The Playbook provides a process with selected tools and resources that public and private sector organizations can use to collectively identify and reduce risks and improve the resilience of their watershed regions

Watershed Regional Risk and Resilience Playbook

Version 2.0 September 2026

The Watershed Regional Risk and Resilience Task Group

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OVERVIEW

The Watershed Regional Risk and Resilience (R3) Playbook offers guidance, tools, and resources to organize, conduct, and sustain stakeholder-developed and managed collaborative initiatives to identify risks and enhance the resilience of watershed regions.

The Playbook operationalizes a Nationwide Watershed R3 Goal & Strategy developed under the U.S. Army Corps of Engineers Dam Sector Regional Risk and Resilience Program (DSR3P). The Goal & Strategy and this Playbook were produced by a national Task Group of more than 100 volunteer practitioners and experts from all levels of government, regional collaboratives, critical infrastructures, national associations, universities, and other private and non-profit organizations. The intent is to help states, localities, and cross-sector stakeholders improve the resilience of their watershed regions and the communities and critical infrastructures located within them in an era of escalating risks.

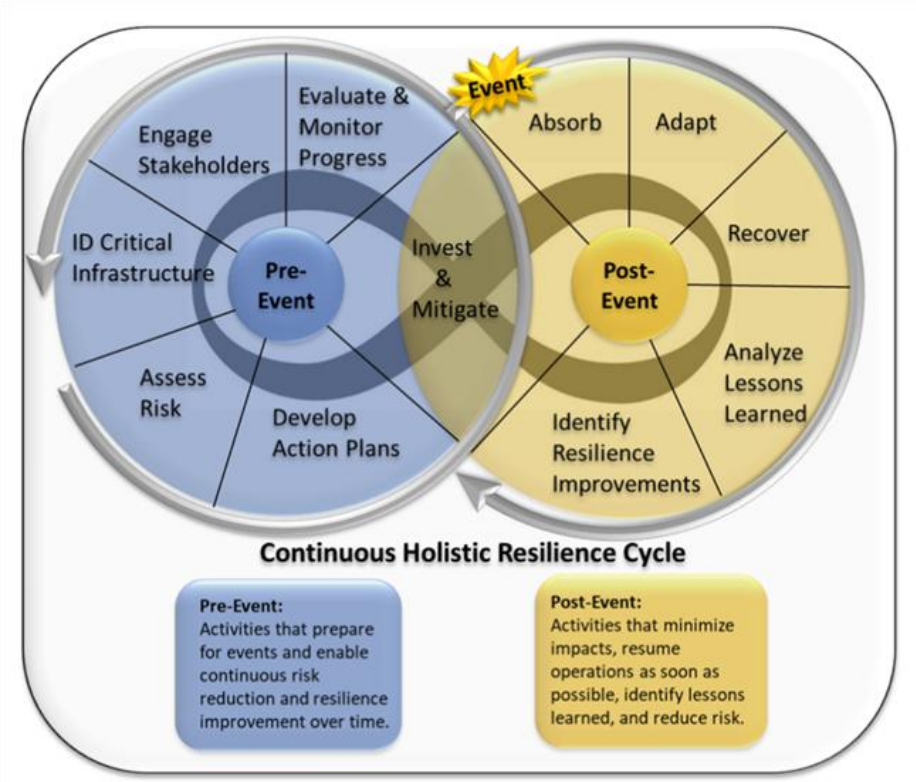
The Changing Risk Landscape. Watershed regions are increasingly being impacted by extreme weather events and other natural and manmade hazards of growing scope, scale, and costs with long-term deleterious effects on health and safety, the economy, the environment, and way of life.

Key factors behind this trend include:

- **Climatic changes** resulting in an unprecedented increase in annual global temperatures, sea-level rise, and altered weather patterns;
- **Technological advances** in electronics, computing, and other digital technologies that are tightening interconnectivity among interdependent critical infrastructure functions and services and supply chains that support watershed regions, making them increasing vulnerable to natural and manmade hazards, including physical and cyberattacks;
- **Societal changes—** ongoing expansion of people and infrastructure into rural and undeveloped areas that lack the resources necessary to devote to hazard prevention, preparedness, and mitigation.

Addressing the challenges of the changing risk landscape requires:

- ***Broad multi-stakeholder engagement and involvement*** to assess watershed regional risk and undertake planning, mitigation, and other resilience improvement actions *Most of these actions will require cross-sector and jurisdiction collaboration to execute.*
- ***A continuous Holistic Approach and process with enabling tools and resources*** that public, private, and non-profit organizations can customize and use to work together to identify risks and build resilience consistent with their interests and priorities.



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.
- Requires an understanding of the ongoing relationship between pre-and post-event resilience planning and activities and the need for continuity and enhanced coordination among them; also investments to help assure the integrity of the interdependent critical infrastructures that support the watershed and communities within it.

Playbook Purpose

The Playbook is intended to enable stakeholder organizations in watershed regions across the Nation to undertake the Holistic Approach and develop and implement an ongoing Action Strategy of projects and activities to improve resilience.

Whom the Playbook is For

The Playbook was developed for decision-makers, practitioners, and experts across all government levels and infrastructure sectors; private sector and non-profit organizations, associations and institutions; and regional governance bodies (e.g., councils of government and

economic development organizations) with roles and responsibilities or vested interests in leading, facilitating, or contributing to a multi-stakeholder initiative to better understand risk and build watershed regional resilience.

Towards this end, the Playbook is designed for users with differing levels of resilience-related knowledge, capabilities, staff, and financial resources. Users can adapt the Playbook guidance to fit their needs and available resources and employ any of the resilience guides or other planning resources cited in the Playbook depending on their interests and/or the requirements of the initiative's sponsoring organization(s). *What is important is the Holistic Approach itself, which enables continuous resilience improvement over time to meet the challenges of the changing risk landscape.*

What the Playbook Provides

To accomplish this goal, the Playbook provides guidance and selected tools and resources that can be customized for undertaking the continuous Holistic Approach with a seven-step process, providing a description of each step in the process and how to accomplish it:

1. Laying the foundation with broad stakeholder engagement,
2. Characterizing regional infrastructures and designing the assessment,
3. Data collection,
4. Undertaking the risk assessment,
5. Developing an Action Strategy and Implementation Plan,
6. Identifying and securing resources and investment for implementation and sustainment, and
7. Enabling continuous resilience improvement using lessons learned from future events, exercises, and best practices from other states and regions.

Playbook users can tailor the guidance and process to focus on resilience needs and actions for any threat or hazard, and focus either across sectors or on a particular sector (electric power, communications, healthcare systems, agriculture and food production, etc.).

The Playbook also provides information on challenges decisionmakers and key stakeholders typically face in endeavoring to enhance muti-hazard resilience and how to address them. Typical challenges include how to facilitate information-sharing, obtain necessary data, secure investments, and generate political will and community support. The Playbook in addition provides examples of Watershed Regional Resilience Initiatives that used a multi-step process.

Playbook Format and Structure

The Playbook is organized into sections and subsections corresponding to the major topical areas that describe how to outreach and engage key stakeholders and develop, conduct, and sustain a Watershed Regional Risk and Resilience Initiative. Each section and subsection provides the relevant guidance with a list of selected enabling tools and resources. Each reference is described with its type (fact sheet, backgrounder, guide or plan, database, software tool, training tool, study or report, website, PowerPoint presentation, or article), and what it provides with an access link to its host Internet site.

Using the Playbook.

Playbook users can scan the guidance on each of the topical areas and examine and choose relevant tools and resources to acquire background information, customize them for undertaking a Watershed Regional Risk and Resilience Initiative, or to meet specific needs associated with assessing risks and identifying gaps and risk reduction actions. Users can also choose to use ***a Watershed R3 Assistant*** to help them operationalize the Playbook guidance. [i]

What an AI-powered Watershed R3 Assistant Can Provide

Such a companion tool can: (1) help users quickly become familiar with the Playbook and the watershed resilience planning process it outlines; (2) direct them to the most relevant resources, tools, and data based on the nature and scope of their particular initiative; and (3) automate and streamline the creation of key planning products, such as stakeholder engagement letters, meeting agendas, scenario-based exercises, and initial assessments. A Watershed R3 Assistant supports users by prompting them with step-appropriate questions, summarizing relevant Playbook content, recommending specific resources, and generating outputs tailored to local needs.

Guidance on how to create and use a Watershed R3 Assistant

Guidance with instructions of how to create *a Watershed R3 Assistant* on an AI platform and examples of prompts and queries to use can be downloaded at **https://nr3c.org/resources-1**. The instruction set is designed to enable users to employ the AI platform of their choice. (Note: initial testing of an AI Assistant to help operationalize the Playbook was performed using ChatGPT and Google Gemini, but there are other AI models available and new ones emerging as AI advances accelerate.)

Important Limitations to Keep in Mind

An AI Assistant does not have access to classified or proprietary data, and cannot currently conduct technical analyses such as hydrologic modeling, detailed economic assessments, or review maps. It may make informational errors and create bogus data, and its outputs must be reviewed for accuracy. It is not a substitute for in-depth local knowledge or decision-making, nor can it replace the collaboration, coordination, and expertise that are foundational to improving watershed risk and resilience. Users should verify responses from a Watershed R3 Assistant with relevant practitioners and experts before using the information in their planning process.

