Climate Change Adaptation in NYC: Building a Risk Management Response

New York City Panel on Climate Change NPCC

Climate Resilient Cities 2010

May 28, 2010

New York City Panel on Climate Change

Purpose and Goals

- Convened by Mayor Bloomberg in August 2008
- Served as an independent advisory body for the New York City Climate Change Adaptation Task Force
- Composed of climate change and impacts scientists, legal, insurance and risk management experts
- Focused on adaptation and infrastructure
- Tasked with producing a foundation report and tools to assist Task Force stakeholders

NPCC Approach

- Build on existing knowledge
- Create integrative process
- Establish guiding principles
- Design and conduct adaptation process

Build on Existing Knowledge

Lessons from Other Cities & Entities

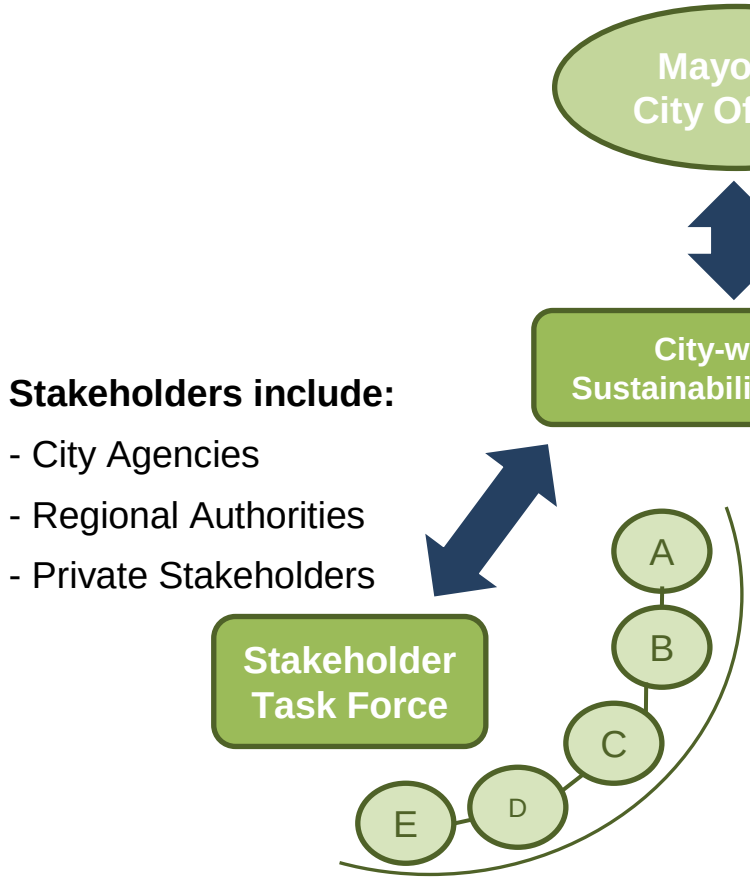
- Other Cities
  - London
  - Chicago
  - King County, Washington
- Corporations and Business
  - Actions in business continuity plans
  - Climate change plans in Strategic Planning or CSR/Sustainability areas

Build on Existing Knowledge

Foundation of Climate Change Action in New York City

YEAR	REPORT TITLE	ORGANIZATION/PUBLIISHER
Underway - 2010	*New York State ClimAID Adaptation Assessment*	*New York State Energy Research & Development Authority*
2009	*New York City Panel on Climate Change*	*Columbia University and CUNY*
Late 2009/early 2010	*New York City Climate Change Adaptation Task Force*	*NYC Office of Long Term Planning & Sustainability*
Underway - 2009	*Long Island Shore Study*	*The Nature Conservancy*
2008	New York City's Vulnerability to Coastal Flooding: Storm Surge Modeling of Past Cyclones	*Bulletin of the American Meteorological Society*
2008	Climate Change Program Assessment and Action Plan	*New York City Department of Environmental Protection*
2007	Confronting Climate Change in the U.S. Northeast: Science, Impacts and Solutions	*Union of Concerned Scientists*
2007	August 8, 2007 Storm Report	*Metropolitan Transit Authority*
2001	Climate Change and a Global City: Potential Consequences of Climate Variability and Change	*U.S. National Assessment & Columbia Earth Institute*
1999	Hot Nights in the City: Global Warming, Sea-Level Rise and the New York Metropolitan Region	*Environmental Defense Fund*
1996	The Baked Apple? Metropolitan New York in the Greenhouse	*New York Academy of Sciences*

