



American Rivers
RIVERS CONNECT US®

ILLINOIS FLOODPLAINS WORK FEASIBILITY STUDY

JULY 2021

Prepared by

SWCA Environmental Consultants



Acknowledgements

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Gratitude

Special thanks to the Grand Victoria Foundation and McKnight Foundation for supporting the publication of this study.

About American Rivers

American Rivers believes a future of clean water and healthy rivers everywhere, for everyone is essential. Since 1973, we have protected wild rivers, restored damaged rivers and conserved clean water for people and nature. With headquarters in Washington, D.C. and 300,000 supporters, members and volunteers across the country, we are the most trusted and influential river conservation organization in the United States, delivering solutions for a better future.



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Cover photo

2017 flooding in downtown Alton, Illinois.

Photo credit: Andrew Dobson

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July 2021

Land Acknowledgement

The state that is now Illinois was and is home to many tribal nations and Indigenous peoples. As colonizers pushed Native Americans and their families off their homelands in the East, many emigrated West, shifting tribal boundaries in and through what is now Illinois. Within a generation following the Revolutionary War, Illinois-land became a destination for European colonizers. The War of 1812, and several skirmishes that lasted until the 1830s, solidified colonists hold on what is now Illinois. In large part due to the outcomes of those wars, Illinois has no federal or state recognized tribal nations. To the best of our knowledge, before Illinois became a state, the land was part of the following Indigenous nations:

- Očhéthi Šakówiŋ (Nation of Seven Council Fires)
- Quawpaw
- Myaamia
- ᏊᏊᏊᏊ (Osage)
- Kaskaskia
- Kiikaapoi (Kickapoo)
- Peoria
- Sauk and Meskwaki
- Bodéwadmíkiwen (Potawatomi)
- Waazija (Ho-Chunk / Winnebago)

We respectfully acknowledge that we are working on the traditional and ancestral lands of many Indigenous people who have called this land home since the beginning, those who continue to call Illinois home, and the Indigenous leaders yet to be born. We apologize for any errors or omissions in our land acknowledgement.

Learn more about Indigenous territories and land acknowledgement at Native-Land.ca.

Executive Summary

Problem Statement

Flood-related threats to health, safety and property are among the most pressing climate change issues in Illinois. Unfortunately, actions to reduce flood risk are not keeping pace with the need to protect people, infrastructure and economies. To accommodate the predicted increase in precipitation, midwestern rivers need more capacity. The changes in land use for expanding flood zones in Illinois can be opportunities to address long-standing racial justice issues and improve biodiversity within the state. This study puts forward an alternative approach to managing flood-prone land for multiple co-equal goals.



“Multi-benefit floodplain development” offers a framework for people living in river communities to address climate disruption, social and racial injustice and biodiversity loss in a holistic way.

Multi-benefit floodplain development recognizes that flooding is a natural process with many ecosystem services – like floodwater conveyance, improved quality of life, water purification, aquifer recharge and wildlife habitat restoration – and it seeks to capitalize on those benefits through intentional planning and development.

Despite the advantages of “multi-benefit floodplain development,” it is not a widely utilized approach in floodplain communities. This study examines how to expand application of this development method in the state of Illinois.

Study Purpose

Other states, include Washington, California, and Vermont, have established programs to advance multi-benefit floodplain development projects. As we began this process, we envisioned an Illinois public-private partnership for multi-benefit floodplain development, similar to the Washington Floodplains by Design Program. We thought this was the best model, given Illinois’ budget constraints. Matching state efforts with private investments could provide resource support for locally driven efforts to plan and implement multi-benefit river corridor projects.

This study explores the Washington model, and others like it, and seeks to understand the unique needs for Illinois’ floodplain communities to gauge the desirability of a public-private partnership program, establish a framework for such a program, if it is recommended, and put forward other public policy reforms to encourage multi-benefit floodplain planning and development in Illinois.

Stakeholder Process

Stakeholder input was used to inform development of the feasibility study findings and recommendations; however, stakeholders were not asked to endorse the feasibility study. Stakeholder meetings focused on case studies that were selected to represent a compendium of floodplain issues and concerns and identified multi-benefit floodplain development

opportunities. Stakeholder input was based on each participant's area of concern, expertise and/or lived experience.

Findings

During the study process, we determined that replicating Washington's dual purpose (public safety and ecosystem restoration) model was not advisable because it did not adequately incorporate the needs of vulnerable populations who may be displaced to accommodate projects. Instead, we recommend a similar public-private multi-benefit floodplain development program with three co-equal goals: public safety, social justice and ecosystem restoration. The proposed program would be tasked with resolving the three primary barriers that were identified in our research and conversations with stakeholders:

- **Lack of Community Led Problem Solving:** A community's needs are dependent on unique conditions found within it, such as culture, social structure, history and assets, to name a few. Therefore, people living within a community are most equipped to speak to these needs. Illinois' elected officials and state agency staff need to work with community members, municipal staff and non-governmental organizations to establish a better framework to support community led problem-solving that is tailored to that community's individual needs. This includes providing more access to information, better venues for collaboration and access to decision-makers.
- **Too Few Hazard Mitigation Projects:** The number of flood hazard mitigation projects needs to dramatically increase throughout the state. This cannot be limited to only "green" or "gray" infrastructure. It will require a combination of the two strategies to build sustainable projects. To support these projects, the Illinois General Assembly needs to take deliberate steps to grow the hazard mitigation field of practice, especially in a multi-benefit floodplain development context, and encourage recruitment in this field.
- **Economic Instability:** Under the current federal and state programs, the local tax base is responsible for paying a significant portion of hazard mitigation costs, especially upfront costs like staffing to apply for grants and oversee programs. But even well-resourced communities cannot keep up with increasing flood risk, and communities of low income are being left behind entirely. Alternative financing, like administrative grants and low-interest loans, and in-kind support, like technical assistance, need to be dramatically expanded. Municipal staff must also be supported to work on interconnected issues, like affordable housing and community revitalization.

Recommendations

- Establish a multi-benefit floodplain planning and development public-private partnership.
- Establish a multi-benefit floodplain development fund to provide flexible funding for planning and projects.
- Reform agricultural programs to incentivize flood-compatible farming and land conservation practices.
- Ensure the Illinois' state agencies provide equitable support services across all programs, including higher levels of planning support for communities that are socially and/or economically disadvantaged.
- Require flood hazard mitigation training for all insurance agents.

Acronyms and Abbreviations

BRIC	Building Resilient Infrastructure and Communities
Corps	U.S. Army Corps of Engineers
FEMA	Federal Emergency Management Agency
HUC	hydrologic unit code
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
NAACP	National Association for the Advancement of Colored People
NFIP	National Flood Insurance Program
NGO	non-governmental organization
USDA	U.S. Department of Agriculture

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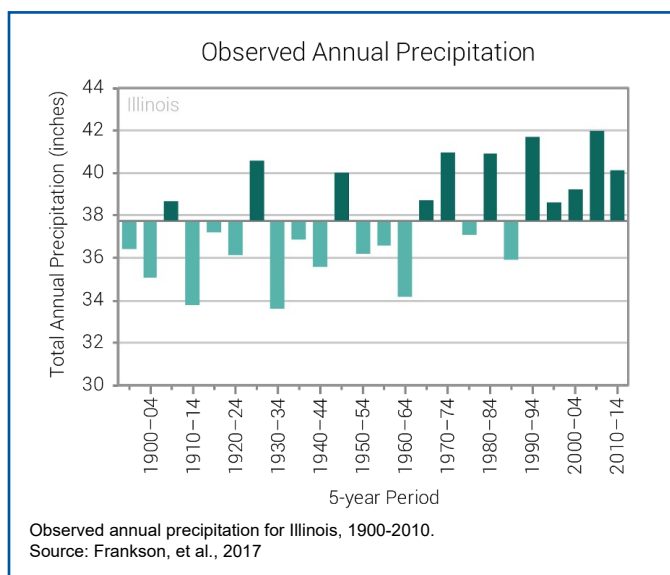
1. Introduction

Midwestern rivers need more capacity to accommodate the climate change fueled storm events and prolonged periods of flooding that climate science predicts (USGCRP, 2018).

In Illinois, damage from floods and stormwater has increased throughout the state in recent years. Flood insurance claims have steeply increased, with the average annual National Flood Insurance Program payout increasing from \$12.5 million in 2000 to \$25.5 million in 2014 (Winters, 2015). Comprehensively, between 2007 and 2014, urban flooding has caused more than \$2 billion in damage in the state (Winters, 2015). In

Illinois, approximately 482,200 properties currently have a 1 percent risk of being damaged by flood events annually (i.e., are located in the 100-year flood zone). Under current climate models, the number of properties in this risk zone will increase to 502,500 in the next 30 years (First Street Foundation, 2021). Flood-related threats to health, safety and property are among the most pressing climate change issues in Illinois. Unfortunately, actions to reduce flood risk are not keeping pace with the need to protect people, infrastructure and economies.

Across Illinois, low income communities and communities of color are experiencing dilapidated stormwater infrastructure that causes serious public health and safety issues. Some outcomes of these problems include wastewater releases in residential areas, loss of useable property, dangerous mold growth and recurring damage to homes. In rural Illinois, agricultural livelihoods are at increased risk as rainfall events become more frequent and severe, causing rivers to flood farmlands, killing crops, preventing planting and damaging infrastructure (Frankson, et al., 2017). Climate change and continued development within floodplains, including flood control measures (which have increased threefold since the 1960s), have resulted in flood damage that continues to escalate (Wright, 2000).





Water over road during 2019 flood, Hannibal, Missouri.
Photo credit: Crystal Dorothy

The flooding issues seen in Illinois are also connected to the global biodiversity crisis. Floodplain habitat is some of the most productive, rich, biodiverse and beneficial type of habitat on Earth. Existing flood management techniques in the state have focused on flood control measures that aim to prevent flooding and move water out of the flood zone rapidly. However, doing so disrupts many of the ecosystem services that flooding, and floodplains enable. These services include filtration of water pollution, creating wildlife habitat, recharging aquifers and offering recreation opportunities and other quality of life improvements. For example, the approximately 87,000 miles of rivers and streams within and bordering Illinois once supported a highly diverse community of

flora and fauna. At the beginning of 20th century, most streams in Illinois had winding courses with associated rich marshes and swamps, and the vegetated stream banks reduced the likelihood of bank failures and heavy erosion (IDNR, 2001). Since then, agriculture and development (including gray infrastructure as a flood management technique) have drastically reduced the health of Illinois floodplains. In addition, channels have been straightened and leveed, resulting in fewer marshes and swamps and more turbidity and bank erosion (IDNR, 2001). Consequently, aquatic insects, freshwater mussels and fish once common to Illinois waters have been extirpated from the state (IDNR, 2001).

Multi-benefit floodplain development provides a framework that accounts for and plans around public safety, social issues and environmental challenges in the floodplain space. Adopting this framework in more Illinois communities will produce more comprehensive solutions to floodplain problems. This study provides a path forward.

1.1 GOALS AND OBJECTIVES

Other states, including Washington, California and Vermont, have established programs to advance multi-benefit floodplain development projects. As we began this process, we envisioned an Illinois public-private partnership that would promote, plan and finance projects with dual public safety and ecosystem restoration goals, similar to the Washington Floodplains by Design program.

In this study we:

1. Review the Washington model, and others like it, to understand the range of programs that exist in the United States.
2. Explore the unique needs for Illinois communities to inform our programmatic recommendations.
3. Establish an Illinois-specific framework for a public-private partnership program.
4. Put forward other public policy recommendations to immediately address some of the most pressing barriers that block implementation of multi-benefit floodplain planning and development in Illinois.

Community and regulatory stakeholder conversations were an important part of this study. Stakeholder discussions helped us understand the greatest community needs. While the stakeholder discussions informed our recommendations, stakeholders were not asked to endorse our findings, and stakeholder participation in the study should not be interpreted as an endorsement of the recommendations herein. Indeed, some stakeholders who participated do not agree with our science-driven assumption that flood control, by itself, is an ineffective and dangerous flood management strategy. This conflict drove home the point that more alternative flood risk reduction projects are needed in Illinois that integrate nature-based flood management and social justice solutions.

2. Study Context

In Illinois, environmental and infrastructural factors contribute to the need for a new floodplain management framework. There are many current and impending public safety, social justice, economic and environmental issues in Illinois' floodplain spaces. To address these issues, the feasibility study attempted to: (1) look at a reasonable cross-section of areas in Illinois that are prone to flooding, (2) solicit input from community leaders and members, and (3) consult with local municipality staff that had first-hand experience with flooding and the efforts used to address it. Also included were State of Illinois staff with expertise in pertinent fields (e.g., water resources, natural resources and disaster mitigation, among others). The input from this group largely drove the process and recommendations provided herein.

A list of publicly available sources of floodplain and community data was used to facilitate the effort of identifying priority watersheds in Illinois. A comprehensive list is presented in Section 2.4 and provides data sources from the Illinois Department of Natural Resources (IDNR), Federal Emergency Management Agency (FEMA), U.S. Army Corps of Engineers (the Corps) and U.S. Department of Agriculture (USDA), among other sources.



2017 flood in downtown Alton, Illinois.
Photo credit: Andrew Dobson

2.1 HISTORY

Illinois has a long history of flooding and floodplain management. Glacial action that occurred over 10,000 years ago flattened the landscape and contributed to slow drainage, with water pooling on the land instead of swiftly discharging into tributaries. Additionally, several of the nation's large rivers are located in and around the state (the Ohio, Mississippi, Illinois and Wabash rivers). These big rivers have large floodplains that attract people due to their proximity to river-borne trade routes, the flat and easily developable land around them, and abundant natural resources that support community health and wealth.

Flood damage has been tracked since colonization. As soon as settlers arrived in what is now Illinois in the early 1800s, they began plowing the prairie, clearing forests, draining wetlands, and building farmsteads. Prior to 1862, these actions fell under the "homestead principal," a European-derived legal strategy that allows individuals to acquire land through active use. Congress codified this practice in the 1862 Homestead Act and subsequent similar acts that rewarded extractive land development.

Because a large portion of Illinois land was prone to flooding or ponding after rain events, settlers organized local drainage and levee districts to pool the community resources required to break up and drain Illinois' wet prairies and floodplains and protect their development from future flood events. In 1870, the Illinois General Assembly formalized these local units of government and passed the first set of drainage laws in 1871 (Illinois Secretary of State, 2021).

The flood management strategy deployed by the early European settlers is known now as “flood control.” Flood control strategies primarily direct water away from people and critical infrastructure. Examples of flood control infrastructure includes levees, dams, levees, tile and other stormwater drainage systems.

While flood control is still the primary approach to reduce flood damage, the strategy, when used by itself, has been proven ineffective because it primarily moves water onto other properties. As a result, it does not truly eliminate flood risk overall, and it creates areas of residual risk (i.e., the false sense of safety in areas that can become inundated when a flood control structure fails) (National Wildlife Federation, 1998).

In the 1960s, recognizing that flood control was not effective at reducing flood losses, Congress passed the Flood Insurance Act of 1968 that created the National Flood Insurance Program, which included incentives to move people and critical infrastructure out of flood-prone areas. This was the formal beginning of a new flood management strategy called “risk reduction.” Flood risk reduction is the opposite of flood control in that it moves people and critical infrastructure away from flood-prone areas, as opposed to trying to move the water away from people. Flood risk reduction examples include buyouts/relocations, home/infrastructure elevations, and floodplain reconnection and restoration. Flood risk reduction is a much more effective strategy for reducing flood damage and protecting public safety because it significantly reduces or eliminates exposure and susceptibility to the flood hazard (Multihazard Mitigation Council, 2019).

As buyout land became available in the late 1960s and 1970s, conservation proponents, including American Rivers, promoted ecosystem restoration on river-adjacent land parcels that could not be re-developed for residential, business or industrial uses. Floodplains are some of the most biologically diverse and productive ecosystems on the planet; however, freshwater species are endangered at higher rates than terrestrial and marine species due in large part to floodplain development (Richter, et al., 1997; Ricciardi and Rasmussen, 1999). To minimize negative impacts on floodplain ecosystems, flood risk reduction projects can incorporate ecosystem enhancement, often referred to as “natural infrastructure” or “nature-based solutions,” into these projects.

Despite the seemingly endless benefits of implementing nature-based solutions, there are several factors that contribute to the limited adoption of natural infrastructure. Part of the issue is a lack of resources. But, even when resources are available, many communities remain resistant to adopting or implementing flood risk reduction approaches due to the following reasons (Browder, et al., 2019):

1. Natural infrastructure projects have greater variability and uncertainty (i.e., it can take time for vegetation features to reach maturity, delaying ecosystem service benefits).



Floodplain pumping stations push water downstream for others to deal with.
Photo credit: Crystal Dorothy

2. Flood problems are often not caused locally, and there are frequent disconnects between upstream causes of flooding and downstream communities struggling to reduce flood damage.
3. Some projects require complex modeling and data collection to design and monitor, which can prevent communities of low income from pursuing nature-based options.
4. Economic benefits associated with healthy ecosystems are challenging to convey to the public and elected officials.
5. Some projects require converting large areas of land from developed to “un-developed,” and this can be costly for communities and can disproportionately impact communities of color and low-income, as well as other vulnerable populations like immigrant, unhoused, disabled and elderly communities.

As the environmental community has largely focused on overcoming these barriers to encourage adoption of natural flood risk reduction infrastructure, the deadly levee breaches in New Orleans following Hurricane Katrina in 2005 raised awareness of how racism increases flood risk for communities of color. Since the founding of the United States, public policies have been crafted specifically to benefit white Americans, including policies around land and home ownership. These race-based policies have and continue to push “undesirable” people onto undesirable land, including flood-prone land.

A stark example of this started in the 1930s under New Deal housing programs. Real estate agents outlined community neighborhoods based on investment risks. Neighborhoods outlined in green were the safest to invest in, blue neighborhoods were still desirable, yellow were in decline, and redlines were drawn around the undesirable areas. Factors that triggered redlines were usually the presence of Black families and/or environmental factors, like flooding, pollution or foul odors (Nelson, et al., n.d.). Federally backed housing development loans were prohibited in redline areas, and the federal loans available in the blue and yellow areas carried riders that prohibited the sale of future properties to Black people. As a result, Black families, regardless of income status, were forced to live in the redlined areas, which were much more likely to be flood prone. Making the situation worse, housing development in redlined areas was not eligible for federally backed bank loans, so houses were made of shoddier construction materials to keep the prices low (Rothstein, 2017).

Due to the above factors, floodplain management is inherently entwined with climate change, the global biodiversity crisis and racism in America. Because these three issues are connected in the same physical space, they must be managed jointly; however, few programs exist to provide a framework for integrating these three issues.

