



Collaborative Community Vulnerability Assessment for North Charleston

Summary

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Acknowledgements, Authors, Reviewers

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Executive Summary

U.S. EPA worked with the Lowcountry Alliance for Model Communities (LAMC) to apply EPA's *Inland Port Community Resilience Roadmap* to conduct a collaborative community vulnerability assessment for North Charleston. This included three primary activities:

- Desk research on community vulnerabilities
- An initial community resilience workshop to discuss community resilience goals, challenges, and opportunities
- A second community resilience workshop to develop an implementation strategy and share resources with the community

Together, these activities brought together community members and leaders in North Charleston to:

- Develop a shared understanding of community resilience goals and objectives;
- Articulate community resilience opportunities and challenges;
- Support existing resilience activities in the community;
- Identify and prioritize feasible resilience strategies;
- Learn about the EPA Inland Port Community Resilience Roadmap and other resources to help address resilience challenges;
- Expand community partnerships; and
- Develop a feasible and actionable resilience strategy implementation plan.

Community Resilience

The sustained ability of a community to withstand and recover from adversity

At the first workshop, participants developed a set of resilience objectives for their community, which included:

- Environment:
 - Maintain and enhance the environmental quality of the community, including ensuring clean air and effective flood management by using environmental best practices.
- Health:
 - Improve the health of the community by improving access to healthy affordable food options;
 - Enhance individual wellness through the availability of preventative, proactive health care; and
 - Enhance community wellness and networks through physical spaces and wellness programs (e.g., community center).
- Housing:
 - Ensure a holistic approach to housing to ensure a full set of housing options and ownership types are considered including attainable housing, transitional housing, and emergency housing;
 - Create decent, safe, healthy, and affordable housing; and
 - Provide pathways to ownership.

- **Transportation:**
 - Improve safe transportation across all modes, by infrastructure improvements that covers roads, sidewalks, crossing;
 - Maintain access to clean affordable transportation options;
 - Enhance mobility for continued economic opportunities to allow access to employment for the community members and to ensure connectivity; and
 - Improve internal connectedness and external connectedness to other communities and other modes of transportation.
- **Economic opportunity:**
 - Enhance economic opportunities for the community and community members through job skills training and economic development.
- **Community partnerships:**
 - Maintain and enhance partnerships with other community organizations and advocacy groups to improve the quality of life for the community.

Workshop participants then brainstormed a series of resilience challenges and solutions for each objective to form the basis of the implementation plan.

At the second workshop, community members revisited these strategies, identified relevant community partners, and developed implementation priorities, timelines, and points of contact to ensure the North Charleston implementation plan was both actionable and feasible. Table 1 summarizes North Charleston's high priority strategies to focus implementation efforts on.

Table 1. High priority resilience strategies from North Charleston's implementation plan

Objective	Challenge	Solution	Time Frame	Current Partner(s)	Potential Partner(s)	Lead
Transportation	Lack of LAMC transportation liaison	Identify a transportation liaison to take the lead on transportation challenges and foster relationships with various transportation agencies in the region	Immediate			LAMC
Environment	Lack of true problem identification	Develop brownfields inventory	Near-term	SC DHEC Brownfields (Mark Berenbrok)	EPA Brownfields (Brian Holtzclaw, Derek Street)	Herb Rahim, Skip Mikell (with help from high school/ college students and

Objective	Challenge	Solution	Time Frame	Current Partner(s)	Potential Partner(s)	Lead
						summer intern)
Community Partnership	Lack of community participation	Showcase tangible accomplishments to increase community interest in LAMC's work (e.g., develop factsheets and update website)	Near-term		College of Charleston communication interns	Thetyka Robinson (marketing and brand consultant)

Immediate next steps for the community are to:

- Begin implementing high priority strategies outlined in the implementation plan
- Identify any data gaps or resources needs that may limit implementation

I. Introduction

U.S. EPA worked with the Lowcountry Alliance for Model Communities (LAMC) to apply EPA's *Inland Port Community Resilience Roadmap* to conduct a collaborative community vulnerability assessment for North Charleston. LAMC is a nonprofit organization that advocates for environmental justice and promotes community development, education, employment, quality housing, and community involvement. LAMC services the North Charleston community in Charleston County, South Carolina, comprised of seven neighborhoods: Accabee, Chicora/Cherokee, Five Mile, Howard Heights, Liberty Hill, Union Heights, and Windsor Place.

The community is located near several major transportation facilities, including Interstate-26 and several industrial rail and port facilities. Community members are predominantly minority, low income, and elderly.

This included three primary activities:

- Desk research on community vulnerabilities (see Appendix C)
- An initial community resilience workshop (held November 3, 2018) to discuss community resilience goals, challenges, and opportunities
- A second community resilience workshop (held April 26, 2019) to develop an implementation strategy and share resources with the community

U.S. EPA and LAMC hosted the first North Charleston Community Resilience Workshop on November 3, 2018. ICF worked closely with EPA Staff to design and facilitate the workshop. The workshop brought together community members and leaders in North Charleston to:

- Develop a shared understanding of community resilience goals and objectives;
- Articulate community resilience opportunities and challenges;
- Support existing resilience activities in the community;
- Identify feasible resilience strategies; and
- Learn about the EPA Inland Port Community Resilience Roadmap and other resources.

Community Resilience

The sustained ability of a community to withstand and recover from adversity

For the purposes of this workshop, community resilience was defined as the sustained ability of a community to withstand and recover from adversity. Adversity can include both chronic conditions and acute events that may exacerbate existing conditions. Stressors of focus for this project included flooding, extreme heat, sea level rise, aging infrastructure, existing inequalities, and environmental degradation.

Recognizing that port communities, such as Union Heights, face a unique set of resilience challenges by virtue of their proximity to and dependence on a

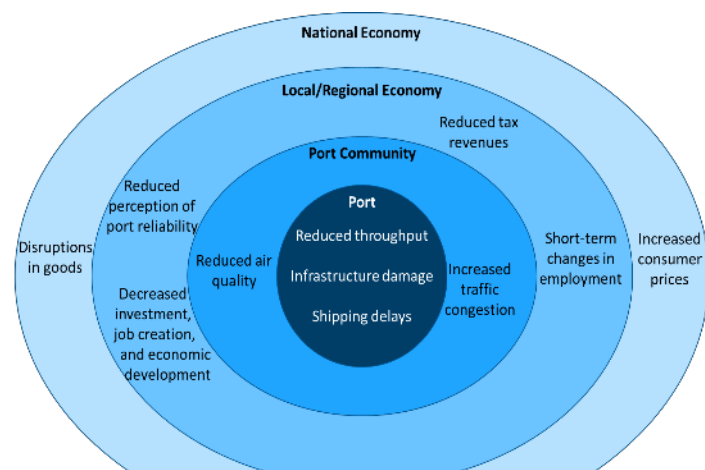


Figure 1. Illustrative summary of impacts of high and low water levels on ports, communities, and economies.

port, workshop participants were also introduced to the [EPA Inland Port Community Resilience Roadmap](#).¹ The roadmap provides step-by-step guidance on increasing port and community resilience to high and low water levels. The typical ripple effects of high and low water levels on ports, communities, local and regional economies, and the national economy are summarized in Figure 1.

As a follow-on to this work, a working session was held on April 26, 2019 in North Charleston to prioritize resilience strategies and develop a feasible implementation plan as well as share key resources with community members. North Charleston's implementation plan is also included in this report.

This report provides a summary of workshop findings and actionable next steps for the Union Heights community to implement.

II. Resilience Workshop Details

U.S. EPA and LAMC held the North Charleston Community Resilience workshop on November 3, 2018 from 9:00am-4:00pm at Calvary Senior Center (2017 Forest Ave. North Charleston, SC 29405). Seventeen community leaders participated in the workshop from the following organizations (see full participant list in Appendix A):

- City of North Charleston
- Charleston Waterkeeper
- Charleston Community Research to Action Board (CCRAB)
- Charleston Audubon
- Community First Land Trust
- Lowcountry Alliance for Model Communities (LAMC)
- New Alpha Community Development Corporation
- Union Heights Community Council
- The Whitney M. Slater Foundation

Prior to the workshop, the project team conducted desk research on resilience challenges and activities in the City of Charleston, the City of North Charleston, and the Port of Charleston to better inform the content of the workshop (see Appendix C). The team collected information on topics such as:

- Port of Charleston activities and the effects on near port communities
- Trends in extreme events (e.g., tidal flooding, sea level rise) in Charleston and North Charleston
- Sustainability and resilience efforts in the City of Charleston

Workshop activities included:

¹ While the roadmap was initially written for inland port communities, the resilience planning model is also transferable to coastal port communities.

- Pre-workshop “resilience walk” through Union Heights on November 2, 2018 to identify resilience challenges and opportunities for further discussion at the workshop the following day.
- A group activity to determine community resilience objectives.
- A group discussion to identify resilience challenges.
- A group activity to identify resilience solutions.
- A presentation and ranking exercise related to the Cumulative Stressors and Resilience Index (CSRI), the results of which are included in this report.

The North Charleston Community Resilience workshop was purposefully designed to mirror the first three steps of the Port Community Resilience Roadmap:

1. Conduct outreach and identify resilience objectives
2. Identify and analyze resilience challenges
3. Identify strategies to improve resilience

III. Resilience Workshop Findings

1. Resilience Walk

LAMC led a neighborhood tour focused on resilience factors (i.e., a “resilience walk”) the day before the workshop to discuss resilience challenges and opportunities within Union Heights and provide background on the community. The resilience walk included 11 participants from EPA, LAMC/CCRAB, ICF, the City of North Charleston Planning Department, Charleston Waterkeeper, and the Union Heights Community Council.

Major community challenges and projects that emerged from the resilience walk included:

- **Recent flooding and identifying the appropriate parties to address flooding**
 - Recent flooding caused \$7,000 worth of damage to Bertha’s Kitchen, attributed to poor drainage at a nearby construction site where a new port access road is being built (Figure 2). The community said it had complained to the South Carolina DOT (SCDOT) that construction materials were blocking the storm drain and causing flooding. SCDOT has since cleared the drains and there has not been any flooding in this area since that time.
 - The community has observed a shift from tidal flooding to more heavy flooding events and is beginning to document flood events with photos and written records.
 - The community has a hard time identifying the responsible party to contact to address various flooding concerns because ownership of stormwater infrastructure is not easily accessible.



Figure 2. Examples of recent construction activity and debris in Union Heights. Photo on the left shows construction barriers that block storm drains (photo: Omar Muhammad). Photo on the right identifies construction debris left after completion of a recent road project (photo: Cassandra Bhat, 11/2/18).

- **Housing condition**

- Much of the housing stock in the Union Heights neighborhood is in poor condition. For example, several homes have damaged roofs, broken windows, or are using makeshift insulation such as blankets to protect their interior from the outdoors (Figure 3). These conditions



Figure 3. Union Heights home with roof damage (top) and using a blanket as insulation (right) (photos: Omar Muhammad).

make the community less resilient to weather events such as heavy rains or heat waves. For example, rain could enter homes with roof damage and cause mold.

- **Affordable housing and heir properties**

- The need for more affordable housing is a pressing issue in the community. On average community members can afford about \$100,000, but new construction now starts at \$150,000, excluding the cost of land. Different communities also have different definitions of affordability. LAMC is working with communities to define affordability in the context of their needs and build more multi-family homes. Zoning and negative perspectives regarding higher-density housing are challenges LAMC is currently working through.

- There are also many heir properties² in Union Heights. Many of these homes are in poor condition, but because there is not a clear title, it is difficult offer aid in making repairs and improvements or sell.

- **Food access**

- Union Heights is recognized as food insecure and many community members are reliant on public transportation and bikes, further amplifying the need for a grocery store within walking distance of the community.
- LAMC is working to acquire and revive an old grocery store that shut down many years prior (Figure 4). The revived grocery store would source from local businesses and farms and include two apartments above the store.



Figure 4. Site of a former grocery store in Union Heights (photo: Cassandra Bhat).

- **Zoning**

- Zoning is a critical challenge that affects housing and small business development in the community. Currently, zoning encourages single family homes in a mostly residential environment. Zoning changes are required to allow more multi-family duplexes to address affordable housing issues and increase housing density. In addition, the community vision is to increase the number of small businesses and amenities.

Other neighborhood projects discussed on the resilience walk include:

- A new port access road is being built near the community, which will decrease truck traffic on neighborhood roads.
- The area adjacent to the new port access road is a brownfield, which will be developed into a passive park for community use. The park will include walking trails, benches, water features, and a vertical community garden. The new park has been subject to a community-design exercise.
- An old highway exit ramp to the port currently splits the Union Heights neighborhood. The community has had discussions with SCDOT about giving the land back to the community once the new port access road is opened rather than conveying the land to North Charleston. If LAMC can secure the land, LAMC hopes to build senior housing.
- LAMC is beginning to work with business owners to implement Community Benefit Agreements, identifying ways the business can give back to the community. For

² Heir property is real property owned by multiple people and informally passed down through generations. Typically, this is from parents or other family members who leave no will. Without a clear title, owners are more vulnerable to laws that allow developers to acquire the property, nor do they qualify for federally funded land improvement programs. The U.S. Department of Agriculture Southern Research Station and the Federal Reserve Bank of Atlanta co-hosted a meeting in July 2017 to address challenges of heirs' property in the South. Proceedings from the meeting were compiled in a technical report and can be accessed via: <https://www.srs.fs.usda.gov/pubs/58543> .

example, a seasonal business could open its doors to residents for other purposes during the off-season or a business could invite kids in to learn about the profession or trade.

The workshop kicked off with a series of photos from the resilience walk and a discussion around resilience in Union Heights. Challenges focused on home maintenance and repairs, such as properly insulating homes and repairing roofs, recognizing that available funds are often a limitation of addressing these problems. However, without addressing these challenges, the impacts of extreme heat and heavy rains can be more severe (e.g., leaking roof). Neighborhood flooding is another challenge as many residents have both limited funds and mobility. If a car or road is flooded, a resident may not be able to get to work and earn the money needed to pay for repairs.

Workshop participants also discussed what resilience means to them considering these challenges:

- Resilience is decreasing suffering from extreme heat, flooding, and other events. Recovery efforts following extreme events is an important component of resilience as well.
- Resilience is improving the economic viability of the community (e.g., adding a grocery store to address food insecurity).
- Resilience is changing the way the community is viewed from the city, county, and state level so that resources are appropriately allocated to the community without having to fight for them.

2. Resilience Objectives

To develop a set of resilience objectives specific to the community, workshop participants wrote down their own objectives for community resilience on sticky notes and placed them on the wall under the following categories from the Roadmap (see Figure 5):

- Environment
- Health
- Housing
- Transportation
- Other

With participant input, facilitators then arranged the sticky notes into like clusters (subsequently referred to as “themes”) and discussed as group. See Appendix B for the complete set of sticky note responses. The group then jointly shaped the emerging themes into specific objective statements for each of the categories.

During the activity, two new categories emerged from “Other,” which are used from this point forward:

- Economic opportunity



Figure 5. Example from resilience objectives exercise: environment category.

- Community partnerships



Figure 6. Workshop participants complete the resilience objectives activity (photo: Robert Kay).

2.1 Environment

Overall Community Environment Objective

- *Maintain and enhance the environmental quality of the community, including ensuring clean air and effective flood management by using environmental best practices.*

The environmental objectives fell into three primary themes:

- **Air quality** – Participants noted the need to improve air quality in the community. A key component of this objective is air quality monitoring: by documenting air quality (e.g., through mobile or stationary monitors and in specific locations such as near the port), the community can better identify opportunities for improvement.
- **Stormwater management and flood control** – Several participants identified the need to reduce flooding in the community through better stormwater management and improved drainage. Specific suggestions included collaborating with partners on stormwater management issues and encouraging the use of green infrastructure and streetscape design.
- **Brownfields** – The community contains many brownfields, and community members noted the goal to address brownfield contamination and, in particular, develop a strategy to transition local brownfields into restoring these properties to productive re-use (e.g., “healthfields” and environmentally-friendly businesses) and revitalizing impacted neighborhoods.

In addition, participants identified the following environmental objectives that didn’t neatly fit into the above categories, including:

- Reduce mold – Mold is a key issue in the community at the intersection of both air quality and stormwater management issues. Flooding often leads to mold growth in homes, which further reduces indoor air quality.
- Improve erosion control due to construction
- Increase access to green space

2.2 Health

Overall Community Health Objectives

- *Improve the health of the community by improving access to healthy affordable food options;*
- *Enhance individual wellness through the availability of preventative, proactive health care; and*
- *Enhance community wellness and networks through physical spaces and wellness programs (e.g., community center).*

The health objectives fell into three primary themes:

- **Food access** – Participants noted the need for a full-service grocery store or “food hub” in the community to improve access to affordable and quality food. Participants also identified a need for food health education.
- **Health care services** – Several participants identified the need for accessible health care in the community with a particular focus on preventative and proactive health care. Specific suggestions included creating a consistent health screening program and increasing opportunities for fitness. The Senior Center at Dorchester was mentioned as a model example that could be replicated in Union Heights, offering fitness programs, wellness programs on health and diet, and an on-site registered nurse.
- **Community networks** – Related to health care services, participants identified a goal for more community networks to increase social interactions and connectedness. Suggestions included a Union Heights community center, which could also encompass the health care services and programs mentioned previously as well as outdoor community spaces for walking, biking, and socializing.

2.3 Housing

Overall Community Housing Objectives

- *Ensure a holistic approach to housing to ensure a full set of housing options and ownership types are considered including attainable housing, transitional housing, and emergency housing;*
- *Create decent, safe, healthy, and affordable housing; and*
- *Provide pathways to ownership.*

The housing objectives fell into four primary themes:

- **Attainable housing** – Participants identified increasing the availability of decent, safe, healthy, and attainable housing as a major objective for the community. Affordable housing brackets do not always include everyone, so the community is focused on expanding attainable housing that meets the unique needs of the community. This effort includes building new housing and rehabilitating existing housing stock.
- **Housing options** – Another community objective was to have a continuum of housing options available to meet a variety of needs, including emergency housing, post-disaster housing, and transitional housing.
- **Homeowner education** – Participants identified homeownership education as an important community resilience objective, particularly for first-time home buyers. Specific suggestions include providing information on pathways to home ownership to help people navigate buying a home and for providing home buyers with information on how to care for and maintain their homes. Several home improvement challenges were identified by participants including insulation, foundation improvements and aging infrastructure.
- **Zoning** – Current zoning presents several challenges for improving and expanding housing options. Re-zoning for multi-family homes would help to provide alternatives to single family homes in the community.

2.4 Transportation

Overall Community Transportation Objectives

- *Improve safe transportation across all modes, by infrastructure improvements that covers roads, sidewalks, crossing;*
- *Maintain access to clean affordable transportation options;*
- *Enhance mobility for continued economic opportunities to allow access to employment for the community members and to ensure connectivity; and*
- *Improve internal connectedness and external connectedness to other communities and other modes of transportation.*

The transportation objectives fell into three primary themes:

- **Road and infrastructure improvements** – Several participants identified a need for road and infrastructure improvements, including improving sidewalks and through traffic control.
- **Mobility and safety** – Participants identified improving mobility and safety within and between communities as a major goal as many residents walk, bike, or rely on public transit. Specific suggestions included increasing the connective tissue between communities through bike paths, transit routes, and the Hospitality on Peninsula (HOP) park and ride service and implementing signage and safety improvements to make the community more pedestrian and bike friendly.
- **Alternative transportation modes** – Several participants also suggested expanding clean, affordable, alternative transportation modes. Specific suggestions included

electric cars and buses, hydrogen-fueled cars, mopeds, and mass transit such as bus rapid transit (BRT).

2.5 Economic opportunity

Overall Community Economic Opportunity Objective

- *Enhance economic opportunities for the community and community members through job skills training and economic development.*

The economic opportunity objective focuses on increasing community economic opportunities through a variety of means. Specific suggestions included:

- Increasing financial literacy
- Improving job skills, including soft skills like resume writing, punctuality, and professional dress
- Increasing educational attainment for both adults and youth
- Re-zoning to allow more economic development in the community

2.6 Community partnerships

Overall Community Partnership Objective

- *Maintain and enhance partnerships with other community organizations and advocacy groups to improve the quality of life for the community.*

The community partnerships objective emerged as a cross-cutting community objective. Several participants identified community partnerships as a component of achieving the environment, health, housing, transportation, and economic opportunity objectives.

3. Resilience Challenges and Solutions

Workshop participants then identified resilience challenges for each objective during a group discussion. The discussion was framed around the question of: what are the challenges to achieving your resilience objectives? Challenges were written on flip charts and discussed as a group.

Later in the afternoon, participants wrote potential solutions to these challenges on sticky notes and placed them next to the corresponding challenge from the previous discussion (see Figure 7). Participants considered the following key questions:

- Are there upcoming opportunities to boost resilience?
- What are the strategies for addressing challenges or seizing opportunities?
- What about strategies for increasing resilience?
- Who is the responsible party to implement each strategy?

The following sections summarize the resilience challenges and solutions from these two activities.



Figure 7. Participants identified solutions for specific resilience challenges (photo: Robert Kay).

Building on the findings from workshop one, a working session was held on April 26, 2019 to develop an actionable implementation plan and determine priorities and next steps for the community (see Figure 8). Where possible, community leadership identified an implementation timeframe, current and potential partners, and a lead individual or organization for each resilience challenge and solution. The implementation plan is structured to be a living document that the community can continue to modify and prioritize actions as needed.

See Appendix D for additional details on the working session and resource sharing opportunity for community members to better address resilience challenges.