[i] The Playbook, now in version 2.0, is reviewed annually to reflect new and additional information and update the tools and resources references. Guidance on how to use a R3 Assistant will be updated as necessary to reflect changes/advances in capabilities of AI models and platforms.

Playbook *Ask the Expert*

The Playbook at the end provides contact information and areas of expertise of Task Group members available to answer questions about using the Playbook guidance, tools and resources, using a Watershed R3 AI Assistant, or direct users to other useful information to help them improve watershed regional resilience.

GUIDANCE WITH SELECTED TOOLS AND RESOURCES

Background Information and Reference Materials

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

Escalating and Emerging Hazards are Raising the Risk Bar

The first step towards organizing a collaborative initiative to assess and reduce multi-hazard risks and build resilient watershed regions is to understand what watersheds are and why their resilience is important. Few appreciate that everyone in the Nation 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 any point along a stream channel." Every one of these watersheds is unique. They can be quite different from one another 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 with extensive co-located infrastructure to a rural area with no to a few small communities and limited, dispersed infrastructures and road access.

Vulnerability to Natural and Manmade Hazards. Whatever their characteristics, all watersheds and the communities and supporting infrastructures that support them have become increasing vulnerable to natural and manmade events in a rapidly changing risk environment.

Over the last decade there have been escalating occurrences and costs of large-scale floods, wildfires, tornado outbreaks extended heatwaves, and droughts affecting virtually all regions of the U.S. In just the last few years, catastrophic flooding in early 2024 caused dam-related incidents in Minnesota, Michigan and Wisconsin, and in September flooding from Hurricane Helene created a path of unprecedented destruction from Florida's west coast through several U.S. southeast states. 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. 2025 began with firestorms devastating communities across Los Angeles County in one of the most destructive wildfires in that region's history, followed until the present by episodes of severe weather with multiple wildfires, tornado outbreaks, and major flood events across the country. *This trend of changing weather patterns and escalating extreme events is predicted to continue* with rapidly rising sea-levels, increases in average annual global temperatures, and potential mega-flooding in the U.S. and other regions of the world.

Beyond extreme weather events, there are other major hazards of concern—earthquakes, environmental disasters (e.g., oil or other hazardous waste spills), unanticipated accidental and deliberate manmade events, including cyber and physical attacks disrupting or damaging water, energy, healthcare, agriculture and food production, and other critical infrastructures. Compounding these risks are accelerating advances in electronics, computing, and other digital technologies that are creating a tightening web of interconnectivity that open new avenues for disruptions and attacks affecting critical infrastructures and supply chains.

Yet an additional exacerbating factor is the condition of the *aging structures, components, and systems that manage, support, and sustain watershed regions*. Looking at dams and levees, for example, the U.S. Army Corps of Engineers (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.

Rapidan Dam, Southern, MN - NYT

The USACE website notes that the Inventory does not yet contain all dams in the Nation that meet these criteria, and that nearly a quarter of the dams identified in the Inventory are not federally or state regulated. 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 with 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.

A further concern is that dams. levees, energy, water/wastewater and other infrastructures in many parts of the country are increasingly stressed beyond their original design by extreme weather conditions, growing demands of burgeoning populations, and the need to support the computing, electronic, and digital systems that enable our way of life.

A prime example of new demands on aging infrastructures are data centers that require continuous large amounts of reliable and redundant power and communications and a substantial water supply for cooling.

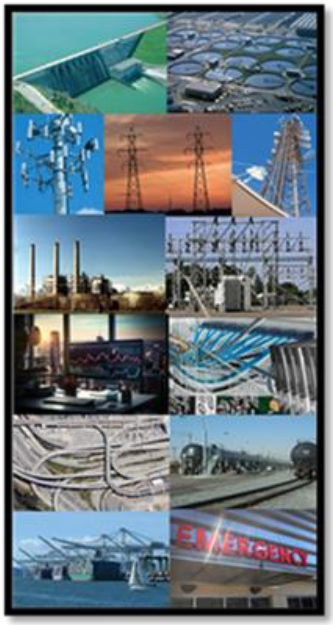
An Amazon Data

The ***Selected Tools and Resources*** *that follow can be used to provide general background for Playbook users and stakeholder participants in Watershed Regional Risk and Resilience Initiatives and provide materials for planning and conduct of a workshop on the changing risk landscape and importance of resilient watersheds.*

Tool/Resource	Description	Owner	Internet Link
Hydrologic Units of the United States	**Website** with background information and interactive map of the Nation's watershed regions that allows users to click on any watershed in the map for boundaries and links to information on its characteristics and hazards.	USGS	Hydrologic Units
What is a Watershed?	**Website** providing a basic primer on watersheds with illustrative graphics and photos.	NOAA National Ocean Service	What is a watershed?
Watersheds and Drainage Basins	**Website** providing a wealth of information on the Nation's watershed regions.	USGS Water Science School	Watersheds and Drainage Basins | U.S. Geological Survey
Climate Change is Increasing the Risk of a California Megaflood	**Study** on "unappreciated" risk to California of extreme flooding conditions based on a variety of modeling data.	Science Advances Journal	Climate change is increasing the risk of a California megaflood | Science Advances
World of Change: Global Temperatures	**Website** overviewing trends in global temperature rise with illustrative maps.	NASA Global Earth Observatory	World of Change: Global Temperatures
Billion-Dollar Weather and Climate Disasters	**Website** with an extensive cost and other data on all types of weather-related hazards.	NOAA National Centers for Environ-mental Information	Billion-Dollar Weather and Climate Disasters | National Centers for Environmental Information (NCEI)
National Risk Index	**Website** with databases covering all natural hazards; provides clickable maps to ascertain a Risk Index score and rating for a community's relative risk for each when compared to the rest of the U.S.	FEMA	Natural Hazards | National Risk Index
Homeland Threat Assessment 2025	**Report** on major bad actor threats facing the Nation's critical infrastructures with reference to climate-related hazards at the end.	U.S. DHS Office of Intelligence Analysis	Threats to America's Critical Infrastructure Are Now a Terrifying Reality | RAND
National Inventory of Dams	**Website** with information on more than 90,000 dams including their characteristics and hazard levels.	USACE	National Inventory of Dams

National Levee Database	**Website** providing a variety of data on over 7,000 levee systems in the U.S.	USACE	National Levee Database
America's Watershed Initiative Report Card for the Mississippi River	**Report** (2015) based on stakeholder assessments rating five major Mississippi River watershed basins on flood control capabilities, the state of their infrastructure systems, and ability to perform essential functions and services	America's Watershed Initiative *(collaborative of public/ private sector from 31 states)*	Mississippi River Report Card Methods v10.1.pdf
ASCE Report Card for America's Infrastructure	**Report** assessing the state of the Nation's critical infrastructures.	American Society of Civil Engineers	America's Infrastructure Report Card 2021 | GPA: C-
2024 Roadmap to a Secure and Resilient Water and Wastewater Sector	**Guidance** that reviews key threats and vulnerabilities of water and wastewater systems and identifies gaps in capabilities and priority actions to address the gaps.	U.S. Environmental Protection Agency(EPA)	2024 Roadmap to a Secure and Resilient Water and Wastewater Sector | US EPA
Fifth National Climate Assessment: Energy Supply, Delivery, and Demand	**Report** on threats/consequences to energy supply/delivery from extreme weather, sea level rise, droughts, wildfires, and other hazards with resilience recommendations	U.S. Department of Energy (DOE)	Fifth National Climate Assessment Ch. 5 Energy Supply, Delivery, and Demand

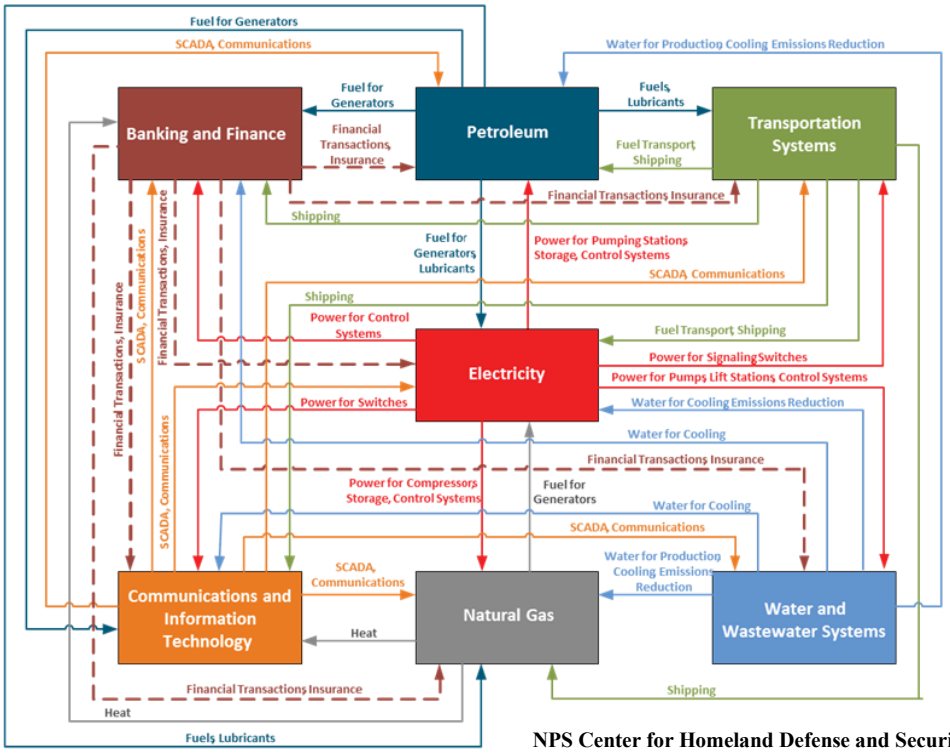
Watershed Critical Infrastructure Dependencies and Interdependencies



