Nationwide Watershed Regional Risk and Resilience Goal & Strategy

Dam Sector Regional Risk and Resilience Task Group

Version 1.0   October 2024

Overview

The Goal & Strategy was developed by a national Task Group of senior government, private sector, and non-profit resilience practitioners and experts to meet the needs of communities and critical infrastructures located within the nation's diverse watershed regions to collaboratively build resilience to address the challenges of a rapidly changing risk landscape.

The Goal & Strategy:

➢ Explains why watershed regional resilience is essential in an era of rapidly escalating risks from climate, technological, and other existing, emerging, and unanticipated threats and hazards and the implications of infrastructure interdependencies within watersheds that drive and determine vulnerabilities, impacts, risk, and risk reduction priorities.

➢ Goes into detail on what watershed regional resilience is and requires and the principles underlying resilient watershed regions.

➢ Describes the essential multi-step Holistic Approach necessary for watershed decision makers and key stakeholders to collaboratively develop an Action Strategy of identified needs and corresponding mitigation and other actions with an Implementation Plan to enable continuous resilience improvement using lessons learned from future events, exercises, and best practices from other watershed regions.

➢ Identifies the comprehensive set of resilience Focus Areas that provides the basis of a regional risk assessment, the key needs and solutions within each of these Focus Areas, and the Attributes and Enabling Capabilities that must be considered to identify mitigation and other risk reduction actions.

➢ Addresses challenges regional decision-makers and key stakeholder typically face and how to address them, including how to access available resilience tools and resources, facilitate information-sharing, obtain necessary data, secure funding and other investments for implementation and sustainment, generate political will and societal support, and ensure necessary collaboration from the local to national levels.

Lastly, the Goal & Strategy points out how watershed communities and their supporting infrastrucures can incorporate resilience into their region's cultures and practices and the benefits of collectively undertaking Watershed Regional Risk and Resilience initiatives.

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Introduction

Purpose, Focus, and Anticipated Users

The Goal & Strategy provides a customizable framework and process with selected resources for public/private sector and non-profit organizations to collectively assess risk and develop and implement an ongoing Action Strategy to improve the resilience of their watershed region to withstand climate change-related and other natural and manmade events. The focus is on threats and hazards that can significantly disrupt or damage water management and other critical infrastructure functions and services and the communities they support, and the overall watershed ecosystem.

The Goal & Strategy was developed by a Task Group of practitioners and experts from federal, state, and local agencies, the private sector, academic and research institutions, and national associations under the Dam Sector Regional Risk and Resilience Program (DSR3P) sponsored by U.S. Army Corps of Engineers Homeland Security. The intent is to provide decisionmakers and other stakeholders that have different levels of resilience-related knowledge, capabilities, staff, and financial resources a practical and achievable process to incrementally improve watershed resilience over time.

Towards this end, the Goal & Strategy leverages various community resilience frameworks and guides to provide a continuous Holistic Approach to assessing regional risk and enhancing resilience that considers both natural and built environments, and economic, health and safety, and other factors. Key objectives include fostering collaboration among watershed decision makers and stakeholders and providing guidance to federal and state agencies on building and strengthening relationships with them through supporting Watershed Regional Risk and Resilience initiatives.

Using the Goal & Strategy

The Goal & Strategy is meant to be used with selected resources and tools provided in an online Watershed Regional Risk and Resilience Playbook (R3 Playbook). Other resources are available on the Internet.

The Goal & Strategy also identifies some of the more important enabling capabilities that are under development, as well as others that need to be developed to undertake and sustain Watershed Regional Risk and Resilience initiatives. It also highlights the individual and collective benefits of these initiatives for regional stakeholders, states, and federal agencies. Lastly, the Goal & Strategy at the end includes a list of Task Group participants. Contact information of Task Group members available to answer questions or direct users to other information to assist them in undertaking Watershed Regional Risk and Resilience Initiatives are provided in the online Playbook .

Why Watershed Resilience is Essential in an Era of Rapidly Escalating Risk

The last several years have witnessed the increasing occurrence, scope, intensity, and cost of events driven by climate change, technological and societal changes, and emerging new threats.

Among the most impactful recently in the U.S. has been two major hurricanes. Helene in September 2024 wreaked a swath of destruction from Florida's Big Bend region on the Gulf Coast through several U.S. Southeast states, followed within two weeks by Milton with extensive coastal damage, major flooding, and tornado outbreaks ravaging communities across central Florida.

Other significant disasters and events over just the past few years have included Hurricane Ian's devastation of the southwest Florida coast in September 2022, tornado outbreaks in the Midwest and South affecting multiple states, annual major floods in California and severe widespread flooding in Kentucky in July 2022, Vermont in July 2023, and southeastern Texas in the spring of 2024. There were record-breaking wildfires across Canada through spring into fall of 2023 causing prolonged smoke pollution over much of Northeastern U.S. and Great Lakes region; a drought and heat wave across the U.S. south, and a hurricane-driven wildfire in August 2023 that devastated a portion of the Hawaiian Island of Maui. Early 2024 saw multiple wildfire events in February and March extending across the Texas panhandle into Oklahoma that torched more than 1 million acres, killing thousands of livestock, decimating crops and small rural communities, and damaging critical infrastrucures. The summer of 2024 witnessed wildfire outbreaks in California, Oregon and Nevada with nationwide intense heat waves. An unanticipated manmade disaster was the collapse of the Francis Scott Key Bridge on March 26, 2024 due to a container ship collision that virtually shut down the port of Baltimore with major national supply chain and regional economic impacts.

According to the NOAA National Centers for Environmental Information, 2023 was a historic year in the number of costly disasters across the U.S. with 28 weather and climate-related events at a cost estimated at $92.9 billion, excluding the costs of the December 16-18 East Coast storm and flood event. In 2024 as of early September before Helene and Milton, there had been 20 events with losses exceeding $1 billion each. (https://www.ncei.noaa.gov/access/billions/) In some cases, flooding from storms exceeded the 100-year event threshold, and some Southern California locations in early 2024 experienced even more severe rainfall events. The rainfall from Milton in the Tampa region was a 1,000-year event. The potential for future "mega-floods" fueled by climate change and other extreme scenarios are now under study by the U.S. Geological Service (USGS) and other research institutions. (Climate change is increasing the risk of a California mega flood | Science Advances)

Beyond extreme weather events, there are other major hazards of concern—earthquakes, environmental disasters (e.g., oil or other hazardous waste spills, unanticipated accidental manmade events, and escalating cyber and physical attacks disrupting or damaging water, energy and other critical infrastructures with the potential for prolonged regional service outages. (https://www.rand.org/pubs/commentary/2024/02/threats-to-americas-critical-infrastructure-are-now-a-terrifying-reality.html)

This trend of escalating risks is expected to continue, compounded by rapidly rising sea-levels and average world temperatures, and aging and deterioration of critical infrastructures that manage, support, and sustain watershed regions. For example, the USACE National Inventory of Dams identifies more than 91,000 dams with an average age of 63 years based on criteria that downstream flooding would likely result in loss of human life and disruption to critical facilities, requiring difficult mitigation efforts. The USACE website notes that the Inventory does not yet contain all dams in the U.S. that meet these criteria and that nearly a quarter of the dams identified in the Inventory are not federally or state regulated. (https://nid.sec.usace.army.mil/#/) USACE's updated National Inventory of Levees lists 6,843 known levee systems averaging 60 years old that have 23 million people, 2,388 communities, 7 million buildings, and 5 million acres of farmland behind them that have an estimated $2 trillion in value. The database does not include thousands of miles of levees whose location, condition, and in many cases, ownership are unknown. (National Levee Database (army.mil)

What Regional Watersheds are and Why their Resilience is Important

Everyone in the United States lives in an area that's part of a regional watershed. Watersheds can be small local areas, but some are so large they span several states or cross national borders. The U.S. Geological Survey (USGS) describes a watershed as "an area of land that drains all the streams and rainfall to a common outlet, such as the outflow of a reservoir, mouth of a bay, or


https://water.usgs.gov/wsc/watershed_finder.html

any point along a stream channel." Every one of these watersheds is unique because of their locations, types of weather, the number of people living there, way of life, and local and state rules and regulations. A watershed region may range from a densely populated urban area of numerous counties and many cities and towns with extensive co-located infrastructure to a rural area with no to a few small low-resourced communities and limited, dispersed infrastructures and road access.

The USGS website has an interactive map of the nation's watershed regions down to local subregions. Click on the above website and then any region in the map to see the watershed boundary and find links to information on its characteristics and typical hazards.

