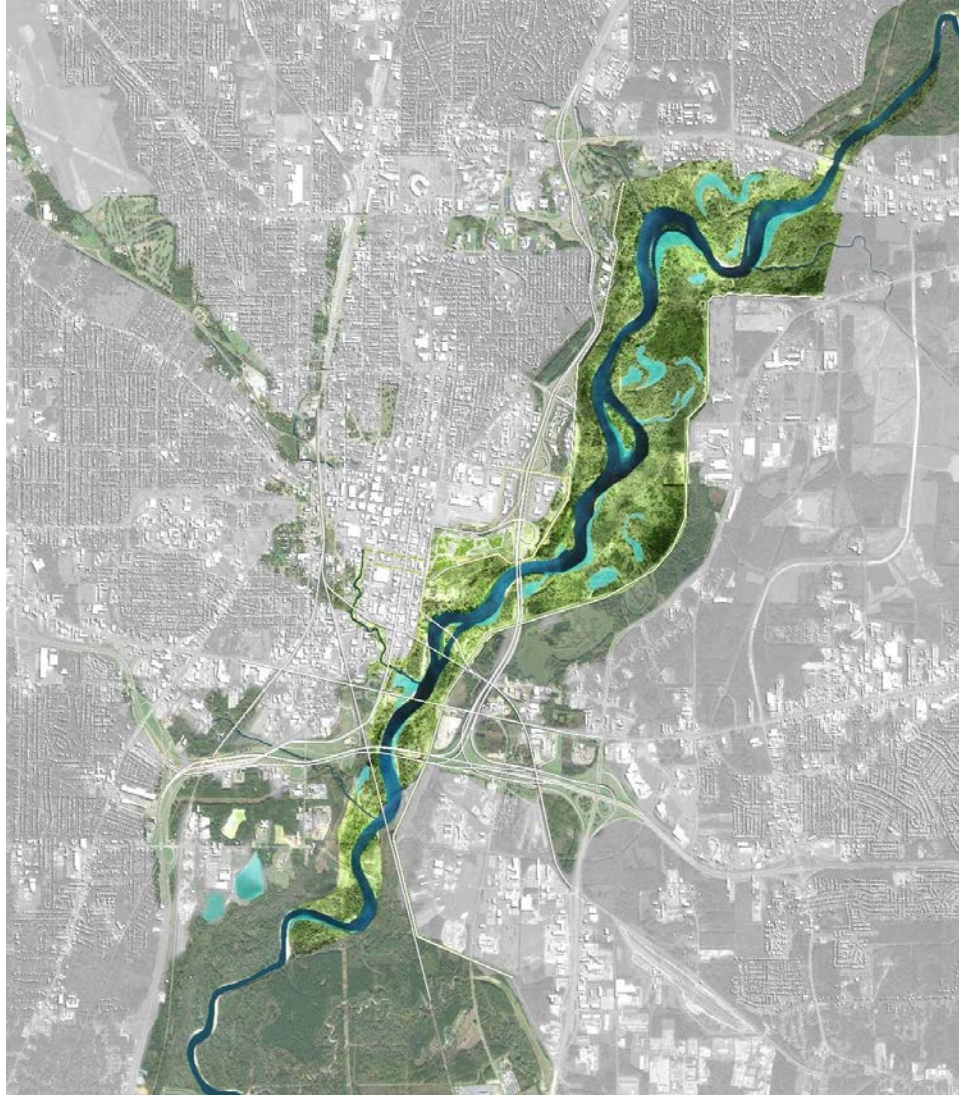


The Green Heart of the Pearl River



A Proposal for Flood Mitigation and Public Access for the Pearl River at Jackson, Mississippi

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The Green Heart of the Pearl River: A Proposal for Flood Mitigation and Public Access for the Pearl River at Jackson, Mississippi

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Based on work completed by the
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Abstract

Jackson, Mississippi, has suffered repeated flooding from the Pearl River and its tributaries. Following the flood of 1961, the US Army Corps of Engineers completed a levee project, but development expanded in the floodplain, and the flood of 1979 resulted in far greater damage. These are only two of the floods that have affected Jackson. Others include floods in 2020 and 2022, which caused contamination of drinking water supplies for weeks for most of the City of Jackson's 150,000 residents. Continued building in the floodplain makes Jackson and nearby communities even more vulnerable to future floods. Mainstem flooding is exacerbated by flow constrictions at rail and highway crossings. However, the most extensive and persistent flooding problems are on the tributaries, some of which flood virtually every year due to insufficient conveyance capacity. These floods affect creekside communities, which are predominantly low-income communities of color. Tributaries and their floodplains have been narrowed by encroaching urban development, and their flows are restricted by bottlenecks such as undersized culverts, which easily plug with debris during storms, backing water up into adjacent neighborhoods. The tributaries also suffer from poor water quality, contaminated by leaks from sanitary sewage pipes and other pollutants.

The Pearl River and its tributaries are largely cut off from public access. The mainstem river is not open to public access along most of its banks through the urban area. Flood-control levees cut people off from the river, depriving residents of open-space opportunities on what is arguably the most important natural feature of their landscape. Similarly, the tributaries are mostly off-limits, flowing as straight, engineered channels, some imprisoned in concrete culverts, and most behind chain-link fences. So while floodwaters from the river and its tributary streams easily reach residential neighborhoods, the public cannot easily reach the Pearl River for recreation and open space.

Solving the twin problems of flooding and public access to the Pearl River will require further research and community outreach. As resources become available, critical next steps include:

- an analysis of **potential public access** to the mainstem Pearl River and tributaries based on both an environmental planning/geospatial analysis and community input
- identifying existing **bottlenecks to flow** (in mainstem and tributaries), and developing measures to open up bottlenecks, accompanied by hydraulic modeling to assess the effects of these measures,
- focus on **tributary flooding**, as this is the most pervasive, and it disproportionately affects disadvantaged communities,
- working with the operators of Ross Barnett Reservoir as partners, jointly explore opportunities during times of flood to **operate the reservoir to benefit downstream communities**, to complement the benefits it has provided to upstream communities in recent decades.

In light of these priorities, we propose a conceptual plan to better manage floods and provide public access to the river, the *Green Heart of the Pearl*. This plan draws upon elements previously proposed by the Rankin Hinds Pearl River Flood and Drainage Control District, notably to make room for floodwaters by setting back levees to create a wider corridor for the Pearl River and remove bottlenecks to flow along the main river. But instead of building a dam and creating a lake adjacent to the center of Jackson, our plan proposes that the river's bottomland be preserved to accommodate floodwaters during times of high water and to provide public access to green parkland during other times (the 'green heart'). Our plan seeks to address flooding from the tributaries by removing bottlenecks to flow and widening the creek corridors where possible, restoring the creeks, and providing public access to them. Our plan also calls for a partnership with the Pearl River Valley Water Supply District to operate Barnett Reservoir to reduce flooding downstream by lowering the water level in the reservoir in advance of floods, which allows the reservoir to store some of the floodwaters and thereby reduce downstream flood peaks (as occurred in 2020). We pair these strategies with restoration of the urban creeks and improved public access to both tributaries and the main river, to provide community members with increased opportunities to enjoy open space along the river. In addition we recommend reducing exposure to flood risk by preventing new housing developments in the floodplain, develop new housing in non-hazard areas, reduce housing vulnerability, and provide funding opportunities for residents to flood-proof existing housing.

Introduction

Urban riverfronts have long provided important open space and leisure opportunities for people of all walks of life. However, living alongside rivers brings with it the risk of flooding, which in many places has motivated the building of flood control structures such as levees. While these structures may reduce the frequency of flooding in a specific area, they tend to encourage more development on the floodplain because people perceive the risk is lower thanks to the levee (a phenomenon known as the "levee effect"). A large flood can overwhelm the levees and cause more extensive damage than would have been the case absent the levees and the development they induced. In many places, the flood control infrastructure prevents people from accessing the river banks and the river itself, thereby cutting cities off from what are often the most important landscape features in the region.

This report results from research concerning issues of flooding, equity, and public access completed for the *Environmental Planning Studio* class (LA205) led by Professor G. Mathias Kondolf, Anna Serra-Llobet, and Matt Smeltzer at the University of California Berkeley's College of Environmental Design (CED) in spring 2023. It also draws upon results of a collaboration between Berkeley and Jackson State University, *Reconnecting With Big Rivers*, led by Bernece Herbert (JSU) and Matt Kondolf (UCB). In this initiative, students and faculty from the two universities jointly conducted site visits and studied public access and flooding issues along the Sacramento River in California, and the Mississippi and Pearl Rivers in Mississippi in 2022. In this report, we summarize our findings and provide an initial proposal for the future of the Pearl River in the Jackson, Mississippi, Metropolitan area. We refer to this proposal as the "Green Heart of the Pearl River Plan".

A Brief History of the Pearl River at Jackson

The Pearl River's headwaters begin in Neshoba County, Mississippi, and the river flows a total of 490 miles and drains a total area of 7,800 square miles before discharging to the Mississippi Sound in the Gulf of Mexico (Figure 1). Jackson, the capital of Mississippi, is located in the upper third of the river basin, with a drainage basin of 3,170 square miles. The river provides drinking water to hundreds of thousands of residents in Metropolitan Jackson (American Rivers 2023). There are multiple stakeholders involved in governing the Pearl River's floodplain near the city of Jackson, including the cities of Jackson, Flowood, Pearl, and Richland, the counties of Rankin and Hinds, and two special districts: the Pearl River Valley Water Supply District and the Rankin Hinds Pearl River Flood and Drainage Control District.

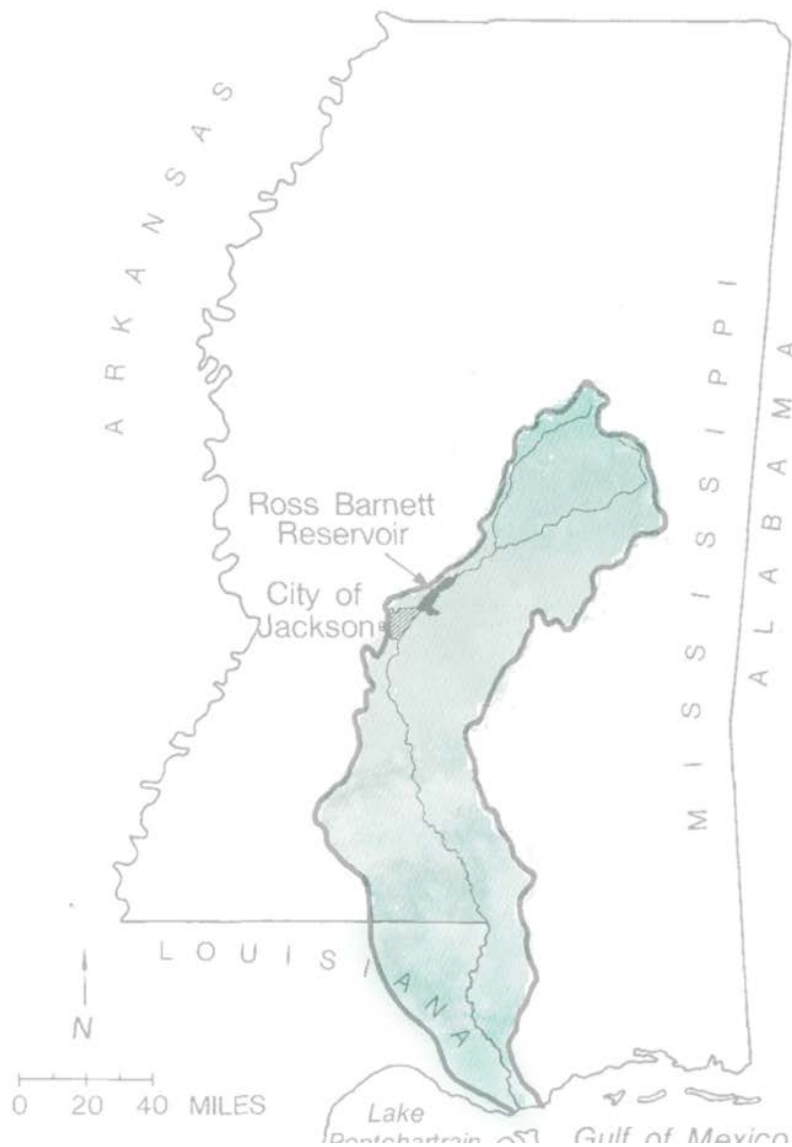


Figure 1. The Pearl River Watershed in the context of the state of Mississippi, the City of Jackson, and the Ross Barnett Reservoir.

