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National Sea Grant Advisory Board Futures Committee
Report to the Board

August 27th, 2009

Committee Formation

The Futures Committee of the National Sea Grant Advisory Board was established by Board action at its November meeting in Baton Rouge, Louisiana. Mayor Jeremy Harris was selected by the Board to serve as Chairman. The Committee was formed as a Committee of the Whole and, as such, all Board members are on the Committee. The first meeting of the Futures Committee was on January 20 & 21, 2009 at the Sea Grant Office at the University of Hawaii.

Statement of Task

The National Sea Grant College Program was established by Congress in 1966. Since that time the program has produced an admirable record of accomplishment in marine research, education and extension services. Despite this fact, the program has failed to grow to realize its full potential.

The task of the Futures Committee is to examine why this has occurred, to assess the successes and failures of the program and to help chart a new course of growth for the program at this time of transition for our country.

The Committee will examine Sea Grant's relationship with NOAA and the Department of Commerce and make recommendations to the Board about Sea Grant's future position and role in the Federal government.

The Futures Committee will also explore Sea Grant's image and brand and make recommendations to the Board on how these important assets can be enhanced.

Finally, the Committee will examine opportunities for Sea Grant to be immediately responsive to the severe environmental and economic challenges that confront our nation by developing initiatives that fully utilize its superb nationwide research and extension talents.

The Committee will also assume any other responsibilities assigned by the Board.

Tenure

The Futures Committee will complete all its work by January 2010.

Futures Committee Recommendations to the Board

Sea Grant Funding

The Committee believes that Sea Grant has faced funding stagnation because it lacks political support in Congress and within Commerce. Sea Grant is not perceived as a political asset or as an agency asset. Sea Grant's clients perceive real benefit from the program but that has not translated into enhanced funding support. Its clear more effort needs to go into organizing Sea Grant clientele into a more vocal advocacy constituency. More effort also needs to go into helping NOAA appreciate the value of Sea Grant and the asset it represents to NOAA.

Recommendation to the Board

The National Sea Grant Office should pursue a renewed, vigorous, outreach effort to strengthen its relationships with the NOAA Administration and with other NOAA agencies. In this context, the NSGO should work to better define its role in the overall NOAA charter of responsibilities and to better articulate its potential as a NOAA asset. It should be noted that NSGO management is already aggressively pursuing these actions with the new NOAA administration.

The National Sea Grant Office, in coordination with the Sea Grant Association (SGA), should expand its efforts to identify its clientele and other public audiences who benefit from Sea Grant research, education, and extension services, and should develop expanded educational initiatives to inform these constituency groups about Sea Grant programs, funding, and resource needs.

Sea Grant's Image

In general, it appears that the Department of Commerce has little knowledge of the Sea Grant Program. The Committee believes that NOAA's view of Sea Grant is generally positive but that Sea Grant is viewed as largely irrelevant to the rest of NOAA. Many in NOAA view Sea Grant as a competitor for funding.

In Congress, Sea Grant is on the radar screen, especially of coastal community Congressional delegations. Despite this, Sea Grant has no real champions in Congress.

Recommendation to the Board

The committee recommends that Congressional champions be sought in both the Senate and House. Meetings should be initiated with selected Representatives and Senators who have been involved with the Sea Grant Program to seek their advice on strengthening the Congressional/Sea Grant relationship.

The Committee recommends that the SGA and the Board be approached for suggestions/contacts in the new Obama White House who should also be approached as potential Sea Grant supporters.

Sea Grant's Structure and Location

It has been suggested that the effectiveness of Sea Grant could be enhanced if it was located in a different federal department or agency. The organizational position of the Sea Grant Program within the Federal government has been reviewed in the past, but the committee believes it should be reviewed again.

Recommendation to the Board

The Committee's recommendation is for the National Sea Grant Office to determine its optimum position within the federal governmental framework and be ready to advocate for that proposal should a major restructuring of Federal research and scientific functions be undertaken by the Obama administration. The committee does not recommend that Sea Grant unilaterally attempt to reposition itself within the bureaucracy absent a major agency shake-up.

The Brand - The Sea Grant Name

While the Sea Grant Program has earned a respectable brand over the last 40 years, the word "grant" continues to cause confusion and a misunderstanding of the Program's mandate.

Recommendation to the Board

The Committee recommends that the name Sea Grant be "enhanced" by adding two or three descriptor words that help define the program's mission in relationship to the urgent challenges the nation faces. An example would be –"NOAA Sea Grant – Helping Build Sustainable Coastal Communities".

The committee recommends that a brochure be developed that highlights the existing capabilities and successes of Sea Grant to illustrate its track record in tackling the issues highlighted by the new brand. This publication would be distributed primarily to elected policy makers at all levels.