This report provides a framework toward integration. As we discuss below, some programs have already been developed to integrate the issues around flood management and biodiversity. While the social and racial justice issues related to floodplains are well documented, they have not been fully integrated into multi-benefit floodplain development programs. This report makes a case not just to manage floodplains for flood risk reeducation and environmental improvements but to also manage them for social and racial justice.¹

¹ This report focuses on the lived experiences of Black floodplain communities because Black populations are the most segregated (Lichter, Parisi, and Taquino, 2015) and socially oppressed (Wilkerson, 2020). We recognize that other socially

2.2 ECOSYSTEM SERVICES

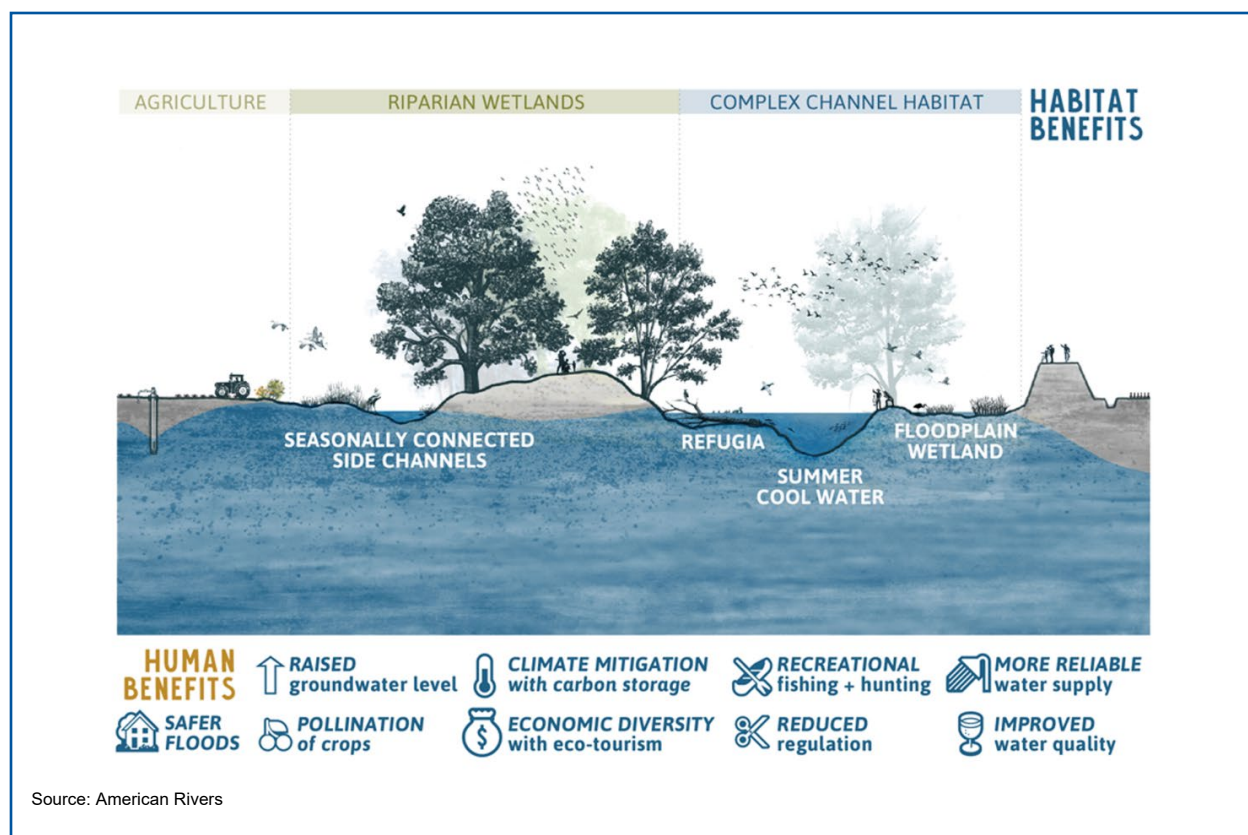
Our multi-benefit floodplain development framework is based on recognizing the full range of services that benefit people when natural systems are healthy and functional (i.e., “ecosystem services”).

In the context of floodplain development, a “functional floodplain” is a floodplain that can perform the natural processes that produce goods and services. The four key attributes necessary for a floodplain to be functional are:

1. **Connectivity:** the floodplain is physically accessible by water from its adjacent river or stream to allow an exchange of water, nutrients, sediment and organisms.
2. **Variable Flow:** the connected river is capable of producing flows with magnitudes large enough to inundate the floodplain. These flows must occur with necessary timing, duration, magnitude and frequency to support native, local biota.
3. **Scale:** the floodplain must have the space to accommodate inundation and resulting habitat and landscape forming processes that occur.
4. **Habitat and Structural Diversity:** A diversity of sediment erosion and deposition conditions, gradients of hydrologic connectivity, ecological succession and naturally accumulated debris generate habitat supportive of terrestrial and aquatic organisms.

A floodplain with these attributes can perform an array of natural functions typical of floodplains. These functions produce economic gains related to flood water conveyance, erosion management, water quality improvements, groundwater recharge, biological productivity, fish and wildlife habitat, carbon storage and an improved quality of life through associated benefits related to recreation and culture (FEMA, 2002; Loos and Shader, 2016; Kusler, 2016; Seavy, et al., 2009).

marginalized populations (such as immigrant, indigenous and disabled people) may have additional issues that they face in the floodplain space and ways of knowing that may help us find better solutions to the range of issues discussed herein. We look forward to future partnerships and studies to improve and refine our proposed framework.



2.2.1 Social Justice

Floodplains are often environmental justice areas – areas where historically marginalized people are subject to environmental degradation and related harms, like flooding. An individual's vulnerability to disasters is the result of (1) their physical proximity to the source of harm, (2) the susceptibility to harm during a disaster, and (3) the individual's capacity to cope and recover from the disaster. Communities of color and other historically marginalized communities are systematically more vulnerable to flood-related disasters due to external conditions and circumstances that negatively influence all three of these factors (UNESCO-IHE, 2021).

1. **Exposure:** Communities of color are more likely to live in flood-prone areas. This is, in part, an outcome of New Deal housing programs and policies (described in Section 2.1) that forced Black families to live in undesirable, redlined neighborhoods, regardless of their income status. Today, most urban areas remain segregated along the same lines established under the New Deal of the 1930s, and race-based exclusion in community decision-making and investment processes is ongoing. Because these areas are also a source of inexpensive housing for other under-resourced populations, including people who are unhoused, impoverished, immigrants, disabled and elderly, there is significant overlap of flood-prone and environmental justice areas (Nelson, et al., n.d.; Rothstein, 2017).
2. **Susceptibility:** Just because someone is in physical proximity to a disaster source does not mean they will be significantly harmed. Upgrades in building materials and designs can reduce property damage, and well-planned and executed evacuations can save lives during disasters. Unfortunately, there are numerous factors that elevate susceptibility of harm among historically marginalized groups. As mentioned in Section 2.1, construction

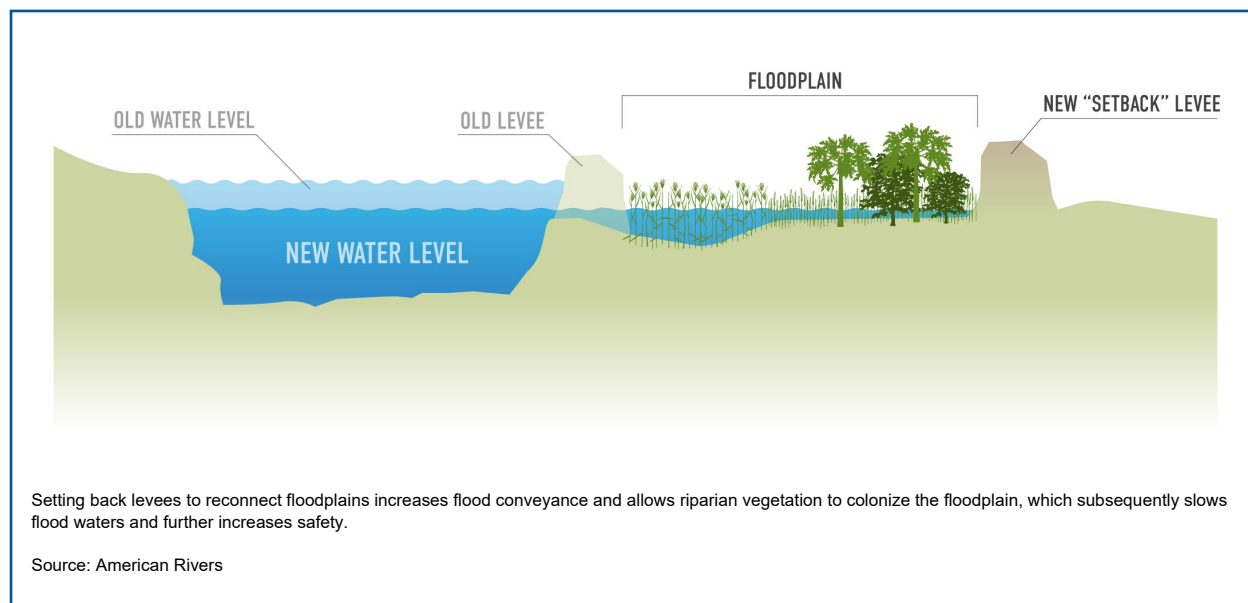
materials used in redline areas, which are more flood prone, are usually inferior to standard building materials due to their cheaper costs (Rothstein, 2017). In addition, impoverished individuals are less likely or unable to upgrade their homes to adhere to higher standards of protection. Also, the needs of historically marginalized populations, by definition, are often neglected during disaster planning. For example, evacuation orders and plans may only be posted in English, making them inaccessible to non-English speaking community members. These factors all contribute to the elevated vulnerability of communities of color and other historically marginalized populations.

3. **Resilience:** Coping with and recovering from disasters is costly and time-consuming. Due primarily to historic and ongoing identity-based discrimination that impacts intergenerational wealth and income, people of color are more likely to be low-income. As a result, white and able-bodied people are better able to weather disasters in a variety of ways. Wealthier people are more likely to have jobs that grant paid time off during a disaster and recovery period. They are more likely to have the time that is required to successfully apply for disaster assistance and have the resources to explore multiple options. They are also more likely to be able to travel away from the disaster and invest in quicker repairs following the disaster. Historically marginalized populations are less likely to have the resources needed to cope with and recover from the disaster, which can result in loss of life and property, job loss, displacement, and other negative outcomes.

While not often recognized as such, floodplains are spaces with significant racial and social justice needs. Incorporating the other ecosystem services through a racial and social justice lens will create more diverse, sustainable and successful communities.

2.2.2 Flood Water Conveyance

Functional floodplains convey flood water and, if managed properly, can be used to divert and/or store flood water away from people and infrastructure. Studies show that when flood water is allowed to access its floodplain, the water slows down, dispersing energy and depositing sediment, which results in the reduction of flood damage and flood-related erosion. (FEMA, 2002; Rohde, et al., 2005; Opperman, et al., 2010).



Using natural floodplains to convey flood water is cost effective. For every dollar spent moving people and critical infrastructure out of floodplains, there is an average of \$6 in savings accrued from minimizing future expenses associated with flood defense, clean up and recovery where flood water can be successfully conveyed (Multihazard Mitigation Council, 2017).

2.2.3 Water Quality Improvements

Water pollution includes a variety of toxins and compounds that threaten human and animal health. Water treatment facilities remove most common pollutants, but they can be imperfect and vulnerable to external factors like new contaminants, excessive contamination, equipment malfunction and pipe or other transport/delivery failures. In general, cleaner source water and cleaner landscapes result in safer and more reliable drinking water for communities. Natural strategies, like floodplain and wetland restoration, can help remove contamination from water and are often significantly cheaper than water treatment facilities (EPA, 2020).

Natural floodplains are hotspots for water purification, though sometimes to the detriment of the floodplain ecosystem. Floodplain wetlands support microbial communities that process pollution out of the water column, especially nutrient and phosphorus pollution that are problematic in Illinois. As floodplains allow water to slow down, sediment and pollutants bound to sediment drop out of the water column, consolidating during the post-flood dry periods. Depending on the types of pollution and vegetation present in the floodplain, some sediment-laden pollutants can be neutralized via plant uptake or other biological methods. Other pollutants, like some heavy metals, may require mechanical removal from the site to ensure the area is safe for people and wildlife (Gordon, Dorothy and Lenhart, 2020). While the safest and most effective strategy to improve water quality is to reduce the sources of pollution, natural floodplains are a reliable and sound option for downstream removal.

2.2.4 Wildlife Habitat

Floodplains are dynamic environments, and their ever-changing nature creates diverse successional stages. As a result, floodplains are some of the most biodiverse and productive ecosystems on the planet (Ward, Tockner and Schiemer, 1999).

During inundation, floodplains support river ecosystems by providing habitat for fish and wildlife, maintaining water quality and supplying nutrients and shelter that enhance fish reproductive success and growth rates. The flood pulse concept (Junk, Bayley and Sparks, 1989) illustrates the ecological value of floods, describing them as periodic pulses of nutrient- and sediment-rich water that spur productivity and connect riverine and floodplain habitats. Flooding underpins the processes that create and sustain the ecological functions of floodplains. Where those natural processes remain intact and ecological processes are sustained, a floodplain is considered to be ecologically functional.



Deer in Illinois River floodplain at Spunky Bottoms, Illinois.
Photo credit: Chris Young

2.2.5 Groundwater Recharge

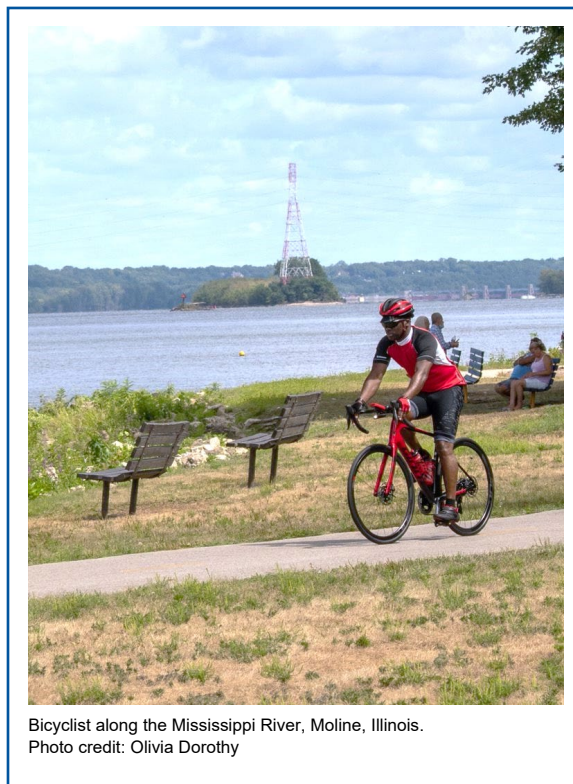
In addition to conveying flood water, floodplains are often recharge zones for aquifers (Doble, et al., 2012; Brunet, Astin and Dartiguelongue, 2003; Zhang, et al., 2017). This includes the “sole-source” Mahomet Aquifer in East Central Illinois, where the floodplains of the Illinois River and other lesser rivers recharge the aquifer (Mahomet Aquifer Consortium, 2018). This groundwater recharge function is critically important under climate change as Midwest precipitation patterns shift to longer droughts punctuated by extreme precipitation events (USGCRP, 2018). Allowing flood water to access the floodplain will recharge aquifers, which can help offset the impacts of drought when river levels are low.

2.2.6 Quality of Life

Functional floodplains improve a community’s quality of life, and these improvements translate to community wealth. Quality of life values are associated with human health and well-being. Studies show that human-nature interactions provide numerous health benefits that range from general feelings of improved happiness to lower blood pressure to longer lifespans (Hartig and Kahn, 2016; Kardan, et al., 2015; Halonen, et al., 2014; Astell-Bert, Feng and Kolt, 2014; Alcock, et al., 2017; Mitchell, et al., 2015; Gascon, et al., 2016; Dadvand, et al., 2017; Dadvand, et al., 2012; Dadvand, et al., 2015; Maas, et al., 2006; Mitchell and Popham, 2007; Seresinhe, Preis and Moat, 2015; White, et al., 2013).

These health benefits translate to a range of economic impacts associated with people *wanting* to live and work in areas with accessible natural spaces. A study that looked at nine urban floodplain restoration projects found that the ecosystem improvements translated to an increase in the local community wealth via the following mechanisms (Parsons, et al., 2020):

- Reduction in costly flood damage repairs and lower flood insurance rates for communities enrolled in FEMA’s Community Rating System.
- Increased property values that more than compensated for the lost revenues from undeveloped parcels.
- Increased business investment and employee attraction due to enhanced recreational opportunities.
- Increases in high-value development, economic growth, and jobs in other parts of the community that cascaded from the employee attraction value due to enhanced recreational opportunities.



2.3 EXISTING PROGRAMS AND DATA

The multi-benefit floodplain development framework is not a new concept. In this section, we explore successful programs in the states of Washington, Vermont, New York and California, as well federal grants and programs which can be used to extrapolate lessons to consider for Illinois. As part of this process, representatives from the various programs and agencies joined our stakeholder meetings to provide information, which was then discussed by stakeholders. Compiled notes from the stakeholder meetings are available in Appendix C.

2.3.1 Washington Floodplains by Design

The Washington Floodplains by Design Program is a public-private partnership grant program between the Washington State Department of Ecology and The Nature Conservancy. The goal of this program is to reduce flood risks, promote floodplain ecosystem health and support agriculture, recreation and clean water. Washington Floodplains by Design is perhaps the most comprehensive multi-benefit floodplain development program in the United States, and over \$165 million in state funding for projects has been leveraged by the program since the first funding cycle in 2013.

After implementing projects for 5 years, Washington Floodplains by Design coordinators realized that outreach was needed to work with and educate the public on multi-benefit floodplain development. To change public perception of how floodplains in the state should be managed, Washington Floodplains by Design conducted a variety of engagement activities that targeted a diverse range of stakeholders. Activities included key decision makers, tribal government representatives, local elected officials, state agency representatives, leaders of agricultural groups, conservation organizations and organizations that represent vulnerable communities. By consulting with such a broad network of stakeholders, coordinators were able to gain a greater understanding of needs and helped to develop a dialogue between the multiple entities that should be involved in floodplain management decisions throughout the state.

Following these initial stakeholder outreach activities, the Washington Floodplains by Design program has normalized integrated (or multi-benefit) floodplain restoration and is building more robust management systems at the local and regional level. Communities are now incentivized to develop local collaboratives that bring together diverse interests to create an integrated approach for managing floodplains. These local groups are now the driving force behind identifying and prioritizing projects. This approach ensures projects meet local needs and have broad support across diverse interests. Washington Floodplains by Design is also engaged in efforts to change the policy and regulatory framework to allow for facilitation of funding and enhanced management of floodplains in the state.

Lessons for Illinois:

- **Collaborations are under-resourced:** Open forums to define floodplain management issues serve the interests of the broader community. To find agreement on an integrated set of actions, local integrated groups are a critical piece for implementing successful on-the-ground actions.
- **Regional integration is as important as local integration:** There are significant constraints generated by state and federal laws, policies and funding programs that limit, restrict and hamper integrated floodplain management at the local level.
- **Integrated floodplain management requires a wide variety of skills:** The needed skills are complex, nuanced and need to be performed at a high level. For

example, technical skills, project management skills, the ability to facilitate visioning, the ability to fit an effort within institutional structures, facilitation, storytelling and grant writing are all necessary skills for these efforts, though a full list of skills would be much longer.

- **Sustained integrated floodplain management requires tracking and measurement of progress:** If participants do not see that progress is being made on the goals they find most important, it will be difficult to maintain both trust and momentum.
- **Integrated floodplain management works best at a large scale and with many voices involved:** The larger the scale (ideally a reach or watershed scale), the more possible it is to develop a package of projects to address a wide range of issues.

2.3.2 Vermont Rivers Program – Functioning Floodplains Initiative

The Vermont Rivers Program is a state organized program spearheaded by the Agency of Natural Resources. The program is aimed at protecting and restoring natural river and floodplain processes to enhance water quality, ecological health and flood resilience. The Vermont Rivers Program has three core focus areas — Streamflow Protection, River Management and River Corridor and Floodplain Protection. Under these three focus areas, the State of Vermont has further subdivided the program into focus areas for specific issues such as hydroelectric power, dam removal, stream alteration, permitting, flood training and National Flood Insurance Program information, among others. Of the Vermont Rivers Program’s many sub-programs and information repositories, the Vermont Functioning Floodplains Initiative provides the most value to the State of Illinois as an example of beneficial and proactive floodplain management.