Create Integrative Process



High-Level Buy-In

Coordinating Role

Stakeholders include:

- City Agencies
- Regional Authorities
- Private Stakeholders

Expert Knowledge:

-Climate change Scientists

-Legal experts

-Insurance experts

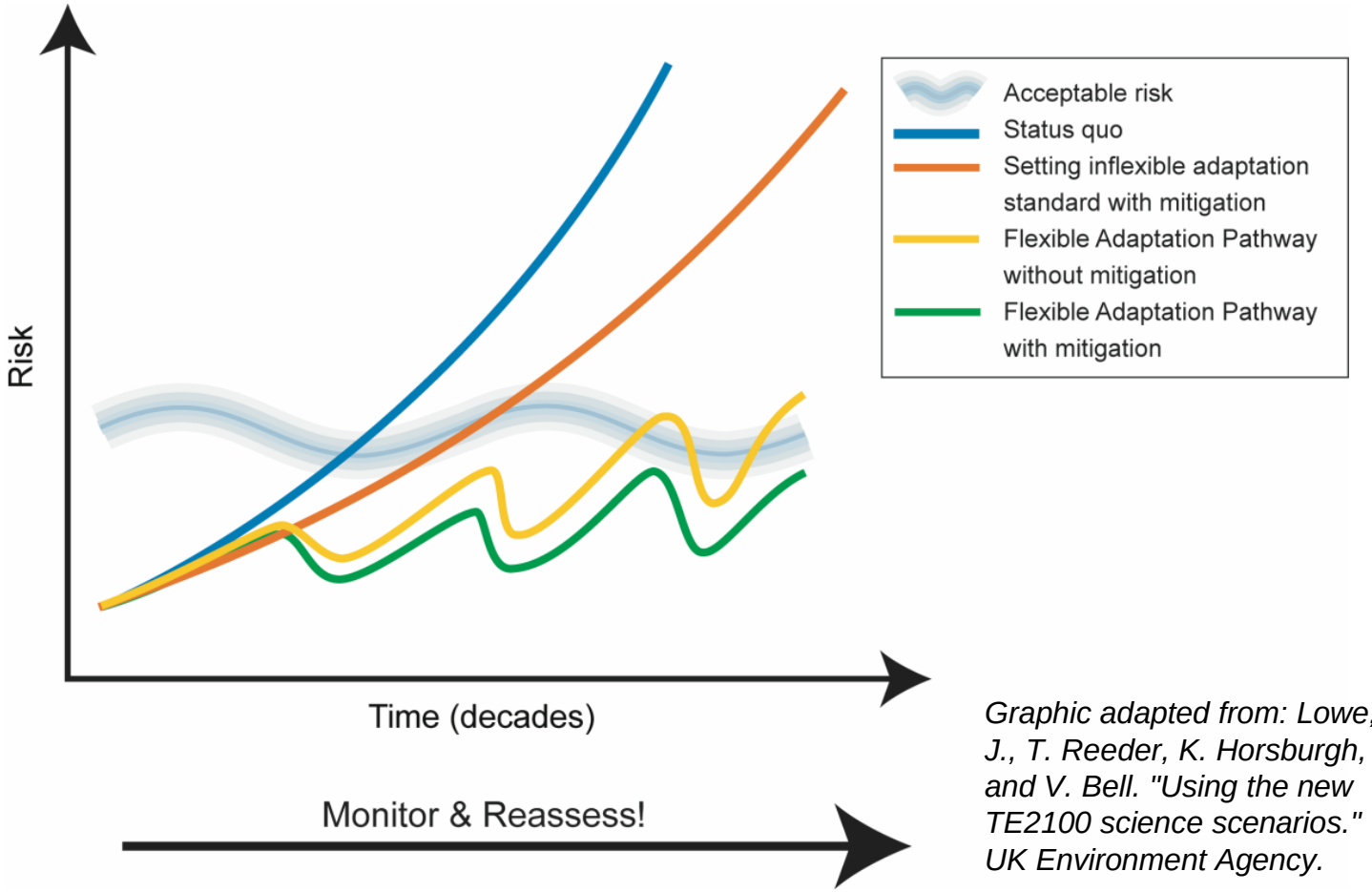
Integration across Sector-specific Working Groups