Infrastructure Dependencies and Interdependencies—Determinants of Watershed Resilience

The resilience of watershed regions relies on the secure and reliable functions and services of physical and cyber infrastructures and their supply chains. They include: water and wastewater, energy (electric power, oil, natural gas, hydropower, and other fuels—production and distribution); all modes of transportation—road, rail, shipping, including on inland waterways; healthcare, emergency services, and public safety; commercial businesses, community institutions, and national defense installations, as well as the "smart" information technologies and the human workforce to operate and manage them. The operation of the physical structures, components, and electronic and cyber systems of these critical infrastructures are dependent on the functions and services of other infrastructures, which in turn are dependent on others. This creates complex multi-level layers of interdependencies that can cause simultaneous, escalating, and cascading impacts and/or damage throughout and beyond a watershed region resulting in prolonged disruptions of essential functions and services, impeding response actions, and complicating and delaying recovery and restoration of facilities, assets, and systems. The growing incorporation of smart technologies into systems and networks to improve management of an increasing range of

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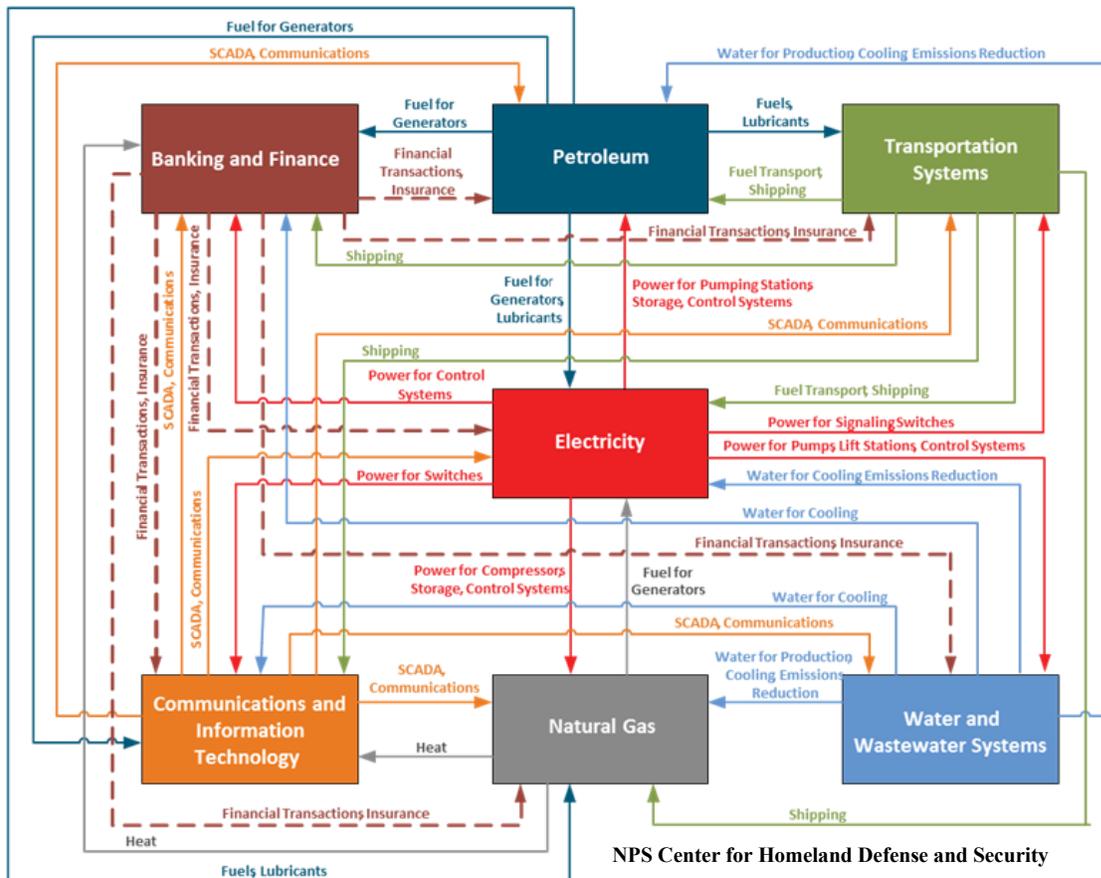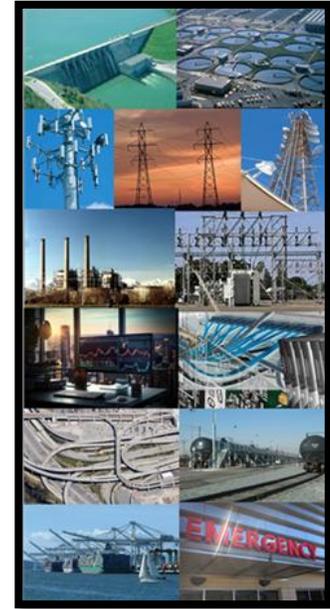
functions and services adds additional layers of interconnectivity that can contribute to the severity of impacts.

Water Management Infrastructure. Crucial to the assured and reliable operation of the interdependent infrastructures that support our watershed regions are publicly and privately-owned and operated water management facilities and systems. Water management facilities play a vital role in our everyday lives. These facilities and systems ensure our taps have running water, treat sewage and waste, control floods, manage rainfall runoff, and maintain the delicate balance of our natural ecosystems.

Water Systems-Related Interdependencies
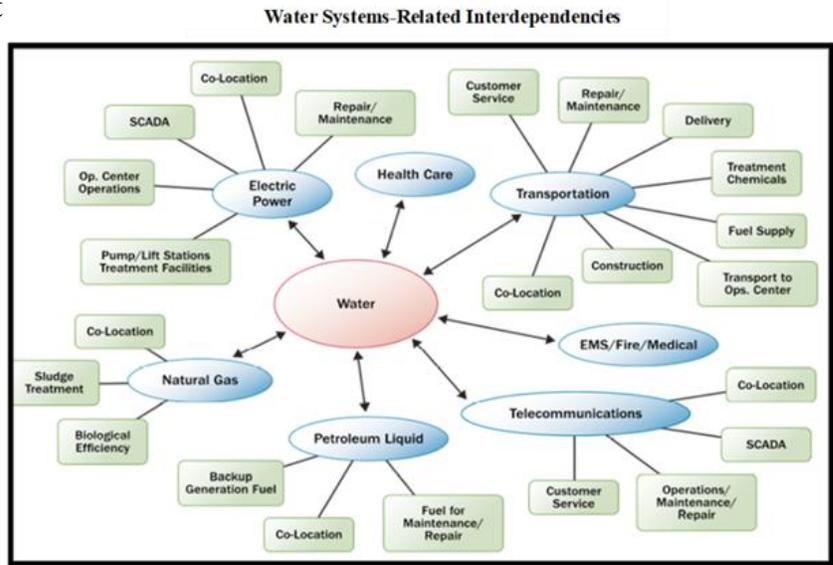
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Water management infrastructure includes dams, levees, reservoirs and other bodies of water, water and wastewater treatment, sewer overflow, stormwater management assets, and recycled water treatment facilities. Water management infrastructure also includes other components that manage or regulate flood control, recreation, waterway navigation, conservation, agriculture, and protection of the environment and endangered animal and plant species.

Hartwell Dam and Lake, one of the Southeast's largest recreation areas
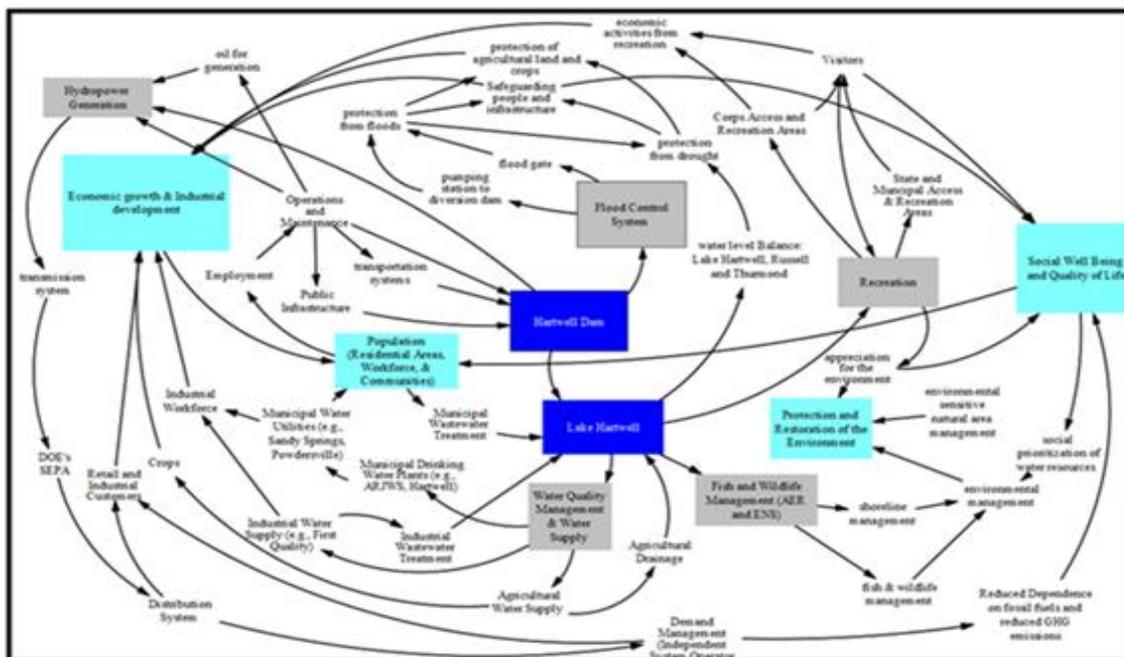
Consequently, interdependent infrastructures must be resilient—*able to adapt to changing conditions and prepare for, withstand, and rapidly recover from damage or disruption.* To achieve watershed regional resilience, decision-makers and other *key stakeholders must appreciate, understand, and assess how these dependencies and interdependencies can cause and/or make vulnerabilities worse under different scenarios, and the cascading impacts that could result.* It is essential to know which risks are the most important and at the same time anticipate the unexpected. Because, as previously noted, all watersheds are unique, the type and priority of these risks will be different for each region.