Building Relevancy

The Committee believes that Sea Grant should seize the current period of opportunity to establish itself as an important asset to the nation in meeting some of the country's most urgent challenges.

While mitigation efforts to reduce the impacts of climate change are ramping up, its clear that many impacts from climate change are unavoidable. With sea level rise and an increased intensity of coastal storms threatening coastal infrastructure and population centers, America's coastal cities are facing perhaps the greatest challenges as a result of this unfolding environmental disaster. These cities are in great need of assistance in planning for and adapting to these climate change impacts.

It's clear that NOAA, with its wide array of expertise in climate related issues, should and will play a major role in the Obama administration's comprehensive climate change strategy. There is a growing consensus within the many agencies within the federal government that are developing the climate change strategy that there is a critical need for a national extension network to work with cities on these pressing issues and other related sustainability challenges.

The Sea Grant Program has an invaluable asset at its disposal that can make an enormous contribution to this effort in its nation-wide extension network. Sea Grant Extension has been actively working with America's coastal communities for decades. Sea Grant Extension professionals have developed relationships with coastal community leaders and government officials, and they have a proven track-record of accomplishment.

While Sea Grant Extension alone probably cannot meet all of the nation's climate change mitigation and adaptation extension needs, Sea Grant can position itself to play a major role and make a major contribution to this staggering national challenge.

Recommendation to the Board

The committee recommends that Sea Grant establish a new pilot program focusing on coastal city sustainability and adaptation to climate change, and that it develop this program into a full-scale national initiative over the next three years.

Since it is unlikely that a second wide-ranging stimulus package will be sent to Congress this year that could provide the immediate full funding that this initiative deserves, the committee recommends that this vital program be

rapidly ramped-up over the next three years as the Obama administration forges its Climate Change Mitigation and Adaptation Strategy.

Climate Change Adaptation Initiative

Coastal cities all across the nation are just beginning to realize the scope of the challenge they face with climate change and rising sea levels. Currently, city leaders have nowhere to turn for an assessment of their vulnerabilities and for recommendations on what they need to begin doing to adapt to this challenge. Our proposal is for Sea Grant to develop a "Climate Change Adaptation Initiative" on a pilot basis using existing resources and to scale-up the initiative to a major national program over the next three years.

Under our proposal, Sea Grant would help local coastal community governments develop their plans for adapting to climate change. The national office would hire a small cadre of specialists in the areas pertinent to this initiative (coastal land use planning, coastal urban infrastructure, etc) who would coordinate the pilot program from Washington. NOAA's extensive expertise in climate related fields would be mobilized, and Sea Grant programs from around the country would identify expertise within their extension programs, as well as within their research and broader University communities in multi-disciplinary adaptation fields. (See attachment 1) This national reservoir of experts would be available to advise local governments in the assessment of their climate change vulnerabilities and in planning to meet their adaptation challenges. (Preliminary discussions with the SGA suggest that this proposal or some variation thereof would have good support from the Sea Grant College Programs.)

In the current year, the National Sea Grant Office should utilize existing funds to develop a pilot project to demonstrate the proof of concept for this initiative. Following that, FY2011 funding should be in the $5 million dollar range, allowing Sea Grant to develop a regional pilot project and begin the work of capacity buildings to broaden its extension expertise into the broad array of coastal adaptation issues that coastal communities are facing.

Over the first three years, funding for this initiative should grow to approximately $50 million annually. This would allow Sea Grant Extension to staff-up to meet the demand for climate change adaptation extension services that will be demanded from the nation's thousands of coastal communities.

This initiative, if developed, would take best advantage of Sea Grant's unique and invaluable resource…its national network of extension agents and programs.

While organizing to enhance its ability to provide climate change adaptation informational services to decision makers, Sea Grant needs to consider how it will complement related extension and training assets contained within NOAA and in other federal agencies. Sea Grant will also need to develop new organizational mechanisms to harness NOAA research and technical services and connect these services to public need.

NOAA currently conducts a wide range of engagement activities in communications, education, extension and training, and regional collaboration. Based on recommendations made by the NOAA Science Advisory Board, NOAA has recently created a new organizational structure to coordinate and provide oversight for its engagement activities, the Executive Committee on Engagement (ECE). The ECE membership is composed of the Chair of the Education Council, the Director of Communications, the Chair of the Regional Collaboration Executive Oversight Group and the Chair of the Extension and Training Services Committee (NETS). The ECE provides corporate guidance and recommends actions to promote a strong dialog and two-way relationship with society that enables NOAA to identify, develop and improve products and services to meet society's needs.

