

Stormwater Management Advisory Commission Annual Report

FY 2022

Approved October 6, 2022

Being Stormwater Smart for a better future.

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Stormwater Management Advisory Commission

The City of Raleigh's [Stormwater Management Advisory Commission](#) (SMAC) offered direction and guidance throughout the fiscal year to support Stormwater Management Division programs, policies, and projects. By attending monthly meetings and participating in sub-committees, the Commission coordinated with and advised City staff in the areas of stormwater budgeting and utility billing, infrastructure project planning and design, erosion and flood damage management, water quality control, flood monitoring, asset management, stormwater system maintenance, watershed and lake protection, and community engagement.



Stormwater Management Advisory Commission members

The FY2022 Stormwater Management Advisory Commission Annual Report provides a synopsis of the Commission's efforts from July 1, 2021, to June 30, 2022.

Mission and Vision Statements

SMAC Mission Statement

"We will manage stormwater to preserve and protect life, support healthy natural resources, and complement sustainable growth for the community."

Stormwater Management Division Vision Statement

"Be the "Smartest" Stormwater Program possible to economically and equitably achieve our Mission."



Storm markers located at on Glenwood Avenue

Stormwater Infrastructure Projects

The Commission received updates and provided input on several major [stormwater infrastructure projects](#) in FY2022. Infrastructure projects were in a heavy phase of design during FY2022 with less ongoing construction. There were 10 new Capital Improvement Program (CIP) projects that saw consulting engineering scopes negotiated and design contracts signed. Approximately 8 to 10 of these projects will move from design into construction in FY2023. A typical design phase takes 18 months to complete the design, including holding public meetings, securing permits, and purchasing easements. In addition, getting a CIP project through the construction bid and contract signing processes takes an additional 4 months. Anticipated construction costs for FY2023 infrastructure projects is approximately \$12 million.

The Commission also reviewed and offered input on planned projects for the Stormwater Capital Improvement Program during fiscal years 2023 – 2027. This five-year CIP is estimated to cost approximately \$64 million.

Infrastructure Highlights

Swann Street Drainage Improvements

Staff observed erosion and flood damage from heavy rainfall after phase one of the Swann Street Drainage Improvements project. Additionally, debris was collected at nearby culverts on another property which caused unexpected flooding, erosion, and maintenance challenges at both properties. To alleviate future flooding, staff replaced the culverts with one larger culvert which will prevent blockages in the stormwater system. This work was completed in August 2021.



Completed Swann Street Drainage Project

Western North Ridge Stormwater Project

The Western North Ridge Stormwater Project is the largest single CIP project in the history of the City's Stormwater Program with design, easement acquisition, and construction costs totaling approximately \$7.5 million. The much-needed project will reduce structural flooding to homes, reduce street and yard flooding, protect private property from future channel instability and improve roadway safety. This project was fully designed in FY2022 with construction proposed to start in early FY2023.

West Street Extension Project

Stormwater CIP funding is being used to study the potential downstream impacts from the stormwater improvements proposed at West Street. This project is part of the Raleigh Department of Transportation's West Street Extension Project which will involve a new crossing of the railroad at West Street. The study will determine the stormwater improvements and costs of the improvements at West Street and any associated improvements.

CIP Projects in Design

The following CIP projects have moved into the design phase of work:

- Dana Drive Culvert Replacement Project
- Glenbrook/Dacian Stormwater Improvement Project
- Glenwood Creston Stormwater Improvement Project
- Lower Longview Stream Stabilization Project
- Upper Durant Wetland Conversion Project
- Eastgate Lake and Dam Rehabilitation
- Camp Pond Dam

Stormwater Technical Specifications Update

The front-end contract documents and Stormwater technical specifications were updated in FY2022 to help our consultants develop a consistent and sound set of construction documents that improve the quality of our Stormwater CIP projects.

Drainage Assistance Program

In FY2022, the Commission approved 10 projects through the [Drainage Assistance Program](#), totaling \$1.815 million, which are fully funded by the stormwater utility fee. Projects through this program address severe streambank erosion, repair stormwater systems, and reduce drainage issues on private property that are impacted by stormwater runoff coming from public streets.

