Executive Summary: Resilient Ribault Project Area Prioritization Report

Overview

This report evaluates the Resilient Ribault Project Area (RRPA) in Jacksonville, Florida, spanning approximately 12,000 acres and housing 53,531 residents. It underscores the vulnerabilities faced by this community, primarily related to water quality issues, aging infrastructure, and significant socio-economic disparities. This evaluation is critical for guiding infrastructural improvements and enhancing resilience against environmental and socio-economic challenges.

Key Findings:

- Environmental Concerns: The RRPA is challenged by water pollution, particularly fecal coliform bacteria. Water quality assessments have shown that areas of the Ribault and Trout Rivers are not meeting health and aquatic life standards due to the presence of these bacteria. Of the monitored sites, 50% show fecal coliform exceedances above 62%. Additionally, there are 2,859 active septic tanks that contribute to this contamination. The proximity to both riverine and coastal areas make the region susceptible to flooding, which is compounded by climate change effects such as sea-level rise and increased storm intensities.
- Socioeconomic Disparities: The area of Jacksonville exhibits significant socioeconomic challenges, including high unemployment rates and low-income levels. These are intensified by environmental burdens, making the community highly vulnerable to both ongoing and emerging stressors.
- Infrastructure Needs: Many of the region's septic systems are outdated and failing, contributing to water quality issues. The need for infrastructure upgrades, especially septic system phase-outs, is critical for improving community health and resilience against environmental impacts.
- Vulnerability Indices: Several indices, such as the CDC's Social Vulnerability Index and the U.S. Climate Vulnerability Index, identify the RRPA as one of the most vulnerable regions in the country. These indices highlight the critical need for targeted interventions to reduce flood and heat risk and enhance resilience.
- Justice40 Initiative: The RRPA qualifies for the Justice40 initiative, which aims to channel 40% of specific federal investments towards addressing disparities in historically marginalized communities. Under the Justice40 initiative, the RRPA stands to benefit significantly, with 92.3% of its tracts designated as disadvantaged. This highlights the area's eligibility for federal funding aimed at improving infrastructure and reducing pollution.

Recommendations:

- Infrastructure Improvement: Accelerate septic to sewer conversions to mitigate pollution and improve water quality. This includes prioritizing funding and support for the most vulnerable tracts.
- Enhanced Monitoring and Regulation: Implement stricter monitoring of water quality and enforce regulations to reduce pollution levels, especially from septic systems and industrial sources.
- Community Engagement and Policy Advocacy: Strengthen community engagement processes to ensure that local voices are central in planning and policymaking. Advocate for policies that address both environmental and socioeconomic vulnerabilities effectively.
- Leverage Federal Funds: Utilize Justice40 and other federal funds to address critical infrastructure needs, enhance community resilience, and reduce environmental health risks.
- Long-term Resiliency Planning: Develop and implement a long-term resiliency plan that includes adaptation strategies for climate change impacts such as sea-level rise and increased frequency of extreme weather events.

Conclusion

The RRPA represents a community at a critical juncture, facing severe challenges that require immediate and coordinated action. By addressing the intertwined issues of environmental degradation, socio-economic inequality, and infrastructure resilience, stakeholders along with community partners can significantly improve the living conditions and sustainability of this vulnerable area. This report serves as a foundational tool for mobilizing resources, guiding policy formulation, and fostering community-centric interventions aimed at transforming the RRPA into a resilient and equitable community.

Resilient Ribault Project Area Prioritization Report

Prepared for the St. Johns Riverkeeper by Ashley M. Johnson, Ph.D.

This report was produced for the Resilient Ribault Project, a LISC Jacksonville and St. Johns Riverkeeper initiative to provide equitable access to local waterways, identify and advocate for needed infrastructure projects, and address social and environmental vulnerabilities.

The St. Johns River is the longest river in Florida, flowing 310 miles north from its headwaters in Indian River County to its mouth at the Atlantic Ocean in Jacksonville. The watershed, or land area that drains into the St. Johns, is nearly 9,000 square miles and includes numerous tributaries that flow into the river. The watershed itself is an area of diverse ecological habitats, and a patchwork of land-uses that support some of the highest population densities in the state. In addition, many of the watershed's features have relatively flat topography at low elevation near the coast, which contributes to a high level of vulnerability to climate change impacts[1].

Some of the most vulnerable census tracts in the watershed are located along the Ribault River and Moncrief Creek, two tributaries of the St. Johns. The residents in these census tracks are vulnerable on three fronts: *environmental stressors, socioeconomic disparities, and flood-based impacts*. This report seeks to describe particularly vulnerable areas and highlight specific changes around those vulnerabilities. Many of these areas also face significant socioeconomic challenges and pollution problems, compounding the vulnerabilities facing their communities.

Environmental Pollutant Analysis

Indicators and indices used to map the Resilient Ribault Project Area (RRPA) are described in Table 1. According to the EPA (in blue), there are several environmental indicators applicable to riverine systems and their surrounding watersheds. This research report analyzes each priority neighborhood/area based on environmental pollutant stressors when applicable[2]. Furthermore, some neighborhoods adjacent to the St. Johns River are characterized by sweeping socio-economic inequities. These disparities result in unequal representation in the field of local and regional resiliency policy.

Table 1: RRPA Vulnerability Indicators and Indices, Descriptions, and Figure Numbers.

Indicator/Index	Description	Figures
Water Quality	Fecal Coliform data from FDEP and WIN sampling sites (geocoded), SSOs Data (FDOH, FDEP, and JEA) geocoded, Septic Tanks (count of active and inactive tanks), septic and sewer parcel analysis	2, 3, 4, 5, 6
Septic Tank Phase Out Areas	Neighborhoods identified by JEA for STPO	3, 4, 5, 6, 7, 8
Septic and Sewer Parcel Analysis	Parcels within the RRPA that have been identified based on septic or sewer	4 & 5
Heat Index for Jacksonville, FL	Data interpolated over the Jacksonville area from Rosenblatt et al. (2022) urban heat study	9
Superfund site/ Ash remediation sites	Count of proposed or listed NPL - also known as superfund/ ash sites were digitized from parcels data	11
CDC's SVI (2021)	CDC's Social Vulnerability Index	12
Justice 40 Census Tracts		13

[1] Crist, P.J., Oetting J., White R., Chesnutt M., Scott C., Sutter R., Cutter P., & Dobson, G. (2019) Coastal Resilience Assessment of the Jacksonville and Lower St. Johns River Watersheds. National Fish and Wildlife Foundation.

[2] Some indicators identified in table one fall outside the boundaries of priority areas, even with the 3-mile buffer included.

The U.S. Climate Vulnerability Index[3]	Score combining environmental, social, economic, and infrastructure climate effects on neighborhood-level stability.	14 & 15
First Street Foundation Flood Factor	Risk of flooding projected to 2050	16
J40 and Flood comparison	Side by side map of J40 and FFF projected to 2050	17

Resilient Ribault Project Area

The Resilient Ribault Project Area (RRPA) is comprised of thirteen census tracts on the northwest banks of the St. Johns River for a total area of approximately 12,000 acres (19.53 square miles), and a total 2020 population of 53,531 (Figure 1). In addition, these tracts collectively include almost equal proportions of people who own or rent their homes, with approximately 11,000 homeowners and 10,000 renters. The average age in this area of Jacksonville is 39 years old, and the average household size is 2.55. These census tracts represent some of the most vulnerable in the city in terms of climate changes, flooding, environmental pollutants, and socio-economic standing.

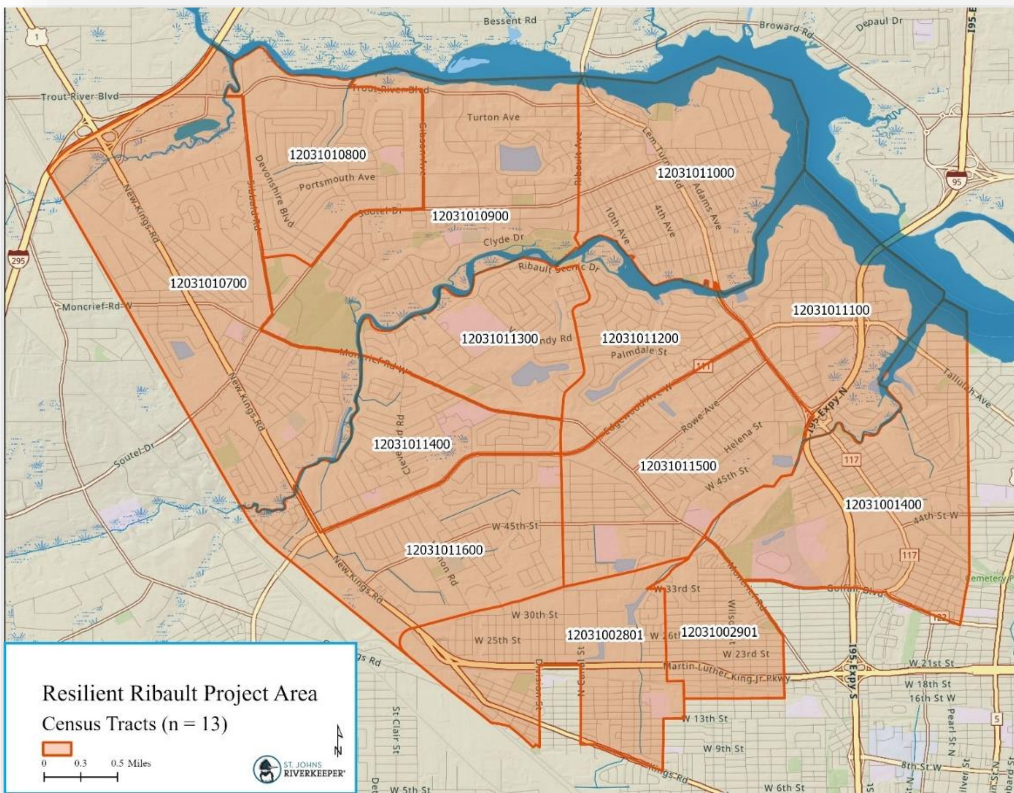


Figure 1: Resilient Ribault Project Area within the Lower St. Johns River Watershed.