The Ross Barnett Reservoir

In 1960, the Pearl River Valley Water Supply District constructed the Ross Barnett Reservoir on the Pearl River just northeast of Jackson, situated between Madison and Rankin counties. The reservoir was constructed to secure a reliable water supply for a growing population and to provide recreational opportunities and aesthetic value for new lakefront property. The Ross Barnett dam created 35,000 acres of reservoir and 17,000 acres of lakeside land, on which housing for 12,900 people was constructed. The Pearl River Valley Water Supply District continues to manage the reservoir to support boating, fishing, and water sports by maintaining a water level of 297.5 feet in the summer and 296 feet in the winter without much variance.



Figure 2. Construction of the Ross Barnett Reservoir Spillway in 1960 (Yancy, 2014).

Flooding and Levees

In response to the flood of 1961 (Figure 3), the United States Army Corps of Engineers (USACE) initiated the construction of a series of levees. Notably, a 10.3-mile levee was constructed on the Rankin County side of the river, protecting 5,870 acres, whereas a 1.5-mile levee was constructed on the Jackson side, protecting 420 acres (Figure 4 & 5).

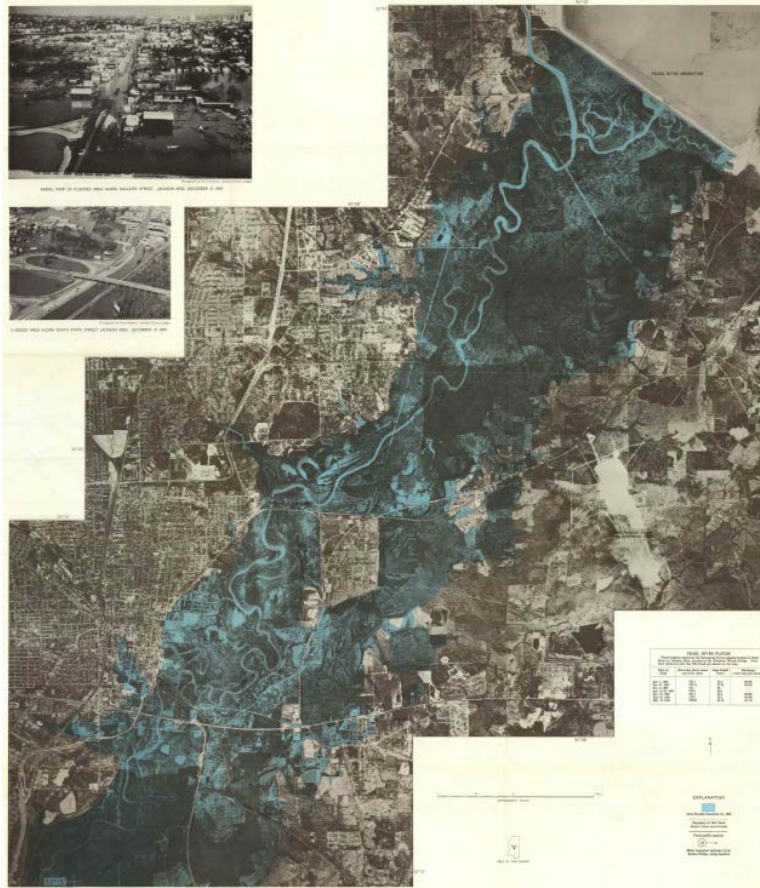


Figure 3. Inundation map of the 1961 flood, which displaced 1,200 people (Shell, 1964).

The Rankin Hinds Pearl River Flood and Drainage Control District (the District) was established to maintain the levees and to act as a local sponsor for federal projects. The District is required to provide land and easements for flood management projects and has been responsible for maintaining the levees since 1967. Costs for the system of levees reached \$8 million for the federal government and \$1 million for the local governments. At the time, Major General Thomas H. Hayes of the USACE claimed that “there is no reason why the project should not give indefinite protection from flooding to the area” (Platt, 1982). However, a decade later, the levees proved ineffective in managing the floodwaters.

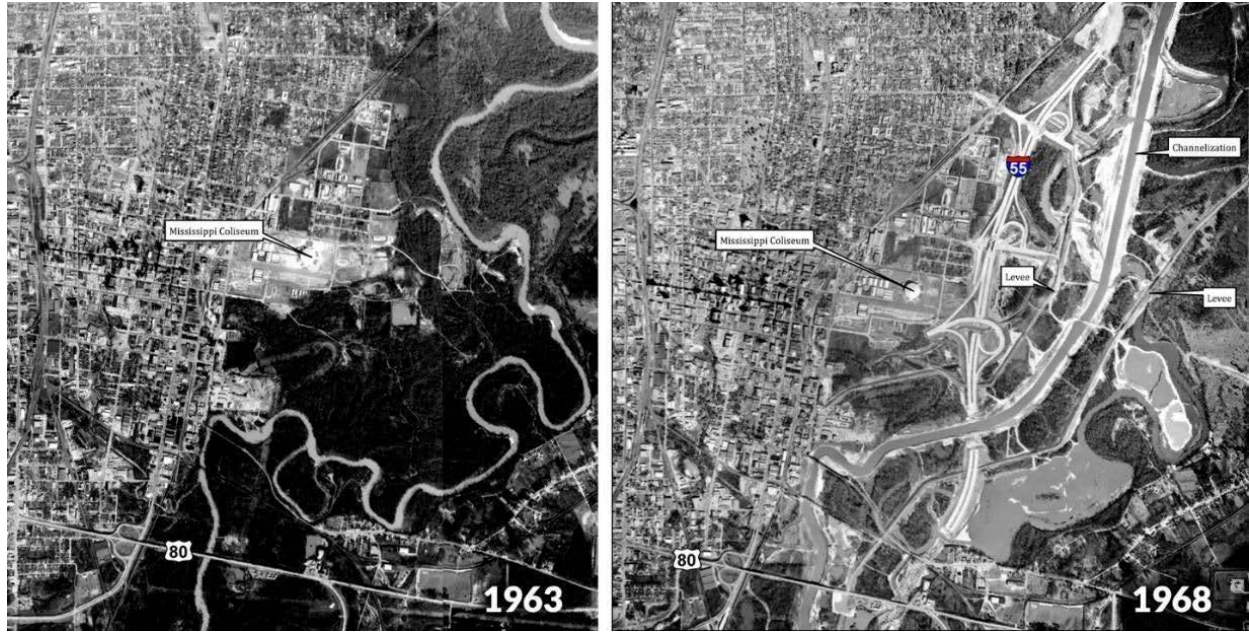


Figure 4. Aerial imagery of the Pearl River near Jackson, Mississippi, in 1963 (left) and in 1968, after the levees were built (right).

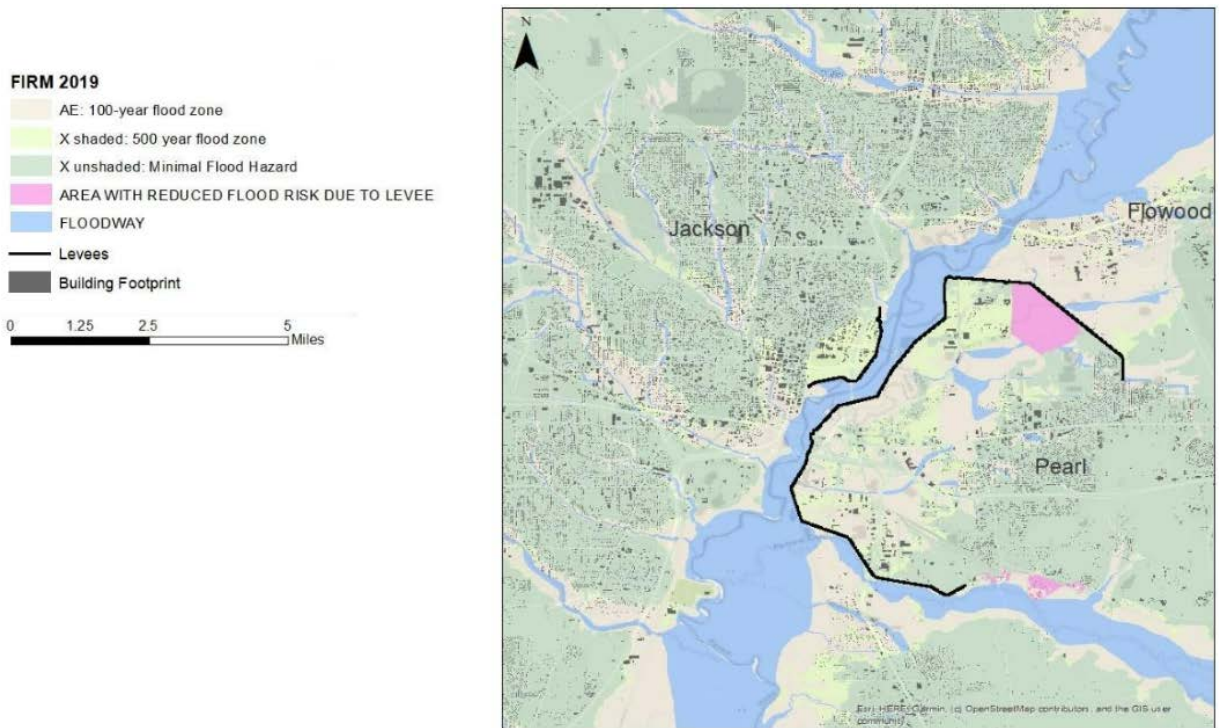


Figure 5. FEMA FIRM Map indicating 100-year flood zone (AE), levees, floodway, and building footprints. Map by Adrienne Dodd.

In 1979, floodwaters on the Pearl River reached a height of 43 feet, displacing 6,400 people in comparison to the 1,200 people who were displaced in the flood of 1961 (Figure 6). It is notable that in the four decades before the levee construction (between 1930 and 1967), there were eight flood events in which the flood stage reached 33 feet or higher. In comparison, in the four decades between the years 1967 and 2005, 23 flood events reached 33 feet or higher. As documented by Platt 1982), “most of the structures damaged [in the 1979 flood] ...did not exist in 1961”.