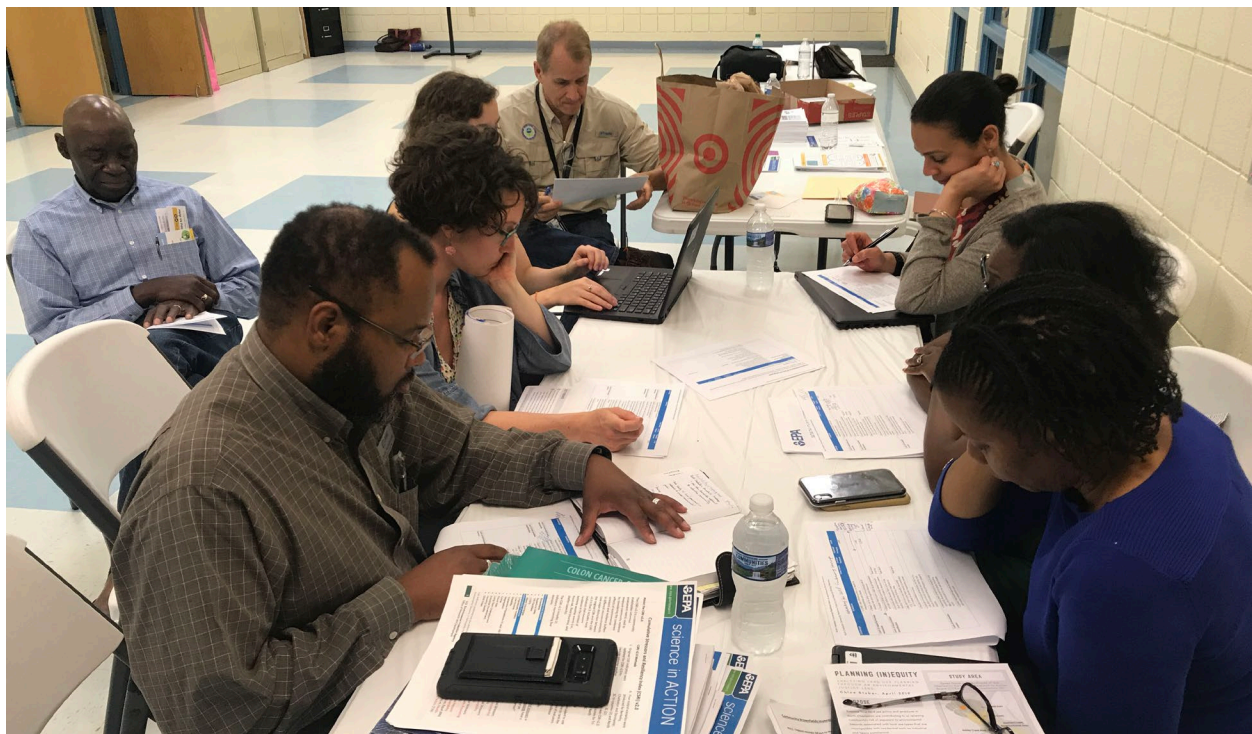


Figure 8. In the April 2018 working session, LAMC/CCRB members worked through the resilience challenges and solutions to develop an actionable implementation plan (photo: Robert Kay).

3.1 Environment

Participants identified five major environment-related resilience challenges and a variety of potential solutions, summarized in Table 2. The timeframes, current and potential partners, and lead individuals or organizations columns reflect additions from the April 2019 working session.

Table 2. Environment-related resilience challenges and solutions

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
Communication challenges and lack of defined responsibility/authority	<ul style="list-style-type: none"> • Establish stronger relationship with EPA (lean more on Sheryl Good) • Communicate and coordinate with environmental advocacy organizations • Attend local and regional meetings and hearings to increase understanding of what's happening around the area and create new partnerships 	Ongoing	EPA Office of EJ (Sheryl Good)	EPA Brownfields (Brian Holtzclaw, Derek Street), NEPA (Ntale Kajumba), Stormwater (Mike Mitchell), Indoor Air (Heidi); State agencies such as SC DHEC (Mark Berenbrok)	LAMC
	<ul style="list-style-type: none"> • Develop a communication plan to amplify the community's voice (Brian Holtzclaw to share communication plan template) 	Near-term			LAMC, CCRAB

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
	<ul style="list-style-type: none"> Utilize a variety of methods for sharing information with the community: <ul style="list-style-type: none"> Reactivate street captains to distribute information door-to-door Post flyers Send texts or emails to a list of community members Post on social media (e.g., establish active Facebook pages for LAMC, CCRAB, and Union Heights neighborhood) Establish a buddy/call system to check in on neighbors and support social networks 	Near-term			High school student or college intern for LAMC or CCRAB
	<ul style="list-style-type: none"> Meet with LAMC community representatives to better understand responsibilities 				LAMC
	<ul style="list-style-type: none"> LAMC take official position on issues so responsibilities are clearer 				LAMC
Lack of capacity/human resources	<ul style="list-style-type: none"> Reach out to other communities/groups to partner with and organize resources (Brian Holtzclaw to investigate West Coast Org) 	Ongoing	Thetyka Robinson (marketing and branding consultant); Network for Good fundraising training	West Side Future Funds; West Coast Org	LAMC
	<ul style="list-style-type: none"> Consider how to grow LAMC as an organization 				LAMC
Lack of true problem identification	<ul style="list-style-type: none"> Continue CCRAB community-based research and data collection to take to decision-makers 	Ongoing			CCRAB

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
	<ul style="list-style-type: none"> • Coordinate with Senator Senn (Chair of the South Carolina legislature's task force on flooding) regarding flooding data 	Near-term	Charleston legislature delegation	Allen Fountain	Skip Mikell
	<ul style="list-style-type: none"> • Map storm drains and identify ownership <ul style="list-style-type: none"> ◦ E.g., Color-code maps based on ownership so it is easier to identify responsible parties 	Near-term	City of North Charleston	College of Charleston	Butch Barfield
	<ul style="list-style-type: none"> • Develop a local brownfields inventory using new community-based survey tool. Research best practices to apply for an EPA Brownfields Community-Wide Assessment Grant (\$300,000; Fall 2019) in order to successfully conduct Phase I and Phase II assessments and conduct brownfields planning and develop site re-use plans for N. Charleston. 	Near-term	SC DHEC (Mark Berenbrok)	EPA Brownfields (Brian Gross, Brian Holtzclaw)	Herb Fraser-Rahim, Skip Mikell (with help from high school/ college students and summer intern)
	<ul style="list-style-type: none"> • Leverage university partnerships and low to no-cost labor to conduct studies and identify root causes of problems using participatory research methods 	On-going	UMD, College of Charleston; NC A&T State University	CUPP (Michael Burns)	Dr. Crabtree – educational PLC for LAMC
Lack of stormwater control	<ul style="list-style-type: none"> • Implement green infrastructure designs in new community development projects, including Mary Lee Davis park to help with stormwater control 	See Local Food Local Places action plan	Charleston Waterkeeper; Calvary AME Church; Charleston County	Mike Mitchell (EPA); Bob Rosen/Brian Holtzclaw (EPA); EPA ORD	Jessica Norris (Audubon Society); Steering committee/task force for park

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
	<ul style="list-style-type: none"> • Contact stormwater management personnel in North Charleston to inquire about ownership and drainage capacity 	Near-term			Skip Mikell
	<ul style="list-style-type: none"> • Contact responsible agencies to create a stormwater management plan 			Mike Mitchell (EPA)	Skip Mikell
	<ul style="list-style-type: none"> • Identify, create, and enforce storm system codes 				CCRAB, College of Charleston
	<ul style="list-style-type: none"> • Leverage National Pollutant Discharge Elimination System (NPDES) permitting process 			Mark Nuhfer (EPA)	Herb Rahim
Lack of community input on zoning decisions	<ul style="list-style-type: none"> • Develop a community plan that documents the wants of the community and identifies the type of necessary zoning <ul style="list-style-type: none"> ◦ When zoning decisions or development projects don't align with the plan, push back • Update LAMC's revitalization plan from April 2009, which was adopted by the city <ul style="list-style-type: none"> ◦ Justify use of technical assistance funds to LAMC/CCRAB board to update revitalization plan (a lot of new development coming to the area) 	Ongoing			Chloe Stuber
	<ul style="list-style-type: none"> • Establish a group to document and share zoning decisions with the community and collect comments on decisions to bring back to the City • Identify a point person, someone with a good understanding of zoning 	Ongoing			Chloe Stuber

3.2 Health

Participants identified three major health-related resilience challenges and a variety of potential solutions, summarized in Table 3. The timeframes, current and potential partners, and lead individuals or organizations columns reflect additions from the April 2019 working session.

Table 3. Health-related resilience challenges and solutions

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
Lack of quality food options near the community	<ul style="list-style-type: none"> • Develop a food-hub in the community <ul style="list-style-type: none"> ◦ LAMC purchase old grocery store and turn into functioning grocery store sourcing local products ◦ City of North Charleston could subsidize a food co-op 	Long-term	Lowcountry Local Firsts; Grow Foods; Fresh Future Farms; Adam McConnell (City of North Charleston)		Rodly Millet
	<ul style="list-style-type: none"> • Make the business case to grocers: <ul style="list-style-type: none"> ◦ Find examples/case studies of other communities with similar demographics who have grocery stores ◦ Collect data on purchases and the successes of the grocery store to show others why they should come here ◦ Educate the community to lower theft 	Long-term	City of North Charleston	City of North Charleston	Rodly Millet
	<ul style="list-style-type: none"> • Offer buyers good quality food at affordable prices to increase the number of customers (recognize that this may mean an initial loss of profits until the number of customers increases) 	Long-term			Rodly Millet
Lack of physical spaces	<ul style="list-style-type: none"> • Raise funds for a fitness center or sports field 	Done	Metanoia		LAMC
	<ul style="list-style-type: none"> • Add bike/walking trail to Mary Lee Davis park 	See Local Foods Local		Kaboom	

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
		Places action plan			
Lack of wellness programs and resources	• Create a local wellness initiative	Ongoing	Pfizer		Tawana Muhammad LAMC, CCRAB, UHCC
	• Educate the community on healthy living (e.g., diet, exercise)	Ongoing	Pfizer		Tawana Muhammad LAMC, CCRAB, UHCC

3.3 Housing

Participants identified four major housing-related resilience challenges and a variety of potential solutions, summarized in Table 4. The timeframes, current and potential partners, and lead individuals or organizations columns reflect additions from the April 2019 working session.

Table 4. Housing-related resilience challenges and solutions

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
Challenges with heir properties	<ul style="list-style-type: none"> Identify heir properties and partner with Center for Heirs Preservation (CHP) to work through properties one-by-one 	Ongoing	CHP		Henrietta Woodward; Rodly Millet
	<ul style="list-style-type: none"> Establish a dedicated person to deal with heir properties (e.g., an internship for a student at Charleston Law School) 				Henrietta Woodward
Competition from developers leading to less attainable housing	<ul style="list-style-type: none"> Zoning advocacy: <ul style="list-style-type: none"> Inclusionary zoning Environmental preservation 				Henrietta Woodward
	<ul style="list-style-type: none"> Continue to establish community benefit agreements (CBA) 	Done	Chicora/Cherokee; Metanoia, Reynolds Avenue Association		Henrietta Woodward
	<ul style="list-style-type: none"> Set up meeting with city to see how taxes are adjusted for existing properties Set up meeting with city to discuss taxes and prevent residents from being priced out 				Henrietta Woodward; Adam (Special Assistant to the Mayor); Ryan Johnson (Special Assistant)

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
Challenges with increasing homeownership	<ul style="list-style-type: none"> • Increase access to capital 	Ongoing	Charleston County Housing Tax Force		Henrietta Woodward; LAMC/Charleston County Housing Tax Force
	<ul style="list-style-type: none"> • Educate community to report capital denials, such as loan rejections (e.g., Community Reinvestment Act) <ul style="list-style-type: none"> ◦ Collect information on capital denials at community meetings (e.g., spotlight meeting topic) or at pop up meetings 				LAMC
	<ul style="list-style-type: none"> • Offer first-time buyer/homeowner education opportunities (e.g., provide binders with information on how to care for your home) 	Ongoing	Charleston Trident Urban League; Metanoia; Origins		Henrietta Woodward
Current zoning limits rebuilding and mixed use	See solutions related to zoning in Table 2				Chloe Stuber

3.4 Transportation

Participants identified six major transportation-related resilience challenges and a variety of potential solutions, summarized in Table 5. The timeframes, current and potential partners, and lead individuals or organizations columns reflect additions from the April 2019 working session.

Table 5. Transportation-related resilience challenges and solutions

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
Lack of LAMC transportation liaison	<ul style="list-style-type: none"> Identify a transportation liaison to take the lead on transportation challenges and foster relationships with various transportation agencies in the region 	Immediate			LAMC
Patchwork of ownership of roads and storm drainage infrastructure	<ul style="list-style-type: none"> Work with College of Charleston professor/Chloe (in progress) to review and compile GIS data for zoning and flooding Send Chloe additional ideas for where GIS/visualization would be helpful <ul style="list-style-type: none"> Storm drains – where are they, who owns them, what is the capacity Roads and other infrastructure – which transportation agencies own what 	Ongoing	College of Charleston	Mike Mitchell (EPA); Local/regional transportation agencies; CUPP (Michael Burns)	Chloe Stuber
Connectedness	<ul style="list-style-type: none"> Connect different modes of transportation to provide safe quick access to work, neighboring communities, food, etc. 		SC Livable Communities Alliance; BCDCOG	SCDOT Safe Routes to Schools (Rodney)	
	<ul style="list-style-type: none"> Better connect Spruill Avenue to the city and to the Hop (e.g., bike path) 	Ongoing		City of North Charleston	
	<ul style="list-style-type: none"> Conduct a local transit study in the seven LAMC neighborhoods to identify transit demand, gaps, and challenges. Bring a transit proposal to CARTA based on data from the study. 			CUPP; University (CC, NCAT, UMD)	

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
Lack of engagement with transportation agencies	<ul style="list-style-type: none"> • Contact CARTA and request participation in meetings (e.g., planning meetings) to express community concerns and ascertain how community can be better accommodated 		BCDCOG, SC Livable Communities Alliance	FHWA SC Division; SCDOT	
	<ul style="list-style-type: none"> • Collaborate with transportation agencies and advocacy groups to work on transportation concerns with a regional approach 		BCDCOG, SC Livable Communities Alliance	FHWA SC Division; SCDOT	
	<ul style="list-style-type: none"> • Contact local government to hear issues and plan for reasonable solutions 				
	<ul style="list-style-type: none"> • Contact Sharon Hollis at Berkeley-Charleston-Dorchester Council of Governments (BCDCOG) to request a presentation on BRT and Regional Transportation Plan 		BCDCOG		
Lack of investment in existing transportation infrastructure	<ul style="list-style-type: none"> • Identify appropriate parties and reach out to all levels of government who are responsible for resolving transportation issues in the community 				
	<ul style="list-style-type: none"> • Add more parking in neighborhood 				
	<ul style="list-style-type: none"> • Launch a tactile urbanization campaign, focusing on improving existing infrastructure: <ul style="list-style-type: none"> ○ Complete streets ○ Build a Better Block initiative ○ Community-built bus shelters 				
Lack of bike/pedestrian safety considerations	<ul style="list-style-type: none"> • Coordinate with Charleston Moves regarding bike safety 		Charleston Moves		
	<ul style="list-style-type: none"> • Coordinate with BCDCOG/SCDOT regarding bike and pedestrian safety 		BCDCOG	SCDOT	

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
	<ul style="list-style-type: none"> • Provide adequate protection to bikers/pedestrians from vehicular traffic, such as through: <ul style="list-style-type: none"> ◦ Protected bike lanes ◦ One-way streets ◦ Speed bumps ◦ Painted cross walks ◦ Streetscaping 				BCDCOG; SCDOT; Charleston Moves
Lack of political will	<ul style="list-style-type: none"> • Meet with legislative representatives for 29405 zip code <ul style="list-style-type: none"> ◦ Establish regular communications ◦ Meet outside of election season 	Ongoing			LAMC
	<ul style="list-style-type: none"> • Partner with other advocacy groups and address legislators 	Ongoing	SC Livable Communities Alliance		LAMC
	<ul style="list-style-type: none"> • Attend City Council meetings and express community concerns 	Ongoing			LAMC
	<ul style="list-style-type: none"> • Host candidate forums in the community 	Ongoing			LAMC
	<ul style="list-style-type: none"> • Bring candidates/legislators/decision-makers on “walk and talk” through the community to discuss issues and show them firsthand how they can help <ul style="list-style-type: none"> ◦ Reframe existing EJ tours to be more appealing to candidates (e.g., livable communities, healthy communities, resilience walk) 				Rodly Millet

3.5 Economic opportunity

Participants identified four major economic opportunity-related resilience challenges and a variety of potential solutions, summarized in Table 6. The timeframes, current and potential partners, and lead individuals or organizations columns reflect additions from the April 2019 working session.

Table 6. Economic opportunity-related resilience challenges and solutions

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
Lack of workforce development	• Form partnerships with companies that will offer skills trainings	Ongoing	SC Works; Trident Literacy; Pfizer; Turning Leaf		
	• Open a technical school to provide skills training	Ongoing	Charleston Country School District		Charleston Country School District
	• Create opportunities for workforce development near unemployed and underemployed residents	Ongoing			LAMC
	• Create partnerships between high schools and possible employers for summer internship opportunities and later employment	Ongoing			LAMC
Lack of soft skills	• Provide a high school course that teaches students how to prepare for a job (e.g., write a cover letter and resume, dress professionally)	Near-term	SC Works		
Lack of access to capital	• Expand LAMC revolving loan program	Ongoing			LAMC
	• Identify lenders that are willing to work with LAMC to make additional funds available to LAMC	Ongoing	Coastal Community Foundation;		

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
			Network for Good		
	<ul style="list-style-type: none"> Encourage and recruit new small business investment 	Ongoing	UHCC, City of North Charleston, Charleston County, South Carolina Government		UHCC, LAMC, City of North Charleston, Charleston County, South Carolina Government
Educational inequality					
Other	<ul style="list-style-type: none"> Raise awareness of how to get flood insurance 	Done			

3.6 Community partnerships

Participants identified three major community partnership-related resilience challenges and a variety of potential solutions, summarized Table 7. The timeframes, current and potential partners, and lead individuals or organizations columns reflect additions from the April 2019 working session.

Table 7. Community partnership resilience challenges and solutions

Challenge	Solutions	Time Frame	Current Partners	Potential Partners	Lead
Lack of communication between partners and groups and competition for resources	• Improve the business case for partnerships	Ongoing			
	• Define clear roles and responsibilities to limit overlap and duplication of services	Ongoing			
	• Integrate solutions into LAMC communication plan	Near-term			
Lack of community participation	• Showcase tangible accomplishments to increase community interest in LAMC's work <ul style="list-style-type: none"> ◦ Develop fact sheets that highlight LAMC's accomplishments that can be handed out at meetings ◦ Update website and use social media to raise awareness of LAMC's accomplishments 	Near-term		College of Charleston communication interns	Thetyka Robinson (marketing and brand consultant)
	• Include community in decision-making processes and assign community members specific tasks so they feel more involved				
	• Involve community members in the development of a community disaster/emergency management plan and train residents in emergency response	Near-term	College of Charleston	Clemson Emergency Management Center	Clemson
	• Create a junior board to mirror organizations like LAMC	Ongoing			LAMC

	<ul style="list-style-type: none"> ○ Pilot in Union Heights first at a community level 			
Lack of tangible accomplishments or “champion” examples	<ul style="list-style-type: none"> • Develop and share annual reports, revitalization plan, factsheets, story maps • Update website and social media (good opportunity for a high school or college student) • Develop a podcast 	Ongoing	College of Charleston; Benedict College (Sheryl Good is an active alumna)	Thetyka Robinson (marketing and brand consultant)

3.7 Cross-cutting solutions

Several cross-cutting resilience solutions also emerged during the discussion, including:

- Voting for individuals who will support the community and having a more active relationship with elected officials.
- Re-zoning Union Heights to allow for multi-family homes, small business development, and community amenities.
- Developing a communication plan to address communication challenges among various organizations and levels of government.
- Assigning clear roles and responsibilities for each community organization to limit duplicative actions.

IV. Conclusions and Next Steps

Three immediate and high priority next steps emerged from the resilience challenges and solution discussion at the first workshop:

- **Problem identification** – Additional data collection and monitoring is needed to identify the main cause of environment, health, housing, transportation, economic opportunity, and community partnership challenges. Otherwise resources are spent treating symptoms and surrounding issues rather than the root cause. In addition, an effort should be made to identify these problems proactively, such as proactively identifying, inventorying and prioritizing all brownfields in the community before redevelopment.
- **Role, responsibilities, and coordination** – Duplicative work is being done by different organizations in the community. Defining clear roles and responsibilities for each organization will help to limit overlap and provide ownership of certain tasks. In addition, identifying opportunities for community groups to work together in a coordinated effort could increase efficiency and productivity.
- **Stormwater mapping** – The College of Charleston is beginning a GIS project to map zoning and flooding locations for LAMC. Workshop discussions revealed that there is limited knowledge and data regarding what organizations are responsible for what elements of the stormwater drainage system making it challenging for the community to know who to contact when there are issues. As a result, the College of Charleston team should also consider mapping storm drain locations, the ownership body, and capacity of each storm drain.

At the follow-up working session, the community worked through the resilience challenges and solutions tables from Section III.3 and assigned responsibilities for each strategy. In addition, community participants began to prioritize strategies and develop implementation targets and timelines. A few high priority resilience strategies that emerged include:

- Identifying a transportation liaison to build relationships with the various local, regional, and state transportation organizations and lead the implementation of the other transportation strategies.
- Conduct a brownfields inventory with help from high school students or college interns and conduct a later brownfields prioritization exercise with community partners.
- Showcase tangible accomplishments to increase community interest in LAMC's work (e.g., develop factsheets and update website)

Immediate next steps for the community are to:

- Begin implementing high priority strategies outlined in the implementation plan
- Identify any data gaps or resources needs that may limit implementation

Finally, several existing LAMC efforts are already helping to address the resilience challenges (see Figure 9 for one example), many of which are noted as “ongoing” solutions in Table 2-Table 6. LAMC can take advantage of the community resilience benefits of these actions as articulated in this report to continue to build support for their programs.



Figure 9. LAMC-purchased home in Union Heights, set aside to become quality affordable housing in the community (photo: Cassandra Bhat).



