

Flooding in Jefferson Chalmers: Recommendations for Resilience



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SEAS Master's Capstone Project
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Image on cover page sourced from Curbed Detroit ¹

Executive Summary

The Jefferson Chalmers neighborhood in Detroit, Michigan, experienced catastrophic floods in the summer of 2021. Jefferson East Inc., a non-profit community development organization committed to improving the lives of Jefferson Chalmers residents, partnered with the SEAS Sustainability Clinic and engaged our team of SEAS Master's students to study the issue and recommend actionable items on how JEI can improve community resilience.

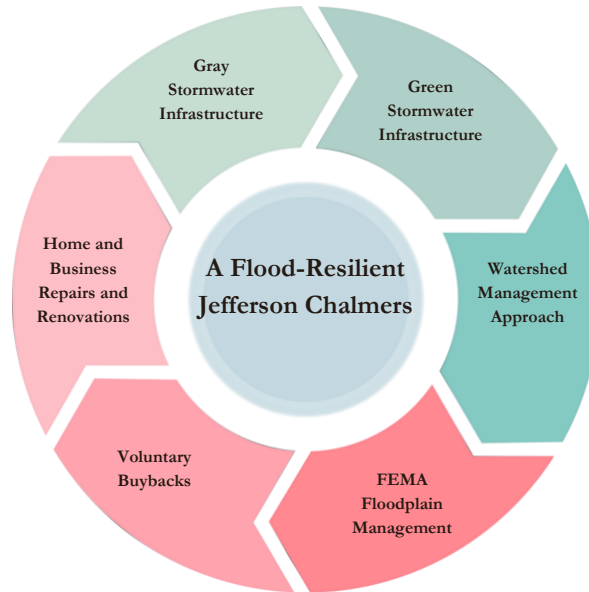
Flooding in Jefferson Chalmers has been a decades-long issue that is due to historical disinvestment from racist redlining practices, poor management, and topographical factors that make the neighborhood prone to flooding. Due to these risks, the Federal Emergency Management Agency (FEMA) has designated almost all the Jefferson Chalmers neighborhood in the 100-year floodplain. This designation puts restrictions on government funds and requires residents to purchase costly flood insurance. Two sources are responsible for flooding in the neighborhood: sewage stormwater backups when the system is overloaded, and surface flooding from the adjacent Detroit River due to high lake levels. Although these issues require broad systemic solutions at the city and regional level, Jefferson East Inc (JEI). can take specific actions to contribute to Jefferson Chalmer's flooding resiliency.

Our vision for a resilient Jefferson Chalmers includes both mitigation and adaptation activities. To mitigate the effects of an overwhelmed sewer/stormwater systems, the region should adopt a watershed management approach for implementing grey and green infrastructure projects. To adapt to flooding in the neighborhood, residents and businesses should repair and renovate their buildings to withstand flooding, engage with FEMA to develop a floodplain management plan and consider voluntary buyback programs to move out of the floodplain.

JEI can support these mitigation and adaptation measures through proactive planning, hiring dedicated resilience personnel, encouraging sustainable and resilient design, acting as a communication hub, continuing equitable community engagement, and engaging in political advocacy.

By engaging in any of these actions, JEI will contribute to the resilience of the Jefferson Chalmers community and support JEI's mission of bringing greater resources, development, and investments to the East Jefferson Corridor.

ADDRESSING FLOODING IN JEFFERSON CHALMERS



JEI ACTIONS TO SUPPORT A RESILIENT JEFFERSON CHALMERS



Proactive Planning

Internal Disaster Response Plan & Community Workshops on flood preparedness & navigating flood insurance

Dedicated Resilience Personnel

Hire staff to manage & coordinate resiliency programming



Sustainable and Resilient Design

Adaptive measures to address flooding in new development and repair/renovation programs

Communication Hub

Space to collect and communicate all flooding related details to Jefferson Chalmers residents and business owners



Sustained Community Engagement

Support government agencies in planning flood resilience projects through equitable and just community engagement

Political Advocacy

For innovations in funding mechanisms, watershed management approach, a state-level water utility commission



Problem Map

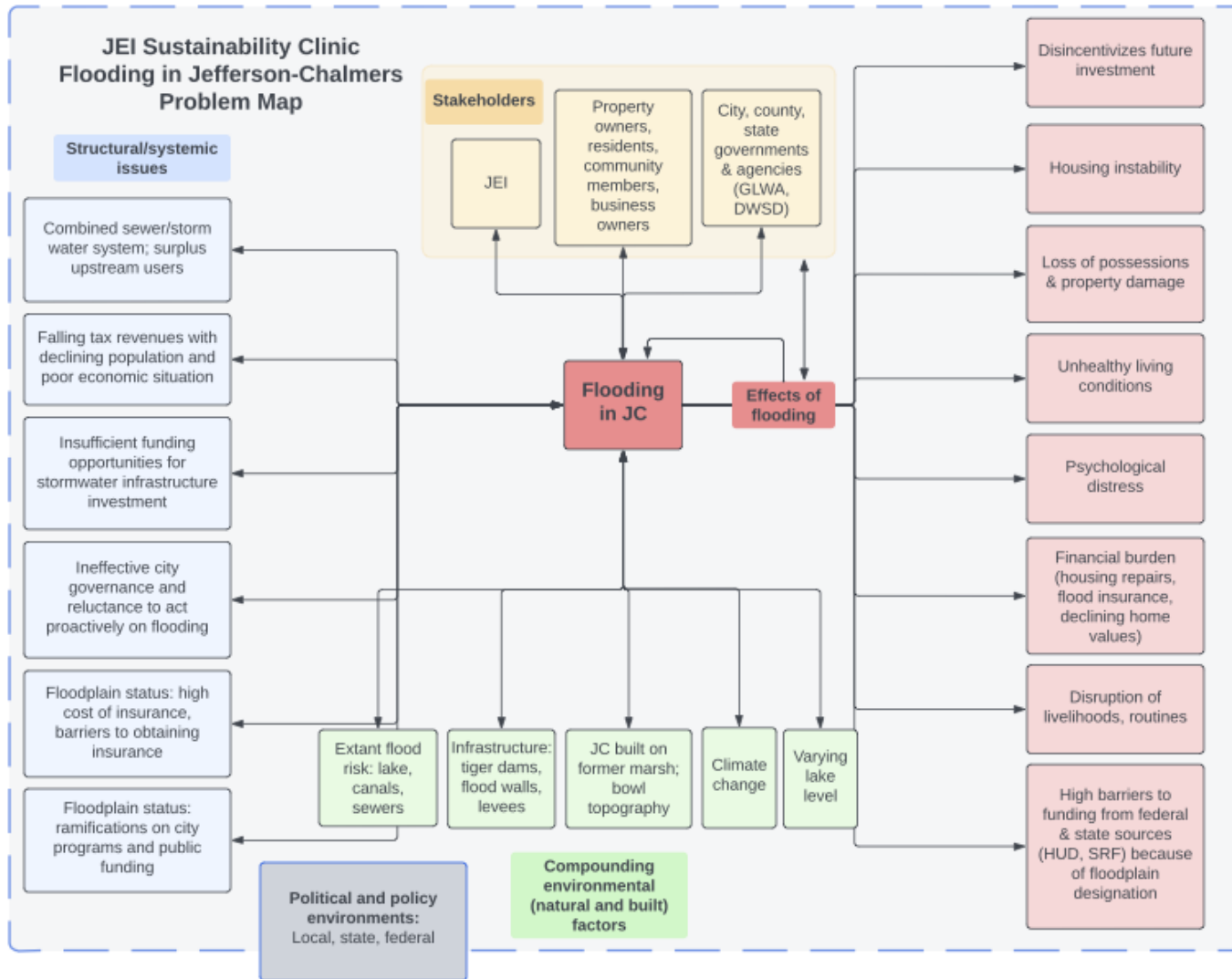


Table of Contents

<i>Acknowledgements</i>	2
<i>Executive Summary</i>	3
<i>Problem Map</i>	5
<i>Table of Contents</i>	6
<i>List of Key Acronyms and Initialisms</i>	9
<i>Project Background</i>	10
Our Client: Jefferson East Inc.	10
Jefferson Chalmers and the 2021 Floods.....	11
Jefferson East Inc. and Flooding Resilience.....	12
Project Scoping Process.....	14
<i>Neighborhood Context</i>	15
Past Flooding Events.....	15
Demographics	16
Flooding and Environmental Justice in Detroit	17
Topography & Water Infrastructure in Jefferson Chalmers	20
Topography	20
Stormwater Infrastructure	22
Lake Level Flooding Infrastructure.....	24
Climate Change Impacts on Flooding	26
<i>Policy Environment</i>	27
Lack of Local Control in Water Governance.....	29
Addressing Combined Sewer Outflows	30
Addressing Lake Level Flooding	32
Evolving Understanding of Flood Risks.....	33
Lack of Dedicated Oversight of Water Infrastructure.....	33

Funding and Affordability Challenges	34
Flood Mitigation: Detroit’s sewers have created a water affordability crisis.....	36
Flood Insurance Affordability & Increasing Costs of Flood Recovery.....	37
Flood Resilience & Recovery: Funding exists but is insufficient and cumbersome.....	38
<i>National Examples of Flooding Resilience.....</i>	40
Municipal Case Studies	40
Motifs from Municipal Case Studies for JEI to Carry on	40
Municipal Case Study Specific Examples.....	47
Organizational Case Studies	49
<i>Vision for a Flood-Resilient Jefferson Chalmers</i>	51
Flood Mitigation Infrastructure and Management	51
Neighborhood Level	51
Regional Level.....	52
Green Stormwater Infrastructure	53
Gray Stormwater Infrastructure.....	55
Flood Adaptation Strategies	56
Home repairs and renovations	56
Floodplain management and working with FEMA	56
Voluntary Buybacks.....	58
<i>Specific Actions That JEI Can Take to Support Flood Resiliency</i>	60
Proactive Planning	60
Dedicated Resilience Personnel	61
Resilient and Sustainable Design	62
Communication Hub.....	62
Sustained Community Engagement.....	64
Political Advocacy	65
<i>Appendix 1: Risk Rating 2.0 Discount Explanation Guide</i>	68
<i>Appendix 2: Proposed Resilience Officer Job Description</i>	71
<i>Appendix 3: Proposed Future Projects for SEAS Sustainability Clinic and JEI</i>	73

Appendix 4: National Conversation on Natural Hazard Mitigation..... 74
Bibliography 75

List of Key Acronyms and Initialisms

BRIC	Building Resilience Infrastructure and Communities
CAP-SSSE	Community Assistance Program – State Support Services Element
CBO	Congressional Budget Office
CDBG-DR	Community Development Block Grant – Disaster Recovery
CSS	Combined Sewer System
CSO	Combined Sewer Overflow
CRS	Community Rating System
DWSD	Detroit Water and Sewage Department
EGLE	Environment, Great Lakes, and Energy
EIBs	Environmental Impact Bonds
FEMA	Federal Emergency Management Agency
FIRM	Flood Information Rate Maps
FMA	Flood Mitigation Assistance
GLWA	Great Lakes Water Authority
GSI	Green Stormwater Infrastructure
GI	Gray Infrastructure
HMGP	Hazard Mitigation Grant Program
HUD	U.S. Department of Housing and Urban Development
ICC	Increased Cost of Compliance
LTCP	Long-Term Control Plan
NFIP	National Flood Insurance Program
SEMCOG	Southeast Michigan Council of Governments
USACE	United States Army Corps of Engineers

Project Background

In June 2021, residents of the Jefferson Chalmers Neighborhood awoke to sewage-flooded basements and streets again when heavy rainfall overwhelmed the aging combined stormwater/sewer system. The destruction by this flood and previous flooding in 2014 and years past has caused financial distress and harmful mental and physical health impacts for residents and businesses. Frustrated and saddened by the continuing devastation, Jefferson East Inc., a non-profit community development organization committed to improving the lives of Jefferson Chalmers residents, partnered with the SEAS Sustainability Clinic and engaged our team of SEAS Master's students to study the issue and provide actionable recommendations on how JEI can improve community resilience.

Our Client: Jefferson East Inc.

Jefferson East Inc. (JEI) self-describes as one of Detroit's "premier community development organizations"². They work in five neighborhoods on Detroit's east side, which includes Jefferson Chalmers (Figure 1). The non-profit's work focuses on bringing businesses and people into the area while ensuring that current residents are not pushed out and benefit from the development. JEI's mission is "Growing Detroit's East Jefferson corridor and its neighborhoods through facilitative leadership, collaborative partnership, innovative and impactful programming." It envisions the neighborhoods to be "regionally competitive and business-friendly districts with equitable economic opportunities for its residents and businesses." JEI values inclusivity and equity in its planning processes and operations and has a long history of working with community members to bring about positive change³.



Figure 1: JEI serves five neighborhoods on Detroit's Eastside.

JEI's operations fall under three general program areas: Housing, Clean and Safe, and Economic Development. Their Housing programs help residents maintain and stay in their homes. These programs connect residents to grant and loan programs, and the staff provides application support and hosts financial literacy workshops and counseling. Under the Clean and Safe category, JEI funds street cleaning services and crime monitoring and prevention programs. Finally, programs and services within their Economic Development category work to bring in businesses and fix up blighted, neglected buildings with support from their for-profit development arm, EJ DevCo. JEI develops and implements many of these programs through collaborative partnerships both within the community they serve and with other organizations throughout Detroit and Southeast Michigan⁴. In times of disaster, JEI also serves the community by connecting residents and businesses to resources to recover and rebuild⁵.

Jefferson Chalmers and the 2021 Floods

In the summer of 2021, Southeast Michigan experienced extremely heavy rainfall that caused massive flooding in many neighborhoods. Jefferson Chalmers neighborhood was particularly hard-hit due to the inadequate capacity of the combined sewer and stormwater system, electricity failures at pump stations, and the neighborhood's topography⁶. More than 6 inches of rain fell in less than 12 hours, much higher than the system capacity of 3.31 inches in 24 hours⁷.

Basements and streets became filled with sewage and stormwater because Detroit has a combined sewer/stormwater system, meaning that they share pipes.⁸ Jefferson Chalmers is also located near one of the major regional pump stations, which receives wastewater from various suburbs. The pipes are gravity

fed, and the pump stations bring water up to a higher level to continue their down-hill slope towards the regional wastewater treatment plant. The combined rainfall from the entire region was too much for the system to handle. There were electricity failures at the pump stations in the neighborhood; however, an independent investigation found that these failures were not the primary cause of the flooding. Even if all of the equipment had functioned normally, there would have still been flooding in basements and roads⁹ due to Jefferson Chalmers' bowl-shaped topography, although how much is unclear. The only way for water to drain out of the bowl is through the stormwater system. When that system backed up, the water had nowhere to go.

The basement and street flooding caused several harmful impacts to the community. Property was damaged and lost, from cars parked on the street to valuables stored in basements¹⁰. The flooded basements created dangerous living conditions due to mold growth, sewage in the basement, and the destruction of water heaters and furnaces. The costly clean-up of basements and streets and repairs needed for foundations, sewer systems, and appliances still financially burden residents today¹¹.

Jefferson East Inc. and Flooding Resilience

The 2021 floods significantly impacted Jefferson East Inc., JEI staff, and the neighborhoods they serve. Flooding is not a new issue, and JEI had already been in conversations with the city about flood-resilient infrastructure when the 2021 floods hit. However, the magnitude of this event spurred JEI to rethink how they manage and respond to flooding in the Jefferson Chalmers community, and the other neighborhoods they serve. Although JEI does not focus on climate resilience, its mission is to bring people and businesses into the neighborhood, and its home repair and housing sustainability programs are inevitably connected to flooding. Since the 2021 floods, many of JEI's home repair assistance programs have focused on providing basement muck-out services ("the removal of mud, muck, silt, and other typically semi-solid material from a home as a result of water inundation"¹²), repairing and replacing damaged basements and appliances, and retrofitting homes with flooding resilience measures, such as raising furnaces and disconnecting downspouts¹³. These programs have been very successful, with over 300 residences receiving clean up assistances¹⁴. JEI was also instrumental in helping residents file claims with the City of Detroit, the regional water provider GLWA, and FEMA after the floods. While these are necessary services JEI will continue to provide when disaster strikes, JEI wants to adopt additional proactive measures to mitigate and adapt to future flooding events¹⁵.

Separate from the 2021 floods, a 2021 change in FEMA floodplain designation also negatively impacts the community. In the fall of 2021, FEMA released updated floodplain maps, which expanded the floodplain designation to include all of the Jefferson Chalmers neighborhood (Figure 2). The floodplain designation restricts government funding for development projects and requires homes with federally-backed mortgages to purchase flood insurance. It closes off a large portion of funds that JEI was planning on using for development projects and puts a greater financial burden on the neighborhood's low-income residents, many of whom are struggling to prevent foreclosure. This issue is discussed in greater depth later in the report.



Figure 2: The top image is the previous floodplain designation, while the bottom image shows the updated floodplain designation. Most of the neighborhood is now in a 100-year floodplain zone (light blue)⁶.

