

INC. VILLAGE OF FREEPORT

Department of Buildings

46 NORTH OCEAN AVENUE
FREEPORT, NEW YORK 11520
(516) 377-2242
FAX (516) 377-2493

ROBERT T. KENNEDY
MAYOR

E-MAIL BUILDINGDEPT@FREEPORTNY.GOV

JOSEPH M. MADIGAN
SUPERINTENDENT
OF BUILDINGS

December 5, 2013

Raymond Andrews, R.A.
Assistant Director for Code Development
NYS Department of State, Codes Division
99 Washington Avenue, Suite 1160
Albany, New York 12231

Re: Flood Damage Prevention

Dear Mr. Andrews:

Enclosed herewith please find The Village of Freeport's Petition to the State Fire Prevention & Building Code Council for the incorporation of more restrictive local standards.

This Local Law change was adopted by the Mayor and Board of Trustees for the Incorporated Village of Freeport on December 2, 2013.

Should you need anything further, please feel free to contact the undersigned or Joseph Madigan, Superintendent of Buildings.

Very truly yours,

Mayor Robert T. Kennedy

RTK/lc
Encls.



New York State Department of State
 Division of Code Enforcement and Administration
 Code Development Unit

**Petition to the State Fire Prevention & Building Code Council
 for the Incorporation of More Restrictive Local Standards**

The chief executive officer or the chairperson of the legislative body of such local government shall petition the State Fire Prevention and Building Code Council for a determination as to whether or not the local law or ordinance is more restrictive than the provisions contained in the New York State Uniform Fire Prevention and Building Code. Such petition shall be submitted within 30 days of enactment or adoption of the local law or ordinance. Any petition failing to comply with the requirements listed below may be rejected by the Council as incomplete; in which case, the local ordinance would not be legally enforceable in the municipality.

The petition from a local government for the incorporation of more restrictive local standards must contain the following:

- A certified copy of the local law or ordinance, indicating the date of enactment.
- A legislative finding setting forth the special conditions prevailing within the municipality which warrant imposing more restrictive local standards.
- Documentation which includes substantiation (such as research reports, statistical analysis, and field-related experience) showing that such local law or ordinance conforms to accepted engineering and fire prevention practices and does not discriminate against material products, methods or systems of demonstrated capabilities.
- An analysis of each section of the local law or ordinance, indicating the content and comparable sections of the New York State Uniform Fire Prevention and Building Code.
- Copies of meeting minutes and/or transcripts if available from meetings or hearings in which the local law or ordinance was discussed and adopted.

The petition shall be reviewed based upon the following criteria:

- Where the council finds that such higher or more restrictive standards are reasonably necessary because of special conditions prevailing within the local government as stated in Section 379(2) of the New York State Uniform Fire Prevention and Building Code Act, the State Fire Protection and Building Code Council shall consider the request based on the merits of the petition.

(Village, Town, City of - please circle one)

Local government name: INCORPORATED Village of Freeport

Chief executive officer (name and title): Mayor Robert T. Kennedy

Local government contact person: Joseph Madigan, Supt of Buildings / Flood Plain Manager

Address: 46 N Ocean Ave, Freeport, NY 11520

Telephone number: 516 377-2249 Fax: 516 377-2493

E-mail address: JMADIGAN@Freeport.ny.gov Date: 12-6-13

Please submit this form and all necessary documentation to substantiate the above proposal to: Raymond Andrews, R.A., Assistant Director for Code Development, NYS Department of State, Codes Division, 99 Washington Ave., Suite 1160, Albany, New York 12231. If you have questions concerning submission requirements, please call the Code Development Unit at (518) 474-4073, e-mail: Raymond.andrews@dos.ny.gov or fax: (518) 486-4487.

ATTACHED IN A COPY FROM THE 2010
RESIDENTIAL CODE OF NEW YORK STATE

applicant shall demonstrate that the effect of the proposed buildings and structures on design flood elevations, including fill, when combined with all other existing and anticipated flood hazard area encroachments, will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction.

R324.1.4 Lowest floor. The lowest floor shall be the floor of the lowest enclosed area, including basement, but excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

R324.1.5 Protection of mechanical and electrical systems. Electrical systems, equipment and components, and heating, ventilating, air conditioning and plumbing appliances, plumbing fixtures, duct systems, and other service equipment shall be located at or above the design flood elevation plus freeboard as specified in Section R323.1.3.3. If replaced as part of a substantial improvement, electrical systems, equipment and components, and heating, ventilating, air conditioning, and plumbing appliances, plumbing fixtures, duct systems, and other service equipment shall meet the requirements of this section. Systems, fixtures, and equipment and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

Exception: Electrical systems, equipment and components, and heating, ventilating, air conditioning and plumbing appliances, plumbing fixtures, duct systems, and other service equipment are permitted to be located below the design flood elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood-resistant construction requirements of the *Building Code of New York State*. Electrical wiring systems are permitted to be located below the design flood elevation provided they conform to the provisions of the electrical part of this code for wet locations.

R324.1.6 Protection of water supply and sanitary sewage systems. New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the systems in accordance with the plumbing provisions of this code. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into systems and discharges from systems into floodwaters in accordance with the plumbing provisions of this code.

R324.1.7 Flood-resistant materials. Building materials used below the design flood elevation shall comply with the following:

1. All wood, including floor sheathing, shall be pressure-preservative-treated in accordance with AWWA

UI for the species, product, preservative and end use or be the decay-resistant heartwood of redwood, black locust or cedars. Preservatives shall be listed in Section 4 of AWWA UI.

2. Materials and installation methods used for flooring and interior and exterior walls and wall coverings shall conform to the provisions of FEMA/FIA-TB-2

R324.1.8 Manufactured housing. New or replacement manufactured housing shall be elevated in accordance with Section R324.2 and the anchor and tie-down requirements of Sections AE604 and AE605 of Appendix E shall apply. The foundation and anchorage of manufactured housing to be located in identified flood ways as established in Table R301.2(1) shall be designed and constructed in accordance with the applicable provisions in the *Building Code of New York State*.

R324.1.9 As-built elevation certifications. A licensed land surveyor or registered design professional shall certify that the building or structure is in compliance with the elevation requirements of Section R323.2 or R323.3.

R324.2 Flood hazard areas (including A Zones). Areas that have been determined to be prone to flooding but not subject to high velocity wave action shall be designated as flood hazard areas. All buildings and structures constructed in whole or in part in flood hazard areas shall be designed and constructed in accordance with Sections R324.2.1 through R324.2.3.

R324.2.1 Elevation requirements.

1. Buildings and structures shall have the lowest floors elevated to or above the design flood elevation plus freeboard as specified in Section R324.1.3.3.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated at least as high above the highest adjacent grade as the depth number specified in feet (mm) on the FIRM, or at least 2 feet (610 mm) if a depth number is not specified.
3. Basement floors that are below grade on all sides shall be elevated to or above the design flood elevation plus freeboard as specified in Section R323.1.3.3.

Exception: Enclosed areas below the design flood elevation, including basements whose floors are not below grade on all sides, shall meet the requirements of Section R324.2.2.

R324.2.2 Enclosed area below design flood elevation. Enclosed areas, including crawl spaces, that are below the design flood elevation shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria:
 - 2.1. There shall be a minimum of two openings on different sides of each enclosed area; if a building has more than one enclosed area below the

THESE ARE NOT OFFICIAL DIRECTIVES UNTIL SAME HAVE BEEN APPROVED BY THE MAYOR AND BOARD OF TRUSTEES, AS THEY MAY BE AMENDED OR CORRECTED.

DIRECTIVE

TO: Howard E. Colton, Village Attorney July 10, 2013

FROM: Pamela Walsh Boening, Village Clerk

The following directive is an excerpt of the Minutes of the Board of Trustees' Meeting of July 8, 2013:

It was moved by Trustee White, seconded by Trustee Martinez, that the following resolution be adopted:

A LOCAL LAW TO AMEND CHAPTER 87 "FLOOD DAMAGE PREVENTION" BY AMENDING SECTION 87-16 "STANDARDS FOR ALL STRUCTURES" TO PERMIT THE SUPERINTENDENT TO MINIMIZE PUBLIC AND PRIVATE LOSSES DUE TO FLOOD CONDITIONS IN SPECIFIC AREAS

2. Chapter 87, §87-16.D(1)(a), which reads as follows is hereby repealed:

D. Utilities.

(1) Location.

(a) New and replacement electrical equipment, heating, ventilating, air conditioning, plumbing connections, and other service equipment shall be located at or above the base flood elevation or be designed to prevent water from entering and accumulating within the components during a flood and to resist hydrostatic and hydrodynamic loads and stresses. Electrical wiring and outlets, switches, junction boxes, and panels shall be elevated to 10 feet mean sea level unless they conform to the appropriate provisions of the electrical part of the Building Code of New York State or the Residential Code of New York State for location of such items in wet locations.

2. Chapter 87, §87-16.D(1)(a), which reads as follows is hereby adopted:

D. Utilities.

(1) Location.

(a) New and replacement electrical equipment, heating, ventilating, air conditioning, plumbing connections, and other service equipment shall be located at or above the base flood elevation or be designed to prevent water from entering and accumulating within the components during a flood and to resist hydrostatic and hydrodynamic loads and stresses. Electrical wiring and outlets, switches, junction boxes, and panels shall be elevated to a minimum of four feet above the base flood elevation or two feet above the New York State freeboard requirement whichever is greater.

3. Chapter 87, §87-16.E(1)(a), which reads as follows is hereby repealed:

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E. Residential structures.

(1) Elevation. The following standards apply to new and substantially improved residential structures located in areas of special flood hazard, in addition to the requirements in §§87-15B and C and 87-16.

(a) Within Zones A1-A30, AE, AH, and also Zone A, if base flood elevation data are available, new construction and substantial improvements shall have the lowest floor (including basement) elevated to or above two feet above the base flood elevation.

4. Chapter 87, §87-16.E(1)(a), which reads as follows is hereby adopted:

E. Residential structures.

(1) Elevation. The following standards apply to new and substantially improved residential structures located in areas of special flood hazard, in addition to the requirements in §§87-15B and C and 87-16.

(a) Within Zones A1-A30, AE, AH, and also Zone A, if base flood elevation data are available, new construction and substantial improvements shall have the lowest floor (including basement) elevated to a minimum of four feet above the base flood elevation or two feet above the New York State freeboard requirement whichever is greater.

5. Chapter 87, §87-16.R(1)(a), which reads as follows is hereby repealed:

R. Nonresidential structures. The following standards apply to new and substantially approved commercial, industrial, and other nonresidential structures located in areas of special flood hazard, in addition to the requirements in §§87-15B and C, and 87-16:

(1) Within Zones A1-A30, AE, AH, and also Zone A if base flood elevation data area available, new construction and substantial improvements of any nonresidential structure, together with attendant utility and sanitary facilities, shall either:

(a) Have the lowest floor, including basement or cellar, elevated to or above two feet above the base flood elevation: or

6. Chapter 87, §87-16.R(1)(a), which reads as follows is hereby adopted:

R. Nonresidential structures. The following standards apply to new and substantially approved commercial, industrial, and other nonresidential structures located in areas of special flood hazard, in addition to the requirements in §§87-15B and C, and 87-16:

(1) Within Zones A1-A30, AE, AH, and also Zone A if base flood elevation data area available, new construction and substantial improvements of any nonresidential structure, together with attendant utility and sanitary facilities, shall either:

(a) Have the lowest floor, including basement or cellar, elevated to minimum of four feet above the base flood elevation or two feet above the New York State freeboard requirement which is greater.

7. This local law shall take effect immediately upon filing with the Office of the Secretary of State.

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The Clerk polled the Board as follows:

Deputy Mayor Piñeyro	In Favor
Trustee White	In Favor
Trustee Martinez	In Favor
Trustee Ellerbe	In Favor
Mayor Kennedy	Excused

Copy to:

<u>X</u> Auditor	<u>X</u> Court	<u>X</u> Purchasing
<u>X</u> Assessor	<u>X</u> File	<u>X</u> Registrar
<u>X</u> Attorney	<u>X</u> Fire Dept.	<u>X</u> Rec. Center
<u>X</u> Bldg. Dept.	<u>X</u> Electric Utili.	<u>X</u> Treasurer
<u>X</u> Board & Comm.	<u>X</u> Personnel	<u>X</u> Deputy Treasurer
<u>X</u> Claims Examiner	<u>X</u> Police Dept.	<u>X</u> Deputy Village Clerk
<u>X</u> Comm. Dev.	<u>X</u> Publicity	
<u>X</u> Comptroller	<u>X</u> Public Works	



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DIRECTIVE

TO: Howard E. Colton, Village Attorney July 10, 2013

FROM: Pamela Walsh Boening, Village Clerk

The following directive is an excerpt of the Minutes of the Board of Trustees' Meeting of July 8, 2013:

It was moved by Trustee Ellerbe, seconded by Trustee White, that the following resolution be adopted:

WHEREAS, the Board of Trustees of the Incorporated Village of Freeport, as lead agency, has determined that the proposed action described below, will not have a significant effect on the environment and neither a draft environmental impact statement nor a final environmental impact statement will be prepared; and,

WHEREAS, the proposed action a proposed amendment to Chapter 87, entitled "Flood Damage Prevention" by repealing said Chapter and adopting a new Chapter 87 entitled "Flood Damage Prevention" to comply with recently enacted Federal statutes.

WHEREAS, this Board determines that the proposed action is an unlisted action, as that term is defined in the New York State Environmental Quality Review Act, herein after referred to as SEQRA. After careful consideration, the Board has concluded that the proposed action will not have a significant effect on the environment for the following reasons:

1. The proposed action will not result in a substantial adverse change in the existing air quality, ground or surface water quality, traffic or noise level, will not affect solid waster production, and will not affect erosion, flooding, leaching or drainage problems.
2. The proposed action will not result in the removal or destruction of large quantities of vegetation or fauna nor interfere with the movement or any resident or migratory fish or wildlife species, nor impact on a significant habitat area, nor result in any other significant adverse effect to natural resources.
3. The proposed action will not encourage or attract a large number of people.
4. The proposed action is consistent with the community's current plans and goals for enforcement of Village laws.
5. The proposed action would not impair the character or quality of important historical, archeological, architectural or aesthetic resources of the Village.
6. The proposed action will not bring about a major change in the use of either the quantity or type of energy.

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7. The proposed action will not create a hazard to human health.
8. The proposed action will not produce a substantial change in the use or intensity of land, including cultural or recreational resources, or its capacity to support existing uses.
9. The proposed action will not create a material demand for other actions that would result in any of the above consequences.
10. The proposed action will not change two or more elements in the environment, which when considered together could result in a substantial adverse impact on the environment.
11. When considered cumulatively with other actions, the proposed action will not have a significant effect on the environment or meet one of the above criteria.

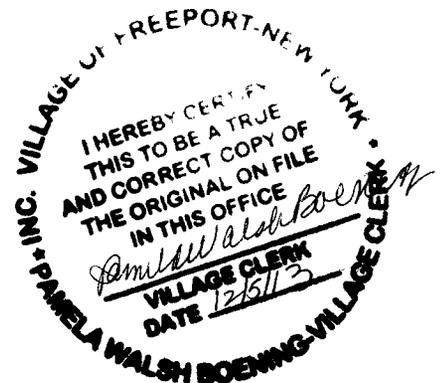
NOW THEREFORE BE IT RESOLVED, that the Board of Trustees of the Incorporated Village of Freeport, after reviewing the above criteria has determined that the proposed action is not environmentally significant.

The Clerk polled the Board as follows:

Deputy Mayor Piñeyro	In Favor
Trustee White	In Favor
Trustee Martinez	In Favor
Trustee Ellerbe	In Favor
Mayor Kennedy	Excused

Copy to:

<input checked="" type="checkbox"/> Auditor	<input checked="" type="checkbox"/> Court	<input checked="" type="checkbox"/> Purchasing
<input checked="" type="checkbox"/> Assessor	<input checked="" type="checkbox"/> File	<input checked="" type="checkbox"/> Registrar
<input checked="" type="checkbox"/> Attorney	<input checked="" type="checkbox"/> Fire Dept.	<input checked="" type="checkbox"/> Rec. Center
<input checked="" type="checkbox"/> Bldg. Dept.	<input checked="" type="checkbox"/> Electric Utili.	<input checked="" type="checkbox"/> Treasurer
<input checked="" type="checkbox"/> Board & Comm.	<input checked="" type="checkbox"/> Personnel	<input checked="" type="checkbox"/> Deputy Treasurer
<input checked="" type="checkbox"/> Claims Examiner	<input checked="" type="checkbox"/> Police Dept.	<input checked="" type="checkbox"/> Deputy Village Clerk
<input checked="" type="checkbox"/> Comm. Dev.	<input checked="" type="checkbox"/> Publicity	
<input checked="" type="checkbox"/> Comptroller	<input checked="" type="checkbox"/> Public Works	



VILLAGE OF FREEPORT
BUILDING DEPARTMENT
INTER-DEPARTMENT CORRESPONDENCE

To: Mayor Robert T. Kennedy
From: Joseph Madigan, Superintendent of Buildings
Date: July 1, 2013

RE: Village Ordinance §87
Flood Damage Prevention

We are request a Public Hearing for July 8, 2013, to Amend sections of Village Ordinance §87, Flood Damage Prevention.

Due to Super Storm Sandy and the forecast for Sea Level Rising along with Hurricane Cycles, we are requesting a a change to the Code of the Village of Freeport, Chapter 87, "Flood Damage Prevention". This is for all new construction or substantially improved construction (more than 50% of the value of the structure minus land value). In addition, we are requesting that the only datum to be used, will be the North American Vertical Datum of 1988 (NAVD88).

The purpose is to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas due to water or erosion hazards. To require that uses vulnerable to floods, be protected against flood damage at the time of initial construction. We are recommending that the lowest floor be at an elevation of a minimum of four feet above the base flood elevation or two feet above the New York State freeboard requirement whichever is greater. This more restrictive requirement will earn the Village of Freeport additional credits through the NFIP (National Flood Insurance Program) CRS (Community Rating System). The Village of Freeport is now at a Class 7 which entitles all structures in a flood zone to a 15% reduction in their flood insurance. The additional credits will put Freeport on a path to a Class 6 (20%).

Therefore, based upon the foregoing we are requesting that §87 be amended as indicated below:

§87-4. Word usage; definitions. MEAN SEA LEVEL

Deleted:

For the purposes of the National Flood Insurance Program, the national Geodetic Vertical Datum (NGVD) of 1929, the North American Vertical Datum of 1988 (NAVD 88), or other datum to which base flood elevations shown on a community's Flood Insurance Rate Map are referenced.

Added:

For the purposes of the National Flood Insurance Program, the North American Vertical Datum of 1988 (NAVD 88).

§87-16.D.(1)(a) Utilities

Deleted:

- (a) New and replacement electrical equipment, heating, ventilating, air conditioning, plumbing connections, and other service equipment shall be located at or above the base flood elevation or be designed to prevent water from entering and accumulating within the components during a flood and to resist hydrostatic and hydrodynamic loads and stresses. Electrical wiring and outlets, switches, junction boxes, and panels shall be elevated to 10 feet mean sea level unless they conform to the appropriate provisions of the electrical part of the Building Code of New York State or the Residential Code of New York State for location of such items in west locations.

Added:

§87-16D.(1)(a) Utilities. The following standards apply to new development, including new and substantially improved structures, in the areas of special flood hazard shown on the Flood Insurance Rate Map.

- (a) New and replacement electrical equipment, heating, ventilating, air conditioning, plumbing connections, and other service equipment shall be located at a **minimum of four feet above the base flood elevation or two feet above the New York State freeboard requirement whichever is greater.**
(**Bold print indicates new language.**)

87-16.E.(1)(a) Residential structures.

Deleted:

- (a) Within Zones A1-A30, AE, AH, and also Zone A, if base flood elevation data are available, new construction and substantial improvements shall have the lowest floor (including basement) elevated to or above two feet above the base flood elevation.

Added:

- (a) Within Zones A1-A30, AE, AH, and also Zone A, if base flood elevation data are available, new construction and substantial improvements shall have the lowest floor (including basement) elevated to a minimum of **four feet above the base flood elevation or two feet above the new York State freeboard requirement whichever is greater.**
(**Bold print indicates new language.**)

87-16.R.(1)(a) Nonresidential structures.

Delete:

- (a) Have the lowest floor, including basement or cellar, elevated to or above two feet above the base flood elevations; or

Added:

- (a) Have the lowest floor, including basement or cellar, elevated to a **minimum of four feet above the base flood elevation or two feet above the new York State freeboard requirement whichever is greater.**

(Bold print indicates new language.)

Should you have any questions concerning this matter, please feel free to contact me.



Joseph Madigan
Superintendent of Buildings
Floodplain Manager/Mitigation Coordinator

JM/lc

C: Howard Colton, Village Attorney
Pamela Walsh Boening, Village Clerk

GUIDE FOR INCORPORATION OF MORE RESTRICTIVE LOCAL STANDARD

Does the proposed local standard significantly affect the level of protection from the hazards of fire?

The proposed local standard can significantly enhance the level of protection from the hazards of fire in that the elevated structure will have all electrical outlets, switches, outlets, wiring, and panel boxes elevated above the Base Flood Elevation. During Hurricane Sandy we had homes and businesses burn down due to flood waters entering the panel boxes.

Does the proposed local standard provide a minimum level of protection to all people of the State from the hazards of inadequate building construction and maintenance?

The requested more restrictive code will provide a basic minimum level of protection to the residents of the Village of Freeport from the hazards of inadequate building construction and maintenance.

Does the proposed local standard provide protection to both residential and non-residential buildings?

The requested more restrictive code is applicable to both residential and non-residential buildings.

Does the proposed local standard increase the cost of doing business in the State by perpetuating multiple requirements, jurisdictional overlap and business uncertainties or artificially induce high construction costs?

The more restrictive code will not increase the cost of doing business in the State, and will not perpetuate multiple requirements or jurisdictional overlap and/or business uncertainties, and will not artificially induce high construction costs.

Are the special conditions self-imposed? No, the Village of Freeport is unique geographically being it is a very low lying community located on the South Shore of Long Island and the entire flood zone is built on marsh land. The grade elevations in our flood zone are lower than in the surrounding communities.

Are the requested standards the least that are warranted by the special conditions?

The requested more restrictive lowest floor code request is the least requested by the special conditions. The Village of Freeport at this time feels that this elevation is adequate to promote the protection of life and property and to enhance the resiliency of our community.

Describe any specific impact that local standard will have on the following:

Code Administration – The Building Department will enforce the more restrictive code.

Design - Design professionals will submit plans based upon the more restrictive code.

Construction – All new construction or construction on substantially damaged or substantially improved structures will have to meet the new more restrictive code.

Maintenance – Periodic checks for compliance with more restrictive code requirements ,Ex: maintaining flood vents and or no construction below the required lowest floor.

Affordability - the more restrictive code will not impede reconstruction or new construction. The cost for the additional 2 feet of freeboard is minimal when compared to the overall cost of a newly constructed structure or an elevation project. The cost savings over time for flood insurance far outweighs any additional cost for construction.

Usability – Allows the residents the opportunity to safely reside in their homes year round without the hardship of being flooded during an event. It also promotes resiliency and provides a better opportunity for local businesses to remain open to serve the residents needs during an event.

Life Safety – Helps to ensure that all homeowners who are required to meet the higher standards can feel assured that their homes and the foundations of their homes will be able to withstand the effects of a major flooding event. As stated previously, during Hurricane Sandy, there were multiple homeowners who were lucky to survive the storm due to foundation collapses.

Liability – There is no liability with the more restrictive code change.

Insurance – The insurance issue plays a major role in maintaining our community whole. The effects of high flood insurance rates may be a huge detriment to the tax base of our Village. Presently, a structure that is constructed to three (3) feet above the base flood elevation will benefit from the greatest decrease in flood insurance rates. We are seeking to go to four (4) feet above the base flood elevation in an effort to remain proactive to possible changes in the Flood Insurance Rate Maps. The more restrictive code allows for sustainability, resiliency and economic continuity. Additionally, the adoption of a more restrictive code will benefit our community rating as a CRS community. Presently out rating of a Class 7 allows for our residents to benefit from a 15% automatic reduction in their flood insurance premiums. The adoption of a more restrictive code may allow for us to be rated a 6 which would allow for the residents to benefit from a 20% reduction in their flood insurance premiums.

Property safety – The installation of flood vents in conjunction with the higher lowest floor requirement, addresses life safety and property protection related issues. It also addresses the protection of foundations to prevent foundation collapses and electrical fires on mitigated homes.

Flexibility – N/A

Jobs – N/A

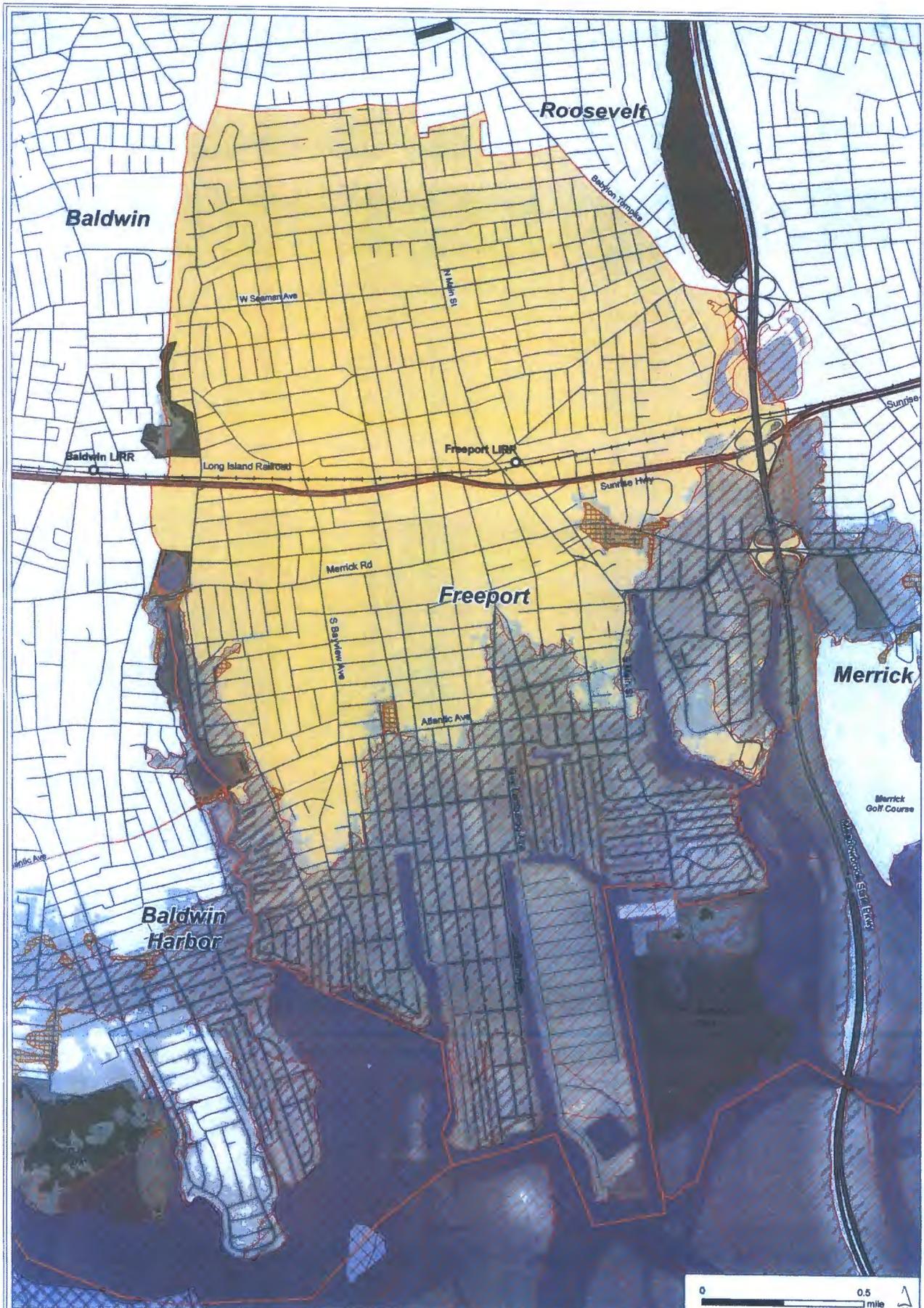
The Village of Freeport lies on the south shore of Long Island. Approximately 1/3 of our Village is in an AE flood zone. The revised 2009 flood maps now have a V zone skirting our properties. We have 3, 515 structures in our flood zone. As of 9/10/13 we have 1,212 Repetitive loss properties.

The more restrictive standard requested for the Village of Freeport will provide both residential and non-residential protection. The additional 2 feet of requested freeboard on new or substantially improved or substantially damaged structures will enhance community resilience , by enabling our citizens to stay in their homes , reduce flood insurance premiums and allow businesses to stay open and avoid the damage that could put them out of business for good. It is also a life safety issue. During Hurricane Sandy there were some residents who stayed in their homes. Some of these people almost lost their lives when their foundation walls collapsed. If a home is elevated, local, state, and federal regulations require for flood vents to be installed to equalize the hydrostatic or hydrodynamic loads on the foundation. This venting will alleviate the damages which these loads can impose.. At this time, just over a year after Hurricane Sandy, there are more than 150 vacant properties in our flood zone. Many people have not returned to their homes.

The savings in flood insurance due to the higher elevation in conjunction with our present 15% savings due to our 7 rating as a CRS community, will allow people to stay in their homes and make those structures more viable for either insuring or selling. At this time, due to the Biggert-Waters Flood Insurance Reform Act of 2012, new quotes on flood insurance rates are astronomical. These insurance rates are almost a reverse condemnation in that our businesses and homeowners cannot sell these properties at competitive local real estate market rates. Additionally, a prospective homebuyer may become disinterested in purchasing a property in the Freeport Flood Zone whose initial flood insurance rates in addition to property taxes may not make it feasible for a new homeowner to afford. As per FEMA documentation, (attached) a homeowner can save over \$90,000 over a 10 year period if you build 3 feet above the base flood elevation. Please see attached document wherein a structure 4 feet below the BFE (Base Flood Elevation) will pay in excess of \$9,500 a year. At 3 feet above the BFE, the cost is only \$427.00. At this time, we expect hundreds of homes to be elevated via a HMGP "Hazard Mitigation Grant Program" and with funding assistance via the New York Rising Program. The time to act is now. This will ensure a viable real estate market and a safe community.

The Village of Freeport has amended our code for the maximum allowable height of a structure which was originally 35 feet. We now allow up to 45 feet and we have waived the Sky Exposure Plane. The aforementioned code amendments are for new construction or mitigated structures only.

Please see attached documentation for Mitigation and Community Resilience, Climate change etc.



**Freeport:
Sandy Inundation
& Floodzones**
September 2013

- Study Area
- Counties
- Parks
- Water
- V zone
- 100 year
- 500 year
- Place Boundaries



ESRI - roads, railroads, water bodies
NOAA - coastline
FEMA - Sandy inundation, floodzones
US Census - towns, places, counties





**Freeport:
Department of State
Risk Areas**
September 2013

- | | |
|------------|------------------|
| Study Area | Extreme |
| Counties | High |
| Parks | Moderate |
| Water | Place Boundaries |

ESRI - roads, railroads, water bodies
NOAA - coastline
NYS DOS - risk areas
US Census - towns, places, counties



1 INCORPORATED VILLAGE OF
2 FREEPORT
3 BOARD OF TRUSTEES MEETING

4 MUNICIPAL BUILDING
5 46 North Ocean Ave
6 Freeport, NY 11520

7 July 8, 2013
8 8:00 p.m.

8 M E M B E R S:

9 CARMEN J. PINEYRO	DEPUTY MAYOR
10 JORGE MARTINEZ	TRUSTEE
11 RONALD ELLERBE	TRUSTEE
12 WILLIAM H. WHITE	TRUSTEE
13 PAMELA WALSH BOENING	VILLAGE CLERK
14	****
15 ROBERT MCLAUGHLIN	DEPUTY VILLAGE ATTORNEY

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4 MR. MCLAUGHLIN: Deputy Mayor and Board of
5 Trustees, the second hearing we are seeking to
6 amend Village Ordinance Flood Damage Prevention
7 87, which is also in reference to Super Storm
8 Sandy and it's seeking to, Flood Damage
9 Prevention, raise the elevation to which
10 residents have their placed electrical
11 equipment, heating, ventilation, air
12 conditioning and plumbing systems. Prior to
13 the Building Department describing the goals of
14 the statute I ask that the following documents
15 be marked into evidence. Exhibit A- the
16 Affidavit of Posting, Exhibit B- the Affidavit
17 of Publication, Exhibit C- Notice of the Public
18 Hearing, Exhibit D- Village Board of Trustees
19 Directive Setting and Public Hearing, Exhibit
20 E- the Negative Declaration for the Negative
21 Environmental Declaration from the Building
22 Department's Superintendent and Exhibit F- the
23 Draft Resolution for New York State
24 Environmental Quality Review Act.