Figure 10. EPA presented a Certificates of Appreciation to Omar Muhammad and to LAMC for the significant work in the community to date, and successfully implementing the resilience roadmap planning process. (photo: Amanda Vargo).

Appendix A: Resilience Workshop Participants

Table 8. Resilience Workshop participants (November 8, 2018)

Name	Organization (if applicable)
Rodly Millet	Community Advocate
Michael Brown	City of North Charleston/Commissioner
Jaleel A. Bradley	LAMC
Herbert Maybank	LAMC
Skip Mikell	CCRAB/UHCC
Loretta Slater	The Whitney M. Slater Foundation
Rev. Leo Woodberry	New Alpha CDC
Roosevelt Mouzoi	19TO Glolawd
Barbara Fordham	LAMC
Henrietta Woodward	LAMC/CFLT
Melvin Smalls	LAMC
Rahim Karriem	LAMC
Jessica Norris	Audubon
Kent Griffin	Charleston Waterkeeper
Omar Muhammad	LAMC
Chloe Stuber	LAMC
Sheryl Good	EPA Region 4
Siobhan Whitlock	EPA Region 4 (by phone)
Robert Kay	ICF
Cassandra Bhat	ICF
Amanda Vargo	ICF
Kristen Naney	North Carolina A&T State University

Appendix B: Resilience Objective Sticky Notes

The following sections list participant's verbatim sticky note responses from the Resilience Objectives activity at the workshop.

1. Environment

Table 9. Sticky note responses for environment objectives

Theme	Objectives (as written on sticky notes)
Air quality	<ul style="list-style-type: none">• Cleaner air• Air quality (x2)• Maintain/improve air quality• Air quality monitors (stationary and mobile) to improve air quality• Monitor air quality near port
Stormwater management	<ul style="list-style-type: none">• Stormwater management (x2)• Flood control• Collaborate with partners for stormwater management• Improve flood water draining• Reduce flooding• Green infrastructure• Streetscape design
Brownfields	<ul style="list-style-type: none">• Brownfield contamination• Brownfield to "healthfield" strategy for area brownfields
Other	<ul style="list-style-type: none">• Erosion control due to construction• Increase access to green space• Mold

2. Health

Table 10. Sticky note responses for health objectives

Theme	Objectives (as written on sticky notes)
Food access	<ul style="list-style-type: none">• Full service grocery store• Food education• Food hub community can have access to necessities• Improve food sources – stores and water
Health care services	<ul style="list-style-type: none">• Accessible health care in the community• Create consistent health screening program• Preventative/proactive health care• Fitness options

Theme	Objectives (as written on sticky notes)
Community networks	<ul style="list-style-type: none"> • Places to support social networks • Increase opportunity to walk and bike our community

3. Housing

Table 11. Sticky note responses for housing objectives

Theme	Objectives (as written on sticky notes)
Attainable housing	<ul style="list-style-type: none"> • Increase housing • Affordable housing • Erect/rehab affordable housing • Build housing that is safe and affordable • Provide decent, safe, healthy, attainable housing
Housing options	<ul style="list-style-type: none"> • Provide continuum of housing options • Emergency housing (during periods of repairs) • Post-disaster housing • Transitional housing
Home ownership	<ul style="list-style-type: none"> • Homeowner education • Pathways to homeownership • Insulation of homes • Foundation improvement of homes • Housing rehab (those who need assistance) • Improve better housing stock • Improve aging infrastructure
Zoning	<ul style="list-style-type: none"> • Re-zoning

4. Transportation

Table 12. Sticky note responses for transportation objectives

Theme	Objectives (as written on sticky notes)
Road and infrastructure improvements	<ul style="list-style-type: none"> • Through traffic control • Road improvement • Road and infrastructure improvements • Sidewalks • Designated parking areas • Improve signage
Mobility/safety	<ul style="list-style-type: none"> • Improve mobility within the community • Ability to walk safely around the community

Theme	Objectives (as written on sticky notes)
	<ul style="list-style-type: none"> • Connecting communities • Improve signage
Alternative transportation modes	<ul style="list-style-type: none"> • Clean, affordable options • Electric cars and buses • Non-fossil fuel-based transport (hydrogen-fueled cars) • Bike lanes/trails • Mopeds (improve safety, acknowledge use) • BRT mass transit

5. Economic Opportunity

Table 13. Sticky note responses for economic opportunity objectives

Theme	Objectives (as written on sticky notes)
Economic opportunities	<ul style="list-style-type: none"> • Increase community economic opportunities • Financial literacy • Increase educational attainment for both adults and youth • Identify job skills • Re-zoning issues

6. Community Partnership

Table 14. Sticky note responses for community partnership objectives

Theme	Objectives (as written on sticky notes)
Community partnerships	<ul style="list-style-type: none"> • More community partnerships

Appendix C: Supplemental Information

This appendix provides additional information on the resilience context and challenges in North Charleston, gathered through desk research that may be useful for the community in supporting their resilience efforts moving forward.

1. Community Demographics and Environmental Justice Screening Maps

EPA's EJSCREEN tool provides a useful first step in understanding or highlighting locations that may be a candidate for analysis, outreach, and in some cases further review. EJSCREEN provides numerical estimates for a specified location, for both environmental and demographic data, such as the traffic proximity indicator, or the percentage of residents who are racial/ethnic minorities.

EJSCREEN offers three types of standard reports for different geographies, as well as maps showing different demographic and environmental indicators by census tract. The EJSCREEN reports and maps for North Charleston are provided below.

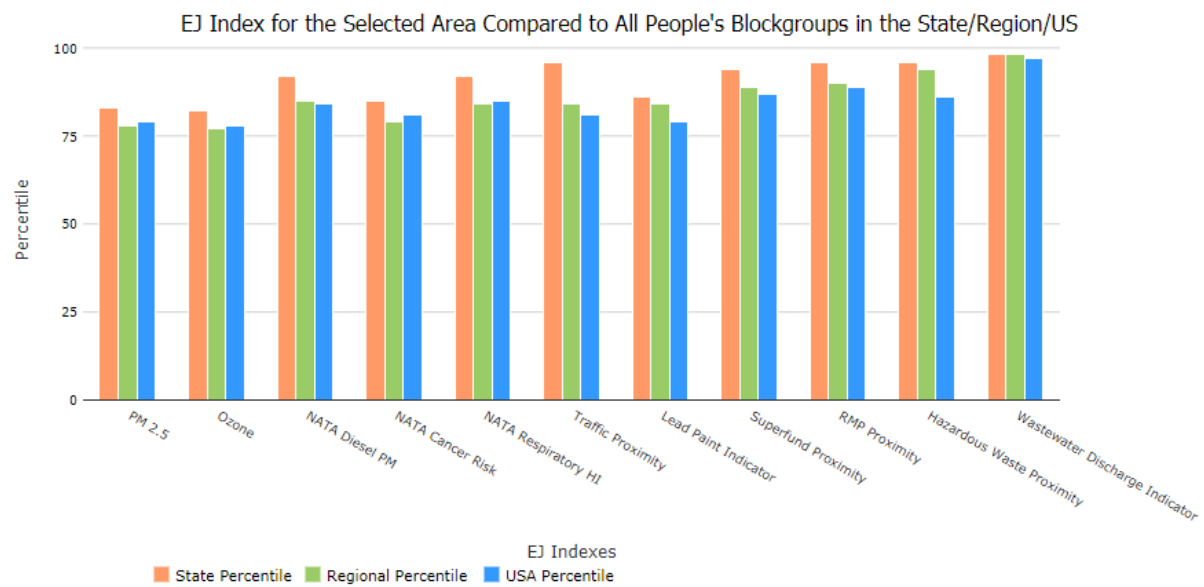
1.1 EJSCREEN Standard Report for North Charleston



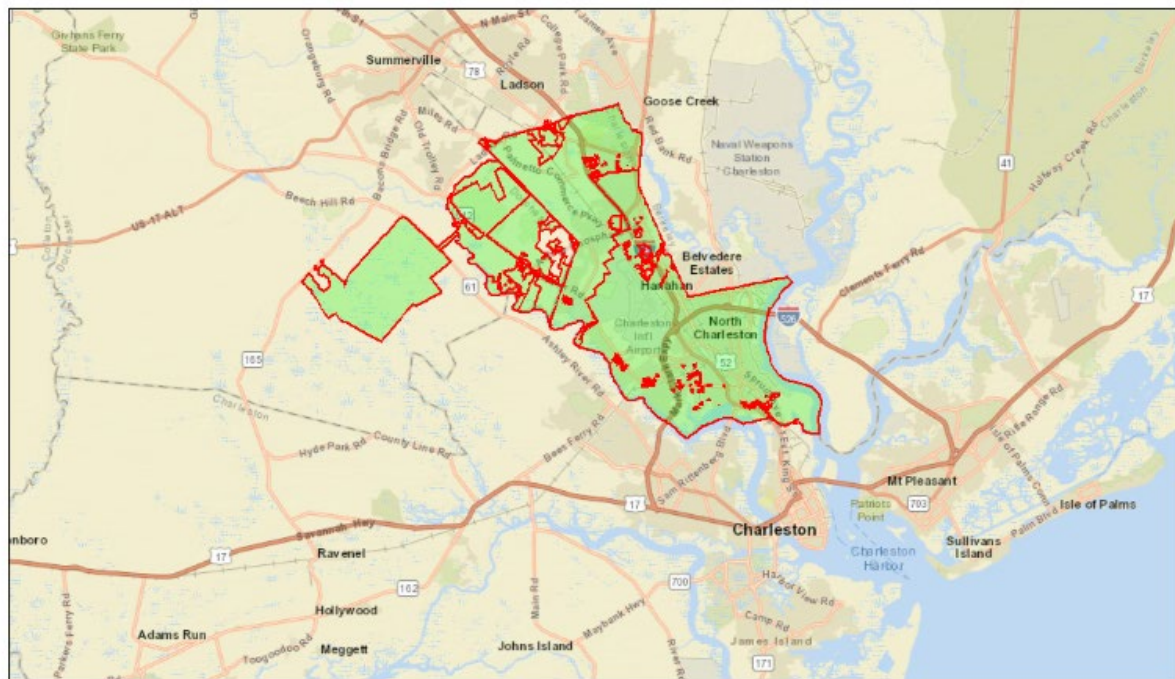
EJSCREEN Report (Version 2018)
City: North Charleston
SOUTH CAROLINA, EPA Region 4
Approximate Population: 106,147
Input Area (sq. miles): 76.86



Selected Variables	Percentile in State	Percentile in EPA Region	Percentile in USA
EJ Indexes			
EJ Index for Particulate Matter (PM 2.5)	83	78	79
EJ Index for Ozone	82	77	78
EJ Index for NATA* Diesel PM	92	85	84
EJ Index for NATA* Air Toxics Cancer Risk	85	79	81
EJ Index for NATA* Respiratory Hazard Index	92	84	85
EJ Index for Traffic Proximity and Volume	96	84	81
EJ Index for Lead Paint Indicator	86	84	79
EJ Index for Superfund Proximity	94	89	87
EJ Index for RMP Proximity	96	90	89
EJ Index for Hazardous Waste Proximity	96	94	86
EJ Index for Wastewater Discharge Indicator	98	98	97

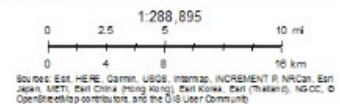


This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.



April 15, 2019

■ Known Geography



Sites reporting to EPA	
Superfund NPL	1
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	14

Selected Variables	Value	State Average	Percentile in State	EPA Region Average	Percentile in EPA Region	USA Average	Percentile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in $\mu\text{g}/\text{m}^3$)	9.25	9.84	17	9.48	36	9.53	41
Ozone (ppb)	36.5	39.3	10	39.4	27	42.5	14
NATA* Diesel PM ($\mu\text{g}/\text{m}^3$)	1.21	0.7	85	0.755	80-90th	0.938	70-80th
NATA* Air Toxics Cancer Risk (risk per MM)	46	44	63	42	60-70th	40	70-80th
NATA* Respiratory Hazard Index	2.5	1.6	95	1.7	90-95th	1.8	80-90th
Traffic Proximity and Volume (daily traffic count/distance to road)	190	53	94	290	71	600	62
Lead Paint Indicator (% pre-1960s housing)	0.17	0.14	70	0.15	69	0.29	47
Superfund Proximity (site count/km distance)	0.13	0.071	90	0.079	85	0.12	78
RMP Proximity (facility count/km distance)	1.2	0.43	90	0.58	85	0.72	80
Hazardous Waste Proximity (facility count/km distance)	1.9	0.52	94	0.5	93	4.3	76
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	0.6	0.32	96	0.27	97	30	94
Demographic Indicators							
Demographic Index	54%	37%	79	38%	76	36%	77
Minority Population	62%	36%	82	38%	77	38%	75
Low Income Population	46%	38%	66	38%	65	34%	72
Linguistically Isolated Population	4%	2%	87	3%	75	4%	68
Population with Less Than High School Education	18%	14%	68	14%	68	13%	73
Population under Age 5	8%	6%	74	6%	73	6%	71
Population over Age 64	9%	16%	22	16%	26	14%	30

*The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: <https://www.epa.gov/national-air-toxics-assessment>.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJSCREEN outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

1.2 EJSCREEN American Communities Survey (ACS) Summary Report for North Charleston



EJSCREEN ACS Summary Report



Location: City: North Charleston city
 Ring (buffer): 0-mile radius
 Description:

Summary of ACS Estimates		2012 - 2016	
Population		106,147	
Population Density (per sq. mile)		1,454	
Minority Population		66,045	
% Minority		62%	
Households		39,006	
Housing Units		44,189	
Housing Units Built Before 1950		3,148	
Per Capita Income		21,143	
Land Area (sq. miles) (Source: SF1)		72.99	
% Land Area		95%	
Water Area (sq. miles) (Source: SF1)		3.67	
% Water Area		5%	
	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	106,147	100%	936
Population Reporting One Race	102,929	97%	2,435
White	47,637	45%	702
Black	50,307	47%	908
American Indian	232	0%	69
Asian	2,271	2%	218
Pacific Islander	60	0%	33
Some Other Race	2,423	2%	505
Population Reporting Two or More Races	3,218	3%	225
Total Hispanic Population	10,583	10%	500
Total Non-Hispanic Population	95,564		
White Alone	40,102	38%	705
Black Alone	49,806	47%	902
American Indian Alone	220	0%	69
Non-Hispanic Asian Alone	2,271	2%	218
Pacific Islander Alone	60	0%	33
Other Race Alone	219	0%	95
Two or More Races Alone	2,886	3%	243
Population by Sex			
Male	52,133	49%	591
Female	54,014	51%	486
Population by Age			
Age 0-4	8,437	8%	330
Age 0-17	25,735	24%	485
Age 18+	80,412	76%	563
Age 65+	9,990	9%	156

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
 N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS) 2012 - 2016 -

Location: City: North Charleston city
 Ring (buffer): 0-mile radius
 Description:

	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	68,645	100%	610
Less than 9th Grade	3,691	5%	157
9th - 12th Grade, No Diploma	8,537	12%	240
High School Graduate	20,260	30%	320
Some College, No Degree	21,772	32%	443
Associate Degree	6,592	10%	233
Bachelor's Degree or more	14,385	21%	270
Population Age 5+ Years by Ability to Speak English			
Total	97,711	100%	893
Speak only English	86,383	88%	744
Non-English at Home ¹⁺²⁺³⁺⁴	11,327	12%	348
¹ Speak English "very well"	6,188	6%	243
² Speak English "well"	2,463	3%	178
³ Speak English "not well"	2,251	2%	191
⁴ Speak English "not at all"	425	0%	137
²⁺³ Speak English "less than well"	2,676	3%	203
²⁺³⁺⁴ Speak English "less than very well"	5,139	5%	243
Linguistically Isolated Households*			
Total	1,560	100%	91
Speak Spanish	1,266	81%	90
Speak Other Indo-European Languages	90	6%	50
Speak Asian-Pacific Island Languages	194	12%	66
Speak Other Languages	10	1%	17
Households by Household Income			
Household Income Base	39,006	100%	251
< \$15,000	6,682	17%	175
\$15,000 - \$25,000	5,728	15%	152
\$25,000 - \$50,000	10,770	28%	276
\$50,000 - \$75,000	7,286	19%	217
\$75,000 +	8,540	22%	210
Occupied Housing Units by Tenure			
Total	39,006	100%	251
Owner Occupied	18,145	47%	219
Renter Occupied	20,861	53%	259
Employed Population Age 16+ Years			
Total	82,531	100%	720
In Labor Force	55,520	67%	633
Civilian Unemployed in Labor Force	4,648	6%	220
Not In Labor Force	27,012	33%	431

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
 N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS)
 *Households in which no one 14 and over speaks English "very well" or speaks English only.



Location: City: North Charleston city
 Ring (buffer): 0-mile radius
 Description:

	2012 - 2016 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	97,711	100%	893
English	N/A	N/A	N/A
Spanish	N/A	N/A	N/A
French	N/A	N/A	N/A
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	N/A	N/A	N/A
Yiddish	N/A	N/A	N/A
Other West Germanic	N/A	N/A	N/A
Scandinavian	N/A	N/A	N/A
Greek	N/A	N/A	N/A
Russian	N/A	N/A	N/A
Polish	N/A	N/A	N/A
Serbo-Croatian	N/A	N/A	N/A
Other Slavic	N/A	N/A	N/A
Armenian	N/A	N/A	N/A
Persian	N/A	N/A	N/A
Gujarathi	N/A	N/A	N/A
Hindi	N/A	N/A	N/A
Urdu	N/A	N/A	N/A
Other Indic	N/A	N/A	N/A
Other Indo-European	N/A	N/A	N/A
Chinese	N/A	N/A	N/A
Japanese	N/A	N/A	N/A
Korean	N/A	N/A	N/A
Mon-Khmer, Cambodian	N/A	N/A	N/A
Hmong	N/A	N/A	N/A
Thai	N/A	N/A	N/A
Laotian	N/A	N/A	N/A
Vietnamese	N/A	N/A	N/A
Other Asian	N/A	N/A	N/A
Tagalog	N/A	N/A	N/A
Other Pacific Island	N/A	N/A	N/A
Navajo	N/A	N/A	N/A
Other Native American	N/A	N/A	N/A
Hungarian	N/A	N/A	N/A
Arabic	N/A	N/A	N/A
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	N/A	N/A	N/A
Total Non-English	N/A	N/A	N/A

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
 N/A means not available. Source: U.S. Census Bureau, American Community Survey (ACS) 2012 - 2016.
 *Population by Language Spoken at Home is available at the census tract summary level and up.

1.3 EJSCREEN Maps

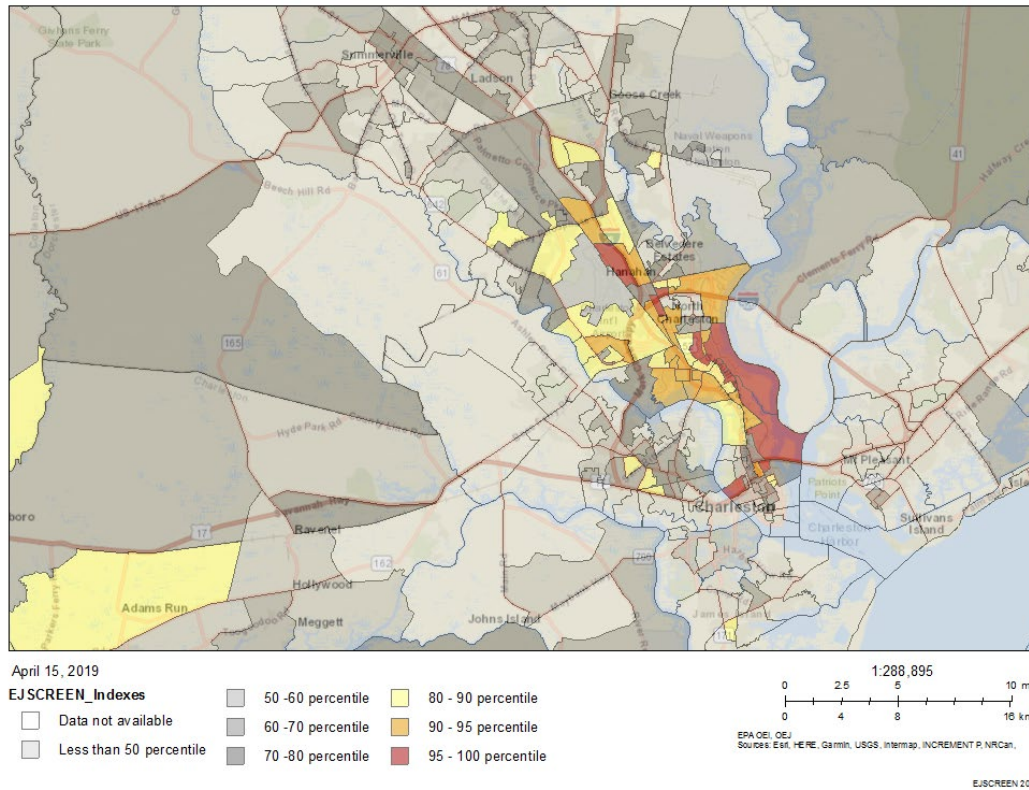
EJSCREEN includes several maps to identify potential Environmental Justice issues in communities across the country.