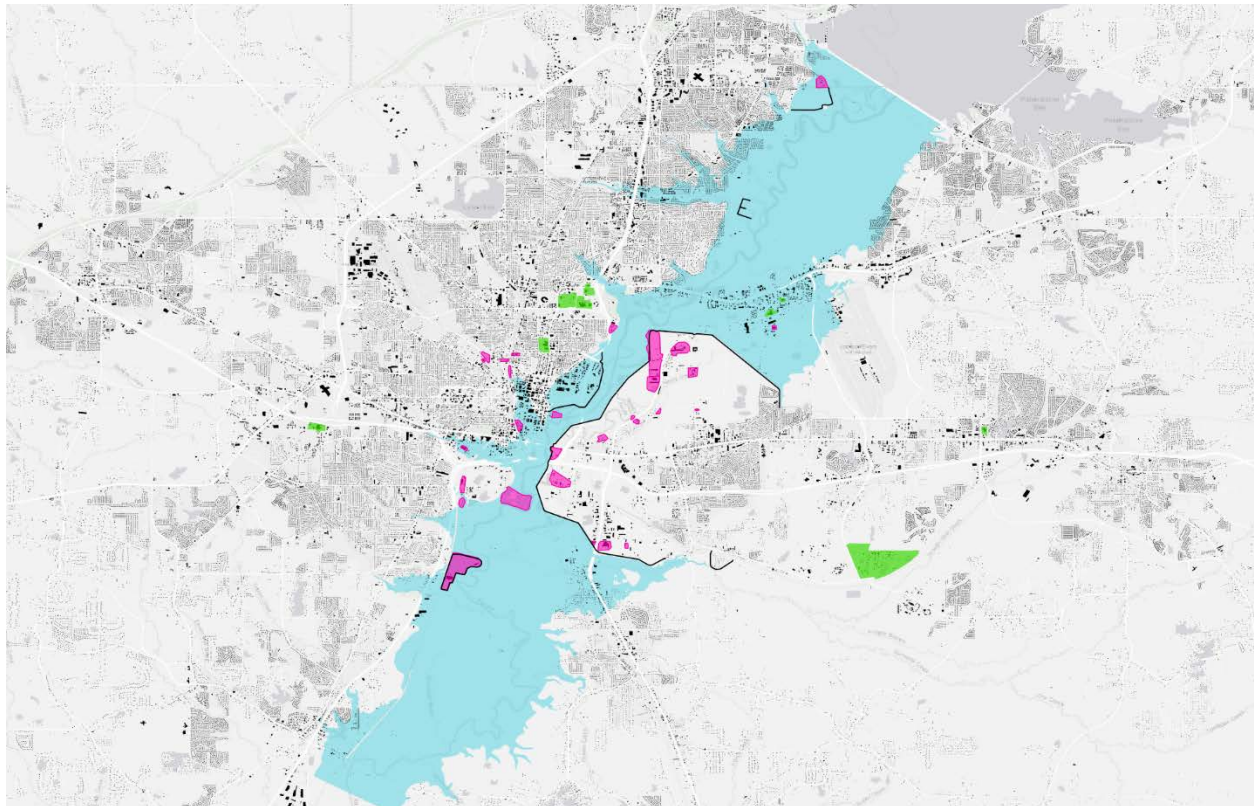


Figure 6: Inundation map of the 1979 flood documenting hazardous sites (highlighted in pink) and critical facilities (highlighted in green). Map by Emmalina Glinskis.

Accounts from a few of Jackson’s residents at the time of the Easter Flood of 1979 illustrate how devastating it was, and how unprepared the city was to alert its people and to address the damages. Ed Smith, a senior customer service specialist in meter reading operations, recalls of the 1979 Easter Flood that “none of us Jackson natives had ever seen the Pearl River rise that high and we did not believe it would happen. The predictions proved true and not only were houses and businesses flooded, but we had to build a levee around the Jefferson Street office and substation” (Goodsell, 2019).



Figure 7: Flooding in Jackson, MS after the 1979 flood. Photos from The Clarion-Ledger.

Grace Sweet, who was a teacher in Jackson during the flood of 1979, recalls that “the end of Monument Street would fill up with water, and we couldn’t get through to get to school. That place was filling up and overflowing with water, and it’s still doing it. The water has been an issue for so long. I think that when something happens repeatedly and often, you just get used to it” (Powell, 2022). William C. West, the head checker at Kroger Supermarket on Interstate 55 North in Jackson, recalls that “no one from the city or county, as far as I know, had warned us. We knew the water was rising, but we didn’t know it would affect our store the way it did. The only way we knew was when we saw the water coming ourselves and we took action by ourselves” (Hetrick, 1980, pp. 3).

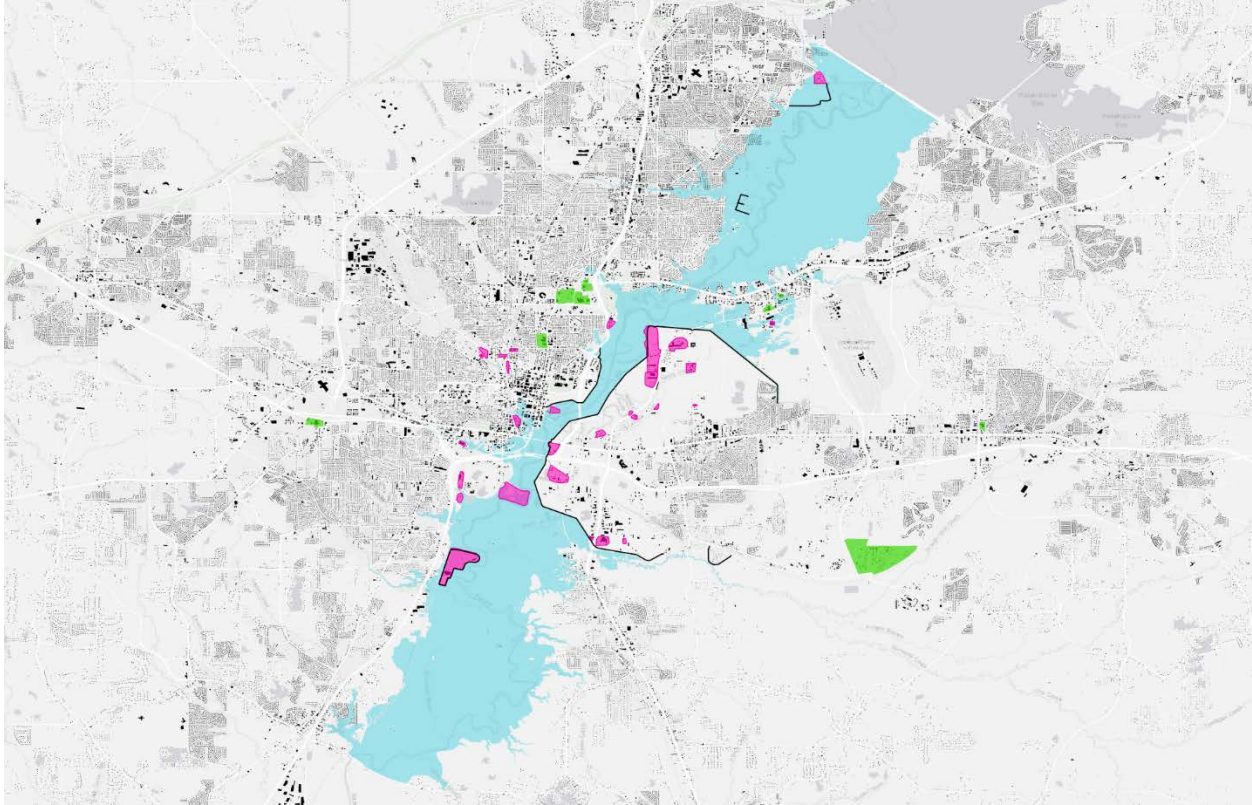


Figure 8. Inundation map of the 2020 flood documenting hazardous sites (highlighted in pink) and critical facilities (highlighted in green). Map by Emmalina Glinskis.

More recently, the flood that took place on February 17th, 2020, crested at 36.67 feet, which is the third highest stage height recorded (Figure 8). This flood had nearly the same discharge as the 1983 flood but reached a stage height 3 feet lower. Serendipitously, the Pearl River Valley Water Supply District had reduced water levels at the Ross Barnett Reservoir from 297.5 feet to 295 feet beginning in December 2019 in an attempt to control an invasive species (the Giant Salvinia; Broom, 2019; Broom, 2020). The pre-flood drawdown of the reservoir served to provide flood storage and thereby lower flood peaks downstream (by 3 feet). While the drawdown was not done for flood management, the 2020 flood experience provides a compelling demonstration of the potential to manage Barnett Reservoir to reduce downstream flooding.

In 2022 the river flooded again. During this flood, the pump failure at the O.B. Curtis water treatment plant—which provides Jackson with most of its drinking water—left approximately 150,000 residents without safe drinking water (Neuman, 2022). Flooding of the Pearl’s tributaries, like Lynch Creek, resulted in large piles of trash and debris left behind when the floodwaters receded. Especially at sites such as the Gallatin Street former landfill, where known Polycyclic Aromatic Hydrocarbons (PAHs) and heavy metals are present, repeat flooding poses large environmental and health risks.



Figure 9. The end of the Byram Swinging Bridge disappears into the floodwaters of the Pearl River Sunday, February 16, 2020. Photo by Barbara Gauntt, the Clarion Ledger.



Figure 10. A "debris field" left behind from flooding at Hanging Moss Creek in 2020. Source: Solis 2020.

The National Flood Insurance Program, the Levee Effect, and Creek-based Flooding

The National Flood Insurance Program (NFIP) was created by Congress to reduce the risk of flooding by regulating floodplains and to provide financial support to people after a flood. Many developed areas across the United States depend on levees for flood protection, but the creation of levees can lead to the “Levee Effect”, which describes the false sense of security following construction of a levee. This leads to further development in the floodplain, thus increasing exposure in the case of a levee failure (Hutton et al., 2019; Ludy & Kondolf, 2012).

This is also true for Jackson: after the levees were built between 1964 and 1967, land in the floodplain was rezoned for residential, commercial, and industrial development (Platt, 1982). After Jackson joined the National Flood Insurance Program (NFIP), areas within the *floodway* were required to have National Flood Insurance (Figure 5). The AE zone shows areas that will flood during a 100-year storm, e.g., a storm determined by historical data to have a 1 percent chance of occurring in any given year (Figure 5 & 11). However, since the area joined the NFIP, development in the floodplain has continued to expand, thereby increasing exposure and risk of flooding. Much of the exposed infrastructure in the FEMA floodplain exists along the tributaries of the Pearl River. Residents have reported that flooding along these tributaries happens on a yearly basis, much more frequently than river flooding. Even when the Pearl River itself hasn't flooded, the tributaries can back up, overflowing onto their floodplains and inundating neighborhoods. When the Pearl River water level rises, it can exacerbate creek flooding by backing the creeks up further. Thus to solve the real flooding problems in and around Jackson, a flood control proposal should address the tributaries (Cany, Hardy, Lynch, Town, Eubanks, Hanging Moss, White Oak, Purple, and Brasher Creeks). These tributaries are the source of most recurrent flooding problems, and they should be a principal focus of any proposal that seeks to reduce flood damages to the community.

