Roadmap to a Secure & Resilient Water Sector

Developed by:

Critical Infrastructure Partnership Advisory Council

Water Sector

Strategic Priorities Working Group

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Introduction

Considerable effort over the last four years to expand mutual aid and assistance, develop critical Water Sector security standards, enhance local, state and Federal partnerships, and release new risk assessment tools are evidence that the Water Sector recognizes the distinct value of enhancing preparedness and resiliency. The Water Sector has approached such risk reduction activities through a partnership approach whereby the government and the sector share the responsibility for improving Water Sector resilience by identifying joint priorities and engaging in coordinated action. As our understanding of risk and the sector's preparedness and resiliency capabilities continue to evolve, the Water Sector partnership must regularly review progress and revise its priorities to reflect the current environment. This *2013 Roadmap to a Secure & Resilient Water Sector* updates priority activities for the partnership over the next five years.

In 2009, the joint Water Sector Coordinating Council (WSCC)-Water Government Coordinating Council (WGCC) Strategic Priorities Working Group released the first *Roadmap to a Secure & Resilient Water Sector*, which identified the joint priority activities needed to improve Water Sector resilience and meet the sector's shared vision:

> The Water Sector's vision is a secure and resilient drinking water and wastewater infrastructure that provides clean and safe water as an integral part of daily life, ensuring the economic vitality of and public confidence in the Nation's drinking water and wastewater service through a layered defense of effective preparedness and security practices in the sector.

The Water Sector partnership has made impressive strides toward those priority activities (summarized in Table 1), and recognized the need to refresh the partnership focus and identify the top priority efforts to emerging sector risks. In September 2012, the WSCC released its updated *WSCC Strategic Roadmap*, which reflects the WSCC's needs and priorities for reducing infrastructure risk. Building on this effort, the WSCC and WGCC came together in March 2013 for a one-day roadmapping workshop to review progress, identify evolving risks, and update this Roadmap for the next five years; and in May 2013 to clarify key points and review and refine the implementation strategy. For more information on the Roadmap update process, please refer to Appendix A: Roadmap Update Process.

Purpose

The purpose of the Roadmap is to establish a strategic framework that achieves the following:

- Articulate the priorities of industry and government in the Water Sector to manage and reduce risk.
- Produce an actionable path forward for the WGCC, WSCC, and security partners to improve the security and resilience of the Water Sector over the near term (within two years) and mid term (within five years).
- Guide sector partners in developing new products and services and formulating budgets.
- Create a shared understanding of and collectively advocate sector priorities, and recognize institutional constraints and different accountabilities.
- Encourage extensive engagement among all key stakeholders to strengthen public-private partnerships and accelerate security advances throughout the Water Sector.

Water Sector Partnership

The Water Government Coordinating Council (WGCC) is chaired by the U.S. Environmental Protection Agency (EPA) with the Department of Homeland Security (DHS) as a vice-chair and consists of representatives from Federal, regional, state, local, and tribal government programs.

The Water Sector Coordinating Council (WSCC) members include municipal and investor-owned water and wastewater utilities, associations, and regional organizations.

Together, these coordinating councils form the public-private Water Sector partnership through which security partners collaborate to plan and implement programs aimed at achieving a common vision.

How the Roadmap Is Used

The Roadmap was developed primarily for the WSCC and WGCC to ensure that joint activities contribute to a common vision. However, water and wastewater utility owners and operators, associations, and government agencies can use the Roadmap as a reference to support their planning processes. The priority activities identified are designed to develop tools, resources, information, and communications that ultimately aid the Nation's water and wastewater utilities in improving their resilience and reducing their individual risks. These activities include communicating with Water Sector stakeholders on behalf of the Nation's utilities.

As a secondary purpose, the Roadmap provides a basis for WSCC and WGCC representatives to educate stakeholders on the Water Sector's joint accomplishments and planned activities for the future. Such stakeholders include state emergency planning agencies, public commissions, and interdependent sectors.

2013 Updates

The 2013 Roadmap was revised using a similar process and format to the 2009 Roadmap and the 2012 *WSCC Strategic Roadmap*. New additions to the 2013 update include Appendix C: Definitions, which defines key terms used by the Working Group throughout the Roadmap (including the roles and responsibilities of coordination leads, co-leads, and partners assigned to the priority activities). Other updates include a review of significant partner progress since the last Roadmap was created, which helped inform the development of 2013 priority activities.

