American Planning Association

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EXECUTIVE SUMMARY

Water—essential for life; guiding our earliest settlement patterns; and at 75 percent of the earth’s surface, all around us. As settlement patterns and lifestyles change, and as growth occurs, so too have our water needs. Communities around the world are grappling with ever-increasing challenges of water, wastewater, and stormwater management; as well as issues related to access, reliability and quality. Those working to improve water management understand its complex nature and need for a comprehensive approach—but most planners have only a general understanding (if any) of anything beyond the basic issues.

The American Planning Association (APA) created a Water Task Force in 2014, comprising a diverse group of planners, landscape architects, economists, policy makers, and academics, to evaluate the link between water management and land use planning, and to offer recommendations to APA’s Board for improved policy and practice. The resulting report is meant to challenge existing water planning silos and encourage the Board to take the lead on addressing this important planning issue. The report provides over 30 recommendations under six core theme areas as summarized in the two tables below:

<table>
<thead>
<tr>
<th>Table 1: Core Themes and Recommendations (abbreviated)</th>
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<tbody>
<tr>
<td><strong>Core Theme 1:</strong> Water is a central and essential organizing element in a healthy urban environment</td>
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<tr>
<td>This is the foundational concept behind these recommendations for improved planning practice and policy. Our recognition of the vital importance of water—for human health, for the natural environment, sanitation, habitat, transportation, and commerce—establishes the rationale for expanded action by planners to better manage, share, and protect this resource.</td>
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<td><strong>Core Theme 2:</strong> Planning practice needs to apply an integrated, systems-oriented, comprehensive approach to water management</td>
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<td>Recommendations:</td>
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<tr>
<td>• Better incorporate water into the comprehensive planning process, as a component of both Comprehensive/Master Plans and Sustainability Plans.</td>
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<td>• View water resource management needs as interdisciplinary, and more than multidisciplinary.</td>
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<td><strong>Core Theme 3:</strong> New mechanisms for interdisciplinary interaction are critical to effective water management (including urban planning/design, engineering, landscape architecture, architecture, hydrology, etc.)</td>
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<tr>
<td>Recommendations:</td>
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<tr>
<td>• Incorporate water management into the comprehensive planning process, as a component of a sustainability plan or via stand-alone water plans.</td>
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<tr>
<td>• View water resource management needs as interdisciplinary, not multidisciplinary.</td>
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<td>• Create a mechanism for planners to measure, understand and convey to communities the value of water and the opportunity costs associated with land use projects.</td>
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<td>• Sponsor training sessions through APA for variety of professionals (e.g. PTS workshops).</td>
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<td>• Create a metrics system to measure progress of adapting water strategies and policies.</td>
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<td>• Align water-based needs and development with other urban development professionals using APA resources. For example, watershed/ecosystem based approaches are being developed by peer organizations—we have a responsibility to connect to these efforts.</td>
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<tr>
<td>• Conduct charrettes involving planners/water professionals/others stakeholders for improved understanding between the professions.</td>
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Note: These recommendations are abbreviated. Please see Sections II and V for a full presentation.
Table 1: Core Themes and Recommendations (abbreviated)

- Develop standards for incorporating water professionals throughout long-term comprehensive planning and individual land-use development decisions in order to better understand the long-term impacts, including infrastructure maintenance costs.
- Establish guidelines and encourage planning agencies and water service utilities to develop a unified message to the public and elected officials about water resource concerns; build solidarity.

Core Theme 4: Planners need new and improved professional practices to manage water more sustainably and provide greater social equity for access

Recommendations:
- Apply goals of environmental justice to equalize the risks to health and public safety from water, or lack of water across income levels and other measures of human diversity, so all citizens share equally in the benefits and the risks of maintaining sustainable water systems.

Core Theme 5: Innovative land use planning and urban design is needed to improve and protect water environments

Recommendations:
- Create tools for planners to easily assess the impacts of projects on natural and urban water resources.

Core Theme 6: Adaptive land use, environmental, & infrastructure planning can help to increase resilience to extreme climate events and climate change; reducing risk & helping to manage uncertainty

Recommendations:
- Improve flooding/hazard mitigation planning by building upon current APA, FEMA and NOAA work for hazard mitigation; should have specific effort to include water/wastewater utilities.

Note: These recommendations are abbreviated. Please see Sections II and V for a full presentation.

Table 2: Other Recommendations where APA can take the lead (abbreviated)

Recommendations – Education and Outreach:
- Revise planning curricula to offer more interdisciplinary classes; develop more technical skillsets.
- Provide interdisciplinary opportunities in graduate studios allowing students to work together on complex projects involving water management.
- Assist applicable APA Divisions in education/outreach around water management issues.
- Consider pilot research/hands-on program application in partnership with others; publicize results.
- Develop and publish reports/documents that provide planners with resources on technical aspects of water planning.
- Create/manage water management repository that provides information on water resource management or potential partner opportunities (similar to APA efforts through the National Disaster Resilience Competition).
- Create "water governance resource map" (i.e. "cheat sheet") that highlights role of local, regional, national stakeholders.
- Publish/update primer on all major water legislation. Create a central repository of information.
- Host series of webinars to provide knowledge exchange between planners and water resource professionals.
- Develop university course on integrated water management within planning design and engineering colleges, ideally with cross-participation during the course.
- Partner with national water service membership agencies (e.g. AWWA, WEF, WRF, WERF for development of cross-industry participation and learning opportunities at respective conferences).
- Lead campaign to help public and officials understand the importance of water resources as part of every community's planning.
- Encourage planners to be conveners and supporters of local efforts to improve water management, as both a resource and an asset.

Note: These recommendations are abbreviated. Please see Sections II and V for the full description.
Table 2: Other Recommendations where APA can take the lead (abbreviated)

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<td>• Write a PAS Report on how to incorporate the new water paradigm into comp plans (specific plans, redevelopment plans, master plans).</td>
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<td>• Update APA Policy Guide on Water Resource Management (2002) to include human development, safety, and sustainability.</td>
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<td>• Write a PAS Report on using the new water module in GIS-based scenario planning tools and other analytical techniques. Develop scenario planning tools as well.</td>
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<td>• Prepare research compendium of the US/international community planning programs for integrated or One Water Management programs.</td>
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<td>• Identify and promote best practices for One Water Management programs.</td>
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<th>Recommendations – General:</th>
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<td>• Develop model ordinance/legislative mechanisms manual for integrated urban water management.</td>
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<td>• Key stakeholders should work together to reevaluate pricing mechanisms for water and stormwater/wastewater service to better understand the true cost of water use.</td>
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The report is divided into six sections, each section building from the previous one, and laying out the case for the consideration of a new and improved approach for the planning profession with respect to water:

• Introduction  
• Core Themes for Improved Water Resource Planning  
• Call to Action and Key Drivers  
• The Challenge for Planning  
• Recommendations for Improved Practice for Planners  
• Looking Ahead – Practice and Policy Development

This report seeks to further engage all planners in the intensely important community-scale issue of water management. Water is essential to the future of every community and therefore should not be treated as just a specialization within the planning field, but rather at minimum, a part of a planner’s basic working knowledge, like land use and zoning competencies.

The planning profession by nature is one that helps communities adapt to change through a thoughtful, comprehensive examination of existing conditions and desired outcomes. In today’s world, threats from urban sprawl, burgeoning populations worldwide, and climate change should challenge us to redefine traditional planning and think more broadly about how we plan. Water should be a core planning theme if we are to be effective in addressing the needs of communities in today’s world; and our approach should be one that includes an integrated water approach as its own topic, and equally as important, be fully embraced as part of the standard comprehensive planning process.

The APA Water Task Force sincerely appreciates the opportunity to present this report for your discussion and careful consideration.

Thank you.
I. INTRODUCTION

The American Planning Association (APA) created a Water Task Force in 2014, comprising a diverse group of planners, landscape architects, architects, economists, policy makers, and academics, to evaluate the link between water management and land-use planning and to offer recommendations to APA’s Board of Directors for improved policy and practice. The product is this Recommendations report—which outlines the many complex issues that affect sustainable water management and offers recommendations for an expanded role for planners in urban water management as well as improvements in both planning practice and policy for water resource management. This report concludes with possible topics for further research, and recommendations for improved educational processes for the public and professionals.1

In April 2002, APA adopted the Policy Guide on Water Resources Management, setting forth three general policies and 12 specific policies for water use. The three general policies focus on managing water as a collective public resource, in a sustainable way, so that it is wisely managed and protected from degradation.2

Management of water resources engages professionals from a wide range of disciplines and professional practices, from planners, architects, engineers, scientists, economists, and hydrologists to lawyers, regulators, and public officials. Water resources not only function to provide essential drinking water, they are a recreational asset, a mechanism to carry away waste, a vehicle for carrying ships and cargo, an ecosystem and vital habitat, a cause of flooding and natural disaster, and more. Because water resources intersect with the human environment in complex and myriad ways, and because they are managed by a wide range of diverse professions, our water resources have suffered from a lack of integrated management, with insufficient understanding of how decisions in one sector affect the availability and quality of the resource in other sectors.

Increased attention to sustainable environments, and awareness of the risk posed by climate change, have led to expanded recognition among water resource professionals that “we must manage land and water together as fully integrated elements that comprise and vitalize both urbanized and natural landscapes.” Also, “we now need to utilize our . . . skills to reintegrate water and land in an urban landscape that replicates the natural systems from which water has been drawn.”3

The World Economic Forum’s (WEF) Global Risks Perception Survey and resulting WEF Report has concluded that future risks (climate change, water crises, biodiversity loss and ecosystem collapse, extreme weather events, natural disasters, man-made environmental catastrophes) are increasing in frequency and impact. These increasing risks often exist at a regional scale, and typically include urban environments. While regional scale increases the complexity of these risks and their impacts, this is also the scale where mankind can most effectively adapt to and mitigate the risks, if we can come forward with a comprehensive approach and connect planning, design, and politics.

This year’s WEF Report put the impact of Water Crises as the number one risk. Despite this risk, water is a global connecting medium, ensuring that we work together to address the risk. Global urbanization gives us growth and prosperity, but climate change, sea-level rise, and the increasing impacts of these risks put pressure on our cities, societies, and citizens, as well as our economy and ecology.

Water is at the heart of this uncertain future. It is through water that we feel the impact of climate change the most. Water is essential for our economy, our social and cultural well-being. Water quality defines our economic and societal prosperity and water risks—whether too much or too little—define our society’s vulnerability.

In our current fragmented society, we tend to take a piecemeal approach, which is insufficient to create capacity
for adaptation, and piecemeal approaches cannot build physical or social resilience. The risks and urgencies require heightened attention and collaboration.
II. CORE THEMES AND RECOMMENDATIONS FOR IMPROVED WATER RESOURCE PLANNING

Six Core Themes (listed below) arose from the Water Task Force’s research into the challenges of achieving sustainable water management. Following the core themes is a review of the drivers for improved water planning and management and recommendations for improved policy and practice. This section concludes with a list of specific recommendations that derive from the concepts and issues below, and the research conducted for this Recommendations Report.

1. Water is a central and essential organizing element in a healthy urban environment.
2. Planning practice needs to apply an integrated, systems-oriented approach to water management.
3. New mechanisms for interdisciplinary interaction are critical to effective water management (including urban planning/design, engineering, landscape architecture, architecture, hydrology, etc.).
4. Planners need new and improved professional practices to manage water more sustainably and provide greater social equity for access.
5. Innovative land use planning and urban design is needed to improve/protect water environments.
6. Adaptive land use, environmental, & infrastructure planning can help to increase resilience to extreme climate events and climate change; reducing risk & helping to manage uncertainty.

Recommendations for Improved Planning Practice & Water Management

1. Water is a central and essential organizing element in a healthy urban environment.
   The concept that water is a central and essential organizing element in the urban environment is the principal foundational concept behind these recommendations for improved planning practice and policy. Our recognition of the vital importance of water— for human health, for the natural environment, sanitation, habitat, transportation, and commerce—establishes the rationale for expanded action by planners to better manage, share, and protect this resource. This first core theme explains the bias for action that is presented herein: to both better define the value of water, which is often seen as a free resource; and to improve the way in which society manages water, by improved planning practices and by achieving broadly expanded interdisciplinary commitment to such action.

2. Planning practice needs to employ an integrated, systems-oriented, comprehensive approach to water management.
   • Incorporate water into the comprehensive planning process, most typically as a component of a larger sustainability plan or via regional stand-alone water plans.
   • View water resource management needs as interdisciplinary, not multidisciplinary.

3. New mechanisms for interdisciplinary interaction by involved professionals (in urban planning and design, environmental engineering, architecture, landscape architecture, hydrology, economics, law/regulation, etc.) are critical to effective water management.
   • Create a mechanism for planners to be able to easily measure, understand and convey to communities the value of water and the opportunity costs associated with planning projects, even those that may not be explicitly water related.
   • Sponsor training sessions through APA for planning directors, mayors, and public works directors,
as well as CEOs and other high-level positions that focus on integrated water concepts and techniques. These could take the form of APA’s PTS workshop format.

- Create a formal metric system that can be used by planners and communities to measure progress made by adapting comprehensive water management strategies and policies.
- Align water-based needs and development with other urban development professionals using APA resources. Watershed and ecosystem based approaches are being developed by our peer professional organizations and we have a responsibility to reach out to them.
- Test planning charrettes involving planners, water resource professionals, and other stakeholders (potentially in energy and other infrastructure industries, as well) to develop a replicable platform for improved understanding between these professions and the work they do.
- Target touch points and develop standards for how planners can incorporate water professionals during long-term comprehensive planning as well as during individual land-use development decisions facing a region or municipality, in order to better understand the long-term impacts to the community, including infrastructure maintenance costs.
- Establish guidelines and encourage planning agencies and water service utilities to work together to develop and use a unified message to the public about regional or local water resource concerns and help build solidarity.