Drainage Assistance Highlights

2809 Newbold Street Drainage Improvements

The existing stormwater pipe crossing the property of 2810 and 2809 Newbold Street has joint failures throughout the pipe resulting in sinkholes in both yards. Additionally, previous sinkholes were repaired on Newbold Street around the same location. Due to downstream conditions, water sits in the pipe constantly and contributes to street flooding during significant rainfall. Staff has looked at repairing the existing pipe with a cured-in-place plastic liner.

3410 Alamance Drive Drainage Improvements

Stormwater runoff from Alamance Drive drains through a culvert running beneath the structure located at 3420 Alamance Drive. The existing private drainage pipe had inadequate capacity for moderate rainfall events and thus structural flooding at 3410 Alamance occurred. The design has re-routed and upsized the stormwater infrastructure located on the property staff have analyzed downstream pipe capacities. These two projects were designed by a consultant and will be going through City plan review in Summer 2022.

Other Drainage Assistance Projects Under Design

In FY2022, the following 11 additional drainage projects have moved into the design phase:

- Dixie Trail (1210)
- Old English Court
- Royal Street
- Melbourne Road
- Cambridge Woods Way
- Fairlie Place
- Poole Road
- East Jameson Road
- Hunting Ridge Road
- Northbrook Drive
- Dahlgreen Road



Streambank erosion on Dixie Trail



A sinkhole in a yard on Fairlie Place

Raleigh Rainwater Rewards

Over the last five years, the Stormwater Management Advisory Commission authorized [Raleigh Rainwater Rewards](#) projects under the Stormwater Quality Cost Share Policy. The policy improves the approval process for small-scale projects that are a shared cost between program participants and the City. Over this time period, the Commission approved 40 projects, Raleigh City Council approved 11 projects, and Stormwater staff approved 90 projects.

There were 39 projects approved in FY2022 valuing approximately \$247,006 (dollar amounts may vary slightly since reimbursement is provided after construction is completed). Additionally, 41 projects were completed through this fiscal year and began maintenance terms.



Silva Cell stormwater device located at John Chavis Memorial Park during construction.

Raleigh Rainwater Rewards Highlights

Significant Raleigh Rainwater Rewards projects include an underground Silva Cell stormwater device at John Chavis Memorial Park and the approval of an integrated project including rain gardens and a cistern at St. Paul's Christian Church on Blue Ridge Road.

Stream Restoration & Water Quality

The Stormwater Management Division continues to implement water quality improvement studies and projects with support from the Commission and in partnership with various City departments and community organizations. More than \$2.3M in outside grant funding, including City ARPA funds as well as state agency funds, was awarded this past fiscal year for water quality CIP projects.

In FY22, several stream-related studies were initiated, and four green stormwater infrastructure (GSI) retrofit projects and a collaborative park improvement project with Raleigh's Parks, Recreation, and Cultural Resources Department were constructed:

Mapping Streambank Erosion Hotspots in Raleigh

In partnership with the U.S. Geological Survey (USGS) and NC State University (NCSU), streambank erosion potential is being assessed using remotely sensed light detection and ranging (lidar) data, field assessments of streambank conditions, and other geospatial data. The three-year study will help the Stormwater Management Division assess existing stream conditions and prioritize future stream projects.

Mitigation Bank Feasibility Study

The Stormwater Management Division completed the first phase of a study to explore the potential for its water quality improvement projects to generate mitigation credits for use by other City of Raleigh departments. Raleigh's municipal mitigation bank could also create a new future revenue stream for the Division to improve stream health within the City of Raleigh.

Walnut Creek Subsurface Gravel Wetland

This innovative project absorbs and stores stormwater runoff with plants and an underground gravel layer before entering a tributary to Walnut Creek. NCSU is monitoring its performance, and a local artist is designing a creative educational display for the project.



Walnut Creek Gravel Wetland completed in Fall 2021



Glenwood Ave Bioretention Area

Glenwood Avenue Bioretention

This project, located at the intersection of Glenwood Avenue and St. Mary's Street, captures the attention of commuters with its colorful plants. It also captures more than 20,000 gallons of stormwater runoff when it rains to help keep pollution out of Crabtree Creek.



