

ULI DISASTER COMBINED ADVISORY SERVICES PANEL

AFTER SANDY: ADVANCING STRATEGIES FOR LONG-TERM RESILIENCE AND ADAPTABILITY



TABLE OF CONTENTS

SETTING THE STAGE

INTRODUCTION - 5

THE RECOMMENDATIONS - 6

GAPS - 14

CONFLICTS - 17

THE PANEL ASSIGNMENT AND GOALS - 19

REPORTS

PLANYC: A STRONGER MORE RESILIENT NEW YORK, City of New York - 25
Climate, Buildings, and Insurance Chapters

ADAPTATION TOOL KIT: SEA LEVEL RISE AND COASTAL LAND USE, GU Climate Center – 92
Executive Summary

BUILD CAPACITY OF ADAPTIVE PLANNING AFTER SANDY, Regional Plan Association – 101
Full Report

BUILDING RESILIENCY TASK FORCE: REPORT TO MAYOR MICHAEL BLOOMBERG AND SPEAKER CHRISTINE QUINN - 37
Full Report

CLIMATE CHANGE ADAPTATION IN NEW YORK CITY: BUILDING A RISK MANAGEMENT RESPONSE, New York Academy of Science - 177
Executive Summary

EXECUTIVE ORDER: ESTABLISHING THE HURRICANE SANDY REBUILDING TASK FORCE – 183

FLOOD-RESILIENT WATERFRONT DEVELOPMENT IN NEW YORK CITY: BRIDGING FLOOD INSURANCE, BUILDING CODES, AND FLOOD ZONING, New York Academy of Science - 187
Extended Summary

GREENING MASS TRANSIT AND METRO REGIONS: THE FINAL REPORT OF THE BLUE RIBBON COMMISSION ON SUSTAINABILITY AND THE MTA - 195
Top Recommendations

MANAGING THE ESCALATING RISKS OF NATURAL CATASTROPHES IN THE UNITED STATES, Lloyds – 203
Full Report

NEW YORK STATE SEA LEVEL RISE TASK FORCE: REPORT TO THE LEGISLATURE – 231
EXECUTIVE SUMMARY AND FINDINGS/RECOMMENDATIONS

NYS 2100 COMMISSION: RECOMMENDATIONS TO IMPROVE THE STRENGTH AND RESILIENCE OF THE EMPIRE STATE'S INFRASTRUCTURE - 239

Executive Summary and Infrastructure Finance Chapter

PLANNYC 2011 UPDATE: A GREENER, GREATER NEW YORK, CITY OF NEW YORK – 259

Climate Change chapter

POST-SANDY INITIATIVE: BUILDING BETTER, BUILDING SMARTER, American Institute of Architects – 275

Executive Summary

BIPARTISAN TASK FORCE ON HURRICANE SANDY RECOVERY: PRELIMINARY RESPONSE AND RECOVERY REPORT, State of New York – 279

Full Report

REBUILDING NYC AFTER HURRICANE SANDY: A GUIDE TO NEW CODE AND ZONING STANDARDS, City of New York – 285

Full Report

RESILIENT COASTS: A BLUEPRINT FOR ACTION, Heinz Center and Ceres – 305

Full Report

RESTORE-ADAPT-MITIGATE: RESPONDING TO CLIMATE CHANGE THROUGH COASTAL HABITAT RESTORATION, Restore America's Estuaries – 315

Chapter 4

RISK AND RESILIENCE IN COASTAL REGIONS: A ULI GLOBAL POLICY AND PRACTICE FORUM REPORT, Urban Land Institute Land Use, Climate, and Energy Initiative – 329

Full Report

NEW YORK – NEW JERSEY HARBOR AND ESTUARY PROGRAM: ROLES AND RECOMMENDATIONS AS THEY RELATE TO SANDY AND PLANNING FOR RESILIENCY TO FUTURE COASTAL STORMS - 369

Full Report

SANDY REGIONAL ASSEMBLY RECOVERY AGENDA: STRATEGIES FOR COMMUNITY-BASED RESILIENCY – 373

Full Report

SEVERE WEATHER IN NORTH AMERICA: PERILS, RISK, INSURANCE, Munich RE – 389

Executive Summary

SEWAGE OVERFLOWS FROM HURRICANE SANDY, Climate Central – 401

Conclusion

STORMY FUTURE FOR US PROPERTY/CASUALTY INSURERS: THE GROWING COSTS AND RISKS OF EXTREME WEATHER EVENTS, Ceres – 405

Full Report

THE CLIMATE RISK CHALLENGE: THE ROLE OF INSURANCE IN PRICING CLIMATE-RELATED RISKS, Zurich – 437

Full Report

USING NATURE TO REDUCE CLIMATE AND DISASTER RISKS, The Nature Conservancy – 449

Full Report

INTRODUCTION

Over eight months after Hurricane Sandy—the second costliest hurricane in U.S. history—hit the New York/New Jersey/Connecticut region, a host of plans to rebuild the region have been developed. Indeed, many plans were also developed before the October 25, 2012 hurricane that were intended to guide the region in preparing for events like Sandy. These reports, both those issued before and after Sandy hit, comprise a rich body of recommendations. Many are quite consistent, some are in conflict, and, oddly, there appear to be some gaps in the recommendations.

At the request of three ULI District Councils—New York, Northern New Jersey, and Philadelphia—this Disaster-Combined Advisory Services Panel has been convened. It is charged with reviewing these many plans and recommendations, to comment on them, and to add whatever additional insights the panel may develop during the course of its work. Because of ULI's unique ability to bring together all segments of the real estate industry, the many ULI Disaster Advisory Services Panels convened over the past years have brought a unique perspective to bear on what is needed to best plan for rebuilding after catastrophic events. In this case, however, rather than setting out yet another set of guidelines on best practices for rebuilding after Sandy, the charge to the panel is to look to the future, to assess how best the region can prepare itself for unknown, uncertain, and unpredictable future catastrophes.

The group will be working in four broad areas: Technology, Infrastructure, and Logistics, Leadership and Governance, Land Use and Development, and Finance and Insurance. Review of reports will be framed using these four themes and in addition, the group will also be asked to think about what a set of overarching principles for resilient communities might look like—thus, using the New York/New Jersey region as a laboratory for developing ULI's principles for resiliency that can be used by other regions facing similar devastations.

The importance of this charge cannot be overstated. It is now widely accepted that as unique and devastating as Hurricane Sandy was, it will not be the last such catastrophic event to affect this region and there will be similar events affecting other regions of the country. Climate change is intensifying the frequency and force of extreme weather events, including heat waves, droughts, heavy rainfalls, coastal storms, hurricanes, and nor'easters. The consequences of such disasters are exacerbated by the continuous rise of global sea levels. The most recent projections estimate that sea levels will rise in New York City in the range of 20 to 50 inches by 2100. These events will continue to cause disasters that risk human life and damage and destroy the built and natural environments.