NETS capabilities encompass a broad range of programmatic and geographic assets that, when employed in a coordinated manner, will assist NOAA in its efforts to fully engage its constituents. NETS provides an integrated national leadership and coordination function for NOAA's sizable and locally placed extension and training assets nation-wide. This function helps to underpin NOAA's Regional Collaboration structure, with a focus on bringing together NOAA assets on the ground in a coordinated manner. This new approach enables the full range of NOAA's extension and training assets to focus on thematic priorities identified by NOAA leadership or by local or regional stakeholders and constituent feedback. The principles underlying this new approach include; national guidance and coordination, regional planning and strategy development, flexible regional, state and local implementation and accountability through collection and analysis of national extension and training metrics. Engaging the public on climate issues is a current priority of ECE and NETS and a Sea Grant climate adaptation initiative should utilize the ECE and NETS structures to help lead, coordinate and enlist relevant NOAA programs to provide needed climate adaptation expertise and technical services.

In addition, other agencies, notably USDA's Land Grant system which employs more than 14,000 Cooperative Extension Service staff nationwide, have important expertise that can be utilized to support a Sea Grant led climate adaptation initiative. Under the auspices of the Association of Land Grant and Public Universities (APLU), recent high level meetings have been held between the NOAA and USDA leadership for the purpose of collaborating on climate extension issues. Adding USDA extension capabilities to those of NOAA's would significantly expand the breadth of technical expertise available to help communities adapt to climate change. NOAA should be encouraged to continue its work to strengthen and formalize its relationship with USDA's Land Grant community and to nurture the formation of a national climate extension service.

Appendix 1

National Sea Grant Program
Climate Change Adaptation Initiative
Program Layout

Scope of Extension Services

In order to meet the extension needs of the coastal cities that are facing impacts from climate change, it is important to project what those impacts may be so that Sea Grant can properly define the content of its extension program and do the capacity building that is necessary to develop the in- house expertise to implement the program.

Following is a breakdown of likely coastal city impacts that will result from the various vulnerabilities that will come from climate change.

Coastal Cities Vulnerability – **Sea Level Rise**

Impacts

Coastal City Impacts – Coastal Zone Inundation

Land Use

Affected Property Types

-Inundation of most valuable coastal lands - coastal commercial/resort centers, downtown centers, industrial centers and facilities, commercial harbor facilities, residential communities, airports, municipal infrastructure/facilities (STPs, baseyards, water system facilities, infrastructure, schools, hospitals, zoos, libraries, etc), wetlands, coastal forests, beaches, bays, estuaries

-Destruction of buildings & facilities in all affected sectors

-Destruction of wetlands/habitat

-Loss of estuaries/marine nurseries/water bird populations

-Destruction of beaches, shoreline parks, recreational areas

-Coastal zone erosion/deteriorated water quality

Land Use Planning/Demographics

-Dislocation of population centers

-Density increases in population receiving sites

-Overburdening of infrastructure and facilities designed for lower densities (roadways, water systems, wastewater systems, parking, etc)
-Loss of open space in population receiving sites
-Redesign of city master plans, zoning maps, development plans, sustainable community plans, design guidelines
-Rezoning of open space to urban use
-Loss of agricultural lands to urbanization
-Adaptive reuse planning for inundated areas

Economic Impacts
-Loss of jobs and employment opportunities
-Loss of investment capital/income
-Failure of insurance systems
-Collapse of coastal economies
-Loss of vital freight/cargo operations
-Economic impacts to non-coastal cities, manufacturers, commodity producers
-Damage to food distribution operations
-Commodity shortages, hoarding, allocation controls
-Loss of mobility, business activity
-Collapse of commercial and recreational fisheries
-Collapse of coastal tourism
-Spike in bankruptcy rates
-Decline in gross assessed RPT valuations
-Massive municipal capital requirements for facilities/infrastructure redesign, relocation, reconstruction
-Financial collapse of local governments
-Reduction/cancellation of local government services

Wastewater Collection, Transmission, Treatment & Disposal
Inundated Coastal Collection System
-Inundated coastal collection system-manhole intrusion
-Saltwater intrusion into wastewater system
-Release of untreated sewage via manholes
-Inundation of wastewater pump stations
-Breakdown of force main system
-Sewage backups into homes and businesses
-Rupture of gravity mains

