SAV phenology) may be due to interpretation of the varying SAV databases during different times of the year (2001 survey conducted

between 16 July 2001 & 31 August 2001, while the 2011 survey was conducted between 24 August 2011 & 18 October 2011). Concerns have been raised about the potential for habitat change."

It was decided that a series of qualitative field assessment surveys would be undertaken to determine the condition of SAV seagrass beds along coastal New Jersey. The field assessment site selections were primarily based on the results of the seagrass mapping project conducted by Lathrop (2011.) All qualitative field assessments were conducted by OS staff (Figures O-2a – O-2c).

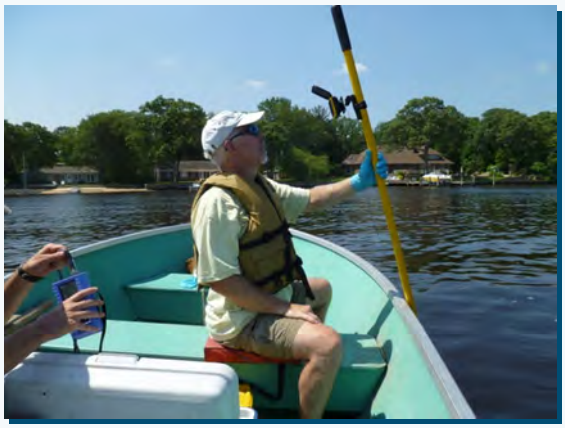


Figure O-2a. Aqua-vu underwater camera

Figure O-2b. Horiba Model 4000 water quality data logger

Figure O-2c. Ponar dredge sediment sampler

Field Assessment Surveys

1.) A field assessment was conducted on July 9, 2013 at the Navesink River from Red Bank to the Oceanic Bridge, Fair Haven. The qualitative assessment indicated very little presence of SAV at any of the 18 sites. Only the green alga *Ulva lactuca* was identified at two of 18 open water locations (Figure O-3). A previous shoreline survey identified *Ulva* at several near shore locations at water depth estimated less than one meter east of the Oceanic Bridge, Fair Haven, NJ.

2.) A Field Assessment was conducted on July 18, 2013 from Toms River to Seaside Park. The qualitative assessment indicated very little presence of SAV at any of the sites within the Toms River estuary; however, both Eel Grass and Widgeon Grass were identified only in a narrow strip of nearshore waters (< 3 ft.) at Seaside Heights and Seaside Park. A previously defined large grass bed south of the Rt. 35 bridge (~ 200 acres) was not located.

Figure O-3. Green macro-alga *Ulva lactuca* at Navesink River estuary

3.) A field assessment was conducted on July 25, 2013 from Lavallette, NJ to the Rt. 35 bridge at Seaside Heights. This qualitative assessment indicated the presence of SAV at 24 of the 30 sites examined. Both Eelgrass and Widgeon Grass were identified throughout this estuary section in waters < 3 ft. deep (Figures O-4 and O-5). Previously defined large grass beds (~ 588 acres) were located and appear to be thriving.

Figure O-4. A narrow strip of Eel Grass *Zostera marina* growing in Barnegat Bay at Seaside Park, NJ (Note: from underwater video capture).

Figure O-5. Ponar sediment sample and eel grass from Barnegat Bay at Lavallette, NJ

4.) A field assessment was conducted on Aug 1, 2013 from Seaside Heights to the IBSP. This qualitative assessment indicated the presence of SAV at 34 sites. Both Eelgrass and Widgeon Grass were identified throughout this estuary section in waters < 3 ft. deep (Figure O-6). Previously defined large grass beds (~ 950 acres) were located and appear to be thriving.

Figure O-6. Dense seagrass beds in Barnegat Bay at Seaside Park to Island Beach State Park, NJ (Note: from underwater video capture).

5.) A field assessment was conducted on Aug. 5, 2013 from Bay Head to Mantoloking. The qualitative assessment indicated very little presence of SAV at any of the sites within the Metedeconk River estuary; however, both Eel Grass and Widgeon Grass were identified in a narrow strip of waters (< 3 ft.) in the cove at Herring Island, Mantoloking, NJ (Figure O-7). The previously defined grass bed within this area (~ 30 acres) was not located.

Figure O-7. Seagrass bed in the cove at Herring Island, Bay Head, NJ

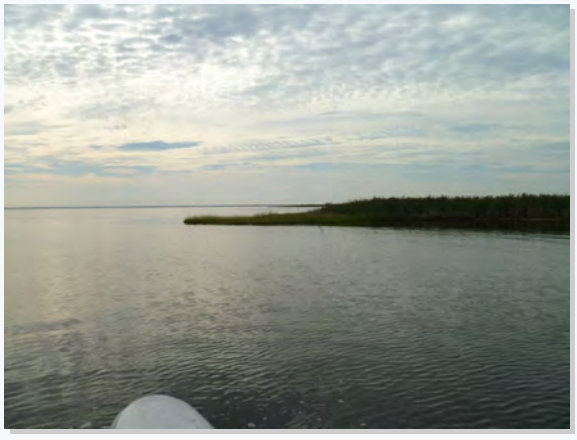


Figure O-8 Barnegat Bay at Conklin Island, seagrass beds are reduced in total acreage.

6.) A field assessment was conducted on Aug. 19, 2013 along the western side of Barnegat Bay (Conklin Island to Gulf Island) south of Barnegat, NJ (Figure O-8). This qualitative assessment indicated the presence of SAV at a limited number of sites along the northern side of the Edwin B. Forsythe NWR. Eelgrass and Widgeon Grass were identified along this section in waters approximately 3 ft. deep. A previously defined large grass bed (~408 acres) was not located.

7.) A field assessment was conducted on Aug. 27, 2013 along the central section of Barnegat Bay west of Loveladies-Harvey Cedars, NJ. This qualitative assessment indicated the presence of SAV at a very limited number of sites along the eastern side of the bay. Very little Eelgrass was identified along this section in waters approximately 3 ft. deep (Figure O-9). A previously defined large seagrass bed (~ 298 acres) was not located.

Figure O-9. Sediment sample from Barnegat Bay west of Loveladies-Harvey Cedars, NJ where large seagrass bed was located in 2009.

Figure O-10. Typical sediment conditions in Barnegat Bay at Long Beach Twp, NJ

8.) A field assessment was conducted on Sept 12, 2013 along the southern section of Barnegat Bay west of Long Beach Township, NJ. This qualitative assessment indicated the presence of SAV at a very limited number of sites along the eastern side of the bay. Very little Eelgrass was identified along this section in waters approximately 3 ft. deep. Previously defined extensive seagrass beds (~ 950 acres) appear to be severely diminished (Figure O-10).

Water-quality samples were collected at each regional area during the evaluation for the presence of submerged aquatic vegetation between July and September 2013. All samples were collected between the hours of 8:30 am and 2:00 pm (Table O-1). Water-quality parameters included temperature, dissolved oxygen, pH, turbidity, and oxidation-reduction potential. Parameter values were determined using a Horiba (model #4000) multi-probe meter. Plots of each parameter for each sample region are provided in Figures O-11 through O-15. Observed water temperatures were greatest during the July 18th survey run. Dissolved oxygen and pH varied the most at the Toms River survey sites. Median dissolved oxygen levels were above 4 mg/l at each regional area and above 5 mg/l at 7 of the 10 regions. Areas where median dissolved oxygen was less than 5 mg/l were the Navesink River, and the two Manahawkin areas. The lowest pH values were collected in the most inward parts of the Toms River estuary. The Toms River drains a portion of the Pinelands and natural pH values above the head of tide are typically less than 6.0[1]. Turbidity measures were relatively uniform with median values between 9.3 and 15.0 NTU at all of the regions except Long

Beach Township (LBT). The median value for this area was 31.9 NTU. Oxidation-reduction potential values were lowest at the northern most Navesink River sites and generally greatest at the Seaside Park and Island Beach State Park sites which were sampled on the same day.

Table O-1. Sample Locations, date, crew, times of the first and last samples, and the number of water-quality samples analyzed.

Regional Area	Code	Date	Field Crew	First Sample	Last Sample	N
Navesink	NAV	7/9/2013	GB, BR, LL	10:44:00 AM	1:22:00 PM	8
Toms River	TOMS	7/18/2013	GB, BR, NP	10:14:00 AM	12:34:00 PM	12
Seaside	BB	7/18/2013	GB, BR, NP	12:47:00 PM	2:03:00 PM	6
Lavallette	NBB	7/25/2013	GB, JB, LL	10:22:00 AM	1:42:00 PM	14
Bay Head	BYHD	8/1/2013	BR, JB, LL	8:42:00 AM	11:08:00 AM	15
Barnegat-Seaside Park	BBSP	8/7/2013	GB, JB, NP	9:38:00 AM	1:51:00 PM	6
Barnegat-Island Beach	IBSP	8/7/2013	GB, JB, NP	11:12:00 AM	1:37:00 PM	8
Barnegat-Manahawkin	BARN	8/19/2013	BR, LL, NP	9:10:00 AM	12:51:00 PM	24
Barnegat-Manahawkin II	BARN II	8/27/2013	BR, LL	9:51:00 AM	12:06:00 PM	13
Long Beach Township	LBT	9/12/2013	BR, LL	9:40:00 AM	12:28:00 PM	14

[1]Data from http://www.state.nj.us/dep/barnegatbay/plan-wqstandards.htm

Figures O-11 – O-15. Graphs of temperature (deg C), dissolved oxygen (mg/1), pH, turbidity (NTU), and oxidation-reduction potential (mv) showing the median and 10th, 25th, 75th, and 90th percentiles of data collected in each of the regions sampled for the presence of submerged aquatic vegetation. Regional codes on the y-axis match those in the Table O-1.

Figure O-11. Temperature (deg C)

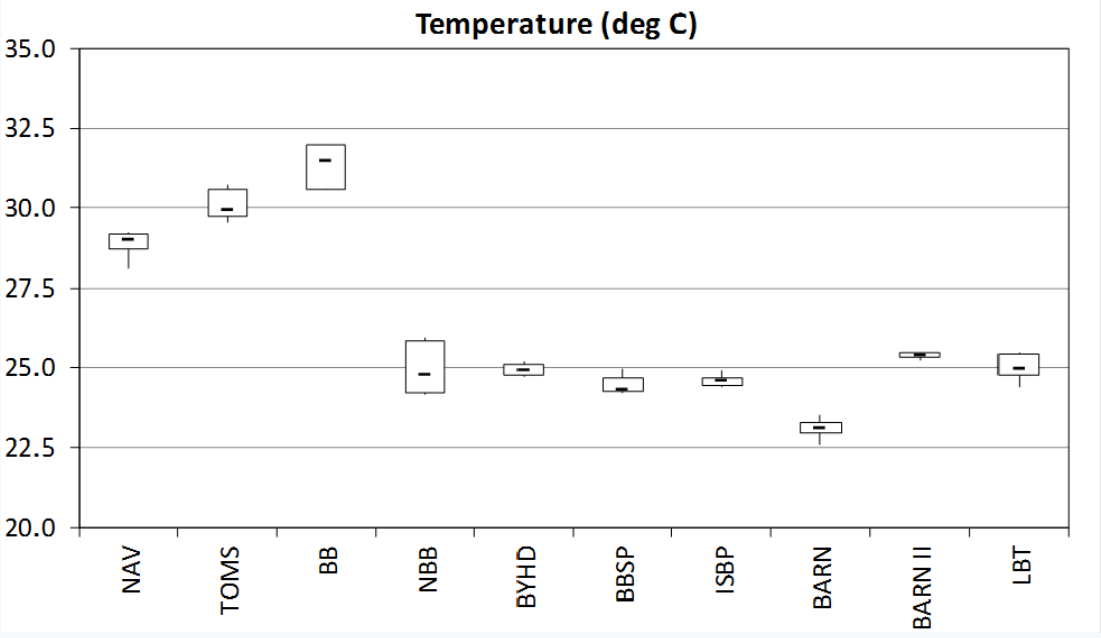


Figure O-12. Dissolved Oxygen (mg/L).