Both short- and long- term comprehensive mitigation and adaptation strategies of an unprecedented nature are needed to address these risks. The costs for some of them are modest, but for many the costs run into the billions of dollars and will take years, if not decades, to fully implement. There are many hard choices to make, and there are uncertainties involved with all of these choices.

The panel is asked to review the studies, plans, and reports that have been prepared and to assess the recommendations set out in the studies. Again, the panel is asked to concentrate on preparing the region for response to future events, not rebuilding in the immediate aftermath of Sandy. As is always the case with ULI panels, the panel will focus on the built environment and how this supports the health, safety, economic vitality, and wellbeing of the region and its people. The panel is also requested to look at new ways to finance the extraordinary costs associated with developing long-term resilience, including best ways to use public dollars to leverage private funding. The

role of the insurance industry is critical in each and every aspect of this planning and building for resilience, and the panel is asked to consider this as well. Finally, the panel will be asked to create a set of principles to guide future development to best ensure preparedness, resilience, and adaptability.

THE RECOMMENDATIONS

Listed below are summaries of the major recommendations from reports issued both before and after Hurricane Sandy. Not all of the recommendations in the reports are included in this briefing memorandum, only those deemed relevant to the work of the panel. Following each section the reports from which the summary has been drawn are listed. The briefing book contains the executive summaries of the reports referenced in this memorandum, and the full reports will be available at the panel's workroom.

As many reports have made similar recommendations, those that are similar have been grouped together, followed by the list of the reports in which they may be found. There are other cases, however, where reports make recommendations that conflict with those found in other reports. Where this is the case, it has been noted. In addition, there are certain potentially critical areas where the reports that were reviewed made few or no recommendations. These gaps have been noted as well.

REGIONAL RECOMMENDATIONS

IMPROVE CLIMATE MODELS AND OVERALL CLIMATE RESEARCH

1. Governments should invest in improving climate models that aide scientific researchers and engineers in determining optimal weather protection measures for particular regions.
2. Governments should develop more accurate hazard mapping data to implement policies and programs that will increase resiliency of buildings located in vulnerable regions.
3. Governments should invest in further climate research to create greater awareness among businesses and homeowners about the inherent climate risks of particular regions and how to better prepare for emergency situations.

Climate Change Adaptation in New York City: Building a Risk Management Response, The New York Academy of Sciences, 2010. Page 10. (Recommendation #2)

Flood-resilient waterfront development in New York City: Bridging flood Insurance, building codes, and flood zoning, The New York Academy of Sciences, 2011, Pages 2-3. (Recommendation #'s 1,2)

PlaNYC: A Greener, Greater New York, NYC Office of the Mayor, 2011, Page 156. (Recommendation #2)

Resilient Coasts: A Blueprint for Action, Ceres/The Heinz Center, 2009, Page 4. (Recommendation #1)

Severe Weather in North America: Perils, Risk, Insurance, Munich Re, 2012, Page 6. (Recommendation #3)

Vision 2020: NYC's Comprehensive Waterfront Plan, NYC Department of City Planning, March 2011, Page 110. (Recommendation # 3)

ADAPT LAND USE PATTERNS

1. Governments should designate no-build or re-build zones in particularly vulnerable regions.
2. Governments should incentivize builders with greater development right opportunities in less vulnerable regions.
3. Governments should implement assessment programs, tax abatements, and tax credits that

incentivize development towards more inland regions.

4. Governments should designate buffer zones that promote conservation and natural protective barriers along shorelines.
5. Governments should implement rolling easements along coastlines to protect natural shorelines from structural barriers; the lack of barrier protection will influence builders to develop further inland.
6. Governments should implement conservation easements to ensure preservation of natural land and declare those regions as natural buffers, habitats, or migration areas.

Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use, Georgetown Climate Center, 2011. Pages 2-4. (All Recommendations)

Building Capacity for Adaptive Planning After Sandy, Regional Planning Association, March 2013. Page 29. (Recommendation #'s 4,5)

Resilient Coasts: A Blueprint for Action, Ceres/The Heinz Center, 2009. Page 5. (Recommendations #'s 1, 2)

Restore-Adapt-Mitigate: Responding to Climate Change through Coastal Habitat Restoration, Restore America's Estuaries, 2012. Pages 39-42. (Recommendation #'s 1,5,6)

Sandy Regional Assembly Recovery Agenda, NYC Environmental Justice Alliance, April 2013, Page 3. (Recommendation #4)

Vision 2020: NYC's Comprehensive Waterfront Plan, NYC Department of City Planning, March 2011, Page 109. (Recommendation #'s 1,5)

ADAPT INFRASTRUCTURE PROTECTION AND DESIGN STANDARDS

1. Governments should implement Capital Improvement Programs (CIP) that promote building new infrastructure in less vulnerable regions, relocating or retrofitting existing infrastructure to meet greater resiliency measures, or discontinuing the maintenance and repair of infrastructure repeatedly damaged by sea level rise.
2. Governments should provide capital investment to infrastructure improvements that are designed to adapt to increasing degrees of climate change.
3. Government and professional organizations should create and implement the certification of resilient design for critical infrastructure.
4. Governments should consider new approaches to infrastructure design, such as decentralized energy and water treatment systems, which are less susceptible to disruption from natural catastrophes than traditional centralized systems.
5. Governments should implement design and technology standards that ensure critical facilities like hospitals, police stations, and data centers can remain in operation during natural disasters.
6. The Federal Government should, and proposes to, create sustainable and resilient hospitals through a public-private partnership with the healthcare industry.

Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use, Georgetown Climate Center, 2011. Page 4. (Recommendation #1)

Climate Change Adaptation in New York City: Building a Risk Management Response, The New York Academy of Sciences, 2010. Page 3. (Recommendation #2)

Designing for a Resilient America: A Stakeholder Summit on High Performance Resilient Buildings and Related Infrastructure, U.S. Department of Homeland Security, 2011. Page 6. (Recommendation #3)

Executive Order Establishing the Hurricane Sandy Rebuilding Task Force, The White House, December 2012 (Recommendation #1)

PlaNYC: A Greener, Greater New York, NYC Office of the Mayor, 2011, Page 156. (Recommendation #2)

Post-Sandy Initiative – Building Better, Building Smarter: Opportunities for Design and Development,

American Institute of Architects – New York Chapter (AIA-NY), May 2, 2013, Page 6. (Recommendation #5)
President Obama’s Plan to Cut Carbon Pollution, The White House, June 2013. (Recommendation #6)
Resilient Coasts: A Blueprint for Action, Ceres/The Heinz Center, 2009. Page 5. (Recommendation #4)

ADAPT BUILDING PROTECTION AND DESIGN STANDARDS.

