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Engagement in Practice: Partnering with Communities to Address Nuisance Flooding Challenges

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Abstract

Many communities are already experiencing the impacts of climate change that disrupt their daily lives. In Coastal Virginia, these impacts take the form of nuisance and stormwater flooding caused by sea level rise and changes in precipitation. Coastal Virginia has one of the highest relative sea level rise rates on the Atlantic Coast and the regional planning district commission recommends that Atlas 14 rainfall intensity, duration, and frequency curves be increased by 20% to account for changes in rainfall. The Coastal Community Design Collaborative (CCDC), a partnership between Hampton University Architecture and Old Dominion University Engineering & Technology, has had multidisciplinary student design teams working in local communities for more than ten years to develop place-based solutions to mitigate nuisance flooding impacts. The CCDC partners with communities and their localities to understand the community's climate change challenges and preferences for solutions to develop preliminary designs solutions. Preliminary design solutions are focused on natural and nature-based solutions (NNBS), however existing gray infrastructure is also evaluated to determine if modifications are required. The CCDC methodology facilitates learning through hands-on engagement with community members, multi-disciplinary collaboration, and place-based design. The CCDC partners with community civic leagues to enable students to engage with community members, tour the community and develop an understanding of the challenges in the community. Student design solutions are focused on solving community challenges and shared with community members for future implementation. Partnering communities have been awarded over $132 million in funding for project implementations based on the CCDC student designs and an additional $20 million in community implementation grant applications are pending. Old Dominion University received $700,000 in grant funding to collaborate with the Southside Community, located in Coastal Virginia. The CCDC is currently working in that community. The Southside Community required extensive partnership development, which was initiated by faculty, to support project design and execution. The project design and implementation have been divided into two phases to be completed over two academic years. The processes used in community engagement and project design and execution are transferable and provide opportunities for integrating community-based design problems in multi-disciplinary educational collaborations.

1.0 Introduction General

The impacts of climate change are intensifying worldwide, with coastal communities facing unique vulnerabilities due to sea level rise, increased storm activity, and shifting precipitation patterns. Coastal Virginia, a region with one of the highest rates of relative sea level rise along the Atlantic Coast, exemplifies these challenges (Karegar et al., 2016). The interplay of subsidence, rising seas, and increasing rainfall intensity has placed significant stress on the area's

infrastructure and communities, resulting in recurrent nuisance flooding that disrupts daily life and endangers long-term sustainability (Najjar et al., 2000; Burgos et al., 2018). Addressing these challenges requires innovative, community-focused approaches that integrate local knowledge and scientific expertise.

Nuisance flooding, often referred to as "high-tide flooding," has grown in frequency and duration, imposing economic and social costs on vulnerable populations (Hauer et al., 2020). Southside Norfolk, an environmental justice community in Coastal Virginia, is disproportionately impacted due to its socioeconomic challenges and geographic vulnerability. This community's demographics, characterized by high unemployment rates, lower educational attainment, and limited access to resources, exacerbate its susceptibility to climate change impacts (City of Norfolk, 2023). Consequently, equitable and inclusive approaches to flood mitigation are essential for addressing systemic environmental injustices in the region.

Globally, the need for equitable and sustainable flood mitigation strategies has gained attention as climate-related risks disproportionately affect vulnerable populations. Studies have shown that socioeconomically disadvantaged communities are more likely to experience adverse outcomes from climate hazards due to limited adaptive capacity, insufficient infrastructure, and systemic inequities (Hauer et al., 2020; IPCC, 2021). In this context, environmental justice frameworks have emerged as critical tools for designing and implementing climate adaptation measures that prioritize the needs of at-risk populations while fostering community resilience (Bowes et al., 2019). These frameworks emphasize participatory approaches that incorporate local knowledge, preferences, and priorities into decision-making processes.

This paper focuses on climate adaptation by examining the Southside Norfolk community's challenges and the collaborative strategies employed to address them. It builds on existing studies by demonstrating how participatory design processes can enhance the effectiveness and equity of flood mitigation efforts in underserved communities (Ismael et al., 2024). Additionally, it highlights the critical role of academic and professional partnerships in bridging gaps between technical solutions and community priorities. By doing so, this work provides a replicable framework for integrating environmental justice principles into climate adaptation initiatives.