Water Sector Partnership Progress

As illustrated in Figure 1, the Water Sector coordinates planning and response among a broad number and scope of partners. The figure includes local partners to water and wastewater utilities, along with Federal, state, and regional partners. Over the past four years, the Water Sector has worked to align security partner efforts among all of these stakeholders.

Figure 1 Examples of Security Partners in the Water Sector

Table 1 Key Water Sector Successes (2009-2013)

Water Sector partners have made many large contributions to the *Water Sector-Specific Plan* goals in the time since the first *CIPAC Roadmap to a Secure & Resilient Water Sector* was issued. Highlights of these achievements are provided in the following table:

Expanded Mutual Aid Programs

- Established 50 *Water/Wastewater Agency Response Networks*[i] (WARN) in the United States and Canada and continued efforts to support their operational plans, outreach and communications
- Conducted nationwide table top exercises to enhance the effectiveness of state WARNs
- Developed the *Water & Wastewater Mutual Aid & Assistance Resource Typing Manual*[ii]

Developed Key Standards

- SAFETY Act designation granted by DHS for ANSI/AWWA G430-09: Security Practices for Operations and Management and ANSI/AWWA J100-10: Risk Analysis and Management for Critical Asset Protection (RAMCAP®) Standard for Risk and Resilience Management of Water and Wastewater Systems (AWWA)
- Issued ANSI/AWWA G440-11: Emergency Preparedness Practices (AWWA)
- ANSI/American Society of Mechanical Engineers-Innovative Technologies Institute/AWWA J100-10: Risk Analysis and Management for Critical Asset Protection® -Standard for Risk and Resilience Management of Water and Wastewater Systems

Developed Key Strategic Planning Resources

- Updated emergency response plans, enacting a shift in focus from terrorism to all-hazards
- EPA-NHSRC and AWWA collaborated to develop *Planning for an Emergency Water Supply*[iii] in response to provisions of the 2002 Bioterrorism Act
- CDC and AWWA collaborated to develop the *Emergency Water Supply Planning for Hospitals and Healthcare Facilities*[iv] and the *Drinking Water Advisory Communication Toolbox*[v]
- Developed the *Climate Ready Water Utilities*[vi] initiative to assist water and wastewater systems with integrating climate change considerations into near- and long-range planning
- Water Research Foundation, AWWA, and EPA developed *Business Continuity Plan Tool Kit*[vii] for water utilities
- Developed *All-Hazard Consequence Management Planning for the Water Sector*[viii]
- Developed *Projects and Activities to Support a Secure and Resilient Water Sector*[ix]
- Developed (2010) and updated the *2011 Water Emergency Roundtable Outline for Discussion Guide*[x]
- Developed the 2012 *Bridging the Gap: Coordination between State Primacy Agencies and State Emergency Management Agencies*[xi] guide
- Developed the 2013 *State Drinking Water Program All-Hazard Preparedness, Mitigation, Response, and Recovery Checklist*[xii] to provide state drinking water programs with internal emergency checklists and best practices

Enhanced Partnerships

- Expanded the *Water Information Sharing and Analysis Center*[xiii] (WaterISAC) with important increases in membership and products and services, such as webcasts and threat briefings
- Leveraged the Critical Infrastructure Partnership Advisory Council (CIPAC) framework to develop sector priorities, build partnerships, and increase collaboration among public and private sector stakeholders
- Improved dialogue between government and industry partners, which has enhanced mutual understanding of water industry issues
- Improved communication with state and local officials on Water Sector issues, including the establishment of annual meetings
- WaterISAC established information-sharing partnerships the National Cybersecurity and Communication Integration Center, ICS-CERT, the National Infrastructure Coordinating Center, U.S. Cyber Command, other ISACs, and state and local intelligence fusion centers