Glen Eden Pilot Park Bioretention Area

Glen Eden Pilot Park Bioretention

Native plant species are incorporated into this tiered bioretention area to provide habitat for pollinators. Stormwater runoff flows from a parking lot and neighborhood streets into the bioretention area, slowly infiltrating into the ground, and replenishing groundwater supplies.



Staff discussing Peterson Street Linear Bioretention Area

Peterson Street Linear Bioretention

Many small GSI projects can make a big impact on water quality! This narrow linear bioretention area fits within the footprint of a 4' wide grass strip between the sidewalk and street and helps protect Walnut Creek.

Wooten Meadow Park Stream Daylighting and Wetlands

Over 70% of Wooten Meadow Park is located within the floodplain of Hare Snipe Creek. A stormwater pipe that previously discharged into the creek through the park property was daylighted and planted as an open stream channel. The stream and several constructed wetlands provide habitat and help manage floodwaters. They also help to clean stormwater runoff from the parking lot, hard surface trails, and the neighboring community.

More construction is planned in the future as the Stormwater Management Division moves forward with water quality improvement projects under design, including GSI and stream restoration projects at Durant Nature Preserve, Spottswood Street, Biltmore Hills Park, Millbrook Exchange Park, Baileywick Park, and Worthdale Park.



Wooten Meadow Park Wetlands

Green Stormwater Infrastructure (GSI) in Raleigh

Staff continue to advance the Commission's recommended [Policy and Plan for Advancing the Use of GSI in Raleigh](#). The Commission and Stormwater staff identified six action items that highlight the advancement of GSI:

1. Lead by Example
2. Support and Incentivize Private Developers
3. Include GSI in Rezoning Decisions
4. Include GSI in City's Planning Reports
5. Propose Regulation Changes to Support GSI
6. Build a Program for Maintaining City-owned GSI



Fox Road Bioretention Area

This past fiscal year, the Stormwater Management Division dedicated higher funding levels in the CIP budget for City-led GSI projects and hired two staff members to serve in GSI Advocate roles in Plan Review. Staff met with colleagues in Engineering Services, Transportation, Parks, Recreation, and Cultural Resources, and other departments to review and discuss the City GSI Policy and Plan in anticipation of the adoption of the policy as a formal City Administrative Policy. Memoranda of Understanding are under development to fund select GSI elements proposed for the East Civic Tower and Dix Park Gipson Play Plaza, which currently are designed to include a green roof, silva cells, bioretention, permeable pavement, and more.

Equity and Inclusion Framework

The Stormwater Division and the Commission are following the City of Raleigh's equity and inclusion goals to implement these important frameworks into stormwater services, operations, public engagement, CIP project prioritization, and budgeting. Through these efforts, the goal is to economically and equitably achieve the mission and vision of stormwater management.

Stormwater staff completed a portion of the Hare Snipe Watershed Study which provided a framework for future projects, such as the Pigeon House Study in FY2023, to help advance the City's equity goals for stormwater services. The Hare Snipe study received approximately 600 responses from various stakeholders which is likely the largest public response that Stormwater has received to date for a watershed study. Moreover, staff envision future updates for Stormwater's integrated CIP prioritization model to improve equity in how capital projects are implemented.

The Stormwater Management Division also received \$3 million from the American Rescue Plan Act (ARPA) funding to implement priority projects in areas of Raleigh that are disproportionately impacted communities. The Commission will remain actively involved with Stormwater's ARPA-funded projects as they move forward and are implemented over the next several years.

The Commission and the Stormwater staff continue to partner with various organizations and City of Raleigh departments, such as the Department of Equity and Inclusion; the Office of Sustainability; Parks, Recreation and Cultural Resources; and Strategy and Innovation, to advance environmental equity, community resilience, and sustainability.

Stormwater Utility Fee

The [Stormwater Utility Fee](#) provides the large bulk of the financial resources to implement Stormwater's key goals to protect people, property, and local waterways by reducing hazardous flooding, preventing erosion, and preventing pollution from entering streams and rivers. In FY2022, the Commission reviewed stormwater fee rate options for FY2023 to present to Raleigh City Council for approval. The fee was subsequently changed from an average residential monthly fee of \$7.00 in FY2022 to \$7.18 beginning July 2023. This represented the third consecutive year of rate adjustments helping to advance the City's Stormwater Program.