The resilience of watershed regions relies on the continued secure and reliable functions and services of critical 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; agriculture and food production, commercial businesses of all types, 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 each of these critical infrastructures are dependent on the functions and services of other critical infrastructures, which in turn are dependent on others. This creates complex, multi-level layers of interdependencies that can cause

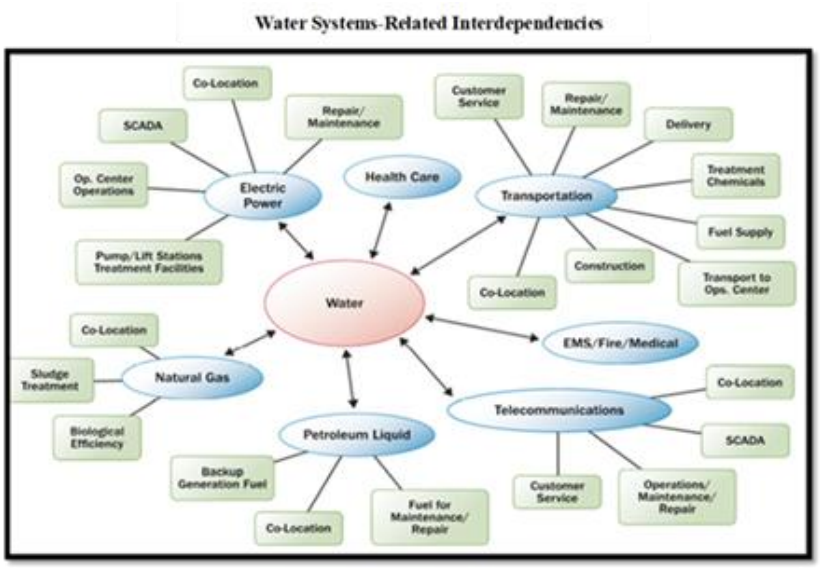
simultaneous, escalating, and cascading impacts and/or damage throughout and beyond a watershed region.



NPS Center for Homeland Defense and Security

These impacts can result in prolonged disruptions of essential functions and services, impede response actions, and complicate and delay recovery and restoration of facilities, assets, and systems. The growing incorporation by communities and critical infrastructures of smart technologies into systems and networks to manage an increasing range of 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 systems ensure running water, treat sewage and waste, control floods, manage rainfall runoff, manage recreation, waterway navigation, conservation, agriculture, and protection of the environment and endangered animal and plant species.



NPS Center for Homeland Defense and Security

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. These systems are interdependent with each other and with other infrastructure sectors. For example, dams provide water to households, businesses, and industries; provide irrigation and flood management to enable agriculture and food production through supporting an estimated 1.9 million farms, hundreds of thousands of restaurants, and more than 200,000 food manufacturing, processing, and storage facilities; provide navigable waterways for transport of people and freight of all kinds; produce hydropower, and support emergency services through supplying water for firefighting and waterborne access in disaster response.

Consequently, these 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, decisionmakers 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 among the cross-sector and multi-discipline and federal-to-local level government agencies with roles and responsibilities in watershed resilience. Their collaboration is necessary in assessing risk across interdependent infrastructures and agreeing to a regional risk reduction Action Strategy with an Implementation Plan of activities and projects that will have shared management and funding responsibilities.

Regional and Sector-Focused Interdependencies Exercises and Workshops

Tabletop exercises and scenario-based workshops are top tools to raise the awareness of watershed decisionmakers and key stakeholders of infrastructure interdependencies and associated vulnerabilities and risks under certain hazard conditions. An increasing number of these exercises and workshops have been conducted across the country largely modeled on the first one held called *Black Ice* co-sponsored by U.S. DOE and the Utah Department of Comprehensive Emergency Management.[ii] These stakeholder events do not test plans and procedures like traditional emergency management exercises, but identify, examine, and discuss interdependency-related linkages, cascading impacts, services outages, and consequences for

[ii] This unprecedented cross-sector tabletop exercise with 225 cross-sector participants examined how interdependencies-related impacts from a severe winter storm could disrupt energy and communications infrastructures during the 2002 Salt Lake City Olympics.

health and safety, the local and regional economies and the environment, and restoration timelines. The overall goal is to increase understanding of these interdependencies and potential consequences, and determine needed actions to enhance resilience under that scenario. These exercises and workshops can be "no frills" events developed by a volunteer planning team and held at a donated meeting site or more resource and process-intensive if sponsored by a government agency with contractor support.

Although after-action reports of regional interdependencies events are largely unavailable on the Internet for proprietary and security regions, there are a few good examples available. The Pacific NorthWest Economic Region (PNWER), a U.S.-Canadian cross-border consortium of five states and five provinces and territories, has on its website the reports and associated action plans from each of a series of eight *Blue Cascades* interdependencies exercises with different scenarios held from 2002 to 2018. These can serve as models to customize for a Watershed Regional Risk and Resilience Initiative or for other purposes. There also are a few federal resources to assist in developing interdependencies-focused exercises which can provide general guidance. However, it should be kept in mind that these federal guides are intended primarily for government officials and select critical infrastructure personnel typically with incident response and initial recovery missions, and are largely focused on test and evaluation of existing policies and procedures.

Blue Cascades VIII Tabletop - PNWER

The Selected Tools and Resources *below provide basic information on physical and cyber interdependencies and on threats and hazards affecting specific sectors and supply chains, including water management systems, healthcare systems, energy, transportation, communications, agriculture, etc.; also examples of scenario-based regional interdependencies exercises and after-action reports.*

Tool/Resource	Description	Owner	Internet Link
Infrastructure Dependency Primer	**Website** providing links and information to a wide variety of federal and non-federal tools and resources help better understand critical infrastructures, dependencies, their impact on communities, and how to take them into account in resilience planning and improvement.	U.S. Department of Homeland Security Cyber and Infrastructure Security Agency (CISA)	Infrastructure Dependency Primer | CISA

Critical Infrastructure Sectors	**Website** providing overviews of all critical infrastructure sectors and high-level interdependencies with links to other federal resources for further information.	CISA	Critical Infrastructure Sectors | CISA
Analysis of Critical Infrastructure Dependencies and Interdependencies	**Study** (2015) by team of national laboratory experts providing excellent overview of critical infrastructure linkages, challenges in assessing them, and recommendations of how to overcome the challenges.	Argonne National Laboratory	https://doi.org/10.2172/1184636
Sector Resilience Report: Dams	**Report (2025)** providing an overview of Dams Sector facilities and an analysis of key dam dependencies and interdependencies.	CISA	OCIA _Dams_Sector_Resilience_Report.pdf
Infrastructure Interdependencies Exercise Black Ice	**PowerPoint Presentation** summarizing the first held interdependencies tabletop exercise, its purpose, focus, format, and and outcomes	Defense Technical Information Center	Infrastructure Interdependencies Tabletop Exercise: Summary of Key Issues and Actions to Date
Blue Cascades Series Infrastructure Interdependencies Tabletop Exercises	**Website** providing links to the outcomes and action plans of eight regional interdependencies tabletop exercises, each with a different hazard scenario focusing on the Puget Sound region of Washington State	Pacific NorthWest Economic Region (PNWER)	Blue Cascades Series - Center for Regional Disaster Resilience
CISA Tabletop Exercise Package: Exercise Planner Handbook	**Guide** providing step-by-step instructions on how to plan, develop, and execute a tabletop exercise with templates provided. Can be customized and simplified to develop a multi-hazard stakeholder regional interdependencies tabletop.	CISA	CTEP Exercise Planner Handbook (2020) Final
NIST Special Publication Guide Brief 5 – Assessing Energy System Dependencies	**Guide** focusing on understanding dependencies from an energy system perspective to assist in resilience planning for a community or region.	National Institute of Standards and Technology (NIST)	Guide Brief 5: Assessing Energy System Dependencies
Critical Infrastructure Regional Integrated Action Strategy	**Plan** of actions needed and improvements with corresponding recommendations for projects and activities developed from regional interdependencies workshops and exercises, with focus on transportation disruptions and other impacts to regional critical infrastructure that could affect supply chains. Action Plan includes brief summaries of each exercise.	PNWER CRDR	puget_sound_critical_infrastructure_regional_integrated_action_strategy__1_.pdf

What Watershed Regional Resilience Requires

There currently is no single agreed definition of watershed regional resilience, although there are a wide variety of resilience-related 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 its decisionmakers and key stakeholders 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.*

Regional Resilience Principles

Foundational to this description are basic principles of regional resilience that have evolved over the last two decades. The following 15 principles have informed national frameworks and regional and community resilience guides that are available today.