Water Quality Analysis

For the Resilient Ribault Project Area the following water quality data were mapped: total maximum daily load by pollutant (Figure 2), these data were obtained by visiting the Florida Department of Environmental Protection Geospatial Open Data (geodata.dep.state.fl.us/). Total maximum daily loads (Figure 2) was obtained

[3] Lewis, P. G. T., Chiu, W. A., Nasser, E., Proville, J., Barone, A., Danforth, C., ... & Craft, E. (2023). Characterizing vulnerabilities to climate change across the United States. *Environment International*, 172, 107772.

from the Florida Geographic Data Library (fgld.org). Septic tank phase out areas were solicited from JEA (Figure 3), the water quality points along the Ribault River, and associated data came from the WIN database, with data analysis completed by Dr. Lucinda Sonnenberg (Figures 4 and 5). Septic tank data and moderate sea level rise projections for 2030 and 2050[4] (livingatlas.arcgis.com) were also mapped (Figure 6). Additional maps for *environmental indicators* include heat index.

Total Maximum Daily Loads

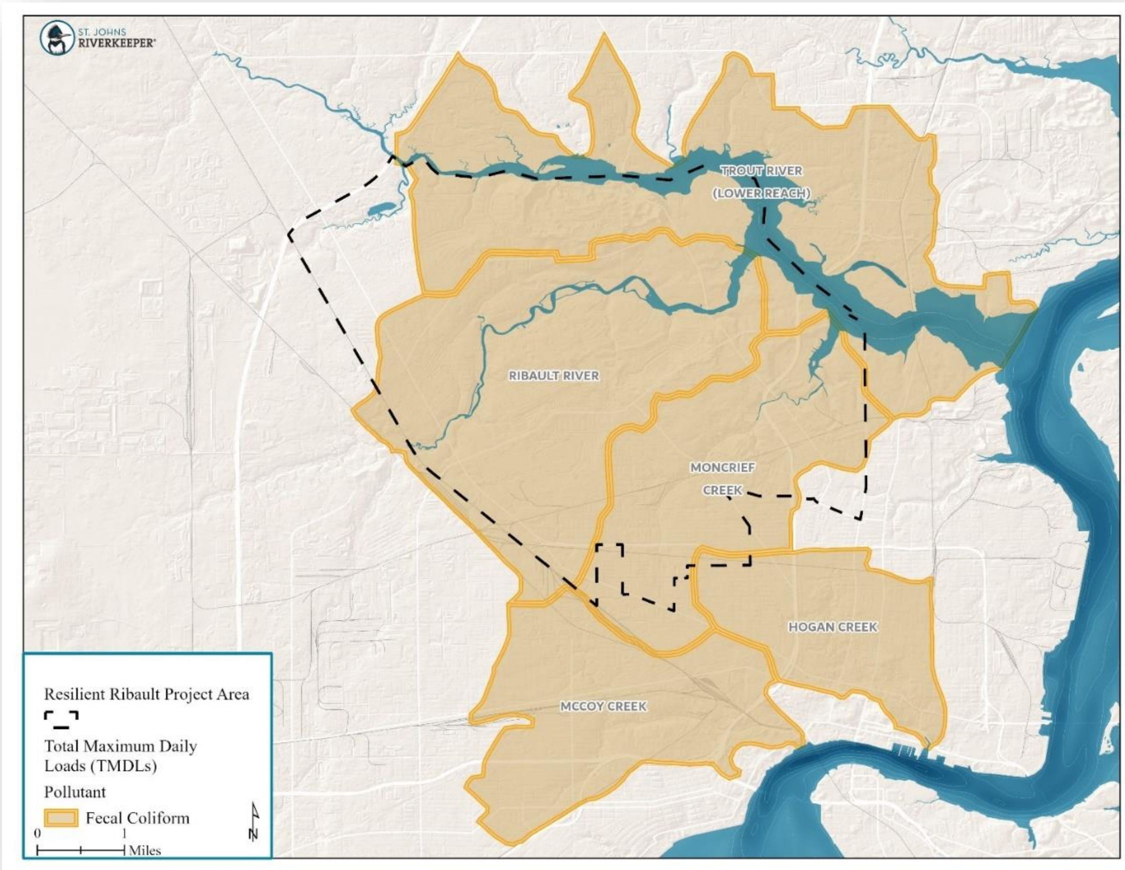


Figure 2: Watersheds impacted by fecal coliform in the RRPA.

A TMDL is the maximum amount of a given pollutant that a surface water can absorb and still meet the water quality standards that protect human health and aquatic life. This area of the Ribault and Trout Rivers was identified as exceeding the maximum amount of ***fecal coliform*** bacteria in 2006, and a plan was developed by the Florida Department of Environmental Protection. However, as of 2021, these areas of the Ribault and Trout Rivers remains under a TDML, meaning that the minimum levels of fecal coliform have not yet been achieved.

Sources of ***fecal coliform*** in surface waters include wastewater treatment plants, septic systems, domestic and wild animal manure, and storm runoff. The presence of fecal bacteria in the river can impact human health through digestive system illness. Additionally, elevated levels of fecal coliform can cause cloudy water, unpleasant odors, and an increased biological oxygen demand which can impact the health of riverine vertebrates and invertebrates.

[4] https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nostechrpt01-global-regional-SLR-scenarios-US.pdf

Septic Systems

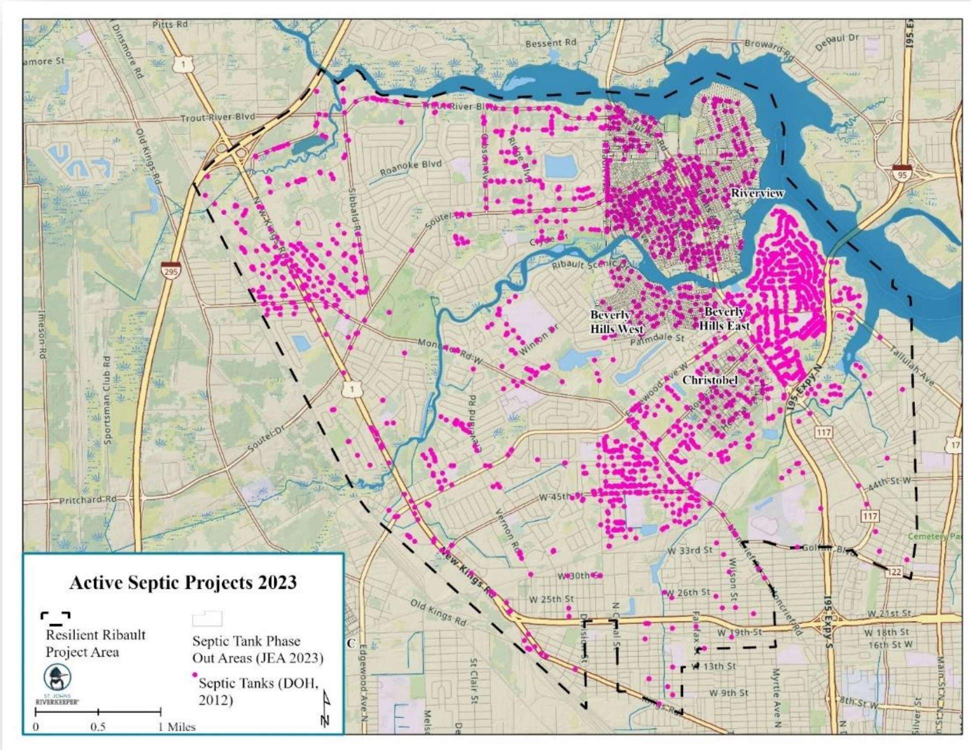
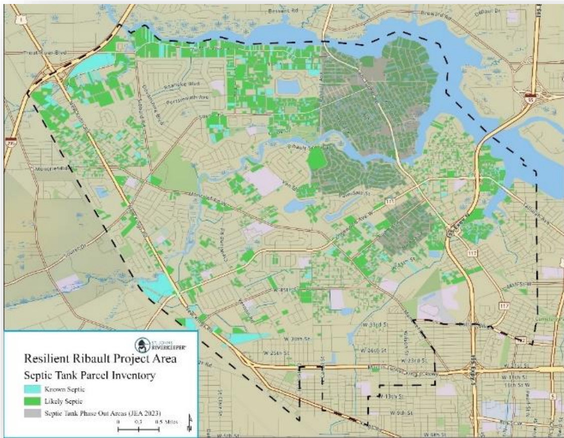


Figure 3: Septic tanks adjacent to the Ribault and Trout Rivers and septic phase out areas.

The latest data available on on-site ***septic systems*** comes from the Department of Health and dates to 2012, this is important to note because in the last ten years there has been additional development in the Resilient Ribault Project Area. Based on the available data, there are 2,874 septic tanks within the project boundary, of those 15 are closed and 2,859 remain active. Septic tanks can be problematic when they fail, releasing fecal waste and contaminating waterways. Figure 3 shows a clustering of septic tanks in residential areas, many of which are located adjacent to the river. Also included in this map are the septic tank phase out areas, these are neighborhoods that have been identified as part of JEA's phase out program. It is estimated that each septic tank conversion will cost approximately $60,000. Conversion costs are funded by JEA and the city through a series of infrastructure grants. Additional septic and sewer analyses were performed at the parcel level (figures 4 & 5).