Project Scoping Process

JEI tasked our team to analyze the flooding issue and make recommendations on how they can best support their community's flooding resilience. Although there is already a considerable amount of information publicly available on this issue, we decided it would benefit future teams and us to write a report consolidating all of this knowledge. To do this, our team researched the history of flooding in Jefferson Chalmers through an extensive literature review of academic papers, government reports, news articles, and organizational documents, and interviewed JEI employees to hear their thoughts on JEI's role in flooding resilience. We also interviewed representatives from other organizations working on flood resilience, including the US Army Corps of Engineers (USACE) and City of Detroit, to gain a clearer perspective on the political environment JEI operates in. Using this information, we crafted our recommendations. JEI was interested in identifying short-term and long-term action items and funding mechanisms to support flood resilience-related programs.

Neighborhood Context

Jefferson Chalmers is a predominantly Black neighborhood on the east side of Detroit (Figure 3). Its contemporary borders are typically drawn by Kercheval Avenue or Vernor Street to the north and bounded by Clairpointe Street and Alter Road to the southwest and northeast, respectively. The neighborhood borders the Detroit River. East Jefferson Avenue is the central artery of the neighborhood. Canals run throughout the neighborhood, providing water recreation opportunities to residents.

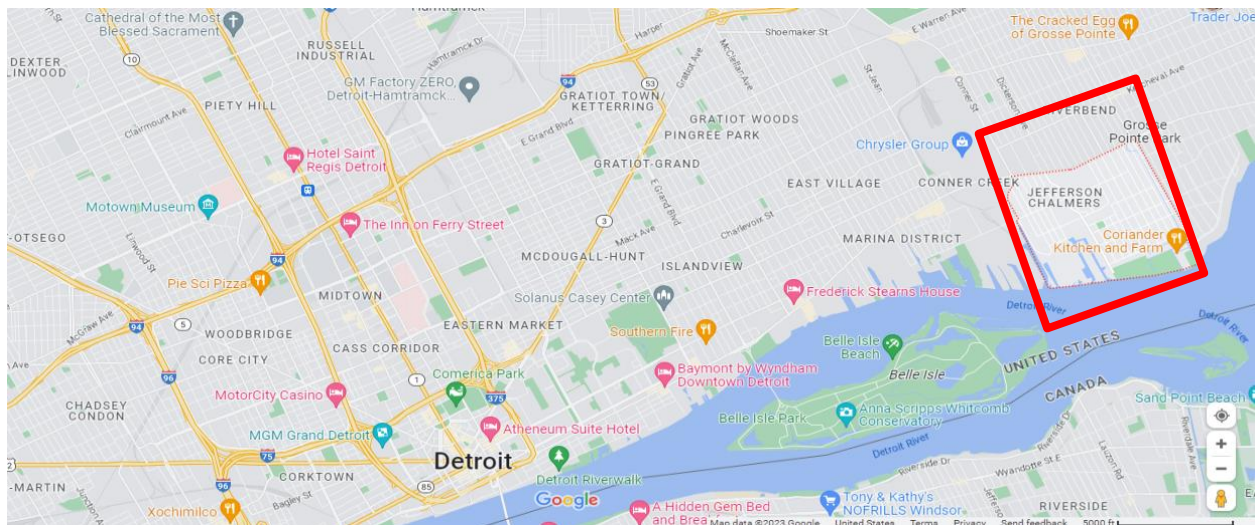


Figure 3: The Jefferson Chalmers Neighborhood (outlined in red) is on Detroit's Eastside along the Detroit River.

Past Flooding Events

The residents of Jefferson Chalmers are, unfortunately, no strangers to flooding. The neighborhood experienced floods in 2021, 2016, 2015, 2014, and 2011 and even more before that^{17,18}. Flooding has and will continue to damage property, cause expensive repairs, and harm residents' physical and mental health and well-being¹⁹. Despite the recurrence of damaging floods, little has been done by government officials to fix the problem, leaving the residents extremely frustrated. At a Flooding Town Hall that we attended in April 2022, we heard stories from residents desperate for solutions and extremely angry at the city for not doing enough to prevent flooding in their neighborhood. The city has been promising solutions for decades, but the floods still come²⁰.

Demographics

Jefferson Chalmers is a predominantly Black neighborhood with wide wealth disparities, leading to environmental justice and equity concerns around flooding vulnerability. With a total population of 7,881²¹, over 83% of residents identify as Black or African American²² and the median household income is \$37,253²³. These statistics are very similar to the City of Detroit as a whole, which is about 80% Black and has a median income of \$34,762²⁴. The distribution of wealth and race within the community closely tracks the river and canals. Figure 4 shows that the white population is concentrated along the river and canals. Additionally, the block groups closest to the water have the highest median incomes of \$63,370 and \$77,734, almost twice the average median income for the neighborhood (Figure 5). The block group farthest away from the water has the lowest median income of \$18,073²⁵. These data show wide wealth disparities. Furthermore, 49.7% of the population is classified as poor or struggling²⁶. These disparities make equitable participation in community decisions regarding flooding resilience critical.

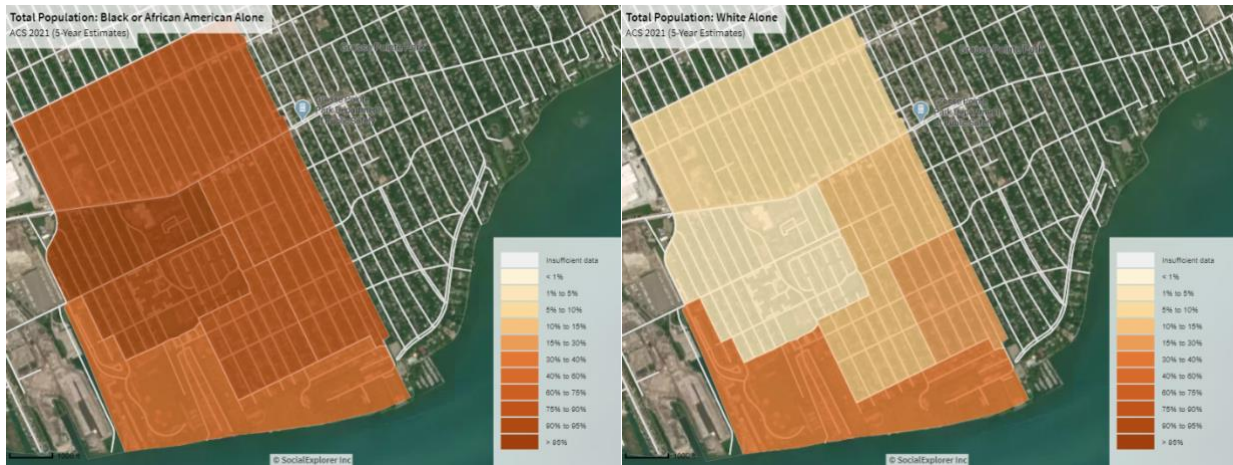


Figure 4: The image on the right shows the percentage of white people living in each block group, ranging from 37.3% (darker orange) to 2.5% (lightest orange). The image on the left shows the percentage of Black people living in each block group ranging from 97% (darkest orange) to 59% (lightest orange).

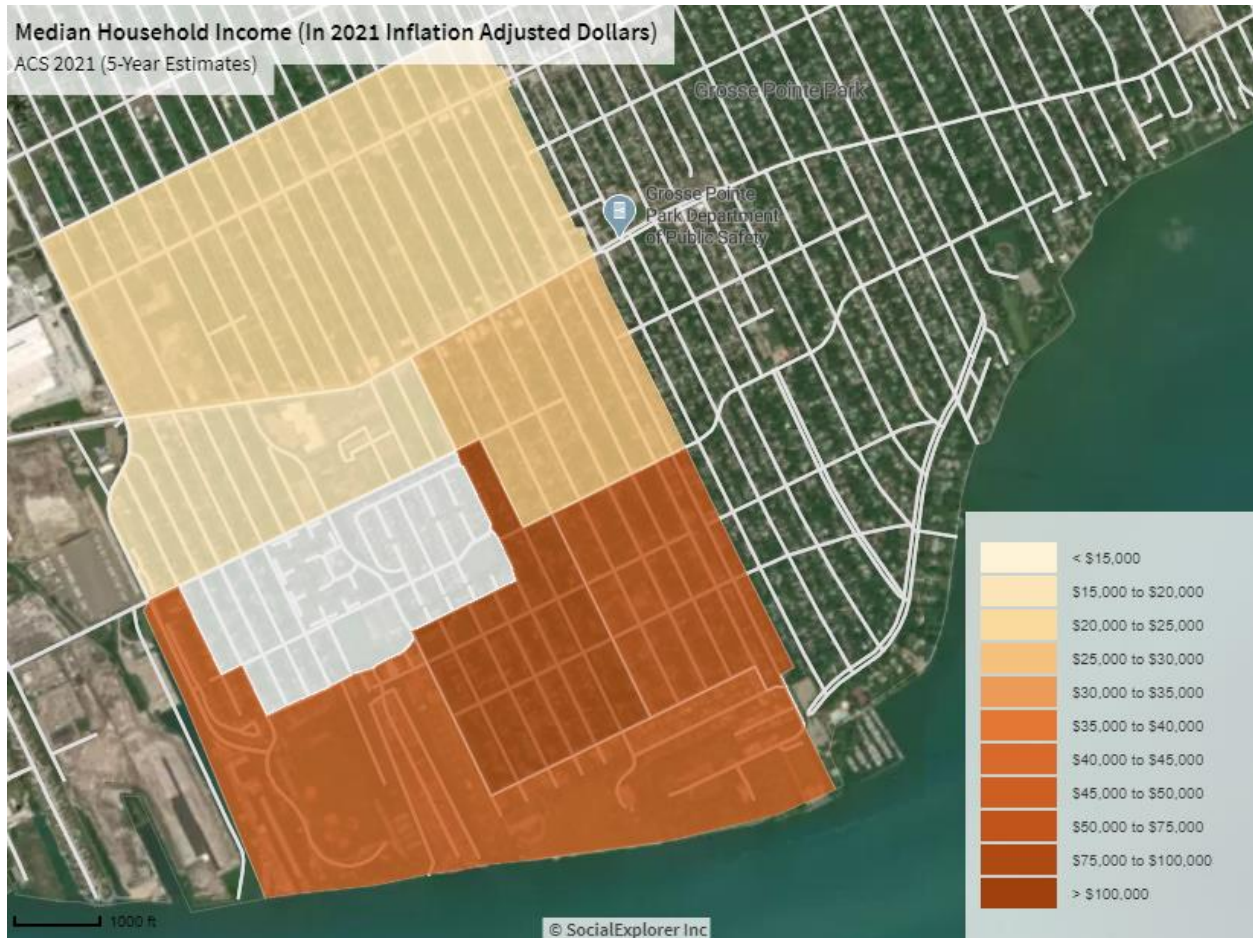


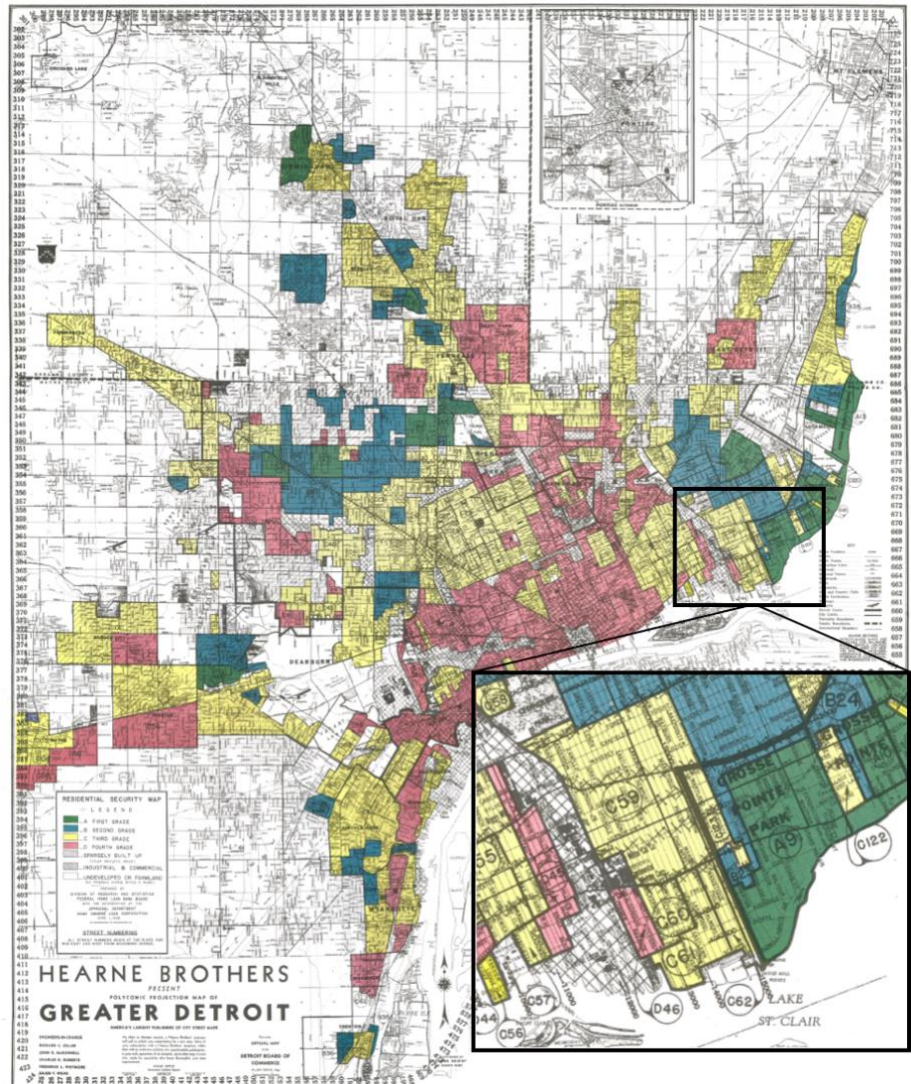
Figure 5: This image shows the median household income for each block group. The lowest median is \$18,073 (lightest orange) and the highest median is \$77,734 (darkest orange).

Flooding and Environmental Justice in Detroit

It is no coincidence that the Jefferson Chalmers neighborhood - an area geographically predisposed to flooding - is predominantly Black or African American, while its neighboring community, Grosse Pointe, is primarily white. While both areas are relatively close in elevation, Jefferson Chalmers has a unique bowl-like topography that is not observable in Grosse Pointe. The topographical phenomenon not only encourages stormwater to naturally flow into the community but makes it difficult for stormwater to flow out. This topography, in addition to other compounding factors such as climate change, have contributed to Jefferson Chalmers being designated as within the FEMA floodplain. In contrast, we see Grosse Pointe remaining out of the FEMA floodplain despite its experience with flooding. These differences in topography between communities that are predominately People of Color and those that

are predominately white are explained by historic practices of discrimination, exclusionary zoning, and federal redlining²⁷.

The City of Detroit was redlined on June 1st, 1939, by the federal government. This act divided and color-coded the city according to how "safe" each area was to insure mortgages. There were four color



designations, each corresponding to a grade. Grade A corresponds with green, grade B with blue, grade C with yellow, and grade D with red. Redlining was a predatory practice and targeted People of Color. It deemed their neighborhood "hazardous" for investment, making them ineligible for government housing investments. This practice zoned the Jefferson Chalmers area primarily yellow and neighboring Grosse Pointe primarily green (Figure 6)²⁸.

Figure 6 : Redlining map of Detroit from 1939. Source: Michigan State University Extension²⁹.

Redlining was the country's attempt to increase America's housing stock by inflating peoples' ability to obtain a mortgage to either buy or build a home. To do such, the Federal Housing Administration (FHA) was created in 1934 to regulate interest rates and mortgage terms. Throughout the 30s, the FHA moved across the country classifying areas either "safe" or "hazardous" for investment with the former tending to be predominately white areas and the latter areas where People of Color lived. While the FHA

has created the current financial mortgage system we see today, it created a lending structure that is fundamental to the racial segregation we see today³⁰. At its core, the redlining excluded Black, African American, or other People of Color from the homebuying market by classifying the neighborhoods they lived in “hazardous” for investment. This classification greatly hindered, and essentially prevented People of Color from obtaining mortgages. Rothstein – the author of *The Color of Law* – calls this malpractice “a state-sponsored system of segregation”³¹. We see this discrimination amplified after the Second World War when the nation began to see the rise of suburban housing developments sprawling beyond the city's boundaries at distances not previously conceived. This sprawl was fueled by Americans' increasing dependency on the automobile and the deindustrialization of urban centers³². Despite the novelty of the suburbs, the FHA ensured that Black, African Americans, or other People of Color were excluded from these communities and were essentially forced into predetermined dense urban residential areas³³.

In addition to the FHA's predatory practice was the Grosse Pointe System that ran from 1945 to the early 1960s³⁴. It was another attempt at racial segregation and excluding People of Color from purchasing a home in Grosse Pointe. Under this system, a realtor would hire a private investigator to make a report on a potential home buyer. The investigator would then give the report to a committee of three brokers, and they would assign points to the home buyer. Points were assigned on things such as how "Americanized" the buyer was or their "general standing" in the community or area. The potential home buyer's appearance, religious beliefs, accent, and use of grammar were all considered in this process. Unless the buyer reached an acceptable amount of points, they were not granted access to purchase a home in Grosse Pointe. And it does not go without saying, but the screening process was not required for persons of Northern European descent³⁵.