4. Planners need new and improved professional practices to manage water more sustainably and provide greater social equity for access to the resource.

- Implement goals of environmental justice to require that the risks to health and public safety from water, or lack of water, are equal across income levels and other measures of human diversity, so all citizens share equally in the benefits and the risks of maintaining sustainable water systems.

5. Innovative land-use planning and urban design are needed to improve and protect water environments.

- Create professional resource tools so planners can easily factor in the impacts of projects on natural and urban water resources. Provide planners with the legal and ordinance tools needed to enable requirements for water neutral development, particularly in areas of water security.

6. Adaptive land use planning, environmental planning, and infrastructure planning can help to increase resilience to extreme events and climate change, by reducing risk, and helping to manage uncertainty.

- Improve flooding and hazard mitigation planning by building upon current APA, Federal Emergency Management Agency (FEMA), and National Oceanic and Atmospheric Administration (NOAA) work for hazard mitigation. There should be a specific effort to bring water/wastewater utilities into the conversation.

**Recommendations Where APA Can Take a Leadership Role**

**Education and Outreach Recommendations**

- Revise planning curricula in planning and design schools to make it easier for students to take interdisciplinary classes that can help develop a more technical skillset which will be useful in
addressing water management issues. This should be applied both ways, by encouraging other disciplines to take planning classes as well.

- Provide interdisciplinary opportunities in graduate studios so students can begin working together on complex water management projects.
- Assist applicable divisions in education and outreach around water management issues.
- Consider pilot research or hands-on program application in coordination with partnerships and trade organizations; publicize the efforts and results.
- Create multiple publishable reports or documents that provide planners with insights and resources to be better versed in technical aspects of water and planning.
- Create and manage within APA a water management repository that can provide planners with information, publications, reports, and opportunities to learn about water resource management or even partner on potential projects (similar to the efforts APA is making to guide planning communities through the National Disaster Resilience Competition).
- Create a “water governance resource map” (i.e. a cheat sheet) that highlights the role of local, regional, and national stakeholders involved in water resource movement.
- Publish a primer on all major water legislation (APA may have something similar but it may need to be updated).
- Host a series of national webinars designed to provide a knowledge exchange between planners and water resource professionals. Example: Planners provide the basics on comprehensive plan development; water professionals provide the basics on the regulations surrounding the provision of water service.
- Develop and embed a university course on integrated water management within planning design and engineering colleges; ideally have cross-participation between these colleges during the course work.
- Partner with national water service membership agencies (e.g., the American Water Works Association (AWWA), Water Environment Federation (WEF), the Water Research Foundation (WRF) and the Water Environment Research Foundation (WERF)) on development of cross-industry participation and learning opportunities at their respective annual national conferences.
- Lead a campaign to help the public and public officials understand the importance of water resources as part of every community’s planning effort. For example, to conserve the ability of rivers, streams, and washes to serve their natural and beneficial functions, all stakeholders should be aware how areas need to be protected and how this relates to land-use decisions.
- Encourage planners to be conveners and supporters of local efforts to improve water management, as both a resource and an asset. For example, communities are reaching out to each other to partner in water banking and other solutions for the future out of necessity driven by droughts or other crises. We need to map similar efforts across the United States, at a minimum. APA can act as a repository and resource that planners and citizens rely on for this information.

Research Recommendations

- Produce a PAS Report on how to incorporate the new water paradigm (integrated planning for urban wastewater/stormwater/water supply) into comp plans (specific plans, redevelopment plans, master plans).
- Update the current APA Policy Guide on Water Resource Management (2002). The current policy guide focuses primarily on supply, quality, and availability of the resource. The Water Task Force recommends that the policy guide be updated to be more inclusive of all the issues related to
water as it affects human development, safety, and sustainability.

- Develop a PAS Report on how to use the new water module in GIS-based scenario planning tools and other analytical techniques. Develop scenario planning tools for water service sectors to evaluate land-use alternatives, perhaps incorporating case studies of localities that have done scenario planning for water at the local and or regional level.

Other Research Opportunities

- Prepare a research compendium of the United States and international community planning programs for Integrated or One Water Management programs.
- Identify and promote best practices for Integrated Resource Management or One Water Management programs being implemented in community planning, public works, and/or utility departments.

General Recommendations

- Develop a manual of model ordinances and legislative mechanisms that promote adoption and secure funding for integrated urban water management planning targeted toward urban planners. The manual should include building code updates, techniques for using green space as a method for managing stormwater, consideration of how to apply water offset policies, etc. There should be a strong emphasis on outreach and collaboration methods with local water service utilities.
- Key stakeholders should work together to reevaluate the pricing mechanisms for water, wastewater, and stormwater services to better reflect the true cost of water use, while recognizing the vital importance of equity, and access to water services.
III. CALL TO ACTION AND KEY DRIVERS

A. Key Drivers for Improved Water Management
What are the causes of the current challenges in water management?

1. Increased Tension Between Social, Physical, & Environmental Issues
Water is necessary to support human settlement. As the population of the United States and the world grows, there will be increasing competition for limited water supplies. Although population growth has slowed in some areas of the country, it has mushroomed in many water-scarce regions.

**Increasing Water Use**
The U.S. Census Bureau projects that population in this country will increase by 95 million, from 321 million people in 2014 to 417 million in 2060. Population growth in the United States depends extensively on migration—two-thirds of the projected population increase is net migration.  

As for international population growth, the United Nations Department of Economic and Social Affairs expects global population to increase from 7.3 billion in 2014 to 9.6 billion in 2050, an increase of 38 percent, according to the “median-variant” scenario, often regarded as “most likely” based on analysis provided by the UN’s Population Division. Further, the UN also projects population will increase by almost one billion people within the next 12 years, reaching 8.1 billion in 2025. Much of the overall increase between 2013 and 2050 is projected to take place in Africa, as well as countries with large populations such as India, Indonesia, Pakistan, the Philippines, and the United States.

UN-Water is the mechanism coordinating the actions and implementing the agenda set by the Millennium Declaration and the World Summit on Sustainable Development (WSSD) in all aspects related to freshwater. According to UN-Water:

"Water use has been growing at more than twice the rate of population increase in the last century, and, although there is no global water scarcity as such, an increasing number of regions are chronically short of water. By 2025, 800 million people will be living in countries..."
or regions with absolute water scarcity, and two-thirds of the world population could be under stress conditions. The situation will be exacerbated as rapidly growing urban areas place heavy pressure on neighboring water resources.\(^8\)

In addition to the anticipated future increase in demand associated simply with population growth, freshwater bodies have a limited capacity to process the pollutant charges of the effluents from expanding urban, industrial, and agricultural uses. Water quality degradation is often a major cause of water scarcity, due to the inability to use local water safely and healthfully.\(^9\)

The population of the United States grew from 281,421,906 in 2000 to 308,745,538 in 2010, a 9.7 percent increase.\(^10\) A number of states, all of which are water-stressed, experienced growth rates higher than the nation as a whole. The five fastest growing states were Nevada (35 percent), Arizona (25 percent), Utah (24 percent), Idaho (21 percent), and Texas (21 percent). The five states adding the most population in terms of people were Texas (4.3 million), California (3.4 million), Florida (2.8 million), Georgia (1.5 million), and North Carolina (1.5 million). All of these states are on record as suffering water supply shortages.

The fastest growing states from 2010 to 2030 are expected to be Arizona (67.6 percent), Nevada (58.6 percent), Florida (52.6 percent), Texas (32.5 percent), and Washington (28.3 percent). In 2030 the most populous states are forecasted to be California (46.4 million), Texas (33.3 million), Florida (28.7 million), New York (19.5 million), and Illinois (13.4 million). Water supply demand in the three most populous states will increase competition over scarce source waters.

**Urbanization**

Urbanization is on the rise, accompanied by a rise in water use. According to a U.S. Census Bureau news release, the United States’ urban population increased 12.1 percent from 2000 to 2010, compared to an increase of 9.7 percent during the same time period for the entire nation.\(^11\) The U.S. Census Bureau map below illustrates the percent of county populations throughout the United States living in urbanized areas.
Water Scarcity

In May 2014, the U.S. Government Accounting Office (GOA) updated its oft-cited 2003 report that provides an overview of trends in freshwater availability and use. As is illustrated in the figure below, 40 of 50 state water managers expect water shortages in some portion of their states under average conditions in the next 10 years. One state was reported as expecting statewide shortages, 24 states expect regional shortages, and 15 expect local shortages. Since the GOA report, California is now experiencing a critical statewide water shortage, with only a year left of surface storage supply. California’s situation has drastically changed since the release of the 2014 GOA report. In fact, after a record low snow fall in 2015, on April 1, 2015 California Governor Jerry Brown ordered a mandatory water use reductions for the first time in California’s history.
Further exacerbating the water crisis are the following factors:

- “Nearly one in 10 U.S. watersheds is “stressed,” with demand for water exceeding natural supply.”
- The Natural Resources Defense Council (NRDC) examined the effects of global warming on water supply and demand in the contiguous United States and found that more than 1,100 counties—one-third of all counties in the lower 48 states—will face higher risks of water shortages by mid-century as the result of climate change. More than 400 of these counties will face extremely high risks of water shortages.
- A report published by the Alliance for Water Efficiency documents 13 cases of communities dealing with their water shortages by enacting water offset land use policies. These policies require new development to offset its water use by reductions elsewhere so as to be “water-neutral.”
- The Aqueduct Water Atlas shows water risk and documents that the areas of highest risk also coincide with the areas of greatest growth:

**Planning Challenge:** knowing that the United States will grow by 90 million people in the next five decades, how will urban areas plan for growth and development, guide land use, and provide infrastructure, considering growing water scarcity and economic, social, and cultural trends that are occurring?

### 2. Climate Change & Sea Level Change

Communities throughout the country have reclaimed their waterfronts after years of postindustrial decline. On the whole, revitalization of the country’s waterfronts has been an important and laudable achievement. Spurred in part by cleaner waters after the Clean Water Act, and paired with increased land availability after industrial decline, the nation's waterfronts have seen an unparalleled revitalization.

As the global climate changes, risks are increasing, associated with rising sea levels and increased severe storm events. The Intergovernmental Panel on Climate Change (IPCC), a scientific intergovernmental body under the auspices of the United Nations, issued its fifth climate assessment in 2014, projecting increased sea levels and greater storm activity as a result of global climate change.

As sea levels rise, the lowest lying communities—those that are just barely elevated above today’s current high tide—may experience monthly or even twice-daily high-tide flooding. Unlike major storm events, this slowly developing problem may first present itself as nuisance flooding—ponding or pooling of low-lying streets. But as sea levels continue to rise, inconvenience and nuisance may become questions of life safety as roads may become impassable for emergency vehicles.

Moreover, higher sea levels may also impact infrastructure, particularly stormwater outfalls that may be blocked by higher tides, causing increased inland flooding.

Climate change is also expected to increase the severity and intensity of storms. There are four primary hazards associated with severe storm events:

- Storm surge
- Wave action
- Rain
- Wind
Each of these hazards can lead to significant damage in a community—causing utilities and infrastructure to fail and significantly damaging homes and buildings. The nature of the risk varies greatly depending on topography, land uses and the design of the buildings and infrastructure in the areas that flood. However, future land-use policy and creating resiliency in existing communities will be critical to manage risk.

Environmental dangers related to trends in climate change, such as flooding, present special risks to lower-income communities and communities that are less likely to receive news and heed warnings from mainstream weather services. Flooding has increased in frequency in the Northeast and Northwestern United States as extreme precipitation events have become statistically more frequent there. Historically, lower-cost land for housing was available in floodplains in cities, as well as in rural areas. Today's flood zones typically contain more low-income residents with less education and less trust in mainstream news sources than the surrounding upland areas. Floodplains may also house more recent immigrants with limited English language skills and reduced access to information as a result.

These are the residents and neighborhoods that may decide to shelter in place against the advice of municipal authorities, either because they do not receive or understand the instructions to evacuate, or because they simply do not have the financial resources to drive out of town and temporarily relocate. Risks are weighed differently in these communities, where taking the precaution of evacuating from flood events carries a much higher practical price.

Planning challenge: With a projected increase in extreme weather events related to climate change, as well as increased flooding from sea-level rise threatening coastal and low-lying communities, how will planners engage communities and elected officials to effectively address current and future land-use policy, design standards, and resiliency practices in order to mitigate and avoid loss of life and property.

3. Resource Conflicts
The Organisation for Economic Co-operation and Development (OECD) has identified four types of risk that must be minimized to achieve water security:

- Risk of water supply shortage (including drought)
- Risk of inadequate water quality
- Risk of flooding
- Risk of undermining hydraulic and biological functions of water

Water has a major impact on public health and safety, the global economy, biodiversity, and the natural environment; improving water security for all populations reduces conflict and improves the ability of communities to function more sustainably.

A broad array of resource conflicts exist, examples of which are listed below.

- Reasonable cost incentives linking flooding impacts to flood insurance rates have not yet been established (Grimm-Waters Act 2013).
- Public health laws have limited the creative use of graywater, stormwater, and reclaimed water in many states, and there is little federal policy on acceptable on-site treatment/reuse of graywater and blackwater.
- Many drinking water supplies are already over-allocated and overused, in part as a result of a historical disconnection between policy makers and available scientific information.
• Droughts and loss of snowpack that are predicted as a result of climate change will reduce the quantity of water that is available for supply allocation from reservoirs and rivers. We will face increasing conflicts over the priorities for water use, as in California’s current drought, where farmers and corporations involved in agriculture are demanding water at the same time urban systems need water and ecosystems need water.

• Water is currently not priced to reflect its inherent value with externality costs. Therefore, conservation is often not encouraged, because without pricing increases, reduced water use reduces short-term revenues of water supply agencies. However, conservation has been shown to reduce water rates in the long term, particularly where communities can avoid new infrastructure costs by lowering water demand.

