

BUILDING FOR THE FUTURE: Five Midwestern Communities Reduce Flood Risk



 **HEADWATERS
ECONOMICS**

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HEADWATERS ECONOMICS

Headwaters Economics is an independent, nonprofit research group whose mission is to improve community development and land management decisions.

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Introduction

Flooding is the most common and expensive natural disaster in the United States. In 2019, historic flooding along the Missouri, Mississippi, and Arkansas rivers resulted in more than \$20 billion in damages.¹ Floodwaters overtopped levees and stayed above flood stage for months – impacting more than 14 million people.²

Living with and adapting to flooding is possible, but few models exist to guide communities. This report highlights five success stories from across the midwestern United States that showcase strategies that local and regional leaders have taken to strengthen their communities and reduce their flood risk. Each case study explores a mitigation project including funding strategies and practical lessons learned.

Flood mitigation work is challenging. Planning and constructing projects can take years or even decades, forcing communities to work hard to maintain community support. Because projects tend to be expensive and infrastructure funding is piecemeal, projects are often built incrementally as money becomes available.

Local leaders must also navigate complex federal and state programs and coordinate engineers, consultants, and other stakeholders. Projects that cross jurisdictional boundaries, such as county or state lines, require additional organization, time, and money.

These challenges underscore the hard work and creativity needed to complete mitigation work. The five communities in this report have each successfully implemented projects to decrease their flood risk:

- In **Austin, Minnesota**, residents rallied around a downtown flood project and approved a local option sales tax to make the project financially feasible.
- **Fargo, North Dakota's** diversion channel crossed state lines and FEMA regions, creating logistical challenges for project organizers. The project's leadership team creatively resolved funding and political challenges to get the project off the ground.
- A watershed district worked closely with community stakeholders to implement a large regional project in **Grand Island, Nebraska**, to increase floodwater storage and protect downstream communities.

Glossary of common terms

100-year floodplain - Area has a 1% chance of flooding in any given year

500-year floodplain - Area has a .2% chance of flooding in any given year

Benefit-cost analysis - Measures cost-effectiveness of project by comparing monetary benefits (including avoided costs) and costs

Community rating system score - FEMA program that incentivizes communities to implement flood mitigation projects to reduce National Flood Insurance Program premiums for residents

Conservation district - Unit of local government tasked with managing natural resources

Federal Emergency Management Agency (FEMA) regions - Regional branches of FEMA that connect federal government with local and state offices

Flood mitigation - Preemptive planning and projects that decrease impacts from flooding

Local option sales tax - Special-purpose tax implemented at the city or county level

Master drainage plan - Comprehensive planning document aimed at eliminating or reducing flood risks

Public-private partnership - Private entities provide funding for projects while sharing risks and benefits with public sector

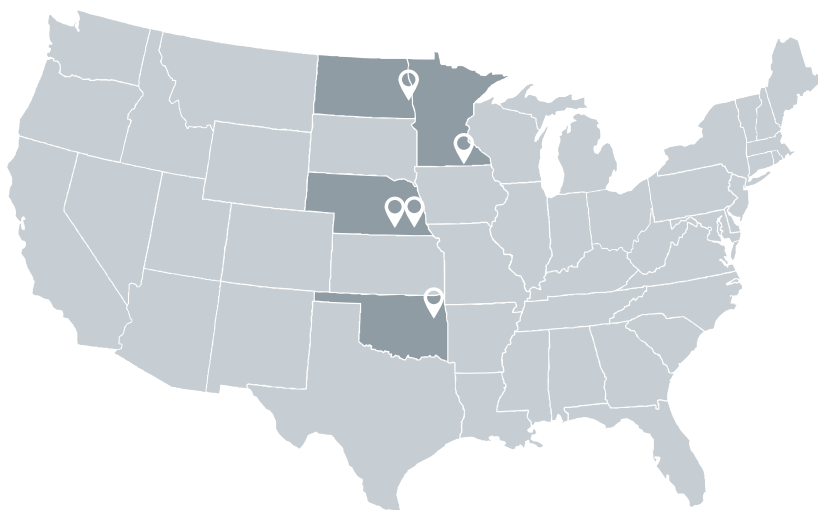
Stormwater utility fee - Fee charged to residents to help pay for stormwater projects

Watershed-scale project - Projects that address flooding at a broader scale, typically with a more comprehensive approach, including water quantity and quality issues and habitat impacts throughout the drainage area

- The project team in **Lincoln, Nebraska**, used a redevelopment project to restore the watershed in a racially diverse neighborhood, conducting more than 1,000 community meetings throughout the process to address community needs and build support.
- In **Tulsa, Oklahoma**, the city incorporated its master drainage plan goals into its planning processes, helping to ensure stormwater management is always front of mind in the city’s decision-making.

Project Background & Case Study Methods

In early 2020 Headwaters Economics researchers interviewed more than 60 experts on flood risk and mitigation strategies. Interviewees identified communities that were doing innovative work to decrease flood risk. From these conversations, five communities were selected for in-depth case studies: (1) Austin, Minnesota, (2) Fargo, North Dakota, (3) Grand Island, Nebraska, (4) Lincoln, Nebraska, and (5) Tulsa, Oklahoma.



These communities have diverse population sizes and experiences with flooding (Table 1). Headwaters Economics interviewed key community members who were instrumental in planning and/or constructing the flood project. Questions focused on the project’s planning and funding strategies, as well as the challenges and successes that the project team encountered.






Table 1. Overview of five case study communities.

City	State	Pop. ³	Flood disaster declarations (1965-2019) ⁴	% of city properties at risk ⁵	Avg. cost of flood insurance/household ⁶	CRS score ⁷
Austin	MN	24,933	9	9%	\$931	5
Fargo	ND	124,844	26	12%	\$598	5
Grand Island	NE	51,478	8	15%	\$1,424	n/a
Lincoln	NE	287,401	8	8%	\$1,258	5
Tulsa	OK	400,699	14	14%	\$702	2

Common acronyms: flood funding sources & stakeholders

- BRIC** Building Resilient Infrastructure & Communities grant program, Federal Emergency Management Agency
- CDBG** Community Development Block Grant, United States Department of Housing and Urban Development
- CRS** Community Rating System (part of the National Flood Insurance Program)
- FEMA** Federal Emergency Management Agency
- FMA** Flood Mitigation Assistance, Federal Emergency Management Agency
- HMGF** Hazard Mitigation Grant Program, Federal Emergency Management Agency
- HUD** United States Department of Housing and Urban Development
- NFIP** National Flood Insurance Program
- USACE** United States Army Corps of Engineers

Lessons Learned

 <h3>Austin, MN</h3> <ul style="list-style-type: none">• Pro-active community engagement is key.• Community members and funders need to understand project benefits.• Projects with local revenue sources are more predictable and self-sustaining.• Community support is easier to catalyze immediately after a flood.	 <h3>Fargo, ND</h3> <ul style="list-style-type: none">• Larger projects require more flexibility and creativity.• Funders have specific requirements and preferences.• Public relations campaigns work.• Projects have long-term fiscal impacts.	 <h3>Grand Island, NE</h3> <ul style="list-style-type: none">• Watershed-scale projects require proactive, sustained communication.• Communities benefit when their local projects are supported by regional and state partners.• Strong project teams are needed to respond to community input and identify the right solution.	 <h3>Lincoln, NE</h3> <ul style="list-style-type: none">• Flooding often disproportionately impacts marginalized populations.• Mitigation projects require investments in community-building.• Projects are stronger when they contribute to larger community goals.	 <h3>Tulsa, OK</h3> <ul style="list-style-type: none">• Risks, regulations, and funding sources related to flood mitigation are constantly changing and require adaptability.• Mitigation is stronger when it becomes a way of life for city operations and planning.• Public outreach maintains community support.• Flood mitigation is long-term work.
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The case studies illustrate a wide variety of approaches to addressing flood risk. The projects range from a commitment to ongoing maintenance, such as **Tulsa's** work to improve their stormwater drainage infrastructure—to green infrastructure solutions like the greenbelt created in **Lincoln**—to large, highly engineered solutions, like the \$2.7 billion diversion channel project being built in **Fargo**. Collectively, these case studies offer important lessons for practitioners, community leaders, and policy makers.

While each case study offers its own set of lessons, several common themes emerged. First, it is easier to fund and build support for mitigation projects when they create social and economic opportunities beyond reducing flood risk. For example, **Lincoln's** mitigation project addressed long-standing transportation issues, created parks and green spaces, and enabled new development opportunities on the University of Nebraska-Lincoln's campus.

Mitigation projects are an opportunity. They can be designed to address multiple community goals in addition to reducing flood risk. Common co-benefits of mitigation projects include (but are not limited to) improving transportation infrastructure, increasing water quality, and creating new recreation opportunities such as parks, trails, sports fields, and hunting opportunities.

Second, a project's funding strategy should identify potential funding sources and also include projections of how the project will impact municipal budgets in the long term. Projects will often require a mix of funding from local, state, federal, and private grants and loans. Local revenue sources, such as from a sales tax or stormwater utility fee, give communities more control over their project and increase long-term certainty.

Some mitigation strategies can adversely affect the community, such as by gentrifying neighborhoods or decreasing the tax base when residents who accept buyouts do not relocate within the community. Proactive problem solving and fiscal planning are key to understanding these scenarios and addressing undesired impacts.