-Loss of wastewater collection services in un-inundated areas
-Damage to SCADA systems
-Sewage contamination of potable water systems
-Public health problems from sewage contamination
Increased I&I (inflow & infiltration)
-Increased I&I from elevated ground water in un-inundated portions of the wastewater collection system
-Inadequate force main capacity
-Disposal of under-treated sewage into receiving waters
STP Damage
-Destruction of STPs in the inundated areas and a complete loss of wastewater treatment capability
-Overwhelmed STPs in the un-inundated zones/inadequate treatment periods resulting from I&I and inundated collection systems
-Salinity increases in STP intake facility
-Loss of wastewater recycling capability
-Agricultural/industrial dislocation from loss of recycled water supply
-Damage to biological treatment capacity
-Massive wastewater bypass into receiving waters for extended periods (3-5 years)
-Massive capital requirements for wastewater system reconstruction

Water Systems-Watersheds, Wells, Reservoirs, Treatment, Transmission
Watershed Damage
-Saltwater intrusion up rivers/streams
-Salinity increases in groundwater
-Damage to coastal forests/watersheds
Wells
-Salinity intrusion into potable wells
-Loss of water quality
Reservoirs
-Possible salinity intrusion into reservoirs from elevated groundwater salinity
Treatment Systems
-Contamination of treatment systems from municipal sewage

-Physical damage to treatment facilities/inundation in the coastal zone

Transmission Systems

-Inundation of mains in the coastal zone
-Erosion/corrosion damage to inundated mains
-Failure of private laterals and internal plumbing in the inundated areas
-Massive water loss thru line breaks
-Saltwater intrusion into water transmission system
-Potential failure of water transmission system
-Need to reroute water flows around inundated areas with new mains

Urban Transportation

Roads & Bridges, Parking Facilities

-Inundation of coastal arterials
-Possible isolation of certain communities
-Alternative routes overwhelmed, increased traffic congestion/gridlock
-Loss of overall roadway system capacity
-Roadways in population receiving sites overwhelmed
-Damaged and destroyed bridge foundations

Stormwater Systems

-Inundation of coastal storm drains/catchbasins
-Stormwater backup in connected but un-inundated areas
-Increased pollution of coastal waters – release of gas and oil from inundated USTs, toxic materials from industrial sites, etc.

Traffic Management Systems

-Damage/destruction to sensors and signalization
-Possible system-wide failure of intelligent traffic systems-computerized traffic signal synchronization systems, video monitoring systems etc
-Damage to street light systems, inundated/shorted out electrical feeds/possible system-wide impacts

Public Transport (bus systems, BRT, rail, subways, etc)

-Inundation/destruction of coastal bus maintenance facilities
-Inundation/destruction of coastal BRT routes/stations
-Inundation/destruction of trolley/light rail/catenary systems
-Flooding of subway tunnels

-Bifurcation of public transportation systems that pass thru inundated areas leaving entire systems ineffective
-Disruption of public mobility/opportunity costs
-Shift from public transit to automobiles/increased traffic congestion/reduced roadway operating performance

Airports/Harbors

-Inundation of coastal airports
-Loss of mobility/cargo capacity/tourism
-Inundation of harbor facilities
-Loss of cargo/freight capability
-Massive facility/infrastructure relocation costs

Transportation Planning

-Need to completely redesign municipal transportation systems from a sustainable perspective. New/post sea level rise transportation planning needs to be integrated with land use, economic development, infrastructure, and energy policy planning. New/post sea level rise cities need to be designed around the pedestrian not the automobile.

Utilities (electric, gas, telephone, fiber optics, etc)

Electric Systems/Natural Gas

-Inundated power stations/transformers/gas lines
-Possible area-wide blackouts
-Possible bifurcated systems/Loss of gas service, steam, etc in some un-inundated areas
-Need to reroute all utilities around inundation areas

Solid Waste Management

Collection/Disposal/Recycling

-Possible need to relocate landfills with water-table changes
-De-construction debris landfills overwhelmed/new facilities needed to receive de-construction debris from the inundated zone
-Need for extensive recycling programs to recapture/reuse building materials harvested from the inundation zone
-Relocation of recycling centers, RDF plants, etc that are located in the inundation zone

Public Facilities

Schools, Convention Centers, Hospitals, Offices, Public Housing, Base Yards, Libraries, etc

-Inundated public facilities will need to be relocated of the flood zones

-Existing facilities in population relocation zones will need to be expanded

Risks

The lack of substantial integrated sustainability planning for post inundation coastal cities will result in haphazard urban redevelopment that is even less sustainable and energy efficient than are today's cities.

Municipal investments in mitigation initiatives to reduce GHG emissions may result in a dis-adaptation to climate change for the city. For instance, new public transit routes and facilities may be developed to reduce fossil fuel consumption and GHG emissions, but if those public transit facilities are located in future flood areas they will represent a dis-adaptation for the city. In addition, changes in building codes for mitigation purposes may not be ideally designed for adaptation purposes and may be counter productive to adaptation goals.
For these reasons, municipal mitigation and adaptation planning must be done as one unified planning process.

