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1. Executive Summary

In the fall of 2021, Orangeburg County received a Community Development Block Grant Mitigation (CDBG-MIT) from the South Carolina Office of Resilience (SCOR) to perform a stormwater drainage study. The funding for this study was provided because of three presidentially declared disasters in South Carolina: Hurricane Joaquin 2015, Hurricane Matthew 2016, and Hurricane Florence 2018. Ultimately, funding became available for flood mitigation projects in qualifying low-to-moderate income (LMI) communities.

Carolina Transportation Engineers & Associates, RK&K, and Stantec (the Study Team) were selected to develop and deliver a Stormwater Drainage Study for the Orangeburg County. The primary purpose of this study is to identify hydraulic deficiencies and provide solutions likely to withstand future disasters. The CDBG-MIT grant promotes the prudent use of public funds by identifying resilient projects in vulnerable communities. To ensure equitable distribution of funding, grant criteria demand strict adherence to the viability of selected projects demonstrated through technical analysis and close examination of socio-economic data.

The Study Team conducted 2 public information meetings to gather data on drainage deficiencies from the citizens across the study area. To engage the public, the team engaged local television and radio stations, social media, newspapers and elected officials to encourage public participation. The first meeting was held on August 30, 2022, at the County Library in downtown Orangeburg and the second meeting was held on September 6, 2022, at Lake Marion High School in Santee. Both meetings were well attended with more than 70 participants. A total of 42 sites were reported for the team to investigate. Field assessments were performed on the sites and 6 of the locations were selected to advance for full analysis and consideration for funding by the South Carolina Office of Resilience.

For the selected sites, alternative analysis and benefit cost analysis were performed. The percentage of LMI households and the Social Vulnerability Index (SoVI) for each site were also recorded. Projects producing a Benefit Cost Ratio (BCR) greater than one (1) was the most critical factor in ranking the sites. This factor and other socioeconomic criteria were used to rank projects for this study and qualify them to compete for funding at the state level.

City of Orangeburg Stormwater Drainage Study

2. Introduction

a. Overview of Study Area

In the fall of 2021, Orangeburg County received a CDBG-MIT grant from the South Carolina Office of Resilience (SCOR) to perform a stormwater drainage study. The funding for this study was provided because of three presidentially declared disasters in the state of South Carolina (Hurricane Joaquin 2015, Hurricane Matthew 2016, and Hurricane Florence 2018). These storms qualified millions of dollars of funding for flood mitigation projects in qualifying LMI communities across the state of Soutth Carolina.

Orangeburg County is the 2nd largest county (by area) in the state of South Carolina. The county is labeled a persistent poverty area with some of the highest LMI census tracts located in the urbanized areas of the county. According to the 2022 Census data, the population of Orangeburg County is 83,094. 12,482 of those citizens live in the City of Orangeburg and the remaining citizens live in and around the 16 towns that occupy the rural communities in the county. The racial makeup is reported as 61.5% African American, 35% White, and 2.7% Hispanic. Compared to the State population percentages, South Carolina's overall population is 26.7% African American, 68.6% White, and 6.4% Hispanic. Orangeburg County's median household income is $38,052 with 26.5% of the population living below the poverty line. The median income for the state was $58,234, while only 14.6% of South Carolinians lived in poverty.

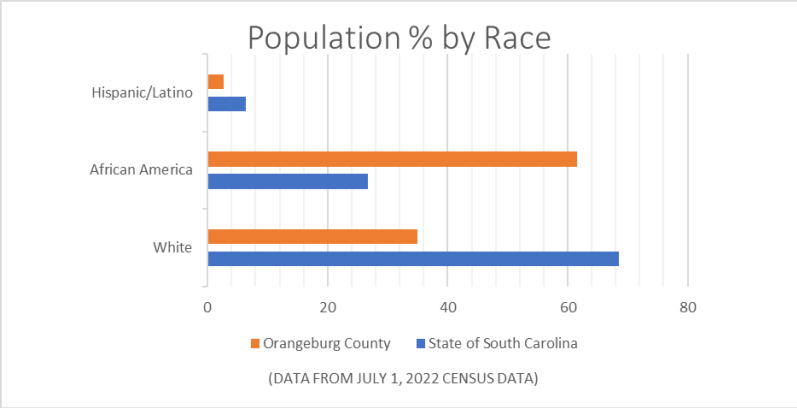

Table 1 – Orangeburg County Population by Race

Considering the socio-economic data and the reciprocal racial makeup of this predominantly rural study area, Orangeburg County is a prototypical candidate for assistance from the Department of Housing and Urban Development (HUD). The CDBG-MIT Program provides a rare opportunity for disadvantaged communities by funding projects

that improve infrastructure by making the qualifying area less susceptible to impact from natural disasters. The grant also emphasizes decreasing the risk of damage due to future disasters by considering resilience.

b. History of Flooding

Orangeburg County lies in a transitional geographic area of the state as illustrated in **Figure 1**.

Figure 1 – Inner and Outer Coastal Plains

The study area is located at the eastern end of the Inner Coastal Plain as it transitions to the Outer Coastal Plain. The terrain in the western portion of the county sheds runoff into the North and South Edisto Rivers. The South Edisto River serves as the southern border of the county while the North Edisto River flows parallel about 13 miles to the north. The North Fork of the Edisto River turns south near the City of Orangeburg and eventually merges with the South Fork just west of the Town of Branchville. The confluence forms the Edisto River. Runoff on the eastern portion of the county flows through Four Holes Swamp. **Figure 2**, (below), shows the 4 major river basins that drain Orangeburg County.

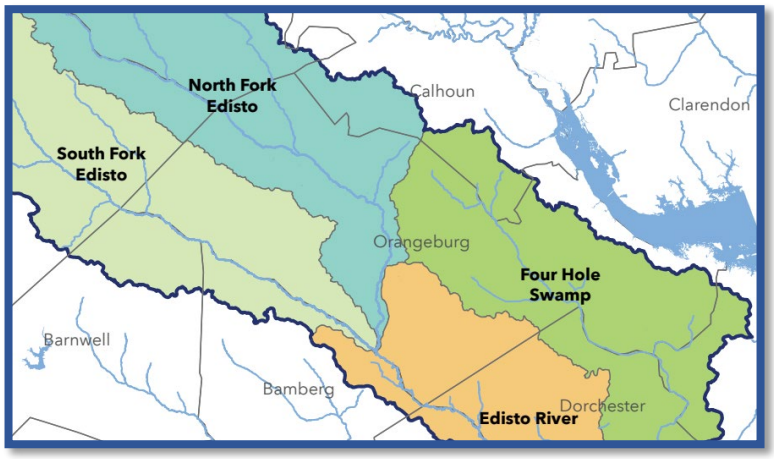

Figure 2. Orangeburg County River Basins

The towns of Springfield, Neeses, Livingston, North, Woodford, Norway, and Neese seldom report flooding issues, as the North and South Edisto River basins easily accommodate runoff from these communities. The towns sit well above flood plains, with elevations ranging from 300 to 400+ feet above sea level. The elevations change quickly protecting these communities from flooding.

Moving east into the central section of the study area, elevations begin to fall and flatten. The City of Orangeburg (elevation 250 ft) rests on the county's transition from Inner to the Outer Coastal Plain. The city is not a part of this study but clearly illustrates the geographic change from the inner to outer coastal plain. Cordova (255') Cope (190') are located west of the North Fork of the Edisto River, just south of Orangeburg but did not report flooding issues during the public interest meetings for this study. Rowesville (166'), Branchville (122') and Bowan are located south and east of the City of Orangeburg. Cow Castle Creek carries drainage south from Orangeburg toward Bowman (131') and eventually merges with Four Hole Swamp. These towns all experience some issues with flooding as they sit in a relatively flat low-lying area of the county.

The eastern part of Orangeburg County is the lowest portion of the county, by elevation, reporting the most problems with flooding. The area east of Interstate 26 is home to Four Hole Swamp boarding Lake Marion to the north. The towns of Eloree, Santee, Vance, Holly Hill and Eutawville are all located in this section of the county. These towns experience frequent and persistent drainage issues. The terrain is exceptionally level. The elevation changes from Santee to Eutawville range from 130 ft to 113 ft above sea level. The Town of Holly Hill sits at approximately 100 ft and is located directly south of the Horse Range Creek Watershed. Due to the low and flat terrain, drainage accumulates quickly in this large basin during heavy rains. With no viable drainage outlets entire communities are inundated with flood waters. Channels are often used to move water to creeks and streams in this part of the county, but it is difficult to create the capacity required to carry the runoff for long distances. The result is persistent flooding with no cost-efficient methods of substantive relief.

Figure 3 – Before and After Flooding on Kings Road, Orangeburg

Figure 4 – Before and After Flooding on Tupelo St, Bowman

During the Historic floods of 2015 low lying areas of Orangeburg County were inundated by flood waters. Many of the communities in eastern Orangeburg County (Orangeburg, Bowman, Holly Hill and Eutawville) were flooded for days as runoff from the midlands and backwater from Four Hole Swamp and the Horse Range watershed covered large portions of eastern Orangeburg County. The county experienced more than 16 inches of rain in a 48-hour period in some areas. Adding to the catastrophic local rain event, the midlands received even more precipitation. The swollen rivers just north of Orangeburg then conveyed even more rainwater from the rolling terrain of the midlands into the level outer coastal plains of Orangeburg County.

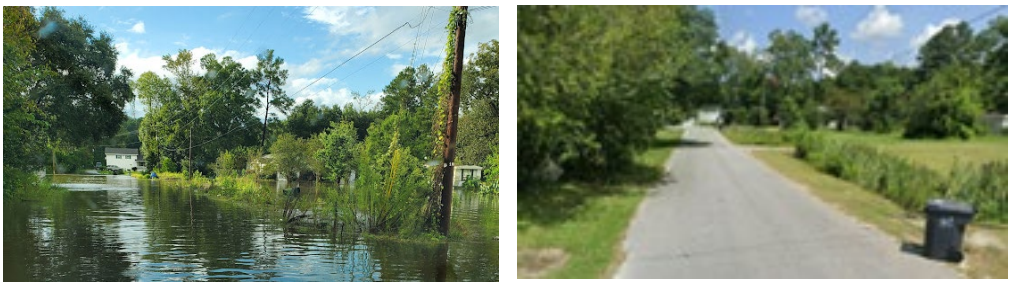

Figure 5 – Before and After Flooding on Poplar St, Bowman

Photographs below provided Orangeburg County staff, and the Times and Democrat show the severity of the flood waters on these small communities. Some residents used boats to navigate their communities and assist stranded neighbors for days after the storms. Some elderly residents were rescued from their homes and taken to safety while standing water hindered emergency services from reaching some areas in their jurisdiction.

Figure 6 - photos of Gilmore St, Holly Hill (flooding photo courtesy of the Times and Democrat)

3. Review of Planning Parameters

Social Vulnerability Index (SVI) uses sixteen United States Census variables to identify communities that are vulnerable to the effects of natural disasters. Social Vulnerability is an adverse impact on a community caused by external stresses. Natural disasters, disease outbreaks or man-made catastrophes all qualify as stresses that cause an increase in an area's social vulnerability. Social Vulnerability is measured in an overall score but is comprised of several components: Socio-economic status, Household Characteristics, Racial and Ethnic Minority Status and Housing Type/Transportation. The index is measured on a scale of 0 to 1, with 1 being the highest reading of vulnerability. Orangeburg County shows higher SVI readings in more densely populated areas of the county with higher percentages minorities exhibiting socio-economic distress. Nationwide, Social Vulnerability tends to be higher in urban areas and lower in rural areas due to sparse population distribution. Variations in household makeup, race, and public resources are also major factors in determining social vulnerability with the education level of the head of household being a major influence.