Get networked

Networking organizations are important sources of information for planning, funding, constructing, and maintaining a flood mitigation project. These organizations were identified as key information sources by case study participants:

[Association of State Floodplain Managers \(ASFPM\)](#)

[Mississippi River Cities and Towns Initiative \(MRCTI\)](#)

[Natural Resources Defense Council \(NRDC\)](#)

In addition to networking with national organizations, it is important to meet with and build relationships with the state floodplain manager and other local representatives from state and federal agencies.

Third, regional projects are typically more effective at addressing flood risk but are also more expensive and time-consuming to coordinate. Regional organizations such as watershed districts that cross jurisdictional boundaries can play critical roles as conveners for these types of projects. **Grand Island's** mitigation project is an excellent example of a regional-scale project. Collaborative projects can open up new funding strategies such as shared risk pools.

Fourth, mitigation projects are political and thus demand meaningful community engagement. Often those living in the most at-risk parts of a community are the most vulnerable. These residential patterns may be a result of land market inequities and/or the legacies of racist housing and zoning policies and practices. Thoughtful, responsive, and long-term community engagement strategies are needed, particularly when marginalized or vulnerable populations are impacted. Often public meetings are not sufficient to gather public input and more creative methods are needed to ensure community members' voices are heard.

Finally, mitigation projects are an investment in the future. While these projects are long-term work and require ongoing maintenance, proactive strategizing and planning can save communities millions in avoided costs.

This report's case studies are presented as stand-alone documents that can be read either together or separately. Collectively, they present a range of mitigation projects, funding strategies, and governance arrangements that communities and regions have used to successfully decrease flood risk.

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- 4 Federal Emergency Management Agency. (2020). *Disaster declarations summary*. (Version 2). Retrieved from <https://www.fema.gov/openfema-data-page/disaster-declarations-summaries-v2>
- 5 First Street Foundation. (2020). *Flood factor*. Retrieved from <https://floodfactor.com/>
- 6 Federal Emergency Management Agency. (2020). *National Flood Insurance Program redacted claims dataset*. Retrieved from <https://www.fema.gov/openfema-data-page/fima-nfip-redacted-claims>
- 7 FEMA's Community Rating System (CRS) incentivizes proactive flood planning by reducing National Flood Insurance Program premiums when communities implement specific mitigation activities. Scores range from 10 (in which communities have implemented no or minimal mitigation efforts) to the best possible score of 1. Federal Emergency Management Agency. (2020). *Community Rating System eligible communities*. Retrieved from https://www.fema.gov/sites/default/files/2020-08/fema_crs_eligible-communities_oct-2020.pdf
- 8 Adapted from Governor's Commission to Rebuild Texas. (2018). *Eye of the Storm: Report of the Governor's Commission to Rebuild Texas*. Retrieved from <https://www.rebuildtexas.today/wp-content/uploads/sites/52/2018/12/12-11-18-EYE-OF-THE-STORM-digital.pdf>

Common flood mitigation strategies⁸

Avoid

Projects that restrict building in flood-prone areas

- Elevate
- Open space protection
- Buy-outs, land acquisition
- Relocation
- Regulations and incentives that steer development away from high-risk areas
 - Buffer and setback ordinances
 - Clustering and density bonuses

Resist

Projects that hold back flood waters

- Reservoirs, channels
- Dams, levees, barriers, floodgates
- Construction of natural features
- Household floodproofing

Accommodate

Projects that allow flooding in specific areas

- Detention and retention areas
- Stormwater management and drainage
- Wetland protection, restoration

Mitigation requires ongoing communication and outreach to raise flood risk awareness and build community support for projects. In addition to public information campaigns, interactive maps and scenario planning are techniques that can be used to communicate flood risk to community members. Other ideas to help members better understand flood risk include installing signs marking record flood levels (e.g. Austin's 2004 high water markers) and hosting community events (e.g. Grand Island's "Flood Control Stroll").

Building Community Support for Flood Mitigation

Austin, Minnesota



QUICK FACTS

Population¹. 24,933
 # of Flood-Related Disaster². 9
 % of City Properties at Risk³. 9%
 Avg. Cost of Flood Insurance Per Household⁴. . . . \$931
 FEMA Community Rating System Score (2019)⁵. 5



Photo: Trey Myers



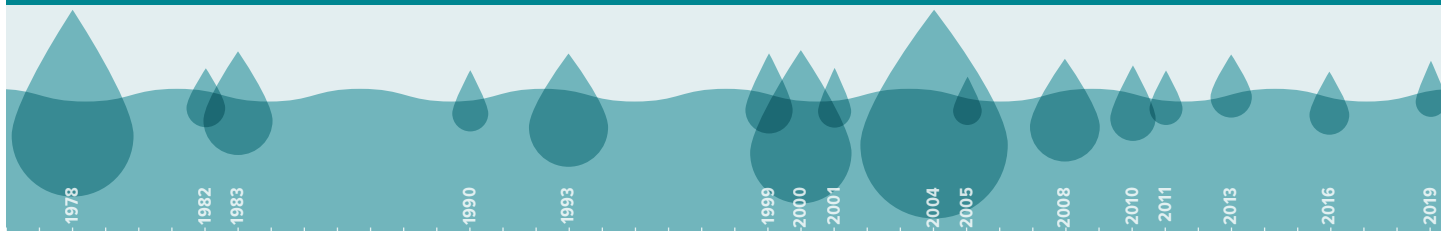
Photo: Tim Ruzek

CHALLENGES

Flash flooding in Austin’s watershed threatened the city’s downtown district and the manufacturing plant of a major employer. Community members supported mitigation efforts, but they also wanted to retain their community’s connection with the river.

YEARS WITH DAMAGING FLOODS, 1976-2019

Size proportional to National Flood Insurance payments.



LESSONS LEARNED

Proactive community engagement is key.

Community engagement works best when it is responsive to residents’ input, goes beyond standard meetings, and includes networking with state and federal partners. Engineers and planners in Austin responded to community concerns about the proposed floodwall by redesigning the project to have removable flood panels to preserve downtown views of the river.

Community members and funders need to understand project benefits.

Austin officials pitched their project by focusing on its economic benefits, such as how it would protect the city’s major employers from flooding. They also highlighted new recreational opportunities and trails that strengthen the community’s quality of life.

Projects with local revenue sources are more predictable and self-sustaining.

Austin passed a ½-cent, 20-year local option sales tax that city officials use for property buy-outs and as local match funds for state and federal grants. The sales tax demonstrates the community’s support for the project and allows the city to implement projects on its own timeline.

Community support is easier to catalyze immediately after a flood.

Austin began planning and implementing its large flood mitigation project following a record-breaking flood in 2004. Community engagement is maintained through ongoing flood education, such as the high-water marker signs that were put up following the 2004 flood.

OVERVIEW

Austin sits at the confluence of the Cedar River, Turtle Creek, and Dobbins Creek and has experienced repeated floodings over the last 50 years. Its most devastating impacts are due to flash flooding from the Cedar River, which runs through its downtown district. During the city's 2004 record flood, the Cedar River rose 22 feet in 24 hours and crested 10 feet above flood stage.⁶ The flood led to two deaths and caused an estimated \$13.8 million in damages to 400 homes, 60 businesses, and public infrastructure. Austin's flash flooding is rapid and dangerous, making preemptive mitigation efforts a priority.

In response to the 2004 flood, the city's leadership and engineers recommended a large mitigation project with a floodwall and earthen berm to protect Austin's major employers and downtown businesses from future flooding.

The city also wanted to continue its property acquisition program, which was established after significant flooding in 1978, to remove structures from the floodplain.⁷ To date, the city has acquired nearly 275 properties with approximately 50 properties still remaining in the floodplain.⁸



Leveraging private philanthropy

Austin is home to the Hormel Foods Corporation headquarters, a Hormel factory, and the SPAM Museum that pays homage to Hormel's most famous product. In addition to being the city's largest employer, Hormel is an important source of capital for local organizations and community projects. To date, the Hormel Foundation has donated \$3.2 million to the Cedar River Watershed District's flood mitigation efforts.

Philanthropic grants can be an important funding source, though they are often overlooked. Communities interested in leveraging local philanthropic grants can collaborate with economic development offices to identify major employers and other potential donors in their region.

Funding Highlights: Austin North Main Flood Control Project		
Local	State	Federal
½-cent local option sales tax (20-year lifespan): ~\$1.4 million/yr	DNR flood mitigation grant assistance: \$7.5 million	FEMA Hazard Mitigation Grant Program (HMGP): \$5 million

RESPONDING TO COMMUNITY INPUT

To build support for flood mitigation, city leaders met with businesses, the chamber of commerce, the parks department, and other stakeholders to understand community needs and priorities. During the meetings, residents voiced concerns that the proposed floodwall would block views, destroying the city's close association with its downtown river.

City officials and engineers listened to community members and, importantly, acted on their feedback. They modified their plans and proposed an innovative solution to raise the road and build a floodwall with removable panels. When the river floods, the panels are put into place. When the river drops, the panels are removed and the views of the river are preserved. Additionally, the city added amenities to the project, including a system of trails, to increase the city's recreation opportunities and enhance aesthetics. These additional benefits helped strengthen community support for the project.