1. Governments should impose stricter building codes that limit the size, use and/or design of buildings (e.g., requiring resilient building materials or increasing building elevation) within specified floodplains in order to participate in the National Flood Insurance Program (NFI)
2. Government and professional organizations should create and implement the certification of resilient design for buildings.
3. Governments should update zoning resolutions to relax height restrictions for property owners that increase building elevation as a resiliency measure against sea level rise.
4. Governments should establish or increase mandatory building setbacks from the coastline to decrease building vulnerability and provide natural protection.
5. The Federal Government should, and proposes to, require all agencies to update flood-risk reduction standards for all federally funded projects.

Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use, Georgetown Climate Center, 2011. Page 4. (Recommendation #’s 1,4)

Designing for a Resilient America: A Stakeholder Summit on High Performance Resilient Buildings and Related Infrastructure, U.S. Department of Homeland Security, 2011. Page 6. (Recommendation #2)

Flood-resilient waterfront development in New York City: Bridging flood Insurance, building codes, and flood zoning, The New York Academy of Sciences, 2011, Page 4. (Recommendation #3)

PlaNYC: A Greener, Greater New York, NYC Office of the Mayor, 2011, Page 156. (Recommendation #3)

Post-Sandy Initiative – Building Better, Building Smarter: Opportunities for Design and Development, American Institute of Architects – New York Chapter (AIA-NY), May 2, 2013, Page 6. (Recommendation #3)

President Obama’s Plan to Cut Carbon Pollution, The White House, June 2013. (Recommendation #5)

Restore-Adapt-Mitigate: Responding to Climate Change through Coastal Habitat Restoration, Restore America’s Estuaries, 2012. Pages 39-41. (Recommendation #’s 1,4)

Vision 2020: NYC’s Comprehensive Waterfront Plan, NYC Department of City Planning, March 2011, Page 109. (Recommendation #’s 1,4)

IMPLEMENT “RISK BASED” INSURANCE PREMIUMS

1. Private insurance companies should set “risk based” premiums that reflect the risks associated with development along coastline and other high-risk communities.
2. Risk premiums should provide incentives to building owners to develop in less susceptible areas or build or retrofit properties to higher standards.
3. Insurance companies should provide building owners insurance rate reductions for demonstrable improvements in building standards and other risk mitigation efforts.

Flood-resilient waterfront development in New York City: Bridging flood Insurance, building codes, and flood zoning, The New York Academy of Sciences, 2011, Pages 3-4. (Recommendation # 1)

Managing the Escalating Risks of Natural Catastrophes in the United States, Lloyds, 2011 (Recommendation #’s 1,2,3)

Resilient Coasts: A Blueprint for Action, Ceres/The Heinz Center, 2009. Page 6. (Recommendation #1)

Severe Weather in North America: Perils, Risk, Insurance, Munich Re, 2012 (Recommendation #’s 1,2,3)

Stormy Future for U.S. Property/Casualty Insurers: The Growing Costs and Risks of Extreme Weather Events, Ceres, September 2012. (Recommendation #’s 1,2,3)

The Climate Risk Challenge: The Role of Insurance in Pricing Climate-Related Risks, Zurich Financial Services

Group, 2009 (Recommendation #'s 1,2,3)

INTEGRATE CLIMATE RISK ANALYSIS INTO FINANCIAL LENDING CRITERIA.

1. Asset managers and banks should include climate risk in their due diligence process to understand their real estate portfolio's risk exposure and how to manage that risk accordingly.
2. Government should provide incentives for financial institutions that offer Location-Efficient Mortgages (LEM)—mortgages that reduce the need for vehicle use and thus mitigate greenhouse gas emissions, which in turn slow the process of climate change.

Resilient Coasts: A Blueprint for Action, Ceres/The Heinz Center, 2009. Page 6. (Recommendation #1)

Greening Mass Transit & Metro Regions, The New York State Metropolitan Transit Authority's Blue Ribbon Commission on Sustainability and Climate Change, chaired by ULI member Jonathan Rose, 2009. Page 65. (Recommendation #2)

NEW YORK RECOMMENDATIONS

In addition to the recommendations listed above that apply generally to the region, several reports have focused specifically on New York State and New York City, and have made certain specific recommendations for better protecting the city and state's vulnerable buildings and infrastructure from climate change risks. These are listed here, and while they were developed with New York State and New York City in mind, many of them are applicable more widely.

TRANSPORTATION

1. The state should determine specific transportation networks that are guaranteed to remain in operation in the event of an extreme weather event.
2. The state should strengthen transportation infrastructure by creating flood proof tunnel systems, performing rigorous maintenance on roads, railroads, bridges, and tunnels, and retrofitting bridges and subways to withstand seismic activity. The state should consider using public-private partnerships for financing the larger infrastructure projects. For example, the Tappan Zee bridge retrofit is a design-build, public-private partnership that will replace the bridge for \$3.1 billion, 40% less than the \$5.2 billion original cost estimate with no private partnership in place.
3. The state should construct transportation network redundancies to create a more resilient, flexible, and adaptive system. Suggested methods include modernizing existing signal and communications systems, building a bus rapid transit network, creating a new trans-Hudson tunnel connection, expanding rail access to and from Manhattan with Metro-North Penn Station access, expanding capacity on the LIRR's main line, and developing alternative modes of transportation.
4. The MTA should implement short- and long-term adaptation strategies to address sea level rise: increase fixed-station pumping capacity, raise subway entrances, curb and ventilate grates, provide additional tunnel sealing, and conduct flood projection assessments for subway expansion projects currently underway.
5. The MTA should make greater use of stormwater like the Corona Maintenance Shop in Queens. The shop drains the stormwater into a 40,000-gallon storage tank and supplies the water to a subway car wash. Then, 80% of the wash water is collected as greywater and recycled.
6. The MTA should implement design standards for new facilities that require stormwater management and minimizing impervious surfaces. Guidelines should also promote retrofits to reduce

stormwater runoff from parking lots and other impervious surfaces. In addition, capital projects should continue the build-out of permeable spaces along Sunset Park Greenway-Blueway, South Bronx Greenway, and Bronx River Greenway.