2.0 Background

2.1 Climate change challenges in Virginia

Virginia is at the forefront of climate-related challenges, with its coastal regions experiencing some of the most pronounced effects of global warming. Rising sea levels, increased rainfall intensity, and the frequency of extreme weather events have made the state highly vulnerable to both acute and chronic flooding (Shen et al., 2022). Coastal Virginia, including the Hampton Roads area, has one of the highest rates of relative sea level rise on the Atlantic Coast, driven by a combination of global sea level rise and significant local land subsidence (Karegar et al., 2016). This dual phenomenon poses a growing threat to critical infrastructure, ecosystems, and communities, particularly those already facing socioeconomic inequities.

Nuisance flooding, often caused by high tides and exacerbated by heavy precipitation, has become a regular occurrence in Virginia's coastal cities. Studies suggest that by 2070, nuisance flooding could become a near-daily event in low-lying areas such as Norfolk, with significant implications for transportation networks, public services, and residential areas (Burgos et al., 2018; Shen et al., 2022). Dynamic modeling efforts have highlighted how the combined effects of storm surges and rainfall are likely to worsen, necessitating adaptive infrastructure planning and innovative mitigation strategies (Shen et al., 2022).

The socioeconomic impacts of climate change in Virginia are disproportionately severe in underserved communities, where systemic inequities, financial constraints, and inadequate infrastructure compound vulnerabilities. Southside Norfolk, an environmental justice community, exemplifies these challenges. Residents face heightened risks from flooding due to aging gray infrastructure systems that are ill-equipped to manage modern climate pressures, such as increased rainfall intensity and rising sea levels (Tran & Lakshmi, 2024). The impacts are especially pronounced for low-income and minority populations, who often lack the resources to recover from repeated climate-driven disruptions (City of Norfolk, 2023).

Southside Norfolk provides a case study for addressing these complex issues through innovative, community-focused solutions. Tackling such challenges requires more than technical fixes; it calls for holistic approaches that integrate community needs and priorities into the planning process. The Coastal Community Design Collaborative (CCDC) exemplifies this methodology, employing multidisciplinary strategies to bridge the gap between technical expertise and community engagement. Its emphasis on green infrastructure, such as living shorelines, rain gardens, and restored wetlands, reflects a growing recognition of nature-based solutions as sustainable, cost-effective alternatives to traditional gray infrastructure (Bowes et al., 2019; Karegar et al., 2016).

2.2 Coastal Community Design Collaborative (CCDC)

Our academic program, the CCDC has developed and followed a program focused on identifying and developing design solutions based on suites of flooding interventions for urban neighborhoods to increase resilience in the face of escalating flooding. The program has been developed as a cross-disciplinary collaboration between architecture students at Hampton University and engineering and technology students at Old Dominion University, working with local academic, professional, and political entities, and the subject community. It has at its core a preference for green over gray infrastructure interventions, although some of the latter are also described herein. These suites of solutions are developed through preliminary design and cost developments for planning purposes. Three scales of intervention types are studied: those with impact for the entire community, those utilizing areas in public control (street right of ways, parks), and parcel level interventions designed for homeowners to execute.

Student work provides guidance for investment versus impact parameters. Its intent is to leave each community with sufficient material to allow community members to continue to advocate for local and regional funding opportunities for those interventions they believe are best suited to

deal with immediate challenges. The fact that many of these projects have found funding over the years speaks to the utility of the approach of providing the fruits of academic efforts to community members. Throughout the planning design process, community input is factored into the development of interventions.

2.2.1 CCDC two-course series

The mechanics of the full-year academic program are as follows: In the first semesters, foci are several: Students apply for time with the subject community's civic league to introduce themselves and aspirations. From this introduction it is usual for a steering committee of community members to work with students on developing further community discussions, walk-abouts, and workshops as may be desired. Second, a series of lectures on a variety of topics that may prove relevant to work are developed, sometimes given by local experts, sometimes by faculty - soils and hydrology, architectural preservation, green infrastructure strategies, urban design, wetlands. After each of these lectures, cross-disciplinary student design teams engage in exercises looking at sites within their subject community. These exercises are often linked back for community input should an exercise exhibit potential. The students will also gather data required to support evaluation of natural and nature-based solutions including elevation, sea level rise projections, recurrent flooding projections, rainfall intensity, duration, and frequency (IDF), utility locations (stormwater, water, sewage, etc.), groundwater elevation, existing green infrastructure, future green infrastructure plans, subsidence, existing shoreline conditions, and so forth. In the second semester, planning design teams are beginning to move from cross- to trans-disciplinary capacities and continue to push forward their planning design interventions, with regular report-outs to community steering committee members.