The maps below show how the census tracts in North Charleston compare to census tracts nationwide in terms of:

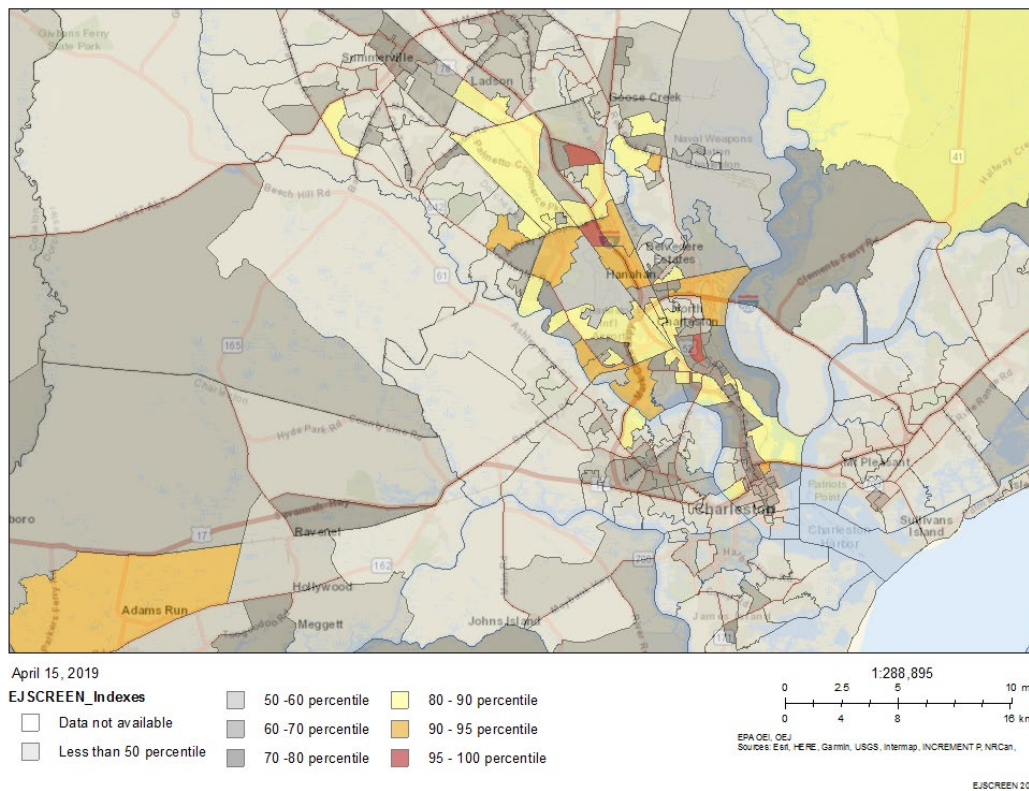
- Demographic Index – a combination of percent low income and percent minority
- PM 2.5 – Fine particulate matter levels in the air, combined with the Demographic Index
- Ozone – Ozone levels in the air, combined with the Demographic Index
- NATA Diesel PM – Diesel particulate matter levels in the air, combined with the Demographic Index
- NATA Cancer Risk – Cancer risk from inhalation of air toxics, combined with the Demographic Index
- NATA Respiratory HI – Air toxics respiratory hazard index, combined with the Demographic Index
- Traffic Proximity – Count of vehicles per day at major roads divided by the distance, combined with the Demographic Index
- Lead Paint Indicator – Percentage of housing built before 1960, combined with the Demographic Index
- Superfund Proximity – Count of National Priorities List/Superfund sites divided by the distance, combined with the Demographic Index
- RMP Proximity – Count of facilities with Risk Management Plans divided by the distance, combined with the Demographic Index
- Hazardous Waste Proximity – Count of transfer, storage, and disposal facilities divided by the distance, combined with the Demographic Index
- Wastewater Discharge Indicator – Toxicity-weighted concentration/meter distance, combined with the Demographic Index

The maps show that at least one census tract in North Charleston is in the nationwide 95th percentile for every single EJ indicator.

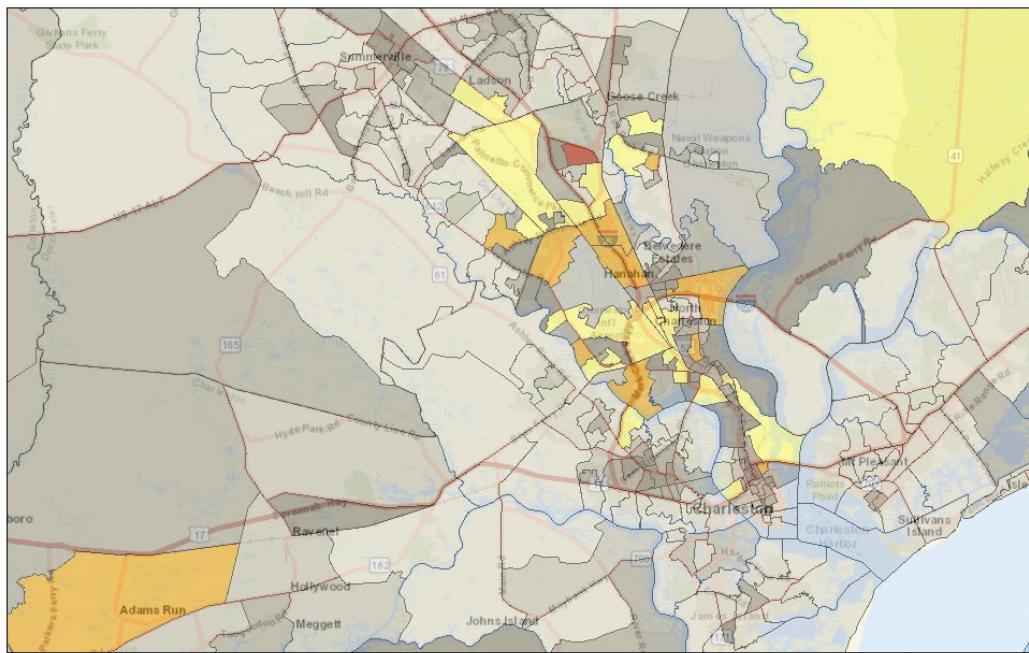
Demographic Index (National Percentiles)



EJ Index PM 2.5 (National Percentiles)



EJ Index Ozone (National Percentiles)



April 15, 2019

EJSCREEN_Indexes

□ Data not available

□ Less than 50 percentile

50 - 60 percentile

60 - 70 percentile

70 - 80 percentile

80 - 90 percentile

90 - 95 percentile

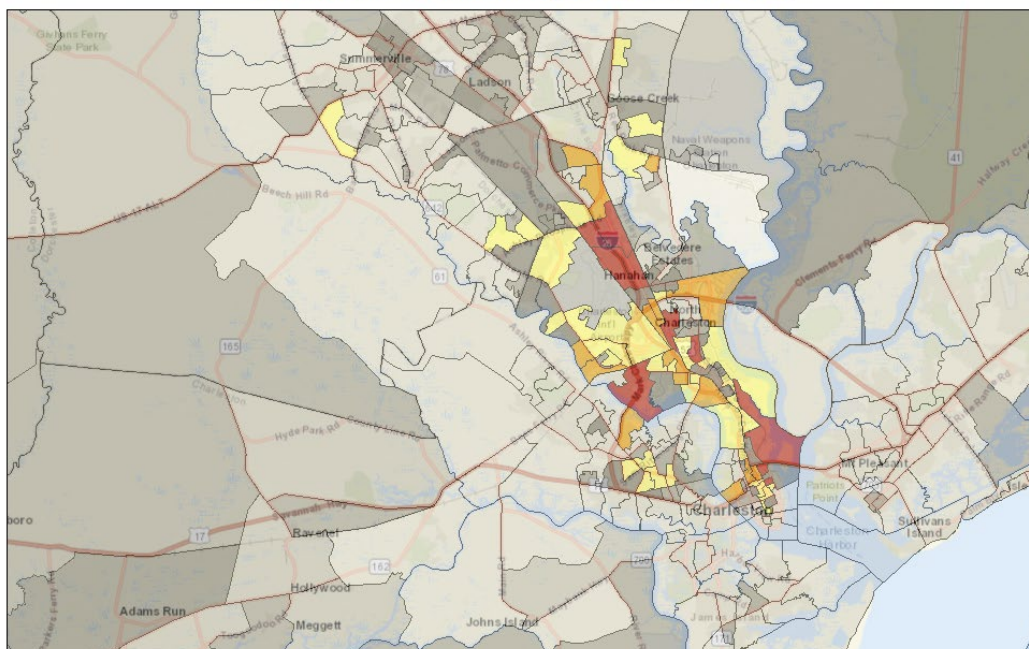
95 - 100 percentile

1:288,895
0 2.5 5 10 mi
0 4 8 16 km

EPA OEI, OEJ
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan,

EJSCREEN 2018

EJ Index NATA Diesel PM (National Percentiles)



April 15, 2019

EJSCREEN_Indexes

□ Data not available

□ Less than 50 percentile

50 - 60 percentile

60 - 70 percentile

70 - 80 percentile

80 - 90 percentile

90 - 95 percentile

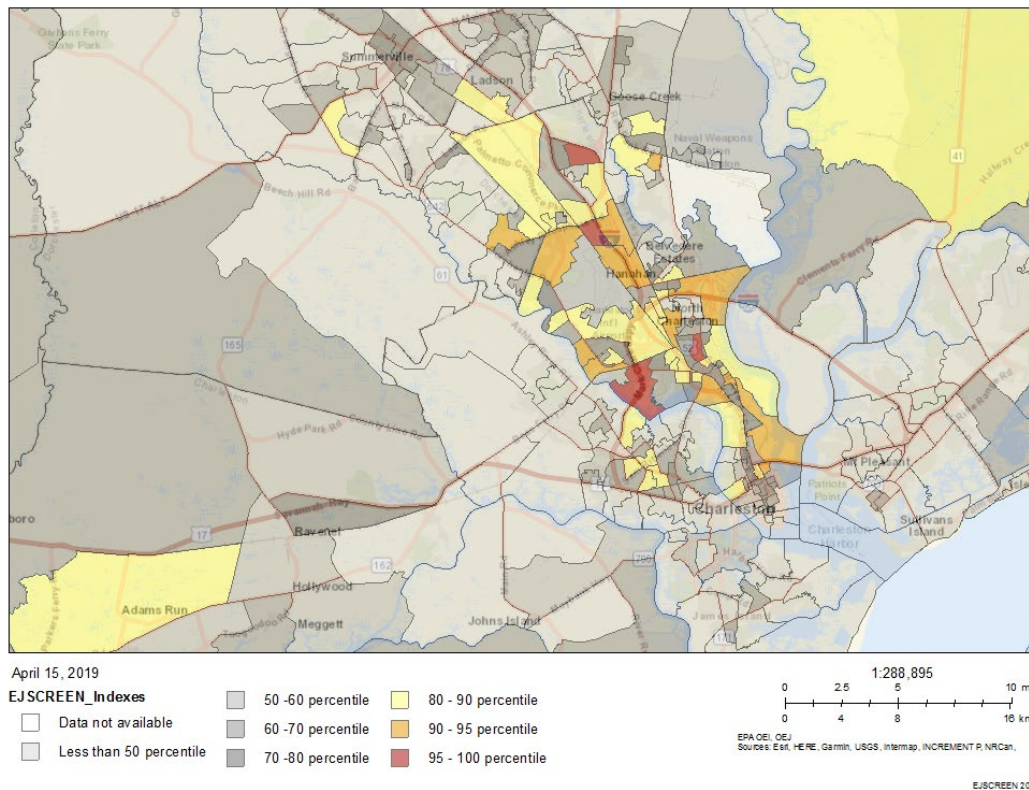
95 - 100 percentile

1:288,895
0 2.5 5 10 mi
0 4 8 16 km

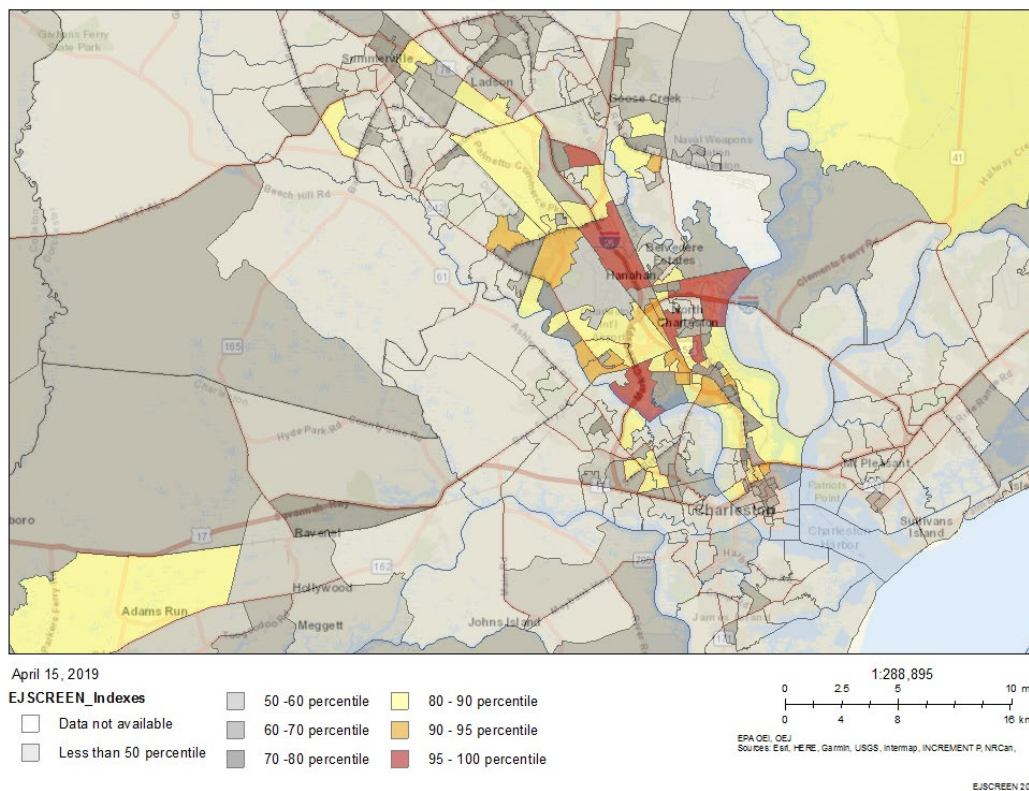
EPA OEI, OEJ
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan,

EJSCREEN 2018

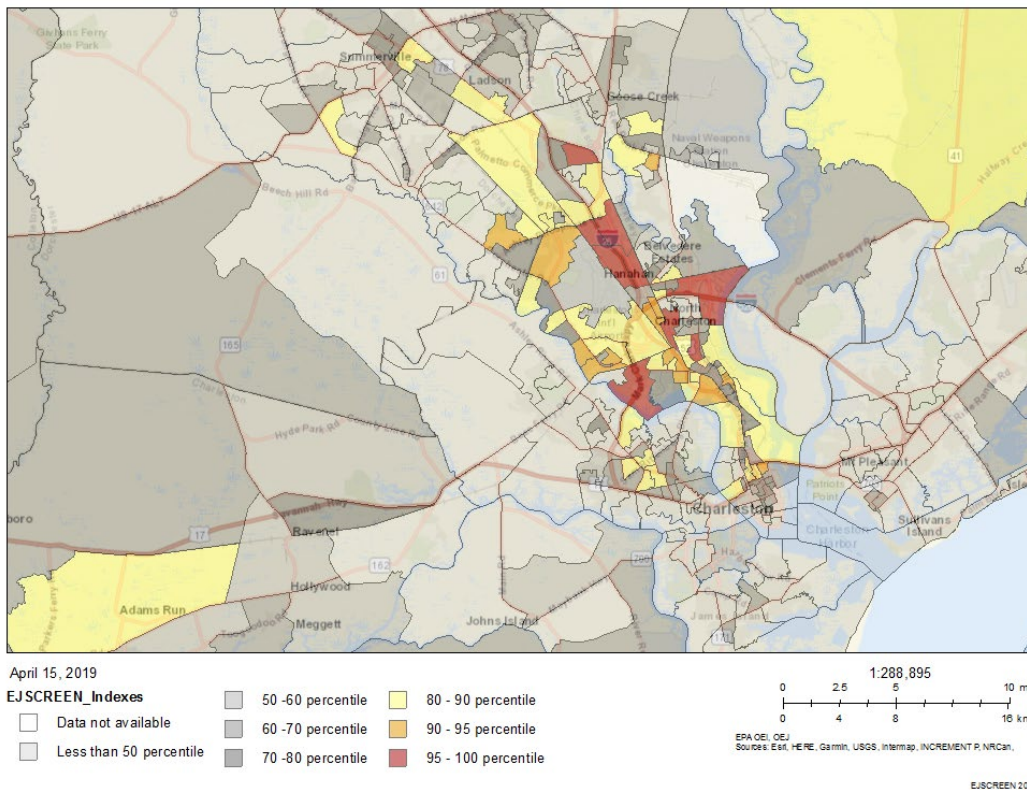
EJ Index NATA Cancer Risk (National Percentiles)



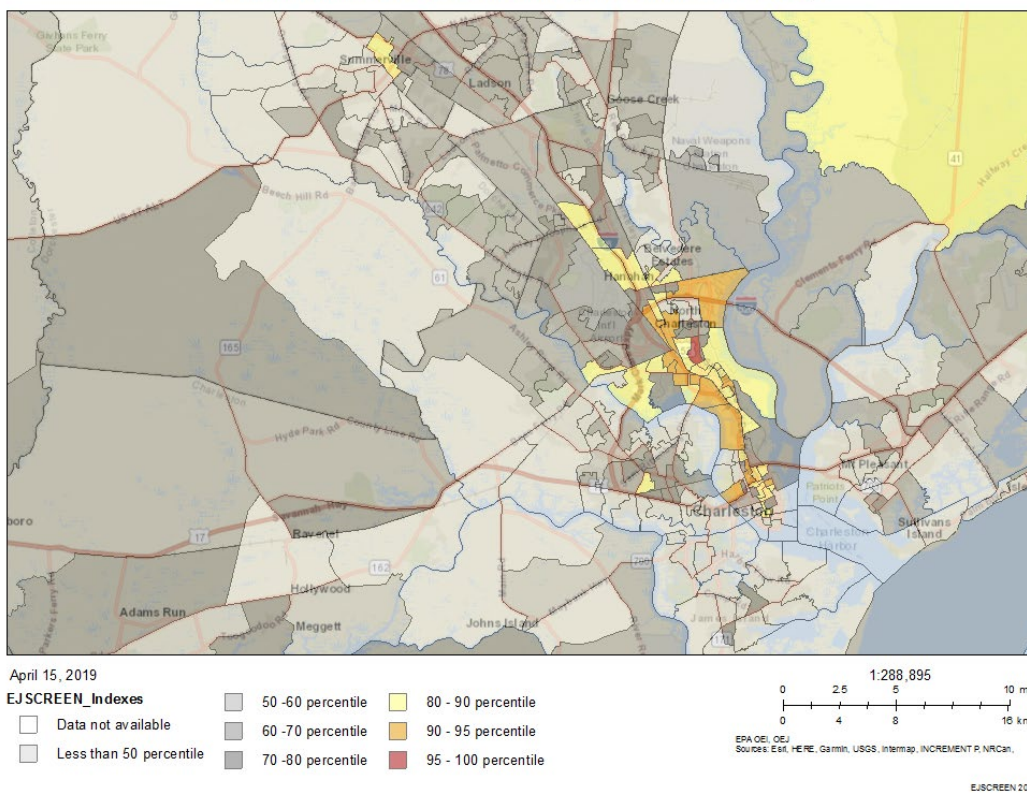
EJ Index Respiratory HI (National Percentiles)



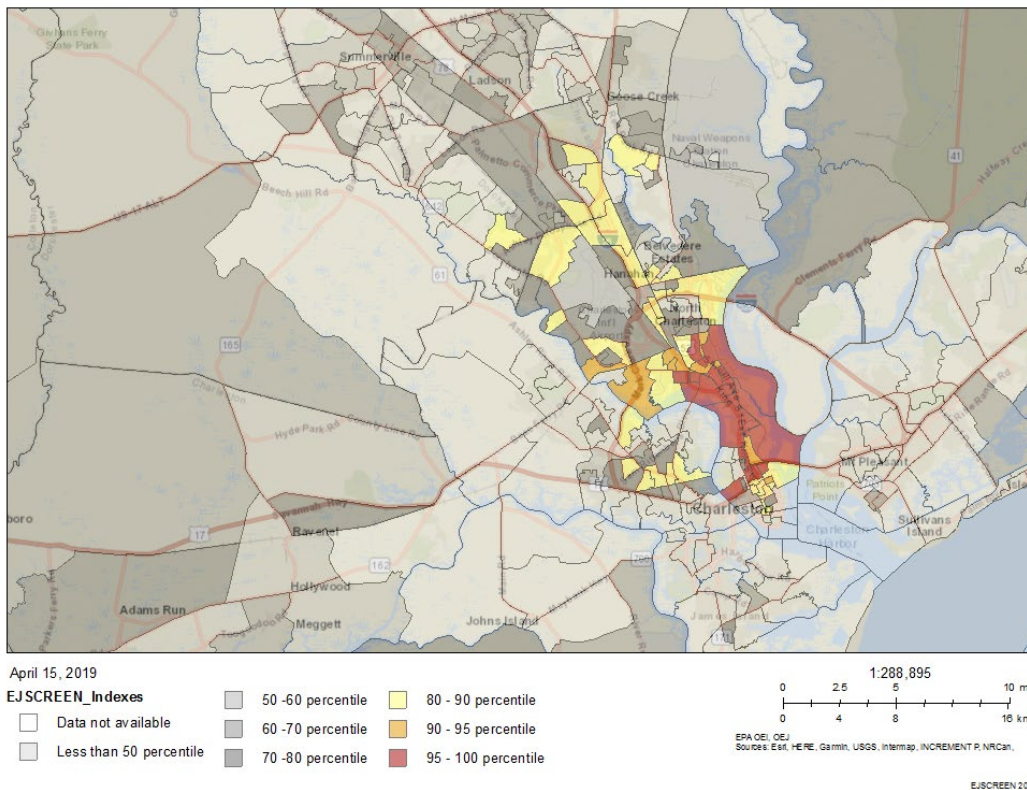
EJ Index Traffic Proximity (National Percentiles)



