INTEGRATING NATURAL HAZARD MITIGATION AND CLEAN WATER ACT PLANNING AND PROJECT IMPLEMENTATION

COHORT-BASED TRAINING WORKSHOP

SEPTEMBER 12-13,2023
CINCINNATI, OH

Welcome!

Welcome to the Integrating Natural Hazard Mitigation and Clean Water Act (CWA) Planning and Implementation Workshop! The Association of State Floodplain Managers (ASFPM), the National Association of Wetland Managers (NAWM) and the U.S. Environmental Protection Agency (EPA) are hosting this event, with funding from a U.S. Environmental Protection Agency cooperative agreement grant. **The purpose of this workshop is to facilitate the creation of collaborative partnerships to build cross-governmental relationships and awareness** across different departments, agencies, and at various levels of government in terms of hazard mitigation and water resource protection planning, program development, and implementation.

We have worked for the past several months to bring you together with a cadre of leaders in the hazard mitigation and water quality fields. Throughout the workshop, these experts will lead discussions on breaking down silos, coming to a common language, floodplains, wetlands, and green infrastructure, hazard mitigation, permitting, regulations, and funding across water quality and mitigation projects, and cost-benefit analysis for nature-based practices. We look forward to the exchange of knowledge between all in attendance, speakers and participants.

We'd especially like to thank U.S. EPA for their generous support of this program. We hope that the information presented and connections made during this convening will be beneficial to you and your community for years to come. **Thank you for taking the time to join us in Cincinnati, Ohio!**

Hotel Information

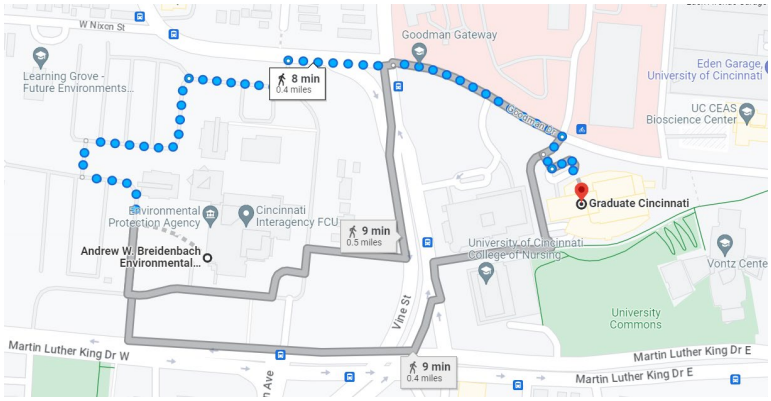
The event hotel is the Graduate Hotel (151 Goodman Dr, Cincinnati, Ohio 45219). Check-in is 4pm; checkout is 11am. Upon checkout, the hotel offers luggage storage; on Day 2, we recommended leaving your luggage at the hotel rather than bringing it to the venue.

Attendees are responsible for arranging their own transportation to/from the hotel. The Cincinnati/Northern Kentucky International Airport (CVG) is approximately a thirty-minute drive to/from the hotel. A taxi or shared ride (e.g., Uber or Lyft) is recommended and should cost approximately $30-50. If you are driving, self-parking with unlimited in/out privileges is available for $10 per night.

Meeting Location & Venue Logistics

The workshop will be held nearby at the Andrew W. Breidenbach Environmental Research Center (26 Martin Luther King Dr W, Cincinnati, OH 45268), which is located across the street from the hotel, less than a 10-minute walk. We will be convening primarily in the Auditorium.

On Day 1, we will meet in the Andrew W. Breidenbach Environmental Research Center auditorium. For those planning to walk over from the hotel, we host a group walk over which will leave at 7:45am. If walking from the hotel to the venue, see the map below. Call 713-501-3242 if you need assistance.



If driving to and parking at the venue, enter the EPA campus from the Martin Luther King Drive side of EPA; the entrance (Gate 5 – Visitors Gate) is across from Campus Green Drive off of Martin Luther King. Vehicles will go through an inspection to enter the property and will be issued a temporary parking pass. You will be directed to the appropriate parking area and instructed on how to enter the main entrance (LOBBY ONLY).

On Day 2, a bus will pick us up from the hotel for the mobile tour. *Please plan to meet in the Graduate Hotel lobby, not the event venue.*

Facility Security

Please note that the meeting site is an EPA facility and those attending this event will be subject to the following security requirements.

- Non-EPA affiliated personnel (Non-PIV issued personnel) will need to provide a government issued ID upon arrival, and should expect to pass through the magnetometer (metal detector) and have any hand carried items X-Rayed. They will also be required to be escorted to the auditorium and any other EPA offices to be visited.
- EPA or other federal agency employees who have a PIV/CAC issued will be allowed unescorted entry to the facility.

Meals

NAWM will provide refreshments (coffee, tea, water, granola bars, fruit, etc.) and lunch both days of the workshop. Dinner will not be provided. However, a list of Google recommended restaurants can be found here (and at the back), and our hotel has two restaurants and a list of recommendations for other food options.

AGENDA

Tuesday, September 12, 2023

8:30am	**Opening remarks**
8:45am	Icebreaker introductions
9:30am	Break
9:45am	**Integration and Partnering** The management challenges and impacts of natural hazards extend beyond just one agency and beyond the boundaries of different programs. Water program integration and nature-based solutions can aid in resilience to flooding and other water related hazards. This session will examine how to build collaborative relationships to strengthen partnerships across goals and activities through integrated planning and implementation. Examples of long-term cooperative partnerships and best practice examples of integrated planning will be discussed. • Marla Stelk, Executive Director, National Association of Wetland Managers • Ellie Flaherty, Biologist, U.S. Environmental Protection Agency • Shubha Shrivastava, CFM, Mitigation Planner, Planning & Safety Branch, Risk Management Directorate, Resilience, FEMA
10:45am	**Coming to a Common Language** Often water quality and hazard mitigation professionals use their own unique terminologies and acronyms that are not readily understood outside of their respective fields. This discussion will focus on defining terminology used in both water quality and natural hazard mitigation practices and identifying the dual benefits of many projects implemented. Part of the discussion will focus on the benefits of: ecosystem management versus resiliency enhancements; and local community versus watershed scale planning. • Ian Grosfelt (facilitator) • Jenna Moran (facilitator)
11:45am	Lunch