• Water is increasingly used for extracting natural gas by hydraulic fracturing—a process that has been estimated to use 70 to 140 million gallons of water each year in the United States.18

Resource conflicts must be resolved in order for planners to provide more sustainable water management. Strategies are required to overcome barriers to collaboration among involved professions, to address resource conflicts, to expand conservation approaches, and evaluate how we value water. At present we principally price and value the treatment and delivery systems—and not the water itself.

Planning challenge: Given the economic, agricultural, public health, and social/recreational demands for water—which is causing challenges for resource management and competition for supply—how will cities prioritize their needs for water and effectively price these needs while also adapting more innovative, creative methods to reclaim water?

4. Aging Infrastructure

In 2013 the American Society of Civil Engineers (ASCE) released its Report Card for America’s Infrastructure. Drinking water infrastructure was given a “D” grade—indicating it is in poor condition. The report notes that there are an estimated 240,000 water main breaks per year in the United States and significant investment is needed to maintain the country’s water supply and wastewater infrastructure. Another report issued by Chicago-based research institute Center for Neighborhood Technology cites that America loses nearly 2.1 trillion gallons of water due to leaks in our aging infrastructure.20

The U.S. Environmental Protection Agency’s 2011 Drinking Water Infrastructure Needs Survey and Assessment suggests that there is a $384.2 billion need for capital improvements over the next 20 years for public water systems in the United States.21

In 2012, the American Water Works Association released, Buried No Longer: Confronting America’s Water Infrastructure Challenge. The report documents that “...a large proportion of US water infrastructure is approaching, or has already reached, the end of its useful life.” It also says, “Investment needs for buried drinking water infrastructure total more than $1 trillion nationwide over the next 25 years, assuming pipes are replaced at the end of their service lives and systems are expanded to serve growing populations.” This investment does not include money needed to shift to more distributed, closed loop, water management. Delaying this investment could mean either increasing rates of pipe breakage and deteriorating water service, or suboptimal use of utility funds, such as paying more to repair broken pipes than the long-term cost of replacing them.22

This is a significant concern for planners who need to accommodate growth within their communities, which are often plagued with antiquated water infrastructure. Add to this situation the need for communities to incorporate “green” infrastructure and infrastructure for water reuse into their existing older systems23.
Planning challenge: Knowing that much of America’s water infrastructure is in poor condition, how will urban professionals work together to implement more forward-looking asset management, and create infrastructure renewal policies that consider the best investments for the next 100 years, rather than replacing infrastructure from the past 100 years, and promote greener, more distributed infrastructure and more sustainable maintenance practices.

5. Impact of Water Crises

The Global Risks 2015 10th Edition report by WEF lists “water crises” as the top global risk in terms of potential impact. It also identifies “Failure of climate change adaptation,” “Failure of urban planning,” and “Failure of critical infrastructure” as notable future risks requiring careful management. The risk and impact rankings are based on WEF’s annual Global Risks Perception Survey, completed by almost 900 members of the WEF’s global multi stakeholder community. Improved planning processes are recommended to build resilience against such risks and to better plan our water future—but it is a challenging and complex process, as described in following sections that illustrate the many “players” involved in the water resource domain, and their general lack of integrated action.24 Water resource management needs to be interdisciplinary, not multidisciplinary!

![Figure 1: The Global Risks Landscape 2015](image)

Source: Global Risks 2015 10th Edition report; World Economic Forum
Planning challenge: Understanding that the only way to address a global water crisis will be through interdisciplinary cooperation, how will planners build their capacity to work with other urban professionals and stakeholders to improve urban planning practice as it relates to water? And how do planners “own” a seat at the table when decisions on investments and governance are made that so much affect the interdisciplinary and comprehensive approaches needed, often across political boundaries? How does this comprehensive framework for planning action play out in our fragmented government structure, without the necessary collaborative processes? How can planners be leaders not only on planning issues but also on the process that leads to these comprehensive and collaborative approaches?

B. Elements of Water Vulnerability

1. Public Health and Safety
The health, safety, and general welfare of American communities are inextricably linked to water management. Water must be safe for drinking and available in adequate quantities for consumption. It must also be safe for fishing and swimming, since we know these activities are practiced by many communities and that their impacts affect children as well as adults. People must be safe from flooding. Citizens deserve to know the flood risks for their property. Flooding also impacts current transportation routes for both commuting and emergency services, which must be reliable as sea levels rise and storm patterns change.

Flooding is the number one natural disaster in the United States. According to the National Weather Service, the 30-year flood loss average for the nation is $8.2 billion. The National Flood Insurance Program (NFIP) experiences total claims paid each year for the last 10 years in the amount of $3.8 billion, which has a significant impact on the national economy. Not only is the economy impacted, but the quality of our drinking water is jeopardized by the debris that washes into our water supplies. Planners can utilize land-use policies to protect property and our water quality as flood events occur, if they contain the appropriate disincentives to building in and near the floodplain, and require natural land buffers along streams to improve the quality of runoff. As we continue to preserve the environment and construct civil engineering improvements to reclaim water and recharge aquifers, we must factor in opportunities to reduce flooding by capturing storm runoff and storing it for more productive uses.

The public perception of “wastewater” as a product to be disposed of needs to shift to a culture of one that embraces the use of reclaimed wastewater. Communities across the United States are increasingly reclaiming wastewater and considering it a valuable resource. East Bay Municipal Utility District in Oakland, California, now runs the country’s first net-energy-positive wastewater treatment plant. 2010 Wastewater Effluent Utilization for Phoenix Active Management Area Data source show that 82 percent of the 371,489 acre-feet per year of total wastewater produced was reclaimed for power, agriculture, recharge, ecosystems (environment), and discharge.

Justice requires that the risks to health and public safety from water, or lack thereof, be equal across income levels and other measures of human diversity, so that all citizens share equally in the benefits, as well as the risks and effort of maintaining sustainable water systems.

Planning challenge: Given that water is essential to U.S. public health and safety, what tools, methods, and policies can planners use to better assist and advocate on behalf of all communities exposed to water-based threats, such as flooding and degraded water quality, both now and in the future? How do we plan for water resources in such a way that they can become more resilient in light of future shocks and stresses?
2. Natural Resource Function

Human overuse of scarce water supplies and water pollution threaten the inherent value of characteristic regional biodiversity, along with the ecosystem services provided by plants and wildlife. New regional patterns of changing surface water levels are also problematic for ecosystems, as they most likely will lower water levels in major inland lakes and raise tide levels on the ocean coasts. In addition to effects that emerge locally, surface and groundwater systems influence the migration and dispersal of both aquatic and terrestrial wildlife, and the dispersal and germination success of plants. Drying landscapes will alter the capacity of animals and plants to disperse to new locations where conditions are more suitable for them. Coastal areas that flood incrementally or in temporary events may release toxins into the aquatic environment, as landfills and other contaminated sites become submerged and the material that serves as protective caps may erode. These toxic releases will affect plants and wildlife unless they are prevented by careful planning and redesign.

Growing energy needs drive the expansion of hydraulic fracturing (also known as fracking). This practice presents new problems for water quality across the gradient from rural to urban communities. This technology for extracting natural gas also uses large quantities of water—often in regions that already experience high water stress and very limited availability—and also create the potential for water supply contamination from discharges of fracking wastewater. Small communities are often asked to accept agreements to allow fracking without the expertise and resources to independently evaluate or monitor the potential impacts on their water quality and water supply.

As land develops, the past trend has been toward controlling the natural environment and confining flows to channels, basins, and stormwater drains under streets. These changes in land cover are the cause of hydro-modification: changes in a site’s natural runoff and transport characteristics. Impervious surfaces, compacted soils, deforestation, and topographic modifications alter the distribution and flow of water across a site, and the speed at which it drains to streams. These changes impact the water balance on-site. Less water infiltrates and is available for groundwater recharge and subsurface flows which contribute to the base flows of receiving streams.

Increased volume of overland flow imparts physical (erosive) impacts on receiving streams and transports pollutants that have collected on impervious surfaces. To address these impacts to waterways, requirements to use green stormwater infrastructure or low-impact development techniques are being incorporated into federal stormwater programs across the United States. EPA’s Impaired Water/TMDL program will also promote green infrastructure under EPA’s Municipal Separate Storm Sewer System (MS4) program.

Hydroelectricity is the largest renewable source for power generation and its share in total electricity generation is expected to remain around 16 percent through 2035. Most of the water used for hydropower generation is returned to the river, although there are important impacts on timing and quality of streamflow. Roughly 75 percent of all industrial water withdrawals are used for energy production and result in cooling water discharges. Energy is almost always required for two components of water supply: pumping and treatment (before and after use).

Planning challenge: As water supply and quality are impacted by urbanization, and efforts to control the natural environment through engineered solutions increase—thereby damaging the natural environment and threatening ecosystems—how will planners work to advocate and implement more natural solutions that support a holistic approach and celebrate water as a resource needed to sustain healthy communities and cities?

3. Economic Growth

Inefficiencies and failures in the functioning of American water systems—in terms of the quality and quantity of our water supply, wastewater treatment processes, and management of drought and flooding—hurt the attractiveness
of American cities and rural areas for investment by the private sector. Cities that lose up to 50 percent of treated drinking water to leaks, or are under frequent boil orders because of pipe breaks and service interruptions, do not inspire the confidence of investors choosing where to locate jobs and housing. Many cities are unprepared for floods that may be caused by a combination of storms and deferred infrastructure upgrades.

Over the past 60 years, the urban public sector has invested in cities to encourage development that seemed to counter the trend of suburbanization. Today’s challenge is to accommodate higher-income housing in cities, while requiring affordable mixed-income developments. Strategic capture of new development fees can help reinvestment in aging urban services, particularly in lower-income and mixed-income neighborhoods, instead of using only public sector investments to catalyze higher-income private sector development. Suburban cities and towns may very well house the next generation of low-income families, and experience declines in property values that threaten the level of service provided to those lower-density suburban areas.

Planning challenge: As communities continue to feel the negative externalities of poor and inefficient management of American water systems, how can planners help elected officials and other urban professionals create and update policies and incentives that will lead to new economic solutions that directly result in the improvement of local and regional water systems?

4. The Cost of Water and Pricing Mechanisms

Water is essential for human life, provides numerous benefits (and threats if polluted) to human health, and is crucial for ecosystem function and the man-made and natural environment. Water also provides essential economic and aesthetic values to human settlements. Historically, water has been treated as a common good. Economics teaches us, however, that anything of value without an appropriate price reflecting that value will be overconsumed or inefficiently managed. Indeed, notwithstanding many demands upon, and key uses for, our water resources, mechanisms to better understand the value (price) of water have been insufficient, inconsistent, incomplete, and haphazardly applied.

Planners, designers, engineers, biologists, farmers, accountants, economists, and other professionals need to develop and apply cost-benefit procedures that more fully capture (a) the benefits from water in their projects and landscape interventions, (b) the negative impacts on the water supply of those projects and of certain actions (pollution), and (c) the impact on lives and capital from too much (floods) and too little (drought) water. A few sectors are worth considering.

The agriculture sector has traditionally paid very little for the water it consumes. Thus, the use of water across regional and local landscapes, and across the many types of crops, livestock, and processing associated with agricultural products, is inefficient. High-value, water-dependent crops are presently grown in arid areas, and crops needing less water are often grown in areas with a reliable water supply. The tortured economics of this is frustrating. Indeed, recent droughts in the United States demonstrate that current practices for crop selection, plantings, and harvesting schedules are not optimal when water is scarce.

One California example makes this case: Almonds, a high-value crop, require a steady supply of water, which implies a reliable source of readily available water. That latter condition applies in the fertile California delta only some of the time. Water storage can make up for seasonal shortfalls, but long cycles of drought make storage investments questionable. Freshwater diversions, and the infrastructure needed to supply that, provide only limited relief. Almond growers, and producers of other high-value produce in the Central Valley, have begun extracting substantial amounts of groundwater to supply their operations and maintain their livelihoods and local communities.
The impacts (and costs) of substantial groundwater extraction, however, are difficult to predict, especially given the continued drought conditions in California. Moreover, because there are no widely accepted valuation and pricing systems for surface- and groundwater, and for water storage infrastructure, growers and other users of freshwater in the California Central Valley are left to make decisions with poor information. Other farmers are foregoing plantings, fallowing land or destroying crops and trees.

Much water from the delta is transported to southern California for uses there, via systems that consume large amounts of energy and allow for considerable evaporation. Some water is targeted for important environmental needs in the delta. Were surface- and ground-water properly priced, and were that price communicated widely, more efficient decisions about what water to use where, when, and how would be made much more efficiently. Put another way, more efficient water pricing in California, where water scarcity is common, would likely lead to more efficient uses of the highly productive and beautiful California Delta and Central Valley.

Urban water infrastructure shows similar inefficiencies. Utilities show substantial water price variability between cities, states, and municipalities, even when the water is drawn from a shared source and supplied by systems of similar age and capacity. Some municipalities and utility commissions, in an attempt to discourage overconsumption, put a price premium on consumption above certain norms. Other cities charge the same price for the first gallon and the millionth gallon. There may be efficiencies of scale—marginal cost of production, distribution, and amortization of capital costs—being passed on to the consumer in these latter instances, but these do not capture well other economic uses of water, especially in times of scarcity. In short, the great divergence in the price of water and the practices governing the distribution of water often encourages overconsumption, but also overinvestment in the infrastructure needed to supply the water.

Similar issues arise in conjunction with water quality. In recent decades, considerable investments have been made to achieve safety and quality of water for humans, ecosystems, etc. We are learning more every year about detrimental impacts caused by pollutants in our waters. State and federal standards on quality are improving, and reflect some cost-benefit analysis supporting approved interventions. It is quite clear, however, that the long-term and downstream impacts on human health, ecosystems, and local economies caused by chemical and oil spills, or by individuals disposing of expired pharmaceuticals via their sewer systems, are externalities difficult to monetize. Similarly difficult to monetize is the transfer of such externality costs to the potable water treatment process. And these are but two well-known examples. Without proper monetization of those costs—and courts in Montana, West Virginia, and Louisiana are presently struggling with this issue—our water systems retain a residual risk that is likely at severe odds with proper standards for human and environmental health. At the same time, the provisions of affordable potable water for all is essential to equality and environmental justice goals, so significant changes in costing water services can have unbalanced economic impacts on a community.