Uncertainties

Cities are unable to reliably determine how, when, and to what degree sea levels will rise in their geographic area. As a result they are unable to determine the amount, timing, or type of investments they need to make to prepare for sea level rise. Inadequate or misdirected infrastructure investments will leave them unable to adequately cope with the coming coastal inundation. Excessive investment in unneeded infrastructure improvements will have disastrous financial consequences for cities.

To eliminate these uncertainties, the federal government needs to provide cities with their best scientific estimate of the effect and timing of sea level rise and other climate change impacts. These projections need to be based on the best available data and not be the result of political compromise. These projections will serve as the basis for municipal action on a nationwide basis.

Once the baseline projections are established, the federal government needs to provide and mandate a uniform methodology for cities to assess their vulnerabilities to climate change and to determine their existing adaptive capacity. By utilizing a uniform methodology, cities will be able to reasonably evaluate the likely impacts and the approximate capital and operating costs that

will be required for various response options. With these tools, city governments can then make their own critical decisions about such things as abandoning or attempting to harden coastal areas. A uniform assessment methodology such as this will also enable the federal government to make fair and reasoned decisions on how it allocates financial resources to affected cities.

Options

To cope with sea level rise resulting from climate change, cities have the option to:

Infrastructure

-retreat from inundated shoreline areas
-attempt to harden and defend coastal urban areas
-relocate buildings and facilities in all affected sectors
-develop new relocation population centers
-redesign city plans in a sustainable way
-develop adaptive reuse plans for inundated structures
-expand and upgrade non-inundated infrastructure to replace lost capacity
-not replace infrastructure and facilities and allow out migration
-invest in infrastructure that will support new economic development strategies to replace lost coastal economies

Energy

-base all municipal decisions on the principles of energy efficiency, a shift to renewable energy sources, and the development of distributed energy systems
-promulgate laws that require all new construction to be based on energy efficient green building design
-implement energy efficiency upgrades on all city facilities
-adopt public incentives/rebates for the use of energy efficient appliances and technologies
-shift the entire municipal fleet to recycled biodiesel fuels
-retrofit all traffic signals/lighting to LED lighting
-develop methane recapture cogen systems for all landfills and STPs
-regulate and develop renewable primary energy sources for the city
-develop energy recapture systems for all MSW (RDF, Plasma Arc, etc)

Policy

-require all new development and re-development to be based on Smart Growth principles to reduce automobile dependence
-mandate coastal zone development setbacks to accommodate further sea level rise

-attempt to develop new revenue sources and financing options for the city
-utilize technology and innovation to improve efficiency and cut costs
-set priorities for city services and cut back operations to live within reduced revenues

Capacity Building

-retrain city workforce to deal with new sustainable technologies and methodologies
-consolidate municipal workforce to operate within budget constraints

Vulnerability – **Increased Precipitation & Severe Weather Events**

Impacts

- Urban Flooding, Storm Surge, and Wind Damage
  - Wastewater Collection, Transmission, Treatment& Disposal
    - Inundated MWW Manholes
      - -Overwhelmed STPs/inadequate treatment periods
      - -Disposal of under-treated sewage into receiving waters
      - -Toxic slugs entering MSW system
      - -Release of untreated wastewater via manholes
      - -Public health problems from sewage contamination
      - -Sewage contamination of potable water systems
      - -Overwhelmed pump stations
      - -Inadequate force-main capacity
      - -Rupture of gravity mains
    - Increased I&I (inflow and infiltration)
      - -Overwhelmed STPs/inadequate treatment periods
      - -Disposal of under-treated sewage into receiving waters
      - -Overwhelmed pump stations
      - -Inadequate force main capacity
      - -Rupture of gravity mains
    - STP Damage
      - -Temporary loss of biological treatment capacity
      - -Contamination of clarifiers
      - -Physical damage to pumps and facilities
      - -Damage to SCADA systems
    - Energy Conservation & Generation
      - -Need to implement system-wide energy efficiency upgrades
      - -Need to develop STP co-generation systems

  - Water Systems-Watersheds, Wells, Reservoirs, Treatment, Transmission
    - Watershed Damage
      - -Loss of forest cover
      - -Slumping/Landslides
      - -Erosion/damage to soils, streams, groundwater
    - Wells
      - -Flooding of well heads, pump stations
      - -Contamination of potable water systems

-Introduction of pollutants into groundwater
-Need for energy efficiency upgrades

Reservoirs
-Contamination from urban runoff (non-point source)
-Contamination from damaged infrastructure (point source)
-Siltation of reservoirs from erosion
-Overtopping of reservoirs
-Failure of dam structures/property damage, loss of life