> **Interdependencies Impact Examples**
> Widespread prolonged power outages
> Water supply cut and/or contaminated.
> Raw sewage dumped
> Natural gas processing shut down
> Electronic control systems disrupted
> Cell phone towers inoperable
> Radio stations offline
> Airport closures – passenger & freight
> ATMS inoperable
> Perishable groceries lost
> Businesses closed
> Manufacturing plant operations curtailed
> Agriculture irrigation disrupted
> Port interruptions
> Roal and rail traffic impeded
> Oil refineries/chemical plants inoperable
> Hazardous materials released
> Nuclear plants shut down

This makes regional resilience a shared responsibility across the communities and their supporting infrastructures within the watershed, and necessitates:

- Building cross-sector and multi-discipline and federal-to-local level relationships among the diverse range of entities with roles and responsibilities in watershed resilience;

- Identifying sources of necessary data and other information and finding ways to collect and assess it in a trusted environment;

- Collaboratively agreeing to a regional risk reduction Action Strategy and Implementation Plan of collaborative activities and projects that involve multiple organizations and shared management and funding responsibilities;

- Securing the investments needed to undertake the identified risk reduction actions and sustain an ongoing process that over time improves the resilience capacities of the watershed and its communities and supporting infrastructures.

What Watershed Regional Resilience Requires

There currently is no single agreed definition of all-hazards regional resilience, although there are a wide variety of resilience definitions using similar terminology that have been developed by federal and state agencies, non-profits, the research community, and individual businesses that reflect sector, discipline, or organizational interests, equities, and perceptions of risk. Based on these definitions we can say that a watershed region is resilient if it can anticipate and adapt to changing conditions, limit impacts and recover rapidly from adverse events, quickly returning people to work, reopening businesses, and restoring critical infrastructure essential functions and services to normal, or in many cases, new normal conditions that may take a longer timeframe. Foundational to this description are basic principles of regional resilience that have evolved over the last two decades. The following 15 principles have informed the current national frameworks and regional and community resilience guides that are available today.

Regional Resilience Principles

1. *Need for a Holistic Approach to Improving all-hazards regional resilience.* This approach requires attention to the long-term and continuous interrelated nature of pre-event and post-event planning and implementation of risk reduction and other resilience actions, including. examining how infrastructures within a region are designed, operated, and maintained to adapt to changing risks; protection and prevention, preparedness, pre-and post-event mitigation, response, recovery/long-term restoration, and obtaining investments for resilience improvements.

2. *Understanding Infrastructure Dependencies and Interdependencies.* Interdependencies exist at multiple levels of increasing complexity and extend beyond a community, a state, and nation. From the grassroots to global levels, interdependencies of integrated physical and cyber systems remain little understood, particularly at deeper levels of complexity. There is a great need to broaden the understanding of the extent, potential impacts, and associated risks of interdependencies particularly in large-scale disasters or long-term disruptions that have regional impacts.

3. *Appreciation of the Regional Risk and Resilience Tautology.* The security and resilience of interdependent critical infrastructure and essential services depend on the resilience of the community and region they serve. Conversely a community or region's resilience depends on the resilience of their supporting infrastructures and other essential services. This means all-hazards infrastructure risk must be analyzed taking organizational and community/regional risk into account and vice versa.

4. *Undertaking an Enterprise-wide Regional Approach to Risk Assessment and Planning.* Risk assessments and risk reduction planning must (1) take an integrated approach to physical and cyber vulnerabilities and associated interdependencies affecting operations, business processes, and supply chains, and (2) examine related community and regional economic, health and safety, environmental, and societal impacts.

5. *Building Resilience into New and Restored Infrastructure.* Security and resilience should be built into plans and designs for cyber and physical systems and commercial and residential structures in the development phase and during post-disaster restoration. Regular maintenance and monitoring should be undertaken with a focus on continuous improvement through adaptation and innovation to ensure infrastructure resilience over time.

6. *Cross-Sector Collaboration and Secure Data Sharing.* Creation and maintenance of public-private collaboratives are necessary to bring key stakeholders together to build trust, foster information sharing and coordination, and cooperatively identify and assess vulnerabilities and resilience needs. These trusted collaborations enable informed decision-making and effective, prioritized orchestration of activities during steady-state, response, initial recovery, and restoration. Such partnerships should include all levels of government, utilities and other service providers, businesses essential to localities, academic and community institutions, non-profit organizations, and special interest groups.

7. *Forward-thinking Risk Mitigation.* In an era of escalating risks from climate, technological, and societal changes, pre- and post-event risk reduction requires "future scenario" thinking that considers long-range needs to address multiple, uncertain hazards and stressors. States, local, territorial, and tribal entities with cross-sector stakeholders need to have and share data to the extent possible on regional interdependent critical infrastructure nodes, links, and assets to help them prioritize mitigation actions and investments.

8. *Recognizing that Adaptive Design Innovation is Essential to Resilience.* Research on adaptive design and management has developed principles and practices for understanding inherent characteristics of adaptive systems and designing physical infrastructure, to include a broad range of nature-based and green solutions that can protect, sustainably manage, and restore ecosystems, communities and infrastructure under adverse conditions. Examples are innovations that mitigate urban heat, support better urban stormwater and flood management, reduce flooding through construction or restoration of wetlands and forests, and installation of micro-grids available to provide power when the electric grid is disrupted.

9. *Understanding the Linkages and Dynamics between Health Resilience and Economic Resilience.* All-hazards major disasters and events since Hurricane Katrina in 2005 through the COVID pandemic to recent the most recent catastrophic hurricanes, other flood events and largescale wildfires have graphically demonstrated the tight interconnection between individual health and community health resilience capacities and the vitality of local economies. People are key assets for critical infrastructures as both employees and customers. If individuals are unable to work for any reason, economic recovery is impeded until the health-related factors are effectively addressed.

10. *Incorporating and Elevating Societal Resilience Considerations in Regional Resilience Planning and Capacity Building.* Societal resilience refers to the ability of a community to cope with and adapt to stresses such as social, political, health and safety, environmental, or economic challenges from adverse events. It is important that those that live and work in watershed regions understand their region's and community's vulnerabilities and are willing to adapt to changes and support risk reduction and broader resilience efforts.

11. *Incorporation of Business and Operational Continuity Practices into Infrastructure Resilience.* Resilience, like continuity practices, depends upon the ability to maintain and sustain operations and shift gears and adapt quickly to new ways of operating. Being able to reorganize quickly, connect to new partners, rethink organizational missions, and exchange information are imperative.

12. *Development of a Nation-Wide Culture of Resilience.* There should be broad recognition of the value of resilience. Instead of spending billions of dollars and massive human capital to rebuild after disasters, limited resources should be targeted at preparedness planning and risk-based prioritized mitigation measures as part of a continual process of building resilience over time. This would also include instilling within the public a "culture of resilience"

through awareness activities and campaigns, leadership development to build support, and training and education to develop a cadre of professionals and experts to sustain and advance regional and community resilience.

13. *Ensuring Effective Risk Communications for Infrastructure Resilience.* It is essential to have clearly expressed, coordinated information and communications tailored to different constituencies and needs, including ethnic, economically disadvantaged and other at-risk communities of interest. This information must be conveyed through a variety of mechanisms to reach target populations. Such mechanisms should be assessed for stakeholder relevance and utility and tested frequently to ensure that these meet their objectives and are both redundant and resilient.

14. *"Whole Community" Involvement in Infrastructure Resilience Capacity Building, including Planning, Capabilities Development, Training, and Exercises.* Community institutions, ethnic and faith-based groups, at-risk populations, and the general public must be involved in resilience improvement activities. It is important to find ways to ensure all members of the community receive the benefits of resilience investments and capacity building.

15. *Integrated Resilience Thinking, Planning and Action at the National, Regional, and Community Levels.* Strategies and actions to achieve resilience must be suited to the underlying conditions, threats/hazards, institutions, economic, environmental, and societal priorities, culture, and unique needs of each region or locality. Federal agencies should work with cross-sector and multi-disciplinary stakeholders to promote collaborative actions to address policy obstacles and help develop and enhance information-sharing capabilities to enable risk assessments, improved preparedness and mitigation planning, and informed decision-making for response and recovery.

For watershed regional resilience, all these 15 basic principles apply, starting with number 1, the all-important Holistic Approach to assessing and reducing risk.

The Holistic Approach

The Holistic Approach assesses regional risk and resilience needs and capabilities across the disaster management mission-space *of preparedness, pre-event mitigation, response, recovery/restoration, and post-event mitigation, and includes protection and prevention.* For watershed regional resilience, all these mission areas come into play.

The Watershed Regional Resilience Mission Space

Prevention	Needs and capabilities necessary to stop, avoid, anticipate, avert, block, or counter the impacts of a threatened or actual natural or manmade event; includes collecting information and intelligence on potential all-hazards threats and sharing this information.

Preparedness	Needs and capabilities necessary to plan, organize, equip, train, and exercise to address those threats that pose risk to watershed regions.
Protection	Needs and capabilities necessary to safeguard watershed region citizens, residents, visitors, critical assets, systems, and networks against serious risks.
Pre & Post-Mitigation	Needs and capabilities necessary to reduce loss of life, property, the built environment and ecosystems by lessening the impact of disasters and significant events to the watershed region. Measures can include making critical infrastructure more resilient and engaging in risk reduction actions for natural hazards and manmade events, including acts of terrorism.
Response	Needs and capabilities necessary to save lives, protect property and the environment, and provide for basic human needs immediately after an incident has occurred.
Recovery/Restoration	Needs and capabilities after an event to coordinate and manage recovery/ restoration and identify post-event mitigation actions, to include constructing resilient watershed infrastructure systems, housing, businesses, the overall economy and environment, and health, social, and community services.