The economic benefits of proper flood protection have gained much attention since Hurricane Katrina in 2005 and Superstorm Sandy in 2012. U.S. federal policy applies a national 1/100 year standard that may be inappropriate to the human and economic risks facing certain cities. Indeed, one could easily argue that certain U.S. cities warrant, on an economic basis, a much higher level of protection than they have. When those areas face a flood, the damage and recovery costs are far higher than the typical protection costs (amortized over its useful life). Indeed, the U.S. Army Corps of Engineers concludes that $1 spent on flood protection infrastructure has a return of $4, and yet the Corps has a backlog of projects that runs into the tens of billions of dollars. That ratio will likely increase as sea levels rise and thus flood risk increases—along the U.S. coastline and in some of its most important cities.

On a more positive note, our understanding of the positive benefits provided by natural infrastructure is increasing by leaps and bounds. Over the last decade, economists, biologists, hydrologists, and other professions have developed
sophisticated tools and models to assess, quantify, qualify, and monetize natural ecosystem services. Such tools enable developers, planners, landscape architects, and others to justify, on an economic basis, the inclusion of natural systems in their projects. By doing so, projects costs are lowered, returns on investment are higher, and our natural environments, including those primarily impacted through or by water, are maintained or increased.

5. Instability in Political and Governance Systems
At the same time planners and designers bear the responsibility to provide effective urban infrastructure, with all its multifunctional benefits, but they also have the responsibility to act as role models and even whistleblowers on the issue of providing good governance. In times of rapid change, such as our current era of urban reinvestment and extreme climate disruptions, planners and designers must attend to (and sometimes redefine) the nature of thoughtful public policy. Planners and designers who act as staff to elected bodies, or play integral roles in public agencies, or who represent private interests in public decisions, must all contribute to transparency and ethical intergenerational decision making at a time when quick decisions may shortchange the future. Methods of valuing the multiple benefits of infrastructure investments should fairly evaluate their value to future generations, as well as today’s citizens, in order to judge the capacity of these systems while the environment changes. Debt periods that are selected to pay for today’s infrastructure investments extend far into the future, and must not be allowed to prevent future generations from making additional investments to adapt to new conditions.

Planning challenge: In an era of 24-hour news cycles with social media intertwined, how can planners and colleagues from affiliated professions better support and educate each other, allowing us to continue advising elected officials and agencies ethically, responsibly, and scientifically on politically sensitive topics that will impact current and future generations?
IV. THE CHALLENGE FOR PLANNING

What should planners consider in addressing the challenges of water management?

Given the breadth, scope, and complexity of achieving more sustainable water management, planners must be able to clearly identify the challenges, the questions that need to be addressed, and the sciences that form the boundary conditions on water management. Neither the planning profession, nor APA, is alone in recognizing the urgency of addressing the complex issues affecting water management. Many agencies and organizations, both domestic and international, are dedicating extensive resources to create a comprehensive framework that can help guide planners in this effort, including the UN-Water program, which is mentioned earlier in this report.

Questions for Planners When Considering the Water Environment

- How are the many competing interests that are involved in water being appropriately balanced?
- What is the basis of decisions that favor certain development at the expense of other development?
- What are the scope and conditions for increasing water efficiency in different water use sectors?
- What analytical tools are available to enable more efficient development and more equitable allocation of water?
- How can the best use be made of the water that is safely available?
- Which additional measures can be put in place to protect water resources and water supply?
- Which institutional and legal mechanisms can ensure adequate professional coordination and public engagement?
- What kind of information is needed by water professionals, and how is public ownership of water-related problems to be ensured?

Source: Coping with Water Scarcity, UN-Water, 2005

In sorting out the many issues surrounding water scarcity, UN-Water has presented several questions that the Water Task Force also viewed as relevant to the general topic of water management. The questions, noted in the box above, were useful as the Water Task Force progressed in its analysis.

Planners have the potential to participate in addressing all of the challenges listed above. We have enormous capacity to find technical solutions to individual issues, but we need a comprehensive approach to “connect the dots,” especially on issues like scarcity, safety, and quality as they relate to resource management on a regional scale. Planners can work on a topical and spatial scale that is more expansive than the local jurisdiction. While bound in a way by the authority granted by the jurisdiction, the topical approach forces the planner to create plans and schemes that are larger and more regional in scale.

Where planners are working collaboratively with all the disciplines that address water, they create more resilient and strategic solutions. This requires an integrated approach, which is typically outside political authority and traditional land use management roles. Who should initiate this expanded and more interdisciplinary role for planners? All the partners need to initiate a collaborative approach together—positioning for leadership causes conflict over the degree of control and collaboration is often not advanced by hierarchical structure.

The array of opportunities for action:
- Policy and Legislation
1. How can planners better address key drivers and causes of water vulnerability?

Improved planning practices with respect to water would better address key drivers and causes of vulnerability as they relate to water, by understanding the environmental/hydrologic and economic/political systems which form the structure of the issues planners face today. By employing a systems-based approach we can better understand why water management is complex and conflict-ridden, and how we reached this point of vulnerability. The more expertise that planners have in water resource issues, the greater will be their ability to provide more sustainable management opportunities, using land-use planning, infrastructure planning, and environmental and economic planning tools.

The public role of planners allows the opportunity to convey to the greater public the complexities of water management in a way that make it clear that the water story begins in the natural world, and not in man-made structures (pipes canals, levees, plants, etc.) which is often how society engages with water at present. Planning can increase awareness of the drivers and causes of water vulnerability explored herein, by reintroducing and reconnecting communities to their water sources and natural systems, and by better describing options and trade-offs associated with alternative approaches to water management.

The water used daily in homes and business usually originates somewhere else—in some cases in a different state—and its transport has been engineered so as to increase its convenient availability and convenient use for society’s needs. While such convenience can provide social, economic, and agricultural benefits, it also introduces energy, resource, and sustainability dysfunction and inefficiencies.

It is important that planners clearly understand how to effectively navigate this tension, insofar as planning provides significant opportunity to address water vulnerability, dysfunction, and inefficiency. Rapid urbanization is forcing daily decisions on how to use our water resources, resulting in changes to the natural environment. Planners can incorporate dynamic, nature-based, sustainable systems and not solely rely on conveyance and treatment to solve immediate problems. Planners can help reconnect society to water’s natural setting, and to identify the complex interdependencies between water use, wastewater disposal, runoff management, surface and groundwater resources, and the natural environment to start solving the many challenges of water.

2. How can planners build collaborative strategic partnerships and better operate across professions, communities, and regions?

We often look to federal and state government systems to fund regional scope projects, especially if they cross jurisdictional borders. However, we can achieve success by starting at the local level and getting citizens engaged in stronger economies and healthier ecosystems. We can evaluate our regulations to assure they encourage innovative ideas from the private sector in how they integrate stormwater management and reuse of wastewater
into development. Technology is advancing. Private industry is a leader in this and should be able to play a big role in better management of water.

Water is ubiquitous in the urban environment and water services are provided every day, every moment—including drinking water treatment and distribution, wastewater collection and reclamation, stormwater management services, and as part of the energy water nexus. The connection with land use and community planning is complex. By connecting with the larger associations and foundations that are dedicated to water issues in the urban environment, APA can leverage expertise, initiatives for sustainability and resiliency, and identify synergy with stakeholders.

The larger service sector associations included for this discussion include the American Society of Landscape Architects (ASLA) that is involved with the green infrastructure industry; the Water Environment Federation (WEF) and Water Environment Research Foundation (WERF), which have both been focused in the water quality industry; and the American Water Works Association (AWWA) and Water Research Foundation (WRF), which have been focused on the potable water industry. As the industry moves toward an integrated “One Water” approach to water issues, those historical focus areas have blurred.

There are many more organizations involved in water resource planning and management, so this listing of involved entities is not exhaustive, but rather representative.

- The American Society of Landscape Architects (ASLA) has been a leading promoter of use of green infrastructure as an alternative to gray infrastructure for several environmental issues including the water challenges of flooding, water quality, and source water protection.
- The American Water Works Association (AWWA) and research partner organization WRF have traditionally focused on potable water industry needs, but as water challenges rise, are increasingly focused on integrated water solutions. Their members and subscribers are involved in everything from source water protection to conservation promotion and user attitudes toward water use.
- The Water Environment Federation (WEF) and its research partner organization, WERF, have traditionally been focused on wastewater and stormwater service needs, but once again as the water challenges rise, these organizations are also increasingly focused on integrated water solutions.

Currently WERF and WRF are working jointly on a research project to characterize the barriers to integrated One Water Management. The report and user-friendly guide to Innovative Institutions for One Water Management will be available in spring 2015. Within that report, the connection between water and community planning was identified as an institutional issue. Communities are working creatively to bring planners and water service sector professionals together in communities such as Seattle and Cincinnati.

Water service sector professionals recognize that the ways in which buildings and neighborhoods are planned and constructed can offer solutions to a community’s water challenges regardless of drought, flood, or water quality impairments. Enabling planners to interact early and often with water service sector professionals to integrate water system needs and opportunities with the other infrastructure services within the community will help achieve resiliency and sustainability of critical water services.

3. What role does design and design thinking play, from the planning research phase until planning strategies and beyond towards implementation?

Planners occupy a unique position in the land management and development process. Design and design approaches are often applied in the architectural phases of construction, where the focus is on mostly automatic utility extension and inclusion of more efficient water using home or business designs, including water supply
appliances, stormwater piping, and sewage conveyance. Rather than assuming that new water and wastewater infrastructure service can always be extended on an affordable basis, planners should work with utility leaders in the community to plan from the start how to best maximize existing resources and infrastructure. As cited earlier, some communities have already adopted ordinances to require that new development be water-neutral; these kinds of innovative approaches work at the front end of the planning and design process, rather than at the back end of water and wastewater infrastructure expansion.

Utilities believe that they have a “duty to serve,” which historically has meant that they were reluctant to get involved in local planning decisions, thinking that it was their duty to provide the water services that their community demanded. But long-term direction and sustainable water resource planning will now require the reverse—it will require that water professionals and planners work more closely together.

Contemporary spatial design faces a political paradox. To address emerging environmental challenges and the risk of climate-related disasters, it must transcend political boundaries to operate regionally. But the regional scale is absent in our current formal governance structures. If they do exist, these regional authorities lack the political authority to decide comprehensively on regional policies, projects, and investments. At the same time, the capacity, as well as the focus of many government organizations is not adequate when it comes to a resilient and comprehensive approach of our uncertain future. Due to the absence of resources and a too short-term focus, these agencies lack leadership and power to confront the challenges and to collaborate on the necessary scale.

With this in mind, designers must engage both space and politics, proposing environmental interventions at the scale of the region and address, organize, and collaborate with political coalitions that have the authority to see those interventions through. It is in this tangled context that the Hurricane Sandy-affected region found itself after the 2012 storm, as states, counties, and municipalities grapple with the reality of sea-level rise and climate risk.

As a way to address environmental concerns, designers are increasingly moving beyond distinct parcels of land in order to operate at the scale of the region. Urbanism has shifted toward a collaborative process merging the landscape, the region and the ecology with the urban issues and the different ways to address these by design. It provided an important framework for this type of approach by placing cities into a broader environmental context. While this approach has done much to advance urban theory, it comes with a shortcoming: regions are politically and administratively impotent. To effectively implement regional strategies, designers must consider the political and administrative landscape, forging inter-jurisdictional coalitions in the pursuit of interests shared between distinct political units.

Spatial planning can no longer be the trade-off of interests. Instead, spatial planning gives direction and shape in visions and stories, in laws and regulations, and through programs and projects—all contributing to the wider perspective of a social, economic, and cultural task. This stretch, this arc of operation is precisely what makes planning socioeconomically and culturally driven. Such planning calls for design excellence to make explicit and confront differences rather than finding generic solutions. In such cases, design and innovation can lead spatial development process.

Test, perform and reflect, with old, new and unexpected partners, with an urban design agenda can emerge from the collaborations in our cities, creating collaborative agendas for improved water management through alliances. Such alliances can make design political.

4. What knowledge and tools should be applied? What new tools are needed?
Planners need both better information about water resource issues (including timely feedback loops on actions taken), and an expanded toolset for water resource scenario planning. Planners also need to help prevent misinformation from being used to promote false vulnerabilities and risks or to skew evidence or advance
dependency on centralized infrastructure that may increase a system’s vulnerability. An improved analytical framework is needed to help guide the effective use of data for building community-driven resilience and water sustainability.

Geographic Information Systems (GIS) can provide a common platform for knowledge sharing and planning between the water and wastewaters sectors of a community, and its planning leaders and decision processes. Historically communities and their water utilities have not shared common platforms and have been operating completely independently.31

5. What new professional strategies and competences are needed?

Given the interdisciplinary nature of water management challenges, and because solutions to water resource challenges range from economic to social to technical, it is reasonable to begin to anticipate an expanded education and training process to prepare new planning professionals. This is not to say that the current type of professional planner is failing to produce or achieve, simply that the range of planning expertise will need to grow and evolve as the nature of planning challenges evolve and become more interdisciplinary.

While fragile, this evolution of the professional planner is an important and necessary step forward. Understanding how to better address the plethora of issues that fall under water management (including water quality, scarcity, and safety) will help create an ecologically sound and economically sound urban system. And understanding water issues will help the planner better understand how urbanization can and should work. By creating education opportunities that reach beyond the classroom and include executive and field-based learning opportunities, we will see a new generation of planners capable of creating more sustainable cities that are designed to protect natural and water resources.