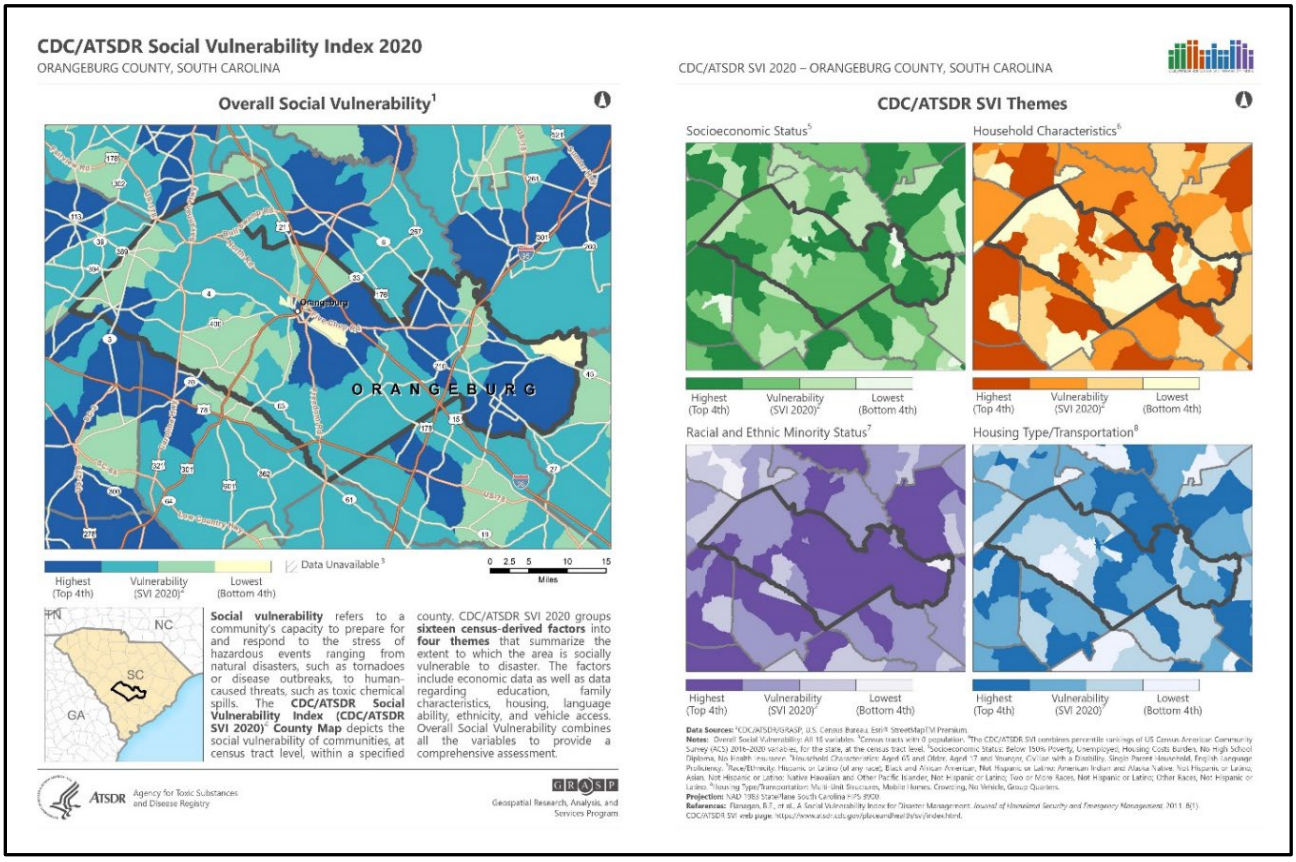

Figure 7. ASTDR Social Vulnerability for Orangeburg County

Low to Moderate Income

Low to Moderate Income (LMI) is a variable used by HUD to characterize the income level of communities. Low income is defined as households earning less than 50% of the area median income while moderate income households have an income between 50 - 80% of the area median income. Combining these categories provides the opportunity to view the income distribution of an area and highlight zones that are at risk due to financial limitations. **Figure 8** illustrates the LMI zones across the study area. The LMI percent for Orangeburg County is 43.11%, with values ranging from 23.19 % near the City of Orangeburg, up to 62.28 % in most

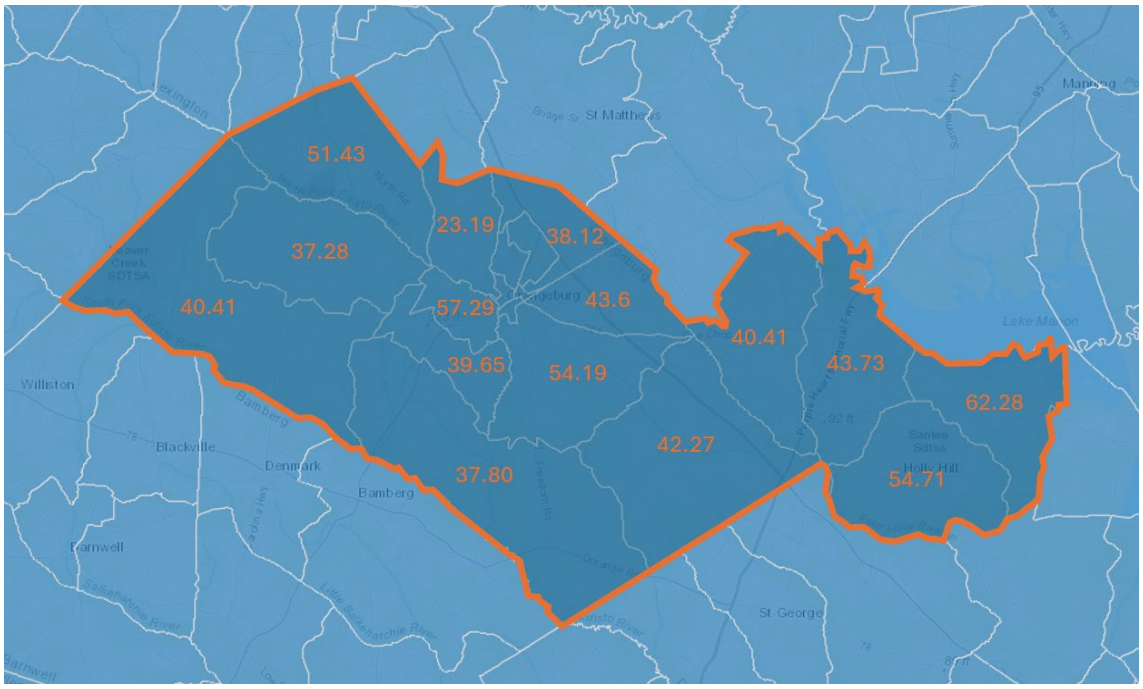

Figure 8 - Low to Moderate Income Map for Orangeburg County

eastern portion of the county. Removing the highest and lowest LMI areas in the county provides a smaller range from 37 to 54 percent. This is common in rural areas as the population density creates less variability in LMI calculation.

The **Community Development Block Grant Mitigation (CDBG-MIT) Program** is a grant program provided by U. S. Department of Housing and Urban Development (HUD). The program targets vulnerable communities in low to moderate income areas to mitigate the risk of future natural disasters. This program awards funding to communities that can demonstrate recent impact by natural disasters. CDBG-MIT grants assist these areas to implement feasible improvements to infrastructure to mitigate risks and reduce the impact of future disasters.

Using social vulnerability and low to moderate income as factors in the ranking and selection of projects, ensures that funding will be allocated to communities with an urgent need and a qualified population. The CDBG-MIT grant also specifies a benefit cost ratio > 1. This is determined using the Federal Emergency Management Agency (FEMA) Benefit Cost Analysis (BCA) Toolkit. This tool provides a concise platform for calculating the direct benefits of a project in comparison to the estimated cost of construction. Projects are considered viable if the benefits are greater than the costs. The higher the benefit costs ratio, the more practical the project.

The projects selected for analysis were all analyzed and ranked using the following criteria: benefit cost ratio, social vulnerability index, low to moderate income percentage and local significance. These parameters were selected to satisfy the CDBG-MIT grant requirements. A **ranking system** was created to fairly incorporate required criteria, considering the significance of each variable to the requirements of the grant.

Ranking Criteria	Percent of Total	Points
Benefit Costs Ratio (BCR)	40%	0 – 20
Low to Moderate Income % (LMI)	30%	0 - 15
Social Vulnerability Index	20%	0 - 10
Local Significance	10%	0 – 5
Total	**100%**	**50**

Table 2. Ranking Criteria and scoring for BCR, LMI% and SoVI

Benefit Cost Ratio Quartile	Points
0-25%	0
25-50%	7
50-75%	13
75-100%	20

Table 3 – BCR Quartile Points

LMI %	Points
0%-25%	0
25%-30%	1
30%- 35%	2
35%- 40%	3
40% - 45%	4
45%-50%	5
50%-55%	6
55%-60%	7
60%- 65%	8
65%-70%	9
70%-75%	10
75%-80%	11
80%-85%	12
85%-90%	13
90%-95%	14
95%-100%	15

Overall SoVI	Points
0- 0.2	1
0.2 - 0.4	3
0.4 -0.5	5
0.5 -0.6	6
0.6 - 0.7	7
0.7 - 0.8	8
0.8 - 0.9	9
0.9 - 1.0	10

Table 4 – LMI% & SoVI Points

4. Agency Coordination

Several agencies assisted in providing information useful for this study. **Orangeburg County** was an eager partner and participant. The County's staff, administration and elected officials participated in public outreach, and coordination for meetings. This group collectively partnered with the study team identifying areas that were persistently troubled with flooding. They had also worked with **Carolina TEA** to produce a study on flooding in Bowman which proved very useful. The study team also reached out to **SCDOT** for information concerning areas of continuous flooding across the county. The agency was extremely helpful and even initiated repairs on several projects after receiving reports of deficiencies from the study team. SCDOT also agreed to commit resources to replace a culvert in conjunction with a project recommended for funding by the study. The **Army Corp of Engineers** was also engaged and provided significant information on Cow Castle Creek. This creek starts just south of the City of Orangeburg and flows south until merging with Four Hole Swamp. A maintenance agreement for this work was shared by the Army Corp of Engineers.

The Department of Health and Environmental Control provided guidance to the study team on staged improvements for a project site and provided a Watershed Water Quality Assessment for the Edisto River Basin. **The Orangeburg County Conservation Commission District** provided a Watershed Management Plan for Caw Caw Swamp but was not able to provide additional documentation for other watersheds across the county. Several other agencies were contacted but were not able to provide additional information. The published information collected by the Study Team is compiled and located in the appendix of this document for reference.

With the information provided, the Study Team reached out to the Orangeburg County Department of Public Works and the South Carolina Department of Transportation (SCDOT) for a better understanding of areas with a long history of drainage issues across the study area. The Study Team hosted a meeting with both entities to discuss their experiences with flooding across the county. Staff from both entities were very helpful in providing information on problems sites and providing insight into why the areas were prone to flooding. Both the County and SCDOT were asked how they documented addressed drainage issues. SCDOT uses and HMMS system

to enter work requests from the citizens. Information is forwarded to work crews stationed in 3 areas of the county and addressed within 30 days. Orangeburg County uses a similar system called Mobile 311. Citizens submit work requests through this system that are routed foremen in one of four sections of county. The requests are assessed and completed within 30 days if possible. Neither of the entity had established inventory of their drainage assets or a system to prioritize the maintenance and replacement of the assets. By incorporating an asset management system, the County and SCDOT would be able to perform annual inspections and develop a replacement schedule for their assets. Both entities would reduce the risks associated with maintaining their assets by budgeting resources over the full life cycle for their drainage system and other assets.

Figure XX shows the Orangeburg County Public Works addressing drainage requests in the central and eastern parts of the study area. Each area shows shallow ditches that have filled with silt. County and SCDOT Maintenance crews are constantly responding to these types of requests to provide relief from flooding to residents.

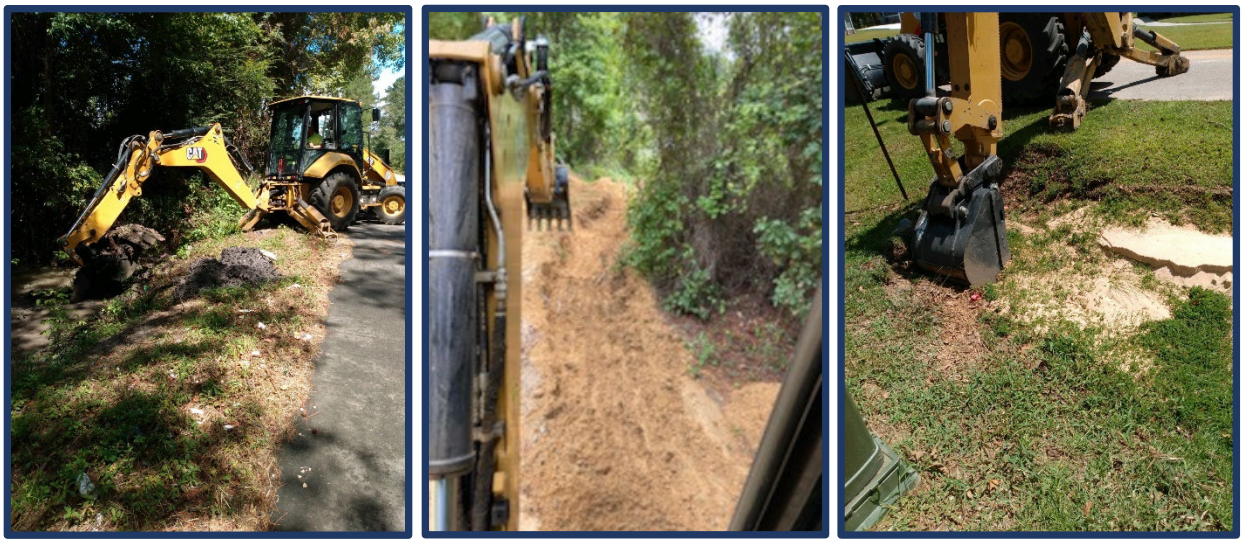

Fig 9 Public Works perform Maintenance on county ditches

5. Comprehensive List of the Project Considered

a. Projects Considered A total of 44 locations were reported during the 2 public information meetings and comment periods for this study. Two locations, identified in red on the map below were referred to the City of Orangeburg, but not recommended for improvements. Three sites were reported by multiple residents, reducing the number of locations investigated to 35. As **Figure 10** illustrates the sites investigated by the study team, several locations were located just outside the City of Orangeburg. The remaining sites were located from Bowman east to the towns of Santee, Holly Hill, Vance, and Eutawville. Several of the sites investigated were referred to SCDOT as maintenance issues. Due to the low and level terrain, many of the remaining sites did not present viable options for repair. For example, there were locations in Eutawville that did not have natural outlets for drainage. To remedy flooding in these areas would require construction and maintenance of trenches for thousands of feet to route the water to lower areas. Other sites were adjacent to flood plains which made them naturally susceptible to flooding with no cost-efficient means of improving the condition.