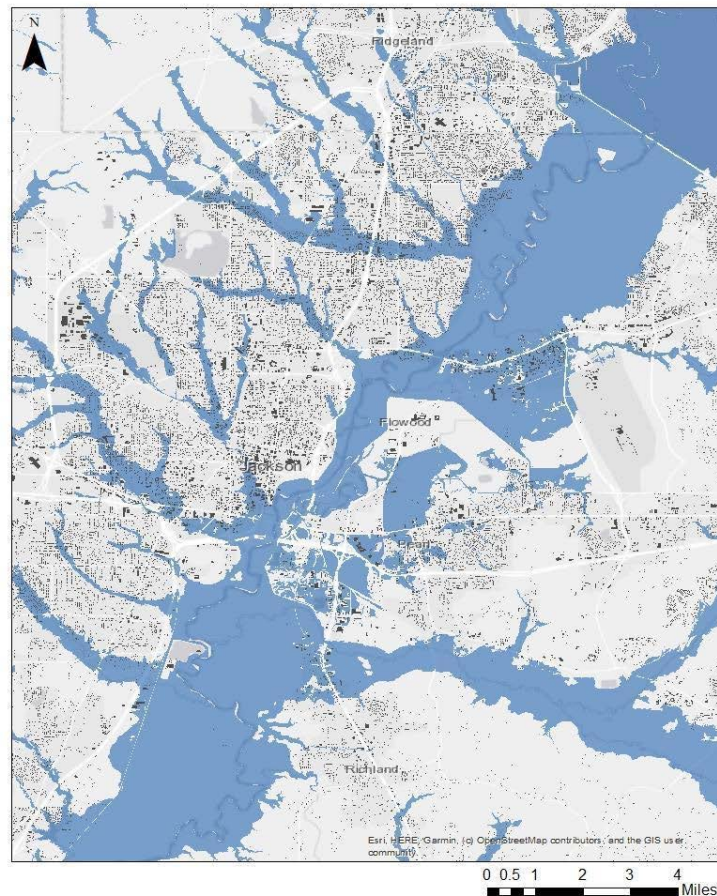


Figure 11. FEMA FIRM 100-year Flood Zone and building footprints. In addition to the inundated areas of the main river floodplain, note the 'fingers' of flooding along the tributaries. Map by Adrienne Dodd.

Equity

When looking at risk and mitigation of hazards, it is especially important to research racial and class inequity in the distribution of flood risk and flood mitigation and to question the causes of this risk distribution (Chakraborty et al., 2014; Lieberman-Cribbin et al., 2021). While flooding as a repeat issue can be established in Jackson, it is important to understand that not all residents bear the same risk. Flood risk varies in part as a function of the dominant race, income, and other characteristics of neighborhoods. In Jackson, flood exposure and damages are disproportionately borne by highly vulnerable non-white communities (Collins et al., 2022). We mapped data from Collins et al. 2022 against the CDC Social Vulnerability Index, which ranks each census tract on 16 social factors, including race, poverty, lack of vehicle access, and crowded housing (CDC/ATSDR 2022). Higher values of the CDC/ATSDR index indicate lower socio-economic status and greater vulnerability to floods. From our results (Figure 12), it is clear that vulnerability is highly correlated with flood damage probability, but also, more importantly, these neighborhoods are disproportionately non-white.

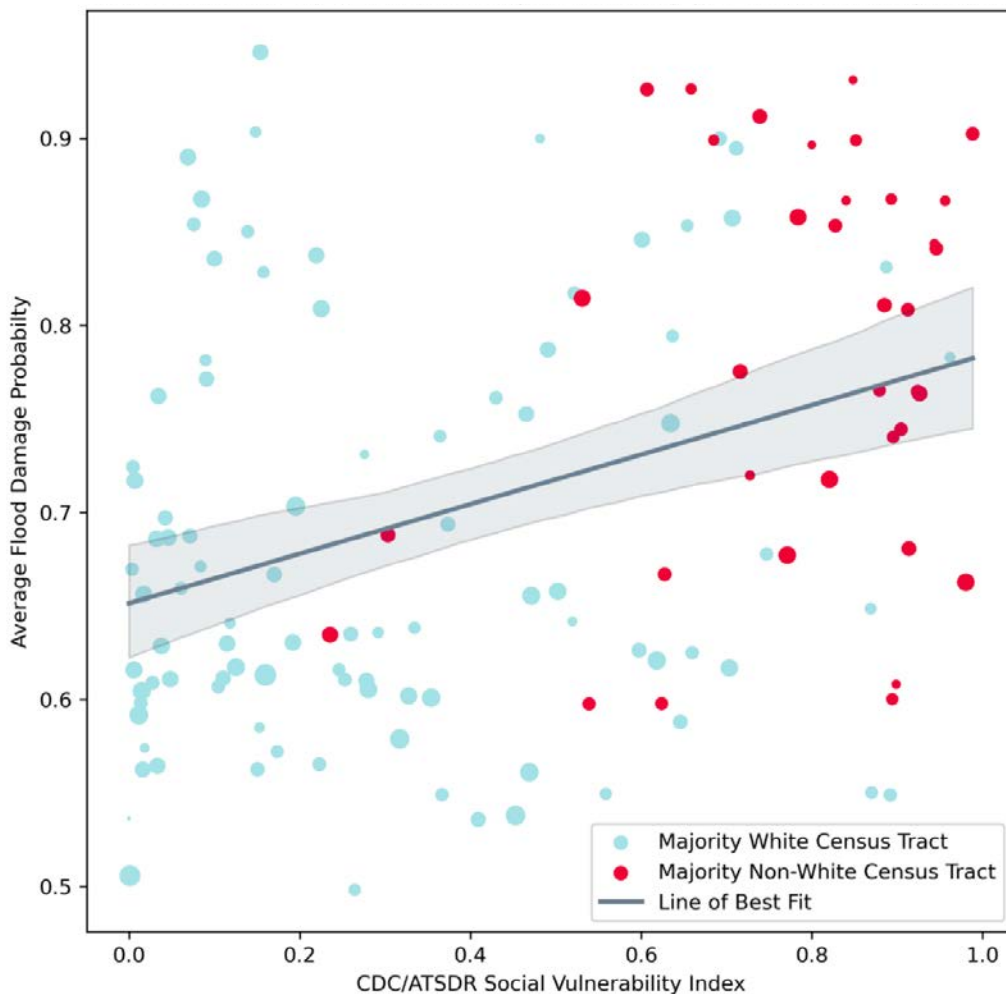


Figure 12. Social Vulnerability and Flood Damage Probability per Census tract; Jackson, Mississippi. Graph by Alicia Arrington.

An important element of how institutionalized racism impacts urban planning and flood risk is the history of redlining. The Home Owners Loan Corporation (HOLC) and the Federal Housing Authority (FHA) were temporary emergency programs that existed in response to the Great Depression. HOLC was created to refinance existing homeownership loans that were struggling between 1933 and 1936. The FHA, established in 1935, helped insure new loans written by private lenders for mortgages with lower interest rates. Both HOLC and FHA were explicitly racist in deciding who to assist, identifying any neighborhoods with people of color as unsafe to lend to. They conducted assessments of “neighborhood quality” which had a large focus on racial composition, perpetuating existing segregationist and discriminatory views of the time. The maps below reflect the origin of the term “redlining”, as the lowest ranked neighborhoods were shaded red, and included essentially all Black neighborhoods (Fishback et al., 2022; Marisco, 2017). Lower-income Black communities are clustered in the areas least protected by levees and in the floodplains of the Pearl River’s tributaries, placing them at the highest risk of flood damage (Figure 13, 14 & 15).

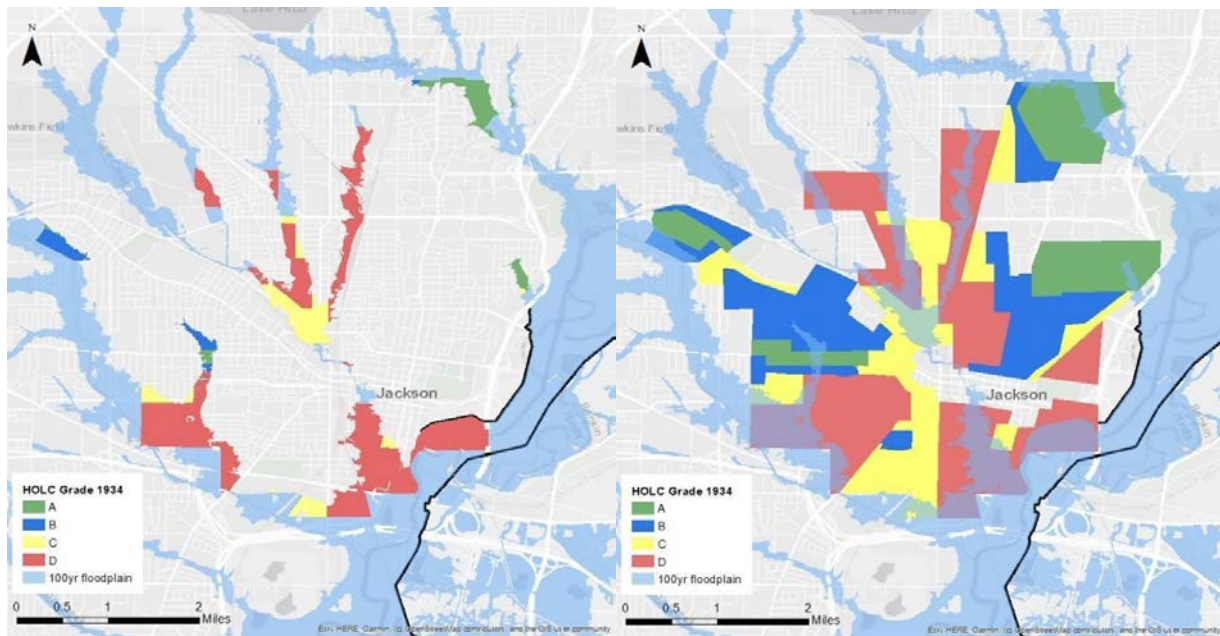


Figure 13. (left) 1934 HOLC Zones overlain with the 2019 100-yr floodplain; (right) 1934 HOLC Zones within the 2019 100-yr floodplain. Map by Adrienne Dodd.