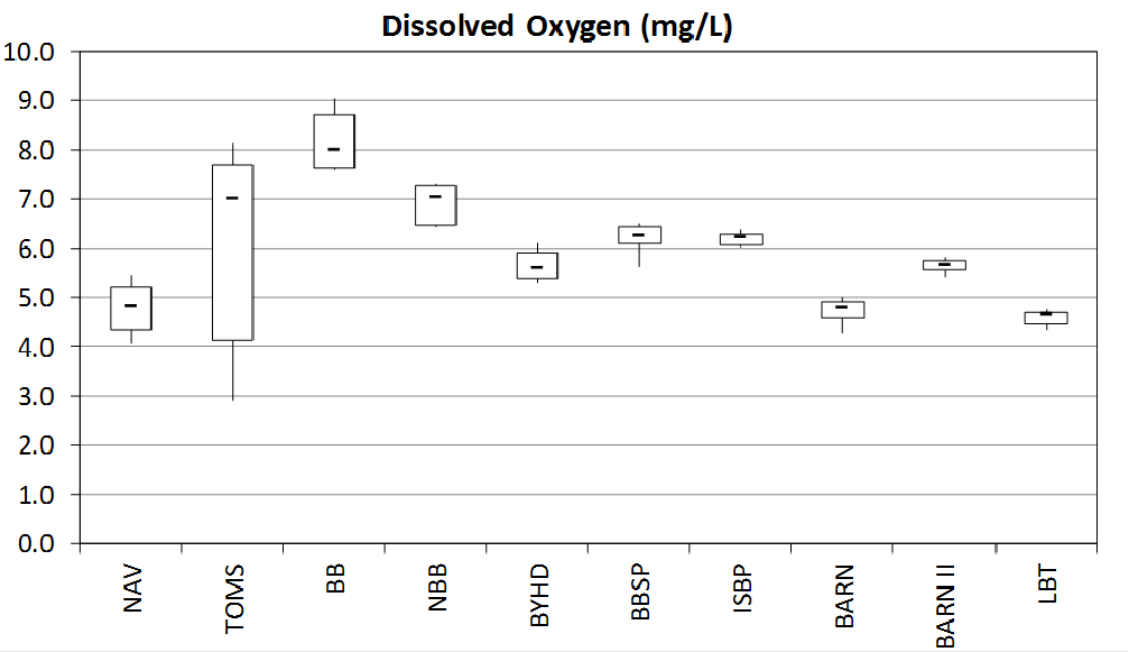


Figure O-13. pH

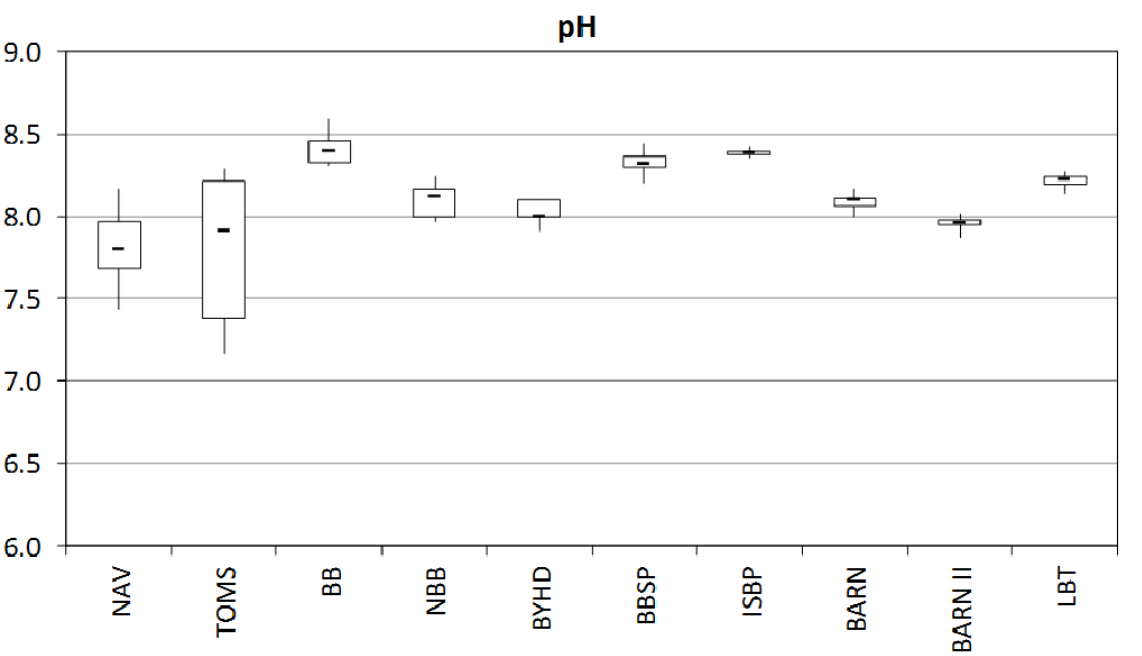


Figure O-14. Turbidity (NTU)

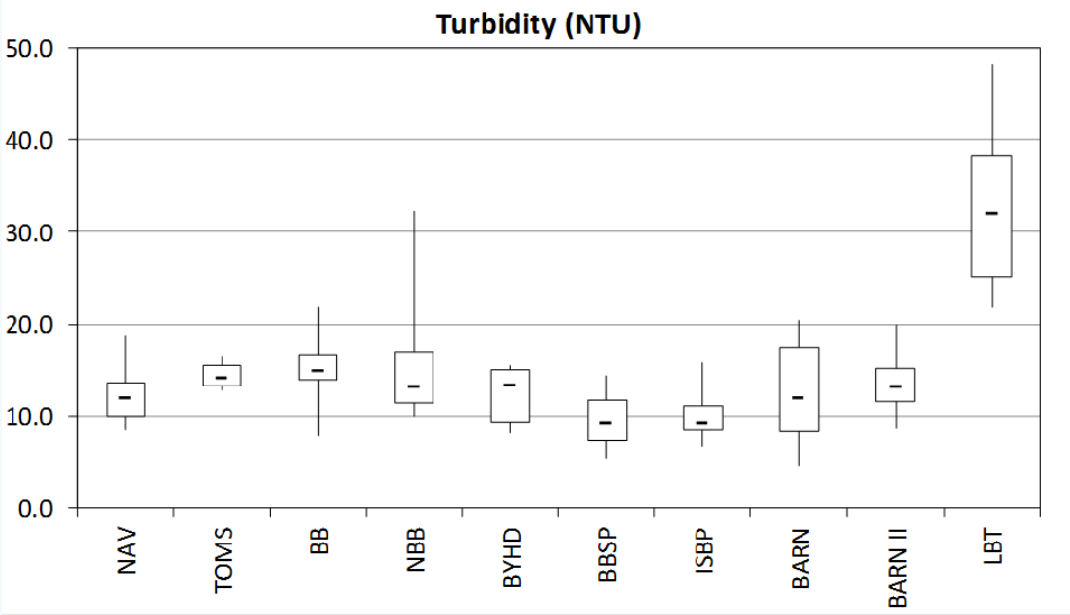
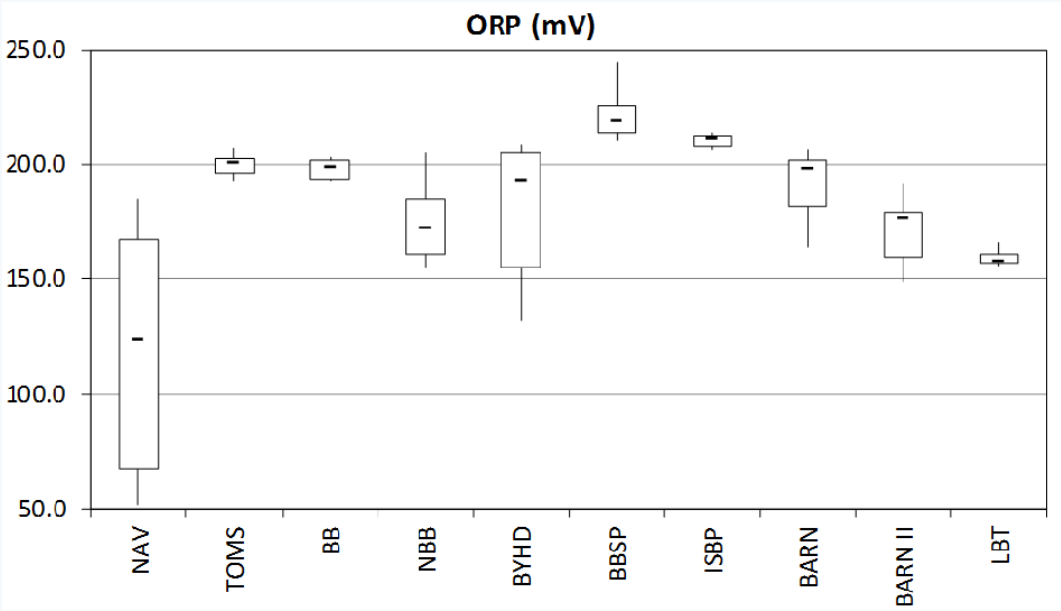


Figure O-15. ORP (mV)

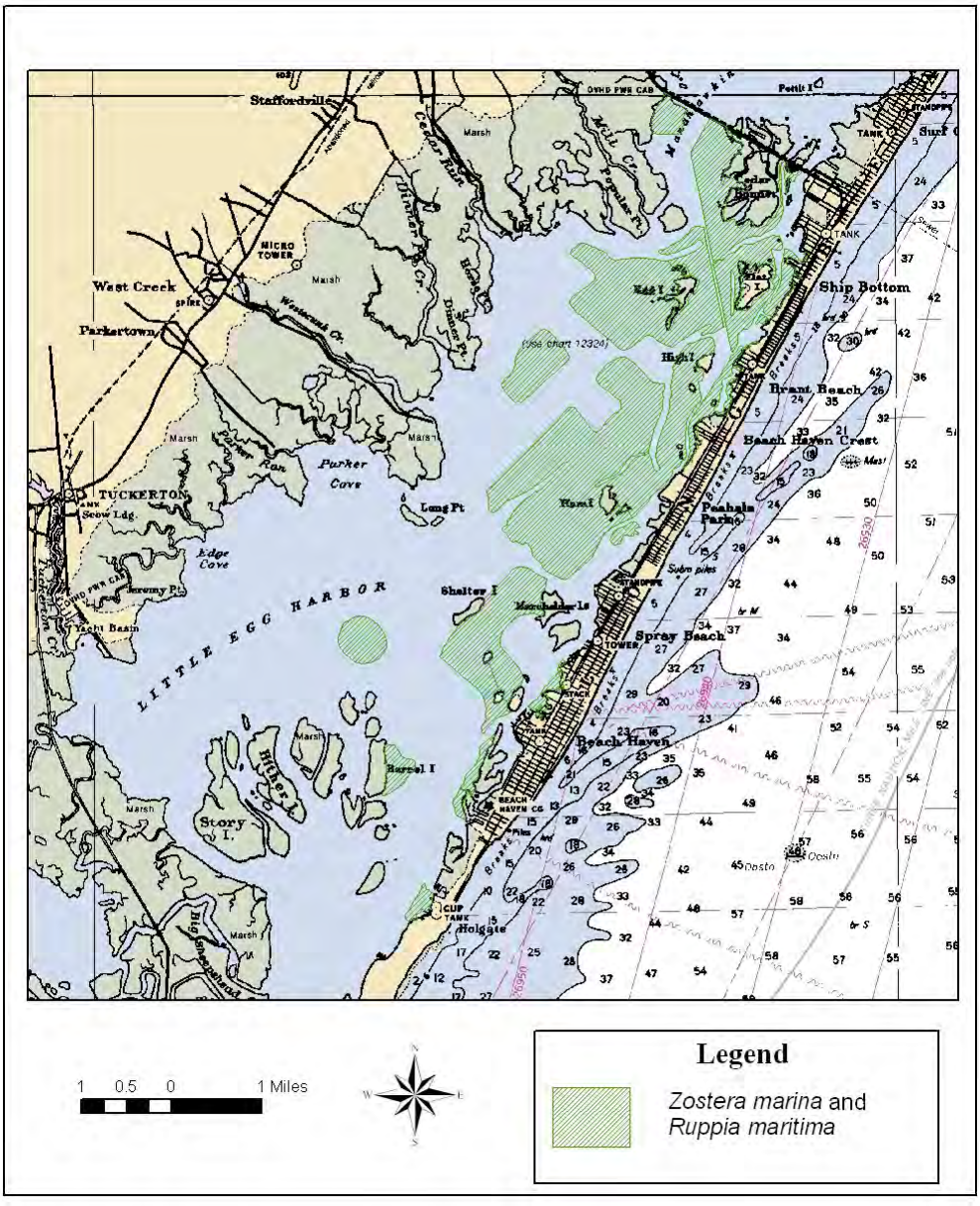


Future Assessments:

Due to the importance of SAV in the estuarine ecosystem, more comprehensive assessments (and continued monitoring) are recommended in order to characterize the current baseline extent and density of SAV. This will allow the impacts of future storms to be more effectively assessed as well as provide data for determining SAV trends. Funding for an assessment within Barnegat Bay for SAV, and other State shellfish waters for both SAV and shellfish, that includes an aerial survey of SAV during the shellfish growing season is recommended. It is also recommended that funding through the Department of Agriculture be pursued for a compilation of projects appropriate to shellfisheries. For example, an oyster shell planting project on the natural seed beds in Delaware Bay has been recommended. Funding for this project (and others related to this) had been proposed following and relative to oyster losses from previous storm events. The significance of this project has increased in the wake of recent hurricane and storm events and could generate useful resource management information.