The Functioning Floodplains Initiative is managed by Vermont’s Department of Environmental Conservation, a department of the Agency of Natural Resources. The Functioning Floodplains Initiative’s goal is “to achieve the highest water quality, flood resilience, and ecological integrity by targeting restoration and reconnection where it is most beneficial. (Vermont Department of Conservation, 2021). This goal is being approached through a multi-phased approach to ensure that the program is developing effective recommendations for restoration throughout the state. To assist with the Functioning Floodplains Initiative, the Department of Environmental Conservation has enlisted a diverse group of stakeholders, including state employees and local governments, non-profits, academia and the private sector. The recently completed Phase 1 is focused on formally assessing rivers and streams throughout the state to determine what percentage of river corridors/floodplains are disconnected in a watershed due to existing constraints or stressors. Phase 2 of the program will develop a list of floodplain reconnection projects and the estimated costs for the implementation of those projects.

Lessons for Illinois:

- **Information on river health is incomplete.** A science-based assessment of rivers and watersheds is needed to provide foundational information, set goals and measure success.
- **Diverse stakeholder engagement is important.** Engaging stakeholders ensures buy-in and sharing of resources and knowledge, both of which will contribute to a more effective and impactful investment in the long term.

2.3.3 New York Rising Communities Reconstruction Program

The New York Rising Communities Reconstruction Program was established in 2013 in response to the damage caused by Hurricane Irene in August 2011, Tropical Storm Lee in September 2011, and Hurricane Sandy in October 2012. The New York Governor's Office of Storm Recovery was allocated over \$650 million in federal funds and has been administering funding for planning and implementation projects across the 124 New York state communities damaged by the storms. Each community identified as being impacted by one of the three storm events was allocated between \$3 and \$25 million to implement recovery and resiliency projects in their community. Additionally, each community that participated in the program and received funding was required to participate in a regional planning group made up of local community members so they could collaboratively identify reconstruction and resilience projects that would improve their collective resilience.

The New York Rising Communities Reconstruction Program is notable because their recovery and resilience initiative utilizes recovery funding for community led resilience planning in addition to direct disaster recovery efforts. In general, community planners felt the program was more successful than previous planning efforts due to the community-driven, consensus-based approach.

For this study, we did not review the entire The New York Rising Communities Reconstruction Program, but just one project in the Village of Sidney, due to the project's integration of social justice issues. Prior to receiving program funds, the Corps evaluated the potential installation of a floodwall to protect the Village of Sidney but found a floodwall does not meet the Corps' cost-benefit threshold. In response, the community started reviewing alternatives, including green infrastructure, to increase their community's resilience. The New York Rising Communities Reconstruction Program community planning effort brought the funding and engagement needed to thoroughly assess and evaluate

Sidney's options. This resulted in a science-based, community-driven plan that outlined almost two dozen projects that will remove residents from danger, increase stormwater storage/conveyance, provide affordable housing options to displaced people and ensure that Sidney's jobs, historic Main Street, and economy remain resilient to future storm events.



Flood wall in Hannibal, Missouri.
Photo credit: Crystal Dorothy

Lessons for Illinois:

- **Community-driven processes create better outcomes.** Village of Sidney officials listened to the needs of the people impacted and then developed creative solutions that solved multiple problems associated with flood risk and economic stability.
- **Solutions need to be problem oriented.** State and federal programs tend to apply a solutions-driven approach, which limits the types of options available (i.e., floodwall versus no floodwall). If the solutions are not feasible, it weakens relationships with the

community. More flexibility is needed to focus on solving problems instead of presuming solutions.

2.3.4 California Department of Water Resources – Division of Multi-Benefit Initiatives

The California Department of Water Resources recently established the Division of Multi-Benefit Initiatives to develop and implement multi-benefit projects that “integrate flood risk reduction, ecosystem uplift, and water supply reliability throughout the Central Valley” (Delta Stewardship Council, 2020). The California Department of Water Resources has been discussing multi-benefit floodplain development since the establishment of their statewide flood management plan in 2012. However, California had not codified the practice as a preferred method of flood resilience management until the establishment of the Division of Multi-Benefit Initiatives in 2019.

The Division of Multi-Benefit Initiatives is focused on achieving the following social goals: public safety, ecosystem health, stable economies and enriching life experiences. Multi-benefit initiatives and projects are unique in that they tend to result in the aforementioned benefits, but the Division of Multi-Benefit Initiatives noted some struggles with changing public perception regarding multi-benefit projects. Typical misconceptions of multi-benefit projects are that these types of projects require more time, are more costly and create less beneficial impact than gray infrastructure solutions (e.g., levees, dams, and floodwalls). However, as the Division of Multi-Benefit Initiatives has implemented more projects, these misconceptions are dissipating as projects that incorporate multiple goals are consistently cost-competitive, effective and pay dividends. As a result, the Division of Multi-Benefit Initiatives has made a tangible impact on flood control throughout the Central Valley.

To generate more projects, the Division of Multi-Benefit Initiatives is correcting misperceptions and implementing more projects by working across all state and local agencies. In doing so, they can find unique solutions that increase the resilience to flooding while improving ecosystems and the quality of life for Californians.

Lessons for Illinois:

- **Goals should be human-centered.** To generate buy-in, program and project goals should clearly articulate how people will benefit from multi-benefit floodplain development. California’s program shows that these projects can achieve broader social goals.
- **Challenge misconceptions.** Understanding public perception is key to developing goals and objectives that address any outstanding questions or misconceptions.

2.3.5 FEMA Building Resilient Infrastructure and Communities (BRIC) Grants

FEMA has been delivering pre-disaster mitigation grants since the signing of the Stafford Act in 1988 (FEMA, 2021a). The Building Resilient Infrastructure and Communities (BRIC) grant program was established in 2018 and consolidates several pre-disaster grant programs. BRIC was created following extensive stakeholder feedback in 2019 (over 5,000 comments received) and is designed to make communities more resilient through multi-benefit flood risk management planning and development. BRIC guiding principles are to support community capacity building, encourage and enable innovation, promote partnerships, enable large infrastructure projects, maintain flexibility and provide consistency. BRIC priorities are to encourage public infrastructure projects, mitigate risk to lifelines, promote nature-based solutions and incentivize adoption of modern building codes. Major programmatic focus is on

funding “lifelines” like communication, power, emergency personnel, etc. In the past, FEMA has focused disaster spending on a structure-by-structure basis, but now wants spending to focus less on individual buildings or pieces of infrastructure and more on sustaining vital community operations during and after the inevitable disaster. Also, BRIC is now funding pre-project planning (i.e., scoping and studies) to encourage community-driven solutions and partnerships, which will be more competitive.



2011 flood in Cairo, Illinois.
Photo credit: Iris Shreve Garrett

Funding for BRIC is based on current federal disaster spending. For each federally declared disaster that occurs, FEMA is required to create an estimate within six months of the declaration for the amount of assistance needed. From that estimate, six percent is set aside for the National Public Infrastructure Pre-Disaster Mitigation Fund, the parent fund that provides funding for BRIC. Each year, FEMA assesses the amount of funding available and makes allocations to the various programs funded through the National Public Infrastructure Pre-Disaster Mitigation Fund (including BRIC). In 2020, \$500 million was allocated to BRIC and roughly distributed as follows: state/territory allocation: \$33.6 million; tribal allocation: \$20 million; mitigation grants: \$446.4 million. Eligible entities include states, territories, federally recognized tribal governments and DC, as well as sub-applicants, including local governments, tribal governments, state agencies and tribal agencies. To submit an application for a BRIC grant, communities must have an approved Hazard Mitigation Plan and that is kept up to date. Hazard mitigation planning is also eligible for BRIC grant funding.

Lessons for Illinois:

- **Federal funding is available for multi-benefit floodplain development.**
Federal funds are available to support multi-benefit floodplain development and, indeed,

such applications would be more competitive than traditional gray infrastructure by itself. Supporting multi-benefit floodplain development projects can bring more federal dollars to the state.

2.3.6 FEMA National Flood Insurance Program

Any resident (property owner or renter) can sign up for flood insurance if the community is part of the National Flood Insurance Program (NFIP). NFIP is a voluntary federal insurance program that maps flood hazard zones and provides incentives for better floodplain management for communities. To join, a community must adopt the flood hazard maps and studies and enforce flood hazard regulations. In Illinois, 89 out of 102 counties have joined and 891 communities have joined. Only a few rural areas have not been mapped; these areas are primarily in counties that are not already members of the program.

The regulated floodplain is defined by the Flood Insurance Rate Map, which defines the areas subject to flooding during 100-year flood events. Buildings within the regulatory floodplain will have higher insurance premiums versus those outside the mapped floodplain. To receive lower flood insurance premiums, structures must be elevated above or relocated outside of the flood zone, as defined by the rate map. Often, urban flooding areas are not shown as having a flood risk because they are behind a levee or are “protected” by another impoundment. Urban areas in densely populated cities will often not show flood risk, even though flooding may be an issue. Flood insurance is required as part of any federally backed loan if a building or mobile home is sited within the Special Flood Hazard Area, as defined by the Flood Insurance Rate Map. The flood insurance is used as a security of the loan. Once the loan is paid off, flood insurance is no longer required but is available for all homeowners and renters, on a voluntary basis, both inside and outside of the Special Flood Hazard Area.

Flood insurance only covers surface water flooding (i.e., it does not cover sanitary issues, basement seepage pump failures, etc.).

Flood insurance premiums also depend on community actions. If a community maintains compliance with NFIP requirements (i.e., the community is consistently enforcing minimum requirements and conducting consistent maintenance to benefit their community) the community can reduce flood insurance premiums for community members and organize a community floodplain management program.

Despite efforts to mitigate flood hazards in floodplains, 92 percent of flood damage in Illinois now occurs outside of the mapped floodplain. (Winters, 2015). This is due to out-of-date flood hazard maps and more intense rainfall. Rainfall has increased by 5 inches per year in the last 120 years, and the number of heavy rain events (2-inches or more per day) has increased 40 percent since 1901. And it is expected to get worse. Climate models predict a further increase in precipitation of 0-6 percent by mid-century and 2-10 percent by 2100 (Wuebbles, Angel, Petersen, & Lemke, 2021). Flooding outside the mapped floodplain is especially problematic because homeowner policies do not typically cover surface flooding and insurance riders are required for sanitary sewer backups.

Lessons for Illinois:

- **Floodplain projects influence community insurance rates.** Multi-benefit floodplain development can help lower flood insurance rates in participating communities.

- **Flood insurance is needed outside the mapped floodplain.** With 92 percent of flood insurance claims originating from locations outside the mapped floodplain, more people need to enroll in the NFIP.
- **Flooding is getting worse.** Flooding trends are tracking with climate models that predict more frequent and severe events. The number of flood hazard mitigation projects needs to increase dramatically.

2.3.7 U.S. Department of Agriculture (USDA) Easement Programs

USDA Easement programs for floodplain areas include the Agricultural Conservation Easement Program – Wetland Reserve Easement Program and the Emergency Watershed Protection Program - Floodplain Easement Option. These USDA easement options are made possible by a landowner's voluntary enrollment in the program. Financial compensation is provided to the landowners in exchange for land-use modifications or restrictions that benefit floodplain ecosystems. The landowner keeps the title and can sell the land or pass it on to heirs. Easements range from 30 years to perpetual, with around 85 percent being perpetual nationwide. Frequently, the 30-year easement holders come back to get perpetual easements.



Flooded farmland with and without conservation easements, along the Edwards River, Illinois.
Photo credit: Roy Plasschaert and LightHawk

Tribal and private landowners can enroll in the Wetlands Reserve Program. The goal of this program is to restore land to baseline conditions (prior to it being farmed) and protect and enhance wetland areas with the purpose of restoring hydrology and native vegetation. The USDA holds the easement and is responsible for monitoring and maintenance of the easement.

The program requires 24-month ownership, and landowners keep the rights to use and enjoy the property, to exclude others, and to possess or to transfer the property by sale or gift.

The Emergency Watershed Protection Program - Floodplain Easement Option is only funded when and where there is a disaster. The goal of the program is to restore the land, to the maximum extent possible, to its natural condition. Funding is requested through a secretarial order and is not something the USDA National Resources Conservation Service provides every year. The Dogtooth Bend area in Alexander County is currently enrolling landowners in floodplain easements. There was a levee in the area, but the Mississippi River breached the levee in 2016 and was not repaired. Farming has been nearly impossible since the levee breached. Finally, in 2019 the Dogtooth Bend area was included in the disaster designation, allowing floodplain easement funds to finally go to helping the landowners in the area.

Lands eligible for the EWPP - Floodplain Easement Option must have been damaged by flooding at least once in the previous calendar year or twice within the previous ten years. Additionally, the land must be within a floodplain and contribute to the restoration of the flood storage and flow, provide for control of erosion, or improve the practical management of the floodplain easement. Landowner eligibility is determined much like Wetlands Reserve Easement program. Should the landowner voluntarily enroll in the program, the landowner keeps the title but is required to comply to terms of agreement that define acceptable land uses.

Landowners are compensated through an appraisal process each year. Compensation value is determined as the lowest of three values:

1. The fair market value of the land. The fair market value may be determined through either of two methods: an area-wide market analysis or survey or an individual Uniform Standards for Professional Appraisal Practice (USPAP) appraisal.
2. The geographic area rate cap (GARC). The GARC reflects the value the State Conservationist, with the advice of the State Technical Committee, determines to be fair compensation for the value of the easement.
3. A voluntary written offer by the landowner. When the landowner applies for the easements, they may voluntarily offer to accept less compensation than NRCS would offer. This may enhance the probability of the easement becoming enrolled during a competitive enrollment cycle.

For EWPP – Floodplain Easements and perpetual ACEP – Wetland Reserve Easements, the NRCS will cover 100 percent of the restoration costs. Restoration actions are focused on restoring floodplain functions back to baseline and include both structural and non-structural conservation practices (e.g., planting trees to cut down the water flow) (USDA-NRCS, n.d.).

Lessons for Illinois:

- **Flooding is both a rural and urban issue.** Oftentimes, floodplain managers focus on flood impacts in urban areas; however, farmland and farm infrastructure can also suffer damage that impacts the bigger regional economies. Given the dominance of agriculture on the Illinois landscape, a multi-benefit floodplain development program needs to provide resources to farmers.

2.4 AVAILABLE DATA

A database query was conducted to fulfill investigations into publicly available data for the case study areas of this feasibility study. The table below details publicly available data that were sourced during this effort.

Dataset	Provider	Communities	Link
Threatened and Endangered Species Occurrences	IDNR	All	*Available upon request from IDNR
Illinois Natural Areas Inventory	IDNR	All	*Available upon request from IDNR
Illinois Land and Water Reserves	IDNR	All	*Available upon request from IDNR
Lands with Illinois Nature Preserves Commission Protection	IDNR	All	*Available upon request from IDNR
Buyouts as of 2017	Illinois State Water Survey	All	*Available upon request from IDNR
Conservation Reserve Enhancement Program Eligible Watersheds	IDNR	All	*Available upon request from IDNR
Landscapes of Ecological Integrity/Inventory	IDNR	All	*Available upon request from IDNR
Conservation Opportunity Areas	IDNR	All	*Available upon request from IDNR
Conservation Stewardship Program Properties	IDNR	All	*Available upon request from IDNR
Conservation Stewardship database	IDNR	All	*Available upon request from IDNR
Forest Development Act Properties	IDNR	All	*Available upon request from IDNR
FEMA National Flood Hazard Layer - Effective Data	FEMA	Freeport, Rockford, Ford Heights, Alexander	https://hazards.fema.gov/gis/nfhl/rest/services/public/NFHL/MapServer
FEMA National Flood Hazard Layer - Preliminary Data	FEMA	Ford Heights	https://hazards.fema.gov/gis/nfhl/rest/services/PrelimPending/Prelim_NFHL/MapServer
National Hydrography Dataset (NHDPlus High Resolution)	USGS	All	https://viewer.nationalmap.gov/services/
Hydric Soils	USDA	All	https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx
Prime Farmland, Farmland of Statewide Importance, Farmland of Local Importance, and Unique Farmland (Soil types)	USDA	All	https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx
Corps Projects	USACE	Alexander, East St. Louis, Rockford	https://geospatial-usace.opendata.arcgis.com/datasets/1019535ea7a848939dc5b5d54aca19a9_1
National Land Cover Database	Multi-Resolution Land Characteristics Consortium	All	https://viewer.nationalmap.gov/services/
Corps National Levee Database	USACE	All	https://levees.sec.usace.army.mil/mapserver/public/ows
Flood Factor	First Street Foundation	All	https://www.illinoisfloodmaps.org/dfd.aspx
Building Footprints	Illinois State Water Survey	All	https://illinoisfloodmaps.org/

Dataset	Provider	Communities	Link
National Agricultural Statistics Service Cropland Data Layer	USDA	All	https://nassgeodata.gmu.edu/CropScape/

3. Stakeholder Engagement

In conjunction with the development of this feasibility study, a community stakeholder engagement process was undertaken to ensure community involvement in identifying the issues that residents and other stakeholders are living with or working to resolve. The engagement process is considered integral to the development of programmatic priorities and objectives for multi-benefit floodplain development. The stakeholder engagement process included four stakeholder meetings that were organized by American Rivers and their partners. Due to health precautions taken for the COVID-19 pandemic, participants attended the stakeholder meetings using Zoom virtual meeting software.

Stakeholders participated in discussions that focused on six case study areas (listed in Section 3.1.1) and assessed the viability of establishing a statewide multi-benefit floodplain development program. The diverse group of stakeholders represented in the meetings included the IDNR, Illinois Farm Bureau, Illinois Environmental Council, Friends of the Chicago River, Illinois Department of Transportation, The Nature Conservancy, various branches of the National Association for the Advancement of Colored People (NAACP), Southern Illinois University, and Blacks in Green, among others. A full list of stakeholder participants and notes from each stakeholder meeting are included in Appendix C.

3.1 STAKEHOLDER ENGAGEMENT PROCESS

The stakeholder engagement process began with the development of a contact/attendee list targeting non-profit or non-governmental organizations, Illinois state agencies, and a cross-section of floodplain users. American Rivers sought to identify potential participants representing the two most common land uses that are negatively affected by flooding or changes in floodplain management — urban uses and agricultural uses. In addition, waterways and their floodplains in Illinois include miles of open space, recreational areas, and natural areas that provide habitat for common and rare species, recreational opportunities and, in some locations, space for a river or creek to overflow during storm and increased water events. American Rivers also sought to include participants who could speak to these uses.

As previously discussed, flooding issues often disproportionately affect communities of color and low income. American Rivers coordinated with the NAACP to identify communities of color in Illinois that have been most impacted by flooding and that should be included in the stakeholder engagement process. American Rivers also coordinated with the Illinois Farm Bureau in an effort to address extensive and repeated flooding that has occurred on agricultural lands; in some watersheds, repeated flooding has resulted in permanent removal of lands from agricultural productivity. In addition, American Rivers coordinated closely with Illinois state agencies that have oversight of floodplain areas or resources that rely upon them. These included IDNR, Illinois Department of Transportation, and others. Academic institutions, such as Southern Illinois University and the University of Illinois State Water Survey, were also included in the coordination efforts. Non-governmental organizations included The Nature Conservancy, the National Resources Defense Council, Blacks in Green, and Prairie Rivers Network.

3.1.1 Stakeholder Meeting #1 (September 15, 2020, 10:00 a.m. to 5:00 p.m. CT)

The first stakeholder meeting was intended to provide the large and diverse group of over 50 individuals an opportunity to be introduced to one another and to the idea of a multi-benefit floodplain program. Presentations were given by representatives implementing similar programs from the states of Washington and Vermont. Additionally, six geographic case studies were proposed:

1. Alexander County
2. East St. Louis
3. Freeport
4. Rockford
5. Effingham
6. Chicago (Ford Heights)

Breakout sessions were held to receive feedback from stakeholders on the proposed case study locations. The breakout sessions were divided by topic: Environment/Natural Resources, Farming/Agriculture and Social Justice/Equity. Attendees were self-elected for the three topic groups.