The conglomeration of these predatory and discriminatory practices drastically narrowed the scope of places within Detroit that People of Color could call home. The majority of Black and African Americans who moved to the city for industrial work were confined to segregated areas due to the restrictive protocol Detroit enacted. In many cases, all that the scope consisted of (i.e., where the white people did not want to live) was low-lying, high-flood-risk areas. Jefferson Chalmers is one of these areas. Commonly, too, these areas do not receive the same level of investment as predominantly white communities. The rapid progression of urban deindustrialization, white flight, and the rise of the suburbs contributed to the lack of investment³⁶.

Lack of investment allowed old and outdated infrastructure to continue aging instead of being replaced or refurbished when deemed necessary. Infrastructure has continued to age, and little is done regarding maintenance until there is a media-grabbing event. This behavior is seen throughout the nation, but the summer floods of 2021 were the last attention-grabbing event that put Jefferson Chalmers on the map.

Topography & Water Infrastructure in Jefferson Chalmers

Urban flooding in Jefferson Chalmers stems from two sources: sewage backup leading to the basement and street flooding from the city's combined sewer overflows, and the coastal influences from Lake St. Clair and the Detroit River levels. During extreme rain events, these two factors interact and compound the pressure on the aging infrastructure. There are many physical features of Jefferson Chalmers that make it particularly vulnerable to flooding, including its elevation, proximity to the Detroit River, canals, and the combined sewer stormwater system (CSS).

Topography

The low-lying nature of Jefferson Chalmers and its bowl-shaped topography makes it difficult for water to drain from the neighborhood despite a functioning a stormwater system. Jefferson Chalmers was built upon a historically low-lying wetland called the Grand Marais, or Great Marsh, by French settlers. This former marsh lay between the Detroit River to the south and Lake St. Clair to the east. It was filled in to create the neighborhood, resulting in the bowl-shaped topography (Figure 9). This means that when water runs into the neighborhood, it collects in the lowest-lying elevations in the middle of the neighborhood. The stormwater infrastructure is critical to drain the water out of the neighborhood.

The canals of Jefferson Chalmers (Figure 7, Figure 8) provide recreation and are a highlight for many neighborhood residents, but they also contribute to the neighborhood's vulnerability. Connor and Fox creeks drain into the Detroit River through Jefferson Chalmers via canals. Some of the neighborhood's homes have water access to the Detroit River via canals, and residents enjoy boating and kayaking directly from their homes. Fluctuations in the Great Lakes water levels influence the Detroit River's height and threaten the neighborhood if the water overtops the canals³⁷.



Figure 7: Our team visited Jefferson Chalmers in March 2022 and is pictured here observing one of the canals in the neighborhood. Photo courtesy of Rachel Woodcock.



Figure 8: A view of the neighborhood canals from the backyard of a property within the Jefferson Chalmers neighborhood. During the team's visit to the neighborhood, neighbors shared their stories about flooding. Photo courtesy of Rachel Woodcock.

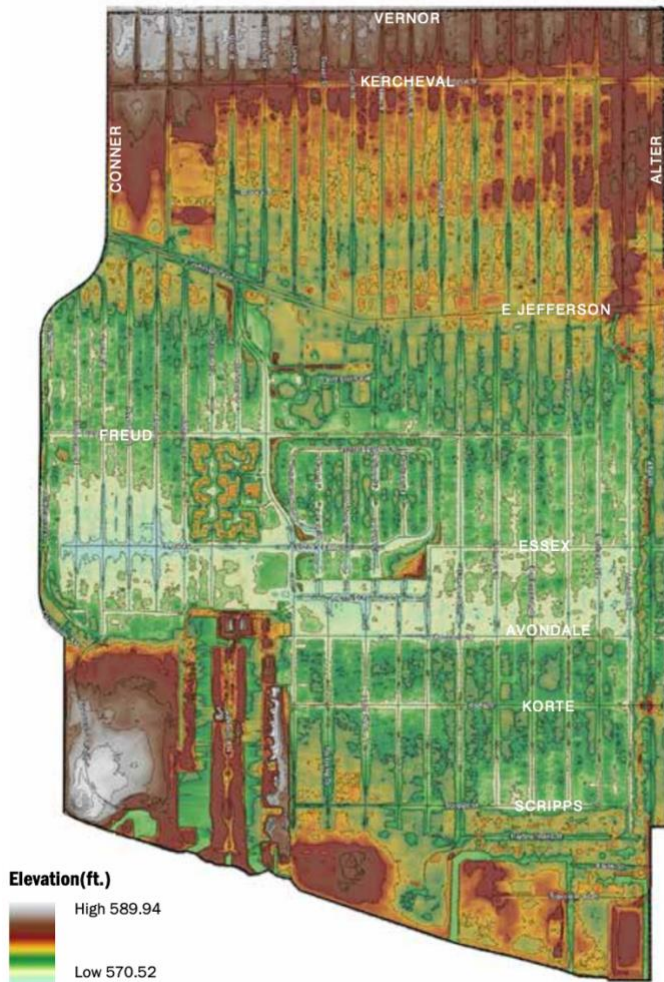


Figure 9: This elevation map of Jefferson Chalmers demonstrates the bowl-shaped topography. Water collects in the middle of the neighborhood, which increases the chances of flooding if the stormwater system is overrun. The Detroit River borders the bottom of the map. Source: City of Detroit, Jefferson Chalmers Neighborhood Framework Plan³⁸.

Stormwater Infrastructure

Detroit has a combined sewer/stormwater system to drain and transport wastewater from city streets and buildings to the water treatment plan. Combined Sewer Systems use the same pipes to carry water running off from streets and roofs as the ones carrying sewage from buildings (Figure 10). Over 700 communities nationwide have CSS, most located in the Midwest and Northeast³⁹. Many new cities separate their sewer and stormwater systems to reduce flooding vulnerability, but combined systems are not obsolete. A water equity report found that “In the region, 3,800 miles of sewer are in Detroit and 8,770 miles in suburban areas. Of the 8,770 miles of suburban sewer, only 970 miles are combined sewer systems, while the vast majority of Detroit’s sewer is combined sewer”⁴⁰. This makes Detroit more

vulnerable than the surrounding area to flooding because if there is a heavy rainfall event, the stormwater runoff can overwhelm the system, causing sewage to back up into basements like in the 2021 floods.

Two main entities control the stormwater infrastructure in Jefferson Chalmers and Detroit: The Great Lakes Water Authority (GLWA) and the City of Detroit Water and Sewage Department (DWSD). These two organizations maintain and manage the pipes, pumps, and other infrastructure that drain and carry stormwater out of the neighborhood.

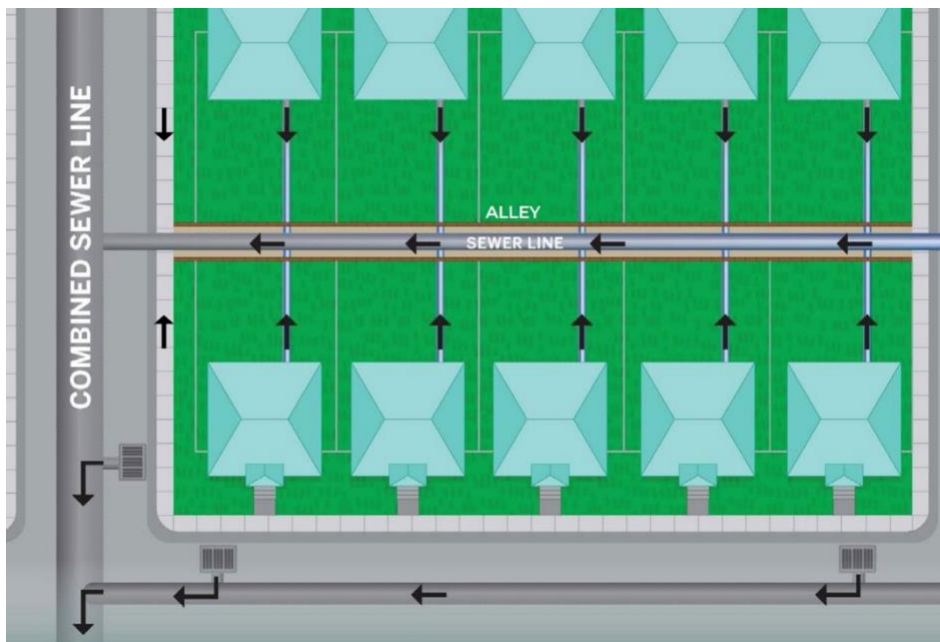


Figure 10. A graphic representation of combined sewer lines and connections to homes or businesses. Sewage from homes combine with stormwater runoff from street drains in large, combined sewer lines. Source: City of Detroit, *Basement Backup and Flooding Handbook*⁴¹.

GLWA operates the regional system. Their pipes are the “freeways” for all water moving through Detroit. Gigantic pipes bring wastewater (both stormwater runoff and sewage) from all over the Southeast Michigan service area to the wastewater treatment plant in Detroit. Many of these ‘freeway’ pipes to the wastewater treatment plant flow under Jefferson Chalmers. Pump stations are required every so often to bring water up to elevation so that it can continue to flow downhill toward the treatment plant. A few of these large pumps are located in and near the Jefferson Chalmers neighborhood. The pumps are electric and thus vulnerable to power outages.

DWSD operates the city sewer pipes that transport the water and waste from people’s homes to GLWA’s larger pipes. These pipes are usually located under the streets. Homeowners are responsible for

maintaining the pipes in their homes and the lateral line from their homes connecting to the city sewer. The majority of the city's water infrastructure was built in the 1930s. It is aging and requires substantial investment to maintain and repair broken pipes. However, there is a smaller population and tax base to support capital improvements, resulting in delays in much-needed repairs⁴².

Lake Level Flooding Infrastructure

In addition to infrastructure to drain the neighborhood, there is also infrastructure in place to prevent flooding from the Detroit River, whose water level is affected by the levels of the Great Lakes. Seawalls are an important structural element of properties along canals or the river. Unfortunately, the seawalls in many properties in Jefferson Chalmers are woefully inadequate. According to a City of Detroit Spokesperson, in 2021, "the seawalls along more than 75% of the neighborhood's 300 waterfront parcels are inadequate to protect against a 100-year flood"⁴³. It is the property owner's responsibility to upkeep the seawalls, but constructing, repairing, and raising seawalls can cost between \$10,000-50,000 per home⁴⁴, a price that is too steep for many of the neighborhood's residents. Until everyone along the canals updates their seawalls, the neighborhood will remain vulnerable to flooding from high lake levels.

High lake levels in recent years prompted the city to install Tiger Dams (Figure 11, Figure 12) on properties along the canals to prevent flooding⁴⁵. Tiger Dams are bright orange tubes filled with water that provide a barrier between the canals and properties. While effective, they are extremely unpopular with residents because they are an eyesore and damage landscaping⁴⁶.



Figure 11: An aerial view of the orange tiger dams in Jefferson Chalmers⁴⁷.



Figure 12 A tiger dam is pictured protecting houses from canal flooding due to high lake and river levels. Photo courtesy of Rachel Woodcock.

Climate Change Impacts on Flooding

Urban flooding is a prevalent issue in the Great Lake region and is only likely to worsen due to climate change. A study by the National Science and Technology Council suggests that states in the Midwest have experienced a 31% increase in "very heavy" precipitation events from 1958 to 2007, with clear trends toward more "very heavy" precipitation for the Midwest.⁴⁸ "Very heavy" precipitation events are defined as the heaviest one percent of all daily events for a given year. These events are on trend to continue increasing with intensity through the 21st century, as stated in a report by the U.S. Global Change Research Program⁴⁹. A Southeast Michigan Council of Governments (SEMCOG) report also said that Southeast Michigan would continue experiencing higher intensities and increasing rainfall volumes in storms exceeding the systems existing capacities⁵⁰. These increased rates of high intensity rainfall events not only will overwhelm the sewer/stormwater system, but also have the potential to increase river and lake levels. However, it is uncertain to what extent climate change will affect lake levels in the future, since the level is dependent on multiple factors other than precipitation, including temperature, evaporation, and ice formation^{51,52}.

Policy Environment

Urban flooding has a complicated governance paradigm where water authorities have to manage multiple responsibilities, including water quality, water quantity, floodplain management, resilience planning and response, regulation of new and re-development, multi-objective planning, ecosystem health, and increasing community expectations for environmental quality. A report from EPA identifies these multi-dimensional priorities as an emerging shift in the stormwater management paradigm where local authorities must consider both water quality and quantity⁵³. They should also consider impacts on private property and public infrastructure usage. Thus, the policy challenge of mitigating urban flooding in Jefferson Chalmers is a cross-sectoral, multi-level, regional issue, with many stakeholders, from city departments and water utilities to national agencies (Figure 13). This paradigm incorporates flooding due to both combined sewer overflows and lake-level fluctuations.



Figure 13: Multiple factors impacting the stormwater management paradigm. Sourced from EPA Environmental Financial Advisory Board Report⁵⁴

Below is a list of the key players we have identified that pertain specifically to the Jefferson Chalmers neighborhood, although many others are working towards flooding resilience in other areas around Southeast Michigan. It is not an exhaustive list.

Local Government:

- Detroit Water and Sewage Department (DWSD)
- City of Detroit Mayor’s Office
- City of Detroit Planning Department
- City of Detroit Department of Neighborhoods
- City of Detroit Housing and Revitalization Department
- Latisha Johnson - City Council member for District 4 (includes Jefferson Chalmers)

Regional

- Water Utility - Great Lakes Water Authority (GLWA)
- SEMCOG, the Southeast Michigan Council of Governments

State Government:

- Senator Stephanie Chang
- Representative Joe Tate
- Michigan Department of Environment, Great Lakes, and Energy (EGLE)

Federal Government:

- Federal Emergency Management Agency (FEMA)
- Army Corps of Engineers
- U.S. Department of Housing and Urban Development

Neighborhood Organizations and Coalitions

- Jefferson East Inc.
- Eastside Community Network
- Detroit Housing Network

While the stakeholder groups involve all three levels of government and interact with community organizations, the governance process for combined sewer management is primarily local and regional, and it is predominantly local and federal for flooding due to lake level. The two processes don't interact much and create a fragmented governance framework. Policy issues also include low local representation in governance processes and a lack of state-level public water utility commission. All of these are built out in more detail below.

Lack of Local Control in Water Governance

Over the past four decades, Detroit's influence over long-term decisions regarding its drinking water and wastewater infrastructure has dwindled, first due to federal oversight from 1977 to 2013 and then the regionalization of the Detroit Water and Sewerage Department (DWSD), which provides the Detroit Metropolitan Region's drinking water, sewage, and stormwater infrastructure, in 2014. The agency has played a significant role in supporting suburban sprawl in the area. In the mid-20th century, as the population began shifting to the suburbs, Detroiters subsidized the growth in the surrounding areas. In 1954, the City served 44 suburban wholesale customers, which more than doubled to 96 in 1973.

However, the City's population declined, and its revenue base grew smaller. DWSD also had a limited ability to pass these costs to suburban customers; thus, these infrastructural investments came at the cost of Detroit, which severely neglected long-overdue upgrades to its water and sewerage system. In 1977, the EPA initiated a suit against DWSD for its wastewater discharge violating the Clean Water Act requirements. It led to Federal Judge Feikens overseeing DWSD for over three decades until 2013, effectively removing local control over infrastructural decisions. This federal oversight didn't come with additional funding for infrastructural improvements. Instead, bureaucratic inefficiencies, inappropriate investments, financial hardship, and corruption added to the degradation of the aging system. Drinking water rates for residents skyrocketed, and DWSD started shutting off drinking water for thousands of residents. This, together with the City's significant debt and the ensuing emergency rule under Michigan Law, created the opportunity to alter DWSD's governance structure⁵⁵.

Thus, GLWA, a regional water authority with a 40-year plan, was born in 2014. Under this plan, while DWSD still owns Detroit's water infrastructure, GLWA leases, operates, and makes decisions about the entire regional water and sewage system for forty years. While a regional strategy is welcome and aligns with the watershed management approach, it comes at the cost of low local representation. Detroit city residents previously had four representatives out of seven on the DWSD Board of Water Commission (57 percent), but now only have two appointees out of six on the GLWA Board. There is a significant income disparity between the residents being represented on GLWA, leading to environmental justice concerns that solutions to address some of the issues with the City's water infrastructure might not necessarily align with its residents' priorities, especially when. Furthermore, GLWA was created under emergency management, and it is widely thought that regionalization of the DWSD would not have occurred if City had followed the process of a public referendum. Years of unelected governance, first under federal rule and now under GLWA, have left residents disenfranchised and underrepresented in

the governance of their water infrastructure^{56,57}. During one of the post-flood town halls, residents of Jefferson Chalmers expressed their mistrust of GLWA and DWSD. They said that the agencies are not taking responsibility for years of infrastructural neglect and are pushing the blame around. They also complained of high administrative burdens and a lack of transparency around recovery programs. The community is frustrated and angry with the lack of response and believes their priorities are not being heard and addressed in a timely manner.