Figure O-16— 2011 Little Egg Harbor Bay Shellfish Inventory: SAV distribution.

SHELLFISH STOCK ASSESSMENT OF LITTLE EGG HARBOR BAY (2011) REPORT
2011 Little Egg Harbor Bay Shellfish Inventory: SAV distribution.



Summary and Recommendations

Wetlands:

Hurricane Sandy's angle of approach, wind speeds and unfortunate timing (making landfall on a full moon high tide) produced record storm surges and devastating impacts to the built communities along New Jersey's coast. However, the wetlands that buffered these developments sustained comparatively less damage. Post-Sandy aerial photography and field assessments showed excessive ponding and the marsh being slow to drain where it was completely inundated by storm surge, areas of shoreline (marsh edge) erosion, and marsh vegetation disturbance. Wetland areas previously impacted by alteration appeared to have sustained more damage and were slower to recover than natural wetland areas. While tidal streams overflowed their banks and there was evidence of shoaling and creation of sand bars at the mouths of these streams, the watercourses themselves retained the same bank configuration. Only at the confluence of the Maurice River and Cohansey River and the Delaware Bay was there evidence of erosion to meanders. Field investigations documented greater adverse impacts to the wetlands on the Delaware Bayshore than on the Atlantic coast and back bay areas.

It was difficult to assess from presently available sources whether, or to what extent, the observed impacts would result in permanent alterations, or whether and how quickly the system would naturally adjust. Many of the questions generated from both the desktop and field assessments would require scientists to wait for one or more growing seasons to ascertain whether the saltwater surge permanently damaged trees on the upland/wetland edge; whether water would recede from ponded areas and vegetation would regrow where it had been scoured; and whether the tidal wetland system would recover from the release of chemicals and petroleum products spilled into the marsh from upland sources. The integrity of New Jersey's coastal wetlands was difficult to assess as is whether these wetlands could sustain additional assaults of the magnitude of Hurricane Sandy and perform as well.

The following recommendations are presented for consideration:

It is suggested that in areas slow to recover, previously altered and/or showing impounded water be considered for restoration utilizing the 'thin layer disbursal of dredge material' (to elevate the marsh).

Consider the regulatory review and application of an 'upland buffer' to tidal wetlands (as in the Freshwater Wetlands Protection Act) to limit upland impacts to tidal wetlands and to further protect development from storm surge.

Consider the re-tabulation of wetland acreage (extent, coverage); new shoreline mapping (v-datum and mean high water line). There is not only a need for more accurate areal baseline data concerning wetlands and shoreline, but also data on health and condition and historic data to document wetland response and recovery over time and to formulate projections to future impacts.

Riparian Habitats/Floodplains:

1.) Based on desktop assessments/aerial photography/Pictometry®Connect, limited change was observed between 2012 and 2013 to the shoreline, however significant changes were observed between 2007 and 2012. There was some difficulty in assessing true impacts to shoreline from Sandy since the stage of tide for the aerial photographs was unknown. Other storms (e.g. Hurricane Irene) may have had an influence.

2.) Long-term monitoring – Baseline data for marsh shoreline/inner channel delineations are largely unavailable prior to Hurricane Sandy, thus quantification of shoreline loss/gain, marsh-sediment accretion, and vegetation loss are difficult to compare to prior conditions or measure full impacts. Establishment of permanent monitoring stations and vertical datum, as well as vegetation surveys/ inventories would effectively fill data gaps so that future impacts can be assessed with confidence.

3.) Restoration & Resilience - Living shoreline projects are highly recommended for shorelines exposed to direct wind and wave action, such as the Great Bay WMA peninsula, Cattus Island, and the north bank of the Navesink River (i.e. Hartshorne Woods Park). However, in order for public open space lands to benefit from these, regulatory coordination needs to occur.

4.) Protection or establishment of Green zones (e.g. forested buffers along Barnegat Bay, connectivity of parks and WMAs, no wake zones, etc.) could protect development located along the bay shorelines, as well as environmentally sensitive area and inland T&E species habitat.

Forests:

Forest natural resource damage was concentrated in areas where the storm surge inundated forested areas in coastal regions and salt water toxicity resulted in dieback of established tree stands. In particular Atlantic white cedar was affected as evidenced by brown needles in the canopy. These areas should be part of a continuing study into the extent of the damage and the potential for regeneration. Other areas inland and on the western edges will be monitored by the NJSFS for regeneration and/or invasive species colonization (D. Swaysland, pers. Comm.).

Open Water:

The assessment surveys presented here were not designed to determine whether there has been a change in seagrass viability and overall coverage due to Hurricane Sandy. However, the losses seen in this limited set of surveys suggests that the stressors on Barnegat Bay-Little Egg Harbor Bay are having an impact on the SAV at specific back bay locations.

It is recommended that data should be gathered in a comprehensive approach to determine the status and trends of seagrass throughout the Atlantic coastal region of New Jersey and the Delaware Bay/Estuary. A greater frequency in high definition remote sensing mapping is needed to more conclusively assess the status and trends in seagrass coverage and density in Barnegat Bay. High definition remote sensing mapping of seagrass beds is also needed throughout the coastal region of the state.

Furthermore, it is necessary to identify the causes of stressors that are having an impact on the health and viability of seagrass beds. Nutrient enrichment has been suggested as the primary driver of change in seagrass habitat of the BB-LEH. Long-term monitoring is essential to understand the impact nutrient enrichment has on seagrass populations and habitat over time. These data would provide the tools environmental managers need to protect and to enhance the natural areas that healthy seagrass beds rely upon.

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1. http://www.csc.noaa.gov/digitalcoast/geozone/hurricane-sandy-geospatial-resources
2. http://storms.ngs.noaa.gov/storms/sandy/download

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USGS Data:

1. http://hdds.usgs.gov/hdds/
2. http://coastal.er.usgs.gov/hurricanes/sandy/_Oblique Photo Pairs (pre and post Hurricane Sandy)

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Appendix A

Questionnaire distributed to NJDEP programs for natural resource damage:

In order to prioritize and articulate the scope of natural resource damages resulting from Super Storm Sandy we would appreciate your consideration of the following questions as they pertain to your program. This information will help us identify what resources need to be assessed, coordinate data collection and assessment efforts, identify major data and resource gaps, help prioritize and articulate the Department's needs and project funding as we move forward.

1. DEP Program
2. Resource of Concern?
   a. Is there a specific geography?
   b. Is there a timing sensitivity?
3. Is there a pre-Sandy Assessment of this resource available?
   a. Date
   b. Status
   c. Type (written report, mapped, GIS)
   d. Scale
4. Is there a post-Sandy Assessment of this resource?
   a. Do you have people in the field?
   b. Status
   c. Type (field recon.; aerial/satellite photo; written report)
   d. Scale
   e. Where is this product located (program, GIS data layer, your computer...)?
5. Do you know of any ongoing assessments of this resource?
   a. Being conducted by whom?
   b. Type of Assessment?
   c. Scale?
6. To conduct an assessment (immediate) what are your needs (limiting factors)?
   a. Equipment
   b. Personnel
   c. Timing
7. Can you recommend a resource (academic institution, state, federal, NGO) to help complete this assessment?

Appendix B

Additional Information on Hurricane Sandy Impacts:

The following reports and data sets have been compiled post Sandy by various agencies. Many of these reports are in draft but may help you frame your data and assessment needs.

1. Natural and Cultural Resource Recovery Support Function: NCR_RSF_MSA_DR_4086_NJ v(3) - attached
2. NOAA Geospatial Resources: http://csc.noaa.gov/digitalcoast/geozone/hurricane- sandy-geospatial-resources
3. The following are NOAA links
   a. http://storms.ngs.noaa.gov/storms/sandy/

iPhone/mobile:

http://storms.ngs.noaa.gov/storms/sandy/mobile

The zip files of the entire flights and imagery is ready for download at:

http://storms.ngs.noaa.gov/storms/sandy/download/ WMTS (ArcGIS 10.1, QGIS 1.9)

http://storms.ngs.noaa.gov/storms/sandy/imagery/wmts?

ArcGIS users (9.3.1->10.1) with the ArcBruTile extension can access tiles as a web service with the following link:

http://storms.ngs.noaa.gov/storms/sandy/imagery/tms

4. Raritan Bay Project – NY/NJ Bay Keeper This map shows the extent of where the Bay Keeper Org. conducted the shoreline survey, but not all the data is uploaded yet for what was done this summer (anything with a green pin is not complete):

   http://www.arcgis.com/explorer/?open=d236435eec7c4a768627234957a95958

5. USGS data: USGS HDDS (http://hdds.usgs.gov/hdds/).
6. LiDAR Collections Attached above: Map showing pre and post Sandy LiDAR Collections– USGS
7. USGS has live links to oblique photo pairs (pre and post storm photos): http://coastal.er.usgs.gov/hurricanes/sandy/
8. Hurricane Sandy Data Sources: Geospatial Information and Remotely Sensed Imagery Products Attached above.
9. Several hundred aerial images of the New Jersey and NY shoreline are available at: https://picasaweb.google.com/psdspix. All images are georeferenced (i.e. you can see them on a Google Map) and grouped by town (or island)

10. Some layers have been added to DEPView (ArcGIS) and DEP Explorer (ArcGIS Explorer) that will help in hurricane Sandy damage assessment:

    a. DEPview updated to include following datasets—

        i. 2012 Imagery (Draft), 2012 Coastal Imagery Sandy. They can be found in the DEP Data-Imagery menu bar.

        ii. Statewide LIDAR, Hillshade and DEMs can be found in the DEP Data-Elevation menu bar.

    b. DEP Explorer updated to include 2012 Coastal Imagery Sandy (2012 Imagery Sandy)

    c. The NJ Office of GIS has posted information on their "Hurricane Sandy GIS Resources" page: http://njgin.state.nj.us/oit/gis/sandy/.

11. NOAA Natural Resource Assessment: ftp link for the zip file containing data (in geodatabase) and spreadsheets: ftp://ftp.csc.noaa.gov/temp/dbetenbaugh/NJ_JFO/ NJ_NaturalAreasImpactAssessment.zip

    a. Within the zip file you will find:

    - Natural Areas Impact Plan (post-analysis notes) - this is the original plan annotated with notes about which data sets were actually assessed and in which spreadsheets they are summarized. This is just included in case it is needed for reference.
    - Folder containing spreadsheets (FinalAnalysisSpreadsheets) - which contains:
        - Data Dictionary for NJ Sandy Storm Surge Analysis
        - Exacerbating Hazards Inundated by Hurricane Sandy Storm Surge in NJ
        - Habitat Assets Inundated by Hurricane Sandy Storm Surge in NJ
        - Land Use & Land Cover Inundated by Hurricane Sandy Storm Surge in NJ
        - Managed Lands Inundated by Hurricane Sandy Storm Surge in NJ
        - Marine and Shoreline Resources Adjacent to Areas Inundated by Hurricane Sandy in NJ
        - Planning Areas Inundated by Hurricane Sandy Storm Surge in NJ

12. Post-Sandy assessment of the New Jersey Beach Profile Network (NJBPN) - Stockton University: Northern Ocean County Initial Report https://docs.google.com/open?id=0B77f6XPBgLKtYTZ4NVgxYXJSR2s

13. American Littoral Society: Assessing the Impacts of Sandy – Report http://www.littoralsociety.org/images/PDFS/Policy/alssandyassessmentreport.pdf

14. USGS: Hurricane Sandy Storm Tide mapper: http://water.usgs.gov/floods/events/2012/sandy/sandymapper.html.

Appendix C

New Jersey State Park Service Report (NJDEP)
March 11, 2014

Island Beach State Park (IBSP):

Destruction of the remaining portions of the former Army Corp of Engineer Dike which had restricted water flow from Barnegat Inlet into the Marine Conservation Zone in and around Island Beach State Park and the Sedge Island Wildlife Management Area.

The dike was constructed years ago to restrict water flow and control erosion. Over the last several years the dike and more specifically the synthetic geotube which contained the sediment to build the dike had been compromised in several locations. The tears resulted in water flow through the sedge. The flow may have been beneficial to the ecosystem. However as result of Hurricane Sandy the remaining sections of geotube were destroyed. The summer of 2013 saw a DRAMATIC increase in boat/vessel traffic. Use was high to points where floats or "raft-ups" of dozens of boats were using the area daily. The vessels may present significant hazard to the Marine Conservation zone by increasing erosion of coastal wetlands, propeller scarring of submerged aquatic vegetation (SAV) beds, disruption of shellfish beds, disruption of nesting bird colonies, and possibly disrupting diamondback terrapin nest activity.