Building Resiliency Task Force (Summary Report), The City of New York, June 2013, Page 17. (Recommendation # 6)

Greening Mass Transit & Metro Regions, The New York State Metropolitan Transit Authority's Blue Ribbon Commission on Sustainability and Climate Change, chaired by ULI member Jonathan Rose, 2009. Pages 54-56. (Recommendation #'s 4,5,6)

NYS 2100 Commission Draft Report, New York State 2100 Commission Jan. 2013, Pages 14 and 161. (Recommendation #'s 2,3)

NY Rising: 2013 State of the State Address, Governor Andrew M. Cuomo, January 2013. Pages 233-234, 238. (Recommendation #'s 2,4)

Preliminary Response and Recovery Report, Senate Bipartisan Task force on Hurricane Sandy Recovery, February 2013, Page 21. (Recommendation #'s 1, 2)

Sandy Regional Assembly Recovery Agenda, NYC Environmental Justice Alliance, April 2013. Pages 3-4. (Recommendation #'s 3,6)

Vision 2020: NYC's Comprehensive Waterfront Plan, NYC Department of City Planning, March 2011, Page 111. (Recommendation # 2)

WASTEWATER TREATMENT FACILITIES

In 2008, the Department of Environmental Protection identified key strategies New York City could implement to reduce the impacts of flooding on wastewater treatment facilities. Key recommendations included:

1. The city should revise the design criteria for plants so that future renovations and plant developments address the issue of sea level rise.
2. Design standards should raise key equipment, such as pumps, generators, and electrical equipment above projected flood heights.
3. Design standards should require watertight doors and windows to protect critical equipment.
4. The city should increase the capacity of storm water collection systems to reduce the runoff that flows into and floods treatment plants.

According to New York City's A Stronger, More Resilient New York, the Department of Environmental Protection and Department of Parks and Recreation will continue to pursue the plan to "capture the first inch of runoff in 10 percent of impervious surfaces citywide in areas within the combined sewer system by 2030." This initiative will help decrease the volume of combined sewer overflows the city is experiencing as a result of increased rainfall and sea level rise.

A Stronger, More Resilient New York, The City of New York, June 2013. Page 216.

Greening Mass Transit & Metro Regions, The New York State Metropolitan Transit Authority's Blue Ribbon Commission on Sustainability and Climate Change, chaired by ULI member Jonathan Rose, 2009. Pages 54-55. (Recommendation # 4)

NYS 2100 Commission Draft Report, New York State 2100 Commission Jan. 2013, Page 16. (Recommendation #'s 1,2,3)

NY Rising: 2013 State of the State Address, Governor Andrew M. Cuomo, January 2013. Pages 239-240.

Sewage Overflows from Hurricane Sandy, Climate Central, April 30 2013. Page 21. (All Recommendations)

ENFORCE ZONING CHANGES.

On May 20, 2013, the Department of City Planning proposed several flood resilient zoning amendments that are currently under public review:

1. Owners are permitted increased building heights to account for increased building elevations.

2. Lost square footage from now unusable space will not count towards building square footage.
3. Owners can move mechanical equipment to higher floors of buildings without it counting towards total building square footage.
4. Ramps that owners need to build inside the building so as not to block the streetscape, will not count towards total building square footage.
5. Owners are expected to include windows or displays that reach below the floodplain so as not to present blank walls for people passing.
6. Owners who elevate their homes are permitted to use the new space created beneath the structure as parking and/or storage.
7. City Planning recommends homeowners to build porches or sloped yards to disguise the additional stairs now needed to reach raised first floors.

On June 13, 2013, the Building Resiliency Task Force developed a report for the City of New York encompassing 33 proposals to improve resiliency for commercial buildings, residential housing, multifamily homes, and hospitals. The proposals call for required upgrades, enforced new codes, and recommended strategies for the city to improve building resiliency in the face of possible future catastrophic events. The report in its entirety is included in the briefing book with each issue and its recommendation to address it highlighted.

Building Resiliency Task Force, The City of New York, June 2013.

Flood Resilience Zoning Text Amendment (Overview), Department of City Planning, May 2013.

Proposed Flood Resilience Text Amendment, Department of City Planning, May 2013.

Rebuilding NYC after Hurricane Sandy: A Guide to New Code and Zone Standards, NYC Buildings, February 2013.

IMPROVE AFFORDABLE HOUSING RESILIENCY MEASURES.

1. All NYCHA or subsidized properties in vulnerable coastline communities should possess backup generators or solar panels that allow elevators to work in the event of a power outage.
2. Building retrofits should move NYCHA HVAC systems from building basements.
3. Independent analysts should conduct NYCHA building audits and provide specific recommendations on how to improve resiliency for each building.
4. Government agencies should improve evacuation procedures for NYCHA public housing.
5. Government agencies should implement legislation that guarantees no reduction in the supply of affordable housing for low and moderate-income residents in the event of a natural disaster.

A Stronger, More Resilient New York, The City of New York, June 2013. Page 84. (Recommendation #2)

Post-Sandy Initiative – Building Better, Building Smarter: Opportunities for Design and Development, American Institute of Architects – New York Chapter (AIA-NY), May 2, 2013, Page 6. (Recommendation #2)

Sandy Regional Assembly Recovery Agenda, NYC Environmental Justice Alliance, April 2013, Pages 9-10. (All Recommendations)

ASSESS STRUCTURAL BARRIER PROTECTION STRATEGIES.

1. Municipalities should analyze the following structural barrier protection strategies and implement those most suitable to mitigate local and regional climate risks:
2. Build bulkheads and seawalls to protect shoreline communities in high demand areas.
3. Build levees, or dikes, to protect coastal areas from wave forces in highly populated regions.

4. Build floodwalls, or surge protection barriers, to contain flooding during a storm but allow water passage during normal conditions.
5. Build revetments made of stones or concrete blocks to weaken wave forces.
6. Build watertight gates at building entry points to prevent water from entering.
7. Build shield panel buildings perched above water to accommodate flooding and storm surge.
8. Use foundation reinforcements to protect windows and doors from water inundation.

A Stronger, More Resilient New York, The City of New York, June 2013. Pages 50-51. (Recommendation #'s 1,2,3,4,5)

Building Capacity for Adaptive Planning After Sandy, Regional Planning Association, March 2013. Pages 28-30. (All Recommendations)

Hydrologic Feasibility of Storm Surge Barriers to Protect the Metropolitan New York – New Jersey Region, Marine Sciences Research Center, Stony Brook University, March 2005. (Recommendation #3)

NYS 2100 Commission Draft Report, New York State 2100 Commission, Jan. 2013, Page 16. (Recommendation # 2)

NY Rising: 2013 State of the State Address, Governor Andrew M. Cuomo, January 2013. Pages 230-231. (Recommendation #'s 1,3)

PlaNYC: A Greener, Greater New York, NYC Office of the Mayor, 2011, Page 158. (Recommendation #'s 1,2)

Post-Sandy Initiative – Building Better, Building Smarter: Opportunities for Design and Development, American Institute of Architects – New York Chapter (AIA-NY), May 2, 2013, Page 6. (Recommendation #'s 1,3,4,5)

Restore-Adapt-Mitigate: Responding to Climate Change through Coastal Habitat Restoration, Restore America's Estuaries, 2012. Pages 35-37. (Recommendation #'s 1,2,4,5)

Vision 2020: NYC's Comprehensive Waterfront Plan, NYC Department of City Planning, March 2011, Page 110. (Recommendation #'s 1,2,3,4,5)

ASSESS “GREEN” INFRASTRUCTURE PROTECTION STRATEGIES.