6. How can planning address uncertainty and risk, and anticipate instability?

WEF’s Global Risk 2015 report highlights the importance of understanding systemic risks and long term thinking in order to mitigate these risks for future generations. Of the top 10 global risks of highest concern for 2015, water crisis is listed first in terms of impact and eighth in terms of likelihood, while several global risks can be explicitly linked to water-related issues (failure of climate change mitigation and adaption, greater incidence of extreme weather events, food crisis)32.

Table 1: Ten Global Risks in 2015 (Source: WEF Global Risk 2015)

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<thead>
<tr>
<th>Top 10 risks in terms of Likelihood</th>
<th>Top 10 risks in terms of Impact</th>
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<tbody>
<tr>
<td>✪ Interstate conflict</td>
<td>✪ Water crises</td>
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<tr>
<td>✪ Extreme weather events</td>
<td>✪ Spread of infectious diseases</td>
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<tr>
<td>✪ Failure of national governance</td>
<td>✪ Weapons of mass destruction</td>
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<tr>
<td>✪ State collapse or crisis</td>
<td>✪ Interstate conflict</td>
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<tr>
<td>✪ Unemployment or underemployment</td>
<td>✪ Failure of climate-change adaptation</td>
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<tr>
<td>✪ Natural catastrophes</td>
<td>✪ Energy price shock</td>
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<tr>
<td>✪ Failure of climate-change adaptation</td>
<td>✪ Critical information infrastructure breakdown</td>
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<tr>
<td>✪ Water crisis</td>
<td>✪ Fiscal crises</td>
</tr>
<tr>
<td>✪ Data fraud or theft</td>
<td>✪ Unemployment or underemployment</td>
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<tr>
<td>✪ Cyber attacks</td>
<td>✪ Biodiversity loss and ecosystem collapse</td>
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The report also states that the frequency of uncertainty and risk is increasing as is the impact such risks will have on a global scale. While this can justifiably been considered bad news, the good news is that in many cases, there is a strong interaction and interdependency of these risks on a larger scale (this is evidenced by how many of the top global risks involve water, for example). This is where the planners and their skillsets become invaluable, as we are trained to address uncertainty on a larger scale and to connect the dots between the disciplines.

Planners have seen from experience that the planning process should be flexible and adaptive. This allows planners to devise strategies that are inherently resilient and able address change. Planners are typically skilled in addressing uncertainty with respect to future conditions, but planners have less training in addressing the uncertainly of climate change, changing water resource conditions, and changing influences on water management. Water resource planning requires interdisciplinary thinking about integrated approaches to water issues—consideration of how the pieces fit together on a larger scale, with a longer time horizon. Planners are trained to analyze and understand the interdisciplinary nature of risks and uncertainty, but they need additional context in the world of water resources.

As our communities grow, an improved planning practice will anticipate that future patterns of growth and resource use will be very different than that experienced in the past. Relative resource abundance—including water—and lack of restrictions on many types of development were largely the norm in the past. The planner of the 21st century now faces resource scarcity, climate change variability, infrastructure deficiencies, funding shortages, and local political barriers.

The most common tools that have emerged to deal with planning uncertainty are scenario management and probabilistic modeling, which can help to manage risk and create more flexibility in local decision making. Scenario management or scenario planning can develop a range of possible future outcomes that will have an impact on resources such as water.

Many determinants of water demand are uncertain, such as population growth, future climatic conditions, and future economic conditions. Scenario planning can allow decision makers to plan for the future under a variety of possible conditions. See Appendix 2 for Resources Related to Planning for Uncertainty for additional planner resources.
V. RECOMMENDATIONS FOR IMPROVED PRACTICE FOR PLANNERS

The recommendations in this section address the six core themes (listed in Section 2) of our recommendations report. They focus on methods and examples that have been used innovatively and successfully to improve planning practice.

Recommendations with Respect to the Core Themes

1. Water is a central and essential organizing element in a healthy urban environment.

The first core theme is essentially the value proposition for water. It states that water has a central role in healthy urban environments, for water supply, natural “green” urban spaces, quality of life, health, and recreation. The central role of water is possible in all but the most arid geographies—and even in such cases, the careful use of water and the reclamation of storm water and wastewater is part of a sustainable urban fabric.

Supporting both the science and philosophy of water being a central and essential organizing element of a healthy urban environment is a basic planning value that improves the sustainable function of our built environments. And even in the densest urban centers, water features can be daylighted from old drainage (but not sewage) pipes and can be added and integrated into urban designs so as to recover the aquatic environments lost in many cities. Think in terms of a transect for the highly connective streams and streamside environments; one that reestablishes the relationship of residents to the original landscape and asserts the value of watersheds.

There are several examples of urban design and infrastructure planning practices where cities use this value proposition and central approach to guide development and changes to the natural environment, and as such are able to achieve the positive impacts of a well-integrated water resource management plan. Planners are uniquely suited to lead this integration of resource management and planning practice in the United States, in ways that technical experts cannot, via their responsibilities for the comprehensive plan, land-use regulation, and public engagement processes.

As noted throughout this report, a key role for planners is to help connect the dots—by engaging the full range of appropriate technical, scientific, and public engagement resources to explain, clearly and explicitly, how the water environment is both directly impacted by, and impacts upon, development, infrastructure expansion, and urban design. It is also incumbent upon planners to identify the close relationship of water to basic urban functions such as provision of drinking water, wastewater treatment, stormwater drainage, public health, and recreation. Most importantly, the planner must coordinate closely with the local officials and professionals responsible for those functions.

Planners must always seek to better integrate the professional disciplines that engage in water resource management, including: future land use planning and management; the science of water and aquatic environments; the engineering of civil/infrastructure works; and the design and landscape of urban settings. This requires that the full range of planning processes be re-evaluated to assure that they adequately recognize the central and essential value of water.

Planning practice has been heavily influenced in recent decades by development review processes, and master plan and zoning development and review processes, which historically did not fully recognize the intensely integrated and holistic nature of our water resources. Planners must also be acutely aware that rarely do political jurisdictions align with watershed boundaries and that there are often several political jurisdictions within a watershed that may need
to be coordinated. Therefore planners should be aware of the larger watershed context they are working within and how their work may be connected to larger watershed issues.

2. Planning practice needs to apply an integrated, systems-oriented approach to water management.

Integrated urban water resource management brings together previously disparate and uncoordinated activities, policies, institutions, and industries to effect positive, sustainable planning with regard to water resources, particularly water management, water use, and the infrastructure associated with this natural resource. The planning practice, by virtue of its talent and focus in collaboration and community engagement, and its tools to manage land use, has an important role to play in coordinating the various agencies involved in water resource management and water services, resulting in a comprehensive systems-oriented approach.

“Systems thinking” is a very Dutch approach, considering how the entire system functions and what its interdependencies are, rather than where the boundaries of the system exist. Systems-thinking is an approach that should be familiar to planners because of their focus on comprehensive planning.

When it comes to the water environment, planners can work to understand the complexities of integrated water resource management, and then can outline an approach that connects the different aspects of water on a regional scale. Planners can link physical resource information to social perspectives, institutional roles, affordability, equity, and future land use, illustrating, for example, how equity is connected to safety, how resiliency is connected to economy, and how economy is affected by scarcity. With this understanding, the planners can then identify the disciplines that need to be included in the dialogue, and how the various professional and political roles mesh and intersect.

Appendix 1 for examples from Seattle, San Francisco, New York City, and the state of Victoria (Australia) that depict how planning initiatives among governmental organizations, industry and business, residents, and resource managers have created beneficial change for integrated urban water resource management.

Watershed- and ecosystem-based approaches are being developed by our peer professional organizations and we have a responsibility to reach out to them and to identify ways to align water based needs and development with all urban development. There is also a need to reach across jurisdictional boundaries and have planners working for separate jurisdictions, but in the same watershed, work together.

It is possible to achieve healthier urban environments—in terms of urban economy, real estate value, capital investment, health and safety security, and climate readiness, using approaches and examples such as “One Water,” as being promoted by the U. S. Water Alliance.33

Integrated urban water resource management requires that planners be advocates for technical findings, including system interactions. Planners need more experience in facilitating the dialogue between the public, stakeholders, and experts, a dialogue that by definition needs to include system level issues related to water management. There are usually hydrological, ecological, and economic interdependencies, and planners can work to frame the questions that better illuminate those connections and lead to more effective decision making.
3. New mechanisms for interdisciplinary interaction are critical to effective water management (including urban planning/design, engineering, landscape architecture, architecture, hydrology, etc.)

New interdisciplinary, multijurisdictional (or interjurisdictional) approaches are needed for integrated water management because water systems are fundamentally cultural systems, developed for the purpose of meeting human goals and needs but limited by natural system boundaries and behaviors. Interdisciplinary approaches are more valuable when they lead to solutions that provide multiple benefits for each dollar invested, including recognition of the treatment and materials breakdown services rendered by wetlands, lakes, and streams and their ecosystems.

As green infrastructure or low impact development requirements are incorporated into federal stormwater permits for over 7,000 communities across the United States to address water quality impairments in streams and waterways, the need to address the impact of land development activities on waterways will grow. These communities will need to consider their land development activities and incorporate appropriate planning, regulation, and design elements to address water quality impairment concerns.

- Several important methods have emerged that can be adopted by other planning efforts, including gamification—the use of games as a component of learning during public meetings as a way of allowing members of the public to state their priorities and intentions
- Design competitions as a method to develop innovative proposals for physical planning
- Repeated workshop events to build relationships and allow for cross-cultural exchange on technical and social issues
- Utilizing asset management as a framework for comparing different physical plans
- Using a formal representative stakeholder process to move beyond fixed political differences
- Using quantitative modeling to set performance goals and meet them through series of interagency charrettes to move beyond standard objections to innovation

The examples in Appendix 1 employ some of these tactics, including the “Game of Floods,” an asset management framework designed to integrate characterizations of capital and maintenance costs over a 50-year period, along with characterization of benefits. Specific tools include the use of quantitative models to optimize design proposals in relation to functional goals and the use of decision-support models.

*It is impossible for a single profession to comprehend and identify all of the system interactions, and the opportunities to achieve multiple benefits, and to simultaneously engage in productive, inclusive conversations with a broad base of citizens and stakeholders who depend on sound water management.*

*Interdisciplinary efforts have proven to be transformative in their ability to synthesize the knowledge of different disciplines, and to guide decisions to improved outcomes. Planners must expand their ability to define the dimensions of water resource challenges, to work interactively with peer professions such as engineering and landscape architecture, and to use decision support and public communications tools to support an interactive work environment. Most importantly, planners must work interactively with their water and wastewater peers, to promote closer cooperation and sustainable water resource planning across these sectors.*

A large number of examples of interdisciplinary projects related to water management have developed over the last 15 years. Most of them involve landscape architects working with planners and civil and environmental engineers to
achieve a wider range of benefits from water management investments in cities like Portland, Oregon; Philadelphia; Washington, D.C.; and Minneapolis, among many others. Several examples can be used to represent insights that were gained repeatedly as teams of professionals and community members worked together, convened under the authority of elected officials and public agencies. See Appendix 1 for detail on these examples.

4. Planners need new and improved professional practices to manage water more sustainably and provide greater social equity for access
Sustainability and equity are concepts that are inextricably linked to one another. Without justice, a society and its systems will not be sustained by its citizens over a long period of time. On the other hand, societies that face repeated challenges because they have not planned for sustainability are unlikely to keep their capacity for justice intact over a series of major disruptions to civic life. Challenges such as urban gentrification and climate disruptions continue to place extra burdens on families who already suffer from reduced access to health care, quality education, and well-paid jobs.

As planning practice seeks to adapt to water management challenges, vulnerable communities will need carefully planned assistance to participate in that process. These communities may include non-English speakers, single parents who can’t afford child care during meetings, people without cars or with other mobility limitations, and people who feel that they have been marginalized and shortchanged historically and that their needs will be ignored once again. They may also need to see attention given to more short-term needs in order for them to consider longer-term adaptation planning, something that might actually result in changes that protect them and their children.

Planners working to help attain social equity must help assure that future investments in water-related infrastructure seek to redress imbalances in water resource availability and quality, improve resources and infrastructure in lower-income neighborhoods that would otherwise be overlooked by new private investments, and address repetitive flooding. Neighborhoods with a long history of pollution from past industry often do not have fishable and swimmable waters. Suburban areas that have long pipe systems serving relatively low residential densities may face declining property values (and therefore reduced investments from local public funds, even as these areas become a haven for lower-income families) as the cost of energy and infrastructure services rises.

New funding approaches, including regional funds, may be required to convert these water systems into more compact and efficient networks that support increased density within suburban communities and provide for water reclamation.

See the examples highlighted in Appendix 1, which provide details on both positive and negative impacts on sustainability and equity.

5. Innovative land use planning and urban design is needed to improve/protect water environments
Historically, rainfall runoff and sewage in the urban environment have been considered a liability, not a resource that enhanced urban space and urban life except for the transportation value of waterways and as direct access to drinking water sources. This is largely due to the outbreak of disease in early American cities in the late 18th and 19th centuries, as well as the need to remove runoff from city streets that often caused flooding, because facilities had not been developed to drain the water. Concern over yellow fever and typhoid epidemics, and the industrialization of, and noxious waste discharges to the Schuylkill River in the 18th and 19th centuries, motivated Philadelphia to create one of the nation’s first public water supply and combined sewer systems.