Natural areas (two wetland/upland forested areas) within Island Beach State Park jurisdiction, specifically in northern Barnegat Bay, were both significantly impacted and have had little mitigation of loss. The Swan Point Natural area has very significant deposition of debris as it lies just southwest and across the bay from the area of Mantoloking breached during the storm. The upland section of the property essentially became a wrack line for debris. The area is very difficult to access and most debris remains. Upland sections also experience saltwater intrusion and vegetation has been compromised. A similar but less severe situation exists on Herring Island, just north of the Mantoloking Bridge. Both of these areas are managed by the SPS/IBSP but we lack resources to address the impacts to either.

Liberty State Park:

Hurricane Sandy impacted Liberty State Park with high velocity wind and a storm surge from the Upper New York Bay and Hudson River of up to 11 feet over the mean high water. The land that the park is situated on is mostly a man-made, built, environment. However, many natural features have been created or enhanced by the NJDEP over the last 40 years to provide for a healthier natural environment and wildlife habitat. Most of the park's damages from Sandy are with its buildings and infrastructure, notably, the Historic CRRNJ Terminal Building and Nature Center, but natural resources were impacted as well. Below is summary of those impacts.

Trees:

80 landscape and ornamental trees were severely damaged or destroyed by wind damage. A certified forester puts an appraised value of the 80 trees at $112,850. The estimated value to properly remove and dispose of these trees was $67,500. Approximately 20 additional trees were damaged from salt-water infiltration due to the storm surge.

Freshwater Wetlands Pond:

The storm surge flooded the 3-acre freshwater pond located near the Nature Center. The saltwater infiltration of the pond killed most fish populations. It took many months for the salt content to drop in the pond. The force of the flooding relocated 3 man-made floating habitat enhancement islands onto the uplands about 100 feet from the pond. The cost to restore the three islands is approximately $10,000. The pond's aerator was also destroyed. The estimated cost to replace the aerator is $13,000. Also, the storm surge transplanted tons of debris into and around the pond.

Richard Sullivan Natural Area and Caven Point Beach Area:

The storm surge transplanted tons of debris onto the beaches and natural areas. The debris included household, chemical, medical and industrial wastes. The total amount of debris removed from the park exceeded 1,000 tons. The estimated total cost of removal, and disposal of debris was over $200,000, including labor.

Jetties and shoreline:

The jetties are man-made, however, they serve a unique recreation opportunity for the public as well as shoreline habitat for certain marine species. The jetties and a properly established shoreline protect upland acres from wave attenuation and degradation. The storm surge and wave action from Sandy degraded the shoreline of the jetties and as a result causing the continual gradual loss of shoreline and upland acres. To date, approximately 0.75-mile of shoreline is still impaired. The estimated cost to restore the jetties is approximately $2,000,000.

State of New Jersey
Department of Environmental Protection
Office of Science
Dr. Gary Buchanan, Director

Mail code 428-01, P.O. Box 420
Trenton, NJ 08625

Phone: (609) 984-6070
Visit the Office of Science web site @ www.state.nj.us/dep/dsr/

December 2014

MODEL NOISE CONTROL ORDINANCE

This model is provided by the NJ Department of Environmental Protection (Department) as guidance for municipalities to follow when adopting a noise control ordinance pursuant to the State's Noise Control Act and seeking to establish specific decibel standards to control noise. All such ordinances must be submitted for written approval to the Department, including an ordinance that is based entirely on the model ordinance provided below.

For assistance, please contact the Department's Office of Local Environmental Management at (609) 292-1305.

Procedures for Written Approval by the Department:

(A) A governing body of a municipality may adopt this model ordinance without change. Changes in formatting, numbering, or any other changes of this type shall not be considered significant changes. Within 30 days after a municipality adopts this ordinance, the municipality shall submit it to the Department, with a certification signed by the Township Clerk, Borough Manager or Administrator. The certification shall state:

I certify that {insert name of municipality} has adopted the Model Noise Control Ordinance without change(s). I further certify that if this statement is willfully false, I am subject to a penalty.

This ordinance shall be approved in writing upon submission by a municipality to the Department, of the fully executed certification and duly adopted noise ordinance. In addition, in the event that a regional or county health agency is identified as the authorized enforcement agency for the purpose of enforcing this ordinance when adopted by a municipality, written consent of the regional or a county health agency must be obtained, affixed to the ordinance and made a part thereof noise ordinances shall be submitted to:

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
COMPLIANCE & ENFORCEMENT
BUREAU OF LOCAL ENVIRONMENTAL MANAGEMENT
401 EAST STATE STREET
4TH FLOOR EAST WING
MAIL CODE 401-04N
P.O. BOX 420
TRENTON, NEW JERSEY 08625-0420

(B) If a governing body of a municipality wants to change any provision(s) of this model ordinance such as hours of operation as it applies to subsequent sections, or wants to develop a noise ordinance that is not based on the model, the entire noise control ordinance including the proposed change(s) shall be submitted to the Department for review and approval, prior to adoption. The Department will review such noise ordinances to determine consistency with the statewide scheme for noise control and whether the ordinance is more stringent than the State's noise code, in accordance with the Noise Control Act.

If the Department approves the change(s), the municipality shall submit a copy of the duly adopted ordinance to the CEHA agency governing its region, if one exists.

If the Department disapproves the change(s), the ordinance shall be returned to the municipality and shall be considered disapproved, meaning that the municipality cannot enforce it.

(C) The Department reserves the right to review, at any time, a noise control ordinance adopted by a municipality.

The model noise ordinance follows:

MODEL NOISE ORDINANCE

I. Declaration of Findings and Policy

WHEREAS excessive sound is a serious hazard to the public health, welfare, safety, and the quality of life; and, WHEREAS a substantial body of science and technology exists by which excessive sound may be substantially abated; and, WHEREAS the people have a right to, and should be ensured of, an environment free from excessive sound,

Now THEREFORE, it is the policy of **{insert name of municipality}** to prevent excessive sound that may jeopardize the health, welfare, or safety of the citizens or degrade the quality of life.

This ordinance shall apply to the control of sound originating from sources within **{insert name of municipality}**.

II. Definitions

The following words and terms, when used in this ordinance, shall have the following meanings, unless the context clearly indicates otherwise. Terms not defined in this ordinance have the same meaning as those defined in N.J.A.C. 7:29.

"Construction" means any site preparation, assembly, erection, repair, alteration or similar action of buildings or structures.

"dBC" means the sound level as measured using the "C" weighting network with a sound level meter meeting the standards set forth in ANSI S1.4-1983 or its successors. The unit of reporting is dB(C). The "C" weighting network is more sensitive to low frequencies than is the "A" weighting network.

"Demolition" means any dismantling, destruction or removal of buildings, structures, or roadways.

"Department" means the New Jersey Department of Environmental Protection.

"Emergency work" means any work or action necessary at the site of an emergency to restore or deliver essential services including, but not limited to, repairing water, gas, electricity, telephone, sewer facilities, or public transportation facilities, removing fallen trees on public rights-of-way, dredging navigational waterways, or abating life-threatening conditions or a state of emergency declared by a governing agency.

"Impulsive sound" means either a single pressure peak or a single burst (multiple pressure peaks) that

has a duration of less than one second.

"Minor Violation" means a violation that is not the result of the purposeful, reckless or criminally negligent conduct of the alleged violator; and/or the activity or condition constituting the violation has not been the subject of an enforcement action by any authorized local, county or state enforcement agency against the violator within the immediately preceding 12 months for the same or substantially similar violation.

"Motor vehicle" means any vehicle that is propelled other than by human or animal power on land.

"Muffler" means a properly functioning sound dissipative device or system for abating the sound on engines or equipment where such device is part of the normal configuration of the equipment.

"Multi-dwelling unit building" means any building comprising two or more dwelling units, including, but not limited to, apartments, condominiums, co-ops, multiple family houses, townhouses, and attached residences.

"Multi-use property" means any distinct parcel of land that is used for more than one category of activity. Examples include, but are not limited to:

1. A commercial, residential, industrial or public service property having boilers, incinerators, elevators, automatic garage doors, air conditioners, laundry rooms, utility provisions, or health and recreational facilities, or other similar devices or areas, either in the interior or on the exterior of the building, which may be a source of elevated sound levels at another category on the same distinct parcel of land; or

2. A building, which is both commercial (usually on the ground floor) and residential property, located above, below or otherwise adjacent to.

"Noise Control Officer" (NCO) means an employee of a local, county or regional health agency which is certified pursuant to the County Environmental Health Act (N.J.S.A. 26:3A2-21 et seq.) to perform noise enforcement activities or an employee of a municipality with a Department-approved model noise control ordinance. All NCOs must receive noise enforcement training as specified by the Department in N.J.A.C. 7:29 and is currently certified in noise enforcement. The employee must be acting within his or her designated jurisdiction and must be authorized to issue a summons.

"Noise Control Investigator" (NCI) means an employee of a municipality, county or regional health commission that has a Department-approved model noise control ordinance and the employee has not received noise enforcement training as specified by the Department in N.J.A.C. 7:29. However, they are knowledgeable about their model noise ordinance and enforcement procedures. A Noise Control Investigator may only enforce sections of the ordinance that do not require the use of a sound level meter. The employee must be acting within his or her designated jurisdiction and must be authorized to issue a summons.

"Plainly audible" means any sound that can be detected by a NCO or an NCI using his or her unaided hearing faculties of normal acuity. As an example, if the sound source under investigation is a portable or vehicular sound amplification or reproduction device, the detection of the rhythmic bass component of the music is sufficient to verify plainly audible sound. The NCO or NCI need not

determine the title, specific words, or the artist performing the song.

"Private right-of-way" means any street, avenue, boulevard, road, highway, sidewalk, alley or easement that is owned, leased, or controlled by a non-governmental entity.

"Public right-of-way" means any street, avenue, boulevard, road, highway, sidewalk, alley or easement that is owned, leased, or controlled by a governmental entity.

"Public space" means any real property or structures thereon that are owned, leased, or controlled by a governmental entity.

"Real property line" means either (a**)** the vertical boundary that separates one parcel of property (i.e., lot and block) from another residential or commercial property; (b) the vertical and horizontal boundaries of a dwelling unit that is part of a multi-dwelling unit building; or (c) on a multi-use property as defined herein, the vertical or horizontal boundaries between the two portions of the property on which different categories of activity are being performed (e.g., if the multi-use property is a building which is residential upstairs and commercial downstairs, then the real property line would be the interface between the residential area and the commercial area, or if there is an outdoor sound source such as an HVAC unit on the same parcel of property, the boundary line is the exterior wall of the receiving unit). Note- this definition shall not apply to a commercial source and a commercial receptor which are both located on the same parcel of property (e.g., a strip mall).

“Sound production device” means any device whose primary function is the production of sound, including, but not limited to any, musical instrument, loudspeaker, radio, television, digital or analog music player, public address system or sound-amplifying equipment.

“Sound reduction device” means any device, such as a muffler, baffle, shroud, jacket, enclosure, isolator, or dampener provided by the manufacturer with the equipment, or that is otherwise required, that mitigates the sound emissions of the equipment.

"Weekday" means any day that is not a federal holiday, and beginning on Monday at 7:00 a.m. and ending on the following Friday at 6:00 p.m.

"Weekends" means beginning on Friday at 6:00 p.m. and ending on the following Monday at 7:00 a.m.

III. Applicability

(A) This model noise ordinance applies to sound from the following property categories:

1. Industrial facilities;
2. Commercial facilities;
3. Public service facilities;
4. Community service facilities;
5. Residential properties;
6. Multi-use properties;
7. Public and private right-of-ways;
8. Public spaces; and
9. Multi-dwelling unit buildings.

(B) This model noise ordinance applies to sound received at the following property categories:

1. Commercial facilities;
2. Public service facilities;
3. Community service facilities (i.e. non-profits and/or religious facilities)
4. Residential properties;
5. Multi-use properties;
6. Multi-dwelling unit buildings.

(C) Sound from stationary emergency signaling devices shall be regulated in accordance with N.J.A.C. 7:29-1.4, except that the testing of the electromechanical functioning of a stationary emergency signaling device shall not meet or exceed 10 seconds.

IV. Exemptions

(A) Except as provided in IX. and X. below, the provisions of this ordinance shall not apply to the exceptions listed at N.J.A.C. 7:29-1.5.

(B) Sound production devices required or sanctioned under the Americans with Disabilities Act (ADA), FEMA or other government agencies to the extent that they comply with the noise requirement of the enabling legislation or regulation. Devices which are exempted under N.J.A.C. 7:29-1.5 shall continue to be exempted.