Addressing Combined Sewer Outflows

With a Combined Sewer System (CSS) that carries both wastewater and stormwater runoff, Detroit is one of the municipalities under the EPA's Combined Sewer Overflows Control Policy. These systems are designed to overflow during heavy rainfall and other wet weather events, leading to a discharge of untreated wastewater mixed with raw sewage and stormwater directly into a nearby water body. EPA recognizes these discharges, known as combined sewer overflows (CSO), as point sources of pollution independent of municipal wastewater treatment plants, requiring their regulation under the terms of the Clean Water Act. One of its requirements is that municipalities develop a Long-Term Control Plan to eliminate or reduce CSO discharges. The policy aims to improve and maintain water quality standards; however, increasing water quantity during storm events creates a tradeoff between managing water quality and quantity. Under this policy, Utilities and operators can be penalized for unauthorized releases, and the overwhelmed system can start backing up. EPA and authorized states are responsible for implementing the policy using the appropriate mechanism, such as permitting and enforcement actions. The State of Michigan is pursuing stricter standards of zero (0) untreated discharges per year compared to the EPA's acceptable standard of four (4) untreated overflows per year⁵⁸. *Two potential solutions exist for municipalities under CSO management - creating a separate sewer system or building additional capacity in the existing one, both of which require significant infrastructural investments.*

Under this policy, Detroit has developed and revised its Long-Term Control Plan (LTCP) five times to update the set of planned projects to control CSOs along the Rouge and Detroit Rivers. Some of the projects identified in the various LTCPs were never constructed due to the city's economic hardship. For example, in 1996, Detroit started planning to build a tunnel near the Rouge River to increase the storage capacity of combined sewer and stormwater flows for treatment at an estimated cost of \$880 million. However, Detroit canceled the project in 2009 after the city began experiencing financial duress, among other reasons. The 2010 LTCP update reflected new, lower-cost alternatives like green stormwater infrastructure (GSI) projects⁵⁹. Since the passage of the Clean Water Act, Detroit has invested \$1.5

billion in CSO treatment facilities and retention basins that add capacity to the sewage system by temporarily holding and/or preliminarily treating combined sewage while other parts of the system are at capacity⁶⁰. The strategy is focused on reducing or eliminating wet weather flows from the combined sewer system where feasible. The city also adopted a Post-Construction Stormwater Management Ordinance for all half-acre land development, both new and redevelopment⁶¹. The ordinance requires these projects to develop and submit a Stormwater Management Plan to DWSD for review. It aims to reduce the amount of stormwater entering the combined sewer system. While these strategies have helped, Detroit's downstream position in the watershed and limited additional GSI capacity restrict the existing system's capacity to handle large storm events. As per SEMCOG, Southeast Michigan has spent more than \$2 billion in reducing and eliminating untreated CSOs to treat 97% of wet weather events and expects another investment of another \$2 billion to address the remaining 3%⁶².

A cooperative watershed approach to stormwater management, like one for Rouge River Watershed, can help manage and reduce CSOs regionally. Under this approach, three counties and 38 local communities established the Alliance Rouge Communities, which assists member organizations in meeting stormwater permit requirements and coordinates other cooperative efforts and funding to improve the water quality, riverine wildlife habitat, and recreational benefits within the Rouge River watershed. Under this, Wayne County administered stormwater management demonstration projects implemented by governmental agencies and not-for-profit organizations using Rouge Project federal funds and local matching dollars. Watershed councils are generally voluntary arrangements, and GLWA believes it will be effectively able to replicate the approach without requiring new legislation or changes to existing law. It would require developing a watershed alliance under the state statute, a watershed plan, a map identifying the watershed boundaries, and a list of participating governmental units. However, the utility isn't confident that Detroit would join such an alliance, as most of the stormwater runs off into the city's combined sewer system and can add to the existing cost burden⁶³. More details on watershed approach are included in the section,

Vision for a Flood-Resilient Jefferson Chalmers.

With current infrastructure and policy constraints, the CSO policy prioritizes water quality over increased basement flooding and overflows into lakes, streams, and rivers during storm events. As climate change intensifies, the frequency of storm events will continue to grow, putting additional pressure on the existing system and necessitating a need to balance private property protection concerns with water quality issues. Unless additional capacity is built, it might mean more frequent untreated discharges before and during storm events which can create social impacts like reducing the community's use of canals and the river for recreational purposes.

Addressing Lake Level Flooding

In recent years, extreme precipitation events in the Great Lakes Basin have led to prolonged high-water conditions causing flooding and shoreline erosion. On Lake St. Clair, along which Jefferson Chalmers lies, water levels have risen over five feet over the past seven years. Water levels in the Great Lakes fluctuate due to precipitation cycles and the surrounding watershed drainage.

In response to the record-high water levels, in December 2018, FEMA updated its preliminary Flood Information Rate Maps (FIRM) to include most of the Jefferson Chalmers neighborhood in a 100-year floodplain (a 1% annual chance of flooding). Before the change, the neighborhood lay in a 500-year floodplain with a 0.2% annual chance of flooding. In 2019, the City contracted an engineering firm to challenge the preliminary FIRM updates; however, they found no technical basis for the challenge.

Later in 2019, the City requested the US Army Corps of Engineers Flood Plain Management Services Program for assistance in identifying effective long-term flood mitigation measures for the neighborhood. This study follows others dating back to 1978. The finalized study was published in July 2022 and outlined some of the main recommendations from USACE. Their recommendations included three options with varying closures of canals, construction of levees and floodwalls, and locks. The Army Corps anticipates in their report that options which close access to waterways would be overwhelmingly unpopular, which has proven to be largely true. Community meetings for Jefferson Chalmers on April 21, 2022, and May 25, 2022, recorded several community members who live on the canals voicing their displeasure with these options. For the time being, the City has declined to pursue this most impactful course of action. However, canal closures and semi-permanent dams are the most cost-effective lake-level-caused flood mitigation methods for homeowners.

City officials have stated that without permanent or semi-permanent canal closures, the remaining option is to enforce seawall maintenance and construction⁶⁴. Seawalls are the responsibility of home and business owners, or the city, depending on who owns the parcel of land. Seawall construction and maintenance can be expensive and can price property owners out of the area. The City must effectively persuade or force property owners to construct and maintain their floodwalls; seawalls must be 100% continuous for them to be effective. This course of action has its own challenges. The burden falls on the city to legally enforce continuous seawalls, and the financial burden falls on the home or business owner to construct and maintain it. While this option maintains the canals for use, the collective responsibility of maintaining seawalls creates a greater chance for error and incomplete action, meaning their effect on flooding mitigation will be incomplete. Where property owners cannot afford seawall construction and maintenance, flooding will impact them more, making this a potentially dangerous and costlier option. Overall, the decision to not construct any sort of permanent or semi-permanent levees and dams is more damaging to low-income property owners and residents in Jefferson Chalmers.

[Evolving Understanding of Flood Risks](#)

In 2021, FEMA updated its FIRM mapping methodology to ‘Risk Rating 2.0’. This new mapping system “leverages industry best practices and cutting-edge technology to enable FEMA to deliver rates that are actuarially sound, equitable, easier to understand and better reflect a property’s flood risk”⁶⁵. Risk Rating 2.0 uses more localized mapping, down to the home level, to determine flood risk. It also now considers private data sets and more flood risk variables: “flood frequency, multiple flood types—river overflow, storm surge, coastal erosion and heavy rainfall—and distance to a water source along with property characteristics such as elevation and the cost to rebuild”⁶⁶. After April 1, 2022, all new and renewing policies are subject to Risk Rating 2.0. FEMA does not guarantee that flood insurance premiums are more affordable under Risk Rating 2.0. Jefferson Chalmers residents are eligible for purchasing flood insurance under the National Flood Insurance Program (NFIP) because the City of Detroit is a participating community⁶⁷. In the Jefferson Chalmers neighborhood, 66% of premium holders saw their premiums decrease, while 34% saw their premiums increase anywhere between \$0-\$10⁶⁸. The variety in rate changes under Risk Rating 2.0 is due to differences in home elevation, the number of stories, whether they have basements, and their distance to possible sources of flooding.

Lack of Dedicated Oversight of Water Infrastructure

Michigan is one of the only six states in the US without a public utility commission regulating water and wastewater utilities. EGLE oversees environmental compliance, which primarily covers water quality standards, but no state-level authority exists for the economic regulation of utilities, including rate-setting. With water and wastewater infrastructure effectively intertwined and the acute water affordability crisis in the state, more deliberative conversation on capital investments, asset management, and cost recovery is needed. The Headlee Amendment and *Bolt v. City of Lansing* put limits on local funding for infrastructure, and a systematic review of existing infrastructural gaps needs to happen. A comprehensive approach that balances stormwater infrastructure's multi-dimensional needs and pressures is required. Many municipalities lack the financial and political will for regional approaches, and a state-level commission can elevate these conversations beyond individual systems⁶⁹.

Funding and Affordability Challenges

As previous sections highlight, large infrastructural projects, whether adding capacity to the existing combined sewer system, separating sewer and stormwater systems, or protective infrastructure along the canals to get the neighborhood outside the floodplain, are needed. These require funds ranging from millions for small-scale neighborhood projects to billions for separating the city-wide combined sewer system. Historically, state and federal governments primarily funded water infrastructure projects. Through the 1970s wave of environmental legislation, the federal government provided cities grants to upgrade their inadequate sewage infrastructure. It led to significant improvements in public health outcomes across the country⁷⁰, but as infrastructure has aged, federal funding has tapered (Figure 14). Localities are left to fund routine maintenance, which has continued growing, and capital projects (Figure 15).

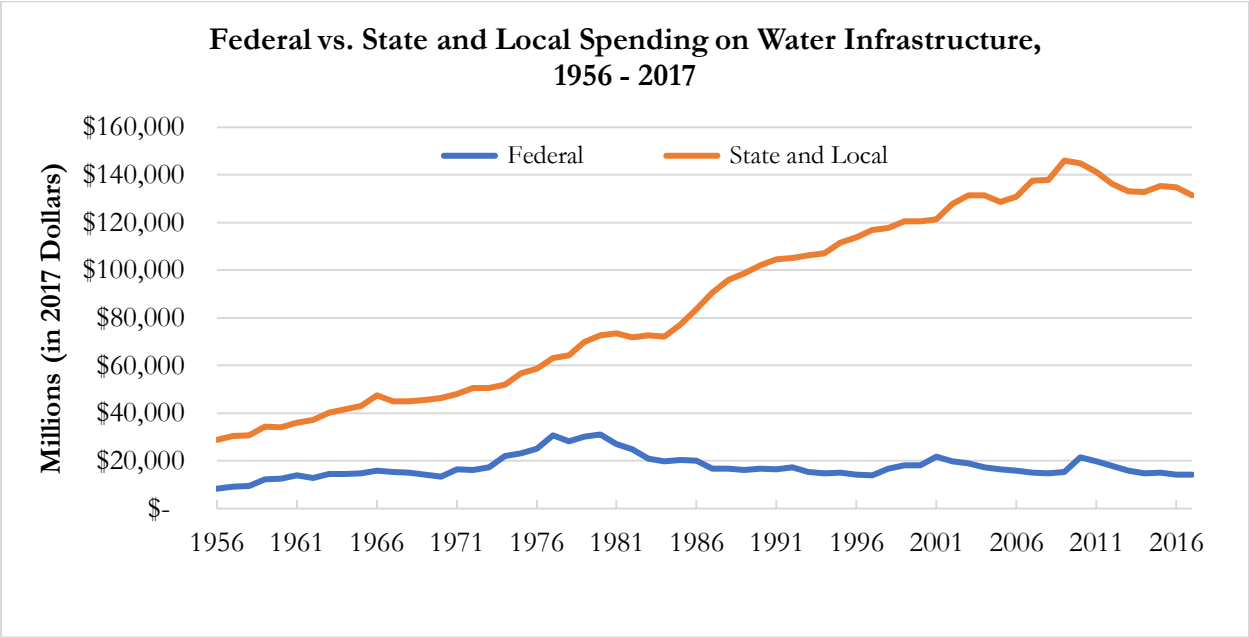


Figure 14: Public Spending on Water Infrastructure (includes water utilities, water containment and freshwater systems). Created with data from CBO⁷¹

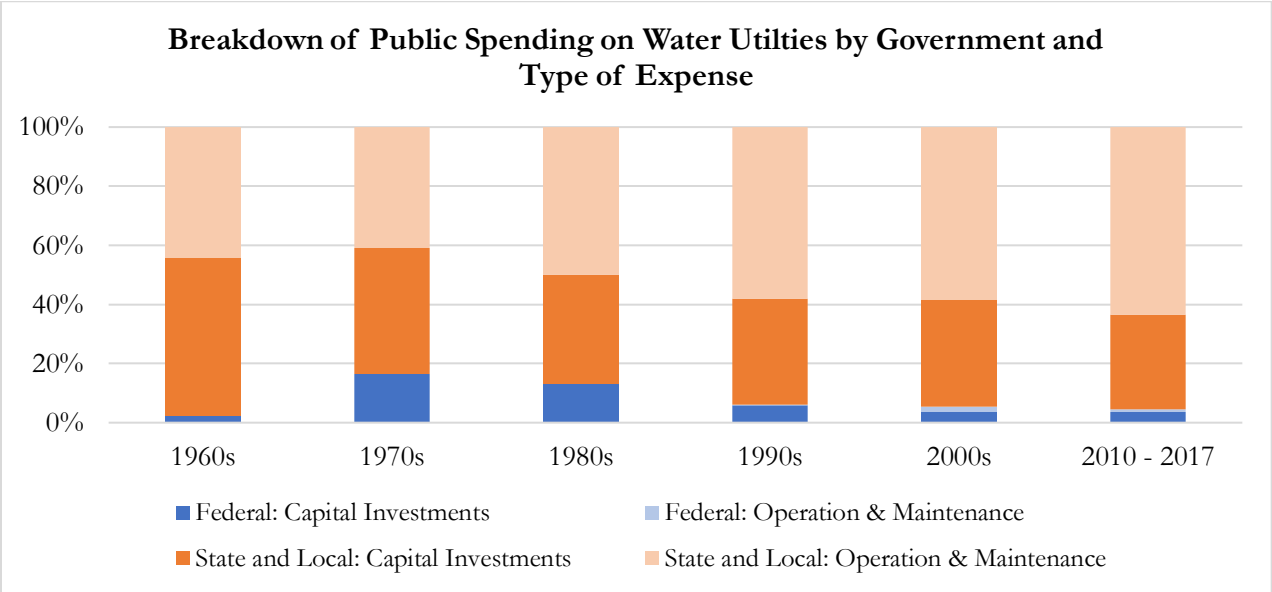


Figure 15: Public Spending on Water Utilities: Federal vs. State & Local, Capital Investment vs. Operation & Maintenance. Created with data from CBO⁷².

Much of this reduced funding now comes as low-interest loans, which might not be accessible to communities with already high debt burdens, like Detroit. Also, many existing policies governing these loan programs, like the State Revolving Fund, generally do not support flooding projects, and stormwater projects are low priority. Most communities also lack dedicated funding to support stormwater projects, thus making repaying loans challenging. Stormwater pollution is now a principal

cause of water quality issues nationwide, but adequate funding to manage its effects lags the corresponding investments made in wastewater management and safe drinking water by decades. EPA estimates that \$67.2 billion is needed for stormwater infrastructure and program investments (for both separate and combined sewer overflows) over the next 20 years⁷³. Many municipalities are turning to stormwater fees as revenue streams. These are similar to service charges and are dedicated local revenue sources tied to the objectives of a specific program they are associated with. They provide a nexus between the user fee and service, as the amount each ratepayer is charged must be related to the “use” of the system. Usage can be interpreted as either direct use through runoff contributions or use through protection from flooding of the property and streets by local stormwater program efforts. They give communities a local, sustainable, recurring revenue stream to fund their stormwater needs⁷⁴. But they are typically insufficient to meet regulatory mandates and the operation and maintenance costs needed to replace or repair urban water infrastructure. This gap has led to utilities undertaking high debt loads and creating price structures based on cost recovery, not affordability.

Flood Mitigation: Detroit’s sewers have created a water affordability crisis

DWSD has not been spared from these national trends. High legal and regulatory burdens, low state & federal funding, and infrastructural developments in the suburbs led the utility to accumulate high-risk debt to manage and operate its assets. Detroit's bankruptcy in 2013 led to the regionalization of the water utility as GLWA. It is a quasi-governmental utility fully funded by ratepayers. GLWA charges sewerage fees largely based on wastewater volume. And given much of the newer infrastructure in the suburbs has separate stormwater runoffs, Detroit bears substantial costs related to its combined sewer system. A 1999 rate settlement overseen by Judge Feikens also stipulates that Detroit covers 83% of the operating costs and the debt associated with CSO facilities that primarily serve Detroit. These facilities serve as retention basins during storm events. However, given the system's interconnectedness and the region's topography, this distinction is unclear. As a result, Detroit customers pay disproportionately higher costs. In 2021, Detroit paid about 40% of GLWA's sewerage budget, even though the system only serves a quarter of GLWA's sewerage customers. An average residential customer in Detroit paid \$81.62 for water and sewage, 75% of which is associated with sewage fees⁷⁵. It also includes a drainage charge, based on the impervious surface area of a property, that the City instituted in 2016. It recovers the cost for operating Detroit’s CSO facilities and treating wet weather flows at the wastewater treatment plant - \$150 million annually⁷⁶. Given these charges are applied to residents' water bills, they have created a water affordability crisis in the city. Some low-income households in Detroit spend at least a quarter of their disposable incomes on water and sewer bills⁷⁷. It is feeding the vicious cycle of poverty and

vulnerability, where poor residents are more vulnerable to climate-change-related events, which is further impacting their ability to escape poverty.