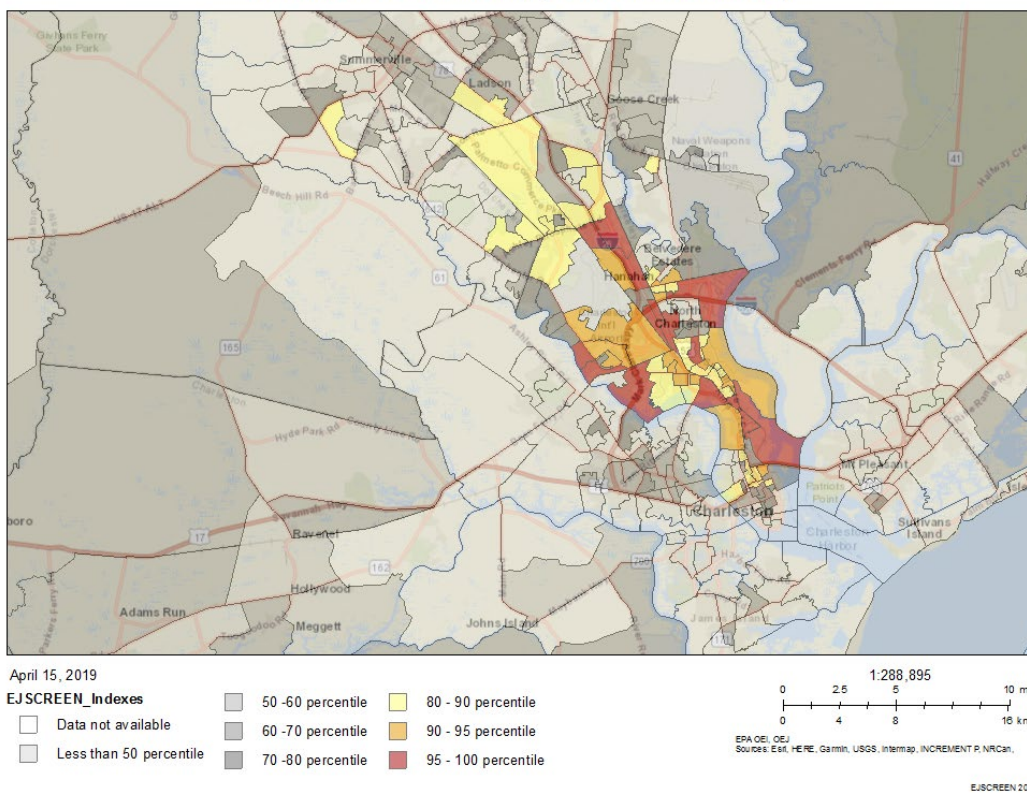
EJ Index Lead Paint Indicator (National Percentiles)



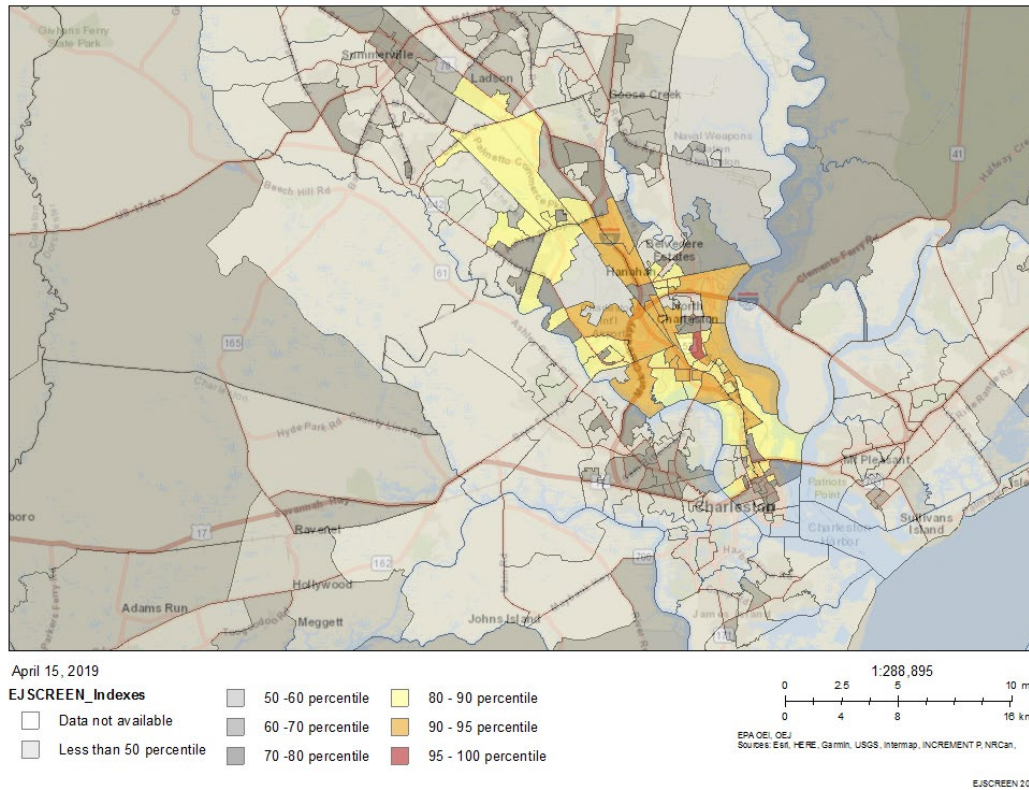
EJ Index Superfund Proximity (National Percentiles)



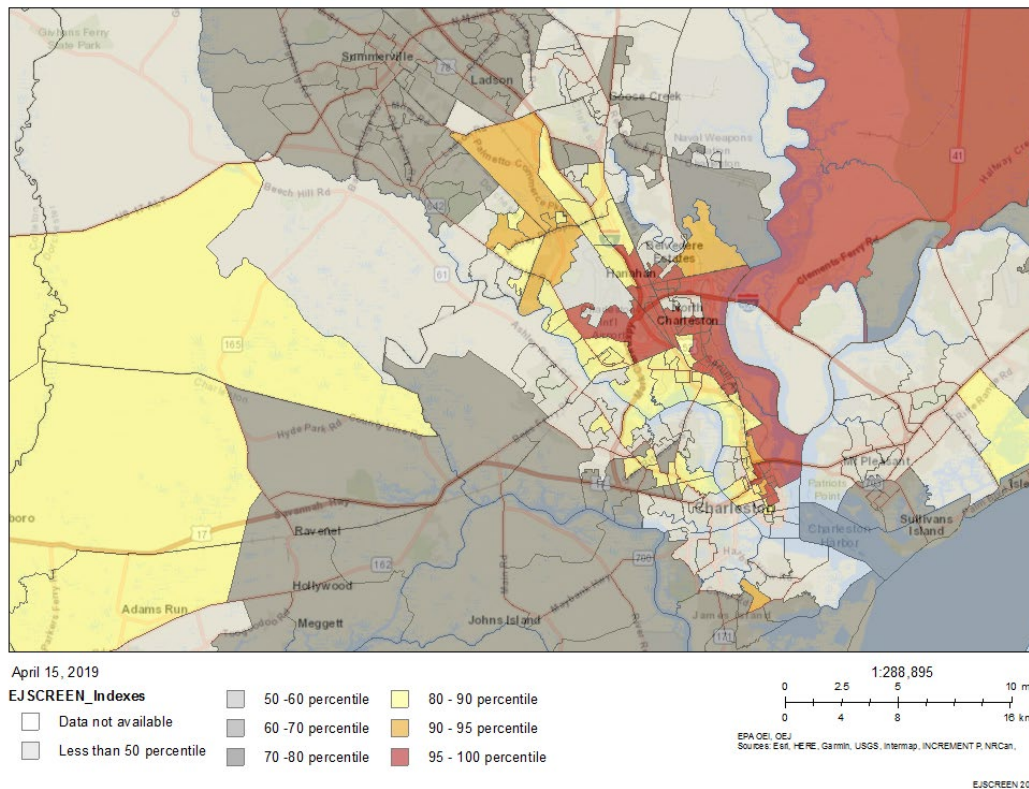
EJ Index RMP Proximity (National Percentiles)



EJ Index Hazardous Waste Proximity (National Percentiles)



EJ Index Wastewater Discharge Indicator (National Percentiles)



2. EnviroAtlas: Identifying Risks to Populations of Concern

Demographic data can be used to identify vulnerable populations. The maps below in Figure 12 show two demographic variables from the 2012 – 2016 American Community Survey (ACS) accessed in EPA's EnviroAtlas. The map on the left shows the Percent Household Income less than \$15,000 per year; Percent Minority Population is on the right. In both cases, darker block groups represent a higher percentage of the population of concern. North Charleston has a high percentage of both low-income and minority populations.

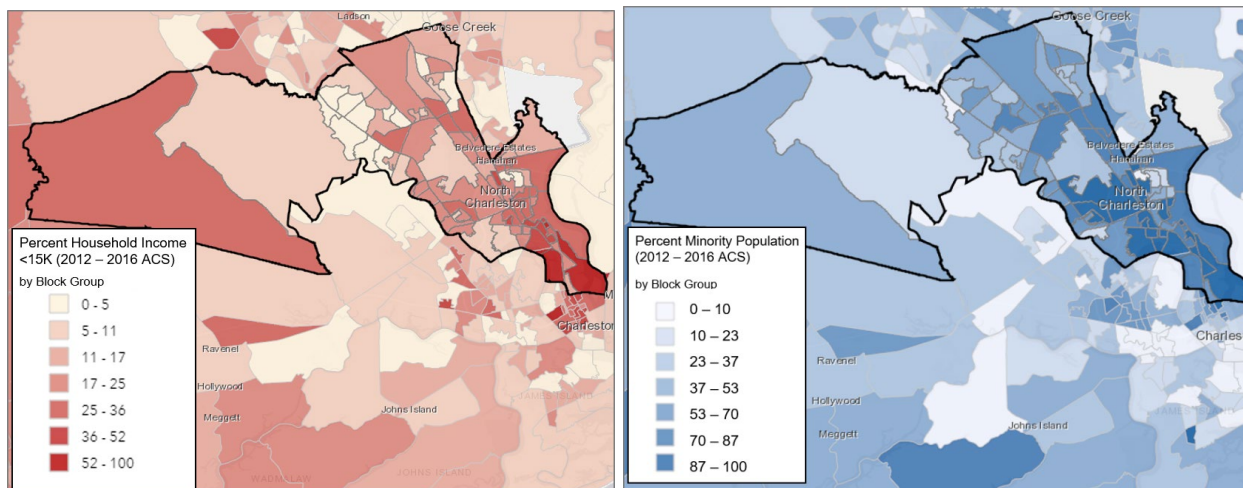


Figure 11. Demographic maps from EPA's Enviro Atlas mapping application.

Vulnerable groups, including low-income, minority, and elderly populations may be disproportionately affected by nearby environmental burdens. The map in Figure 12 shows Superfund National Priorities List (NPL) sites and limited preliminarily identified and assessed brownfields sites (as reported in EPA's ACRES database by one local EPA Brownfields grantee) in North Charleston. Both site types are concentrated in communities with higher percentages of populations of concern.

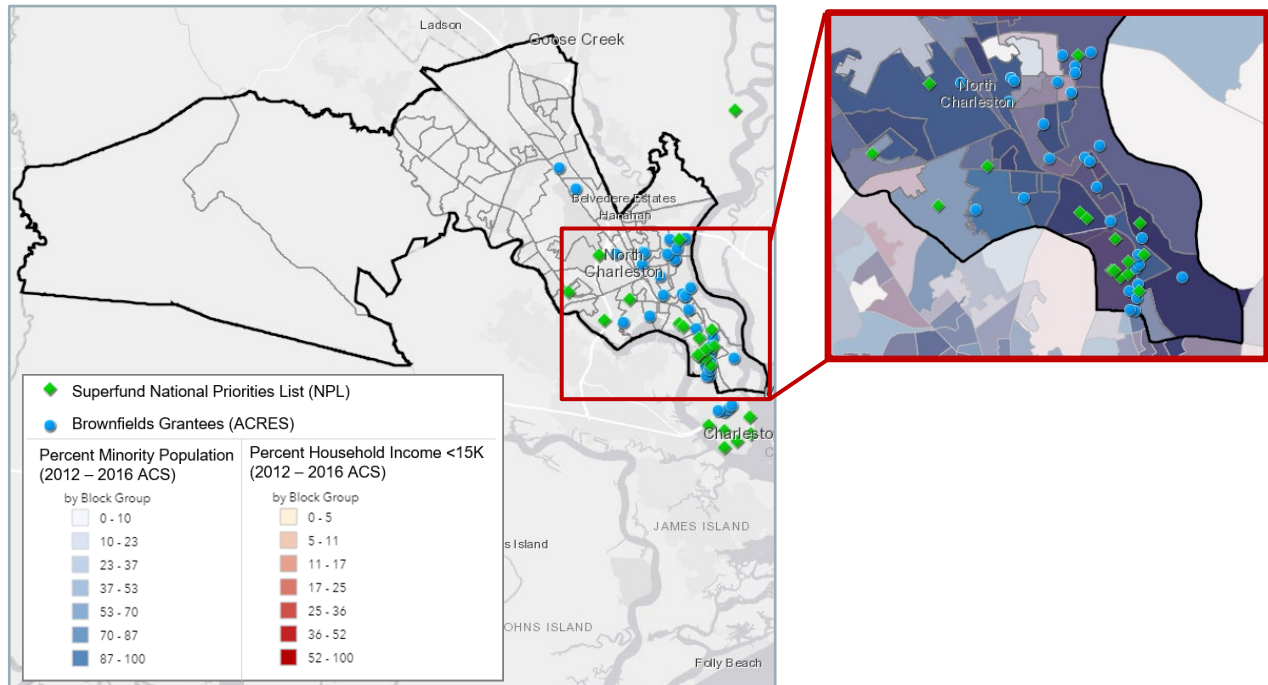


Figure 12. Map showing Superfund NPL Sites (includes actual and proposed sites, and those being screened for inclusion) and preliminarily identified and assessed brownfields sites (as reported in EPA's ACRES database by one local EPA Brownfields grantee). Map zoom shows both site types, overlaid with percent minority and percent low-income populations.

EnviroAtlas can also be used to assess flood risk. Figure 13 shows the area assessed by FEMA to determine flood hazard area (shown as areas in purple and cream). At present, these data do not include the entire North Charleston area. However, North Charleston is prone to flooding and much of the area likely exists in a floodplain.

The EnviroAtlas Estimated Floodplains map fills in the area that is potentially the 100-year floodplain and is not currently covered in FEMA's map. There are several NPLs (green diamonds) in North Charleston that are in the floodplain (indicated in medium blue) and may be prone to inundation during heavy rain events. Using maps like these can help planners identify areas that may be prone to flood and sites that may be priority areas for special attention during heavy rain and flooding. Using these maps with demographic data can identify populations that may be especially vulnerable during these events.

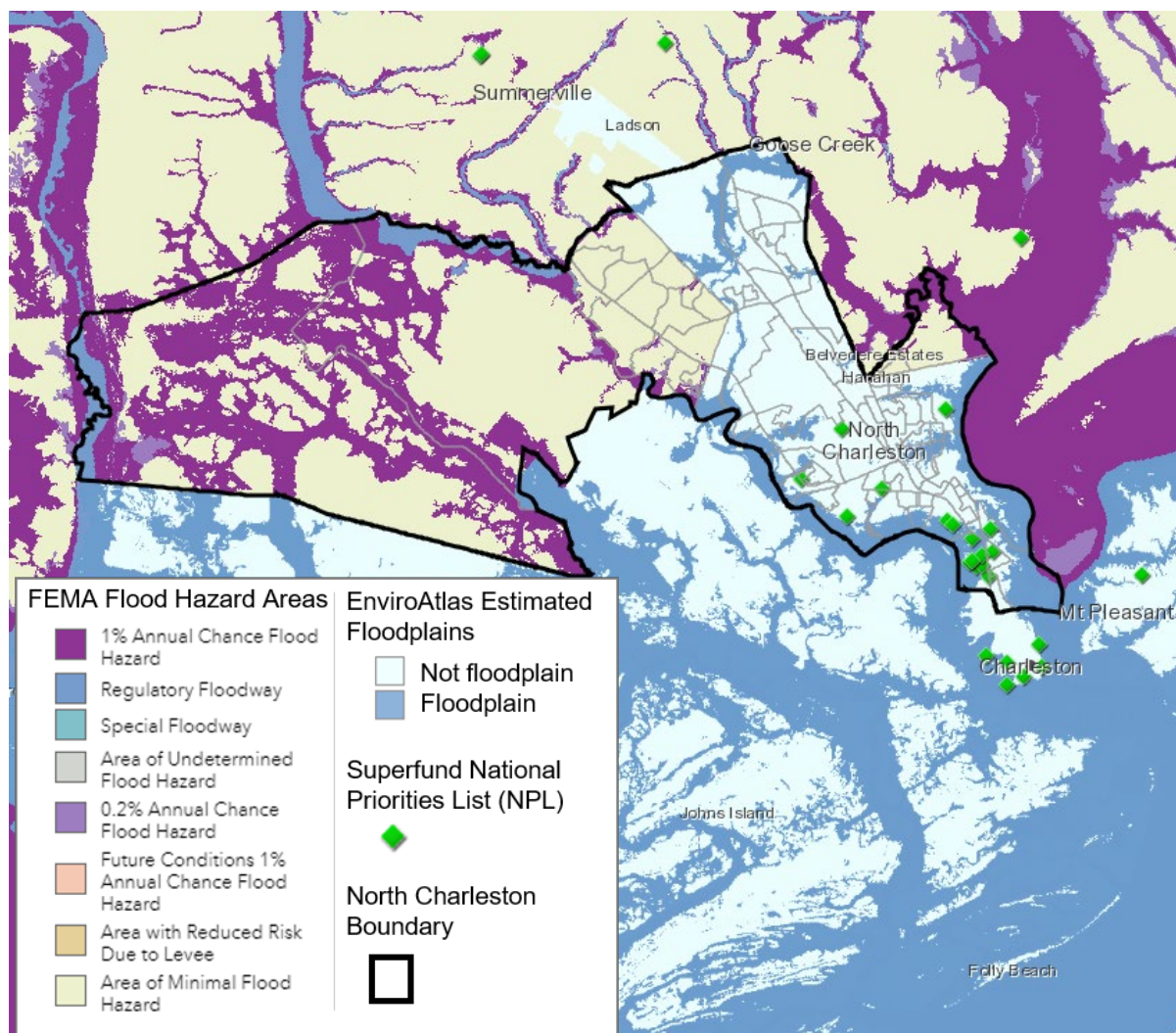


Figure 13. Map image showing FEMA USA Flood Hazard Areas, EnviroAtlas Estimated Floodplains in the US and Superfund NPLs (includes actual and proposed sites, and those being screened for inclusion). FEMA has developed preliminary flood hazard data that will cover North Charleston once it becomes effective.

3. Extreme Events: Past, Present & Future

Flooding and drainage have been challenges for the Charleston area since the City of Charleston's founding in 1680. Sea level rise, more frequent heavy rain events, tidal flooding, and increased development have worsened flooding and flood drainage issues over time.³

3.1 Sea level rise

Global sea level has been rising over the past century and continues to rise at an increasing rate. Sea level is primarily measured using tide stations (local level readings) and satellites (average height of ocean). Absolute sea level has risen at an average rate of 0.06 inches per

³ NOAA. 2017. Stories from the Field: Building the Case for a Comprehensive Sea Level Rise Strategy in Charleston, South Carolina. NOAA Office for Coastal Management, DigitalCoast. <https://coast.noaa.gov/digitalcoast/stories/charleston-slr.html>

year from 1880 to 2013. Since 1993, however, the rate of sea level rise has doubled at 0.11 to 0.14 inches per year.

Sea level rise is caused by melting glaciers and ice sheets, which add more water volume to the ocean and rising temperatures and thermal expansion.