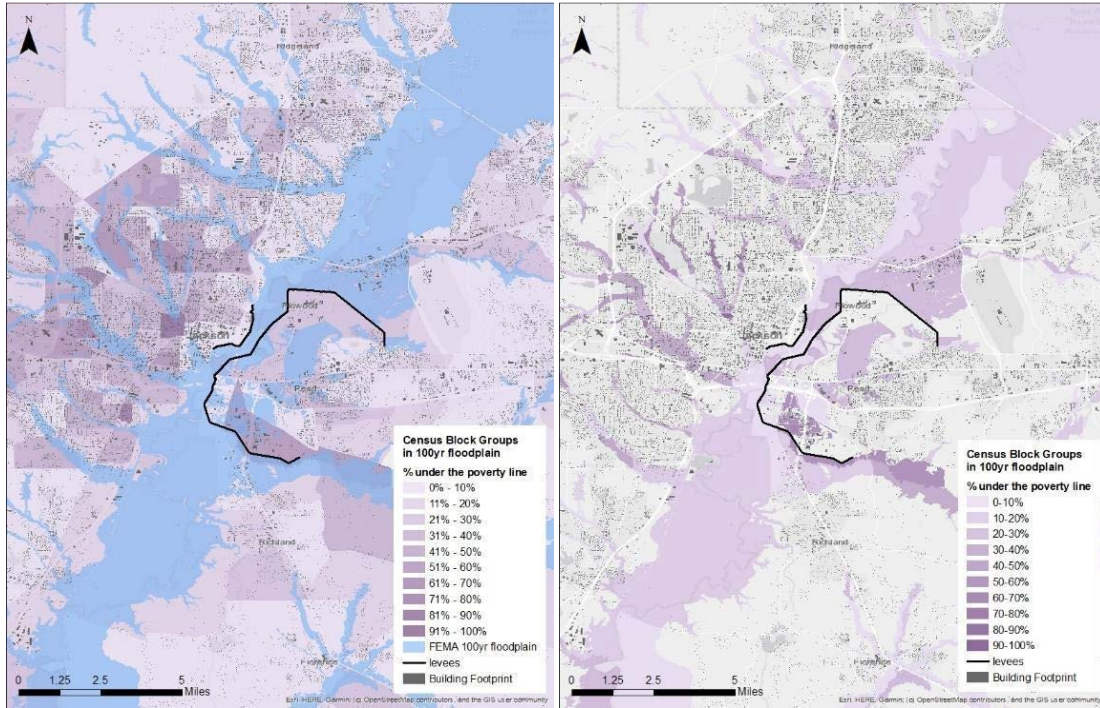


Figure 14. (left) Percent of the population under the poverty line by census block group overlaid with the 2019 100-yr floodplain; (right) Percent of the population under the poverty line by census block group within the 2019 100-yr floodplain. Map by Adrienne Dodd.

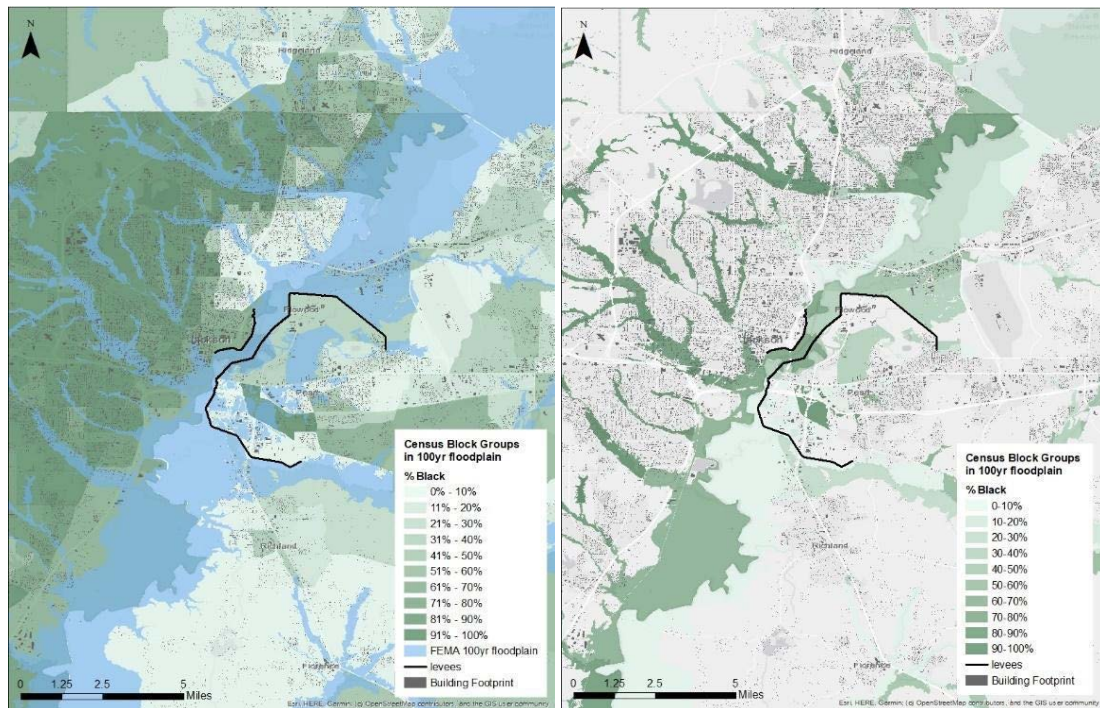


Figure 15. (left) Percent Black by census block group overlaid with the FEMA 100-year floodplain, (right) Percent Black by census block group within the FEMA 100-year floodplain. Map by Adrienne Dodd.

There are other considerations of harm stemming from the relationship between the river and its tributaries that are important to note. For example, the Mississippi Department of Environmental Quality (MDEQ), has had a water contact advisory on the Pearl River and its tributary streams for over four years. Sewage flows into the tributaries and makes its way to the river, illustrating the importance of creek health for the overall health of the river. Robert Lee, Jackson’s City Engineer, in an August 2022 interview, addressed reports that tens of millions of gallons of raw sewage have flowed into nearby waterways between April and June of 2022. He said that fixing those leaks—particularly the single leak that led to about 20 million gallons of untreated wastewater flowing into Town Creek, a channelized tributary to the Pearl—is difficult and expensive. He said that the largest collapsed sewer line is located under a railyard, and that raw sewage continues to leak out and make its way into the creek, which flows into the Pearl River (Sanderlin, 2021; Perlis, 2022). Town Creek flows alongside residential communities and through downtown Jackson, where a portion of the creek flows under the city. The southeast end of the creek daylights before it meets the confluence of the Pearl River. Residents who live near Town Creek have experienced the dual misfortunes of both poor water quality and repeated flooding, which both the city and state have failed to address.

Mitigation Options

The City of Jackson does not have a Local Hazard Mitigation Plan (LHMP), or a plan focused on flood risk, mitigation, response, and recovery. The plans that do exist are regional and the City is not the major stakeholder or decision-maker in the development of the plans. Options to mitigate flooding arise throughout the flood risk management cycle (Figure 16), but they should be focused first on reducing exposure by stopping new housing development in the floodplain, developing new housing in non-hazard areas, and providing funding opportunities for residents to flood-proof existing housing. Additionally, we can make room for floodwaters by widening the Pearl River’s active channel and floodplain, removing bottlenecks to flow along the main river and tributary creeks, draw down Barnett Reservoir in advance of floods, and pair these strategies with creek restoration and improved public access to provide community members with increased opportunities for connectivity to the river.

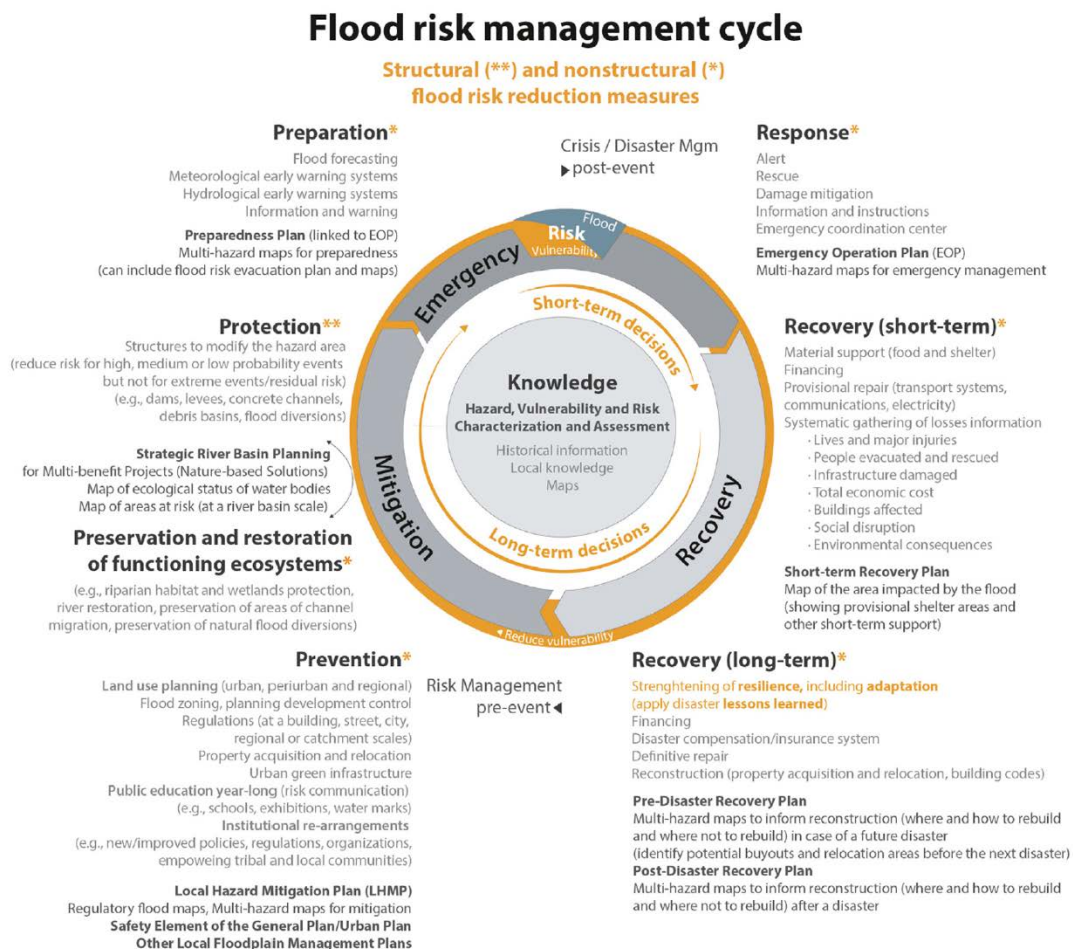


Figure 16. Flood risk management cycle (Serra-Llobet et al. 2023).

To reduce flooding of creekside communities will require removing or otherwise altering bottlenecks to flow and expanding the width of the creek corridor where possible, to improve the flow conveyance of the creeks. The level of the mainstem river downstream should not be raised to avoid exacerbating backwater flooding. As a part of a comprehensive management plan,

undersized and deteriorating bridge crossings and culverts should be identified and replaced with larger structures that allow flood flows to pass without creating backwater. Deteriorating concrete-lined channels can be dismantled and replaced with wider, natural channels. Improving water quality requires repairs to failed sewer pipelines, abatement and clean-up of pollutants within creek-adjacent properties, and implementation of low-impact development strategies for stormwater drainage. Converting abandoned and under-used creek-adjacent properties to active floodplains can be part of a comprehensive, multi-objective watershed-scale approach to flood risk management and water quality protection promoted and implemented nation-wide, and is consistent with current policies of the US Army Corps of Engineers. Additionally, it would deliver socio-economic benefits to creekside communities through new opportunities to engage and interact with creek corridors leading through Jackson to the Pearl River. Funding can be made available for compensation and relocation assistance for homeowners offered voluntary buyouts, in cases where homeowners are interested in moving to safer ground. In other cases, flood-proofing may be possible. For all these new approaches, political leadership and public investment are desperately needed.