Treatment Systems
-Contamination of treatment systems/sewage
-Physical damage to treatment facilities
-Need for energy efficiency upgrades

Transmission Systems
-Flooding caused soil slumping/expansion
-Rupture of mains and laterals
-Ruptured mains cause hillside slippage
-Damage to all buried infrastructure, property damage from slippage

Urban Transportation

Roads & Bridges, Parking Facilities
-Accelerated deterioration of pavement surfaces
-Increased pothole repair demands
-Accelerated re-pavement schedules
-Overwhelmed and damaged culverts
-Damaged and destroyed bridge foundations
-Roadway cleanup costs/debris & mud removal
-New route construction around new flood zones
-Need to shift to permeable concrete paving

Storm Drains and Canals
-Overwhelmed drainage systems, transmission capacity
-Inadequate catch basin capacity, litter wash-back
-Increased pollution of receiving water (streams, coast, etc.)
-Increased need for watershed management infrastructure
-Increased need for public education re: watershed management

Traffic Management
-Damage to sensors and signalization
-Damage to roadway markings and signage
-Reduced mobility/opportunity costs
-Need for energy efficiency upgrades (LED lights, signals)

-Need for deployment of PV/wind powered lighting

Public Transport (bus systems, BRT, rail, etc.)
-Damage to bus yards/rolling stock
-Damage to BRT routes/stations
-Damage to trolley catenary systems
-Flooding of subway tunnels
-Disruption of public mobility/opportunity costs
-Need to relocate transit systems from new flood zones
-Need to expand non-fossil fueled public transit capacity

Airports/Harbors
-Damage to facilities
-Disruption of service
-Possible relocation of facilities
-Economic impacts
-Need for energy efficiency upgrades
-Need to shift to renewable energy sources

Transportation Planning
-Need to integrate trans/land use/infrastructure planning
-Need to develop enterprise wide GIS based management

Solid Waste Management

Collection/Disposal/Recycling
-Disruption of collection routes/services
-Public health problems from uncollected waste
-Disruption of landfill operations
-Increased waste volumes–greenwaste, deconstruction debris
-Contamination of groundwater/ leachate collection system failures
-Need to relocate landfills based on new rainfall patterns
-Need to establish methane recapture/cogeneration facilities at landfill sites
-Need demand management systems to reduce waste generation and accompanying energy demand
-Need to develop recycling systems to recapture energy and resources
-Need to develop waste to energy systems for MSW (RDF, plasma arc, etc)

Public Facilities

Schools, Convention Centers, Hospitals, etc

-Damage to facilities
-Increased maintenance and operational costs
-Need for facility relocation out of flood zones
-Need for energy efficiency upgrades
-Need to develop cogeneration at facilities

Public Buildings-Offices, Libraries, Public Housing

-Damage to facilities/increased maintenance costs
-Need for energy efficiency upgrades
-Need to develop cogeneration systems
-Increased affordable housing maintenance costs

Community Services

Homeless Facilities & Services, Elderly Affairs

-Increased demand for homeless facilities
-Greater homeless health and medical challenges
-Increased pressure on elderly services, health & mobility

Parks & Recreational Facilities

-Damage to parks/playgrounds
-Increased maintenance of park lands/facilities
-Conversion of parklands to floodways, retention ponds
-Reduced revenue from public golf courses/zoos, etc.
-Increased operational costs for golf courses/zoos, etc.

Risks

Lack of substantial municipal investment in new infrastructure and equipment as well as lack of increased expenditures for maintenance, operations, and training will result in increased property damage, morbidity, and loss of life.

Uncertainties

Cities are unable to reliably determine how and to what degree weather patterns will change for their geographical area. As a result, they are unable to determine the amount or type of investments they need to make to adapt to climate change. Inadequate or misdirected infrastructure investments will leave them unable to adequately cope with the coming

climate related problems. Excessive investment in unneeded infrastructure improvements will have disastrous financial consequences for cities.

Most cities are currently unable to finance the capital costs necessary to adapt to climate change and they do not have an adequate tax base to pay the increased operating costs associated with adaptation.