Expanded Use of Tools, Programs, Exercises, and Training

- Completed deployment, commenced analysis, and began publication of results from EPA's five *Water Security Initiative*[xiv] pilots, which involved designing and testing contamination warning systems
- Conducted numerous state tabletop exercises focusing on natural disasters with state drinking water and wastewater agencies, state and Federal emergency response officials, and water utilities
- Conducted full-scale exercises in participation with 25 Federal, state, local and commercial laboratories
- Developed the Water Laboratory Alliance training center to provide tools and other resources to water utility and state laboratories
- Completed development of the *Water Health and Economic Analysis Tool*[xv] drinking water and wastewater modules for hazardous gas and loss of operating assets scenarios
- Conducted 20 water-specific training courses on how to use the Incident Command System (ICS) and the National Incident Management System (NIMS) effectively during emergency response situations
- Developed the *Community Based Water Resiliency Tool*[xvi] to assist water utilities in enhancing the preparedness of their communities
- Partnered with the Federal Bureau of Investigation (FBI), U.S. Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) to sponsor four Multi Sector Infrastructure Protection and Threat Workshops
- Completed integration of the National Environmental Methods Index for Chemical, Biological, and Radiological Methods data into the *Water Contaminant Information Tool*[xvii]
- Developed the *Tabletop Exercise Tool for Water Systems: Emergency Preparedness, Response, and Climate Resiliency*[xviii] to aid in the development of customized scenario-driven, discussion-based tabletop exercises
- Developed *Containment and Disposal of Large Amounts of Contaminated Water: A Support Guide for Water Utilities*[xix]
- Worked with the Preparedness, Emergency Response, and Recovery CIPAC Workgroup to develop the *All-Hazard Consequence Management Planning for the Water Sector*[xx] guide to developing and implementing emergency response plans
- Developed and published updated versions of *Standardized Analytical Methods for Environmental Restoration Following Homeland Security Events*[xxi]
- Developed and tested new methods for the detection and sensing of contaminants in water systems
- Developed data for use in risk and threat assessment from chemical, biological and radiological contaminants
- Provided new versions for cyber-based tools for physical infrastructure protection, for example, a sensor event detection algorithm and a sensor placement optimization tool, and a new real time extension for EPANET; provided user manuals and conducted training and user group sessions to support the use of these tools
- Developed *Need to Know: Anticipating the Public's Questions during a Water Emergency*,[xxii] a tool for risk and hazard communication for water utilities
- Produced data on the persistence, fate, and decontamination of a variety of contaminants for integration into the *Water Contaminant Information Tool*[xxiii]
- Developed and demonstrated tools and processes for managing contaminants in wastewater and runoff
- Developed the *EPA Waste Estimation Support Tool*[xxiv] (WEST) that incorporates wastewater considerations in development of integrated response/recovery strategies from radiological incidents
- Developed *Federal Funding for Utilities – Water/Wastewater – in National Disasters*[xxv] (FedFUNDS) tool to
- provide tailored information to utilities about applicable Federal disaster funding programs
- Developed the *RDD Wash Aid*[xxvi] program to demonstrate mitigation of radioactive cesium contamination

2013 Top Priority Activities

The Strategic Priorities Working Group identified three top priority activities out of the 21 needed activities identified by meeting participants. The Working Group established the following criteria for selecting priorities. Priority activities should exhibit the following:

- Result in a significant and needed contribution to the Water Sector's vision and goals as stated in the *Water Sector-Specific Plan* (SSP).
- Have a high probability of success within a reasonable timeframe: near term (within 2 years) or mid term (within 5 years).
- Identify practical solutions that, if implemented, would result in meaningful risk reduction.
- Consider the *Water Sector Coordinating Council Strategic Roadmap*.
- Fall within the capabilities of WSCC and WGCC associations and agencies (e.g., resources, authorities).

Scope

The scope of the Roadmap security and resilience activities encompasses:

- Prevention, detection, response, and recovery
- Water and wastewater infrastructures
- All hazards, such as natural disasters, economic crises, accidental releases, and intentional physical and cyber attacks
- Top-priority issues for the WSCC and GCC
- Five-year time frame

Roadmap contributors believe these top priority actions must be pursued to mitigate significant risks in the Water Sector, including: natural disasters (e.g., water quality & quantity impacts from floods, hurricanes, earthquakes, ice storms, pandemic flu, and other catastrophes depending on geographic location); economic issues from aging infrastructure and limited resources for adequate response planning and resilience investments; cyber events; and current capability deficiencies to manage large-area losses of water. Risks identified by meeting participants are provided in Appendix B: Summary of Water Risks.

The top priority activities are listed in Table 2, followed by a series of tables providing more detailed descriptions of each activity.

Table 2 Top Priority Activities for the Water Sector

Top Priority Activities for the Water Sector
A. Advance the development of sector-specific cybersecurity resources
B. Raise awareness of the Water Sector as a lifeline sector and recognize the priority status of its needs and capabilities
C. Support the development and deployment of tools, training, and other assistance to enhance preparedness and resiliency

To be successful, each activity will need the support of the WSCC, WGCC, and security partners. If achieved, these activities together will strengthen the sector's ability to plan for effective response and recovery, maintain resilience during a calamitous event, and garner support for both disaster and risk mitigation cost recovery. Roadmap contributors have defined the following roles and responsibilities for implementing each top priority activity:

- **Coordination Lead:** Provides direction and guidance to keep the activity on track, establishes work groups when needed, and brings in other organizations and experts to help execute the activity.
- **Principal Partner:** Initiates the activity, contributes the necessary financial and technical resources, and communicates progress.