The history of this need to treat water supply and drain rainfall is well described in the five paradigms of water offered by Novotny and Brown. The paradigms (historic phases of water management in U.S. cities) most relevant to this discussion of innovative practice are summarized below:
• The second paradigm was the engineered construction of water storage facilities, pipes, and drainage facilities. Drainage facilities address stormwater runoff and stream flows resulting from rainwater and snowmelt, including the contamination of drainage by the often purposeful addition of human waste.
• The third paradigm involved awareness of the degradation of water quality resulting from the growth of industrial cities. Cities then began to provide water treatment both at the source of supply and at the point of disposal to receiving waters.
• The fifth paradigm involved the design and creation of an urban landscape that mimics but does not necessarily reproduce the processes and features present in a natural system. This new or retrofitted urban landscape includes storage-oriented drainage with less reliance on underground conduits and more surface storage and infiltration.34

Urban streams are often polluted by urban runoff and combined sewer outflows, as well as being eroded by floods. Past development practices have often resulted in alteration of urban streams to increase flood carrying capacity by concrete lining and relocating streams into culverts, whereby historic streams have been relocated to underground pipes to convey combined sewage and floodwater. These modifications significantly degrade the habitat for fish and aquatic species as well as the urban landscape. Such drainage alterations shift local flooding downstream due to alterations of the natural landscape.

Improved urban design calls for managing water more holistically and more naturally in cities. It involves what is known as water-sensitive urban design and low-impact development (LID). In this case LID refers to minimizing the effects of development on the natural environment.

Typical design approaches to water-sensitive urban design and LID include:

• Creating a public vision for water management and water health
• Bioretention systems
• Rain gardens and infiltration systems
• Porous paving
• Created wetlands and restored stream corridors
• Natural drainage swales (as opposing to piping)
• Stormwater reuse

Examples of close integration of water into urban environments is afforded by several key practitioners and via several key examples:

• Herbert Dreiseitl is an internationally renowned sculptor, artist, landscape architect, and interdisciplinary planner. A hallmark of his work is the innovative use of water to solve environmental challenges. He has realized groundbreaking contemporary designs in the fields of urban hydrology, water design, and stormwater management. His design philosophy is that art connects people with place, making the esoteric understandable, and to make clear the benefits of integrated water systems. His book Recent Waterscapes provides excellent examples of integrated urban/water design practice.
• Singapore is at the forefront of new water technology. The city knows the issues are not only about technology—they also involve aesthetics. Function and form and aesthetics are strongly integrated in Singapore’s water planning, and complement each other.
• Implementing green stormwater infrastructure in ways that significantly transform the urban environment.35

6. Adaptive land use, environmental, & infrastructure planning can help to increase resilience to extreme climate events and climate change; reducing risk & helping to manage uncertainty.

Coastal and riverfront communities across the country face risks from flooding, inherent hazards from living and working near the water’s edge. As the global climate changes, these risks are increasing, with rising sea levels and increased severe storm events. The IPCC issued its fifth climate assessment in 2014, projecting increased sea levels and greater storm activity as a result of global climate change.

While major hurricanes like Hurricane Katrina and Superstorm Sandy make national headlines, smaller storms cause flooding every year in low-lying urban neighborhoods. Rising sea levels and increased frequency and intensity of storms will increase the risk of water impacting the built environment, especially close to water features. As sea levels rise, the lowest elevation communities—especially those that are just barely elevated above today’s current high tide—may experience much more frequent high-tide-related flooding.

Coastlines, now and even more so in the future, are especially vulnerable to threats posed by tides and coastal storms, due to geologic processes, changing climate, and on-going development.

U.S. Army Corps of Engineers, 2013, Coastal Risk Reduction and Resilience

Unlike large storm events, this slowly developing problem is likely to first present itself as nuisance flooding ponding or pooling of low-lying streets. But as sea levels continue to rise, inconvenience and nuisance will raise serious questions of risk to life and safety. Not only are key community features flooded, roads become impassable for emergency vehicles, power and communications are interrupted, and recovery requires significant investment of public and private resources.

Rather than pursuing, as in the past, post-disaster recovery actions, better management of the urban flooding and sea-level rise environments require more adaptive land-use management, implementation of environmental conservation planning, and changes in infrastructure planning to help increase the resiliency of urban environments to the risks created by proximity to the water environment.

The National Flood Insurance Program (NFIP) is a program created by the Congress of in 1968 through the National Flood Insurance Act of 1968 (P.L. 90-448). The program enables property owners in participating communities to purchase insurance protection from the government against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods. Communities that participate in the NFIP are required to integrate the regulations from the NFIP into the building code. Though primarily an insurance program, the NFIP standards have become the de facto code for most communities.

Codes are effective for new buildings and those buildings undergoing substantial reconstruction—especially buildings that predate contemporary codes and standards. Pursuant to recent disasters, much additional analysis and many new approaches are available for the resilient and cost-effective retrofit of buildings and urban spaces.
Natural and Nature-Based Infrastructure at a Glance

**General Coastal Risk Reduction Performance Factors:**

- Storm intensity, track, and forward speed, and surrounding local bathymetry and topography

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**Dunes and Beaches**
- Benefits/Processes
  - Break offshore waves
  - Attenuate wave energy
  - Slow inland water transfer
- Performance Factors
  - Berm height and width
  - Beach slope
  - Sediment grain size and supply
  - Dune height, crest, width
  - Presence of vegetation

**Vegetated Features: Salt Marshes, Wetlands, Submerged Aquatic Vegetation (SAV)**
- Benefits/Processes
  - Break offshore waves
  - Attenuate wave energy
  - Slow inland water transfer
- Performance Factors
  - Marsh, wetland, or SAV elevation and continuity
  - Vegetation type and density

**Oyster and Coral Reefs**
- Benefits/Processes
  - Break offshore waves
  - Attenuate wave energy
  - Slow inland water transfer
- Performance Factors
  - Reef width, elevation and roughness

**Barrier Islands**
- Benefits/Processes
  - Wave attenuation and/or dissipation
  - Sediment stabilization
- Performance Factors
  - Island elevation, length, and width
  - Land cover
  - Breach susceptibility
  - Proximity to mainland shore

**Maritime Forests/Shrub Communities**
- Benefits/Processes
  - Wave attenuation and/or dissipation
  - Shoreline erosion stabilization
  - Soil retention
- Performance Factors
  - Vegetation height and density
  - Forest dimension
  - Sediment composition
  - Platform elevation

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VI. LOOKING AHEAD—PRACTICE AND POLICY DEVELOPMENT

The goal of Section IV is to recommend future strategies to help resolve barriers and increase opportunities to expand “best practices”. Items A–H below identify possible areas for future action by planners.

A. Policy Development

Water policy is often thought of as being created largely at federal and state levels with input from local stakeholders. Most of these policies are in the form of protections for water quality and other environmental concerns. Enforcement generally occurs federally and at the state level, while implementation occurs locally via municipalities and quasi-jurisdictional agencies, regional agencies, and state agencies.

However, policy that is created and enforced wholly at the local level often has the most impact and successful results. Local level water policy typically includes stormwater regulations, water usage/conservation laws, green infrastructure, water-neutral offset policies, and environmental rules regarding particular bodies of water, among others. In large part, the successful impact of local policy is due to the fact that local policymakers tend to better understand their specific settings and conditions best and therefore create better targeted policies with the best-suited metrics and enforcement for that community. Provided that these policies are grounded in factual, legally defensible criteria, local policies have far more likelihood of success than policies adopted at more remote governmental levels. Misalignment of political and natural boundaries has contributed to this dysfunction.

B. Government’s Roles in Resource Management

Water does not follow political boundaries. Considering the water cycle, rain falls where it falls, rivers flow where they flow, and fresh water lakes, aquifers, and water tables serve multiple communities, irrespective of man-made jurisdictions. Water is handled and regulated by different units and levels of government. At the local level, some communities regulate usage and/or carry on duties of water treatment, while others do not. In other instances, this occurs regionally across multiple jurisdictions by way of quasi-jurisdictional agencies. There are local, subregional and regional entities that are engaged in varying capacities. Given these complexities, planners should at a minimum be aware of the nature of the governance of water and work to research and document all of the stakeholder agencies and levels of government involved in water supply and demand for their community. This “water governance resource map” can be useful in future planning efforts because it highlights all of the required stakeholders to engage, and can also be used as an education tool for government officials and the surrounding community.

C. Education and Leadership

As planners, we have a responsibility to not only practice but to continue educating ourselves, the communities around us, and future planners with an appropriate knowledge base.

In the 20th century, America’s rapid development occurred with little consideration of environmental impacts. Plentiful and affordable access to important quality-of-life elements like water and energy displaced the need to assess the true cost of development. As a result, the general public is often unaware of access to water, water quality, and waste/stormwater treatment unless faced with an immediate threat. Americans are finally coming to terms with unchecked growth and beginning to understand the true (and rising) costs for households and businesses, environmental impacts, and even security concerns related to water. Concerted, comprehensive actions from policy makers, government officials, and end users must take place in order to effectively impact the magnitude of this issue. Therefore, planners have a critical role in educating themselves and their communities on water—from immediate local issues, to the regional network around them, and to some degree, national issues.
These efforts should take place in both policy and action-oriented engagement. The decisions made by planners regarding land use, density, zoning and building codes determine where and how we build, which directly impact water consumption at individual and community scales. Because of this, planners should use traditional planning policy, tools, and practice—like the comprehensive planning process and a commitment to public input through stakeholder engagement—to effectively address water issues with elected (and other) government officials and people in the community.

Depending on the severity of water issues, planners in some areas have begun to incorporate water into the comprehensive planning process, most typically as a component of a larger sustainability plan or via regional standalone water plans. Common elements of these plans include source and availability, communitywide water consumption and patterns, low-impact development, ecosystem service values, and how zoning patterns affect water demand, information about soils, water, and biodiversity. They also include implementation; and implementation strategies, including finance and maintenance. Minimally, understanding where a community gets its water and its typical consumption patterns are crucial baseline details needed to determine what to implement and from what starting point to measure progress. Most plans include an analysis of water conservation strategies that will reduce consumption and impact on the existing system.

As planners provide leadership and respond effectively to emerging water issues, APA members should commit to educating themselves and their respective professional planning circles by identifying partners for long-term collaborative learning and sharing such as AWWA and WEF, and identifying opportunities for integrating water and planning wherever applicable.

Opportunities to do this could include:

- Organizing water-planning sessions at NPC
- Providing information training and guidance on these issues to applicable divisions through seminars, PTS, webinars, etc.
- Creating workshops and training sessions with other water specialists—this can be an interdisciplinary “train the trainer” series.
- Assisting applicable divisions in education and outreach around these issues
- Considering pilot research or hands-on program application in coordination with partnership and trade organizations; publicize the efforts and results
- Developing a water planning policy guide
- Working with water organizations such as AWWA, WEF, NACWA, AMWA, the U.S. Water Alliance, and the Alliance for Water Efficiency to publish a model water planning efforts/best practices manual.

Future planners need to be equipped with the appropriate tools to be effective in their communities. Planning school curriculums have adapted in the past to include new technologies such as GIS, but new subject matter is still often relegated to specializations and elective courses. The intersection of planning and water, energy, and climate is the new normal and should be integrated into traditional planning education side by side with land use, zoning, and transportation. There is enough literature, technical tools, and real-world applicability that warrant some level of insertion into the basic working knowledge of new planners, while standardizing deeper specialization opportunities as well. APA is best suited to advocate this position and should consider heeding that call, lest planners be left on the sidelines as others continue to chart the path. Anything less is a disservice to the future of the profession.

The profession should work with other disciplines to foster education programs and water-based curricula for primary, middle, and secondary schools as well as university and community colleges. Broadening the education of
the populace about water-related principles, issues, and opportunities, as well as providing training for jobs in this emerging sector, are essential.

D. Transitioning Urban Water Systems to a New Integrated Management Paradigm

Integrated Water Resource Management (also referred to as integrated resource planning) is an emerging practice to plan for water in a comprehensive manner by considering all components of water—supply, wastewater, stormwater, and water quality—and their relationships to each other as well as other aspects of the environment, both natural and man-made. Present day planning in many communities is conducted in completely separate silos.

The following are recommendations about how APA can help the planning industry to better prepare itself and engage in cross-industry collaboration for sustainable, integrated water resource management for communities.

Short-term:

- **Codify the larger, growing concept of “One Water” and integrated water resource management in partnership with the water service industry in order to have a universal, working definition for ease in communication among different professions and industries.**
- **Develop a manual of model ordinances and legislative mechanisms that promote adoption and secure funding for integrated urban water management planning targeted toward urban planners. This should include building code updates, green space as an instrument for managing stormwater, water-neutral offset requirements, etc. A strong emphasis on outreach and collaboration methods with local water service utilities should be prioritized.**
- **Test planning charrettes for planners, water resource and related professionals, and other applicable stakeholders (potentially energy and other infrastructure industries as well) to develop a replicable platform for improved understanding between these professions and the work they do.**
- **Host a series of national webinars designed to provide knowledge exchange between planners and water resource professionals. Example: planners provide the basics of comprehensive plan development; water professionals provide the basics on the regulations surrounding the provision of water service; scientists provide the basics on the natural principles that underlie effective planning; and designers and engineers provide the basics on opportunities for urban form and system design.**

Long-term:

- **Develop and embed a university course on integrated water management within planning, design, and engineering colleges; ideally have cross-participation between these colleges during the course work.**
- **Partner with national water service membership agencies (e.g., AWWA and WEF) on development of cross-industry participation and learning opportunities at their respective annual national conferences.**
- **Engage water professionals during the comprehensive planning process as well as during individual development land-use decisions facing a region or municipality, in order to better understand the long-term impacts to the community including infrastructure maintenance costs.**
- **Establish guidelines and encourage planning agencies and water service utilities to work together on developing and using a unified message to the general public about regional or local water resource concerns; help build solidarity.**
E. Research
Research is an important element in documenting the implementation of successful practice and policy. Successful research outlines applicable best practices, lessons learned, and measurable impacts for others to consider and apply in their own communities. In the absence of a widespread, standardized methodology for comprehensive water planning, verified research would be a valuable resource for water planning. If we know better, we can do better. APA should prioritize their research needs by taking into consideration our Core Theme that water is a central and essential organizing element in a healthy urban environment. APA's research projects should consider how water elements are included. APA will need to prioritize their needs and potential funding and partner opportunities but the Water Task Force has identified several water based research efforts and topics that can help with this integration.