(C) Construction and demolition activities are exempt from the sound level limits set forth in tables I and II and III except as provided for in IX. below.

V. Enforcement Officers

(A) Noise Control Officers shall have the authority within their designated jurisdiction to investigate suspected violations of any section of this ordinance and pursue enforcement activities.

(B) Noise Control Investigators shall have the authority within their designated jurisdiction to investigate suspected violations of any section of this ordinance that do not require the use of a sound level meter (i.e., plainly audible, times of day and/or distance determinations) and pursue enforcement activities.

(C) Noise Control Officers and Investigators may cooperate with NCOs and NCIs of an adjacent municipality in enforcing one another's municipal noise ordinances.

VI. Measurement Protocols

(A) Sound measurements made by a Noise Control Officer shall conform to the procedures set forth at N.J.A.C. 7:29-2, except that interior sound level measurements shall also conform with the procedures set forth in VIB of this ordinance and with the definition of "real property line"

as contained herein.

(B) When conducting indoor sound level measurements across a real property line the measurements shall be taken at least three feet from any wall, floor or ceiling and all exterior doors and windows may, at the discretion of the investigator, be closed. The neighborhood residual sound level shall be measured in accordance with N.J.A.C. 7:29-2.9(b)2. When measuring total sound level, the configuration of the windows and doors shall be the same and all sound sources within the dwelling unit must be shut off (e.g., television, stereo). Measurements shall not be taken in areas which receive only casual use such as hallways, closets and bathrooms.

VII. Maximum Permissible Sound Levels

(A) No person shall cause, suffer, allow, or permit the operation of any source of sound on any source property listed in III.(A) above in such a manner as to create a sound level that equals or exceeds the sound level limits set forth in Tables I, II or III when measured at or within the real property line of any of the receiving properties listed in Tables I, II or III except as specified in VI(B).

(B) Impulsive Sound

Between 7:00 a.m. and 10:00 p.m., impulsive sound shall not equal or exceed 80 decibels. Between 10:00 p.m. and 7:00 a.m., impulsive sound which occurs less than four times in any hour shall not equal or exceed 80 decibels. Impulsive sound which repeats four or more times in any hour shall be measured as continuous sound and shall meet the requirements as shown in Tables I and II.

TABLE I
MAXIMUM PERMISSIBLE A-WEIGHTED SOUND LEVELS
WHEN MEASURED OUTDOORS

RECEIVING PROPERTY CATEGORY	Residential property, or residential portion of a multi-use property		Commercial facility, public service facility, non-residential portion of a multi-use property, or community service facility
TIME	7 a.m.-10 p.m.	10 p.m.-7 a.m.	24 hours
Maximum A-Weighted sound level standard, dB	65	50	65

TABLE II
MAXIMUM PERMISSIBLE A-WEIGHTED SOUND LEVELS
WHEN MEASURED INDOORS

RECEIVING PROPERTY CATEGORY	Residential property, or residential portion of a multi-use property		Commercial facility or non-residential portion of a multi-use property
TIME	7 a.m.-10 p.m.	10 p.m.-7 a.m.	24 Hours
Maximum A-Weighted sound level standard, dB	55	40	55

Note: Table II shall only apply when the source and the receptor are separated by a real property line and they also share a common or abutting wall, floor or ceiling, or are on the same parcel of property.

TABLE III
MAXIMUM PERMISSIBLE OCTAVE BAND
SOUND PRESSURE LEVELS IN DECIBELS

Receiving Property Category	**Residential property, or residential portion of a multi-use property**		**Residential property, or residential portion of a multi-use property**		**Commercial facility, public service facility, non-residential portion of a multi-use property, or community service facility**	**Commercial facility or non-residential portion of a multi-use property**
	OUTDOORS		**INDOORS**		**OUTDOORS**	**INDOORS**
Octave Band Center Frequency, Hz.	**Octave Band Sound Pressure Level, dB**		**Octave Band Sound Pressure Level, dB**		**Octave Band Sound Pressure Level, dB**	**Octave Band Sound Pressure Level, dB**
Time	7 a.m.-10 p.m.	10 p.m.-7 a.m.	7 a.m.-10 p.m.	10 p.m.-7 a.m.	24 hours	24 hours
31.5	96	86	86	76	96	86
63	82	71	72	61	82	72
125	74	61	64	51	74	64
250	67	53	57	43	67	57

500	63	48	53	38	63	53
1,000	60	45	50	35	60	50
2,000	57	42	47	32	57	47
4,000	55	40	45	30	55	45
8,000	53	38	43	28	53	43

Note: When octave measurements are made, the sound from the source must be constant in level and character. If octave band sound pressure level variations exceed plus or minus 2 dB in the bands containing the principal source frequencies, discontinue the measurement.

VIII. Sound Production Devices

No person shall cause, suffer, allow, or permit the operation of any sound production device in such a manner that the sound crosses a property line and raises the total sound levels above the neighborhood residual sound level by more than the permissible sound level limits set forth in Table IV when measured within the residence of a complainant according to the measurement protocol in VI(B) of this ordinance. These sound level measurements shall be conducted with the sound level meter set for "C" weighting, "fast" response.

TABLE IV
MAXIMUM PERMISSIBLE INCREASE IN TOTAL SOUND LEVELS WITHIN A RESIDENTIAL PROPERTY

Week nights 10:00 p.m. - 7:00 a.m. Weekend nights 11:00 p.m and 9:00 a.m.	All other times
3 dB(C)	6 dB(C)

IX. Restricted Uses and Activities

Note: This section is optional; any numbered paragraph may be adopted in its entirety.

The following standards shall apply to the activities or sources of sound set forth below:

A. Excluding emergency work, power tools, home maintenance tools, landscaping and/or yard maintenance equipment used by a residential property owner or tenant shall not be operated between the hours of 8:00 p.m. and 8:00 a.m., unless such activities can meet the applicable limits set forth in Tables I, II or III. At all other times the limits set forth in Tables I, II or III do not apply. All motorized equipment used in these activities shall be operated with a muffler and/or sound reduction device.

B. Excluding emergency work, power tools, landscaping and/or yard maintenance equipment

used by nonresidential operators (e.g. commercial operators, public employees) shall not be operated on a residential, commercial, industrial or public (e.g. golf course, parks, athletic fields) property between the hours of 6:00 p.m. and 8:00 a.m. on weekdays, or between the hours of 6:00 p.m. and 9:00 a.m. on weekends or federal holidays, unless such activities can meet the limits set forth in Tables I, II or III. At all other times the limits set forth in Tables I, II or III do not apply. All motorized equipment used in these activities shall be operated with a muffler and/or sound reduction device.

C. All construction and demolition activity, excluding emergency work, shall not be performed between the hours of 6:00 p.m. and 7:00 a.m. on weekdays, or between the hours of 6:00 p.m. and 9:00 a.m. on weekends and federal holidays, unless such activities can meet the limits set forth in Tables I, II or III. At all other times the limits set forth in Tables I, II or III do not apply. All motorized equipment used in construction and demolition activity shall be operated with a muffler and/or sound reduction device.

D. Motorized snow removal equipment shall be operated with a muffler and/or a sound reduction device when being used for snow removal. At all other times the limits set forth in Tables I, II or III do not apply.

E. All interior and exterior burglar alarms of a building or motor vehicle must be activated in such a manner that the burglar alarm terminates its operation within five (5) minutes for continuous airborne sound and fifteen (15) minutes for intermittent sound after it has been activated. At all other times the limits set forth in Tables I, II or III do not apply.

F. Self-contained, portable, non-vehicular music or sound production devices shall not be operated on a public space or public right-of-way in such a manner as to be plainly audible at a distance of 50 feet in any direction from the operator between the hours of 8:00 a.m. and 10:00 p.m. Between the hours of 10:00 p.m. and 8:00 a.m., sound, operated on a public space or public right-of-way, from such equipment shall not be plainly audible at a distance of 25 feet in any direction from the operator;

G. It shall be unlawful for any property owner or tenant to allow any domesticated or caged animal to create a sound across a real property line which unreasonably disturbs or interferes with the peace, comfort, and repose of any resident, or to refuse or intentionally fail to cease the unreasonable noise when ordered to do so by a Noise Control Officer or Noise Control Investigator. Prima facie evidence of a violation of this section shall include but not be limited to:

(1) Vocalizing (howling, yelping, barking, squawking etc.) for five (5) minutes without interruption, defined as an average of four or more vocalizations per minute in that period; or,

(2) Vocalizing for twenty (20) minutes intermittently, defined as an average of two vocalizations or more per minute in that period.

It is an affirmative defense under this subsection that the dog or other animal was intentionally provoked to bark or make any other noise.

X. Motor Vehicles

Note: This section is optional; any numbered paragraph may be adopted in its entirety.

Violations of each paragraph of this section shall be considered purposeful and therefore non-minor violations.

(A) No person shall remove or render inoperative, or cause to be removed or rendered inoperative or less effective than originally equipped, other than for the purposes of maintenance, repair, or replacement, of any device or element of design incorporated in any motor vehicle for the purpose of noise control. No person shall operate a motor vehicle or motorcycle which has been so modified. A vehicle not meeting these requirements shall be deemed in violation of this provision if it is operated stationary or in motion in any public space or public right-of-way.

(B) No motorcycle shall be operated stationary or in motion unless it has a muffler that complies with and is labeled in accordance with the Federal Noise Regulations under 40 CFR Part 205.

(C) Personal or commercial vehicular music amplification or reproduction equipment shall not be operated in such a manner that it is plainly audible at distance of 25 feet in any direction from the operator between the hours of 10:00 p.m. and 8:00 a.m.

(D) Personal or commercial vehicular music amplification or reproduction equipment shall not be operated in such a manner that is plainly audible at a distance of 50 feet in any direction from the operator between the hours of 8:00 a.m. and 10:00 p.m.

XI. Enforcement

(A) Violation of any provision of this ordinance shall be cause for a Notice of Violation (NOV) or a Notice of Penalty Assessment (NOPA) document to be issued to the violator by the Noise Control Officer or Noise Control Investigator.

(B) Any person who violates any provision of this ordinance shall be subject to a civil penalty for each offense of not more than the maximum penalty pursuant to N.J.S.A. 40:49-5, which is $2,000 as of December 2014. If the violation is of a continuing nature, each day during which it occurs shall constitute an additional, separate, and distinct offense.

(C) Upon identification of a violation of this Ordinance the Noise Control Officer or Noise Control Investigator shall issue an enforcement document to the violator. The enforcement document shall identify the condition or activity that constitutes the violation and the specific provision of this Ordinance that has been violated. It shall also indicate whether the violator has a period of time to correct the violation before a penalty is sought.

(D) If the violation is deemed by the Noise Control Officer or Noise Control Investigator to be a minor violation (as defined in Section II of this ordinance) a NOV shall be issued to the violator.

1. The document shall indicate that the purpose of the NOV is intended to serve as a

notice to warn the responsible party/violator of the violation conditions in order to provide them with an opportunity to voluntarily investigate the matter and voluntarily take corrective action to address the identified violation.

2. The NOV shall identify the time period (up to 90 days), pursuant to the Grace Period Law, N.J.S.A. 13:1D-125 et seq. where the responsible party's/violator's voluntary action can prevent a formal enforcement action with penalties issued by the (Health Department) _____. It shall be noted that the NOV does not constitute a formal enforcement action, a final agency action or a final legal determination that a violation has occurred. Therefore, the NOV may not be appealed or contested.

(E) If the violation is deemed by the Noise Control Officer or Noise Control Investigator to be a non-minor violation, the violator shall be notified that if the violation is not immediately corrected, a NOPA with a civil penalty of not more than the maximum penalty allowed pursuant to N.J.S.A. 40:49-5, which is $2,000 as of December 2014, will be issued. If a non-minor violation is immediately corrected, a NOV without a civil penalty shall still be issued to document the violation. If the violation occurs again (within 12 months of the initial violation) a NOPA shall be issued regardless of whether the violation is immediately corrected or not.

(F) The violator may request from the Noise Control Officer or Noise Control Investigator, an extension of the compliance deadline in the enforcement action. The Noise Control Officer or Noise Control Investigator shall have the option to approve any reasonable request for an extension (not to exceed 180 days) if the violator can demonstrate that a good faith effort has been made to achieve compliance. If an extension is not granted and the violation continues to exist after the grace period ends, a NOPA shall be issued.

(G) The recipient of a NOPA shall be entitled to a hearing in a municipal court having jurisdiction to contest such action.

(H) The Noise Control Officer or Noise Control Investigator may seek injunctive relief if the responsible party does not remediate the violation within the period of time specified in the NOPA issued.