Sea level rise at specific locations may be more or less than the global average due to local factors, such as:

- Subsidence
- Upstream flood control
- Erosion
- Regional ocean currents
- Variations in land height

In Charleston, sea level has risen more than one foot over the last 100 years (see Figure 14). NOAA estimates an additional of 2-7 feet of sea level rise in Charleston over the next 100 years (Figure 15).⁴

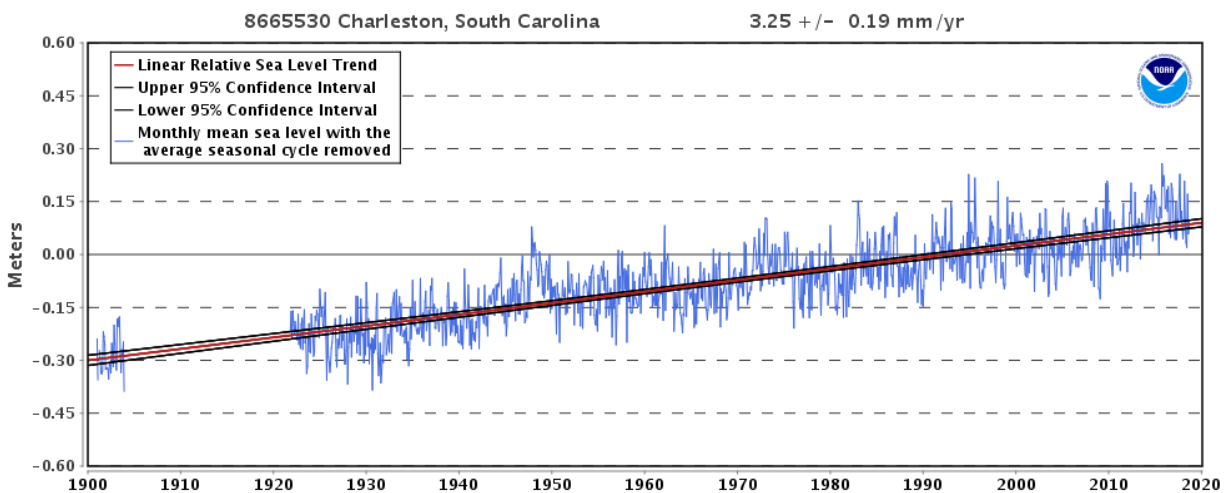


Figure 14. Observed sea level trends in Charleston, SC.⁵

⁴ City of Charleston. 2015. Sea Level Strategy. <https://www.charleston-sc.gov/DocumentCenter/View/10089>

⁵ NOAA. 2018. Tides and Currents, "Relative Sea Level Trend." https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8665530

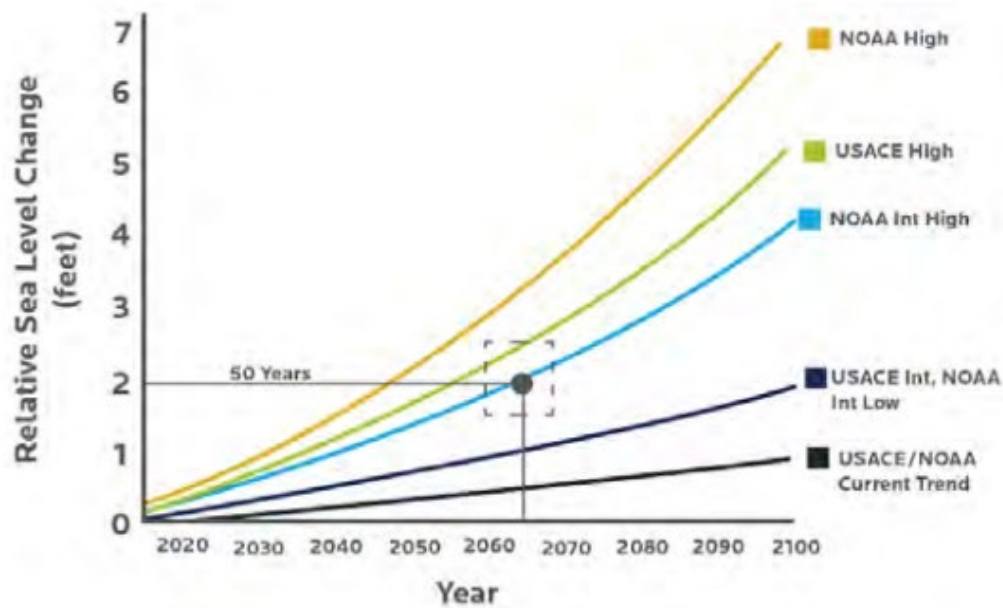


Figure 15. Sea level rise projections for Charleston based on analysis from the U.S. Army Corps of Engineers (USACE) and NOAA. Box indicates the planning parameters for the 50-year outlook in the Charleston Sea Level Rise Strategy.⁶

A map of modeled inundation at current mean higher high water and 2 feet of sea level rise are shown in Figure 16 and Figure 17, respectively.

⁶ City of Charleston. 2015. Sea Level Strategy. <https://www.charleston-sc.gov/DocumentCenter/View/10089>

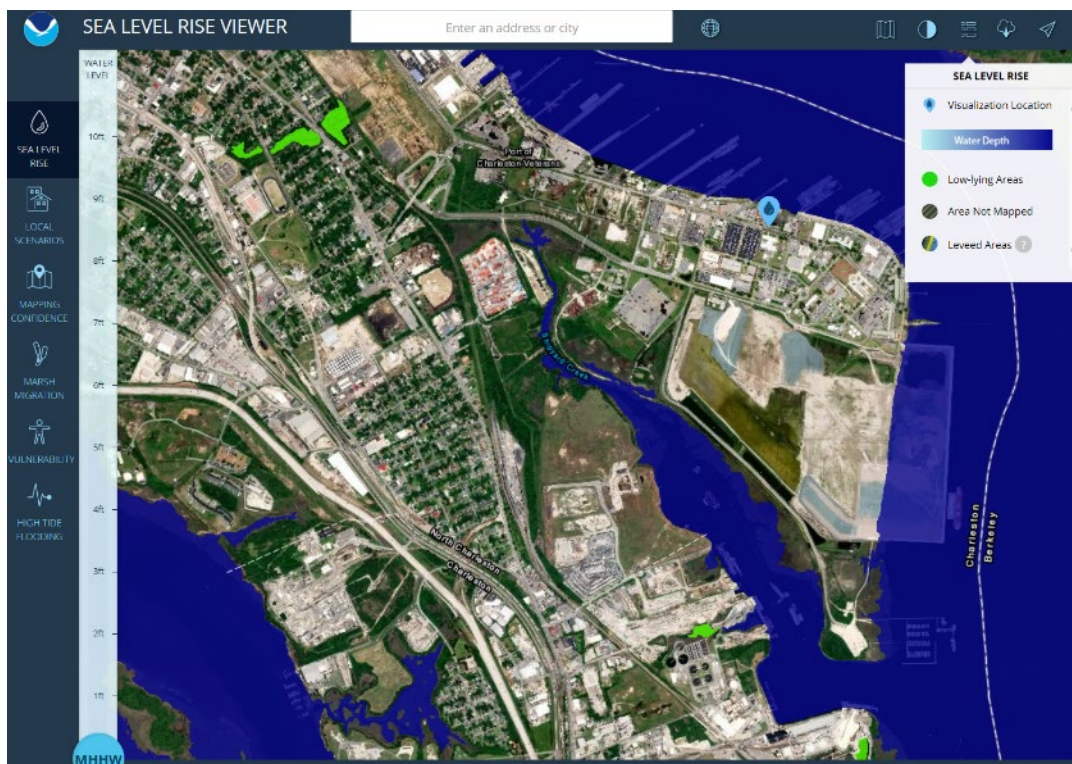


Figure 16. Current mean higher high-water level (blue = inundated, green = low-lying).⁷

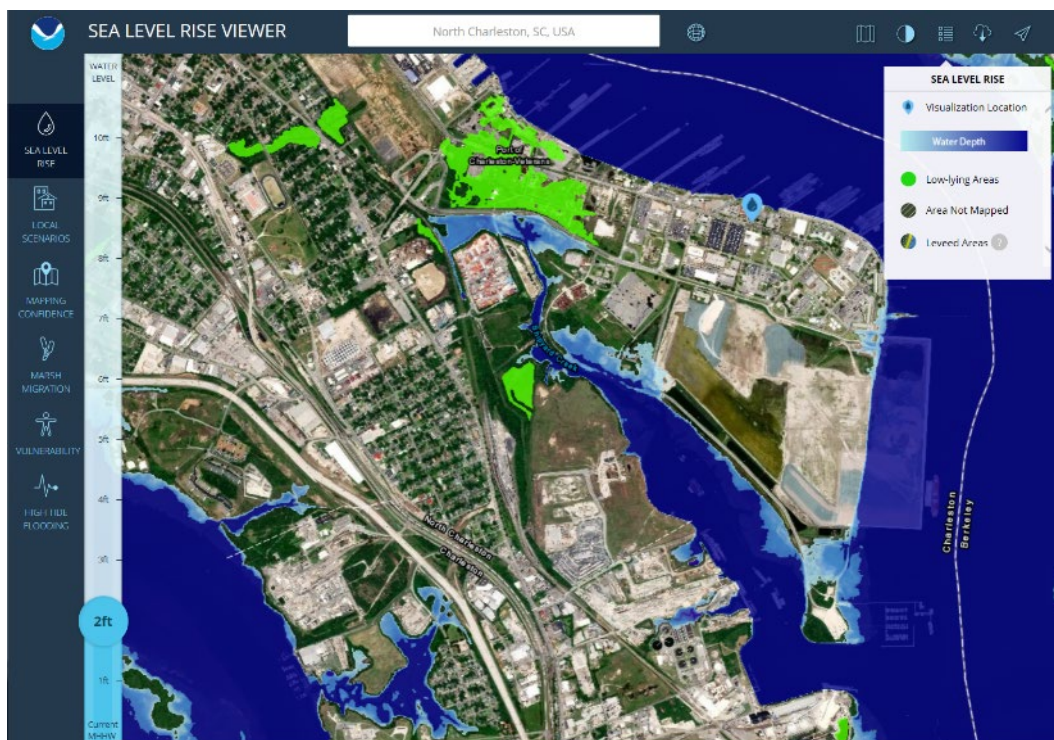


Figure 17. Two feet of sea level rise relative to the mean higher high water (blue = inundated, green = low-lying).⁸

⁷ NOAA, 2018, Sea Level Rise Viewer, <https://coast.noaa.gov/slr/#>

⁸ NOAA, 2018, Sea Level Rise Viewer, <https://coast.noaa.gov/slr/#>

Sea level rise in inland areas such as Union Heights can have a number of impacts, including:

- Raised groundwater tables, which may inundate underground infrastructure, including drainage infrastructure
- Drainage issues as ocean water may move up through the drainage pipes and into the streets
- Storm surge farther inland
- More frequent nuisance flood events

3.2 Tidal flooding

Tidal flooding has also increased in recent decades in Charleston. In the 1980s, the City of Charleston experienced an average of 4 days of tidal flooding a year.⁹ In 2016, Charleston experienced 50 days of tidal flooding.¹⁰ By 2045, the City of Charleston is projected to experience 180 days of tidal flooding a year.¹¹ This projection assumes 2.5 feet of sea level rise over the next 50 years.¹²

3.3 Heavy rain events

Union Heights and other communities in North Charleston often experience repeat flood events from heavy rain, the most recent of which occurred in July 2018.¹³ The frequency and severity of heavy rain events is projected to increase due to climate change.

4. Port of Charleston Activities near Union Heights

The Port of Charleston is the 4th largest U.S. container port,¹⁴ with two terminals and a proposed railyard in the vicinity of Union Heights:

⁹ Elizabeth Fly, Laura Cabiness, and Carolee Williams. No date. Charleston takes on Sea Level Rise: Strategies, Projects, Funding, and Progress. PowerPoint presentation. <http://www.charleston-sc.gov/DocumentCenter/View/12347>

¹⁰ Glenn Smith and Tony Bartelme. September 18, 2017. A fix to flood-proof Charleston could top \$2 billion and take a generation to complete. https://www.postandcourier.com/news/a-fix-to-flood-proof-charleston-could-top-billion-and/article_a353083e-9c9c-11e7-86b9-4b51391dde5c.html

¹¹ City of Charleston. 2015. Sea Level Strategy. <https://www.charleston-sc.gov/DocumentCenter/View/10089>

¹² Abigail Darlington. January 29, 2017. Charleston's new resilience director starts work to brace city for sea level rise. The Post and Courier. https://www.postandcourier.com/charleston_sc/charleston-s-new-resilience-director-starts-work-to-brace-city/article_f694959e-e3fb-11e6-b39d-1fbf07151109.html

¹³ Hannah Alani. July 25, 2018. After floods swamp neighborhoods, no hope in sight for these North Charleston residents. The Post and Courier. https://www.postandcourier.com/news/after-floods-swamp-neighborhoods-no-hope-in-sight-for-these/article_07b855d6-8f72-11e8-aac4-679a6fd80409.html

¹⁴ Sue Kimbrough, Gayle Hagler, Jonathan Steffens, Timothy Barzyk, Vlad Isokov, Ryan Brown, and Alan Powell. 2015. Measuring the Impact of Port of Charleston Activities on Local Air Quality. AWMA 108th Annual Conference, Raleigh, NC, June 22-25, 2015. https://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryId=320510

- Veterans terminal – 110-acre bulk,¹⁵ break-bulk,¹⁶ roll-on-roll-off,¹⁷ and project cargo¹⁸ facility.¹⁹
- Hugh K. Leatherman, Sr. Terminal – 280-acre container terminal. This terminal is under construction with phase one expected to be complete in mid-2020.²⁰
- Navy Base Intermodal Container Transfer Facility – 118-acre railyard to transfer cargo on and off freight transportation. This facility just received a permit and will be located near Veterans Terminal.

A new port access road is also being built over the Union Heights neighborhood, which will help to decrease truck traffic in the community.

The port is also vulnerable to extreme events, which can have ripple effects on the community. The Veterans Terminal in particular is expected to experience flooding from 2 feet of sea level rise and be inundated by 3 feet of sea level rise. Flooding or sea level rise impacts to the port could include:²¹

- Damage to port infrastructure
- Inundation of critical infrastructure
- Ships unable to access the port due to high/fast waters and excess sediment in shipping channels
- Trucks and employees unable to access the port due to flooded access roads
- Decreased bridge clearance, preventing some larger ships from passing under bridges
- Hazardous working conditions
- In extreme cases, port closure

5. Related Resilience Work in North Charleston

There are a few examples of existing resilience work in the North Charleston area including:

- The [Lowcountry Alliance for Model Communities](#) (LAMC) is actively working to increase the resilience of North Charleston communities with initiatives such as:
 - Increasing attainable housing options
 - Collecting flood data information
 - Working to acquire and open a grocery store in Union Heights

¹⁵ Bulk – Commodity cargo transported unpackaged in large quantities.

¹⁶ [Breakbulk](#) – General cargo or goods that do not fit in or utilize standard shipping containers or cargo bins. Breakbulk cargo is transported individually, often times on a skid or pallet or in a crate.

¹⁷ [Roll-on Roll-off](#) – Cargo rolls on or off the vessel as opposed to being lifted using cranes. Some cargo rolls on and off with its own wheels (e.g. cars) or cargo is placed on handling equipment with wheels to roll on and off.

¹⁸ [Project cargo](#) – Term used to broadly describe the national or international transportation of large, heavy, high value, or complex pieces of equipment. Primarily used by oil and gas, wind power, mining, engineering, and construction industries.

¹⁹ South Carolina Ports. 2018. Veterans Terminal. <http://www.scspa.com/locations/veterans-terminal/>

²⁰ South Carolina Ports. 2018. Hugh K. Leatherman, Sr. Terminal. <http://www.scspa.com/locations/hugh-k-leatherman-sr-terminal/>

²¹ EPA. 2018. Inland Port Community Resilience Roadmap. <https://nepis.epa.gov/Exe/ZyPDF.cgi/P100UA4W.PDF?Dockkey=P100UA4W.PDF>

- The [Charleston Resilience Network](#), which LAMC is a member of, is a collaboration of public, private, and non-profit organizations in the Charleston area. The mission of the network is to foster a unified regional resilience strategy and provide a forum to share science-based information, educate stakeholders, and enhance long-term planning decisions that result in resilience.

6. Cumulative Stressors and Resiliency Index

The following sections provide a high-level summary of the Cumulative Stressors and Resiliency Index (CSRI) v2.0 discussion and survey findings from the workshop.

6.1 Resilience Index Session Overview

EPA, LAMC, community residents, and non-community stakeholders participated in an interactive “Resilience Index” workshop session.

Resilience Index Session Purpose

- *Provide an overview of the original CSRI;*
- *Introduce new indicators proposed for the CSRI v2.0;*
- *Discuss the new methodology that distinguishes the original CSRI from the CSRI v2.0;*
- *Rank CSRI v2.0 indicator domains; and*
- *Finalize the master list of indicators to be included in the CSRI v2.0 model.*

Details were presented during the workshop on the original CSRI, which was developed in 2016 to rank human health and environmental risk at the census tract level for communities in South Carolina (SC). The initial index was informed by North Charleston community stakeholders who participated in a ranking exercise to determine the environmental stressors and resiliency factors that most influenced health in their respective neighborhoods. The CSRI v2.0 emanated from the growing need to include additional indicators that could quantify resilience based on more weather-related environmental impacts. Updates to the original CSRI indicators, domains, and methodology were discussed throughout the workshop session.

Thirteen stakeholders completed a paper-based CSRI v2.0 survey to rank the four domains of the index according to the degree of negative influence each domain had on community resilience using a 5-point Likert scale questionnaire. The ranking exercise was an expert elicitation process that allowed each stakeholder to use their community expertise to participate in one aspect of weighting the indicators for the CSRI v2.0 model. The CSRI v2.0 indicators were divided into the following four interrelated domains: 1) Environmental Stressors, 2) Environmental Hazards, 3) Vulnerability Factors, and 4) Health-Promoting Factors (Figure 19). Community stakeholders had an opportunity to evaluate all the indicators within each domain to finalize the master list of CSRI v2.0 variables.



Figure 18. CSRI v2.0 domains.

6.2 Cumulative Stressors and Resiliency Index (CSRI) Background

The CSRI is a community-informed screening tool that was developed to comprehensively assess the cumulative burden of environmental stressors while accounting for resilience or health-promoting factors (i.e., grocery stores, health insurance, and primary healthcare).²² Specifically, the CSRI screens for cumulative risk based on a multiplicative relationship between chemical and non-chemical stressors and resiliency buffers that may counteract the negative impacts of exposures to various environmental hazards. Environmental stressors and resiliency buffers have been designated as primary domains in this index while the four sub-domains include the following: 1) Environmental Hazards, 2) Environmental Exposures, 3) Pathogenic Factors, and 4) Salutogenic Factors (Figure 20). Pathogenic factors are defined as features in one's environment that may increase vulnerability by negatively influencing health and resiliency.^{23,24} In contrast, salutogenic factors represent assets in one's environment that may strengthen resiliency by promoting health and wellness.^{25,26}

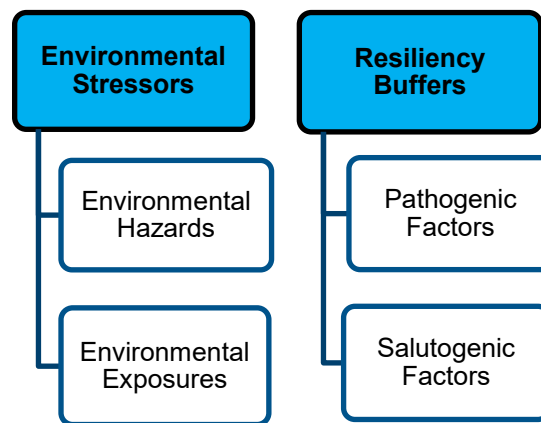


Figure 19. CSRI domains and sub-domains.

During the resilience index workshop session, community and non-community stakeholders were presented with information on the indicators and methods used to calculate the original CSRI. For the original CSRI, community stakeholders from North Charleston, SC participated in a research study that allowed them to rank or prioritize environmental stressors and resiliency factors that most influenced health using a Likert scale questionnaire. Twenty-six indicators

²² Burwell-Naney K, Wilson SM, He X, Sapkota A, Puett R. Development of a Cumulative Stressors and Resiliency Index to Examine Environmental Health Risk: A South Carolina Assessment. *Environmental Justice*. 2018; 11:165-175.

²³ Antonovsky A. *Unraveling the mystery of health: How people manage stress and stay well* (1st ed.). San Francisco, CA: Jossey-Bass; 1987.

²⁴ Wilson, S. An Ecologic Framework to Study and Address Environmental Justice and Community Health Issues. *Environmental Justice*. 2009; 2:15-24.

²⁵ Antonovsky A. 1987.

²⁶ Wilson, S. 2009.

were identified from the literature and included in the questionnaire. The participant's responses coupled with a statistical procedure known as principal component analysis (PCA) were used to condense the twenty-six proposed variables to twenty that best represented indicators of environmental stress and resilience (Table 15).

Table 15. Proposed CSRI indicators* (Start = 26, End = 20)

Environmental Stressors	Resiliency Buffers
Environmental Exposures <ul style="list-style-type: none"> • Diesel Particulate Matter (DPM) • Lead Paint • Ozone (O₃) • Fine Particulates (PM_{2.5}) • Traffic Density • Toxic Releases from Facilities 	Pathogenic Factors <ul style="list-style-type: none"> • Linguistically Isolated • Low Birth Weight • Long-Term Unemployment • Low-Income • Gini Index • Violent Crime • Alcohol Outlet Density • Residential Segregation
Environmental Hazards <ul style="list-style-type: none"> • Brownfields • Superfund Sites • Toxic Releases Inventory (TRI) Facilities • Leaking Underground Storage Tanks (LUSTs) 	Salutogenic Factors <ul style="list-style-type: none"> • Green Space • Mental Healthcare • Primary Healthcare • Grocery Stores • Fitness Facilities • Educational Attainment • Health Insurance Coverage • Homeownership

*Removed indicators: 

CSRI scores were calculated for all census tracts in South Carolina and had a possible range of 0 to 100. Specifically, CSRI scores were calculated by multiplying environmental stressors (exposures + hazards) by resiliency buffers (pathogenic + inverse of salutogenic factors) (Figure 20) to derive a more accurate value of risk that could characterize a community's state of resilience. In version 1.0, higher CSRI scores were indicative of communities with several resilience challenges while lower scores represented high resilience communities. The inverse value for salutogenic factors in the equation meant lower scores were assigned to community assets on the higher end of the spectrum (i.e., high access to grocery stores) to represent greater resilience, and higher scores given to assets on the lower end of the spectrum (i.e., percent of uninsured population) to reflect lower resilience.

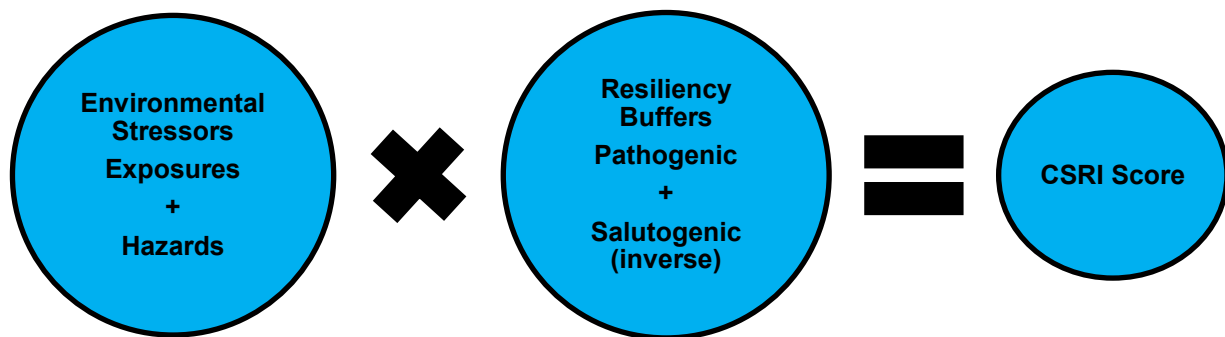


Figure 20. CSRI equation.