High water and sewage burdens severely limit the City's ability to overhaul its stormwater infrastructure. Gary Brown, DWSD Director, estimates that about \$2.2 billion is needed to separate the City's combined sewer system. With federal funds available through the Bipartisan Infrastructure Law, municipalities are leveraging innovative financing methods such as municipal environmental impact bonds (EIBs) to fund climate adaptation^{78,79}. However, Detroit's existing high debt burden and water affordability crises make strategies that add on more debt or pass costs to customers politically challenging or infeasible. GLWA's regional governance, competing drinking water and regulatory infrastructure needs, and existing debt burden limit the utility's ability to foot these costs as well. The utility's wastewater revenue already covers a debt service of 43.6%, with only 7.3% available for financing capital projects⁸⁰. DWSD has been investing in smaller-scale nature-based projects to expand localized capacity in City's neighborhood. One such project in Rouge Park will add retention capacity for nearly 100 million gallons of stormwater annually⁸¹. The success of such projects in neighborhoods like Jefferson Chalmers might be limited due to its proximity to the lake and increased flood risk due to lake levels.

[Flood Insurance Affordability & Increasing Costs of Flood Recovery](#)

Flood insurance affordability is a major concern for low-income property owners who own homes in floodplains. NFIP premium rates are determined by the risk faced to the property, without any consideration to affordability or cost burden. FEMA does not have any explicit affordability or equity programs for the NFIP. Options for cost-mitigation will be expanded more under the Recommendations section.

While flood insurance helps rebuild and repair buildings after floods, it can perpetuate maladaptation. President Biden's 2023 Economic Report outlines the mounting challenges and costs associated with climate change. As residences and businesses flood, sometimes repeatedly, flood insurance can make it financially possible to rebuild and remain in a flood-prone area. As is often the case, when these same buildings undergo further damage from future flooding events, more money is spent on recovery. Flood insurance can skew a property owner's risk perception and perpetuate damage. It is not economically viable for the federal government and undesirable for property owners who do not want their homes and business consistently damaged by floods. The NFIP is a textbook example of moral hazard and will

continue to put life and property at risk. To counteract this risk perception, the Biden administration is promoting efforts to communicate better the risk level involved when purchasing in floodplains. The administration has also identified major opportunities to incentivize adaptation measures with federal funding and using climate risk models to inform costs. An example of this would be flood insurance premiums accurately representing the risk and cost to repair after flood damage. The report specifically cites Risk Rating 2.0 as a program that moves towards accurate pricing of climate risk: “Risk Rating 2.0, which prices policies based on individualized flood risk assessments while continuing to provide discounts for investments by individuals or communities that lower flood costs”⁸². The exact path the Biden administration will take to operationalize these identified opportunities further is not yet finalized, and there is no indication FEMA plans to raise NFIP rates to ‘market levels.’ However, the NFIP will continue to cost United States taxpayers billions of dollars every year, and property owners will continue to face flooding risks with higher costs.

Flood Resilience & Recovery: Funding exists but is insufficient and cumbersome

Following the 2021 Presidential Major Disaster Declaration, the U.S. Department of Housing and Urban Development (HUD) announced in March 2022 that the City of Detroit, Housing and Revitalization Department will receive \$57.5 million in funding to support long-term flood recovery and mitigation efforts. HUD estimates that the total unmet needs are about \$142 million for all impacted areas in Michigan. However, only \$86 million was available in the congressional appropriation, and Detroit was awarded approximately 60%. Residential flooding and related infrastructure account for about 75% of the unmet needs. *Given that the unmet needs are much higher than the funding available, the city has proposed prioritizing housing recovery for low-to-moderate-income households and protective infrastructure needs*⁸³.

Housing Recovery: Many impacted households had basement flooding, leading to property loss and health concerns. Based on resident experiences with past floods, the City believes installing basement backup valves can avoid much of this flooding. To this effect, DWSD launched a Basement Backup Protection Program to outfit homes with basement flooding prevention controls, like backwater valves. The City earmarked \$15 million for the program's first phase, providing eligible homeowners \$6000 apiece for flood control installation. However, much of the housing stock is quite old, and many eligible homes need repairs to private lateral sewer lines before backwater valve installation. These can cost up to \$25,000 per house. Based on a sample of DWSD customers, approximately 30,000 houses have broken lateral sewer lines. Advocates believe that years of negligence and failure on DWSD's part to maintain

public sewer lines have led to these issues. The city plans to utilize federal funding to assist households with these costs. These funds are pending approval and won't be available until Fall 2023 at the earliest. Beyond these, no other potential funding source for lateral sewer lines exists. As of December 2022, only about half of the homes accepted for the Basement Backup Program were completed. As of December 2022, only about half of the homes accepted for the Basement Backup Program in Phase 1 were completed. While other homes wait for repair funding to flow in, twenty-five homes in the Jefferson Chalmers neighborhood, technically eligible in Phase 2, completed backwater valve installations. Over 2000 homeowners have applied for funding in the program's second phase and are still waiting for recovery efforts to accelerate almost two years after the flood⁸⁴.

Protective Infrastructure Needs: The City of Detroit also proposed utilizing federal funds to construct protective infrastructure as recommended in the USACE report to assist the Jefferson Chalmers neighborhood in getting out of the 100-year flood plain. While the report put forth multiple options, all included some form of canal closure, at least temporarily. The project would have cost approximately \$10 million and benefitted over 200 households. However, as previously mentioned, neighborhood residents vehemently opposed the canal closure, and the city has withdrawn the proposal leaving the \$10 million CDBG-DR dollars unallocated at the moment. The city will conduct public outreach to determine how to utilize these funds at a later time⁸⁵.

National Examples of Flooding Resilience

Jefferson Chalmers and Detroit face many unique challenges in addressing flooding. Stakeholders can look to multiple communities employing innovative strategies to address flooding across the country. In this section, we showcase the flooding resilience work of municipalities and organizations that can serve as examples for work in Jefferson Chalmers and Detroit.

Municipal Case Studies

A component of our literature review was exploring other cities to understand what they are doing to handle flooding events. This process incorporated cities that also regularly experience flooding and have combined sewer systems. We selected four cities for comparison: Milwaukee, Wisconsin; Philadelphia, Pennsylvania; Dearborn, Michigan; and Grosse Pointe, Michigan. Each city's demographics were considered as we aimed to create a collection that exposed the disparities between predominately white communities and predominantly People of Color. Showcasing these disparities are Grosse Pointe and Dearborn, as they are communities that fall in the predominately white category. For each case study, we explored the demographics and investigated the city's current procedures for handling a flooding event. We were mindful to identify whether these procedures were proactive, reactive, or both.

Motifs from Municipal Case Studies for JEI to Carry on

As we explored the case studies, reoccurring themes began to appear. These are concepts that JEI can use to help model their future initiatives and be utilized concurrently with our recommendations.

- **Political Advocacy**
 - Grosse Pointe's statement on flooding has highlighted the need for the city to advocate for its residents at the county, state, and federal levels for initiatives that complement that city's waste and stormwater management strategies.
 - Dearborn's Mayor, Abdullah Hammoud, has listened to his constituents' request of wanting to be flood plain designated and is advocating at the federal level for their cause.
- **Proactive Management**
 - Dearborn recognizes the need for long-term hazard mitigation efforts and has received funding from FEMA to install two new shut-off gates and construct an overflow structure. Additionally, the city has begun exploring short- and long-term solutions to flooding.
 - Philadelphia's water department created [Green City Clean Water](#) – a program focused on reducing the amount of stormwater that enters the system – in 2011 as a response to

CSS, specifically in regard to basement backups and sewer overflows entering local waterways.

- **Regional Collaboration**

- Grosse Pointe has stated that there is a necessity to work collaboratively and regionally to address the issue of stormwater infrastructure.
- As a downstream city, Dearborn acknowledges the lack of watershed management and has contributed as a factor to the flooding it experiences.
- The Milwaukee Metropolitan Sewerage District acknowledges that what one municipality does can affect the entire Sewerage District's system. The institution is responding to this by financially assisting municipalities within the Sewerage District in the separation of their CSS.

- **Community Engagement**

- Philadelphia's water department created [Soak It Up Adoption](#) – a program that allows civic and non-profit groups to adopt GSI sites - for communities across Philadelphia to help implement, maintain, and share knowledge about GSI.
- The Milwaukee Metropolitan Sewerage District has created its [Green Infrastructure Partnership Program](#) as a way to reduce the amount of stormwater that enters sewers and encourage private, public, and not-for-profit organizations to become more sustainable by incentivizing GSI installation.
- To increase the general public's support and understanding of its operations, the Milwaukee Metropolitan Sewerage District has dispatched local public educational programs.

Grosse Pointe

As of July 2021, the total population of Grosse Pointe was 5,584, with 92.2% identifying as White and only 2.8% identifying as Black or African American. Comparatively, in Jefferson Chalmers, over 83% identify as Black or African American. Grosse Pointe's median household income is noted at \$117,222, and persons in poverty is at 2.8%. In contrast, Jefferson Chalmers median household income is \$37,252, and 49.7% of its population of 7,881 are classified as poor or struggling⁸⁶. It is safe to say that this community that neighbors Jefferson Chalmers exists in a wealthy, predominantly white bubble. This division in income and demographics has only been compounded since Detroit was redlined in the 1930s. The continued growth of wealth and community investment in Grosse Pointe has contributed to

the area's infrastructure management and upkeep, thus, contributing to Grosse Pointe's high flood management adaptive capacity – in stark comparison to Jefferson's Chalmers.

The most notable difference in management is the construction and handling of its three-mile seawall along Lake St. Clair. As of 2021, this seawall was eroding and in need of repair. It did not take long for the bureaucratic wheels to turn and earmark funding for this renewal project. The first movement towards allocating funding was by State Representative Joe Tate. Tate called for \$750,000 of the state's fiscal year 2022 budget to be allocated to the seawall renewal project. The next avenue for potential funding also came from the state's 2022 fiscal year budget via the High Water Infrastructure Grants for local communities. Zooming out to the federal level, a portion of the American Recovery Plan Act could also fund some seawall renewal projects⁸⁷. While there have been no physical changes to the seawall yet, the swift movement of fund allocation speaks volumes to the community's bureaucratic pull.

Grosse Pointe also released a statement on flooding shortly following the 2021 flood. This statement by the City Council had four major components: making sure that current stormwater systems work, keeping stormwater out of the system, examining system capacity improvements, and advocating for supportive state and federal policies as well as their residents. The statement emphasized how the June 2021 flooding event was a prime example of how the current stormwater system does not work and how dependent municipal stormwater systems are on the regional system. The city understands that there is a necessity to work collaboratively and regionally to address the issue of stormwater infrastructure. What one city does, or doesn't do, can impact the entire watershed. At the time of their statement, the council and city staff requested GLWA to enact an independent review of the June 2021 flood response. At a more local level, the council has stated that it will continue to monitor the city's 80- to 100-year-old stormwater pipes and increase efforts to replace and repair them⁸⁸.

To reduce the amount of stormwater that enters the system, Grosse Pointe City Council has stated that part of the solution is disconnecting roof downspouts from underground pipes, incorporating permeable infrastructure to absorb rainfall, and promoting the use of rain gardens and barrels. The city has found other ways to hold itself accountable for reducing the stormwater entering the system. Recently, Grosse Pointe has taken on the Mack Avenue Corridor Improvement Plan, which calls for permeable green infrastructure⁸⁹.

Lastly, the City Council put a significant emphasis on the need for the city to be an advocate for its residents. Residents must be supported by the city advocating at the county, state, and federal levels. These advocacy channels are crucial to creating a movement for regional and local stormwater initiatives. The City Council states that it will continue to advocate for water and sewer initiatives at the state and federal levels that complement the city's strategies. To directly assist Grosse Pointe's residents, the city has chosen to lobby federal, state, and county governments to help secure any potential disaster aid that can be allocated to the residents⁹⁰.

Dearborn

As of July 2021, the total population reached 108,420, with 89.9% identifying as White and 3% identifying as Black or African American. The median household income is noted at \$56,302, and persons in poverty are 26.1%⁹¹. Comparatively, in Jefferson Chalmers, 83% of the population identifies as Black or African American, the median household income is \$37,253, and 49.7% of the population is classified as poor or struggling⁹².

In 2018, the city was awarded \$1,302,573 in Hazard Mitigation Grant Program (HMGP) funds from FEMA to support a stormwater diversion mitigation project. The project includes installing two new shut-off gates in the West Dearborn Sewage District and constructing an overflow structure. The HMGP is a grant that aims to assist in implementing long-term hazard mitigation measures. The FEMA grant covers 75% of the total cost, while the state, local, or tribal governments will pay the remaining 25%. In the case of Dearborn, the HMGP grant will cover 75% of the total \$1,736,764 project cost, and the city will cover the remaining 25% of the cost⁹³.

As of 2022, three projects are underway in Dearborn addressing flood mitigation. The first will insert flap valves within sewer lines that are being excavated for other projects around the city. This initiative is expected to help prevent flooding or mitigate some potential flooding for roughly 3,200 homes. The second project underway is having the city provide opportunities for residents to get discounted backflow preventers. The city hopes to achieve this by pairing with contractors who are excavating sewer lines. The hope is that since the lines are already being excavated, homeowners can take advantage of the lines being exposed by installing backflow preventers. This installation method is anticipated to save homeowners \$3,000 by reducing the normal cost of a backflow preventer from \$4,000 to \$1,000. Lastly, the city of Dearborn is aiming to have a study of its water and sewage system conducted. This study will

identify what happened during the summer floods of 2021 and how the city can act to prevent them from happening again⁹⁴.

Dearborn appears to have momentum toward finding solutions and future flood prevention. Short- and long-term solutions are being scoped out, and the completion of the impending study will help highlight what they have missed. The mayor, Abdullah Hammoud, is working with U.S. Representative Debbie Dingell (D-12th District) to get more areas of Dearborn recognized as a floodplain. The reason for this is that residents will be able to purchase flood insurance once their home is recognized as being in the floodplain. More and more residents want to purchase flood insurance as flooding has impacted nearly two-thirds of the homes in the city⁹⁵. Dearborn's preference to be classified as residing in the floodplain starkly contrasts Jefferson Chalmers' desire to get out of the floodplain.

Hammoud understands that flooding is not an issue that formed overnight. It was created over the last couple of decades. Over that time, Dearborn underfunded its water and sewage infrastructure improvement and is feeling the effects today. There is also an acknowledgment that this is a regional issue. Dearborn is one of the last downstream communities within its watershed - what the upstream communities do impacts Dearborn. If the cities upstream dump more stormwater than they capture, Dearborn is at risk of reaching overcapacity in its stormwater infrastructure. Coupled with declining and mismanaged infrastructure is the increasingly drastic weather this community has been facing due to climate change. Dearborn has experienced five 'hundred-year storms' in the last eight years. Despite these hardships, Hammoud appears committed to untangling the issues surrounding Dearborn's aging infrastructure and the lack of regional watershed management to find solutions that will benefit the community⁹⁶.

Philadelphia

On the other side of the spectrum, we selected a city that more closely resembles the demographics of Jefferson Chalmers than that of the two previous case studies. As of July 2021, Philadelphia's population totaled 1,576,251, with 39.3% identifying as White and 41.4% as Black or African American. For comparison, over 83% of the population in Jefferson Chalmers identifies as Black or African American, while in Grosse Pointe, it is 2.8%, and in Dearborn, 3%^{97,98,99}. Philadelphia's median household income is \$56,302, and 26.1% of the population is in poverty¹⁰⁰. For reference, Jefferson Chalmers has a median household income of \$37,253, and 49.7% of its population is classified as poor or struggling¹⁰¹. The demographic resemblance these communities share has contributed to each city's current standing of

infrastructure, specifically that of storm and wastewater management systems. The most striking infrastructural commonality between Philadelphia and Jefferson Chalmers is their use of a Combined Sewer System.

The City of Philadelphia's storm and wastewater infrastructure is mostly comprised of a combined sewer system. This aging system serves roughly 60% of the city and is known to overflow during wet weather. Overflows result in billions of gallons of stormwater and diluted sewage flowing into local waterways yearly¹⁰². In addition to the mass pollution events that combine sewer systems create, they also contribute to city residents experiencing basement flooding via basement sewer backup¹⁰³. Philadelphia's water department has created the Green City Clean Water to combat these issues¹⁰⁴.

Green City Clean Water is the city's response to its CSOs. Its main goal is to make local waterways cleaner and neighborhoods greener by reducing stormwater entering the system. The project has been in motion since 2011, installing over 2,800 GSI projects that have kept more than 2.7 billion gallons for stormwater runoff and sewer overflows out of local waterways¹⁰⁵. Green City Clean Water has four avenues of engagement citizens can use to become involved and contribute to the project's success: schools, businesses, residential, and community. The most local avenue is the individual level. It offers individuals information on how to manage best stormwater runoff – permeable paving, rain barrels, downspout planters, and rain gardens – and advice on how to reduce the amount of pollutants a household releases¹⁰⁶. There are also opportunities for individuals to receive free rain barrels and discounted landscape upgrades that manage stormwater. Businesses can receive help with meeting stormwater regulations and incentives to increase stormwater management on their property via stormwater grants. Public and private schools can become involved by transforming their outside space into GSI, which doubles as hands-on learning for students. The last avenue for involvement is at the community level, which allows community groups, institutions, non-profits, and places of worship to partner with the city through its program Soak It Up Adoption¹⁰⁷.