Watershed Risk and Resilience Focus Areas, Needs and Capabilities

To achieve resilient watershed regions, we need to consider key **Focus Areas** that together comprise the scope of the Holistic Approach. Each of these Focus Areas has a set of **Needs and Capabilities** that should be examined across the regional resilience mission space noted above to determine mitigation and other risk reduction actions.

These Focus Areas are shown in the circle graphic. They were developed by a national task force of practitioners and experts in the aftermath of the devastation of the New Orleans Region by Hurricane Katrina in August 2005. Since then they have been customized by national governments, states, localities, and non-profit organizations for use in all-hazards resilience planning and capacity building.

Multi-Stakeholder Collaboration & Decision-making

Financial and Other Resourcing Requirements

Infrastructure Interdependencies Analysis

Public Information & Media

Environmental/ Eco-systems Impacts & Analysis

Legal & Liability Issues

WATERSHED REGIONAL RESILIENCE FOCUS AREAS

Cyber & Physical Security

Training & Exercises

Business & Operational Continuity, Supply Chains

Human Factors, At-Risk Groups & other Social Issues

Cross-Sector Information Sharing

Public Health & Healthcare

Examples of Needs and Capabilities in the Respective Focus Areas

Multi-Stakeholder Collaboration and Decision-making	Engagement of broad stakeholder constituencies and creation of or utilizing existing cooperative mechanisms to enable coordination and collaboration, collectively assess risk and identify associated risk reduction actions. Includes "whole community" outreach to public, private, and non-profit organizations and associations with resilience roles and responsibilities or interests; determining resource requirements and overseeing pre- and post-mitigation project management; and creating an ongoing and sustainable process and action strategy for watershed risk and resilience.
Infrastructure Interdependencies Analysis	All-hazards threat characterization/assessment; identification and prioritization of: • Critical assets, systems and associated functions and services within the watershed region; • Interdependencies and dependencies-related vulnerabilities, resultant consequences and risk, including from potential and cascading impacts on infrastructures and essential goods/services and associated supply chains under different threat scenarios; • Interdependency-related impediments to response and recovery and identification of potential mitigation actions.
Environmental/ Ecosystems Impacts and Analysis	Assessing risk from threats and hazards affecting the watershed environment and respective impacts and pre-and post-mitigation needs to address availability and reliability of water resources and systems for human consumption, waste management, recreation, navigation, agriculture/food supply, animal health and endangered species; continual agriculture and animal surveillance and monitoring of food safety; also health and ecosystem impacts that could affect human health and safety, e.g., erosion, potential land or mudslides, invasive species, and hazardous materials that require debris decontamination, removal, and disposal.
Cyber & Physical Security	Improved awareness of all-hazards threats and events that affect watershed resilience; intelligence collection, analysis, and dissemination; screening, search, and detection for all-hazards threats, including chemical, biological, radiological, nuclear, and explosives; identifying risks of cyber and physical attacks on facilities, assets, systems, and networks and other unanticipated events; delaying, stopping, or securing threats and hazards with procedures, personnel, protective measures and systems, and supporting law enforcement capabilities.
Cross-Sector Information Sharing	Secure and ethical procedures and processes for exchanging information, data collection, analysis, and dissemination; availability of reliable, compatible, and redundant communications and other IT systems, including healthcare systems.

Public Health and Healthcare	Medical surge capacity, including for pediatric, geriatric, and disabled health, and mental health needs; availability of pharmaceuticals, medical, and other materials; availability of essential healthcare support services, including water, power, and fuel; backup generators, ambulances, etc.; essential personnel and critical vendor availability; healthcare-facility-related public safety and security; public health surveillance and epidemiological investigation; laboratory testing capacity and timeliness; medical countermeasures planning and dispensing; community disease control measures; access to personal protective equipment and life-sustaining resources (e.g., food supply and potable water); alternative care facilities; effectiveness of health preparedness and response plans; prioritized distribution of vaccinations/antivirals; availability of medical/hygiene supplies, lab analysis capabilities, disaster sheltering, medical and disaster assistance *v*olunteer recruitment, and training.
Continuity of Business, Operations, and Supply Chains	Economic consequences of different scenarios, identification of essential operations and activities and assessment of potential disruptions to services and associated risks; identification of pre-and post-mitigation actions; personnel needs and workforce policy issues; involvement of businesses in continuity and resilience-related activities; training of employees and exercising of plans and procedures that includes short and longer-term recovery measures.
Human Factors, At-Risk Groups and other Social Issues	Understanding and dealing with the psychological impacts of all-hazards events on individuals, including those at-risk (elderly, disabled, economically challenged, children, pregnant women) and ethnic and cultural response needs; evacuation, mass care, disaster assistance, temporary sheltering and long-term housing needs; identifying and addressing family assistance needs; resuming activities of schools/other academic institutions, and addressing special needs of adult care facilities, community centers, daycare centers, and places of worship.
Training and Exercises	Educational resources for the general population on threats, risks, and preparedness actions; training on plans and procedures; targeted workshops and exercises to test plans and equipment; regional interdependencies and other multi-stakeholder exercises to raise awareness of vulnerabilities, consequences, and gaps with "whole community" participation.
Legal and Liability Issues	Contractual issues and human resource and personnel issues; obtaining information from/coordination with regulators; privacy, including health information privacy (HIPAA) regulations and ethical issues; environmental regulations, waivers, and other issues; liability associated with vaccine distribution and administering and volunteerism.
Public Information and Media	Procedures and systems for coordinating across jurisdictions and stakeholder communities, emergency, public health and other information; identification of information to convey; pre-event identification of regional coordination process and mechanisms that can be used including traditional media and social media; plans for maintaining public trust and confidence and outreach to groups servicing at-risk individuals; information for cultural and faith-based groups through social and traditional media and personal contact.

Financial and Other Resourcing Needs	Pre-event determination of procedures, key decision makers, and mechanisms for obtaining necessary recovery and mitigation financial and technical resources from federal, state, and local agencies; addressing private-sector disaster recovery financial needs and identifying other potential sources of support.

Together with the Focus Areas, the Needs and Capabilities provide:

➢ *A template to categorize and organize* dozens of different needs and capabilities across the resilience mission space for assessing, identifying, and prioritizing risks and risk reduction actions.

➢ *A framework for a Watershed Regional Risk and Resilience Action Strategy* of short (quick-win) and longer term projects and activities with a corresponding Implementation Plan.

➢ *A detailed checklist* that can serve as a simple metric and tool to use for a gap analysis to gauge the current state of existing capabilities (plans, procedures, policies, systems, and other resources) and what is needed to meet watershed regional resilience shortfalls.

Resilience Attributes and Enabling Capabilities

The Holistic Approach also requires taking into account important A**ttributes and Enabling Capabilities** that have been identified by resilience experts as necessary for resilient regions, their communities, and supporting infrastructures.

Attributes include:

- **Robustness, flexibility and redundancy** in infrastructure design and planning;
- **Ability to absorb** immediate effects of an event;
- **Building Back Better** to make infrastructure and the built environment resilient to future all-hazards risks;
- **Effective communication and coordination** among stakeholders, government agencies, and the public;
- **Information-sharing and ability to learn** from past events;
- **Investment in innovation and technology**, including secure smart systems to improve resilience;
- **Sustainability** through an ongoing process of building resilience that includes long-term maintenance and upgrading of critical infrastructure and implementing environmentally sound practices and services;
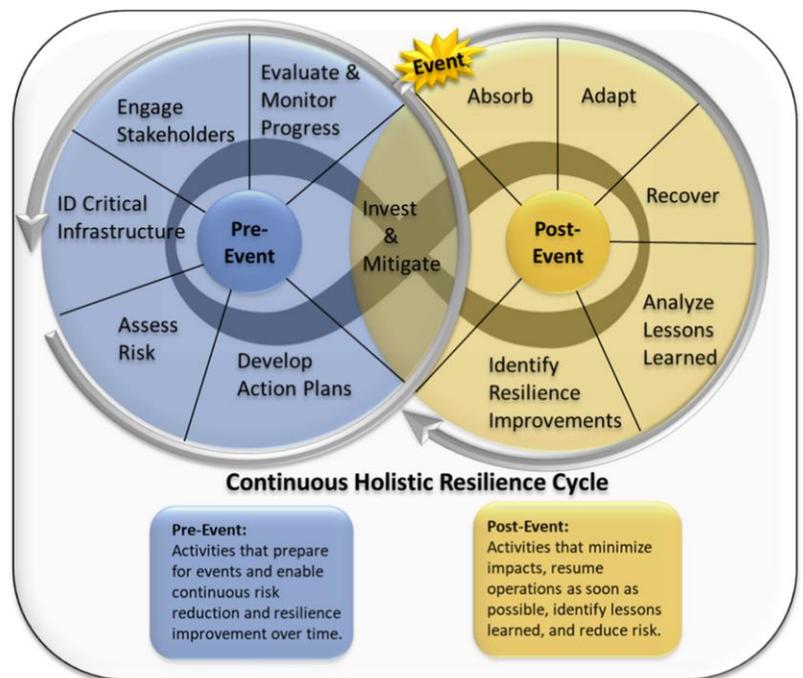- **Adaptability** in scenario and preparedness planning and mitigation.