1 Water Sector Coordinating Council – Cyber Security Working Group, *Roadmap to Secure Control Systems in the Water Sector*, 2008.

Table 2a Top Priority Activity for the Water Sector

Advance the development of sector-specific cybersecurity resources

Opportunity: Development of cybersecurity resources that enhance Water Sector capabilities, increase cybersecurity education and awareness, build a business case for cybersecurity investments, streamline information sharing between government and industry, and strengthen cybersecurity culture. Increases the potential for better preparedness and resilience of water and wastewater infrastructure during a cyber event.

Challenges to Implementation:

- Increasingly sophisticated, fast-changing cyber threats are difficult to keep up with
- Complex and evolving cyber vulnerabilities are time and resource-intensive to mitigate
- Resources available for the implementation and continual adaptation of cybersecurity programs and products relevant to the Water Sector are limited

Coordination Lead:
WSCC

Principal Partners:
American Water Works Association, DHS, EPA, WaterISAC

Most Aligned with SSP Goals:
Goal 2: Recognize and reduce risk; Goal 3: Maintain a resilient infrastructure.

Corresponding SCC Priority:
Enhance the cybersecurity posture of the Water Sector

Description/Application: In 2008, industry and government partners created a common vision of cybersecurity and a roadmap to get there. This voluntary, collaborative approach has aligned joint resources and capabilities to enhance cybersecurity of the Water Sector. Advancing these efforts will help the sector achieve its vision: to survive a cyber event with no loss of critical function.[1] Leveraging existing resources that address the unique performance requirements and operational needs of the sector will help develop useful products for the sector.

Efforts to enhance Water Sector cybersecurity practices could include:

Near Term (within 2 years):

- Develop advanced cybersecurity guidance, practices, and tools that are sustainable, effective, and implementable for utilities of all sizes and types
- Enhance practices and resources to strengthen and maintain a culture of cybersecurity among industry, government, and citizen stakeholder groups
- Enhance resources to raise the education and awareness of cyber risks and lessons learned from past incidents in the Water Sector
- Improve methods for government to share threat information with industry
- Conduct multi-sector cyber event exercises including the Water Sector
- Engage vendors, integrators, and other critical sectors to jointly address and develop next-generation cyber and physical tools and practices

As Federal cybersecurity regulations and policies, such as the Executive Order 13636 and Presidential Policy Directive 21, evolve, the Water Sector will continue to consider their impact on future efforts.

Table 2b Top Priority Activity for the Water Sector

Raise awareness of the lifeline status of the Water Sector and establish its needs and capabilities as priorities

Opportunity: Provides the Water Sector as well as local, state, and Federal emergency planners, regulators, and ratepayers with an understanding of the benefits of a secure and resilient Water Sector, enabling decision makers to effectively prioritize Water Sector needs in resilience and emergency response planning. Expedites community recovery.

Challenges to Implementation:

- The concept of a lifeline sector is not commonly understood among all levels of government, critical infrastructure sectors, and the communities they serve.
- The failure to include the Water Sector as a key priority increases the risk of cascading consequences during a catastrophic event.

Coordination Lead:
Joint WSCC and WGCC

Principal Partners:
Sector associations and government agencies

Most Aligned with SSP Goals:
Goal 3: Maintain a resilient infrastructure;
Goal 4: Increase communication, outreach, and public confidence.

Corresponding SCC Priority:
Raise the profile of the criticality of the security and resilience of the Water Sector

Description/Application: Lifeline sectors—of which the Water Sector is routinely identified by Federal and state/local leadership—ensure the resilience, safety, prosperity, and rapid recovery of the communities they serve.[2] Defined priorities for resource requests from drinking water and wastewater utilities can help mitigate or avoid public health and environmental impacts. For example, the Water/Wastewater Agency Response Network's (WARN's) *Superstorm Sandy After-Action Report* found that a clear and recognized priority status among emergency management and the power utilities may have directed greater attention to loss of power at water and wastewater facilities.