Comprehensive planning efforts:
- Create a mechanism to compile, organize, and share the considerable amount of information on the many water issues that is available and can help guide planners.
- Produce a PAS report on how to incorporate the new water paradigm (integrated planning for urban wastewater/stormwater/water supply) into comp plans (specific plans, redevelopment plans, master plans). The process for connecting water resource planning efforts including integrated water or One Water Initiatives into land-use planning documents or other land governance systems can be unclear. Watershed management plans or other integrated water efforts are often developed outside the land-use governance process, which can limit a community’s options for truly sustainable and resilient water systems. This PAS report would identify where those connections need to be made so planners and water resource managers can identify needed collaboration efforts, synergies, or conflicts between the water planning and land-use planning processes.
- Update the current APA Policy Guide on Water Resource Management. The current guide focuses on supply, quality, and availability of the resource. The Water Task Force recommends that the policy guide be updated to be more inclusive of the range of issues related to water as it affects human development, safety, and sustainability.
- Prepare and update the research compendium of the United States and international community planning programs for integrated or One Water Management programs.
- Develop a PAS report on how to use the new water module in GIS-based scenario planning tools and other analytical techniques. This could include a scenario planning tool for water service sectors to evaluate land-use alternatives, and perhaps case studies of localities that have done scenario planning for water at the local and or regional level.
- Identify and promote best practices and state of the art programs for integrated or One Water Management programs being implemented in an integrated manner across community planning, public works and/or utility departments.
- Improve flooding and hazard mitigation planning by building upon current APA, FEMA, and NOAA work for hazards mitigation. There should be a specific effort to bring water and wastewater utilities into conversation.

Water research projects that support local efforts:
- Community design: urban design alternatives that include water catchment for potable and nonpotable uses. Many communities currently depend on one central water source for all water needs, but it may not be able to be expanded for future growth. The ability to incorporate multiple water sources to meet potable or nonpotable needs can assist a community with resiliency in natural and manmade disasters such as contamination of the source water to drought or floods. This study would develop potential community design alternatives to include water catchment, either
on the building scale or a more regional scale; incorporation of that water into the potable system or for nonpotable uses; and the impact to the stormwater or surface water system.

- Feasibility of integrated water and/or distributed infrastructure: A benefit of moving toward a One Water paradigm is that resiliency is gained from the incorporation of distributed infrastructure systems within the service area to recover energy and high quality wastewaters for multiple uses on site. Advantages of using distributed systems include reducing the energy needs required to convey water long distances in some larger centralized systems, potential energy and water recovery closer to the intended use, and the ability to add capacity to existing urban areas that are experiencing densification beyond current water and sewer pipe capacities. Implementing such programs require additional analysis of the appropriate scale, environmental, and community drivers, and what regulatory changes might be needed for successful implementation of more distributed systems.

**Regulatory research:**

- Best practices guidance for planners on stormwater management for water quality and quantity: incorporating green infrastructure, regional facilities, alternative water supplies, riparian buffer zones, etc., into the land development documents to implement effectively.
- Best practices guidance for planners on water conservation codes and practices. Incorporating high-efficiency plumbing fixtures and appliances, water conserving landscapes, and alternative water supplies, this guide should include innovative practices such as local retrofit on resale ordinances. The Alliance for Water Efficiency should be a partner.
- Creation of a PAS report focused on how to change development codes for stormwater management and water conservation. Include ordinances and codes for water-neutral offsets.
- Creation of best practice rating systems for water management. Similar to the vision for sustainable infrastructure systems rating system, the planning profession could be in a unique position to evaluate all water systems of a community and develop a rating system for sustainable water management practices to help communities benchmark their water management services.
- Exchange in One Water or integrated water building technologies (living machine, etc.). The living machine and its counterparts have been around for 20 years and there are many examples. Creating a knowledge exchange of how these systems work and how they can effectively be incorporated into the potential solutions for communities would help communities evaluate their options. Creating a network to help planners reliably consider options include what could work and what may not live up to expectations, and could help overcome resistance at many levels of government to implementing new paradigms, processes, and technologies.

**Financing innovative water improvements:**

- Integrated urban capital investment strategy for resiliency in water services (or all services): To develop a sustainable funding strategy, it is essential to evaluate the capital cost impact to the entire community of an integrated capital investment strategy of the water supply, wastewater, and stormwater management systems to meet growth needs with consideration of co-benefits, including ecological and return on investment. It is also important to analyze the role that conservation plays in reducing new infrastructure cost.

**Rebuilding aging infrastructure and neighborhoods:**

- Like our nation’s transportation infrastructure network, communities across the country are facing water infrastructure challenges. AWWA states that ‘restoring existing water systems as they reach the end of their useful lives and expanding them to serve a growing population will cost at least $1
trillion over the next 25 years.”36 Delayed investment means a reduction in water service as we know it today, an increase in disruptions, and an increase in emergency repairs and costs. “The more we delay the harder the job will be when the day of reckoning comes, its report says.”37 As communities grapple with these infrastructure challenges, access to information, tools, and best practices such as those below may prove to be the vital impetus for encouraging action as soon as possible.

- Expand best practices for communities to strengthen their economy while renewing infrastructure.
- Identify real estate value trends and opportunities based on rebuilding and renewing infrastructure—is there an economic gain in the community to joint water/street/sewer infrastructure renewal projects?
- Consider infrastructure impacts on the base layers of ecology, hydrology, and ecology should inform next generation infrastructure investments.

F. Education and Training

It is important to arm planners with a more technical skillset to address water issues so they have the confidence to continue their participation in water management dialogues. Planners working in water management can often be hesitant to step up and direct the conversation. We usually stop at the role of facilitator and yield to more technically inclined water experts to take control. While their expertise is indeed a necessary part of the equation, it is the planner who has the ability to see the big picture and connect what water experts are saying to other important urban issues. By updating skillsets that incorporate more technical knowledge (engineering and hydrology for example) planners can not only facilitate the water management dialogue but also drive it. The Water Task Force recommends the following ways to improve the overall education of planners working with water.

- Update planning curriculums to incorporate classes that would provide students with a basic understanding of the more technical components of water management (such as those based in engineering, urban design, and earth and environmental sciences).
- Create a model curriculum for planning students to understand the water service sector.
- Create a model curriculum for civil/environmental students to understand planning sector.
- Create training sessions for planning directors, mayors, and public works directors in integrated water concepts and techniques.
- Provide educational opportunities in the field, not just in the classroom. A real-life example of this would be the Rebuild by Design (RBD) competition.38 RBD provided an educational opportunity for everyone to learn how their disciplines and expertise fit together, effectively breaking down silos. Opportunities like RBD need to be evaluated, refined, and continued with appropriate funding for participants as there is a wealth of professional learning and development that can be achieved. Outcomes and lessons learned from collaborations like RBD or Dutch Dialogues can also be used in curriculum development. Universities can embrace such tools to help shape a curriculum that is grounded in planning theory, but also reflects active real-world practice. Through such processes, executives are also given the chance to enhance their professional knowledge and practice. APA can help facilitate that change by creating executive programs.

G. Monitoring progress and metrics to assess improved water management: Measure early and often

To assess whether the policies and actions have made any relevant impact, one must first be working from a baseline that measures “resulting change that is caused by or linked to some intervention that you have implemented.”39 Without a baseline measurement, the success or limitations of most water planning strategies would be indeterminable. This is true at any scale, from individual households to an entire region. Accurate data establishes a
concrete starting point from which to measure progress and with some analysis, may also assist in targeting the most appropriate strategies.

Baseline metrics are also important for the following reasons:

- **Accurate data.** Actual data provides a more precise picture of a community’s current conditions in contrast to national or regional averages.
- **Consistency of data points.** Identifying and using common metrics promotes consistency between communities and allows for comparisons between jurisdictions.
- **Opportunity to customize datasets to reflect local area concerns are not precluded.**
- **Data indicators.** Data helps document opportunities for improvement and thus, to identify strategic approaches a community can target.

Further, an important element of water planning involves identifying metrics for ongoing performance monitoring. By using an agreed-upon set of metrics, one can better assess how well a policy or action is performing and allow the agency to make program adjustments early on, long before any annual program evaluation takes place and valuable time is lost. This adaptive approach and level of accountability and transparency are key attributes for comprehensive efforts that require integration from multiple implementation partners and stakeholders.
APPENDIX 1. REAL-WORLD EXAMPLES FOR “SECTION 5: RECOMMENDATIONS FOR IMPROVED PRACTICE FOR PLANNERS”

The recommendations in this report build from real-world examples, not theoretical, untested ideas. Below are some best practices and success stories from other communities for reference, organized by several of the core themes of the recommendations section.

Core Theme 2: Planning practice needs to employ an integrated, systems-oriented, comprehensive approach to water management.

- **Seattle, Washington**: The Thornton Creek watershed is Seattle’s largest watershed and drains into Lake Washington. Throughout the history of the city, this creek had been buried to allow development and was confined to a 60-inch pipe running underground. As Seattle became more aware of water quality issues related to Thornton Creek, they began to think of ways to improve water quality and find a balance between urbanization and environmental sustainability. The city convened a group of stakeholders from business, community and environmental interest groups in order to propose a facility that would improve water quality in both Thornton Creek and Lake Washington while also promoting open space, livability and economic development. This group of 22 members decided (by consensus) that the facility ultimately built would be an improvised biofiltration swale that served as a way to slow stormwater and retain pollution-laden sediment. In addition, the facility has also served as an anchor to private development including both residential and retail developments which are estimated to bring an additional 200 million dollars to the Northgate neighborhood.

- **San Francisco, CA**: In an effort to prepare for projected climatic changes and population increases, and to reduce system vulnerability to seismic activity, the San Francisco Public Utilities Commission (SFPUC) evaluated its water supply system in order to identify options for increased water efficiency and reuse. The SFPUC noted a host of potential sources for recycled water including living machines (a system of constructed wetlands that collects and treats sewage), rainwater harvesting technologies, and greywater systems. However, California plumbing codes lacked explicit instruction on how to maintain these systems and protect public health when using recycled sources of water. In 2012, SFPUC developed a program to streamline the permitting process for the installation of non-potable water systems. By collaborating closely with different city departments, specifically the Department of Public Health and the Department of Building Inspection, the program established regulatory guidelines, specific city department responsibilities, and provided technical assistance for developers interested in installing non-potable water systems in new commercial, multi-family, and mixed-use developments.

- **Solaire Building, New York City, NY**: The Solaire Building is a 293 unit residential building in Battery Park City (BPC) with an internal wastewater recycling system that collects black and grey wastewater, treats it in the basement and uses the recycled water for toilet flushing, air conditioning water, and irrigation of a nearby park. When this building was built in 2001, internal water recycling guidelines were not in existence by the state. Therefore, the standards, commissioning protocol, and subsequent monitoring requirements had to be set up through collaboration between the NYC Health Department, the NYC Department of Environmental Protection, the Battery Park City Authority, the building’s owners, and the design team. Since then, the NYC Department of Buildings has adopted official water reuse code requirements, which now include laundry and sidewalk washing.
• **State of Victoria, Australia:** In response to past droughts and a new demand from the community for livable cities and green open spaces, the Victorian state Government in Australia developed a new vision for urban water. Urban development and water planning had historically been undertaken by different institutions within the State of Victoria. A single, state-based institution was formed called the Office of Living Victoria (OLV), which has supported a new water system approach within the region by driving reform through the coordination of urban and water planning institutions.

**Core Theme 3:** New mechanisms for interdisciplinary interaction by involved professionals is critical to effective water management, bringing together urban planning, environmental engineering, landscape architecture, urban design, hydrology, economics, law/regulation, etc.

• **Marin County, CA:** “Game of Floods” public outreach meetings on sea level rise adaptation (2014): One of Marin County’s elected County Supervisors, Kate Sears, initiated a planning group in her district of southern Marin to identify community assets that are vulnerable to sea level rise. The senior County civil engineer, Roger Leventhal, proposed a game to be played in community workshops that he called the “Game of Floods.” A landscape architect, Kevin Conger (founding principal of CMG landscape architects in San Francisco), developed the concept of the game with his staff and prepared it for community meetings, along with other members of Supervisor Sears’ working group, wetland restoration ecologists and Mr. Leventhal. Approximately 90 members of the Marin community played the game at the first public event in November of 2014, and used it effectively to learn more about adaptation options as well as communicate their priorities and intentions to County staff and elected officials. This example included the synthesis of knowledge from different disciplines, the development of an interdisciplinary partnership, the use of new methods, and the production of a valuable tool (the “Game of Floods”) that can be used repeatedly.

• **New York - New Jersey, Rebuild by Design HUD Competition (2013):** The US Department of Housing and Urban Development (HUD) sponsored this competition to draw out ideas for physical planning along the New York-New Jersey (and Connecticut) coastline to increase the region’s resilience to hurricane events. Teams were composed of landscape architects, building architects, engineers, and planners. After finalists were selected and complete submissions were evaluated, a winning competition entry proposed to build lines of rock breakwaters that would protect the shore of Staten Island from storm surges and very large waves generated by hurricane-force winds. The breakwaters would also be designed to function as habitat for shellfish and other plants and animals associated with rocky habitats. HUD has funded an initial phase of this work, and set an important precedent for increasing resiliency on land by re-shaping the bathymetry of coastal areas, rather than building larger and larger dikes and levees that are single-function structures.