25 At this time I ask for a motion to take a

1 Draft Resolution for Resolution?
2 DEPUTY MAYOR PINEYRO: Motion?
3 TRUSTEE ELLERBE: So moved.
4 TRUSTEE WHITE: Second.
5 THE CLERK: Deputy Mayor Pineyro?
6 DEPUTY MAYOR PINEYRO: In favor.
7 THE CLERK: Trustee White?
8 TRUSTEE WHITE: In favor.
9 THE CLERK: Trustee Martinez?
10 TRUSTEE MARTINEZ: In favor.
11 THE CLERK: Trustee Ellerbe?
12 TRUSTEE ELLERBE: In favor.
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MR. MCLAUGHLIN: We would also ask that the SEQRA Resolution be labeled Exhibit G and Exhibit H, will be a copy of the Local Law?

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DEPUTY MAYOR PINEYRO: So moved.

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MR. MCLAUGHLIN: At this time I would ask Mr. Mauras to come up and explain the goals for this.

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MR. MAURAS: As previously stated, this is in reference of course to properties that are Substantially Damaged. We cannot not mandate that an existing home have their utilities raised. We would like to recommend it and of course we don't want anyone to suffer in case another hurricane comes along. Again, there are methods that can be utilized but we cannot mandate the elevation of utilities unless the property has been substantially damaged. If the property has been substantially damaged, during the elevation process the requirement of all utilities including electrical and mechanical, which includes our hot water heaters be elevated to the newest elevation

1 which is 4' above the base level elevation.

2 TRUSTEE MARTINEZ: You said before, you're
3 not looking give the Superintendent the power
4 to mandate but the power to have some leeway?

5 MR. MAURAS: Under Section 210 or under
6 Section 87. Under the 87 it's basically set in
7 stone that any new construction or
8 substantially damaged properties must have
9 their utilities at that elevation.

10 TRUSTEE MARTINEZ: It is.

11 DEPUTY MAYOR PINEYRO: Are there any
12 grants or avenues out there for resident's who
13 have to raise their utilities--

14 MR. MAURAS: Grants programs are presently
15 being put into play. There is nothing concrete
16 at the moment but there are multiple grants
17 programs coming into play to be develop, flood
18 programs they take some time to be completely
19 implemented but that will be an option sometime
20 later on in the year.

21 TRUSTEE MARTINEZ: And if the resident's
22 have any questions they could contact your
23 office?

24 MR. MAURAS: Absolutely.

25 TRUSTEE MARTINEZ: And you can give them

1 an idea as to what will be available?

2 MR. MAURAS: Yes, absolutely.

3 TRUSTEE MARTINEZ: Now, some of these
4 grants it is viable to begin to submit these
5 applications now?

6 MR. MAURAS: That was the purpose of the
7 Recreate New York Program where the State was
8 actually gathering information to see who is
9 interested in applying for a grant.

10 DEPUTY MAYOR PINEYRO: Have many homes
11 raised their utilities?

12 MR. MAURAS: In many cases the residents
13 did elevate their electrical panels, but there
14 are also many cases where it's just not
15 feasible your mechanical or electrical being
16 that they were in the basement. Many residents
17 who want to protect, there are smaller units
18 you can have on the wall, of course they are
19 more expensive. There is a benefit to coming
20 up, there is no funding but they are actually
21 very energy efficient. A resident also does
22 have the option of applying for a permit to put
23 a new addition on to their house and use that
24 as mechanical in a sense. That's basically it.

25 DEPUTY MAYOR PINEYRO: Anymore questions

1 from the Board?

2 (Whereupon there was no verbal
3 response from the Board.)

4 DEPUTY MAYOR PINEYRO: Any Public Comment?

5 THE CLERK: First we have Alan Jay.

6 MR. JAY: After World War II I had a
7 friend that built a subdivision in Merrick,
8 waterfront property. He was an ex-engineer and
9 he insisted on driving piles into the ground
10 without any government intervention or
11 coercion. I don't know how our homes would
12 rest on piles but it was a big asset during the
13 flooding times. So, there are a lot of angles
14 to be learned. Once again I hope our engineers
15 will swallow their pride and go to the
16 Netherlands and learn how these people with
17 there exposure to perpetual storms under sea
18 level can cope for so many years with their
19 homes and roads overlaps and they managed to
20 thrive with this exposure to salt water. So,
21 there are short cuts and angles to be learned
22 there and I hope our engineers will consult
23 with these guys and get some new ways to
24 approach this problem. Also I would like to
25 see our new codes account for the higher

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1 elevations of our homes. They are going up,
2 the bottom structure and the zoning should
3 allow for the growth on the upside with people
4 like children, which is an amazing invention.
5 Some of them take in parents. There are
6 expansions of family life and we can't start
7 finishing basements like in the old days. So,
8 they are going to have to build up. So, I
9 would like to see some softening of regulations
10 on the upside. Everybody will have 100%
11 exposure to sunshine. So, let's be realistic
12 about family expansion. That's the main
13 purpose of building homes. Let's keep that in
14 mind. Some visibility may have to be
15 sacrificed but the main purpose is to establish
16 good healthy living quarters for our
17 population, thank you.

18 THE CLERK: Mark Devella.

19 MR. DEVELLA: Just a couple of additional
20 questions that I had. Basically for homeowners
21 that are south of Atlantic, if we already
22 rebuilt or we are in the process of rebuilding,
23 we're safe from the Building Department coming
24 in and basically saying stop what you're doing,
25 it's up to us to repair it, we've been

1 compensated by our insurance companies. We are
2 in the process of rebuilding as per the
3 insurance policy. We are moving forward to
4 restoring our lives, we are safe from that,
5 correct?

6 MR. MAURAS: If you are determined to be
7 Substantially Damaged and you have already
8 repaired your home, you will still be mandated
9 to elevate your home. The difference is once
10 you elevate your home you can be in perfect
11 condition to elevate your home. The way that
12 the houses are elevated now, steel beams go
13 underneath your structure, underneath the
14 framing. I'll give you a good example. We
15 happen to have one property here in the Village
16 of Freeport, the first resident to have been
17 elevated. During the elevation process the
18 only thing that had to be removed is a few
19 picture frames. If you have a china cabinet,
20 it's not going to move. So, you can have a
21 completely restored home.

22 MR. DEVELLA: If you've done repairs and
23 you're mandated to be elevated, is the Building
24 Department of Freeport going to walk in and say
25 you're mandated now do it or the consequence is

1 what?

2 MR. MAURAS: The repairs that would have
3 been made generally inside the structure would
4 be the electrical system and the mechanical
5 system as long as the resident's obtained the
6 proper permits. So, there are no permits
7 required for sheet rock or wood floors. So as
8 long as you obtain all the proper permits there
9 should be no issue with the Building Department
10 as long as you have the mechanical permits and
11 the electrical permits. If you have had some
12 structural damage, those structural damage
13 permits should also be filed so the Village
14 could waive the fees.

15 MR. DEVELLA: I think a number of us are
16 on poured slab on grade with a column that was
17 raised and heated--

18 MR. MAURAS: Yes.

19 MR. DEVELLA: That can't be raised because
20 it's cemented on top of the pilings. In order
21 to raise a house you would have to come in at
22 grade level below that slab and raise the house
23 below the slab leaving 800 or 900 square feet
24 attached to the ground at 8' and then would
25 have to put new flooring. So, on top of, let's

1 say the \$100,000.00 the cost to elevate the
2 house, now you have a flooring condition that
3 you have to replace as well. And the elevation
4 no longer exists.

5 MR. MAURAS: The technology the way that
6 it is now, I've seen quite a few projects
7 designed by professional engineers and
8 architects where it is feasible to elevate
9 slabs. It's not easy to do but it is possible.
10 Nonetheless, some people would rather do it the
11 way their house are now. So, eliminate that
12 slab scenario most of the architects in the
13 market are recommending cable (phonetic) piles
14 in order to make sure the house is structurally
15 sound. Of course it is also required that
16 flood vents be installed where water or
17 hydrostatic pressure water is destroying your
18 home flood vents are required. There's so many
19 different ways you can have it done.

20 MR. DEVELLA: Hydrostatic water what does
21 it mean?

22 MR. MAURAS: Hydrostatic pressure is water
23 that sits within the basement.

24 MR. DEVELLA: The utilities you claim
25 should be 4' above instead of 2' above grade so

1 that would be an elevation within the occupied
2 residence of 16'?

3 MR. MAURAS: Twelve feet if your first
4 floor is at 12' for the new constructions and
5 the substantially damaged homes. The approved
6 structured homes, the minimum should be at that
7 4' above base level.

8 MR. DEVELLA: So, 12 plus the 4--

9 MR. MAURAS: Well, 10 will only be
10 relevant if you happen to be at that water
11 level and if your water level is a 10.
12 Sportsman Avenue is an 8, South Long Beach is
13 an 8 or 9. So, it's relative to where the
14 structure is located.

15 MR. DEVELLA: Is there an address for
16 flood victims where they could find grant
17 papers?

18 MR. MAURAS: There is an address it is
19 called the Recreate New York Program, if you
20 would like to get in contact with me, I would
21 be more than happy to do that. Basically you
22 can sign up online.

23 MR. DEVELLA: Phone number?

24 MR. MAURAS: I can get that for you.

25 MR. DEVELLA: Your phone number?

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1 MR. MAURAS: 377-2242 and 2243.

2 MR. DEVELLA: Last question, some of the
3 houses in Freeport are built on pilings and
4 they currently have a land front yard and they
5 have a land elevation of 10 and they sit on
6 pilings and they are partially destroyed or
7 they are more than 50% destroyed, what are the
8 guidelines on those at this point, is it the
9 same as pure land property or once they're gone
10 they're gone and they won't be able to return
11 they don't have any material foundation other
12 than the floor will the Village actually allow
13 them to capulate titles that are there and
14 enclose some type of bulkhead?

15 MR. MAURAS: That determination can only
16 be made once final reviews are submitted by a
17 licensed professional.

18 MR. DEVELLA: I have no further questions.

19 DEPUTY MAYOR PINEYRO: Any other
20 questions?

21 THE CLERK: No further questions.

22 MR. MCLAUGHLIN: Deputy Mayor at this time
23 we ask for a motion from the Board to close the
24 hearing?

25 DEPUTY MAYOR PINEYRO: Motion to close the

1 hearing?

2 TRUSTEE ELLERBE: So moved.

3 TRUSTEE WHITE: Second.

4 THE CLERK: Deputy mayor Pineyro?

5 DEPUTY MAYOR PINEYRO: In favor.

6 THE CLERK: Trustee White?

7 TRUSTEE WHITE: In favor.

8 THE CLERK: Trustee Martinez?

9 TRUSTEE MARTINEZ: In favor.

10 THE CLERK: Trustee Ellerbe?

11 TRUSTEE ELLERBE: In favor.

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DEPUTY MAYOR PINEYRO: Now I need a motion
to adopt the chapter?

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TRUSTEE WHITE: So moved.

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TRUSTEE MARTINEZ: Second.

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THE CLERK: Deputy Mayor Pineyro?

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DEPUTY MAYOR PINEYRO: In favor.

9

THE CLERK: Trustee White?

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TRUSTEE WHITE: In favor.

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THE CLERK: Trustee Martinez?

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TRUSTEE MARTINEZ: In favor.

13

THE CLERK: Trustee Ellerbe?

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TRUSTEE ELLERBE: In favor.

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DEPUTY MAYOR PINEYRO: That concludes the
hearing, thank you everyone.

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CERTIFICATION

I, Michele Burruano, a Notary Public in
and for the State of New York, do hereby certify:

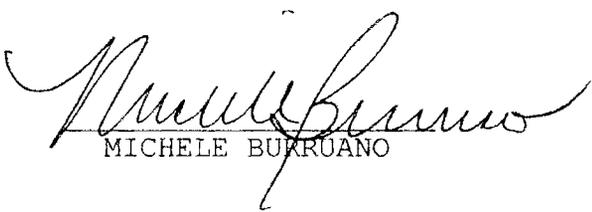
THAT the witness whose testimony is
hereinbefore set forth, was duly sworn by me; and

THAT the within transcript is a true
record of the testimony given by said witness.

I further certify that I am not related,
either by blood or marriage, to any of the parties
to this action; and

THAT I am in no way interested in the
outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my
hand this 8th day of July, 2013.


MICHELE BURRUANO

Colorado State University Forecast Q&A

Following are frequently asked questions about Colorado State University's hurricane forecasting:

Q: Why do you issue seasonal hurricane forecasts?

A: There is an inherent curiosity amongst the general public about how active or inactive the coming season is likely to be. Using historical data, there is considerable hindcast (using the past to predict the future) skill available for predicting the upcoming season. However, one must realize that these are statistical forecasts which will fail in some years. We find that we learn a lot from our forecast errors. Our end-of-the-season verifications give much information on explaining what the factors were that dictated the number and frequency of storms. Some of these factors may not have been considered in our forecasts for that particular year, and we often add new predictors in a quantitative or qualitative manner based on our end-of-the-season verifications.

There is also an educational component to these forecasts. For example, it was discovered about 25 years ago that El Nino reduced hurricane activity in the Atlantic. Through the issuing of these seasonal forecasts, this relationship has become well-known amongst the general public. Also, these seasonal hurricane forecasts have taught us many new relationships between climate features and Atlantic basin hurricanes such as sea surface temperatures, sea level pressures and levels of vertical wind shear in the tropical Atlantic.

Q: Should coastal residents prepare differently if an active or inactive season is predicted?

A: Coastal residents need to prepare for every hurricane season, regardless of seasonal predictions. There is inherent uncertainty in seasonal predictions. Also, seasonal forecasts do not say anything about when or where storms are going to make landfall. This information is typically only available 3-5 days before a storm actually makes U.S. landfall.

Coastal residents need to realize that the probability of landfall for any one point along the coastline is quite small in any year. However, one must also realize that it only takes one storm making landfall in your neighborhood to make it an active season for you. Major hurricanes have made U.S. landfall in inactive seasons (e.g., Hurricane Alicia - 1983 and Hurricane Andrew - 1992).

Q: How are hurricane insurance rates set? (answer provided by Insurance Services Office, Inc.)

A: While procedures vary, insurers generally use sophisticated probabilistic models to assess the wide range of hurricane activity that can occur over the long-term. These models use a meteorological database of tropical cyclones of over 100 years; sophisticated wind field algorithms; actual historical hurricane characteristics and costs; engineering expertise; etc. to develop reliable estimates of expected hurricane losses -- by geographic area, by construction type, by deductible purchased, etc. These models provide a much more stable and reliable measure of insurance rates than would result from the use of past hurricane claims alone -- because hurricane activity is very volatile from year to year. If such volatile hurricane loss data were to be primarily relied upon, rather than stochastic models, insurance rates could swing wildly upward and downward from one year to the next -- solely due to the occurrence (or absence) of a major hurricane. So, in addition to bringing more accuracy to the ratemaking process, probabilistic models also enhance rate stability -- a main actuarial consideration in ratemaking.

Of course, new information emerges when hurricanes do occur. For example, new knowledge about the performance of various construction types may become available which can further refine future loss estimates. So, while hurricane models, reinsurance, and other mechanisms greatly help mitigate the

"shock" effects of new hurricane events on insurance rates, it is natural and appropriate to expect some changes as well.

Q: How do I find the probabilities of landfall for my region, sub-region or county?

A: Probabilities of landfall are available from the following webpage: <http://www.e-transit.org/hurricane>. From this webpage, click on Interactive Landfall Probability Display, then click on the county for probabilities. Or you can obtain probabilities from a spreadsheet located here: <http://www.e-transit.org/hurricane/Full Data Table.xls>

Q: I've noticed that we've had a lot more activity in the Atlantic since 1995. Is global warming the cause of this increased activity?

A: The Atlantic basin tends to go through periods of about 25-35 years with heightened major (Category 3-4-5) hurricane activity and then similar periods of about 25-35 years with less activity. We believe that these multi-decadal variations are mostly due to changes in large-scale ocean circulations referred to as the Atlantic Ocean thermohaline circulation. For a more detailed discussion, please refer to the following webpage and read Section 9: <http://tropical.atmos.colostate.edu/Forecasts/2008/april2008/apr2008.pdf>.

Q: How accurate are your forecasts?

For a complete spreadsheet with all of our forecasts from 1948-2012, view the following MS Excel file: http://tropical.atmos.colostate.edu/Includes/Documents/Publications/forecast_verifications.xls

Our forecasts for June and August that have been issued since 1984 show significant skill when evaluated against climatology or the previous five-year mean. Our earlier seasonal forecast, issued in early April, shows somewhat less skill.

Q: Why do you issue a forecast during the middle of the season (August 1)?

A: Although the Atlantic basin hurricane season starts on June 1, more than 90 percent of all tropical cyclone activity and 95 percent of major hurricane activity occurs after August 1 in an average season. In general, our seasonal forecasts issued on August 1 show the greatest skill.

Q: How can you issue a forecast so far in advance of the season (e.g., April 1) when scientists generally can't issue skillful forecasts for more than one to two weeks in advance?

A: The issue at hand is the difference between statistical and dynamical forecasts. Dynamical forecasting, which takes initial value observations and integrates them forward in time, usually loses all skill after about 2 weeks. Statistical forecasting uses large-scale ocean/atmosphere empirical relationships to issue forecasts. Much more in-depth discussions of statistical versus dynamical forecasting are available in Section 1 here: <http://tropical.atmos.colostate.edu/Forecasts/2006/june2006/jun2006.pdf>

Q: How does your forecast compare to the forecast issued by the National Oceanic and Atmospheric Administration (NOAA)?

A: The Colorado State University forecasts are issued independently of NOAA. For the latest forecast from NOAA, visit the following webpage:

<http://www.cpc.ncep.noaa.gov/products/outlooks/hurricane.shtml>

NOAA makes two forecasts per year (late May and early August) and issues a prediction for a range of named storm, hurricane, major hurricane and Accumulated Cyclone Energy (ACE) index values. NOAA does not issue specific two-week forecasts or landfall probability forecasts.

Q: Do other groups issue Atlantic basin seasonal hurricane forecasts?

A: Yes, several other groups issue Atlantic basin forecasts. Among these are Tropical Storm Risk (TSR) and the Cuban Institute of Meteorology. TSR's forecasts are located here:

<http://www.tropicalstormrisk.com>

The Cuban Institute of Meteorology's forecasts are located here: <http://www.met.inf.cu/>

Q: How much activity occurs in an average year before August 1?

A: On average, 1.4 named storms, 0.6 hurricanes and 0.1 major hurricanes occur before August 1. The average full season between 1950 and 2000 witnessed a total of 9.6 named storms, 5.9 hurricanes and 2.3 major hurricanes.

Q: When is the most active part of the average Atlantic basin hurricane season?

A: About 90 percent of all Atlantic hurricane activity takes place during the months of August, September and October. The most active 30-day period during the season is approximately August 25-September 25.

Q: Does an active June-July mean that the rest of the season is likely to be more active?

A: In general, June-July activity does not correlate very well with the rest of the season's activity. However, if storms form in the deep tropics (i.e., south of the Tropic of Cancer - 23.5N - and east of the Leeward and Windward Islands) during June and July, this, in general, means that the season is going to be very active.

Q: Do you issue forecasts for other basins (e.g., the West Pacific, East Pacific)? Does anyone issue forecasts for these basins?

A: We do not issue forecasts for other tropical cyclone basins. NOAA issues forecasts for the East Pacific, and these forecasts are available here:

http://www.cpc.ncep.noaa.gov/products/Epac_hurr/Epac_hurricane.html

Tropical Storm Risk issues forecasts for several tropical cyclone basins. Their forecasts are available here: <http://www.tropicalstormrisk.com/>

The City University of Hong Kong issues forecasts for the West Pacific. Their forecasts are available here: <http://weather.cityu.edu.hk/>. Prof. Johnny Chan issues these forecasts. He is a former graduate student of Bill Gray.

Q: Is there an FAQ site available with answers to general questions about hurricanes?

A: Chris Landsea, Science and Operations Officer at the National Hurricane Center, maintains a detailed FAQ webpage available here: <http://www.aoml.noaa.gov/hrd/tcfaq/tcfaqHED.html>

Q: I'm traveling to Florida in August. What are the probabilities of landfall during that time period?

A: Currently, our landfall probability webpage does not provide these shorter-period probabilities. We intend to include this information in the future. Useful maps of landfall probabilities for shorter periods are available from Chris Landsea's Hurricane FAQ webpage:
<http://www.aoml.noaa.gov/hrd/tcfaq/G13.html>

Q: Does Colorado State University issue forecasts for individual storms?

A: No. Colorado State issues seasonal and two-week forecasts, that is, they predict how many storms are likely to occur during an individual season or two-week period. Individual storm track and intensity predictions are only issued by NOAA's National Hurricane Center. Their forecasts are available here:
<http://www.nhc.noaa.gov>

For questions about individual storms, please contact Dennis Feltgen, NOAA Public Affairs Officer for the National Hurricane Center at dennis.feltgen@noaa.gov.

Q: Why are we performing research forecasting hurricanes from Colorado?

A: Herbert Riehl, who started the Atmospheric Science department at Colorado State University in 1962, was a world-renowned hurricane researcher in the 1950s at the University of Chicago. One of his doctoral students and researchers at the time was Bill Gray. Gray followed Riehl from the University of Chicago to Colorado State University and has been a professor at Colorado State University since 1964.

Q: How long has Dr. Gray been issuing hurricane forecasts?

A: Dr. Gray has been issuing Atlantic basin seasonal hurricane forecasts since 1984 (30 years) and has been studying hurricanes for over 50 years.

Q: Is Dr. Gray retiring?

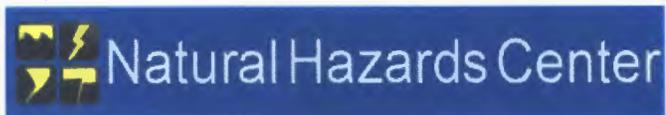
A: Dr. Gray has officially retired as a professor from Colorado State University. He is now an Emeritus Professor and is free to spend more time in his research endeavors. He plans to be involved in the issuing of the seasonal hurricane forecasts for the foreseeable future. He is also deeply engrossed in trying to better understand the links between climate change, global warming and hurricanes.

Q: How active was the 2005 season?

A: The 2005 hurricane season broke many records with its level of activity. A total of 27 named tropical storms and one unnamed subtropical storm formed during the year, along with 15 hurricanes and seven major (Category 3-4-5) hurricanes. The 27 named tropical storms broke the old record of 21 named tropical storms set in 1933 (although several named storms may have been missed in 1933 since there was no satellite monitoring or aircraft reconnaissance at that time). The 15 hurricanes broke the old record of 12 hurricanes set in 1969. The seven major hurricanes did not break the old record of eight major hurricanes set in 1950. These types of unusually active seasons occur about once every 40-50 years.

Q: What conditions came together to make the 2005 season so active?

A: A combination of several features came together to make 2005 active. There was very low vertical wind shear, especially in the Caribbean during the August-October period. In addition, warm sea-surface temperatures and abundant moisture dominated the tropical Atlantic providing very favorable conditions for hurricane development and intensification. Refer to our 2005 forecast verification for a more in-depth discussion of features in place that made the 2005 hurricane season so active. The forecast verification is available here: <http://tropical.atmos.colostate.edu/Forecasts/2005/nov2005/>



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Mitigation Generates Savings of Four to One and Enhances Community Resilience



MMC Releases Study on Savings from Mitigation

In December, the Multihazard Mitigation Council (MMC) of the National Institute of Building Sciences released to the Federal Emergency Management Agency (FEMA) *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*, the culmination of a three-year, congressionally mandated independent study. The MMC Board of Direction and oversight committee, a team of more than 30 researchers from academic institutions and private-sector organizations across the United States assembled by the Applied Technology Council, and many others contributed to the study, which represents the most comprehensive quantitative analysis of hazard mitigation activities to date.

The research findings provide independent evidence to support what nearly every member of the hazards community knows anecdotally—generally, FEMA mitigation grants are highly cost-effective. On average, across all grants,

regions, and hazards studied, each dollar spent on mitigation saves society an average of \$4 in avoided future losses. Results also indicate that, based on the eight communities studied in depth, FEMA mitigation grants, including those associated with Project Impact, play a significant role in a community's mitigation history and often lead to additional loss reduction activities.

The study, which examined 10 years of FEMA mitigation grants (1993-2003), consisted of a statistical analysis and community analyses. The statistical analysis estimated the future savings from expenditures using a statistically representative national sample of FEMA-funded mitigation grants. The community analyses assessed the future savings from mitigation activities through quantitative and qualitative research in eight communities where FEMA-funded mitigation activities were conducted, including five Project Impact communities.

Statistical Analysis

The statistical analysis of individual grants focused on FEMA-funded mitigation activities in three broad hazard categories: flood (coastal and riverine), wind (hurricane, tornado, typhoon, and severe storms), and earthquake. The MMC chose these hazards because of both the number of FEMA grants and the size of FEMA expenditures dedicated to their mitigation.

The analysis distinguished between project and process mitigation activities. Project mitigation activities are akin to investments in physical capital and are frequently referred to as brick-and-mortar projects because they result in tangible physical change to the built or natural environment. Quantitative benefit-cost assessments are more easily conducted for grants funding these types of activity. Typical project mitigation activities funded by FEMA included drainage enhancement, acquisition and relocation of at-risk structures, structural and nonstructural improvements, lifeline improvements, and land improvement projects.

Process mitigation activities lead to policies, practices, and projects that reduce risk and are much like investments in human, social, or institutional capital. Outcomes of these activities, particularly over the short term, tend to be difficult to predict and quantify. Examples of process mitigation activities include vulnerability assessments, community priorities and action plans, education campaigns for decision makers and constituents, and development of codes and regulations. These activities stimulate the commitments needed to instigate and sustain mitigation over the long term and play a large role in building community resilience.

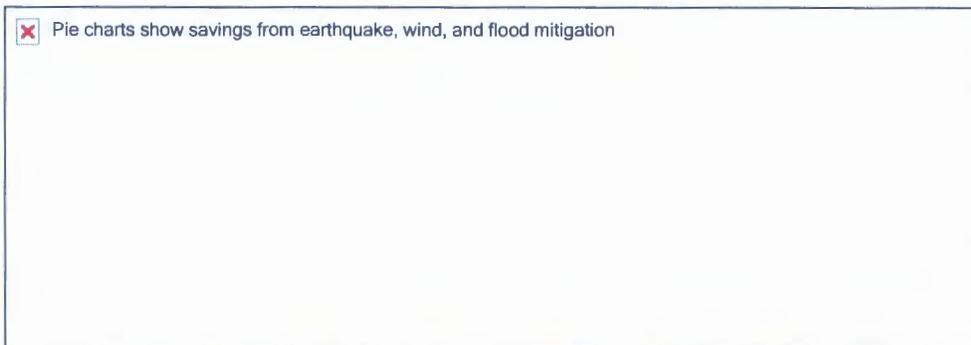
The research team obtained project cost data directly from FEMA's National Emergency Management Information System database. They applied, and developed where necessary, state-of-the-art methods grounded in benefit-cost analysis to measure the benefits from mitigation. HAZUS-MH (FEMA's software program for estimating potential losses from disaster) was used to estimate earthquake casualties as well as direct property damage and direct business interruption losses from earthquake and hurricane wind. Supplemental methods were used to assess direct property losses from floods and tornadoes; casualty losses from hurricanes, tornadoes, and floods; business interruption losses for utilities; environmental and historic preservation benefits; and process mitigation activities.

Using an innovative sampling strategy, the research team estimated mean benefits as losses avoided for each activity type and hazard (process and

project mitigation activities for flood, wind, and earthquake hazards). The ratio of estimated benefits to costs produced the benefit-cost ratio that was then applied to each category in the population of FEMA grants from which the sample was taken. The sample estimates were then scaled up to the population of FEMA grants for wind, flood, and earthquake mitigation issued between 1993 and 2003.

The study estimated that societal benefits from FEMA mitigation grants during the period studied had a discounted present value of \$14 billion compared to the \$3.5 billion value of the resources employed for an overall benefit-cost ratio of 4:1. Sensitivity analyses showed that these results are robust to the assumptions made and to uncertainties of parameters and models.

Figure 1 provides a graphical representation of the avoided losses compared to program costs for each hazard. It shows the contribution to total savings from avoided losses to buildings and contents, business interruption (BI) and household displacement, the economic equivalent value of environmental and historical losses, and casualties. (Casualties are measured both in terms of the number of avoided future deaths and injuries as well as the dollar amount the federal government would deem a reasonable expense for life-safety measures with similar effectiveness).



Community Analyses

The community analyses component of the study featured in-depth examinations of eight communities to assess the influence of FEMA-funded mitigation activities in a holistic context. The study included all FEMA mitigation grants received by the communities since the grant programs began. It also explored how additional mitigation activities percolated throughout the communities in the form of synergistic activities, which accrued benefits ultimately attributable to FEMA grants.

The researchers selected communities with diverse characteristics to obtain a variability of contexts in which to observe mitigation outcomes. Researchers ensured that the eight communities were diverse in size, the kinds of hazards present, the number and type of grants received, and geographic distribution. Each community had received at least \$500,000 in funds from as many as 15 FEMA grants. The communities were Freeport, New York; Hayward, California; Horry County, South Carolina; Jamestown, North Dakota; Jefferson County, Alabama; Multnomah County, Oregon; City of Orange, California; and Tuscola County, Michigan.

The community studies were designed to identify the impact of FEMA-funded

mitigation activities in situations where multiple FEMA and non-FEMA funded projects and processes may have coexisted and interacted. Data on mitigation activities were collected and reviewed, key people were interviewed by telephone, field visits were conducted to gather more data and to followup with those interviewed, and extensive postvisit analyses were undertaken.

During the community studies, the researchers noted activities and effects that reduced risks (or increased benefits of risk-reduction activities) that were not funded by FEMA. Qualitative analysis of these activities found that mitigation efforts funded by FEMA often led to additional, nonfederal mitigation efforts. Termed synergistic activities, they were divided into three categories:

- Spin-off activities—activities that resulted from FEMA hazard mitigation grant support
- Collateral activities—activities that did not result from FEMA hazard mitigation grant support
- Spillover effects—effects that enhanced the value of community assets because of FEMA hazard mitigation grant support.

Five of the eight communities had spin-off activities, three had collateral activities, and three had spillover effects.

In the communities studied, FEMA mitigation grants were a significant part of the community's mitigation history. The researchers found that the FEMA-funded mitigation activities brought about the most nonfederally funded mitigation benefits if the grant was of the sort that helped to institutionalize mitigation. Interviewees reported that the grants were important in reducing community risks, preventing future damages, and increasing a community's capability to reduce losses from natural hazards. Most interviewees believed that the grants permitted their communities to attain mitigation goals that might not otherwise have been reached and that the mitigation benefits of the activities funded by the grants went beyond what could actually be measured quantitatively (e.g., increased community awareness, esprit de corps, and peace of mind).

Savings from Mitigation

The detailed analysis of communities provides evidence to support the statistical analysis finding of positive net benefits from hazard mitigation. And, it goes even further to show that important additional benefits exist within communities across individual mitigation programs that are not reflected in the calculation of grant-level net benefits.

The overall study's main findings can be stated simply:

- The net benefits of FEMA's hazard mitigation program to society as a whole are positive with an average overall benefit-cost ratio of 4:1.
- The average benefit-cost ratio for all FEMA flood-related grants is 5:1.
- The average benefit-cost ratio for all FEMA wind-related grants is 3.9:1.
- The average benefit-cost ratio for all FEMA earthquake-related grants is 1.5:1.
- Synergistic activities occur in communities that have institutionalized their hazard mitigation programs.

In addition to the analytical results discussed above, the MMC report includes three basic recommendations derived from the study:

- Mitigation is sufficiently cost-effective to warrant federal funding on an ongoing basis both before disasters and during postdisaster recovery. The nation will always be vulnerable to natural hazards; therefore, it is only prudent to invest in mitigation. In this context, mitigation should be considered in the broadest possible sense to encompass projects and processes that relate to enforcing strong building codes and land use and zoning measures as well as developing comprehensive plans that limit disaster-caused damage and promote reduced losses.
- Mitigation is most effective when carried out on a comprehensive, communitywide, and long-term basis. Single grants or activities can help, but carrying out a slate of coordinated mitigation activities over time is the best way to ensure that communities will be physically, socially, and economically resilient to future hazard impacts.
- Continuing analysis of the effectiveness of mitigation activities is essential for building resilient communities. The need to integrate social science research into traditional hazard mitigation evaluation is strongly encouraged, especially when benefits are difficult to isolate and measure as in the case of process activities. The study highlighted the need for more systematic data collection and assessment of various mitigation approaches to ensure that hard-won lessons are incorporated into disaster public policy. In this context, postdisaster field observations are important, and statistically based postdisaster data collection is needed for use in validating mitigation measures that are either costly, numerous, of uncertain efficacy, or that may produce high benefit-cost ratios.

Philip T. Ganderton, University of New Mexico
Linda Bourque, University of California, Los Angeles
Nicole Dash, University of North Texas
Ron Eguchi, ImageCat, Inc.
David Godschalk, University of North Carolina at Chapel Hill
Claret Heider, National Institute of Building Sciences
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Keith Porter, Consultant
Adam Rose, Pennsylvania State University
L. Thomas Tobin, Tobin and Associates
Craig Taylor, Natural Hazards Management, Inc.