Establish Guiding Principles

Including…

- Work with stakeholders at all stages of the process
- Identify uncertainties and help stakeholders navigate them
- Address climate change adaptation as a risk-management issue
- Build adaptation into systems already in place, where possible
- Encourage Flexible Adaptation Pathways as ongoing response

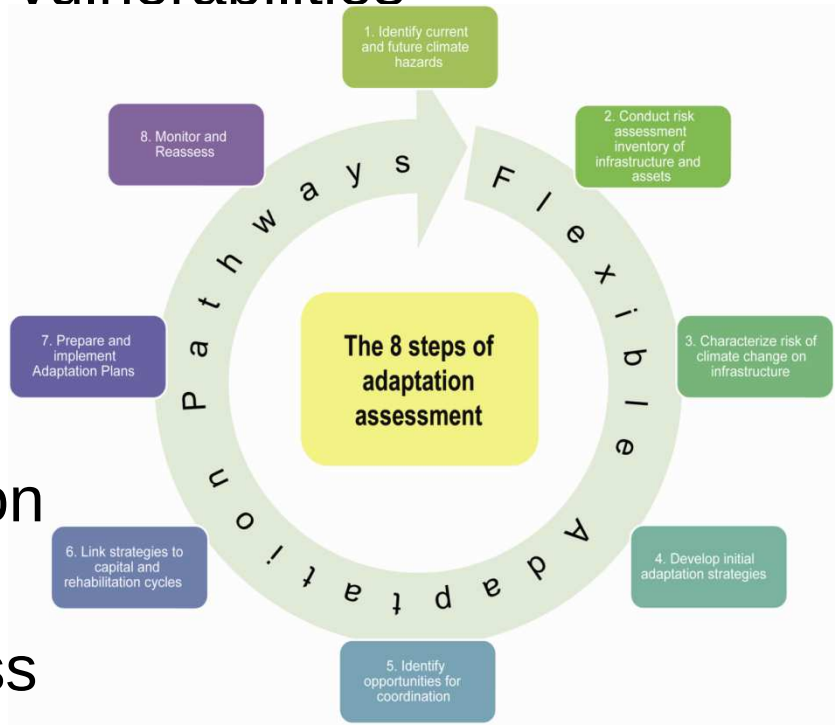
Flexible Adaptation Pathways



Graphic adapted from: Lowe, J., T. Reeder, K. Horsburgh, and V. Bell. "Using the new TE2100 science scenarios." UK Environment Agency.

Design Adaptation Process

1. Identify current and future climate hazards
2. Conduct inventory of infrastructure and assets and begin to identify vulnerabilities
3. Characterize risk
4. Develop initial list of strategies
5. Prioritize strategies
6. Prepare and implement Adaptation Plans
7. Monitor and reassess