Under the new utility rate, the stormwater budget for FY2023 is approximately \$34 million, with \$12 million available for upcoming capital improvement projects. The rate change also helps improve water flow in stormwater systems, repair aging stormwater pipes and streams, invest in green stormwater projects to reduce water pollution, and address hazardous flooding and erosion.

Stormwater Design Manual

Stormwater staff composed the final draft of the Stormwater Design Manual to present to the Commission and Planning Commission for review in Winter 2022-2023. Once the final draft is approved and adopted by Raleigh City Council, the changes can be implemented. Staff also maintained contact with the North Carolina Department of Environmental Quality for their Neuse Model Ordinances Adoption, which is anticipated to be released in Spring 2023.

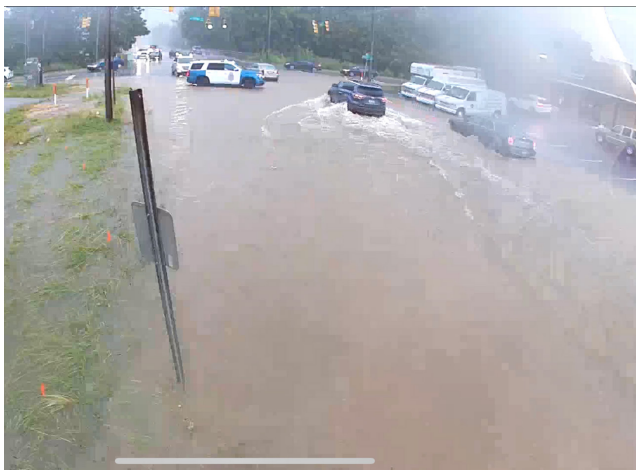
Flood Early Warning System

Commission members continued to support staff in enhancing the City's [storm and flood monitoring](#) efforts. This included working with a consultant to add the Neuse River basin modeling to the flood early warning system software, expand Hotspot Area configuration, incorporate Dam Safety Monitoring and Alert Notification, develop and configure "What-if" scenarios web app, develop an Automated Storm Reporting web app, continue End of Monthly (EOM) Hydrometeorology Gage Adjusted Radar Rainfall (GARR) QC and Review, and develop Model Updates for Elevation Rating Curves.

In addition, staff continued to work closely with partners at the United States Geological Survey (USGS) and completed the installation of the Alert 2 Radio Frequency Data Reporting System for all our Stream and Rain Gauges across Raleigh. Now that this system is in place, staff receives 5-minute data from all the Stream and Rain gauges across Raleigh. The 5-minute data is also being funneled into our [Flood Early Warning System](#) (FEWS) software which is updating staff with new flood predictions every 5 minutes during storm events.



Flood Warning Sign



Flood Monitoring Camera showing flood activity in Raleigh.

Staff also continued to add Flood Monitoring cameras to the traffic network system in flood-prone locations and started a new pilot project with cellular cameras that are solar-powered. The cellular cameras can be placed in flood prone areas where the traffic network system is not available.

On October 7, 2021, an update was given to SMAC on the progress of the FEWS program, which included a presentation on all the aspects of the FEWS and examples of data from past storm events.

The FEWS was also recognized in December 2021 as a finalist for the 2021 Research Triangle Cleantech Cluster (RTCC) Cleantech Innovation Awards.

Floodplain Regulations

The floodplain regulations approved by the Commission in April 2021 were adopted and implemented in July 2022 to coincide with the newly released floodplain maps provided by the North Carolina Department of Public Safety. The new floodplain regulations included changes to building new structures in the floodplain, new roads providing dry access during a major rainstorm, and impacting vacant lots in the floodplain.

Benefits of the floodplain regulation changes include:

- Reducing the severity of flooding
- Benefiting the quality of streams and rivers
- Protecting wildlife habitat
- Reducing risk to people and chances of property damage
- Reducing instances of emergency rescue since fewer people will be in harm's way
- Lowering flood insurance premiums for people living in Raleigh.