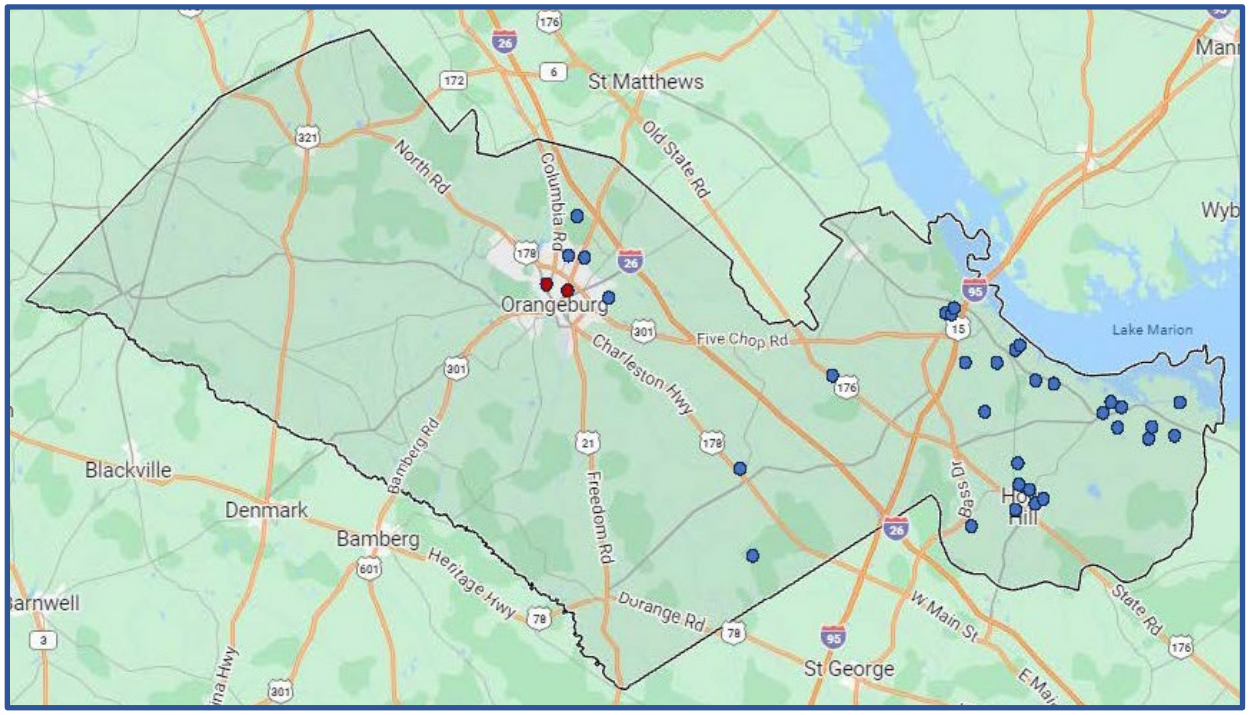

Fig 10 – Comprehensive Projects Locations Map

Table 5 is a comprehensive list of the projects considered for this study. Only the sites investigated by the team are identified below, corresponding to the location on the map above.

Table 5 - Projects Considered					
1	Solomon Terrace	**13**	Homestead Road	**25**	Sands Point Street (2)
2	Porter Street	**14**	Unity Road	**26**	Warren Street
3	Magnolia Street	**15**	Porcher Road	**27**	Gilmore Park
4	Malibu Apartments	**16**	Carolina Avenue	**28**	Bennett Circle
5	Theatre Drive	**17**	LTD Road	**29**	Oregon Street
6	Glenwood Drive	**18**	Sands Point Street	**30**	Sheard Drive
7	Red Bank Drive	**19**	Lauderdale Road	**31**	Bradford & Britian Street
8	Mill Creek Road	**20**	Camden Road	**32**	Joel Drive
9	Gibbs Drive	**21**	Lodge Hall Street	**33**	Gilliard &Cortier Street
10	Eutawville Rd	**22**	Camden Road	**34**	Peake Street
11	Old Number Six Hwy	**23**	Lauderdale Road (2)		
12	Polar Street	**24**	Old State Road		(Site Out of Study Area)

To ensure the required parameters of the CDBG-MIT grant were adhered to during the development of the study, a thorough process for the initial assessment was created to perform field assessments. Locations received from public comments and the City of Orangeburg staff were compiled and investigated using the assessment form created by the Study Team. The assessment was completed in two steps. **Step 1** was an objective field evaluation of the reported sites. No initial consideration was given to the planning parameters identified for the study area. The locations were evaluated to document the Study Team's assessment of reported deficiencies. This provided a balanced geographic representation of problem areas that would be included in the study for future use by City Officials beyond the assistance provided by this study. The following criteria were used at each location to standardize the process and provide a baseline for the consistent and objective evaluation of all reported sites. (Step 2 criteria are denoted in blue.)

- **Project Within Study Limits** – limits established to determine the boundaries of the study area and if projects would qualify for funding if selected. Some locations were reviewed outside the study area for inclusion in the summary of the study.
- **Maintenance Issue** – The SC Office of Resilience specified that CDBG-MIT funds could not be used to address maintenance issues. Sites meeting this criterion were reviewed, noted, and referred to public entities for repair.
- **Social Vulnerability Index (SoVI)** – summary of a community's susceptibility to manmade or natural disasters. Rating is provided by the Centers for Disease Control and Prevention (CDC) and calculated from the Census to determine the overall SoVI index number.
- **Low to Moderate Income –** an individual or household with an annual income between 50% and 80% of the area median income.
- **Flood Plain** – an area of land adjacent to a river subject to flooding during periods of high discharge. Sites located in flood plains generally produce lower BCR values, increased opportunities for buyouts, and lower potential for success against future disasters.
- **Property Owned by a Public Entity** – this criterion was used to gather additional information on assets (plans, date of installation, history of failure, etc.) and determine responsibility for current and future maintenance if deficiencies were identified.
- **Property Required** – an initial assessment of the need to acquire additional property for green projects, detention, or mitigation as a part of the proposed project.
- **Comments** – summary of the Study Team's initial field assessment of sites. This information was used as the primary assessment of sites by confirming the deficiencies, evaluating the need for improvements, or assigning sites to responsible entities for repair. Comments were discussed with the full team (SCOR, City Officials, and the Study Team) to determine if further investigation through the study was recommended.

After an independent review of all the sites was completed**, Step 2** commenced. Planning parameters for the study area were determined for each location selected to advance in the study. Social vulnerability and Low-to-Moderate Income (LMI) percentages were added to the initial assessment before review by the full committee. These criteria would be used later in the study

as factors in the ranking process to demonstrate the community's needs in specific subsections of the study area. Examination of each site's socio-economic factors was purposefully performed independent of the field analysis for two reasons. First, it guaranteed that each site would receive a fair evaluation, and the resulting study would represent a comprehensive evaluation of drainage issues across the study area. Secondly, it ensured the requirements of the CDBG-MIT grant were objectively included in the study's assessment, allowing the ranking system to prioritize the projects.

The CDBG-MIT grant had very specific parameters. Drainage issues resulting from a lack of maintenance were exclusively prohibited. Projects, with a benefit cost ratio of less than one, were not favorable candidates to compete for funding. Many locations reviewed in this study were determined to be maintenance issues. The Study Team summarized the problems and forwarded them to the South Carolina Department of Transportation and the City of Orangeburg as owners of most drainage assets in the study area. Most sites were located on or adjacent to SCDOT right of way and Orangeburg County was also referred locations that required action. These sites were noted and forwarded to be addressed as maintenance or utility issues by respective owners. Comments are included in the **Initial Assessment Worksheet** for all projects considered and can be viewed in the **Appendix (section d).**

6. Project Analysis

Overview of Analysis

The Study Team developed a summary of the six (6) project sites analyzed as a part of this study. The Drainage Report, Benefit Cost Analysis, Low to Moderate Income, Social Vulnerability, and Project Ranking are included in the appendix of this study. This information serves as documentation of the study team's analysis and as reference for the information summarized in this section of the report.

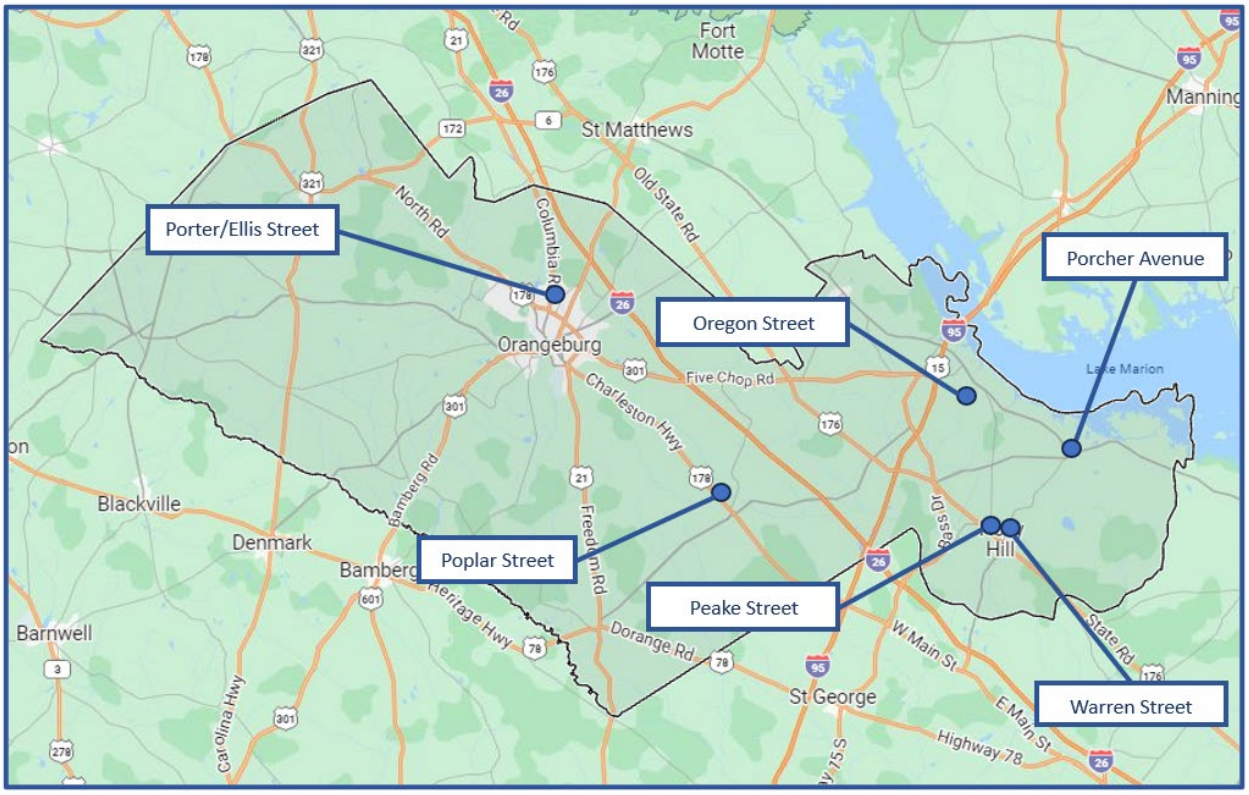

Fig 11 Location of 6 Sites Analyzed

Figure 11 is a location map for the 6 projects selected for analysis. With the exception of Porter/Ellis Street in the City of Orangeburg, the remaining 5 locations were in central and eastern portion of Orangeburg County. All the sites were located on state-maintained roads owned by SCDOT. Because these locations had existing drainage infrastructure, all sites were considered grey projects. Recommended improvements upgraded or improved existing structures. For one of the 6 sites, Porcher Avenue, an option to construct a drainage pond, but the option was not chosen because it produced a higher benefit cost ratio. To standardize

recommended improvements, the study team developed projects to accommodate the drainage for 25-year storms to meet the design requirements of SC Office of Resilience. **Table 6** summarizes the physical characteristics of each site the influence the probability of flooding.