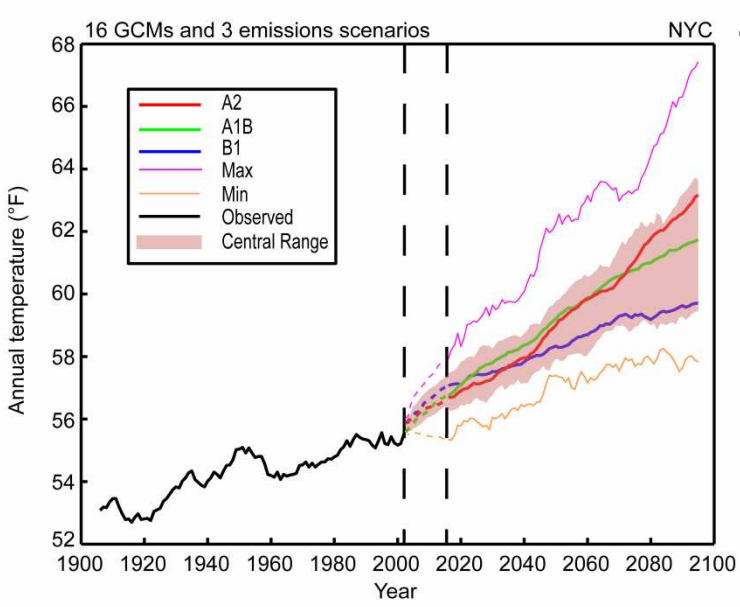
New York City Panel on Climate Change

1. Climate Hazards: Key Findings

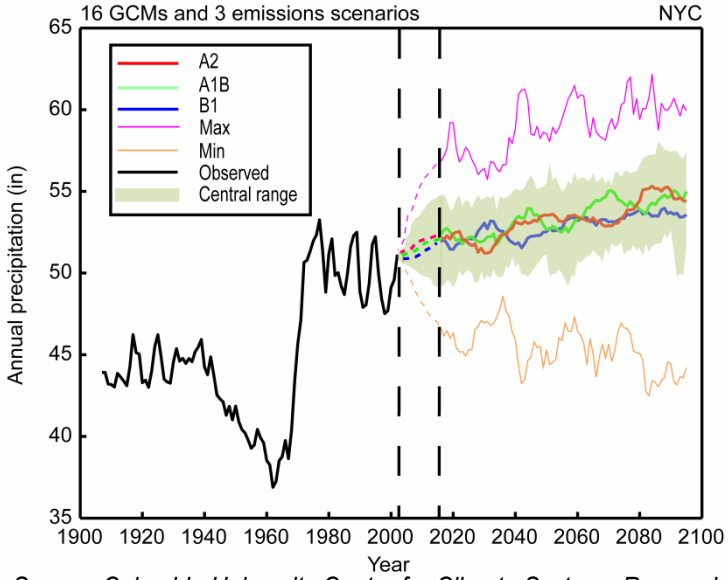
- NYC's climate is already changing
- During the 21st century
  - Heat waves are very likely to become more frequent, intense, and of longer duration
  - Intense rain events are likely to become more common
  - Rising sea levels are extremely likely, and are very likely to lead to more frequent and damaging coastal flooding
- Climate projections should be updated regularly by leveraging NYC's science institutions, as well as improvements in observational data and modeling.

1. Future Climate Projections

Future Climate Projections



Temperature



Precipitation

Source: Columbia University Center for Climate Systems Research

1. Mean Annual Changes

	Baseline 1971-2000	2020s	2050s	2080s
Air Temperature Central Range[2]	55˚F	+ 1.5 to 3.0˚F	+ 3.0 to 5.0˚F	+ 4.0 to 7.5˚F
Precipitation Central Range	46.5 in[3]	+ 0 to 5 %	+ 0 to 10 %	+ 5 to 10%
Sea level rise[3] Central Range	NA	+ 2 to 5 in	+ 7 to 12 in	+ 12 to 23 in
Rapid ice-melt scenario[4]	NA	~ 5 to 10 in	~ 19 to 29 in	~ 41 to 55 in

Source: Columbia University Center for Climate Systems Research

[1] Based on 16 GCMs (7 GCMs for sea level rise) and 3 emissions scenarios. Baseline is 1971-2000 for temperature and precipitation and 2000-2004 for sea level rise. Data from National Weather Service (NWS) and National Oceanic and Atmospheric Administration (NOAA). Temperature data are from Central Park; precipitation data are the mean of the Central Park and La Guardia Airport values; and sea level data are from the Battery at the southern tip of Manhattan (the only location in NYC for which comprehensive historic sea level rise data are available).

[2] Central range = middle 67% of values from model-based probabilities; temperatures ranges are rounded to the nearest half-degree, precipitation to the nearest 5%, and sea level rise to the nearest inch.

[3] The model-based sea level rise projections may represent the range of possible outcomes less completely than the temperature and precipitation projections. For more information, see the "sea level rise" paragraph in the "mean annual changes" section.

[4] "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.

1. Extreme Events

	Extreme Event	*Baseline (1971-2000)*	2020s	2050s	2080s
Heatwaves & Cold Events	# of days/year with maximum temperature exceeding 90°F	*14*	23 to 29	29 to 45	37 to 64
	# of heat waves/year[2] Average duration (in days)	*2* *4*	3 to 4 4 to 5	4 to 6 5	5 to 8 5 to 7
	# of days/year with minimum temperature below 32°F	*72*	53 to 61	45 to 54	36 to 49
Intense Precipitation & Droughts	# of days per year with rainfall exceeding1 inch	*13*	13 to 14	13 to 15	14 to 16
	Drought to occur, on average[3]	*~once every 100 yrs*	~once every 100 yrs	~once every 50 to 100 yrs	~once every 8 to 100 yrs
Coastal Floods & Storms[4]	1-in-10 yr flood to reoccur, on average	*~once every 10 yrs*	~once every 8 to 10 yrs	~once every 3 to 6 yrs	~once every 1 to 3 yrs
	1-in-100 yr flood to reoccur, on average	*~once every 100 yrs*	~once every 65 to 80 yrs	~once every 35 to 55 yrs	~once every 15 to 35 yrs