Asset Management

Stormwater staff continued to implement the Municipal Separate Storm Sewer System (MS4) Asset Management Program that has been supported by the Commission. In FY2022, the program focused on the following:

- Developed a risk framework and integrated it with the asset inventory to identify stormwater assets with the highest risk of failure
- Conducted proactive condition assessment in coordination with the watershed studies
- Began projects to rehabilitate and renew infrastructure



Stormwater staff inspecting drainage access

Dams and Stormwater Control Measures

Advancement of asset management fundamentals included inventorying all City-owned Stormwater Control Measure (SCM) assets and continued effort towards documenting condition. The City currently has 94 SCMs that range from installed owing to regulations to voluntary measures that were designed to improve water quality. These devices will soon be supplemented by a series of 18 additional devices that are coming out of the construction phase in the project life cycle over the next year. The condition of the devices ranges from excellent to poor and under variable departmental ownership – some devices are owned by multiple departments. Plans are coming together to rehabilitate the SCMs that are not functioning according to design. Devices in the inventory include:

- Wet pond
- Dry pond
- Green roof
- Bioretention
- Proprietary devices
- Constructed wetland
- Permeable pavement
- Underground detention
- Level spreader/ filter strip
- Rainwater harvesting/ cistern



Camp Pond Dam

The City also currently has an interest in 35 dams. Of these structures, fifteen are in parks and four are associated with previous capital improvement projects. The remaining sixteen structures are associated with City right-of-ways (i.e., roadways would be impacted in the event, however unlikely, of a dam safety emergency). It is important to note that many of the structures associated with City right-of-ways have complex consortium ownership with private ownership as well as City interest through right-of-ways and/or easements. Camp Pond Dam is currently the structure in the worst condition, and as a result, a study is underway to assess the various project alternatives consistent with the updated Lake Management Evaluation Policy.

Discussions are underway that will shape the future of the inventory including lessons learned from rainwater harvesting practices, bioretention, permeable pavement, constructed wetland, and the proprietary devices which have been implemented to varying degrees of success.

Stormwater Maintenance Unit

In FY2022, the Commission provided continued support to the Stormwater Maintenance Unit (SMU) and the growth of SMU programs. The SMU provides maintenance to the portion of the MS4 storm drainage system that is within the City's Right-of-Way. In addition to maintenance, the SMU supports several Stormwater Management Division programs including Asset Management, Watershed Planning, Drainage Assistance, Education and Outreach, Capital Improvements, and the Leaf Collection Program.

The Commission participated in a tour of the SMU facility at the Central Operations Facility on May 5, 2022, which included an introduction to supervisor staff, demonstrations of maintenance equipment, and a guided walkthrough of a portion of the maintenance yard.



Stormwater staff assessing pipe condition

The SMU continued to grow and advance the City's maintenance capabilities. A new pole camera crew was added as part of the SMU program development and direct support from the Commission. As a result, 112,653 LF of pipe was inspected within the first 6 months of the creation of the dedicated pole camera crew. SMAC also supported two additional staff to man a stormwater flush/vac truck. These staff will increase our maintenance unit's effectiveness and help reduce our existing backlog of flushing/vac needs. Table 1 below highlights a portion of the maintenance statistics over FY 2022.

Task	Asset Quantity
Pipes Inspected	5,039/ (325,463 LF)
Catch Basins Inspected	691
Pipes Flushed	14,099 LF
Replaced or Repaired Pipe	689
Catch Basins Repaired	385
Streets Sweeping	4,951 curb miles

System Maintenance Projects

In addition to routine maintenance and minor repairs, the SMU does several larger system repair projects each year and plans to expand this component of the program. Using in-house maintenance crews to construct larger system repair level projects reduces the project timeline, reduces cost, and allows the City to have greater control over design-bid-build projects. These projects are typically designed in-house but can also be consultant designed. Below is the list of projects completed or started over the past fiscal year.

Vann St

Construction completed on 370 linear feet of newly installed 24" stormwater pipe within the right of way. This added system extended an existing system that did not have a formal outlet but rather terminated in a catch basin box. The project was identified as part of the Drainage Assistance Request, designed by in-house staff and constructed by SMU crews.