2.2.2 Studio based learning

The CCDC's programs revolve around studio-based learning (SBL), which includes a dedicated workspace, the exploration of iterative design solutions to a "ill-defined" problem, an extended interface between students and faculty, formal critique involving participation by additional academic and non-academic professionals, informal critique in which faculty and students seek ways of framing and reframing solutions for questions and problems, and peer participation.

2.2.3 Working across disciplines – cross disciplinary collaboration

Students develop iterative investigations into design interventions using SBL while they are receiving formal and informal feedback from their faculty, outside professionals and peers. They cultivate a knowledge base to facilitate informed decision-making and comprehension from a cross-disciplinary perspective. This supports the development of the students' ability to examine, investigate, and evaluate alternative solutions, and to collaborate in decision-making processes. They also enhance their critical listening skills and cultivate the capacity to articulate problems and solutions without jargon. Students are motivated to pursue more research and work in STEM disciplines due to their efforts to resolve immediate real-world issues.

The program's first project, done in 2014/2015 with Wetland's Watch, offers a fine case study on the sorts of interventions students may propose. At the community level, students proposed several interventions. They proposed a living shoreline graded to allow for retreat as sea levels rise. The toe of the slope was developed as an oyster reef. An existing wetland was proposed as a rainwater storage area during storm surge by the installation of a tide gate at its mouth to deter its use by river flood water. The project was taken as a basis for a state application to HUD's National Disaster Resilience Competition, was awarded $112 million and installation is now complete with a ribbon-cutting ceremony in June 2023.

While not all projects have found immediate funding sources for all work proposed, the paradigm of equipping communities with the knowledge of interventions and their costs empowers them to keep moving forward and many have done so. Also, included in the work are some initiatives and some projects that can be executed by the human capital invested in each community. Other interventions in other areas have sometimes included pumps to storage, but the overarching impulse has been to work with gravity and natural systems. The Chesterfield Heights (Ohio Creek Watershed) project (https://www.norfolk.gov/3867/Ohio-Creek-Watershed-Project) has been used to illustrate interventions as it lies immediately across the Elizabeth River from the new subject site, Southside Norfolk.

The CCDC approach implemented in Chesterfield Heights has been supported by the five environmental justice neighborhoods in Southside Norfolk, as evidenced by the community participation described in this paper. The current effort in southside Norfolk is funded by a $700,000 grant from the National Fish and Wildlife Foundation, facilitated by ODU in collaboration with Hampton University, City of Norfolk, and Wetlands Watch in January 2024.

Recently, the Environmental Protection Agency (EPA) funded a $20 million grant as a resilience implementation project to the City of Hampton and Wetlands Watch for the Aberdeen Gardens Community in Hampton, Virginia. This was also a result of the work of CCDC (Old Dominion University and Hampton University), and Wetlands Watch who collaborated with the community and developed adaptive and resilient design strategies to alleviate flooding problems.

The City of Norfolk has submitted a $19.7 million EPA Community Change Grant proposal, *Lifting as We Climb Toward a Healthier Environment in the Southside Communities of Norfolk, VA,* which includes design solutions developed as part of the CCDC Southside project for the Oakleaf Forest Community.

The Olde Huntersville Empowerment Coalition has collaborated with faculty from the Institute for Coastal Adaptation and Hanbury Architects to submit two EPA Thriving Community Grants using design solutions from the 2017-2018 academic year of the CCDC. These proposals are a Tier 2 *Connecting Streets* Proposal and a Tier 3 *Empowerment Center and Urban Garden.*

3.0 Case Study Southside Norfolk

3.1 Understanding the community

Southside Norfolk, an environmental justice community, comprises the neighborhoods of Berkley, Campostella, Campostella Heights, Oakleaf Forest, and Diggs Town in Norfolk, Virginia (Figure 1). This community faces systemic challenges rooted in both environmental and socioeconomic inequities. With a population of 7,156 residents in its primary zip code, the area exhibits significant disparities in education and employment. Approximately one-third of the population has graduated high school, 17.1% have attended high school but did not earn a diploma, and 18.6% hold a college degree. The unemployment rate among residents aged 25 to 64 stands at 9.7%, highlighting economic challenges that intersect with environmental vulnerabilities (Ismael et al., 2024).