Founded as a response to Superstorm Sandy’s devastation, Rebuild by Design (RBD) was dedicated to creating innovative community- and policy-based solutions to protect U.S. cities that are most vulnerable to increasingly intense weather events and future uncertainties. Initiated by the Presidential Hurricane Sandy Rebuilding Task Force and a partnership between U.S. Housing and Urban Development and the Rockefeller Foundation and five other funders, RBD’s aim was to connect the world’s most talented researchers and designers with the Sandy-affected area’s active businesses, policymakers, and local groups to better understand how to redevelop their communities in environmentally- and economically-healthier ways, and to be better prepared for the next storm.
RBD developed into a partnership of the Task Force with the Municipal Arts Society (a non-profit advocacy organization), the Van Alen Institute (an organization with experience in architecture and design processes), the Regional Plan Association (an organization focused on the entirety of the region through research and planning) and the Institute for Public Knowledge at New York University. Each organization allocated significant staff, time, and expertise of the region during the design phase. This partnership collaborated with State and Local governments including the States of New York, New Jersey and Connecticut, and New York City in addition to a dozen federal agencies, local agencies, and local and regional stakeholders, community groups, and businesses.

The competition addressed the structural and environmental vulnerabilities that Hurricane Sandy exposed in communities throughout the region, and developed solutions to better protect residents from the dangers posed by future climate events. Due to the enormity of this challenge, the Rebuild by Design process was developed to find better ways of implementing designs and informing policy. While those affected by the storm continued to push forward with the recovery process, it is clear that simply rebuilding what existed before would be a missed opportunity. Thinking differently this time around was the only way to make sure the region would be resilient enough to withstand its uncertain future. It is for this reason that the goal for RBD was to engage as many groups as possible—not only to utilize the expertise from everyone (those on the ground to those at the top) to develop sound design solutions but also to rethink their communities in times of climate change and increased weather events.

The competition, named one of CNN's 10 Best Ideas of 2013, included a year of thoughtful engagement by the design teams who formed local coalitions to develop fundable, implementable solutions that will inform new policies on every level. RBD and its partners have demonstrated that by working together in this regional design process, we can set ambitious, realistic, more resilient standards of development and infrastructure that respond to communities' needs within a new, changing world.

- **Dutch Dialogues workshops (2006-2009):** In the months after Hurricane Katrina, the Dutch government reached out to the City of New Orleans and the State of Louisiana to offer technical assistance via the Dutch Dialogues workshops, which were sponsored by the Dutch Embassy and Waggonner & Ball. These workshops brought Dutch engineers, economists, hydrologists, planners, landscape architects, building architects and urban designers together with local professionals in New Orleans and a set of American experts to study the existing situation in New Orleans, develop analytical resources for planning, and eventually to develop proposals for how the City might increase its resilience to extreme rain events. The Dutch Dialogues events contributed by building relationships and a working method among the participants that was fundamental to a successful international collaboration, across cultures as well as disciplines.

- **Greater New Orleans Urban Water Plan (2013):** Building off of the Dutch Dialogues workshops, Waggonner & Ball led a team of local and international water management and climate adaptation experts to create the Greater New Orleans Urban Water Plan. The Urban Water Plan is the first regional water plan of its kind in the U.S. It integrates infrastructure planning, land use planning, and urban design at a regional scale, and provides a framework with which to guide public and private investments for the next 50 years. The plan signals a paradigm shift in water management, from a complete reliance on pumping stormwater and groundwater (fighting water) to finding ways to slow and store stormwater (living with water) while addressing soil
stability and groundwater issues. The Urban Water Plan process included design and planning workshops, technical workshops on topics such as financing, geomorphology and subsidence, extensive outreach, and meetings with systems managers and an advisory council. The layered planning approach that undergirds every aspect of the Urban Water Plan process is replicable in communities across the U.S. Climate change and natural disasters serve as constant reminders of the importance of understanding the geological, hydrological, and ecological context within which each community is situated. In the Mississippi River Delta and other deltaic environments, soil and water management pose particularly difficult challenges, and the Urban Water Plan provides both a methodology and prototypical planning and design solutions with which to address those challenges. The Urban Water Plan team is a member of the Connecting Delta Cities collaborative, an international effort to foster shared knowledge, and team members contributed expertise gained through the Urban Water Plan process to regions as diverse as Lafourche Parish on the Louisiana coast to the Eastern Seaboard during Hurricane Sandy recovery.

- **Seattle, Thornton Creek Water Quality Channel and Thornton Place development project (2003-2006):** This project was unique because not only did it bring professionals together from hydrology, economics, landscape architecture, planning and civil engineering, but it also brought a team of public communication professionals together to run a novel form of public process. The City of Seattle had been having significant difficulties permitting development on a 10-acre parking lot that sat on top of a filled wetland and creek, which had been placed in a large pipe. Neighborhood groups that wanted the creek to be opened up to the surface as a habitat and recreational area had successfully blocked conventional development of the site and become a significant political force in municipal elections. Seattle Public Utilities hired a facilitation team (Triangle Associates), the landscape architect for the community group (Peggy Gaynor), and the landscape architecture firm that had helped them with previous stormwater projects (SvR Design) to develop analyses and proposals that could be brought before a committee of appointed stakeholders, who would represent the community and whose decisions would be treated as binding. By jointly using Asset Management assessment tools, which evaluate the 50-year maintenance costs as well as the capital costs and benefits of an infrastructure project, the various professionals were able to clarify the differences among several proposals to the citizen stakeholder committee. A preferred alternative was built that brought in a movie theater and an assisted living facility for elderly people, but also created a park that allowed baseflow from the stream to create habitat and recreational space for the neighborhood. The stakeholder process was uniquely well-suited to resolving the dispute, and the asset management evaluation tools provided a common language and framework for a careful comparison of design alternatives.

- **Seattle, High Point Neighborhood, Hope VI Re-Development Project (1999-2004):** As part of an ongoing HUD grant program to re-design public housing to reduce the social stigma associated with living in areas that were easily identifiable as public housing, the Seattle Housing Authority (SHA) received millions of dollars to remove and rebuild housing units within a 120-acre area known as High Point. This area also functioned as a small, intact watershed that drained to a stream known to have Coho salmon, which is a species of conservation concern. The goal was to re-build High Point according to designs that were modeled and optimized using HPSF software to predict stormwater discharge, and then monitor the resulting discharge to learn from the case. The design effort began in a graduate studio at the University of Washington, as a way of engaging professionals in a wide range of early ideas. Subsequently, professional landscape architects, civil engineers, planners, real estate developers, and hydrologists worked together as
members of Seattle Public Utilities staff, SHA staff, and the street utility’s staff and consultants to develop a sophisticated set of design proposals that placed social justice and ecosystem health at the top of the agenda, along with the marketability of the housing units that would be sold to private owners. This project has since won numerous national awards for its vision and capacity to bring these often disparate goals together in one very successful urban district. Many of the most difficult decisions were made during and after charrette-style workshops that required people from multiple disciplines to let go of their standard objections to ideas that would change the function of the streets, open space and infrastructure in relation to stormwater. This workshop method wore down the objections of staff from multiple agencies with a combination of patience and a sense of urgency.

Core Theme 4: Planners need new and improved professional practices to manage water more sustainably and provide greater social equity for access to the resource.

- **Seattle, WA**: Seattle Public Utilities (SPU) initiated a program it called an “Environmental Justice Needs Assessment” (EJNA) in 2002. By 2009, it had been renamed the “Environmental Justice Network in Action” (also EJNA), and involved twenty different organizations that were engaged in outreach and communication both to and from SPU. Outreach events have led to insights about the best methods with which to reach communities that are not normally in direct communication with a public utility, including an emphasis on visual and experiential communication – including tours of SPU facilities, videos, and community meetings with hands-on activities. SPU has used this partnership to identify the concerns of communities about new policies the utility wishes to implement, as well as ongoing concerns about services and rates. It has also built capacity for organizing and for more effective communication on both sides – within the water utility and within the community groups.

- **State of California, California Public Utilities Commission**: In California, the Environmental Justice Coalition for Water (EJCW) was formed by a statewide coalition of nine grassroots organizations and advocacy groups to train local community officials and activists in how to advocate successfully for justice in water planning. They advocate for inclusive, community-based decision making about water systems with the goal of making water clean, safe and affordable in low-income communities and communities of color. Like the People’s Water Board in Detroit, they argue that access to clean, safe water is a basic human right. They release publications about injustices in the California water system, as well as conducting training and advocacy sessions. In 2008, they succeeded in persuading authorities to dedicate 10 percent of integrated regional water planning funds in each region to disadvantaged communities. EJCW helps to make sure those funds reach communities that need them the most, and coordinates a statewide strategy for making the best use of those funds.

Core Theme 6: Adaptive land use planning, environmental planning and infrastructure planning can help to increase resilience to extreme events and climate change, by reducing risk, and helping to manage uncertainty.

- **The Dutch Delta Program**: The Netherlands is a low-lying country, vulnerable to flooding. The government intends to protect the Netherlands against high water and secure a sufficient supply of fresh water now and in the future. For this reason, we are planning ahead in the Delta Program, in which various authorities and other organizations collaborate. The plans are being drawn up under the direction of the government commissioner for the Delta Program, the Delta Commissioner.
Increased rainfall, rising sea levels, higher temperatures
After the disastrous flood of 1953, the government took measures to better protect the country against flooding. For example, agreements were made regarding the height of dikes and coastal management.

Yet now, 50 years later, circumstances have changed:
• Measurements taken have shown that the sea level is rising while the land is subsiding further;
• The number of rainy spells is increasing and rainfall is becoming more severe;
• The temperature is rising.
• Furthermore, a flood would have a greater impact today than it would have had 50 years ago. The population of the Netherlands has increased, which means that in the event of a flood, there would be more casualties than in the past. Nearly 60 percent of the Netherlands is at risk of becoming inundated by flood waters. This area comprises the largest cities as well as the economic centre of the Netherlands. For these reasons, adequate protection from flooding – from the sea and rivers alike – is vitally important.

This is why the Netherlands needs to look far ahead and draw up sound plans for the future. These plans are presented in the annual Delta Program.

Aim of the Delta Program
The aim is to ensure that our water safety and freshwater supply are sustainable and robust by 2050, so that our country will be better equipped to withstand weather extremes. This time around we will take measures focused on disaster prevention rather than on the aftermath.

Together with other organizations, the government will be concentrating on three areas in its new approach to working on the delta:
• New water safety standards will be set: these will not only be linked to the likelihood of flooding, but also to the consequences thereof (risk-based approach). The scope of the consequences is the decisive factor in setting the standard;
• The availability of fresh water for agriculture, industry and nature will become more predictable;
• Spatial planning will become more climate-proof and water-robust.

Adaptive delta management
The national government ensures that the Netherlands is prepared for various future scenarios. We choose strategies and measures that enable us to come up with a flexible response to new measurements taken and new insights into the climate, for example. We are doing what we need to do at this time. Supplementary measures are ready should we need them in the future. We call this approach adaptive delta management. All stakeholders view this approach as a pragmatic solution for dealing with developments that are uncertain.
APPENDIX 2. RESOURCES RELATED TO PLANNING FOR UNCERTAINTY

Planning for uncertainty is an increasingly important theme among water experts. The resources below provide useful information for practicing planners, engineers and other professionals.

APPENDIX 3. APA WATER TASK FORCE - ROSTER

Bill Cesanek, AICP, Co-Chair - APA Water Task Force
Lindy Wordlaw, AICP, Co-Chair - APA Water Task Force (Chair, ENRE Division)
Mary Ann Dickinson, Task Force Member (Member, Sustainable Communities Division)
Danielle Gallet, Task Force Member (Member, ENRE Division)
Kristina Hill, Task Force Member
Thomas Hamed, APA Region II Student Representative
Michael Marella, AICP, Task Force Member
Henk Ovink, Task Force Member
Kelli Sertich, AICP, Task Force Member (Member, Hazard Mitigation and Disaster Recovery Planning Division)
David Waggoner, Task Force Member
Jennifer Graeff, APA Staff and Contributor (Member, International and Sustainable Communities Division)

The Water Task Force would also like to thank Laura Buhl, (Past Chair, International Division), Joe MacDonald, AICP, and Dale Morris for their contributions to report.
END NOTES

1. The Water Task Force co-chairs wish to acknowledge and extend sincere thanks to the Task Force members, who, through many meetings, communications, and writing contributions have contributed the information and recommendations contained herein. Water Task Force members are listed in Appendix A.

2. The specific policies call for APA and its Chapters to support legislation and funding for state comprehensive water planning and permitting; source water protection; water conservation; standards for wells; improved stormwater management; updated wastewater facility plans and application of Total Maximum Daily Loads to waters; aquatic biodiversity and habitat recovery; expanded Clean Water and Safe Drinking Water Acts; expanded regional compacts to limit overuse of shared groundwater and surface water; and integrated management of ground and surface water supplies.


10. U.S Census Bureau, Population Division.


16. wri.org/our-work/project/aqueduct/aqueduct-atlas


23. U.S. Environmental Protection Agency website on “Advanced Concepts.”


30. UN World Water Development Report 2014


33. The U.S. Water Alliance is building a network of leaders representing an array of research foundations, national trade associations, federal agencies, and nongovernmental organizations to unite for integrated water management, and to consider next steps toward the “One Water Management” vision (OWM), which is closely aligned with and builds upon the work on Integrated Water Resources Management. All recognize that breaking down barriers, entrenched “silos,” inside and outside the water sector, will be a process with many policy, institutional, and technical aspects. From flood and stormwater managers in the East; water suppliers and recyclers in the West; efficiency and conservation gurus in the Midwest; and urban planners and smart growth advocates in the South, all were united in recognizing the value of collaboration and integrating for better water management. Activities of the OWM network include identifying barriers to integrated action, developing pilot projects to reduce or overcome barriers, and to analyze best practices, support demonstration projects, and test decision-making tools.


37. RBD is a design competition initiated by the U.S. Department of Housing and Urban Development) and the Presidential Hurricane Sandy Rebuilding Task Force that connects researchers and designers from the around the world with communities impacted by Superstorm Sandy. The goal is to help local businesses, policy makers, and community groups to better understand how to redevelop their communities in environmentally and economically healthier ways. RBD is discussed further in the Appendix (http://www.rebuildbydesign.org).