1. Municipalities should analyze the following “green” infrastructure strategies and implement those most suitable to mitigate local and regional climate risks:
2. Build sand dunes to protect coastal properties and infrastructure from surges and wave forces.
3. Create or restore wetlands to reduce wave height, provide habitat and filter contaminants.
4. Construct artificial reefs or barrier islands to reduce wave action, mitigate flooding and restore marine habitat.
5. Develop groins and jetties to reduce the impact of waves and provide marine habitat.
6. Design living shorelines, using vegetative materials anchored by sand, to mitigate erosion and protect against little to moderate wave action.

A Stronger, More Resilient New York, The City of New York, June 2013. Page 51-53. (All Recommendations)

Building Capacity for Adaptive Planning After Sandy, Regional Planning Association, March 2013. Pages 31-32. (All Recommendations)

NYS 2100 Commission Draft Report New York State 2100 Commission Jan. 2013, Page 16. (Recommendation #'s 1,2)

NY Rising: 2013 State of the State Address, Governor Andrew M. Cuomo, January 2013. Pages 227-230. (Recommendation #'s 1,2,3)

PlaNYC: A Greener, Greater New York, NYC Office of the Mayor, 2011, Page 158. (Recommendation #'s 1, 2)

Post-Sandy Initiative – Building Better, Building Smarter: Opportunities for Design and Development, American Institute of Architects – New York Chapter (AIA-NY), May 2, 2013, Page 6. (Recommendation #2)

Protecting New York as an Eco-System, Testimony by Dr. Franco Montalto, PE to the New York State Assembly Standing Committee on Environmental Conservation at a Public Hearing on the Environmental Causes and Effects of Extreme Weather Events, January 2013. (Recommendations 1,2,3,5)

Resilient Coasts: A Blueprint for Action, Ceres/The Heinz Center, 2009. Pages 5-6. (All Recommendations)

Restore-Adapt-Mitigate: Responding to Climate Change through Coastal Habitat Restoration, Restore America's Estuaries, 2012. Pages 37-38. (Recommendation #'s 1,4,5)

Roles and Recommendations as they relate to Sandy and Planning for Resiliency to Future Storms, New York-New Jersey Harbor & Estuary Program, 2012, Pages 2-3. (Recommendation #'s 1,2)

Sandy Regional Assembly Recovery Agenda, NYC Environmental Justice Alliance, April 2013, Pages 7-8.

Using Nature to Reduce Climate and Disaster Risks, The Nature Conservancy, 2012. (Recommendation #'s 1,2,3,5)

Vision 2020: NYC's Comprehensive Waterfront Plan, NYC Department of City Planning, March 2011, Page 110. (Recommendation #'s 1,2,3,4)

NEW JERSEY RECOMMENDATIONS

While New Jersey and its municipalities have yet to release a detailed report providing long-term sustainability and resiliency rebuilding plans similar to New York City's A Stronger, More Resilient New York, it appears similar actions are underway. On June 18, 2013, New Jersey's Governor Christie and Department of Community Affairs Office of Local Planning Services (LPS) announced the administration is using \$5 million from the awarded Community Development Block Grant-Disaster Recovery (CDBG-DR) funds to create a Post-Sandy Planning Assistance Grant Program. The program is available to the nine most impacted counties of New Jersey (Atlantic, Bergen, Cape May, Essex, Hudson, Middlesex, Monmouth, Ocean, and Union) and will provide funding to these regions to hire professional planners to help develop long-term rebuilding strategies. The plans will develop methods to increase building resiliency against future storms and stimulate sustainable, economic growth for the state.

Before the announcement of the CDBG funds, New Jersey adopted several similar strategies as New York and will face comparable obstacles in the months and years to come as they're implemented. For example, New Jersey adopted FEMA's Advisory Base Flood Elevation (ABFE) height and construction requirements as a state standard for reconstruction. How will this impact Hoboken, Jersey City, and other cities within the state where elevating structures is not plausible? Can New Jersey residents afford the increased insurance rates they are likely to face if their homes do not meet FEMA standards? In addition, the American Planning Association – New Jersey Chapter voiced its concerns regarding the displacement, lack of resources, and attention given to low-income communities, special needs, and homeless populations. How will the state ensure the safety and resiliency needs for these vulnerable communities?

It is evident that New Jersey, New York, and other heavily impacted regions from Hurricane Sandy face many years of redevelopment that require short- and long-term mitigation and adaptation strategies tailored to regional and local vulnerabilities. To help launch critical initiatives, The Rebuilding Task Force announced REBUILD BY DESIGN, a regional design-competition that will implement innovative strategies to increase coastal and building resiliency (June 2013). Selected proposals will receive public and private funding, including CDBG-DR funding, to develop winning designs in highly devastated states.

Christie Administration Announces Post-Sandy Planning Assistance Grant Program, State of New Jersey Department of Community Affairs, June 2013.

Comments on the March 13, 2013, NJDCA CDBG-DR Action Plan, American Planning Association – New Jersey Chapter, March 2013.

Governor Christie Outlines Regulations to Allow Residents and Businesses to Rebuild Faster, Stronger and Safer from Hurricane Sandy, State of New Jersey Governor Chris Christie, January 2013.

REBUILD BY DESIGN: Hurricane Sandy Regional Planning and Design Competition, The Hurricane Sandy Rebuilding Task Force, June 2013.

CONFLICTS

NEW YORK STATE RETREAT VERSUS NEW YORK CITY REBUILD

In 2010, the Sea Level Rise Task Force presented a plan for the New York State Legislature that detailed a set of findings and recommendations to better protect vulnerable coastal communities and natural resources from rising sea levels. The recommendations are as follows:

1. Adopt official projections of sea level rise and ensure continued 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 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 storms to reduce risk in those areas.*
5. Reduce vulnerability in coastal areas at risk from sea level rise and storms. Support increased reliance of 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.

While the City of New York was a member of the task force, New York City did not endorse recommendations 2, 3, 4, 5, and 7. New York City thought the recommendations were “not supported by

thorough scientific, environmental, or cost-benefit analysis (and did) not recognize the differences between undeveloped areas and densely populated cities” (New York State Sea Level Rise Task Force: Report to the Legislature, p. 6). Nevertheless, as noted, the Sea Level Rise Task Force plan was created in 2010 and New York City has since applied and continues to implement the very recommendations it previously refuted.