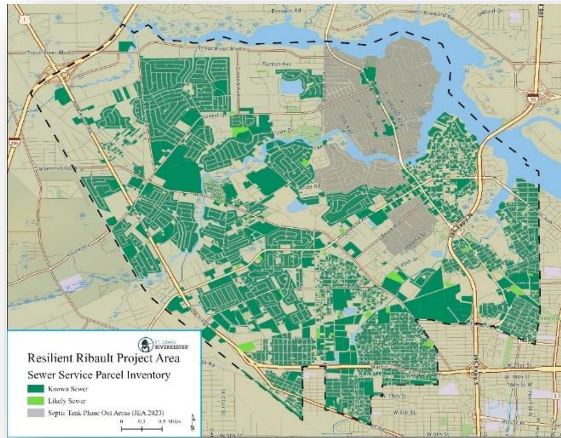


Figure 4 & 5: Septic tank and sewer parcel level analysis in the RRPA.

Notice that the septic tank phase out areas correspond to areas with a high density of septic tank presence and parcels identified as likely and known septic.

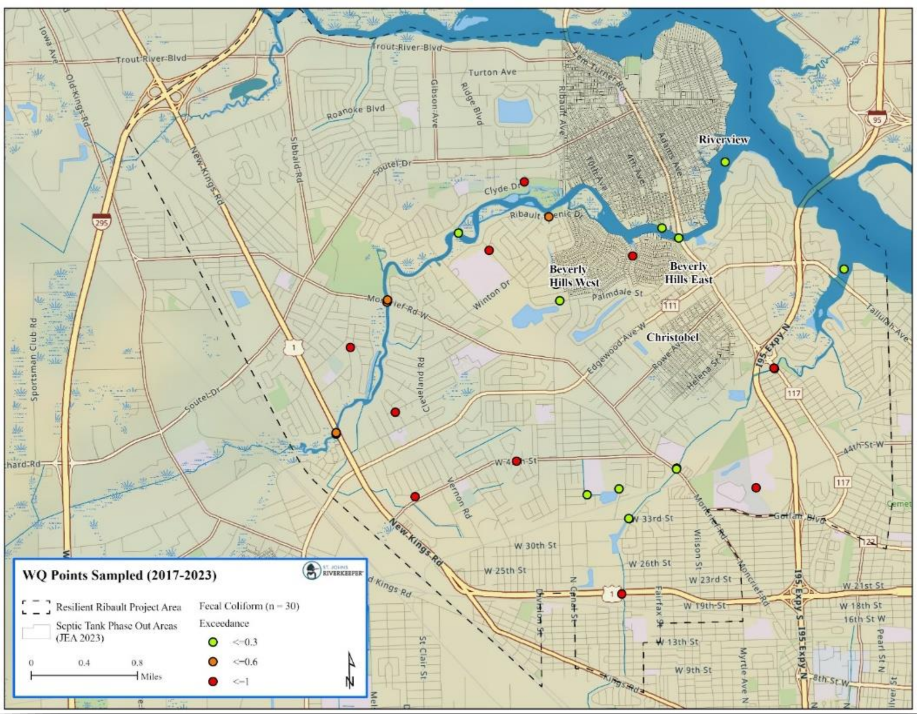


Figure 6: Water Quality Sampling Sites with Fecal Coliform Exceedance Data in the Ribault and Trout River Basins.

Nutrients and pollutants, such as nitrogen, phosphorus, fecal coliform, and total suspended solids (TSS) are contained in the effluent of septic tanks and are either filtered from the drain field into the local water table or are transported by rain to nearby surface waters[5]. These pollutants can sicken swimmers and others who use the

[5] EPA. (2002). Onsite Wastewater Treatment System Manual. www.Epa.Gov/Sites/Production/Files/2015-06/Documents/2004_07_07_septics_septic_2002_osdm_all.pdf

river for recreation or eat raw shellfish or fish. Other potential health effects of septic tank effluent can include diseases of the skin, eyes, ears, and respiratory tract. Eating fish or shellfish harvested from waters with fecal contamination can also result in human illness.[6]

Figure 6 illustrates water quality data compiled from the Watershed Information Network (WIN) database and analyzed by Dr. Lucinda Sonnenberg. An overabundance of ***nutrients*** is present in the watersheds of the Ribault and Trout Rivers. Over-nutrified waterbodies lead to the increase of plant growth in the water column, often causing eutrophication of the waterbody. Eutrophication can impact water quality in a variety of ways, including algal blooms, fish kills, and dangerous swimming and boating conditions. It is important that water quality sampling sites are inventoried for useful data. The WIN data was analyzed using the fecal coliform parameter, fifteen of thirty (50%) points fall within the highest category of exceedances. In other words, fifteen sites have exceeded the parameter for fecal coliform by 62% or higher. Bivariate symbology shows the quantitative relationship between two variables, and figure 7 shows the fecal coliform exceedances and the geomean of the exceedances for each point. According to the Florida DEP, fecal coliforms and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes.[7] Microbes in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.

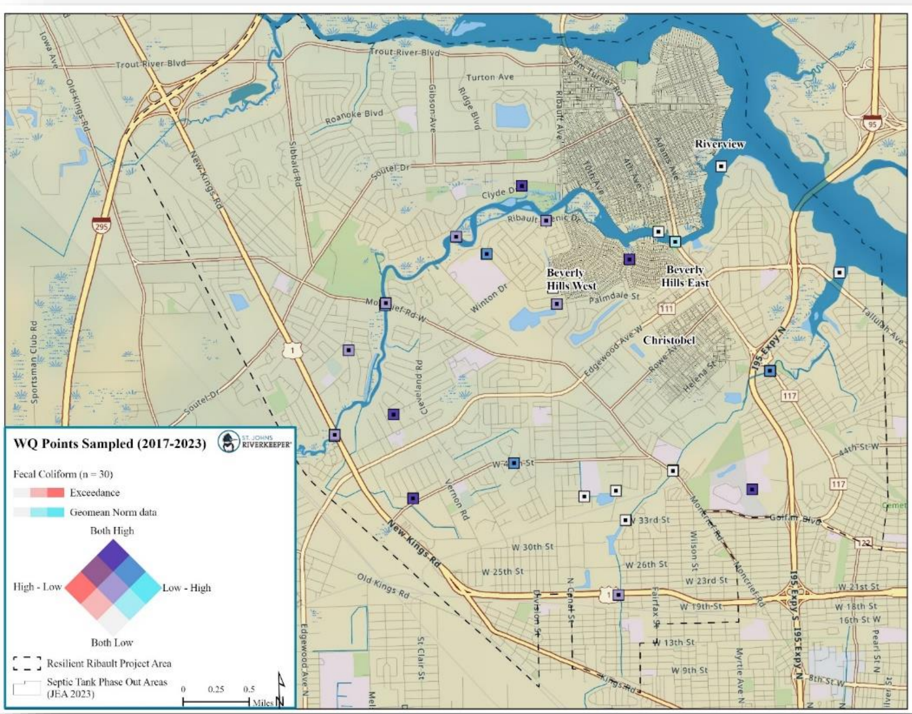


Figure 7: Bivariate display of fecal coliform exceedances in the Resilient Ribault Project.

As riverine and coastal flooding increases so will the number of failing septic tanks. In 2014 the Intergovernmental Panel on Climate Change (IPCC) Assessment Report indicated that flooding is likely to increase from two to seven feet over the next 50 years and the frequency and intensity of tropical storms and hurricanes will increase. The latest findings of the IPCC (2023) are that over the next 2000 years, global mean

[6] EPA (2022) National Aquatic Resource Surveys. Accessed at https://www.epa.gov/national-aquatic-resource-surveys/indicators-enterococci
[7] https://floridadep.gov/TMDL

sea level will rise by about 2–3 m if warming is limited to 1.5°C and 2–6 m if limited to 2°C[8]. Duval County experienced compound flooding in 2017 with Hurricane Irma, which flooded major portions of the city located near the St. Johns River. The onsite sewage treatment and disposal systems regulation[9] states that a septic tank must not be within 75 feet of the mean high-water line or mean annual flood line of a surface water body. However, the statute does not contain any setback standards or language to address climate change impacts and the issues associated with it, such as sea level rise and stronger hurricanes. Figure 8 illustrates intermediate projected sea level rise for 2030 (orange) and 2050 (yellow), note the proximity to many active septic tanks.

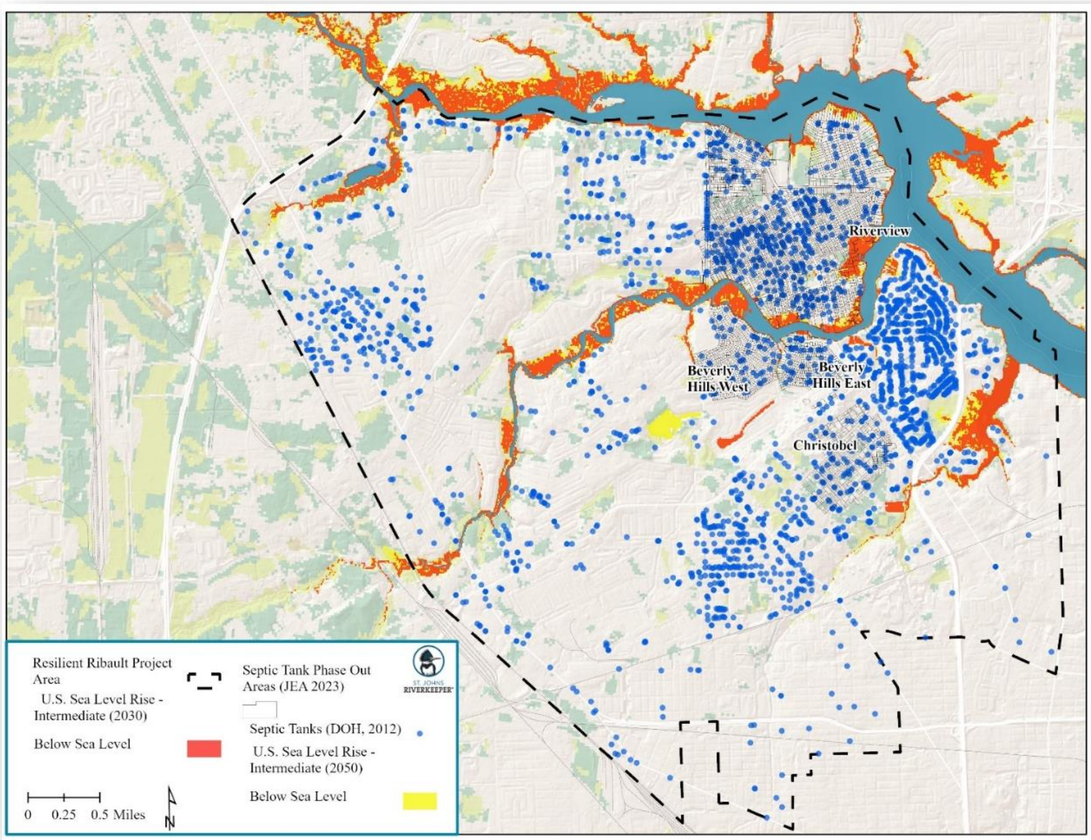


Figure 8: Intermediate projected sea level rise for 2030 (orange) and 2050 (yellow) and active septic tanks.