Priorities for the Pearl River and Tributaries

In light of the historical (and continuing) patterns of flooding, inequities in exposure to flooding, and the need for public access to the river and tributaries, we propose this prioritization to guide work needed to move ahead with a technically effective solution, and one that addresses public concerns. To solve the twin problems of flooding from and public access to the Pearl River and to address each of these priority areas, will involve further research and community outreach. As resources become available, the critical next steps should be to analyze potential public access to the mainstem Pearl River and tributaries based on both an environmental planning/geospatial analysis and community input, identify potential bottlenecks to flow (in mainstem and tributaries), and develop measures to open up bottlenecks, accompanied by hydraulic modeling to assess the effects of these measures, and improve understanding of tributary flooding, as this is the most pervasive flooding, and it disproportionately affects disadvantaged communities. A key priority is to partner with the Pearl River Valley Water Supply District to jointly explore opportunities to draw down Ross Barnett Reservoir when floods are anticipated, thereby reducing flood peaks for the benefit of downstream communities, to complement the benefits the reservoir has provided to upstream communities in recent decades.

The Green Heart of the Pearl River Plan

To start discussion of a sustainable and equitable approach to public access and managing floods, we sketch out an approach which we refer to as the “Green Heart of the Pearl River Plan”. Borrowing from the Harrison Studio’s (1984) vision for the Green Heart of Holland, we propose the Pearl River and its tributaries be seen as an ecological, social, and economic resource to the community, a “Green Heart”. The *Green Heart* plan aims to create more space for the river to connect with its floodplain, moving vulnerable communities out of flood-prone areas and

offering new opportunities to connect with the river and its tributaries through ecological restoration and enhanced public access.

The design has three parts: (1) Pearl River management, which will include a) levee setbacks and removal of constrictions and pinch points to flood flows of the Pearl River, b) ecological improvements and c) enhanced public access and recreation on the Pearl River, (2) Community-based tributary management, which includes community engaged planning around a) removal of constrictions and pinch points to flood flows, b) ecological improvements, c) and enhanced public access and recreation along the creeks, and (3) Ross Barnett Reservoir management for downstream flood mitigation.

Pearl River Management

The current conditions of the levee system—including a narrow channel and in-channel blockages—constrict the flow of the river near Jackson. Our alternative builds upon elements of the Rankin Hinds Pearl River Flood and Drainage Control District’s ‘One-Lake’ plan, notably setting levees back to increase conveyance of flood waters, removing bottlenecks to flow of the Pearl River in flood, and improved public access. We seek to address these objectives through more sustainable approaches.

Consistent with the One-Lake proposal, our alternative involves setting the levees back (Figure 17). However, our levee setback would serve to allow floodwaters to spread out over a wider floodplain (rather than creating a “lake”), and our proposal would involve much less excavation and no dam in the river. Also consistent with the One-Lake plan, our Green Heart of the Pearl River Plan aims to reduce flood risk by removing constrictions to the Pearl River in flood stage. However, rather than flood conveyance through a new reservoir, our plan would restore a free-flowing channel-floodplain complex.

Bottlenecks on the Pearl River and its tributaries will be addressed through bridge and conveyance improvements (Figure 18). For example, we propose to remove a railroad bridge that is no longer in use, and in this same area, to rethink and potentially remove a weir used as the diversion point for 30% of the municipal water supply. Other options for diverting water to supply this water treatment plant can and should be explored. We also propose the addition of a bypass, new bridges, and the upgrade of a railroad bridge just southeast of the Interstate-20 highway. Our plan will remove the undersized channel the Army Corps constructed in the 1960s, and create “room for the river” to flood and also to have a naturally migrating channel with complex habitats for birds and wildlife. The channel will be restored at the Gallatin Street and Jefferson Street landfills by removing the hydraulic blockages. Additionally, floodplain bypass channels—or corridors with no shrubs and trees to allow high flows to split and move quickly downstream—could be incorporated into the Green Heart of the Pearl River Plan as a flood management strategy that could also provide recreational opportunities, doubling as bicycle and ATV trails that access the river’s edge. Evaluation of these aspects of the Green Heart of the Pearl River Plan should be informed by detailed hydraulic modeling, with the models made available for review by other experts.

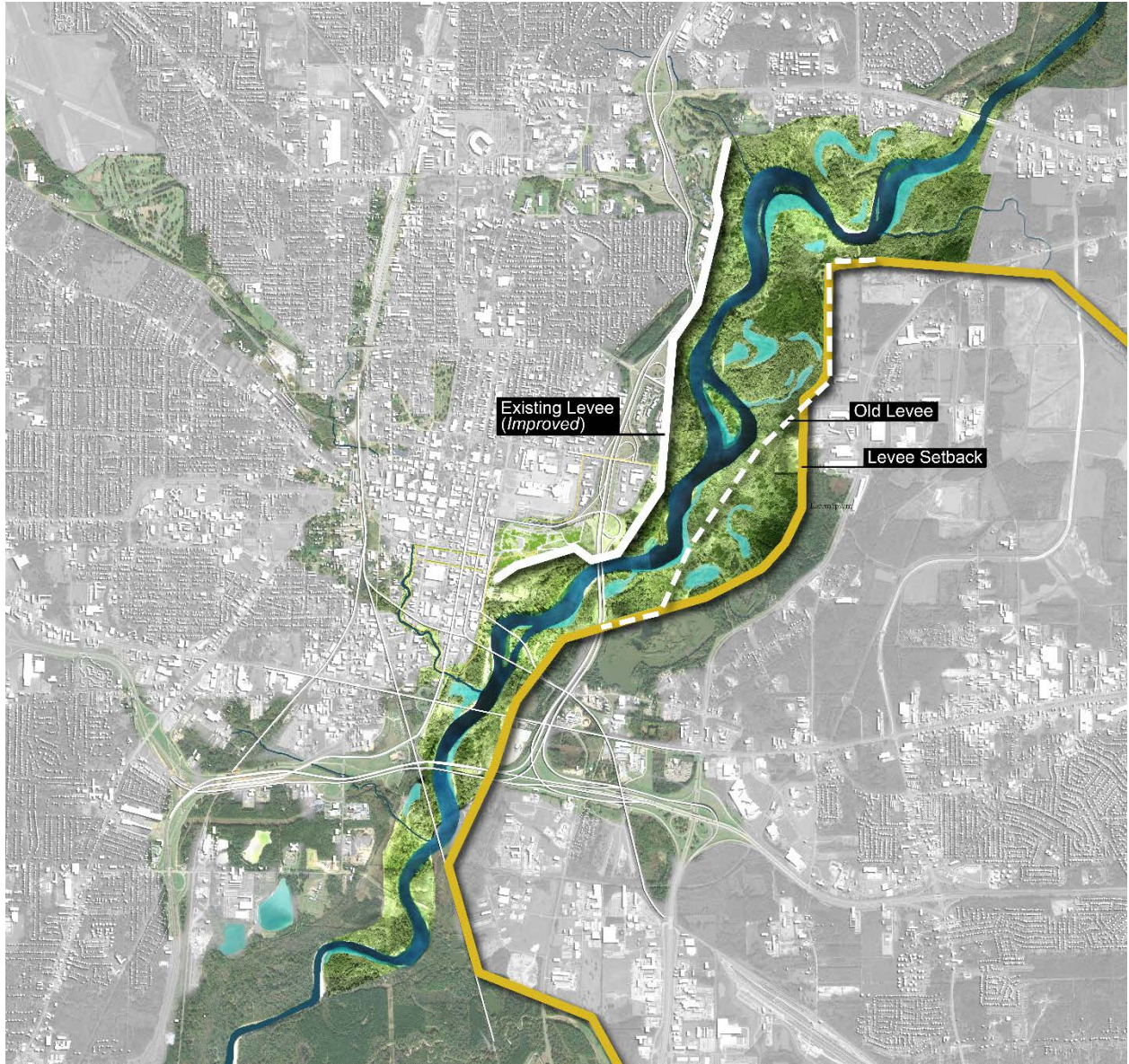


Figure 17. Proposed levee setbacks and improvements on the Pearl River. Map by Lulu Liu and Hannah Hansen.

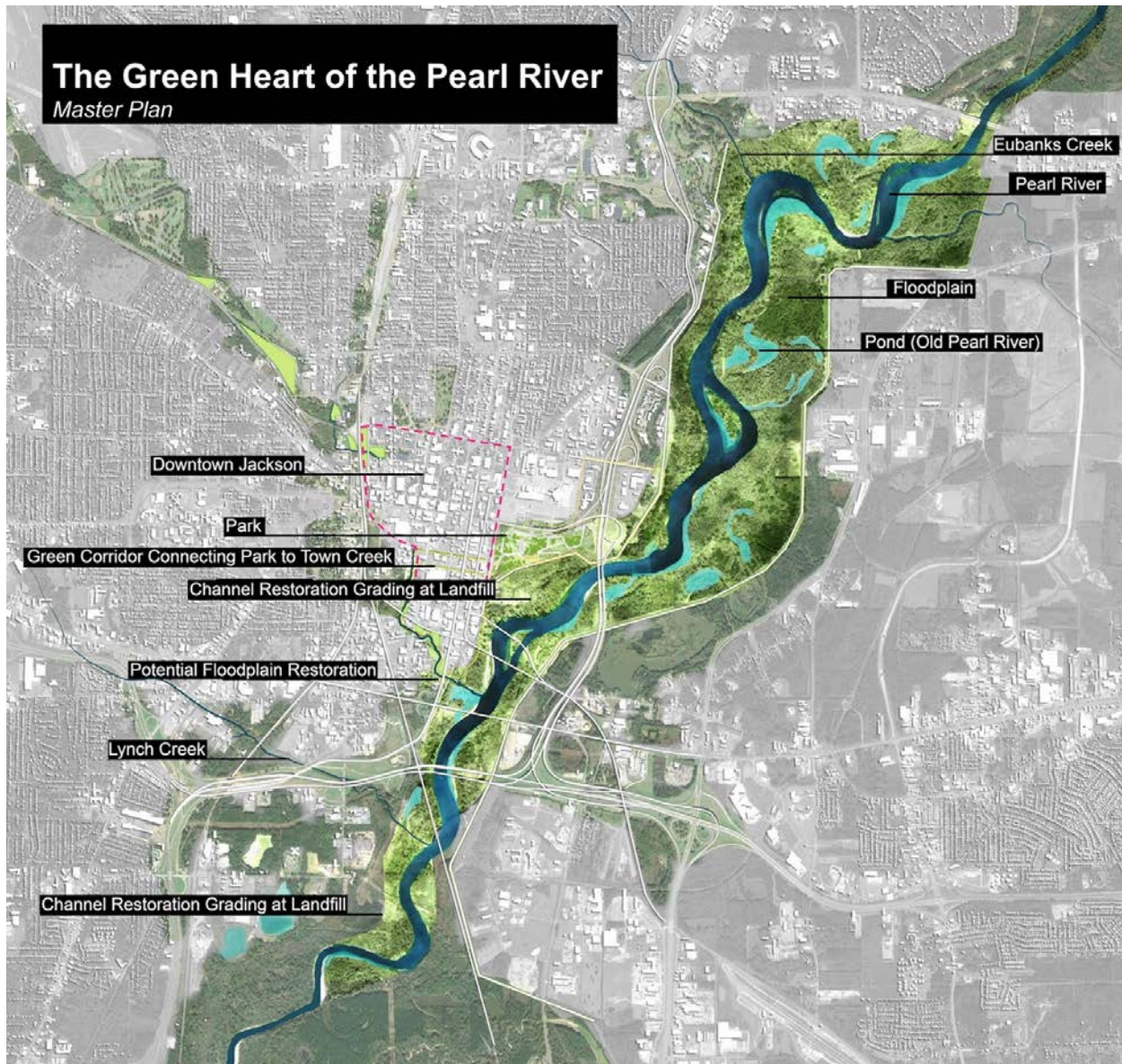


Figure 18. *The Green Heart of the Pearl River Conceptual Master Plan. Plan by Lulu Liu and Casey Jones.*

We propose the restoration of native riparian vegetation within this “Green Heart” and propose the exploration of phytotherapy strategies to mitigate hazardous pollutants in the LeFleur’s Landing landfill constricting the Pearl River. The persistent problem of leaky sewage pipes contaminating the stream network remains to be addressed, and we suggest that a community-based, stewardship-driven, city-wide program be initiated to reduce non-point sources of pollution (e.g., debris and contaminants) to Town Creek and other tributaries. Low-impact development strategies, such as use of permeable paving and bioretention basins, can filter contaminants and reduce peak flood flows.