1. *Need for a Holistic Approach to Improving multi-hazard 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 protection and prevention, preparedness, pre-and post-event mitigation, response, recovery/long-term restoration, and obtaining resilience investments.
2. *Understanding Infrastructure Dependencies and Interdependencies.* Interdependencies exist at multiple levels of increasing complexity and extend beyond a community, a state, and Nation. Regional interconnectedness remain little understood beyond superficial levels. There is a great need to broaden the understanding of the extent, potential impacts and associated risks of interdependencies particularly in large-scale events with prolonged disruptions.
3. *Appreciation of the Regional Risk and Resilience Tautology.* The security and resilience of interdependent critical infrastructures depend on the resilience of the communities and regions they support. Conversely community and regional resilience depend on the resilience of the supporting infrastructures and other essential functions and services. This means regional risk must be analyzed taking both community and infrastructure risk into account.
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 build trust, foster information sharing and coordination, and identify and assess vulnerabilities and resilience needs. 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.
8. *Recognizing that Adaptive Design Innovation is Essential to Resilience.* Research on adaptive design has developed principles and practices that can protect, manage, and restore ecosystems, communities and infrastructure under adverse conditions. Examples are innovations that mitigate urban heat, support better stormwater and flood management, reduce flooding through restoration of wetlands and forests, and installation of micro-grids for power outages.
9. *Understanding the Linkages and Dynamics between Health Resilience and Economic Resilience.* Multi-hazard major disasters have graphically demonstrated the tight interconnection between individual health and community health resilience capacities and the vitality of local economies. 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.* Individuals and communities must cope with and adapt to stresses such as social, political, health and safety, environmental, or economic challenges from adverse events. They must be 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. to include promoting a "culture of resilience" through awareness activities, 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, including ethnic, economically disadvantaged and other at-risk communities. This information must be conveyed through a variety of mechanisms to target populations.
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 community. Federal agencies should work with stakeholders to develop policies and undertake actions to build resilience.

The Watershed Regional Resilience Mission Space

The Holistic Approach assesses regional risk and resilience needs and capabilities across the disaster management missions 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.*

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 multi-hazard 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 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 enable rapid stabilization of damaged and disrupted critical infrastructures and essential services and meet temporary housing needs for displaced populations; 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.

These mission area descriptions are a composite of those from different Federal agencies that have disaster management and infrastructure security responsibilities and are customized for watershed regional resilience. FEMA, CISA, NIST, and USACE have various planning frameworks focusing on these mission areas that can provide additional information on their respective requirements.

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.

The Focus Areas are shown in the circle graphic. The initial set of these was developed by a national task force of practitioners and experts as the framework for the first regional resilience guidelines produced in the aftermath of the devastation of the New Orleans Region by Hurricane Katrina in August 2005.[iii] Since then they have been expanded and customized by national governments, states, localities, and non-profit organizations for use in multi-hazard resilience planning and capacity building.

Following are examples of Needs and Capabilities that fall under 12 of the 15 Focus Areas. Needs and Capabilities of the remaining three Focus Areas (Response Requirements, Recovery & Long-term Restoration, and Risk-Based Prevention and Pre-and Post-Event Mitigation) are listed in the previous section describing the Resilience Mission Space.

[iii] The Infrastructure Security Partnership, *Guide for an Action Plan to Develop Regional Disaster Resilience*, 2006 Edition.

Examples of Needs and Capabilities in the Respective Focus Areas

Multi-Stakeholder Collaboration and Decision-making	Engagement of 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	Multi-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, hazards, including concurrent events, such as high-rain and flooding after wildfires, 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, ensuring agricultural production/food supply, animal health and endangered species; continual agriculture and animal disease surveillance and monitoring of food safety; also health and ecosystem impacts that could affect health and safety, including threats from vector-borne and other diseases, livestock and animal life; e.g., erosion, potential land or mudslides, invasive species and vector-borne, fungal, and bacterial hazards, and hazardous materials that require debris decontamination, removal, and disposal.
Cyber & Physical Security	Improved awareness of multi-hazard threats and events that affect watershed resilience; intelligence collection, analysis, and dissemination; screening, search, and detection for multi-hazard 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.
Communications and 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; 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 multi-hazard 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 cross-sector 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.
Alert and Warning, 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*** different needs and capabilities across the resilience mission space to assess, identify, and prioritize 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 an 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 Enablers

The Holistic Approach also requires taking into account important **Attributes and Enabler**s 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 multi-hazard 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.

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

These Attributes and Enablers should serve as guides and drivers for each of the activities throughout the Continuous Holistic Resilience Cycle. This will provide continuity and enhanced coordination among pre-and post-event mitigation, preparedness, recovery, and other risk reduction planning and implementation, as well as in securing investments to help assure the integrity of interdependent infrastructures and prevent cascading and long-term disruptions.

Watershed Key Stakeholder Engagement

Creating a resilient regional watershed means identifying and engaging 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 and ensure stakeholder validation of, and buy-in for, the results. 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 what role these public/private sector and non-profit organizations will play in addressing different types of events that can impact the watershed region. Their respective 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).

- ***Agriculture and food production—*** Farmers associations, suppliers of agricultural needs, such as seeds, fertilizers, pesticides, food producers, processors, distributors and grocers and other food retailers.
- ***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.

Metrics and Standards for Watershed Regional Resilience

Over the last several years there has been substantial research on resilience indicators with development of some frameworks and guides for infrastructure systems, community resilience, and hazard resilience metrics. However, development of metrics and standards for multi-hazard regional resilience is still evolving and remains challenging, There are a number of reasons for this, including lack of consensus on the definition of resilience and how resilience is related to other similar terms such as vulnerability, recovery, adaptability, and sustainability; and the wide range of hazards that must be taken into account and their respective impacts on the different infrastructure sectors, built environment, and ecosystems that comprise a watershed region. Then there is the problem of reliance on subjective judgements to determine resilience indicators and how much weight to assign to each. An additional complication is how to aggregate resilience indicators across a region with multiple different jurisdictions and supporting infrastructures and essential services and to monitor progress over time.

That said, there are existing resilience metrics and standards that can help serve as guidelines to assist in the development of a Watershed Risk and Resilience Initiative and in gauging improvements accomplished over the longer term. These include various government-produced and private sector metrics and basic tools, such as checklists, to determine resilience levels that focus on sectors or critical functions, business continuity, communities, etc. Considering that Watershed regional resilience is a continuous process and will be built incrementally over time, a simple measure of success can be demonstrating the completion of the risk reduction projects and activities in the Action Strategy and the incorporation of new resilience improvement actions identified to the Strategy and its Implementation Plan from follow-on risk assessments and lessons learned from future events.

The Selected Tools and Resources *that follow include examples of useful federal, state, private sector and non-profit produced planning guides, reports, and studies that provide additional information on regional resilience principles, the focus areas, needs/capabilities and resilience attributes/enablers. Many of these resources also address broad stakeholder inclusion and concepts to measure and gauge resilience progress.*

Tool/Resource	Description	Owner	Internet Link
National Resilience Guidance a Collaborative Approach to Building Resilience	**Guide** providing key principles to strengthen resilience; how to organize and engage stakeholders into planning and prioritizing projects and programs, financing resilience efforts, and measuring and evaluating resilience. Includes a high-level community resilience maturity model.	FEMA	FEMA National Resilience Guidance: A Collaborative Approach to Building Resilience | U.S. Climate Resilience Toolkit
Resilience Principles	**Fact Sheet** providing a framework for communities and practitioners to understand and apply resilience concepts that can be integrated into planning and development.	New York State Department of State	Resilience Planning | Department of State
U.S. Climate Resilience Toolkit Case Studies	**Website** focusing on regions across the U.S. providing hundreds of cases studies, action plans, and tools to address impacts on a wide range of infrastructure sectors of climate-related hazards.	NOAA	Case Study | U.S. Climate Resilience Toolkit
Regional Resilience Toolkit: 5 Steps to Build Large Scale Resilience to Natural Disasters	**Toolkit** to build Regional Resilience produced by EPA, FEMA, and Bay Area Association of Governments. Provides guidance and resources for engaging a broad coalition of regional stakeholders, conducting vulnerability assessments, writing required plans, and implementing projects with worksheets and additional information and resources for each step.	U.S. Environmental Protection Agency (EPA)	EPA regional_resilience_toolkit.pdf
North Carolina Resilient Communities Planning Guide	**Guide** to assist localities to plan for natural hazards and climate resilience from stakeholder engagement, hazard assessment, and creation of an action plan with implementation guidance.	North Carolina Office of Recovery and Resiliency	https://www.rebuild.nc.gov/resilient-planning-communities-guide/open
Planning Community Toolbox	**Guide** for civil works planning providing a wealth of information, tools, and resources, including policy and compliance guidance.	USACE	Planning Community Toolbox

Flood After Fire	**Website** that provides factual information and links to additional resources covering how wildfires can increase flood risk, post-wildfire flooding impacts, and practical guidance on steps that can be taken to mitigate impacts.	USACE	Flood After Fire
Drought and Infrastructure: A Planning Guide	**Guide** to assist in understanding potential impacts to infrastructure assets and systems resulting from drought and possible mitigation actions.	CISA	Drought and Infrastructure - A Planning Guide
National Cohesive Wildland Fire Management Strategy	**Website** with downloadable Strategy that describes a national vision for wildland fire management, wildland fire challenges, and identifies opportunities to reduce wildfire risks with focus on managing vegetation and fuels; protecting homes, communities, and other assets at risk; managing human-caused ignitions; and effectively and efficiently responding to wildfire.	U.S. Department of the Interior	The National Cohesive Wildland Fire Management Strategy
Building Private Public Partnerships	**Guide** providing recommendations and resources for establishing and maintaining public-private partnerships to help coordinate mitigation, response and recovery planning and preparedness.	FEMA	Other: Building Private-Public Partnerships | FEMA.gov
A Framework for Defining and Measuring Resilience at the Community Scale	**Report** on research to establish a holistic framework for defining and measuring disaster resilience for a community at various scales using 7 dimensions characterizing community functionality: population and demographics, environmental and ecosystem, organized governmental services, physical infrastructure, lifestyle and community competence, economic development, and social-cultural capital.	NIST	Microsoft Word - RCh-MCEER GCR 10-930 _11-03-10_.docx
Resilience Analysis and Planning Tool (RAPT)	**Software Tool** providing access to data and GIS mapping with more than 100 preloaded layers that include community resilience indicators, current census data, infrastructure, and hazards.	FEMA	Resilience Analysis and Planning Tool (RAPT)
U.S. Climate Toolkit Resilience Metrics	**Software tool** that addresses how to achieve successful adaptation to climate change, tracking progress toward resilience goals, and how to measure success with guidance and tools that can be adapted to different localities and regions.	NOAA	Resilience Metrics | U.S. Climate Resilience Toolkit