Options

To cope with increased precipitation and flooding resulting from climate change, cities have the option of:

Infrastructure

- replacing storm-water infrastructure with higher capacity catch basins, storm drains, drainage canals, etc.
-systematically replacing existing hardscape with permeable concrete surfaces to increase soil absorption and reduce runoff.
-increasing urban green-space to reduce runoff and heat island effect
-relocating infrastructure and facilities from new flood prone areas
-converting public lands (parks, golf courses, etc.) to detention and retention systems to handle increased flood flows

Equipment

-deploying new and expanded equipment to clean and maintain catch-basins and storm drain systems (vactor trucks, etc.)
-deploying barcode/computer/enterprise GIS systems to improve the efficiency of storm water management systems

Policy

-instituting code changes to require building rainwater catchment, retention and reuse systems to reduce runoff and water pumping energy costs.
-changing zoning and land use laws to restrict development in areas subject to flooding as a result of increased precipitation
-mandating smart growth land use policies to reduce auto dependence

-mandating green building/energy efficiency design for all public and private construction to reduce GHG emissions.
-retrofitting all government buildings for energy efficiency
-shifting all municipal fleets to recycled biodiesel fuels
-shifting municipal energy usage to renewable fuels
-developing cogeneration capability at city facilities

Capacity Building

-retraining city workers to utilize new sustainable technologies
-hiring additional city workers to cope with new challenges

Finance

-utilize creative financing mechanisms to finance infrastructure upgrades (ESCO's, public-private partnerships, tax increment financing, etc.)
-increase property taxes, fees, to cover increased operating costs and to service increased general obligation bond debt
-change Federal policy to reinstitute revenue sharing so the Federal government can again provide financial assistance to cities

Vulnerability – **Decreased Precipitation**

Impacts

Droughts

Water Systems–Watersheds, Wells, Reservoirs, Treatment, Transmission

Watershed Damage

-Loss of forest cover from drought, pest and disease caused tree death

-Increased erosion hazard from forest die-off

Wells

-Drying up of aquifers

-Deterioration of water quality

-Reduction of well capacity

-Decreased recharge of groundwater systems

-Salt water intrusion/increased salinity of aquifers

Reservoirs

-Reduced seasonal runoff/reduced snow-pack etc.

-Dropping reservoir levels

-Reduced recreational opportunities

-Reduced lake levels/habitat destruction

-Reduced stream flow/habitat destruction

-Increased stream temperatures/habitat destruction

-Reduced hydroelectric generation capability

Treatment

-Increased treatment costs

Transmission & Distribution

-Contamination of transmission lines

-Inadequate capacity for all user groups

-Allocation conflicts between ag/industry/res/environment

New Source Development/Conservation

-Increased demand for desalinization plant development

-Expanded application of water catchment systems for buildings

-Increased demand for water efficient appliances

-Increased pressure for water conservation ordinances

Wastewater Collection, Transmission, Treatment & Disposal

-Increased demand to recycle wastewater for industry and agriculture

-Increased demand for more efficient distributed wastewater technologies
-Increased demand to develop and deploy non-water based sewage treatment systems
-Increased demand for efficient MBR technologies

Community Services

Parks and Recreational Facilities/Urban Forestry

-Loss of irrigation allocations/urban green space loss thru water loss, disease, & pests

Public Safety

Fire Suppression

-Increase in forest and brush fires
-Increase property damage from fire loss

Risks

A lack of substantial municipal investment in wastewater recycling and other water reclamation technology could leave cities dangerously short of adequate water resources to provide fire suppression services, which could lead to increased property damage and loss of life.

Inadequate potable water resources could threaten public health and economic development opportunities.

Uncertainties

Uncertainty about the quantifiable impact of climate change on the city's future water resources will limit a city's ability to invest appropriately in advance.

Most cities are financially unable to meet the costs associated with this adaptation and the increased costs of providing water services may make water prohibitively expensive. This could result in the dislocation of large urban populations.

Options

To cope with the decreased precipitation resulting from climate change cities have the option of:

Infrastructure

-developing new water supply systems based on alternative technology, such as, recycling of wastewater, desalinization, temperature differential condensation technology

-revitalizing water transmission systems to reduce line loss

-promoting the use of xeroscape species in both public and private landscaping

-mandating water catchment/reuse systems on all public and private buildings

-developing non-water based sewage treatment technology

-reforesting impacted watersheds with drought resistant species

Equipment

-purchasing new fire fighting equipment to combat increased forest and brush fires

-deploying state of the art SCADA systems to increase the efficiency of water transmission systems

-deploying barcode/computer/enterprise GIS systems to improve the efficiency of water transmission systems

-deploying telemetry water-meter reading technology

Policy

-instituting strict water conservation ordinances

-providing rebates for the use of low flow toilets, shower heads, and appliances

-establishing policies for the allocation of limited water resources

-promulgating water allocation quotas for various sectors

-changing building codes to reduce water consumption and require building water catchment