The two-volume study report is available for free download at
<http://www.nibs.org/MMC/mmchome.html>.

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Natural Hazards Research and Applications Information Center - Institute of Behavioral Science
University of Colorado at Boulder | Last Modified: February 24, 2006

Flood Insurance Changes Might Affect You

As risks change, insurance premiums also change to reflect those risks. Your flood insurance premiums may be going up.

However, you may be able to reduce your premium if you build your home or business to be safer, higher, and stronger.

The Biggert-Waters National Flood Insurance Reform Act of 2012 provides long-term changes to the National Flood Insurance Program.

Under the new law, rates are likely to increase overall to reflect the true flood risk of your home and many insurance discounts will be eliminated.

For example, rates for certain secondary homes in high-risk areas will increase 25 percent per year over the next 4 years starting in 2013.

Policy rates for all properties could increase based on one or all of the following circumstances:

- Change of ownership
- Lapse in coverage
- Change in risk
- Substantial damage or improvement to a building

Some changes will depend on external factors such as when flood risk maps are revised, buildings are damaged or improved, or when flood claims are filed.

Talk with your community officials and insurance agent to see how these changes could affect you.

Resources for More Information

To ask questions and get information about flood insurance, call the National Flood Insurance Program Help Center at **1-800-427-4661**

To see if you are eligible for Hazard Mitigation grants and loans:
www.fema.gov/hazard-mitigation-assistance

To learn how to build safer and stronger and potentially decrease your flood insurance premiums:
www.fema.gov/building-science/hurricane-sandy-building-science-activities-resources

To learn more about the National Flood Insurance Program or find an insurance agent:
www.FloodSmart.gov or **1-888-229-0437**

For information about local building code and permit requirements, contact your community officials:



**IF YOUR HOME OR BUSINESS
WAS FLOODED BY SANDY**

**Build Back
Safer and Stronger**

What You Need to Know



FEMA



Manage Your Future Risk

If your home or business was damaged or destroyed by Sandy, you face major decisions about your property. Do you repair? Do you rebuild? Do you relocate?

The decisions you make now can help provide a safer, stronger future for you and your family. If you decide to repair or rebuild, here are some points to consider:

- The risk you faced yesterday might not be the same risk you face today or in the future.
- By rebuilding higher, you can reduce — or perhaps avoid — future flood loss and reduce the impact on your finances.
- The financial consequences of not having flood insurance coverage could be devastating if another flood occurs.

Before you build, consult your local government officials to determine the mandatory elevations for your home or building.

BASE FLOOD ELEVATION (BFE) — The elevation shown on the Flood Insurance Rate Map (FIRM) for high-risk flood zones ("A" and "V" zones) indicates the water surface elevation resulting from a flood that has a 1 percent chance of equaling or exceeding that level in any given year.

Reduce Your Risk, Reduce Your Premium

A primary way to reduce or avoid future flood losses is to raise your building above the Base Flood Elevation (BFE). As the graphic below shows, you could reduce your flood insurance premium by 85 percent or more — and save thousands of dollars over the life of your home or business. It is important to understand the long-term costs and benefits when considering your options for repairing, rebuilding, or relocating.

Insurance Considerations:

- How elevating your home or business can help reduce your rates
- Future premium increases for all homes and businesses
- Options for insuring your building and its contents
- Changes in rates for secondary homes
- Other circumstances that could increase your rates

Building Considerations:

- Meeting building code requirements and current best practices
- Revised Flood Insurance Rate Maps and advisory flood risk products
- Hazard mitigation grant programs
- Other grant programs and loans to help rebuild or acquire your home or business

If you rebuild to pre-flood conditions, your flood insurance premium could increase dramatically in the future.

Under the Flood Insurance Reform Act of 2012, You Could Save More than \$90,000 over 10 Years if You Build 3 Feet above Base Flood Elevation*

PREMIUM AT 4 FEET BELOW
BASE FLOOD ELEVATION

\$9,500/year
\$95,000/10 years



PREMIUM AT
BASE FLOOD ELEVATION

\$1,410/year
\$14,100/10 years



PREMIUM AT 3 FEET ABOVE
BASE FLOOD ELEVATION

\$427/year
\$4,270/10 years



*\$250,000 building coverage only (does not include contents), AE (high to moderate risk) zone, single-family, one-story structure without a basement at 4 feet below Base Flood Elevation (BFE), at BFE, and at 3 feet above BFE. (Rating per FEMA flood insurance manual, October 1, 2012). The illustration above is based on a standard National Flood Insurance Program (NFIP) deductible.



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Climate Change Adaptation

Comprehensive Evaluation of Projects with Respect to Sea-Level Change



Climate Change Adaptation Home | Coastal Risk Reduction and Resilience | Complex Systems Approach to Global Change | Comprehensive Evaluation of Projects with Respect to Sea-Level Change | Update Drought Contingency Plans | Update Reservoir Sediment Information

This effort relies on the extensive expert science provided by the NOAA National Ocean Service with respect to tides and gauges. Their participation on the USACE team allows rapid infusion of science into engineering.

The Comprehensive Evaluation of Projects with Respect to Sea Level Change (CESL) purpose is to screen and assess the vulnerability of USACE projects to the effects of Sea Level Change and provide added benefits to other USACE activities (such as Asset Management and Recapitalization).

Internal and external analyses performed after Hurricane Katrina identified the need to incorporate new and changing information into project planning, design, construction, operation, and maintenance. As a result of these findings, the USACE initiated the Comprehensive Evaluation of Project Datums (CEPD) to evaluate and correct those projects that were not accurately related to the current National Spatial Reference System (NSRS) and local tidal datums.

USACE also updated its guidance on considerations for sea-level change (SLC) in Civil Works programs and projects. Combining the post-Katrina recommendations around land subsidence, tidal fluctuations, and sea level change, and to ensure sustainable performance in the future, we must now evaluate all of our projects with respect to sea-level change, whether they are operating, in planning, in engineering, or currently under construction.

CESL consists of a web-based Geographic Information Systems (GIS) tool that provides information related to the impact of Sea Level Change on USACE projects. This tool has multiple features for users to enter data, view project information, view SLC curves for gauges at or near project sites, view Extreme Water Level information, and view projects on a map interface. One of the main functions of this tool is to perform an Initial Vulnerability Assessment for USACE coastal projects and determine the SLC curve that is expected to impact a project in the 50- and 100-year planning horizons. Access to this tool is currently limited to USACE only.

- [CESL Benefits](#)
- [CESL Contacts](#)
- [CESL Definitions](#)
- [CESL FAQs](#)
- [CESL Links and Tools](#)
- [SLC Curve Calculator](#)
- [Sea-Level Calculator for non-NOAA tide gauges](#)

revised 14 August 2013

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USACE Curves computed using criteria in USACE EC 1165-2-212

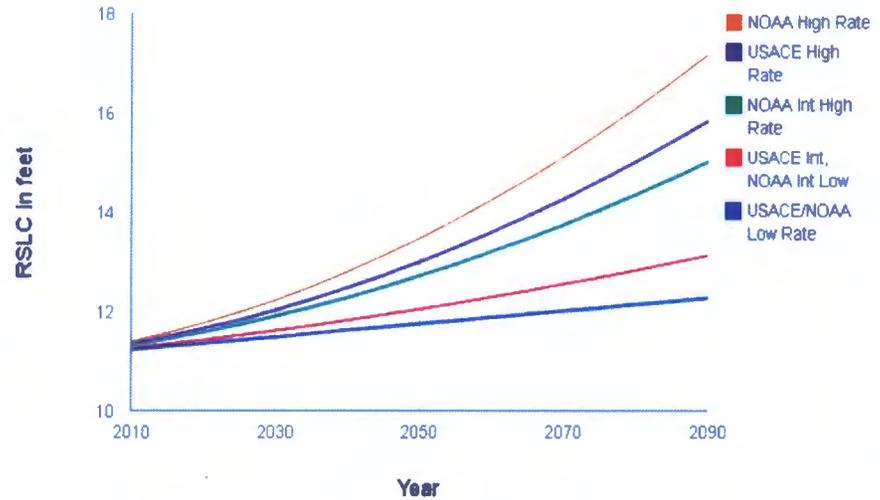
NOAA Curves computed using criteria in NOAA SLR Report
 06-Dec-2012

Gauge: 8531680, NJ, Sandy Hook 75 yrs
 All values are in feet

Year	NOAA Low	USACE Low	NOAA Int Low	USACE Int	NOAA Int High	USACE High	NOAA High
2010	11.23	11.23	11.26	11.26	11.33	11.35	11.40
2015	11.30	11.30	11.35	11.35	11.45	11.50	11.57
2020	11.36	11.36	11.43	11.43	11.59	11.66	11.77
2025	11.43	11.43	11.53	11.53	11.74	11.83	11.99
2030	11.49	11.49	11.62	11.62	11.91	12.03	12.23
2035	11.56	11.56	11.72	11.72	12.09	12.25	12.50
2040	11.63	11.63	11.83	11.83	12.28	12.48	12.80
2045	11.69	11.69	11.94	11.94	12.49	12.73	13.13
2050	11.76	11.76	12.05	12.05	12.72	13.00	13.47
2055	11.82	11.82	12.17	12.17	12.95	13.29	13.85
2060	11.89	11.89	12.30	12.30	13.21	13.60	14.25
2065	11.95	11.95	12.42	12.42	13.47	13.93	14.67
2070	12.02	12.02	12.56	12.56	13.75	14.27	15.12
2075	12.08	12.08	12.69	12.69	14.05	14.64	15.60
2080	12.15	12.15	12.83	12.83	14.36	15.02	16.10
2085	12.21	12.21	12.98	12.98	14.68	15.42	16.63
2090	12.28	12.28	13.13	13.13	15.02	15.84	17.18

[Print Table](#)

USACE and NOAA SLC Curves - Gauge: 8531680, NJ, Sandy Hook: 75 yrs
 USACE Curves computed using criteria in EC 1165-2-212



[Print Chart](#)



New York State Sea Level Rise Task Force Report to the Legislature



December 31, 2010

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Acknowledgements

The New York State Sea Level Rise Task Force was created by an act of the New York State Legislature (Chapter 613 of the Laws of New York) in August 2007. New York State Department of Environmental Conservation (DEC) Commissioner Pete Grannis, Chair of the Task Force, assigned Special Counsel Robin Schlaff to establish and chair a steering committee. Kristin Marcell served as steering committee vice-chair.

The steering committee, comprised of state agency staff and representatives of non-governmental organizations (NGOs), spent an extraordinary amount of time researching, discussing and deliberating issues addressed in the report. Members of the steering committee coordinated the work of five work groups: Community Resilience, Ecosystems and Natural Resources, Infrastructure, Legal and Public Outreach. Each work group included representatives from academia, businesses, NGOs, environmental justice and community groups, and federal, state and local agencies. This report is the result of their efforts, and the Task Force gratefully acknowledges their contributions.

Projections of sea level rise affecting New York State were provided by the Columbia University Center for Climate Systems Research based on work undertaken for the New York City Panel on Climate Change.

DEC Assistant Commissioner Jared Snyder provided leadership and guidance throughout development of this report. Alan Belenz, Director of the DEC Office of Climate Change, provided a critical review of an early draft. Additional DEC staff contributors to writing, editing and production of this report include Audrey Their, Elaine Bloom, Bernadette LaManna and Ellen Bidell. Kim Farrow and Mary Kadlecek maintained the Sea Level Rise Task Force webpage. Mark Lowery provided editorial assistance and managed public outreach efforts.

The development of this report included a public review of the sea level rise projections, the Task Force process and an early draft of the report and recommendations. Throughout the process, participation of stakeholders and their thoughtful comments improved the quality of the report.

Executive Summary

New York State's extensive ocean coastline has places that we know, that we remember and that have shaped us in some way. The state's coastline includes many notable locations—Montauk Point, Coney Island, Robert Moses State Park, Battery Park and the Hudson River's shores from New York City to the federal dam at Troy. More than 60 percent of New Yorkers live in homes on or near these waterfront areas. Each shoreline area is unique and part of the essence of New York. But these places will change as sea level rises, and the differences will become more obvious as the sea continues to rise to levels never experienced by humans. A result of the world's changing climate, a rising sea will alter more than just the coastline. The entire state will feel the effects as residents and a significant amount of the landscape are affected. These areas are diverse and interconnected and share New York's rich agriculture, commercial, economic and environmental history and resources.

The communities along New York State's coastline, including their structures, their residents, their environment and the surrounding natural resources, are products of decisions made over the course of many years. These decisions shaped decades of investment, development and conservation. While the extent of the impacts to coastal communities from a rising sea are not fully known, even the most conservative projections make clear that there will be dramatic changes in this century. Thus, how coastal communities and our state address this collective challenge is important to today's decision makers. The responses needed to protect communities from the threat posed by sea level rise will take time, and now that the challenges are better understood, government is obligated to protect its citizens while there is time to do so effectively. New York must focus on the smart use of limited resources to address the impacts associated with sea level rise.

THE SEA LEVEL RISE TASK FORCE

In 2007, the New York State Legislature created the Sea Level Rise Task Force and charged it with preparing a report that addresses these issues, including recommendations for an action plan to protect coastal communities and natural resources from rising sea levels. The New York State Department of Environmental Conservation leads the Task Force, which has a diverse membership that includes representatives of state and local government agencies, non-governmental organizations and affected communities. The legislature directed the Task Force to "evaluate ways of protecting New York's remaining coastal ecosystems and natural habitats, and increasing coastal community resilience in the face of sea level rise, applying the best available science as to sea level rise and its anticipated impacts." The Task Force has studied and deliberated, with public participation, the complex issues involved with sea level rise in New York State; however, a thorough analysis of the costs and benefits associated with sea level rise and potential adaptation strategies was beyond the scope of this effort. The findings and recommendations in this report are an important first step in increasing the resilience of our coastal communities but should be further analyzed to evaluate their site-specific applicability and effect on economic development, greenhouse gas mitigation efforts, the environment and other factors.

While this report is the result of the considerable efforts of many dedicated individuals, it does not represent the unanimous consent of the Task Force. The City of New York, which was a member of the Task Force and has launched a comprehensive climate-resilience effort as part of its long-term sustainability plan, PlaNYC, does not support recommendations 2, 3, 4, 5 and 7. As detailed in comments submitted to the Task Force and available as an appendix to this report and at <http://www.dec.ny.gov/energy/69851.html>, New York City believes that these recommendations “are not supported by thorough scientific, environmental, or cost-benefit analysis [and] do not recognize the differences between undeveloped areas and densely-populated cities... since this analysis has not been done, we do not fully understand the potential impacts of sea level rise and storm surge on coastal infrastructure and communities—much less many of the intended and unintended consequences of the proposed policy recommendations in the draft report.” Similar concerns were expressed by others in public comments to the Task Force. The Task Force recognizes the divergence of opinion of its members and looks forward to continuing to work with all affected stakeholders to respond to the real and significant challenges posed by sea level rise.

Findings

1. Sea level rise and coastal flooding from storm surge are already affecting and will increasingly affect New York's entire ocean and estuarine coastline from Montauk Point to the Battery and up the Hudson River to the federal dam at Troy.
2. The likelihood that powerful storms will hit New York State's coastline is very high, as is the associated threat to human life and coastal infrastructure. This vulnerability will increase in area and magnitude over time.
3. Natural shoreline features, such as wetlands, aquatic vegetation, dunes and barrier beaches, currently provide large-scale services, such as flood protection, storm buffering, fisheries habitat, recreational facilities and water filtration, at almost no cost. These services would be prohibitively expensive to replicate with human-built systems. New York is losing tidal marshes at a rapid pace and with them the natural infrastructure that protects the shore from floods, wave attack and erosion.
4. Sea level rise will cause all shoreline ecosystems to become more frequently inundated. Low-lying locations will become permanently submerged. Habitats and the species associated with them may migrate landward; this migration, however, will be impeded by the density of development on much of the state's shoreline and the widespread hardening of that shoreline.
5. Current investment and land-use planning practices by both New York State and local governments are encouraging development in areas at high risk of coastal flooding and erosion.
6. Over the long term, cumulative environmental and economic costs associated with structural protection measures, such as seawalls, dikes, and beach nourishment, may be more expensive and less effective than non-structural measures, such as elevation of at-risk structures and planned relocation away from the coastal shoreline, especially in less urbanized areas. Solutions for urban areas, however, may require a mixed approach of structural and non-structural solutions.
7. As water levels rise, sea walls, dikes and similar structures along the state's coastline may limit public access to beaches as the publicly accessible intertidal zone is eliminated.
8. Existing maps of New York State's coast that identify communities, habitats and infrastructure at greatest risk of flooding and erosion are inaccurate, out of date, not detailed enough for planning and regulatory purposes and fail to incorporate historic and projected sea level rise.
9. There are low-cost, high-benefit actions that can be taken now to reduce vulnerability along New York State's coastline.

Recommendations

1. Adopt official projections of sea level rise and ensure continued and coordinated adaptation efforts.
2. Require state agencies responsible for the management and regulation of resources, infrastructure, and populations at risk from sea level rise to factor the current and anticipated impacts into all relevant aspects of decision making.*
3. Classify areas where significant risk of coastal flooding due to storms has been identified and implement risk reduction measures in those areas.*
4. Identify and classify areas of future impacts from coastal flooding from projected sea level rise and storms to reduce risk in those areas.*
5. Reduce vulnerability in coastal areas at risk from sea level rise and storms. Support increased reliance on non-structural measures and natural protective features to reduce impacts from coastal hazards, where applicable.*
6. Develop maps and other tools required to assist local decision makers in preparing for and responding to sea level rise.
7. Amend New York State laws and change and adopt regulations and agency guidance documents to address sea level rise and prevent further loss of natural systems that reduce risk of coastal flooding.*
8. Provide financial support, guidance and tools for community-based vulnerability assessments and ensure a high level of community representation and participation in official vulnerability assessments and post-storm recovery, redevelopment and adaptation-planning processes.
9. Undertake a comprehensive assessment of the public health risks associated with sea level rise, coastal hazards and climate change including compromised indoor air quality, drinking water impacts, post-traumatic stress and other mental health problems, increases in disease vectors, impaired access to health care and loss of reliable access to food and medical supplies.
10. Raise public awareness of the adverse impacts of sea level rise and climate change and of the potential adaptive strategies.
11. Develop mechanisms to fund adaptation to sea level rise and climate change.
12. Fund research, monitoring and demonstration projects to improve understanding of key vulnerabilities of critical coastal ecosystems, infrastructure and communities from sea level rise.
13. Ensure continued and coordinated adaptation to sea level rise.
14. Seek federal funding, technical assistance and changes to federal programs to make them consistent with, or accommodating to, state policies, programs and adaptation measures related to sea level rise.

* Recommendation does not have the unanimous support of the Task Force.

THE SEA IS RISING

Our climate is changing, causing the world's seas to rise. Since 1970, the Northeast has witnessed increases in average temperatures of more than 1.5°F. These changes have resulted in warmer winters and hotter summers and other changes in the form of fewer, but heavier, snows and heavier, more intense rainfall and storms. The warming produced by global climate change causes the sea level to rise because warmer water takes up more space, and higher temperatures are melting ice sheets around the globe. New York Harbor has experienced an increase in sea level of more than 15 inches in the past 150 years, with harbor tide gauges showing a rise of between 4 and 6 inches since 1960.

The Task Force looked to the best available science to estimate potential sea level rise. Not all regions of the marine coast will be affected in the same way, and this report focuses on estimates for two areas: the lower Hudson Valley and Long Island, including New York City, and the mid-Hudson Valley and Capital Region. Sea level rise affecting the Lower Hudson Valley and Long Island is projected to be 2 to 5 inches by the 2020s and 12 to 23 inches by the end of this century. However, rapid melt of land-based ice could double these projections in the next few decades, with a potential rise of up to 55 inches by the end of the century. Sea level rise in the mid-Hudson Valley and Capital Region will be somewhat less but will follow similar trends. The combination of rising sea level, continuing climate change, and more development in high-risk areas has raised the level of New York's vulnerability to coastal storms. Without meaningful action on a number of key fronts, this vulnerability will increase in area and magnitude over time.

EVERY NEW YORK TIDAL COASTAL COMMUNITY WILL BE AFFECTED BY SEA LEVEL RISE

Sea level rise will have dramatic implications for New York's coastal communities and their natural resources, affecting the entire ocean and estuarine coastline of the state. Every community along the Hudson River from the Federal Dam at Troy to New York Harbor and along Long Island Sound and the Atlantic coastline will be affected.

Sea level rise will continue to increase the risk to developed areas, future development and coastal habitats which are already highly vulnerable to flooding and storm damage. Many neighborhoods and their associated buildings, roads, and utilities will be directly affected, with the most vulnerable communities permanently inundated.

An area far broader than the immediate coastline will witness flooding and erosion associated with increasingly powerful storms. The effects will be potentially more dramatic because of the broad extent of effects on the utilities and infrastructure systems upon which our modern society relies: sewage, stormwater, fuel storage, energy generation, communication, solid waste, and transportation, including road, rail, airports, and ports. The emergency services that provide relief and support during storm events and flooding will be more overwhelmed in areas where the intensity of impacts increases.

Secondary impacts such as water-borne pollution associated with flooding of contaminated lands located throughout coastal communities may affect water quality and ecosystems, having long-term implications for New York's seafood industries. Public health will be further affected by vector-borne diseases and impacts to water supplies caused by changes in rainfall, heat and saltwater intrusion.

New York's natural resources and ecosystems will be greatly affected by the human response to sea level rise. Natural systems such as wetlands currently provide critical benefits, including flood protection, to coastal communities on a large scale at almost no cost. These benefits would be expensive to replicate with human-engineered solutions. Responses that harden the coastline, such as sea walls and bulkheads, prevent natural systems from migrating inland as water levels increase, leaving them to drown in place. In addition, such solutions can limit public access to beaches. Thorough analysis of the environmental effects, long-term effectiveness and costs of alternative management measures relative to coastline hardening will be required, particularly in less urbanized areas, and different types of shorelines will require different types of protection.

While the recommendations contained in this report strongly favor and support first consideration of non-structural strategies, the Task Force recognizes that responses must be flexible to account for unique local circumstances and may require multi-faceted approaches. Further, the Task Force recognizes the need and appropriateness of structural shore protection solutions in highly developed areas or where water-dependent infrastructure exists. New York City is home to approximately 43 percent¹ of New York State's population, with approximately 18 million² people from the tri-state metropolitan area relying on New York City's extensive transportation, communication, and utility infrastructure. Much of this infrastructure is located in close proximity to the coast, without the benefit of natural systems, such as wetlands, to mitigate the effects of climate change. Responding to sea level rise in this area will require analyses to develop a mix of both non-structural and structural solutions.

THE TASK FORCE REPORT

The Task Force worked for more than two years to produce this report, which examines the complexities of sea level rise and its implications for New York in the twenty-first century. This report includes 9 findings and 14 specific recommendations for action. Many of the recommendations require additional analysis before implementation, and the proposed timelines for implementation of each recommendation reflect the necessary sequence of this work. The recommendations do not represent the unanimous consent of the Task Force. The City of New York, which was a member of the Task Force and has launched a comprehensive climate-resilience effort as part of its long-term sustainability plan, PlaNYC, does not support recommendations 2, 3, 4, 5 and 7.

¹ 2009 US Census Bureau

² Ibid.

The report's findings coalesce around the need for immediate action. Every day, New York's residents, governments and businesses make decisions that affect the future vulnerability of the state's coastline. The magnitude and scope of the challenge posed by sea level rise require that relevant and accurate information about climate risk, resilience and adaptation become part of these everyday decisions. The vulnerabilities of coastal communities must be inventoried and assessed, and this information shared with residents of at-risk communities. Appropriate responses must be formulated and implemented. Government policies and actions must be coordinated and prioritized to assist communities at greatest and most immediate risk in the most cost-effective ways and in ways that recognize the importance of our natural coastal resources and their role in New York's future. These efforts must be guided by accurate science, up-to-date mapping and effective planning tools.

We hope that the Task Force's work will spark action. The public and its governments must be invested in meeting the challenge of sea level rise. The challenge is real, and sea level rise will progress regardless of New York's response.

Introduction

The sea is rising, driven by changes in global climate, and New York State's low-lying marine and estuarine coastal areas—their people, businesses, infrastructure, and ecosystems—are at risk. More than 62 percent of New York's population lives in marine coastal counties, and these areas have tremendous economic value in terms of commerce and natural benefits such as habitat, water-quality improvement, flood control, and storm protection. Sea level along New York's coast has been rising at the rate of almost one foot per century for at least 100 years,³ resulting in more severe storm impacts, shoreline erosion, and coastal flooding experienced by coastal communities today. The rate of rise is expected to increase with global warming, perhaps doubling over the next century.⁴ Table 1 provides projections of sea level rise in New York.



Infrastructure critical to both the state and national economies will be subjected to increased risk of coastal storm damage as sea level rises.

A powerful coastal storm occurring today poses great danger to the region, and this threat will intensify as sea level continues to rise. New York State must initiate action to safeguard its natural resources, human communities and economic assets. We must work to increase community resilience—the capacity to withstand or recover from loss or damage—while embracing a long-term commitment to understand evolving threats and adjust responses into the future.

The Sea Level Rise Task Force (Task Force) was established by statute in 2007.⁵ It was charged with summarizing what is known about the impact of sea level rise and recommending actions that will both protect coastal ecosystems and help human coastal communities to increase resilience and adapt to rising sea levels. The Task Force was not charged with studying other climate-related impacts to our oceans, such as acidification, changes to ocean currents and other effects of warming ocean temperatures.

The New York State Department of Environmental Conservation leads the Task Force, whose workgroups include representatives



Rising seas threaten to permanently inundate valuable coastal habitats.

³ Leatherman, S.P., R Chalfont, E. Pendleton, S. Funderbunk and T. McCandless. 1995. *Vanishing Lands*, Sea Level, Society, and Chesapeake Bay. Univ. of Maryland Laboratory for Coastal Research & US Fish and Wildlife Service Chesapeake Bay Field Office.

⁴ Tanski, J. 2007. *Long Island's Dynamic South Shore, A Primer on the Forces and Trends Shaping Our Coast*. NYS Sea Grant.

⁵ Chapter 613 of the *Laws of New York*, 2007.

from multiple state agencies and authorities, federal and local government, community and non-governmental organizations, businesses and academia.⁶

The Task Force has sought public comment and engagement throughout the process of developing this report.⁷

Although the Task Force's effort is the only one focused primarily on sea level rise in New York State, it exists within a larger context of complementary initiatives that have examined climate change and coastal hazards.⁸

The wide variety of state, local government and private partners participating in current efforts to assess climate change risk are using the same projections of sea level rise and coastal hazards in developing policy for New York State. They also agree on the types of actions that should be taken to reduce long-term vulnerability in our coastal areas. This work will now help shape the efforts of the New York State Climate Action Council (CAC) as it drafts the state's Climate Action Plan.

Though scientific and policy unknowns remain, inaction is not a responsible option. New York State, working with other levels of government, must address the challenges presented by sea level rise, even as coastal communities and ecosystems are increasingly affected.

The following discussion outlines the basic hazards and challenges of sea level rise and presents the Task Force's recommendations for protecting the state's communities—both human-built and natural—in the face of these dangers.

Counties Affected by Sea Level Rise

- Albany
- Bronx
- Columbia
- Dutchess
- Greene
- Kings (Brooklyn)
- Nassau
- New York (Manhattan)
- Orange
- Putnam
- Queens
- Rensselaer
- Richmond (Staten Island)
- Rockland
- Suffolk
- Ulster
- Westchester

⁶ See Appendix A: Members of the Task Force and Workgroups.

⁷ See Appendix B: Public Outreach Summary.

⁸ New York City Panel on Climate Change's Climate Risk Information, New York City's Climate Change and Climate Adaptation Task Force, Metropolitan Transit Authority Adaptations to Climate Change, New York City Department of Environmental Protection's Climate Change Task Force, New York State Energy Research and Development Authority's Statewide Climate Impacts Assessment (ClimAID), the Nature Conservancy's Rising Waters and Coastal Resilience projects, and the Union of Concerned Scientists' Northeast Climate Impacts Assessment.

Key Terms⁹

Beach nourishment: the addition of sand, often dredged from offshore, to an eroding shoreline to enlarge or create a beach area, offering temporary shore protection and recreational opportunities. The NYS Coastal Erosion Hazard Act specifically defines beach nourishment as a structural measure.

Coast: In this report, this term refers to New York State's marine coastline only, not to the Great Lakes or other inland coastlines.

Coastal hazards: negative impacts associated with sea level rise, storm surge, wind-driven waves and erosion

Coastal Risk Management Zone: areas to be classified as currently at significant risk of coastal flooding due to storms and areas projected to be at high risk of flooding from projected sea level rise and strong storms

Ecosystem services: the benefits people obtain from ecosystems that communities would have to replace artificially if the natural systems were lost. These benefits include, among others, flood control, water-quality improvement, storm protection, food production, nursery grounds, wildlife habitat and carbon sequestration.

Natural protective features: natural features such as the nearshore area, wetlands, dunes, bluffs, barrier islands and aquatic vegetation, the alteration of which might reduce or destroy the protection afforded other lands against erosion or high water, or lower the reserves of sand or other natural materials available to replenish storm losses through natural processes¹⁰

Non-structural protection or non-structural measures: Non-structural protective measures address storms, flooding and erosion, and minimize current and future damage through sustainable adaptation of development within the context of the natural environment. From the land-use perspective, non-structural measures include excluding development from unsafe, high-risk locations through land-use regulation, zoning, open-space conservation, land trusts, easements or other land-use measures that protect communities, development and natural resources. Non-structural measures also include building-construction techniques that achieve resilience to environmental conditions, such as relocation, elevation, and flood proofing or other measures applied to development. Retrofits, tax incentives, post-storm adaptation, transfer of development rights, voluntary acquisition and temporary lease/occupancy agreements are

⁹ Adapted from Titus, J.G. 2009. US Global Climate Science Program Synthesis and Assessment Product 4.1. http://www.gcrio.org/orders/product_info.php?products_id=239

¹⁰ As defined in regulations corresponding to the Coastal Erosion Hazard Areas Act (6 NYCRR Part 505).

examples of non-structural measures to reduce coastal storm and inundation impacts for existing development.¹¹

Shore protection: a range of management and engineering responses that focus on protecting land from inundation, erosion or storm-induced flooding through traditional armoring (seawalls; bulkheads; or revetments made from concrete, rock, steel or timber and placed parallel to the shoreline); shoreline stabilization structures and facilities (groins, breakwaters, sills, vegetation, wetland or ground water drainage) designed to slow the erosion rate; beach and dune reconstruction, designed to replace sediment on the beach or dune; non-structural measures (see above); or a combination of these approaches

Soft shore protection, shoreline softening or soft engineering: methods of shore protection that prevent or reduce shore erosion through the use of natural materials similar to those already found in a given location, such as using sand for beach or dune reconstruction or the planting of native vegetation to retain soils along the shore; or through use of structures designed to provide riparian habitat or to emulate natural shorelines for the purpose of adding habitat value

Storm Surge: a dramatic elevation of the ocean surface that leads to rapid flooding

Hard shoreline protection, shoreline hardening, shoreline armoring or hard engineering methods : concrete, rock, sill, timber or other structures such as groins, jetties and breakwaters, designed to slow erosion; or bulkheads, dikes, revetments and seawalls, designed to manage the erosive effect of waves on property or landward infrastructure

¹¹ New York State Coastal Policy 17. http://nyswaterfronts.com/downloads/Coastal_Policies/Generic44policies.pdf.

Sea Level Rise: Causes and Projections

Sea level rise is caused by a complex suite of factors. Climate change contributes to global sea level rise in two ways: 1) higher seawater temperatures cause the volume of seawater to increase, a phenomenon known as “thermal expansion,” and 2) melting ice caps, glaciers and ice sheets increase the total amount of seawater.

Local sea levels are affected by ocean currents, gravitational forces, prevailing winds, and rise and fall of the land mass. Within the coastal regions of New York State, the land mass is slowly sinking, with the exception of the Hudson estuary north of Kingston. This movement is a result of geological forces and impacts of human activity and development. It affects local, or relative, rates of sea level rise. The effects of sea level rise are compounded by potential increases in extreme precipitation and storms associated with climate change.

TABLE 1: Projected Sea Level Rise in New York¹

Lower Hudson Valley & Long Island	2020s	2050s	2080s
Sea level rise ²	2 to 5 in	7 to 12 in	12 to 23 in
Sea level rise with rapid ice-melt scenario ³	5 to 10 in	19 to 29 in	41 to 55 in
Mid-Hudson Valley & Capital Region	2020s	2050s	2080s
Sea level rise ²	1 to 4 in	5 to 9 in	8 to 18 in
Sea level rise with rapid ice-melt scenario ³	4 to 9 in	17 to 26 in	37 to 50 in

¹ NYSERDA ClimAID Team. 2010. Integrated Assessment for Effective Climate-change Adaptation Strategies in New York State. C. Rosenzweig, W. Solecki, A. DeGaetano, M. O’Grady, S. Hassol, P. Grabhorn, Eds. New York State Energy Research and Development Authority, 17 Columbia Circle, Albany, NY 12203.