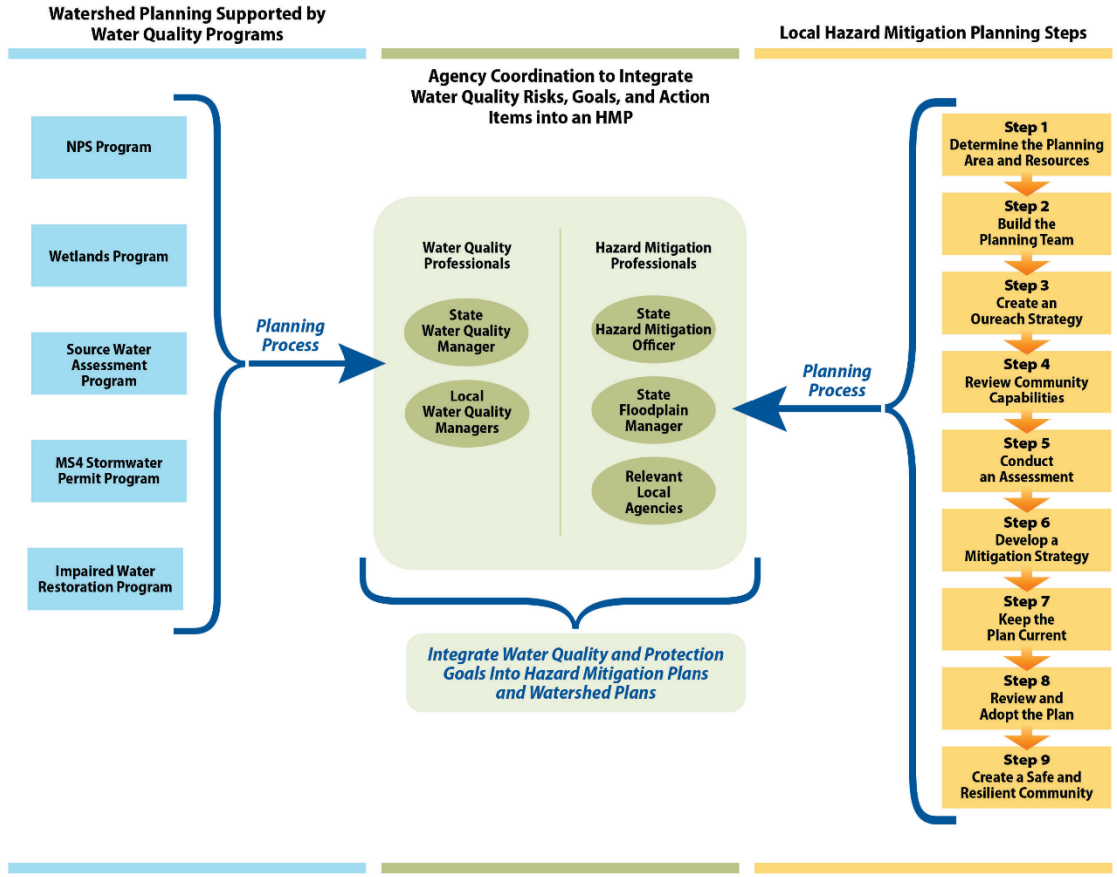
1:00pm	**Floodplains, Wetlands, and Green Infrastructure** A key component of natural hazard mitigation is replicating the functions of naturally occurring ecological resources. This session will focus on the functional benefits that nature-based solutions provide and how to select design criteria, modeling methods, and project locations for projects in order to maximize ecological benefits while providing opportunities for optimizing hazard buffering capacities. Existing resources to help in these efforts will also be discussed. • Eileen Shader, CFM, Director, Floodplain Restoration, American Rivers • Ceil Strauss, CFM, State Floodplain (NFIP) Manager, Ecological and Water Resources Division, Minnesota Department of Natural Resources • Isabelle Horvath, Infrastructure Specialist, Permits Branch, Water Division, Region 5
2:30pm	Break
2:45pm	**Hazard Mitigation** Hazard Mitigation is any sustained action taken to reduce or eliminate long-term risk to life and property from hazards. Mitigation comes in many forms, including projects, plans, and regulations. The effectiveness of hazard mitigation can be enhanced when implemented under a long-term comprehensive planning process. This session will discuss how local, state, and federal agencies work together to: improve local resilience to hazards through planning and project implementation; and better integrate planning efforts where synergies and common goals exist. • Nick Crossley, Director of the Emergency Management & Homeland Security agency, Hamilton County, OH • Steve Ferryman, CFM, Mitigation Branch Chief, Ohio Emergency Management Agency • Steven Greene, Mitigation Planning/Public Assistance Mitigation Supervisor, FEMA • Shubha Shrivastava, CFM, Mitigation Planner, Planning & Safety Branch, Risk Management Directorate, Resilience, FEMA
3:45pm	**EXERCISE: Barriers to collaboration in planning and implementation** This exercise will engage participants in breakout roundtable discussions on successes and challenges they have faced related to collaboration around integrated planning and implementation of joint projects, including acquiring funding. See page 9 for exercise worksheet. • Jenna Moran (facilitator)
5:15pm	End of day wrap up
5:30pm	Adjourn Day #1