Following the first stakeholder meeting, extensive notes were sent to attendees along with a post-meeting survey asking participants to provide feedback on meeting format and topics and for suggestions on additional stakeholders or participants. As a result of the feedback, one case study, Effingham, was removed and replaced with Danville and two of the case studies became more focused on specific areas: Cairo in Alexander County and Centreville in East St. Louis. The revised six geographic case studies discussed at subsequent stakeholder meetings were:

1. Alexander County (Cairo)
2. East St. Louis (Centreville)
3. Freeport
4. Rockford
5. Danville
6. Chicago (Ford Heights)

Stakeholders also requested that the meetings be shortened from 6 hours, and this request was adopted for subsequent meetings.

3.1.2 Stakeholder Meeting #2 (October 27, 2020, 12:00 p.m. to 5:00 p.m. CT)

The goals of the second stakeholder meeting were to further define and clarify for attendees what is meant by multi-benefit floodplain development and to also provide attendees with responses to concerns about the case study locations. Lessons learned from the first meeting were discussed. Two education panel presentations were given, one on the California Department of Water Resources Multi-Benefit Floodplain Project Office and the other on the New York Rising Project in the Village of Sydney.

Stakeholder Meeting #2 focused on three of the six case studies: East St. Louis (Centreville), Alexander County (Cairo) and Rockford. Presentations from community members on the three case study areas affected by flooding (local municipality or county officials, the Illinois Farm Bureau and non-governmental organizations) preceded breakout sessions for each case study area. Breakout group attendees were randomly selected at the end of the presentations for each of the case studies. The objectives for each case study breakout session were to receive input on solutions to the flood-related issues being experienced in each location and to identify resource gaps to implement those solutions. Breakout session attendees were asked to provide their ideas to solve flood-related issues (if given unlimited resources) and to provide information on any existing programs or funding that may be available to the case study areas. Section 4 provides a summary, by case study area, of the feedback and input from the case study breakout sessions.

3.1.3 Stakeholder Meeting #3 (March 9, 2021, 12:00 p.m. to 5:00 p.m. CT)

Stakeholder Meeting #3 was set up similarly to the second stakeholder meeting and focused on the remaining three case study areas: Chicago (Ford Heights), Freeport and Danville. Educational panel presentations for the third stakeholder meeting included presentations on the Building Resilient Infrastructure and Communities Grant Program, the NFIP and the Agricultural Conservation Easement Program.

Presentations from community members on the three case study areas affected by flooding (local municipality or county officials, the Illinois Farm Bureau and non-governmental organizations) preceded breakout sessions for each case study area. Breakout group attendees were randomly selected at the end of the presentations for each of the case studies. The objectives for each case study breakout session were to receive input on solutions to the flood-related issues being experienced in each location and to identify resource gaps to implement those solutions. Breakout session attendees were asked to provide their ideas to solve flood-related issues (if given unlimited resources) and to provide information on any existing programs or funding that may be available to the case study areas. Section 4 provides a summary, by case study area, of the feedback and input from the case study breakout sessions.

3.1.4 Stakeholder Meeting #4 (April 27, 2021, 12:00 p.m. to 5:00 p.m. CT)

The fourth and final stakeholder meeting focused on the draft conclusions of the case studies as well as the findings and stakeholder recommendations resulting from the previous meetings and discussions. The participants reviewed all six case studies to ensure that their recommendations and feedback on the existing flooding conditions, challenges, barriers and potential solutions were accurately captured. Breakout sessions were held for each case study so that participants could discuss the most important lessons learned, record any information that was missed or misinterpreted, and provide any additional information stakeholders wanted to share about each location. At the end of the breakout sessions, American Rivers gave a presentation on the overall big-picture recommendations, which were based on stakeholder input and extensive literature research conducted by American Rivers. The presentation included an overview of why changes to floodplain development need to be made, the advantages of multi-benefit floodplain development, what kind of support is needed in Illinois to implement multi-benefit floodplain development, and the overarching recommendations that will be made to the Illinois General Assembly (based on the stakeholder meetings). At the end of the presentation, participants were asked to share their reactions and thoughts on the high-level recommendations. Revisions were made, and the final recommendations are discussed further in Section 4.5.

4. Case Studies

4.1 SELECTION PROCESS FOR CASE STUDIES

A desktop review was conducted to identify areas that are disproportionately impacted by flooding and floodplain-related issues. Following the desktop review, a preliminary list of six geographic case studies was presented to stakeholders during the first stakeholder engagement meeting. The initial list was revised and refined by meeting participants, and the final list of case study areas was carried forward in subsequent meetings and are discussed below. For the purpose of this discussion, the case study areas are grouped into three regions: Southern Illinois, Central Illinois, and Chicago (see Appendix B).

4.2 SOUTHERN ILLINOIS

4.2.1 Alexander County

4.2.1.1 Location and Demographics

Alexander County is located in the southwestern tip of Illinois. It is bordered by the state of Missouri to the southwest, Pulaski County, Illinois, and the state of Kentucky to the east, and Union County, Illinois, to the north. The county has an area of 253 square miles and contains the city of Cairo, a rural, historic community that was a focal point of discussion during Stakeholder Meeting #2 due to the complex floodplain issues facing the city. Alexander County had a population of 8,238 people during the 2010 census. The U.S. Census Bureau estimates that the county has seen a 30.1 percent decrease in population since the 2010 census, placing the current population estimate at 5,761 people (USCB, 2019a).

The city of Cairo is an Illinois Environmental Protection Agency (IEPA) designated environmental justice area within Alexander County (see Appendix B). IEPA defines areas of environmental justice concern as “communit[ies] with low-income and/or minority populations greater than twice the statewide average” (IEPA, 2018). Large portions of Cairo are located within the FEMA floodplain and are inhabited by communities of color or low income.

ALEXANDER COUNTY RACIAL DEMOGRAPHICS (Source: USCB, 2019a)

<i>Census Group</i>	<i>Percent of Population</i>
White	64.9%
Black or African American	31.8%
American Indian or Alaska Native	0.5%
Asian	0.3%
Native Hawaiian or Other Pacific Islander	0.2%
Two or More Races	2.4%
Hispanic or Latino	1.9%

ALEXANDER COUNTY INCOME DATA (Source: USCB, 2019a)

County Median Household Income:	\$38,806
National Average Median Household Income:	\$68,703
Percent of Population in Poverty	24.0%

4.2.1.2 Existing Conditions

During Stakeholder Meeting #2, floodplain and flooding issues were discussed in depth. Representatives from Alexander County, Alexander County Soil and Water Conservation District, The Nature Conservancy, Cairo NAACP and the Illinois Farm Bureau were present during the meeting and discussed the flooding issues the county is facing. A synopsis of these issues can be found in the subsections below. Specific recommendations on how to address these issues are included in Section 3.7.

4.2.1.2.1 Hydrology

The western and southern boundary of Alexander County (and Illinois) is formed by the Mississippi River, and the eastern boundary of the county is formed by the Cache and Ohio rivers. The southernmost point of Alexander County is located at the confluence of the Mississippi and Ohio rivers. Alexander County is primarily located in the Upper Mississippi River drainage basin, with a small portion of the southeastern part of the county in the Ohio River drainage basin. Alexander County is intersected by multiple U.S. Geological Survey eight-digit Hydrologic Unit Code (HUC8) watersheds (i.e., sub-basin level hydrologic units, such as medium-sized river basins), including the Upper Mississippi-Cape Girardeau (HUC8 07140105), Cache (HUC8 07140108), and Lower Ohio (HUC8 05140206) watersheds. Mean annual precipitation for Alexander County is approximately 47.6 inches, with precipitation being evenly distributed throughout the year, averaging between 3.0 to 4.8 inches per month.

Alexander County is bordered by the Mississippi and Ohio rivers, resulting in a large portion of the county being in the FEMA floodplain. Dogtooth Bend, a riverine peninsula formed by a meander of the Mississippi River, is located west of Cairo. Located north of Dogtooth Bend is Horseshoe Lake, an oxbow lake that was formerly a large meander of the Mississippi River but has since been abandoned by the mainstem. Additional levees are located east of Dogtooth Bend surrounding the city of Cairo. These levees are managed by the Corps' Mississippi River Commission as part of the Mississippi River and Tributaries System. An additional agricultural levee is located in northern Alexander County across from Cape Girardeau and protects approximately 550,000 acres of farmland.

4.2.1.2.2 Flooding Impacts

Alexander County has been subject to many flooding events throughout its history. In recent years, agricultural lands at Dogtooth Bend have been flooded to the point that they are no longer farmable. To combat the financial impacts to farmers and other residents in the Dogtooth Bend area, The Nature Conservancy has been working with the Natural Resources Conservation Service and local residents to enroll landowners in easement programs that provide financial compensation to those that are unable to farm their land due to flooding. This helps to reconnect the floodplain to these agricultural areas and increases floodplain benefits for those living in the area (USDA-NRCS, 2020).

The Len Small Levee, initially installed in 1945 to enable agriculture at Dogtooth Bend, was breached in 1993, 2011 and 2016 and has remained in disrepair following the most recent failure. The levee's failure has been linked to the alluvial sediment deposited at the location by the historical Ohio River. This sediment is readily eroded by the Mississippi River and further levee repairs will only serve as a temporary solution that fails to address the larger structural issues present (Olson and Speidel, 2020). In addition, water contained behind the Len Small Levee results in backwater flooding into Horseshoe Lake located upstream. The flooding is threatening infrastructure at Horseshoe Lake and the associated sedimentation from flooding is

damaging existing natural resources (i.e., habitat for waterfowl), recreational resources and associated recreational infrastructure.



2011 Flood (top) and 2010 (bottom) in Alexander County, Illinois.
Photo credit: NASA

Cairo is regularly subjected to flooding events that disproportionately impact the city's communities of low-income and color. In April 2011, Alexander County received 16.1 inches of rainfall which, combined with upstream runoff from snowmelt, brought the river to a record 61.72 feet, within 2 feet of the levee's capacity (Shaw, Song and Michels, 2018). To prevent the Ohio River's levee from breaking and flooding the town, the Corps manually breached the levee downstream and flooded the Birds Point New Madrid Floodway, a 130,000-acre parcel of farmland located downstream in the state of Missouri. In addition to concerns about the effectiveness of Cairo's levee system, Cairo suffers from groundwater intrusion and has

outdated, underperforming storm and sewer infrastructure. The impacts of inadequate storm and sewer infrastructure are felt by residents on an annual basis when intense rainfall events overwhelm the existing infrastructure and flood residential areas and homes.

The U.S. Census Bureau's 2019 population estimate shows Cairo's population is rapidly shrinking, which directly impacts the tax revenue that the City is able to generate to maintain critical infrastructure, including levees. Although these levees are managed by the Corps, the City of Cairo is responsible for maintaining the associated pump stations. In light of these population and tax revenue estimates, Cairo's financial capabilities to maintain the pump stations is a concern.

4.2.1.2.3 Biological and Natural Resources

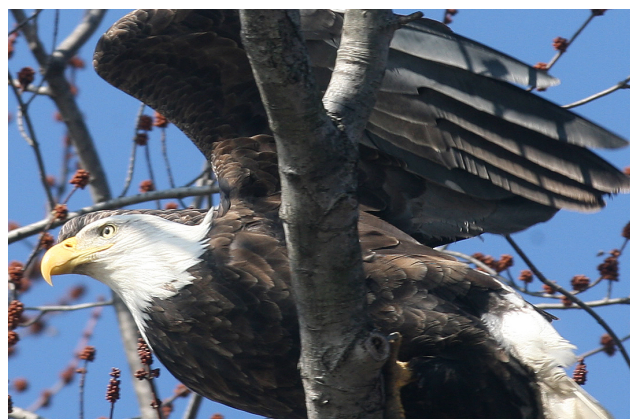
A total of 36 federally listed threatened and endangered species or critical habitats occur in Alexander County. These species should be considered when discussing potential floodplain management decisions in the county. The 12 federally listed threatened species include one mammal, one bird, one reptile, one mussel, and eight plants. The 21 federally listed endangered species include two mammals, two birds, one fish, 10 mussels, one snail, three insects, one crustacean, and one plant. Additionally, Alexander County contains designated critical habitat for one bird, one mussel, and one insect. A comprehensive list of species can be viewed online through the U.S. Fish and Wildlife Service website at fws.gov/midwest/endangered/lists/illinois-spp.html

A total of 47 IDNR state-listed threatened and endangered species occur in Alexander County. These species should also be considered when discussing potential floodplain management decisions in the county. Of these species, 13 are state-listed threatened, including seven plants, two amphibians, one fish, one bird, one mammal, and one reptile. State-listed endangered species in Alexander County include 17 plants, six fish, five birds, four mammals, one reptile, and one crustacean. A comprehensive list of species can be viewed online through IDNR's website at www2.illinois.gov/dnr/ESPB.

Additionally, the bald eagle (*Haliaeetus leucocephalus*), which is afforded protection through the Bald and Golden Eagle Protection Act, is present in Alexander County.

Although none of these resource concerns occur directly within the city of Cairo, both the state-listed endangered osprey (*Pandion haliaetus*) and bald eagle have been spotted in proximity to the city and have potential to occur within the city limits.

Alexander County contains numerous sections of land enrolled in the Illinois Natural Areas Inventory. The inventory shows high-quality natural areas, habitats of endangered species and other significant natural features intended to guide and support public, private and non-governmental organization land acquisition and protection. These lands, however, are disconnected from Cairo, the only environmental justice community in Alexander County. Illinois Natural Areas Inventory lands within Alexander County can be viewed in Appendix B.



Bald eagle, Illinois River, Illinois.
Photo credit: Chris Young

4.2.2 East St. Louis and Centreville²

4.2.2.1 Location and Demographics

Centreville is located in western Illinois within St. Clair County, along the state's border with Missouri (see Appendix B). The border follows the Mississippi River, which separates East St. Louis, Illinois, from the city of St. Louis, Missouri. Centreville covers approximately 4.2 square miles southeast of East St. Louis and is part of the larger St. Louis metropolitan area. Centreville had an estimated population of 5,309 at the 2010 census. The U.S. Census Bureau estimates that the city has seen a 5.8 percent decrease in population from 2010 to 2019, with the estimated population in 2019 being 4,999 people (USCB, 2019b).

Centreville has multiple IEPA-designated environmental justice areas that are populated by communities of low income and color (see Appendix B).

CENTREVILLE RACIAL DEMOGRAPHICS (Source: USCB, 2019b)	
Census Group	Percent of Population
Black or African American	93.2%
White	4.6%
Native American or Alaska Native	1.6%
Asian	0.2%
Two or More Races	0.4%
CENTREVILLE INCOME DATA (Source: USCB, 2019b)	
Centreville Median Household Income:	\$21,370
National Average Median Household Income:	\$68,703
Percent of Population in Poverty	42.1%

4.2.2.2 Existing Conditions

During Stakeholder Meeting #2, flooding and floodplain issues in East St. Louis and Centreville were discussed in depth. Residents from Centreville and representatives from the East St. Louis NAACP and the Illinois Farm Bureau were present and discussed the issues these communities are facing. A synopsis of these issues can be found in the subsections below. Specific recommendations on how to address these issues are included in Section 3.7.

4.2.2.2.1 Hydrology

Centreville is located in the Upper Mississippi River drainage basin within the Cahokia-Joachim watershed (HUC8 07140101). The Mississippi River is located in proximity to Centreville, which is situated within its floodplain. This part of the Mississippi's floodplain is known as the American Bottom. Mean annual precipitation for East St. Louis and Centreville is 39.46 inches. May is typically the wettest month, with an average 4.2 inches of precipitation.

² During the course of this study, a referendum was passed that combined the neighboring municipalities of Centreville, Cahokia, and Alorton. While the new community of Cahokia Heights was established by the finalization of this report, we maintained the original names for clarity.

Near Centreville, the Mississippi River is contained by the Metro East Levee system. During precipitation events, runoff in the Cahokia-Joachim watershed flows from east to west toward the Mississippi River due to topographical influence. Precipitation that falls in the bluffs east of Centreville drains into Centreville, resulting in frequent urban flooding events. Stormwater infrastructure is designed to pump the water out of Centreville into East St. Louis and subsequently into the Mississippi, but similar infrastructure issues in East St. Louis prevent Centreville from pumping stormwater out of the area. East St. Louis' stormwater infrastructure is unable to handle the combined stormwater input from Centreville in addition to their own load. As a result, stormwater accumulates in Centreville and overloads their current infrastructure, resulting in constant degradation and increasingly common flood events.

4.2.2.2.2 Flooding Impacts

Many residents attribute the current infrastructure issues in Centreville to extreme flooding that occurred in 1993, commonly referred to as the Great Flood of 1993. The Great Flood of 1993 resulted in at least 32 deaths and approximately \$15 to \$20 billion in damage (Larson, 1996). During stakeholder engagement sessions, residents of Centreville noted that infrastructure issues in the city became much worse following these floods; residents assume that infrastructure became damaged during the flood and never received necessary repairs. Because of this, the aboveground stormwater pumps and sewage system do not function properly and continue to degrade.

Centreville's pump systems are unable to keep up with the amount of water they need to convey to keep residents' homes safe from flood events. Because of the overloaded stormwater and sewage systems, basements in Centreville flood on an annual basis and residents are replacing major appliances (i.e., water heaters, furnaces, air conditioning systems, etc.) every 2 to 3 years. During annual flood events, raw sewage backs up into residential properties and spills out of toilets and sinks. To avoid interior damage from sewer backups, some residents have installed "clean-out pipes" in their yards that allow sewers to spill out onto their lawns instead of the inside of their homes. Residents are then required to pay for removal of the sewage from their lawns in addition to the sewer fees they are already paying for and outdated, damaged infrastructure.

Due to Centreville's failing stormwater and sewer infrastructure, many residents are concerned for their health. Clean-out pipes re-route sewage onto the lawns, the city's wastewater is seen bubbling out of manholes, and many residents report living with mold in their homes (St. Louis Post-Dispatch, 2020). Residents also expressed concerns about the quality of their drinking water. Illinois American Water has flushed the lines in Centreville and declared the water is safe to drink, but many residents still do not trust the infrastructure and resort to purchasing and obtaining bottled water through organizations, like the Urban League of Metropolitan St. Louis, to avoid the risk.

Frequent flooding and substandard municipal infrastructure have lowered property values in Centreville. Due to the issues described above, many homeowners are unable to sell their homes and relocate to safer areas. Updates to municipal infrastructure are not currently possible due to the magnitude of the problem and negative population trends over the past decade that have resulted in a shrinking tax revenue pool necessary for capital improvements. To compound problems even further, many grant programs that are available for infrastructure upgrades are not accessible to these communities due to cost-sharing requirements.

4.2.2.2.3 Biological and Natural Resources

Centreville has no recorded sightings of federally or state-listed threatened or endangered species. However, Alorton, Illinois, located 0.5 mile west of Centreville, is home to the Alorton Heron Rookery, which contains habitat for the snowy egret (*Egretta thula*), little blue heron (*Egretta caerulea*), black-crowned night-heron (*Nycticorax nycticorax*) and the yellow-crowned night-heron (*Nyctanassa violacea*), all state-listed endangered species. Additionally, Centreville is intersected by the Frank Holten State Recreational Area, a 1,080-acre urban state park that contains habitat for the state-listed threatened blue sage (*Salvia azurea*) and bald eagle (protected under the Bald and Golden Eagle Protection Act). Because of their proximity to Centreville, these species should be considered when discussing potential floodplain management decisions.