Characterized by higher uncertainty than mean annual changes

Central range (middle 67% of values from model-based probabilities) across the GCMs and greenhouse gas emissions scenarios

Source: Columbia University Center for Climate Systems Research

2. Identify Infrastructure Vulnerabilities

Such as…

Temperature

- Equipment and facilities damage
- Higher demand for cooling, with frequent outages
- Power line sagging
- Increased evaporation
- Adverse effects on waste treatment processes

Precipitation

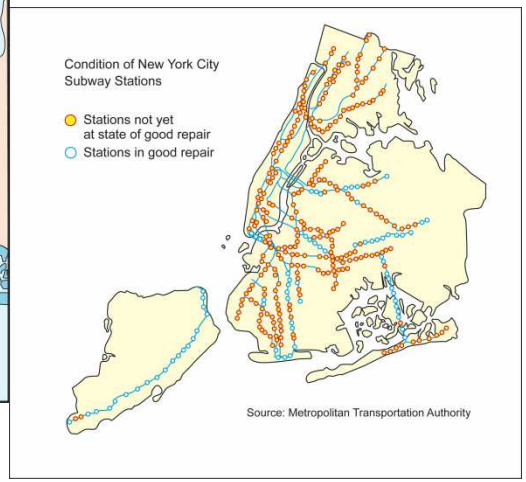
- Equipment damage from corrosion
- Insufficient pumping capacity to cope with flooding
- Flooded utility corridors deteriorating service levels
- Contaminant leaching and runoff

2. Identify Infrastructure Vulnerabilities

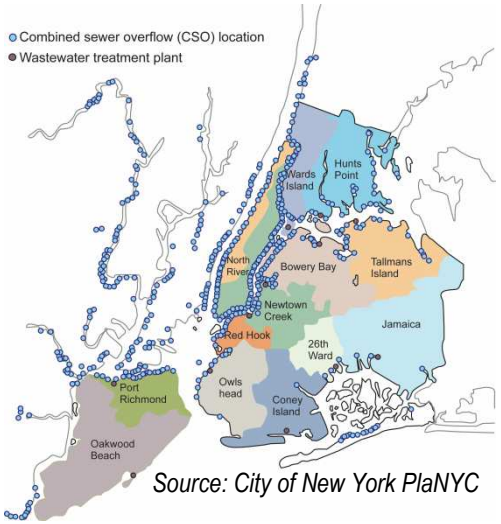
Sea Level Rise

- Equipment damage from salt-water corrosion
- Flooded utility corridors impeding service