Wednesday, September 13, 2023

8:30am	**Mobile Tour: Lick Run Project** **MEET IN THE GRADUATE HOTEL LOBBY, NOT AT THE MEETING VENUE** The Metropolitan Sewer District of Greater Cincinnati's Lick Run Project, completed in 2021, is a "green" wet weather project that focuses on reducing combined sewer overflows (CSOs) in the Cincinnati neighborhood of South Fairmount into Mill Creek, a tributary of the Ohio River. The project uses a combination of green infrastructure, dedicated storm sewers, and real-time controls to eliminate over 800 million gallons annually of CSOs into the creek. This mobile tour will start at Lick Run Greenway's Forebay Pond before going into the watershed to see its bioswale and stream restoration projects, ending at Headwaters Park. • Deb Leonard, Communications Manager, Office of the Director, Metropolitan Sewer District of Greater Cincinnati • Leslie Schehl, P.E., MBA, PMP, Metropolitan Sewer District of Greater Cincinnati
11:00am	Break
11:15am	**Local Permitting & Regulations Across Water Quality and Mitigation Projects** Understanding the permitting and regulatory requirements for constructing nature-based mitigation and water quality projects is a key element to the successful design and implementation of these strategies. This session will engage the participants to discuss past experiences. • Suzanne Chubb, Regulatory Program Manager, Great Lakes and Ohio River Division, U.S. Army Corps of Engineers
12:05pm	Lunch
1:05pm	**Funding Mechanisms and How to Combine Funding Sources** There are a number of potential funding opportunities available to assist with hazard mitigation and water quality improvement project planning and construction. This session will focus on various state and federal loan and grant programs which are designed to assist communities with these projects that could enhance aquatic systems and resiliency. Participants will gain a better understanding of the funding sources available to support nature-based practice planning, design, or implementation; the requirements of each funding type; and the process of applying to potentially receive these funds. • Josh Human, BRIC Partnership Lead, FEMA • Franny Josephs, CWSRF Financial Analyst, U.S. EPA • Sanjiv K. Sinha, P.E., Ph.D., CEO, Corvias Infrastructure Solutions, LLC (CIS)

2:05pm	**Benefit-Cost Analysis** Protecting communities from flooding through a variety of mitigation techniques is essential to creating a more resilient future. One way to assess the feasibility of a given mitigation project is the benefit-cost analysis (BCA). BCA is a method that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its costs. Funding for flood mitigation often relies on the project having a benefit cost ratio (BCR) that exceeds 1. Given the traditional BCA methodology, it can be hard for underserved communities and communities looking to undertake green infrastructure projects to exceed that threshold. This session will explore alternative cost-effectiveness methodologies. • Jenna Rao, PE, PG, CFM, Engineer, Flood Modeling, Water Science and Conservation, Texas Water Development Board • Travis Grout, Regional Economist, NOAA Office for Coastal Management
3:35pm	Break
3:50pm	**EXERCISE: Integrating Natural Hazard Mitigation and Clean Water Act Planning** The exercise will have participants breaking into small groups to think through the development of a plan and process for integrating nature-based practices in and around a city to achieve flood risk reduction and water quality benefits. Participants will brainstorm potential project partners, what permit/regulatory needs may there be, what agencies should you contact, funding sources, cost/benefit analysis (project justification), what would project success be, and how would you know. After the analysis is completed, everyone will re-convene to discuss via "report outs" the scenario, the needs/issues identified, and any questions and concerns raised. See page 10 for exercise worksheet. • Ian Grosfelt (facilitator)
4:30pm	Closing thoughts
4:45pm	End of day wrap up
5:00pm	Adjourn Day #2

Water Quality and Natural Hazard Mitigation Planning Processes



Transfer of Information Among Water Quality and Hazard Mitigation Professionals

Barriers to Collaboration and Implementation Exercise Worksheet

Breakout #1: What successes/challenges have you experienced with collaboration between clean water programs and natural hazard mitigation programs? Do you have any integrated plans? Have you found and/or used any unique funding sources? Create a list.

- During planning

- During implementation

Breakout #2: What successes/challenges have you experienced with collaboration between different levels of government in your program area? State and local agencies? Federal agencies? Create a list.

- During planning

- During implementation

Breakout #3: What successes/challenges have you experienced when collaborating with regional planning organizations (COGs, MPOs, etc.)? Other stakeholder groups? What kinds of stakeholder groups? Create a list.

- During planning

- During implementation

Breakout #4: What are your successes and challenges with getting projects approved and/or acquiring funding for projects? How do you sell the idea of projects to planning boards/commissions? To other funders? What other resources in your area support or may support integrated planning and implementation, or may be generally relevant to supporting these partnership goals? Create a list.

Tabletop Exercise:
Integrating Natural Hazard Mitigation and Clean Water Act Planning

Based on the, "Storm Smart Cities Guide, Integrating Green Infrastructure into Local Hazard Mitigation Plans" report developed for Huntington, WV.

Scenario

Flooding has been a significant concern for the City of Fairwind for many years. Multiple large flood events from the nearby Clare River in 1962 and 1970 heavily damaged portions of the city, with each flood event impacting an estimated 30,000 residents. To prevent future disaster events, the city worked with the US Army Corp. of Engineers (USACE) in 1972 to build a floodwall along the Clare River where in runs through downtown Fairwind.

The floodwall significantly reduced the risk of future largescale flood events, however, several areas of Fairwind still experience regular, localized flooding issues. Additionally, since the floodwall was constructed in the 1970s, increased urbanization and development in Fairwind has led to greater impervious surface area which has increased stormwater runoff volume and surface flow in the downtown area. Flooding from Clare River tributaries has caused increasingly significant flooding in low lying areas in downtown Fairwind. Areas affected by these localized flooding issues include multiple community lifelines and key transportation routes. Additionally, the Clare River is impaired for sediment-siltation and bacteria.

The City currently maintains a total of 321 National Flood Insurance Program (NFIP) policies, with $41 million coverage. To date, 201 losses have been paid, totaling $1.5 million. Note that this figure does not capture the full impact of these flood events as many City of Fairwind residents do not have NFIP policies and some may not have made claims following flood events.

The Fairwind Sewer District (FSU) is the local agency responsible for managing both the floodwall along the Clare River, and stormwater runoff within the city. FSU also manages the city's Phase II MS4 permit. Under the MS4 permit, the FSU implements the following:

- public education and outreach regarding development permitting requirements;
- public participation and involvement in the process;
- detection and elimination of illicit discharges;
- runoff control at construction sites; and
- stormwater management, and pollution prevention.

FSU began implementing green stormwater infrastructure practices (GSI) following a 2018 state regulation requiring, "all new and redevelopment sites (disturbing 1 acre or greater) must capture and manage on site the first inch of rainfall in a 24-hour storm using, "canopy interception, soil amendments, evaporation, rainfall harvesting, engineered infiltration, extended filtration and/or evapotranspiration and any combination of [these] practices." Because of this regulation, several individual GSI practices have been involved in newly developed sites across the city.