The United States Army Corps of Engineers (USACE) developed Coastal Storm Risk Management (CSRM) Plans for Norfolk, which include wet and dry floodproofing solutions designed to protect against major coastal storms. However, these measures do not address the recurrent nuisance flooding caused by rising sea levels, minor coastal storms, and prolonged rainfall (Najjar et al., 2000). Without interventions tailored to these localized issues, Southside Norfolk remains disproportionately vulnerable to climate-related hazards. A concurrent priority-setting process that integrates city-wide flood infrastructure investments with community-centered planning could create more equitable outcomes for residents (Shen et al., 2022). Such an approach would not only improve resilience to future flood events but also ensure that marginalized communities have a voice in the planning and implementation process.

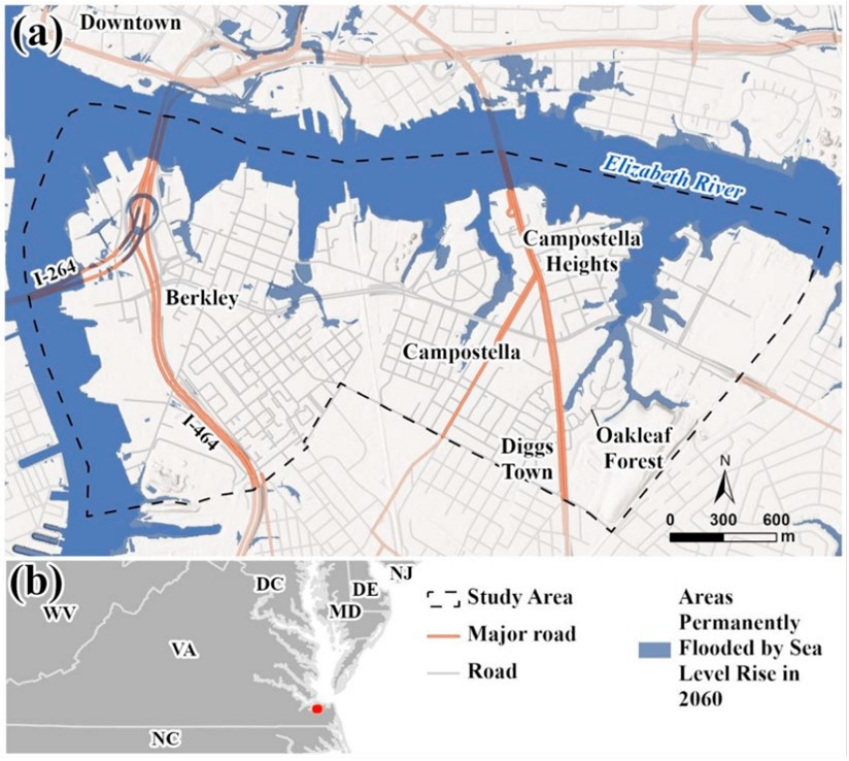

Figure 1. A map illustrating the study area and its associated neighborhoods (a), along with its relative position on the U.S. East Coast highlighted in red (b) (Ismael et al., 2024).

3.2 Environmental justice

Southside Norfolk exemplifies the intersection of environmental injustice and systemic inequity, enduring disproportionate climate-related risks without sufficient investment in mitigation or adaptive infrastructure. Its low-lying geography, aging stormwater systems, and lack of robust flood protection leave it highly susceptible to recurrent flooding, a pattern consistent with national trends where communities of color and low-income populations face disproportionate environmental burdens (Hauer et al., 2020; Tran & Lakshmi, 2024). These inequities are further exacerbated by limited community participation in decision-making processes, as flood management plans often prioritize technical efficiency over inclusive engagement (City of Norfolk, 2023). Adopting an environmental justice framework that integrates local knowledge, ensures equitable resource distribution, and centers vulnerable populations can bridge the gap between policy goals and the lived realities of affected communities (Bowes et al., 2019).

3.3 Social demographics

Southside Norfolk's demographic profile reveals systemic inequities that increase the community's vulnerability to climate change. With 17.1% of residents lacking a high school diploma and an unemployment rate of 9.7%, limited economic opportunities constrain residents' ability to adapt to flooding and other environmental risks (Ismael et al., 2024). Black and African American residents, who are disproportionately represented, face compounded challenges due to historical marginalization and inadequate access to healthcare, transportation, and resilient infrastructure (Benevolenza & DeRigne, 2018). These disparities align with national trends where low-income and minority populations experience greater exposure to environmental hazards (Carleton & Hsiang, 2016). Addressing these challenges requires equity-focused interventions that prioritize investments in education, adaptive infrastructure, and inclusive planning to enhance resilience and empower residents.