[8] IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 35-115, doi: 10.59327/IPCC/AR6-9789291691647

[9] F.S. 381.0065

Heat Index

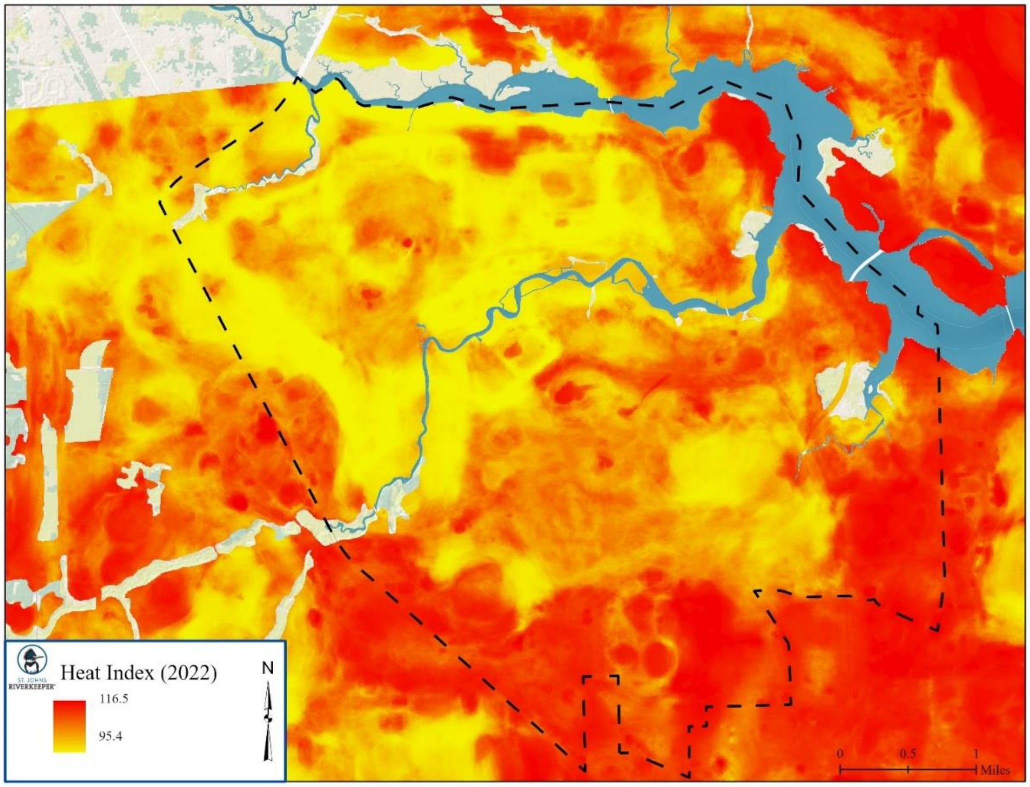


Figure 9: Heat index of Duval County using sensors, June of 2022[10].

Heat plays a major role in the health of communities. Over the span of three decades, federal statistics reveal that the primary factor contributing to weather-related fatalities in the United States is extreme heat. Urban heat islands, intensifying the effects of extreme heat, can result in heightened respiratory challenges, heat exhaustion, and heat stroke. These adverse heat consequences disproportionately impact the most susceptible populations, including children, the elderly, and individuals with preexisting health conditions. Recent findings revealed in the National Conference of Citizenship's (NCoC) Pandemic to Prosperity report in July, the NCoC, a congressionally chartered nonprofit dedicated to promoting civic life in the U.S., reported an alarming 88% surge in heat-related fatalities in Florida between 2019 and 2022[11].

In Florida, heat is an especially acute issue, in the summer of 2021 there were 26 heat related hospitalizations and 213 heat related emergency room visits[12]. In the summer of 2022, a team from the University of North Florida conducted an urban heat study. Figure 9 maps the results of that study, it should be noted that the ***heat index*** overall is quite high, with a minimum temperature of 95.4° and a maximum temperature of 116.5°. The average temperature across the area was 100.5° at the time of data collection. Some of the highest heat indexes correspond to areas of residential and industrial development.

Land Use

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[10] https://environment.domains.unf.edu/heatmap/
[11] https://www.pandemictoprosperity.org/
[12] According to the Florida Department of Health Environmental Public Health Tracking data (https://www.floridatracking.com/healthtracking/topic.htm?i=13).

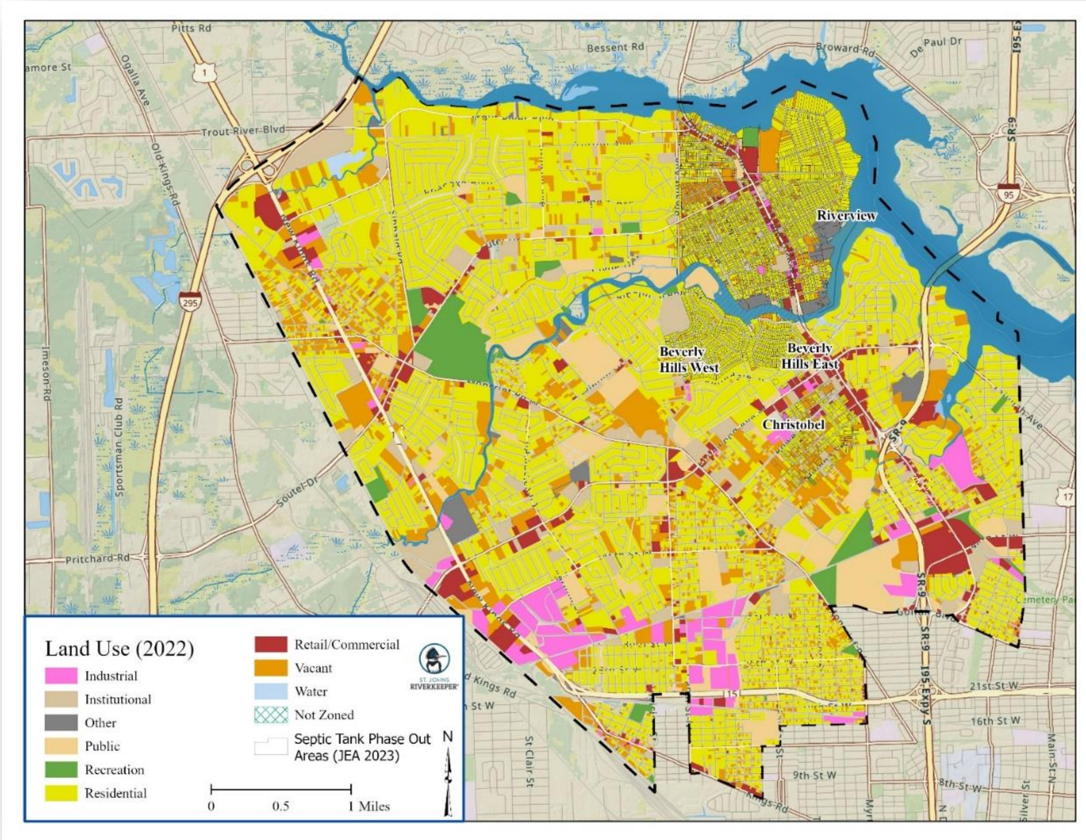

Figure 10: Land use in the Resilient Ribault Project Area.

Much of the landscape in this area is dominated by residential land uses. There are 9,843 acres of zoned real property in the Resilient Ribault Project Area. A little over 50% of those parcels are zoned residential (5,063 acres). Land use is an important source of potential pollutants due to point and non-point source pollution such as surface water runoff.