FSU has seen success in stormwater runoff capture with the practices that have been implemented to date, and is interested in expanding the use of GSI more systematically across the city to meet MS4 permit requirements, address city-wide localized flood issues, and contribute to water quality goals in the Clare River. Consider if the City of Fairwind was in you state/was your city, and work through the following questions to develop a plan and process for integrating nature-based practices, including GSI, in and around the city to achieve flood risk reduction and water quality benefits.

Discussion Questions

Please work together to complete the following questions. In doing so, please discuss taking into account issues, regulations, and agencies that are specific to your state/jurisdiction.

- What federal/state/local/other agencies or organizations should be engaged and brought to the table?
- Are there considerations that should be kept in mind when building the team?
- What state or local plans are relevant to this goal and could be leveraged to further the mission?
- What are the planning cycles for these documents, and where do potential synergies exist?
- When a team is assembled, what are the first steps to collaboration?
- What are the potential co-benefits of nature-based practices/GSI in this scenario?
- Are there considerations that should be kept in mine/planned for when implementing nature-based practices?
- What are the first steps as a team in determining if/how GSI or other nature-based practices may be effective in achieving FSU's goals?
- What types of practices may you recommend the City of Fairwind consider?
- How may you recommend engaging the public in this process?
- What potential funding sources exist to support nature-based practice implementation in Fairwind?
- What geographic scale(s) are appropriate to consider for this effort?

GLOSSARY

Hazard Mitigation is any sustained action taken to reduce of eliminate long-term risk to life and property from hazards. Mitigation is taking action now to prevent natural hazards from becoming disasters. Mitigation comes in many forms: plans and regulations; natural systems protection or restoration; infrastructure projects; education and outreach. The effectiveness of hazard mitigation can be enhanced when implemented under a long-term comprehensive planning process.

Hazard Mitigation Planning is planning that state, local, territory and tribal (SLTT) governments engage in to identify risks and vulnerabilities associated with natural disasters, and develop long-term strategies for protecting people and property from future hazard events (FEMA 2019a). SLTT entities may choose to integrate their existing water quality programs with their HMPs. The integration of water quality into hazard mitigation planning has been promoted by changes in FEMA policy, and funding is potentially available for projects that integrate wear quality and hazard mitigation.

A Hazard Mitigation Plan (HMP) is a plan that assesses the current and possible future risk, and the community capabilities to address risk for a given geographic area. HMPs then assign long-term mitigation strategies to address vulnerabilities (FEMA 2019b). A FEMA-approved HMP is required in order to be eligible for some FEMA grant programs.

Nature-Based Solutions are engineered or naturally-occurring landscape features or management practices used to provide hazard mitigation while producing environmental, economic, and social co-benefits. Examples of nature-based practices include green infrastructure, constructed waterways, living shorelines, ecosystem restoration, and some types of agricultural conservation practices. Nature-Based Solutions may be used to protect water quality, reduce natural hazards, and improve overall quality of life in areas they are implemented. They meet multiple goals by aiming to increase resilience to impacts from natural hazards while protecting, managing, and restoring natural or modified ecosystems. Many nature-based solutions focus on increasing the resilience of water resources, both with regard to quantity and quality, and can include the following principles:

- Preserving and restoring uplands, stream, and their floodplains;
- Using swales, enhanced-soil infiltration basins, trees, and other approaches control rate of flow during storm events;
- Restoring native vegetation for erosion, wildfire, and drought mitigation;
- Using trees and green roofs as green infrastructure to mitigate urban heat island effects; and
- Managing agricultural land use practices that enhance soil health and reduce excess runoff volumes.

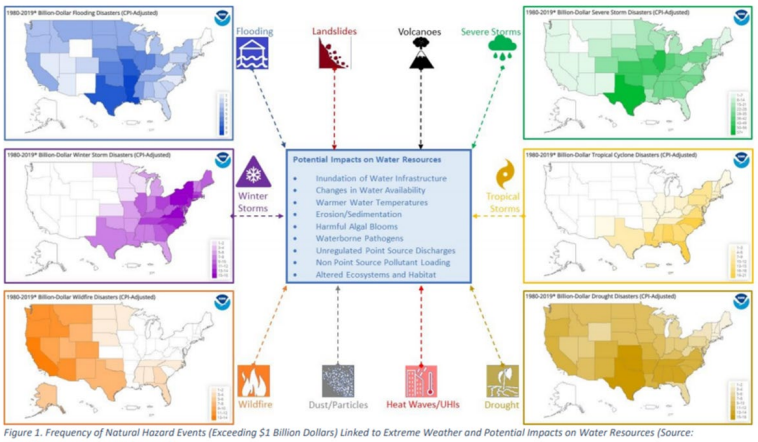


Figure 1. This figure from NOAA illustrates major natural hazards that can drive changes in water quality, and outlines regions of the country that have been at risk over the last 30 years. While it should be noted that nature-based solutions may have little mitigation effect on major natural disasters of the scale presented in this figure, these strategies can provide a buffer in less severe, recurring events, and support overall resilience.

Green Infrastructure (GI) is the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface water.

Green stormwater infrastructure is another term sometimes used for green infrastructure by the stormwater management design community.

Low impact development (LID) is an approach to site design that strives to limit the amount of impervious area, preserve and create connected natural spaces, and use green infrastructure throughout to limit the overall functional impact to the natural landscape.

Integrated Planning, in this context, refers to a planning approach that recognizes the synergies and common goals between hazard mitigation and water quality programs, and works to collaborate across programs, share data, and leverage resources and expertise. The goal of this collaboration is to produce robust hazard mitigation and/or water quality plans that address multiple goals, and implement practices that produce co-benefits for hazard resilience and water quality. (Note: integrated planning for the purpose of this training is not referring to the six planning elements found in the 2012 Integrated Municipal Stormwater and Wastewater Planning Framework as defined under Section 402(s) of the Clean Water Act.)

Types of Natural Hazards and Water Quality Issues. Natural hazards have direct and indirect impacts to both water quality and quantity. They drive changes in water quality and quantity. There are many different types of hazards, but the six primary types that impact water quality or quantity are flooding, drought, wildfire, extreme or urban heat, landslides or mudslides, and airborne and dust particles.