Building Support for Funding

As city leaders modified their plans in response to community feedback, they were also building support to pass a local options sales tax to fund the project. Some businesses opposed the tax, and city officials worked hard to emphasize the economic benefits of the mitigation project. They noted that when Austin floods, major employers are forced to temporarily stop operations, damaging the region's economy. They also highlighted the money that homeowners would save due to lower flood insurance premiums.

In 2007, residents voted to pass a 20-year ½-cent local option sales tax.⁹ The tax generates approximately \$1.4 million annually for flood mitigation projects. This local source of funding has been critical in helping to secure additional grants from state and federal programs. The city has also used the sales tax revenues to acquire additional properties located within the flood plain. As former Austin City Council Representative Roger Boughton was quoted in the Austin Daily Herald, "Taxes do make a difference."

Engaging with Regional Partners & Accessing Private Funding Sources

Austin’s commitment to mitigation extends beyond the city to the Cedar River Watershed District, which Austin city officials were instrumental in creating. The goal of the watershed district is to reduce the peak flood flow from the Cedar River by 20% during heavy rain events by changing land use and agriculture practices upstream from Austin and building capital improvement projects. Although these projects have been completed largely independently from the city of Austin, the District has increased the region’s flood mitigation capacity with positive benefits for the city.

The Cedar River Watershed District has benefited from a partnership with the Hormel Foundation. To date, the Watershed District has completed 14 projects with \$3.2 million in funding from The Hormel Foundation and another \$3.4 million from state grants and its own budget.¹⁰

City leaders have also extended their outreach to state and federal partners, leading to greater access to funding resources. When interviewed, state officials were familiar with Austin’s successes and praised the city for its staff and public education.

Developing strong relationships with stakeholders—both with groups that are affected by mitigation and groups that can affect mitigation outcomes—is critical to project success. Project teams are strongest when led by local and regional organizers who are responsive to local needs and supported by state, regional, and federal networks.

Maintaining Community Support

Austin’s lower insurance premiums, demonstrated successes, and risk awareness programs have secured long-term support from residents, who continue to have a positive relationship with flood control efforts.

Maintaining interest and support for mitigation projects is challenging. Immediately following a flood, community members are often catalyzed to implement projects. However, as time passes, interest can wane. This so-called “flood amnesia” can inhibit progress if residents begin prioritizing other community projects. One of the ways Austin



Austin installed flood markers throughout town that remind residents of the city’s flood risk. Photo: Trey Myers

preserves risk awareness among its residents is with flood markers that illustrate how high the 2004 flood waters reached. These signs serve as constant reminders of the city’s flood risk and the need for preemptive flood mitigation and management.

Lower flood insurance premiums can also serve as a tangible reminder to residents about the importance of mitigation. The National Flood Insurance Program (NFIP) offers communities reduced insurance rates in exchange for flood mitigation through the Community Rating System (the best score is a 1 and

the worst is a 10).¹¹ The mitigation projects Austin pursued reduced their NFIP Community Rating System score to a 5, which decreases insurance premiums by 25% for homes in special flood hazard areas and 10% for all other homes. Austin’s rating is noteworthy. Only 7% of communities that participate in the NFIP also participate in the Community Rating System, and of these, less than 10% have scores of 5 or lower.

Austin’s commitment to community engagement has resulted in a project that successfully mitigates flood risk and meets the community’s needs for recreation, aesthetics, and a continuing relationship with the river.



Public Works employees install the removable panels to Austin’s flood wall to prepare for high waters.

Invisible flood wall preserves river views

Austin constructed an innovative “invisible flood wall” that permanently protects the downtown area from flooding at the level of the 2004 flood. The floodwall’s unique design has removable panels that can be attached during severe floods to provide an additional three feet of protection. After a flood, the panels are removed so residents can continue to enjoy views of the Cedar River from downtown.

LEARN MORE ABOUT AUSTIN'S FLOOD MITIGATION EFFORTS

City of Austin's Flood Mitigation Program

<http://www.ci.austin.mn.us/public-works/flood-mitigation-program>

FEMA Lost Avoidance Study for Austin, Minnesota, October 2013

<http://www.ci.austin.mn.us/Engineering/PDF/Final2013.pdf>

Austin, MN: Community uses local sales tax to help fund flood mitigation

<https://floodeconomics.com/communities/austin-mn>

ACKNOWLEDGMENTS

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Photo: Trey Myers

Local sources of revenues empower the community

A local option sales tax is one strategy communities can use to generate local funding for mitigation projects. Austin's local option sales tax has allowed them to pursue mitigation projects like property buy-outs on the city's own timeline. They've also used the tax's revenues to meet state and federal grant requirements for local funding matches.

Local option sales taxes are designed to finance specific projects in communities, including flood mitigation as well as transportation and community revitalization programs. In Minnesota, local governments are generally prohibited from adding local sales taxes to state sales tax, but the state legislature may approve local taxes like Austin's in special circumstances. States have different policies regulating local sales taxes. It is important for project managers to understand their state's fiscal policies and also network with state program officers.

Overcoming Financial Obstacles

Fargo, North Dakota



QUICK FACTS

Population ¹	124,844
Flood-Related Disaster ²	26
% of City Properties at Risk ³	12%
Avg. Cost of Flood Insurance Per Household ⁴	\$598
FEMA Community Rating System Score (2019) ⁵	5



Photo: Amanda Savitt

CHALLENGES

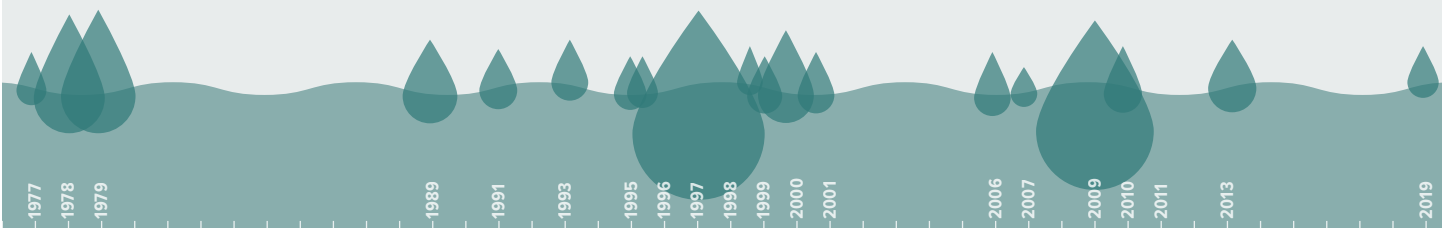
The Fargo-Moorhead Diversion project is a large, complex, and very expensive flood control project that includes a 30-mile diversion channel, levees, and upstream staging areas. The project team had to coordinate with stakeholders across multiple state and regional jurisdictional boundaries. At times, the project has been politically contentious.



Photo: Samantha Montano

YEARS WITH DAMAGING FLOODS, 1976-2019

Size proportional to National Flood Insurance payments.



LESSONS LEARNED

Larger projects require more flexibility and creativity.

Fargo's flood mitigation project is estimated to cost \$2.75 billion.⁶ A project of that scale inevitably has unexpected challenges. The organizing team had to be flexible and responsive to keep the project moving. For instance, the project team chose a route that was less efficient from an engineering perspective but more politically acceptable given stakeholder objections. Negotiating skills were key.

Funders have specific requirements and preferences.

Fargo's project had a low benefit-cost ratio, which made it less competitive for funding from the U.S. Army Corps of Engineers. Fargo officials, however, understood that the Corps was interested in exploring creative financing mechanisms with private funding. The city proposed a public-private partnership and pitched it as an opportunity to experiment with this model. The Corps agreed and prioritized the project. Funding applications should be specific to the funder and demonstrate an understanding of its priorities.

Public relations campaigns work.

Fargo's emergency response programs are heavily dependent on volunteers. Program team members created a public relations campaign to secure votes for a local sales tax by reminding community members of the harsh conditions of volunteering to fight floods in North Dakota's sub-zero weather.

Projects have long-term fiscal impacts.

Fargo understood that property buyouts may diminish their municipal revenues if residents leave the city. They provided financial incentives for buyout participants who chose to stay in the community, thereby protecting an important part of the tax base.

OVERVIEW

The Red River divides Fargo, North Dakota and Moorhead, Minnesota as it flows north to Lake Winnipeg. The geography is exceptionally flat, heightening the risk for annual spring flooding. Between 1965 and 2019, the Federal Emergency Management Agency (FEMA) issued 26 disaster declarations for Cass County. Major flood events in 2009, 2010, 2011, 2013, and 2019 have reinforced the importance of flood protection.

In 2009 Fargo experienced a nearly 41-foot flood event that inundated parts of the city. This event motivated the community to initiate a large-scale flood diversion project spanning the Minnesota and North Dakota state line. It includes a 30-mile diversion channel, a 20-mile southern embankment to regulate flood water flows through the metro area, and in-town levees in Fargo and Moorhead. The project was designed to protect the city from a 100-year flood event and reduce the flood risk for 230,000 people in Fargo, Moorhead, West Fargo, Horace, and Harwood. Construction of the diversion channel is expected to be completed in 2027.



Fargo community volunteers saved the city from devastating flooding in 2009.

Flood fighting in Fargo: The 2009 flood

Fargo's long history of "flood fighting" prompted the city to develop an extensive volunteer-based approach to emergency management in which hundreds of community members help sandbag and build temporary levees.