² Shown is the central range (middle 67%) of values from model-based probabilities (16 global climate models by 3 GHG emissions scenarios) rounded to the nearest inch.

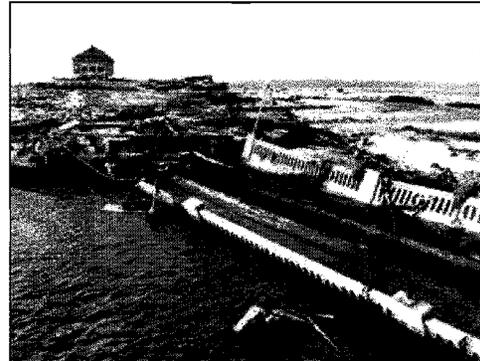
³ The rapid ice-melt scenario is based on acceleration of recent rates of ice melt in the Greenland and west Antarctic ice sheets and paleoclimate studies.

The interplay of these various factors and the gaps in our current knowledge make precise sea level predictions for any given geographic area difficult. However, all models agree that the outlook for our region is dramatic and will change the coast in fundamental ways. The New York City Panel on Climate Change and the draft New York State Climate Impacts Assessment (ClimAID) aggregated the projections for mean annual sea level rise shown in Table 1. The New York State Climate Action Council is using

these projections in developing its Climate Action Plan, and the Task Force has chosen to use this range of projections as the foundation for its risk assessments and recommendations.

These projections are supported by empirical data documenting recent sea level rise in New York State. For example, gauges at the New York City Battery indicate that sea level in the 2000s is 4 to 6 inches higher than in the early 1960s.¹² The New York City Panel on Climate Change found that as global temperatures have increased, the regional sea level has risen more rapidly in the past 100 to 150 years than during the last 1,000 years.¹³

Beyond models and measurements, New Yorkers have their own firsthand experience to confirm that the dangers of flooding and storm surges exacerbated by rising waters are real and immediate.



Only a small, sagging portion of the main building of the West Bay Beach Club in Quantuck, Suffolk County, remained after the 1938 "Long Island Express" hurricane.

Five Category 3 hurricanes have made first landfall in New England since 1900. With the exception of one, all made landfall along Long Island's coastline.¹⁴ In 1938, the Great New England Hurricane or "Long Island Express" struck Long Island communities with devastating results. A storm surge of approximately 10 feet submerged low-lying areas; hundreds of homes were destroyed, and at least 50 lives were lost. The storm would have been considered a Category 3 using today's measurement scale for hurricane intensity. If the same hurricane were to hit now, with current levels of coastal development in New York and New England, the total insured loss to commercial and residential property associated with the storm surge flooding alone has been estimated at between \$6 billion and \$10.5 billion (2008 dollars).¹⁵

In 1962, a powerful Nor'easter known as the Ash Wednesday Storm struck the eastern third of the United States, generating ocean waves of 20 to 30 feet.¹⁶ Surge at the Battery was more than 7.5 feet and more than 9 feet at Willets Point in Queens. East of Fire Island Inlet two and a half days (five high

¹² Colle, B.A., K. Rojowsky, and F. Buonaiuto. 2010. New York City storm surges: Climatology and an analysis of the wind and cyclone evolution. *Journal of Applied Meteorology and Climatology* 49: 85-100. Pub ID# 3772.

¹³ New York City Panel on Climate Change Climate Risk Information. http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf

¹⁴ *The 1938 Great New England Hurricane: Looking to the Past to Understand Today's Risk*, Patricia Grossi, et al., Risk Management Solutions, Inc., Newark, CA, 2008, p.17

¹⁵ *Ibid.* p. 14

¹⁶ NYS Coastal Erosion Task Force Report, 1994.

tides) of high water carved through dunes and created a new inlet 1,200 feet wide at Westhampton Beach. Parts of Coney Island were entirely inundated from ocean to bay.¹⁷

At Seagate, waves overtopped and severely damaged timber bulkheads. In Jamaica Bay, low-lying areas were completely flooded. The Rockaways experienced severe erosion and lost eight homes. Estimates of damage on Staten Island, Brooklyn's South Shore, the Rockaways, Long Beach Island, Long Island, Fire Island, Westchester and the Peconic shoreline totaled more than \$220 million in today's dollars (adjusted for inflation).¹⁸

More recently, a Nor'easter on December 11 and 12, 1992 caused a storm surge of nearly 7.75 feet at the Battery, propelled by wind gusts of 80 to 90 mph. Tunnels and subways in lower Manhattan flooded, as did portions of the Manhattan Eastside FDR Drive, areas of Seagate, Broad Channel and many coastal towns on Long Island.

New York has always been vulnerable to tropical storms, hurricanes and—more commonly—Nor'easters. Without action to reduce community vulnerability, similar storms will, in the future, threaten many more lives, public infrastructure and private property in New York's coastal areas due to ever increasing development and population growth in these areas. With elevated sea levels and associated higher storm surges, the geographic extent of vulnerable areas and damage will increase dramatically.

In addition to the devastating impacts of these acute events, gradually encroaching seawater will have chronic, incremental effects on coastal ecosystem structure and functions and on human uses of the coast. Some low-lying areas in New York already experience flooding during spring high tides or due to the inability to drain storm water in coastal floodplains.

¹⁷ NYS Coastal Erosion Task Force Report, 1994

¹⁸ \$31 million in 1963 dollars adjusted for inflation using Bureau of Labor Statistics CPI calculator.
<http://data.bls.gov/cgi-bin/cpicalc.pl>

Hazards of Sea Level Rise

Sea level rise, by itself and in combination with other coastal hazards, such as intense storms and the effects of climate change, will have many interacting consequences.

Rising Water Table

Higher groundwater levels may submerge infrastructure elements, interfering with their function and preventing access. Failed septic systems can create public health problems and harm ecosystems. Saline groundwater can corrode vulnerable infrastructure components. A higher water table also reduces the ability of the soil to absorb runoff, increasing the likelihood of flooding.

Saltwater Intrusion

As seawater rises, it encroaches upon estuarine, brackish and freshwater environments, increasing their salinity and permanently altering ecosystems. Saltwater intrusion also threatens aquifers and other freshwater sources of public drinking water.

Inundation and Flooding

Permanent inundation refers to those areas that are completely underwater or are underwater for a portion of each day. *Frequently flooded* areas experience inundation regularly, in contrast to *episodically flooded* areas, which are at risk only from extreme weather events. Rising sea levels will expand the areas experiencing all types of inundation and flooding and push their boundaries further inland. Episodes of severe flooding will also become more frequent as the sea rises.¹⁹

Storm Surge

Storm surge is a dramatic elevation of the ocean surface that leads to rapid flooding. It is caused by the combined effects of ocean water pushed landward during a storm, low pressure at the sea surface, and high tides. With higher baseline sea levels, the effects of storm surge will be felt further inland. Increased storm intensity will compound coastal erosion and damage from storm surge. Further, the frequency of surge events of a given intensity is expected to increase with increased sea level.²⁰

¹⁹ Goddard Institute for Space Studies, Institute on Climate and Planets. 2004. *Climate Impacts in New York City: Sea Level Rise and Coastal Floods*. <http://icp.giss.nasa.gov/research/ppa/2002/impacts/results.html>

²⁰ Colle, B. A. and F. Buonaiuto. 2009. Climatology and Forecasting of New York City Storm Surges, in *Against the Deluge: Storm Surge Barriers to Protect New York City*, proceedings of the American Society of Civil Engineers, Infrastructure Group.

Coastal Erosion

Coastal erosion is a process whereby waves, storms, flooding, and human activities contribute to the wearing away of the beaches and bluffs along the coast. Human activities that contribute to erosion include excavation, prevention of natural sediment transport in dunes and beaches, and shore defense structures that interfere with natural sediment transport. Erosion undermines and often destroys homes, businesses, and public infrastructure built too close to the shoreline and can have long-term economic and social consequences. Erosion may claim one out of four houses within 500 feet of the U.S. shoreline by mid-century.²¹ It is anticipated that coastal erosion will be accelerated by rising sea levels.

Realistic projections of the effect of these phenomena in any given location over time are crucial in order to properly plan to reduce risk. Development, human populations and ecosystems will interact with sea level rise and related coastal hazards and with each other, according to local circumstances. The following discussion summarizes the major systems that will affect and be affected by sea level rise.

²¹ NOAA: <http://coastalmanagement.noaa.gov/hazards.html#erosion>

Ecosystems

Intact natural systems are essential to the health and functioning of the coast's ecological and human communities. They perform a wide variety of economically valuable functions²² including water quality protection, water supply, commercial and recreational fish production, flood mitigation, recreation, carbon storage and storm buffering. They provide important habitat for plants and wildlife. Shoreline vistas, beaches and open spaces define coastal community character and quality of life for residents and visitors.

Although ecosystem change over time is a natural process, *accelerated* sea level rise and related coastal impacts caused by climate change will lead to fundamental changes in the nature of coastal habitat. Typical salt marsh vegetation could be lost when marshes are inundated. Deeper water or larger bays could lead to higher wave energy that could cause further erosion and marsh loss.

With inundation, nearshore habitats tend to "migrate" landward as shoreline ecosystems convert from one habitat type to another and the species present also shift. To the extent that human development or steep slopes inhibit these natural shifts in response to sea level rise, New York State risks losing many valuable coastal resources and ecological functions altogether.



A number of salt marshes on the south shore of Long Island and along the Long Island Sound have been lost through conversion to intertidal mudflats or submergence below the water surface.

²² Costanza, R., et al. 2006. The Value of New Jersey's Ecosystem Services and Natural Capital. Report to New Jersey Department of Environmental Protection, Division of Science, Research, and Technology, Trenton, NJ. <http://www.nj.gov/dep/dsr/naturalcap>

Property damage caused by sea level rise and storm surges is likely to prompt greater public demand for shoreline armoring such as seawalls, bulkheads or shoreline stabilization structures such as groins.

These measures are intended to protect the land use behind them, but they also prevent the shoreline and its associated species from moving landward. They may also disrupt the sediment supply, resulting in erosion to adjacent or down-drift areas and hindering the formation and adaptation of many shoreline features, including the ability of beach, dune and barrier island systems to migrate landward. In addition, these structures will impair public access as water levels rise and will have other unintended consequences. For example, they can alter tidal and wave energy, causing damage to submerged aquatic vegetation, wetlands, parks and other waterfront amenities. Shoreline-stabilization structures placed perpendicular to the shoreline trap sediment passing through the areas in which they are built and protect the land behind them, but they may also cause erosion to areas downdrift of the structures. While they offer short-term protection, traditional shoreline stabilization structures may not be the best choice to reduce the vulnerability of property and resources to coastal hazards and should only be considered after a thorough analysis of costs, benefits and environmental effects as part of a comprehensive shoreline management strategy.

Coastal Natural Resources Provide Significant Human Benefits

A two-year economic study commissioned by the New Jersey Department of Environmental Protection in 2004 established values for some “ecosystem services” provided by coastal wetlands, beaches and estuaries in New Jersey. Ecosystem services are the benefits people obtain from ecosystems, such as flood control, water-quality improvement, carbon storage, and storm protection that communities would have to replace artificially if the natural systems were lost. The report estimated that the waste treatment services provided by coastal wetlands in New Jersey were valued at over \$1 billion a year. It is important to note that this study focused solely on the economic value provided to humans and probably underestimates the absolute value of these unique natural resources.

Source: Costanza, R., et al. 2006. The Value of New Jersey's Ecosystem Services and Natural Capital. Report to New Jersey Department of Environmental Protection, Division of Science, Research, and Technology, Trenton, NJ. <http://www.nj.gov/dep/dsr/naturalcap>

The Task Force assessed seven major ecosystem types it deemed most threatened by sea level rise: tidal wetlands, low- to moderate-energy shorelines, submerged aquatic vegetation, barrier islands, coastal bluffs, marine rocky intertidal areas, and freshwater resources.

Tidal Wetlands

Wetland loss in coastal areas is a nationwide phenomenon,²³ and New York State is no exception. Tidal wetland acreage is dropping along the state's marine coast, and what remains is shifting from high marsh (periodically inundated) to low marsh (inundated daily at high tide).²⁴ In New York City's Jamaica Bay, vegetated tidal wetlands are undergoing rapid conversion to mudflats, experiencing a 40 percent loss since 1974.²⁵ Extensive wetland areas have been filled in New York State to create land for development. In addition to the loss of natural services caused by filling wetlands, the low-elevation neighborhoods that take their place are at high risk from storm surge and sea level rise. To illustrate the scale of the problem, a report for the New York Bight by the U.S. Fish and Wildlife Service stated, "Approximately 121,410 hectares of tidal wetlands and underwater lands have been filled and only about 20% of the once existing tidal wetlands remain. Of the estimated 90,653 hectares of freshwater wetlands that existed in New York City prior to the American Revolution, only small areas remain. At the same time, a large percentage of the upland area has become urban developed land..."²⁶



Besides serving as important fish and wildlife habitats, coastal wetlands are an important form of natural infrastructure and offer protection from coastal storm damage.

Coastal wetlands and marshes are an important form of natural infrastructure along the shore and are estimated to prevent approximately \$23 billion dollars in coastal storm damage each year on the southeast and Gulf of Mexico coasts.²⁷ Tidal wetlands provide critical spawning grounds, nurseries, shelter, and food for finfish, shellfish, birds and other wildlife. They also improve surface water quality by filtering, storing, and detoxifying wastes.

²³ Stedman, S. and Dahl, T.E. 2008. *Status and trends of wetlands in the coastal watersheds of the Eastern United States 1998 to 2004*. National Oceanic and Atmospheric Administration, National Marine Fisheries Service and US Department of the Interior, Fish and Wildlife Service.

²⁴ DEC data.

²⁵ Hartig, E.K., et al. 2002. Anthropogenic and climate-change impacts on salt marshes of Jamaica Bay, New York City. *Wetlands* 22: 71-89.

²⁶ US Fish and Wildlife Service. 1997. Significant Habitats and Habitat Complexes of the New York Bight Watershed. Southern New England - New York Bight Coastal Ecosystems Program, Charlestown, Rhode Island.

²⁷ Costanza, R., et al. 2006. The Value of New Jersey's Ecosystem Services and Natural Capital: Part One, 3, <http://www.nj.gov/dep/dsr/naturalcap/nat-cap-overview.pdf>.

Although there are many factors involved in tidal wetland loss, sea level rise will exacerbate the phenomenon. Loss of marsh islands, which are particularly vulnerable to sea level rise, has been identified in areas from Peconic Bay to the north shore of Long Island and from the south shore of Long Island to Jamaica Bay.

Physical disruption and increased inundation caused by storms undermine the integrity of marsh structure and processes. Recent studies suggest that storm surges superimposed on higher sea levels will increase the frequency and extent of flooding in coastal regions and estuaries, thus increasing the risk of damage to vulnerable wetlands.²⁸

At the lower end of projected sea level rise rates, the slow deposition of water-borne sediment will enable some tidal wetlands to migrate into adjacent upland areas, mitigating their loss. Such migration will not be possible in areas where shoreline protective structures, development, or natural impediments (open water or steep slopes) prevent it, as is the case along much of New York State's heavily developed coastline. If the higher rates of projected sea level rise occur, migration will not be possible in most areas. New York State's tidal wetlands, especially marsh islands, will be lost to inundation.²⁹



As seas rise, natural migration of coastal features is critical to their long-term survival and is dependent on sediment transport processes. Where sediment transport is interrupted, natural features may be compromised. Credit: Jay Tanski

Low- to Moderate-Energy Shorelines

Low- to moderate-energy shorelines are small, non-vegetated beaches and tidal flats along the margins of protected areas such as estuaries and barrier island lagoons. Their narrow, steep upper beaches and relatively flat low-tide areas³⁰ contain a mosaic of microenvironments.³¹ This intertidal habitat supports resident species such as horseshoe crabs, killifish, crabs and shorebirds. Along with damage to these

²⁸ Gornitz, V., S. Couch and E.K. Hartig. 2002. Impacts of sea level rise in the New York City metropolitan area. *Global and Planetary Change*, v. 32, p. 61-88 and Rosenzweig, C. 2009. Climate Risk Information: New York City Panel on Climate Change. http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf

²⁹ Hartig, E.K., et al. 2002. Anthropogenic and climate-change impacts on salt marshes of Jamaica Bay, New York City. *Wetlands* 22: 71-89. and Fallon, D. and F. Mushacke. 1996. Tidal Wetlands Trends in Shinnecock Bay, New York 1974 to 1995. New York State Department of Environmental Conservation. 36pp. (unpublished).

³⁰ Nordstrom, K.F. 1992. *Estuarine Beaches*. London: Elsevier Science Publishers.

³¹ The New York Sea Grant Institute. 1993. *Estuarine Resources of the Fire Island National Seashore and Vicinity*. Report NYSGI-T-93-001. Stony Brook, New York.

populations, loss of this type of shoreline may lead to changes which affect human uses of these areas, including access to the upland area, fishing and boating access, and residential use.



Beach erosion could lead to loss of recreational areas.

It is difficult to predict how low- to moderate-energy shorelines will respond to sea level rise. At the lower projections of sea level rise, they might migrate at sites where there is adequate sediment, a relatively low slope, and no obstructions. Higher rates of relative sea level rise or lack of adequate sediment supply would drive the shoreline inland faster and could have other effects that cannot yet be easily assessed. Sandy beaches may increase as marshes are lost.

Significant changes in water depths or embayment size could accelerate erosion. Where sediment supplies are limited, landward migration of beach dune systems may be limited.

Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) is a group of flowering plants that have adapted to living fully submerged in lagoons, bays, estuaries and coastal marine waters. This type of vegetation has a profound influence on coastal and estuarine environments. It regulates water flow, stabilizes sediments, serves as a food source for marine life, and replenishes dissolved oxygen in the surrounding waters. It provides critical habitat and nursery grounds for wading birds and waterfowl and for commercially, recreationally, and ecologically important fish and shellfish.



Hardened shorelines, likely to increase as sea level rises, will prevent the landward migration of existing seagrass beds and decrease the availability of suitable nursery habitat for nearly every important finfish and shellfish in New York. Credit: Chris Pickerell

SAV beds are currently threatened by a host of factors.³² In 1930, there were an estimated 200,000 acres of marine SAV beds in New York State. This area has decreased by almost 90 percent over time to 21,803 acres. According to the 2009 New York State Seagrass Task Force Report, most of this loss is associated with water pollution, fishing and boating.³³ But increasingly, sea level rise and climate-driven temperature change could become important stressors. The deeper waters caused by rising sea

³² Orth, R.J., T.J.B. Carruthers, W. Dennison, C.M. Duarte, J.W. Fourqurean, K.L. Heck, A.R. Hughes, G.A. Kendrick, W.J. Kenworthy, S. Olyarnik, F.T. Short, M. Waycott and S. L. Williams. 2006. A global crisis for seagrass ecosystems. *Bioscience*. 56:987-996.

³³ *New York State Seagrass Task Force Report, 2009.*
http://www.dec.ny.gov/docs/fish_marine_pdf/finalseagrassreport.pdf

levels could limit light penetration. Distribution of SAV is also dependent on water temperature. While global water temperatures will increase, it is not clear what effect sea level rise may have on tidal flushing through the inlets along the south shore which may affect temperature.

Hard shoreline protective structures would prevent the landward migration of existing beds into newly inundated areas and may result in scour of soft-bottom habitats. As sea levels rise, contaminants leaking from inundated septic systems or brownfield sites could cause further degradation, resulting in additional damage to SAV beds and limiting the available nursery habitat for economically important fish and shellfish.³⁴

Barrier Islands

Barrier islands are long, relatively narrow islands and spits running parallel to the coast, enclosing bays and lagoons.³⁵ Composed primarily of sand, barrier islands are constantly reshaped by wind, waves, and currents, especially during storms. They protect natural and human communities from ocean storms. Commercial and sport craft seek shelter behind these islands for safe passage between ports. Sheltered by barrier islands, salt marshes provide habitat critical to the spawning and early life stages of many fish species, supporting the multi-million dollar commercial and sport-fishing industries along our coasts. These islands support unique ecological communities, and many of the bays and estuaries enclosed by barrier islands on the north and south shores of Long Island are designated as Significant Coastal Fish and Wildlife Habitat Areas by the New York State Department of State.

The processes controlling barrier islands are not completely understood, and there are significant local variations. For example, while all are highly dynamic and constantly changing, some have not migrated significantly during the last 750 to 1,300 years. The relationship between the rate of sea level rise and response of the barrier islands is not a simple one. During the next 30 to 50 years, at projected low to moderate rates of sea level rise, the greatest impact to barrier islands will likely be from storms and disruption of sediment transport by human activity. Over time, barriers may not be able to maintain themselves if sea level rise



Increased erosion of barrier islands could result in loss of important nesting, foraging and spawning sites. Credit: Jay Tanski

³⁴ *Op. cit.*

³⁵ The term *barrier island*, as used here, includes barrier spits and tombolos.

outpaces the ability of the system to supply sediment. At the highest rates of sea level rise, overwash (the process by which storm surges flow across barrier islands, depositing sediment and raising their elevation) and breaching of new inlets would increase significantly, potentially changing the physical and environmental characteristics of the bays. The habitat affected by changes to barrier islands includes horseshoe crab egg-laying sites; shorebird foraging, nesting and resting sites; and fish spawning and nursery sites. Because the natural mechanisms that create barrier islands depend on the islands' ability to change in response to storms and sea level rise, efforts to stabilize coastal barrier islands are contrary to the very processes that sustain them.

Coastal Bluffs



Sea level rise may increase bluff erosion. Credit: Jay Tanski

Bluffs are relict features of the shoreline, meaning they were formed by processes that no longer take place. As a result, coastal bluffs can remain stable or they can erode, moving landward as they do, but they will not increase. Bluff erosion supplies the materials that form other shoreline features: clay, fine silt, sand, gravel and boulders.

Rising sea levels combined with frequent, intense storms are likely to increase severe bluff erosion. In areas where bluff composition is chiefly fine-grained silt and clay unsuitable for beach building, sea level rise may increase the amount of this material deposited in offshore waters,³⁶ where it could smother colonies of blue mussel, ribbed mussel and American oyster. Closer to shore, large sediment deposits can damage fish spawning, feeding and nursery areas.

Where bluffs are composed primarily of sand and other coarse material, increased rates of erosion may change the present equilibrium between sediment supply and other processes that govern the formation and movement of shoreline features.

In addition to the impacts of eroded materials on aquatic and coastal habitat, increased bluff erosion presents a threat to homes built on or near bluffs and loss of habitat for species such as bank swallows. Increased bluff erosion may lead to an increased demand for shore stabilization. Stabilization of bluffs composed primarily of sands and cobbles, however, may cut off the supply of material to beaches, causing them to shrink or even disappear entirely over time.³⁷

³⁶ Tanski, J.J. 1981. *Episodic bluff erosion on the north shore of Long Island, NY*. Master's Thesis. Marine Sciences Research Center, State University of New York at Stony Brook.

³⁷ Bokuniewicz, H. and Tanski, J. 1980. Managing localized erosion of coastal bluffs. *Proceedings of Coastal Zone '80*. American Society of Civil Engineers. Hollywood, Florida. pp. 1883-1898.

Marine Rocky Intertidal Areas

Rocky intertidal areas are dominated by bedrock, stones, or boulders, with little vegetation. They are generally high-energy habitats, exposed to continuous erosion by wind-driven waves or strong currents, and can be either natural formations or human-made structures such as stone jetties and rock revetments.

These zones have high biodiversity and high productivity, providing habitat, nursery grounds and food for marine and terrestrial organisms. Because of their exposed position and the fact that their resident species are dependent on a tidal cycle of alternating wet and dry periods, these areas are particularly vulnerable to sea level rise and other phenomena related to climate change. As the duration of tidal inundation increases, species will migrate landward. In areas that become completely inundated or where landward migration is obstructed, intertidal species will be lost.

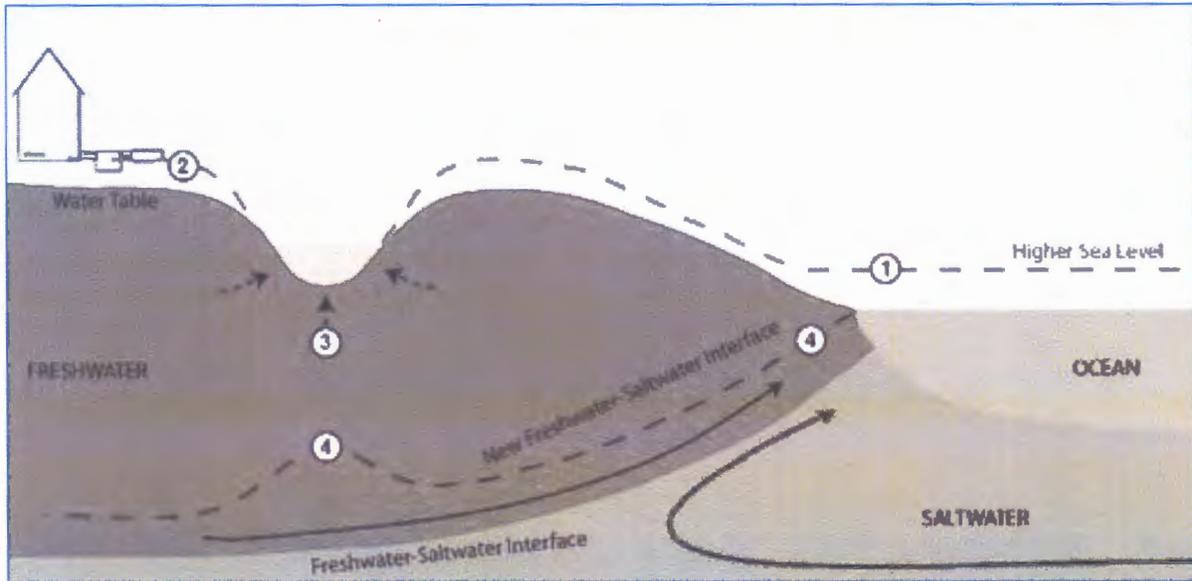


Natural rubble fields can expand only if the upland glacial soils within which they are buried are allowed to erode with advancing sea level. Credit: J. Meyerowitz

Rocky intertidal habitat can be created or preserved through both natural (deposits of stone eroded in adjacent or updrift areas) and artificial means (jetties and rock revetments). Jetties and rock revetments are often constructed on existing native habitat—frequently sandy beaches or bluffs—to protect shoreline property; this activity destroys the value associated with the original habitat.

Freshwater Resources

As sea level rises, so will the groundwater level, and this will have several different effects on freshwater ecosystems. First, a higher water table will mean a thinner unsaturated layer between the land surface and the water table and less time during which soils in low-lying areas experience dry conditions. This will substantially alter the habitat in these areas, increasing wetland or moisture-tolerant species, including disease-vectors and pests, at the expense of upland species that require drier conditions.



Freshwater is underlain by denser saltwater in the shallow (water table) aquifer system of Long Island. 1. Conceptualized position of higher sea level. 2. Corresponding position of higher water table. 3. Resulting increase in hydraulic gradient and flow to streams. 4. Associated decrease in the depth to freshwater-saltwater interface. As this interface moves higher drinking water supplies may be affected. Credit: Ben Gutierrez, USGS

Second, as sea level rises, the point at which freshwater and saltwater meet will shift further upstream in rivers and streams, and further inland and upward in coastal aquifers. Vegetation will likewise shift from freshwater to brackish or salt-tolerant species.

Anadromous fish (marine fish that spawn in freshwater) will be affected, as will other freshwater fish and fauna that currently use these areas for nesting, spawning and foraging. Freshwater habitat could migrate inland, though dams, bridges, shoreline development and other obstructions will impede such movement.

Ecosystems: Actions Needed to Adapt to Sea Level Rise

To maintain and expand the ecosystem services provided by New York's coastal systems, the state should pursue the following goals:

- Minimize future habitat loss
- Protect fresh drinking water resources
- Provide coastal natural resources with adequate space to adapt to sea level rise
- Restore the natural mechanisms, such as sediment movement in coastal waters, which drive adaptation processes, including landward migration of habitat

It is essential to start with a current and accurate accounting of shoreline conditions throughout New York State (Recommendation 6) that shows how shorelines may change with rising sea levels. Such an inventory should include the location of areas of potential inundation as well as current locations of structural protection measures that could hinder the migration of natural systems responding to sea level rise.

The collected information must serve as the basis for coastal natural resource management strategies that are coordinated on federal, state and local levels. Such strategies should emphasize ecosystem-based management and ensure adequate funding to promote effective adaptation (Recommendations 2, 11, 12, 13).

As the first line of defense against extreme storms, features such as dunes, barrier islands and tidal wetlands take the brunt of waves and storm surge, reducing the impact on coastal communities and infrastructure. To preserve coastal ecosystem functions, natural features must be allowed to respond naturally or migrate inland as sea level rises.



New York State needs a regulatory framework that considers sea level rise in proposals for development in areas where the migration of dunes and other natural features may be restricted.

Structural measures, such as seawalls and dikes, can be expensive to build and maintain, and they often interrupt sediment transport processes, result in biological impacts, and change erosion patterns. They create barriers that prevent natural systems such as tidal wetlands from migrating inland to adapt to sea level rise, simultaneously risking the reduction or elimination of foreshore areas currently accessible to the public under the Public Trust Doctrine.³⁸ Additionally, there is no assurance that they will be adequate protection from long-term sea level rise.

Conversely, solutions such as elevation and strategic relocation can reduce or eliminate the long-term threat of flooding with fewer impacts to natural systems and at potentially lower costs. In light of these factors, federal and state agencies have begun to incorporate such solutions into their long-term coastal protection planning and management.³⁹

³⁸ http://www.nyswaterfronts.com/waterfront_public_trust.asp

³⁹ US Army Corps of Engineers: Environmental Operating Principles: <http://www.usace.army.mil/environment/Pages/eop.aspx>

If feasible and protective, environmentally beneficial techniques sometimes referred to as “soft engineering” or “living shorelines,” could be used where shoreline stabilization is required to maintain public infrastructure that cannot otherwise be secured by non-structural measures. Properly designed and implemented, these approaches, which integrate structural shore elements such as breakwaters and sills with habitat-sustaining elements such as marshes, beaches and reefs, can preserve environmentally beneficial qualities of riparian, intertidal and near-shore zones, and minimize negative effects. While they are generally more environmentally benign than hard structures, such techniques do not completely eliminate the negative impacts of structures and they may not replace the habitat originally characteristic of the site. Such solutions, however, may be appropriate in areas where natural systems are largely absent, such as Manhattan.

New York State needs a regulatory framework that considers sea level rise in proposals for development and infrastructure in high-risk coastal areas where the migration of dunes and other natural features may be restricted (Recommendations 4, 5, 7). Such regulations should do the following:

- Restrict hard structural shoreline protective measures and development in priority areas for wetland, dune, and beach migration
- Prioritize and incentivize the use of non-structural and soft shoreline protection measures to reduce risk
- Provide larger buffers or setbacks between natural protective features and new development
- Require local and regional planning efforts to establish areas for migration of natural protective features

There is also a need for additional studies, including establishment of long-term monitoring systems that will improve our vulnerability analyses for natural areas at greatest risk of flooding (Recommendation 12). These include the following:

- Monitor and evaluate the cause of tidal wetland loss and changes at a landscape scale
- Evaluate potential shifts in the upstream extent of the Hudson River salt front and inundation of underground drinking water supplies on Long Island
- Map projected range shifts of key coastal species
- Better understand how sea level rise, storms, erosion, and engineered shoreline modifications affect shoreline changes, water quality, wetlands and aquatic habitat

Public Works and Infrastructure

Public and private infrastructure dominates large sections of New York's coastline. This infrastructure includes power plants, sewage and drinking-water treatment plants and pump stations, landfills, waste transfer stations, major road and rail transportation networks, air and sea ports, and a host of industrial facilities. Underneath the streets of New York City, elaborate systems of public utilities that enable the



Sea level rise will threaten critical power generation and distribution facilities.

city to function are vulnerable to increased flooding from the intrusion of surface water as well as from rising groundwater levels. Densely populated communities line our marine coasts, along with the housing, businesses, recreational resources and institutions that serve them and help shape their character.

Nearly all this infrastructure was constructed before sea level rise was recognized as a significant problem. Today, sea level rise is recognized as a phenomenon with potentially dramatic impacts on existing and new infrastructure. Decisions regarding coastal infrastructure are complex in process (Table 2). Decision makers in both public and private sectors must ensure that relevant planning decisions reflect this reality so that New York State's economy and communities are poised to thrive well into the future.

If we do not begin proactive adaptation planning, sea level rise and related coastal hazards will significantly exacerbate current flooding problems that much of New York State's coastal infrastructure already faces and create new problems as well. The impacts of inundation and flooding are complex. It is not only water that causes damage. Sea water contains salt, which corrodes equipment and undermines its strength. Floodwaters can release stored chemicals and petroleum, pick up contaminated soil and transport lead-based paint. Floodwaters can overwhelm combined storm and wastewater sewer systems and lead to release of untreated sewage. Many elements of existing infrastructure were not designed to withstand extended exposure to moisture. Much infrastructure will be susceptible to ongoing structural and mold problems, such as those that became long-term hindrances to recovery after Hurricane Katrina.