4.0 Methodology Used in Southside

4.1 Partnership development (CCRFR/ICAR) city of Norfolk and community

Old Dominion University has had a memorandum of understanding (MOU) with the City of Norfolk since 2018 to work collaboratively with their Office of Resilience on flooding related issues and other resilience topics. Biweekly meetings are held to discuss Norfolk's project needs and to further collaboration. The Southside Community was identified by Norfolk as a community that faces nuisance flooding challenges that will not be addressed by the current United States Army Corps of Engineers (USACE) Coastal Storm Risk Management (CSRM) project. The Institute of Coastal Adaptation and Resilience (ICAR) at Old Dominion University which includes the Commonwealth Center for Recurrent Flooding Resiliency (CCRFR) agreed to engage this community to understand flooding problems and develop solutions to mitigate the flooding.

The CCRFR supports state and local governments by engaging faculty expertise and resources in conducting studies, technical and non-technical services, and policy guidance in recurrent flooding resilience. Old Dominion University faculty started engaging the Southside community

leaders in December 2022 to understand community concerns related to flooding, which included a bus tour of flood concerns. Subsequently, an engagement strategy was developed, presented, and revised based on a follow-up meeting in February 2023 and presented to the Southside Community Task Force, a coalition of civic league leaders. Old Dominion University faculty engaged in the Southside CCRFR project also work in the CCDC and committed to developing flooding solutions for the Southside community as part of their interdisciplinary coursework during the 2023-2025 academic years. The commitment to provide design solutions for the flooding problems provided incentive for the community to move forward with the project.

Building trust with the community was a crucial step in project success. This community verbalized their distrust of organizations requesting partnerships that end up being one-sided data acquisitions that provide no benefit to the community. Engagement in this community was adapted based on community input throughout the project. The project team showed their commitment to the community by attending regular Southside Task Force meetings and scheduling all engagements at the convenience of the community including timing and location. Additionally, engagement attendance was incentivized by providing food, and a $50 gift card raffle at all engagement meetings.

With the support of the City of Norfolk's' Department of Neighborhood Development, Office of Resilience and the Redevelopment and Housing Authority, five community engagement meetings followed, working through the civic leagues (Campostella, Campostella Heights, and Berkley) and community organizations (Diggs Town and Oakleaf Forest) between June and September 2023.

4.2 Understanding community challenges and preferences

Community engagement activities were designed to be interactive, providing educational information about climate change impacts and solutions while also gathering insights from the community about their flooding challenges and preferred mitigation strategies. Participants were recruited through the Southside Task Force, civic leagues, and community organizations. Additional outreach was provided for the final meeting via mailer to one hundred randomized addresses in the Berkley community.

The engagement process took approximately two hours and included seven stations. The first five stations were education stations (posters) focusing on (1) climate change information including causes and effects, (2) sea level rise and flooding including maps with local sea level rise projections and explanations of terminology, (3) stormwater flood solutions focusing on green infrastructure, (4) coastal flood solutions including structural and non-structural, and (5) flooding images in Norfolk, which were added based on requests from the community. The last two stations were designed to get community feedback including (6) education and flood solutions survey to understand how knowledge about flooding increased and community preferences for flood solutions, (7) community assets and flooding challenges mapping to understand what the community values and needs access to and where flooding creates challenges in the community.

Participants in the community engagement indicated that education stations 1 through 4 increased their knowledge about climate change impacts and solutions. Over 70% of respondents indicated that Station 2 (sea level rise and flooding) increased their knowledge a great deal. About two-thirds of respondents indicated that Stations 3 and 4 (stormwater flood solutions and coastal flood solutions) increased their knowledge a great deal, as did 60% for Station 1 (climate change information). Participants preferences for stormwater flooding solutions included rain gardens, permeable pavers, stormwater planters and rainwater harvesting. Their preferences for coastal flooding solutions included seawalls, bulkheads, breakwaters, marsh fringe and revetments. Preferences for nuisance flooding solutions included oyster reefs and living shorelines. In addition, at community feedback station 7 (community assets and flooding) participants recorded sixteen total assets within the study area including: Roads/Bus Routes (5), Public Services (4), Housing (3), Other (3), and Community (1). Participants recorded 107 challenges within the study area including: Flooding (105), and Other (2).