A widened river-floodplain system will likely provide better water quality than an artificial lake, whose stagnant waters could accumulate pollutants and nutrients, potentially developing eutrophication problems and concentrating contaminants. The problems resulting from damming

a river in the heart of a city are well illustrated by Voronezh, Russia, where a 1972 dam transformed the Voronezh River into the Voronezh Reservoir, one of the largest reservoirs in the world within an urban area. At first the reservoir was a recreational asset, but within 20 years the reservoir had become so polluted that authorities had to prohibit human contact with the water (LAP 2023). A free-flowing river is less vulnerable to accumulation of pollutants than a static body of water, and the wetlands of a channel-floodplain complex provides multiple opportunities to filter water and improve water quality through plant uptake. The new wetland habitats produced from widening the Pearl River's corridor could be showcased using elevated pedestrian and bicycle pathways, offering visitors a panoramic view of the river and the city skyline and connecting the new recreational spaces.

The *Green Heart* plan aims to reverse the legacy of failed river management and repetitive flooding, especially of underserved communities along tributaries. The real issues for managing floods are likely the numerous constrictions to flow, both in the mainstem and tributaries. Some of the key constrictions identified to date are shown in Figure 19. By eliminating the hydraulic constrictions, the Green Heart of the Pearl River plan would provide flood risk reduction. Our plan restores the Pearl River floodplain as a resource for flood mitigation, ecological restoration, and public recreation, rather than converting it into a second reservoir.

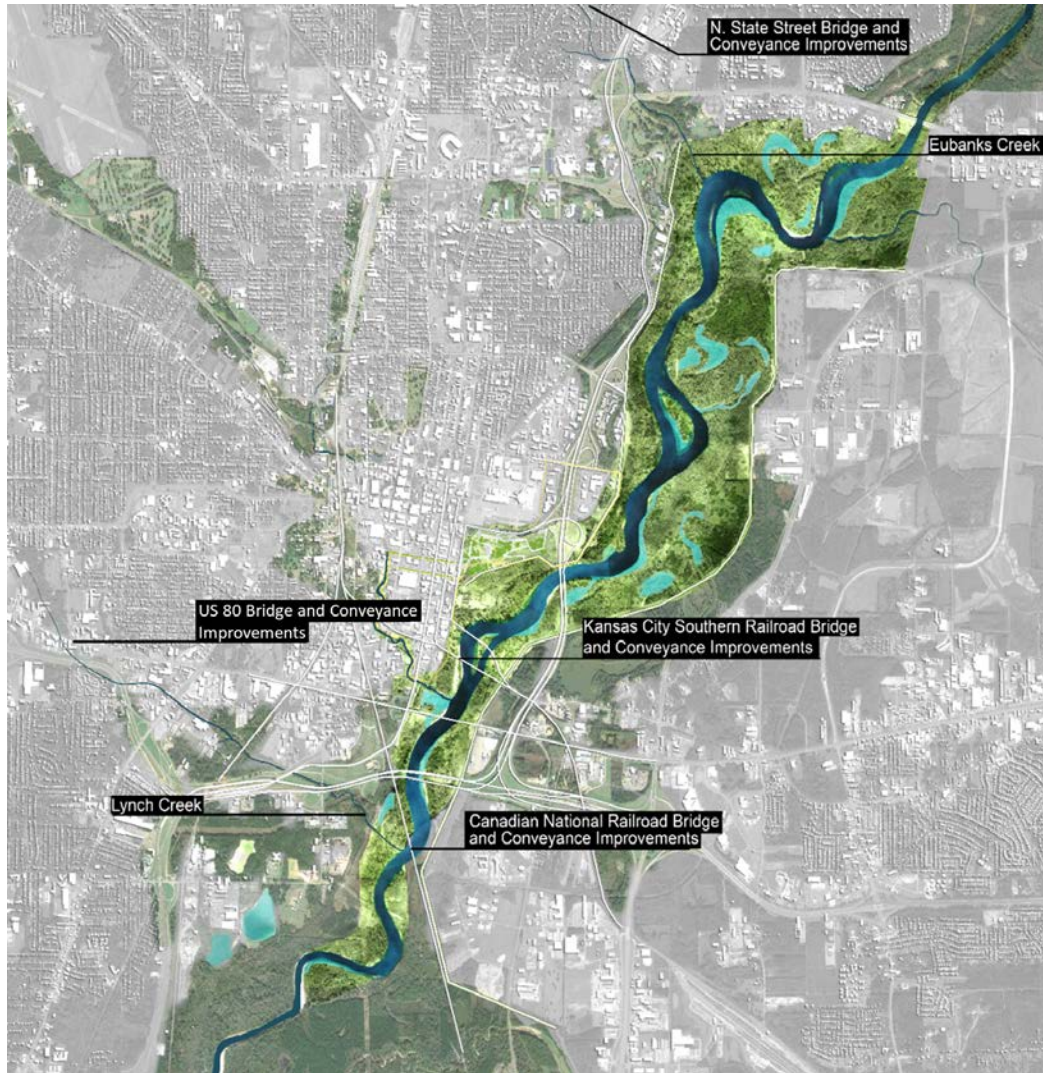


Figure 19. Some flood conveyance constrictions identified to date along the Pearl River and tributaries (Lynch Creek and Eubanks Creek).

Tributary Management

The second component of the Green Heart of the Pearl River Plan is to address creekside flooding through creek restoration, beginning with Town Creek as a pilot project. This plan includes treating bottlenecks and replacing failing bridges and other infrastructure to improve flood conveyance and reduce flash flooding. Two potential bottlenecks to flow are the Highway 80 bridge over Lynch Creek, which reportedly induced backwater flooding at Jim Hill High School in January 2020 (16 WAPT News Jackson, 2020), and the North State Street bridge over Eubanks Creek, where residents report regular overtopping (Fernandez, 2023) (Figure 20). Further hydrologic analysis and input from community members regarding historical patterns of flooding are needed to identify areas in and around the tributaries of the Pearl River that experience flooding, and opportunities for channel and infrastructure changes that can improve flood conveyance.

In addition, tributary creeks can be restored to enhance physical and ecological processes, as well as social connections to the creeks. If flood management approaches such as compound channels can be designed to enhance ecological conditions, they represent tremendous opportunities to restore waterways affected by urbanization. This process requires community involvement and consent, as these tributaries run through the neighborhoods of Jackson, and any changes will have lasting economic, social, and health impacts on the people of Jackson. We developed a preliminary plan for what creek restoration could look like within the city of Jackson along Town Creek. This vision includes widening of the creek, removing bottlenecks and choke points, creating trails, and restoring ecological function along the creek. The plan is preliminary because it has not yet included input from community members, but can be used as a jumping off point for engaged planning. This vision includes a new recreation park behind the levee near the confluence of Town Creek and the Pearl River, which will offer opportunities to access the river, the creek, and the downtown area. This strategy would offer residents the chance to enjoy beautiful scenery and reconnect to the creek and river with enhanced street corridors.

Where the creek corridor can be widened, Town Creek can be de-channelized by removing hard concrete infrastructure currently used for flood conveyance and replacing it with natural embankments, which will allow for native vegetation to establish and natural fluvial geomorphological processes to be restored, creating a ribbon of green through downtown. The ecological restoration of the river and its tributaries can act as a catalyst for transformation in the north-east quadrant of Jackson's downtown. Parks, parking, and new public spaces along Town Creek on the north side of downtown Jackson give residents the opportunity to engage with the creek. Restoring a natural creek corridor to a continuous channel-floodplain complex with enlarged crossing and grade control infrastructure can safely convey floodwaters through Jackson down to a re-naturalized Pearl River floodplain (Figures 20-23).



Figure 20. Axonometric perspective of a restored Town Creek running through downtown Jackson. Drawing by Hozefa Haidery.

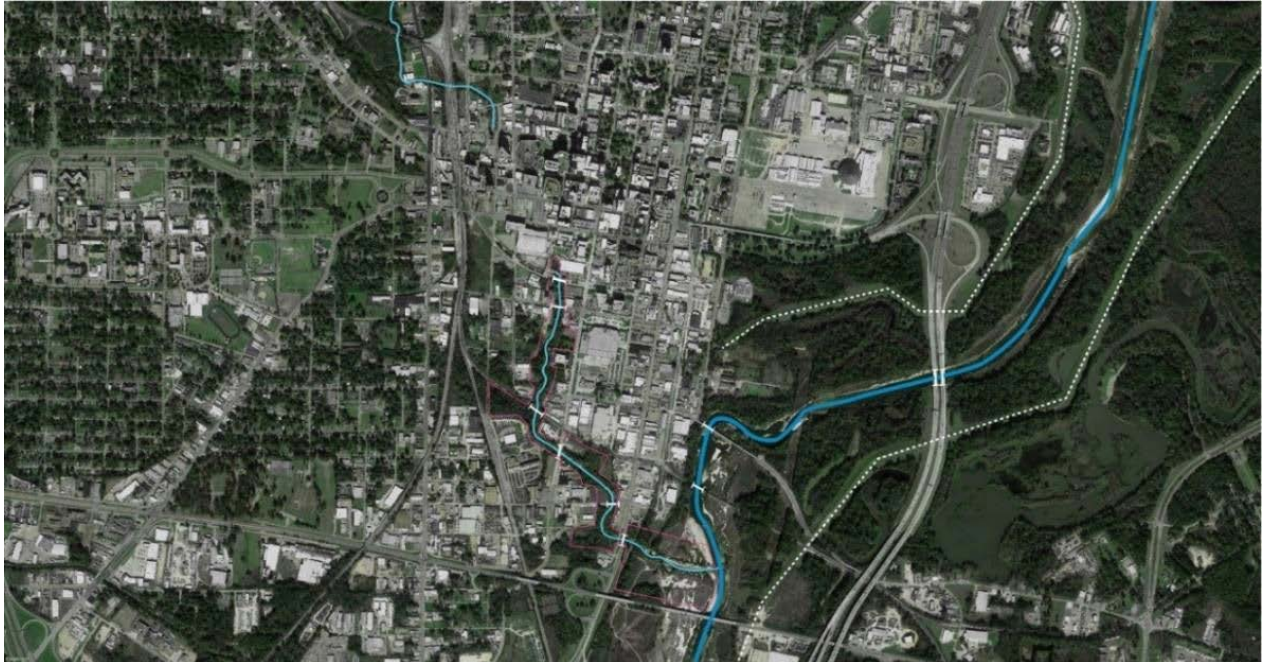


Figure 21. Aerial Image showing the confluence of Town Creek with the Pearl River, with bridges shown in white. Map by Kim Deniz.