Table 6 – Flooding Causes

Location	Physical Characteristics
Oregon Street, Vance	This residential community does not have existing culverts under many of the existing residential drives nor the drainage ditches required to move the runoff. The proposed project installs ditches and reduces standing water but does not provide sufficient fall to move collected runoff away from project site.
Warren Street, Holly Hill	Improvements will collect runoff in a closed system routing it to a recently upgraded system adjacent to the project. System will remain functional, but level terrain will not provide the fall to move runoff during torrential events.
Porter/Ellis Street, Orangeburg	Recommended upgrades for this site will reduce the occurrence of roadway and residential flooding. The new system will add capacity and improve public safety. With minimal terrain and hydraulic fall for the system, this will continue to flood in catastrophic events.
Porcher Avenue, Eutawville	Upgrades for this system will greatly reduce standing water in travel lanes. Flat terrain and proximity to flood plains reduces this project's hydraulic efficiency in storms greater than 25-year event.
Peake Street, Holly Hill	Increasing the volume of the culvert under Peake Street will reduce the occurrence of flooding in low-level storm events. Due to level terrain within the town limits and the Horse Creek Watershed's located to the north. Improvements will not eliminate flooding during future disasters.
Poplar Street, Bowman	Recommended improvements will eliminate the pinch point at the driveway. Flooding will still occur in storms greater than a 25-year storm event and the new structure will remain susceptible to flooding in catastrophic events

Figure 11 clearly illustrates the county's susceptibility to flooding in the central and eastern sections. As stated earlier in the study, the incidence of flooding increases as the terrain becomes flatter. These effected communities are small and rural in nature, presenting minimal variations in **Low to Moderate Income (LMI)** percentage. The exception was Warren Street in Holly Hill with an LMI of 74.07 while the remaining sites ranged from 36 to 49 percent. The **social vulnerability index (SoVI)** for the sites ranged from 0.4 to 0.8. The sites on Ellis Avenue, just outside the city limits of Orangeburg and Poplar Street in Bowman produced much lower SoVI values than the 4 sites in the extreme eastern portion of the county. These locations (Porcher, Warren, Oregon and Peak) produced values between 0.76 to 0.80. These values are moderate to high and indicate a high need for support and assistance in these communities.

As part of the FEMA Hazard Mitigation Grant Program, a benefit cost analysis (BCA) has been developed using the FEMA BCA Toolkit 6.0. The PCSWMM outputs were used as inputs to develop the BCA. Professional expected damages were used for the roadway. It was assumed that the probability of success for all roadway flooding was controlled by the storm drain system and would not improve any flooding above the 4% AEP event (25-year storm event). Expected damages were modeled and used for all building flooding. The FEMA BCA Toolkit 6.0 has a predetermined damage curve that evaluates the PCSWMM data for the 10-, 50-, 100-, 500-year storm events. The probability of success is incorporated into the BCA analysis. See **Table 6** below for ranking information. Five (5) of the sites produced benefit cost ratios greater than one.

The CDBG Mitigation Grant outlines specific criteria to qualify for funding. The benefit cost ratio is the most critical component. This parameter requires the benefit of the project to exceed the cost, producing a ratio greater than 1. The socio-economic criteria are then factored in to equitably demonstrate the needs of the community. The ranking system in Chart 6A summarizes the data found calculated for each of the 6 sites.

Table 7 – Final Project Ranking

			40%		*30%*		*20%*		*10%*		
Project Name	Benefit	Cost	BCR	Score 0-20	LMI	LMI pts 0-15	SoVI	SoVI pts 0-10	Local 0-5	Total	Rank
Ellis Ave, Orangeburg	$ 5,865,265	$ 1,711,258	3.43	20	49.06	5	0.4402	5	0	**30**	2
Poplar St, Bowman	$ 251,774	$ 212,774	1.18	7	37.43	3	0.5123	6	0	**16**	5
Porcher St, Eutawville	$ 3,215,131	$ 1,501,131	2.14	13	36.1	3	0.7822	8	0	**24**	3
Warren St, Holly Hill	$ 3,360,618	$ 932,962	3.60	20	74.07	10	0.7607	8	0	**38**	1
Oregon St, Vance	$ 643,931	$ 900,862	0.71	0	47.78	5	0.7998	8	0	**13**	6
Peak St, Holly Hill	$ 2,069,903	$ 1,453,998	1.42	7	43.81	4	0.7607	8	0	**19**	4

Oregon Street, Vance

Fig 12 - Project Location - Peake St.

Oregon Street is a 2-lane road, serving a rural residential community. The project site is located just west of Vance. This small town sits in the eastern portion of Orangeburg County, less than 2 miles south of Lake Marion. The location was reported to the study team during the second public information meeting by the Mayor of Vance. Residents report flooding in this vicinity of Oregon Street during heavy rains.

Currently, there are no ditches or culverts under the driveways on the north side of Oregon Street. An open ditch does exist on the south side of the roadway, connecting the drainage infrastructure along Oregon Street to the system on Vance Road but the capacity of the ditch is not capable of efficiently handling runoff. The system is relieved by a 24-inch diameter crossline under Vance Road, discharging water to a wooded area to the south.

The proposed improvements increase the capacity and operational efficiency of the existing drainage system. The upgrades increase the cross section of the ditch along Oregon Street and increase the diameter of crossline pipes allowing water to move through the system more efficiently. The resulting improvements are illustrated below in Figure 7.2, the existing and proposed 25-year flood maps. The most noticeable locations are on Vance Rd and its intersection with Oregon Street.

The study team calculated the benefit of proposed improvements and the cost to construct the

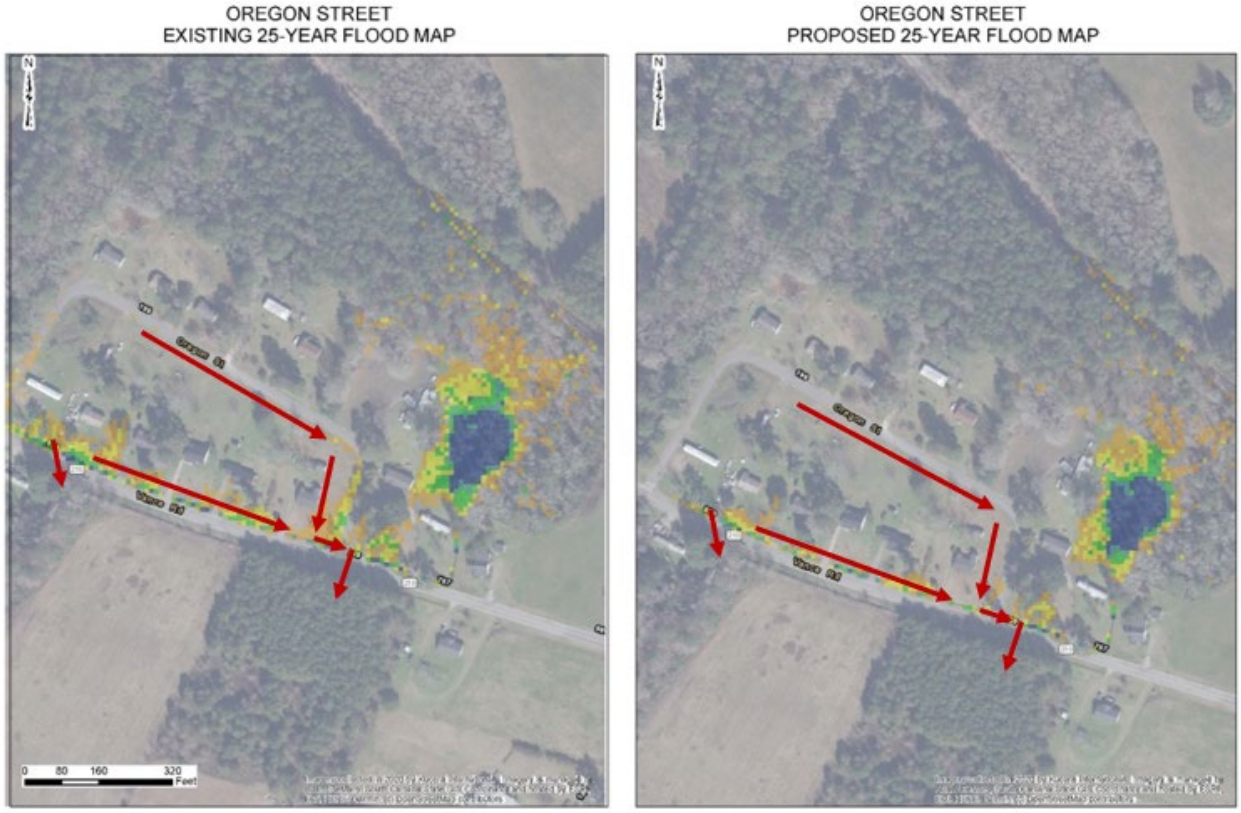

Fig 13 - Existing and Proposed Flood Map - Oregon St.

improvements. The resulting **benefit cost ratio** was 0.71, which falls below the minimum requirement of 1.0. A total of 14 homes received a benefit from the recommended improvements as well as upgrades to 3 SCDOT drainage structures for a calculated benefit of $643,931. The cost to construct the project was estimated to be $900,862. A list of the impacted homes can be viewed in (chart &.7.1). Due to the low benefit cost ratio, this project is not recommended to compete for funding through CDBG mitigation. However, funding and resources from local stakeholders could be used to be applied to provide relief to residents in this community.

List of Impacted Properties					
	Property Type	Address		Property Type	Address
1	Drainage Structure	Vance Road (Various)	8	Home	812 Vance Rd
2	Home	144 Oregon St	9	Home	818 Vance Rd
3	Home	138 Oregon St	10	Home	824 Vance Rd
4	Home	134 Oregon St	11	Home	716 Vance Rd
5	Home	120 Oregon St	12	Home	830 Vance Rd
6	Home	126 Oregon St	13	Home	836 Vance Rd
7	Home	804 Vance Rd	14	Home	722 Vance Rd
	(No buyouts recommended)				

Chart 8 Impacted Homes - Oregon St.

Socio Economic data generated for this project was comparable to other projects sites in eastern Orangeburg County. The **low to moderate income** was 47.78%, which was the second lowest LMI % of the 6 projects selected for full analysis. The **social vulnerability index** was 0.7961, which is the highest value recorded for this study. The combined socio-economic factors indicate the community's vulnerability, and its need for assistance to perform infrastructure improvements. However, the low benefit cost ratio eliminates this specific project from competing for funding.

The **environmental clearances** for this project are minimal. As most of the improvements upgrade existing drainage assets, no right of way and environmental approvals are required. An SCDOT encroachment permit will be needed prior to construction as Oregon is a state-maintained road.

Environmental Clearance	Requirement	Duration	Comments
SCDOT	Encroachment Permit	3 months	SCDOT, Orangeburg

Table 9 Environmental Clearances - Oregon St.

While this project reduces flooding for residents, it can be constructed with minimal **risks** and easily maintained. This project could be constructed in 3 to 4 months. With the replacement of 3 crosslines and widening of the existing ditch lines, utility coordination would be critical to the success of this project and the contractor's ability to adhere to a timely construction schedule. Figure 7.3., the proposed project plans, demonstrate the simplicity of the recommended improvements. (A set of plans is located in the appendix of this report.) The long-term risks of

the existing condition are public safety concerns, due to roadway flooding on Oregon Street and the long-term effects of water standing on residential property. The proposed project eliminates flooding in the 25-year storm event. **Table10** summarizes the project risks.

Fig 14 Proposed Plans – Oregon St.

Site Risks	Do Nothing (EXISTING CONDITION)	25 yr (HEAVY RAINS)	100 yr (HISTORIC FLOODS)
Oregon St	Flooding will continue to impact Oregon St, and runoff will continue to pond on private property creating health risks and damage to homes and property.	Improvements will eliminate roadway flooding on Oregon Street. Flooding on private property will be greatly reduced.	Constructing this project will not eliminate flooding in the catastrophic events. Improvements will be resilient, easily withstanding events beyond the 25-year storm event.

Table 10 Project Risks – Oregon St.

Peake Street, Holly Hill

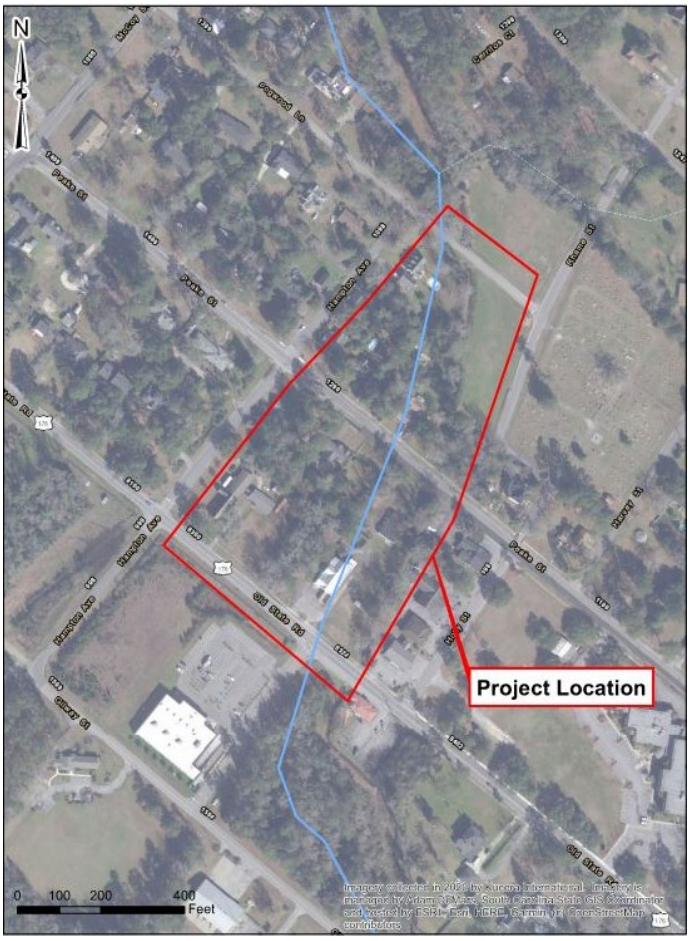

Fig 15 Project Location - Peake St.