4.3 Community engagement

All community activities were first presented to community leaders and the Southside Task Force prior to engaging with individual civic leagues. All meetings, presentations and engagements were scheduled at the preference of the civic leagues and community organizations. One civic league preferred engagement at regularly scheduled meetings (Campostella Heights) while other civic leagues and community organizations (Campostella, Oakleaf Forest, Diggs Town, and Berkely) preferred meeting outside of regularly scheduled meetings. Some meetings took place at lunch and others took place in the late afternoon/early evening.

As part of the commitment to work in the community, ICAR made a commitment to apply for funding to support the work. ICAR and CCDC faculty were successful in obtaining grant funding to compensate community members for their participation in engagement activities and fund a community steering committee to help the project team better understand and connect with the community and communicate to the community the work product that will be produced.

4.3.1 Community steering committee

The community steering committee was designed to include two community members from each of the five Southside neighborhoods. Currently the steering committee has six of the ten planned members that represent three of the five communities. Community steering committee members are compensated for their participation and have provided excellent guidance and support for the project. Their role includes:

1. Attending quarterly meetings for project updates and providing guidance.
2. Acting as a liaison with community members to encourage participation in engagement events to understand community perspectives on flooding problems and solutions.
3. Encouraging community participation in a field trip to the Ohio Creek Project in Norfolk to highlight nature-based design solutions.
4. Encouraging youth participation in engagement and learning opportunities.
5. Encouraging high school student participation in the Chesapeake Bay Landscape Professional (CBLP-A) entry level program.

We anticipated that existing community leaders would take a more active role in the community steering committee, but that has not occurred. So, an additional responsibility of the community steering committee is to recruit additional members to the committee.

4.4 Project design

In the 2023-2024 academic year the CCDC students worked in the communities of Campostella Heights and Oakleaf Forest to develop preliminary design solutions based on community preferences from engagement that was completed in September 2023. Design solutions for Oakleaf Forest were shared with the community in the fall of 2024 and they provided feedback on the design solutions. A meeting will be scheduled with Campostella Heights to get the same type of feedback. In the current academic year (2024-2025) students' designs are focused on the Campostella, Diggs Town, and Berkley communities. Once students complete design solution for the last three communities we will schedule engagement sessions in those communities for feedback and ranking of solutions.

Project designs are focused on natural and nature-based solutions (NNBS), including downspout disconnects, rainwater harvesting, permeable pavement, subsurface stormwater storage, rain gardens, bioretention basins, stormwater planters, living shorelines, and oyster reefs. While the focus is on NNBS, students research the community's existing infrastructure to determine if upgrades, modifications, or stormwater system additions are necessary. Inclusion of backflow prevention devices on existing stormwater outfalls, to prevent backflow from river systems during tidal events, can reduce nuisance flooding in some communities.

Once communities have provided feedback on design solutions and ranked order of preference for solutions, a project booklet will be developed to show design solutions that can be used for future project grant applications and implementation.

4.4.1 Preliminary project design

In the community of Campostella Heights preliminary design solutions include living shorelines, oyster reefs, and a floating dock to provide water access for the community. In addition, in areas where stormwater drainage problems exist, dry swales provide stormwater storage and direct stormwater to renovated curb, gutter, and inlets. In addition, new stormwater piping is needed for proper stormwater drainage from the community to include curb and gutter renovations and additions, inlets, and piping needed for conveyance of stormwater.

Oakleaf Forest solutions included modifications to roundabout located in entrances to provide stormwater storage and drainage, NNBS include permeable pavement, rain barrels for rainwater retention, and living shorelines. An added feature in the community is a pedestrian bridge, which provides direct student access to the community elementary school.

4.4.2 Feedback on designs

As indicated previously, Oakleaf Forest is the only community that has reviewed preliminary designs and provided feedback. The community overall was satisfied the student design solutions

and rank ordered their preference of solutions as the pedestrian bridge, modifications to roundabouts for stormwater storage and drainage, rain barrels for stormwater retention and living shoreline interventions.

4.4.3 Additional community outreach

As part of the CCDC's commitment to fostering community engagement and education, several youth-focused outreach events were conducted in collaboration with GEAR recovery, a non-profit organization that stands for Guidance, Education, Advocacy, and Resources. These events aimed to increase awareness of climate, resilience, and inspire the next generation to actively participate in addressing flooding challenges within their communities.