Similarly again, the city is in divergence with state initiative. Specifically, the conflict of retreat vs. rebuild is in question post Hurricane Sandy. Mayor Bloomberg maintains that waterfront development is a valuable asset to New York City and spurs economic development through job creation and recreational activities for millions of New Yorkers; therefore, retreat is not an option. Rather, The City of New York’s report, “A Stronger, More Resilient New York,” details numerous hard and soft infrastructure barriers that the city should implement to adequately protect vulnerable coastal regions. Even further, contrary to retreat tactics, New York City views building resilient infrastructure as an opportunity to increase waterfront development to accommodate the growing population. For example, A Stronger, More Resilient New York proposes developing Seaport City, a city modeled after Battery Park City that will spur residential and commercial development along the East River (page 385). The city plans to develop a multi-purpose levee that will protect the region south of the Brooklyn Bridge from extreme flooding. The goal is for the NYCEDC to launch the study for this proposal in 2013.

While the State of New York does not oppose developing protective barriers along waterfronts and even suggests them as a mechanism of protection in the NYS 2100 Commission report, Governor Cuomo does propose using the NY – Home Buyout Program to allow individuals and even entire communities to sell their properties and move to less vulnerable regions (New York Rising, p. 225). In New York City, Staten Island residents are most frequently taking advantage of the buyout program. Therefore, if large numbers of a community decide to relocate, is it economical to use millions of dollars to build protective barriers that will only protect a limited population? Should New York City be willing to retreat from vulnerable coastlines in the less populated, outer boroughs of Manhattan?

A Stronger, More Resilient New York, The City of New York, June 2013.

City’s Boom Spurs a Need for Housing, The Wall Street Journal, June 2013.

New York Homeowners Cool to Post-Sandy Buyout Offers – Except for Staten Island, The Journal of Light Construction, May 2013.

NY Rising: 2013 State of the State Address, Governor Andrew M. Cuomo, January 2013. Pages 225-226.

NYS 2100 Commission Draft Report, New York State 2100 Commission Jan. 2013.

New York State Sea-Level Rise Task Force, Report to the Legislature, December 2010, Pages 5-10.

NATIONAL FLOOD INSURANCE PROGRAM (NFIP) VERSUS PRIVATE INSURANCE CARRIERS

The National Flood Insurance Program, administered through the Federal Emergency Management Agency (FEMA), establishes insurance rate premiums and minimum building standards according to Flood Insurance Rate Maps (FIRM). The NFIP sets competitive rates and very limited coverage maximums; therefore, residential policyholders predominantly utilize it.

Private insurance carriers maintain that the federal government should only act as an “insurer of last resort.” For the task of insuring against extreme weather events, private market insurers assert that they

possess the necessary underwriting skills and risk management services necessary to create suitable risk-based insurance premiums. However, if the NFIP continues to allow subsidies for pre-FIRM and grandfathered properties, the private market will struggle to establish risk-based rates that are both competitive with the NFIP and promote resiliency and sustainability for vulnerable properties. In 2012, Congress passed a law requiring several reforms to the NFIP, including the elimination of most subsidies (Changes in the Flood Insurance Program, Preliminary Considerations for Rebuilding, FEMA). Will this allow the private market to set competitive rates with the NFIP, or will this merely deter people from seeking flood insurance at all because the rate increases will become unaffordable? How can the sectors effectively collaborate to accurately establish risk-based premiums that are still reasonable for residential policyholders?

Changes in the Flood Insurance Program, Preliminary Considerations for Rebuilding, FEMA, 2012.

Managing the Escalating Risks of Natural Catastrophes in the United States, Lloyds, 2011.

Severe Weather in North America: Perils, Risk, Insurance, Munich Re, 2012.

Stormy Future for U.S. Property/Casualty Insurers: The Growing Costs and Risks of Extreme Weather Events, Ceres, September 2012.

Risk and Resilience in Coastal Regions, A ULI Global Policy and Practice Forum Report, January 2013. Pages 14-15.

The Climate Risk Challenge: The Role of Insurance in Pricing Climate-Related Risks, Zurich Financial Services Group, 2009.

NFIP BUILDING REQUIREMENTS VERSUS NEW YORK CITY LANDSCAPE

As a result of Hurricane Sandy, nearly double the number of New York City buildings are now included in the 100-year floodplain (approximately 677,000) when compared to the 1983 Flood Insurance Rate Maps (FIRMs) (approximately 355,000). About 85% of the buildings now located within the floodplain were built prior to building codes mandating all new construction be developed at or above the Base Flood Elevation (BFE). Consequently, when the final FIRMs are created by 2015 to reflect risk-based premiums, New York City homeowners whose homes fall below building height requirements will experience a drastic increase in their flood insurance rates.

New BFE standards will require homeowners in the five boroughs to raise their residences by an average of 1–4 feet. The NFIP will set lower rates for homeowners who raise their homes 1-3 feet above the BFE in the Design Flood Elevation (DFE) level. If the homes are not raised, homeowners will face paying approximately \$9,500 per year in flood insurance, compared to homeowners who will pay about \$1,410 per year if their homes meet BFE requirements and only \$427 per year if their homes are built above BFE requirements.

It is not feasible to raise much of the New York City building stock above the new BFE, particularly for semi-detached, detached and larger structures, because of their size and/or building characteristics. Therefore, these buildings will face increased insurance rates, which will decrease the value of all buildings located within the floodplain. In order to prevent the inevitable increase in insurance rates and decline in building values when the new rates take effect, the city needs to work with the NFIP to set requirements specifically tailored to New York City's building stock. What potential new building requirements can sufficiently protect New York City from flood risk and also meet NFIP standards, without requiring the need for raising building heights?

A Stronger, More Resilient New York, The City of New York, June 2013. Pages 92 – 103.

Bloomberg Pushes for Tough Building Codes Post-Sandy, Law360, June 2013.

Flood-resilient waterfront development in New York City: Bridging flood Insurance, building codes, and flood

zoning, The New York Academy of Sciences, 2011, Pages 3.

Rebuilding NYC after Hurricane Sandy: A Guide to New Code and Zone Standards, NYC Buildings, February 2013.

MAINTAINING AFFORDABLE HOUSING VERSUS GENTRIFICATION

The participants in the Sandy Regional Assembly Agenda outlined the need for legislation to ensure that post-disaster rebuilding initiatives will not lead to the reduction of affordable housing for low- and moderate- income residents. While no initiatives are currently in place to reduce affordable housing, the present uncertainties associated with the insurance and housing markets are inadvertently causing the gentrification of neighborhoods Post-Sandy.