The Soak It Up Adoption program allows communities across Philadelphia to partner with the Philadelphia Water Department to help implement, maintain, and share knowledge about GSI. Civic or non-profit groups are eligible to adopt GSI sites, becoming responsible for maintaining their aesthetics and functionality. In return, the groups will receive small annual grants to assist in the GSI site maintenance. Adopters are required to visit and report on their site(s) once a week, and there is mid and end-of-year reporting. One example of the program in action is adopting a couple of rain gardens in

Hetsenville, Philadelphia, by the Philadelphia Parks Alliance. So far, Soak It Up Adoption has 17 organizations involved, with 5,000 people engaged¹⁰⁸.

Milwaukee

Similar in demographics to Philadelphia and Jefferson Chalmers, we selected Milwaukee as our final case study. Based on the July 2021 Census, Milwaukee's population totaled 569,330, with 42% identifying as White and 38.8% as Black or African American. The median household income is \$43,125, and persons in poverty are 24.6%¹⁰⁹. Comparatively, over 83% of the population in Jefferson Chalmers identifies as Black or African American, 2.8% in Grosse Pointe, and 3% in Dearborn. Milwaukee also has a comparable median household income to Jefferson Chalmers's \$37,253.¹¹⁰

Arguably, the city's biggest undertaking was the Milwaukee Deep Tunnels. This project has prevented more than 145.2 billion gallons of stormwater overflow from reaching Lake Michigan. Since 1994, the tunnels have allowed Milwaukee Metropolitan Sewage District (MMSD) to capture and clean 98.5% of all stormwater and wastewater entering the region's sewer system. The project consists of 28.5 miles of deep tunnels dug up to 340 feet below the surface. These tunnels were designed to store 521 million gallons to reduce sewer overflows and basement backups in the city. While the project came with a hefty price tag of roughly \$2 billion, the results are undeniable. Before the tunnels, Milwaukee experienced an average of 50 to 60 overflows into Lake Michigan yearly. Now, with the tunnels, the city experiences an average of 2.3 overflow events¹¹¹. This addition to the city's combined sewer system has been great for its people and natural environment.

Milwaukee appears committed to ensuring its citizens proper storm and wastewater management. This attentiveness to the cause is most apparent in the breadth and capacity of MMSD. The MMSD is a regional government agency that provides flood management and water reclamation services to the Greater Milwaukee Area. They are dedicated to creating a cleaner, healthier, and more resilient region¹¹². Acknowledging climate change and how it will impact their community – more frequent sewer overflows and flooding due to increasing storm intensity - is embedded in MMSD's values and is at the crux of their decision-making. One reflection of this dedication is that MMSD has invested over \$4 billion to reduce sewer overflows¹¹³.

Another example of the city's commitment to achieving proper storm and wastewater management is MMSD's creation of its 2035 Vision. This initiative was created in 2010 to transform their approach to

water. Not only has this program been influential in streamlining the city's storm and wastewater management, but it also has helped to clean up the area's rivers and preserve Lake Michigan. The main two components of the 2035 Vision are 1) integrated watershed management and 2) climate change mitigation/adaptation with an emphasis on energy efficiency. To tackle the first objective of this project, MMSD has been working with fellow municipalities with the Sewerage District to reduce the volume of stormwater they deliver to MMSD's sewer system, expand GI and integrate it with GSI, and increase the general public's support and understanding of MMSD's operations through public educational programs. MMSD has been working on completing the second half of its vision by expanding GSI to make the region more resilient to intense storms and becoming more efficient and renewable with energy usage¹¹⁴. Many programs also spurred from the 2035 Vision, but the two that were most pertinent to our study are the Green Infrastructure Partnership Program (GIPP) and Green Solutions (GS)¹¹⁵.

Starting with GIPP, this program offers incentive funding on per-gallon captured of stormwater through approved GSI strategies designed to capture and clean water where it falls. Reimbursement for GSI installation can also be provided. Private, public, and not-for-profit organizations within the Sewerage District area are eligible to apply. This program will allow organizations to become more sustainable and help reduce the amount of stormwater that enters the sewers, especially in high precipitation events¹¹⁶. In 2022, GIPP partnered with 18 organizations that are expected to capture nearly 1.6 million gallons of stormwater with their GSI¹¹⁷. The second initiative, GS, is a program that aims to assist the municipalities within the Sewerage District in improving their municipal stormwater management and helping them achieve water quality compliance. It is because MMSD acknowledges that what one municipality does can affect the entire Sewerage District's system. Through this project, MMSD will act as a funding mechanism for installing GSI and separating combined sewer systems¹¹⁸.

Municipal Case Study Specific Examples

Organization: Philadelphia Water Department

Program: Soak It Up Adoption

Location: Philadelphia, PA

About the Program:

The Philadelphia Water Department has created the [Soak It Up Adoption Program](#) to allow civic or non-profit groups to be eligible to adopt city GSI sites, becoming responsible for maintaining their aesthetics and functionality. In return, the groups will receive small annual grants to assist

in the GSI. The program aims to help implement, maintain, and share knowledge about GSI site maintenance.

Connections to JEI:

Soak It Up Adoption can act as an example to JEI for one avenue of community involvement. While we recognize GSI is not 'the end-all' solution to flooding in Jefferson Chalmers, GSI is not off the table. JEI-sponsored adoption of their GSI projects would promote community engagement and education on stormwater management while alleviating JEI of GSI maintenance. The program can also act as a blueprint for future community building and interaction JEI undertakes.

Organization: Milwaukee Metropolitan Sewage District

Program: Green Infrastructure Partnership Program & Green Solutions

Location: Milwaukee, WI

About the Program:

The MMSD created [GIPP](#) to financially incentivize private, public, and not-for-profit organizations to install GI. It is done to capture rainwater where it falls and reduce the stormwater entering the sewer system.

The MMSD created [GS](#) to act as a funding mechanism for installing GSI and separating combined sewer systems for municipalities within the Sewerage District. It is done to help municipalities improve their stormwater management and achieve water quality compliance.

Connections to JEI:

JEI can take inspiration from GIPP as a model to financially incentivize private, public, and not-for-profit organizations to increase their water-retention capacity to reduce the amount of stormwater that enters the sewer system. GIPP may act as a direct example for JEI to undertake or as an outside program they can advocate for and support. While this model is GI-specific, it can be applied to other sectors within storm and wastewater management in which JEI works in or around.

Both programs can be examples of what GLWA or a regional authority could incorporate into its waste and stormwater management. JEI can advocate for these initiatives – or something similar – to improve flooding resiliency in Jefferson Chalmers and encourage a watershed management approach.

Organizational Case Studies

In addition to municipalities taking on flooding resilience, we researched different organizations from across the country working to improve their community's flooding resilience. Since JEI is not a municipality, it can use these case studies to model its own flooding resiliency programs.

Organization: Center for Neighborhood Technology (CNT)

Program: RainReady

Location: Chicago, IL

About the Organization:

The Center for Neighborhood Technology's [RainReady¹¹⁹](#) program offers a model for communicating information on flooding. RainReady's program "helps individuals, businesses, and communities find solutions to the problem of urban flooding"¹²⁰ through factsheets, projects, and workshops. They focus on sewage backups, seepages and building dampness, and yard and street flooding.

Connections to JEI:

The RainReady program works to combat similar issues that Jefferson Chalmers faces from stormwater and river flooding. CNT can inspire how JEI might better inform the community on resiliency through:

1. Past Project examples including [Climate Resiliency Planning](#), [Flood Assistance Program](#),
2. Resources and Guidelines on topics including [Insurance Policies](#), [Actions for Homeowners](#), [Actions for Cities and Towns](#), and [Actions for State and Regions](#)

Organization: SBP

Programs: Build, Share, Prepare, Advise, Advocate

Location: New Orleans, LA

About the Organization:

[SBP¹²¹](#) is a non-profit organization that works to "shrink the time between disaster and recovery" using five interventions:

1. Building back efficiently using the Toyota Production System
2. Sharing their model with others
3. Preparing homes and businesses for disasters through resilience training
4. Advising municipal and state officials for disaster response, and

5. Advocating for policy changes and improvements in disaster recovery.

Connections to JEI:

JEI can take inspiration from SBP’s resilience training, advocacy, and advising efforts. For example, by offering workshops on navigating flood insurance and ways to make properties more resilient to flooding. In order to draw more resources to Jefferson Chalmers, JEI can create a more robust advocacy and advising program, using SBP as an example. See their website for resources and examples.

Organization: Urban Waters Learning Network

Resources: State Revolving Fund Advocacy Toolkit, Mitigation Action Portfolio

Location: National

About the Organization

The Urban Waters Learning Networks is “a peer-to-peer network for sharing practical on-the-ground experiences in order to improve urban waterways and revitalize the neighborhoods around them.”¹²² Their website provides multiple toolkits, factsheets, and examples of ways organizations and cities are addressing urban water issues, including flooding.

Connections to JEI:

The [State Revolving Fund Advocacy Toolkit](#)¹²³ helps nonprofit and community-based organizations advocating for water issues influence how federal water infrastructure funds are distributed. JEI can use this toolkit to inform their advocacy and direct funds to benefit the residents of Jefferson Chalmers.

[The Mitigation Action Portfolio](#)¹²⁴ contains case studies of how governments and organizations are managing natural hazards. There are many examples JEI can consider proposing to government officials, including voluntary buyouts, which are cost-effective and successful at getting people out of the floodplain¹²⁵. The examples in this portfolio demonstrate how nonprofits, communities, and government agencies can work together to reduce flooding. While many are outlined in the portfolio, we have selected three examples around voluntary buyouts that will provide an option to residents to leave the floodplain if they wish.

Vision for a Flood-Resilient Jefferson Chalmers

This section outlines possible pathways for flood mitigation and adaptation. While they are not all recommendations, per se, we hope these provide a vision for what might best serve the Jefferson Chalmers community. These ideas are bigger than JEI or Jefferson Chalmers. Their scope is much larger and effects further reaching than the neighborhood level. We advise that JEI use this vision to guide its actions beyond our specific recommendations; this is the roadmap for a future resilient to flooding.

Flood Mitigation Infrastructure and Management

Neighborhood Level

There is some flood mitigation infrastructure already present in Jefferson Chalmers: tiger dams, individual homeowner floodwalls, and the typical CSO stormwater infrastructure. Residents are incredibly dissatisfied with the city mandated tiger dams. While unpopular, without larger flood mitigation structural improvements, the tiger dams will remain.

The City of Detroit engaged the US Army Corps of Engineers (USACE) to mitigate flooding within Jefferson Chalmers. Their recommendations, as mentioned previously -- composed of filling canals, constructing sea walls, building levees, and dams -- were met with resident pushback. However, these actions that were so unappealing to residents are the measurable risk reduction measures that could have any effect on the floodplain designation. USACE does include non-structural measures as possible options (see p. 21 of report for further detail) and states “non-structural measures could also be used in combination with structural measures to reduce the potential for flood damages.” A non-exhaustive list of non-structural measures includes permanent relocation/removal of buildings and property from the floodplain, floodproofing of houses, and filling basements to reduce flood impacts to structures. USACE also mentions that “[n]one of the nonstructural measures listed below will protect the combined sewerages system.”

We recommend conducting more robust community engagement around both structural and non-structural options from USACE. As previously stated, non-structural options alone will not protect the combined sewage system. Without addressing the sewage system, flooding mitigation will be minimal. It is worthwhile to explain the options and their likely outcomes in a community-centered way. Perhaps when community members grasp the probable results of the structural and non-structural options, there

will be more understanding and acceptance that structural options may remove the floodplain designation from Jefferson Chalmers.

Regional Level

GLWA has attempted to sensitize the City and surrounding areas to a regional watershed management approach; however, this has proven unpopular. The City of Detroit is especially against it because most costs and actions would fall on their shoulders. A watershed management approach, as mentioned in the previous section, Addressing Combined Sewer Outflows, is defined by the EPA as:

“A coordinating framework for environmental management that focuses public and private sector efforts to address the highest priority problems within hydrologically-defined geographic areas, taking into consideration both ground and surface water flow,”^{cxxvi}. Watershed management approaches can be administratively and politically complex but can offer great outcomes. Watershed management approaches have been gaining popularity since the 1990s, and motivations for adopting them include^{cxxvii}:

- Reducing public-private conflict
- Addressing growing coordination challenges
- Improved efficiency
- Increased adaptability

The EPA endorses a watershed management approach and has three guiding principles for such approaches^{cxxviii}:

1. **Partnerships:** Those most affected by management decisions are involved throughout and shape key decisions. It ensures that environmental objectives are well integrated with those for economic stability and other social and cultural goals. It also provides that the people who depend upon the natural resources within the watersheds are well informed of and participate in planning and implementation activities.
2. **Geographic Focus:** Activities are directed within specific geographic areas, typically the areas that drain to surface water bodies or that recharge or overlay ground waters or a combination of both.
3. **Sound Management Techniques based on Strong Science and Data:** Collectively, watershed stakeholders employ sound scientific data, tools, and techniques in an iterative decision-making process

The EPA also offers plenty of online training and resources for becoming versed in and trained on watershed management approaches^{cxxix}.

JEI should, if possible, advocate for a watershed management approach for better integration of stormwater, floodplain, and land-use management throughout the Detroit region. This is a much larger and more long-term recommendation that should be taken with other approaches.

Green Stormwater Infrastructure

The United States Environmental Protection Agency defines green stormwater infrastructure (GSI) as: “the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters”¹³⁰.

GSI increases the permeability of surface areas, which allows water to flow through and be absorbed into the ground below more easily. Increasing permeability in urban areas is especially important since so much of the typical surface area in urban areas is non-permeable. Urbanization— basically the increased amount of non-permeable surfaces in streets, highways, buildings, sidewalks, etc. — has had a measurable negative impact on the quantity and quality of runoff water¹³¹, meaning there is more runoff and it is more polluted. Increasing permeability isn't just important for reducing flood vulnerability. Impervious surfaces can cause stream channel erosion, diminish groundwater stocks' recharge, and degrade fisheries' habitat. Impervious surfaces also transport pollutants, bacteria, pesticides, and other substances more rapidly.

Possible green stormwater infrastructure improvements to the Jefferson Chalmers neighborhood have been expertly cataloged in a 2014 Master's Project from SEAS (formerly the School of Natural Resources and Environment)¹³². This report undertakes a topographical analysis of the site situation, water flows, and then-empty lots. It posits that vacant lots, either paved or less-permeable turf, are underutilized in stormwater management. The main recommendations from this project are:

- Converting vacant lots south of Jefferson Ave. to ‘stormwater parks’ to promote even more water infiltration
- Converting vacant lots north of Jefferson Ave. to ‘stormwater parks’ for prevention of water flowing further downhill into the Jefferson Chalmers ‘bowl’
- Construction of conveyance channels for stormwater running east and west through the neighborhood

These proposed plans are at the municipal level because of a stated lack of impact on stormwater management from individual action. This is largely in line with the popular understanding of best

practices surrounding stormwater management. However, it's not to say that action taken at the individual or household level does nothing. Rain gardens at any scale positively impact water infiltration in urban areas.

Rain gardens are small, shallow, sunken areas of plantings that collect stormwater runoff from roofs, streets, and sidewalks. Also known as bioretention cells, they are designed to mimic the natural ways water flows over and absorbs into the land to reduce stormwater pollution¹³³. Rain gardens have certain siting conditions for ideal construction and water absorption¹³⁴. Homeowners may not have the square footage available on their lots for a rain garden to be properly constructed. Rain gardens are visually appealing, provide small amounts of habitat for wildlife and beneficial insect life, and reduce the heat island effect found in many cities. While they may not be a solution at-scale, rain gardens certainly contribute positively towards reducing stormwater runoff and reducing flooding.

The City of Detroit has already highlighted the use GSI can play in reducing flooding. However, the additional stormwater retention and absorption provided by GSI is a fraction of what's needed to reduce or stop flooding and stormwater system backups. Wayne State University civil and environmental engineering professor Bill Shuster estimates that vacant lots in Detroit “function as ‘passive green infrastructure,’ absorbing rainfall and taking pressure off the regional sewer system”¹³⁵. An Erb Family Foundation study found that planting more trees and increasing the tree canopy throughout the city could be more cost-effective than larger GSI projects. They estimated that a 30% increase in tree cover could add 2 billion more gallons of capacity to a stormwater system¹³⁶.

On the whole, green stormwater infrastructure has a role to play in reducing flood vulnerability. However, the City of Detroit may already be using its available GSI at nearly maximum capacity, and additional GSI is not the most cost-effective investment for reducing flood vulnerability. Additional small-scale GSI within Jefferson Chalmers may not have a measurable effect on flooding because of the topography. If JEI wishes to construct or support the construction of additional GSI, doing so outside of Jefferson Chalmers, as detailed in the 2014 report from SNRE students, would be a more effective use of funds and a more effective to reduce flooding. Overall, we recommend that JEI not rely heavily on GSI in its flood resilience strategy. Undertaking more GSI projects will likely not exacerbate flooding in Jefferson Chalmers but will not be the most cost-effective method for reducing flood risk.

Gray Stormwater Infrastructure

Gray infrastructure (GI) is the more conventional form of infrastructure for built environments. As it relates to stormwater and flooding events, some examples of GI are sewer pipes and other treatment hardware, seawalls, pumping systems, water-holding structures and systems, and levees.