- **Flooding**. When thinking of hazards associated with water, flooding is one of the first hazards that comes to mind. Different types of flood events have varying impacts on water quality.
    - **Flash or rapid flooding** can be caused by heavy precipitation events, rain-on-snow events, and/or storm surges combined with normal high tides.
    - **Slow rise flooding** and/or **storm surges** can be caused by heavy or regular rainfall (depending on the natural topography) and is characterized by steadily rising river or lake levels over a number of days.
    - **Sea level rise** or **high tidal flooding** can be seen when tides reach anywhere from 1.5 to 2 feet above the daily average high tide and start spilling onto streets or bubbling up from storm drains. As sea level rise continues, damaging floods can happen more regularly, such as during a full-moon tide or with a change in prevailing winds or currents. (NOAA)

- **Drought** can cause low stream flow volumes that deteriorate water quality and threaten drinking water sources by increasing water temperatures and concentrating contaminants, such as nutrients. In watersheds that depend on snowmelt to sustain water supplies, changes in snow quantity or snowmelt timing due to climate change can contribute to drought or low flow conditions and can impact water availability.

- **Wildfires** are another type of disaster that are becoming increasingly common and severe due to dry and hot conditions, particularly in the western United States. In addition to climate change factors, other human activities can also increase the potential wildfire risk and subsequent water quality issues. Human and non-human activities influence the potential for wildfire and result in water quality and quantity concerns. Examples of water quality and quantity impacts of wildfire include: reductions in riparian vegetation post-fire can increase light penetration to waterbodies and increase water temperature; increased rates of erosion caused by lack of upland vegetative cover can subsequently increase nutrient and sediment loading to waterbodies, which may result in impairment and destruction to aquatic habitats; and fire-driven decreases in soil permeability can lead to rapid increases in surface runoff and debris flows from post-fire storm events.

- **Extreme heat or urban heat islands** are metropolitan areas that are considerably warmer than surrounding, more rural, areas because of human activities and infrastructure (e.g., high density of impervious surfaces including buildings and parking lots). Effects from urban heat islands or extreme heat events can increase thermal inputs to waterbodies. The temperature of stormwater runoff from urban, impervious surfaces can be elevated on hot days causing spikes in the temperature of receiving waters.

- **Landslides or mudslides**. Heavy rainfall, snowmelt, changes in water levels, stream erosion, changes in groundwater, and other factors including earthquakes and human activities can initiate landslides and mudslides. Landslides and mudslides can overwhelm waterbodies and pollute them with excess sediment and other contaminants. In extreme cases, waterbodies can become dammed or relocated, resulting in major impacts to water quality and flooding.

- **Airborne and dust particles.** Acid precipitation (caused by sulfur and nitrogen oxides) and other particulate matter that impact nutrient balances can pollute waterbodies. Agricultural tilling, wildfire, and drought conditions can contribute to airborne particulate matter and/or dust storms.

- **Harmful Algal Blooms (HABs)**. Nitrogen and phosphorus pollution from point and nonpoint sources can cause eutrophic conditions and algal blooms. Toxins produced by certain harmful algae and cyanobacteria can cause water-related illnesses in humans, pets, and agricultural livestock. HABs can also cause significant economic impacts in communities with fishing and/or tourism industries. Lakes, estuaries, and large rivers are more vulnerable to HAB events when eutrophication occurs together with warmer air and water temperatures and calm water conditions (e.g., sill or slow-moving water, water with increased temperature, or summer droughts).

- **Erosion or Sedimentation**. Erosion and sediment transport from intense rainfall or channeled stormwater. Land disturbances that expose (e.g., construction, mining, timber harvest, and heavy rainfall events in areas with low vegetative cover) can increase the risk of erosion or sediment loading to waterbodies. Erosion and sedimentation are influenced by interactions with land use, topography, land management, soil properties, stormwater management and flood control infrastructure, riparian vegetation, construction, and other human activities. They often have negative impacts on water quality and aquatic life, while exacerbating water quantity issues in future storm events. They may also increase the transport of other pollutants that have been absorbed by the sediment (e.g., phosphorous and metals). Increased water quality from floods and loss of vegetated cover from wildfire or drought events can worsen erosion and sedimentation issues.

Geographically-specific environmental factors interact with weather to make different regions of the United States more vulnerable to specific natural hazards. Human activities can also exacerbate the impacts of natural hazards.

Ecosystem goods and services, often shortened to ecosystem services (ES), are the benefits that humans receive from nature. These benefits underpin almost every aspect of human well-being, including our food and water, security, health, and economythe additional benefits, beyond mitigating the impacts of natural hazards, that nature-based solution can provide to the environment and human populations, such as air quality, water filtration, and recreation space. The crosswalks on the following pages help to illustrate the different benefits that can be achieved through practices that are commonly implemented in EPA's water quality programs, and the different ecosystem service benefits that can be achieved through various nature-based practices. The examples of not intended to be a complete list of nature-based solutions, or a complete list of mitigation practices.