In 2009, Fargo experienced a massive flood in early spring. The city and volunteers rallied to fill millions of sandbags, ultimately placing them over 19 miles and building another 69 miles of temporary flood measures in freezing winter conditions. Thanks to the volunteers' heroic efforts, the city was largely spared from flood damages. Late Mayor Dennis Walaker joked that, if the flood fight successfully spared the city, he would buy everyone in Fargo a beer.⁷ He later handed out 9,000 "Denny Dollars" coupons that could be used for \$1 off beers at a local bar.

When city officials proposed the Fargo-Moorhead Diversion channel, they reminded community members of the risk the flood posed and the effort it took to save the city. To build support for the project, they created a successful public relations campaign with pictures of volunteers placing frozen sandbags in neighborhoods during a frigid North Dakota March. The campaign worked and voters approved a local sales tax to kickstart the flood control project.

Funding Highlights: Fargo-Moorhead Diversion Project			
Local	State	Federal	Private
Two ½-cent local sales taxes and one ½-cent countywide sales tax (\$1.1 billion)	Funding from both MN (\$86 million) and ND (\$870 million)	\$750 million from U.S. Army Corps of Engineers	Public-private partnership

LARGER PROJECTS REQUIRE CREATIVE FUNDING AND FLEXIBILITY

The diversion project is one of the most expensive flood mitigation projects currently being undertaken in the United States. The estimated costs range from \$2.2 – 2.7 billion, and piecing together its funding has taken years.⁶

Fargo faced many challenges in the design and implementation of the project. It involves six rivers, protects more than five jurisdictions, and crosses not only state lines but also FEMA regions. Working across jurisdictions required the diversion's advocates to negotiate priorities, requirements, and even different interpretations of the same policies in multiple cities and states.

According to city officials and U.S. Army Corps of Engineers' assessments, given the geography and hydrology of the region, protecting the Fargo-Moorhead region from flooding would have been nearly impossible without such an expensive and ambitious design. Some of the costs still have not been funded. However, the tactics Fargo has used to secure the funding to date have been innovative and noteworthy.

1. Overcoming a Low Benefit-Cost Ratio

One of the first challenges Fargo encountered when seeking funding for the diversion project was its low benefit-cost ratio. To qualify for federal funding, projects must be shown to be cost-effective, which is proven through a benefit-cost ratio. While property buyouts in the floodplain are typically cost-effective, the diversion project's expensive price tag skewed the benefit-cost ratio downward. Further, the properties being bought were predominantly residential, which often have lower property values than commercial properties and served to further lower the benefit-cost ratio. As a result, the diversion project was not competitive for funding from the U.S. Army Corps of Engineers.

Instead of giving up on Corps funding, Fargo leadership presented an innovative strategy for implementation: a public-private partnership that would help cover costs and create new funding and organizational opportunities. The proposed partnership

was designed to supplement public funding with capital from private investors. In Fargo's project, the investors' upfront capital gets paid back with interest over time drawing from voter-approved sales tax revenues. In this public-private partnership, the investors also design, construct, and maintain the project for 30 years, but the infrastructure remains publicly owned.

The creative funding won over the U.S. Army Corps of Engineers. They pledged \$750 million in funding and prioritized the project. Under the agreement, the public-private partnership will pay for the diversion channel itself (when construction begins in 2021), whereas the Corps provided funding for the southern embankment construction (that began in 2017).

2. Leveraging Local Revenues to Jumpstart the Project

Another challenge for accessing funding was the relative absence of flood losses in Fargo. Although the city is prone to flooding, its exceptional record of "flood fighting" and emergency response measures—conducted, in large part, by volunteers—have often prevented major flood losses. As a result, Fargo was ineligible for some forms of federal funding. However, emergency measures such as constructing temporary levees and producing and placing sandbags were expensive and exhausting for volunteers. Fargo's city government and flood-fighting residents were motivated to find a better solution.

City officials used their history of sandbagging and successful flood fighting to the city's advantage, despite the consequences for funding eligibility. To generate local funding, Fargo and Cass County proposed a ½-cent sales tax increase in 2010 with revenues earmarked for flood control projects. Fargo officials developed a public relations campaign that focused on how the diversion project would relieve frustrations that many residents felt when forced to sandbag in freezing conditions to prevent their community from flooding.

The public relations campaign worked, and the sales tax passed with over 90% of the vote.⁸ In 2013, another ½-cent increase in the city's sales tax was approved by voters for flood protection.⁹ Both 1/2-cent sales taxes will be in place until 2084. Long-term local sales taxes like these provide a stable source of funding that is not subject to changing state or federal funding priorities. Local funding is projected to cover a greater percentage of the project than is required by federal partners, making Fargo a more attractive funding partner.

3. Making Buyouts Work for the City

The diversion required properties in the floodplain to be purchased by the city. Since 1997, more than 200 homes have been acquired by the city of Fargo.¹⁰ In many communities, these buyouts can result in residents leaving the jurisdiction entirely, reducing the tax base and resulting in decreasing municipal revenues. To encourage residents to stay and reduce negative revenue impacts, Fargo provided \$15,000 in cash incentives for those who remained in the community following buyouts. The city also paid residents 110% of the assessed values of their homes to generate goodwill.

Although Fargo's flood project is unusual in terms of scale and cost, many flood mitigation projects include substantial infrastructure changes or updates. These types of projects are expensive and often take decades to complete. A community may be motivated to reduce its flood risk even without large investments from federal or state partners. These challenges force communities and local leaders to think creatively about how to develop local funding or how to convince stakeholders



Photo: Samantha Montano

What's a benefit-cost analysis?

The Federal Emergency Management Agency (FEMA) relies on benefit-cost analyses to assess the net advantages of flood mitigation projects. The analysis estimates costs and benefits over a defined time period and results in a benefit-cost ratio that is used to compare cost-effectiveness of projects.

FEMA has defined methods for how to calculate the benefit-cost ratio. For flood mitigation projects, the analysis will include the costs to develop and maintain the project, including the costs of acquiring properties and rights-of-way, planning and engineering costs, construction and materials costs, and administrative costs. Benefits will include the value of risk reduction (i.e., costs of damages and service losses avoided), as well as co-benefits like improved access to recreation.

If the ratio of benefits to costs is greater than one, it means a community will benefit more from the project than the project will cost. FEMA's Hazard Mitigation Grant Program requires projects to be cost-effective to be eligible for funding. In other words, the benefit-cost ratio must be higher than 1.0.

to participate. Fargo's use of a public-private partnership, its local sales tax, and its approach to buyouts suggest how innovative thinking can generate community support for projects while also attracting unexpected funders.

LEARN MORE ABOUT FARGO'S FLOOD MITIGATION EFFORTS

Fargo-Moorhead Area Diversion Project

<https://fmdiversion.gov/>

City of Fargo Flood Control Projects and Protection

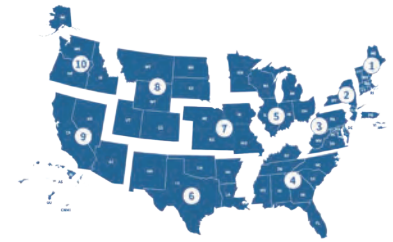
<https://fargond.gov/city-government/departments/engineering/flooding-flood-control>

ACKNOWLEDGMENTS

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Federal Emergency Management Agency regions

The Federal Emergency Management Agency (FEMA) is tasked with coordinating disasters that overwhelm the capacity of local and state governments. FEMA is headquartered in Washington, DC, and organized into 10 multi-state and territory regions. These FEMA Regions serve as a liaison between the federal government and local and state offices.

FEMA Regions are also responsible for administering specific delegated programs and for setting certain regional priorities. Because the regions may interpret federal guidance differently from each other, projects such as Fargo's that span regions may run into challenges negotiating these different interpretations.

Implementing Watershed-Scale Flood Mitigation Projects

Grand Island, Nebraska



QUICK FACTS

Population¹. 51,478
 Flood-Related Disaster² 8
 % of City Properties at Risk³ 15%
 Avg. Cost of Flood Insurance Per Household⁴. . . \$1,424
 FEMA Community Rating System Score (2019)⁵. Not a participant

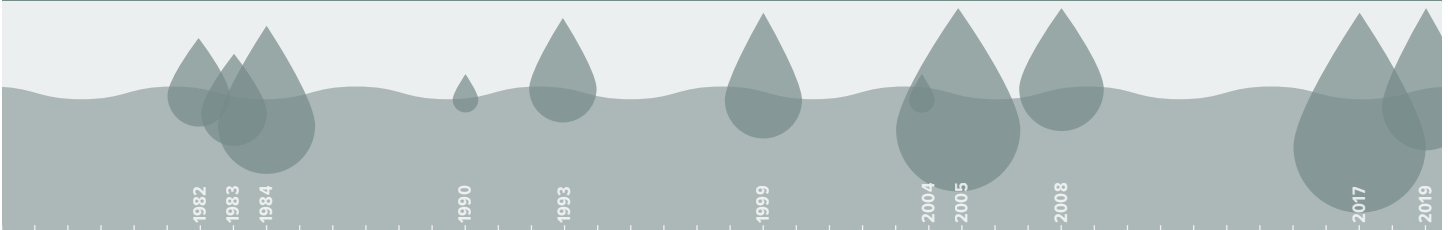


CHALLENGES

Grand Island experiences periodic floods from heavy rains. The city's geography, including its flat terrain and multiple rivers, lends itself to watershed-scale, regional mitigation projects. These types of projects have unique logistical challenges. To be successful, the project team in Grand Island had to prioritize project management skills, build support in multiple communities, and coordinate with local, state, and federal stakeholders.