Peake Street is in the town of Holly Hill, located in eastern Orangeburg County. Reports of flooding at this location were received from Orangeburg County staff and residents during the second public information conducted for this study. In the current condition, an undersized culvert conveys water from Home Branch Creek under Peake Street. This creek flows south through Holly Hill serving a drainage area of over six square miles to the north. Water backs up at the current Peake Street site during 10-year storm events. The crossing is currently served by three 48" reinforced concrete pipes.

The study team proposes to reduce flooding on Peake Street and areas within the city limits and further upstream by replacing the existing reinforced concrete pipes with 2 box culverts. This upgrade conveys water produced in the 25-year storm. The reduction in flooding is illustrated in **figure 15**, the existing and proposed 25-year flood maps. The solution does not fully resolve the issue of flooding, as the capacity of culverts downstream from Peake Street are constricted to avoid flooding the City's wastewater plant. A close examination of the existing and proposed flood map does show a significant reduction in flooding in the areas upstream of the project site.

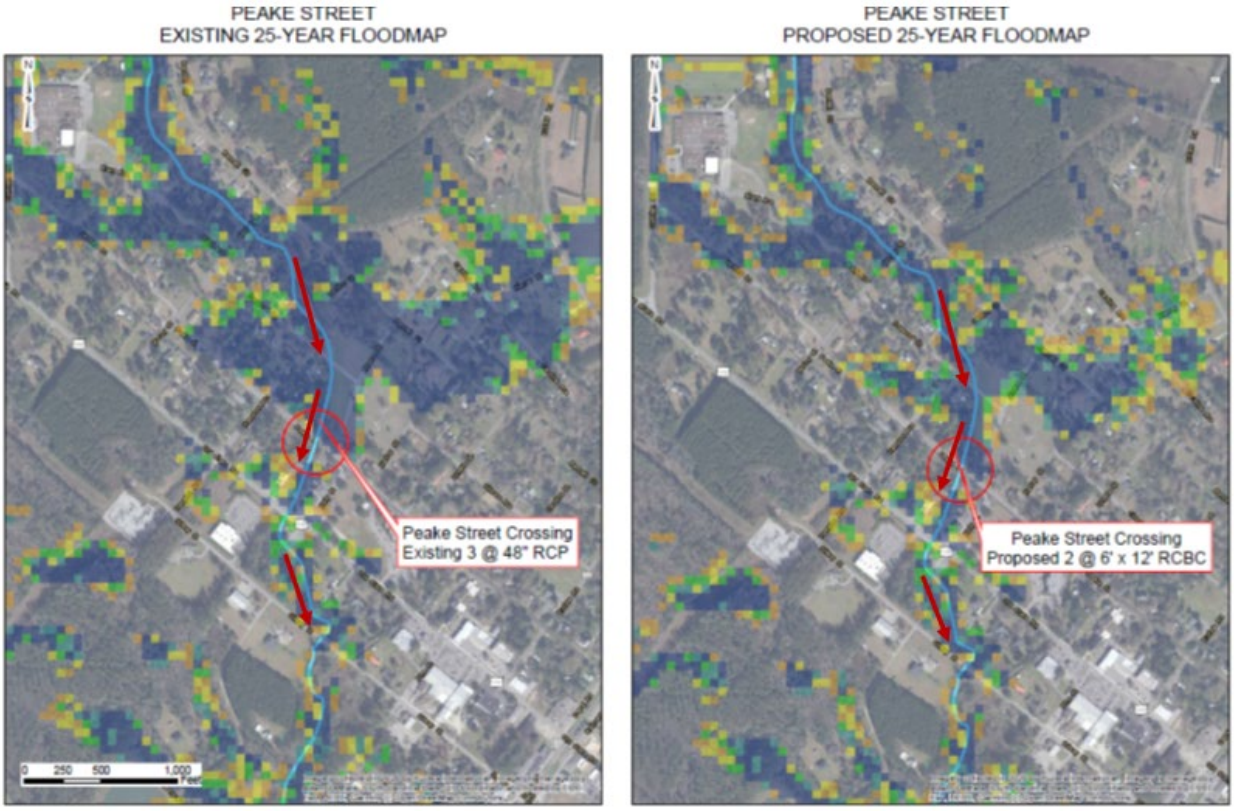

Fig 16 Existing and Proposed 25-year Flood Map - Peake St.

List of Impacted Homes		
	Property Type	Address
1	Culvert	1278 Peake Street
2	House	1272 Peake Street
3	House	1264 Peake Street
4	House	1224 Peake Street
5	House	1279 Peake Street
6	House	1271 Peake Street
7	House	1265 Peake Street
8	House	1225 Peake Street
(No buyouts recommended)		

Table 11 Impacted Properties - Peake Street

Peake Street produced a **benefit cost ratio** of 1.42. The recommended improvements provided a direct impact to 7 properties and upgraded the undersized culvert. A benefit of $2,069,903 was calculated as result of the recommended project at an estimated cost of $1,493,998. The town of Holly Hill consistently reports issues due to flooding across a large portion of the town. While the recommended project reduces flooding in the 25-year condition, the town is in a FEMA flood zone AE and remains prone to flooding during periods of heavy rain.

Peake Street is in a census tract with a **low to moderate income percentage** of 43.81%. While the LMI is just below the threshold of 50%, the town of Holly Hill has limited resources to address flooding caused by relatively flat terrain and the location of the town. Holly Hill sits between a large flood basin to its north and Four Hole Swamp to the South. Home Branch Creek

and several other channels convey runoff through this municipality. The improvements provided by the recommended project reduce the frequency of flooding but do not eliminate flooding in storm events of over 25 years. The **social vulnerability index** of Holly Hill produced a value of 0.7607. The value is common for rural communities as there is generally a smaller variation in the number of households in the census block.

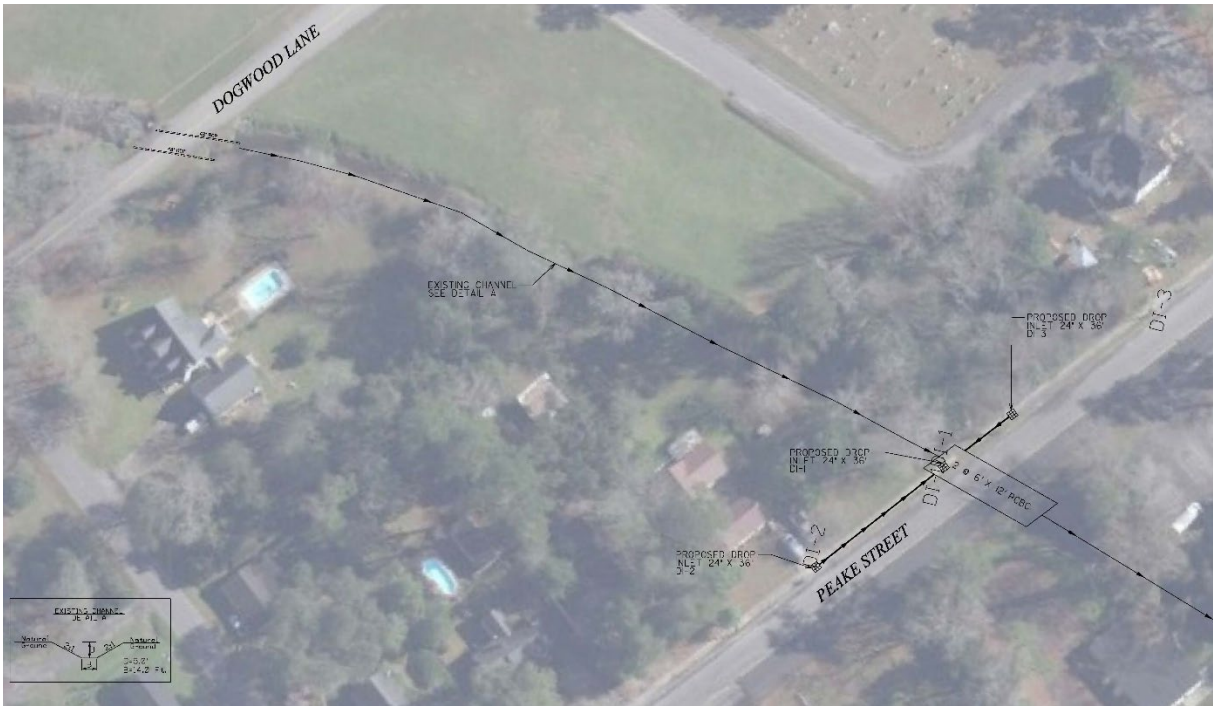

Fig 17 Proposed Project Plans - Peake Street

The study team recommends upgrading the existing RCP culverts with 2 (6'x12') concrete culvert pipes. A diagram of the proposed improvements is illustrated in **figure 17**. The new box culvert widened channel and new drop inlets along the north shoulder of Peake Street provide immediate relief from flooding for the town's residents.

The solution, however, presented a new risk. The capacity of the system is limited by the location of the City's wastewater facility just south of the project site. No other options were explored for this location, as new right of way was not available and rerouting the stream was not deemed a viable option. The risk table below summarizes the impact of constructing the recommended improvements. While this project produced an acceptable benefit cost ratio, and improved the towns drainage issues, the increased runoff downstream presents and increased risk of flooding to the town's wastewater facility.

Site Risks	Do Nothing (EXISTING CONDITION)	25 yr. Storm Event HEAVY RAINS	100 + yr. Storm Event HISTORIC FLOODS
Peake St.	Flooding in the town persists, causing property damage and routinely limiting access to public facilities and emergency services.	The project is advanced to construction; flooding is reduced in rain events up to 25-year storms. Residents will benefit with less impact on private property, but increased flows downstream could threaten the wastewater treatment plant.	Due to the study area being in a flood zone. The community will still be subject to flooding in 100-year storm events and beyond. The proposed improvements will not be damaged by historic rainfall events.

Table 12 Risk Table – Peake St.

The proposed construction improvements replace an existing double barrel culvert. The project would require an encroachment permit from SCDOT. A NEPA document would not be required but could be considered to inform the public of the impending improvements and benefits of the project prior to construction. Because the project is located in a flood zone, a Conditional Letter of Map Revision (CLOMR) will be required from FEMA. Additionally, utility relocations may be necessary as the proposed culvert is larger than the existing pipes.

Environmental Clearances	Requirement	Duration	Comment
FHWA	NEPA Document		Not required
SCDOT	Encroachment Permit	3 months	project on SCDOT RW
FEMA	CLOMR	6 months	Possible CLOMR required

Table 13 Environmental Clearances - Peake St.

Poplar Street, Bowman

Poplar street is located in the town limits of Bowman. This Town is located in central Orangeburg County. The site reported to the study team for review is a culvert under a private driveway at the corner on Poplar Street and Oliver Street. The project is located along Even Branch Creek, which is designated as a FEMA Zone AE floodplain. The stream serves as the primary drainage system for the Town of Bowman connecting to Cow Castle Creek on eastern side of the town.

Fig 18 Project location – Poplar Street

The study team analysed Even Branch from the existing culverts under US 178, Charleston Highway to the culvert located at Homestead Road. Both locations have 6x6 box culverts to convey water through the Even Branch. However, the existing culvert located between the 2 boxes is a 54 inch reinforced concrete pipe. The size of this culvert creates a pinch point in the system causes water to back up on the inlet side on of the culvert flooding Poplar and Oliver Street, The adjacent homes and the neighboring church.

The Study Team analyzed three alternatives. **Alternative 1**, proposes the construction of a 10'x6' box culvert to increase the capacity at this pinch point and reduce overtopping at the drive and flooding of the roadway. Additional riprap is also recommended with the improvements to reduce scour at bend of the chanel. **Alternative 2** also replaces the existing culvert with a 10x6 culvert and relocates the two utility lines that current obstruct flow on the inlet side of the existing culvert. This will eliminate overtopping in the 10 year event and remove the utilities

from the flow line of the stream. **Alternative 3** creates a new driveway at the end of Tuepelo Street to access the residence on Poplar Street from the rear of the property. If approved, this option would create a no-build scenario and the undersized culvert could be removed to create a free flow condition.