NFPA 1660 Standard for Emergency, Continuity, and Crisis Management: Preparedness, Response, and Recovery (2024 Edition))	**Website** with information and free download of latest version of longstanding standard that addresses preparedness, including program management, risk assessment, business impact analysis, loss prevention/hazard mitigation, emergency management, business continuity, crisis management, and crisis communications. Also provides many informative annexes including checklists.	National Fire Protection Association (NFPA)	NFPA 1600 2019 Edition: A Resource for Every Practitioner's and Auditor's Toolbox - Risk and Resilience Hub
ISO 31000	**Website** describing and enabling download of standard that provides principles and guidelines for risk management with a comprehensive approach to identifying, analyzing, evaluating, treating, monitoring and communicating risks across an organization.	International Organization for Standardization (ISO)	ISO 31000:2018 - Risk management — Guidelines
California Water Plan Watershed Hub Resilience Indicators and Metrics	**Report** documenting the development of a proposed set of indicators and metrics to assess current water resources conditions for watersheds across the State of California.	California Department of Water Resources	Watershed Hub Resilience Indicators and Metrics

Operationalizing Watershed Regional Risk and Resilience Initiatives

The Seven-Step Process and How to Execute It

The following process was initially developed by The Infrastructure Security Partnership in 2006 for the *Guide for an Action Plan to Develop Regional Disaster Resilience* and updated in the 2011 edition of the Guide. 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 past two decades 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, only a few focus on conducting risk and resilience assessments on a regional scale. These include frameworks and guidelines referenced in the Background & Informational Guidance and Reference Materials sections of this Playbook produced by different federal agencies—CISA, FEMA, NIST, EPA, DOE, and NOAA. While each of these resources have a different number of steps and terminologies to describe them, the process is largely the same. Some have useful templates that can be used to implement each of the steps.

Following are descriptions of each of the seven basic steps. The steps are designed to be adapted to suit the goals, objectives, needs, and unique characteristics, culture, leadership, and capabilities of any region to address any hazard scenario.

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 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 to provide guidance and oversight.
- **Forming a *Regional Multi-Stakeholder Coalition*** that together with the facilitating entity and core team guidance will define the focus and scope of the Initiative, the tasks and timeline to undertake it, and identify/review existing plans, studies, maps, and other resources that need to be leveraged for the Action Strategy. This coalition should 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 as many of the following entities as feasible: 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 decisionmakers to know who their region's key stakeholders are, have their contact information, and have a mechanism to facilitate relationship-building, which is essential for resilience planning, sharing information, and disaster response and recovery coordination. The coalition offers stakeholders the opportunity to develop a shared appreciation of the watershed risk landscape and contribute to regional risk assessment that takes into account the collective vulnerabilities and interdependencies-related consequences across the watershed of a natural or manmade event, which can greatly assist in their organization's or jurisdiction's own risk assessment and operational continuity planning.

- **Holding an *Initiative Kick-Off Meeting* followed by a *Scenario-Based Infrastructure Interdependencies Workshop*** that demonstrate the need to identify potential priority risks. mitigation and broader resilience capacity-building improvements.

Step 2: Identify Regional Infrastructures and Design Assessment

This step entails:

- **Working with 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 includes identification of priority assets and functions and associated high-level dependencies and interdependencies.
- **Determination 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 includes:
  - ***The geographic extent (region) to be studied*** – e.g., jurisdictional boundaries (metropolitan area, multiple communities, etc.) and service areas; natural features (mountains, rivers, lakes, vegetation, etc.), clusters of key industries, education or health care facilities, supporting infrastructure systems and supply chains, risk exposure zones (floodplain, earthquake zones, etc.).
  - ***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.
  - ***Data sources and analysis methods***.
  - ***The risk levels that would be used*** in the assessment.
  - ***The process and timeline for the Initiative*** (i.e., conduct of the assessment and development of the resulting Action Strategy and accompanying 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.
- ***Surveying across the region's current local resilience plans, procedures, capabilities and resources, including policies and regulations*** to ascertain what can be leveraged and where there are gaps or areas where improvement is needed.

  Both 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 potentially 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. 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 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 involves:

- ***Use of the data and information from Step 3 to examine vulnerabilities to threats and hazards and consequences*** that may result. This typically will entail using an analytical approach that incorporates 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. Ideally, the goal is 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, when expert technical expertise is limited or unavailable, this analysis can be accomplished at a superficial level relying on high-level data gained through scenario-based workshops, tabletop exercises, targeted focus groups. and discussions with individual cross-sector stakeholders.

Step 5: Develop Action Strategy with an 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:

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

There are templates developed by regional collaboratives and guidance by federal agencies that can be leveraged for this.

Step 6: Identify and Secure Resources

This step requires

- ***Finding ways to secure the resources necessary for implementing the Action Strategy*** projects and activities. 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 the Action Strategy projects and activities as resources allow and evaluating progress*** made to accomplish each action and new risk reduction measures that have been added. 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 learned 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.

Implementation Considerations

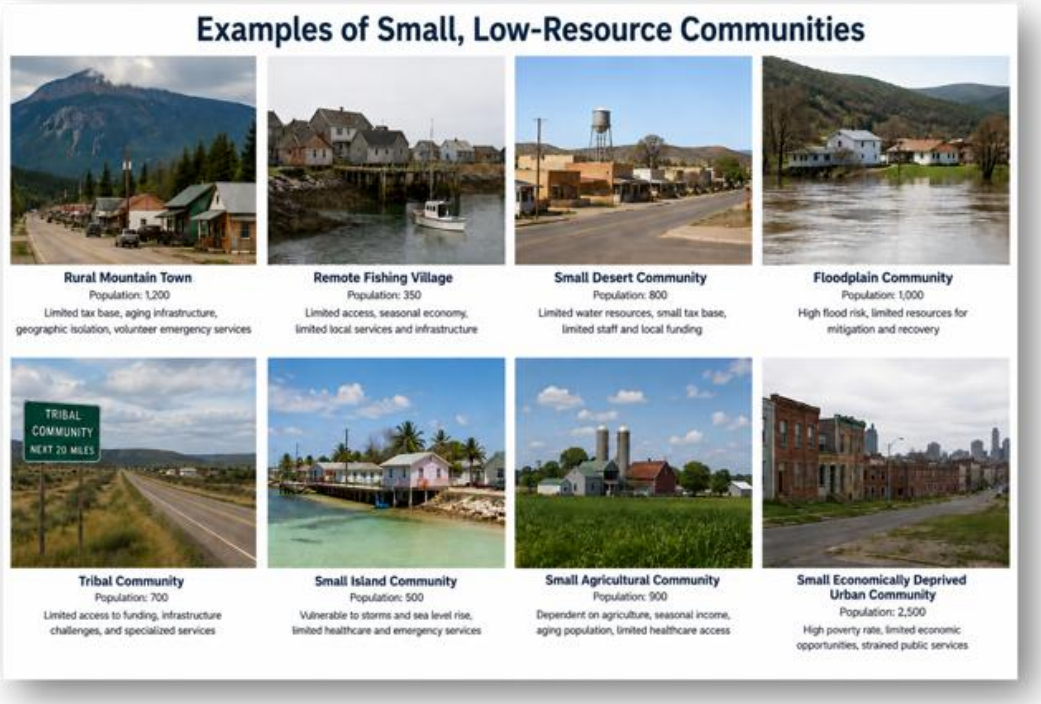
Accommodating Needs of Low-Resource Communities and Smaller Infrastructures

Many major metropolitan areas across the country have had multi-stakeholder resilience activities for some time and have a basic understanding of multi-hazard risks and infrastructure interdependencies, 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.

It is these low-resource communities and service providers, particularly in rural areas without disaster plans and dedicated emergency management staff, that are most often hardest hit by hurricanes, wildfires, major inland flood events and tornado outbreaks. An example are small communities in mountain regions of Western North Carolina hard hit by Hurricane Helene where recovery has been exacerbated by bureaucratic challenges and limited resources.