Egrets in a floodplain, Illinois.
Photo credit: Chris Young

4.3 CENTRAL ILLINOIS

4.3.1 Freeport

4.3.1.1 Location and Demographics

The city of Freeport is located in northern Illinois within Stephenson County, approximately 20 miles south of the Wisconsin border (see Appendix B). The estimated population of Freeport was 25,638 at the 2010 census. The U.S. Census Bureau estimates that the city has seen a 7.3 percent decrease in population from 2010 to 2019, with the estimated population in 2019 being 23,775 people (USCB, 2019c).

Large areas of northeastern Freeport are dominated by low-income residents and have been designated as environmental justice areas by the IEPA (see Appendix B).



Flood damage in Freeport, Illinois.
Photo credit: U.S. National Archives

FREEPORT RACIAL DEMOGRAPHICS (Source: USCB, 2019c)

<i>Census Group</i>	<i>Percent of Population</i>
White	81.8%
Black or African American	13.8%
Native American or Alaskan	0.2%
Asian	1.0%
Pacific Islander	0.04%
Other Races	1.0%
Two or More Races	2.2%
Hispanic or Latino of any Race	2.1%

FREEPORT INCOME DATA (Source: USCB, 2019c)

Freeport Median Household Income:	\$35,399
National Average Median Household Income:	\$68,703
Percent of Population in Poverty	13.1%

4.3.1.2 Existing Conditions

During Stakeholder Meeting #3, floodplain and flooding issues for the city of Freeport were discussed in depth. Representatives from NFIP, the NAACP and the Illinois Farm Bureau were present during the meeting and discussed the flooding issues the community is facing. A synopsis of these issues can be found in the subsections below. Specific recommendations on how to address these issues are included in Section 3.7.

4.3.1.2.1 Hydrology

Freeport is bordered by the Pecatonica River along the northern boundary of the city and Yellow Creek along the southern boundary of the city. The Pecatonica River is a major tributary of the

Rock River. Freeport is entirely within the Pecatonica watershed. The Pecatonica River is one of the major rivers that comprises the Rock River Basin, which occupies 6,481 square miles in northwest Illinois. Mean annual precipitation in Freeport is approximately 37.2 inches, occurring throughout the year. June is the wettest month on average, which combines with spring snowmelt from upstream and results in flooding along the Pecatonica River. The river channel that comprises the Pecatonica River has wide bows and frequently doubles back, creating a wide floodplain with an average width of 1 mile or more (Sinclair, 1996).

The Pecatonica River watershed runs south from southern Wisconsin into Illinois, with the majority of the land cover within the watershed used for agricultural practices (82 percent) and only a small portion of the watershed being urban residential (7 percent), mostly within the east side of Freeport. The Pecatonica River watershed is predominantly characterized by rolling hills and well-developed stream valleys (IEPA, 2014).

A 2016 study by the Wisconsin Department of Natural Resources focused on the non-wadable waters of the Pecatonica River upstream of Stephenson County, Illinois. The study determined that the best approach for mitigating excessive flooding and poor water quality downstream is to focus efforts in smaller HUC12 watersheds (i.e., sub-watershed level hydrologic units, such as tributary systems), as practically-sized implementation areas. Implementing landscape-level best management practices may slowly improve the water quality and reduce flood risks in the watershed over long periods of time. Implementation practices such as barnyard and pasture management and streambank stabilization to reduce sediment runoff and nutrients from fields and reduce erosion of streambanks are all viable options.

4.3.1.2.2 Flooding Impacts

The Pecatonica River and Yellow Creek both experience regular flooding, impacting both residential and agricultural communities. There are no levees in place outside of the city of Freeport.

In March 2017, the Pecatonica River reached its highest river crest since 1938, reaching a height of 17 feet. Since flooding events in 2017 and 2018, many community members on the east side of Freeport have been forced to relocate, leaving many empty homes. Since May 2017, the Pecatonica River has flooded Freeport seven times. The necessary flood cleanup has cost the City of Freeport more than \$1.5 million (Better Government Association, 2019).

Construction along the Pecatonica River within Freeport has been halted since severe flooding in 1994. The City of Freeport has pursued homeowner buyout programs due to increased flooding occurrence, but lack of outreach and limited public interest has affected the success of the buyout programs and, in general, the buyout programs have had a contentious history in Freeport, even with increasing efforts by individuals, families and City officials to mitigate flooding impacts on an annual basis. With the current suite of flood risk reduction options, buyouts are the only path forward for the residents on the east side of Freeport. Many of the homes within the Pecatonica River floodplain, especially in the northeast portion of Freeport, have low property values. Because these buyouts are based on a home's current market value in the city of Freeport, where home values are typically low, homeowners accepting a buyout cannot afford to purchase a home elsewhere. Additionally, the remaining families and individuals are deeply culturally connected to the east side of Freeport and are hesitant about losing touch with their local cultural heritage. Outside of the city of Freeport, land use is predominantly agricultural, which raises some community stakeholder concerns about overlapping land use.

4.3.1.2.3 Biological and Natural Resources

State-listed endangered species present within Freeport include yellow birch (*Betula alleghaniensis*), downy yellow painted cup (*Castilleja sessiliflora*), spike (*Eurynia dilatata*) and blacknose shiner (*Notropis heterolepis*). Additionally, the state-listed endangered tall sunflower (*Helianthus giganteus*) may occur within the vicinity of Freeport. There are no state-listed threatened species in Freeport.

The Freeport Prairie Nature Preserve is the only nature, land or water preserve located in the city of Freeport. The preserve is located in the south-central part of Freeport and is in proximity to the environmental justice areas of concern in the city.

4.3.2 Rockford

4.3.2.1 Location and Demographics

The city of Rockford, Illinois, is located in central Illinois within Winnebago County, approximately 20 miles south of the Wisconsin border and 25 miles east of Freeport (see Appendix B). Rockford has an area of approximately 65.39 square miles and the largest population in the state of Illinois outside of the Chicago metropolitan area, with an estimated population of 152,871 at the 2010 census. The U.S. Census Bureau estimates that the city has seen a 4.8 percent decrease in population since the 2010 census, placing the current (2019) population estimate at 145,609 people (USCB, 2019d).



Kent Creek in Rockford, Illinois.
Photo credit: Olivia Dorothy

The city of Rockford contains many IEPA-designated environmental justice areas (see Appendix B) that are inhabited by populations of color or low income.

ROCKFORD RACIAL DEMOGRAPHICS (Source: USCB, 2019d)

<i>Census Group</i>	<i>Percent of Population</i>
White	65.1%
Black or African American	20.5%
Native American	0.4%
Asian	2.9%
Pacific Islander	0.01%
Other Races	7.5%
Two or More Races	3.6%

ROCKFORD INCOME DATA (Source: USCB, 2019fd)	
Rockford Median Household Income:	\$38,000
National Average Median Household Income:	\$68,703
Percent of Population in Poverty	14.0%

4.3.2.2 Existing Conditions

During Stakeholder Meeting #2, floodplain and flooding issues for the city of Rockford were discussed in depth. Representatives from the Rockport NAACP, the City of Rockport, and the Illinois Farm Bureau were present during the meeting and discussed the flooding issues the community is facing. A synopsis of these issues can be found in the subsections below. Specific recommendations on how to address these issues are included in Section 3.7.

4.3.2.2.1 Hydrology

Rockford is situated on the banks of the Rock River, which flows south into the Mississippi River. Rockford is located in the Upper Mississippi drainage basin and almost entirely within the Lower Rock watershed (HUC8 07090005). A small portion of the eastern and southern boundaries of the city lies within the Kishwaukee watershed (HUC8 07090006). The Rock River is one of the major rivers that comprises the Rock River Basin, which occupies 6,481 square miles in northwest Illinois. Mean annual precipitation in Rockford is approximately 36.2 inches, occurring throughout the year; June is typically the wettest month, with an average 4.7 inches of precipitation.



Rock River floodplain, Illinois.
Photo credit: Olivia Dorothy

Increased development along the Rock River coupled with increasing storm frequency has created more severe flooding events within the city of Rockford. Currently, there are no levees or adequate stormwater infrastructure in place along the Rock River to mitigate flooding events. During Stakeholder Meeting #2, local stakeholders commented on the lack of land use plans addressing flooding along the Rock River.

4.3.2.2.2 Flooding Impacts

Within Rockford, the major areas of concern for high-risk flooding coincide with areas with communities of color and low income. Areas such as the southern and western sides of Central Avenue frequently sustain the worst impacts of flooding events and have the most difficulty rebounding economically, as many families struggle to afford flood insurance premiums. Most of the western side of Rockford has been designated by the IEPA as environmental justice areas, with communities of color and low income.

Most watersheds in Rockford have a combination of urban and rural land uses. Concerns raised by some community stakeholders directly relate to the overlapping land use. Specifically, residents expressed concern about a large condominium community on the east side of Rockford, where water that is discharged from farmland located upstream of the community frequently floods the building and its grounds where it ponds into a lake. The people who live in the condominiums are often displaced and live with environmental and public health concerns as a result of these upstream releases.

In recent years, flooding events in the Rock River have steadily become more frequent. Two of the top five historic crests of the Rock River, measured a few miles upstream from Rockford, were recorded in 2018 and 2019 (NOAA, 2021a). The significant increase in Rock River flooding has exacerbated impacts to citywide infrastructure, residential subdivisions, and agricultural zones. Local stakeholders have commented on agricultural practices being severely impacted with damaging flooding events now occurring every 1 to 2 years within the last decade, which previously occurred an average of only 2 out of every 10 years. One local farmer whose land abuts Keith Creek put 10 acres into a wetland reserve program, as those acres had become unsustainable to use as productive agricultural land.

In 2006 and 2007, Keith Creek sustained back-to-back years of 100-year flooding events. Keith Creek is a tributary of the Rock River and runs west to east across the northwestern section of Rockford. Since the flooding events in 2006 and 2007, the City of Rockford has invested heavily in acquisition and demolition of residential homes in the path of the Keith Creek floodplain. These activities have resulted in 122 homes being acquired and demolished through grants to return the creekside to a more natural setting and encourage stream meandering. However, the creek is essentially channelized at this location and requires additional investment to restore it to natural greenspace. Funding for citywide restoration projects continues to be the most pressing issue preventing large-scale floodplain and infrastructure improvements.

The Alpine Dam, which is located east of Rockford along Keith Creek and regulates flow into Rockford, is scheduled to undergo infrastructure improvements to satisfy infrastructure standards over the next 2 years after the City of Rockford allocated \$2.5 million in funding for the necessary upgrades. In a 2007 report written by the Corps, the Alpine Dam is described as “in poor condition due to its age and does not meet federal design standards” (The Corps, 2009). Improvements are aimed at better regulating flood waters and preventing dam failure.

Rockford currently lacks an extensive network of stormwater basins, whereas other nearby municipalities have regional stormwater management infrastructure. Additionally, Winnebago County does not have the State-granted authority for countywide stormwater management. Rockford does, however, have an established Stormwater Environmental Management Team, whose purpose is “protecting and improving the quality of local bodies of water [...] by implementing flood control systems, water monitoring, and enforcing water-friendly construction practices that follow Environmental Protection Agency standards.” The Rockford Stormwater Environmental Management Team has produced regulatory documents such as the 2015 Stormwater Management Plan, the 2015 Stormwater Management Ordinance, and 2018 and 2019 Annual Reports. These documents are made available for public viewing on the website for the City of Rockford.

4.3.2.2.3 Biological and Natural Resources

A total of seven state-listed threatened and endangered species are present within the city of Rockford. These species should be considered when discussing potential floodplain management decisions in Rockford. State-listed threatened species include gravel chub (*Erimystax x-punctatus*), river redhorse (*Moxostoma carinatum*), black-billed cuckoo (*Coccyzus erythrophthalmus*) and Franklin’s ground squirrel (*Poliocitellus franklinii*). State-listed endangered species include rusty patched bumblebee (*Bombus affinis*) (also federally listed endangered), upland sandpiper (*Bartramia longicauda*), and large-flowered beard tongue (*Penstemon grandifloras*). In addition, bald eagles (federally protected under the Bald and Golden Eagle Protection Act) are present in the city of Rockford.

The Searls Park Prairie Nature Preserve is the only Illinois nature preserve within the city limits and is located several blocks away from IEPA environmental justice communities. In the area surrounding Rockford (outside of the city limits), there are several other Illinois nature, land and water preserves. Similar to the Searls Park Prairie Nature Preserve, these are all disconnected from IEPA-designated environmental justice communities. These include the Harlem Hills Nature Preserve to the northeast, the Johns Mound Group Land and Water Reserve, the Silver Creek Prairie Natural Heritage Landmark, the Howard D. Colman Dells Nature Preserve and the Severson Dells Nature Preserve, all to the west, and the Winquist Prairie Natural Heritage Landmark to the southeast.

4.3.3 Danville

4.3.3.1 Location and Demographics

The City of Danville is the county seat of Vermilion County. Danville is located approximately 120 miles south of Chicago and 35 miles east of Champaign-Urbana (see Appendix B). The population of Danville was estimated at 33,027 in 2010. The U.S. Census Bureau estimates that the city has seen a 7.7 percent decrease in population since the 2010 census, placing the current estimated population at 30,479 people (USCB, 2019e).

The IEPA has designated large sections in the center of Danville along Stoney Creek and along Lick Creek in the northwestern edge of Danville as environmental justice areas because they contain mostly communities of color and low income (see Appendix B).

DANVILLE RACIAL DEMOGRAPHICS (Source: USCB, 2019e)	
Census Group	Percent of Population
White	70.2%
Black or African American	24.4%
Native American	0.2%
Asian	1.2%
Pacific Islander	0.03%
Other Races	2.1%
Two or More Races	1.9%
Hispanic or Latino of any Race	4.6%
DANVILLE INCOME DATA (Source: USCB, 2019e)	
Danville Median Household Income:	\$30,143
National Average Median Household Income:	\$68,703
Percent of Population in Poverty	18.1%

4.3.3.2 Existing Conditions

During Stakeholder Meeting #3, flooding and floodplain issues in Danville were discussed in depth. Representatives from NFIP, the City of Danville, the NAACP and the Illinois Farm Bureau were present and discussed the issues Danville is facing. A synopsis of these issues can be found in the subsections below. Specific recommendations on how to address these issues are included in Section 3.7.

4.3.3.2.1 Hydrology

Danville is almost entirely within the Vermilion watershed (HUC8 05120109), with a small section of the eastern edge of the city within the Middle Wabash-Little Vermilion watershed (HUC8 05120108). Average monthly precipitation ranges from 1.99 inches in February to 4.70 inches in June, which is the wettest month of the year for Danville.

Lake Vermilion, a 1,000-acre reservoir and important recreational and tourist attraction, is located along the northern edge of Danville. Danville is within the floodplain of several nearby rivers and creeks, including the Vermilion River, North Fork River, Lick Creek and Stony Creek. These waterways are all tributaries of the larger Wabash River, which conveys flow from headwaters in Ohio through Indiana and joins the Ohio River on the border of Illinois and Kentucky. Stony Creek runs through a community of color as well as a community of low income in the center of Danville.

4.3.3.2.2 Flooding Impacts

In recent years, increasing flooding occurrence and severity has promoted community investment in mitigating flood risks and damage; however, Danville still lacks adequate funding to combat current flood risks and the likelihood for increased flood risk in the future. Buyout programs, organized by the City of Danville, are currently in place in areas of high flood risk, such as where Stony Creek flows through the center of Danville's communities of low income. Common issues faced by city residents include flooding in the streets, which restricts vehicular transportation, and flooding of residences, which causes millions of dollars in property damage and threatens the health and safety of residents. During Stakeholder Meeting #3, community stakeholders expressed concerns about the flooding along Stony Creek that impacts residences in communities of low-income. Stakeholders also shared concerns regarding inadequate and outdated infrastructure along North Fork Creek, which impacts citywide resources.

Sequential storm days resulted in 6 to 8 inches of rainfall within a few days across Danville in 2016. Severe flooding coupled with the overloaded and outdated stormwater drainage system forced the Danville Elementary School into closure for the remainder of the 2016–2017 school year. Infrastructure in Danville is outdated, ranging in age from 50 to 80 years of operation.

North of the city of Danville, the North Fork of the Vermilion River floods annually and causes problems in recreational parks frequented by Danville residents as well as structures downstream. In 1994, the Danville Sanitary District's water treatment plant was inundated with flood water and caused a sewage leak into the watershed and residential areas. Immediately following the incident, a barrier was placed around the water treatment plant in Danville to prevent floodwater from the Vermilion River from contaminating the treatment facility and to prevent sewage leaks. Additionally, dams were removed from the North Fork of the Vermilion River in 2018, which has had some positive impacts on flooding reduction south into Danville.

The City of Danville and the NFIP conducted a previous community outreach exercise to gain input on flooding issues in the city. Results from a survey into citywide drainage problems resulted in a common understanding of problems facing Danville, including street flooding, property flooding, erosion, rolling topography, abundance of creeks and watersheds in the area, overdevelopment in creeks and drainages and out-of-date infrastructure. The takeaway of the survey was that, at this time, community stakeholders are interested in focusing efforts on infrastructure updates to address the issues created through overdevelopment and out-of-date, inadequate infrastructure.

In addition to these data gathering efforts by the City of Danville and the NFIP, community members are engaged in an existing effort to select and implement infrastructure improvements in Danville. Forty potential projects were identified by the NFIP and the City of Danville; however, there is insufficient funding to pursue these projects. An effort to prioritize some of these projects resulted in 10 top-priority projects being selected. The City Council of Danville approved a rate increase on the storm and sanitary sewer bills in 2020, which is set to generate close to \$1 million a year to go toward stormwater and sewer projects. However, residents expressed concern over the priority projects that were selected, citing that the distribution of these projects is inequitable and does not benefit communities of color proportionally.

4.3.3.2.3 Biological and Natural Resources

A total of seven state-listed threatened and endangered species are present within Danville. These species should be considered when discussing potential floodplain management decisions in Danville. State-listed threatened species include wavy-rayed lampmussel (*Lampsilis fasciola*), purple wartyback (*Cyclonaias tuberculata*), bigeye chub (*Hybopsis amblops*), monkeyface (*Quadrula metanevra*), eastern sand darter (*Ammocrypta pellucida*) and river redhorse. State-listed endangered species include bluebreast darter (*Etheostoma camurum*).

Danville has no Illinois nature, land, or water preserves or INAI lands within its city limits.

4.4 CHICAGO

4.4.1 Ford Heights

4.4.1.1 Location and Demographics

The village of Ford Heights is located approximately 25 miles south of Chicago in Cook County, Illinois (see Appendix B), and has an area of 1.95 square miles. Ford Heights is 3.5 miles west of the state's border with Indiana and is bisected by Deer Creek, a source of frequent urban flooding events in the village.

Ford Heights had an estimated population of 2,858 at the 2010 census. The U.S. Census Bureau estimates that the village has seen a 4.3% decrease in population since the 2010 census, placing the current population estimate at 2,736 people (USCB, 2019f).

Ford Heights is an IEPA-designated environmental justice area that is inhabited by communities of color and low income (see Appendix B).

FORD HEIGHTS RACIAL DEMOGRAPHICS (Source: USCB, 2019f)	
Census Group	Percent of Population
Black or African American	95.6%
White	2.9%
Two or More Races	1.4%
FORD HEIGHTS INCOME DATA (Source: USCB, 2019f)	
County Median Household Income:	\$34,167
National Average Median Household Income:	\$68,703
Percent of Population in Poverty	41.2%

4.4.1.2 Existing Conditions

During Stakeholder Meeting #3, flooding and floodplain issues in Ford Heights were discussed in depth. Representatives from NFIP, Kankakee NAACP, the Metropolitan Water Reclamation District of Greater Chicago, and Ford Heights Mayor Annie Coulter were present and discussed the issues Ford Heights is facing. A synopsis of these issues can be found in the subsections below. Specific recommendations on how to address these issues are included in Section 3.7.