GLWA and DWSD's planned upgrades to the already extant infrastructure in Detroit are intended to reduce flooding impacts by increasing the capacity of the stormwater system. GLWA has stated that it needs to add millions, or perhaps billions, of gallons of capacity to reduce flooding risk effectively¹³⁷. This added capacity could take anywhere from \$5 to \$20 billion¹³⁸.

GLWA commissioned a study of the June and July 2021 flooding events to generate recommendations for improvements. The study, done collaboratively by Wade Trim and Brown and Caldwell¹³⁹, developed several preliminary recommendations. The most impactful recommendations, per the report, are below:

- Short term (2022)
 - Complete Conversion of Power Supply for Freud & Bluehill Pump Stations
 - Increase Staffing and Update Standard Operating Procedures
- Medium Term (2023-2025)
 - Evaluate Power and Pumping Requirements and Redundancy System-Wide
 - Continue to Improve System Management Through Staffing and Training
- Long Term (Post 2025)
 - Complete the Freud and Connors Creek Pump Station Improvements

Improvements to the Freud and Connors Creek Pump Stations are planned for future years, with the Connors Pump Station not even starting until at least FY2026¹⁴⁰. The report from Wade Trim and Brown and Caldwell recommends accelerating those actions as much as possible. Doing so will allow for better emergency flood relief, among other improvements.

JEI should advocate whenever possible to accelerate improvements to relevant GI. This can include separating the CSO system into individual stormwater and sewage systems, increasing system capacity, improving pumping station capacity and resilience, and building new pumping and wastewater treatment plants elsewhere in the system to reduce pressure on system components within Jefferson Chalmers.

Flood Adaptation Strategies

Flooding adaptation is a growing field of study due to increased concerns about widespread flooding in many places worldwide. Adaptation measures are limited by the available funding, topography, technology, and capacity of implementers. Adaptations to flooding mainly attempt to 1) redirect and absorb water and 2) increase building and infrastructure resiliency to reduce vulnerability. There are different possible categorizations of adaptation strategies. While there are more flooding adaptation measures than elucidated here, these seem particularly relevant to the Jefferson Chalmers neighborhood context.

Home repairs and renovations

Home repairs and renovations like disconnecting downspouts, installing backwater valves, installing sump pumps, clearing lateral lines, sloping land away from homes, repairing foundation cracks, and replacing or adding home drainpipes can be helpful flood mitigation measures.

Programs like the City of Detroit's Basement Protection Program¹⁴¹ can help residents proactively protect their homes against flooding. Jefferson Chalmers was included in the second phase of implementation, which was scheduled to begin in 2022. The accompanying handbook to this program also provides homeowners with some actions they can take without the city's help¹⁴². FEMA also has guidance on additional actions homeowners can take to reduce flooding mitigation¹⁴³.

Floodplain management and working with FEMA

As previously mentioned, FEMA currently has no income-based adjustments for flood insurance premiums under the NFIP. However, there are certain things the Jefferson Chalmers community can do to save money. Because of the structure of the NFIP and Risk Rating 2.0, premiums are lowered when risk is reduced. If Jefferson Chalmers residents can reduce their risk, they can reduce their premiums. This is key for the Jefferson Chalmers community, since the entire neighborhood is classified in Zone AE, and is required to have flood insurance¹⁴⁴. Jefferson Chalmers residents may be eligible for a 70% discount on their first 'term' of an NFIP policy (see Appendix 1: Risk Rating 2.0 Discount Explanation Guide, p.3).

It may be helpful to understand how rates originate and how building characteristics like foundation type, number of stories, and the number of 'flood openings'. This information can be found in more detail in Appendix 1: Risk Rating 2.0 Discount Explanation Guide

The City of Detroit participates in the Community Rating System (CRS). CRS promotes risk reduction with three goals:

1. Reduce and avoid flood damage to insurable property
2. Strengthen and support the insurance aspects of the National Flood Insurance Program
3. Foster comprehensive floodplain management

There are ten classifications under CRS, with a class 10 community receiving a 0% discount and a class 1 community receiving a 45% discount. The City of Detroit is a class 8 community and receives a blanket 10% discount on insurance premiums.

Another cost-reduction option is an Increased Cost of Compliance (ICC) claim¹⁴⁵. An ICC can be filed if a property has sustained damage that will cost up to 50% of its value to repair or if there has been FEMA-recorded repetitive damage. ICC claims will cover up to \$30,000 for elevation, relocation, demolition, or flood-proofing (typically only offered to non-residential structures). An ICC claim requires a declaration from the local floodplain administrator. See below the section The following recommendations will require working with new partners in potentially different ways. In an effort to address mission creep, we advise that JEI identify partner organizations that address portions of these recommendations that JEI does not do currently.

Proactive Planning for the contact information of the local floodplain administrator.

Federal funding is available through the Community Assistance Program – State Support Services Element (CAP- SSSE). FEMA offers this funding via the Department of Homeland Security and is administered through NFIP coordinating agencies. Michigan’s NFIP coordinating agency is EGLE.

Fundable activities include:

- Assistance to Communities in Responding to Disasters
- Community Assistance Visits (CAVs) and Community Assistance Contacts (CACs)
- Community Information System (CIS) Entry
- Community Rating System (CRS) Support
- Coordination with Other Programs and Agencies
- Endangered Species Act (ESA) activities
- Enrollment of Communities
- Floodplain Management Regulation Assistance

- General Technical Assistance
- Mapping Coordination Assistance
- Outreach, Workshops and Other Training
- Planning
- Selection of Communities that Receive CACs, CAVs, Trainings, or other Technical Assistance
- State Model Regulation Updates and Monitoring of State Regulatory Environment

JEI can work with EGLE and the local NFIP administrator to determine if there is an opportunity for CAP-SSSE funding to support Jefferson Chalmers’ flood adaptation and flood response.

While it is possible to change floodplain designation, it is an incredibly lengthy and administratively burdensome process¹⁴⁶. Because of the resources needed—updated topographic information, form completion, administrative follow-up—it’s only recommended to do this after there has been a measurable change to flood risk.

Voluntary Buybacks

Voluntary buybacks, also known as managed retreat, is “the coordinated process of voluntarily and equitably relocating people, structures, and infrastructure away from vulnerable coastal areas in response to episodic or chronic threats in order to facilitate the transition of individual people, communities, and ecosystems (both species and habitats) inland,”¹⁴⁷. This is admittedly a difficult and unpopular undertaking, even in the best cases. However, “buying and removing buildings in the floodplain is one of the most cost-effective ways to reduce long-term flood damage” according to FEMA¹⁴⁸. Given the right conditions, these programs can be extremely popular as they allow residents to relocate out of danger if they wish. A program in Harris County, Texas, has a waiting list of over 1,000 residents¹⁴⁹. Although many residents may not want to leave their homes, this option should be explored for those who wish to relocate.

FEMA has grant programs like the Flood Mitigation Assistance (FMA) Grant Program¹⁵⁰, the Hazard Mitigation Grant Program (HMGP)¹⁵¹, and the Building Resilience Infrastructure and Communities (BRIC) Grant Program¹⁵² that can be used to fund voluntary buyback programs. These require a federal grant writer to compose and submit the proposal and a grant manager to run and administer the program. The HMGP can be used to relocate individuals and communities, should that interest anyone

in the community. The FMA and BRIC grants can be used for buyouts or increasing resilience. We have highlighted examples of successful voluntary buyout programs across the country below.

1. Charlotte – Mecklenburg Flood Mitigation Buyout Program:¹⁵³

- Mecklenburg County Storm Water Services has operated a voluntary floodplain buyout program since 1999.
- They estimate that these buyouts will ultimately avoid over \$300 million in future losses.
- Over 400 structures have been relocated outside of the floodplains.
- Funding: FEMA Pre-Disaster Mitigation Funding, Hazard Mitigation Grant Program, North Carolina Hazard Mitigation, local utility fee, local partners

2. Foster Floodplain Natural Area¹⁵⁴

- The city bought up property to help 60 families move out of the 100-year floodplain and turn it into a natural area to reduce flood risks.
- Funding: FEMA Pre-Disaster Mitigation Funding: 2.7 million, Stormwater utility fees: 10.3 million

3. Harris County Flood Control District Voluntary Acquisition Program¹⁵⁵

- Voluntary acquisition for homes at risk of repetitive flood losses in Harris County, TX
- The biggest challenge is that the waitlist is over 1,000. There is more demand for buyouts than available funding.
- Over 3,000 properties acquired so far.
- Funding: FEMA Flood Mitigation Assistance, Harris County

Specific Actions That JEI Can Take to Support Flood

Resiliency

JEI is well positioned to be a leader in flood resiliency for Jefferson Chalmers, the East Side of Detroit, and Southeast Michigan more broadly. JEI should continue providing flood support to residents and help residents reduce their risk for maximizing the possible savings under Risk Rating 2.0 (see Appendix 1: Risk Rating 2.0 Discount Explanation Guide) by integrating the specific risk-reducing construction options.

The following recommendations will require working with new partners in potentially different ways. In an effort to address mission creep, we advise that JEI identify partner organizations that address portions of these recommendations that JEI does not do currently.

Proactive Planning

What: An Internal Flooding Disaster Response Plan for employees to understand what needs to be done in the event of a flood and community workshops for residents and businesses to learn how to prepare for floods and what resources JEI offers.

When: The Disaster Response Plan can be created as soon as possible in preparation for the summer ahead. Workshops may take time to develop but holding them throughout the spring and summer would be ideal timelines to prepare for summer flooding events.

It was clear from our interviews with JEI staff that JEI's response to previous floods has been reactionary, creating a confusing and hectic atmosphere for employees, residents, and businesses trying to gather and distribute supplies, disseminate information about relief, and apply for claims and relief funding. Although any disaster will inevitably be chaotic, creating an internal Flooding Disaster Response Plan describing what JEI plans to do in the event of a flood would help staff manage the disaster better. For example, the Disaster Response Plan can include information about JEI's partners and contractors in distributing supplies or mucking out basements and their contact information, who is in charge of contacting these partners, what happens if the Neighborhood Hub is flooded, where will JEI be located to help with processing claims, and what are staff member's roles during an event like this. Although it is impossible to plan for every contingency, and knowing that a disaster will bring uncertainty, having a written standard operating procedure will at least help jumpstart relief efforts.

In addition to internal preparedness, JEI can play a role in helping the community proactively plan for future floods. Workshops led by JEI staff could go over best practices for preventing loss of property, such as elevating basement appliances and valuables and disconnecting downspouts. Leading workshops on how to navigate flood insurance and reduce premiums would also be helpful to residents. We have included the contact information for the current floodplain management specialist and NFIP Coordinator below, who may be helpful in developing these workshops. Workshops can also be a good place for JEI to share its plans and resources with the community and hear input on unmet needs.

The current floodplain management contact is:

Brian Killen, CFM

Sr. Floodplain Management Specialist

Mitigation Division | FEMA Region 5

Mobile: (202) 803-3757

brian.killen@fema.dhs.gov

The current NFIP Coordinator is:

Matt Occhipinti

occhipintim@michigan.gov

Dedicated Resilience Personnel

What: A dedicated resilience staff position. This position should be someone who:

- Advocates for climate adaptation and environmental justice
- Educates to activate a community-wide resilience ethic for all ages by providing programs and resources that support awareness and knowledge of Jefferson Chalmer's flood risk and adoption of achievable adaptation behaviors
- Identifies and nurtures opportunities for affecting positive policy and systemic change within communities
- Expands our environmental justice work to include a new community capacity-building program that creates climate-ready and healthy communities.
- Promotes equitable, holistic strategies and multi-sector collaboration that builds the Jefferson Chalmers community's resilience and adaptive capacity to present and future climate risks

Why: If JEI wants to incorporate more flooding resilience programming, they will need someone to manage the disaster and community resilience programs and coordinate with other organizations to

further resiliency efforts. It is critical this person understands the community needs and works with the community to find solutions. A recommended job description is in Appendix 2: Proposed Resilience Officer Job Description.

Resilient and Sustainable Design

What: Incorporating and retrofitting of green, permeable infrastructure into new and old buildings while staying cautious of potential green gentrification.

Who: JEI and EJDevco

- **Sustainable Development:** Continue to implement sustainable designs into new development projects to ensure new construction or renovations is capable of handling future risks.
 - Some examples of this may include: GSI parking lots or permeable paving, especially outside of Jefferson Chalmers; solar panels; higher base elevation, no basements (see Appendix 1: Risk Rating 2.0 Discount Explanation Guide)
- **Sustainable Housing Programs:** Besides helping residents access the City of Detroit’s Basement Protection Program¹⁵⁶, JEI’s own home repair and basement muck-outs are critical post-flood responses and should continue. JEI offers many services to help keep residents in their homes, including funding for repairs and financial literacy workshops, and counseling. This work is essential to increasing the resilience of homes and the community.
- **Green Gentrification:** This is a process that occurs when environmental greening leads to the increase in perceived local desirability that results in higher property values and rents. While this appears to be a “win-win” solution, this is not the case. This perceived increase in desirability commonly attracts wealthier residents and businesses, which in turn can increase the cost of living in said area. Local, lower-income residents feel the burn of this new increased cost of living that their new, higher-income neighbors. In some cases, green gentrification can lead to vanishing community institutions and the physical displacement of lower-income residents¹⁵⁷.

Communication Hub

What: A virtual and physical space to share information on flooding resilience with residents and gather feedback to share with officials and policymakers.

Where: At the JEI community hub, the neighborhood community center, and online on JEI’s website.

Who: A dedicated resilience coordinator should manage the hub and communicate with JEI management to keep up to date with the latest news.

Communication is extremely important before, during, and after a disaster occurs. We heard from the community meetings and from our interviews with JEI staff and government officials that one major challenge for Jefferson Chalmers is the lack of communication between the neighborhood and the government. Residents and businesses were confused or uninformed about what city programs and funding opportunities were available and the processes to apply. There was also lots of frustration and confusion about communicating resident needs and concerns to the city (e.g., sandbag pick-ups and repairs from city projects). In this confusion and frustration, we see an opportunity for JEI to make a difference: creating a Neighborhood Communication Hub.

Through the Hub, JEI could communicate updates from the city, state, and federal levels on all things flooding resilience related to Jefferson Chalmers residents. Our research has shown that this issue is complicated and that things are changing every month. Although it should be the city's job to provide clear information, JEI has the power to step in and provide clear information on a neighborhood level. This would be a place to share resources, strategies, events, workshops, and programs. It would also be a place to keep tabs on various projects, such as GLWA and DWSD repairs, larger infrastructure projects, and floodplain status.

Since equitable engagement with the community on projects is essential, the Hub can also act as a means for the residents to share their feelings, ideas, and questions that JEI can bring to meetings with the city and other organizations. Residents should also be able to share resources and ideas with JEI to post to the Communication Hub.

Due to the socioeconomic diversity of Jefferson Chalmers, we are recommending that the Hub be in two forms: a website form and a physical bulletin board at the Neighborhood Hub and/or Community Center. A potential model website is the Center for Neighborhood Technology's RainReady page¹⁵⁸.

Finally, JEI should advertise its communication hub to the community in various ways, including flyers, email blasts, word of mouth, and any JEI social media. While flooding resilience could be one aspect of the Hub, JEI can consider expanding topics to include other neighborhood needs (e.g., information for cold weather resilience, heat safety, etc.).

Sustained Community Engagement

What: Continued engagement with the City of Detroit and community on flood-resilience strategies

Who: JEI

This recommendation builds upon the notable engagement efforts that JEI has taken for supporting information flows, resource sharing, and community engagement efforts between the City of Detroit and neighborhood residents. JEI should continue strengthening this work, but we want to highlight two specific areas where we believe JEI is best suited to lead local community engagement efforts.

- **Engage in a community-wide conversation to identify projects mitigating the neighborhood's FEMA Floodplain status:** A community-driven approach that centers local development contexts and existing burdens on low-income residents is critical to identifying solutions to alleviate the neighborhood's floodplain status. As mentioned previously, Jefferson Chalmers neighborhood residents have already rejected the City of Detroit's proposal to build protective infrastructure along the neighborhood's canals, which would have removed the area from a 100-year floodplain. Community members believe the project would harm waterfront property values, local business activity, and their ability to use the river for recreation. As a result, City has \$10M appropriated but unallocated CDBG-DR funds available that it can utilize for flood mitigation activities. Also, the onus for mitigating lake-level exposure from canals is now on individual private property owners through seawall remediation, which can cost up to \$50,000 per home in a neighborhood where the median income is \$29,750¹⁵⁹. It also requires City to enforce seawall protection and maintenance policies, which can further hamper the already contentious relationship between the City and Jefferson Chalmers community. The situation necessitates a local leader to engage the community in a conversation discussing the challenges of proposed solutions and identifying alternatives that can utilize the CDBG-DR funding opportunity. These solutions must be equitable and balance the needs of low-income residents with their more affluent neighbors. We believe JEI, with its trusted networks with both residents and businesses in the neighborhood, can effectively lead this conversation and steer the community toward a constructive discussion.
- **Work with the City of Detroit to take steps to improve City's rating in the FEMA's Community Rating System (CRS):** While getting out of the floodplain is a critical goal for

Jefferson Chalmers residents, it will be an extremely daunting task without implementing structural solutions. In that scenario, we recommend JEI partner with the City of Detroit and community members to improve Detroit's CRS rating from Class 8. A community can engage in 19 creditable activities to improve their rating. These activities span four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Warning and Response. Each action earns points, and every incremental Class improvement can add a 5% NFIP policy premium discount, thus reducing flood insurance burdens¹⁶⁰. JEI can utilize the support of a student-led team to study the feasibility of these actions for Detroit and propose recommended actions for the City to implement (see Appendix 3: Proposed Future Projects for SEAS Sustainability Clinic and JEI for more potential student team-led projects ideas).