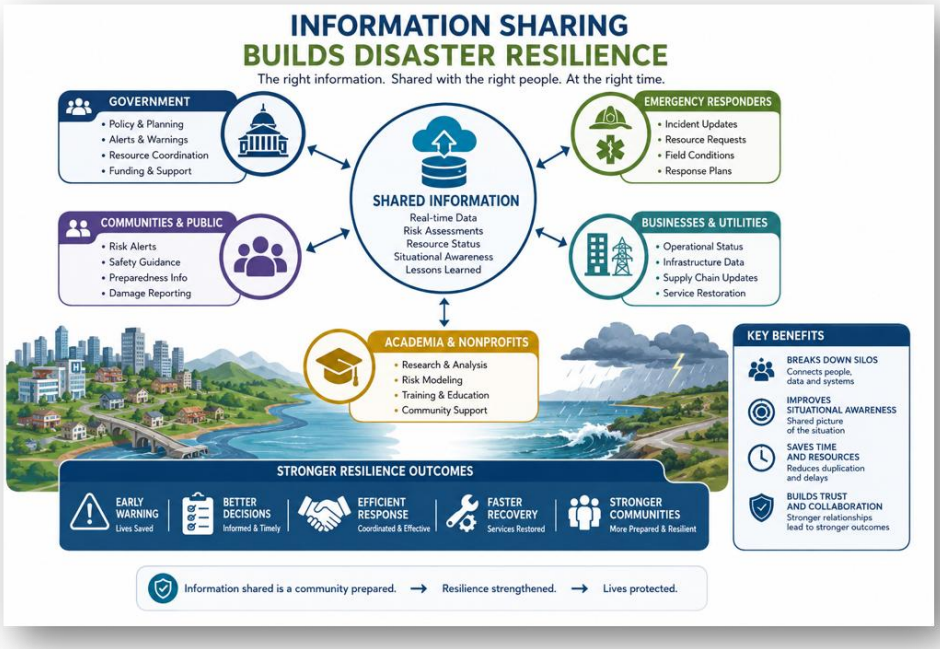
Ideally, states could take a leadership role to bring together low-resource communities and small utilities and other service providers in different watershed regions that are the most vulnerable to these significant hazards. These low-resource communities can also benefit from participating in a Regional Risk and Resilience Initiative and other 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 alternatively on their own undertake a "lite" version of the seven-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 low-resource stakeholders to share information and decide together on gaps and needed resilience improvements. These workshops and exercises can also assist state emergency management to better understand the needs of low-resource communities and smaller infrastructures, build relationships with them, and help them overcome bureaucratic and cultural obstacles that constrain improving their resilience.

Facilitating Information-Sharing and Obtaining Data

There have long been major constraints in obtaining the necessary data to adequately assess regional risk. An overarching challenge is the sheer number of diverse stakeholders that need to be included and barriers to accessing 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, assess disruption impacts, 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.



Moreover, 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.

As already noted, 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 region 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."

Potential additional solutions. There are avenues that are being explored to address information-sharing 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 enable 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 resilience 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.
- Enabling use of DHS CISA's Suite of Tools for the Analysis of Risk (STAR) for watershed regional stakeholders to assess risks. STAR operationalizes and integrates the capabilities of several National Laboratories and other Federally-Funded Research Centers into one web-based application that could be used to 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, 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.

The Selected Tools and Resources *include general planning references that use some variant of a multi-step process and which are available for community and sector-specific resilience planning; state initiatives that address regional interdependencies, risk assessment methodologies, and data resources; background information on resilience needs of low-resource communities, and information on "Sandbox" virtual information-sharing environments and cross-sector information systems and software tools.*

Tool/Resource	Description	Owner	Internet Link
Infrastructure **Resilience Planning Framework (IRPF)**	Guide providing framework for incorporating critical infrastructure resilience into planning and to help communities, regions, and infrastructure owners and operators better understand critical infrastructure risk, identify opportunities to enhance resilience, and inform policy and investment decisions.	CISA	Infrastructure Resilience Planning Framework (IRPF)
Methodology For Assessing Regional Infrastructure Resilience Lessons Learned	**Guide** providing foundational regional resilience concepts, and a scalable methodology for assessing the resilience of critical infrastructure, identifying resilience improvement actions.	CISA	DIS_DHS_Methodology_Report_ISD20Signed_with%20alt-text_0.pdf
Threat and Hazard Identification and Risk Assessment (THIRA) and Stakeholder Preparedness Review (SPR) Guide	**Guide** for conducting a Threat and Hazard Identification and Risk Assessment (THIRA) and Stakeholder Preparedness Review (SPR), through a standard process for identifying community-specific threats and hazards and setting targets for each core capability identified in the National Preparedness Goal.	FEMA	Comprehensive Preparedness Guide (CPG) 201, 3rd Edition
Community Resilience Planning Guide Playbook Template and Additional Resources	**Website** with guide providing a six-step process with useful templates for stakeholder engagement and characterizing community infrastructures and built environment and other supporting materials to assist in resilience planning and identifying optimal resilience-improvement actions.	National Institute of Standards and Technology (NIST)	https://www.nist.gov/community-resilience/planning-guide/planning-guide-playbook-templates-additional-resources
Community Resilience Planning Guide Briefs	**Website** providing methods and best practices to complement the NIST Community Resilience Planning Guide, including mapping social dimensions and determining performance goals for buildings and infrastructure systems under different hazard conditions.	NIST	Community Resilience Planning Guide Briefs | NIST

The Community Resilience Economic Decision Guide and Online Tool	**Software tool** that provides a standard economic methodology for evaluating resilience investment decisions through a seven-step process that assesses and compares alternative infrastructure projects for community resilience by analyzing the benefits and costs associated with competing capital improvements to support selecting investment strategies**.**	NIST	The Community Resilience Economic Decision Guide and Online Tool | NIST
State of VA Department of Emergency Management Blue Book Project	**Website** with white paper describing FEMA grant funded project to develop a coordinated operational process to support local, state, federal, and private sector operational priorities to ensure continuity of government under a coordinated cyberattack on critical infrastructure systems	Virginia Department of Emergency Management	white-paper-1-vdem-blue-book-project-overview.pdf &
Colorado Whole of State Critical Infrastructure Protection Project	Website describing program to develop and implement a whole-of-state critical infrastructure protection plan that includes a comprehensive database of public and private infrastructure.	Colorado Department Office of Homeland Security and Emergency Management	Whole of State Critical Infrastructure Subcommittee | Division of Homeland Security and Emergency Management
Marine Transportation System Resilience Guide	**Guide** to assist in understanding resilience challenges to the marine transportation system (MTS), especially the inland marine transportation system, and provides a framework and methodology for conducting MTS resilience and assessments with tools, resources, and data sources, including a series of case studies ways to improve resilience.	CISA & USACE Engineering Research and Development Center (ERDC)	MARINE_TRANSPORTATION_SYSTEM_RESILIENCE_ASSESSMENT_Guide_j19eOn6rW6okZ1rLETxG1RG6Fs_95568(1).pdf
Assessing Resilience Case Studies and a Path Forward for the Marine and Inland Waterborne Transport	One of several PowerPoint video presentations followed by interactive discussion by experts providing a useful primer on the importance of marine transportation resilience, hazards, risks, challenges, and recommended actions.	World Ocean Council	Bing Videos

State Energy Assurance Guidelines	Guide to assist states in planning for energy emergencies and enhancing resiliency through improving response capabilities and reducing multi-hazard risks to energy infrastructure.	U.S. Department of Energy (DOE) with the National Association of State Energy Officials (NASEO)	state-energy-assurance-guidelines
Local Government Energy Assurance Guidelines	**Guide** to assist localities in pre-disaster planning and risk reduction and improving multi-hazards response and recovery from energy emergencies and other events which impact energy system and the critical functions and services they sustain.	U.S. DOE	pti_local_governement_energy_guidelines.pdf ti_local_governement_energy_guidelines.pdf
HUD Community Resilience Toolkit	**Guide** with information, resources, and suggested solutions to assist communities in enhancing their resilience to climate-related natural hazard risks with focus on enhancing housing, living environments and expanding economic opportunities principally for low-and moderate-income individuals.	U.S. Department of Housing and Urban Development (HUD)	HUD Community Resilience Toolkit - HUD Exchange
Climate Adaption Knowledge Exchange	**Website** providing database of case studies, documents, and tools for increasing climate adaptation and resilience standards for individuals, communities and municipalities. Users can also share their experiences tools and useful documents, adding to the available resources on the database.	Climate Adaption Knowledge Exchange	Home | CAKE: Climate Adaptation Knowledge Exchange
Clearinghouse for Environmental Finance	**Website** providing information on funding opportunities, planning and other resources for land air and water-related resilience, with links to grants, case studies, report and guides.	EPA	Clearinghouse for Environmental Finance
Suite of Tools for the Analysis of Risk (STAR)	**Fact Sheet** on STAR describing an integrated software system of standard analytic tools and reproducible processes for assessing risks to interdependent critical infrastructures).	CISA	Suite of Tools for the Analysis of Risk (STAR) Fact Sheet | CISA
CISA Gateway	**Website** providing information on how the Gateway serves as the single interface through which authorized government agencies and critical infrastructure stakeholders can infrastructure protection tools and information to conduct risk analysis.	CISA	CISA Gateway | CISA

Securing Funding and Other Resources for Implementation and Sustainment

Assessing risk and enhancing the resilience of even the smallest watersheds, from stakeholder engagement to developing a basic Action Strategy and Implementation Plan, can be accomplished in less than a year or may extend out many months, depending on desires and available resources of the Initiative's organizers' and/or sponsors. Regarding timeframes for implementation of the projects and activities in the Strategy, short-term "quick wins," such as updating plans and improving existing capabilities can 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.