These infrastructure sectors influence and are dependent upon one another. Disruption in one often impedes the function of, or exacerbates the damage to, others. For example, solid waste removal systems depend heavily on transportation networks, and all sectors rely on transportation for access to sites that need repair after flooding.

Past experience has further illuminated the consequences of such interdependence. A Federal Communications Commission (FCC) independent panel noted in the aftermath of Hurricane Katrina that most public safety agencies plan only for one- or two-day power failures. Soon after the hurricane struck, fuel supplies for emergency generators became scarce, and natural gas supplies were disrupted.

TABLE 2: Examples of Parties Responsible for Coastal Infrastructure Decisions

Examples of Infrastructure	Planning & Development	Potential financing & Incentives	Approval or Permits Often Required
<i>Telecommunications cables</i>	Private utility	Usually private funding only	Public Service Commission State or local transportation department Federal Communications Commission Municipalities
<i>Power plants</i>	Private utility State Energy Plan NYSERDA (research assistance)	Usually private funding only	NYSDEC NYSDOS (Coastal Zone Mgt) Public Service Commission US EPA Federal Energy Regulatory Commission Local planning commission
<i>Electric and natural gas delivery infrastructure</i>	Private utility	Usually private funding only	Public Service Commission State or local transportation dept Federal Communications Commission Municipalities
<i>Residential development</i>	Private developer or landowner Local waterfront or zoning plan	Empire State Development Corp. Local economic development corporation Federal flood insurance DEC and DOS via Brownfield Cleanup Program Environmental Facilities Corporation	NYSDEC NYSDOS (Coastal Zone Mgt) Army Corps of Engineers Local planning commissions County departments of health
<i>Commercial development</i>	Private developer or landowner Local waterfront or zoning plan	Empire State Development Corp. Local economic development corporation DEC and DOS via Brownfield Cleanup Program	NYSDEC NYSDOS (Coastal Zone Mgt) Army Corps of Engineers Local planning commission
<i>Waste transfer stations</i>	Municipality or private company Local solid waste mgt plan Local waterfront or zoning plan	Environmental Facilities Corporation	NYSDEC NYSDOS (Coastal Zone Mgt) Army Corps of Engineers Local sanitation dept Local planning commission
<i>Shoreline protection structures</i>	Private sector Municipal governments Army Corps of Engineers	Private funding Municipal governments Empire State Development Corp. Local economic development corporations	NYSDEC NYSDOS (Coastal Zone Mgt) Office of General Services (state land) Army Corps of Engineers US Dept. of Interior (including Fish & Wildlife Service) Local planning commission
<i>State roads</i>	NYSDOT	Governor Federal Dept. of Transportation (matching funds)	NYSDEC NYSDOS (Coastal Zone Mgt) Army Corps of Engineers US EPA US Coast Guard (bridges) US Dept. of the Interior
<i>Wastewater and sewer lines</i>	Municipality Combined sewer overflow management plans	Environmental Facilities Corporation (Potential for private financing in future)	NYSDEC NYSDOS Local planning & zoning commissions County departments of health Local building departments

Similarly, portable radio charging units and handheld satellite units became unusable when there was no power to charge their rechargeable batteries.⁴⁰ If not addressed, these and other complex interactions will hinder both recovery from major weather events associated with sea level rise and adaptation to its chronic effects.

The Task Force examined several infrastructure sectors and the ways in which they may be compromised by sea level rise and related coastal hazards.

Communications

Communication networks are vital to every aspect of daily life, but especially to police, fire and other emergency services. Many of today's communications networks (wireline, wireless, Internet, voice-over Internet protocol and cable) are interconnected and thus vulnerable to disruption. Flood-induced outages to one centralized facility or primary cable path can result in total loss of service over an entire area. "Cascade-effect" outages can affect facilities beyond the immediately damaged area. Frequent inundation of communication delivery systems will accelerate deterioration of cable sheathing, telephone poles, and other components, making outages more likely and longer lasting. Outages will increase as the areas affected by storm surges expand to places where infrastructure was not designed to withstand such events.

Energy

The risks to energy facilities parallel those facing communication infrastructures. Flooding of power plants can result in total loss of service for a given area. Frequent inundation of electric and gas transmission and distribution systems can accelerate their deterioration, causing more frequent and longer-lasting outages with extended repair times. Flooding and a higher water table can impede access for repair and maintenance of underground gas and electric lines and equipment. Above- and below-ground storage tanks containing bulk liquids along the coast could be damaged in storms or corroded by saltwater inundation. Leakage could contaminate ecosystems and drinking water and be costly to clean up.

Shoreline Protective Structures

When water overtops bulkheads, seawalls and revetments—structures intended to protect the shoreline against seawater and erosion—buildings can be damaged or lost, especially if the presence of protective structures has encouraged development in high-risk areas. As sea level continues to rise, efforts to prevent overtopping coastwide may ultimately be futile.

⁴⁰ Federal Communications Commission Independent Panel. March 6, 2006. Reviewing Impact of Hurricane Katrina on Communications Networks: Lessons Learned for Emergency Communications.

Economists have identified perverse subsidies as a stimulant that encourages development in high-risk locations. A report in the journal *Ecological Economics* highlighted some of the negative effects of these subsidies and stated “Many existing perverse subsidies should be eliminated. Tax breaks to the oil and gas industries, to homeowners of coastal developments, and for new, publicly funded infrastructure in coastal zones fall into this category. These programs are economically inefficient, environmentally and/or socially damaging, and benefit the few and often wealthy and politically well connected at the expense of the majority of US taxpayers.”⁴¹

Hurricane Katrina prompted the National Academy of Engineering and National Research Council to declare that “...because of the possibility of levee/floodwall overtopping—or more importantly...failure—the risks of inundation and flooding never can be fully eliminated by protective structures no matter how large or sturdy those structures may be.”⁴²

Shoreline protective structures have limited life spans, lasting only a few decades, and attempts to maintain them in the face of sea level rise will be costly.⁴³ For example, the costs of beach nourishment alone are substantial.



Engineered shoreline protection structures have the potential to exacerbate erosion.

The NOAA Coastal Services Center reports expenditures in New York for beach fill grew from approximately \$2 million annually in 1962 to almost \$32 million in 1996.⁴⁴ The escalation of beach fill costs will accelerate in the future with sea level rise. Given the length of New York’s coastline, it would be prohibitively expensive to engage in beach fill as a routine means of combating beach erosion resulting from sea level rise. Notwithstanding the benefits for ocean-front homes, beach nourishment does not reduce the long-term risk of development in high-risk locations. Major storms will continue to affect coastal areas, some barrier breaches will occur despite prevention efforts, bay-shore communities will be flooded from storm surges through ocean inlets, and some of the most exposed areas will not be

⁴¹ Bagstad, K.J., K. Stapleton, J.R. D’Agostino. 2007. Taxes, subsidies and insurance as drivers of United States coastal development, *Ecological Economics*, 63: 285-298.

⁴² National Academy of Engineering and National Research Council. 2009.: *The New Orleans Hurricane Protection System, Assessing Pre-Katrina Vulnerability and Improving Mitigation and Preparedness.*

⁴³ Cooper, J.A.G., J. McKenna. 2008. Social justice in coastal erosion management: The temporal and spatial dimensions. *Geoforum* 39:294-306.

⁴⁴ <http://www.csc.noaa.gov/beachnourishment/html/human/socio/images/b3f9.htm>

secure, even with beach nourishment. If the protective measures are eventually undermined or destroyed, the public investment would be lost. However, there will be some areas where shoreline protective measures may be necessary due to the substantial existing investment and lack of feasible or economically viable alternatives, as for example in densely developed near-shore areas of New York City. In such cases, feasible soft-engineering techniques should be evaluated in comparison with other structural and adaptation options to identify the combination of measures that will provide adequate safety for human uses and optimal environmental quality.

Solid Waste

Flooding can cause structural damage to solid waste facilities and the transportation infrastructure that allows movement of waste in and out of them. Post-storm repair work on solid waste facilities and transportation infrastructure, moreover, will conflict with the increased demand for debris removal that occurs after a storm, potentially overwhelming the system. Waste facilities inundated by water have significant potential to contaminate floodwaters with petroleum and other noxious substances, causing odors and pathways for disease and affecting nearby ecosystems, residents and businesses.



Sea level rise threatens marine transfer stations and other coastal waste management facilities. Such facilities are also potential sources of contamination if they are flooded during storms.

Transportation

Reliable, operational transportation networks are essential for maintaining normal business and residential life. The need for these systems is never more critical than during emergency response and evacuation. Loss of road, air, ship and rail transportation from flooding has widespread repercussions, compounded by prolonged repair times due to lack of service. Sections of commuter and freight railways along the Hudson are at special risk due to their location just feet from the river, as are coastal airports.

Regular or profound flooding could threaten rail movement throughout the Hudson Valley, including plans for high-speed rail development. Foundations for rail lines could be undermined by erosion, and signaling systems damaged by saltwater infiltration could lead to service disruptions. Rising water tables will increase the risk of flooding and the need to pump standing water from underground or low-lying facilities such as the New York City subway system. They could also weaken the substrate or subgrade for other transportation infrastructure. Public roadways can become permanently obstructed or rendered impassable, requiring relocation of critical thoroughfares.



Railroads, highways and subways are all at risk from coastal flooding and salt water damage.

Of the major airports in the New York metropolitan area, LaGuardia is at risk of flooding from powerful coastal storms and sea level rise. Even without sea level rise, a ten-foot storm surge, similar to that of Hurricane Donna in 1960, would begin to overtop its protective barriers. Water levels above 13 feet would cause significant flooding at the airport. However, such flooding is not expected to affect the airport's structures and equipment uniformly; a more detailed study is needed to evaluate which areas would be most vulnerable.

Sea level rise will also affect public commerce. The goods-movement industry, especially in coastal states, relies heavily on waterborne transit. Sea level rise may affect ports, navigable waterways, freight railways, roadways, and transportation infrastructure connections.

Drinking Water Supplies

Salt water intrusion threatens potable water supplies, especially on Long Island, where salt water intrusion into the sole source aquifer would compromise drinkable water for hundreds of thousands of people. It also threatens the Hudson River, which is a primary water supply source for many communities and a potential emergency water supply source for New York City, having been used as such during three severe water shortages within the past 45 years. Saltwater intrusion could affect freshwater intakes at the Chelsea Pumping Station, Castle Point Medical Center, Poughkeepsie, Port Ewen, Highland/Town of Lloyd, Dutchess County Water Authority and Rhinebeck. In addition, flooding and other sea level rise effects pose many of the same risks to drinking water treatment facilities as those that threaten other infrastructure types: corrosion, erosion and deterioration.



Sea level rise will push the Hudson River salt front upriver, threatening water supplies of several Hudson Valley communities and businesses, including this water intake at the IBM facility in Poughkeepsie.

Water-supply wells and distribution systems are at risk from salt water corrosion and rising groundwater conditions. Costs of necessary repairs, placements and updates to New York State's water infrastructure over the next 20 years have been estimated at \$38.7 billion, although estimates of the costs of modifications to respond to climate change specifically have not been developed. These costs will, however, be significant.⁴⁵

Wastewater Management Systems

Wastewater treatment plants in the coastal zone are at risk from flooding and the associated corrosion caused by salt water infiltration. In addition to the treatment facilities themselves, the substrate for sewer pipes could be damaged by erosion and a rising water table. Septic systems are also at risk from salt water corrosion and rising groundwater conditions. Costs of necessary repairs, placements and updates to New York State's municipal wastewater infrastructure over the next 20 years have been estimated at \$36.2 billion, although estimates of the costs of modifications to respond specifically to climate change have not been developed. These costs will, however, be significant.⁴⁶

Combined sewer outfall systems, already experiencing untreated discharges during high-rainfall events, will be further compromised by backflow and/or gravity discharge problems as sea level rises. Treatment plants located at low elevation to maximize gravity flow may be jeopardized, and additional pumping may be necessary to maintain service in low lying areas. Studies demonstrate excessive nutrient contributions from near shore septic systems.⁴⁷ These systems will be further compromised by sea level rise.

Public Works and Infrastructure: Actions Needed to Adapt to Sea Level Rise

The first step in assessing the vulnerability of New York's infrastructure is to identify and map areas at greatest risk. The next step is to begin planning for risk reduction in those areas (recommendations 3, 4, 5). Alongside that effort, an inventory of the types and value of



Construction of shoreline protection structures can encourage development in high-risk areas.

⁴⁵ NYS Department of Health, Drinking Water Infrastructure Needs of New York State, November 2008, http://www.nyhealth.gov/environmental/water/drinking/docs/infrastructure_needs.pdf.

⁴⁶ NYSDEC, 2008. Wastewater Infrastructure Needs of New York State. 37pp.

⁴⁷ See, for example, US Geological Survey. 2009. Analysis of the Shallow Groundwater Flow System at Fire Island National Seashore, Suffolk County, New York. Scientific Investigations Report 2009-5259.

infrastructure, critical facilities (hospitals, police and fire departments, schools, emergency services, key transportation routes), and private and commercial property in high risk areas is required (Recommendation 6).

Policy changes needed to reduce vulnerability include limitations on the siting of new development or infrastructure (including transportation corridors) in high-risk areas (recommendations 2, 5, 7). Also needed are changes to permit requirements for setbacks and design elevations and modifications to building codes for structural elements and corrosion-resistant equipment.

Non-structural solutions, such as elevation and relocation of structures, must play a major role in a statewide response, especially in less urbanized areas where they may be less expensive and more effective at reducing long term vulnerability (Recommendation 5).

Long-term plans for maintenance, retrofits and upgrades should incorporate opportunities for adapting existing infrastructure to projected changes in flood risk through elevation, relocation, increased capacity or other measures. Emergency management planning must incorporate increased demand for emergency services and consider sea level rise impacts on evacuation routes. Use of state resources for repair or construction of shoreline protective measures—whether natural or engineered, temporary or long term—should be evaluated to ensure that they are the most cost-effective, long-term, site-specific approaches feasible. Plans for back-up measures for critical systems such as energy and drinking water should include impacts of sea level rise. Determinations of priority for remediation of

hazardous waste sites and brownfields should consider the likelihood of increased flood risk. Residents of some areas may have to explore alternative sources for drinking water should their primary sources be degraded.

Non-structural solutions, such as elevation and relocation of structures, must play a major role in a statewide response, especially in less urbanized areas where they may be less expensive and more effective at reducing long-term vulnerability (Recommendation 5). Such strategies include conserving natural systems such as barrier islands, tidal wetlands and dune systems that currently provide flood protection and community benefits at no cost. Low-impact development and green infrastructure could also help mitigate the effects of sea level rise, including flooding. Low-impact development emphasizes conservation and use of on-site natural features to protect water quality. Green infrastructure refers to the use of natural or engineered systems that mimic natural processes. It includes rain gardens, rooftop catchment systems and green roofs, technologies and practices that allow treated wastewater and stormwater to infiltrate back into groundwater systems rather than piping it into the nearest waterbody, where it may exacerbate coastal flooding.

Due to their escalating capital and maintenance costs and the incentives they create for new development in high-risk areas, reliance on structural protection measures alone, as well as funding such measures, without examining alternative or complementary solutions, should be significantly reduced over time. State and federal support for shore defense measures will likely be reduced and become uncertain in the future as sea level rise effects, distributed over an expanding geographic area, compete for funding with other budget priorities. Local governments and private interests compound their risks by relying on these uncertain external subsidies for high-risk development. A more efficient, market-based approach to decisions on siting development or undertaking adaptive measures for existing development will be needed to distribute finite resources. A close association between development decisions and costs for emergency services, coastal hazard defenses and environmental impacts would facilitate more realistic analysis of the full costs associated with coastal infrastructure and development.

In areas where structural protection is warranted, such as some areas of New York City, the state should develop guidance to enhance the ecosystem value of structural protection measures (Recommendation 8). At the same time, the state must coordinate with federal agencies like the Federal Emergency Management Agency (FEMA) and the U.S. Army Corps of Engineers to reduce incentives for new development and redevelopment in high-risk areas (recommendations 5, 14).

Communities

Without sound planning for adaptation, sea level rise and associated coastal hazards will wreak damage on both individual and community scales. Because of all the amenities that life near the shore offers, people have long been drawn to settle in the areas most vulnerable to storm damage. The number of people at risk from a Category 3 hurricane along New York State's coast, for example, has been estimated at nearly 2 million and, for a Category 4 hurricane, more than 3 million.⁴⁸ Residential structures in the 100-year floodplain of New York City and Nassau, Suffolk and Westchester counties have a total estimated value of over \$125 billion. While this figure includes riverine as well as coastal flood plains, it reflects the scale of flood exposure in the region.⁴⁹

While coastal development has burgeoned, the many federal, state, and local decisions governing siting, design, construction and financing have not yet incorporated measures necessary to address the long-term effects of sea level rise and related coastal hazards. For example, Flood Insurance Rate Maps (FIRMS) issued by FEMA as part of the National Flood Insurance Program (NFIP) establish areas at current risk from 100-year and 500-year floods and dictate rates of flood insurance for structures within

⁴⁸ New York State Office of Emergency Management. *New York State Standard Multi-Hazard Mitigation Plan*, Volume 1, Section 3, Table 3-29: Estimated Population Residing Within Hurricane Storm Surge Zones, p. 3-170. Report approved by FEMA 1/04/08. <http://www.semo.state.ny.us/programs/planning/hazmitplan.cfm>

⁴⁹ Ibid. Table 3-18: Estimating Potential Flood Loss by County, p. 3-146.

those areas. However, FEMA flood maps in coastal counties in New York State, with the exception of Nassau and Suffolk counties, use outdated flood studies from the 1980s. Although FIRMS are designed solely to serve as insurance rate maps, they are often used by state and local planners to approve or disapprove structures, decisions that have inherent long-term impacts. Because many FIRMS are outdated and do not include areas where risk of flooding will increase due to sea level rise, this practice dramatically underestimates the actual long-term cumulative impacts of individual development decisions in high-risk areas.

The structure of many current federal and state-funded actions and programs protect or subsidize high-risk coastal development by shifting the cost of flood protection and storm recovery from property owners and local governments to state and federal taxpayers. Examples of these subsidies include funding for structural shoreline protection (which includes artificial fill or 'beach nourishment'), insurance coverage through the National Flood Insurance Program, and federal and state post-disaster recovery funding and assistance that encourage replacing or rebuilding structures with a high level of risk exposure.⁵⁰ These programs distort market forces and favor coastal development. One unintended effect of programs that support development in coastal floodplains will be increased risk of negative impacts from storm surge and inundation due to sea level rise.

According to New York University's Institute for Policy Integrity:

*As a result of the National Flood Insurance Program's (NFIP) below-market premium rates, building in floodplains appears more attractive to private developers ... In other words, the flood insurance program encourages private development at a rate that is inefficient and unsupported from a social perspective that more fully considers the ecological and financial risks.*⁵¹

Protecting development at high risk of coastal flooding thus far has come at great expense to the taxpayers of New York State. In the last five years alone, the state spent more than \$22.6 million in projects to protect public infrastructure, and commercial and residential property from erosion and flooding in coastal areas. Costs are expected to continue to rise due to inflation and market forces. The predicted total cost for the construction of a planned project in Long Beach, Nassau County is estimated at over \$100 million, with a projected state and local cost of roughly \$30-35 million. The implementation of the Fire Island Inlet to Montauk Point Storm Damage Reduction Project alternatives in Suffolk County has the potential to cost New York State and local governments upwards of \$700 million over several

⁵⁰ Bagstad, K.J., K. Stapleton, J.R.D'Agostino. 2007. Taxes, subsidies, and insurance as drivers of United States coastal development. *Ecological Economics*. 63:285-298.

⁵¹ Holladay, S. and J. Schwartz. 2010. *Flooding the Market: The distributional costs of the NFIP*. Institute for Policy Integrity at the New York University School of Law. Policy Brief No. 7.

decades, including a cost of \$500 million for building retrofitting, and over \$200 million for other solutions such as beach fill, restoration alternatives and other approaches.⁵²

Large-scale, engineered fortifications may not be the best way to protect large cities and densely populated urban areas such as New York City from coastal storm impacts and inundation. The devastation following Hurricane Katrina resulted in an examination of structural protection measures, leading to findings that have broad national implications.

Among the significant findings of the National Academy of Engineering and the National Research Council:

*...the risks of inundation and flooding never can be fully eliminated by protective structures no matter how large or sturdy those structures may be.*⁵³

The Council found that continued implementation of primarily structural defenses sends an unreliable message to the public—that they are safe: "Hard structures, like levees, more often than not give coastal residents a false sense of security."

Non-structural solutions can reduce or eliminate the long-term threat of flooding with fewer impacts to natural systems and at potentially lower long-term costs. These alternatives rely on planning strategies such as land acquisition, buffer zones, conservation of natural flood protection systems, building elevation, building codes and other local regulations.^{54, 55}

The most notable research specifically evaluating the efficacy and efficiency of non-structural approaches to risk reduction, such as land-use planning in coastal areas, has been conducted at Texas A&M University under Dr. Samuel D. Brody. Research in multiple local communities examined the relationship between specific mitigation techniques and insured flood losses and demonstrated that none of the structural approaches significantly reduced insured residential property damage. In contrast, almost half of the non-structural strategies were found to be significantly related to reduction of losses from floods reported to the National Flood Insurance Program. Having a flood policy within a local comprehensive or development management plan was found to have the strongest statistical

⁵² New York State Department of Environmental Conservation, Division of Water, Coastal Management Bureau.

⁵³ National Academy of Engineering and National Research Council. 2009. The New Orleans Hurricane Protection System: Assessing Pre-Katrina Vulnerability and Improving Mitigation and Preparedness. National Academies Press.

⁵⁴ Jacob, J.S. & S. Showalter. 2007. The Resilient Coast: Policy Frameworks for Adapting the Built Environment to Climate Change and Growth in Coastal Areas of the US Gulf of Mexico. Sea Grant - Texas.

⁵⁵ It is important to note that non-structural approaches do not include 'soft structural' techniques such as beach nourishment due to the narrow definition of "structural" under the Shoreowner's Protection Act (Environmental Conservation Law, Article 34) and corresponding regulations (6 NYCRR Part 505).

correlation with damage reduction. Protected areas and setbacks from flood-prone areas were also significantly associated with reduced flood loss.⁵⁶

In light of these factors, federal and state agencies have begun to incorporate non-structural solutions into their long-term coastal protection planning and management.

Risk in coastal areas is also increasing due to decisions that favor coastal development at the local level. Local governments are at the front lines of decision making about regulation, taxation, zoning and development decisions in New York State's 315 coastal cities, towns and villages. Because New York is a 'home rule' state, local governments have the power to control land use as long as their decisions are consistent with a local comprehensive plan or other well-considered plan. They decide how close landowners can build to the water, enforce building codes and permit development projects. In most communities, these decisions are made in isolation. Communication between localities is minimal and regional-scale impacts of development on natural systems are often not considered. In addition, many local leaders have little knowledge of the risks posed by sea level rise and continue to permit new development in high-risk coastal areas.

Knowledge of how local governments function and fund services is important in understanding why high-risk coastal development is so often permitted and even encouraged at the local level. Local governments typically have limited financial resources and staffing available to develop and implement climate-change adaptation or other hazard-related strategies.

Local political pressures generally favor economic growth. New residential development is the primary means to raise revenue for these governments through assessment of real property taxes. Commercial development translates to investment dollars, creation of jobs and local economic stimulus. Coastal locations have premium real estate values, making them highly desirable to buyers and the local governments that receive tax revenue. This situation presents a serious obstacle to dealing with climate change impacts locally.



City of Albany waterfront.
Waterfront amenities will be increasingly vulnerable to flooding.

Finally, the perception of risk is greatly skewed by human memory. Several decades have passed since a major storm has devastated New York State, and investors, decision makers and buyers have been lulled into underestimating the actual risk over the lifetime of the development and the cost to recover.

⁵⁶ Blackburn, J. & P. Bedient. 2010. Learning the Lessons of Hurricane Ike - A Synopsis of Ongoing SSPEED Center Research Funded by the Houston Endowment.

The cumulative effect of the above factors is that the potential consequences of a large storm event continue to increase. Indeed, the resilience of communities such as Long Beach and the north shore of Staten Island is increasingly being tested as their protective natural systems and critical infrastructure are under threat or in decay.

Community resilience to threats related to sea level rise involves more than physically protecting property, buildings or structures from potential impacts. The concept encompasses a range of intangible considerations that are critical to a particular community's capacity to withstand and recover from loss or damage.

The various considerations for community resilience, recovery and adaptation fall into four broad categories:

- Public health
- Loss of shelter
- Disrupted livelihoods and loss of economic vitality
- Quality of life and community cohesion

Public Health

Storm surges and other flooding events can cause injury and death. They can also generate a host of more persistent environmental health hazards, including bacterial, fungal and chemical contamination of drinking water sources, sewage and solid waste system disruption, hazardous materials releases, and increased or displaced populations of insects, rodents and other disease vectors.

Typical land-use planning and permitting processes and public-health policies seldom explicitly address the public-health implications of development in areas at high risk for flooding.⁵⁷ During and after floods, the imperative to restore the *status quo* as quickly as possible can interfere with efforts to identify and address less obvious problems, such as newly contaminated soil or housing.⁵⁸ In fact, lack of specific information, data and analysis regarding post-storm vulnerability to flood-dispersed contamination represents a significant public-health concern for coastal communities. Recovery can be further hampered by gaps in understanding of risk factors and treatments for post-flood disease outbreaks.

⁵⁷ Levi, J., et al. 2009. Health problems heat up: Climate change and the public's health. Trust for America's Health. See also Morello, L. 2009. Adaptation: public health often moves behind the climate curve study. ClimateWire: The Politics and Business of Climate Change. <http://www.eenews.net/climatewire/2009/10/27/>

⁵⁸ Gautam, K.P. and E.E. van der Hoek, E.E. 2003. Literature Study on Environmental Impact of Floods. Delft Cluster and the Netherlands Centre for River Research.

Loss of Shelter

Besides physical injury, the most significant risk from flooding is long-term or permanent loss of shelter. Weakened structures, damaged electrical or plumbing systems, mold, and contamination can render buildings uninhabitable. Housing degradation can result from both acute events such as storm surges and the more gradual effects of sea level rise, including erosion and salt water inundation.

Without realistic risk assessments for structures in high-risk and chronically affected areas temporary shelters become strained, leading to permanent relocation of a significant percentage of a community's population.



Long Beach lost many homes and other structures to the 1938 "Long Island Express." The potential for catastrophic losses among south shore communities has increased with rising seas and development in high-risk areas.

Disrupted Livelihoods and Loss of Economic Vitality

The full economic impact of storm surges and inundation goes beyond direct damage and losses. Though less well studied, indirect losses from the disruption of the local economy—key industries, employers, commercial centers or tourist attractions—can have devastating consequences for a community. These losses are harder to

measure than those stemming directly from physical damage. Determining the cost of repairing a ruptured power line is straightforward. It is a greater challenge to determine the losses to businesses or industries forced to close because of a power failure or interrupted transportation network. The effects can be long lasting, entailing economic consequences from which a community may never recover.

There are few, if any, mechanisms in place to measure such indirect losses, and those that are available (such as business interruption and unemployment insurance) are often not applicable to the small businesses that form the economic backbone of many communities. Small businesses account for approximately 75% of all new jobs in the United States, but they are also the most vulnerable to a disaster.⁵⁹ Understanding the vulnerability of interdependent networks of small businesses and other hubs of local economic activity is critical to strengthening community resilience in the face of sea level rise. Current guidance on conducting such assessments, however, is lacking.

⁵⁹ Lam, N., K. Pace, R. Campanella, J. LeSage & H. Arenas. 2009. Business Return in New Orleans: Decision Making Amid Post-Katrina Uncertainty. PLoS ONE. 4:1-10.

Quality of Life and Community Cohesion

Flood and storm damage can lead to transient or permanent loss of services and amenities—hospitals; clinics; community, senior and day care centers; schools; and recreational open space. In many cases, communities, especially low-income communities, have invested considerable time and energy to secure these amenities, and their full value may not be reflected in typical vulnerability assessments. Such losses degrade the quality of life for shoreline communities.

To avoid irreplaceable loss from sea level rise and catastrophic storms, cultural and natural resource assets, as well as infrastructure and development, must be adapted for coastal resilience. The important socio-cultural, economic and natural assets of a community must be assessed for vulnerability and relocated or otherwise adapted as environmental conditions change, so that the functions and way of life that define a sense of community can continue. Losses of these services cannot be measured in terms of simple monetary value.

Climate Justice

Climate justice is a relatively new area of research and analysis that focuses on the ethical dimensions of climate change.¹ The term also describes a social and political movement that demands that government policies and actions aimed at mitigating and adapting to climate change address human rights and environmental justice.

Without proactive policies, climate change could be particularly damaging to the people least able to respond to it.^{2,3} In addition, if climate justice is not considered, government and private sector actions to mitigate and adapt to shifting climate could create uneven financial burdens as well as social and cultural disruptions.

Because low-income communities of color could be disproportionately affected,⁴ their participation is critical to adaptation and community resilience planning efforts. Local residents have on-the-ground and historical knowledge of local land uses and hazards that is vital to adaptation planning and developing effective response strategies to sea level rise impacts. Engaging members of the community in the planning process gives them a sense of ownership of the final outcome. Participating in the process builds awareness and promotes action to limit risks.

Two New York City-based environmental justice organizations, UPROSE (Sunset Park, Brooklyn) and WE ACT (Harlem, Manhattan), have led the effort to include local communities in federal, state, and local government community resilience planning. Their work is centered on ensuring that environmental justice communities are economically viable and have access to public health and safety protections, municipal services, and prompt and appropriate emergency response.

1. Estrada-Oyuela, R. A. 2002. *Equity and Climate Change*. in Ethics, Equity and International Negotiations on Climate Change, P. R. Luiz and M. Mohan (eds.). Cheltenham, UK.

2. Patz, J. 2005. Impacts of Regional Climate Change on Human Health. *Nature* 384:310-317.

3. Morello-Frosch, R., M. Pastor, J. Sadd, S.B. Shonkoff. 2009. *The Climate Gap: Inequalities in How Climate Change Hurts Americans & How to Close the Gap*.

4. Medina-Ramón, M., A. Zanobetti, D. Cavanagh, J. Schwartz. 2006. Extreme temperatures and mortality: assessing effect modification by personal characteristics and specific cause of death in a multi-city case-only analysis. *Environ Health Perspect*, 114:1331-1336.

Communities: Actions Needed to Adapt to Sea Level Rise

New York State is at a crossroad. State government has the authority to participate in shore-defense projects but lacks policy guidance in the application of this authority that would encourage property owners and communities to avoid high-risk locations or to assume responsibility for site conditions. Sea level rise, coastal erosion and storms are projected to expand risks and impacts beyond levels state government can address. The state and local governments must revise past approaches to managing coastal hazards or increasing impacts due to sea level rise will escalate until they become unmanageable. Our fundamental choices for responding to the increased risks to communities from sea level rise and resultant flooding include the following:

- Maintaining the *status quo* by allowing communities to respond to events as they occur, with state assistance in emergencies
- Continuing to support protective measures and absorb increasing costs, environmental impacts and expanding development risk until chronic effects, catastrophic events or economic realities force management changes.
- Setting new design standards for new development and for retrofitting existing development to achieve resilience in areas where occasional flooding may occur but that are otherwise deemed safe and habitable and where such conditions are acceptable in the community
- Reducing risk through planned adaptation including land-use management, elevation and relocation of at-risk development and infrastructure over time
- Prioritizing the conservation of natural systems like tidal wetlands, dunes, coastal barriers and natural sediment transport so they continue to provide large-scale beneficial services including flood damage reduction, storm water management, water quality maintenance and other important economic and environmental benefits

Ideally the state would support development of local or regional plans that emphasize long-term reduction or elimination of risk, take into account the cumulative environmental impacts or benefits of decisions, and include the most cost-effective mix of the above solutions tailored to the specific needs of communities and geographic areas. It is essential that land-use decisions, planning and funding of adaptive or protective measures internalize the full cost of impacts and that costs be apportioned to beneficiaries, so that realistic, market-based evaluation is incorporated into management decisions.

Building the resilience of downstate communities to sea level rise and storm surge will require improving community-level planning and decision making in a number of critical areas, including land use, public health, and emergency response and post-storm recovery. To effectively confront these threats, it will be necessary to build local capacity to conduct and sustain a range of planning, awareness-raising, and implementation activities by providing technical assistance and guidance, clear legal and regulatory frameworks, and financial resources.

Regional planning is critical to ensure sound decision making to reduce risk along the coast. Uncoordinated, *ad hoc* responses to coastal hazards will likely result in escalating costs for chronic damages due to sea level rise and high costs for post-storm recovery. Varying levels of protection among communities due to differences in local resources will leave some communities at risk of casualties and significant loss of property. A failure to address regional ecosystems holistically will lead to burgeoning environmental impairments and social problems and the loss of critical natural systems and the services they provide.