Superfund and Ash Remediation Sites

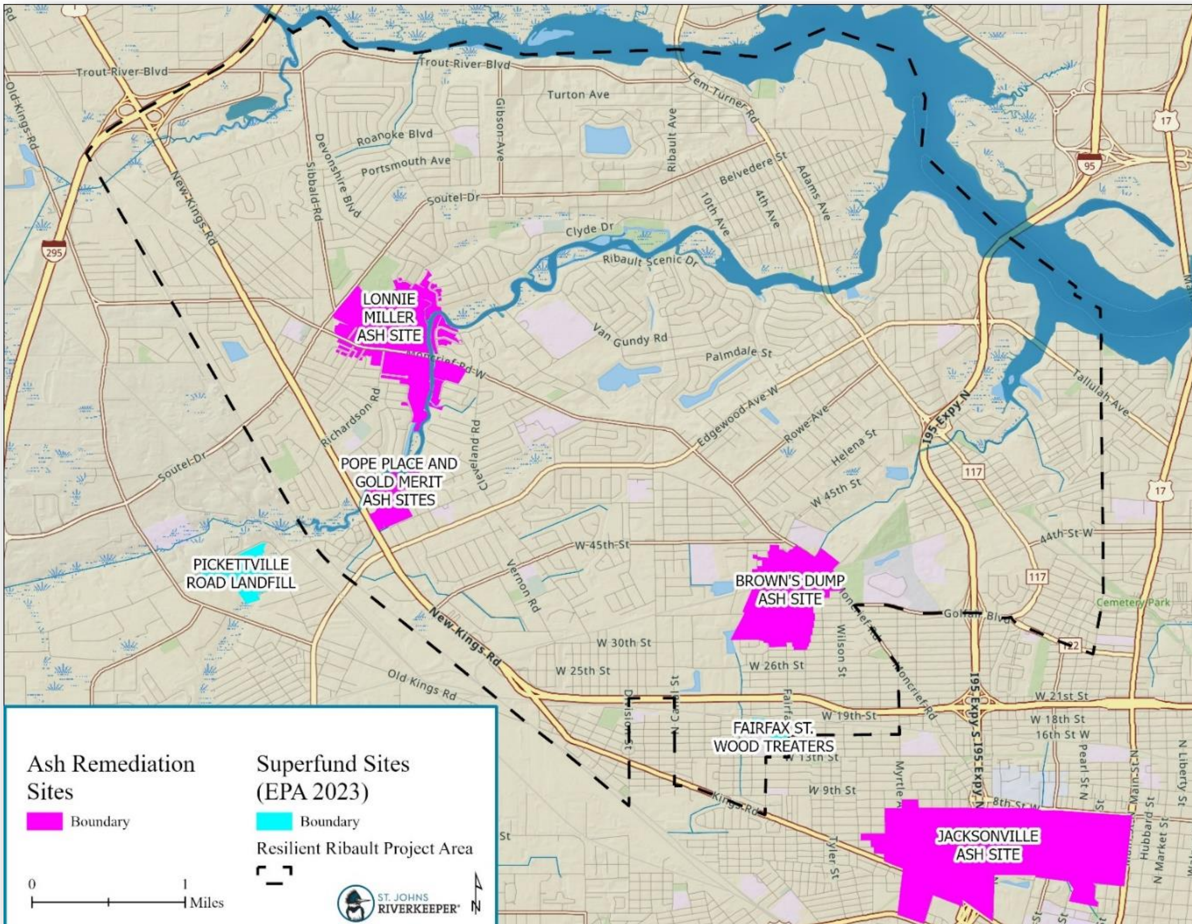

Figure 11: Superfund sites and ash remediation sites for the Resilient Ribault Project Area.

Since 1980, the EPA's Superfund program has been cleaning up lands associated with industrial and commercial activities that produce by-products toxic to the environment and human health. Figure 11 shows major remediation and superfund projects within and adjacent to the project area. There are three ash remediation sites within the project boundary and one large one right outside the boundary. The ash is a product of solid waste incineration that took place in Jacksonville for about 60 years starting in the early 1900s. The ash byproduct was mixed with soil and given away to area residents and used as fill material as well as disposed at several dump sites, some sites have been remediated, however, figure 11 shows the ash sites that are still in need of cleanup. According to the EPA, site investigations found contamination in soil that could potentially harm people in the area. Soil contamination resulted from disposal practices at the site. Primary contaminants of concern include lead, arsenic, dioxins, and polycyclic aromatic hydrocarbons (PAHs)[13]. The two Superfund sites shown are on the National Priorities List (Pickettville Road Landfill and Fairfax St. Wood Treaters).

As stated by the EPA, from 1940 to the mid-1960s, the Pickettville Road Landfill started off as a borrow pit for sand and waste disposal. In 1968, the City of Jacksonville began leasing the property for landfill operations, including the disposal of municipal and industrial waste. In 1971, the landfill no longer accepted municipal waste and accepted hazardous wastes only. In 1977, all waste disposal operations ended, and the City of Jacksonville closed the landfill. In 1983, EPA listed the site on the NPL. The City of Jacksonville remains the

[13] https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.contams&id=0407002

owner of the site, and the site is not currently in use. The EPA continues to monitor and review the site every five years.[14]

Fairfax St. Wood Treaters[15] was recently deleted from the NPL list. The site was used, starting in the 1980s, to pressure treat utility poles, pilings, and other lumber products. The wood treating operations resulted in soil, water and sediment contamination with chromium, copper, and arsenic. When the company went bankrupt in 2010, vats containing high levels of these toxins were left on the property. In 2019 the EPA completed remediation and clean-up efforts at the site and in 2020 the site was removed from the Superfund NPL list. It remains identified in the database due to the recent cleanup efforts, it will remain part of the NPL list until the site is reevaluated in 2025.

Social Vulnerability Maps

Social vulnerability occurs when social, political, and economic processes combine to create increased exposure to, and impact from, hazards for some populations[16]. Recent research has shown discrete hotspots of flood exposure and social vulnerability in the United States and several of those hotspots fall within the St. Johns River watershed[17]. This report details areas, identified using geospatial data, which are vulnerable to not only environmental but also social stressors. The maps and data that follow represent three distinct datasets, the CDC's social vulnerability index published in 2020[18]and updated in 2022[19], the White House's Council on Environmental Quality's Justice 40 analysis published in May of 2022, and the U.S. Climate Vulnerability Index[20] published in 2023. These analyses use census tracts, which are a small unit of geography, that generally have populations of between 1,200 - 8,000 people. The data is also reported in percentiles which show how much burden each tract experiences when compared to other tracts in the United States.

[14] https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0400859#bkground
[15] https://semspub.epa.gov/work/04/11140099.pdf
[16] Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly*, 84(2), 242-261.
[17] Tate, E., Rahman, M. A., Emrich, C. T., & Sampson, C. C. (2021). Flood exposure and social vulnerability in the United States. *Natural Hazards*, 106(1), 435-457.
[18] Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. CDC/ATSDR Social Vulnerability Index 2020 Database for Florida. https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html. Accessed on 12/27/2022.
[19] https://www.atsdr.cdc.gov/placeandhealth/svi/data_documentation_download.html
[20] Lewis, P. G. T., Chiu, W. A., Nasser, E., Proville, J., Barone, A., Danforth, C., ... & Craft, E. (2023). Characterizing vulnerabilities to climate change across the United States. Environment international, 172, 107772.

CDC's Social Vulnerability Map

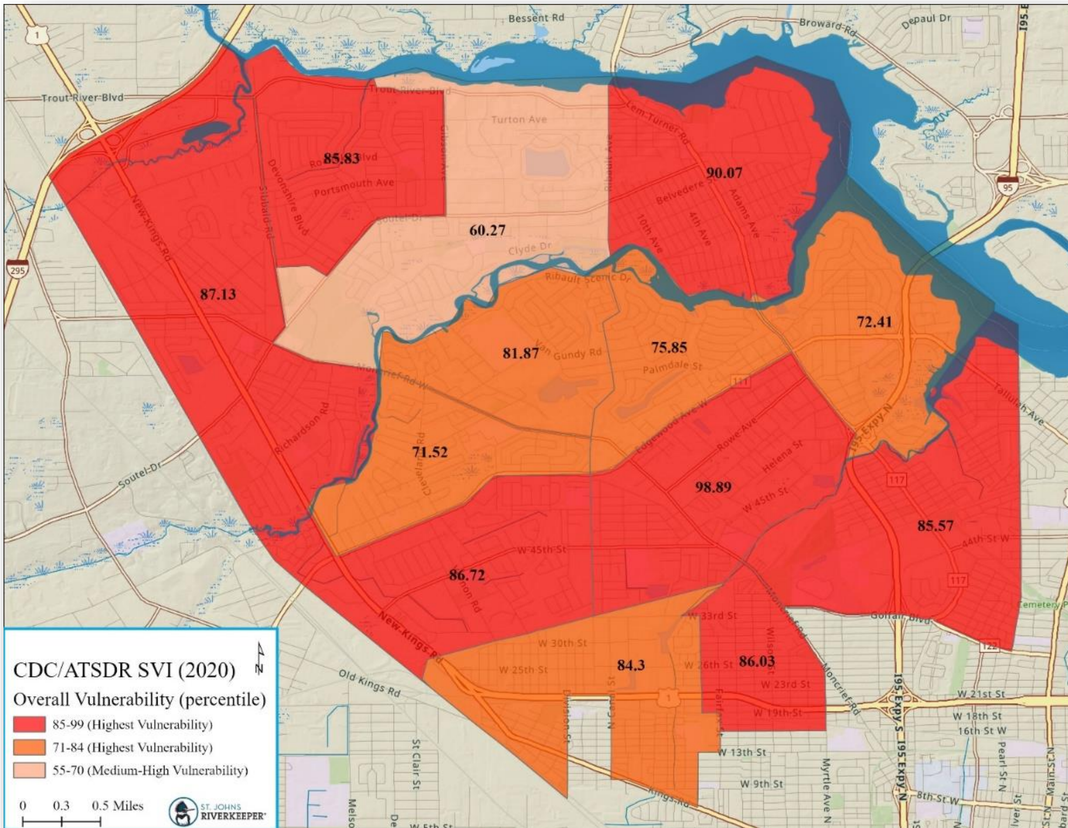

Figure 12: Overall Social Vulnerability Index mapped for the Resilient Ribault Project Area using CDC/ATSDR Social Vulnerability Index (2020).

Figure 12 shows census tracts within the project area rendered on the CDC's social vulnerability index (SVI). The SVI indicates the relative vulnerability of every U.S. census tract[21]. Possible scores range from 0 (lowest vulnerability) to 100 (highest vulnerability). The index evaluates areas based on 15 social factors, including unemployment, minority status, and disability, and groups them into four related themes.