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 multi-hazards resilience. 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. According to a DHS CISA's website on Resilience Hubs, there are currently 252 active Hubs across the Nation that assist states and communities by educating vulnerable populations, providing research support for planning for coastal and climate threats, and other types of assistance.

In addition, FEMA has been 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 the Silver Jackets Program can engage Silver Jackets interagency teams to address flood and other natural disaster risks and help with 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-related changes 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 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. 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 activities. This means government agencies in the future will need to expand existing grants or develop new ones and seek increased and or expanded programmatic funding to help support regional resilience planning-related activities.

The Selected Tools and Resources *below provide guidance and information on funding and investment opportunities for watershed regional risk and resilience activities and for technical assistance, to include links to information on federal agency and state-supported programs and private sector or non-profit organizations or groups that provide grants, technical assistance, or other types of expertise.*

Tool/Resource	Description	Owner	Internet Link
Compendium of Programs and Mechanisms for Funding Infrastructure Resilience	**Guide** providing a comprehensive list of dozens of federal, state, and non-governmental grant and other funding programs with each entry describing the types of financing available and application requirements with Internet links to assist state, local, tribal, territorial communities, private sector owners and operators of infrastructure assets to improve the security and resilience of their communities and infrastructure systems.	CISA	Compendium of Programs and Mechanisms for Funding Infrastructure Resilience
FundsforNGOs	**Website** providing information to help non-governmental organizations secure investors in community resilience capacity-building projects for risk assessment, community training, infrastructure development, and public awareness campaigns.	Funds for NGOs	50 Donors Funding Disaster Preparedness Projects - fundsforNGOs
National Coastal Zone Management Program	**Website** providing information on program, which works with coastal states and territories to protecting, restoring, and responsibly developing U.S. coastal communities and resources, to include protecting natural resources, managing development in high hazard areas, providing public access for recreation, prioritizing water-dependent uses, and addressing climate-related event issues.	NOAA Office for Coastal Management	NOAA Office for Coastal Management | About the Office

National Oceans and Coastal Security Fund	**Website** describing program that invests in projects to restore or expand natural features that minimize the impacts of flooding on nearby communities, including those that are low-resource, and infrastructures in coastal areas to improve climate resilience.	NOAA	National Oceans and Coastal Security Fund | National Oceanic and Atmospheric Administration
Hazard Mitigation Grant Program	**Website** with information on program providing funding to state, local, tribal and territorial governments to develop hazard mitigation plans and rebuild to reduce, or mitigate future disaster losses in their communities. This grant funding is available after a presidentially declared disaster.	FEMA	Hazard Mitigation Grant Program HMGP (HMGP) | FEMA.gov
FEMA Pre-Disaster Mitigation Grant Program	**Website** with information on federal funds available for local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures to reduce risk to individuals and property from future natural hazards while also reducing reliance on federal funding from future disasters.	FEMA	Pre-Disaster Mitigation (PDM) Grant Program | FEMA.gov
Rehabilitation Of High Hazard Potential Dam Program	**Website** proving information on award requirements and eligibility for new grant program under FEMA's National Dam Safety Program for Rehabilitation of High Hazard Potential Dams (technical, planning, design, and construction assistance).	FEMA	Rehabilitation Of High Hazard Potential Dam (HHPD) Grant Program | FEMA.gov
Building Resilient Infrastructure and Communities (BRIC)	**Website** providing guidance on grant program that provides support to communities as they build resilience capabilities and capacity with focus on infrastructure projects and fostering public-private partnerships.	FEMA	Building Resilient Infrastructure and Communities | FEMA.gov
Flood Mitigation Assistance Grant Program	**Website** providing information on program funding to state, territory and local governments and federally recognized Tribal Nations for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the National Flood Insurance Program.	FEMA	Flood Mitigation Assistance Grant Program | FEMA.gov
Rehabilitation of High Hazard Potential Dam Grant Program	**Website** with information on FEMA grants to provide technical, planning, design, and construction assistance for rehabilitation of eligible high hazard potential dams**.**	FEMA	Rehabilitation Of High Hazard Potential Dam (HHPD) Grant Program | FEMA.gov
Hazard Mitigation Grant Program Post-Fire	**Website** providing information on assistance available to help communities implement hazard mitigation measures after wildfire disasters.	FEMA	Hazard Mitigation Grant Program Post Fire | FEMA.gov

Community Wildfire Defense Grant Program	**Website** providing information on grant that funds low-resource communities or regions in an area identified as having high or very high wildfire hazard potential, or impacted by a severe disaster within the previous 10 years which increased wildfire risk and/or hazard.	USDA Forest Service	Community Wildfire Defense Grant Program | US Forest Service
Promoting Resilient Operations for Transformative Efficient, and Cost-saving Transportation Program (PROTECT)	**Website** providing information on the PROTECT program, which funds projects to ensure surface transportation resilience to natural hazards including changing climatic conditions, sea level rise, flooding, extreme weather events, and other natural disasters including support of planning activities, resilience improvements, community resilience and evacuation routes, and at-risk coastal infrastructure.	U.S. Department of Transportation (DOT)	Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT) | US Department of Transportation
Clean Water State Revolving Fund (CWSRF)	**Website** with information on a federal-state partnership that provides low-cost financing to communities for a wide range of water quality infrastructure projects, including municipal wastewater facilities, nonpoint source pollution control, decentralized wastewater treatment systems, stormwater runoff mitigation, green infrastructure, estuary protection, and water reuse.	EPA	Clean Water State Revolving Fund (CWSRF) | US EPA
Emergency Relief Fund	**Website** providing information on funding opportunities to repair federal-aid highways and federal lands roads damaged by natural disasters and catastrophic events.	DOT Federal Highway Administration	ER - Federal-aid Programs - Federal-aid Programs and Special Funding - Federal Highway Administration
Hazard Mitigation Assistance Program and Policy Guide (updated 2024)	**Guide** outlining policy and procedural requirements of FEMA's HMA Programs. Covers the Hazard Mitigation Grant Program, Hazard Mitigation Grant Program Post-Fire, Building Resilient Infrastructure and Communities, and Flood Mitigation Assistance.	FEMA	Hazard Mitigation Assistance Program and Policy Guide
Community Development Block Grant Disaster Recovery Fact Sheet	**Fact Sheet** describing HUD Community Development Block Grant Disaster Recovery grant funds to rebuild disaster-impacted areas and provide seed money to start the long-term recovery process, to include restoration of infrastructure, housing, and economic revitalization. Grant money flows through states to non-profit organizations, economic development agencies, citizens, and businesses.	HUD	CDBG-DR Fact Sheet

Floodplains by Design	**Website** providing information on grants and funding programs to reduce flood risks along Washington State's major river corridors to improve the resilience of floodplains to protect local communities and the health of the environment.	WA State Department of Ecology	Floodplains by Design - Washington State Department of Ecology
Planning for Natural Disaster Debris	**Website** providing guidance to assist communities in planning for natural disaster debris before a disaster occurs to increase community preparedness and resilience. Topics covered include recommended components of a debris management plan, suggested management options, case studies of how several communities prepared for and managed debris after recent natural disasters, and planning resources for natural disasters.	EPA	Guidance about Planning for Natural Disaster Debris | US EPA
Silver Jackets	**Website** with information on teams that across the Nation that bring together multiple state, federal, and sometimes local agencies and Tribes to reduce risk from floods and other natural hazards. Silver Jackets teams conduct diverse collaborative efforts to enhance preparedness, mitigation, and response and recovery. Resources for activities are provided through the individual programs of participating agencies within constraints of available budgets/authorities.	Silver Jackets	Silver Jackets
DHS Resilience Hub Finder	**Website** with information on more than 200 resilience hubs across the Nation and interactive map where users can click on an area to obtain information on active resilience hubs across the United States with hub name, facilitating organization, city, state, zip code, resource function, and organizational website.	CISA	DHS Resilience Hub Finder
FEMA Disaster Resilience Hub	**Website** with a wide range of information and tool, including interactive maps, to help effectively prepare for, respond to, recover from and mitigate the probability of future hazard events**.**	FEMA	FEMA Disaster Resilience Hub
Restoreyoureconomy.org	**Website** providing best practice information to public and private stakeholders that are looking to build their local economies after a major disaster. Operates as a one stop shop for prevention, preparedness, response, and economic recovery tools, event announcements and a platform to connect with peers through social media groups.	EDA	Home - Restore Your Economy

Community Mitigation Assistance Team	**Website** providing information on assistance teams that work closely with local governments, the Forest Service or other land management agencies and community residents and leaders to identify mitigation opportunities, help them resolve mitigation challenges and build long-term mitigation efforts using best practices.	USDA Forest Service	Community Mitigation Assistance Team | US Forest Service
The National Watershed Coalition	**Website** providing information on nonprofit coalition comprised of national, regional, state, and local organizations, associations, and individuals offering on watershed planning.	National Watershed Coalition	Home | National Watershed Coalition

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 broad 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 specialized training session for state and local political officials, 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 multi-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 regional 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.

Engendering 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.

Incorporating Watershed Resilience into 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 multi-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 multi-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 Playbook 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.

Examples of Watershed Regional Resilience Initiatives

To date there have been only a few watershed-focused, multi-stakeholder regional initiatives. They include the:

Dam Sector Regional Risk and Resilience Program (DSR3P) Pilot Project. Initiated by USACE in 2022, this three-year program included a pilot project focusing on the Savannah River Watershed with facilitation and other assistance from Clemson University that covered more than a dozen South Carolina counties. The goal of the program was 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 Watershed R3 Goal & Strategy and Playbook were key outcomes 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 has been an ongoing collaborative effort of U.S. EPA 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 not-for-profit community groups, local, state, and federal agencies.