Political Advocacy

What: A robust political advocacy plan to encourage action at all levels of government.

Who: JEI and coalition partners

To achieve JEI's strategic goals of a thriving East Side corridor that attracts business development and provides housing stability, JEI must incorporate managing climate change impacts in its portfolio. With effects ranging from public health concerns, property protection, hurdles to future development, and neighborhood affordability, climate change in Jefferson Chalmers poses a transdisciplinary and multi-level infrastructural challenge. Mitigating and adapting to these challenges at the neighborhood level will require reconfiguring existing higher levels of governance structures. These often tolerate changes poorly and need sustained engagement. JEI has been an active player in building power at the neighborhood level and has been advocating for residents and businesses in the Jefferson Chalmers Neighborhood; however, we believe these efforts can be more explicit and target specific policy channels that support JEI's broader vision for the neighborhood. JEI can play an instrumental role by elevating the realities on the ground to regional, state, and federal levels and advocating for community-led modifications that support adaptability and flexibility in policy design and implementation.

We recognize the enormous energy required to build advocacy efforts and recommend JEI develop its political advocacy actions by collaborating with other community-based organizations, leveraging their skillsets in areas outside JEI's expertise, and harnessing synergies. With increasing climate impacts, we also believe that investing in these efforts today will provide the neighborhood with a solid foundation for handling a rapidly evolving future. We also recognize that traditional systems of non-profit

governance that rely on tangible, short-term outcomes for evaluation don't necessarily align with long-term, collaborative political advocacy actions. However, in light of increasing climate change impacts and deadlocked policy processes, we recommend JEI adds institutional engagement around climate resiliency and policy adaptability as one of its strategic goals. While political advocacy action can span a wide range of impact areas, we recommend JEI kickstart these efforts with opportunities highlighted below.

- **Advocate for innovations in existing funding mechanisms to align with stormwater management needs:** Current primary infrastructure funding mechanisms like federal grants and state revolving funds do not actively support stormwater projects. A common barrier to increased CWSRF lending for NPS pollution abatement is the difficulty of identifying a dedicated revenue stream for repayment. However, states have a lot of leeway in implementing these funds, and JEI should encourage Michigan to implement a broader interpretation of what kind of projects can be funded based on community needs¹⁶¹. One example would be advocating for Sponsorship Programs (examples [here](#)) that allow utilities to use SRF funds for watershed restoration or protection priorities without passing the costs directly to customers¹⁶². Examples of how other states have used this program can be found. Jefferson Chalmers can potentially use such a program to secure additional financing for neighborhood-level green and gray infrastructure projects. JEI can also combine efforts with other groups to advocate state legislature for dedicated water resource program funds, including the possibility of a statewide bond. At the federal level, advocacy efforts should align with the Water Resources Development Act timeline for securing federal project funding. We recognize that these efforts require additional work on JEI's behalf, but an Environmental Financial Advisory Board report from EPA identified a lack of political will as the most significant barrier to stormwater financing, and advocacy is the pathway to overcoming it. A direct quote from the report, "Perhaps the biggest obstacle to closing the stormwater funding gap is the lack of political will to increase revenues dedicated to stormwater investment at the local, state and federal levels. Without leadership, stormwater infrastructure investment will continue to fall short of annual needs and future generations will be burdened with failing stormwater systems." JEI can refer to the [State Revolving Fund Advocacy Toolkit](#) to identify specific steps to influence federal funds disbursement.
- **Advocate for Watershed Management Approach to reduce flows into Jefferson Chalmers:** Given Detroit's topography, a watershed management approach making

infrastructural changes in upstream systems can relieve some pressure on the combined sewer system. Such efforts are voluntary and require coalition-building and a systems-based framing toward infrastructure management. JEI can play a vital role by educating the community on a watershed approach and then advocating for Jefferson Chalmers' needs in such an effort. One concrete example would be to advocate for setting GSI targets outside Detroit and Jefferson Chalmers's boundaries in upstream systems where the potential to reduce additional flows is higher, compared to Detroit, where additional GSI will have limited improvements. Another opportunity is to consolidate multiple point source, nonpoint stormwater programs into a single, comprehensive regional permit and/or adoption of the U.S. EPA's Regional Planning Framework. Under this approach, a single regional entity, such as GLWA, could have the technical and financial resources and authority to implement integrated regional responses to state and federal-mandated requirements that could be more cost-effective and efficient.

- **Advocate for a state-level water utility commission:** JEI should collaborate with other community-based organizations to advocate for a state-level water regulatory authority. It will provide localities with a direct pathway to elevate their concerns around water and wastewater-related infrastructural challenges to a comprehensive statewide discussion. A public utility commission will be best positioned to pursue system analyses around regional watershed management and to coordinate efforts with federal and state regulators to develop a balanced approach to the state regulatory regime that balances private property protection with water quality standards.

Discount Explanation Guide

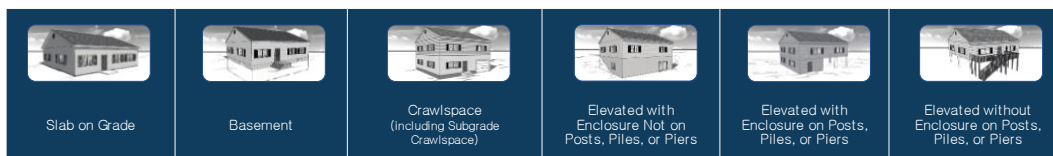
Risk Rating 2.0: Equity in Action is FEMA's individualized approach to risk assessment, built on years of investment in flood hazard information.

By using current data, flood models, and technology, FEMA considers many risk factors for individual properties, including frequency of flooding, multiple flood types, distance to a flooding source, and property characteristics such as elevation and the cost to rebuild.

Mitigation efforts, community programs, and other discounts can help reduce flood damage and, potentially, the cost of flood insurance. This guide provides discount information on certain rating variables that are generally applied to the building and contents premium.

Foundation Type

Below are the six Foundation Types, which provide important insight as to where the flood risk is likely to begin. Buildings Elevated with Enclosure Not on Posts, Piles, or Piers will have a higher premium than buildings Elevated without Enclosure on Posts, Piles, Piers, if all rating variables are the same.



First Floor Height

The First Floor Height (FFH), or the height of the building's first lowest floor above the adjacent grade, is another rating variable critical to understanding the flood risk. Generally, buildings that are higher off the ground have lower risk. The following chart shows the discount percentage based on the foundation type and FFH, which is included in the amount charged for building and contents coverage. For example, a building with a crawlspace foundation and FFH of 3 feet above adjacent grade corresponds to a 22.1% discount compared to the same building having a FFH of 0. Between whole numbers, the discount for FFH is continuously provided (interpolated). For example, a building with a slab-on-grade foundation and FFH of 1.25 feet will receive a discount of -9.85%, which is a quarter of the way between the discount for 1 foot and 2 feet.

First Floor Height* (In Feet)	Slab on Grade	Basement	Crawlspace (Including Subgrade Crawlspace)	Elevated with Enclosure Not on Posts, Piles, or Piers	Elevated with Enclosure on Posts, Piles, or Piers	Elevated without Enclosure on Posts, Piles, or Piers
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1	-8.0%	-8.0%	-8.0%	-8.0%	-9.0%	-10.0%
2	-15.4%	-15.4%	-15.4%	-15.4%	-17.2%	-19.0%
3	-22.1%	-22.1%	-22.1%	-22.1%	-24.6%	-27.1%
4	-28.4%	-28.4%	-28.4%	-28.4%	-31.4%	-34.4%
5	-34.1%	-34.1%	-34.1%	-34.1%	-37.6%	-41.0%
6	-36.7%	-36.7%	-36.7%	-36.7%	-43.2%	-46.9%
7	-39.3%	-39.3%	-39.3%	-39.3%	-48.3%	-52.2%
8	-41.7%	-41.7%	-41.7%	-41.7%	-53.0%	-57.0%
9	-44.0%	-44.0%	-44.0%	-44.0%	-57.2%	-61.3%
10-14	-46.3%to-54.4%	-46.3%to-54.4%	-46.3%to-54.4%	-46.3%to-54.4%	-61.1%to-73.3%	-65.1%to-77.1%
15-25	-56.2%to-70.9%	-56.2%to-70.9%	-56.2%to-70.9%	-56.2%to-70.9%	-75.7%to-86.6%	-79.4%to-88.9%

*Although the chart shows FFHs up to 25 feet, we recognize it is rare that the FFH will reach those measurements for most foundation types.



Flood Openings

Policyholders may receive a mitigation discount if the building's enclosure or crawlspace is constructed with proper flood openings or engineered openings with documentation. Flood openings can lower a building's flood risk as they allow floodwaters to flow through a building's enclosure or crawlspace. The following chart shows the discount percentages based on eligible foundation types and FFH. For example, a building Elevated with Enclosure Not on Posts, Piles, or Piers with a FFH measurement of 9 feet above the adjacent grade corresponds to a 11.8% mitigation discount, compared to the same building without proper flood openings, which would receive no flood openings discount. Between whole numbers, the discount for Flood Openings is continuously provided (interpolated). For example, a building with a crawlspace foundation and a FFH of 4.25 feet will receive a discount of -2.225%, which is a quarter of the way between the discount for 4 feet and 5 feet.

First Floor Height* (In Feet)	Crawlspace (including Subgrade Crawlspace)	Elevated with Enclosure Not on Posts, Piles, or Piers	Elevated with Enclosure on Posts, Piles, or Piers
1	-0.5%	-0.5%	-0.5%
2	-1.1%	-1.1%	-1.1%
3	-1.7%	-1.7%	-1.7%
4	-2.1%	-2.1%	-2.2%
5	-2.6%	-2.6%	-2.7%
6	-5.2%	-5.2%	-3.2%
7	-7.4%	-7.4%	-3.7%
8	-9.6%	-9.6%	-4.3%
9	-11.8%	-11.8%	-4.7%
10-14	-13.8% to -20.6%	-13.8% to -20.6%	-5.1% to -7.1%
15-25	-22.1% to -27.1%	-22.1% to -27.1%	-7.8% to -9.0%

*Although the chart shows FFHs up to 25 feet, we recognize it is rare that the FFH will reach those measurements for most foundation types.

Machinery & Equipment

Policyholders may receive a **5% mitigation** discount if certain covered Machinery and Equipment (M&E) and appliances servicing the building, whether inside or outside the building, are elevated to at least the elevation of the floor above the building's first floor.

Floor of Interest: Number of Floors in Building

The building's number of floors above the ground (excluding enclosures, on grade or subgrade crawlspaces, basements, and attics used only for storage) may result in reduced insurance rates. For example, a building with three floors may receive a greater discount for this rating variable than if that same building had only one floor. The table below shows discounts based on the number of floors in the building and occupancy type. This rating variable does not apply to residential or non-residential units.

Number of Floors in Building	Single Family Home Building Occupancy	All Other Building Occupancies (Excluding Residential Unit and Non-Residential Unit)
1	0.0%	0.0%
2	-10.0%	-10.0%
3	-30.0%	-30.0%
4	-	-37.3%
5	-	-42.3%
6	-	-45.9%
7	-	-48.8%
8-100	-	-51% to -69%

Learn more at fema.gov/flood-insurance/risk-rating

April 2022 2

Floor of Interest: Floor of Unit

For a residential or non-residential unit inside a multi-floor building, the floor where the unit is located may impact the premium. Units above the first floor receive a higher discount as shown in the table below.

The Floor Where the Unit Is Located	Residential/Non-Residential Unit Building Occupancy
1	0.0%
2	-71.8%
3	-88.4%
4+	-88.9%

Statutory Discounts

FEMA provides statutory discounts on the first \$35,000 of coverage for buildings and \$10,000 of contents coverage for pre-Flood Insurance Rate Map (FIRM) primary residences and newly mapped properties, as well as those in the Emergency Program or located in the AR or A99 flood zone.

The table below shows the discount percentage that applies to the policy's first term of eligibility for the statutory discount. For subsequent renewal terms, the statutory annual increase cap applies.

Statutory Discount	Discount Percentage
Newly Mapped	70%
Pre-FIRM Discount	60%
Emergency Program	60%
AR Zone	60%

CRS Discount

Under Risk Rating 2.0: Equity in Action, Community Rating System (CRS) discounts ranging from 5% to 45% are applied uniformly. The community's CRS discount applies to all CRS eligible NFIP policies in the community regardless of flood zone.

Note: A loss and expense constant is applied to the full risk premium separate from any of the discounts mentioned above. As a result, the difference in full risk premium between any two quotes will not exactly match the percentages listed. Additionally, certain discounts may not apply to the coastal erosion portion of the premium, if applicable. Policies may also be subject to minimum or maximum rates by peril and coverage, which may impact how discounts are applied and the specific amount of premium savings.

Appendix 2: Proposed Resilience Officer Job Description

Title: Community Resilience and Engagement Officer

We are searching for a results-oriented leader with a proven track record of linking public action to community resilience. The Community Resilience and Engagement Officer will activate JEI's community members for resilient climate action and flood mitigation. They will be responsible for promoting resilient neighborhood education and action. The Community Resilience and Engagement Officer will connect residents and business owners to funding streams and resources to support recovery after floods. Ideally, they promote environmental justice throughout all their interactions and work. They will work with JEI staff members in housing, business development, and community engagement.

The Community Resilience and Engagement Officer should be someone who can effectively:

- Advocate for climate adaptation and environmental justice
- Educate to activate a community-wide resilience ethic for all ages by providing programs and resources that support awareness and knowledge of Jefferson Chalmer's flood risk and adoption of achievable adaptation behaviors
- Identify and nurture opportunities for affecting positive policy and systemic change within communities
- Expand our environmental justice work to include a new community capacity building program that creates climate-ready and healthy communities.
- Promote equitable, holistic strategies and multi-sector collaboration that builds the Jefferson Chalmers community's resilience and adaptive capacity to present and future climate risks

You ideally bring the following qualifications:

- A bachelor's degree in a related field like environmental science, sociology, urban planning, public health, or similar.
- 3 years of experience, ideally in urban, justice-focused environments with experience in climate resilience a plus
- Strong administrative and project management skills and experience
- Experience working with federal funding; direct experience with FEMA is a plus
- Strong communication skills and a commitment to follow through

- Ability to achieve and execute goals while working with other departments
- An entrepreneurial attitude who asks for help when needed
- A commitment to diversity, equity, inclusion, and justice
- Proven ability to prioritize and handle multiple tasks independently; effective management of shifting priorities and time-sensitive projects to meet deadlines.

Appendix 3: Proposed Future Projects for SEAS Sustainability Clinic and JEI

Investigating FEMA’s Community Engagement Prioritization Tool

Have a team look into options, if any, listed under FEMA’s [Community Engagement Prioritization Tool](#) (registration required to see tool, what’s listed as priority)

Investigating Voluntary Buyouts in Jefferson Chalmers

Have a team research the feasibility of voluntary buyouts: how would they be funded, how can JEI engage with buy-outs, what are resident’s feelings about buy-outs.

1. Buy outs have been popular in certain flood prone areas (ex: Harrison County, TX has waiting list of over 1,000 homes)
2. Opportunity to turn bought-out properties into wetlands, providing mitigation to other residents
3. Important aspect of investigation is researching where bought out residents could relocate to

Developing Flood Preparedness Workshops

Have a team create and pilot flood preparedness workshops and materials for residents and businesses. Topics can include:

1. Navigating flood insurance
2. Programs and funding to repair and retrofit homes and businesses
3. Opportunities for advocacy

Study Feasibility of Flood Protection Activities to Improve CRS Class Rating

Have a team study the feasibility of FEMA 19 flood protection activities for Detroit and recommend specific actions for the City to implement.

Appendix 4: National Conversation on Natural Hazard

Mitigation

In July 2022 our team had the opportunity to attend the Natural Hazards Conference, where speakers from industry, government, academia, and non-profits shared their insights on addressing equitable and just natural hazards. Flooding was a common topic, and the team came away with insights on how to address flooding resilience.

Many speakers spoke of the importance of finding co-benefit programs. How can programs be implemented to address multiple hazards concerns? Although this project focuses around flooding, JEI could consider how their current programs address extreme heat and cold. For example, could the Communication Hub we propose as an action be used to communicate information about more than just flooding?

During the conference we heard from [West Street Recovery](#), a non-profit that formed in response to Hurricane Harvey to help the community recover from disaster and build community power.¹⁶⁴ The communities they serve in Houston also have seen frequent and severe rainfall events, with inadequate government response. They provide funding for home repairs using resilient designs like muck-ready walls, distribute emergency supply kits to the community, set up generators in houses with vulnerable folks, and provide leadership and capacity building trainings for community members to organize themselves to push government agencies to respond. Finally, they also conduct participatory research projects to identify barriers of recovery, demonstrate dissatisfaction with government response, and share strategies that households use to improve their resilience. They use this research to identify solutions that are community-supported.

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