Local planning for sea level rise must identify vulnerable development, critical facilities, infrastructure, and natural resource assets at the site level, and should evaluate strategies to reduce risk over time. The state should provide grants, guidance, risk maps and other tools and technical assistance to empower local decision makers to analyze their communities' circumstances through vulnerability assessments that will lead them to develop appropriate strategies for reducing vulnerability (recommendations 2, 3, 4, 6, and 11). A database of feasible adaptation responses for communities and habitats should be created that allows each community to compare alternate strategies for achieving mutual, desired goals and to select the strategy most appropriate for its own situation (Recommendation 8).

Guidance on these assessments must acknowledge the role of independent, community-based assessments conducted by local organizations. These assessments can produce more detailed information on the specific risks and vulnerabilities that threaten selected neighborhoods, community amenities or vulnerable populations within a community (Recommendation 8).

Well designed and inclusive multi-stakeholder planning processes can raise awareness, build capacity, generate community-specific knowledge, and strengthen community cohesion and identity (recommendations 8, 10).

Particular effort and funding should be dedicated to ensuring that lower-income communities and communities of color are adequately involved in planning efforts. The members of such communities often have less discretionary time and resources to devote to participation, and without adequate representation, their needs may be overlooked.

Guidance should address evaluating and updating emergency management strategies and plans. In particular, there is a critical need for more focused and sustained engagement by public health professionals (Recommendation 9). Better data and analysis are needed to help communities assess their vulnerability to immediate mortality risks, risks of infectious and vector-borne diseases, health-related costs of flooding and mental health problems, and the need for early warning systems.⁶⁰

⁶⁰ Ahern, M., et al. 2005. Global Health Impacts of Floods: Epidemiologic Evidence, *Epidemiologic Reviews*, Johns Hopkins Bloomberg School of Public Health.

Communities need guidance to develop and implement local regulations and zoning laws that will reduce new development in high-risk areas and manage risks to existing infrastructure, property and people. Developing appropriate plans for recovery and redevelopment (Recommendation 5) following powerful storms can provide communities with an opportunity to proactively decrease their vulnerability and identify areas that can provide restoration and migration opportunities for natural resources.

In some cases, state regulation is needed to mandate risk-reduction strategies where local governments lack the resources or authority to pass or enforce local regulation to reduce risk or conserve natural flood protection systems (recommendations 5, 7).

Internalizing the costs of emergency services, storm recovery and environmental impacts into coastal development would make investment in high-risk areas much more realistic. Planning, zoning, subdivision, community development and property management should take such costs into account. All levels of government should require that infrastructure siting, design and construction explicitly evaluate the potential impacts of storm surge and sea level rise, as well as the potential for infrastructure to stimulate private development in unsafe locations. Real estate titles or other consumer-oriented information should disclose projected risks to buyers. Flood-insurance programs and state building codes should strengthen siting and building standards in coastal areas (Recommendation 7). Actions that foster consideration of environmental conditions and impacts associated with coastal development could dramatically reduce risk exposure over time by bringing a market-based rationale to the decision process. Loss of life, structure and infrastructure damage, environmental degradation, compromised communities and inability to recover from extreme weather events will increase if external subsidies conceal the true costs of high-risk development. All state policies and programs should be carefully reviewed to evaluate whether they encourage at-risk development and to suggest appropriate modifications (Recommendation 2).

At the present time, standardized reporting for periodic coastal hazard impacts is limited primarily to weather reports by the National Weather Service (NWS) and documentation supporting requests for FEMA Presidential Disaster Declarations. Records on local storm damage are largely anecdotal or from news media, and federal records of events are not readily accessible to state or local planning staff. These existing sources are insufficient to support local or regional planning or to document the effectiveness of management measures. As a result, it is difficult for planners to compile background information to support management actions or to modify existing plans or programs based on experience. A standardized reporting system should be developed using forms that could be completed and filed by local planning, recovery or emergency management staff (Recommendation 8). It should provide adequate detail to describe the locations and types of coastal hazard impacts and to give a description of the source or cause of the impacts. Planners and managers could use this database to prepare measures to address coastal hazards over time according to their record of performance.

Federal, state and local agencies will need to coordinate to comprehensively address vulnerabilities in high-risk coastal areas (Recommendation 13). Effective interagency coordination on climate change would have an enormous benefit to regional and local governments dealing with a dizzying array of uncoordinated agency funding and regulatory programs. Consolidation of policy and regulatory priorities, funding programs, and technical assistance across agencies would conserve both state and local resources and potentially save tax dollars.

Adaptation Champions

Community-based organizations in New York State can provide strong and sustained local leadership on climate-change adaptation. The following are examples of “adaptation champions” from the three main regions of the state affected by sea level rise. Their sustained efforts have stimulated local interest in adaptation, increased buy-in for climate-change adaptation projects and attracted external resources.

The Hudson Valley

To help people think about the local impacts of climate change—and how the Hudson Valley might prepare for them—the Rising Waters project brought together private and public stakeholders in the fields of transportation, health care, utilities, emergency preparedness, planning and environmental advocacy. The project developed contrasting scenarios to explore the future consequences of climate-change adaptation decisions. Participants reached consensus on key findings and recommendations for adaptation, which were released in a May 2009 report. Several stakeholders are now engaged in developing a climate change speakers’ bureau in the Hudson Valley, promoting a sustainable shoreline initiative and conducting marsh restoration. Rising Waters was spearheaded by The Nature Conservancy’s eastern New York chapter and partners such as DEC’s Hudson River Estuary Program and National Estuarine Research Reserve, Cornell University, the Cary Institute of Ecosystem Studies, and Sustainable Hudson Valley.

New York City

Parts of Sunset Park, a waterfront community in Brooklyn, are less than 10 feet above sea level, and flooding during major storms is a critical local concern. UPROSE (United Puerto Rican Organization of Sunset Park), a grassroots environmental justice organization, is developing a community-specific climate-change adaptation plan that can be tailored and replicated by other vulnerable communities. The initiative is part of PlaNYC, New York City’s comprehensive sustainability plan to reduce the city’s greenhouse gas emissions by 30% and adapt to climate change. UPROSE educates residents about the science of climate change and simple changes they can make in their daily lives to reduce their carbon footprint. UPROSE works with constituencies to identify resources that can help them implement adaptation strategies and build Sunset Park’s resiliency.

Long Beach, Nassau County

The neighborhood of North Park is taking steps to ensure that the city of Long Beach on Long Island takes seriously the existing and potential effects of sea level rise and other coastal hazards. For decades, residents have endured severe flooding. The area’s inadequate and aging shoreline infrastructure and its proximity to Reynolds Channel makes North Park particularly vulnerable to impacts from sea level rise, storm surge and tidal influences. At high tide, even relatively mild storms have been known to create knee-deep water in some streets, at times forcing children to wade to their school buses or stranding seniors in their homes. Citizen activists and the Long Beach Latino Civic Association have drawn attention to these impacts through repeated testimony before local authorities and consistent participation in municipal and state-level planning processes.

Meeting the Challenge

Despite data gaps, we now possess sufficient information, consensus and growing political will to support responsible actions to deal with sea level rise. New York State must now decide what these actions will be.

Coastal communities are already experiencing damage from sea level rise and other coastal hazards and, even today, are at great risk from the impacts of a powerful storm. If a Category 3 hurricane similar to the “Long Island Express” of 1938 hit New York’s coast now, there would be severe and long-term economic, ecological and public health consequences.

Holding back the rising sea on a large scale is not practical or even possible. The actions recommended in this report are to guide communities—people, with their accompanying infrastructure—out of harm’s way and to allow coastal ecosystems to migrate landward so that those ecosystems may continue to provide natural protection against flooding and other coastal hazards.

There is a tremendous need for new and updated information to make decisions. High-resolution elevation maps are needed coastwide to outline areas of greatest vulnerability to coastal hazards. Storm-surge models should be run with sea level rise projections. FEMA flood studies must be updated to reflect current conditions. Shoreline inventories should be completed for infrastructure, critical facilities and existing structural shoreline-defense measures. Tidal wetland and coastal erosion hazard area maps have not been updated in decades even though, in the case of coastal erosion hazard area maps, such updates are required by law. The implications of sea level rise for emergency management systems must be fully vetted. We also must continue to monitor coastal processes and improve our understanding of how they will be affected by sea level rise.

Enacting cost-effective adaptation policies in advance of rising seas and ecological shifts is the most responsible management path.⁶¹ However, efforts to fill data gaps should occur at the same time we are acting to preserve and protect coastal communities and ecosystems. The best available data must be brought to bear at every stage through an adaptive management approach. Such an approach can reduce uncertainty in long-term decisions over time by monitoring and evaluating the results of research and policy actions and changing the course of action as needed.

Structural approaches to shore protection to manage vulnerability to coastal hazards have long been the norm, but they do not recognize the natural and beneficial functions or mitigating capacities of the landscape. The cumulative effects of many of these structures can compromise entire ecosystems. In addition, by appearing to reduce vulnerability, they can promote development in hazardous areas.

⁶¹ The precautionary principle of ecosystem management suggests that in the absence of all the answers, we should not wait for the answers, but should take action to protect the ecosystem using the best available science while we improve our understanding.

The recommendations contained in this report strongly favor and support non-structural strategies as the first line of protection to be fully considered and applied in most circumstances, but adaptation to sea level rise along New York's coast will require a multitude of flexible, non-exclusive, location-specific approaches: One size, or one measure, will not fit all. The existing risks to development and infrastructure from coastal storms, escalating threats from sea level rise and differing capacity among the communities of the New York coastal area suggest that careful planning is necessary to foster adaptation to a more resilient condition.

The historical reliance on armoring the shoreline will not always provide the desired protective shield against coastal storms and has been shown to be flawed, as demonstrated in other regions, sometimes with devastating consequences. Further, storm effects will be exacerbated by rising sea levels. The National Academy of Science recommends that such technological solutions be accompanied by redundant measures so that failures are not catastrophic. Over the long term, it is not likely to be feasible for the state to fund the continued construction and maintenance of armored approaches along its entire shoreline, and non-structural approaches must be considered. In addition to the risks and costs associated with shore defense structures, the environmental effects of widespread shoreline armoring are unacceptable.

However, there are locations in the state, particularly in densely populated urban areas, where non-structural strategies may not be practical or appropriate. Densely developed urban areas, such as Manhattan, may require defensive measures not appropriate for less densely developed regions. Reliance on non-structural responses alone will not be adequate. Existing vulnerable areas with substantial public-infrastructure investment, water-dependent facilities or critical facilities like power plants represent viable assets if they can be protected relatively efficiently and/or if they can function effectively for an interim period while communities develop more resilient alternatives.

The selection of which measures to employ should include an assessment of the best possible relationship among risk exposure, resources available for implementation, feasible alternatives, environmental effects and safety, so that the limited resources available are allocated most efficiently to foster sustainable communities. In order to accomplish the dual goals of increasing community resilience while simultaneously protecting the remaining coastal ecosystems and natural habitats, the appropriate adaptive responses must be informed by a number of site- and community-specific considerations. Accordingly, the recommendations in this report endeavor to provide a comprehensive set of measures that will foster community resilience while supporting a sustainable economy, and viable coastal ecosystems and natural habitats.

We can be certain that communities will continue to be exposed to natural hazards. Land development is what can, and should, be managed to lower vulnerability.

*The preponderance of opinion in both the academic and practitioner communities is that keeping people out of harm's way through the "soft mitigation" practice of planning, particularly land use planning, is far preferable to investments in either hard protective structures or investments in community reconstruction after the fact, necessary though these last two occasionally may be.*⁶²

Sea level rise will affect almost every aspect of coastal life—physical, social, economic, and ecological. The response to it must be similarly comprehensive. It must begin with the state's explicit adoption of sea level rise projections and incorporation of adaptation strategies into all relevant regulatory, funding and programming decisions.

A high priority is identifying and mapping the regions at greatest immediate and future risk from sea level rise. This will raise awareness in communities about the risk so that they can act to reduce the vulnerability of high-risk areas. With state assistance local and regional scale planning must be done to identify the most appropriate strategies for each area of the coastline. Those involved in shaping decisions at every level will need to strike a balance among the many competing claims on scarce shoreline resources and ensure that long-term risks are factored into daily choices.

Community-based organizations and independent assessments that originate at the community level are important to understanding the socioeconomic factors, language barriers, social divisions and local traditions that affect vulnerability to, and ability to recover from, damage from sea level rise and related coastal hazards. Community-based organizations are critical to effective communication with residents, for whom sea level rise and climate change effects may seem abstract or remote. They can mobilize public opinion in ways that a top-down, regulatory approach cannot.

Any sea level rise adaptation strategy, including the recommendations in this report, represents only one stage in a planning process that must be continuously reviewed and revised to incorporate new data, new experience and the changing needs of communities and natural ecosystems. The Task Force is committed to seeing that the insight gained through its work continues to inform future efforts.

⁶² Jacob, J.S. and S. Showalter. 2007. *The Resilient Coast: Policy Frameworks for Adapting the Built Environment to Climate Change and Growth in Coastal Areas of the US Gulf of Mexico*. Sea Grant-Texas.

STORM-SURGE BARRIERS ("floodgates" or "barrages") are artificial obstructions at the mouth of a tidal watercourse with adjustable gates that are closed during large ocean-dominated flood events or surges and reopened after the floodwaters recede. The feasibility and sustainability of storm-surge barriers in New York and their long-term financial, social and ecological impacts must be assessed. The question of who pays and who gets the benefits—and who does not—is a potent social justice issue. While barriers may be a viable option for interim periods (decades), they may actually increase long-term catastrophic risks if prolonged sea level rise in combination with storm surges eventually render them ineffective. It is important to note that barriers cannot be used alone. They must be coupled with extensive systems of levees and pump facilities requiring large amounts of space and costly maintenance. Planning, financing, operation and maintenance will require multi-state agreements. If considered at all, they must be part of a broader comprehensive and sustainable coastal management strategy that includes a long-term exit strategy from high-risk areas.



Eastern Scheldt storm-surge barrier, Netherlands. Credit: Raimond Spekking/
Wikimedia Commons/CC-NY-SA-3.0 & GFDL

Recommendations of the Sea Level Rise Task Force

In 2007, the New York State Legislature created the Sea Level Rise Task Force and charged it with preparing a report and recommendations for an action plan to protect coastal communities and natural resources from rising sea levels. The New York State Department of Environmental Conservation leads the Task Force, which has a diverse membership that includes representatives of state and local government agencies, non-governmental organizations, and affected communities. The legislature directed the Task Force to “evaluate ways of protecting New York’s remaining coastal ecosystems and natural habitats and increasing coastal community resilience in the face of sea level rise applying the best available science on issues associated with sea level rise and its anticipated impacts.” The Task Force has studied and deliberated, with public participation, the complex issues involved with sea level rise in New York State. This report, including findings and recommendations, is the result of the considerable efforts of many dedicated individuals; however, the recommendations do not represent the unanimous consent of the Task Force. As detailed in its public comments (Appendix E), the City of New York does not support recommendations 2, 3, 4, 5 and 7. The findings and recommendations in this report are important first steps toward increasing the resilience of New York’s coastal communities with the understanding that in many cases further analysis may be necessary to evaluate their site-specific applicability and effect on the State and local economies, economic development, greenhouse gas mitigation efforts, environment and other factors. The proposed timelines for implementation of each recommendation reflect the necessary sequence of this work.

1. Adopt official projections of sea level rise.

What: Formally adopt the projections of the Sea Level Rise Task Force for relative sea level rise in all marine coastal areas of the state, including the Hudson River to the Federal Dam at Troy, for use by all state agencies and authorities. These projections should serve as recommended standards for other government, non-government and private interests. Projections should be developed with the best available science, extend for at least 100 years into the future, and be reviewed and updated on a regular basis.

How/Who: An act of the Legislature or, in the absence of legislative action, an executive order should require the state to adopt projections of sea level rise and call for their update on a regular basis. The proposed New York State Climate Science Institute, or other such state scientific body, led by the State Department of Environmental Conservation and State Department of State, and with the cooperation of other relevant state agencies and local governments, should develop guidance for incorporation of projections into relevant policies and regulations. Local governments should also consider adoption of these projections for planning purposes.

When: Full implementation within two years.

2. Require state agencies responsible for the management and regulation of resources and infrastructure subject to sea level rise and management of at-risk populations affected by sea level rise to factor the current and anticipated impacts of sea level rise into all relevant aspects of decision making.

What: Sea level rise poses a significant risk to the citizens, infrastructure, economy and natural resources of the state. Official state projections of sea level rise, and associated impacts of sea level rise, should be factored into all relevant aspects of state agency decision making including long-term planning, programming, permitting, regulating and funding decisions, and the state should seek and provide technical guidance consistent with anticipated changes. Agencies should consider storm and sea level rise impacts over the lifespan of proposed projects or actions and the time horizon of any associated impacts to the proposed projects or actions in all state operational, permitting and/or funding decisions. Relevant agencies should regularly update, modify, and refine guidance documents and plans based on the most current information on sea level rise.

How/Who: An executive order should provide direction to all relevant state agencies to factor current and anticipated impacts of sea level rise into all relevant aspects of decision making. Implementation involves changes to regulation and agency guidance. Relevant agencies include, but are not limited to, DOS, DEC, Office of Emergency Management (OEM), Environmental Facilities Corporation (EFC), Energy Research and Development Authority (NYSERDA), Office of Parks, Recreation, and Historic Preservation (OPRHP), Department of Health (DOH), Office of General Services (OGS), Office of Housing and Community Renewal (OHCR), Empire State Development (ESD), Department of Transportation (DOT), Metropolitan Transit Authority (MTA), Port Authority of New York and New Jersey (PANYNJ), New York Power Authority (NYPA), Long Island Power Authority (LIPA) and the Public Service Commission (PSC).

When: Full implementation within two to five years.

3. Classify areas where significant risk of coastal flooding due to storms has been identified in order to implement risk-reduction measures in those areas.

What: Define immediately the most vulnerable coastal areas and revise standards for development and redevelopment to reduce risk in these areas. Areas at high risk of coastal flooding have already been identified by the Federal Emergency Management Agency (FEMA). The state should define a new "*coastal risk management zone*," comprised of, and consistent with, zones designated by FEMA to include coastal high hazard areas (V, V 1-30, or VE zones) and any areas defined by FEMA as "Areas of Moderate Wave Action" (i.e., areas within the A zone and subject to wave action of 1.5 to 3 feet) as areas currently most vulnerable to coastal hazards. These zones should provide the basis for additional review under state regulatory authority and guidance such as additional focus or analysis under State

Environmental Quality Review Act review to reduce vulnerability in coastal areas as outlined in the following recommendations.

How/Who: A statute or an executive order should define the coastal risk management zone. DEC and DOS should provide guidance for agency implementation in cooperation with other federal, state and local agencies.

When: Full implementation within two to five years.

4. Identify and classify areas of future impacts from ocean coastal flooding due to projected sea level rise and storms in order to reduce risk in those areas.

What: Develop maps that extend the area of the *coastal risk management zone*, acknowledging differential levels of risk, to include areas potentially vulnerable to projected changes in sea level and high-intensity storm events based on projections of sea level rise adopted by the state including the following:

- Areas at greatest risk from sea level rise
- Areas at risk from storm surge with current sea levels
- Areas at risk from storm surge with sea level rise

Since it is much more cost effective to prepare hydrologic modeling on a regional basis, as opposed to municipalities modeling their administrative areas individually, the state should support hydrologic modeling for regions vulnerable to sea level rise. Such modeling should use the best available topography and bathymetry, and include the connectivity of adjacent channels and waterways to estimate the boundaries of inundation due to projected sea level rise and storm surge.

These maps should be used by permitting authorities, regulators and planners to manage the risk of coastal flooding from sea level rise. Methodology and criteria should also be developed and promulgated to map areas that may be sites of dune, barrier beach and/or wetland migration in response to sea level rise with disclosure of sources of uncertainty. Digital base maps from the National Flood Insurance Program could be utilized as a basis for maps of projected flood plain inundation. All maps should be updated regularly as new projections for sea level rise are adopted by the state. The most recently updated maps should serve as official maps.

How/Who: This recommendation should be implemented in a two-step process.

- 1) DEC and DOS should develop maps for planning purposes in cooperation with federal and state agencies, coastal counties and local governments. These maps should reflect projected sea level rise and changes in coastal flooding through 2100. Maps of high-risk areas and the

methodology for classification of risk should be made available to local governments and to the public via openly accessible online tools.

2) Official state maps should be developed to identify the *coastal risk management zone* and depict coastal areas that are at increased risk for flooding. These maps should acknowledge differential levels of risk. This *coastal risk management zone* should provide the basis for additional review under state regulatory authority and guidance such as additional focus or analysis under State Environmental Quality Review Act review to reduce vulnerability in coastal areas as outlined in the following recommendations and for coastal and local planning as outlined in the following recommendations.

When: Planning maps based on the best available current science should be produced as soon as possible for counties for which high-resolution elevation data are available and for other counties upon data availability. Priority for data acquisition should be given to counties of greatest vulnerability. Official maps should be developed upon adoption of projections of sea level rise and strong storms and identification of areas of dune, barrier island and/or wetland migration. Full implementation within five to ten years.

5. Reduce vulnerability in coastal areas at risk from sea level rise and storms (*coastal risk management zone*) and support increased reliance on non-structural measures and natural protective features to reduce impacts from coastal hazards, where appropriate.

What: The preference for new development and re-development in the *coastal risk management zone* should be for projects or actions consistent with policies and programs that rely on natural protective features and non-structural shoreline protection measures to minimize negative effects of coastal storms, erosion and sea level rise. To reduce incentives that increase or perpetuate development in high-risk locations and to create incentives for sustainable adaptation planning, state funding for coastal defenses should be conditioned on: 1) preparation of effective adaptation plans, 2) the presence of significant public investment or critical infrastructure that cannot be otherwise adapted, or 3) the presence of state-supported water-dependent uses that require a location with some exposure to vulnerability in order to function. In particular, the state should encourage and support the following:

- Regional and/or local planning efforts to reduce risk from sea level rise and coastal hazards
- Projects or actions identified in plans to conserve natural protective features
- Projects or actions to secure opportunities for habitat migration in response to sea level rise
- Implementation of site-appropriate structural and non-structural measures to reduce risks from coastal hazards
- Adaptive transition of infrastructure and development over time, in coordination with planning, capital expenditures and maintenance, and as storm and sea level rise impacts occur

Policies and programs resulting from such planning efforts should be consistent with the federally approved New York State Coastal Management Program Policies, pursuant to the Coastal Zone Management Act and other state policies and programs (e.g., Environmental Conservation Law articles 25 and 34) and should accomplish the following:

Part I: Coastal Resilience Plans

- a) Public investment, programs and policies should be directed toward the development and implementation of long-term regional scale *coastal resilience plans*. These plans should identify non-structural alternatives to structural measures to reduce vulnerability in the coastal risk management zone wherever use of non-structural measures is feasible; identify areas where structural protection is needed to protect significant public investment, water dependent uses and/or critical infrastructure; and identify opportunities to further reduce vulnerability through non-structural measures in the recovery and restoration process following high-intensity coastal storms.
- b) *Coastal resilience plans* should meet the following criteria:
 - i. Use of New York State accepted sea level rise and storm surge projections
 - ii. Inclusion of vulnerability assessments that take into account developmental, economic, environmental quality and socio-cultural functions and that use topographic and other relevant data necessary to support effective land use planning
 - iii. Identification of zones, areas or sites that are appropriate to elevate, relocate, protect, and/or "accommodate" (do nothing as water rises) infrastructure and/or coastal development in high-risk coastal areas located either wholly or in part in the *coastal risk management zone*
 - iv. Identification of long-term policies or measures to reduce vulnerability, to be implemented following high-intensity storm events including, but not limited to, the following:
 - Landscape-scale planning measures:
 - Assessments of future impacts of sea level rise and coastal hazards in land use planning and redevelopment decisions
 - Projections of future land use patterns
 - Restriction of new development and redevelopment in high-risk areas, including the pathways of former breaches or washovers on barrier islands
 - Plans for infrastructure risk mitigation and relocation, if warranted
 - Identification and reduction of long-term risks to public health
 - Preservation and protection of natural processes and protective features, including processes that shape and form natural protective features

- Site-based measures:
 - Rebuilding with construction techniques that reduce risk, utilize relocation and elevation, where appropriate, and minimize the negative effects of chronic flooding and high-intensity storm events
 - Development of measures to reduce risk to legal, non-conforming uses
 - Criteria to evaluate habitability of structures
 - Acquisition or donation of substantially damaged or repetitive-loss properties from willing owners
 - Environmental restoration opportunities
 - Evaluation of actions:
 - Evaluation of short-term recovery actions to ensure they do not inhibit long-term adaptation
 - Identification of implementation costs, benefits, sources of funding and resources to implement actions
 - Consistency with local hazard mitigation plans
 - Adoption of necessary local laws to make a plan enforceable by local government
 - Other long-term recovery issues identified by the community
- v. Transparency of planning processes and incorporation of citizen participation
- vi. Designation of locations that will require continued funding for structural protection measures because relocation, elevation or employment of non-structural measures is not feasible for facilities or infrastructure of critical public necessity and/or water dependent uses
- vii. Plan approval by DOS and DEC to the extent required by existing law
- c) Criteria for approval of *coastal resilience plans* should be developed in coordination with local governments.
- d) Support, including guidance and funding, should be directed to, and increased for, regional, county and/or local planning offices in coastal areas to develop coastal resilience plans through existing planning support programs such as hazard mitigation plans and local waterfront revitalization plans, the Climate Smart Communities program, and small grants programs such as the Hudson River Estuary grants program.
- e) Communities located wholly or in part in the coastal risk management zone should be encouraged to implement county/regional or local *coastal resilience plans* as part of revisions or modifications to their comprehensive plans, hazard mitigation plans and/or local waterfront revitalization plans and to achieve consistency with the state's *coastal risk management zone* policies.

Part II: Criteria for funding

- a) In jurisdictions with approved *coastal resilience plans*, projects or actions seeking state funding should be consistent with such plans.
- b) Projects or actions seeking state funding in jurisdictions within the coastal risk management zone that do not have approved *coastal resilience plans* should meet the following conditions:
 - i. The existing standards and policies of the applicable Local Waterfront Revitalization Program (LWRP) or state Coastal Management Program (CMP), as appropriate, are maintained and the project or action is consistent with local hazard mitigation plans. Where a LWRP, CRP or hazard mitigation plan is not finalized or has not been developed or adopted, care should be taken so that projects or actions do not compromise local ability to develop and implement such a plan.
 - ii. Proposed projects or actions should account for potential impacts due to projected sea level rise, using state-accepted projections during the functional lifetime of the proposed project, including impacts to shore protection measures, upland uses and adjacent areas and for potential vulnerabilities following the useful lifespan of the project.
 - iii. Projects or actions should not compromise existing public access to the water as sea level rises. Where public access is constrained by the design of a project, replacement access, including links to adjacent publicly accessible areas, should be provided. Projects or actions should be designed to increase public access wherever possible as consistent with the WRP or LWRP.
 - iv. Applicants' plans must include estimates for the construction and maintenance costs for the functional lifetimes of the proposed projects or actions.
 - v. A project or action commenced after the effective date of this policy should not serve as the basis for the justification of a structural shore protection project.
 - vi. If the proposed project or action is a structural shoreline protection project it should be subject to the following additional conditions:
 - 1. The applicant should demonstrate that protection appropriate to, and compatible with, both the character and purpose of the activity or development cannot be achieved through one or a combination of non-structural measures.
 - 2. Redundant, non-structural measures should be provided, to the extent feasible, so that in the event of failure of the structural protective measures life and safety are not imperiled and essential services are maintained or quickly restorable.

3. The proposed project or action should not result in an unavoidable barrier to migration of an existing tidal wetland habitat, submerged aquatic vegetation, dune or barrier island system and should not cause adverse impacts to adjacent properties or ecological systems. If the project or action does result in an unavoidable barrier, the proponent of the project or action should have the burden to demonstrate that the creation of such barrier or causation of adverse impacts is unavoidable because reasonable alternatives do not exist and that the benefits of the proposed project or action outweigh its adverse impacts.

The proponent should further demonstrate that the proposed project or action should minimize the effect of such barrier or adverse impacts, and should provide for mitigation to offset all unavoidable effects.

4. All maintenance costs will be the responsibility of the applicant, and the mechanism for funding and implementing long-term maintenance needs must be specified.
- c) An open and transparent review process for proposals for projects or actions should be developed.
 - i. Such review should be conducted with minimal procedural and administrative delay, and where feasible, be combined or consolidated with other review requirements to avoid unnecessary duplication of review.
 - ii. For *de minimis* projects and actions such review process should be streamlined and should take into consideration staffing and other constraints while insuring adequate and timely review.
 - d) All projects or actions are subject to approval by DEC and DOS.

How/Who: An executive order or legislation should provide direction to DEC, DOS, ESDC, DOT, OGS, OEM, and other agencies as appropriate. DOS should work with other agencies to ensure that policies of this recommendation are consistent with New York State coastal policies.

When: Full implementation within 10-15 years.

6. Develop maps and other tools to assist decision makers in preparing for, and responding to, sea level rise.

What: Ensure that decision makers have access to current and accurate planning data in the following categories:

a) Basic mapping data:

- i. *High-resolution elevation data*: Land-elevation data are critical to mapping the projected impacts of sea level rise, related storm surge and flooding. The best available technology should be used to gather these data.
- ii. *Coastal erosion hazard areas (CEHA)*: Remapping is necessary for effective management of New York State's coastal erosion hazard areas to minimize investment in areas subject to coastal storm damage, erosion and sea level rise impacts. The original maps should be replaced with digital maps using geographic information systems (GIS) and current imagery with accurate coastal erosion hazard areas delineated.

Subsequent periodic review and update of CEHA maps will be needed in order to maintain accurate identification of erosion hazard areas and the use of this information to reduce the loss of property, investment and lives.

- iii. *Tidal and freshwater wetland boundaries*: The state should maintain complete up-to-date maps of tidal and freshwater wetlands. The existing tidal wetlands maps are nearly 40 years old and should be updated to include all existing tidal wetland areas. Guidance and criteria to map areas of tidal wetland migration should be developed. The Tidal Wetland Act should be modified to include consideration of the effects of sea level rise on tidal wetlands over time and tidal wetlands should be re-inventoried to include migration areas.
- iv. *Detailed shoreline inventories*: The state should map the location and status of critical habitats, natural and human-made shoreline protective features, infrastructure and critical facilities at risk.
- v. *FEMA floodplain maps*: Accuracy and electronic access to these maps should be improved for local governments and the public to allow them to identify areas within the *coastal risk management zone* more readily.
- vi. Socio-economic and environmental data on relevant non-climate stressors should be made available for incorporation into vulnerability assessments.

- b) The state should adopt, support and promote the use by the public and private sector of sources of decision-support tools and information for planning (maps and data), such as the existing Nature Conservancy model (www.coastalresilience.org), or similar models, including maps of areas of future inundation from sea level rise and high-intensity storms, changes in shoreline position, and areas of potential habitat migration including wetlands, dunes and barrier islands.

How/Who: New York State agencies (e.g., DOS, DEC, Office of Cyber Security (OSC), DOT, OEM) with an interest in, and/or responsibility for, data collection and dissemination should form a working group to identify and implement funding strategies at the state and federal agency levels to ensure that

information collection and dissemination are coordinated with federal agencies, New York City and other local governments, and that information is updated on a regular basis.

When: A working group should determine funding strategies within one year. Priority for high-resolution elevation data acquisition should be given to unmapped counties of greatest vulnerability. Full implementation within five to ten years.

7. Amend NYS laws, and change and adopt regulations and agency guidance documents to address sea level rise and prevent further loss of natural systems that reduce risk of coastal flooding in the coastal risk management zone.

What: Subject to further analyses during the respective legislative or regulatory processes to evaluate the effect on the State and local economies, economic development, greenhouse gas mitigation efforts, environment and other factors, the Legislature and appropriate regulatory agencies may consider the following statutory or regulatory changes to protect New York's remaining coastal ecosystems and natural habitats and to increase coastal community resilience in the face of sea level rise.

SEQRA—State Environmental Quality Review Act (ECL Article 8) and corresponding regulations (6 NYCRR Part 617)

Potential statutory or regulatory change for consideration:

- a) Add a definition of the phrase *coastal risk management zone* to 6 NYCRR 617.2.
- b) Strengthen the environmental impact review process for certain actions if they are undertaken in a *coastal risk management zone*. Specifically,
 - i. add a new sub-paragraph 12 in section 6 NYCRR 617.4(b) to read as follows:
"any Unlisted Action occurring wholly or partially within the *coastal risk management zone*"
 - ii. Or in the alternative, amend the criteria for determining significance in 6 NYCRR § 617.7(c) to incorporate potential significant adverse impacts related to sea level rise into the determination process.
- c) Add a section to the short and long environmental assessment forms, requiring an evaluation of impacts from or to the proposed project based on the risk of sea level rise and coastal hazards (e.g., rising groundwater, coastal flooding, saltwater intrusion or other impacts) and other related effects of sea level rise.
- d) Develop guidance for environmental review to require that decisions in the *coastal risk management zone* consider potential coastal flooding and other effects of climate change for the expected "lifetime" of the project, structure or facility.