Raising awareness of the priority status of the Water Sector could build on existing tools and include:

Near Term (within 2 years):

- Conduct state/local exercises that improve understanding of Water Sector interdependencies and impacts of loss of service during a disaster
- Develop and implement an education and awareness campaign that helps utilities to communicate the importance of including the Water Sector in emergency planning and to describe the costs and benefits of risk reduction investments to states and public commissions
- Develop and implement public messaging to gain consumer in addition to local, state, and Federal support for pre-disaster risk reduction and resilience activities
- Enhance engagement with utilities during smaller emergencies and planned maintenance to assess emergency response plans
- Determine the applicability of FEMA assistance criteria to address Water Sector needs and ensure the criteria is clear and well understood
- Improve engagement with the SLTTGCC to raise awareness at the state/local level

Mid Term (within 5 years):

- Develop incentives—through grants, insurance, standards, and certification—to increase investment in Water Sector infrastructure
- Perform after-action analyses performed after large events that highlight economic implications for the Water Sector
- Conduct tabletop exercises and workshops to improve understanding of interdependencies with other sectors and leverage that reliance to raise awareness of Water Sector criticality
- Develop Federal incentives for state drinking water programs and emergency management programs to support hazard mitigation investments

2 The Water Sector is identified as a lifeline sector in the following documents, among many others: National Infrastructure Advisory Council (NIAC) Regional Resilience Working Group, *Report to the NIAC Quarterly Business Meeting*, 2012; State, Local, Tribal, and Territorial Government Coordinating Council, *Landscape of State and Local Government Critical Infrastructure Resilience Activities & Recommendations*, 2011.

Table 2c Top Priority Activity for the Water Sector

Support the development and deployment of tools, training, and other assistance to enhance preparedness and resiliency

Opportunity: Provides development of resources to support the Water Sector in assessing risk; updating and maintaining emergency response and risk management plans; and prioritizing resilience practices and investments. Improves resiliency and preparedness.

Challenges to Implementation:

- Many utilities lack the resources to sift through an array of tools to identify the most relevant and useful for their unique conditions
- Evolving threats and risk management concepts necessitate periodic reviews and updates of risk management and emergency response plans

Coordination Lead:
Joint WSCC and WGCC

Principal Partners:
WSCC (ERP updates); GCC (tool development)

Most Aligned with SSP Goals:
Goal 1: Sustain protection of public health and the environment;
Goal 2: Recognize and reduce risk.

Corresponding SCC Priority:
Streamline the security decision-making processes for water utility owners and operators

Description/Application: Risk cannot be completely eliminated, but water and wastewater utilities can more effectively use limited resources to manage risks and improve infrastructure resilience with sector-specific decision-making processes. Tools and resources can help the Water Sector to better assess risk, prioritize future activities and investments, update risk management and emergency response plans, and leverage lessons learned from past events to constantly improve their processes.

Decision-making resources to improve resilience could leverage and promote existing tools, training, and other assistance and include:

Near Term (within 2 years):

- Develop a tool consistent with the J100-10 standard to help utilities update all-hazards risk assessments, and then leverage them to update emergency response and risk management plans; perform after-action analyses; and incorporate lessons learned following an event
- Develop a method to coordinate cyber and physical risk assessment tools to enhance management decision-making
- Integrate Water Sector considerations into emergency response planning to ease access and credentialing issues for water utility personnel during an event
- Communicate the value of existing decision-making resources and promote their use to avoid duplicating efforts and foster better decision-making
- Leverage tools and best practices from interdependent sectors to understand their potential application to the Water Sector
- Examine climate change adaptation strategies to identify "no regret" measures that offer multiple types of benefits
- Update the All-Hazards Consequence Management Plan to create a better understanding of current threats and vulnerabilities and strategies to reduce the impacts of an emergency event
- Harness existing tools and guidance to develop an overarching tool/resource that defines key actions and procedures to help utilities enhance their preparedness and resilience
- Integrate water sector considerations into all-hazards preparedness and response tools designed to support wide-area urban contamination incident response