(I) Any claim for a civil penalty may be compromised and settled based on the following factors:

1. Mitigating or any other extenuating circumstances;

2. The timely implementation by the violator of measures which lead to compliance;

3. The conduct of the violator; and

4. The compliance history of the violator.

XII. Consistency, Severability and Repealer

(A) If any provision or portion of a provision of this ordinance is held to be unconstitutional, preempted by Federal or State law, or otherwise invalid by any court of competent jurisdiction, the remaining provisions of the ordinance shall not be invalidated.

(B) All ordinances or parts of ordinances, which are inconsistent with any provisions of this ordinance, are hereby repealed as to the extent of such inconsistencies.

(C) No provision of this ordinance shall be construed to impair any common law or statutory cause of action, or legal remedy there from, of any person for injury or damage arising from any violation of this ordinance or from other law.

New Jersey Hurricane Sandy (DR-4086)

Navigation

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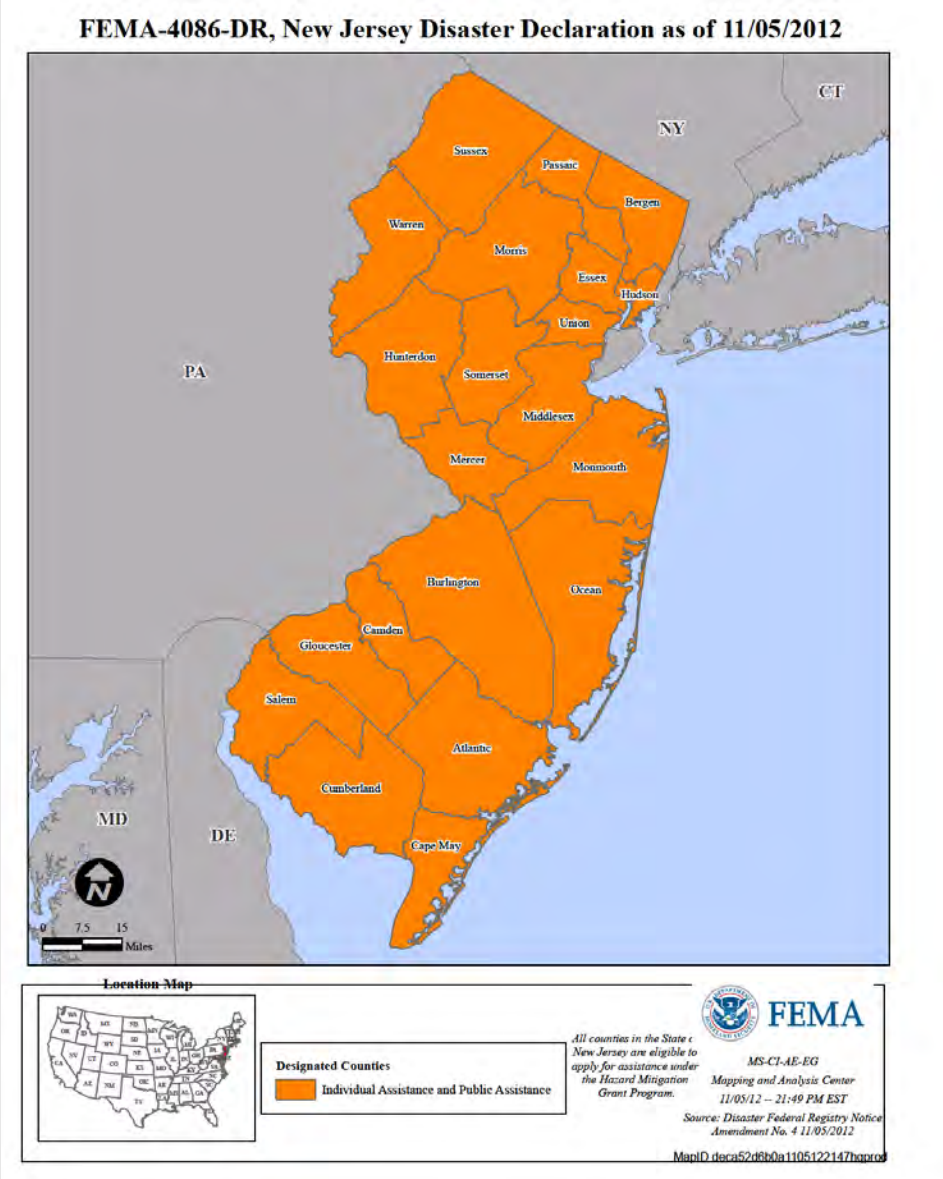
Incident Period: **October 26, 2012 - November 08, 2012**

Major Disaster Declaration declared on **October 30, 2012**



PDF of Map (//gis.fema.gov/maps/dec_4086.pdf) Google

Earth (//gis.fema.gov/maps/dec_4086.kmz) Need help with this map? (/webform/ask-question)

Individual Assistance Applications
Approved: 61,442

Total Individual & Households Program
Dollars Approved: $422,887,543.39

Total Public Assistance Grants
Dollars Obligated: $1,994,861,759.56

Designated Counties (Individual Assistance):

Atlantic, Bergen, Burlington, Camden, Cape May, Cumberland, Essex, Gloucester, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Salem, Somerset, Sussex, Union, Warren

Expand All Sections

Resources For Survivors

Financial Assistance

Preliminary Damage Assessment Report

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(https://www.oig.dhs.gov/hotline)

Official website of the Department of Homeland Security

properties (NOAA, 2012).

4.3.1.1 Location and Extent

Ocean County's coastal and bayside communities from Point Pleasant Beach to Long Beach are subject to coastline changes due to coastal erosion. Coastal erosion can be classified as either chronic erosion or episodic erosion. Chronic erosion is characterized as the gradual recession of the shoreline over a period of decades. Episodic erosion occurs in response to flood events or coastal storms with a rapid recession of the shoreline (DNREC, 2013). Across the US, erosion rates can vary greatly; it is not uncommon to find erosion rates ranging from 2 feet per year on barrier islands in the Southeast to 50 feet per year along the Great Lakes (NOAA, 2012). However, coastal erosion rates can also be much lower and will depend on human activities, severe storms, flooding, and sea level rise in a given area.

Generally, coastal erosion rates will increase with increases in sea level rise rates. While actions such as construction of seawalls or beach nourishment may mitigate coastal erosion i an attempt to fix the location of the present day open coast shoreline, certain communities wil become increasingly vulnerable to sea level rise in low-lying bayside locations. Barnegat Ligh Borough, Beach Haven Borough, and Surf City Borough serve as examples of this bayside inundation exposure.

Erosion can also impact the estuarine wetland shorelines along the bay in Ocean County. Wetland shoreline erosion is also an increasingly important element of erosion. Wetland plant serve as physical barriers to waves and anchor soils, making soils less likely to wash away. In 2012, NJDEP's Coastal Management Office modeled shoreline retreat along the western side Barnegat Bay. This GIS exercise showed an average shoreline loss of 75 feet of retreat with a overall range of 21 to 107 feet from 1995 to 2007 (NJCMO, 2012). After Hurricane Sandy, the has been a great deal of attention placed on preventing shoreline loss and using living shorelines to reduce wetland losses and protect wetlands.

The coastal areas of Ocean County are located in the following municipalities: the Township o Barnegat, the Borough of Barnegat Light, the Borough of Bay Head, the Borough of Beach Haven, the Township of Berkeley, the Township of Brick, the Township of Eagleswood, the Borough of Harvey Cedars, the Township of Lacey, the Borough of Lavallette, the Township o Little Egg Harbor, the Township of Long Beach, the Borough of Mantoloking, the Township of Ocean, the Borough of Point Pleasant Beach, the Borough of Point Pleasant, the Borough of Seaside Heights, the Borough of Seaside Park, the Borough of Ship Bottom, the Township of

United States Environmental Protection Agency

Ozone Designations - 2015 Standards - New Jersey State Recommendations and EPA Response

Ozone Designations for the 2015 Standards- New Jersey

You may need a PDF reader to view some of the files on this page. See EPA's About PDF page to learn more.

- New Jersey State Recommendation (PDF) (4 pp, 770 K)
- New Jersey State Recommendation - Technical Support Document (PDF) (48 pp, 3 MB)
- EPA's Response to New Jersey (PDF) (4 pp, 2 MB)
- New Jersey Technical Support Document (PDF) (36 pp, 6 MB)
- New York Metro Area Technical Support Document (PDF) (30 pp, 4 MB)
- Final EPA Technical Support Document for Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE (PDF) (40 pp, 5 MB)
- Final EPA Technical Support Document for New York-Northern New Jersey-Long Island, NY-NJ-CT (PDF) (30 pp, 7 MB)

LAST UPDATED ON MAY 1, 2018

NJEJA

Superstorm Sandy Child and Family Health Study Finds Lingering Effects of Mental Health Distress, PTSD and Depression

August 1, 2015 by njeja (http://njeja.org/?author=2)

Rutgers and NYU researchers release study of New Jersey residents living in Sandy's path

Wednesday, July 29, 2015

(http://news.rutgers.edu/sites/medrel/files/inline-img/Sandy%20photo%201.jpg)

Hurricane Sandy left a path of destruction in New Jersey.

Superstorm Sandy continues to affect the lives of tens of thousands of New Jersey residents, in the form of unfinished repairs, disputed claims and recurrent mold.

These after-effects still linger for Sandy-impacted residents and are associated with increased odds of residents experiencing mental health distress, post-traumatic stress disorder and depression.

According to the Sandy Child and Family Health Study (http://goo.gl/7KfRU1), a representative population study of 1 million New Jersey residents living in Sandy's path, more than 100,000 New Jersey residents experienced significant structural damage to their primary homes from Superstorm Sandy. Based on findings released from this study, which was conducted by Rutgers University and New York University, in collaboration with Columbia University and Colorado State University, among those New Jersey residents whose homes suffered such damage, 27 percent are experiencing moderate or severe mental health distress and 14 percent report the signs and symptoms of PTSD even two and a half years after the storm.

The first two briefing reports were released on July 30, 2015, "The Hurricane Sandy PLACE Report (http://goo.gl/SqcVKf): Evacuation Decisions, Housing Issues and Sense of Community," and "The Hurricane Sandy PERSON Report (http://goo gl/YnWQ61): Exposure Health Economic Burden and Social Well

(http://goo.gl/YnWQ61): Exposure, Health, Economic Burden and Social Well-Being" (www.scafh.org (http://www.scafh.org/)). Additional briefing reports that focus on persistent and unmet needs, and the status of residents' disaster recovery, will be released in the next several months.

"Recovery, or stalled recovery, is not as dramatic as the storm and the initial response," noted David Abramson, the study's principal investigator. "But it is what exacts the greatest toll both financially and psychologically. Sandy may have occurred nearly three years ago, but it has had an enduring impact on those individuals and communities exposed to it," he said.

Among the study's objectives were to help the state identify the health and well-being of residents exposed to the storm and to begin to identify unmet needs.

"The state always knew recovery from Superstorm Sandy would take years," New Jersey Health Commissioner Mary O'Dowd said. "In the aftermath of Sandy, the Department of Health recognized the need for research and so we funded this study so we could hear the concerns of recovering families and modify our ongoing Sandy programs to better address the needs of those who are still coping with recovery issues. For example, the department recently extended programs for behavioral health assistance and lead screening for another year."

"It was striking to us and to our field team of over 30 interviewers how Sandy still dominated the lives of so many New Jersey residents, even two and a half years after the event," added Rutgers University's Donna Van Alst, the study's co-principal investigator. "People across the economic spectrum were affected."
Other findings from the study revealed that:

- **Children in hurricane-damaged homes are at higher risk for mental health problems than children whose homes who suffered no damage. Children living in homes with minor damage were over four times as likely to feel sad or depressed as children in homes that were not damaged and more than**

or depressed as children in homes that were not damaged and more than twice as likely to have difficulty sleeping. Children whose homes suffered major damage were affected as well, although, interestingly, those in homes with minor damage demonstrated the most substantial mental health effects.

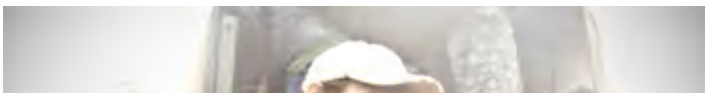
- **The health effects associated with catastrophic damage to one's home are similar to those felt by people living in deep poverty. A number of the residents whose homes suffered major damage said that they often did not have enough money for rent or mortgage, to pay for utilities, to pay for transportation, or to pay for all the food that they or their family needed.**

- **Mold was significantly associated with both asthma and with mental health distress.**

- **Despite the efforts of public officials to urge residents to move out of harm's way prior to the storm, only one-third of the residents living in mandatory evacuation zones heeded the calls to evacuate their homes.**

The findings are based on face-to-face surveys with 1,000 randomly sampled New Jersey residents living in the state's nine most-affected counties. The research team from the four universities deployed a team of nearly three dozen community-based interviewers to conduct the surveys. In addition, the team used flood sto

The 1,000-person sample was drawn to be representative of the 1,047,000 residents living in this disaster footprint. The footprint extends from Cape May in the south of the state to several miles north of the George Washington Bridge, and stretches from the shoreline to over 20 miles inland.