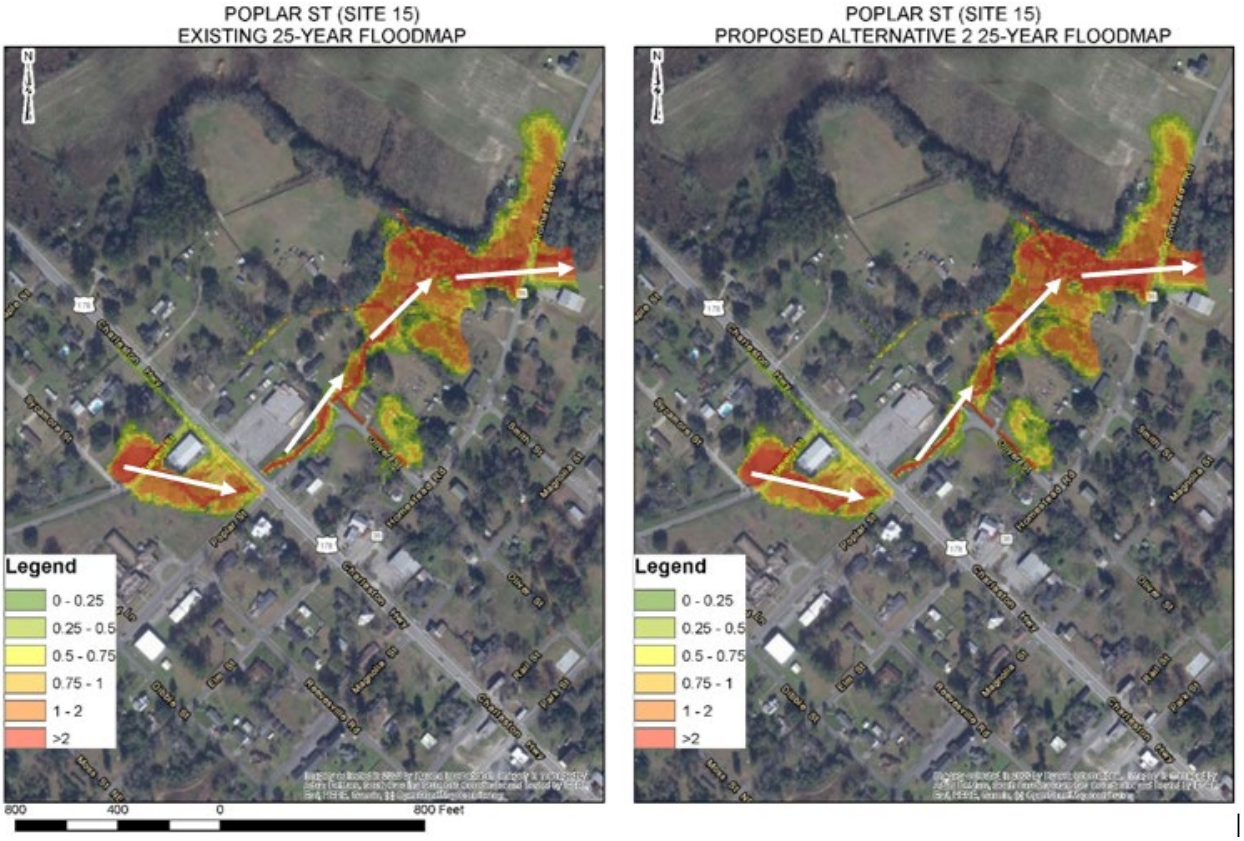

Fig 19 Existing and Proposed Flood Map - Poplar St.

In viewing the existing and 25 year storm flood maps, replacing the culvert reduces the impact of flooding in the vicinity of the project site. It is important to note, that SCDOT was contacted by the study team. Local officials with the agency have worked with County and Town Administrators to address drainage issuses in the Town of Bowman. Analysis shows that upsizing the culvert at Homestead Road could greatly decrease the back water in the study area. Since there are no homes located between Homestead and Even Branch's confluence with Cow Castle, this would be a viable option to provide additional relief to the town and the proposed project site on Poplar Street.

Fig 20 Proposed Project Plans - Poplar Street

The Study Team recommends Alternative 1. The resulting project will eliminate roadway flooding in the 10 and 25 year storm events and require relocation of the utilities to by owners. The **benefit cost ratio** for this project is 1.18. Estimated costs of the project is $212,774 with a calculated benefit of $251,774. With addition resources from Orangeburg County and SCDOT, the project BCA could be increased and flooding could be reduced further.

The **low to moderate income percentage** is 37.43 and the **social vulnerability index** was 0.5123. A total of 5 properties received direct relief from the recommended improvements. The project will indirectly benefit the entire community by reducing the occurrence of flooding at this location and improving the flow of water though Even Branch. Citizens and the Town of Bowman are not able to address these drainage concerns without finacial assistance.

Impacted Properties		
	Property Type	**Address**
1	Home	391 Poplar St
2	Home	111 Oliver St
3	Home	151 Oliver St
4	Public Utility	3918 Homestead Rd
5	Home	3764 Homestead Rd
No buyouts recommended		

Table 14 Impacted Properties – Poplar Street

The environmental clearances, scheduling, and utility coordination for this project will be very straight forward. The permitting may require a FEMA CLOMR due to the project being in a flood zone. An encroachment permit from SCDOT will be required to construct the recommended improvements. Even though Even Branch is not located on SCDOT's right of way, construction staging will be required on Poplar and Oliver Street. Roads may be temporarily closed to remove the existing culvert and install the new structure. Finally, utility coordination will be very important. Because it will be performed independent from the project, completion of the utility relocation prior to the replacement of the culvert is critical.

Environmental Clearance	Requirement	Duration	Comments
FEMA	CLOMR	6 months	CLOMR may be required or the recommended improvements.
SCDOT	Encroachment Permit	3 months	SCDOT, Orangeburg. Required for use of right of way as staging area for construction and any required road closures.
Utility Coordination	Relocation of water and sewer lines	3 months	Utility relocations for private lines are generally not paid for through publicly funded sources. Local resources must be identified.

Table 15 List of Environmental Clearances – Poplar Street

This site has some risks associated with the construction of this project. The town has a long history of flooding along the floodplain of Even Branch. During heavy rain events, runoff inundates Even Branch and backs water into residential properties, public facilities and commercial buildings. By not pursuing a solution, Bowman will continue to suffer from flooding at locations all along the creek. There is also the risk of doing nothing to the utilities in the creek.

One of the lines could break causing unforeseen health risks and environmental fines to the Town.

Site Risks	Do Nothing (EXISTING CONDITION)	25 yr (HEAVY RAINS)	100 yr (HISTORIC FLOODS)
Poplar Street	The water continues to back up on Poplar and Oliver St. Eventually the erosion could cause the fill around the culvert to fail. Utility lines are also at risk as they are currently located in the flowline of the channel.	Improvements will eliminate roadway flooding in 25-year storm events. However, utilities would be at a higher risk to fail due to the increased flow rate and channel width, as it passes under the drive at 391 Poplar St.	Advancing this project will not eliminate flooding in catastrophic events. Flooding will persist in storms events beyond the 25-year due to the project being located in a floodplain.

Table 16 List of Environmental Clearances – Poplar Street

Porcher Avenue, Eutawville

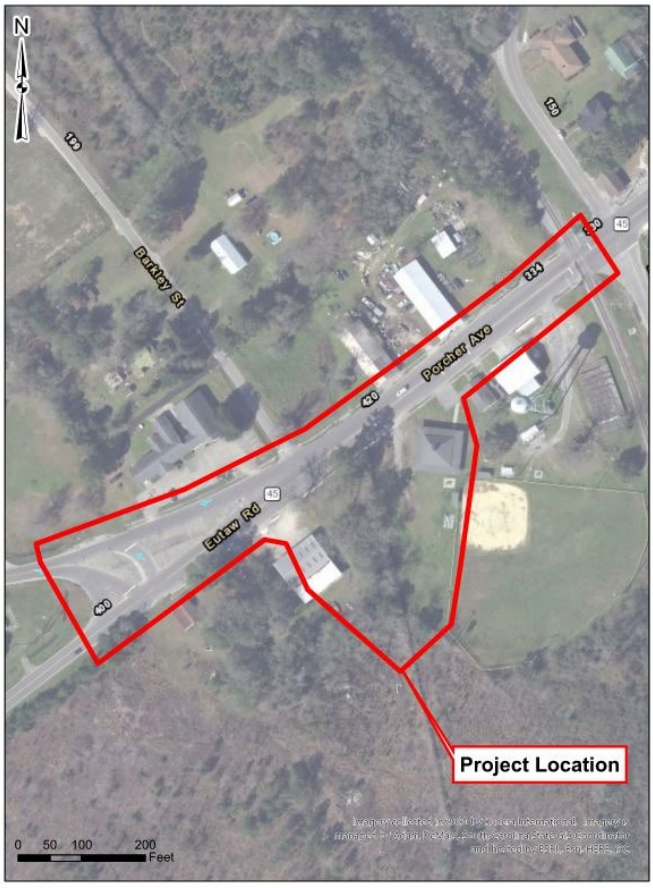

Fig 21 Project Location – Porcher Avenue

Porcher Avenue is a 2 lane road in the town on Eutawville. This town is located in the far eastern corner of Orangeburg County and the project site is centrally located in an urban portion of this small town. The complaint of flooding was received from the mayor stating that the road floods during every rain event. The location is in front of the Eutawville Community Center with a baseball field located behind the building. Runoff regularly stands in the eastbound lane and during heavy downpours the spread can overtake most of both travel lanes.

The study team developed two alternatives for this site. **Alternative 1** eliminated flooding in the 10- and 25-year storm events. This system abandoned the existing pipe to the north as the grades were inconsistent and required a long distance to provide any relief to the system. The existing pipes were upgraded to increase the capacity of the system by adding 6 new catch basin and 27 linear feet of new pipe. Because the terrain was so flat, the existing shallow outfall ditches did not provide the needed fall or capacity, the team proposed to construct a pond to hold the runoff for a 25-year storm event adjacent to the Community Center. The pond would require the purchase of property and for construction it will require maintenance. (See figure x.x.2)

Alternative 2 will also accommodate flooding for 10- and 25-year events. The proposed improvements will use upsized pipe and nearly 400 feet of new pipe to move water away from the site. This option calls for the pipe on the north side of the system and the south the drain to

transport water away from the site. Because of the level terrain, the pipes will flow at capacity and require routine maintenance at the outfalls to ensure positive drainage.

Figure 7.1 illustrates the flood reduction resulting from the recommended improvements. In the 25-year flood event, the new system completely eliminates roadway flooding and a large area of standing water to the north of the project.

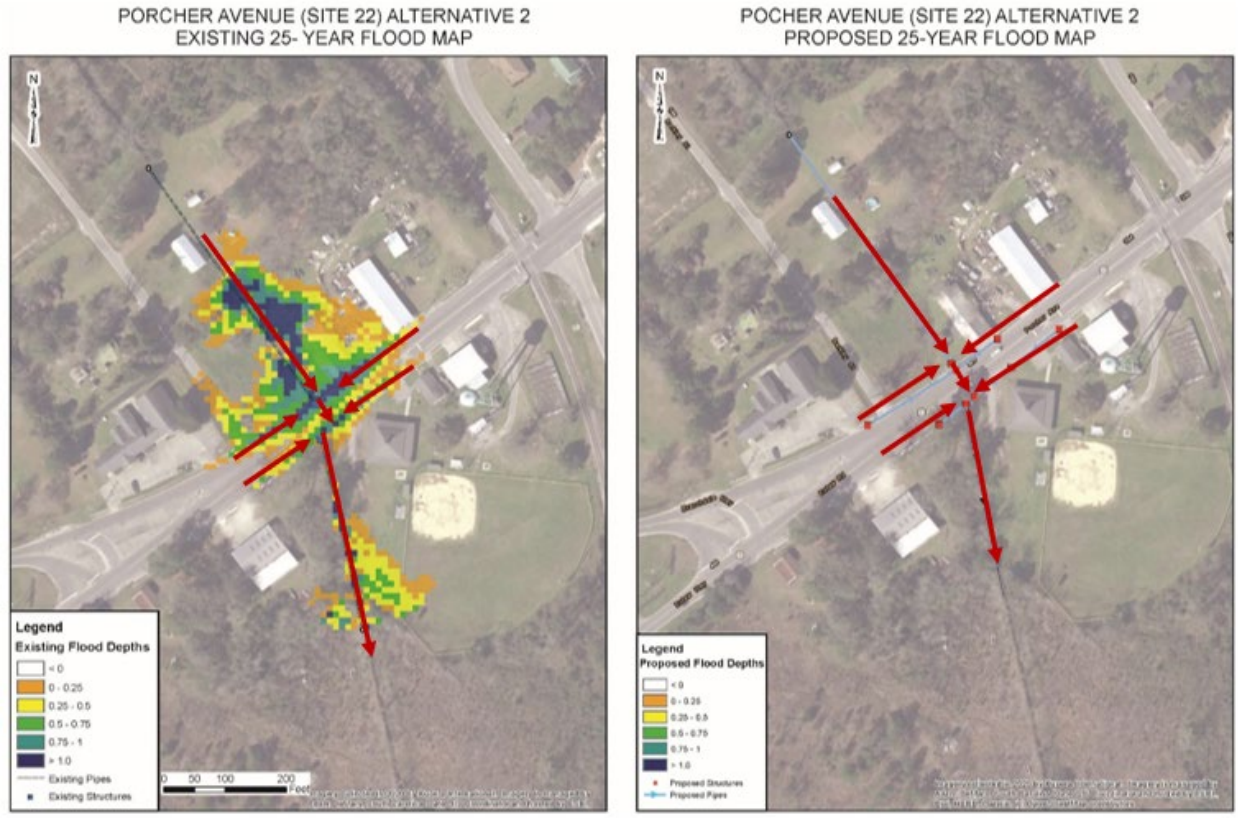

Fig 22 Existing and Proposed Flood Map – Porcher Avenue

The study team recommends Alternative 2. This option produced a BCA of 2.14 which was slightly higher than Alternative 1 at 1.88. While both options eliminate flooding below the 25-year event, the cost of purchasing property to construct the pond and the required maintenance cost made Alternative 1 a less desirable option.