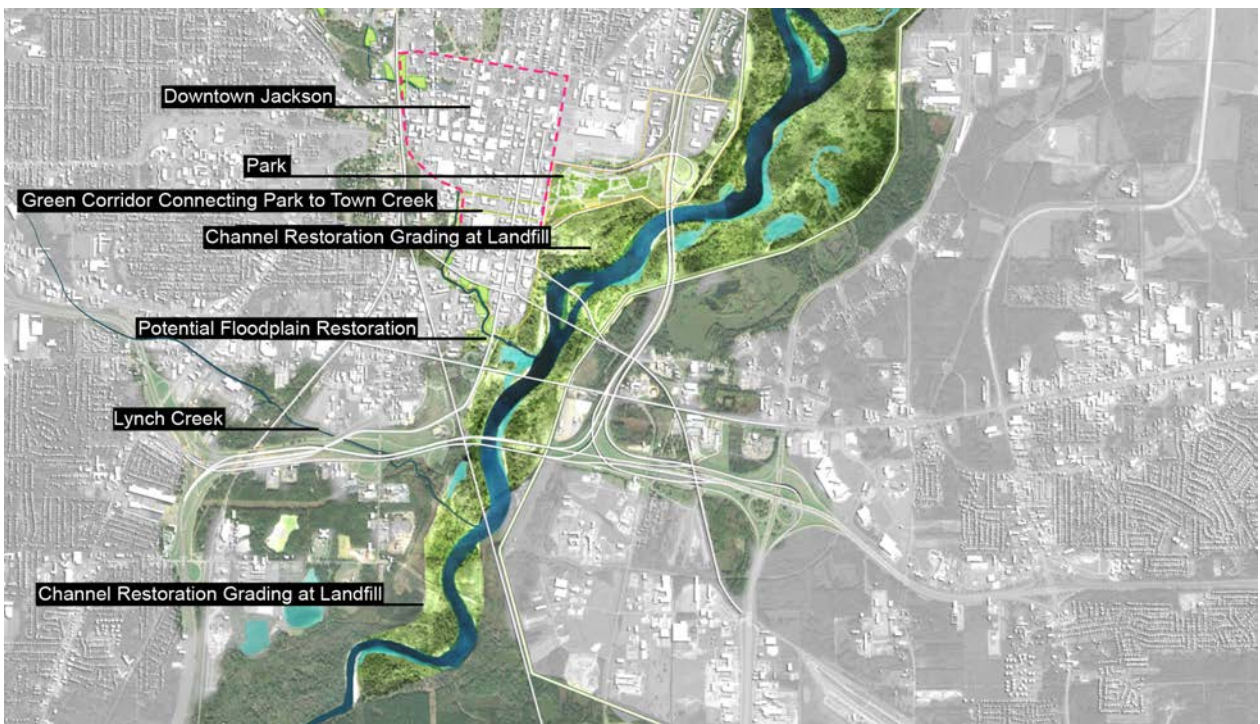


Figure 22. Plan detail of the "Green Heart" where Town Creek meets the Pearl River. Plan by Lulu Liu and Casey Jones.

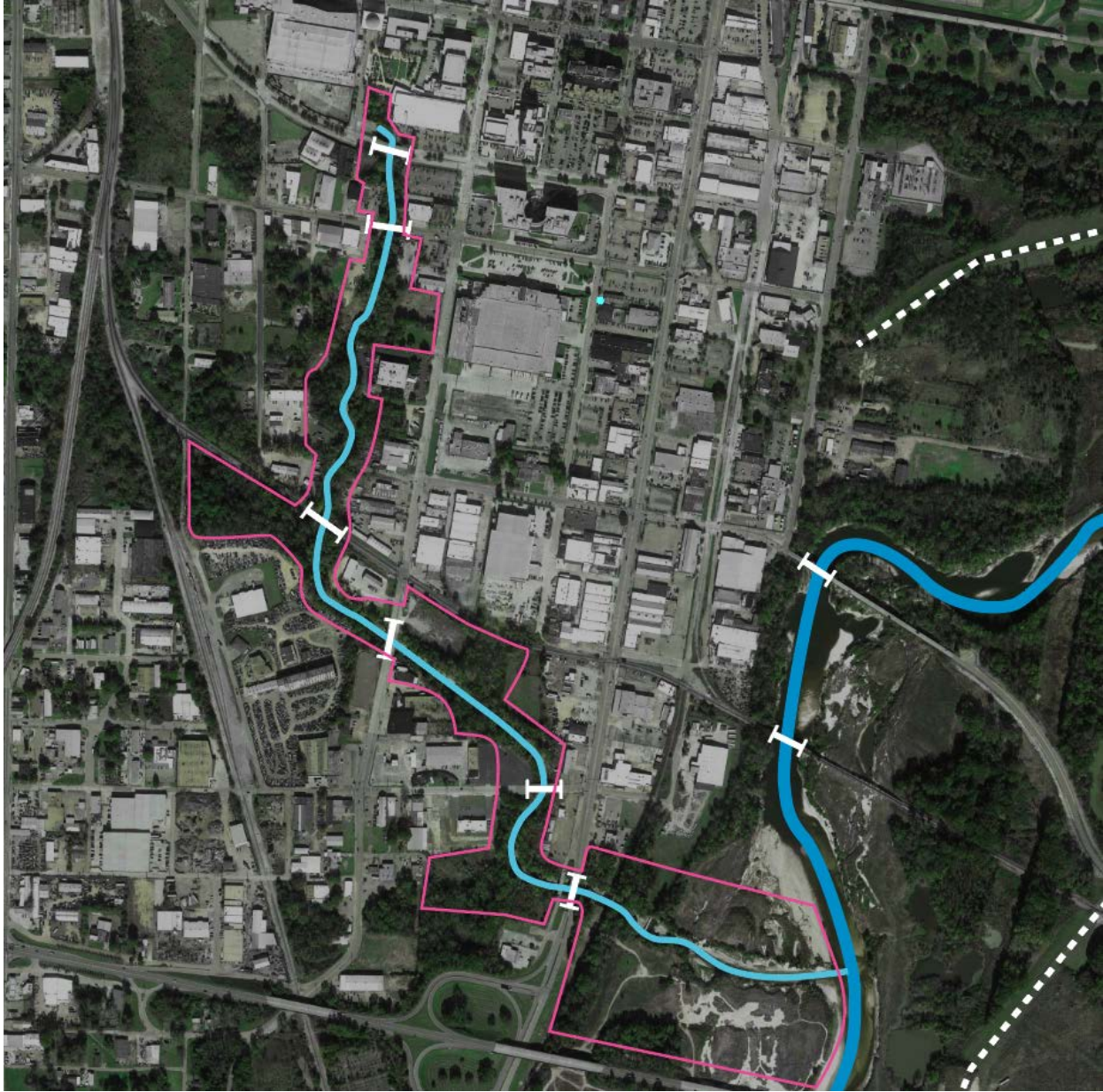


Figure 23. Plan detail indicating potential extent of stream corridor and bridge crossings along the downstream-most reach of Town Creek. Map by Kim Deniz.

Ross Barnett Reservoir

A key component of our plan is the proposed reoperation of the Ross Barnett Reservoir to provide flood risk reduction benefits to Rankin and Hinds counties. Because the 1960s Army Corps of Engineers flood control project has not delivered adequate protection, incorporating the reservoir as part of the flood risk management plan may be the best way to realize true, effective flood risk reduction. Returning to the 2020 flood described above, the systematic lowering of the reservoir over the span of two weeks to eradicate an invasive species provided a “flood pool”, that is, a volume of empty reservoir that absorbed floodwaters, and thereby reduced the stage

height of the February 2020 flood downstream by 3 feet. Though it was not purposefully timed, the experience from the February 2020 flood provides a compelling demonstration of the potential effectiveness of operating the Ross Barnett Reservoir to absorb floodwaters and thereby reduce flood damages downstream (National Weather Service, 2020). While flood control was not the original purpose of Ross Barnett Reservoir, we hope the managers of the reservoir will be open to exploring opportunities to modify its operation to reduce flood peaks downstream to relieve flooding for downstream communities.

Conclusions

The Pearl River's persistent flooding will continue to have disastrous consequences if management of the river and its tributaries continues in the current "business as usual" mode. Moreover, residents of Jackson and nearby communities have been cut off from the open space opportunities that the river and tributaries could and should offer them.

Before deciding to move forward with any construction project, we recommend that local, state, and federal authorities first focus on these priority objectives as a basis for formulating and evaluating alternatives that are technically effective, equitable, and sustainable.

Analyze potential public access to the mainstem Pearl River and tributaries drawing both on an environmental planning/geospatial analysis and more extensive community input

Identify potential bottlenecks to flow (in mainstem and tributaries), and develop measures to open up bottlenecks, accompanied by hydraulic modeling to assess the effects of these measures,

Improve understanding of tributary flooding, as this is the most pervasive flooding, and it disproportionately affects disadvantaged communities,

Partnering with the Pearl River Valley Water Supply District, jointly explore opportunities to **operate Ross Barnett Reservoir to benefit downstream communities** through flood peak reduction, to complement the benefits it has provided to upstream communities in recent decades.

With these objective in mind, we formulated the *Green Heart of the Pearl River* plan. The *Green Heart* plan aims to reconnect the Pearl River with its floodplain to increase flood conveyance capacity, while simultaneously reintegrating the river with the surrounding community, and to improve flood conveyance by removing obstructions and pinch points in both the mainstem Pearl and its tributaries. The Green Heart of the Pearl River Plan includes strategies to mitigate creekside flooding and rehabilitate Town Creek to provide a vibrant community space in the heart of downtown Jackson. The restoration of Town Creek (and potentially other downtown tributaries) is an important measure to simultaneously reduce tributary flooding and also create vibrant public spaces for the people of Jackson.

Acknowledgements

Funding for the Berkeley-Jackson-State collaboration and research support for the Environmental Planning Studio class was provided by the Beatrix Farrand Endowment, Riverlab, and Global Metropolitan Studies (UCB), and American Association of Geographers Bridging the Digital Divide and Maritime Transportation Research and Education Center (MarTREC) grants (JSU). Thanks to Juan Fernandez, Andrew Whitehurst (Healthy Gulf), and Abby Braman (Pearl Riverkeeper) for providing valuable background information. LTC Andrew Boggs, San Francisco Deputy District Commander US Army Corps of Engineers and District Environmental Justice Coordinator and Flood Risk Program Manager Jessica Ludy provided subject matter expertise and background information to students on current USACE policy guidance on environmental justice, comprehensive benefits, Engineering with Nature, and Army Corps planning process, and served as studio reviewers of student projects.

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