(http://news.rutgers.edu/sites/medrel/files/inline-img/sandyphoto2.jpg).

The New Jersey National Guard evacuating residents and their pets from Long Beach Island, NJ before Hurricane Sandy made landfall.

The study is modeled upon a similar five-year study conducted by Abramson and Columbia University's National Center for Disaster Preparedness in Louisiana and Mississippi after Hurricane Katrina, the Gulf Coast Child and Family Health Study. The Sandy study was funded by the New Jersey Department of Health using Social Services Block Grant (SSBG) – Sandy Supplemental funds. The Department of Health's O'Dowd recognized this study as an opportunity to gain valuable, unprecedented insight on the public health impact of the storm on New Jersey residents and to guide the department's recovery activities.

"The similarities between Hurricanes Katrina and Sandy are quite disturbing," noted NYU's Abramson. "Many adults and children are still experiencing emotional and psychological effects, so long after the storm passed. In a significant number of cases housing damage is at the heart of the problem, and it's very concerning to hear that so many of the federally financed programs have ended even though the needs still clearly persist."

Experts are further concerned that the results of this study reflect a pattern that is seen after many large-scale disasters in the U.S and internationally. "By far, one of the least understood aspects of disaster management is how to make recovery from catastrophic events efficient and rapid so that people can return to a state of

from catastrophic events efficient and rapid, so that people can return to a state of normalcy as quickly as possible," said Irwin Redlener, director of the National Center for Disaster Preparedness at Columbia University's Earth Institute. "This prolonged uncertainty and persistent trauma are very difficult for families and especially traumatic for children," added Redlener, who is president of the Children's Health Fund and a professor at the Mailman School of Public Health.

The study is a partnership of four academic centers – the Program on Population Impact, Recovery, and Resiliency (PiR^2) at NYU's College of Global Public Health, led by Abramson; the Institute for Families, at Rutgers' School of Social Work, represented by Donna Van Alst, Patricia Findley and Sandra Moroso; Columbia University's National Center for Disaster Preparedness, represented by Irwin Redlener and Jonathan Sury; and Colorado State University's Center for Disaster and Risk Analysis, led by Lori Peek.

For media inquiries, contact Amber Hopkins-Jenkins at ah600@ucm.rutgers.edu (mailto:ah600@ucm.rutgers.edu) or 848-932-0554.

Significant Habitats and Habitat Complexes of the New York Bight Watershed

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click image for title page

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Chapter 242: Noise

[HISTORY: Adopted by the Township Committee of the Township of Little Egg Harbor; see Ch. 1, General Provisions, Art. I. Amendments noted where applicable.]

GENERAL REFERENCES
Fire and burglar alarms — See Ch. **128**.
Vehicular sound reproduction — See Ch. **326**.

242a Table II Max Perm Oct Band Sound-Pres

§ 242-1 Findings; policy.

A. Whereas, excessive noise is a serious hazard to the public health and welfare and the quality of life; and a substantial body of science and technology exists by which excessive noise may be substantially abated; and the people have a right to and should be ensured an environment free from noise that may jeopardize their health or welfare or degrade the quality of life; and the necessity in the public interest for the provisions and prohibitions hereinafter contained and enacted is declared as a matter of legislative determination and public policy; and the provisions and prohibitions hereinafter contained and enacted are in pursuance of and for the purpose of securing and promoting the public health, comfort, convenience, safety, welfare and the peace and quiet of the inhabitants of the Township of Little Egg Harbor.

B. Now, therefore, it is the policy of the Township of Little Egg Harbor to prevent excessive sound that may jeopardize the health, welfare or safety of the citizens or degrade the quality of life. This chapter shall apply to the control of sound originating from sources within the Township of Little Egg Harbor.

§ 242-2 Definitions.

As used in this chapter, the following terms shall have the meanings indicated:

CONSTRUCTION
Any site preparation, assembly, erection, repair, alteration or similar action, including demolition of buildings or structures.

DEMOLITION
Any dismantling, destruction or removal of buildings, structures or roadways.

DEPARTMENT
The New Jersey Department of Environmental Protection.

EMERGENCY WORK
Any work or action necessary to deliver essential public services, including but not limited to repairing water, gas, electricity, telephone, sewer facilities or public transportation facilities, removing fallen trees on public rights-of-way, dredging navigational waterways or abating life-threatening conditions.

IMPULSIVE SOUND
Either a single pressure peak or a single burst (multiple pressure peaks) that has a duration of less than one second.

MOTOR VEHICLE
Any vehicle that is propelled other than by human or animal power on land.

MUFFLER
A properly functioning sound-dissipative device or system for abating the sound of escaping gases on equipment where such a device is part of the normal configuration of the equipment.

MULTI-DWELLING-UNIT BUILDING
Any building comprising two or more dwelling units, including but not limited to apartments, condominiums, co-ops, multiple-family houses, townhouses and attached residences.

MULTI-USE PROPERTY

Any distinct parcel of land that is used for more than one category of activity. Examples include, but are not limited to:

A. A commercial, residential, industrial or public service property having boilers, incinerators, elevators, automatic garage doors, air conditioners, laundry rooms, utility provisions or health and recreational facilities or other similar devices or areas, either in the interior or on the exterior of the building, which may be a source of elevated sound levels at another category on the same distinct parcel of land; or

B. A building which is both commercial (usually on the ground floor) and residential property located above, behind, below or adjacent.

NOISE CONTROL OFFICER

An employee of a local, county or regional health agency which is certified pursuant to the County Environmental Health Act (N.J.S.A. 26:3A2-21 et seq.) to perform noise enforcement activities; or a Little Egg Harbor Township police officer and/or code enforcement officer who has received noise enforcement training and is currently certified in noise enforcement. The officer must be acting within his or her designated jurisdiction and must be authorized to issue a summons in order to be considered a noise control officer.

PLAINLY AUDIBLE

Any sound that can be detected by a person using his or her unaided hearing faculties. As an example, if the sound source under investigation is a portable or personal vehicular sound amplification or reproduction device, the detection of the rhythmic bass component of the music is sufficient to verify plainly audible sound. The noise control officer need not determine the title, specific words or the artist performing the song.

PRIVATE RIGHT-OF-WAY

Any street, avenue, boulevard, road, highway, sidewalk, alley or easement that is owned, leased or controlled by a nongovernmental entity.

PUBLIC RIGHT-OF-WAY

Any street, avenue, boulevard, road, highway, sidewalk, alley or easement that is owned, leased or controlled by a governmental entity.

PUBLIC SPACE

Any real property or structures thereon that are owned, leased or controlled by a governmental entity.

REAL PROPERTY LINE

Either:

A. The imaginary line, including its vertical extension, that separates one parcel of real property from another;

B. The vertical and horizontal boundaries of a dwelling unit that is part of a multi-dwelling-unit building; or

C. On a multi-use property, the distance between the two portions of the property on which different categories of activity are being performed (e.g., if the multi-use property is a building which is residential upstairs and commercial downstairs, then the "real property line" would be the interface between the residential area and the commercial area).

WEEKDAY

Any day that is not a federal holiday, and beginning on Monday at 7:00 a.m. and ending on the following Friday at 6:00 p.m.

WEEKEND

Beginning on Friday at 6:00 p.m. and ending on the following Monday at 7:00 a.m.

§ 242-3 **Applicability.**

A. This chapter applies to sound from the following property categories:

(1) Industrial facilities.

(2) Commercial facilities.

(3) Public service facilities.

(4) Community service facilities.

(5) Residential properties.

(6) Multi-use properties.

(7) Public and private rights-of-way.

(8) Public spaces.

(9) Multi-dwelling-unit buildings.

B. This chapter applies to sound received at the following property categories:

(1) Commercial facilities.

(2) Public service facilities.

(3) Community service facilities.

(4) Residential properties.

(5) Multi-use properties.

(6) Multi-dwelling-unit buildings.

C. Sound from stationary emergency signaling devices shall be regulated in accordance with N.J.A.C. 7:29-1.3, except that the testing of the electromechanical functioning of a stationary emergency signaling device shall not meet or exceed 10 seconds.

§ 242-4 **Noise control officers.**

A. It shall be the duty and the responsibility of a properly certified Little Egg Harbor Township police officer or code enforcement officer to enforce the provisions of this chapter. A person shall be qualified to be a noise control officer if the person meets the criteria set forth in the definition above and completes, at a frequency specified by the Department in N.J.A.C. 7:29-2.11, a noise certification and recertification course which are offered by the Department of Environmental Sciences of Cook College, Rutgers, The State University of New Jersey or any other noise certification or recertification course which is offered by an accredited university and approved by the Department.

B. Sound measurements made by a noise control officer shall conform to the procedures set forth at N.J.A.C. 7:29-2, except that interior sound level measurements shall also conform to the procedures set forth in § **242-5C** and **D** of this chapter and with the definition of "real property line" as contained herein.

C. Noise control officers shall have the power to:

(1) Coordinate the noise control activities of all departments in the Township of Little Egg Harbor and cooperate with all other public bodies and agencies to the extent practicable.

(2) Review the actions of the Township of Little Egg Harbor and advise of the effect, if any, of such actions on noise control.

(3) Review public and private projects, subject to mandatory review or approval by other departments or boards, for compliance with this chapter.

(4) Investigate and pursue possible violations of this chapter for sound levels which equal or exceed the sound levels set forth in Tables I and II,[1] when measured at a receiving property located within the designated jurisdiction of the noise control officer, in accordance with § **242-7** below.

[1] *Editor's Note: Table I is included in § **242-5D**, and Table II is included at the end of this chapter.*

(5) Cooperate with noise control officers of adjacent municipalities in enforcing one another's municipal noise ordinances.

§ 242-5 **Maximum permissible sound levels.**

A. No person shall cause, suffer, allow or permit the operation of any source of sound on any source property listed in § **242-3A** above in such a manner as to create a sound level that equals or exceeds the sound level limits set forth in Tables I and II when measured at or within the real property line of any of the receiving properties listed in Tables I and II, except as specified in Subsection **B** below.

B. When measuring total sound or residual sound within a multi-use property, or within a residential unit when the property line between it and the source property is a common wall, all exterior doors and windows shall be closed and the measurements shall be taken in the center of the room most affected by the noise. Residual sound shall be measured in accordance with N.J.A.C. 7:29-2.9(b)2. When measuring total sound or residual sound, all sound sources within the dwelling unit must be shut off (e.g., television, stereo). Measurements shall not be taken in areas which receive only casual use such as hallways, closets and bathrooms.

C. Indoor measurements shall only be taken if the sound source is on or within the same property as the receiving property, as in the case of a multi-use property (e.g., sound generated within a commercial unit of a multi-use property building and received within a residential unit of the same building) or multidwelling building. In addition, indoor measurements shall be taken if the property line between the receiving property and the source property is a common wall, such as in a multi-dwelling-unit building. The allowable sound level standards for indoors are as shown in Tables I and II.

D. Impulsive sound. Between 7:00 a.m. and 10:00 p.m., impulsive sound shall not equal or exceed 80 decibels. Between 10:00 p.m. and 7:00 a.m., impulsive sound which occurs less than four times in any hour shall not equal or exceed 80 decibels. Impulsive sound which repeats four or more times in any hour shall be measured as impulsive sound and shall meet the requirements as shown in Table I.

(1) Table I, Maximum Permissible A-Weighted Sound Levels.

(a) No person shall cause, suffer, allow or permit the operation of any source of sound on any source property listed in § **242-3A** above in such a manner as to create a sound level that equals or exceeds the sound levels listed below:

[1] Outdoors.

	Receiving Property Category		
	Residential Property or Residential Portion of a Multi-Use Property		**Commercial Facility, Public Service Facility, Nonresidential Portion of a Multi-Use Property or Community Service Facility**
	7:00 a.m. to 10:00 p.m.	**10:00 p.m. to 7:00 a.m.**	**24 Hours**
Maximum A-weighted sound level standard (dB)	65	50	65

[2] Indoors.

	Receiving Property Category		
	Residential Property or Residential Portion of a Multi-Use Property		**Commercial Facility,* or Nonresidential Portion of a Multi-Use Facility**
	7:00 a.m. to 10:00 p.m.	**10:00 p.m. to 7:00 a.m.**	**24 Hours**
Maximum A-weighted sound level standard (dB)	55	40	55

* NOTE: In those instances when a commercial facility shares a common wall/ceiling/floor with another facility that is producing the sound.