List of Impacted Properties		
	Property Type	**Address**
1	Drainage structure	419 Porcher Ave
2	Community Center	412 Porcher Ave
3	Commercial Building	412 Porcher Ave
	(No buyouts recommended)	

Table 17 Impacted Homes - Porcher Avenue

Porcher Street produced a **low to moderate income %** of 36.1 and a **social vulnerability index** of 0.7822. Both criteria qualify favorably for the CDBG-MIT funding. The two properties and the existing drainage structure would benefit from the improvements recommended. The flooding reported temporarily limits access when runoff stands in travel lanes. The frequent occurrence is a safety hazard to residents as they are forced to drive through standing water or find an alternate route.

This community needs this project and assistance in other areas to reduce similar incidents of flooding. Eutawville produced several sites with no outlet for drainage. Water collects in these areas with no viable outlet to release runoff.

Fig 23 Existing and Proposed Flood Map – Porcher Avenue

Figure 7.1. is a schematic of the **proposed plans for this project. Risks** associated with this project are moderate to minimal. The location of the project during construction could impact traffic flow, access to emergency services, existing utilities, and essential businesses. The completed project will route runoff into an area already prone to flooding. The community has a terrain consistent with the rest of eastern Orangeburg County. It is very flat, lacking a hydraulic gradient that moves water efficiently.

Site Risks	Do Nothing (EXISTING CONDITION)	25 yr. (HEAVY RAINS)	100 yr. (HISTORIC FLOODS)
Porcher Avenue	Roadway flooding will continue to be a hazard to motorists. Temporary access to emergency services could be impacted.	Improvements will eliminate flooding up to 25-year storm events. Impact to traffic will be eliminated for this storm year event	Constructing this project will not eliminate flooding in catastrophic events. Improvements will sustain future flooding routing runoff to a low-lying area south of the site.

Tables 18 Project Risks – Porcher Ave

Environmental clearances for this project should not be underestimated. An SCDOT Encroachment Permit would be required, as the proposed project is within SCDOT right of way. A Public Information Meeting would be encouraged, due to impact to traffic and access to the Community Center, emergency services and shopping centers in the downtown area. The project site's proximity to the flood zone to the south will likely require a CLOMR, as the improved drainage system will convey water at an increased rate into the flood zone.

Environmental Clearance	Requirement	Duration	Comments
FHWA	NEPA	6 months	Upgrades to the system may require public involvement if funded by federal dollars.
SCDOT	Encroachment Permit	3 months	SCDOT, Orangeburg
FEMA	CLOMR	6 months	Project drains into a flood zone

Table 19 Environnemental Clearances - Porcher Avenue

Environmental concerns were minimal with respect to the permitting and construction of the proposed project. The site is urban with no existing environmental challenges. Inspection of the community reveals older homes located adjacent to commercial areas that are the subject of revitalization by the City of Orangeburg. If federal funds are used to fund this project, an environmental document may be required, as well as an encroachment permit from SCDOT. There are no concerns with the planning and execution of this project.

Porter and Ellis Avenue, Orangeburg

Ellis Avenue is located just outside the city limits of the City of Orangeburg. The area is a mix of residential properties and municipal facilities. Homeowners on Porter Avenue, which intersects with Ellis Avenue, complained of roadway flooding and water backing up in the stream located just north of Porter Street. Runoff from that stream is conveyed through a culvert under Ellis Avenue and enters a closed system on the grounds of the County Maintenance facility. Currently, the system does not have the capacity to accommodate 10- and 25-year storms.

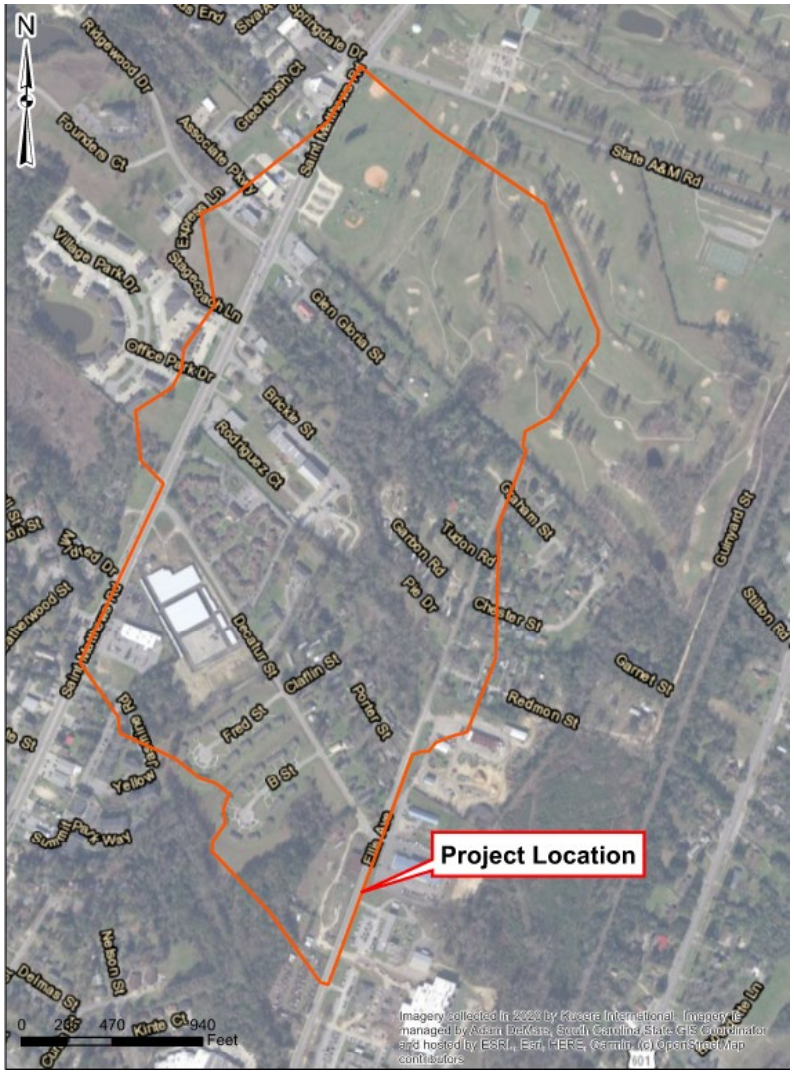

Fig 24 Project Location – Porter St

The study team developed two alternatives for this location. **Alternative 1** added nearly 1,000 linear feet of pipe, along Ellis Street along with 20 new catch basins and 2 new drop inlets. This alternative would eliminate water standing on the roadway by providing increased capacity and inlets to the system. It would also reduce the backup of water passing under Ellis and through the closed system in at the County Maintenance Office. **Alternative 2** would simply upgrade the system's capacity by upsizing the sections of the pipe and the adjoining catch basins. Analysis shows that the surface water was negligible south of the intersection of Ellis and Porters seen on the Flood Map developed for the site.

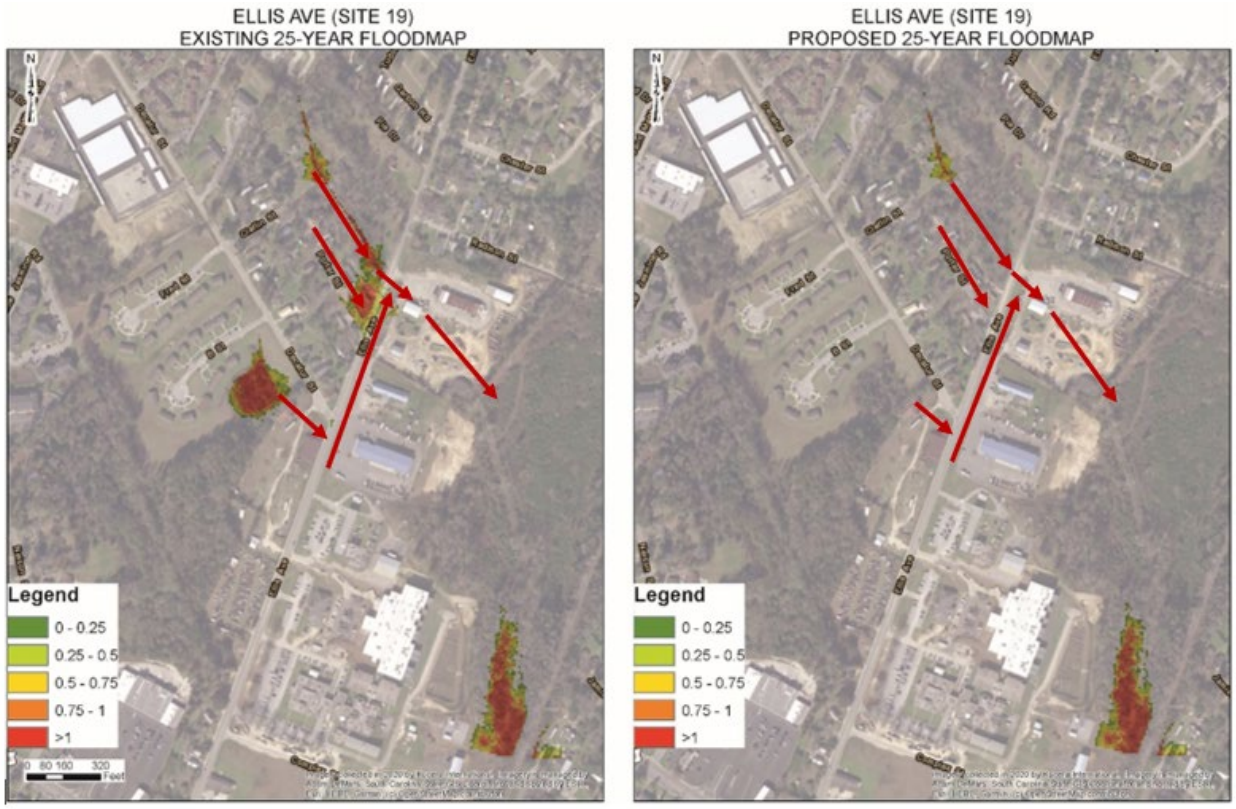

Fig 25 Existing and Proposed Flood Map – Ellis and Porter Street

The study team recommends Alternative 1. This project produced a **benefit cost ratio** of 3.43 which was the highest value in the study. The total benefit was $5,865,265 with a construction cost of $1,711,258. The **low to moderate income percentage** for the site was 49.06, just under the threshold of 50%. The **social vulnerability index** was 0.4402. There were 9 properties that received a direct benefit because of the recommended improvements. Those locations are listed in **Table 20** below.

List of Impacted Properties					
	Property Type	Address		Property Type	Address
1	Structure	1753 Ellis St	6	House	1080 Porter St
2	Structure	1098 Porter St	7	House	1098 Porter St
3	House	1753 Ellis St	8	House	1158 Porter St
4	House	1785 Ellis St	9	House	1170 Porter St
5	House	1795 Ellis St			
(No buyouts recommended)					

Table 20 Impacted Properties – Ellis and Porter St

If the project were advanced to construction, an SCDOT encroachment permit would be required to construct the improvements. If federal funds are used to fund the project, a public information meeting may be required in advance of the project due to temporary impacts near public facilities and residentials properties. No easements would be required to construct this alternative, but Orangeburg County would need to provide permissions to upgrade the portion of the closed system on the the maintenance facility. The county is advised to locate the outlet of the system for the purpose of inspection and routine maintenance. Construction is estimated to take 12 to 15 months.

Environmental Clearance	Requirement	Duration	Comments
FHWA	NEPA	6 months	Required for most federally funded projects
SCDOT	Encroachment Permit	3 months	SCDOT, Orangeburg

Table 21 Environmental Clearances – Ellis and Porter Street

Site Risks	Do Nothing (EXISTING CONDITION)	25 yr (HEAVY RAINS)	100 yr (HISTORIC FLOODS)
Ellis Street	During heavy rains, runoff will continue to flood private property, creating hazards for motorists with standing water on roads and residential property.	Improvements will eliminate roadway flooding and significantly reduce standing water on private property.	Advancing this project will not eliminate flooding in catastrophic events. Increased capacity of the system will provide improved protection in future disasters.

Table 22 Project Risks – Ellis and Porter Street

Construction of this project would require minimal risks. Optimizing access to the Orangeburg County maintenance and emergency facilities during construction would be critical to the citizens of the surrounding community. Residents and citizens traveling Ellis Street would be relieved of flooding an standing water during heavy downpours. The outfall for the new system will be primarily located on the grounds of the Orangeburg Maintenance Facility. The upgraded system is not designed to handle storms above 25-year events but would remain viable.