1. Socioeconomic
2. Household Composition & Disability
3. Minority Status & Language
4. Housing Type & Transportation

Figure 12 shows SVI ranks for overall vulnerability (a combination of all four themes) and the thirteen census tracts contained in the project area are labeled with their respective SVI number. This part of Jacksonville contains some of the most vulnerable areas in the city and state, as well as the country (Table 2). The vulnerability of each tract is relative to the United States, meaning that if a tract is indexed at the 90th percentile, only 10% of census tracts in the entire country are considered more vulnerable. The average rank for the Resilient Ribault Project Area is 83rd percentile which indicates that this region of the city is highly vulnerable.

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[21] For more information on how the CDC calculates the SVI please visit: https://www.atsdr.cdc.gov/placeandhealth/svi/documentation/SVI_documentation_2020.html.

Table 2: Resilient Ribault River Area Census Tracts Relative Vulnerability to the United States

Tract Number	Percentile (RRA)	Index Rank
107	87th	High Vulnerability
108	86th	High Vulnerability
109	60th	Medium to High Vulnerability
110	90th	Highest Vulnerability
111	72nd	High Vulnerability
112	76th	High Vulnerability
113	82nd	High Vulnerability
114	72nd	High Vulnerability
115	99th	Highest Vulnerability
116	87th	Highest Vulnerability
28.01	84th	High Vulnerability
29.01	86th	Highest Vulnerability
140	86th	Highest Vulnerability
Average Percentile Ranking	83rd	High Vulnerability

Justice 40 Initiative

The Justice40 Initiative seeks to invest 40% of certain federal funds into areas that have historically been "marginalized, underserved, and overburdened by pollution"[22]. Justice40 investments include green and clean energy and transit as well as creating resilient infrastructure to climate change impacts. ***Communities are identified as disadvantaged if they are in census tracts that are at or above the thresholds in one or more of eight categories of criteria below.***

1. Climate change
2. Clean energy and energy efficiency
3. Clean transit
4. Affordable and sustainable housing
5. Reduction and remediation of legacy pollution
6. Critical clean water and wastewater infrastructure
7. Health burdens
8. Training and workforce development

Under the current formula, a census tract must meet two criteria:

1. **IF** the census tract is above the threshold for one or more environmental or climate indicators
2. **AND** the census tract is above the threshold for the socioeconomic indicators.

This national dataset was queried resulting in table 3.

Table 3: Justice40 disadvantaged census tracts proportions.

Geography	Number of Disadvantaged Tracts/Total Tracts by Area	Percent
Florida	1,482/4,245	10.4%
St. Johns River Watershed	224/783	28.6%
Duval County	58/195	29.7%
Ribault River Area (RRA)	12/13	92.3%

[22] https://www.whitehouse.gov/environmentaljustice/justice40/

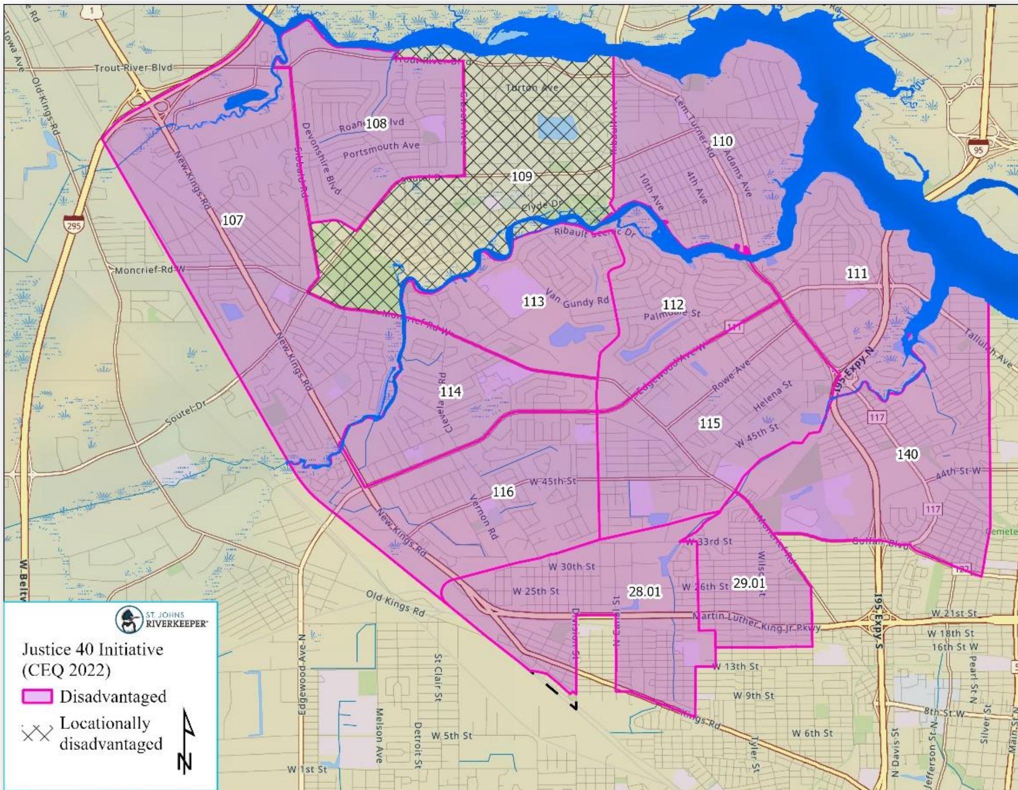

Figure 13: Disadvantaged census tracts in the RRPA mapped by Justice40 data.

Figure 13 displays the RRPA using data from the Justice40 initiative[23]. Each census tract contained in the RRPA was analyzed based on the Justice40 dataset and table 4 contains the results of that analysis. Specific environmental, health, or economic burdens, from the list of eight categories above, are associated with each tract within the RRPA. Low income is defined as people in households where income is less than or equal to twice the federal poverty level, not including students enrolled in higher education. Tract 109 is not technically classified as disadvantaged based on the criteria used, however, since it is surrounded by other disadvantaged census tracts, it has been flagged by the Justice40 initiative.

Table 4: Ribault River Area census tract analysis based Justice40 data.

Tract Number	**Burden(s) –** above 90th percentile	**Low Income –** above 65th percentile	**High School Education**[24] **–** above 10%	**Unemployment**[25] -- above 90th percentile	**Disadvantaged (Y/N)**	**Rank in the RRSA**[26]
107	**Health** -- diabetes (98th), low life expectancy (98th), and heart disease (93rd) **Legacy Pollution** – proximity to Superfund sites (94th)	68th	15%	97th	Y	3
108	**Health** – diabetes (98th) and heart disease (90th)	85th	14%	38th	Y	2
109	**Health** – diabetes (90th)	51st	16%	75th	Y, locational	1
110	**Health** – diabetes (93rd) and low life expectancy (93rd) **Workforce Development** – unemployment (98th)	89th	22%	98th	Y	4

[23] For more information on thresholds and variables please visit: https://screeningtool.geoplatform.gov/en/methodology
[24] Percent of people ages 25 years or older whose high school education is less than a high school diploma.
[25] Number of unemployed people as a part of the labor force
[26] The number assigned to each tract is based on the quantity and magnitude of each Justice40 social burden. Each tract is compared within the study area and ranked 1-13; with 13 having the most social burdens and 1 sharing the least.

111	**Health** – asthma (91st), diabetes (95th), and low life expectancy (94th) **Legacy Pollution** -- Proximity to Risk Management Plan facilities[27] (93rd) **Transportation** -- Traffic proximity and volume[28] (92nd) **Wastewater** -- Underground storage tanks and releases[29] (92nd) **Workforce Development** – low median income (92nd)	83rd	12%	86th	Y	10
112	**Health** – asthma (92nd), diabetes (99th), low life expectancy (97th), and heart disease (94th) **Legacy Pollution** -- Proximity to Superfund sites[30] (91st) **Wastewater** -- Underground storage tanks and releases (92nd)	83rd	21%	89th	Y	5
113	**Health** -- asthma (95th), diabetes (98th), and heart disease (93rd) **Legacy Pollution** – Proximity to Superfund Sites (94th) **Transportation** – Transportation barriers[31] (93rd) **Workforce Development** – Unemployment (91st)	94th	16%	91st	Y	7
114	**Energy** – energy costs[32] (90th) **Health** – asthma (90th), diabetes (99th), low life expectancy (98th), and heart disease (98th) **Legacy Pollution** -- Proximity to Risk Management Plan facilities (94th), Proximity to Superfund sites (96th) **Wastewater** – Underground storage tanks and releases (94th) **Workforce Development** – low median income (92nd)	88th	17%	77th	Y	6
115	**Energy –** energy costs (91st) **Health –** asthma (95th), diabetes (98th), low life expectancy (99th), and heart disease (91st) **Legacy Pollution --** Proximity to Risk Management Plan facilities (96th), proximity to Superfund sites (95th) **Wastewater –** Underground storage tanks and releases (94th)	93rd	16%	96th	Y	12
116	**Energy –** energy costs (91st) **Health –** asthma (93rd), diabetes (99th), low life expectancy (94th), and heart disease (98th) **Legacy Pollution** -- Proximity to Risk Management Plan facilities (99th), proximity to Superfund sites (96th) **Wastewater –** Underground storage tanks and releases (94th)	91st	18%	94th	Y	11
28.01	**Energy** – energy costs[33] (90th) **Health –** asthma (91st), diabetes (98th), low life expectancy (99th), and heart disease (90th) **Housing** -- Historic underinvestment[34] **Legacy Pollution** -- Proximity to Risk Management Plan facilities (99th), Proximity to Superfund sites (98th) **Wastewater –** Underground storage tanks and releases (97th)	92nd	15%	97th	Y	9
29.01	**Energy** – energy costs (96th) **Health –** asthma (96th), diabetes (99th), low life expectancy (97th), and heart disease (97th) **Housing** -- Historic underinvestment (yes), housing costs[35] (91st) **Legacy Pollution** -- Proximity to Risk Management Plan facilities (99th), proximity to Superfund sites (99th) **Wastewater –** Underground storage tanks and releases (94th) **Workforce Development** – low median income (95th), poverty[36] (96th)	96th	21%	71st	Y	8
14	**Energy** – energy costs (89th) **Health –** asthma (90th), diabetes (94th), and low life expectancy (99th) **Housing** – lead paint[37] (85th) **Legacy Pollution** -- Proximity to Risk Management Plan facilities (98th), proximity to Superfund sites (93rd)	87th	16%	75th	Y	13

[27] Count of Risk Management Plan (RMP) facilities within 3 miles of tract
[28] Count of vehicles at major roads within 500 meters
[29] Formula of the density of leaking underground storage tanks and number of all active underground storage tanks within 1500 feet of the census tract boundaries
[30] Count of proposed or listed Superfund (or National Priorities List (NPL)) sites within 3 miles of tract
[31] Average of relative cost and time spent on transportation.
[32] Average annual energy costs divided by household income.
[33] Average annual energy costs divided by household income.
[34] Census tracts with historically high barriers to accessing home loans.
[35] Share of households making less than 80% of the area median family income and spending more than 30% of income on housing
[36] Share of people in households where income is at or below 100% of the Federal poverty level.
[37] Share of homes that are likely to have lead paint.