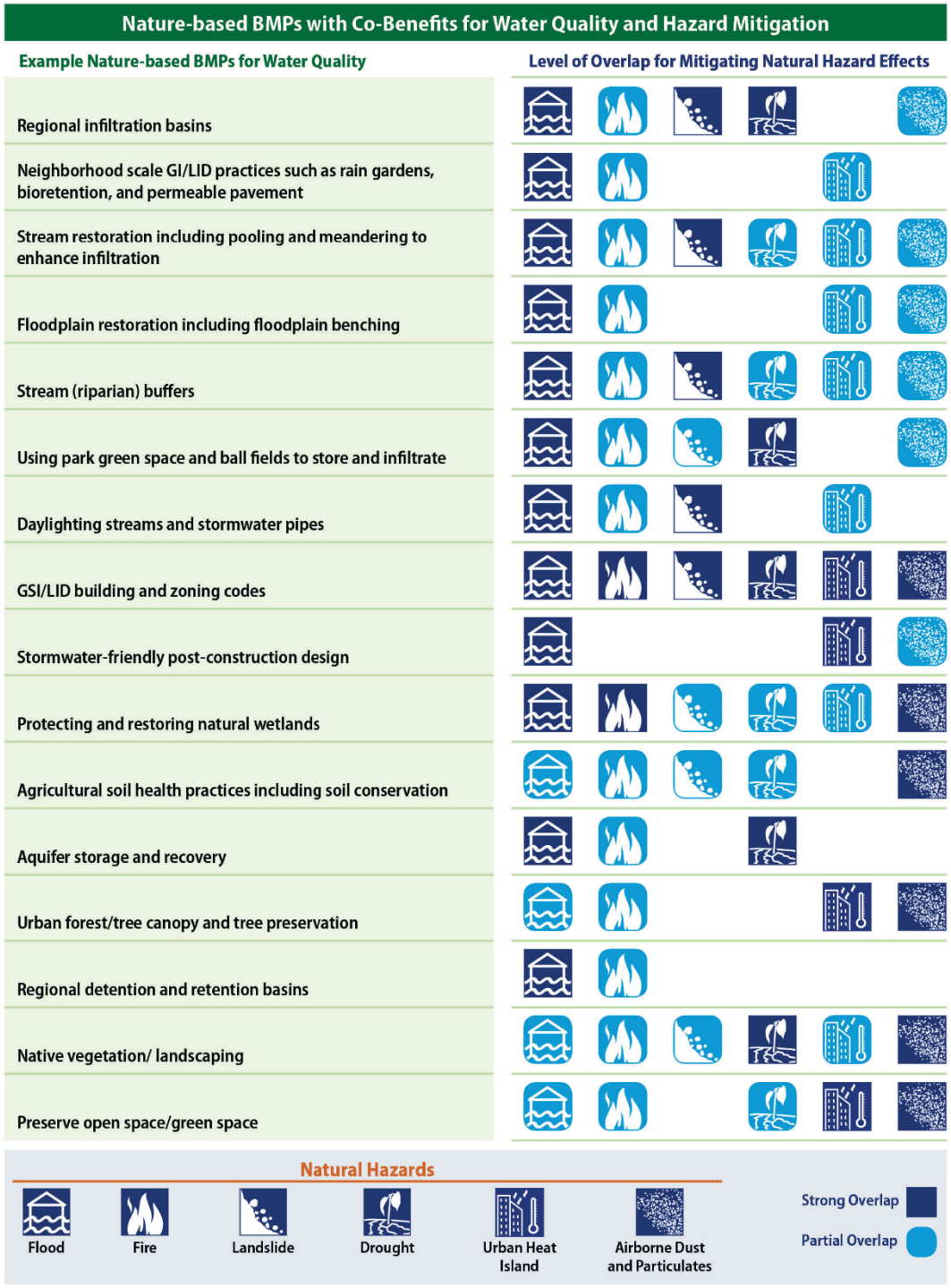
Scales of Nature Based Solutions (NBS). There are three primary scales at which nature-based solutions can be implemented:

- **Watershed or landscape**, which include wetland restoration and protection, floodplain restoration, large-scale land conservation or acquisition, stormwater parks, and greenways. These are interconnected systems of natural areas or open space. They require long-term planning and coordination.
- **Neighborhood or site**, which include green infrastructure practices such as rain gardens, green roofs, permeable pavements, biofiltration systems, vegetated swales, rainwater harvesting, tree canopy protection and restoration, and green street practices. These distributed stormwater management practices manage rainwater where it falls and can often be built into a site, corridor, or neighborhood without requiring additional space.
- **Coastal area**, which include coastal wetlands, dunes, oyster reefs, living shorelines, and waterfront parks. These nature-based solutions stabilize the shoreline, reducing erosion and buffering the coast from storm impacts. While many watershed and neighborhood-scale solutions work in coastal areas, these systems are designed to support coastal resilience.

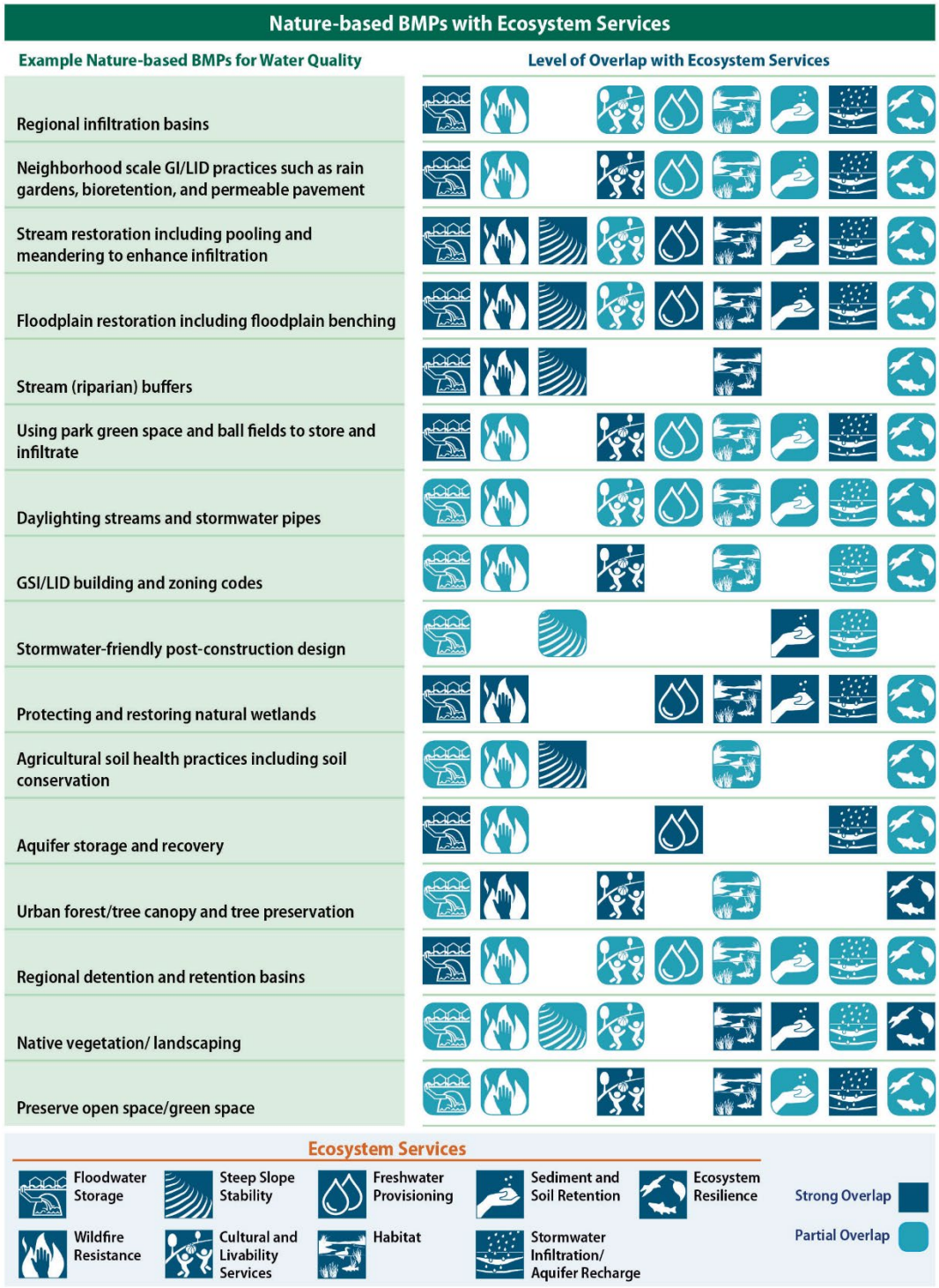
FEMA's Building Community Resilience with Nature-Based Solutions: A Guide for Local Communities, from which this information has been pulled, also provides examples of NBS practices that fall under each of these scales. This list is not exhaustive but will give a sense of the variety of practices that can be implemented to address hazards on a variety of sites. Different types of funding may be available for different types and scales of practices.