Source: Columbia University Center for Climate Systems Research

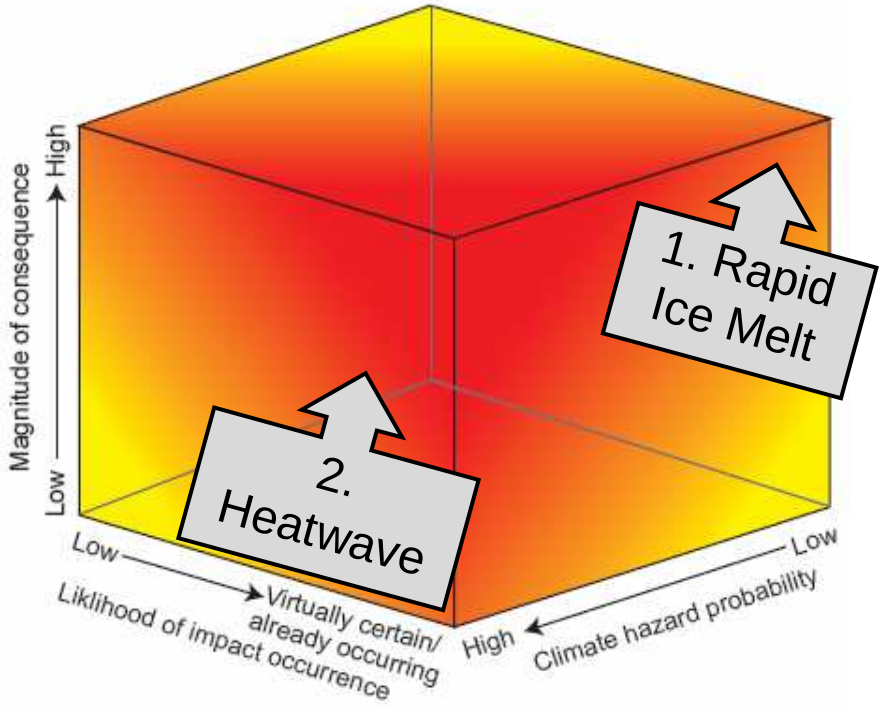


Source: City of New York PlaNYC



Source: City of New York PlaNYC

3. Characterize Risk



Red	risks for which adaptation strategies should be developed
Orange	risks for which adaptation strategies may need to be developed or for which further information is needed
Yellow	risks for which impacts should be monitored but which may not need actions at this time

Source: Columbia University Center for Climate Systems Research

To determine risk of climate change on infrastructure

1. Probability of a climate change hazard
2. Likelihood of that hazard causing an impact
3. Magnitude of consequence, should that impact occur

4 & 5. Develop and Prioritize Adaptation Strategies

Potential Strategy Prioritization Categories

- Cost
- Feasibility
- Timing of Implementation
- Efficacy
- Resiliency Rating
- Co-benefits

Adaptation Strategy	Strategy Cost (1 = low to 3 = high)	Strategy Feasibility (1 = high to 3 = low)	Timing of implementation (1 = high to 3 = low)	Efficacy (1 = high to 3 = low)	Resiliency rating (1 = high to 3 = low)	Co-benefits (1 = high to 3 = low)	Average*	Notes & institutional considerations
Clean drains	1	1	1	2	2	2	1.8	
Build flood walls	3	2	2	1	3	2	2.2	

1 = high priority strategy, 2 = medium priority strategy, 3 = low priority strategy

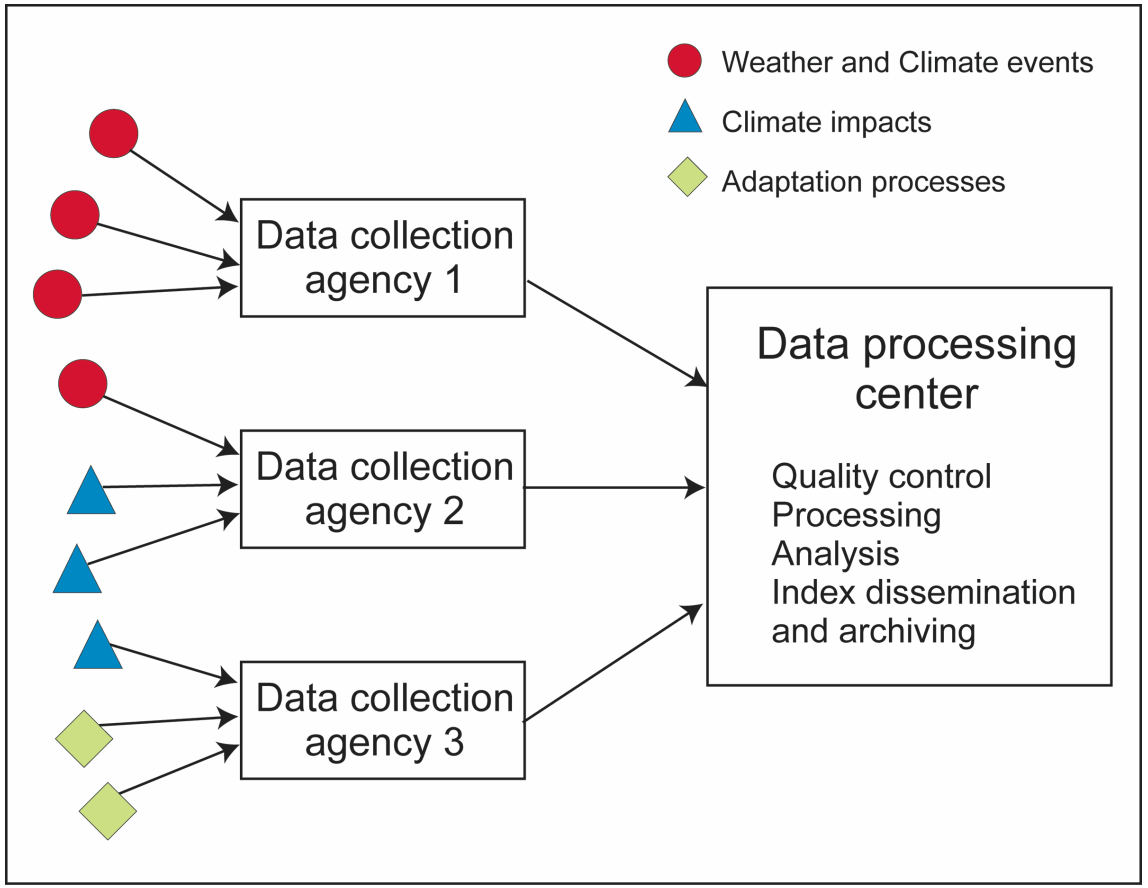
6. Prepare and Implement Adaptation Plans