Enabling capabilities include:

- **Risk assessment** to identify potential hazards, vulnerabilities, and associated risk reduction actions and management strategies;

- **Community engagement and empowerment** in resilience planning, exercises and training, and in the planning, design, and implementation of infrastructure projects;

- **Cost-effective policies, supporting institutions, and public/private sector leadership;**

- **Technical planning and design;**

- **Operations and maintenance** to assure continuous resilience;

- **Policy and mitigation strategies** to facilitate risk reduction;

- **Financial and other resourcing** arrangements **and incentives;**

- **Performance standards** to guide resilient technical planning and design, operations and maintenance;

- **Expertise and accountability** through developing and sustaining a cadre of experts to ensure ongoing regional risk and resilience capacity building.

Other Resilience Requirements

Recognition of the Continuous Holistic Resilience Cycle. Key to assuring resilient watershed regions is understanding the ongoing relationship between pre-and post-event resilience activities. The graphic at right illustrates these linkages and demonstrates the need for the Holistic Approach to provide continuity and enhanced coordination among pre-and post-event mitigation, preparedness, recovery, and other risk reduction planning and actions; as well as investments to help assure the integrity of both watershed management and other infrastructures to prevent cascading and long-term disruptions.

Continuous Holistic Resilience Cycle

Pre-Event:
Activities that prepare for events and enable continuous risk reduction and resilience improvement over time.

Post-Event:
Activities that minimize impacts, resume operations as soon as possible, identify lessons learned, and reduce risk.

> *The Attributes and Enabling Capabilities listed above should serve as guides and drivers for each of the activities throughout the Continuous Holistic Resilience Cycle.*

Engagement of Decisionmakers and Key Stakeholders with Resilience Roles, Responsibilities, and Authorities. Creating a resilient regional watershed means engaging all relevant entities that have resilience-related roles, responsibilities, and authorities *at the beginning* of the initiative in an ongoing coalition to facilitate collective sharing of information

and knowledge. This is necessary to credibly identify and agree on priory risks and gain consensus and support for hazard mitigation planning and resilience capacity-building. It is also essential to gain an understanding of, and coordinate the parts that these public/private sector and non-profit organizations will play in addressing different types of events that can impact the watershed region. Their respective roles, responsibilities, and authorities will depend on the locality, region, or state in which they are located, the event and the extent of its impacts on health and safety, the economy, environment and national security, as well as traditions, cultural, and political considerations. These decisionmakers and key stakeholders include:

- *Local government agencies*—emergency management (in larger counties and cities these may include a formal resilience officer), public health, fire departments, law enforcement, transportation, public works, communications/IT, education, environmental health, hazardous materials, social services, locality-owned utilities (e.g., power and water systems), and other agencies and components depending on locality size and resources.

- *Special Districts*—organizations and associations, including public utilities that have a function authorized by law with a governing board, appointed or elected that oversees usually a single mission; uses public funds that can be raised by taxes, special assessments, property sales, or revenue from issuing bonds and utilities; have staff and can contract out services and may cross jurisdictional boundaries and serve a community, region, a large portion of a state, or more than one state. Examples include port authorities, transportation authorities, fire protection, school, and public utility districts (e.g., water, sewage, electric power and gas utilities), redevelopment or housing authorities, stadiums, irrigation and water conservation districts, and air quality districts.

- *Tribal Governments*—Tribal councils or committees that have the authority to determine their own governance structures, enforce laws through their own police departments and tribal courts, and operate apart from state or federal governments.

- *State agencies* ranging from emergency management, energy and environment to transportation, public safety, and national guard units that have roles in all aspects of resilience. Governors offices may have a significant role depending on the state.

- *Federal agencies* large and small and their respective components and programs—U.S. Departments of Homeland Security, Health and Human Services, Energy, Transportation, Agriculture, and Housing and Urban Development; the Environmental Protection Agency, Economic Development Administration, Food and Drug Administration, USACE, and others with sector or function-specific responsibilities, including the Department of Defense, which provides a wide array of federal military disaster support services to civil authorities.

- *Utilities, transportation, and communications providers*—energy companies (power, pipelines, natural gas, fuel distributors), water and wastewater utilities, telecommunications, communications, and critical IT service providers (phone, cell phone, cable service, internet service providers, data storage facilities, etc.);

transportation, including road (construction, trucking/shipping firms), maritime (ports and port stakeholder organizations, such as hotels, restaurants, shipping lines, boat pilot associations, ferries, and harbor police); rail (rail and rail freight companies), public transportation, and airports.

- *Hospitals and healthcare providers*—hospitals and health centers and emergency clinics, pharmacies, diagnostic laboratories, blood centers, dialysis centers, essential medical and support staff, physicians, hospital security personnel, adult care facilities (can be used as alternative medical facilities under certain circumstances), and medical equipment and materials suppliers.

- *Mass care and social service non-profits and community groups*—these range from large national organizations (Red Cross, United Way, Salvation Army with local and regional chapters) to community-focused groups of volunteer help, faith-based organizations, ethnic and other community groups, volunteer disaster assistance groups, and other social service groups.

- *Businesses of all types*—big box stores, building materials and equipment suppliers, pharmacies, grocers, fuel distributors, car rentals (which can provide emergency vehicles, parking lots for staging response activities, and fuel for responders), small and medium businesses that provide specialized supplies, and the tourism industry (hotels, convention centers, sports stadiums, etc. that may be needed for temporary shelters or to house damage assessors and construction contractors), and heavy construction contractors (concrete, asphalt and other roadway/bridge materials).

- *Service providers with resilience roles and missions*—debris handling firms (temporary placement, hazmat storage, removal, inspectors of structures, bridges, tunnels, etc.), salvage companies to handle sunk boats and other underwater debris, restoration services to deal with flooded homes and black mold, insurance agents (home, commercial, and auto), financial services providers for cash availability and loans, transportation support, and private security officers.

- *Schools and academic institutions* that provide shelters, contribute to continuity and emergency management, and in the case of universities and colleges, are responsible for the health, safety, and sustainment of residential student populations.

Using a Multi-Step Process. The Holistic Approach is based on a Multi-Step Process that leverages existing all-hazards jurisdictional and organizational disaster management, continuity, and resilience plans and resources applicable to the watershed. The process involves input and buy-in from onset to completion from the public-private sector and non-profit stakeholder entities previously noted in a collaborative facilitated and trusted initiative. The process also enables identifying strategic goals, major focus areas, priority needs and stakeholder-validated improvement actions that go into an Action Strategy and Implementation Plan. The Implementation Plan designates leads and partner agencies and organizations for each activity or project, along with a realistic and flexible timetable for completion, how each potentially will be funded, and staff resources required. The plan also describes a sustainable process for

continuous watershed regional resilience improvement that can be resourced through multi-stakeholder sharing of monetary and in-kind costs. (This Multi-Step Process and how to execute it is described in detail in the next section of the Goal & Strategy.)

Metrics and Standards. While still evolving, there are existing resilience metrics and standards that can assist in determining the level of watershed resilience needed and accomplished.   They can be simple or complex, community or infrastructure sector-focused. *(Note: The Watershed Regional Risk and Resilience (R3) Playbook provides Internet links to several of these metrics resources, including new tools developed under the USACE DSR3P.)*

Identification and Securing Technical Assistance, Investments, and other Resources. Assessing risk and enhancing the resilience of even the smallest watersheds from stakeholder engagement to developing a basic Action Strategy and Implementation Plan may extend out many months. The times to complete the identified risk reduction projects will depend on the type of action. If they are short-term "quick wins," such as updating plans and improving existing capabilities, this could be accomplished relatively quickly depending on availability of staff and budget resources. Long-term hardening, relocating, or siting and constructing new infrastructure may take years and require significant capital investments.

Finding the resources and opportunities to acquire funds from various sources will be necessary. Smaller, low-resourced communities and infrastructures will also need technical assistance to respond to grant and other funding requirements that are increasingly becoming available at the federal level. A way to address this need is to create "Resilience Hubs" within watershed regions. These can be virtual or brick and mortar, and established by a state, locality, university, non-profit entity, or a federal agency. *(The Watershed R3 Playbook provides examples of resilience funding resources and Resilience Hubs to assist in improving watershed regional resilience.)*

Understanding that Watershed Regional Resilience is a Continuous Process and will be Built Incrementally Over Time.   Progress can be demonstrated by the completion of the risk reduction projects and activities in the Implementation Plan and new actions identified and added to the Action Strategy and the Plan from follow-on risk assessments and lessons learned from future events impacting the watershed.

Undertaking Watershed Regional Risk and Resilience Initiatives

What the Multi-Step Process Entails and How to Execute It

The following process described in the Goal & Strategy was initially developed by The Infrastructure Security Partnership (TISP) in 2006 for a Regional Disaster Resilience Guide and updated in 2011. The process was meant to provide general guidelines that could be customized for use at the local level for organizations wishing to collaboratively improve regional resilience. These guidelines have been subsequently expanded and adapted over the years in the U.S. by federal agencies, states, localities, and non-profit groups, and by other nations and international

organizations. Today there are numerous online guides and other resources to help with resilience planning and execution.

While many of these resources are valuable in community and sector-specific resilience planning, few focus on conducting risk and resilience assessments *on a regional scale*. These include frameworks and guidelines produced by the U.S. Department of Homeland Security's Cybersecurity and Infrastructure Security Agency (CISA), Federal Emergency Management Agency (FEMA), and the National Institute of Standards and Technology (NIST). Also, NOAA's Climate Program Office has an online U.S. Climate Resilience Toolkit developed with other departments and agencies in the United States Global Change Research Program. While each of these resources have a different number of steps and terminologies to describe them, the process is largely the same. *(The Watershed R3 Playbook has a set of short descriptions and links to these and other resources that use a multi-step process to assess regional risk.)*

Following are the basic steps with a description of each. The steps are designed to be customized to suit the goals, objectives, needs, and unique characteristics, culture, leadership, and capabilities of any region to address any scenario.