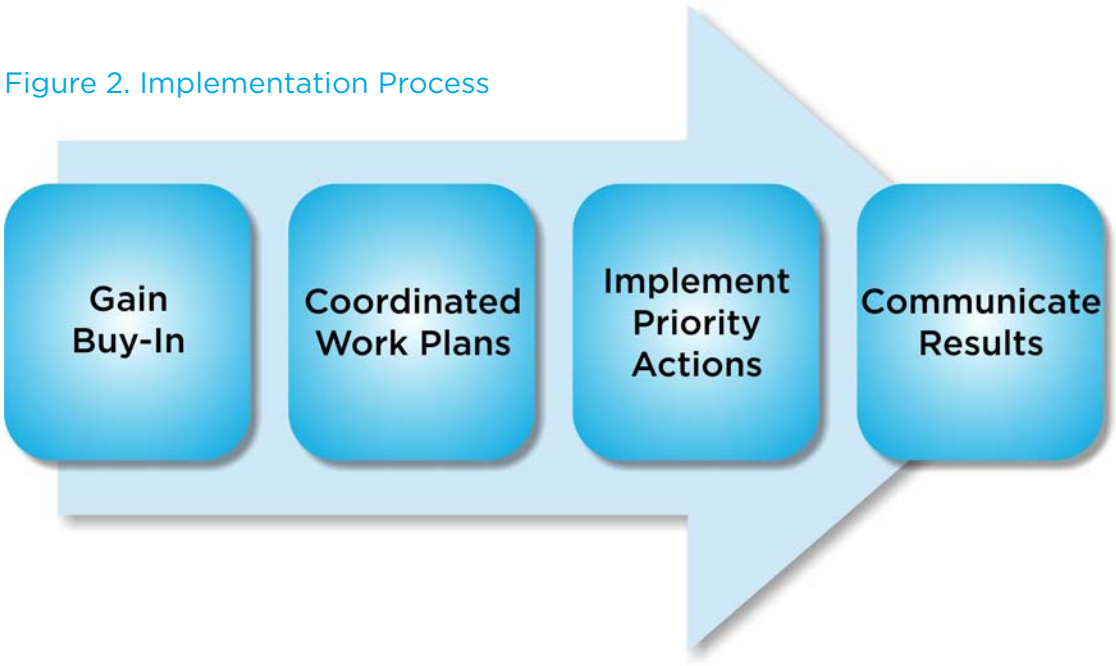
Mid Term (within 5 years):

- Periodically assess available resources, identify current needs and gaps, and improve existing resources or develop new ones
- Demonstrate the capabilities of existing tools and develop case studies to communicate their success

Implementation

By working together to develop the *Roadmap to a Secure & Resilient Water Sector*, the sector has leveraged a broad range of operational and infrastructure protection experience to identify the most pressing sector needs and prioritize actions that industry and government can take to begin immediately enhancing water preparedness and resiliency. While Water Sector members recognize that a major infrastructure disruption—whether deliberate, natural, or accidental—may prompt changes in the type and level of risks, they will use the priority framework to coordinate changes in work plans as needed. Figure 2 outlines the main Roadmap implementation steps.

Figure 2. Implementation Process



Gain Buy-In

The Working Group will engage Water Sector association, regional organization, and agency leadership, to communicate and gain buy-in on Roadmap priorities, and motivate Coordination Leads and Principal Partners to step up and take action.

Coordinate Work Plans

Coordination Leads will provide direction and guidance to keep the activity on track, establish work groups when needed, and bring in other organizations and experts to help execute top priority activities.

Implement Priority Activities

Principal Partners will identify top priority Activity Leads who will initiate and manage their activity plans, contribute the necessary financial and technical resources, encourage active stakeholder participation, collaborate with Coordination Leads to stay on track, and deliver tangible results.

Communicate Results

Activity Leads will inform the public, the Administration, and Water Sector security partners on progress. Leads should take into account and make use of the communications capabilities available on the WaterISAC as they execute their activities. When progress is achieved, the results will be promoted to facilitate widespread application throughout the United States.

Appendix A: Roadmap Update Process

The *Roadmap to a Secure & Resilient Water Sector 2013* was developed according to the process shown in Figure A.1 and described below.

Figure A.1. Roadmap Update Process

Form CIPAC Water Sector Strategic Priorities Working Group

In February 2013, the Strategic Priorities Working Group established itself under the CIPAC framework.

Set Priority Criteria and Develop Work Plan

On March 8, 2013, the Working Group held a Strategic Priorities Update planning call to establish the Working Group purpose, document update requirements, set priority criteria, and develop a work plan for updating the 2009 *Roadmap to a Secure and Resilient Water Sector*.

Assess Progress and Identify Top Priorities

On March 20, 2013, the Working Group held a CIPAC Strategic Priorities Planning Meeting in Washington, D.C. During the meeting, 23 representatives from the Water Sector, including Working Group members, owners and operators, state representatives, associations, and subject matter experts, reviewed the accomplishments made since 2009; examined remaining opportunities; identified the scenarios that create the highest risk to the Water Sector and established the top priorities to improve the security and resilience of critical infrastructures over the next five years.

Refine Implementation Strategy

The draft strategic Roadmap was developed and circulated among meeting participants, the Working Group, and other key stakeholders for added insight and clarification. A webinar was held on April 15, 2013, and an in-person meeting was held on May 7, 2013, to clarify key points and review and refine the implementation strategy.