High-risk communities were identified as those with CSRI scores in the 90th percentile for their respective Environmental Affairs (EA) region (Lowcountry, Pee Dee, Upstate, and Midlands). A one-way analysis of variance (ANOVA) was calculated to examine regional differences, and a linear regression model was used to assess racial disparities in CSRI scores.

CSRI scores ranged from 7.4 to 64.0 (M = 29.1) across the state, and statistically significant differences were found in regional scores except between the Lowcountry and Pee Dee area. Moreover, a one unit increase in the percentage of non-white populations per census tract increased CSRI scores by 6.1%. This finding demonstrated that non-white populations were more likely to live in low resilience communities. This study was published in 2018 and additional information can be found in *Environmental Justice*.²⁷

6.3 Cumulative Stressors and Resiliency Index Version 2.0

The CSRI v2.0 is like the original CSRI in that it is an assessment metric used to quantify community resilience by considering the combined effects of environmental stressors and resilience buffers in different microenvironments. One major distinction between these screening tools is that the CSRI v2.0 includes more indicators that may be used to measure resilience related to the effects of extreme weather events (i.e., flood risk, flood insurance, and shelter capacity). The CSRI v2.0 is comprised of 31 indicators representing four domains (Table 16):

- **Environmental Hazards:** These are identified as proxies of exposure that may negatively influence health and community resilience (i.e., Superfund Sites, Toxic Release Inventory [TRI] Facilities, and Leaking Underground Storage Tanks [LUSTs]).
- **Environmental Stressors:** These are stressors or harmful exposures that may have more of a direct, negative impact on health and community resilience (i.e., traffic density, ozone [O₃], and fine particulate matter [PM_{2.5}]).
- **Vulnerability Factors:** These are factors that may lower community resilience by making individual's more susceptible to the impacts associated with exposures to environmental hazards and stressors (i.e., disability, segregation, and flood risk).
- **Health-Promoting Factors:** These are factors that may promote community resilience due to their ability to counteract the physiological and psychological responses to the cumulative impacts of environmental exposures (i.e., access to education, grocery stores, and transportation).

Table 16. CSRI v2.0 domains and indicators

Environmental Hazards	Environmental Stressors
<ul style="list-style-type: none"> • Brownfields • Superfund Sites • TRI Facilities • LUSTs • Water Discharges 	<ul style="list-style-type: none"> • DPM • O₃ • PM_{2.5} • Traffic Density • Lead
Vulnerability Factors	Health Promoting Factors

²⁷ Burwell-Naney K, Wilson SM, He X, Sapkota A, Puett R. Development of a Cumulative Stressors and Resiliency Index to Examine Environmental Health Risk: A South Carolina Assessment. *Environmental Justice*. 2018; 11:165-175.

- | | |
|---|---|
| <ul style="list-style-type: none"> • Linguistically Isolated • Low-Income • Disability • Vulnerable Populations (<5 and >65 Years Old) • Segregation • Crime • Flood Risk • Long-Term Unemployment • Industrial Development • Housing Quality • GINI Index | <ul style="list-style-type: none"> • Mental Healthcare • Primary Healthcare • Hospitals • Grocery Stores • Transportation • Education • Health Insurance • Shelter Capacity • Flood Insurance • Homeownership |
|---|---|

The CSRI v2.0 model was applied to Charleston, Berkeley, and Dorchester counties, as well as North Charleston, SC to examine community resilience at the census tract level. A modified version of the Analytic Network Process (ANP) model was used to inform the calculation of the index and may be defined as a multi-criteria decision analysis method that incorporates network structures (i.e., goals, nodes, and clusters), expert elicitation, and pairwise rankings.²⁸ The hybrid ANP model is best suited for the CSRI v2.0 because it can produce weights for the indicators by using both qualitative and quantitative data.

The calculation for the CSRI v2.0 is based on EPA's Regional Vulnerability Assessment (ReVA) program methods for assessing risk associated with cumulative and aggregate stresses to ultimately prioritize actionable risk management solutions.²⁹ The strengths of using the ReVA method are that the number of indicators included in the model are less restricted. As a result, it can weight indicators based on their correlation, and the product of the calculation allows us to score and rank communities at the census tract level according to their resilience status. Dual weighting is achieved by integrating stakeholder survey responses in the ANP model with the ReVA method of calculating weights from the correlation between indicators.

Data sources for the CSRI v2.0 are from EPA's EJSCREEN assessment tool, EPA's library database system, U.S Census Bureau, and the original CSRI. We calculated CSRI v2.0 scores and rankings to simulate community resilience in four different scenarios (Figure 21):

- Scenario 1: Berkeley, Charleston, and Dorchester, SC tri-counties without community stakeholder input from the CSRI v2.0 Survey;
- Scenario 2: Berkeley, Charleston, and Dorchester, SC tri-counties with community stakeholder input from the CSRI v2.0 Survey;
- Scenario 3: North Charleston, SC without community stakeholder input from the CSRI v2.0 Survey + the industrial development indicator; and
- Scenario 4: North Charleston, SC with community stakeholder input from the CSRI v2.0 Survey + the industrial development indicator.

We developed color-coded maps for all four scenarios in ArcMap 10.6.1 and identified census tracts that ranked and scored the highest and lowest for community resilience using RStudio. The maps show the highest resilience communities in green and the lowest resilience

²⁸ Saaty TL. The Analytic Network Process. IJOR; 2008; 1:1-27

²⁹ Locantore NW, Tran LT, O'Neill RV, McKinnis PW, Smith ER, O'Connell M. An Overview of Data Integration Methods for Regional Assessment. Environ Model Assess. 2004; 94:249-261.

communities in red. Furthermore, we examined differences in community resilience rank and score by domain for tri-county and North Charleston, SC census tracts. There are 155 total census tracts in the tri-county area; however, one census tract was excluded since it was assigned to a body of water and had little or no residential population. As a result, CSRI v2.0 rankings had a potential range of 1 to 154. Communities with a high CSRI v2.0 ranking are considered more resilient than communities with lower ranks. CSRI v 2.0 rankings and scores were mapped to depict variability in community resilience for each scenario.

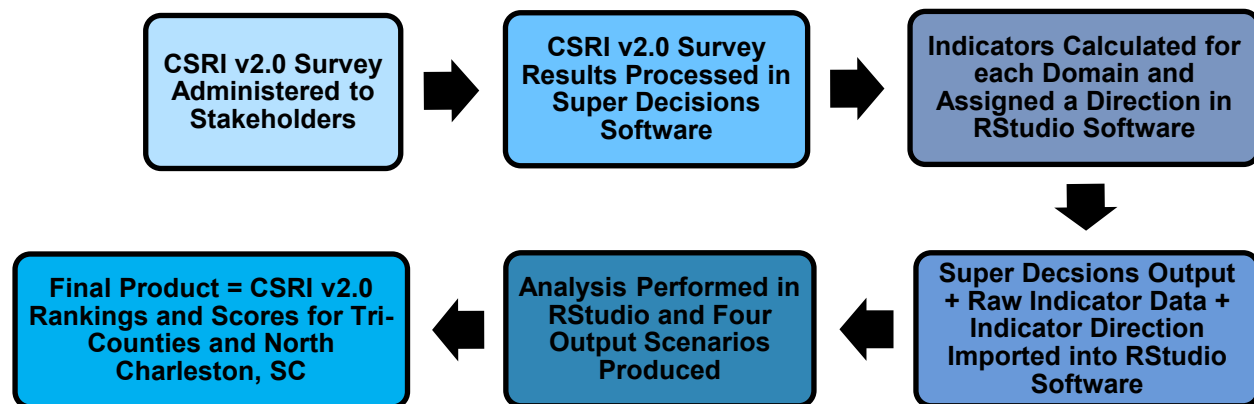


Figure 21. CSRI v2.0 process flow.

6.4 CSRI v2.0 Ranking Exercise

During the ranking exercise, stakeholders were asked to complete a “Cumulative Stressors and Resiliency Index v2.0 Survey” comprised of seven questions to inform part of the weighting for the index. Community and non-community stakeholders (13) were asked to use their expertise as key informants to complete a paper-based survey ranking the negative influence of indicators on community resilience across four domains: 1) Environmental Stressors, 2) Environmental Hazards, 3) Vulnerability Factors, and 4) Health Promoting Factors.

For example, participants were asked the following question: “Do **environmental stressors** or **environmental hazards** have a stronger negative influence on community resilience? Select one.”. Once the stakeholders selected one of two possible domain options, they were asked to use their response to answer a secondary question of “How much more [does domain x have a stronger negative influence on community resilience]? Circle one.”. The stakeholders were then given five choices to answer the secondary question: a. Equal, b. Moderately, c. Strongly, d. Very Strongly, and e. Extreme (Table 17). Questions 2 through 7 corresponded with the way the information is presented in Super Decisions so the participants’ responses could easily be entered into the software program post-workshop. In addition, participants were asked to identify their stakeholder affiliation in question 1 and could select more than one answer choice out of six possible options.

Table 17. CSRI v2.0 survey results

CSRI v2.0 Survey Questions	Responses
1. Stakeholder Affiliation	Community: 8 Government: 3 Commercial/Private: 2 Academic: 1 Non-Profit: 7 Other: 2
2. Environmental Stressors vs. Environmental Hazards	Environmental Stressors: 5 (38%) <ul style="list-style-type: none"> a. Equal: 0 b. Moderately: 1 c. Strongly: 1 d. Very Strongly: 3 e. Extreme: 0 Environmental Hazards: 8 (62%) <ul style="list-style-type: none"> a. Equal: 0 b. Moderately: 1 c. Strongly: 4 d. Very Strongly: 3 e. Extreme: 0
3. Environmental Stressors vs. Vulnerability Factors	Environmental Stressors: 1 (8%) <ul style="list-style-type: none"> a. Equal: 0 b. Moderately: 0 c. Strongly: 1 d. Very Strongly: 0 e. Extreme: 0 Vulnerability Factors: 8 (92%) <ul style="list-style-type: none"> a. Equal: 0 b. Moderately: 0 c. Strongly: 4 d. Very Strongly: 6 e. Extreme: 2
4. Environmental Stressors vs. Health-Promoting Factors	Environmental Stressors: 5 (38%) <ul style="list-style-type: none"> a. Equal: 0 b. Moderately: 0 c. Strongly: 3 d. Very Strongly: 2 e. Extreme: 0 Health-Promoting Factors: 8 (62%) <ul style="list-style-type: none"> a. Equal: 0 b. Moderately: 0 c. Strongly: 3 d. Very Strongly: 2 e. Extreme: 2
5. Environmental Hazards vs. Vulnerability Factors	Environmental Hazards: 6 (46%) <ul style="list-style-type: none"> a. Equal: 1* b. Moderately: 1

	c. Strongly: 3 d. Very Strongly: 2 e. Extreme: 0 Vulnerability Factors: 6 (46%) a. Equal: 1* b. Moderately: 0 c. Strongly: 0 d. Very Strongly: 6 e. Extreme: 0 Equal: 1* (8%)
6. Environmental Hazards vs. Health-Promoting Factors	Environmental Hazards: 3 (23%) a. Equal: 0 b. Moderately: 0 c. Strongly: 3 d. Very Strongly: 0 e. Extreme: 0 Health-Promoting Factors: 10 (77%) a. Equal: 0 b. Moderately: 1 c. Strongly: 5 d. Very Strongly: 3 e. Extreme: 1
7. Vulnerability Factors vs. Health-Promoting Factors	Vulnerability Factors: 6 (46%) a. Equal: 1* b. Moderately: 0 c. Strongly: 3 d. Very Strongly: 3 e. Extreme: 0 Health-Promoting Factors: 4 (31%) a. Equal: 2* b. Moderately: 0 c. Strongly: 1 d. Very Strongly: 2 e. Extreme: 1 Equal: 3* (23%)

While completing the survey, stakeholders had access to the four lists of CSRI v2.0 indicators representing each domain that were displayed on easels around the room. The CSRI v2.0 Survey responses were used to build an ANP model in Super Decisions, which is a multi-criteria software application that can be used to implement ANP and Analytic Hierarchy Process (AHP) models.³⁰ The domains were entered as nodes in Super Decisions and compared to each other to quantify and rank the degree of negative influence a specific domain has on community resilience. The domain selected by most participants for survey questions 2 through 7 was entered into the software as having a greater negative influence on community resilience

³⁰ Saaty TL. The Analytic Network Process. IJOR; 2008; 1:1-27

between the two choices. When asked “How much more?”, the Likert scale survey response with the most votes was selected.

For example, 62% of the stakeholders perceived environmental hazards as having a stronger negative influence on community resilience than environmental stressors in question 2 (Table 17). Environmental hazards were selected in the software as well as “strongly” since that option received the most stakeholder responses (Figure 22). This process was followed until all domains were compared with each other to complete the six pairwise rankings. In the case of question 5 where stakeholders equally identified environmental hazards and vulnerability factors as having a stronger negative influence on community resilience, we selected vulnerability factors as having a stronger negative influence but said they were equal in the secondary question.

Each domain could receive any weighted value between 0 and 0.1 to equal 100%. Domains with weighted values closer to 0.1 had a greater negative influence on community resilience, meaning the contribution of those factors may have the greatest impact on whether a community is resilient. In contrast, domains weighted closer to zero may have a lower impact on a community’s resilience status.

Figure 22. Super decisions interface for entering CSRI v2.0 survey responses.

6.5 CSRI v2.0 Indicator Evaluation

Community and non-community stakeholders were given an opportunity to review the indicators for each domain to determine which indicators, if any, should be removed or added to the master list of variables. While no indicators were removed from the master list, stakeholders suggested adding “industrial development” and “housing quality.” The industrial development indicator was added to the CSRI v2.0 as a vulnerability factor and calculated as the percentage of a census tract zoned for light and/or heavy industrial activity. This zoning data was only assessable for North Charleston, SC census tracts and was not used in the overall tri-county community resilience assessment. Since this particular indicator was important to the community and they were already in the process of analyzing this data with their College of Charleston partners, we performed an additional assessment and created separate maps for North Charleston, SC to document the influence of this variable on the model (Scenarios 3 and 4). Housing quality was also added to the master list as a vulnerability factor using data from the U.S. Census Bureau on the percentage of older homes within a census tract (i.e., percentage of

homes built pre-1950's). We later included the Gini coefficient as a vulnerability factor, which was an indicator used in the original CSRI to measure income inequality.

6.6 CSRI v 2.0 Findings

The CSRI v2.0 Survey responses were all entered into the Super Decisions software program and the results demonstrated that vulnerability factors were perceived as having a stronger negative influence on community resilience (0.50) (Table 18). This means that communities with more vulnerabilities (i.e., crime, disability, and industrial development) may experience more challenges achieving community resilience. Environmental stressors (i.e., PM_{2.5}, traffic density, and lead) were ranked the lowest (0.04) in terms of their ability to negatively influence community resilience. While community stakeholders ranked environmental stressors as least important, it was in the context of the other domains and does not mean they do not have an impact on community resilience. Overall, vulnerability and health promoting factors accounted for almost 80% (0.78) of the domain weights that were factored in to the CSRI v2.0 calculation. As a result, indicators assigned to those domains had the greatest contribution in determining a community's resilience status.

Table 18. CSRI v2.0 survey results: Node comparison values for each domain

Domains	Node Comparison Values
Environmental Hazards	0.18
Environmental Stressors	0.04
Health-Promoting Factors	0.28
Vulnerability Factors	0.50

Since the survey results were not used in the tri-county assessment without stakeholder input; the domains received equal weights of 1.0 for one aspect of the weighting process and the correlation between indicators completed the dual weighing feature of this model. The results for the tri-county analysis without stakeholder input indicated that the most resilient community was in a Berkeley County census tract (45015020403) and received the highest overall rank of 154. When considering the individual domain rankings for this particular census tract, the highest rank was assigned to vulnerability factors (147). The next highest rank was found in the environmental stressors domain (143), followed by environmental hazards (120) and health-promoting factors (79). The census tract with the most resilience challenges received the lowest rank of 1 and was also found in Berkeley County (45015020804). Of the four domains, this census tract performed best in the area of vulnerability factors (69) and worst regarding health-promoting factors (12). The environmental hazards and environmental stressors domains received low ranks as well, 24 and 32 respectively.

Figure 23 corroborates the aforementioned findings, where Berkeley County has quite a few census tracts at the high and low ends of the community resilience spectrum. Many of the higher resilience communities in Berkeley County seem to be concentrated in Cross, Moncks Corner, and the very western part of the Bonneau area. The higher resilience tracts for Charleston County are in the southwest region and encompass Edisto Island, Ravenel-

Hollywood, and Johns Island. In Dorchester County, the most resilient communities appear to reside in the western portion of Summerville near the border of Charleston County.

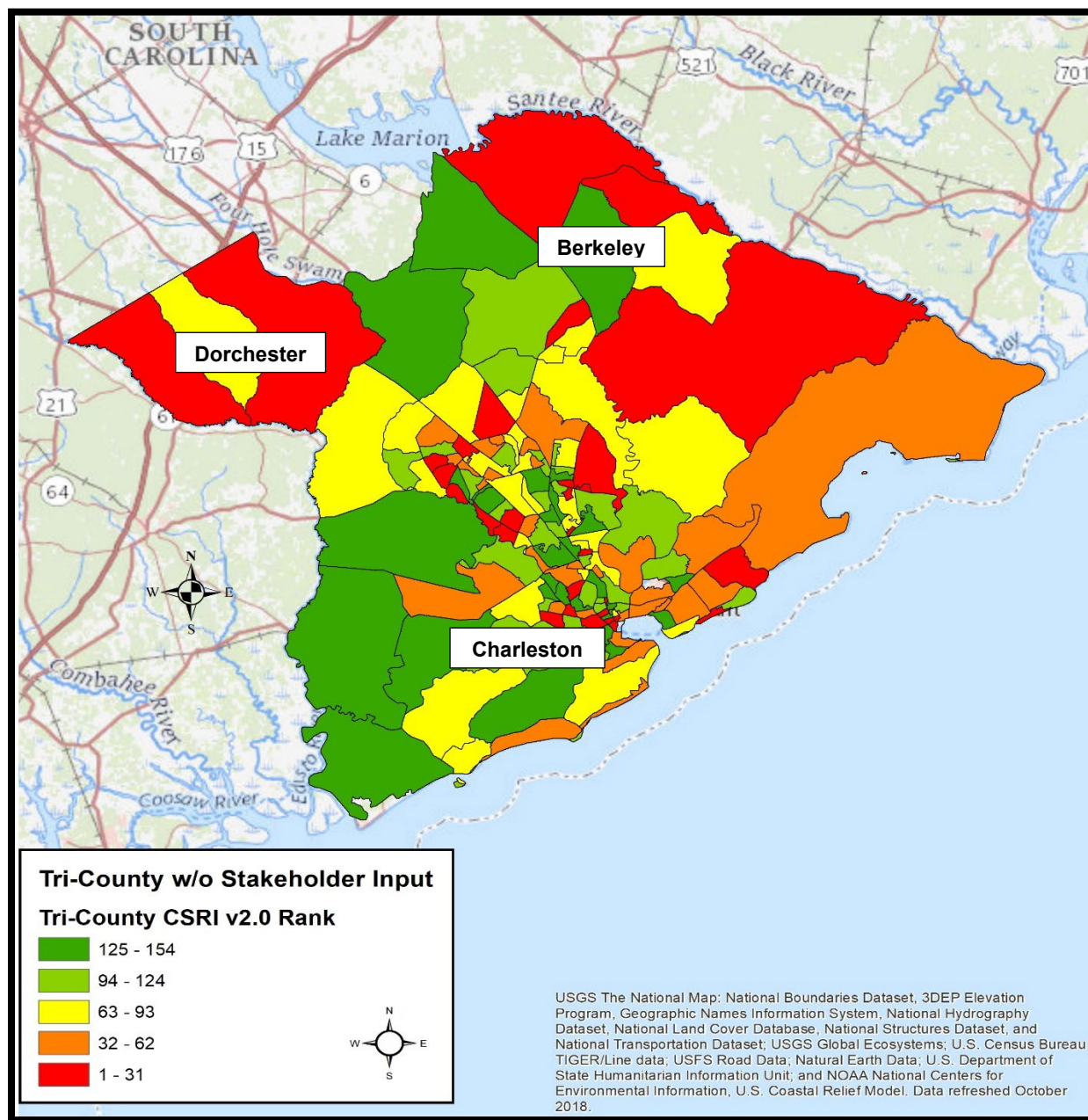


Figure 23. Tri-County CSRI v2.0 rankings without community stakeholder input for Dorchester, Charleston, and Berkeley Counties. Note: The highest resilience communities are in green and the lowest resilience communities are represented in red.

When the tri-county analysis was performed with stakeholder input (Figure 24), there were a few changes that occurred in census tract rankings due to the higher weighting placed on vulnerability factors from the CSRI v2.0 Survey. The community in Berkeley County that was most resilient without stakeholder input remained the most resilient in the model with stakeholder input (45015020403). There was also no change in the domain rankings. In contrast, the census tract designated as having the most resilience challenges without

stakeholder input changed when examined with stakeholder input. While still located in Berkeley County, this census tract (45015020405) received the lowest rank for health-promoting factors (1) when considering all four domains. Vulnerability factors were ranked as the second lowest (34) for this census tract, followed by environmental hazards (91) and environmental stressors (117). The census tract previously ranked the lowest without stakeholder input is now ranked 6th for community resilience with stakeholder input.