4.4.1.2.1 Hydrology

Ford Heights is located in the Upper Mississippi River drainage basin and lies within the Chicago watershed (HUC8 07120003). Mean annual precipitation for Ford Heights (Cook County) is 36.45 inches occurring throughout the year. June is typically the wettest month, with an average of 4.3 inches of precipitation.

Peak precipitation in June combines with spring snowmelt from upstream and results in overbank flooding in Deer Creek, which has damaged approximately 40 percent of the homes in the area (The Corps, 2014). To help prevent overbank flooding in Ford Heights, the Corps constructed a 238-acre-foot reservoir in 2014. The reservoir is located in southeast Ford Heights, west of Illinois Route 394 and south of U.S. Route 30. Additional work was done within Deer Creek, including channel clearing, channel modifications and ecosystem restoration.

FEMA flood maps for the residential areas west of Deer Creek and north of Lincoln Highway show that the 100-year flood event is restricted to the banks of Deer Creek. The FEMA 500-year floodplain includes small portions of the residential area. However, local topography slopes westward toward the residential area, which allows water to pond in areas outside of the FEMA-mapped floodplain.

4.4.1.2.2 Flooding Impacts

Despite the Corps' efforts to reduce flooding, Ford Heights is still subjected to annual flooding from Deer Creek. Flood events in February 2018 overwhelmed the village and shut down many roads and schools. Although the areas that are flooding on an annual basis are in the 500-year FEMA floodplain, representatives from Metropolitan Water Reclamation District of Greater Chicago indicated that only 2 or more inches of rain is needed to result in overbank flooding that will drain west into the residential area. These flows overwhelm Ford Heights' existing stormwater infrastructure and make streets impassable, preventing residents from leaving their homes and causing structural damage.

Flooding issues in Ford Heights are multi-faceted. Although there has been some planning done to evaluate the benefits of a levee system, this improvement alone likely would not stop flood events from occurring. The existing stormwater infrastructure in Ford Heights cannot handle the large precipitation events that are occurring annually; therefore, in addition to flood mitigation infrastructure like levees, an overhaul of existing stormwater infrastructure will need to occur to completely mitigate risk.

4.4.1.2.3 Biological and Natural Resources

Ford Heights has no recorded sightings of federally or state-listed threatened or endangered species. Southeast of Ford Heights in Sauk Village, there is INAI-designated Category I prairie habitat at the Sauk Village Railroad Prairie.

4.5 STAKEHOLDER RECOMMENDATIONS

Throughout the stakeholder engagement process, recommended actions to help resolve and/or lead to improvements to floodplain issues were discussed and recorded. In addition, any potential barriers (i.e., regulatory, funding, environmental, etc.), that would limit actions that would lead to multi-benefit floodplain development were outlined, as were any existing programs or funding sources that support this work.

Many potential solutions were identified by the stakeholders for the multitude of issues in the six case studies. It is worth noting that similar issues were identified and similar recommendations were made for many of the case studies. Because of the similarities identified in issues and recommendations, a Stakeholder Recommendations Table (Appendix A) has been developed. The significant overlap and consistency in issues indicates widespread flood risk management problems in Illinois communities.

These themes emerged in all six case studies:

- Lack of community education and community led public engagement.
- A clear need for combinations of green and gray infrastructure.
- Housing and relocation assistance with buyout programs.
- Resiliency planning.
- Flood insurance accessibility.

The Stakeholder Recommendations Table in Appendix A provides additional details on the most common recommendations listed above as well as others that were made throughout the stakeholder process.

5. Strategies for Floodplain Management in Illinois

To assist both urban and rural communities in reducing flood risk and improving health, safety and economic prosperity, several strategies for enhancing floodplains and reducing flood risk are discussed in this section. Technical floodplain management strategies (like infrastructure improvements or modification) and non-technical strategies (like community education and outreach) are both discussed in detail to cover the broad range of issues facing the state of Illinois. These specific strategies were developed based on the community issues identified during the stakeholder engagement process (see Appendix A – Recommendations Table).

5.1 TECHNICAL FLOODPLAIN MANAGEMENT STRATEGIES

Technical floodplain management strategies for reconnecting and managing hydrology can come in many forms. Prior to employing any of these techniques, it is important that proper investigation and study into the underlying problems are conducted to determine the best site-specific solution. In some cases, utilizing multiple techniques and solutions will result in the most resilient and sustainable option. In addition, because floodplain systems are complex, improvement efforts need to look beyond surface characteristics and concentrate on restoring the underlying processes that create and sustain floodplains and their functions (Rohde, et al., 2006; Matella and Jagt, 2014; Matella and Merenlender, 2014). By first identifying the

attributes that underpin functional floodplains (i.e., biophysical and flow), restoration efforts can be directed toward more impactful and self-sustaining outcomes (Loos and Shader, 2016).

The strategies outlined below do not represent the entirety of potential floodplain resiliency techniques. However, these particular technical solutions directly correlate to the issues and potential solutions that were discussed during the stakeholder engagement process. All techniques outlined below follow best available science and are proven (i.e., previously implemented and field tested) to reduce flood risk and address multiple floodplain issues.

5.1.1 Green Infrastructure

Green infrastructure is a restoration and rehabilitation technique that utilizes natural surfaces to capture, hold and percolate water where it falls. It is an approach to water management that protects, restores or mimics the natural water cycle (American Rivers, 2021). This technique builds resiliency by managing stormwater runoff with green space enhancement in urban areas and drainage management in rural areas. Green infrastructure can be used to manage both stormwater quantity and quality, reduce urban “heat islands” (i.e., metropolitan or urban areas that experience higher temperatures than the surrounding, more rural areas), provide wildlife habitat, create open space and generate resilience to climate change. Use of green infrastructure as a water management practice can result in better quality of life by providing open space for community recreation and engagement, filtering stormwater runoff for improved water quality and reducing air temperature and pollution.

Heavy rains have become more frequent and intense in the United States over the past 50 years, increasing the risk of flooding and sewer system overflows (EPA, 2021a; Kennedy, 2014). As a result, the average size of a 100-year floodplain is likely to increase 45 percent by 2100, potentially increasing annual economic damage from flooding by \$750 million (EPA, 2021a). Another growing problem is urban flooding, which is caused by too much rain on impervious surfaces (not by storm surges or overflowing bodies of water). Urban floods primarily affect communities of color and low-income and can result in serious health problems such as asthma and illnesses caused by mold. Installation of green infrastructure reduces flood risk and bolsters climate resiliency and quality of life for communities by capturing rain where it falls and keeping it out of sewers and waterways (Denchak, 2019).



Planter box, Washington, DC.
Photo credit: DC Green Infrastructure

In the context of flood risk reduction, green infrastructure reduces stormwater runoff and protects floodplain ecosystem services. Green infrastructure can be applied to manage both localized and riverine floods. In areas affected by localized flooding, green infrastructure practices absorb rainfall, thereby preventing water from overwhelming stormwater infrastructure, and also prevents ponding and pooling in streets or basements. Rain gardens, rainwater harvesting, bioswales, and permeable pavement are types of green infrastructure practices that enhance local water infiltration. In areas impacted by riverine flooding, green

infrastructure, open space preservation, and floodplain management can complement gray infrastructure approaches, all of which are discussed in this chapter. This approach reduces the quantity of stormwater that flows into streams and rivers, helps protect the floodplains' natural function, and reduces infrastructure and property damage (EPA, 2021a).

5.1.1.1 Rain Gardens

A rain garden is a manmade depression in the landscape that collects rain and surface water from hardened infrastructures (i.e., roofs, streets, parking structures, driveways, sidewalks, etc.), allowing it to percolate into the ground. These depressions can be used in a variety of settings and are scalable. From street medians to yards to urban green spaces such as parks, rain gardens typically feature native vegetation in a shallow basin. For example, planter boxes are a type of rain garden and feature elevated sides with openings that allow water to enter and be absorbed by the vegetation and soil. These green infrastructure features can be used in the space between a sidewalk and street to beautify urban areas with a practical function. In addition to allowing rainfall to evapotranspire (i.e., the sum of evaporation from the land surface plus transpiration from plants) or seep into the ground, rain gardens improve water quality, recharge underground aquifers, provide habitat for wildlife, reduce the quantity of water in stormwater gray infrastructure and beautify urban landscapes (USGS, 2021).

A typical rain garden is 30 percent more absorbent than a conventional lawn. In an analysis of Seattle area rain gardens, researchers estimated that a typical 1,200-square-foot residential rain garden can filter as many as 30,000 gallons of stormwater in a year (Denchak, 2019).

5.1.1.2 Rainwater Harvesting

Rainwater harvesting is a method of capturing rain, stormwater, and runoff from a rooftop or other structure and storing it for later use. Harvested rainwater does not require water treatment and can be used for various municipal activities such as watering lawns and greenspace. In addition, rainwater harvesting provides another avenue for communities to rein in the stormwater runoff that is overwhelming current gray infrastructure throughout Illinois. This green infrastructure practice has the potential to meet 21 to 75 percent of a city's annual water needs, effectively supplying enough non-potable water for up to hundreds of thousands of residents (Garrison, Kloss and Lukes, 2011). Rainwater harvesting can be accomplished in various ways, but typically utilizes cisterns or rain barrels to collect runoff from impervious surfaces (i.e., rooftops, pavement, etc.), making it a relatively inexpensive method of capturing and redistributing stormwater runoff. This green infrastructure practice provides a practical way to meet municipal water needs in the face of climate change, population growth and increased demand from industries such as agriculture and energy, both of which strain water supplies.

5.1.1.3 Bioswales

Bioswales are stormwater runoff conveyance systems that provide an alternative to the use of storm sewers. They tend to be long, relatively deep channels planted with native vegetation and soils that run parallel to impervious surfaces such as roads, parking lots and buildings. They can absorb low flows or carry runoff from heavy rains to storm sewer inlets or directly to surface waters (USDA-NRCS, 2005). Bioswales improve water quality by infiltrating the runoff and filtering the sometimes large quantities of runoff from impervious surfaces. It is estimated that effective bioswales can capture and filter out as much as 90 percent of trace metals, oil, and grease, 70 percent of sediment and about 30 percent of phosphorus from the runoff they collect (Denchak, 2019). In addition, they slow the release of water from heavier rains to sewers or surface waters, thereby limiting floods. This green infrastructure approach emphasizes design and planning techniques that mimic the natural, infiltration-based, groundwater-driven hydrology of the Illinois landscape.



Bioswale.
Photo credit: SUNY College of Environmental Science and Forestry

5.1.1.4 Permeable Pavements

Over half of the rain that falls in urban areas winds up as stormwater runoff (Denchak, 2019). To help reduce runoff from entering urban infrastructure and flooding natural and manmade channels, permeable pavement or porous pavement (including pervious asphalt, pervious concrete, interlocking pavers and plastic grid pavers) can be installed. This pavement system is often used for sidewalks, parking lots, or driveways and allows rainfall to seep through to underlying layers of pollutant-filtering soil before entering groundwater aquifers. Once installation costs are factored in, it can cost as much as 50 percent less up front than conventional pavement systems, and it can be less expensive in the long run to maintain (Clements, St. Juliana and Davis, 2013). In addition, this type of green infrastructure can reduce the need for road salt and cut down on construction costs for residential and commercial development by decreasing the need for conventional drainage features (EPA, 2021b).



Permeable pavement.
Photo credit: Center for Neighborhood Technology

5.1.2 Gray Infrastructure

As discussed in Section 2, gray infrastructure is the most frequently used strategy to reduce flood damage; however, as also discussed, over-reliance on gray infrastructure has many public safety, financial and environmental consequences. Therefore, communities should always consider green infrastructure and other types of natural infrastructure when evaluating flood-related problems. Gray infrastructure relies on “hard structures,” such as levees, which block

water flow, and storm drains, concrete and pipe, that collect and quickly discharge water into rivers or other water bodies. Gray infrastructure does not provide the same range of benefits as green infrastructure, such as flow reduction, water quality improvements, habitat restoration, recreation opportunities and aquifer recharge. In fact, gray infrastructure often has the opposite result, which is why new frameworks and strategies are needed to address flood issues. However, depending on the scale, location and other factors (such as population density), gray infrastructure may be required to complement green infrastructure.

5.1.2.1 Levee Improvements

Seventeen million people live or work behind the approximately 30,000 miles of levees across the United States. Levees protect critical infrastructure systems, \$2.3 trillion of property, and 4,500 schools that collectively enroll over 2 million students (ASCE, 2021). Levees are considered gray infrastructure and can be made of concrete, rock, steel, earth, or any combination of those materials. Many of the existing levees were built prior to 1970 and were, therefore, built using engineering standards less rigorous than the current best practices (ASCE, 2021). Many of the existing levees throughout the United States are built and maintained by the Corps. However, according to the National Levee Database, up to 10,000 miles, or one-third, of levees exist outside of the Corps' portfolio, and the locations and conditions of these levees are unknown due to complex and varying local ownership (The Corps, 2021). Due to levees being undersized, neglected and deteriorating, the Corps estimates that \$21 billion is needed to improve and maintain the moderate to high-risk levees in its portfolio, which represents approximately 15 percent of the known levees in the United States (ASCE, 2021).

As more extreme weather events result in increased flooding, such as the \$20 billion in damages caused by flooding in the Midwest in 2019, it is important that levees across the state of Illinois are maintained, upgraded and replaced, if necessary, in order to mitigate flood risk. In recent years, several innovations have been developed and utilized to help maintain and modernize levees. LIDAR (i.e., light detection and radar) technology is being employed to help assess existing levee vulnerabilities and maintenance issues and efficiently and cost-effectively target improvements (ASCE, 2021). This technology allows for a more accurate evaluation of the risk of a catastrophic levee failure in order to mitigate the impacts. Another more recent technology is the use of drones to fly over levees to collect pertinent data, saving both time and cost (ASCE, 2021).



Mississippi River levee in Illinois.
Photo credit: Crystal Dorothy and LightHawk

Caution should always be used when considering levee improvements due to potential impacts on neighboring properties. Improvements to existing levees should mitigate impacts and integrate green infrastructure wherever possible. Examples include moving levees away from the channel and building spillways to allow water to access the floodplain without damaging the infrastructure, or establishing a tiered levee system, with a lower levee that overtops more frequently, closer to the river, and a higher levee to protect people and critical infrastructure. In addition, some longer levee systems, such as those along the Lower Mississippi River that start

in southern Illinois, use “fuses” to allow water to divert away from areas where there are high concentrations of people, property and infrastructure. Much like fuses designed to protect electronic devices, levee fuses “break” and redirect floodwater into lower-risk areas. While broken levee fuses would require post-flooding repair, the costs to repair the fuses are dramatically lower than the cost of restoring flood-damaged properties and infrastructure in areas of higher population. Restrictions on land development in floodplains, even if they are protected by levees, should be considered to reduce the residual flood risk should the levees fail.

5.1.2.2 Infrastructure Upgrades

Most flood damage in the United States occurs outside of mapped 100-year floodplains. This will only be exacerbated by the projected 45% expansion of the 100-year floodplain by 2100 (EPA, 2021a). In particular, urban flooding occurs largely outside mapped floodplains where runoff overwhelms drainage systems. While this is not a widely studied issue, one study in Illinois found that 90 percent of flood damage claims from 2007 to 2014 were from outside the mapped floodplains (Winters, 2015).

Localized flooding, which occurs when rainfall overburdens urban drainage systems, is among the types of flooding that will likely become more frequent over time; therefore, stormwater infrastructure upgrades are necessary to combat localized flooding. Like other types of infrastructure, the condition of stormwater infrastructure is a function of the quality of construction, appropriateness of size and stability for ever-changing systems, and regular maintenance (National Academies of Sciences, Engineering and Medicine, 2019). Adequate maintenance and timely rehabilitation will keep high-quality and correctly installed infrastructure from deteriorating. However, climate change is driving a need to replace older, smaller infrastructure with larger systems that can convey the ever-increasing amounts of stormwater runoff. As such, stormwater infrastructure should be implemented with a context-sensitive approach. A localized understanding of flood risk and an awareness of land-use practices and regulatory expectations should be taken into consideration during project design and implementation (ASCE, 2021).



This undersized stormwater outfall broke, causing the collapse of the ground above and around the outfall and displacing the outfall structure about 30 feet away from the rest of pipe, East Moline, Illinois.
Photo credit: Olivia Dorothy

To create effective and resilient infrastructure, technological innovations, such as real-time control systems, can be used to model flood events and stormwater surges and predict flooding in various stormwater structures. These systems leverage complex modeling, cloud computing, data storage and predictive analysis. Large datasets can be used to improve the capacity of stormwater conveyance, storage and treatment systems (ASCE, 2021). The affordability of stormwater sensors has also improved, which expands the opportunity for collecting real-time data and having more control over infrastructure functions.

5.1.3 Making Room for the Water

Most large watersheds in the United States have undergone some type of major hydraulic modification for flood control or water supply (e.g., levees, dams, pump stations and diversions) (EPA, 2015). This work is done to facilitate development of floodplains that offer rich resources and proximity to waterways. Floodplains have served as thriving centers of agriculture, trade, industry and residential development for all of human history. Unfortunately, most people do not realize how harmful engineered structures can be, especially since large floods can still overwhelm flood-control structures. When structures fail, they release massive amounts of water all at once, which endangers lives, destroys homes and businesses and costs millions of dollars in repairs. In 2018, the National Weather Service estimated the 30-year flood loss average in the United States to be 82 fatalities and \$7.96 billion annually (Sadiq et. Al, 2019).

In addition to creating an artificial sense of security and encouraging risky development, dams and levees often disconnect rivers from their floodplains and convert them for other uses. Floodplains have been disconnected from waterways on a massive scale across the United States. Floodplains covered an estimated 7 percent (over 270,000 square miles) of the North American continent prior to colonization (Loos and Shader, 2016). Today over 50 percent of North American wetlands have been drained, with the largest loss from forested riverine wetlands, and 46 percent of continental U.S. river riparian areas are classified as intensively cultivated (Tockner and Stanford, 2002).

Engineered river channels are the most common source of disconnection between rivers and floodplains, and structures can take multiple forms, including levees, channelization and channel straightening. Levees, a common flood control tool, were described previously. Other types of river engineering can also limit the amount of water that rivers can safely convey. To facilitate river navigation, river channels are often straightened, dredged, and cleared of snags and obstructions. These engineering practices turn rivers into simplified pipes that move water downstream more quickly and with more energy. As a result of these projects, large areas of once functional floodplain become disconnected from rivers. The Mississippi River is one of the best examples of this. Today the Mississippi River has over 2,200 miles of levees and a net river length around 150 miles shorter than it did in 1929 as a result of straightening (Alexander, Wilson and Green, 2012).

In smaller rivers, channel straightening can lead to floodplain disconnection through incision (Loos and Shader, 2016). In channelized reaches, sediment is transported downstream faster than new sediment is deposited, leading a riverbed to erode downwards over time (Shields, Knight and Cooper, 1994). This scenario is often exacerbated in areas where river flow is impeded by dams upstream that alter sediment supply (Dixon, et al., 2015). Dams catch sediment in their reservoirs rather than passing it downstream; therefore, the energy once used to transport sediment is instead eroding riverbanks. Over time, incision can result in a deep channels precluding floodwaters from overtopping riverbanks and disconnect water from the floodplain. Whether through engineering practices or worsened through incision, once a river and floodplain become disconnected, the exchange of nutrients, sediment and organisms is eliminated and habitat corridors are severed (O'Hanley, 2011; Tockner, Schiemer and Ward, 1998).