New York State Uniform Fire Prevention and Building Code Act
Executive Law Article 18

Potential statutory or regulatory change for consideration:

Evaluate and revise existing building standards to address sea level rise and wind- and water-related impacts associated with coastal storms and coastal flooding. These revisions should become mandatory within the *coastal risk management zone* over time, using an incremental implementation approach.

- a) Restrict the use of systems, materials or practices within the *coastal risk management zone* that may pose a significant risk of water pollution when flooded if alternatives exist to these systems, materials or practices.

Proposed change in guidance or programming:

- a) Provide guidance for local application of revised standards in areas designated for elevation, relocation, protection or accommodation.

Real Property Law
Article 14, sections 460 - 467

Potential statutory or regulatory change for consideration:

Add a new Article 15 to the Real Property Law that provides for notification and informed purchasing decisions of owners, buyers and tenants in the *coastal risk management zone*. Specifically,

- i. require that the maps created by the state to identify the *coastal risk management zone* be filed in the office of each of the county clerks of the State of New York, or at the New York City Department of Finance in the case of New York, Kings, Queens, Richmond and Bronx counties and with other municipal agencies responsible for the maintenance of property records or tax maps, and that the maps are made accessible to the public both online and in the same manner as other property records and tax maps;
- ii. require that until these new maps are prepared and publicized, the most recent FEMA flood-insurance rate maps be filed in the offices and agencies listed in the preceding paragraph and made accessible in the same manner, along with a description of how the FEMA maps will serve to identify the *coastal risk management zone* until maps depicting projected vulnerability from sea level rise can be developed;
- iii. require that all real estate brokers and lending institutions involved in real property transactions affecting property wholly or partially situated within the *coastal risk management zone* include language in any contract with an owner, buyer, or tenant that identifies the subject property as being located in the *coastal risk management zone*. Prior to the preparation and filing of the state's maps depicting the *coastal risk management zone* these requirements should apply to any property identified as wholly or partially situated

within a “coastal high hazard area” (V, V 1-30, or VE zone) and those areas identified by the FEMA as “Areas of Moderate Wave Action.”

- a) Amend the NYS Property Disclosure Statement in section 462 (2) of the Real Property Law by including the following language:

“10. Is any or all of the property located in a FEMA designated coastal high-hazard area, area of moderate wave action, or floodplain? YES NO UNKN NA (IF YES, EXPLAIN BELOW)”

Coastal Erosion Hazard Areas Act (CEHA)

ECL Article 34 and corresponding regulations (6 NYCRR Part 505)

Note: There currently are no specific penalties provided for violations of ECL Article 34, which defines and regulates those areas of the state’s coastline most prone to erosion hazards. DEC therefore relies on the general civil penalty provisions of ECL §71-4003, which allows a maximum fine of only \$500, plus \$500 per day of continuing violation; this penalty has not been a sufficient deterrent to continuing violations.

Potential statutory or regulatory change for consideration:

Amend ECL Article 71 by adding a new Title 34 that provides for appropriate penalties on the order of \$10,000 to \$25,000 per violation of ECL Article 34 as well as injunctive relief to allow DEC to compel removal of unauthorized structures and/or restoration of unauthorized excavation within coastal erosion hazard areas.

- a) Incorporate areas within coastal barrier breaches and washovers and their associated sandy shoals into the regulated natural protective features as provided in Article 34 of the state’s Environmental Conservation Law, where excavation and permanent development are prohibited.
- b) Strengthen the act to increase effectiveness of delegated local implementation of CEHA through consideration of the following:
- i. New York State indemnification of properly-administered local CEHA programs against takings claims (e.g., Pine Barrens §57-0123.6 and the Hudson Valley Greenway Compact §44-0119.7) to reduce the influence of potential litigation costs, including potential takings claims, on local program decision making
 - ii. DEC authority to reverse or veto local actions or decisions that are inconsistent with the purposes and policies of Article 34
 - iii. Review and, as necessary, revision of the definition of “coastal erosion hazard area” or “erosion hazard area” in ECL §34-0103 and the corresponding provisions in ECL Article 34 to properly account for sea level rise

Waterfront Revitalization of Coastal Areas and Inland Waterways
New York State Executive Law Article 42

Potential statutory or regulatory change for consideration:

- a) The Legislature should add “adaptation to sea level rise” as an additional policy in Executive Law Article 42 §912.
- b) DOS should review and amend as appropriate state and regional Coastal Management Program policies, using the new sea level rise legislation to enforce the policy change, to ensure that discretionary actions that would create new development and/or expand existing development are consistent with the new state standards and guidelines developed for the *coastal risk management zone* as proposed in recommendations 2, 3, 4, and 5. Regulations for state agency consistency should be reviewed and modified to ensure state agency adherence to coastal policies.

Proposed changes in guidance or programming:

- a) DOS should ensure that policies developed at the regional and local levels to protect natural resources and development at risk from sea level rise are consistent with the purpose and intent of state Coastal Management Program policies.
- b) DOS should provide guidance and criteria for municipal development of *coastal resilience plans*, in partnership with DEC.
- c) The Significant Coastal Fish and Wildlife Habitat Program should consider sea level rise in updates to impact assessments and narratives.

Local planning and zoning laws

Village Law §7-722(2) (a); Town Law §272-a (2) (a); General City Law §28-a (3) (a)

Potential statutory or regulatory change for consideration:

- a) These laws should be amended to require consideration of sea level rise impacts in comprehensive plans for coastal communities that are wholly or in part included in the coastal risk management zone.
- b) Communities should be encouraged to include buffer areas and/or other land use based coastal protection strategies in their zoning of waterfront areas in comprehensive plans and/or local waterfront revitalization plans to reduce risk to natural resources and ensure that all planning related to new construction and/or infrastructure is consistent with the new state standards and guidelines developed for the coastal risk management zone as proposed in recommendations 2, 3, 4, and 5.

- c) Following the development of appropriate guidance and funding mechanisms for local implementation, encourage communities wholly or in part located in the *coastal risk management zone* to meet designated criteria for implementation of *coastal resilience plans*, including post-storm recovery and redevelopment planning that recognizes the long-term risks of high-intensity storm events, as part of revisions or modifications to their comprehensive plans and/or local waterfront revitalization plans (see revisions to Article 42 above).

Solid and Hazardous Waste Law

ECL Article 27

Potential statutory or regulatory change for consideration:

- a) DEC regulations should be amended to consider the impacts of coastal hazards over the lifetime of the project in the siting and design of solid waste facilities that are located within, or rely upon infrastructure located within, the *coastal risk management zone*.
- b) Include considerations of sea level rise and its impact on groundwater levels and erosion in determinations of threat significance under the NYS Inactive Hazardous Waste Disposal Site Program, determinations of eligibility under the brownfield programs, and remedial decisions under these and the state's other cleanup programs (e.g., oil spills and cleanup measures undertaken as part of the implementation of the Environmental Quality Bond Act).

Proposed changes in guidance or programming:

- a) Revise technical manuals, training and guidance documents to reflect changes in regulations.
- b) Assess performance of hazard mitigation projects and identify opportunities to remediate design shortcomings due to past lack of consideration of the effects of sea level rise on long-term re-suspension of contaminants.

Tidal Wetlands Act

ECL Article 25 and corresponding regulations (6 NYCRR Part 661)

Potential statutory or regulatory change for consideration:

- a) Amend ECL §25-0102 by adding the phrase: "*It is declared to be the public policy of the state to preserve and protect tidal wetlands and to prevent their despoliation and destruction, giving due consideration to the occurrence of sea level rise that will result in wetlands loss and migration, and to the reasonable economic and social development of the state.*"
- b) Amend ECL §25-0103 by adding definitions of sea level rise and *coastal risk management zone* and include adopted projections of sea level rise.

- c) Develop criteria to inventory and map tidal wetland migration areas resulting from sea level rise and incorporate such criteria into the mapping protocols for tidal wetlands. Update this inventory every 10 years.
- d) Revise the Tidal Wetlands Act to define and include tidal wetland migration areas.
- e) DEC should amend the implementing regulations at Part 661 to correspond to the principles articulated above.
- f) DEC should revise and narrow the criteria for variances in section 661.11 similar to the criteria set forth in 505.13.

Proposed changes in guidance or programming:

- a) DEC should establish guidance for permitting to ensure that decisions on tidal wetland permits take into account the expected “lifetime” of the project, structure or facility.
- b) DEC should provide guidance or, if necessary, make regulatory changes to ensure that the approval of stabilization structures (e.g., bulkheads, seawalls) will not eventually result in the elimination of foreshore areas and the public trust embedded in those areas due to restriction of landward movement of high-water lines.

Freshwater Wetlands Act

ECL Article 24 and corresponding regulations (6 NYCRR Part 663)

Potential statutory or regulatory change for consideration:

- a) DEC should revise Part 664 by designating those smaller wetlands that are in close proximity to the tidally influenced coastline of the state as having "unusual local importance."

Shore Protection Authorization Laws

Unconsolidated Laws Chapter 7—Projects to Prevent Shore Erosion (§§1531 et seq.)

Potential statutory or regulatory change for consideration:

- a) After the development of appropriate guidance and funding mechanisms, implement the following:

Require that any municipality that enters into a cost-share shore protection contract with New York State under this law meet the criteria for implementation of a coastal resilience plan in conformance with the criteria developed by DEC and DOS (see discussion of Executive Law Article 42, above).

Long Island South Shore Estuary Reserve Act
Executive Law Article 46

Potential statutory or regulatory change for consideration:

- a) Amend the act to require the South Shore Estuary Reserve Council to consider regional implementation of sea level rise adaptation following the guidance developed by DOS and DEC (see discussion of Executive Law Article 42, above), and to develop regional policies, consistent with the state Coastal Management Program policies and the intentions of this Task Force, to guide adaptation by communities along the Long Island south shore.

How/Who: An executive order should direct agencies to amend or develop regulation and guidance as appropriate. The New York State Legislature should amend or enact new laws where necessary.

When: Full implementation of all regulatory recommendations within 10-15 years.

8. Provide financial support, guidance and tools for community-based vulnerability assessments and ensure a high level of community representation and participation in official vulnerability assessments and post-storm recovery, redevelopment and adaptation planning processes.

What: Support the development of community-based efforts and strengthen and expand existing state and local programs to develop vulnerability assessments, *coastal resilience plans* and adaptation plans based on current and projected risks from coastal hazards such as sea level rise and storm surge and ensure that community members are actively included in all planning processes. The state should create financial and technical support programs for community-based organizations so that they can work in partnership with state and municipal entities to develop and implement planning processes.

Programs should include the following:

- a) Guidance on the incorporation of the most current scientific information and data on increasing risks associated with coastal hazards such as sea level rise and relevant stressors such as demographic changes, economic downturns and poverty
- b) Guidance on the process for developing vulnerability assessments, implementing *coastal resilience plans*, and incorporating them into broader climate-change adaptation planning processes
- c) Guidance to help communities identify and assess risks to local community assets including centers of economic activity, high-profile community amenities and landmarks, and other potential effects that could undermine community cohesion, identity or character

- d) Mechanisms such as grant programs, technical assistance programs, legal training and capacity building to encourage and support vulnerability assessments, implementing *coastal resilience plans* and post-planning implementation activities available to both government planners and community representatives
- e) Guidance for local decision makers and community members on assessment of vulnerabilities and risks associated with the public-health effects of sea level rise and storm surge
- f) Development and dissemination of guidance and training on climate adaptation, use of adaptation decision-support tools and model laws through the state's Climate Smart Communities and Local Waterfront Revitalization programs, including the benefits of intermunicipal and/or regional partnerships to achieve adaptation goals
- g) Development and dissemination of guidance on structural and non-structural shoreline management techniques, shoreline erosion-control methods and green infrastructure as tools to manage flood and erosion hazards and to maximize ecosystem benefit
- h) Guidance to assist communities in development of post-storm recovery and redevelopment plans
- i) Guidance on preparation and filing of storm damage reporting forms (Recommendation 6) to serve as a basis for community record keeping and for reference by planners at the community, county and state levels.

How/Who: DEC, DOS and other relevant state agencies should partner with the private and philanthropic sector, community leaders and community-based organizations.

When: Full implementation within two to five years.

9. Undertake a comprehensive assessment of the public health risks associated with sea level rise, coastal hazards and climate change including compromised indoor air quality, effects on drinking water, post-traumatic stress and other mental health problems, increases in disease vectors, impaired access to health care, and loss of reliable access to food and medical supplies.

What: Require the public health sector to lead an assessment of, and preparation for, significant short-, medium- and long-term public health risks from hazards associated with sea level rise in New York State. The information in the assessment should be used to inform the implementation of all the recommendations of the Task Force, in particular, in the creation of maps and guidance to support development of *coastal resilience plans* (recommendation 5, 6, 8) and to inform state agency

incorporation of the current and anticipated impacts of sea level rise into all relevant aspects of decision making.

How/Who: The Department of Health should be tasked to coordinate with other state agencies and stakeholders to complete this critical assessment. DOH should coordinate with appropriate agencies and stakeholders.

When: Full implementation within two to five years.

10. Raise public awareness of the adverse impacts of sea level rise and climate change and the potential strategies to adapt.

What: Relevant New York State agencies should develop a coordinated message and programming in a variety of venues for a wide range of audiences to build an aware, informed and engaged public and ensure that state and local decision makers and community leaders are aware of the vulnerabilities associated with sea level rise in coastal areas. Support sustained efforts by local leaders such as community-based organizations, elected officials and educational institutions to engage with the public through a variety of methods and ensure effective community-focused efforts.

Potential specific actions:

- a) Provide sustained support and model tools for outreach efforts that incorporate opinion leaders from all sectors of the community, are tailored for specific audiences and include a particular focus on vulnerable populations
- b) Develop guidelines and protocols for making use of community-based and non-English media and other communication mechanisms
- c) Channel resources to community-based organizations to enable them to engage in sustained awareness-raising and community education activities around climate adaptation
- d) Support the establishment of community-based mechanisms to facilitate the flow of information from individuals and neighborhoods experiencing impacts to planners and responders, as well as from the science and response community to local decision makers

How/Who: DEC and DOS should lead this effort, partnering with New York Sea Grant, OEM, local governments, universities, NGOs and community-based organizations.

When: Full implementation within two to five years.

11. Develop mechanisms to fund adaptation to sea level rise and climate change.

What: Conduct an assessment of viable funding mechanisms for the development of tools and research to support the development and implementation of *coastal resilience plans*, coastal area mapping, restoration of natural protective features and critical habitats, green infrastructure and the acquisition of lands in vulnerable areas. Significant financial resources are needed to meet the planning and adaptation needs at the state and local levels.

How/Who: Develop an agency working group to recommend and prioritize specific funding actions for the Governor and Legislature. Potential approaches include the following:

- a) Use revenues generated by real property and real estate transfer taxes for new construction with a sales price of \$1 million or more in the coastal risk management zone. A similar strategy has been implemented in New Jersey.
- b) Use FEMA post-disaster mitigation funds to carry out adaptation measures identified in approved coastal resilience plans.
- c) Create a new “coastal users’ tax” for hotels, motels, guest lodging and vacation rental properties in the coastal risk management zone. A similar strategy has been implemented in Florida.
- d) Use publicly owned properties acquired through real estate tax delinquency as relocation sites for exchange with willing flood vulnerable owners. A similar strategy has been employed successfully in the Town of Brookhaven.
- e) Earmark penalties from enforcement of the Shoreowner’s Protection Act.
- f) Pass an environmental bond act.
- g) Increase or add permit fees for new construction in the *coastal risk management zone*.
- h) Consider modifications to the evaluation criteria of the State Open Space Plan, Comprehensive Outdoor Recreation Program, and Coastal and Estuarine Land Conservation Program to include acquisition of coastal natural protective features.
- i) Apply savings from the phase-out of state funding for unsustainable shore protection measures to implementation of nonstructural disaster-resilient methods.
- j) Prioritize resilient adaptation strategies in state, county and local hazard mitigation plans when allocating state post-disaster mitigation funds.
- k) Explore and promote tax incentives for donations of conservation easements on vulnerable properties, to encourage private preservation at low or no cost to public acquisition programs,

such as state income tax credits, uniform bargain sale policies for public acquisition programs and guidelines for local tax assessors on property tax abatement for eased properties.

- l) Leverage state resources through partnerships with land trusts, philanthropic and federal granting communities.
- m) Allocate monies from state enforcement actions such as environmental benefit projects and programs.

When: Implementation within two years.

12. Fund research, monitoring, and demonstration projects to improve understanding of key vulnerabilities to critical coastal ecosystems, infrastructure and communities from sea level rise.

What: State agencies should coordinate funding priorities for future research initiatives including the following:

- a) Improve information, definition and explanation of the areas at greatest risk of flooding due to sea level rise and the impacts of high-intensity storms
 - i. Track trends in water levels and land subsidence that contribute to relative sea level rise through a long-term monitoring network of tidal gauges in the Hudson River estuary and Long Island Sound, and along the Atlantic coast
 - ii. Improve understanding of the effects of climate change on high-intensity storm events
 - iii. Complete fine-scale modeling in coastal New York State, including the Hudson River Estuary, to determine which shoreline areas are at greatest risk from sea level rise and storm surge and how the salt front, a critical factor for drinking water supplies and aquatic life in the Hudson River, will be affected by sea level rise
 - iv. Help communities monitor the location and scale of coastal hazard impacts including storm damages and chronic effects of moderate to low-intensity coastal-inundation events; prepare an impact reporting system to support planning and adaptation
- b) Track tidal wetland trends at a landscape scale and understand the key factors contributing to their loss
 - i. Expand existing monitoring of trends in tidal wetland health to all tidal wetlands in the marine district and the Hudson River (to the Federal Dam at Troy) and add other critical habitats affected by sea level rise including pocket marshes, islands, fringe marshes and marshes with varying tidal periods

- ii. Unify tidal wetland monitoring and assessment programs in the marine district and the tidal Hudson River (to the Federal Dam at Troy)
 - iii. Model the likely migration pathways of tidal wetlands and other coastal habitats in response to sea level rise. Develop methodology and criteria to map areas that may be sites of tidal wetland migration in response to sea level rise
 - iv. Clarify the role of sea level rise in ongoing tidal wetlands loss and assess the relative effects of other factors contributing to marsh loss such as eutrophication and conversion of tidal habitats (e.g., high marsh to low marsh, vegetated to unvegetated)
 - v. Determine how productivity of marshes changes with sea level rise
- c) Improve understanding of natural processes affecting land forms in coastal areas, including how sea level rise affects shoreline change
- i. Develop coastal and estuarine sediment budgets, quantifying sources, sinks and pathways of sediment transport and effects of fine sediment on wetlands and coarser sediment on beaches, bluffs, barrier islands and other coastal habitats
 - ii. Assess ecosystem services in natural and engineered shorelines and identify best practices for enhancing ecosystem services in engineered shorelines
 - iii. Evaluate reinstating or expanding the Atlantic Coast of New York beach monitoring program with a focus on providing useful information for incorporation into local government and infrastructure planning for coastal resilience
 - iv. Collect reliable high-resolution shoreline-change data for estuarine shorelines and initiate continuing monitoring program to assess present and future conditions
 - v. Assess and quantify the physical and geological factors controlling movement of shorelines, including barrier islands and estuarine shoreline, and develop projections of future shoreline migration and change
 - vi. Develop guidelines and design criteria for the use of innovative erosion management measures that incorporate natural elements and focus on community resilience and natural resource conservation
 - vii. Develop accurate high-resolution data to quantify the interaction among bluff erosion, beach width, sediment supply and shoreline protection structures
 - viii. Examine legal issues surrounding ownership of emergent lands following strong storms

- d) Improve understanding of how hazards associated with sea level rise affect water quality and aquatic habitats
 - i. Track basic water quality parameters, such as temperature, salinity, pH and dissolved oxygen, to gain better understanding of habitat health factors
 - ii. Identify sentinel species for sea level rise impacts and their likely migration pathways if their existing habitats are diminished (e.g., horseshoe crabs)
 - iii. Determine factors that will facilitate the migration of submerged aquatic vegetation inland and identify areas for future migrations
 - iv. Assess the impact of changes in quantity and quality of groundwater on submerged aquatic vegetation health
 - v. Map depth to groundwater in coastal areas to understand where high-water tables are located and in coastal (saline) areas to understand the location and relationship between the fresh- and salt-water tables and effects on drinking water supplies
- e) Monitor coastline conditions, ocean temperatures, wetland area, real-property losses due to flooding and erosion, and climate-related public-health effects to track trends related to climate change and hazards associated with sea level rise
- f) Policies that limit the beneficial use of dredged materials for habitat restoration should be reassessed to ensure they do not unnecessarily hinder wetland restoration along the coastline

How/Who: DEC and DOS should coordinate with relevant agencies and scientific bodies to develop and implement research priorities in concert with federal, state and private research agencies and organizations.

When: Full implementation within 10-20 years.

13. Ensure continued and coordinated adaptation to sea level rise.

What: Create a permanent mechanism to ensure the following:

- a) Interagency coordination
- b) Review of projections of sea level rise and anticipated impacts on a regular basis following the IPCC schedule (roughly every 5 years)
- c) Development of priorities for federal, state and local research, and policy and regulatory initiatives to respond to sea level rise

- d) Management of progress in policy implementation, including the recommendations of the Sea Level Rise Task Force

Individual state agencies or interagency teams should be responsible for developing priorities based on their respective expertise, and these agencies should work to implement agreed upon priorities and incorporate findings related to sea level rise into all state planning processes. The Office of Climate Change, Office of Emergency Management and the DOS Coastal Program should coordinate the mechanism and include adequate involvement from non-governmental stakeholders.

How/Who: An executive order should direct the DEC Office of Climate Change, in coordination with DOS, to coordinate development of this effort with appropriate state agencies (see Recommendation 2).

When: Full implementation within two years.

14. Seek federal funding, technical assistance and changes to federal programs to make them consistent with, or accommodating, to state policies, programs and adaptation measures related to sea level rise.

What: Identify opportunities to leverage federal programs and resources to reduce coastal vulnerability. Review federal programs for compatibility with the recommendations of the Sea Level Rise Task Force and seek modifications or assistance at the federal level to improve coordination of adaptation strategies at all levels of government. The following actions would provide opportunities for improvement:

- a) Encourage federal agencies to adopt regional sea level rise projections and to include sea level rise in all relevant decision making
- b) Examine how current federal policies (e.g., FEMA planning, mitigation and disaster recovery funding; Army Corps of Engineers storm-damage-reduction projects), rules and regulations can be modified to reduce the number of new structures and encourage relocation of existing structures in high-risk coastal floodplains
- c) Evaluate whether changes to the current federal and state cost-share formula for the coastal storm damage risk reduction program (i.e., Shore Protection Program) could be used as a practical and effective disincentive to discourage new development and re-development in the coastal risk management zone
- d) Evaluate whether current methodologies used in completing benefit/cost analyses for coastal protection projects account for sea level rise and do not unfairly favor structural alternatives over non-structural alternatives

- e) Evaluate whether current rules, regulations and funding policies disadvantage communities that have taken positive steps to limit new development and re-development within high-risk coastal floodplains when those communities apply for federal grants or other monies
- f) Examine the practicality of revising the current policies to support actions that allow a transition to non-structural measures (e.g., acquisition, relocation, elevation and strategic reconfiguration of infrastructure networks)
- g) Develop tools and mechanisms to more thoroughly and fairly evaluate benefit/cost effects to natural resource communities
- h) Seek modifications to the National Flood Insurance Program so that rates better reflect actual risk exposure, including sea level rise, such as the following:
 - i. Delineate a coastal zone that recognizes risks from storm surge and erosion due to sea level rise
 - ii. Ensure that flood insurance rates reflect full risk exposure and include risks of sea level rise, particularly in repetitive-loss areas
 - iii. Create federal incentives for the relocation of existing development out of floodplains and disincentives for siting new structures in floodplains
 - iv. Consider adoption of the “No Adverse Impact” standards developed by the Association of State Floodplain Managers
 - v. Strengthen incentives in FEMA’s Community Rating System for the implementation of resilient land-use management strategies
 - vi. Create a program to track gain and loss of structures in high-risk areas
 - vii. Evaluate a flood insurance surcharge that could be used to fund adaptation planning and implementation
- i) Coordinate state agency communication on climate change, sea level rise and adaptation measures with federal agencies to deliver consistent messages and formulate outreach programs to deliver the messages to the public
- j) Evaluate and understand the needs of the users of natural and social science data, research and analysis so that the needs and interests of users are taken into account by federal, state and other generators of scientific information; facilitate communication among all entities

How/Who: The DOS and DEC should convene a working group of agencies to investigate and recommend changes in federal laws, regulations and practices.

When: Working group convened within one year. Recommendations finalized in two to five years.

Appendix A: Members of the Task Force and Workgroups

Members, Sea Level Rise Task Force

Pete Grannis, Former Commissioner, NYS Department of Environmental Conservation, Task Force Chair

Peter Iwanowicz, Acting Commissioner, NYS Department of Environmental Conservation, Task Force Chair

Fred Anders, Chief, Natural Resources Management, NYS Department of State (representing Ruth Noemí Colón, Acting Secretary of State)

John Gibb, Director, NYS Office of Emergency Management

Ivan Lafayette, Deputy Insurance Superintendent for Community Affairs, NYS Department of Insurance (representing James Wrynn, Superintendent, NYS Department of Insurance)

Jared Snyder, Assistant Commissioner for Air Resources, Climate Change and Energy, NYS Department of Environmental Conservation (representing Pete Grannis, former Commissioner, and Peter Iwanowicz, Acting Commissioner, NYS Department of Environmental Conservation)

Richard Svenson, Director of the Division of Environmental Health Protection, NYS Department of Health (representing Richard F. Daines, M.D., Commissioner, NYS Department of Health)

Lloyd Wilson, Director's Office, Research and Special Projects, NYS Department of Health (representing Richard F. Daines, M.D., Commissioner, NYS Department of Health)

Lisa Weiss, Route 9A Urban Design Director (representing Stanley Gee, Acting Commissioner, NYS Department of Transportation)

Fred Nuffer, NYS Office of Emergency Management, representing John Gibb, Director, NYS Office of Emergency Management

Adam Freed, Deputy Director, New York City Mayor's Office of Long-Term Planning and Sustainability

Carrie Meek Gallagher, Commissioner of Environment and Energy, Suffolk County

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Appendix B: Public Outreach Summary

The Public Outreach Work Group adopted and implemented an outreach plan with the goal of supporting the SLRTF's decision-making process. The plan included six objectives:

Objective 1. Incorporate stakeholders into impact-sector deliberations.

Objective 2. Provide public access to information on the SLRTF's activities and informational documents.

Objective 3. Provide opportunities for public participation in SLRTF meetings.

Objective 4. Provide opportunities for public input on specific issues.

Objective 5. Provide opportunities for public review of draft recommendations.

Objective 6. Provide opportunities for public review of draft final report.

Objective 1 - Incorporate stakeholders into impact-sector deliberations.

Agencies participating in the SLRTF assigned appropriate staff to the legal and sector impact work groups. These staff, in turn, actively recruited experts and stakeholders from academia, businesses, other agencies and non-governmental organizations. The broad spectrum of individuals, including community representatives, in the work groups provided insight, discussion and recommendations" that are reflected in the content of the Task Force report.

Objective 2 - Provide public access to information on the SLRTF's activities and informational documents.

To facilitate public participation in the development of recommendations, staff of DEC's Office of Climate Change created and maintained an SLRTF website at www.dec.ny.gov/energy/45202.html. This website included instructions for enrolling in the SLRTF listserve and provided an e-mail address (slrtf@gw.dec.state.ny.us) to which unsolicited comments and questions could be directed. The Public Outreach Work Group assembled a list of potentially interested organizations and distributed direct notice of the opportunity to enroll in the e-mail listserve and watch the website for information on the SLRTF's activities and opportunities to participate. Announcements of all public and Task Force meetings were distributed to the listserve, and announcements and summaries of all public and Task Force meetings were posted on the website.

Objective 3 - Provide opportunities for public participation in SLRTF meetings.

The SLRTF held six meetings at the Public Service Commission offices at 90 Church Street, New York City, and held one videoconference among members. All SLRTF meetings were open for observation by the public, and opportunities for observer comment were provided at each meeting.

Objective 4 - Provide opportunities for public input on specific issues.

The SLRTF and its work groups invited several leading researchers to provide input on climate science and projections of sea level rise, held a focus group for municipal officials from communities along the Hudson estuary to discuss findings and policy recommendations, and met with policy leaders from a variety of disciplines to discuss potential state responses to sea level rise.

Objective 5 - Provide opportunities for public to comment on approach and suggest issues to be addressed in SLRTF recommendations.

The Task Force held a series of five public meetings in late January 2009 to describe the approach it was using to generate its recommendations, to hear public comment on that approach and to allow the public to suggest issues to be addressed by the recommendations. Meetings were held in New York City, Poughkeepsie, Nassau County and Suffolk County. Public notice of the meetings included a DEC news release, which generated several newspaper articles describing the Task Force and its objectives and announcing the meetings. Approximately 150 individuals attended the five meetings.

Objective 6 - Provide opportunities for public review of draft final report.

The Steering Committee produced a draft final report incorporating recommendations for future action as recommended by the work groups and approved by the SLRTF. The draft final report was released for public review and comment in fall 2010. Release of the draft report was accomplished through the website, listserv and news release and included notice of opportunities to comment. Written public comment was accepted during a 30-day public comment period following release of the draft report. The Task Force conducted a public information and comment videoconference and webinar during the public comment period. Videoconference locations included DEC offices in Albany, Westchester, New York City and Suffolk County. The webinar was also accessible via Internet connection.

Appendix C: Organizational Framework

Chapter 613 of the Laws of New York, 2007 established the New York State Sea Level Rise Task Force (SLRTF) and charged it with the creation of a report to the Legislature. The statute identified six *ex-officio* Task Force members and ten members to be appointed by various elected officials. The statute directed that the Task Force would be chaired by the commissioner of Department of Environmental Conservation.

Chapter 613 initially required the SLRTF to deliver its final report to the governor, the temporary president of the senate and the speaker of the assembly by December 31, 2009. The statute was subsequently amended to extend the due date to January 1, 2011. The report must include an assessment of the anticipated impacts of sea level rise; recommendations to provide more protective standards for coastal development, wetlands protection, shoreline armoring and post-storm recovery; recommendations of measures to protect and connect habitats to facilitate range shifts, protect and restore critical habitats and ecosystem services, identify and monitor climate change effects on natural biota, and integrate climate-change adaptation strategies into state environmental plans; and recommendations on regulatory and/or statutory changes to respond to sea level rise.

The geographic scope of the SLRTF's recommendations included the coastlines of the counties of Suffolk, Nassau and Westchester, New York City, and the shoreline of the main stem of the Hudson River to the Federal Dam at Troy.

Commissioner of Environmental Conservation Alexander Grannis appointed Special Counsel Robin Schlaff to organize and chair a steering committee and Special Projects Coordinator Kristin Marcell as executive assistant and vice chair of the steering committee. Both Ms. Schlaff and Ms. Marcell worked with staff of the Office of Climate Change to identify representatives of several state and local agencies to serve on a steering committee. Individuals from academia and non-governmental organizations were added to the steering committee as the process developed. Members of the steering committee were responsible for the work products that ultimately resulted in the SLRTF report. Ms. Schlaff served as the liaison of the Steering Committee to the SLRTF and was responsible for bringing matters that required action to the SLRTF.

The SLRTF steering committee organized five work groups necessary to complete its charge:

- Ecosystems and Natural Habitats
- Infrastructure
- Community Resilience
- Legal
- Public Outreach

Ms. Schlaff appointed chairs or co-chairs of each work group. Chairs recruited individuals with appropriate expertise to serve as work group members and incorporated specific stakeholders as integral members of the work groups. Group chairs coordinated the efforts of work group members and ensured that required products were delivered in a timely fashion.

Work group chairs communicated regularly to share information and relevant research and to inform each other of potential overlapping issues.

Each sector work group produced a sector report for incorporation into the larger SLRTF report. Sector reports summarized existing information on likely sea level rise effects to the sector, described the current regulatory environment as it relates to the sector, identified ongoing programs as they relate to sea level rise impacts to the sector, and provided recommendations for filling gaps in necessary information for impact assessment, regulatory changes and management actions.

The legal work group served as a resource to address legal questions as they arose during the work of the other work groups and developed recommendations for specific statutory and regulatory changes to implement sector work group recommendations.

The public outreach work group developed and implemented a stakeholder involvement plan to support the SLRTF's decision-making process.

It was recognized that the involved agencies and other organizations have numerous ongoing research, monitoring, planning and management efforts that the report and recommendations should consider. To facilitate identification of such programs, staff surveyed other agencies, academic institutions and organizations to develop an understanding of relevant past and ongoing work. The sector work groups drew on this work to identify opportunities for integration of programs and needs for supplemental work. The final report represents a synthesis of relevant past and ongoing research and monitoring activities pertinent to the responsibilities of the SLRTF and a review of applicable current federal, state and local laws and regulations.

Time and resources allocated for generation of the SLRTF report did not allow for development of a comprehensive vulnerability assessment and site-specific, risk-reduction strategies. Emphasis was placed on describing the potential risk of coastal inundation along New York's shorelines and the likely affected sectors, identifying research and monitoring needs, suggesting adaptation strategies, and developing a roadmap for future work.