YEARS WITH DAMAGING FLOODS, 1976-2019

Size proportional to National Flood Insurance payments.



LESSONS LEARNED

Watershed-scale projects require proactive, sustained communication.

The Upper Prairie - Silver - Moores project ran into several unexpected challenges, including cost increases and contamination cleanup. Project leaders credited their monthly stakeholder meeting for helping to overcome these barriers and raise additional revenues.

Communities benefit when their local projects are supported by regional and state partners.

Nebraska's natural resources districts are unique. They are organized around river basins and supported through a property tax, both of which strengthen their capacity to coordinate watershed-scale projects. The Central Platte Natural Resources District has been an important partner for planning and implementing mitigation projects that decrease flood risk in Grand Island.

Strong project teams are needed to respond to community input and identify the right solution.

When Grand Island residents objected to a mitigation plan proposed by the U.S. Army Corps of Engineers, the Central Platte Natural Resources District advocated on behalf of the community. The district was willing to go to bat for the community, refusing funding that did not meet their needs and reimagining the project to address community concerns.

OVERVIEW

Rainstorms cause flooding on the Wood River and Upper Prairie - Silver - Moores creeks in and around Grand Island. During a major flood in 2005, seven inches of rain fell in less than eight hours, leading to dozens of home evacuations in Grand Island and millions of dollars in damages throughout the county.

Grand Island has addressed its flood risk by participating in regional, watershed-scale projects, two of which are the Wood River Diversion project and—the most recent one—the Upper Prairie - Silver - Moores project.

Funding Highlights: Upper Prairie - Silver - Moores Project	
Local	State
\$671,000 (Hall County)	\$14.8 million (Natural Resources Commission)
\$335,000 (Merrick County)	
\$6.2 million (Grand Island)	
\$6.2 million (CPNRD)	

GRAND ISLAND BENEFITS FROM TWO WATERSHED-SCALE FLOOD PROJECTS

1. The Wood River Diversion Project

The Wood River Diversion project was a collaboration between the U.S. Army Corps of Engineers, the Nebraska Department of Natural Resources, the Central Platte Natural Resources District, Hall and Merrick counties, the City of Central City, and the City of Grand Island. It consists predominantly of small levees, as well as a flood control gate with a low levee that diverts water six miles to the Platte River to protect the southern part of Grand Island. The 2005 flood occurred shortly after the project's completion and illustrated its value. While the project cost \$15.5 million to construct, it prevented an estimated \$23 million in damages in just this one flood event.⁶

2. Upper Prairie - Silver - Moores Project

In 2004 the Central Platte Natural Resources District, the City of Grand Island, and two counties signed an interlocal agreement to build the Upper Prairie - Silver - Moores project. The project included a series of dry dams, a levee, and water detention cells. The project is designed to hold a massive amount of water, approximately 5,000 acre feet. Project planning and hydrology analysis began in 2002 with construction beginning in 2007. The majority of the project was completed by 2019, though additional projects are ongoing.

NEBRASKA'S INNOVATIVE RIVER-BASIN NATURAL RESOURCE DISTRICTS ADDRESS LOCAL NEEDS

The Central Platte Natural Resources District is one of 23 natural resources districts in Nebraska.⁷ These districts are unique in that they are organized by river basins and cover large geographic regions. Other states typically organize their conservation or watershed districts along county lines, making it harder to negotiate watershed-scale projects. Nebraska's natural resource districts are also tax-funded and locally controlled, increasing their accountability to local taxpayers.

For example, in the Upper Prairie - Silver - Moores project, the relationship between the Central Platte Natural Resources District and the community resulted in substantial changes to the project design. The U.S. Army Corps of Engineers originally offered to help fund a version of the project in which channels would be widened to flood farmland.



Flood Control Stroll public outreach event

As part of its flood mitigation work, the Central Platte Natural Resources District conducts public outreach about flood risk and mitigation project benefits. For the Upper Prairie - Silver - Moores project, the Natural Resources District hosted a "Flood Control Stroll" event in June 2019. The event started at Wave Pizza Company where residents picked up their punch cards and learned about flood risks. They then meandered through town, stopping at participating businesses to get their cards punched and sample flood-themed food and drinks. The event ended at Prairie Pride Brewery with live music and a raffle for people who collected all six punches during the stroll. The event was a creative way to help community members understand the purpose and benefits of the Upper Prairie - Silver - Moores project while also enjoying local music, art, and food.

However, this would have resulted in losses for the agricultural community, and the community did not support it. In response, the Central Platte Natural Resources District rejected the project design and the Corps withdrew their funding. The district then redesigned the project to better address local concerns. They constructed detention cells to regulate flows, allowing the streams to run at higher levels for longer rather than shorter, more extreme bursts of water.

Importantly, the Central Platte Natural Resources District has the staff and funding capacity to plan and implement strategic flood mitigation projects at the watershed scale, as well as build support in the 30 municipalities it serves. The district also conducts public outreach about flood risk. Its coordination improves trust amongst stakeholders and helps ensure that communities downstream from projects will not be disproportionately harmed.

WATERSHED-SCALE PROJECTS REQUIRE FLEXIBILITY AND PROACTIVE COMMUNICATION

While watershed-scale projects may protect more people and substantially reduce flood risks, they also encounter unique challenges. Regional projects cross jurisdictional boundaries and thus involve complex networks of local, state, and federal partners, as well as a host of consultants. As a project's scope and scale increase, so do unexpected challenges and costs.

For example, construction of the Wood River Diversion was delayed by a regulatory shift at the U.S. Army Corps of Engineers. After major flooding on the Red River, the Corps required new projects to meet a 500-year flood standard rather than the previous 100-year standard. The Wood River Diversion had to be redesigned. Delays like this are common in larger, regional projects, requiring project teams to be flexible and accommodate changes in plans. In another example, the Upper Prairie–Moores–Silver project underestimated the costs of fuel for earthwork and land acquisition. The project was also delayed for two years when the detention cell that the county had purchased from the Corps needed to be properly cleared of hazardous materials. These factors substantially increased the budget and required the project team to secure additional funding.

Proactive, regularly scheduled communication among partners can facilitate creative problem-solving. Although networking is time-consuming, it pays dividends when unexpected challenges arise. In the Upper Prairie–Moores–Silver project, the Central Platte Natural Resources District convened monthly meetings over the 15-year course of the project's construction, ensuring that everyone was kept apprised of developments. The strong relationships built during these meetings were identified by participants as a major contributor to the project's success, as the project team was able to manage expectations, work around construction delays, and use the network to find additional funding for unexpected costs.

It is critical to have effective governance structures and communication strategies in place for mitigation projects, especially for larger, watershed-scale projects. When unexpected challenges occur, trust and effective communication help communities creatively solve problems and overcome barriers.



Complex projects have shifting stakeholders

The Upper Prairie - Silver - Moores project involved a mix of local, state, and federal government partners and a host of consultants. Since many flood mitigation projects take decades to plan, fund, and construct, this network of stakeholders—including regulators, funders, project managers, and beneficiaries—is constantly evolving.

For instance, in the Upper Prairie - Silver - Moores project, the U.S. Army Corps of Engineers was originally a key stakeholder and funder. However, when the Corps' plans were dismissed by local stakeholders, they withdrew their support. The stakeholder map shifted in response.

Understanding a project's complex map of stakeholders is key for creating a proactive, inclusive communication plan. Stakeholders can be kept in the loop through regularly scheduled meetings, newsletters, and email and/or phone communications. On-site tours are also very effective at helping stakeholders understand the importance of projects and its challenges.

LEARN MORE ABOUT GRAND ISLAND'S FLOOD MITIGATION EFFORTS

Upper Prairie/Silver/Moores Creek Flood Control Project (Northwest Flood Control)

<https://www.grand-island.com/departments/public-works/engineering/2019-planned-projects/upper-prairie-silver-moores-creek-flood-control-project-northwest-flood-control>

Central Platte Natural Resource District

<http://cpnrd.org/flood-control/>

Flood Risk Reduction for Grand Island, Nebraska

<https://www.floodsafe-cpnrd.org/>

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Models of conservation districts in the United States

Nearly 3,000 conservation districts throughout the United States are tasked with managing natural resources, including water, soil, forests, and wildlife. Conservation districts are established by state law and have various names, from soil and water conservation districts to land conservation committees. Since districts are unique to each state, they also vary in design and structure, funding, authority, and capacity.

Nebraska's natural resources districts are unique because they are organized around river basin lines instead of county lines, and every corner of Nebraska is included in a district.⁷ The districts were formed through legislation passed in 1969, which consolidated 154 special purpose resource districts—which often had competing goals—into 24 streamlined natural resources districts.⁸ Additional merging later resulted in 23 districts. The districts are funded through property taxes and have a variety of programs including flood control, soil erosion, groundwater management, and others.

At the state level, the Nebraska Association of Resources Districts helps coordinate the work of the 23 districts. Nebraska's natural resources districts are generally seen as a higher-capacity form of conservation district because they have a stable source of funding and strong local authority.