As discussed in Chapter 2, flood control is still the primary approach to reduce flood damage, even though it is ineffective because these structures just move water onto other properties, elevating the flood risk elsewhere (National Wildlife Federation, 1998). Making room for flood water to spread out and slow down has been the preferred policy since Congress passed the Flood Insurance Act of 1968 that created the NFIP. Programs and projects that move people and critical infrastructure out of flood-prone areas is called “flood risk reduction”. Flood risk reduction examples include buyouts/relocations, home/infrastructure elevations, levee setbacks, and other types of floodplain reconnection. This approach makes room for rivers to flood and is a much more effective strategy for reducing flood damage and protecting public safety because it significantly reduces or eliminates exposure and susceptibility to the flood hazard (Multihazard Mitigation Council, 2019).



Incised channel below an outdated and poorly maintained stormwater outfall. Such neglect of stormwater infrastructure can cause significant erosion, which contributes to downstream sediment pollution, East Moline, Illinois.
Photo credit: Olivia Dorothy



Home elevations on the Mississippi River, Illinois.
Photo credit: Jenny Hoffner

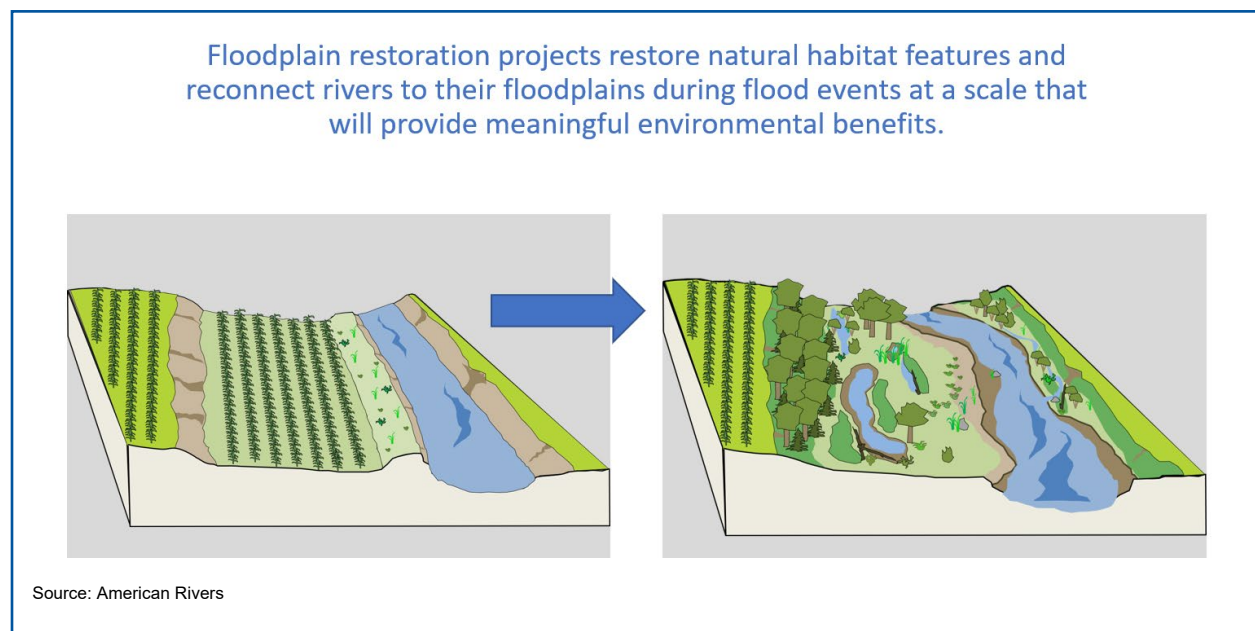
5.1.3.1 Flood Bypass Channels

Diversion channels are constructed to divert waters from the main channel for purposes such as flood control, municipal water supply and irrigation. A type of diversion channel used for flood control is a flood bypass channel or floodway. A flood bypass channel is a separate channel into which flood waters are directed to lessen the impact of flooding on the main river system. Diversion channels on large river systems, such as the Mississippi River, can consist of adjacent low-lying areas or old river courses. Control structures may be located at the head of the diversion channel to divert flows during periods of high water and return flows during low water. Some diversion channels bypass the flood flows into an adjacent waterway, while others return the flows back into the same stream a distance downstream from the point of the diversion. Diversion channels are often used in urban areas where it is not possible to widen the existing channel due to development. Diversion channels may be used to provide a means of diverting floodwater across the neck of a meander or series of meanders (Acheson, 1968). Major considerations for diversion channels include: 1) determining if the channel should convey partial or all flows, 2) design of appropriate controls, 3) the size of the channel needed to convey the design discharge, and 4) design to reduce maintenance (Nunnally, 1985). To be effective in reducing the flood stage, the distance between the point of diversion and point of return to the main channel must be of sufficient length to prevent backwater effects. Additionally, it is essential to consider potential morphologic effects on both the main channel and receiving channel.

5.1.3.2 Floodplain Restoration

Floodplain restoration reestablishes a floodplain to an ecologically functioning status and supports the various ecosystem services. Floodplain systems are complex; therefore, to ensure more successful and self-sustaining projects, restoration efforts need to look beyond surface features and focus on restoring underlying processes that create and sustain floodplains and their functions (Rohde, et al., 2005; Matella and Merenlender, 2014; Matella and Jaget, 2014).

Ecologically functional floodplains depend on three essential elements: 1) hydrologic connectivity between a river and floodplain, 2) variable flow regime that produces high and low flows, and 3) a sufficient spatial scale for floods to occur and benefits to accrue to an ecologically meaningful level (Opperman, et al., 2010).



Floodplain restoration requires a localized, process-based restoration approach that focuses on correcting the underlying causes of ecosystem degradation. Because no two rivers are alike, restoration objectives will be unique among rivers and often among reaches of the same river (Beechie, et al., 2010; Beechie, et al., 2008; Roni, Hanson and Beechie, 2008; DiGennaro, et al., 2012; Opperman 2012; Rohde, et al., 2005). Therefore, instead of attempting to restore every floodplain to an idealized state, floodplain restoration projects should first focus on restoring underlying processes that are impaired in the individual floodplain system. The four steps listed below ensure that a restoration project is designed to correct the causes of floodplain disconnection and degradation and not just the symptoms (Loos and Shader, 2016).

1. Identify why the floodplain is currently not functional (i.e., which functional attributes are missing from the river-floodplain system?).
2. Define restoration objectives.
3. Acknowledge the limits inherent to the project location.
4. Identify the minimum actions needed to return floodplain functions to a level that meets restoration objectives.

5.1.4 Watershed Planning

A watershed is an area of land that channels rainfall and snowmelt to waterbodies, starting first with creeks, streams and rivers, and eventually to outflow points such as reservoirs, bays and oceans. Watersheds connect terrestrial, freshwater, and coastal ecosystems and provide ecosystem services, such as carbon sequestration, water supply, filtration and purification. The size of a watershed depends on the geography and can range from small (e.g., an inland lake or a single county) to large (e.g., the Mississippi River Watershed, which drains 1.15 million square miles) (NOAA, 2021b).

The health of a watershed substantially affects both the environment and its ecosystem services, as well as human quality of life. Healthy watersheds support nutrient reduction, erosion and sediment control, water storage and filtration, flood control, wildlife corridors, carbon storage, biodiversity and recreation opportunities. These goods and services are essential to social, environmental and economic well-being. The wide array of critical ecosystem services provided by healthy watersheds is frequently undervalued when making land use decisions. Therefore, it is important for community leaders to go through the practice of watershed planning, which provides assessment and management information for a geographically defined watershed. A watershed plan is a document that outlines a community's strategy for achieving water resource goals. The outcomes of such a plan can include:

- The community's goals and objectives to protect and enhance local water resources.
- A plan to update local ordinances in order to protect water resources.
- Plans or information to assist in the development of conservation plans.
- Identifying and prioritizing specific projects that will assist with flooding and resiliency.
- Identifying public education opportunities.

The benefits of watershed planning range from environmental (by protecting natural landscapes and wildlife habitat, enhancing water supply, controlling flooding), to community (by directly involving community members in developing a vision for a watershed and providing opportunities for public education), to financial (providing an organization through which to receive grant money for implementing multi-benefit floodplain development projects).

5.1.4.1 Pre-Disaster Resilience and Planning

The ability of a community to successfully manage flood events begins with its efforts in pre-disaster preparedness, mitigation, and recovery capacity building (FEMA, 2017). These pre-disaster planning efforts result in more resilient communities with an improved ability to respond to, endure, and recover from flooding. This type of planning fosters community engagement and considers the needs and resources of all its members, promoting social equity. During the process, the community should provide leadership in developing recovery priorities and activities that are well planned, realistic, and clearly communicated (FEMA, 2017). A community comprises a variety of partners, affordable housing advocates, faith-based organizations, economic development professionals, business leaders, and functional and access needs populations, all of which have a role to play in pre-disaster resilience planning.

In addition to restoring the infrastructure, services, economy and tax base, housing, and physical environment of a community, successful post disaster recovery encompasses re-establishing civic and social leadership, providing a continuum of care to meet the needs of affected community members, reestablishing the social fabric, and positioning the community

to meet the needs of the future (FEMA, 2017). Encouraging a community to make progress toward recovery efforts may be difficult, particularly after a catastrophic disaster. Preparation efforts are a critical step in ensuring that leadership, government, and nongovernmental organizations are organized and communicating effectively, so that recovery actions post-disaster occur quickly and efficiently.

5.2 NON-TECHNICAL FLOODPLAIN MANAGEMENT STRATEGIES

As demonstrated by the list above, we already have the technical knowledge to solve most flood-related issues. Most barriers to multi-benefit floodplain development are non-technical and are significant hurdles. To implement any of the technical floodplain management strategies outlined above, some non-technical activities will need to take place to facilitate their execution. Below are the non-technical strategies that need significant financial and structural investment to accelerate and maximize the number of floodplain management projects that can be completed.



Ducks on the Illinois River, Illinois.
Photo credit: Chris Young

5.2.1 Community Education

Education is a critical component to ensure community members understand existing options, make informed decisions, independently improve their situations, and ensure long-term project success. Stakeholders who participated in the engagement process for this study uniformly felt as though existing flood risk reduction efforts lacked substantial community education and participation components. In addition, many residents expressed feelings of helplessness due to a perceived lack of individual power over their situation.

Educating people who live in flood-prone areas about the issues that are of most concern and urgency for them will increase individual involvement in subsequent planning efforts and inspire community leaders to collaborate with municipal and agency staff to identify and solve problems. Education allows local leaders to move these issues forward rather than depend on outside agents to remedy issues for them. Local knowledge is a powerful tool, but a lack of education prevents communities from fully utilizing that valuable knowledge. This has very real impacts on the availability of funding and resources that communities need to solve flood-related problems. Ensuring that funding is available for community education will break down these barriers.

5.2.2 Community Planning

Many communities lack or have outdated regional plans for water management. A recurring concern identified during stakeholder engagement activities for this study was that communities could not access federal funding (i.e., FEMA hazard mitigation assistance grants) due to expiration of their Hazard Mitigation Plans. To ensure that these communities can access the federal programs and associated funding, they will need assistance updating the expired plans.

Funding for this is available through the BRIC grant program, but it requires a local municipality to sponsor the effort.

Further, regional planning, such as the development of regional watershed plans, would be beneficial to flood-sensitive communities, as it enables communication between rural and urban areas. Enabling platforms for such communication would ensure that individual floodplain and water uses will not disproportionately impact specific populations of people, as seen in the Centreville case study described previously.

5.2.3 Legislative Action

Floodplain and flooding issues within the state are widespread. A larger role must be taken by the State of Illinois to address the negative impacts that were highlighted in the stakeholder engagement process for this study. Issues like the urban flooding in Centreville requires the attention of multiple state and federal agencies to provide adequate relief for the area's residents and environment. Private partnerships are needed to help communities get out of the "flood-repair-flood-repair" cycle and develop long-term, resilient solutions with multiple state, federal and private resources.

For the State of Illinois to remedy these problems, funding will need to be allocated for the express purpose of improving flood management systems, the quality of life, and environment. To accomplish these goals, we recommend establishing a public-private partnership and grant program for multi-benefit floodplain development. In addition, IDNR's Office of Community Outreach should be re-established and appropriately funded to accelerate and maximize the number of projects that can be completed. See Chapter 7.3 below for more details.

6. Anticipated Challenges

Multi-benefit floodplain development provides a consensus-based, community led and scientific method to reduce flood risk for the residents of Illinois, but there are multiple hurdles that pose challenges to getting more projects on the ground.

These barriers fall into three major categories:

Community Led Problem Solving	More Projects	Equitable Economic Growth
<ul style="list-style-type: none"> - Public education around flood issues and solutions - Support for community visioning - Access to decision-makers and other people in power - Recognizing that floodplain management is intertwined with housing, transportation, access to food and other social services. 	<ul style="list-style-type: none"> - Direct funding to do projects - Outreach to community leaders to update building codes and local ordinances - Homeowners insurance agent education - Incentives for private sector job growth in flood hazard mitigation and nature-based solutions 	<ul style="list-style-type: none"> - Economic revitalization grants, forgivable loans, or low-interest loans for planning and development - Policies and ordinances to ensure communities of color benefit from economic growth - Reparation-type financing and/or mortgage structures to reimburse lost wealth due to housing discrimination in floodplain areas

6.1 REGULATORY FRAMEWORK

The existing state and federal regulatory framework pose multiple challenges for the implementation of multi-benefit floodplain development projects in Illinois. All three of the identified barriers have regulatory hurdles that dissuade the use of multi-benefit floodplain development, as described below.

6.1.1 Community Led Problem Solving

The federal and state permitting and project planning processes often interfere with or hinder community engagement because agencies are incentivized to put forward solutions before evaluating the problem. Agencies tend to respond to complaints about perceived problems and/or demands with limited, “one-size-fits-all” solutions. In addition, agencies often respond to problems by putting forward the solutions that fit solely within their authority. This hinders multi-benefit floodplain development because it: 1) often fails to identify the underlying cause(s) of a problem, 2) is a siloed approach that does not lead to the full range of practicable solutions both within and outside the agency’s jurisdiction, and 3) often starts the community engagement process so late in the decision-making process that community input is no more than perfunctory.

More than any underlying law or regulation, these challenges also reflect a lack of resources, failures of policy guidance, and inadequate staff training. Due to budget cuts and other factors, agency staff tend to do only what is minimally required when it comes to problem-solving and community engagement. Successful multi-benefit floodplain development projects require community led visioning and decision making. Most federal and state programs can be adapted to support this strategy if it is prioritized by the Illinois General Assembly and executive branch.

6.1.2 More Hazard Mitigation Projects

Accelerating and maximizing the number of projects that can respond to climate disruption is primarily a function of available funding. However, even when funding is available, most communities opt for gray infrastructure like levees, floodwalls, pumps, stormwater pipes and dams. Factors that contribute to this trend are discussed in Chapters 2 and 5. In general, city planners need access to more information and technical resources to fully understand the value of multi-benefit floodplain development projects and where they can be implemented. Therefore, while more funding is definitely needed, funding by itself will likely only result in more gray infrastructure projects. In addition to funding, more guidance and direct engagement with municipal leaders and staff will be needed to accelerate and maximize the number of multi-benefit floodplain development projects that can be implemented.

Targeting this information for local leaders and staff will improve outcomes, as their position allows them to demand inter-agency coordination, which will lead to more problem-oriented solutions. This is again due to the intersectional nature of multi-benefit floodplain development that requires coordination across multiple agencies. In the case studies, successful projects will require (at a minimum) consultation with and (at a maximum) direct funding from programs not just administered by the IDNR, but also FEMA, the USDA, the U.S. Environmental Protection Agency, the Department of Housing and Urban Development, the Illinois Department on Aging, the Illinois Department of Commerce and Economic Opportunity and others. The siloed nature of agencies within the Illinois Executive Branch hinders the application of more projects. Chapter 6.3 provides a complete list of programs that fund floodplain projects, and there is very little overlap and coordination between the programs. Therefore, it is important to establish a public-private partnership, as non-governmental organizations are better equipped and incentivized to build collaboration and inter-agency cooperation.

6.1.3 Sustainable Economic Growth

Lack of economic stability in our case study communities was a significant barrier to developing any type of flood risk reduction project, let alone multi-benefit floodplain development projects. Most federal and state grant programs require cost-share and/or repayment with interest. While some will lower or waive cost-share for historically underserved communities, the process of applying for these funding sources requires staff to complete the application and oversee the project – even well-resourced communities sometimes struggle to meet these requirements, and communities of low income are being left behind entirely. Support is needed to help with administrative barriers. This can be achieved with additional set-asides or loan forgiveness programs to help underserved communities build stronger local economies and absorb the change required to adjust their landscapes to the new climate.

To address these issues, agencies should 1) emphasize engaging communities around problem-solving, not prescribed solutions, 2) improve collaboration via public-private partnerships to leverage more funding for projects, and 3) provide more administrative-level support to help communities transition to more resilient economies.

6.2 INCENTIVIZING FLOODPLAIN MANAGEMENT

During the stakeholder engagement process, the majority of the participants indicated support for multi-benefit floodplain restoration in their communities. However, there was some concern over the lack of existing incentives for residents to independently develop projects and devote

resources to floodplain management. Specifically, many were concerned about the impact that floodplain reconnection could have on the livelihoods and culture of those that live and work in the floodplain. In rural, generally agricultural areas, residents voiced concerns about their connection to their land – many have been working and managing these areas for multiple generations. For these landowners, floodplain reconnection can be seen in a negative light since it has the potential to decrease the total farmable land and impact their culture and occupation. Similarly, in urban areas, floodplain communities tended to be communities of color and/or low income and environmental justice areas. Urban community members present in the stakeholder engagement process were aware that they are living in unsafe areas and would like to reduce their risk. However, many have spent their entire life in those neighborhoods and do not want to abandon their culture-rich areas through a buyout process that may not provide them with the ability to purchase a different home in a safer location within the same community.

Illinois will need to address the potential for dispersal and negative cultural impacts that floodplain reconnection can have on residents in both rural and urban areas. Developing proper incentives and programs to mitigate these impacts will increase support and improve program success, especially if they are developed in a collaborative setting with direct input from the impacted communities.

6.3 FUNDING

Grant and loan programs that can be utilized for floodplain reconnection/restoration or watershed planning in the State of Illinois are almost exclusively federal programs. Existing federal programs have a non-federal cost-sharing mechanism that is required for all applicants, placing some of the financial burden on grantees to procure supplemental funding from private, state or local sources. To facilitate the participation of communities of low income in these programs, it is recommended that the State of Illinois establish and provide funding for a state-managed grant program that can fill the current “match gap.”

At the state level, IEPA considers floodplain reconnection an eligible project type under their Green Infrastructure Grant Opportunities program. However, this program does not allow for community planning or stakeholder engagement activities. Additionally, there are many other eligible green infrastructure project types that will compete with floodplain reconnection for grant funding. Outside of this green infrastructure project category, the State of Illinois does not have a state-managed program for floodplain reconnection/restoration or watershed planning. Instead, applicants are required to pull non-federal matching funds from their tax revenue (if applicants are local governmental entities and have supplemental revenue), or secure funding from a private entity, such as foundations or private donors.

In addition to the green infrastructure grant discussed above, other state funding sources, including wildlife and sport fish habitat grants, conservation/wetland reserve enhancement programs and the Office of Water Resources Acquisition funds, offer the best opportunities to finance floodplain restoration, but the programs are extremely siloed. The Office of Water Resources is the primary program responsible for floodplain management activities throughout the state and is responsible for issuing permits for construction within and along streams and rivers, implementing non-structural flood mitigation, including property acquisition and building removal, floodplain mapping, and assisting communities in implementation of flood risk reduction projects that include open space. However, floodplain “open spaces” rarely have habitat restoration components and most habitat grants go toward game species. There is limited coordination with the Office of Water Resources and other grant providers within the Department of Natural Resources.