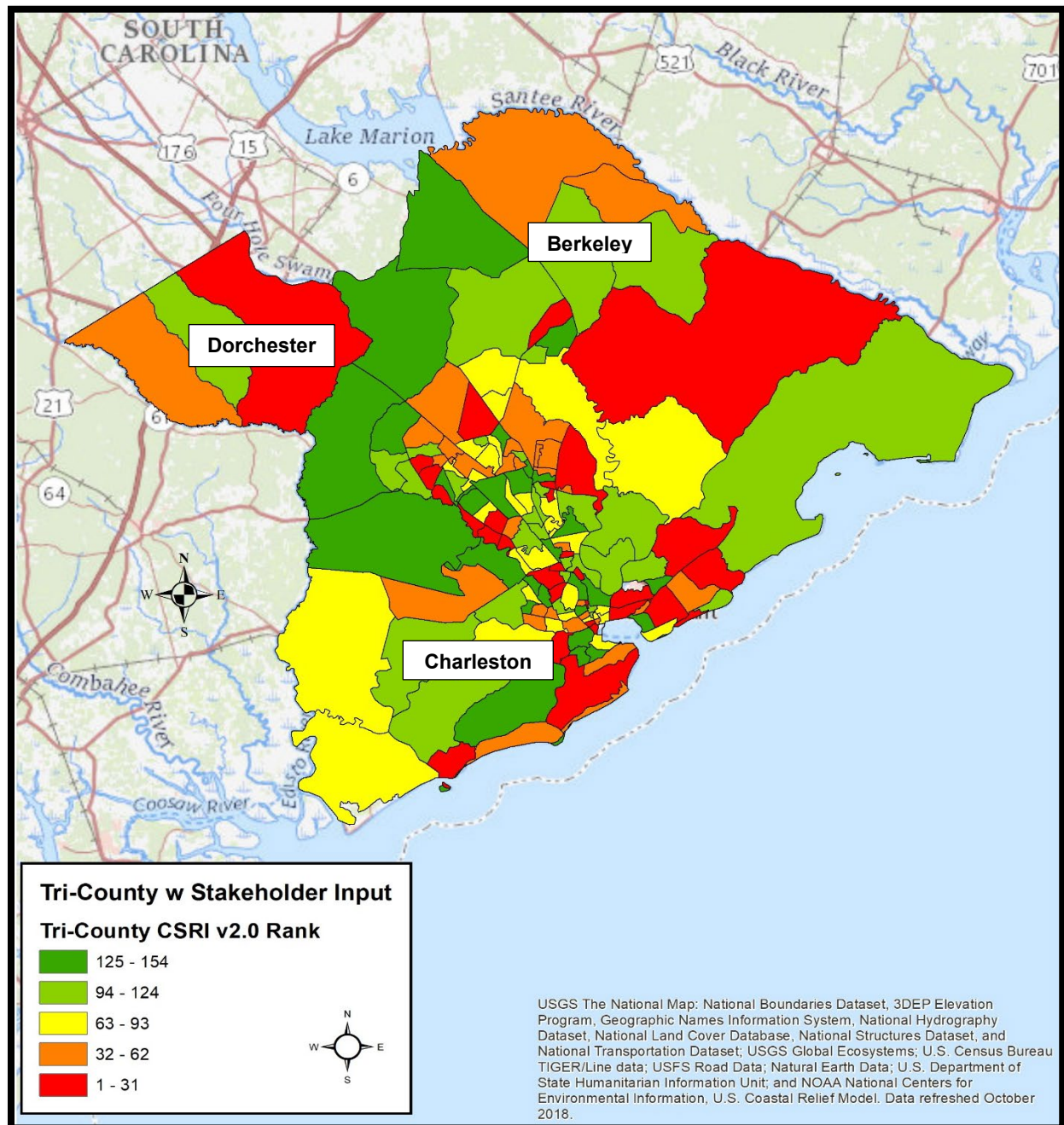


Figure 24. Tri-County CSRI v2.0 rankings with community stakeholder input for Dorchester, Charleston, and Berkeley Counties. Note: The highest resilience communities are in green and the lowest resilience communities are represented in red.

When comparing Figure 23 and Figure 24, Figure 24 shows a shift in census tract rankings for all three counties. For example, the new assessment shows Dorchester County having more census tracts with higher resilience rankings compared to the same geographic region without stakeholder input. This relationship appears to be the same for Berkeley County; however, there is a decrease in high resilience tracts located in Charleston County.

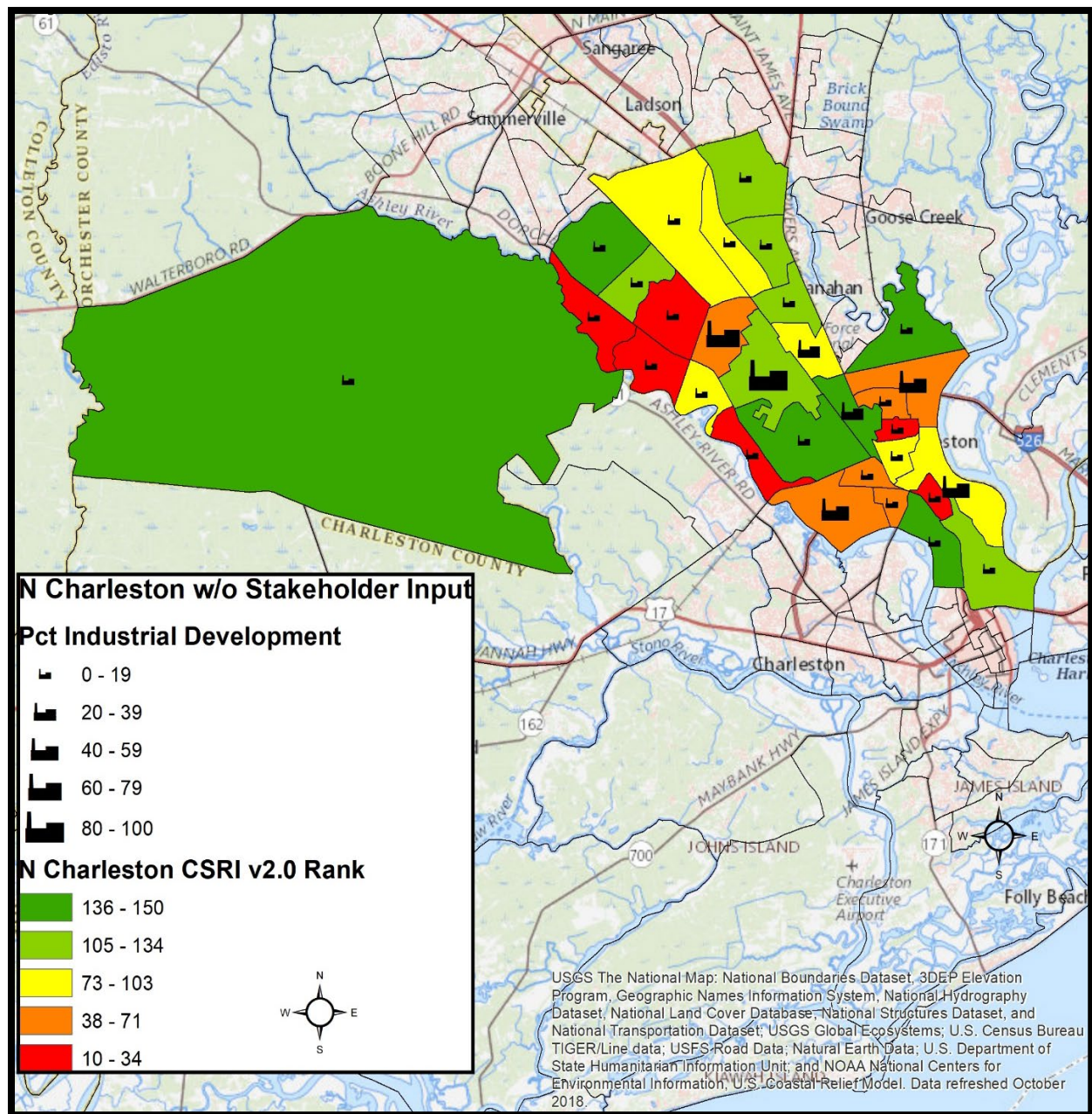


Figure 25. CSRI v2.0 rankings for North Charleston, SC with industrial development and without community stakeholder input. Note: The highest resilience communities are in green and the lowest resilience communities are represented in red.

Figure 25 shows census tracts in North Charleston have community resilience rankings ranging from 10 to 150. There appears to be no relationship between the percentage of a tract zoned for industrial activity and the CSRI v2.0 ranking for community resilience. The census tracts ranked

lowest for community resilience were mostly located along the Ashley River and coincide with I-26. With stakeholder input (Figure 27), CSRI v2.0 scores range from 3 to 149 and follow a

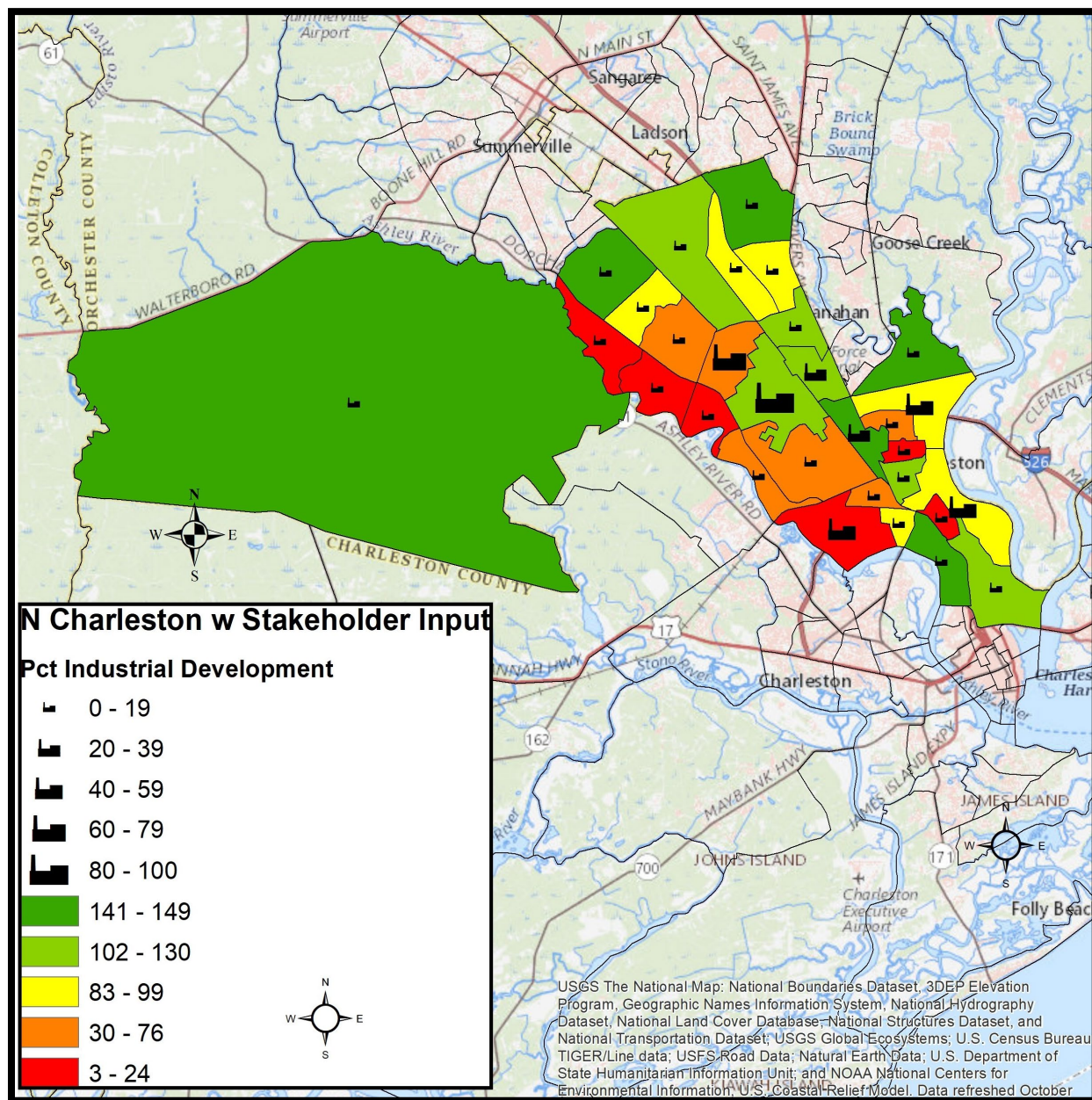


Figure 26. CSRI v2.0 rankings for North Charleston, SC with industrial development and community stakeholder input. Note: The highest resilience communities are in green and the lowest resilience communities are represented in red.

similar pattern of low resilience along the Ashley River and I-26. A few census tracts decreased in community resilience while others improved due to stakeholder weighting.

6.7 CSRI v2.0 Discussion

Determining environmental differences between high and low resilience communities requires a deeper understanding of which indicators are contributing to a community's state of resilience. For example, the tri-county assessment showed Berkeley County contained the census tracts

for the highest and lowest ranked communities. When we explore the census tract ranked highest for community resilience in more detail, particularly the indicators in the vulnerability factors domain, we are able to construct a community profile that characterizes resilience. For example, the high resilience community may be described as a higher income community (7% low-income) with newer housing (0% pre-1960's housing), moderate income inequality (0.43), and a low disabled population (3%), unemployment rate (4%), and segregation (11%) (Figure 27). In contrast, the lowest resilience community had a large low-income population (45%), high segregation (75%), older housing (11% pre-1960's housing), a larger disabled population (7%), greater income inequality (0.53), and a higher unemployment rate (11%). The population of vulnerable residents (<5 and >65) was also slightly higher in the lower resilience community (23%) compared to the high resilience community (19%). Crime, flood risk, and linguistic isolation had the same or similar values for both resilience levels and were not distinguishable factors.

The health-promoting factors domain received the second highest weight from the CSRI v2.0 survey responses and may provide additional insight on community resilience. The greatest differences between the two resilience levels were found in transportation, education, and health insurance status. Specifically, the high resilience tract was more educated (98% vs. 77%), had greater access to public transportation (80% vs. 0%), and a lower percentage of uninsured individuals (3% vs. 27%) (Figure 22). The high resilience census tract had slightly shorter distances to hospitals, grocery stores, and shelter, and a marginally higher percentage of homeowners (87% vs. 84%). By comparing these two communities, we can ascertain the factors that may be driving a community's resilience status. Further analysis is necessary to determine whether statistical differences exist between high and low resilience communities.



Figure 27. High and low resilience community features.

6.8 Community Case Study

While the highest and lowest resilience communities were found in Berkeley County, we can use the location of Bertha's Kitchen (2332 Meeting Street Road, Charleston, SC 29405) as a relevant case study for Charleston County. As part of the Resilience Workshop, a few stakeholders met at Bertha's Kitchen (restaurant) to participate in a "Resilience Walk" to identify and photograph resilience opportunities and existing features of the community that represented resilience. The data showed Bertha's Kitchen was located in an area (census tract 45019005400) ranking 15th for community resilience, which meant that the surrounding community was part of the lowest resilience category in North Charleston (Figure 28).

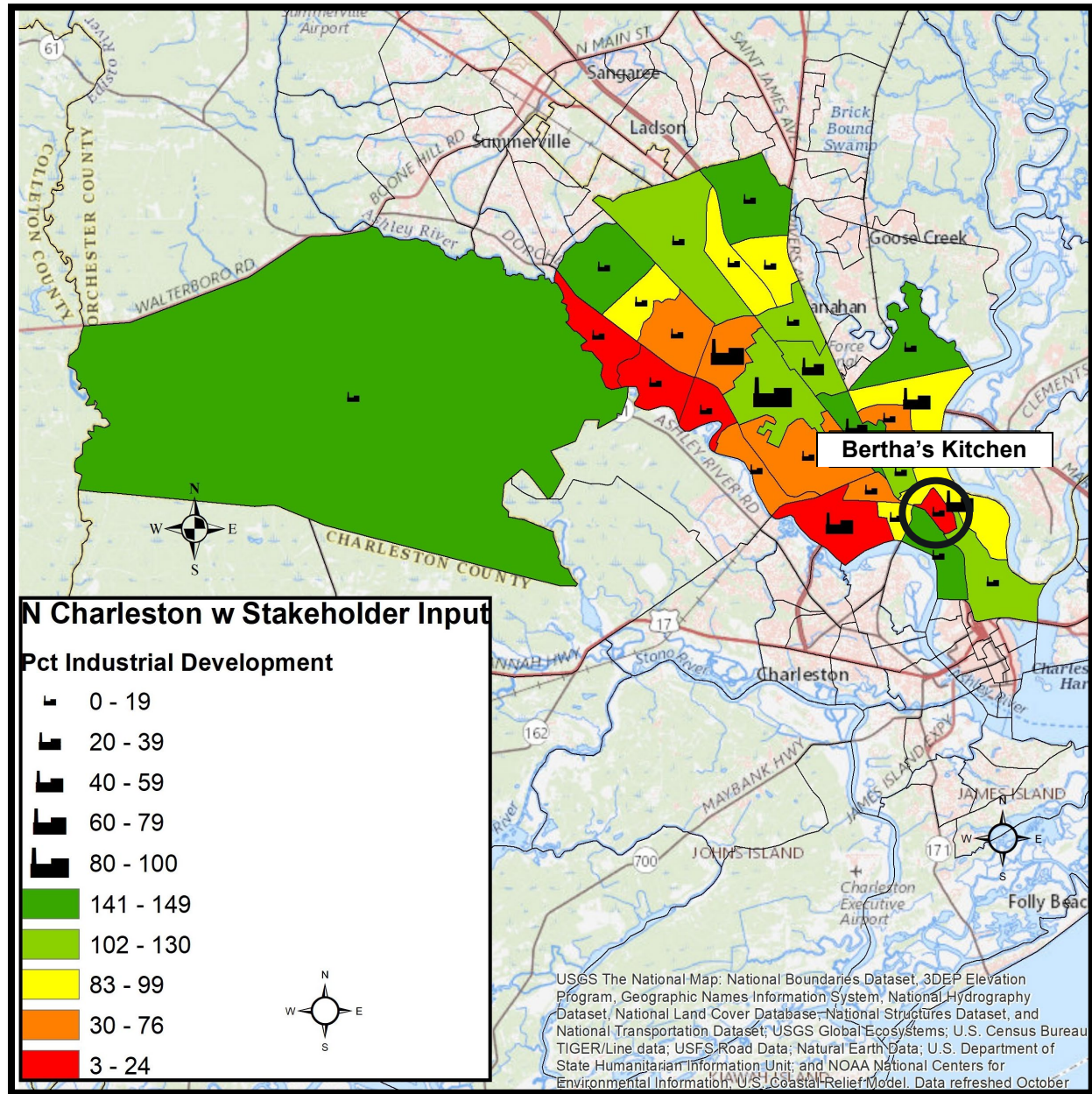


Figure 28. Location of Bertha's Kitchen. Note: The highest resilience communities are in green and the lowest resilience communities are represented in red.

The greatest opportunity to strengthen resilience in this particular community would be to focus on improving the vulnerability factors since they were ranked the lowest compared to other communities in North Charleston (1). Specifically, the community surrounding Bertha's Kitchen was the most segregated (90%) of all the tri-county census tracts, it had the 5th highest percentage of low-income residents (70%), highest income inequality (0.64), and shared the highest unemployment rate (11%). These vulnerability factors indicate a need for more employment opportunities and higher paying positions for residents in this community in order to see a positive shift in resilience. Prioritizing the mitigation of environmental stressors (54) should be the next step, followed by increasing the presence of and access to health-promoting factors (87). Environmental hazards (140) were the least problematic in this community. Understanding and prioritizing opportunities for resilience will allow residents to propose neighborhood specific solutions to decision-makers who are responsible for changing the socio-economic landscape of their community.

Appendix D: Follow-up Working Session and Community Resource Fair

EPA and LAMC hosted a follow-up working session on April 26, 2019 from 2:00pm-8:00pm at Perry Webb Community Center (3200 Appleton Ave. North Charleston, SC 29405) to develop an actionable implementation plan and share key resources with community members to help them address the resilience challenges and solutions identified at the first workshop.

Participants included individuals from:

- Accabee and surrounding neighborhoods
- Berkeley-Charleston-Dorchester Council of Governments (BCDCOG)
- Charleston Community Research to Action Board (CCRAB)
- Federal Highway Administration South Carolina Division
- Ingevity
- LAMC
- Metanoia
- New Taberwade Church
- North Carolina Agricultural and Technical State University
- North Charleston City Council
- Pfizer
- South Carolina Department of Health and Environmental Control
- South Carolina Department of Transportation (SCDOT)
- South Carolina Living Communities Alliance
- Three Oaks Engineering
- TriCounty Cradle to Career
- U.S. EPA
- Wando High School



Figure 29. Participants learn about the I-526 West Corridor project at the community resource fair (photo: Robert Kay).

Activities included:

- A working session with LAMC board members and executive staff to prioritize resilience strategies and develop a feasible implementation plan.
- A hands-on community-based brownfields training and sharing a survey tool for community members on how to identify, inventory, and prioritize brownfields.
- A resource sharing session, which included information on:
 - Cumulative Stressors and Resiliency Index
 - Community engagement in NEPA
 - How to identify, inventory, and prioritize brownfields
 - General information on how to apply for an EPA Brownfields Grant
 - Pfizer health resources
 - A Healthy Environmental Actions Database (AHEAD)

- Federal Emergency Management Agency (FEMA) flood insurance
- U.S. Department of Energy (DOE) resources for increasing access to capital, understanding energy burden, and increasing energy efficiency
- Lowcountry Rapid Transit project
- FHWA/SCDOT I-526 West Lowcountry Corridor Project
- Safe Routes to Schools
- SC Livable Communities Alliance
- Goods Movement Federal Resources Compendium

See the North Charleston Community Resilience Resource Compendium for detailed information on these and other programs and resources.



Figure 30. EPA Region 4 staff conducts a community-based brownfields training (photo: Siobhan Whitlock).

Appendix E: Lessons Learned for the Roadmap

Lessons learned for improving the EPA port community resilience roadmap and workshop include:

- The resilience walk was an informative and engaging component of the workshop.
- The length of the workshop was appropriate for the audience and material.
- Although a strong list of solutions was produced for the community, more time could be allocated to the resilience solutions activity to discuss the implementation of each strategy.
- Two new resilience objective categories emerged from the goals and objectives identification activity: (1) economic opportunity and (2) community partnerships. These could be reflected in the roadmap.
- Overall, the community found the workshop to be very valuable and is excited about next steps.