Addressing Flood Mitigation Impacts on Marginalized Neighborhoods

Lincoln, Nebraska



QUICK FACTS

Population ¹	287,401
Flood-Related Disaster ²	8
% of City Properties at Risk ³	8%
Avg. Cost of Flood Insurance Per Household ⁴ . . .	\$1,258
FEMA Community Rating System Score (2019) ⁵	5

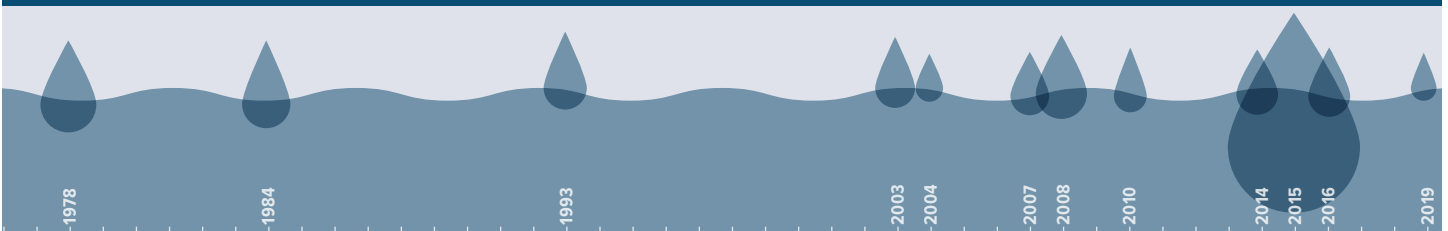


CHALLENGES

Lincoln's city leadership recognized that urban flooding could devastate diverse inner-city neighborhoods, but some residents in these neighborhoods didn't trust the government to facilitate a fair solution.

YEARS WITH DAMAGING FLOODS, 1976-2019

Size proportional to National Flood Insurance payments.



LESSONS LEARNED

Flooding often disproportionately impacts marginalized populations.

Lincoln city leaders recognized their project would impact neighborhoods that were more racially diverse than other parts of the city. They took a proactive approach to listening to community members and responding to needs, such as helping to support a community center.

Mitigation projects require investments in community-building.

Building trust with residents is always important for mitigation projects, but it is especially important when engaging historically neglected and/or vulnerable communities. City leaders in Lincoln hired a consultant team to conduct extensive outreach to build trust and develop solutions that reflected local priorities.

Projects are stronger when they contribute to larger community goals.

Lincoln's flood mitigation was part of a larger community revitalization plan that addressed transportation problems and increased recreational opportunities while decreasing flood risk. Mitigation projects that are incorporated into larger community and economic development goals will attract more community support and funding.

OVERVIEW

Lincoln stands out for implementing a mitigation project that incorporated flood control into a broader community redevelopment plan. While many communities begin mitigation projects after a flood occurs, Lincoln’s project was not a direct response to a major flood. Rather, the city’s leadership team proactively identified flood risk from Antelope Creek, which runs through Lincoln’s historic urban core. Hundreds of homes and businesses were in the 100-year floodplain and thus vulnerable if the creek flooded.

In addition to flood risk, Lincoln’s inner-city neighborhoods also suffered from poor transportation infrastructure, blight, and disinvestment. Lincoln developed a comprehensive solution – the Antelope Valley Project – to revitalize the community through the development of an urban greenbelt. The project involved re-routing major roadways, building new parks and trails, and decreasing flood risk by removing properties from the floodplain and restoring a major waterway.

Funding Highlights: Antelope Valley Project*			
Local	State	Federal	Private
City of Lincoln: \$52.5 million Natural Resource District: \$17 million Railway Transportation Safety District: \$13.7 million	NE Department of Roads: \$60.6 million	U.S. Army Corps of Engineers: \$28 million	University of NE – Lincoln provided right of way as in-kind donation and \$0.9 million

* This project had hundreds of funding sources. Only a few highlights are included in this table.

DESIGNING A COMPREHENSIVE SOLUTION: THE ANTELOPE VALLEY PROJECT

City officials, in collaboration with the University of Nebraska-Lincoln and the Lower Platte South Natural Resources District (LPSNRD), formed the Joint Antelope Valley Authority to develop and lead the Antelope Valley Project. The project addressed the neighborhoods’ major transportation, community development, and flood risk challenges.

The project was extensive. The Authority acquired properties using buyouts and transformed parts of the floodplain into a park with an amphitheater and bike trails. As a result of mitigation efforts, the 100-year floodplain was reduced and no longer contains any private properties, protecting residents and businesses from future floods.

Seven bridges were constructed, all of which are on the edges of neighborhoods rather than dividing them. A weir—a small dam built across a river to regulate its height and flow—was constructed to manage water volumes. When water levels are low, the water passes through the new waterway. During flood events, water also runs through a conduit from the weir. For larger events, such as the 2014 and 2015 floods Lincoln experienced after the project was completed, water overtops the weir and, by design, passes through the new waterway and through the expanded park system.

The project also allowed the University of Nebraska - Lincoln to expand, including the Nebraska Innovation Campus and a combination parking structure and student housing. New housing developments have been built, including some by NeighborWorks Lincoln, a nonprofit organization pursuing community revitalization and facilitating home ownership.



What’s a 100- or 500-year floodplain?

Floodplains are mapped by FEMA and often labeled as “100-year” or “500-year.” Unfortunately, these terms are less intuitive than their names suggest. When a floodplain is labeled “100-year” it means that the area has a 1% chance of flooding each year. All things being equal, one would expect to experience a flood once every 100 years. However, a 100-year flood could occur in any given year, and – although the risk is low – 100-year floods can and do occur in back-to-back years.

Similarly, a 500-year floodplain has a .2% chance of flooding annually, meaning that, statistically, one would expect to experience such a flood once every 500 years. Again, this does not mean that a community will not experience multiple 500-year floods in a 5- or 10-year timeframe. It simply means the odds of that occurring are low. Importantly, parts of the United States are still unmapped by FEMA and none of FEMA’s mapped areas have future environmental changes incorporated into the risk projections.

The project cost \$246 million.⁶ Of that total, 46% went to transportation, 13% went to community revitalization, and 41% went to flood control.

IMPLEMENTING PROJECTS IN RACIALLY DIVERSE NEIGHBORHOODS: INVESTING IN TRUST-BUILDING

Notably, the neighborhoods that were impacted by the Antelope Valley Project were more racially diverse than the rest of Lincoln as a whole. While African Americans and Asians each represent just 3.8% of the city's population, the neighborhoods impacted by the project (North Bottoms, Clinton, Malone, Hawley, Woods Park, and Near South) are 9% African American and 10.5% Asian.⁷



Community members celebrate the creation of three plaques that document the history and struggles of African Americans in Lincoln's Malone neighborhood.

This community had historically been neglected. Years before the Antelope Valley Project was conceived, city officials attempted to site a major road through the middle of an inner-city neighborhood, generating hostility and anger. As a result, trust in city government among some residents was low.

The Joint Antelope Valley Authority was committed to avoiding a similar situation and took a proactive approach to generating community support for the project. The Authority hired a consultant team to hold community meetings and collect public input. While the consultant team was expensive (more than \$1

million for the project), the communication they fostered was critical to building trust between the city and residents impacted by the project. The consultant team conducted more than 1,000 meetings with residents, ranging from one-on-one meetings to large community events. These meetings helped prove to the community that the Authority was serious about listening to them and making changes to reflect their priorities.

Community input shaped the project. For example, updated transportation routes were sited on the edges of neighborhoods rather than through them, which diverted traffic and noise to the outskirts. Further, in response to community concerns that the buyout program would harm neighborhood identity and destroy their shared history, the Authority created a housing preservation and infill program to assist residents who would like to move their household as part of the buyout process. Typically, houses that are acquired to reduce flood risk are demolished. The preservation and infill program provided assistance for residents to avoid demolition. The historically significant homes that could not be moved were memorialized with plaques.

The Joint Antelope Valley Authority also instituted a Citizens' Committee to review project design and suggest improvements. This citizens' committee included architects, developers, landscape designers, trails advocates, and community activists. The committee provided suggestions about aesthetics and maintaining local legacies and neighborhood character. This gave a wide variety of residents more ownership in the project.

The Authority also surveyed residents about their priorities. Residents emphasized neighborhood vitality, which the project designers implemented by creating or bolstering local community centers, expanding recreation opportunities and trails, making small but important safety and aesthetic improvements to the neighborhoods, and increasing and improving housing stock.



Lincoln's flood mitigation projects were part of a larger community redevelopment project, which included Union Plaza Park.

Using mitigation projects to increase quality of life: Union Plaza Park

The Antelope Valley Project contributed to broader community goals by creating a greenbelt with new parks, trails, and recreational facilities. Union Plaza Park was part of this effort. The six-acre urban park includes a meandering waterway with play areas and fountains, a 200-person amphitheater, public art, and paved trails. Not only did this give the Antelope Valley Project more bang for the buck, it also allowed a broader coalition of stakeholders to support and get involved with the project.

Projects that meet multiple community goals are more appealing to decision makers and funders. When designing projects, project teams should brainstorm secondary benefits that could be included: increased recreational opportunities such as new bike trails and/or pedestrian paths, improving water quality, preserving or creating green spaces, and other quality of life improvements. Include these benefits in the economic pitch for a project and highlight them repeatedly during community meetings.