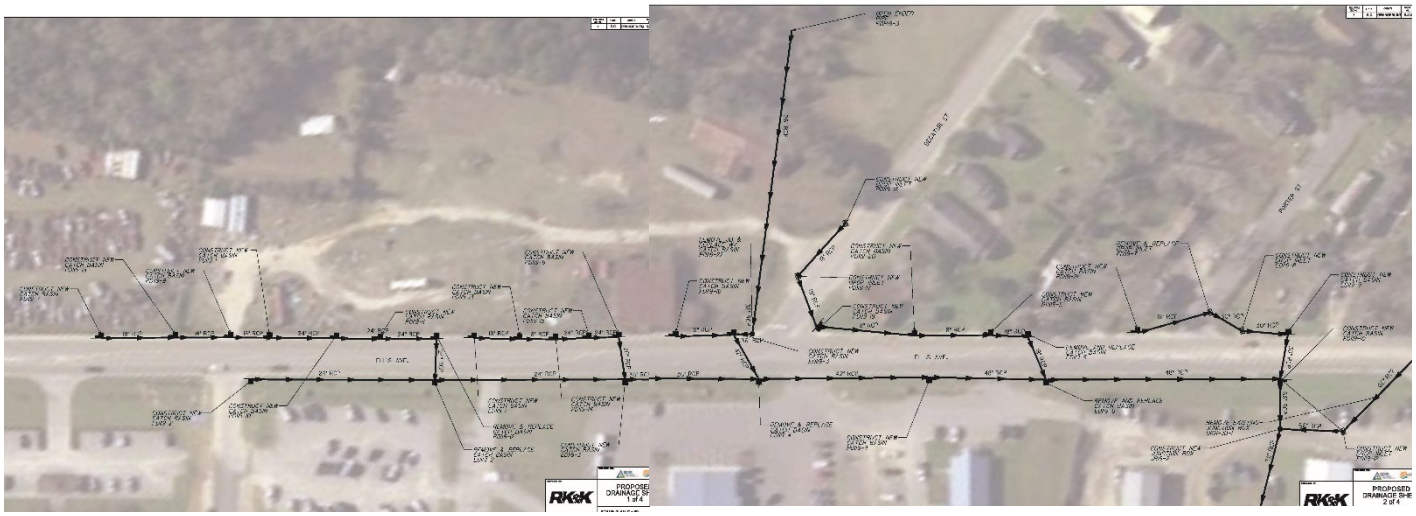

Fig 26 Environmental Clearances – Ellis and Porter St

Warren Street, Holly Hill

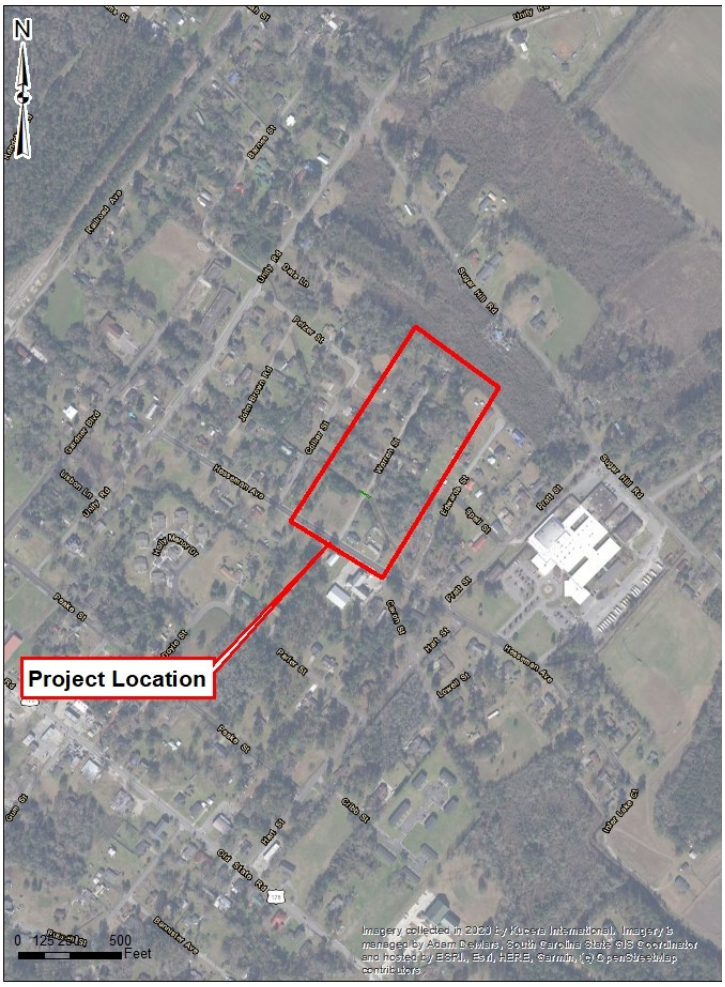

Fig 27 Project location – Warren St.

Warren Street is a two-lane state-owned road located in the town of Holly Hill. This site is in the western portion of Holly Hill near Robert's Middle School. Residents reported flooding on the lower (northern) end of Warren Street. Surface runoff from the roadway and runs along the existing valley gutter and stands at the end on Warren Street. Some residents have standing water in their yards during heavy rains and are not able to access their property or leave if they are at home during these events.

Proposed improvements will upgrade the existing drainage system by installing a closed system. The new system meet 25 year storm requirements and allow the roadway to passable. The upgraded drainage system will add 7 additional catch basin and 525 linear feet of new pipe to Warren Street. These improvements will collect runoff from the roadway and discharge into an established tributary to Briner Branch that crosses Warren Street before the intersection with Hesseman Street.

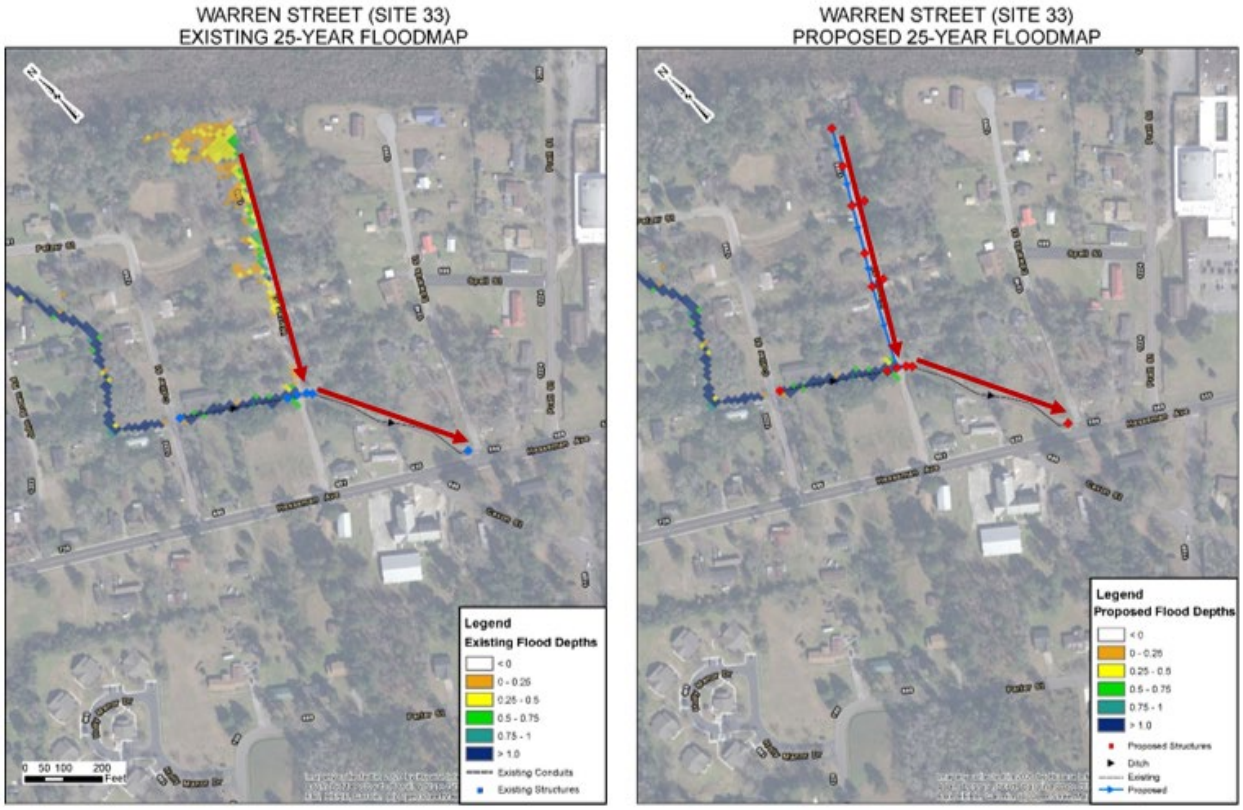

Fig 28 Existing and Proposed Flood Map – Warren St.

The **benefit cost ratio** for Warren Street was calculated to be 3.60. The estimated cost of the improvements is $932,962 with a benefit of $3,360,618 to the residents of the community. A total of seven properties will be impacted by the proposed construction. All benefiting properties are on Warren Street. The project will provide a means for the standing water to be minimized and possibly reduce the spread in adjacent low-lying areas.

The **Low to Moderate Income %** for this location was 74.07. The **Social Vulnerability Index** was found to be 0.7607. The numbers indicate a distressed community in need of financial assistance to perform drainage infrastructure improvements. Flooding is very common in this part of the area due to the level terrain and FEMA flood plains existing to the east and west of the proposed project site. Holly Hill experienced some of the worst flooding in the county during the 2015 and 2016 1,000 year storms. The town was inundated by flood waters.

The construction of this project would require minimal **environmental clearances**. Construction would be confined to the limits of SCDOT right of way. The work would be approved by

encroachment permit and may require a public meeting in advance of the work. Construction could easily be performed in 4 to 6 months.

There are minimal risks associated with this project. Current conditions do not allow an outlet for runoff on the northern end of Warren Street. The water collects at the lower end of the street becoming a nuisance for residents.

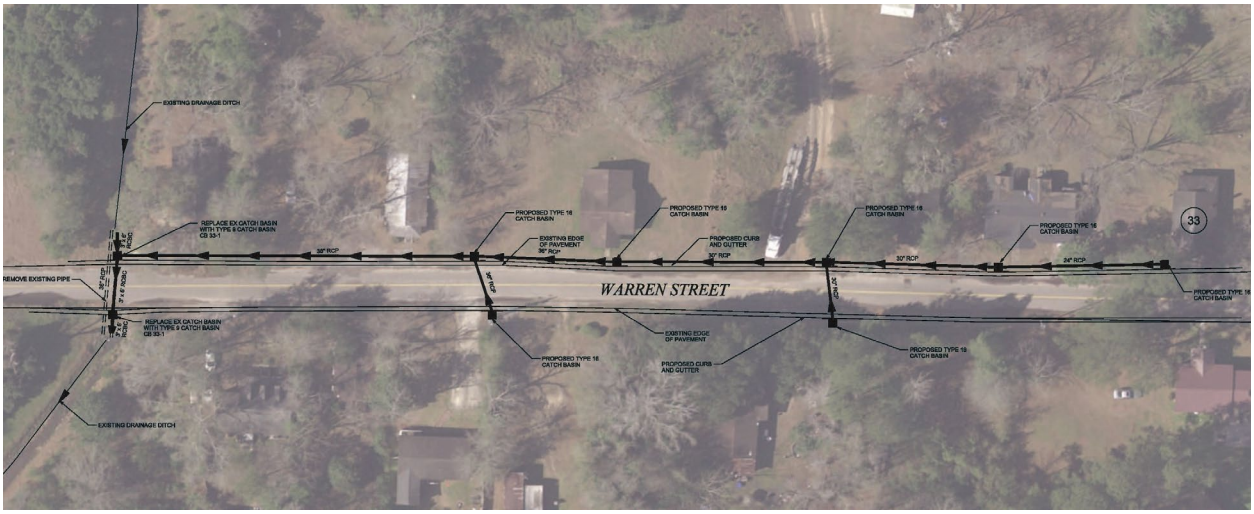

Fig 29 Environmental Clearances – Warren St.

List of Impacted Properties					
	Property Type	**Address**		**Property Type**	**Address**
1	Drainage Structure	1224 Warren St	5	Home	1240 Warren St
2	Home	1274 Warren St	6	Home	1230 Warren St
3	Home	1268 Warren St	7	Home	1224 Warren St
4	Home	1266 Warren St		***(No buyouts recommended)***	

Table 23 Proposed Improvements – Warren St

The **LMI %** for this site was 60.0% with an accompanying **Social Vulnerability Index** of 0.7739. This neighborhood consists of older homes and an established community of older citizens. No major infrastructure upgrades have been undertaken in this community in several decades. This is reflected in the outdated system and the condition of the outfalls serving the community.

This project will require a significant effort to complete. It will impact traffic on Bayne and

Environmental Clearance	Requirement	Duration	Comments
FHWA	NEPA	6 months	Required for most federally funded projects
SCDOT	Encroachment Permit	3 months	SCDOT, Orangeburg

Table 24 Environmental Clearances – Warren Street

Recommendations for improvements at this location will impact the community due to the scale of the improvements. If no work is performed, the existing system will continue to deteriorate, causing more inconvenience to residents and the traveling public. The existing terracotta pipe is fragile and does not allow the option for repair. Instead, damaged sections must be fully replaced. Upgrading the drainage system will reduce incidents of roadway and residential flooding and increase the system's capacity. While the impact from catastrophic events is not eliminated, the new system will reduce the community's frequency and susceptibility to flooding in future disasters.

Site Risks	Do Nothing (EXISTING CONDITION)	25 yr (HEAVY RAINS)	100 yr (HISTORIC FLOODS)
Bayne Street	Flooding will continue to impact public safety with ponding on roadways and on private property. Drainage systems will continue to fail with age.	Improvements will eliminate roadway flooding and greatly reduce the standing water on private property.	Constructing this project will not eliminate flooding in the catastrophic events. The level terrain will make the area subject to flooding in future disasters.

Table 25 Project Risks – Warren Street