Benefit-Cost Analysis (BCA) is a method that determines the future risk reduction benefits of a hazard mitigation project and compares those benefits to its costs. The result is a **Benefit-Cost Ratio (BCR)**, or the present value of net project benefits divided by the project costs. A FEMA project is considered cost-effective when the BCR is 1.0 or greater.

NOTES



Nature-based BMPs with Co-Benefits for Water Quality and Hazard Mitigation



Ecosystem Services for Stormwater Management Practices

Summary of Water Quality Planning Programs and Hazard Mitigation Frameworks

Local Hazard Mitigation Planning Steps	**Water Quality Planning Steps**		
Local Mitigation Planning Handbook (FEMA 2013)	Watershed (USEPA 2008)	Source Water Protection (USEPA 2018)	Stormwater Management (USEPA 2007)
DOCUMENT PURPOSE			
Helps local governments in developing or updating a **local hazard mitigation plan.** Provides guidance to develop/update plans to meet the requirements of 44 CFR section 201.6 for FEMA approval and eligibility to apply for FEMA Hazard Mitigation Assistance grants. Also offers practical approaches and examples for communities to engage in effective planning to reduce long-term risk from natural hazards and disasters.	**Watershed plans** are a means to resolve and prevent water quality problems that result from both point source and nonpoint source problems. Watershed plans are intended both to provide an analytic framework to restore water quality in impaired waters and to protect water quality in other waters adversely affected or threatened by point source and nonpoint source pollution.	**Source water assessments** provide water utilities, community governments, and others with information needed to protect drinking water sources. The 1996 amendments to the Safe Drinking Water Act (SDWA) outline six steps for conducting source water assessments for public water systems (PWSs).	The objectives of **stormwater management planning** are to: (1) identify potential sources of stormwater pollution on a construction, industrial and/or municipal site; (2) describe stormwater control measures and Best Management Practices (BMPs) that will be used to reduce or eliminate pollutants in stormwater discharges from the project site; and (3) identify the procedures the operator of the project site will implement to comply with the terms and conditions of the site-specific general permit.
PLANNING STEPS			
1. Determine the planning area and resources Determine the planning area and the participating jurisdictions, who will lead the plan, and the resources needed to support the planning process. **2. Build the planning team** Assemble a planning team of representatives from each jurisdiction and partner organization. These planning partners have the expertise to develop the plan, and their organizations have the authority to implement the mitigation strategy developed through the planning process. This is the core group of people responsible for developing and reviewing drafts of the plan, creating the mitigation strategy, and submitting the final plan for local adoption. **3. Create an outreach strategy** Develop an outreach strategy that identifies what you want to accomplish through your outreach efforts, who to involve in the process, and how and when to effectively engage the community. **4. Review community capabilities** Assess your community's existing authorities, policies, programs, and resources available to accomplish mitigation. **5. Conduct a risk assessment** Conduct a risk assessment to determine the potential impacts of hazards to the people, economy, and built and natural environments of the community.	**1. Build partnerships** (a) Identify key stakeholders (b) Identify issues of concern for inclusion in the watershed plan (c) Set preliminary goals (d) Conduct public outreach **2. Characterize the watershed** (a) Collect existing data (b) Analyze data (c) Identify causes and sources of pollution to control (d) Identify data gaps and collect additional data if needed (e) Quantify pollutant loads **3. Finalize goals and identify solutions** (a) Set overall goals and management objectives (b) Develop indicators/targets (c) Determine load reductions needed (d) Identify critical areas (e) Develop management measures to achieve goals **4. Design an implementation program** (a) Develop implementation schedule	**1. Delineate the source water protection area (SWPA)** States delineate (map) the land area that could contribute pollutants to the water supply for each public water system. **2. Inventory known and potential sources of contamination** This inventory can provide a list and map of facilities and activities within the delineated area that might release contaminants into the source water. **3. Determine the susceptibility of the water supply to contamination** The state combines the inventory results with other relevant information to decide how likely a water supply is to be contaminated by identified potential sources of contamination. **4. Notify the public about threats identified in the contaminant source inventory and what they mean to the PWS.**	**1. Apply for NPDES stormwater permit coverage for the jurisdiction or entity if applicable** **2. Follow permit requirements that can be permittee- specific. For example, for a Small MS4 there is a requirement to develop a SWMP that addresses six minimum control measures:** (a) Public Education and Outreach on Stormwater Impacts (b) Public Involvement/Participation (c) Illicit Discharge Detection and Elimination (d) Construction Site Runoff Control (e) Post-Construction Stormwater Management in New Development and Redevelopment (f) Pollution Prevention/Good Housekeeping for Municipal Operations **3. Implement the SWMP using appropriate stormwater management controls, or BMPs** **4. Develop measurable goals for the SWMP** **5. Evaluate the effectiveness of the SWMP** **6. Address stormwater impacts to any threatened / impaired waters (i.e., TMDLs)**