- February 15, 2024: This engagement event included a series of educational posters designed to inform youth about climate change and climate resilience strategies. Students engaged with the posters sequentially, progressing from introductory topics on climate change causes and impacts to detailed explanations of solutions, including nature-based strategies. This structured approach provided a comprehensive learning experience, guiding students from foundational knowledge to actionable solutions.
- November 20, 2024: A "Climate Adventure Hour" was organized in a public library in Norfolk. The event began with educational posters that introduced students to natural and nature-based solutions for flood mitigation, providing a foundation for understanding climate resilience. Students then participated in hands-on water filtration experiments, working in age-similar groups to conduct the activity themselves. At the final station, students had the opportunity to select a book related to climate change, encouraging engagement and continued interest in the topic.
- April 2025: This is a planned event aimed at engaging the youth in climate resilience.

There is ongoing communication with community members to identify the specific needs and interests of their youth. This will guide the development of additional tailored educational activities that are relevant to the community's goals.

5.0 Transferability/Process Replication

The methodologies and outcomes of the CCDC offer a blueprint for addressing flooding challenges in all communities. The success of the program in Southside Norfolk and other communities highlights key components that are both transferable and replicable in similar contexts locally and globally:

- **Community-Centric Engagement**: The CCDC's emphasis on community involvement ensures that flooding solutions are tailored to local needs and are more likely to be adopted. This participatory model can be implemented in other communities by:
  - Forming steering committees with local representatives.
  - Conducting workshops, surveys, and interactive sessions to gather community input about where the flooding occurs.

    - Adapting engagement strategies to the cultural and logistical preferences of the community.
- **Interdisciplinary Collaboration**: The collaboration between architecture and engineering students, local governments, and environmental organizations demonstrates the value of integrating diverse expertise in tackling nuisance flooding due to climate change. Similar cross-disciplinary partnerships can be initiated in other regions to leverage academic and professional resources effectively.
- **Focus on Natural and Nature-Based Solutions (NNBS)**: The preference for green infrastructure, such as rain gardens and living shorelines, provides sustainable and cost-effective alternatives to traditional approaches. These NNBS are adaptable to various climatic and geographic conditions, making them widely applicable.
- **Educational Integration**: The CCDC model, which incorporates studio-based learning, not only addresses real-world challenges but also trains future professionals in flood resilience planning. Other academic institutions can replicate this model by:
    - Embedding community projects in curricula.
    - Collaborating with local governments and organizations.
    - Offering incentives for student and faculty participation in community-focused research.
- **Framework for Funding and Advocacy**: Providing communities with well-researched, preliminary designs and cost analyses empowers them to secure funding. This approach has led to a substantial grant application for Southside Norfolk and can be adapted to help other communities advocate for regional and national support.

The implementation of CCDC designs in projects like the Ohio Creek Watershed and funding achievements demonstrate the approach's effectiveness. The replicability of this model is further supported by its alignment with global environmental justice frameworks and its adaptability to diverse socioeconomic and environmental contexts. By documenting processes, challenges, and successes, the CCDC sets a precedent for similar initiatives nationally, enabling other communities to address the challenges of flood vulnerability and systemic inequity.

6.0 Conclusion

The CCDC’s approach to flood mitigation in Southside Norfolk exemplifies the potential of community-based, participatory design processes to address the complex challenges posed by climate change. By integrating local knowledge, engaging with diverse stakeholders, and prioritizing nature-based solutions, the CCDC provides a model for equitable climate adaptation that can be replicated in other vulnerable communities. As climate change continues to affect coastal regions, the need for inclusive, innovative, and sustainable solutions will only grow.

The work of the CCDC in Southside Norfolk demonstrates the power of community-driven, interdisciplinary collaboration to address environmental justice challenges. By engaging locals at each phase of the process, from problem identification to design development, the project has facilitated the creation of flood resilience solutions that are both effective and aligned with community interests. This case study demonstrates that a dedication to equality and inclusion

may facilitate significant engagement, resulting in lasting and scalable solutions for climate adaptation in marginalized areas.

The CCDC also demonstrates an impactful approach to addressing the challenges of nuisance flooding in underserved communities. By combining interdisciplinary collaboration, hands-on engagement, and a focus on environmental justice, the CCDC has shown how community-driven solutions can be developed to tackle the impacts of climate change.

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