New Mexico 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 has been 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.

Selected Tools and Resources *below provide information on regional resilience initiatives.*

Tool/Resource	Description	Owner	Internet Link
The Mystic River Watershed Initiative	**Website** describing a collaborative effort to improve water quality and environmental conditions to the Mystic River and its tributaries through safe public pathways and access points.	EPA	The Mystic River Watershed Initiative | US EPA
Post-Fire Recovery Action Strategy State of New Mexico February 2023	**Report** on the Action Strategy from an innovative initiative by state of New Mexico with FEMA Region 6 and other government and private sector and non-profit stakeholders focusing holistically on the state's watershed regions.	Argonne National Laboratory	https://hermits-peak-calf-canyon-fire-resources-nmhu.hub.arcgis.com/pages/post-fire-recovery-action-strategy
USDA Natural Resource Conservation Service Watershed Programs	**Website** describing NRCS sponsored initiatives with watershed regional stakeholders in different regions of the Nation to provide technical and financial assistance to help address natural resource concerns and help communities build-in infrastructure practices that prevent future flooding, save lives and protect property addressing each region's unique concerns.	USDA	Watershed Programs | Natural Resources Conservation Service
2009 Dams Sector Exercise Series - Columbia River Basin (DSES-09)	**Fact Sheet** overviewing the initiative and how it was developed, including a description of the five-tracks in the initiative and timeline for each with workshops leading to a final action strategy	Center for Regional Disaster Resilience, PNWER	DSES-09 FACT SHEET

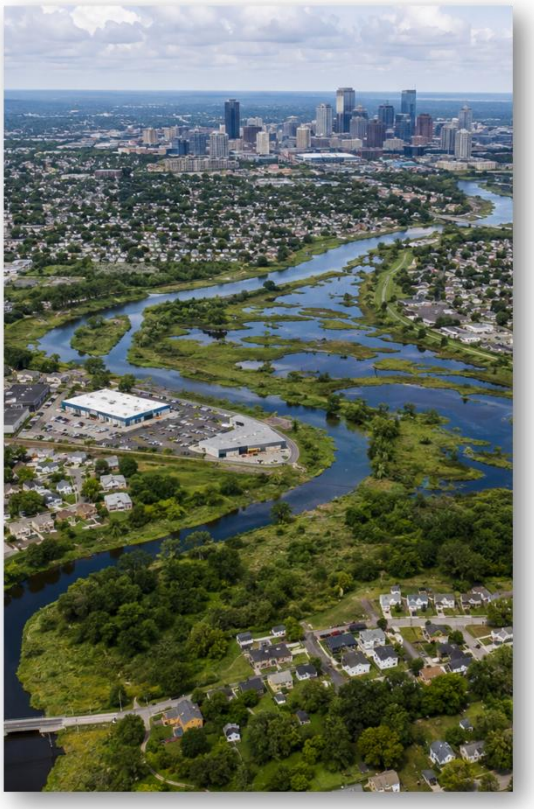
Filling the Gaps in Watershed Regional Resilience Enabling Capabilities

The tools and resources in this Playbook are representative of what is currently available to assist decision makers and key stakeholders in undertaking Watershed Risk and Resilience Initiatives. Subsequent updated versions of the Playbook will be issued annually with newly available tools and resources added. 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 will require 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-hazard 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 advances on utilizing AI in finding and addressing gaps in, and enhancing regional resilience.

Benefits of Watershed Regional Risk and Resilience Initiatives

The continuous Holistic Approach and Process outlined in this Playbook is in many respects essential to dealing with the growing challenges of a changing risk landscape. Undertaking regional risk and resilience initiatives provides states, localities, and cross-sector stakeholders enhanced understanding of the changing risk landscape and associated vulnerabilities, impacts, and risks that can be used for planning and resilience capacity-building.



At the same time, these initiatives facilitate collaboration among private-public sector and non-profit organizations and develop the trust and relationships necessary to sustain continuous resilience improvements. Most importantly, these initiatives enable development of a roadmap to watershed regional resilience through providing stakeholders access to guidance, technical assistance, avenues to share information, and other tools and resources.

Watershed Regional Risk and Resilience Task Group & Partners

More than 100 practitioners and experts from the following organizations contributed to the development of versions 1.0 and 2.0 of the Watershed Regional Risk and Resilience Playbook and the Goal & Strategy on which it is based. Many are veteran cross-sector and multi-discipline professionals who have served in different positions in government, the private sector, academia, and non-profit organizations.

Collaboratives

Nationwide Regional Risk and Resilience Collaborative (NR3C)

Pacific NorthWest Economic Region (PNWER) and PNWER's Center for Regional Disaster Resilience

ChicagoFIRST

California Resiliency Alliance

Colorado Emergency Preparedness Partnership

New Orleans Regional Emergency Preparedness Partnership

Mystic Watershed Association

InfraGard - Pittsburgh

InfraGard National Disaster Resilience Council

FBI-InfraGard Los Angeles

FBC, CyberUSA

CyberMaryland

Cyber Resilience Institute

Threat Intelligence Network

State, Local, Tribal, and Territorial Governments Coordinating Council

Government

US Army Corps of Engineers (USACE)

USACE National Silver Jackets Program

US Army Engineer Research and Development Center

Mission Branch, CISA, DHS

Dams Sector, CISA, DHS

Resilience Services Branch, DHS CISA

Stakeholder Engagement Division, CISA, DHS

Regions 3, 4, and 10. DHS

Health, Food and Agriculture Resilience, Office of Health Security, DHS

Office of International Affairs, DHS

Directorate of Science &Technology, DHS

U.S. Department of Energy

Government Facilities, General Services Administration

U.S. Geological Survey

Federal Disaster Recovery, FEMA

Mitigation Framework Leadership Group, FEMA

Resilience Analysis and Capacity Development Division, FEMA

Office of Resilience Strategy, FEMA

Regions 4 and 6, FEMA

U.S. Department of Agriculture

USDA Natural Resource Conservation Service

Utah Division of Emergency Management

Food and AG Security, Iowa Homeland Security

Oklahoma Department of Emergency Management

California Department of Water Resources

Colorado Division of Homeland Security and Emergency Management

Texas Division of Emergency Management

Texas General Land Office

Yorba Linda Water District, Orange County, CA

National Associations

National Hazard Mitigation Association (NHMA)

America's Watershed Initiative

Society of American Military Engineers (SAME)

San Francisco Chapter, SAME

National Academies of Sciences, Engineering, and Medicine

Alliance for National and Community Resilience

Flood Mitigation Industry Association

Academia

North Carolina State University

Johns Hopkins Applied Physics Lab

Georgetown University

University of Georgia

University of Nevada Desert Research Institute

George Washington University

University of Denver University

Clemson Engineers for Developing Communities, Clemson University

Iowa State University

Global Resilience Institute, Northeastern University

University of Virginia

Warren Wilson College, NC

Infrastructure Sectors

Electric Infrastructure Security Council

Southern California Edison

Lumen Corp

Warren County Telecommunications

Allegheny County Sanitary Authority (ALCOSAN)

American Water Works Association

United States Society on Dams

California Water/Wastewater Agency Response Network (CALWARN)

National Water/Wastewater Agency Response Network

Northern Water, Colorado,

Water Information Sharing and Analysis Center

Security Association of American Railroads

Resilience Subject Matter Experts

Institute for Innovating Security and Resilience

Institute for Sustainable Development

Foresight Consulting, LLC

Brown and Root

Hagerty Consulting

ANSER

AECOM

VSA Van Scoyoc Associates

Setracon

MITRE Corporation

Resilience Solutions Consulting

AcquSight

Towill Survey, Mapping, and GIS Services

Gannet Fleming

StateBook International

Stantec Consulting Services

Sudol Environmental Associates Inc.

Freese and Nichols, Inc.

Hamilton Advisors, LLC, Charleston SC

Traiden Global Solutions

Ask the Expert

Following are names and contact information of Task Group members with their areas of expertise who are available to provide advice and guidance to Playbook users.

Expert	Areas of Expertise	Contact Information
Paula Scalingi, Ph.D. Executive Director, Institute for Innovating Security and Resilience; Chair, Nationwide Regional Risk and Resilience Collaborative, Adjunct Associate Professor, Georgetown University	Guidance on conducting Regional Risk and Resilience Initiatives, infrastructure interdependencies, general questions about Playbook use and implementation	pscalingi@I2SR.org 925-683-3101
Stephen Cauffman, Foresight Consulting, LLC; former Chief, Resilience Services Branch, DHS CISA	Infrastructure and community resilience, built environment resilience, Watershed R3 Assistant	steve@foresightconsulting.llc 703-201-2155
David Vaughn, Professor of Practice, Director of Engineers for Developing Communities, Clemson University	Multi-hazards risk, community resilience, low-capacity communities	dev@clemson.edu 864-907-8646
Preston Wilson, President, Resilience Solutions Consulting, former Training Manager, National Dam Safety Program, FEMA	Dam safety, emergency management	preston.wilson@resiliencesolutionsconsulting.com 202-820-0032
Calandra Cruickshank, Founder and CEO, StateBook International	Data collection and analysis	calandra@statebook.com 845-853-3760