-restrict the installation of new water meters

Vulnerability – **Increased Temperatures**

Impacts

Water System Stress

Water Systems-Watersheds, Wells, Reservoirs, Treatment, Transmission

-Increased evaporative loss from reservoirs

-Reduced stream flows

-Increased demand for water for drinking, irrigation, air conditioning

-Accelerated snowmelt/diminished watershed capacity

Roadway Impacts

Urban Transportation – Roads

-Accelerated buckling of pavements/increased repaving costs

-Increased demand for roadside irrigation

Energy Impacts

Public Facilities

-Increased air-conditioning/cooling demand

-Need for increased primary power generation

-Need to retrofit existing facilities to reduce heat gain

Vulnerable Populations

-Prohibitive energy costs

Community Services Impacts

Homeless Facilities & Services, Elderly Affairs

-Increased health risks for the homeless, elderly, poor, and other vulnerable populations

-Need for enhanced health services

-Need to retrofit homeless facilities and senior housing to reduce passive heat gain

Parks & Recreational Facilities

-Stress on urban landscaping

-Spread of new pests and diseases

Health Services

-Reduced ambient air quality

-Increased respiratory disease

-Spread of new infectious diseases

Brush Fire/Forest Fire Impacts

Fire Suppression

-Increases in forest and brush fires

-Demand for expanded fire-fighting capacity

Crime Impacts

Urban Crime

-Increase in urban street crime

Risks

Inadequate municipal response will result in increased energy costs; fire caused property damage, morbidity, and loss of life.

Uncertainties

Inadequate information on the degree of heat increase projected in each geographic area.

Options

To cope with the increased heat burden resulting from climate change, cities have the option of:

Infrastructure

-expanding electrical generation facilities

-retrofitting public facilities to reduce passive heat gain

-deploying energy efficient cooling systems (district cooling, etc)

-expanding water sources, reservoirs, transmission systems

Equipment

-expanding fire fighting capacity with specialized equipment

Policy

-mandating water conservation measures

-providing incentives/rebates for water conservation

-promulgating green building design standards

-increasing the frequency of road resurfacing and repair

-shifting from asphalt to concrete paving systems

-promulgating a model energy code

-shifting to xeroscape landscaping techniques

-expanding health services for vulnerable populations
-increasing Fire Department capabilities
-promulgate open fire burning restrictions

Overarching Municipal System-wide Impacts from Climate Change

City Management

In order to effectively cope with adaptation to climate change, city managers will need more definitive information on the nature, extent, and timing of the impacts that their city must adapt to. Political leaders and managers will need training and capacity building to meet the challenges this threat poses to cities.

Climate change and sea level rise will also trigger an avalanche of new legal issues for local governments as large areas of private property and facilities are inundated or deemed unsafe to the public, and population centers are relocated.

Emergency Management

Currently, emergency management capabilities at the local government level are designed to cope with emergency events and their aftermath. Sea level rise will pose a long term protracted emergency that will require new training and technology. Immediate planning is needed at the city level that integrates GHG mitigation planning and climate change adaptation planning.

Energy Policy

Cities need to develop policies, pass ordinances, develop facilities, and apply technology and equipment that implement energy efficiency, a shift to renewable energy sources for primary and transportation energy, and the development of distributed energy systems. All land use planning, transportation planning, and infrastructure planning needs to be integrated to reduce energy consumption.

Planning & Permitting

All building codes, energy codes, design codes, and zoning ordinances need to be refined to address GHG mitigation and climate change adaptation.

Design & Construction

Starting immediately, all future municipal construction of public facilities and infrastructure needs to utilize both mitigation and adaptation design standards so that we do not further exacerbate the climate change challenge.

Police, Fire, Ambulance, Medical Examiner

Sea level rise will present emergency response services with unique and increasing burdens. These challenges will require the application of new technologies and expanded training and capacity building programs.

Information Systems &Technology

To meet the challenges ahead, most cities will need substantial upgrades to various municipal technologies. In order to adequately plan and manage the complex and interrelated municipal operations that will be required, cities will need to reorganize themselves around enterprise-wide Geographic Information Systems (GIS).

Human Resources

Sea level rise will result in increased municipal costs and reduced revenues. This will likely require a reduction in city staffing and an expansion of training and capacity building programs by city human resource departments.

Budget & Finance

Climate change and sea level rise will require cities to 1) write off massive investments in inundated infrastructure (in many cases the city will need to continue to pay debt service on those lost assets), 2) invest in new replacement infrastructure without adequate financing, 3) increase operating budgets to maintain service levels, and 4) absorb large drops in their property tax base.

In many cases these circumstances will result in a significant downgrade in the cities bond rating by the bond rating agencies. This will limit future borrowing and increase debt costs. In short, under current circumstances, cities will not be able to finance the infrastructure nor pay the operating costs of dealing with climate change.

One alternative is for the federal government to establish a Climate Change Adaptation Bank that could serve as the lending source to finance municipal climate change adaptation projects. Such a bank could be modeled after the World Bank that was established after WWII to help finance post war reconstruction.