Local Hazard Mitigation Planning Steps	Water Quality Planning Steps		
Local Mitigation Planning Handbook (FEMA 2013)	Watershed (USEPA 2008)	Source Water Protection (USEPA 2018)	Stormwater Management (USEPA 2007)
6. Develop a mitigation strategy Describe how the community will accomplish the overall purpose, or mission, of the planning process. **7. Keep the plan current** Develop procedures to monitor, evaluate, and update the mitigation plan over time. **8. Review and adopt the plan** Incorporate feedback from the planning team, stakeholders, and the public on the final plan document. Accomplish final review and adoption of the plan document by the community and acquire FEMA plan approval. **9. Create a safe and resilient community** Learn about common challenges communities face in implementing their mitigation strategy, suggestions for how to overcome mitigation barriers, and some funding and resources available to help.	(b) Develop interim milestones to track implementation of management measures (c) Develop criteria to measure progress towards meeting watershed goals (d) Develop monitoring component (e) Develop information/ education component (f) Develop evaluation process (g) Identify technical and financial assistance needed to implement plan (h) Assign responsibility for revising the plan **5. Implement watershed plan** (a) Implement management strategies (b) Conduct monitoring (c) Conduct information/education activities **6. Measure progress and make adjustments** (a) Review, evaluate information (b) Prepare annual workplans (c) Report back to stakeholders and others (d) Make adjustments to program	Effective programs ensure that the public has information necessary to act to prevent contamination. **5. Implement management measures to prevent, reduce, or eliminate risks to your drinking water supply.** These measures can be tailored to address each threat or array of risks specific to each PWS. **6. Develop contingency planning strategies that address water supply contamination or service interruption emergencies.** Water supply replacement strategies are important in the event of water drinking water supply disruption.	**7. Provide reports on program status**

Restaurant Recommendations

Catskeller
4.4 (55) · American
Veterans Bridge
Campus pub with live music & games

Conscious Kitchen
4.4 (636) · $ · Restaurant
2912 Vine St

Pieology Pizzeria U Square, Cincinnati, OH
4.4 (737) · $ · Pizza
128 W McMillan St Ste 154

Good Plates Eatery
4.8 (168) · $ · Restaurant
235 W McMillan St

BIBIBOP Asian Grill
4.4 (373) · $ · Asian
228 Calhoun St

HangOverEasy
4.5 (2.1K) · $$ · Breakfast
13 W Charlton St

Fortune Noodle House
4.4 (593) · $$ · Noodle Shop
349 Calhoun St #1332

El Taco Veloz Authentic Mexican flavor
4.3 (554) · $ · Mexican
7 Martin Luther King Dr E
Campus haunt for tacos & margaritas

Thai Express
4.6 (512) · $ · Thai
213 W McMillan St
No-frills Thai spot mostly for carryout

Piada Italian Street Food
4.4 (236) · $ · Italian
291 Martin Luther King Dr E
Customizable Italian fast food

Chicago Gyros and Dogs
4.4 (1.3K) · $ · Greek
201 W McMillan St

Currito
4.3 (184) · $ · Restaurant
222 Calhoun St

Drunken Tacos
4.3 (764) · Mexican
200 W McMillan St
Casual outpost for Mexican cooking

Taco Lab (Clifton)
4.5 (91) · $ · Tacos
127 Calhoun St

Martino's On Vine
4.1 (659) · $ · Italian
2618 Short Vine St
Italian-American fare & Steelers theme

Alabama Que
4.2 (1K) · $$ · Barbecue
2733 Short Vine St
Southern-style smoked meats & sides

Mecklenburg Gardens Restaurant
4.2 (975) · $$ · German
302 E University Ave
German cuisine & an outdoor beer garden

About Association of State Floodplain Managers

Association of State Floodplain Managers (www.floods.org) is an organization of professionals involved in floodplain management, flood hazard mitigation, National Flood Insurance Program and flood preparedness, warning and recovery. Its mission is to promote education, policies and activities that mitigate current and future losses, costs and human suffering caused by flooding, and to protect the natural and beneficial functions of floodplains - all without causing adverse impacts.

About National Association of Wetland Managers

The National Association of Wetland Managers (www.nawm.org) works to build capacity for state and tribal members and foster collaboration among the wetland community of practice by encouraging the application of sound science to wetland management and policy, promoting the protection and restoration of wetlands and related aquatic resources, and providing training and education for members and the general public. As a result of NAWM's work, the wetland community has access to and effectively uses sound science, policy, and private/public partnerships to preserve, protect, and restore the nation's precious and limited wetlands and related aquatic resources.

About U.S. Environmental Protection Agency

The mission of the U.S. Environmental Protection Agency (www.epa.gov) is to protect human health and the environment. EPA works to ensure that: Americans have clean air, land and water; national efforts to reduce environmental risks are based on the best available scientific information; Federal laws protecting human health and the environment are administered and enforced fairly, effectively and as Congress intended; environmental stewardship is integral to U.S. policies concerning natural resources, human health, economic growth, energy, transportation, agriculture, industry, and international trade, and these factors are similarly considered in establishing environmental policy; all parts of society--communities, individuals, businesses, and state, local and tribal governments--have access to accurate information sufficient to effectively participate in managing human health and environmental risks; contaminated lands and toxic sites are cleaned up by potentially responsible parties and revitalized; and chemicals in the marketplace are reviewed for safety.

Acknowledgements

This event was developed with funding support from the U.S. Environmental Protection Agency.

ASSOCIATION OF STATE FLOODPLAIN MANAGERS

IMAGE: A rain garden at 7sigma in Minneapolis, MN. Image by BrianAsh via Wikimedia Commons.