	Wastewater -- Underground storage tanks and releases (90th), wastewater discharge[38] (92nd) **Workforce Development** – low median income (91st), poverty (86th)					

Climate Vulnerability

Based on research by Lewis and others[39] (2023), the Climate Vulnerability Index (CVI) for the United States was created by incorporating input from community stakeholders, as well as using multiple datasets and existing indices that map public health, social, economic, environmental, and climate data across the U.S. and encompass 184 indicators[40]. This integration of this information resulted in the CVI for the U.S. and comprises four fundamental vulnerabilities (health, social/economic, infrastructure, and environment) and three specific climate change risks (health, social/economic, extreme events). The analysis reveals a significant disparateness in climate change vulnerability as well as highlighting areas with similar climate risks but varying baseline vulnerabilities[41]. These findings underscore the complex nature of climate change impacts: not only are they widespread and diverse across the U.S., but they also exacerbate existing disparities[42].

The CVI data was downloaded in tabular format, and then constrained to the state of Florida using census tract boundaries. Based on Lewis and others (2033) the overall climate vulnerability score combines environmental, social, economic, and infrastructure effects on neighborhood-level stability. The state of Florida ranks 16 out of 51 States and Districts in the U.S. and is classified as having a "higher vulnerability" and is in the 70th national vulnerability percentile[43]. Of the ten most vulnerable census tracts in the state of Florida, seven are within Duval Country and three fall within the RRPA. Putnam and Hillsborough counties share the top ten spots with Duval, Putnam ranked first and third in vulnerability, and Hillsborough ranked ninth. Figures 14 and 15 show the CVI data constrained to the RRPA. The CVI shows what is ***driving*** vulnerability, including chronic diseases, exposure to harmful pollutants and inadequate access to fresh, nutritious foods. Figure 14 maps the overall climate vulnerability scores (.68 is the highest score in Florida)[44]. Figure 15 shows the census tracts in the RRPA with the nationwide percentiles labeled on each tract. These percentiles represent the overall CVI value at a particular rank. For example, census tract 113 is in the 95th percentile, a common interpretation is that only 5% of the census tracts in the country are ranked more vulnerable than 113.

[38] Modeled toxic concentrations at parts of streams within 500 meters of tract.
[39] Lewis, P. G. T., Chiu, W. A., Nasser, E., Proville, J., Barone, A., Danforth, C., ... & Craft, E. (2023). Characterizing vulnerabilities to climate change across the United States. *Environment international*, *172*, 107772. (https://www.sciencedirect.com/science/article/pii/S0160412023000454)
[40] Ibid.
[41] Ibid.
[42] Ibid.
[43] https://map.climatevulnerabilityindex.org/report/cvi_overall/florida?mapBoundaries=Tract&mapFilter=9&reportBoundaries=Tract&geoContext=State
[44] Ibid.

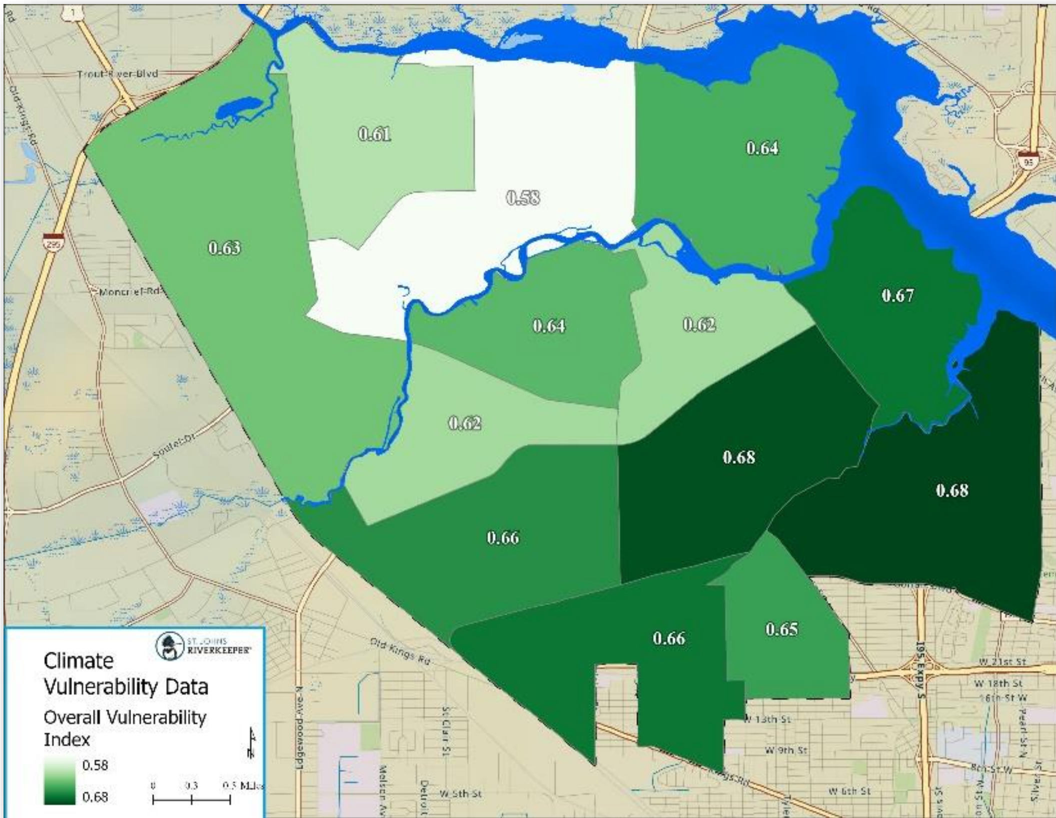

Figure 14 Climate Vulnerability Index by census tracts (Lewis et al. 2023).

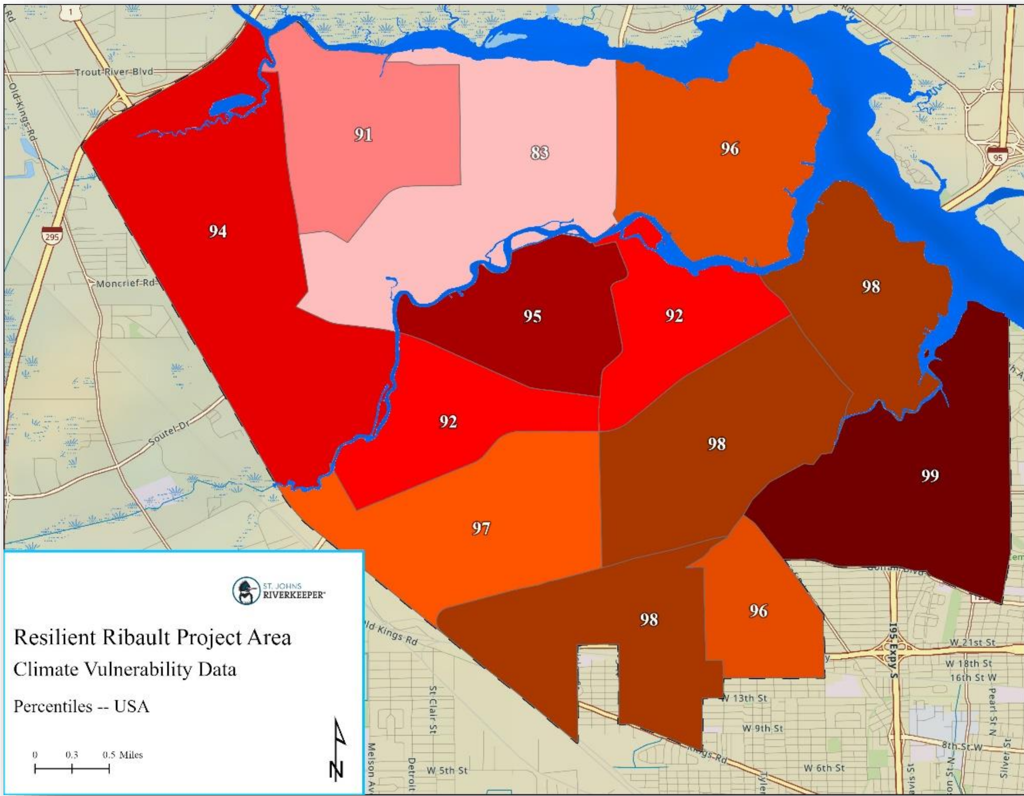

Figure 15: Climate Vulnerability Index percentiles of vulnerability (relative to the entire U.S.)