Homeowners were given federal funds through FEMA to help rebuild damaged homes after the storm. However, the money FEMA provided was not enough for many homeowners to rebuild because they did not also have flood insurance. As a result, many homeowners are currently selling their homes. As the number of homes on the market increases, the values of the properties decrease. In addition, the pool of buyers is limited because people are in fear of buying a home in a vulnerable location before new insurance rates and building codes are finalized. To worsen the situation, banks are reluctant to provide mortgages on homes in the areas hardest hit by Hurricane Sandy. Consequently, many real estate transactions now require all cash buyers.

Given these circumstances, real estate investors and wealthy individuals are purchasing the distressed homes at discounted prices. These buyers are gentrifying the neighborhoods into wealthy areas and displacing the residents who previously resided in them. That situation leads to the question: is creating new legislation the most effective way to prevent this displacement from happening again when another event occurs, or are there other solutions that can address this issue?

Sandy Regional Assembly Recovery Agenda, NYC Environmental Justice Alliance, April 2013, Pages 9-10.

GAPS

LOGISTICS – FOOD, WATER, GASOLINE

Hurricane Sandy severely limited peoples' access to vital resources post-disaster: food, water, and gasoline. As a result, new reports are outlining the need to address these issues. For instance, the Sandy Regional Assembly Recovery Agenda mentioned the importance of protecting the nation's largest food distribution center: Hunts Point, which handles 70% of the Tri-State area's produce alone. In terms of access to water, the Building Resiliency Task Force report suggests implementing upgrades that require residential buildings to "provide drinking water to a common area, supplied directly through pressure in the public water main." Lastly, reports suggest gasoline stations should possess generators so they are not dependent on electricity in a blackout. The reports that address the importance of accessibility to these resources were created Post-Sandy in 2013. Therefore, determining the best methods of protecting and providing food, water and other critical resources post-catastrophe are still under review.

Building Resiliency Task Force (Summary), The City of New York, June 2013. Page 23.

NY Rising: 2013 State of the State Address, Governor Andrew M. Cuomo, January 2013, Page 226,251-257.

Preliminary Response and Recovery Report, Senate Bipartisan Task force on Hurricane Sandy Recovery, Febru-

ary 2013, Page 31.

Sandy Regional Assembly Recovery Agenda, NYC Environmental Justice Alliance, April 2013, Page 9.

INSURANCE COVERAGE FOR COMMERCIAL BUILDINGS

The National Flood Insurance Program (NFIP) predominantly provides flood insurance for average mortgage-backed residential properties. Due to NFIP limitations, high-value residential homes, commercial properties, and industrial buildings seek insurance from the private market. As a result of Hurricane Sandy, the NFIP is updating the Flood Insurance Rate Maps (FIRMs) to reflect more accurate risk-based insurance rates for residential homes by 2015.

While numerous reports detailed the need to update flood maps and therefore update residential insurance rates, little was discussed about commercial building insurance. Should the NFIP expand its coverage and provide insurance to commercial and industrial buildings as well? If not, how will the private market accurately reflect risk-based insurance premiums for commercial buildings? Do private insurers have the expertise to accurately value risk for these buildings?

A Stronger, More Resilient New York, The City of New York, June 2013. Pages 92 – 103.

Flood-resilient waterfront development in New York City: Bridging flood Insurance, building codes, and flood zoning, The New York Academy of Sciences, 2011, Page 4.

Preliminary Response and Recovery Report, Senate Bipartisan Task force on Hurricane Sandy Recovery, February 2013, Page 23.

Sigma - Natural catastrophes and man-made disasters in 2012: A year of extreme weather events in the US, SwissRE, March 2013, Page 17.

STORMWATER RUNOFF REDUCTION FOR BUILDINGS

Constructing permeable surfaces along vulnerable coastlines is a sustainable way to reduce stormwater runoff, provide surge protection, decrease the urban heat island effect, and promote open space. The City of New York has proposed developing permeable surfaces near critical transit and wastewater treatment facilities to decrease the risk of flooding vital infrastructure.

The reports focused on utilizing permeable surfaces as a means of flood protection for critical infrastructure, but not for residential and commercial buildings. As the city is currently undergoing changes to the zoning and building codes, should the city create standards that require new developments to construct permeable surfaced rooftops, plazas, decks, and sidewalks?

Greening Mass Transit & Metro Regions, The New York State Metropolitan Transit Authority's Blue Ribbon Commission on Sustainability and Climate Change, chaired by ULI member Jonathan Rose, 2009. Pages 54-56.

Sandy Regional Assembly Recovery Agenda, NYC Environmental Justice Alliance, April 2013, Page 9.

Sewage Overflows from Hurricane Sandy, Climate Central, April 30 2013. Page 21. (All Recommendations)

THE PANEL ASSIGNMENT AND GOALS

The panel has been asked address a series of questions that have been loosely categorized into four topics areas: Technology, Infrastructure, and Logistics, Leadership and Governance, Land Use and Development, and Finance and Insurance. These questions are based on the recommendations made by the many reports and papers found in your briefing book that are already looking at these issues and their relationship to resiliency

Our goals for the week are three-fold, and extend beyond the questions that have been posed. Through the week, the group will also be asked to think about what a set of overarching principles for resilient communities might look like. In addition, we will be using our discussions and conclusions to evaluate the recommendations made in other reports from ULI's unique perspective – which are the most valuable, which need to be strengthened or modified, etc., and finally, what is missing.

COMMUNITY TYPOLOGIES

Because, like many coastal regions around the world, the New York/New Jersey metropolitan region is large with a diverse built environment the panel is asked to consider the questions with two broad community typologies in mind – High Density Urban Communities and Coastal Communities. These typologies roughly correspond with the areas the panel will visit on their site tours.

HIGH DENSITY URBAN COMMUNITIES

Included on site tours: Coney Island; Hoboken; Jersey City; Lower Manhattan; Red Hook
These areas are characterized by high densities, an intense mix of uses, and – usually – transit accessibility. Housing is typically multifamily. With some exceptions, the water's edge in these locations is reserved for industrial or urban public recreation uses such as parks and trails.

COASTAL COMMUNITIES

Included on site tours: Long Beach, NY; Long Branch, NJ; The Rockaways; Staten Island
Coastal Communities are primarily low to medium density residential, with commercial areas that range from tourist-serving to main streets to suburban-style strip centers. The built environment and lifestyle is centered on the beach and other types of recreational water access. Single-family homes are typically on small lots.

RESILIENCY

Resilience—from the Latin *resilio*, meaning “to spring back”—is the ability to recover after an impact or misfortune. It is the ability to adapt to the consequences associated with an instance of failure or systemic breakdown.