Prepare, Review, and Publish Roadmap

The revised draft strategic Roadmap was circulated among meeting participants, the Working Group, and other key stakeholders for added insight and clarification. A final conference call was held on May 20, 2013, to resolve outstanding issues. The comments of all reviews have been integrated into this final Roadmap document.

Appendix B: Summary of Water Sector Risks

On March 20, 2013, the Working Group held a CIPAC Water Sector Priorities Update Meeting in Washington, D.C. During the workshop, 23 representatives from the Water Sector, including Working Group members, owners and operators, state representatives, associations, and subject matter experts, discussed the key concerns that could drive sector activities and coordination over the next five years.

Participants identified the scenarios that create the highest risks to the Water Sector, based on their personal experience and expertise; see Table B.1. Identified risks included threats, vulnerabilities, and consequences; however the consequences identified remained threat-neutral. These are general risks, not quantitative risks, for the sector, and each utility will face different risks with differing priority levels depending on their size, location, and risk profile.

Participants prioritized the risks into three categories:

Most significant risk:

Risks that need the Water Sector's most urgent attention and greatest resources, based on the pervasiveness of the threat or the potential high impact. Priority activities should directly mitigate one or more of these risks.

High risk:

Risks that need serious attention and resources; and can shape how priority activities for the sector are identified and implemented, as many activities can reduce the impacts of both most significant and high risks.

Medium risk:

Risks that need thoughtful attention and resources, as a disruptive event can escalate the level of risk. Medium risks are considered when identifying and implementing priority activities.

A single risk event can cause multiple effects. For example, a hurricane (most significant risk) can cause communication and technology issues (medium risks). However, interoperability issues can escalate to high risk if they inhibit a coordinated response and responders cannot secure backup generation and prevent a loss of system pressure.

Table B.1. Strategic Priorities Working Group Identified Risks for the Water Sector

Most Significant Risks

- Natural disasters (such as water quality and quantity impacts from floods, hurricanes, earthquakes, ice storms, pandemic flu, and other geographic catastrophes)
- Economic implications of aging infrastructure
- Cyber events
- Capability in managing an area-wide loss of water
- Although the Water Sector has been defined as a lifeline sector, it is not commonly recognized among all relevant stakeholders, which can escalate consequences during area-wide events

High Risks

- Economic costs of preparation and response – the Water Sector can create a large economic risk in a disaster, but there are insufficient funds to prepare and address risks ahead of time
- Ignorance about the consequences of inaction and apathy from some stakeholders in utilities, the customer base, state/local government, and Federal Government/Congress
- Inadequate coordination and information sharing during preparation, response, and recovery
- Malicious intentional acts
- Limited resource availability – Many utilities are faced with competing immediate, concrete needs (e.g., regulatory, aging infrastructure, environmental and public health protection, and workforce succession requirements) that can limit resource availability for implementing preparedness and resiliency improvements
- Unenforced and outdated requirements that do not address evolving threats

Medium Risks

- Lack of mutual aid agreements, effective education and outreach to emergency management, and best practices for emergency response planning
- Technology interoperability issues that create information sharing challenges during response
- Insufficient communication of the definition, management, and prioritization of critical assets and needs to water utility boards

Appendix C: Definitions

To ensure a common understanding of the Roadmap, it is helpful to work from the same definition of key terms. The following definitions were drawn from sector resources as noted in a footnote, or defined by the Strategic Priorities Working Group for the purposes of this Roadmap and its results.

Lifeline Sectors: Energy, Water, Telecommunications and Transportation—those sectors that are of primary concern in disaster response and recovery and that, because they provide supporting infrastructure to all other sectors, can negatively impact all critical infrastructure and the surrounding community and region when they fail.[3]

Priority Activities

Coordination Lead: Provides direction and guidance, keeps the activity on track, establishes work groups when needed, and brings in other organizations and experts to help execute the activity.

Principal Partner: Initiates the activity, contributes the necessary financial and technical resources, and communicates progress.

Short term: A major milestone of the activity can be achieved or delivered within two years.

Mid term: A major milestone of the activity can be achieved or delivered within five years.

Risks

Most significant risk: Risks identified by Roadmap contributors that need the Water Sector's most urgent attention and greatest resources, based on the pervasiveness of the threat or the potential high consequences. Priority activities should directly mitigate one or more of these risks.

High risk: Risks identified by Roadmap contributors that need serious attention and resources; and can shape how priority activities for the sector are identified and implemented, as many activities can reduce the impacts of both most significant and high risks.