Although community outreach and engagement are always important for cities pursuing flood mitigation, they are even more important in historically marginalized communities. Committing to and investing in community engagement, even before a project has been fully developed, will lead to better ideas and long-term community support.

LEARN MORE ABOUT LINCOLN'S FLOOD MITIGATION EFFORTS

City of Lincoln's overview of Antelope Valley Project
<https://www.lincoln.ne.gov/city/ltu/projects/antelope/>

Lower Platte South Conservation District
<https://www.lpsnrd.org/projects/completed-projects/antelope-valley-project>

ACKNOWLEDGMENTS

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Lincoln's ongoing flood mitigation projects

The Antelope Valley Project is only one project within Lincoln's broader strategy of decreasing their flooding risk. Most of the city's flood mitigation efforts have focused on implementing land use regulations to restrict development. These regulatory changes were largely the result of intensive development pressures. Prior to the regulations, developers were allowed to shorten or even remove channels from sites, which created erosion problems and intensified flooding. New regulations prohibited these types of changes and protected the city's parks and waterways. Although the regulations prompted initial pushback from developers and some members of the public, city officials hosted community meetings to explain why stringent protections were crucial for Lincoln's safety and future.

In addition to regulation changes, the city has acquired and removed approximately 1,000 properties from the floodplain and plans to remove an additional 500 properties. The city has also built detention basins in the floodplain to decrease the intensity of runoff flows during heavy rain events.

Creating a Long-Term, Adaptive Approach to Flood Mitigation

Tulsa, Oklahoma



QUICK FACTS

Population¹. 400,699
 Flood-Related Disaster² 14
 % of City Properties at Risk³ 14%
 Avg. Cost of Flood Insurance Per Household⁴. . . \$720
 FEMA Community Rating System Score (2019)⁵ 2



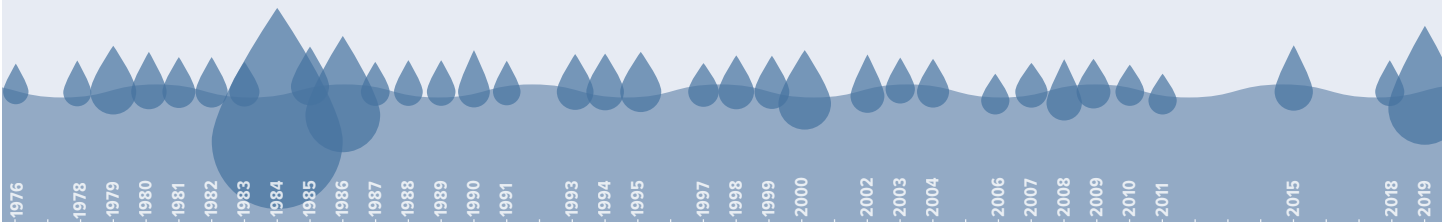
CHALLENGES

Tulsa experienced a devastating flood in 1984 that resulted in 14 deaths, 288 injuries, and extensive damage to the city’s buildings and infrastructure. While the flood catalyzed a progressive flood mitigation program, the program has continually adapted to meet changing needs over the last 30+ years.



YEARS WITH DAMAGING FLOODS, 1976-2019

Size proportional to National Flood Insurance payments.



LESSONS LEARNED

Risks, regulations, and funding sources related to flood mitigation are constantly changing and require adaptability.

Tulsa’s willingness to reimagine its approach to mitigating floods has allowed its programs to remain useful and relevant. Tulsa originally created a Stormwater Management department to manage flood risk but later adapted to changing needs by distributing stormwater staff across government departments.

Mitigation is stronger when it becomes a way of life for city operations and planning.

Tulsa’s Stormwater Management department developed a master drainage plan to help them strategically implement projects across government departments. Tulsa’s stormwater staff always have a seat at the project-planning table, ensuring mitigation is considered in capital improvement projects.

Public outreach maintains community support.

Tulsa’s stormwater staff prioritize public outreach to ensure flood risk is communicated to community members through regular meetings and stakeholder networks.

Flood mitigation is long-term work.

Flood projects do not end once the physical infrastructure is built. Effective mitigation programs require ongoing outreach and maintenance. While Tulsa’s major construction phase was completed by the 1990’s, the city continues to decrease its flood risk through ongoing maintenance and stormwater management projects. Their stormwater utility fee allows consistent funding for these projects.

OVERVIEW

Tulsa is nationally recognized as a leader in flood mitigation. Their progressive approach to flood mitigation began in response to a major flood on Memorial Day in 1984. The flood devastated Tulsa, resulting in 14 deaths, 288 injuries, and \$180 million (1984 dollars) in damages.⁶

The flood prompted Tulsa to rethink its approach to flood control. The city relocated 300 homes and a mobile home park, invested more than \$10 million in flood control projects, and spent \$2.1 million to develop master drainage plans.⁷ It was an early adopter of the National Flood Insurance Program's Community Rating System (CRS). Over time it has reduced its rating in that system to a 2, one of only six communities in the country with such a low rating. (The rating system ranges from 1 to 10, with 1 being the best possible score.) As a result of their participation in CRS and their rating, Tulsa residents benefit from a 40% discount on National Flood Insurance Program premiums.



The Community Rating System

The Community Rating System (CRS) was instituted in 1990 as a complement to the National Flood Insurance Program. CRS is designed to incentivize proactive flood mitigation projects by reducing National Flood Insurance Program premiums when cities implement specific mitigation activities. CRS scores range from 10 (in which communities have implemented no or minimal mitigation efforts) to the best possible score of 1.

When communities implement mitigation projects within the following categories, they can lower their CRS score:

- Public Information
- Mapping and Regulations
- Flood Damage Reduction
- Flood Preparedness

The more qualifying mitigation projects that communities undertake, the lower their CRS score. For every one-point score reduction, residents who live in special flood hazard areas receive a 5% reduction in their National Flood Insurance Program premiums. Tulsa's CRS score of 2 indicates that the city has done a great deal to mitigate its flood risk. As a result, its residents in special flood hazard areas receive a 40% reduction in their flood insurance premiums resulting in approximately \$790 annual savings per household.

Funding Highlights: Stormwater Maintenance		
Local	State	Federal
\$8.35 monthly stormwater utility fee	Oklahoma agencies have funded projects with mitigation co-benefits (e.g., OK Dept. of Transportation)	Hazard Mitigation Grant Program funding

ADAPTING GOVERNMENT PROCESSES TO MEET FLOOD CHALLENGES

One of the results of Tulsa's initial flood mitigation efforts following the 1984 flood was the establishment of a Stormwater Management department within city government. The new department helped build support for and implement mitigation projects.

As the construction phase of Tulsa's mitigation projected ended, the city diversified its flood control to focus more on maintenance. In 1991, stormwater management employees were moved into other departments, including engineering, streets, and development, to increase efficiency and collaboration. Stormwater management is now integrated throughout government processes, enabling mitigation to be incorporated into seemingly unrelated capital improvement projects. Since stormwater management is now incorporated into many different city departments, stormwater staff always have a seat at the table when decisions about the city's infrastructure are being made.

The city has also committed to a stormwater-oriented approach to flood mitigation through the establishment of its Stormwater Management and Hazard Mitigation Program, which was written into Tulsa's Code of Ordinances in 2008. In addition to defining the scope and responsibilities of stormwater management staff within the Public Works department, the Code also defined the Stormwater Drainage and Hazard Mitigation Advisory Board. The board's purpose is to advise the mayor on appropriate policy to protect Tulsa from flood risk, to commission studies on stormwater issues and flooding, and to review Tulsa's hazard and disaster plans.

MASTER DRAINAGE PLAN

Tulsa's investment in planning and creating a master drainage plan has been key in enabling its adaptive approach to flood mitigation. The purpose of a master drainage plan is to identify potential or actual drainage problems and to develop strategies to fix them. Since 1990, Tulsa has had a citywide master drainage plan that identifies recommendations, goals, and objectives, and prioritizes projects according to their flood risk reduction potential along with several other criteria. The plan is updated routinely on an as-needed basis.



Tulsa often leverages money from the Department of Transportation to help fund stormwater improvements to its road infrastructure.

According to city officials, the master drainage plan has been integral to incorporating flood mitigation into projects throughout the city. For example, the master drainage plan enabled the integration of drainage improvements into a major, decade-long transportation project to widen and update a stretch of interstate highway (I-44) that runs through Tulsa. Having a master drainage plan in place gives Tulsa the ability to make consistent

and strategic decisions about drainage projects throughout the city, as well as to include drainage system updates in transportation and other related projects.

A LONG-TERM APPROACH

Tulsa remains a leader in flood mitigation more than 30 years after its program was initiated—quite a feat, especially considering the relative absence of major flood events during that time. Flood mitigation has been institutionalized through the master drainage plan and stormwater management staff throughout local government, as well as through communications strategies to increase risk awareness.

From the beginning of its flood mitigation programs in 1984, Tulsa has prioritized public outreach to increase community awareness about flood risk. This includes conducting community meetings as well as building networks with stakeholders. For example, the Disaster Resilience Network was incorporated in 2000 with the mission of empowering “people, businesses, and communities to reduce the impact of disasters.” The Council’s subgroup on housing has conducted outreach about the use of low-impact development practices and green infrastructure strategies to address flooding and stormwater drainage issues such as rain gardens, bioswales, and pervious concrete.