Included below is a selection of existing programs that are frequently utilized to fund floodplain-related projects. Focus areas are noted for each program and a checkbox was included to indicate which programs require cost-sharing for the applicants. An additional field titled “Environmental Justice Considered” was included to indicate whether the program takes environmental justice issues into account. Programs will recognize environmental justice issues in multiple ways, either through an increased score during evaluation of applications, a dedicated environmental justice category, or reduced cost-sharing requirements for environmental justice applicants. If the program includes an environmental justice component at some level, this box was checked.

STATE FUNDING SOURCES FOR FLOODPLAIN PROJECTS	Flood Risk	Water Quality	Habitat	Land Protection	Agriculture	Environmental Justice Considered	Cost Sharing Required
Department of Natural Resources							
Office of Water Resources Acquisition	X					X	5% or \$1000, whichever is less
Natural Resource Damage Assessment Restoration		X	X	X			N/A
Wildlife and Sport Fish Habitat Grant Programs			X	X			25%
Conservation/Wetland Reserve Enhancement Program			X		X		N/A
Environmental Protection Agency							
Wastewater/Stormwater and Drinking Water Loans	X	X				X	1.1% loan interest rate
Water Quality Grants: Green Infrastructure Grant Opportunities	X	X	X			X	25%
Emergency Management Association							
Flood Mitigation Assistance	X						25%

There are numerous federal programs that fund components of floodplain projects. Below is a list that includes many of the programs used by states and their local communities. Each program has restrictions on the activities (land acquisition, planning, habitat restoration, etc.) that may be funded and/or the project goal (flood risk reduction, habitat, water quality, etc.). No federal program requires projects to meet co-equal goals of flood risk reduction, social justice, and improvements to the environment. Most programs require matching funds to be provided by non-federal sponsors.

FEDERAL FUNDING SOURCES FOR FLOODPLAIN PROJECTS	Flood Risk	Water Quality	Habitat	Land Protection	Agriculture	Environmental Justice Considered	Cost Sharing Required
Federal Emergency Management Administration							
Hazard Mitigation Grants	X					X	10-25% cash, in-kind services, or materials
Pre-Disaster Mitigation Program	X						10-25%
Building Resilient Infrastructure and Communities (BRIC)	X	X	X	X	X	X	10-25% cash, in-kind services, or materials
Department of Housing and Urban Development							
Community Development Block Grants	X					X	Funds may be used to meet the non-federal match requirements of other federal programs
U.S. Department of Agriculture							
Wetland Reserve Easements			X	X			0-50%
Environmental Quality Incentives Program		X	X		X	X	25%
Conservation Stewardship Program			X		X	X	N/A
Emergency Watershed Protection-Floodplain Easements	X		X		X		N/A
Regional Conservation Partnership Program		X	X	X	X	X	≥50%
Conservation Innovation Grants		X	X		X	X	50%
U.S. Army Corps of Engineers							
Flood Risk Reduction Projects	X						35%
Habitat Restoration Projects			X				25-50% phase dependent
Upper Mississippi River Restoration Program		X	X				35%
Silver Jackets Program	X						N/A
Planning Assistance to States	X	X	X				50%
PL 84-99 Emergency Levee Repair	X						20%
Section 206, Aquatic Ecosystem Restoration			X				35-50% phase dependent
Section 1135, Project Modifications for Improvement of the Environment			X				25-50% phase dependent
U.S. Department of Interior							
National Fish Passage Program			X			X	50%
National Fish Habitat Partnership			X				50%
North American Wetlands Conservation Fund			X				1:1
Cooperative Endangered Species Conservation Fund			X				25%

FEDERAL FUNDING SOURCES FOR FLOODPLAIN PROJECTS	Flood Risk	Water Quality	Habitat	Land Protection	Agriculture	Environmental Justice Considered	Cost Sharing Required
State and Local Assistance Programs				X			Program dependent
U.S. Environmental Protection Agency							
Environmental Justice Grants		X	X			X	N/A
Wetlands Program Development Grants		X	X				25%
Clean Water Act Section 319 Nonpoint Source Grants		X	X			X	25% or completion of a waiver or reduction of the funding match for communities of low income
Water Infrastructure Financing and Innovation Act funding		X	X	X		X	Long-term, low-cost supplemental loan program
National Fish and Wildlife Foundation							
Multiple Grant Programs		X	X	X		Program dependent	Varies; 1:1 match most common

7. Findings and Recommendations

7.1 FINDINGS

During the feasibility study process, we determined that replicating the State of Washington’s dual purpose (public safety and ecosystem restoration) model is not advisable because it did not adequately incorporate racial justice needs in floodplain communities. Instead, we recommend a similar public-private partnership program with three co-equal goals: public safety, social justice and ecosystem restoration. The proposed partnership would be tasked with resolving the three primary barriers that were identified in our research and conversations with stakeholders:

1. **Community Led Problem Solving:** A community’s needs are dependent on unique conditions found within it, such as culture, social structure, history and assets, to name a few. Therefore, people living within a community are most equipped to speak to these needs. Illinois’ elected officials and state agency staff need to work with community members, municipal staff and non-governmental organizations to establish a better framework to support community led problem solving that is tailored to that community’s individual needs. This includes providing more access to information, better venues for collaboration and access to decision-makers.
2. **More Hazard Mitigation Projects:** The number of flood hazard mitigation projects needs to dramatically increase throughout the state. This cannot be limited to only green or gray infrastructure. It will require a combination of the two strategies to build sustainable projects. To support these projects, the Illinois General Assembly needs to take deliberate steps to grow the hazard mitigation field of practice, especially in a multi-benefit floodplain development context, and encourage recruitment in this career field.

3. **Sustainable Funding:** Under the current federal and state programs, the local tax base is responsible for paying a significant portion of hazard mitigation costs, especially upfront costs like staffing to apply for grants and oversee programs. But even well-resourced communities cannot keep up with increasing flood risk, and communities of low income are being left behind entirely. Alternative financing, like administrative grants and low-interest loans, and in-kind support, like technical assistance, need to be dramatically expanded. Municipal staff must also be supported to work on interconnected issues, like affordable housing and community revitalization

7.2 RECOMMENDATIONS

Addressing these barriers will take time. As part of our study, we identified five immediate steps that could be taken by the Illinois General Assembly.

1. Establish a Multi-Benefit Floodplain Planning and Development Public-Private Partnership.
2. Establish a Multi-Benefit Floodplain Development Fund to Provide Flexible Funding for Planning and Projects.
3. Reform agricultural programs to incentivize flood-compatible farming and land conservation practices.
4. Ensure the State provides equitable support services across all programs, including higher levels of planning support for communities that are socially and/or economically disadvantaged.
5. Require flood hazard mitigation training for all insurance agents.

7.2.1 Establish a Multi-Benefit Floodplain Planning and Development Public-Private Partnership

Many communities, especially communities of low-income and communities of color, do not have access to or are not otherwise benefiting from the full suite of flood risk reduction tools and are not adequately represented in community planning and problem-solving for flood risk management. State and federal agency staff often limit community assistance to only those programs administered by their respective agencies and limit communications within the community to only municipal staff and/or elected officials. This creates barriers for individuals, communities and/or neighborhoods that may have under-resourced, uninformed and/or otherwise unstable local governments. To overcome this barrier, there is a need for state agency staff to form stronger bonds with non-profit, private and other non-governmental organizations to better serve communities.

The Illinois General Assembly should establish a public-private partnership to support multi-benefit floodplain planning and development that is focused on helping residents, unofficial community leaders, municipal staff and elected officials find safe, just and environmentally sustainable solutions to flood issues. The goal of the partnership will be to accelerate the implementation of climate hazard mitigation projects through multi-benefit floodplain development. This will be accomplished via projects, programs and other tools that meet needs in the following four areas:

1. Community education on flood-related issues and solutions, including flood insurance rate map use and interpretation, flood insurance programs and rates, flood hazard mitigation and floodplain ecosystem services.
2. Community visioning processes with a focus on addressing environmental justice issues like racial equity, affordable housing, storm and wastewater infrastructure, transportation, access to healthy food and improved environmental quality.
3. Community guidance for accessing appropriate resources and funding opportunities to address flood-related issues, like Silver Jackets Flood Studies, FEMA BRIC grants and other resources.
4. Community support for administrative tasks, like grant writing and project tracking, to build community capacity for multi-benefit floodplain planning and development that maximizes climate change resilience, social justice and ecosystem health.

Structure

Through legislative action, the Illinois General Assembly should establish a Public-Private Partnership Multi-Benefit Floodplain Development Team (“Team”) that is led by the Illinois Department of Natural Resources, Office of Water Resources, Division of Community Outreach. The Team should be comprised of the following agencies and organizations:

Illinois Agencies, including

- Illinois Department of Natural Resources Office of Resource Conservation
- Illinois Environmental Protection Agency
- Illinois Emergency Management Agency
- Illinois State Water Survey
- Illinois Department of Aging
- Illinois Department of Transportation
- Illinois Department of Agriculture
- Illinois Department of Health and Human Services
- Illinois Rivers Coordinating Council

Federal agencies, including

- U.S. Army Corps of Engineers (SilverJackets Coordinators)
- Federal Emergency Management Agency
- U.S. Environmental Protection Agency
- U.S. Department of Agriculture
- U.S. Department of Transportation
- U.S. Department of Housing and Urban Development

The Team should work with non-government stakeholders, including:

- Environmental Organizations
- Conservation Organizations
- Land Trusts
- Social Justice Organizations
- Affinity Organizations that Represent Minority Populations
- Farm Organizations
- Sustainable Development Organizations
- Floodplain Managers
- County and Municipal Organizations
- Flood Hazard Mitigation Businesses
- Regional Departments of Commerce
- Ecosystem Restoration Businesses

Annual Report

Starting in year 2, and each year thereafter, the Team shall submit an Annual Report to the General Assembly that transparently accounts for the public and private spending (cash and in-kind), and the socio-economic information of community partners and/or project beneficiaries.

Every five years, the Team will submit a Report to the General Assembly which shall include additional information that estimates economic benefits (including ecosystem services) of completed projects, more detailed information about project beneficiaries, and performance reviews completed by partnering communities and Team responses to the review comments.

Work Plan

With the Annual Report, the Team will also submit a Work Plan for the coming fiscal year with funding recommendations, available cash and in-kind matches from the private/non-profit sector.

Budget

The Illinois General Assembly should allocate \$1,000,000 for the first year to establish the interagency public-private team (\$500,000 to support the IDNR Office of Water Resources, Division of Community Outreach, and \$500,000 distributed among the other agencies). Each year thereafter, the Team will submit an annual report and work plan, which will include funding recommendations, to the Illinois General Assembly.

For work planning purposes, the Team will prioritize communities based on a matrix that will include: 1) known flood-related issues (flood insurance claims, disaster declarations, etc.), and 2) social vulnerability (socio-economic information, density of grocery stores, etc.).

How will this help Illinois Communities?

Most communities struggle to navigate complex flood risk management problems alone, especially since the root of the problems might be outside the municipal boundaries. In our case studies, the community of Centreville was emblematic of this issue. As the poorest community in Illinois and as a Black community, it is both economically and socially disadvantaged. This compounds the town's ongoing struggle with frequent flooding that is caused by multiple factors inside and outside of their community. Due to their socio-economic status, they have struggled to secure long-term and sustainable solutions for their community, especially in terms of working with outside units of government to resolve “upstream” causes to their flood issues. At the state-level, agency siloes are contributing to disjointed assistance. Multi-benefit floodplain development could expedite attention to community issues across state and federal agencies and engage stakeholders inside and outside the community.

7.2.2 Establish a Multi-Benefit Floodplain Development Fund to Provide Flexible Funding for Planning and Projects

Floodplains are important landscapes that provide multiple ecosystem services (improved water quality, aquifer recharge, wildlife habitat, etc.) and they need to be managed to sensibly balance community resilience and environmental health. Unfortunately, most programs that support floodplain planning and development are siloed. Funding sources for gray infrastructure, green infrastructure and other community needs (housing, economic development) are often disparate—housed in different agencies and offices with limited staff or program cross-over. Green infrastructure programs often prohibit spending on gray infrastructure, limited information is available on how green infrastructure can be incorporated with gray infrastructure projects, and economic development programs rarely consider natural resource or public safety needs. To get the most benefit out of their floodplains, communities need to plan and develop for all these issues and opportunities simultaneously. To do this most effectively, communities need access to flexible funding to maximize public safety, climate resilience and natural resource benefits in their frequently flooded and floodplain areas.

Structure

To meet the urgency of climate change adaptation, the Illinois General Assembly should establish a multi-benefit floodplain development low-interest loan and/or grant program to be administered by the IDNR. Grants should be made available to municipalities and non-governmental organizations to advance multi-benefit floodplain planning and development that meets co-equal goals of reducing flood risk, social justice and environmental health. Funding priorities should be set by the Team.

Budget

Starting two years after the establishment of the Team, and annually thereafter, the Team will submit to the Illinois General Assembly a list of projects to be funded via grants and/or low interest loans.

How can this help Illinois communities?

All of the case study areas need a source of flexible funding to solve problems in their floodplains. In Cairo, the community's identity is inextricably tied to the Mississippi and Ohio rivers. To be successful, the city needs assistance revitalizing itself from top to bottom to comprehensively address flooding issues, housing stock, public services and economic

development. Funding or assistance for this type of comprehensive economic and natural resource community planning is not available in every region. For example, in Northeastern Illinois, the Chicago Metropolitan Agency for Planning provides this type of planning assistance through its Local Technical Assistance Program. Unfortunately, the sister agency in southern Illinois, the Greater Egypt Regional Planning and Development Commission, does not cover Alexander County. A low-interest loan and grant program for communities of low-income and non-governmental organizations that work in those communities can help meet needs where gaps in programs and funding exist.

7.2.3 Reform Agricultural Programs to Incentivize Flood-Compatible Farming and Land Conservation Practices

There are over one million acres of farmland in Illinois prone to flooding, and hundreds of thousands of these acres are “protected” by levees. Levees lower crop insurance rates by pushing flooding problems onto other areas – sometimes other farmland and sometimes urban areas. Additionally, vast expansions in tile drainage systems accelerate the movement of water off the land and into rivers and streams, thus contributing to flashier high-water events in some watersheds. As climate change alters precipitation patterns in the region to more frequent and extreme precipitation events, adaptation efforts need to focus on slowing water wherever it falls on the landscape. Slowing water on the landscape creates more predictability in the river systems and gives floodplain managers time to take necessary steps to protect people and infrastructure. As 75 percent of Illinois’ landmass is in agricultural production, the Illinois General Assembly needs to facilitate and create programs, projects and incentives to farmers to slow the movement of water off the landscape. These might include reforming conservation easement programs to enroll more flood-prone acres, incentivizing cropping systems that hold more water in the soil, amending the antiquated Illinois drainage code to align with modern flood risk management goals and standards, and changing the crop insurance program to not penalize farmers who convey water across their lands during flood events.

Structure

The Illinois General Assembly should mandate a report from the Illinois Department of Agriculture, with consultation from the Team, to examine farming practices and programs to identify incentives to encourage more widespread adoption of flood-compatible farming and farmland management practices.

Budget

Report, one year, \$200,000

How will this help Illinois communities?

In Illinois, most agricultural policies and practices are integrated with the “flood control” approach to managing water. Most farmers invest in projects that move water off their land as quickly as possible, and farm policies encourage this approach. For example, farmers have difficulty securing USDA Agricultural Conservation Easements on flood-prone acres. Frequently flooded land is ranked lower by the state-administered USDA Agricultural Conservation Easement investments due to the risk of floods damaging the restoration projects. The Emergency Watershed Protection Easements do offer permanent easements on frequently flooded lands, but funding for enrollment is tied to federal disaster declarations, which are triggered by flood damage on urban infrastructure (often far removed from the rural agricultural land). In Alexander County, an agricultural levee was breached in 1993, 2011 and 2016, and

following the 2016 breach, it was not repaired. Even though landowners could not farm the acres, the land could not be enrolled in any easement programs until, by chance, the 2019 flood triggered a federal disaster declaration that allowed USDA Floodplain Easements to be paired with Wetland Easements within the effected levee district. Farm practices and policies need to be more closely examined to identify necessary reforms and incentives to encourage farmers to slow runoff and convey floodwater during extreme events.

7.2.4 Ensure the Illinois' State Agencies Provide Equitable Support Services Across All Programs, Including Higher Levels of Planning Support for Communities that are Socially and/or Economically Disadvantaged

Some communities have more resources than others. Pre-disaster resilience planning and project funding sources always require some type of community investment, like municipal staff to apply for grants, direct match, upfront costs for development concepts, access to various experts, a tax-base for loan repayments, etc. The Illinois General Assembly should direct all state agencies to provide tiered assistance to ensure communities get equitable access to resources like planning assistance, grants, technical help, etc. Assistance levels should be based on census block data, and communities with populations that meet multiple census thresholds should be prioritized for higher levels of planning assistance, greater access to funding and more equitable match requirements. State agencies should be held accountable through transparency and reporting requirements in their assistance and grant-making programs.

Structure

The Illinois General Assembly should require state agencies to develop plans to track, publish and allocate resources equitably throughout the state. These agencies should track investments along racial, economic and other social factors (like ability, age, etc.). It is paramount that resource allocation is equitable for each group. This involves recognizing different challenges, needs and histories. Generally, the communities that were addressed in this study will require more state investments across all programs to ensure equity.

Budget

To be determined.

How will this help Illinois communities?

All of the case study areas have large communities of color and low income. Cairo and Centreville also have a declining tax base that cannot support full-time municipal staff, let alone support the staff with the various floodplain management certifications. These factors limit their ability to apply for existing grant programs for watershed planning and green infrastructure, including FEMA's BRIC grants and EPA's Revolving Loan programs and Section 319 Non-point Source Pollution grants. Ensuring that communities that need more assistance are receiving it from the State will help Illinois communities be more competitive for federal assistance and other private-sector investments.

7.2.5 Require Flood Hazard Mitigation Training for All Insurance Agents

One of the goals of establishing the Multi-Benefit Floodplain Development Program is educating Illinois' citizens about floodplains and flood risk management. However, when it comes to decisions about hazard mitigation on private properties, most renters and home and business owners turn to their insurance agents for guidance. Insurance agents are the primary trusted

sources of flood-related information in the general population. Unfortunately, many insurance agents are not adequately trained to provide accurate information about flood insurance, flood risk or hazard mitigation options. FEMA provides free virtual and in-person classes on these topics for insurance agents. The Illinois General Assembly should mandate flood insurance and hazard mitigation training for all homeowner insurance agents.

Structure

The Illinois General Assembly should allow the Illinois Department of Insurance to mandate continuing education specific to flood insurance for insurance agents.

Budget

Not applicable.

How will this help Illinois communities?

In Centreville, community members can clearly see the impacts of poor flood management and floodplain development as their homes and yards are frequently flooded with stormwater and wastewater. Many residents relocated to Centreville after flood buyouts in another area of the Metro East and are now facing the same problems in their new homes. Determined not to “make the same mistake twice,” community members are trying to get access to more effective and sustainable alternatives. Unfortunately, when residents approached their insurance agents, they were almost always given incorrect information about flood insurance availability, eligibility requirements, mitigation options and/or rates. None of the stakeholder participants could recall a single example of their insurance agents suggesting structural modifications to lower flood insurance rates, even though many options exist (e.g., home/utility elevations, foundation openings, dry or wet proofing, construction materials, etc.). Insurance agents must be required to provide accurate information about flood insurance and mitigation options to homeowners and renters.

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APPENDIX A

Stakeholder Recommendations Table

APPENDIX B

Maps and Graphics

APPENDIX C

Notes from Stakeholder Meetings