BOUNCING BACK

While there is no single professional or technical definition for the term, recently, in the wake of Hurricane Sandy and after several years of record losses from weather-related disasters, resilience is a term being used to describe the inherent qualities or capability of organizations and communities to recover quickly and resume their activities after natural catastrophes. This concept is often referred to as the ability to “bounce back.”

BOUNCING FORWARD

Another way of looking at resilience is the ability not only to bounce back but also to “bounce forward”—to recover and at the same time to enhance the capacities of the community or organization to better withstand future stresses.

As Andrew Zolli, author of *Resilience: Why Things Bounce Back*, and CEO of PopTech, put it in an interview with Richard Florida and Jonathan Rose,

“A good working definition, particularly in an urban planning context, is: the ability to maintain core purpose, with integrity, under the widest variety of circumstances. More broadly, it’s the ability to recover, persist, or even thrive amid disruption.”

The following quotation from “Reconsidering Resilience for the 21st Century,” a paper by Judith Rodin, President of the Rockefeller Foundation, and Robert Garris, a Managing Director for the Rockefeller Foundation, published in *USAID Frontiers in Development*, goes into this aspect of resilience more fully:

“The concept of resilience has a well-established history in many fields, but in almost all contexts, it is closely linked to the concept of vulnerability. In this way of thinking, then, resilient communities, people, and systems have the ability to thrive, improve, or reorganize themselves in a healthy way in response to stress; that is, they are less vulnerable to breakdown in the face of shocks and stress. Poor resilience makes a person or system more vulnerable to serious harm and more likely to break down if the stress or threat is severe enough. With increased resilience, on the other hand, one is less vulnerable to breaking down in the face of adversity. Moreover, resilient systems, communities, or people recover their normal states more quickly after stress and are capable of enduring greater stress. They demonstrate greater adaptive capacity and can maintain “system functions” in the event of disturbances. This capacity applies to the ability to withstand acute, immediate, and sudden stresses as well as long-term chronic challenges. Most discussions of resilience agree that it is a multifaceted concept and should be understood and measured across multiple social dimensions, including physical, social, economic, institutional, and ecological fronts.

...

“In Complex Adaptive Systems, three key properties contribute to resilience:

- *Diversity and Redundancy. The functioning and adaptive capacity of the system does not depend on any single component, community, or individual, and multiple parts of the system can substitute if one component fails.*
- *Modular Networks. The system comprises multiple smaller systems that are relatively independent of each other, complement each other, to a certain degree replicate each other, and are buffered from each other to minimize the transmission of shocks. Connections between subunits are necessary to enable the system to function as a whole, but structures exist to prevent the propagation of failures.*
- *Responsive, Regulatory Feedbacks. Structures or processes exist to transmit learning throughout the system. These feedback loops must be horizontal and vertical to maximize adaptability. Feedback loops must be understood as broadly as possible; for example, to include social-ecological feedback loops as well as feedback loops within traditional social or governance systems. “*

QUESTIONS

With the two typologies described above in mind, please consider the following questions in the panel break-out groups. The reports detailed in the briefing book can be used as references.

TECHNOLOGY, INFRASTRUCTURE, AND LOGISTICS

Resilient infrastructure and the technology to support it play not only a critical role in disaster recovery, but also have an enormous effect on a region's ability to mitigate a disaster's impact from the outset. Infrastructure investments cover a wide breadth of essential services, including transportation, electricity, water, food, and fuel.

- What is the group's shared vision for resilient technology, infrastructure, and logistics?
- Are there infrastructure investments that could be considered universal priorities for resiliency?
- Is there a way to balance the need to invest in new infrastructure with the need to update and maintain existing systems? Are there ways to maintain existing systems that improve them and enhance their flexibility and resilience?
- What does a resilient and integrated regional infrastructure system (including transportation, water, energy, food, and fuel, etc.) look like?
- How can regions address infrastructure investment planning in a way that accounts for probable future events?

LEADERSHIP AND GOVERNANCE

Without strong and strategic leadership, resilient governance systems cannot exist. Recent thinking on resiliency in this realm often revolves around the systems that are in place to expedite disaster recovery, and how these systems can create redundancies to ensure communities are able to help themselves in the potential short term absence of larger post-disaster systems. Effective governance can also serve as a coordinating body for the region and an implementer of bold new regional visions for resiliency.

- What is the group's shared vision for resilient leadership and governance?
- How can regional and jurisdictional leadership promote resiliency measures while engaging the investment community?
- What are the most effective strategies for building the political will necessary to implement resiliency measures?
- What decisions are better made at the local, community level and which by government at various levels?
- How should a region coordinate plans, infrastructure, and other investments to create the most sustainable development patterns?
- How can private sector and public sector leadership best partner to develop and implement a regional vision for a resilient built environment?
- What are the current challenges to building strong leadership able to adjust the course and implement change in public infrastructure investment patterns?

LAND USE PATTERNS AND DEVELOPMENT

Land use is one of the most critical building blocks in a community's ability to withstand and adapt to disasters and more subtle changes in the environment. Addressing the complex issues surrounding land use and development patterns requires strong partnerships between the public and private sector, and a clear regional vision for future growth and rebuilding.

- What is the group's shared vision for resilient land use patterns and development?
- How can both land use regulations and the development community best balance the "reality of geography" with market realities in high-value urban and suburban coastal regions?
- What might be an effective model for ensuring that land development regulations of the many jurisdictions within a region work together to promote resilient community building?
- Are there overarching best practices in coastal development?
- What are the challenges in current "business as usual" practices?
- What building design features for new buildings and retrofits of existing buildings would best meet the expected conditions in the future?
- How can the public and private sectors meet the challenges of implementing bold new land use strategies?

FINANCE AND INSURANCE

Documented trends of increased property damage and associated economic losses are already discernible as market trends in the United States. The combination of population growth, more coastal development, and higher real estate asset values points to increasing market risk factors in coastal regions. Because of this, the finance and insurance industries are central to the built environment's role in resiliency, from investing in infrastructure to establishing real estate risk-mitigation models.

- What is the group's shared vision for financing strategies that support resiliency?
- How could innovative partnerships help plan and finance infrastructure investment?
- What are possible scenarios for leveraging private sector innovation and investment with public sector resources?
- How can regional and jurisdictional leadership promote resiliency measures while engaging the investment community?
- How do the new climate risks affect pricing and investment models for insurance, debt, and equity?
- Should there be a new/different set of mitigation criteria under the National Flood Insurance Program for dense, urban environments like those in the New York/New Jersey region?
- How can the insurance industry and real estate investors be effective partners in designing and implementing climate change risk-mitigation measures for real estate?