Medium risk: Risks identified by Roadmap contributors that need thoughtful attention and resources, as a disruptive event can escalate the level of risk. Medium risks are considered when identifying and implementing priority activities.

3 Though lifeline sectors have not been defined in Federal doctrine, many common definitions center on these four sectors, including this definition from the National Infrastructure Advisory Council.

Appendix D: Acronyms

AMWA	Association of Metropolitan Water Agencies
ASDWA	Association of State Drinking Water Administrators
AWWA	American Water Works Association
CIPAC	Critical Infrastructure Partnership Advisory Council
DHS	U.S. Department of Homeland Security
EPA	U.S. Environmental Protection Agency
ERP	emergency response plan
FEMA	Federal Emergency Management Agency
ISAC	Information Sharing and Analysis Center
NACWA	National Association of Clean Water Agencies
NAWC	National Association of Water Companies
NIPP	National Infrastructure Protection Plan
NRWA	National Rural Water Association
RAMCAP	Risk Analysis and Management for Critical Asset Protection
SLTTGCC	State, Local, Tribal, and Territorial Government Coordinating Council
SSP	Sector-Specific Plan
WARN	Water/Wastewater Agency Response Network
WEF	Water Environment Federation
WERF	Water Environment Research Foundation
WGCC	Water Government Coordinating Council
WaterISAC	Water Information Sharing and Analysis Center
WaterRF	Water Research Foundation
WSCC	Water Sector Coordinating Council

Appendix E: References

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Full Links for Publications in Table 1 Key Water Sector Successes (2009-2013)

[i] http://www.nationalwarn.org/

[ii] http://www.awwa.org/Portals/0/files/resources/water%20knowledge/rc%20emergency%20prep/rc%20warn%20resources%20pdf/typingmanual.pdf

[iii] http://www.awwa.org/Portals/0/files/resources/water%20knowledge/rc%20emergency%20prep/Emergencywater.PDF

[iv] http://www.cdc.gov/healthywater/pdf/emergency/emergency-water-supply-planning-guide.pdf

[v] http://www.cdc.gov/healthywater/pdf/emergency/drinking-water-advisory-communication-toolbox.pdf

[vi] http://water.epa.gov/infrastructure/watersecurity/climate/

[vii] http://collab.waterrf.org/Workshops/BCP/default.aspx?PageView=Shared

[viii] http://www.awwa.org/Portals/0/files/resources/water%20knowledge/rc%20emergency%20prep/All-Hazard.pdf

[ix] http://asdwasecurity.files.wordpress.com/2010/09/projects-and-opportunities_final1.pdf

[x] http://www.asdwa.org/document/docWindow.cfm?fuseaction=document.viewDocument&documentid=1333&documentFormatId=1521

[xi] http://water.epa.gov/infrastructure/watersecurity/emerplan/upload/epa817f12006.pdf

[xii] http://water.epa.gov/infrastructure/watersecurity/

[xiii] http://www.waterisac.org

[xiv] http://water.epa.gov/infrastructure/watersecurity/lawsregs/initiative.cfm

[xv] http://yosemite.epa.gov/ow/SReg.nsf/description/WHEAT

[xvi] http://water.epa.gov/infrastructure/watersecurity/communities/

[xvii] http://water.epa.gov/scitech/datait/databases/wcit/index.cfm

[xviii] http://yosemite.epa.gov/ow/SReg.nsf/description/TTX_Tool

[xix] http://water.epa.gov/infrastructure/watersecurity/emerplan/upload/epa817b12002.pdf

[xx] http://www.wef.org/uploadedFiles/Access_Water_Knowledge/Water_Security/Water_Security_PDFs/All-HazardCMPNovember2009FINAL.pdf

[xxi] http://nepis.epa.gov/Exe/ZyNET.exe/P1005B4P.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000011%5CP1005B4P.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL

[xxii] http://cfpub.epa.gov/si/si_public_record_report.cfm?address=nhsrc/si/&dirEntryId=240476

[xxiii] http://water.epa.gov/scitech/datait/databases/wcit/index.cfm

[xxiv] http://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=246738&fed_org_id=1253&address=nhsrc/si/&view=desc&sortBy=pubDateYear&showCriteria=1&count=25&searchall='indoor%20outdoor%20decontamination'%20AND%20'radiological

[xxv] http://water.epa.gov/infrastructure/watersecurity/funding/fedfunds/

[xxvi] http://www.warrp.org/capstone_docs/7.6.1-Radiological%20Wash%20Aid%20and%20Collection%20System%20for%20Critical%20Infrastructure.pdf