> *Note: Stakeholders have the option to tailor for use the general process described in the Goal & Strategy for a Watershed Regional Risk and Resilience Initiative or employ a federal guide or other resilience planning tool depending on their interests and requirements of sponsoring organizations. What is important is the process itself, which enables continuous regional resilience improvement to meet the challenges of the changing risk landscape.*

Step 1: Lay the Foundation

This step entails:

- **Recruitment of a Watershed Regional Risk and Resilience initiative** *facilitating entity* (e.g., a non-profit, public or private sector organization, consultant, or university) to conduct outreach, help engage key watershed stakeholders, and provide administrative and other support. *(Note: facilitators of past regional resilience initiatives have included state and local emergency management, regional councils of government, chambers of commerce, economic development associations, federal and state agencies, multi-state and regional resilience collaboratives, university faculty, and senior resilience consultants.)*

- **Creation of a *Core Team* (e.g., a Leadership Group or Steering Committee)** of representatives from key cross-sector and discipline stakeholders with resilience roles, responsibilities, and authorities as previously described.to provide guidance and oversight.

- **Bringing together a regional multi-stakeholder coalition** that together with the facilitating entity and core team guidance will define and scope the initiative, the tasks and timeline to undertake it, and identify/review existing plans, studies, maps, and other resources. This coalition would be informal and inclusive to allow participation by practitioners and experts from any sector, discipline, or functional area and avoid the legal

or bureaucratic restrictions on membership in external groups often imposed by government and private sector organizations on their employees.

The coalition would ideally include representatives of water management systems, utilities, and other critical infrastructures; county and municipal emergency management, emergency services, law enforcement, public health and healthcare, mass care and voluntary assistance, older adult and childcare facilities, community planners and land use planners, environmental, flood control, and conservation managers; forest management, animal control, air quality and other toxic materials monitoring entities; elected and appointed officials at all levels, tribal representatives, regional and local governance councils and committees, including councils of government, chambers of commerce, economic development associations; watershed associations, and other business or special interest groups; community groups (e.g., faith-based, ethnic-based, and other special interest groups), K-12 public and non-public schools, institutions of higher education and research organizations; business chains (grocers, "big box" retailers, pharmacies, and business associations that represent the interests of small enterprises); and various advocacy groups that focus on health and safety, the economy, and the environment.

At the state level, participants would include representatives from relevant state agencies and National Guard, and at the federal level, FEMA and CISA Regional Offices, the Department of Agriculture, and regional representatives from USACE, USGS, the Environmental Protection Agency, Department of Energy, U.S. Department of Defense and the Economic Development Administration. Participation from the FEMA and CISA Regional Offices is particularly important because they can bring to the initiative important federal technical expertise and assistance.

Depending on the size of the watershed region, this broad coalition may range in size from a few dozen participants in rural areas with one or more small communities to hundreds in multi-county regions. An example of the latter is the San Francisco Bay Area, which has several resilience-focused facilitating organizations, including the regional Urban Area Security Initiative (UASI), that collectively engage more than 3000 stakeholders in workshops, exercises, and resilience improvement activities. Coalition members will selectively participate in those activities that fit their interests.

Having a broad coalition enables knowing who they are, having their contact information, and offering them the opportunity to contribute. It also greatly facilitates relationship-building, essential for resilience planning, sharing information, and disaster response and recovery coordination.

- **Building trust among coalition members and developing a shared appreciation of the watershed risk landscape** and how a *regional risk assessment* that takes into account the collective vulnerabilities and interdependencies-related consequences across the watershed of a natural or manmade event can greatly assist in their organization's or jurisdiction's own risk assessment and operational continuity planning. These initial discussions should have a

strong focus on infrastructure interdependencies and resilience challenges and needs. This can be accomplished with an *initiative kick-off meeting* followed by a *scenario-based workshop* on infrastructure interdependencies and associated risks that demonstrate the need to identify potential mitigation and broader resilience capacity-building improvements.

Step 2: Identify Regional Infrastructures and Design Assessment

This step entails:

- **Working with the Initiative coalition members to identify and characterize public and private infrastructures and other essential service providers** along with the characteristics of the communities they support. This characterization would include identification of priority assets and functions and associated high-level dependencies and interdependencies.

- **Determination and agreement by the stakeholders of the threats/hazard(s) and potential impacts** on interdependent physical/cyber systems and functions that require assessment; consequences that need to be addressed, and the factors driving the need for the regional risk assessment and risk reduction Action Strategy.

- **Determination of the scope of the assessment and the methods and tools to be used**, which would include:

  o The geographic extent (region) to be studied – e.g., jurisdictional boundaries (metropolitan area, multiple communities, etc.) and service areas; natural features (navigable waterways, watershed, etc.), clusters of key industries, education or health care facilities, supporting infrastructure systems and supply chains, risk exposure zones (floodplain, earthquake zones, etc.).

  o The physical/cyber systems and functions that would be the focus of the assessment, e.g., power, water/wastewater, telecommunications, fuel production and distribution, healthcare facilities, agricultural industries, transportation modes, government services, etc.

  o Data sources and analysis methods.

  o The risk levels that would be used in the assessment.

  o The process and timeline for the risk assessment and development of the resulting Action Strategy and Implementation Plan.

Step 3: Data Collection

This step covers two broad data collection tasks:

- **Identifying and obtaining data and other information** to illuminate vulnerabilities, damage and disruption durations under certain scenarios, and potential interdependencies-related impacts.

- **Identifying existing capabilities,** including current local resilience plans, procedures, capabilities and resources, including policies and regulation to ascertain what can be leveraged and where there are gaps or areas where improvement is needed.

    o   *These tasks are labor and resource intensive and would need to be tailored to available staff, funding, and technical expertise.* Data could be provided by federal, state, tribal, and local agencies with appropriate data security and protection procedures. DHS CISA has data on nationwide infrastructure systems through conducting over a hundred regional risk assessments under its Regional Resiliency Assessment Program (RRAP) and could provide selected data. Similarly, states that have collected information on their critical infrastructure assets and systems could provide information. County and city emergency managers and public works directors can help provide data on assets and systems in their jurisdictions.

    o   Other data collection activities could include: open source research, multi-agency collaboration, subject matter expert interviews, facilitated group discussions, site assessments, reviews of past regional exercises and disaster/event after-action reports, stakeholder-designed regional and targeted scenario-based workshops and exercises, inventorying of regional and community resilience capabilities, available resources, and best practices; GIS mapping information, lidar data to analyze geologic hazards and potential infrastructure vulnerabilities, hazard maps, hazard modeling data, disaster economic impact data, and cyberattack and cybersecurity-related information. Additional data could be available from infrastructure owners/operators on assets and functions, continuity plans, and resilience actions. If resources allow, it would be useful to create an online portal to catalog existing information and plans, which could be updated and used in follow-on assessments.

The Core Team will need to determine how the data collection can be conducted with limited resources and made manageable and still provide enough information for an effective assessment. An approach would be to agree on the level and type of data needed to perform the assessment and the minimum optimal amount necessary to draw conclusions. This would require a template to input the data and an agreed process for its collection. Partnering with FEMA, CISA, USGS, USACE, and other federal agencies with regional resilience responsibilities could result in useful data and technical assistance in organizing collected data. This data could be maintained for use in future risk assessment and resilience capacity-building activities with arrangements to accomplish this in a secure manner.

Step 4: Determine Priority Risks and Resilience Actions

This step takes the data and information from Step 3 and examines vulnerabilities to threats and hazards, and consequences that may result. This will entail use of an analytical approach that may incorporate one or more techniques to integrate and assess collected data (e.g., geospatial analysis, modeling, simulation) to evaluate the interdependencies-related risks to infrastructure systems and functions of interest.

This analysis can be accomplished at a superficial level with the help of technical expertise supported by participating infrastructure operators and government agencies. Ideally it would be useful to have the analytical tools and expertise provided by national laboratory or other research institution experts who have access to sophisticated modeling and simulation capabilities. However, because stakeholders at the regional and local levels currently do not have access to these capabilities or the financial resources to contract for them, partnering with FEMA, CISA, or other federal agencies may offer a way to enable much more in-depth analysis of interdependencies–related risks.

Step 5: Develop Action Strategy and Implementation Plan

This step requires:

- **Identifying resilience issues, challenges, and gaps** and validating these outcomes with participating stakeholders.

- **Collectively determining and prioritizing remedial and mitigation solutions**.

- **Incorporating these into a regional risk reduction Action Strategy** of short, medium-term, and longer-term projects and activities.

- **Producing an Implementation Plan** that:

  o Describes how each of the projects and activities would be administratively managed, conducted, and monitored with arrangements for multi-stakeholder oversight and cost-sharing, both financial and in-kind contributions.

  o Covers how to sustain the coalition and Watershed Regional Risk and Resilience Initiative, including a process that enables continuous resilience improvement through adding needs and actions based on new lessons learned from future watershed region threats/events and exercises.

There are templates developed by regional collaboratives and guidance developed by federal agencies that can be leveraged for this. *(The Watershed R3 Playbook provides links to examples.)* Stakeholders would determine designated lead and partner organizations for each project, estimate resources needed, and potential investment sources.