- Could be agency-specific or city-wide
- Could include things such as:
  - Identifying key strategies, such as those that address high-risks, are win-win with mitigation, or low-cost

-Laying out specific steps and timeline for implementation, including identifying responsible parties

- Examples include:
  - New York City Department of Environmental Protection Climate Change Adaptation and Assessment Plan
  - Chicago Climate Action Plan
  - New York State Climate Action Plan (in development)

7. Monitor and Reassess



Proposed structure and process of monitoring climate change, impact, and adaptation parameters, and for translating them into indicators for New York City

NPCC Report 2010

Climate Change Adaptation in New York City: Building a Risk Management Response

Report Structure

1 – New York City Adaptation in Context

2 – Adopting a Risk-Based Approach

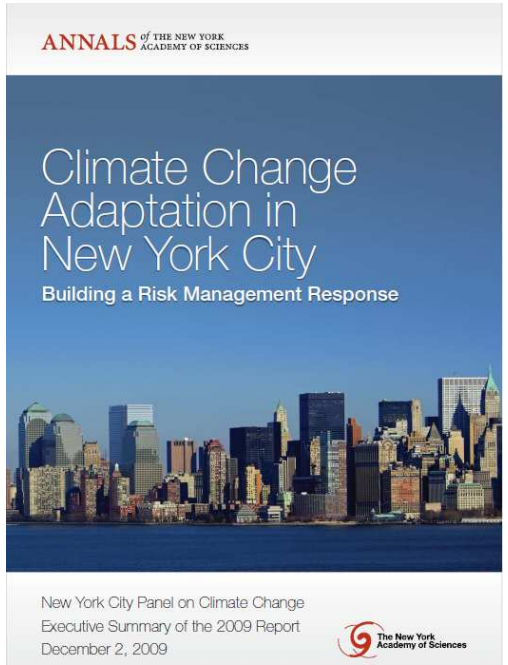
3 – Climate Observations and Projections

4 – Infrastructure Impacts and Adaptation Challenges

5 – Law and Regulation

6 – Insurance Industry

7 – Indicators and Monitoring



Workbooks

Climate Risk Information

Adaptation Assessment Guidebook

Climate Protection Levels

Recommendations for Action

- Involve multiple partners, including scientific experts, in the process, with high-level proactive leadership and bottom-up involvement
- Create a standard set of regional climate scenarios
- Adapt a risk-based approach to develop Flexible Adaptation Pathways
- Focus on strategies for incremental changes as well as for long-term low-probability, high-impacts events
- Pay particular attention to early win-win strategies
- Work with the legal, engineering & insurance industries
- Conduct a review of standards and codes
- Create a mandate for an on-going body of experts
- Establish a climate change monitoring program

Areas for Further Studies

- Identify, characterize, and understand nonlinear tipping points, triggers, and decision pathways
- Analyze the economics and financing of adaptation
- Conduct feasibility study of non-structural and structural citywide protective measures
- Do sensitivity tests of critical infrastructure facilities and operations
- Study the interdependencies between and within infrastructure sectors and systems

Key Findings

- NYC should begin to adapt to climate change today as we already face a number of climate risks even without climate change as a factor
- Temperature increases and sea level rise are already occurring and, along with other climate changes, will continue to occur and accelerate in the future
- There is a potential for “tipping points” in the climate system, such as a rapid melt of polar ice sheets, which would have a great magnitude of consequence on the City
- Current risk management, legal or insurance structures can be built upon to begin to address climate change adaptation