Appendix D: Summary of State Sea Level Rise (SLR) Policy Development – Mid-Atlantic and Northeast

State	Authority	Climate and/ or SLR Action Plan	SLR Projections; Derivation	Notes
NY	Executive Order, 2007 [Established Sea Level Rise Task Force]	SLR Task Force report due January 1, 2011	Yes; regional projections based on IPCC models, as adopted by the New York City Panel on Climate Change (NPCC). For more information: http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf	Report will include recommendations to specifically address SLR impacts, vulnerabilities and recommendations for adaptation. For more information: http://www.dec.ny.gov/energy/45202.html
MD	Executive Order (2007)[Est. Maryland Commission on Climate Change]	<i>Maryland Climate Action Plan, 2008</i>	Yes; regional projections based on IPCC models.	Comprehensive climate plan with SLR subcomponent, “ <i>Comprehensive Strategy for Reducing Maryland’s Vulnerability to Climate Change, Phase 1: Sea-level rise and coastal storms,</i> ” that includes an assessment of impacts, vulnerabilities and recommendations for adaptation. For more information: http://www.mde.state.md.us/assets/document/Air/ClimateChange/Chapter5.pdf
VA	Executive Order (2007) [Est. Governor’s Commission on Climate Change]	Governor’s Commission on Climate Change, Final Report, <i>A Climate Change Action Plan, 2008</i>	Yes; largely used Chesapeake Bay Program Scientific and Technical Advisory Committee (STAC) report, “ <i>Climate Change and the Chesapeake Bay: State-of-the- Science Review and Recommendations.</i> ”	The Action Plan focuses primarily on energy and emissions reduction with less discussion of SLR. For more information: http://www.chesapeake.org/stac/Pubs/climchangereport.pdf and http://www.deq.state.va.us/export/sites/default/info/documents/climate/CCC_Final_Report-Final_12152008.pdf
NJ	NJ DEP’s Coastal Management Office (NJ CMO)	NJCMO policy to work with pilot communities on SLR	While NJ has not officially adopted SLR projections, NJ CMO is using 0.5, 1.0, and 1.5 m increase by 2100 in their current coastal hazards work with pilot communities.	The NJ CMO’s SLR projections are consistent with DE’s Coastal Program and the rates under consideration by the Mid-Atlantic Regional Council on the Ocean (MARCO). For more information: http://www.state.nj.us/dep/cmp/czm_hazards.html

State	Authority	Climate and/ or SLR Action Plan	SLR Projections; Derivation	Notes
DE	DE Coastal Management Program (DCMP)	Statewide SLR adaptation plan (in process); Sea Level Rise Initiative	Yes; Regional projections based on IPCC projections. DE will assess vulnerabilities using 0.5, 1.0 and 1.5 m scenarios by 2100.	Adaptation plan will specifically address SLR impacts, vulnerabilities and adaptation strategies; results may be incorporated into a larger climate change plan if one is developed. For more information: http://www.swc.dnrec.delaware.gov/coastal/Pages/SeaLevelRiseAdaptation.aspx
CT	Section 7 of Public Act No. 08-98 (2008)[<i>An Act Concerning Connecticut Global Warming Solutions</i>]	Connecticut Climate Change Action Plan, 2005; Governor's Steering Committee on Climate Change Impacts report, <i>The Impacts of Climate Change on Connecticut Agriculture, Infrastructure, Natural Resources and Public Health</i> , 2010	Yes; Relies on a combination of the New York Panel on Climate Change (NPCC) and the Northeast Climate Impacts Assessment (NECIA) projections. For more information: http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf and http://www.northeastclimateimpacts.org/	Additional report on adaptation strategies for vulnerabilities identified in the Impacts report are due December 2010. For more information: http://ctclimatechange.com/index.php/ct-happenings/gsc-adaptation-subcommittee/
RI	R.I. Coastal Resources Mgmt Pgm Section 145 (2009); R.I. General Laws § 23-84 (2010)	State Coastal Policy on SLR; The Climate Risk Reduction Act of 2010 calls for a new Climate Change Commission that will evaluate SLR	Yes; coastal policy based on projections of 3 to 5' of SLR by 2100 based on regional adjustments of IPCC estimates and data on historical shorelines in RI. Long term SLR will be periodically reassessed to incorporate new scientific information.	State policy in effect using adopted projections of SLR and directly affecting planning and management in coastal zones. New Climate Change Commission will address SLR as it studies the impacts of climate change to RI and develops recommendations to respond. For more information: http://www.crmc.ri.gov/climatechange.html
MA	Chapter 298 (2008) [<i>An Act Establishing the Global Warming Solutions Act</i>]	State coastal hazards policies; Final Report of the Coastal Hazards Commission, 2007	No state projections of SLR have been developed to date.	The Global Warming Solutions Act of 2008 mandated a climate-change adaptation strategies report be developed by the state Secretariat of Energy & Environment and submitted to the governor and legislature. A report by the Coastal Hazards Commission addresses SLR mapping, data needs, planning, and management. The MA Office of Coastal Zone management has a

State	Authority	Climate and/ or SLR Action Plan	SLR Projections; Derivation	Notes
MA (cont.)				"Storm Smart Coasts" program through which regional coordinators provide technical assistance to municipalities. It includes guidance on SLR. For more information: http://www.mass.gov/czm/stormsmart/index.htm
NH	Executive Order, 2007 [Est. Climate Change Policy Task Force]	<i>New Hampshire Climate Action Plan, 2009.</i>	No state projections of SLR have been developed to date; report references IPCC where SLR is mentioned.	Focus on broad actions, not SLR; reference to improved land use; coastal program - special project to examine adaptation planning.
ME	38 M.R.S.A §480, Ch. 355 (2006)	Coastal setback that accounts for 2' of SLR in the next 100 years.	No state projections of SLR have been developed to date.	A project may not be permitted if, within 100 years, it is likely to be severely damaged by erosion to the property after allowing for a 2' rise in sea level over 100 years. Beach nourishment and dune restoration projects are excluded from this requirement. For more information: http://www.maine.gov/dep/blwq/topic/dunes/index.htm

**Appendix E: Comments of the City of New York on the NYS Sea Level Rise
Task Force Draft for Public Comment**



OFFICE OF THE MAYOR
Office of Long-Term
Planning and Sustainability
253 Broadway, 10th Floor
New York, New York 10007
www.nyc.gov/planyc2030

Memorandum

To: Peter Iwanowicz
Acting Commissioner, New York State Department of Environmental Conservation

From: Adam Freed
Deputy Director, New York City Mayor's Office of Long-Term Planning and Sustainability

Date: December 14, 2010

Subject: Comments on NYS Sea Level Rise Task Force Report Draft for Public Comment

As a member of the New York State Sea Level Rise Task Force (SLRTF) and Steering Committee, I appreciate the opportunity to provide comments on behalf of the City of New York on the draft report of the SLRTF, as released on November 9, 2010. The City commends the State for examining the challenges associated with sea level rise and climate change and is committed to working with the State and other local and statewide groups to address these critical issues. As articulated throughout this process; however, the City has a number of concerns about the recommendations in the draft report, many of which are not supported by thorough scientific, environmental, or cost-benefit analysis or do not recognize the differences between undeveloped areas and densely-populated cities. The City looks forward to working with the Task Force to address these concerns and develop recommendations that enhance the resilience of our state without imposing unnecessary burdens and obstacles.

Through PlaNYC, Mayor Bloomberg's comprehensive plan to create a greener, greater New York, the City has already begun to prepare for a changing climate and take actions to build climate resilience. In 2009, the City adopted official climate change projections that were developed by the New York City Panel on Climate Change, an expert panel of scientists, academics, economists, risk management experts and private sector practitioners appointed by the Mayor to advise the City on climate change. The City convened the NYC Climate Change Adaptation Task Force, which consists of 40 City, State, and Federal agencies and private companies that operate, regulate, or control critical infrastructure, to assess risks and develop strategies to increase the city's climate resilience. Earlier this year, the City also acquired new high-resolution mapping and elevation data. This data will be used to better understand the risks the city faces from inland and coastal flooding and to update the city's Flood Insurance Rate Maps (FIRMs) in partnership with FEMA—a critical first step that is needed to better understand the risks we currently face from coastal storms. The City has also begun to analyze potential changes to codes and land use regulations as part of the process to create the City's Comprehensive Waterfront Plan and through the

Green Codes Task Force, an outside advisory group of hundreds of technical experts convened by the Urban Green Council. Finally, the City has launched a major initiative to evaluate the potential public health impacts from climate change through a multi-year grant awarded by the Centers for Disease Control.

New York City, which has over 570 miles of coastline—the most of any city in the U.S.—is keenly aware of the risks posed by climate change and sea level rise. The City is taking a risk-based approach to climate resilience planning based on state-of-the-science information for both public- and private sector actors that involves near-term actions and periodic re-evaluation of long-term risks and strategies. In addition, as part of the legally-required process to update PlaNYC, we are working to further establish an ongoing and iterative planning process for long-term resilience, which will be necessary as new and more refined information about future conditions becomes available from climate science.

The SLRTF draft report and the work of the Task Force over the past two years are an important first step to identify many of the potential impacts from sea level rise and build capacity to address these risks. The City generally supports those recommendations in the draft report related to building capacity at the community level, researching and analyzing the impacts of climate change, developing tools to support planning, and raising public awareness. These actions will result in better planning and ultimately in smarter decisions.

Specifically, the City generally supports many recommendations, including:

- Adopting official climate change projections statewide (Recommendation 1)
- Developing tools and updating maps to assist decision-makers (Recommendation 6)
- Providing financial support and tools to communities (Recommendation 8)
- Undertaking an assessment of public health risks (Recommendation 9)
- Raising public awareness of the impacts of sea level rise (Recommendation 10)
- Conducting an assessment of viable funding mechanisms (Recommendation 11)
- Undertaking research, monitoring and demonstration projects to improve understanding of key vulnerabilities (Recommendation 12)
- Ensure continued and coordinated adaptation (Recommendation 13)
- Seek additional federal funding and evaluate changes to federal programs (Recommendation 14)

We continue to have serious concerns about a number of recommendations, which should be removed or substantially revised before the draft SLRTF report is completed and submitted to the Legislature.

Specifically, the City does not endorse:

- A blanket executive order for State agencies to amend permitting and regulatory standards based on climate change projections and speculative mapping (Recommendation 2)
- The proposed expansion of environmental review and SEQRA requirements (Recommendation 3)
- Creating a statewide set of regulatory maps that is separate from the FEMA floodplain maps (Recommendation 4)
- Adding additional burdens to the regulatory process by extending the level of review and approval by the State in local planning efforts (Recommendation 5)
- Amending or creating additional regulatory requirements without undertaking the appropriate research and analysis to understand both the potential impacts of climate change as well as the potential costs and benefits of the proposed changes to regulations (Recommendation 7)

The City's concerns are further articulated in the following three main points:

1. Many of the draft recommendations are not based on thorough analysis and require additional research and analysis to determine specific regulatory responses to the long-term impacts of sea level rise

The draft report correctly identifies that many research, monitoring, and demonstration projects are needed to improve understanding of key vulnerabilities to critical coastal ecosystems, infrastructure, and communities from sea level rise. Recommendation 12 lists over twenty specific initiatives that are necessary to better understand the impacts of sea level rise. These are important areas to explore, and we look forward to working with the State on these efforts.

However, since this analysis has not been done, we do not fully understand the potential impacts of sea level rise and storm surge on coastal infrastructure and communities—much less many of the intended and unintended consequences of the proposed policy recommendations in the draft report. Therefore, we strongly believe it is premature to propose specific regulatory changes without conducting the necessary research and analysis. Many of the recommendations presented in the report outstrip the analysis performed by the Task Force. The benefits and costs of proposed regulatory changes, including an assessment of the relevant State agencies' ability to administer such regulatory changes in a timely manner, are not known at this time, and additional assessment must be done.

Further, measures to increase resilience to climate change must consider a range of goals, including economic development, greenhouse gas mitigation, public access, ecological health, and more. Strategies should be evaluated based on consideration of a full range of costs and benefits, including their consequences for other parts of the state, resources available for other efforts, and their ability to produce co-benefits or advance other desirable ends.

Building resilience to coastal storms and flooding anticipated in the future does not lend itself to quick solutions. Climate change poses real and significant risks to New Yorkers, but our response must be based on science and rational, risk-based planning that allows us to make more informed decisions about how to build resilience to sea level rise. In particular, we must better understand the impacts associated with the sea level rise levels projected for the 2050s and beyond since these are the most severe, yet also the most uncertain.

2. The draft report and recommendations do not sufficiently recognize the unique challenges facing urban areas, particularly with regard to the potential for non-structural measures to adequately provide coastal protection into the future

Building resilience to coastal storms and flooding requires recognition of the characteristics of all of New York State's coastal areas as well as the climate risks they face. The report does not appropriately recognize the unique characteristics of urban areas and the long-term need to protect New York City.

The draft report has a strong bias toward non-structural measures that is not supported by any environmental, feasibility, or cost-benefit analyses that are based on conditions in New York. Many of the academic studies that are utilized throughout the draft report were conducted in non-urban areas, and it is not appropriate to extrapolate the conclusions from these areas onto New York City. The draft report also cites New Orleans on several occasions. In New Orleans, substantial portions of the city are located below sea level, and floodwaters do not naturally recede after a storm event, exacerbating the potential for damage and disruption, as illustrated by the experience of Hurricane Katrina. Unlike New Orleans, most portions of New York City stand several feet or more above sea level, and therefore face different challenges from New Orleans.

In the absence of an evaluation of the relative costs and benefits of alternative approaches to sea level rise in New York City, it is premature to dismiss structural measures. It is likely that New York City will need to utilize a host of structural and non-structural measures to protect its residents and critical infrastructure from sea level rise in the future. Absent rigorous analysis, flexibility must be given to localities to identify and implement the most appropriate climate resilience strategies that take into account a variety of considerations and concerns.

As written, the draft recommendations could result in a policy of disinvestment in and promote relocation from existing urban areas. This would have dire economic and environmental consequences for the city and the state. There are over 215,000 people living within the FEMA 1 percent chance flood zone in New York City and more than 185,000 jobs present in this zone. In the 0.2 percent chance flood zone the population is more than 475,000, and there are over 290,000 jobs. These populations and jobs are of great significance to the city, state, and broader economy. Moreover, the city is built on a vast fixed infrastructure including transit and sewer systems that cannot be moved to higher ground. These assets are themselves a mitigation strategy for climate change: they enable New Yorkers to live in dense settlements in which our per-capita carbon emissions are already just one-third of the national average, and targeted for a further reduction of 30 percent by 2030 under PlaNYC. The capacity to support a large population in a small area is one of NYC's greatest contributions to the environment, and enables the preservation of natural resources elsewhere.

3. If implemented, the proposed regulatory changes would create unnecessary additional oversight for local land-use decisions and could add significant costs and time to projects in coastal areas, including those undertaken for public health and safety or to reduce flood risks

The City supports the use of climate change projections to create maps depicting sea level rise for planning purposes, but is concerned that basing regulatory policy and additional permitting requirements on these maps is problematic given the uncertainty and imprecision associated with current mapping and modeling technology. We do not support the concept of creating coastal risk management zones for regulatory purposes based on such predictive mapping, nor do we support the proposals outlined in Recommendation 7 that would change regulatory requirements within and based on these zones. We are further concerned that the recommendations to create these maps, as well as other recommendations such as amending wetlands regulations to cover lands that may transition to wetlands in the future, are based on assumptions that outstrip the predictive capacity of scientific evidence and methodologies. There are also legal implications that need to be explored related to making permitting decisions based on projected conditions.

It would be also problematic if the State created regulatory maps that conflicted with the FEMA FIRMs. Instead, efforts should focus on coordinating with FEMA to regularly update their flood maps as opposed to creating an additional set of regulatory maps that could create conflicts, confusion, and additional regulatory burdens. If the State determines that there are areas of risk that are outside the FEMA A zones, property owners may be unable to get flood insurance in these zones, while they are able to get under the National Flood Insurance Program. The result could be to push development *into*, rather than out of, the most vulnerable areas.

The proposal to require local climate resilience plans that require approval by both the Department of Environmental Conservation and the Department of State represents a major expansion of regulatory powers over local decision-making. Further, it is unclear how the State would manage, review, and approve the process proposed in Recommendation 5. If a municipality did not have an approved local coastal resilience plan in place, then it appears that every action within a "coastal risk management zone" that uses State funding would be subject to a review or require a permit. Yet the draft report and

recommendations do not indicate how this review will occur. This is especially important considering the current financial situation facing the State. Any delays in review or permitting would have an adverse impact on projects aimed at increasing the city's climate resilience. New York City already has a robust climate change planning process underway as part of its comprehensive long-term plan. This process has resulted in numerous projects that are reducing our exposure to climate change. Awaiting approval from two State agencies for a formal plan adds unnecessary time, costs, and unpredictability into an already complicated process.

The proposed changes to SEQRA could also require additional costs and time for local projects. Making any unlisted action in a coastal area into a Type I action could have an adverse effect on property investment in the New York City – and thus New York State – economy. This recommendation suggests that the issuance of a discretionary permit – e.g., for expansion of an existing bulkhead – is more likely to require an EIS. This would ultimately impede adaptation in highly-urbanized areas. Adding such actions to the Type I list would accomplish little except adding cost and time to actions, including actions that are necessary for adaptation. Implementation of this recommendation could require the preparation of a future development scenario 50-100 years or more into the future, which is neither practical nor helpful.

Adding additional burdens to the regulatory process (by adding new layers of review and analysis) could also prevent actual adaptation activities from occurring by increasing costs and directing investments (including flood mitigation strategies) away from coastal areas. In locations where retreat is not viable, increased stress on existing coastal infrastructure will require more frequent maintenance or upgrading. Predictable and timely regulatory approvals will therefore be a key part of a climate resilience strategy.

As drafted, the SLRTF recommendations have the potential to add substantial costs and time to development projects and infrastructure investments. While codes and regulations will need to be updated to account for the impacts of climate change, implementing these measures without a thorough understanding of the cost and time implications or the scope of their reach is premature.

The City looks forward to working with the State Department of Environmental Conservation and the members of the Sea Level Rise Task Force to address our concerns and develop final recommendations that will increase the city and state's resilience to sea level rise.

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MAYOR KENNEDY: We have a public hearing at 7:45. We're running a few minutes late.

MR. MCLAUGHLIN: Thank you, Mr. Mayor. This is a public hearing that you've previously heard before to amend Section 87 of the Village Code with regards to flood damage prevention. For a few housekeeping matters, I'd like to put the following documents into evidence. Exhibit A, the affidavit of publication. Exhibit B would be the affidavit of posting. Exhibit C would be the affidavit of public notice. Exhibit D would be the directive of the public hearing, and Exhibit E would be a copy of the local law.

MAYOR KENNEDY: Very good.

MR. MCLAUGHLIN: Can we have them marked into evidence?

MAYOR KENNEDY: Please mark them into evidence.

MR. MCLAUGHLIN: Mr. Mayor, the Village Board had previously heard this matter, I believe in August. Now, at this point we need for the Village Board to reaffirm the local law in order to send the local law to New York State Co-counsel and get the approval of the New York State Co-counsel.

MAYOR KENNEDY: Okay. You want to briefly explain?

MR. MCLAUGHLIN: Yes. I do have the head of the building department here available for any questions, Mr. Madigan.

1 MAYOR KENNEDY: Mr. Madigan, please explain to everyone
2 the code.

3 MR. MADIGAN: Yes. Upon filing the previously adopted
4 law, it was told to us by the Department of State, Division
5 of Code Enforcement Administration Code Development Unit that
6 when we adopt a more restrictive standard we have 30 days to
7 get it before their Board. This is really merely a formality
8 to get it before their Board on the their December 11th
9 hearing.

10 MAYOR KENNEDY: Okay.

11 TRUSTEE WHITE: This is to amend the flood standard?

12 MR. MADIGAN: This is amending Chapter 87-16 for the
13 four feet of freeboard above the baseboard elevation.

14 MAYOR KENNEDY: Could you explain to the residents what
15 specifically we are doing?

16 MR. MADIGAN: Yes, we adopted a more restrictive
17 standard. Right now presently New York State code has two
18 feet of freeboard above the baseboard elevation for new
19 construction, or substantially damaged, or substantially
20 improved structures. We are adding an additional two feet on
21 that due to the fact that Freeport is more prone to flooding
22 than other areas, as other communities down in the flood zone
23 are lower than the surrounding communities and areas. This
24 will help people with their flood insurance. Instead of
25 paying \$4,000 for a new policy, you'll only be paying \$400 if

1 you're a new construction or an elevated building. It would
2 also help us in the CRS program which is Community Rate
3 System. We are a Class 7 at this time, which allows the
4 residence of the Village of Freeport who are in a flood zone
5 to get a 15 percent reduction on their flood insurance. That
6 is handed down automatically by the NFIP which is the
7 National Flood Insurance Program. We are -- this is going to
8 help us to get to a Class 6 which we hope to do in the next
9 year which would be a 20 percent reduction of flood
10 insurance.

11 MAYOR KENNEDY: So by conforming to this code we'd
12 actually be reducing our insurance costs in the future?

13 MR. MADIGAN: It will help reduce flood insurance costs
14 in the future. It's going to make houses sellable, you know,
15 and resistant to flood damage.

16 MAYOR KENNEDY: You got anything else?

17 MR. MADIGAN: No, sir.

18 THE CLERK: We have three questions. Frank Grossman.

19 MR. GROSSMAN: You made changes to the code --

20 MAYOR KENNEDY: Please come up to the --

21 MR. GROSSMAN: What it really is -- and I'm against
22 these changes. There's too many regulations. I don't want
23 changes.

24 MAYOR KENNEDY: Please state your name for the record.

25 MR. GROSSMAN: Frank Grossman. Anything else?

1 MAYOR KENNEDY: Your address.

2 MR. GROSSMAN: 4 Saint Marys, Freeport.

3 MAYOR KENNEDY: Just repeat what you were saying.

4 MR. GROSSMAN: Frank Grossman. 4 Saint Marys.

5 MR. MCLAUGHLIN: You have to repeat your question.

6 MR. GROSSMAN: What changes are you talking about? That
7 you're making to the code?

8 MR. MADIGAN: As previously stated, we are requesting an
9 additional two feet of freeboard. Freeboard is any
10 requirement above the base flood elevation. Base flood
11 elevations are set by FEMA. They are basically, they're
12 elevations, there's data used now that new constructions or
13 substantially damaged structures, so when they go to rebuild
14 they're going to have to meet these requirements. We are
15 adding an additional two feet on that, which is going to help
16 the Village of Freeport. It's going to help the residents.
17 It's going to help somebody in a flood zone, if you're in a
18 flood zone. It's going to reduce your flood insurance
19 drastically.

20 MR. GROSSMAN: How is it going to reduce it unless I
21 raise it?

22 MR. MADIGAN: That's what we're talking about.

23 MAYOR KENNEDY: If you raise the building --

24 MR. MADIGAN: This would only apply to an elevated
25 structure, an elevation project, or a new construction.

1 MR. GROSSMAN: What if you don't have the money to do
2 the elevation? Then what happens?

3 MR. MADIGAN: Then you should contact New York Rising.
4 They are giving out grants of up percent for elevation
5 projects.

6 MR. GROSSMAN: That's the only alternative? You have to
7 get involved with this organization? It's going to cost the
8 taxpayers.

9 MR. MADIGAN: It's not going to cost the taxpayers
10 anything.

11 MR. GROSSMAN: It's not?

12 MR. MADIGAN: No.

13 MR. GROSSMAN: Not going to cost anything? They're
14 going to raise your house to the new elevation?

15 MR. MADIGAN: New York Rising is giving up to 100
16 percent funding for the elevation projects.

17 MR. GROSSMAN: Where do you think they get their money
18 from?

19 MR. MADIGAN: They get it from the federal government.

20 MR. GROSSMAN: From the tax payers in the private
21 sector. Unbelievable.

22 MAYOR KENNEDY: Thank you, Mr. Madigan.

23 THE CLERK: Alan Jay.

24 MR. JAY: Hating to be repetitious --

25 MAYOR KENNEDY: Could you please state your name and

1 address for the record, sir.

2 MR. JAY: Alan Jay. J-A-Y is the last name. We all
3 know that one more Sandy type storm will finish our real
4 estate here, and our way of life in Freeport, and the whole
5 south shore. No storm, no beach can be left unturned. We've
6 got to beat this thing, and again I say for the fifth time,
7 somebody concerned with the preparations here, preferably
8 architectures, engineers, should visit with the Dutch.
9 They've lived with this thing for hundreds of years
10 successfully. In 1973 they lost about 100,000 people to a
11 terrible flood. They have better experience with this, and
12 also successful, and we're going to invest billions and
13 billions of dollars fighting this thing, and I think it'd be
14 very foolish to ignore their experience. There are angles we
15 never even dreamed of what they're doing over there to
16 successfully limit the potential of disastrous flooding.

17 So again I say the village is a little too small maybe
18 to handle the whole expense, but at least one or two
19 architects or engineers should go over there for a week, ten
20 days, and learn a lot of techniques that we, like I said, we
21 never dreamed of doing here. Almost grotesque types of
22 defense mechanisms they employ. So we can't afford to be
23 wrong and overlook anything. Let's give some serious
24 consideration and maybe New York State will provide the
25 experts with a vision. It won't be, what they call it, a

1 junction kind of an expedition. Thank you.

2 MAYOR KENNEDY: Thank you very much. Madam clerk.

3 THE CLERK: Mark Davella.

4 MR. DAVELLA: Mayor, Trustees, Mark Davella, 286 West
5 Side Avenue, Freeport, New York 11520. Mr. Madigan, with
6 regards to the changes that we're putting in front -- I just
7 want to make sure, in layman's terms, what I remember we were
8 talking about from August which is basically, most of
9 Freeport is basically at, let's say, an eight foot, foot
10 plane at street level. The Village changes to Chapter 87, if
11 I'm wrong please correct me, is that the elevation levels, if
12 you are a repeat flood victim of 50 percent of substantial
13 damage or better is that if you have not yet started your
14 repairs, if you have not yet finished your repairs, or if you
15 have more than 50 percent substantial damage and you have not
16 come back in to do your renovations, at this point in time,
17 once this law is adopted, we will wind up being at an
18 elevation 12 and the heating elements and the mechanicals
19 that are in a household have to be at elevation of 14?

20 MR. MADIGAN: No.

21 MR. DAVELLA: No?

22 MR. MADIGAN: All at 12. Everything has to be at 12.

23 MR. DAVELLA: And once we meet that certificate of
24 elevation for the surveyor, we would then be eligible for a
25 15 percent discount depending on what the village has set up?

1 MR. MADIGAN: You would be eligible to a 15 to
2 20 percent discount without even elevating your home.

3 MAYOR KENNEDY: Please speak into the microphone.

4 MR. MADIGAN: You're eligible for a 15 to 20 percent
5 discount on flood insurance just by being a Village of
6 Freeport resident in a flood zone. You don't have to
7 mitigate your property to get that.

8 MR. DAVELLA: So if you were to come in and buy a house
9 in a flood zone area, you would get a 15 to 20 percent --

10 MR. MADIGAN: 15 percent reduction in your flood
11 insurance. That is handed down automatically by the NFIP.

12 MR. DAVELLA: Even if I'm not elevated?

13 MR. MADIGAN: It can be where it is. It can be lower
14 than ten. Any new flood policies --

15 TRUSTEE WHITE: If I may just -- I want to elaborate on
16 that, Mr. Davella. What Mr. Madigan is talking about is this
17 15 percent discount has been ongoing for years, and the
18 reason why village residents have been able to have that
19 discount is because of the proactive work that's been done by
20 Mr. Madigan and his building department over many years. The
21 passing of the local law that we passed in August just
22 continues to supplement that. If you have a flood policy on
23 either side of the Village of Freeport you do not get that 15
24 percent discount, so somebody who is paying \$2,000 flood
25 insurance -- that discount is thrown right on top, and that

1 discount has been done over many years by Mr. Madigan and
2 others, through their relationships with FEMA and through the
3 proactive passage of ordinances like we passed in August.

4 MAYOR KENNEDY: That's correct.

5 TRUSTEE WHITE: That is there -- the advantage of living
6 in a municipality that aggressively is proactive.

7 MAYOR KENNEDY: Thank you, Trustee White.

8 MR. DAVELLA: One last question I have if a new home
9 buyer comes into the village and they buy an existing home at
10 flood level 7, 8, 9, that existed and that house is able to
11 be inhabited by humans and is deemed stable by the building
12 department, they have no issues with having to raise unless
13 they get damage in the future, and they're not at elevation
14 12, correct?

15 MR. MADIGAN: They would have to be damaged over
16 50 percent to be mandated, declared substantially damaged to
17 be mandated to elevate that structure or knock it down and
18 rebuild.

19 MR. DAVELLA: All right, I just wanted that in layman's
20 terms. Thank you.

21 MAYOR KENNEDY: Thank you.

22 MR. MADIGAN: Just for the record I'd like to also say
23 before us, and what this code changes was the datum reference
24 from NGDC which is the National Geophysical Data Center which
25 is the North American Data Center, that's required by FEMA

1 for us to do that and it's 1.1 reference.

2 MAYOR KENNEDY: That's the data we're using for the
3 approving Board?

4 MR. MADIGAN: Correct.

5 MAYOR KENNEDY: Thank you. Madam Clerk?

6 MR. MCLAUGHLIN: Mr. Mayor, we do have one final
7 housekeeping matter. In August we had passed a SEQRA
8 resolution in this matter here as a reaffirmation for New
9 York State Co-counsel, and there are no changes in this SEQRA
10 resolution, there is no need at this time to pass a judicial
11 SEQRA resolution. I'm just advising the Board why there
12 isn't one on this case. At this time we'd ask that -- being
13 there is no more public comment, we'd ask that the meeting be
14 closed for evidence and testimony.

15 MAYOR KENNEDY: Thank you very much. Madam Clerk.

16 TRUSTEE MARTINEZ: So moved.

17 TRUSTEE WHITE: Second.

18 MAYOR KENNEDY: Madam Clerk, please poll the Board.

19 THE CLERK: Deputy Mayor Pineyro?

20 DEPUTY MAYOR PINEYRO: In favor.

21 THE CLERK: Trustee White?

22 TRUSTEE WHITE: In favor.

23 THE CLERK: Trustee Martinez?

24 TRUSTEE MARTINEZ: In favor.

25 THE CLERK: Trustee Ellerbe?

1 TRUSTEE ELLERBE: In favor.

2 THE CLERK: Mayor Kennedy?

3 MAYOR KENNEDY: In favor.

4 MR. MCLAUGHLIN: At this time we would need a motion on
5 the passage of the local law as outlined in the agenda.

6 TRUSTEE WHITE: So moved.

7 MAYOR KENNEDY: Do we have a second?

8 TRUSTEE MARTINEZ: Second.

9 MAYOR KENNEDY: Madam Clerk, please poll the Board.

10 THE CLERK: Deputy Mayor Pineyro?

11 DEPUTY MAYOR PINEYRO: In favor.

12 THE CLERK: Trustee White?

13 TRUSTEE WHITE: In favor.

14 THE CLERK: Trustee Martinez?

15 TRUSTEE MARTINEZ: In favor.

16 THE CLERK: Trustee Ellerbe?

17 TRUSTEE ELLERBE: In favor.

18 THE CLERK: Mayor Kennedy?

19 MAYOR KENNEDY: In favor.

20 MAYOR KENNEDY: That concludes the hearing?

21 MR. MCLAUGHLIN: Yes.

22 MAYOR KENNEDY: Thank you. Do we have a motion to
23 adjourn?

24 TRUSTEE MARTINEZ: So moved.

25 TRUSTEE ELLERBE: Second.

1 MAYOR KENNEDY: Madam Clerk, please poll the board.

2 THE CLERK: Deputy Mayor Pineyro?

3 DEPUTY MAYOR PINEYRO: In favor.

4 THE CLERK: Trustee White?

5 TRUSTEE WHITE: In favor.

6 THE CLERK: Trustee Martinez?

7 TRUSTEE MARTINEZ: In favor.

8 THE CLERK: Trustee Ellerbe?

9 TRUSTEE ELLERBE: In favor.

10 THE CLERK: Mayor Kennedy?

11 MAYOR KENNEDY: In favor. Ladies and gentlemen, thank
12 you very much. We'll see you next week. Have a great day.

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C E R T I F I C A T I O N

I, Julia M. Speros, a Notary Public in and for the state of New York, do hereby certify:

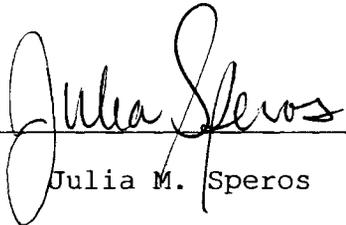
THAT that the witness whose testimony is hereinbefore set forth, was duly sworn by me; and

THAT the within transcript is a true record of the testimony given by said witness.

I further certify that I am not related, either by blood or marriage, to any of the parties to this action; and

THAT I am in no way interested in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 2nd day of December, 2013.



Julia M. Speros