Flooding Impacts

Flooding along the St. Johns River is commonplace in many areas of the watershed. Unfortunately, increased flood activity across the watershed is predicted, and exacerbated by compound flooding[45]. The RRPA was mapped using the First Street Foundation's Flood Factor model[46] (Figure 16). This methodology incorporates flooding on four fronts: tidal, rain, riverine and storm surge. This is a national dataset, and each census tract is assigned a percentile based on the percent of properties with exposure to flooding in the 100-year flood scenario. Percentiles are relative to all other census tracts in the contiguous United States. This dataset calculates tract-level risk as the share of properties that meet the risk threshold and does not consider property value.

There are several areas of indexed values in the RRPA, and each census tract is labeled (Figure 16). Census tract 110 and 111 are in the highest risk category, falling in the 44th percentile and the 35th percentile, respectively. Census tracts 113, 114, and 107 fall between the 22nd and the 25th percentile and are projected to have a moderately high risk of flooding. The remaining census tracts are at moderate risk of flooding, falling beneath the 20th percentile ranking.

[45] See Juárez, B., Stockton, S. A., Serafin, K. A., & Valle-Levinson, A. (2022). Compound flooding in a subtropical estuary caused by Hurricane Irma 2017. Geophysical Research Letters, 49(18), e2022GL099360.
[46] https://firststreet.org/risk-factor/flood-factor/

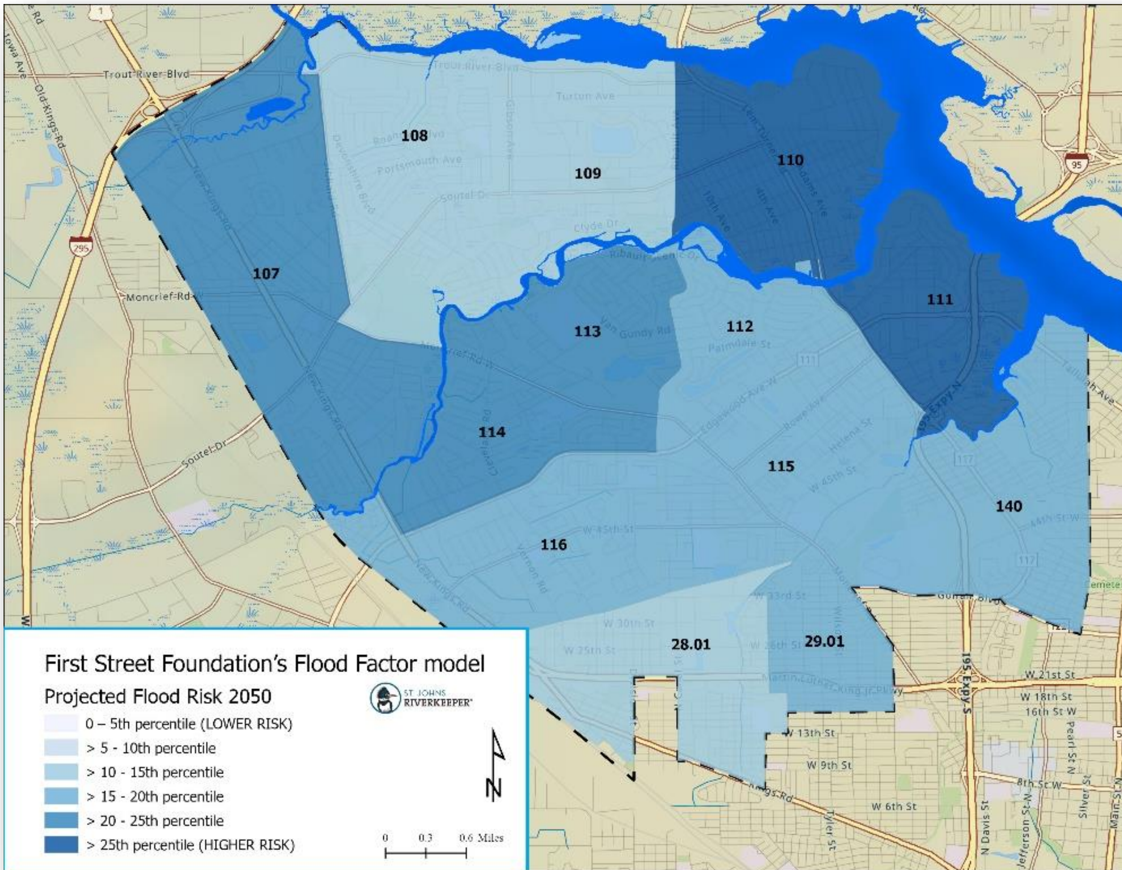

Figure 16: Projected Flood Risk 2050 (FSF 2021)

Prioritization of the Resilient Ribault Project Area

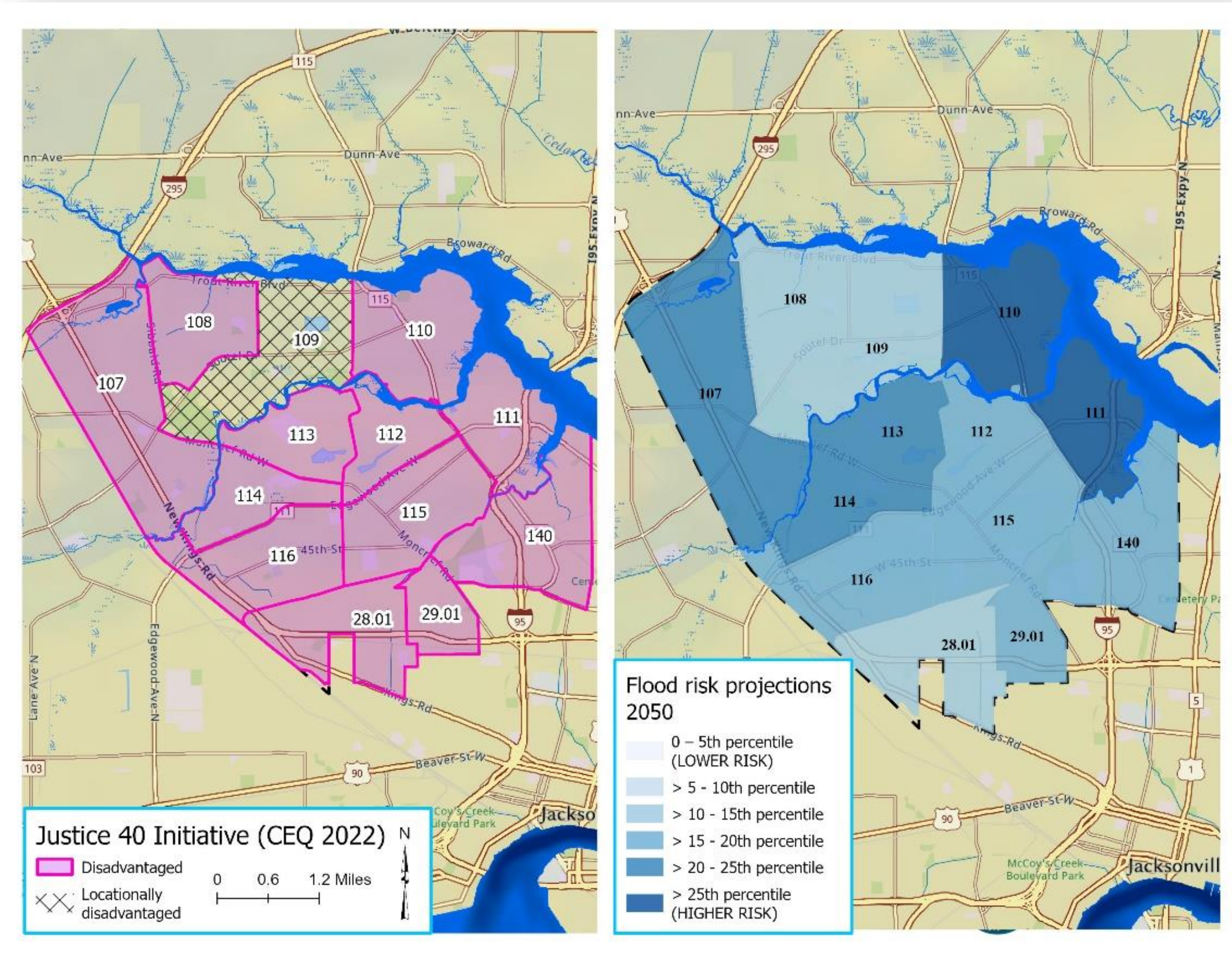

Figure 17: Social Vulnerability and Flood Risk Projections for the RRPA.

Based on initial analysis, the communities adjacent to the Ribault and Trout Rivers are vulnerable on three fronts: environmental stressors (including climate vulnerability), socioeconomic disparities, and flood-based impacts. Census tracts 108 and 112 have the highest indexed values for social vulnerabilities, but all the census tracts in the RRA are indexed at very high values relative to the rest of the Duval County and Florida (Table 2). Census tracts 110 and 111 are particularly vulnerable to flood risk, however, all the census tracts are at risk for some magnitude of flooding. Census tract 111, 113 and 114 have the highest number of burdens based on the Justice40 data, exceeding the thresholds on health, legacy pollution, transportation, energy, workforce development, and wastewater. The CVI (Lewis et al. 2023) placed tract number 140 in the highest percentile for climate vulnerability and ranked it 4th most vulnerable tract in the entire state.

The data shows spatial disparities between climate and social vulnerabilities. As researchers continue to refine these vulnerability indexes, the rankings of census tracts in the RRPA may change, but these thirteen tracts will remain on top of the list of vulnerable census tracts regardless of changes in the parameters and variables in published indices. Without a concerted effort to improve quality of life in the RRPA, this part of the city of Jacksonville will remain vulnerable on many fronts.