Step 6: Identify and Secure Resources

This step requires finding ways to secure the resources necessary for implementing risk reduction strategy projects. It also includes finding resources to sustain the Initiative, its facilitation, and stakeholder coalition activities. These activities would include periodic workshops and exercises along with the continuous process to monitor, evaluate, assess and further improve the effectiveness of resilience capabilities. Potential sources of funding include grants, program funds, capital investments, and other sources.

Step 7: Implement, Monitor Progress, and Sustain Continuous Improvement

The final step entails moving forward with Action Strategy projects and activities, including newly identified risk reduction actions as resources allow and evaluating progress made to accomplish each action. Resilience metrics and standards can be used to help gauge progress made in resilience improvements. Periodic scenario-based exercises are particularly useful to examine how well actions completed have resulted in a more resilient watershed region, and what additional risk reduction actions need to be undertaken. Lessons from the Initiative should be shared with other regions in the nation and internationally to leverage knowledge and best practices that can be utilized for maintaining and sustaining continuous resilience improvement.

Guidance for Low-Resource Communities and Smaller Infrastructures and Organizations in Undertaking the Multi-Set Process

Many major metropolitan areas across the country have had multi-stakeholder resilience activities for some time and have a basic understanding of all-hazards risks, infrastructure interdependencies and associated impacts and needs. At the same time, many of the small and mid-size communities and infrastructure providers that comprise most of the nation's watershed regions do not.

These low resource communities can benefit from participating in regional resilience activities that include larger cities, regional utilities, and corporations that can take on lead roles and contribute expertise and other resources. Low resource communities and organizations can also undertake a "lite" version of the multi-step process to identify high-level risk priorities and mitigation actions affordably by using in-kind volunteer expertise from participating stakeholders, local colleges and universities, and non-profits.

Regional and sector-focused scenario-based workshops and tabletop exercises can be used throughout the multi-step process to enable stakeholders to allow everyone involved to discuss, share information, and decide together on gaps and needed resilience improvements.

Examples of Watershed Regional Resilience Initiatives that have used a Multi-Step Process

To date there have been only a few watershed-focused initiatives. Examples are below. They demonstrate how the multi-step process can be customized to meet the unique needs and available resources of the nation's diverse watersheds. They include the:

Dam Sector Regional Risk and Resilience Program (DSR3P). Initiated by USACE in 2022, the program includes a pilot project focusing on the Savannah River Watershed with facilitation and other assistance from Clemson University that covers more than a dozen South Carolina counties. The goal of the program is to provide a customizable watershed regional risk and resilience model with supporting tools and resources that can be used nationwide to enable communities and the interdependent infrastructures within them to collectively identify and implement risk reduction actions. The Goal & Strategy is a key element of this program.

USDA Natural Resource Conservation Service Watershed Programs. This longstanding multi-faceted initiative provides technical and financial assistance to solve natural resource issues within communities. The Watershed and Flood Prevention Operations program and the Watershed Rehabilitation Program use a multi-step process. The Emergency Watershed Protection program provides disaster relief to communities impacted by flood disasters. Most projects affect more than one county or state and involve partnerships of federal, state, local, and private entities.

Mystic River Watershed Initiative. The Initiative is a longstanding collaborative effort of the U.S. Environmental Agency and watershed public and private partners to improve water quality and environmental conditions of the rivers, streams, lakes, and ponds that drain into a 76 square mile area with 21 municipalities located north of Boston, MA. The Initiative has a steering committee composed of 22 organizations including not-for-profit community groups, local, state, and federal agencies.

Regional Post-Fire Initiative. The initiative focuses holistically on several watershed regions in the state of New Mexico to assess risk and develop a risk reduction and long-term recovery strategy for wildfires and multiple hazards, including floods, flash floods, debris flows and hazardous materials. The initiative is led by FEMA Region 6 in partnership with DHS CISA, USGS, USACE, state, tribal, and local agencies and regional stakeholders. The initiative's focus areas include planning, economic recovery, historical and cultural resources, watershed mitigation, drinking water, health and social services, and housing recovery. The effort is multi-year and uses a community engagement process of focus groups, town halls, recovery summits, and regional exercises

Dam Sector Exercise Series. Two regional initiatives supported by USACE in collaboration with the DHS Office of Infrastructure Protection and FEMA with state and regional stakeholders, were conducted from 2009 to 2010. The projects focused on Washington State's Columbia River Valley in the central part of the state and the Green River Watershed in the Seattle-Tacoma area. Both projects were facilitated by the Pacific NorthWest Economic Region, a U.S.-Canadian consortium, and focused on assessing risk from major flood threats and identifying risk reduction actions. The projects relied heavily on regional exercises to examine interdependencies and associated impacts to identify pre- and post-mitigation needs and improve preparedness, response, and recovery in an extreme flood event impacting regional dams and interconnected infrastructure. *(Details on each of these initiatives and links to further information is provided in the Watershed R3 Playbook.)*

Key Challenges and Ways to Address Them

Enabling Access to Available Resilience Processes, Tools, and Resources

As noted, there is a wealth of these resources available on the Internet, some sector and others cross-sector-focused, that have been developed by state and local governments, national and sector-focused associations, and regional organizations. These resources are being used in

regions and local jurisdictions throughout the country and can be leveraged for Watershed Regional Risk and Resilience Initiatives. They range from guides, templates, models and assessment tools, and examples of best practices on establishing regional collaboratives, undertaking resilience gap analyses, conducting interdependencies exercises, assessing risk, and developing action plans. *(Links to these resources are provided in the Playbook as examples, including the CISA IRPF, FEMA's Comprehensive Preparedness Guide, National Critical Functions Framework, Community Lifelines Framework and Building Public-Private Partnerships guide; EPA's Regional Resilience Toolkit; DOE's State and Local Energy Assurance Guidelines; USAID's Power Sector Resilience Planning Guidebook; NIST's Community Resilience Planning Guide; USDA's DamWatch web-based monitoring software that enables dam owners to monitor dam infrastructure to better protect against hazardous events, USACE's Planning Community Toolbox, etc.)*

Facilitating Information-Sharing and Obtaining Necessary Data

There have long been major constraints to assessing regional risk because of lack of access to secure and proprietary data needed for infrastructure characterization, vulnerability assessments, and interdependencies-related risk analysis. These constraints can be overcome by using publicly available data and limiting information shared to the minimum necessary to characterize community and regional infrastructures and identify and prioritize interdependencies-related risks. For example, the DSR3P Savannah River Watershed Pilot Project for risk assessment used ESRI ArcGIS Utility Network Solutions to create virtual models for utilities that included water/wastewater systems, electric power and gas pipelines, and communications. The pilot also used open source data from FEMA's Resilience Analysis and Planning Tool (RAPT) and Failure Modes and Effect Analysis approach to assess flood risks.

Also, information shared among cross-sector stakeholders does not need to include sensitive operational information on utility or other critical infrastructure key assets in order to identify higher-level interdependencies. Rather the focus can be on outage areas, anticipated durations, and cascading and other impacts in different scenarios. These other impacts could include supply chains and restoration of services that affect public health and human safety, local and regional economies, and the environment.

Scenario-based workshops and exercises can be used to highlight interdependencies and demonstrate key assets that could pose significant vulnerabilities under certain conditions. Likewise, workshops, conferences, and webinars on resilience topics can be used to raise awareness and facilitate mutual analysis among watershed organizations. Stakeholders within their respective regions would need to determine as part of the "collect data" step in the assessment process the types of information they would be willing to share. Contributors can meet one-on-one or collectively to share information and then each "take their data home."

There are avenues that are being explored to address the above information challenges by federal and state agencies and private sector vendors, including development of:

- "Sandbox" virtual information-sharing environments with safeguards to protect sensitive and proprietary information to allow resilience data-sharing.

- A customizable cross-sector information-sharing system with security safeguards to enable the broad range of cross-sector stakeholder "communities of interest" to share information within and among sectors, state and local government agencies, community institutions, and other non-governmental groups with responsibilities or vested interests in regional risk and resilience. Technical capabilities, best practices, and prototype systems already exist that can be leveraged to produce this customizable cross-sector stakeholder information sharing capability.

- Use of the Internet-based DHS CISA Gateway platform to create and maintain secure Regional Information-Sharing Hubs and assist in data integration, aggregation, and analysis to conduct comprehensive vulnerability assessments and risk analysis. The CISA Gateway is a web-based platform that provides a single interface to access a large range of integrated infrastructure protection tools and information used to conduct comprehensive vulnerability assessments and risk analysis. The Gateway could be adapted and expanded beyond its current largely government user base to enable regional stakeholders to benefit from the capabilities and large amount of information and data resources that reside within it. These resources include National Laboratory tools, findings from physical and cyber vulnerability assessments and other critical infrastructure information, including assessments, analytical products, and reports; integrated data visualization and mapping applications to support complex data analysis; and a data search capability. Expanding access to the Gateway to regional stakeholders would necessitate policy changes and addressing security and technical issues.

- Completion of the development of DHS CISA's Suite of Tools for the Analysis of Risk (STAR) and exploring how to use it at the regional level. STAR operationalizes and integrates the capabilities of several National Laboratories and other Federally-Funded Research Centers into one web-based application that can be used by watershed stakeholders to holistically assess risk from emerging threats, hazards, vulnerabilities, and their cascading consequences. STAR does this by leveraging network graph data sets, ESRI GIS functionality and the tools noted above to explore critical infrastructure functions and assets, visualize dependencies across them, overlay geospatial data in a GIS, identify asset data (e.g., region, state, owner, type), and export results to support analytic products.