As cities contemplate mitigation programs, it is important to consider how these programs will be maintained over time. Tulsa’s willingness to adapt its approach to flood control allowed the city government to evolve with changing needs. Deciding on a governance structure and maintenance plan for flood projects are key decisions for local governments. For Tulsa, writing a master drainage plan, maintaining and implementing it, establishing a department to administer flood mitigation, and deciding where that department should be situated within local government were all critical decisions that contributed to long-term success in reducing flood risk.



Stormwater utility fee

Tulsa uses a stormwater utility fee to help fund its Streets and Stormwater Department projects, including operation and maintenance of detention ponds and other stormwater facilities. The 2020 rate for Tulsa residents is \$8.35 per month.⁸ When compared to other tools for generating local revenue, stormwater utility fees are typically a more predictable and stable source of funding.

Taxpayers may resist the creation of stormwater utility fees, so generating support through public information and education campaigns is critical. Explain that the fee will be used to fund projects that will make the community safer and result in more reliable infrastructure. Emphasize that investing in the community today will help the community avoid tragedies that could have enormous costs tomorrow.

LEARN MORE ABOUT TULSA'S FLOOD MITIGATION EFFORTS

City of Tulsa

Flood Control: <https://www.cityoftulsa.org/government/departments/engineering-services/flood-control/>

Flood History: <https://www.cityoftulsa.org/government/departments/engineering-services/flood-control/flooding-history>

How Tulsa Became a Model for Preventing Floods. NPR: <https://www.npr.org/2017/11/20/564317854/how-tulsa-became-a-model-for-preventing-floods>

The City Preparing for Climate Change Without Ever Saying the Words. Governing: <https://www.governing.com/topics/transportation-infrastructure/gov-tulsa-climate-change-resilience-adaptation-flooding.html>

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Creative mitigation strategies: Using sports fields as stormwater detention basins

Tulsa's stormwater management program includes over 155 publicly and privately maintained detention basins.⁹ Detention basins are designed to either temporarily or permanently hold floodwaters during heavy rain events. In Tulsa, many of its "dry" detention basins are large grassy areas that serve as parks, soccer fields, and football fields during normal days. When heavy rain events occur, the water temporarily pools up and is stored in the basin, reducing the flow of runoff water. By preserving vegetation and trees, the basins decrease downstream flooding impacts while also helping to promote water quality.

Tulsa also has "wet" detention basins that permanently hold water. An example of a wet detention basin is Carol's Pond, named after the late Tulsa resident and flood-mitigation advocate Carol Sue Williams. This pond was created after properties on the floodplain were bought, and the space was transformed into a park. The detention basin and surrounding green space provide fishing, golfing, and frisbee opportunities while improving stormwater drainage.

Detention basins require regular maintenance to prevent clogging and ensure full drainage capacities. Tulsa funds this maintenance through its stormwater utility fee.



Conclusion

Many communities have implemented flood mitigation solutions to protect their residents and save lives, money, and heartbreak. As weather and development patterns change, the threat of floods is likely to grow. The lessons these communities have learned through successful mitigation projects can help other communities that face similar risks.

This report highlights several of these crucial lessons. Engaging your community to generate the will to complete a mitigation project is critical (**Austin, Minnesota**), and even more important when the affected residents have been historically marginalized (**Lincoln, Nebraska**). These projects frequently have unexpected challenges, but they can be overcome through strong relationships and partnerships (**Grand Island, Nebraska**) and creative problem solving (**Fargo, North Dakota**). Once a project is complete, continuing to reduce flood risk by embedding mitigation work into routine public works maintenance and projects can help a community meet flood-related challenges (**Tulsa, Oklahoma**).

Flood mitigation projects often compete with other community projects for attention and funding. Every community in this report was engaged in many different kinds of activities to build support, overcome challenges, and foster long-term success. **Austin**, for example, continues to generate flood awareness through its high-water markers placed throughout the city. Sustained community outreach is critical.

The communities in these case studies also faced the challenge of piecing together funding. The infrastructure projects in this report range in cost from approximately \$15 million for **Austin's** North Main flood control project to \$2.7 billion for the massive diversion project in **Fargo**. Every project relied on a diverse set of funding sources, from local revenues to state and federal grants.

Because mitigation projects are complex and often expensive, they typically require strategic coalitions and strong partnerships. Developing, maintaining, and investing in relationships with agency partners and funders was a key task for all five communities. Although coordinating projects and pursuing funding can be a daunting task, the successes of **Austin** and **Grand Island** show that smaller, rural communities can achieve large-scale mitigation projects.

Advice from communities

Community members interviewed for this report offered the following pieces of parting advice to other communities preparing to implement flood projects:

1. Get to know partners and keep them engaged through meetings, calls, and site tours.
2. Listen to and work with community members to design projects that help the community achieve its broader social and economic goals.
3. Expect and adapt to unexpected challenges and expenses. Be prepared to make changes when problems arise.



Photo: Tim Ruzek

POLICY BARRIERS AND ONGOING DEBATES

Each community's mitigation project is shaped by its local context—its geography and watershed features, as well as the community's capacity, leadership, and access to resources. Each project is also shaped by state and federal policies that prioritize certain strategies over others, often through funding allocations.

Community leaders identified common barriers, most of which were related to policies and funding structures beyond their control. These challenges are briefly summarized below to acknowledge their importance and prompt additional discussion.

Funding for mitigation projects is often piecemeal and reactive.

Funding sources are often available only after a flood event and typically only allow communities to rebuild what previously existed. This barrier can inhibit communities from implementing innovative, forward-thinking projects that address the increasing severity of floods. Further, state and federal grant applications are very competitive and typically require a local match between 25 and 30%. This local match can be an insurmountable burden for under-resourced communities.

Mitigation projects are political.

Mitigation projects create winners and losers. Development pressures can intensify opposition to zoning and land use changes. Local politics can be tricky to navigate and require extensive community outreach. At the state and federal level, grant requirements can have unintended consequences. For example, cost-benefit analyses favor projects that involve high-value properties, often at the expense of funding projects that cover lower-value properties.

Regional projects are hard to coordinate, fund, and implement.

While some states have robust regional entities to coordinate watershed projects, such as Nebraska's Natural

Resources Districts, other states lack this capacity. One-off projects may be more feasible to implement but less effective than coordinated responses. There is little structure to help communities participate in and fund regional projects. See the [*Regional Resilience Toolkit: 5 Steps to Build Large Scale Resilience to Natural Disasters*](#) for advice on starting a regional project.

Flooding does not impact everyone equally.

Communities of color tend to disproportionately reside in neighborhoods that are at higher risk for flooding. Further, towns that are wealthier and predominantly white tend to fare better after a disaster compared to communities that are more racially diverse and/or have lower socioeconomic metrics. Systemic problems with funding allocations and recovery assistance can create barriers for implementing mitigation projects in lower-resourced communities.

The future has many unknowns.

Changing weather patterns, the economic impacts of COVID-19, and other socioeconomic factors will likely reshape how communities address flood risk in the future. Long-term planning is difficult, and assessments of impacts are often incomplete. For instance, project teams rarely take into account how mitigation strategies will impact future municipal budgets, though these impacts can be significant.

LESSONS LEARNED



Austin, MN

- Pro-active community engagement is key.
- Community members and funders need to understand project benefits.
- Projects with local revenue sources are more predictable and self-sustaining.
- Community support is easier to catalyze immediately after a flood.



Fargo, ND

- Larger projects require more flexibility and creativity.
- Funders have specific requirements and preferences.
- Public relations campaigns work.
- Projects have long-term fiscal impacts.



Grand Island, NE

- Watershed-scale projects require proactive, sustained communication.
- Communities benefit when their local projects are supported by regional and state partners.
- Strong project teams are needed to respond to community input and identify the right solution.



Lincoln, NE

- Flooding often disproportionately impacts marginalized populations.
- Mitigation projects require investments in community-building.
- Projects are stronger when they contribute to larger community goals.



Tulsa, OK

- Risks, regulations, and funding sources related to flood mitigation are constantly changing and require adaptability.
- Mitigation is stronger when it becomes a way of life for city operations and planning.
- Public outreach maintains community support.
- Flood mitigation is long-term work.

MITIGATION IS AN INVESTMENT IN THE FUTURE

The communities in these case studies faced common challenges, many of which were regulatory in nature and outside of their control. For example, many FEMA grants are available to communities only after floods occur, making it hard to get in front of the problem. Flood policies and spending also exacerbate inequalities. Many rural, low-income, and racially diverse communities suffer greater impacts from flooding. Yet, more federal disaster funding flows to wealthier communities.

Finally, changing weather patterns, the long-term impacts from COVID-19, and other socioeconomic changes create many unknowns, making it challenging for communities to plan for the future.

Despite these barriers, the local leaders highlighted in this report successfully reduced flood risk through strategic partnerships, innovative solutions, and creative funding. Communities large and small created lasting change by:

- generating millions of dollars to protect residents and businesses;
- solving problems that cross city, county, and state lines;
- restoring wetlands and creating new parks and recreational trails;
- protecting residents and businesses in marginalized neighborhoods; and
- creating predictable revenue for ongoing needs.

These experiences provide important lessons for other communities interested in investing in the future by reducing the risk of flooding.



Headwaters Economics is an independent, nonprofit research group whose mission is to improve community development and land management decisions.
<https://headwaterseconomics.org>