(2) Table II.[1]

[1] *Editor's Note: Table II, Maximum Permissible Octave Band Sound-Pressure Levels in Decibels, can be found at the end of this chapter.*

§ 242-6 **Restricted uses and activities.**

A. Except as provided in Subsection **C** below, the provisions of this chapter shall not apply to the exceptions listed at N.J.A.C. 7:29-1.4.

B. Construction and demolition activities are exempt from the sound level limits set forth in Tables I and II,[1] except as provided for in Subsection **C** below.

[1] *Editor's Note: Table I is included in § **242-5D**, and Table II is included at the end of this chapter.*

C. Notwithstanding the provisions of Tables I and II, the following standards shall apply to the activities or sources of sound set forth below:

(1) Noncommercial or nonindustrial power tools and landscaping and yard maintenance equipment shall not be operated between the hours of 8:00 p.m. and 8:00 a.m., unless such activities can meet the applicable limits set forth in Tables I and II. All motorized equipment used in these activities shall be operated with a muffler. At all other times, the limits set forth in Tables I and II do not apply to noncommercial or nonindustrial power tools and landscaping and yard maintenance equipment.

(2) Commercial or industrial power tools and landscaping and yard maintenance equipment, excluding emergency work, shall not be operated on a residential property or within 250 feet of a residential property line when operated on commercial or industrial property, between the hours of 6:00 p.m. and 7:00 a.m. on weekdays, or between the hours of 6:00 p.m. and 9:00 a.m. on weekends or federal holidays, unless such activities can meet the limits set forth in Tables I and II. In addition, commercial or industrial power tools and landscaping and yard maintenance equipment, excluding emergency work, utilized on commercial or industrial property shall meet the limits set forth in Tables I and II between the hours of 10:00 p.m. and 7:00 a.m. All motorized equipment used in these activities shall be operated with a muffler. At all other times, the limits set forth in Tables I and II do not apply to commercial or industrial power tools and landscaping and yard maintenance equipment.

(3) Construction and demolition activity, excluding emergency work, shall not be performed between the hours of 6:00 p.m. and 7:00 a.m. on weekdays, or between the hours of 6:00 p.m. and 9:00 a.m. on weekends and federal holidays, unless such activities can meet the limits set forth in Tables I and II. All motorized equipment used in construction and demolition activity shall be operated with a muffler. At all other times, the limits set forth in Tables I and II do not apply to construction and demolition activities.

(4) Motorized snow blowers, snow throwers and lawn equipment with attached snowplows shall be operated at all times with a muffler. At all times, the limits set forth in Tables I and II do not apply.

(5) An exterior burglar alarm of a building or motor vehicle must be activated in such a manner that the burglar alarm terminates its operation within five minutes for continuous airborne sound and 15 minutes for impulsive sound after it has been activated. At all times, the limits set forth in Tables I and II do not apply.

(6) Personal or commercial vehicular music amplification or reproduction equipment shall not be operated in such a manner that it is plainly audible at a residential property line between the hours of 10:00 p.m. and 8:00 a.m.

(7) Personal vehicular music amplification equipment shall not be operated in such a manner as to be plainly audible at a distance of 50 feet in any direction from the operator between the hours of 8:00 a.m. and 10:00 p.m.

(8) Self-contained, portable, hand-held music or sound amplification or reproduction equipment shall not be operated on a public space or public right-of-way in such a manner as to be plainly audible at a distance of 50 feet in any direction from

the operator between the hours of 8:00 a.m. and 10:00 p.m. Between the hours of 10:00 p.m. and 8:00 a.m., sound from such equipment shall not be plainly audible by any person other than the operator.

(9) Sound levels exceeding the limits set forth in Table I and Table II shall be prohibited between residential units within the same multi-dwelling-unit building. Measurements shall be taken indoors as per § **242-5B** and **C**.

§ 242-7 **Enforcement; violations and penalties.**

A. Violation of any provision of this chapter shall be cause for an enforcement document to be issued to the violator by the noise control officer according to procedures set forth in N.J.A.C. 7:29-1.6. The recipient of an enforcement document shall be entitled to a hearing in a Municipal Court having jurisdiction to contest such action.

B. Any person who violates any provision of this chapter shall be subject to a civil penalty for each offense of not more than $2,000. If the violation is of a continuing nature, each day during which it occurs shall constitute an additional, separate and distinct offense.

C. No provision of this chapter shall be construed to impair any common law or statutory cause of action, or legal remedy therefrom, of any person for injury or damage arising from any violation of this chapter or from other law.

Birds of Conservation Concern

WHAT ARE BIRDS OF CONSERVATION CONCERN?

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the U.S. Fish and Wildlife Service (USFWS) to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." **Birds of Conservation Concern 2008** is the most recent effort to carry out this mandate. Bird species considered for the BCC include:

- nongame birds
- gamebirds without hunting seasons
- subsistence-hunted nongame birds in Alaska
- ESA candidate, proposed, and recently delisted species

The overall goal of the Birds of Conservation Concern is to accurately identify the migratory and non-migratory bird species (beyond those already designated as Federally threatened or endangered) that represent our highest conservation priorities. Bird species considered for inclusion on lists in this report include nongame birds, gamebirds without hunting seasons, subsistence-hunted nongame birds in Alaska; and Endangered Species Act candidate, proposed endangered or threatened, and recently delisted species.

Birds of Conservation Concern *2008* encompasses three distinct geographic scales including at the National level (United States in its entirety, including island "territories" in the Pacific and Caribbean), at the North American Bird Conservation Initiative (NABCI) Bird Conservation Regions (BCRs) (http://www.nabci-us.org/map.html), and at U.S. Fish and Wildlife Service Regions (https://www.fws.gov/where/) level. This is primarily derived from assessment scores from three major bird conservation plans: the Partners in Flight (http://www.partnersinflight.org/)North American Landbird Conservation Plan, the United States Shorebird Conservation Plan (https://www.fws.gov/shorebirdplan/USShorebird.htm) , and the North American Waterbird Conservation Plan (http://www.waterbirdconservation.org/plans.html).

The **Birds of Conservation Concern** includes some non-MBTA-protected species because their conservation status and efforts are of concern to the U.S. Fish and Wildlife Service.

To maximize the usefulness of this report to multiple partners, the **Birds of Conservation Concern** *2008* lists are presented in 46 separate tables, comprising 37 BCR lists (Tables 2 to 38), 8 USFWS Region lists (Tables 39 to 47) and 1 National list (Table 48). Summaries of the status of each species at each of the three distinct geographic scales are provided in Appendix B, and a list of scientific names of all species mentioned is found in Appendix C. The BCR lists range from 10 to 53 species, U.S. Fish and Wildlife Service Region lists range from 27 to 78 species, and the National list consists of 147 species. The number of priority species represents roughly 10 to 15 percent of all bird species of any given geographic unit. View table (342.6KB) (../../../migratorybirds/pdf/management/BCC2008.pdf).

Last Updated: September 25, 2015

Migratory Bird Treaty Act

BIRDS PROTECTED

The Migratory Bird Treaty Act (https://www.fws.gov/laws/lawsdigest/migtrea.html) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. The migratory bird species protected by the Act are listed in 50 CFR 10.13 (../../../migratorybirds/pdf/policies-and-regulations/MBTAListofBirdsFinalRule.pdf).

Alphabetical list of MBTA protected birds (../../management/managed-species/migratory-bird-treaty-act-protected-species.php)

The U.S. Fish and Wildlife Service has statutory authority and responsibility for enforcing the Migratory Bird Treaty Act (https://www.fws.gov/laws/lawsdigest/MIGTREA.HTML) (MBTA) (16 U.S.C. 703-712), the Fish and Wildlife Improvement Act (https://www.fws.gov/laws/lawsdigest/FWIMPR.HTML) of 1978 (16 U.S.C. 742l) and the Fish and Wildlife Act (https://www.fws.gov/laws/lawsdigest/FWACT.HTML) of 1956 (16 U.S.C. 742a-j). The MBTA implements Conventions between the United States and four countries (Canada, Mexico, Japan and Russia) for the protection of migratory birds.

What criteria are used to identify individual species protected by the MBTA?

A species qualifies for protection under the MBTA by meeting one or more of the following four criteria:

(1) It is covered by the Canadian Convention (https://www.fws.gov/laws/lawsdigest/treaty.html#MIGBIRDCAN) of 1916, as amended in 1996, by virtue of meeting the following three criteria: (a) It belongs to a family or group of species named in the Canadian Convention, as amended; (b) Specimens, photographs, videotape recordings or audiotape recordings provide convincing evidence of natural occurrence in the United States or its territories; and (c) The documentation of such records has been recognized by the AOU or other competent scientific authorities.

(2) It is covered by the Mexican Convention (https://www.fws.gov/laws/lawsdigest/treaty.html#MIGBIRDMEX) of 1936, as amended in 1972, by virtue of meeting the following three criteria: (a) It belongs to a family or group of species named in the Mexican Convention, as amended; (b) Specimens, photographs, videotape recordings or audiotape recordings provide convincing evidence of natural occurrence in the United States or its territories; and (c) The documentation of such records has been recognized by the AOU or other competent scientific authorities.

(3) It is listed in the annex to the Japanese Convention (https://www.fws.gov/laws/lawsdigest/treaty.html#MIGBIRDJAP) of 1972, as amended.

(4) It is listed in the appendix to the Russian Convention (https://www.fws.gov/laws/lawsdigest/treaty.html#MIGBIRDSOV) of 1976.

In accordance with the Migratory Bird Treaty Reform Act of 2004 (MBTRA) (Pub. L. No. 108-447, 118 Stat. 2809, 3071-72), we included all species native to the United States or its territories, which are those that occur as a result of natural biological or ecological processes (See 70 FR 12710, March 15, 2005). We did not include nonnative species whose occurrences in the United States are solely the result of intentional or unintentional human-assisted introduction(s).

Last Updated: December 3, 2017

Eagle Permits

Midwest Region

EAGLE PERMITS HOME

PERMIT FOR NON-PURPOSEFUL TAKE

PERMIT TO REMOVE AN EAGLE NEST

PERMITS TO TAKE, POSSESS, OR TRANSPORT EAGLES

PERMIT APPLICATION FORMS

EAGLE NATURAL HISTORY & SENSITIVITY TO HUMAN ACTIVITY

DEFINITIONS

CONTACT US

U.S. Fish & Wildlife Service
5600 American Blvd. West,
Suite 990
Bloomington, MN 55437-1458
Phone: 612-713-5360

The Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

"Disturb" means: “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment.

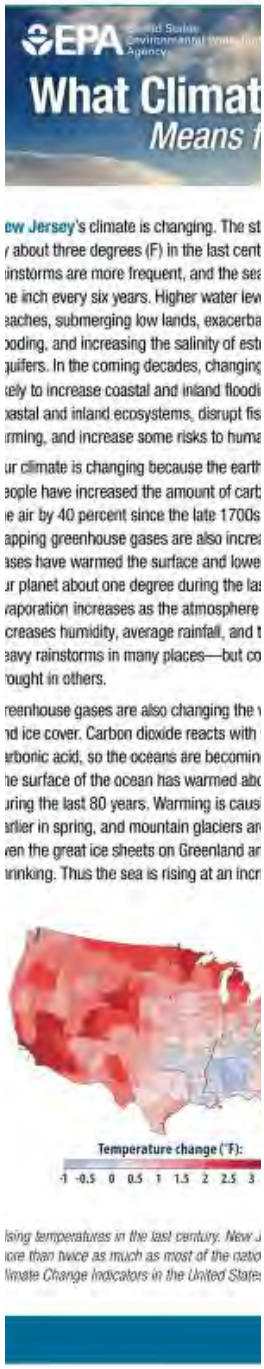
A violation of the Act can result in a fine of $100,000 ($200,000 for organizations), imprisonment for one year, or both, for a first offense. Penalties increase substantially for additional offenses, and a second violation of this Act is a felony.

A copy of the Bald and Golden Eagle Protection Act is available at: http://www.fws.gov/permits/ltr/ltr.html.

Bald and Golden Eagle Act Permit Regulations - Code of the Federal Register 50 Part 22

Eagle Permits Home

Last updated: February 1, 2016



What Climate Change Means for New Jersey (EPA 430-F-16-032)

by United States Environmental Protection Agency

Publication date 2016-08

Topics climate change, environment, EPA, United States of America
Collection opensource
Language English

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23 Views

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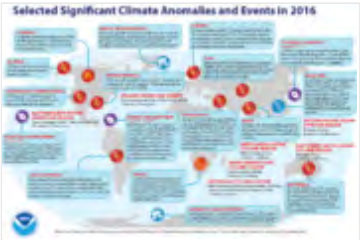

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