- Adoption of a Memorandum of Understanding among federal agencies that can be leveraged for data sharing agreements.

Securing Funding and Other Investments for Implementation and Sustainment

The level of financial/in-kind and staff expertise at the state, local, and regional levels required to support a Watershed Regional Risk and Resilience Initiative will depend on the size of the watershed region and scope of the effort. Universities and community colleges can be a good

source of assistance, providing technical expertise and also student workers, who will gain experience in all-hazards resilience.

To help enable this, FEMA is developing a Direct Technical Assistance program to assist communities to develop and implement hazard mitigation plans, climate resilience plans, and natural hazards risk assessments. State-level Emergency Management Associations can also supply guidance and expertise, as they typically have mitigation and recovery task forces already in place and are addressing risk and resilience issues. States that are members of USACE's Silver Jackets Program can provide Silver Jackets interagency teams to address flood and other natural disaster risks and enhance preparedness, mitigation, response, and recovery efforts. As noted, a "lite" Initiative can be undertaken that identifies high-level interdependencies and risk reduction actions with volunteer participants and in-kind support and is led by a local official (e.g., a resilience officer or emergency manager). This would make new funding necessary only for limited technical support. More complex and ambitious initiatives may require federal and/or state funds and resources.

Whatever the case, building watershed regional resilience over time to deal with escalating risk from climate change and other natural and manmade hazards will require major investments, innovation, and generational thinking. Financial resources will be needed to cover the planning phase of an initiative, sustain the watershed stakeholder coalition, and implement the resilience improvements. There are federal and state grants and programmatic funds that can be used to assist with infrastructure characterization and risk assessment activities and also mitigation projects, e.g., FEMA's Dam Emergencies Collaborative Technical Assistance grants and Rehabilitation of High Hazard Potential Dams Grant Program, and the Building Resilient Infrastructures and Communities (BRIC) grants. *(Planning for Dam Emergencies Collaborative Technical Assistance Program | FEMA.gov, FEMA High Hazard Potential Dams is another funding source and Building Resilient Infrastructure and Communities | FEMA.gov).* Funds also exist for regional infrastructure resilience exercises and training, e.g., Urban Area Security Initiative funds. As yet there are no specific grants providing funds for conducting and sustaining regional risk and resilience planning. This means government agencies will need to expand existing grants or develop new ones and seek increased and or expanded programmatic funding to help support resilience planning-related activities.

Funding for Low Resource Communities. A promising development is the recent focus at the federal and state levels in establishing funding opportunities for low resource communities that can be used for resilience-related risk reduction activities. For example, EPA's Environmental Justice Thriving Communities Grantmaking program, created by the Inflation Reduction Act, is making $50 million available through a foundation to communities in the Pacific Northwest states to address climate change-related mitigation needs. Also, USDA's Natural Resources Conservation Service Watershed Programs financial and technical assistance is available to local sponsors to implement watershed conservation practices. These sponsors are typically an entity (federal, state, local, or tribal governments) that can levy taxes that provide financial support for

ongoing operations and maintenance and has the authority to evoke eminent domain when needed. https://www.nrcs.usda.gov/nrcs-watershed-programs-resources

Generating Political Will and Societal Support

Political and societal support will be necessary to sustain forward progress on watershed regional resilience and securing investments. Obtaining resources for regional resilience capacity-building remains a fundamental problem – not just for low-resource communities but also well-resourced ones. Moreover, most risk reduction actions require multi-stakeholder collaboration and public-private sector resourcing, which are viewed by typically siloed organizations as outside their interest or responsibility.

Dealing with this challenge will require a "top down and bottom up" approach. It will be necessary to raise the awareness of government, private sector, and community leaders and elected officials on rapidly escalating threats and hazards and encouraging them to make risk assessment and resilience capacity-building a high-priority and ongoing mission. This can be accomplished by outreach and engagement of these leaders, who can serve as "resilience champions," inviting them to speak at stakeholder and community meetings and allow their employees or staff to participate in and contribute to these meetings. Innovative ways to generate political and business leader support could include promoting the creation of resilience-focused caucuses within state legislatures or a Congressional caucus at the national level, and establishing or using existing regional trade or economic corridors to demonstrate the need to reduce risk and improve all-hazards resilience.   An example of an available resource is the National Watershed Coalition, which with the National Association of Conservation Districts acts as a congressional liaison for communities to ensure assistance is provided by Congress. Both organizations actively engage their elected representatives on the need for building resilience in their watershed regions. The National Watershed Coalition also provides training on dam operation and maintenance and other dam safety issues.

Need for Public Education. Leadership recruitment activities should be coupled with a public education campaign that includes community meetings, outreach and engagement of community leaders and special interest groups, and promotion of initiative activities and accomplishments using traditional and social media. Crafting a communication strategy that highlights the benefits and risks associated with infrastructure interdependencies can also build political and societal support for watershed resilience. Working together on consistent and cohesive messaging will broaden the reach and raise awareness from the local level to policy makers to facilitate further federal funding.

Ensuring Necessary Collaboration from the Local to National Levels

Through undertaking collaborative Watershed Regional Risk and Resilience Initiatives, federal and state agencies can work with watershed region stakeholders to promote collaborative actions. These include addressing policy obstacles and helping to develop and enhance information-sharing capabilities to enable risk assessments, improved preparedness and mitigation planning,

and informed decision-making for response and recovery. These initiatives will also help ensure that resilience-related activities do not conflict with but leverage other regional and community resilience activities and best practices.

Filling the Gaps in Watershed Regional Resilience Enabling Capabilities

Several federal agencies are working on creating ways to share information and other resources we need for resilient watersheds. For example, the resilience-focused federal interagency Mitigation Framework Leadership Group is developing a web-based compilation of federal resources that could be used for watershed regional risk and resilience initiatives. At the same time, there are infrastructure interdependencies and other analysis tools and data bases, and cross-sector information-sharing systems that have been developed but not been made available for public use.

Development of other needed resources requires research. These include model structures and mechanisms that can facilitate pooling public and private sector funding to support multi-stakeholder risk reduction actions, an integrated regional risk assessment system that can aggregate and analyze multi-organizational risk data in different formats for regional risk analysis and decision-making, flexible resilience standards that take into account regional interdependencies and provide a basis for improved metrics to guide and measure the utility of reduction and disaster recovery decision-making, and ways to utilize artificial intelligence in finding and addressing gaps in and enhancing regional resilience.

Also needed are additional ways for Federal Regional Offices to assist watershed stakeholders in undertaking Regional Risk and Resilience Initiatives. In addition, it would be useful at the national-level to create a collaborative of cross-sector and federal-to-local practitioners and experts to promote and help support watershed risk and resilience assessments.

Conclusion

Incorporating Resilience into Watershed Regional Cultures and Practices

Creating resilient watersheds is imperative to meet the challenges of a changing risk landscape characterized by escalating extreme events. It requires an on-going process that must be undertaken using a holistic, collaborative approach that involves the broad range of key stakeholder constituencies with roles, responsibilities, and vested interests in assessing and reducing all-hazards watershed regional risks. Risk assessment and identified risk reductions actions should be tailored to the needs and desired solutions of the watershed, its communities and their supporting infrastructures.

Current abilities to understand, assess, and reduce regional all-hazards risks are still evolving, with many of the tools and other resources yet to be fielded or developed. This includes new funding/investment opportunities for regional stakeholders to address and reduce risk. That said, regional decision makers and key stakeholders can use currently available capabilities and funding opportunities with the guidance provided in this Goal & Strategy to undertake

Watershed Regional Risk and Resilience initiatives. Federal and state agencies should be essential players and supporters in these initiatives, providing technical support, grant opportunities, and other avenues for funding.

Delaying addressing risks and building the resilience of the nation's watersheds should not been viewed as an option.

Benefits of Watershed Risk and Resilience Initiatives

For watershed regional stakeholders these include:

- Providing the means to understand the changing threat environment, identify existing and potential vulnerabilities and impacts, and appreciate escalating all-hazards risks to interdependent infrastructures and communities.

- Bringing together private-public sector and non-profit organizations in collaboration to bridge organizational, bureaucratic, and institutional silos, and build the trust and relationships necessary to assess risk and agree on mitigation and other risk reduction measures to improve preparedness, response, and recovery.

- Enabling practitioners and experts to work with federal and state government partners and have access to guidance, technical assistance, avenues to share relevant information, and other tools and resources needed to characterize regional infrastructures, understand impacts and cascading disruptions associated with interdependent physical and cyber systems, and determine how to best invest in infrastructure upgrades to assure security and resilience.

For states the value of these initiatives beyond improving regional watershed resilience is in greatly increasing their engagement and information-sharing with key infrastructures and other organizations to provide improved mapping of statewide critical assets and chokepoints, including supply chains.

Federal agencies will be able to engage and build relationships with watershed regional stakeholders and have a direct way to learn about regional watershed resilience needs and provide federal tools and resources. These initiatives can also help in developing a shared understanding of regional critical assets and function, and how these can affect security and resilience at the national level.

Over time with development of enhanced analytical capabilities and other enabling tools and resources, these initiatives will result in greatly improved understanding of priority all-hazard risks to the nation's watersheds regions and targeting investments to strengthen the resilience of the critical infrastructure and communities located within them.

Watershed Regional Risk and Resilience Task Group

The following practitioners and experts contributed to, reviewed, and guided the development of the Watershed Regional Risk and Resilience Goal & Strategy. Many are veteran cross-sector and discipline resilience professionals who have served in different positions in government, the private sector, academia, and non-profits.

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