Burkwood

This project will add a second parallel line to an existing undersized stormwater pipe to increase capacity, reduce yard and structural flooding and reduce reoccurring maintenance requests. The project is designed and will be built in early FY2023, a delay from the original design schedule due to material acquisition challenges.

Carriage Pine

This project is a pipe rehabilitation project that has been designed and will go into construction in early FY2023. City staff will use an internal pipe sleeve to stop soil and water from infiltrating into a single pipe joint creating a sink hole under a utility pedestal. This is a new rehabilitation approach being used by our stormwater maintenance unit. We have high hopes that this approach can save the city time and money and reduce repair time for our citizens.

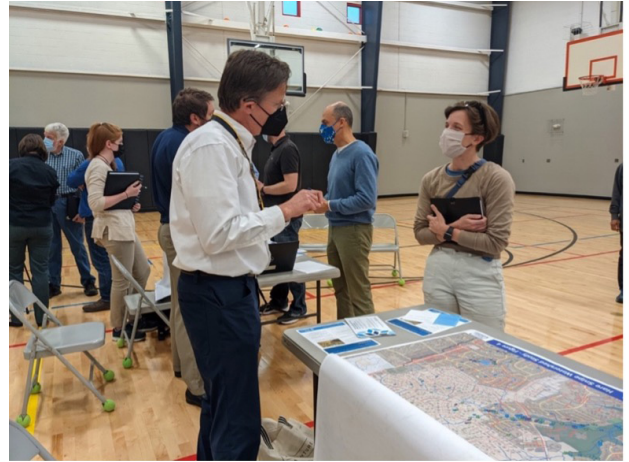
Watershed Planning

The Commission continued to provide input on the [Watershed Master Plan](#), which allows the City to take a holistic approach to improve the stormwater system while preserving natural resources in watersheds throughout Raleigh.

The Commission provided input on the [Hare Snipe Creek Watershed Study](#) equity framework which explored opportunities to integrate pro-equity actions into community engagement, project selection, prioritization, and development as well as in future capital planning work. The framework was developed in coordination with the Department of Equity and Inclusion along with other departments to align the Division's equity goals and actions with the larger context of equity work within the City.

The equity framework will also be applied to the [Pigeon House Watershed Study](#), which is currently underway.

The Commission also provided input on preliminary equity screening that was used to help identify the next watershed study to be undertaken in the Rocky Branch and Walnut Creek watersheds. This watershed study will include portions of south Raleigh inside the beltline.



Hare Snipe Public Meeting held in November 2021

Managing Lakes in Raleigh

Stormwater staff continued efforts to [manage lakes in Raleigh](#) in conjunction with the Lake Management Evaluation Policy to increase public safety, reduce flood risks, protect waterways and watersheds, and adhere to regulatory compliance.

The Stormwater Division applied to the NC Land and Water Fund for a \$1 million grant in February 2022 to convert Upper Durant Lake to a sustainable and resilient wetland habitat system. After gathering public input and presenting their recommendations to the Commission, the project was approved to begin the design phase in FY2023.

MS4 Permit Compliance & Stormwater Management Plan

The Stormwater Division completed the North Carolina Department of Environmental Quality Compliance Self Audit in April 2022 and presented the audit results to the Stormwater Management Advisory Commission in June 2022. The [Stormwater Management Plan](#) is available online and during FY2023, Stormwater staff will collaborate with the Commission to update the plan and provide opportunities for public comments and engagement. The Stormwater Management Plan aims to protect local waterways by monitoring and managing stormwater runoff throughout the city. Stormwater staff review the plan annually and updates are reported to the Commission and the North Carolina Department of Environmental Quality.

Raleigh Rainwater Rewards

Stormwater continues to offer a [Rain Barrel Program](#) with partners EPOCH Rain Barrels and Rain Water Solutions. Through the two vendors, the program offers discounted rain barrel sales to promote stormwater pollution prevention. During FY2022, staff hosted four rain barrel/rain garden workshops, totaling approximately 50 attendees, to demonstrate how these features operate and how to properly install and use them.

Education and Outreach

The Commission was actively involved in [outreach and education strategies](#) for various stormwater initiatives throughout the year to improve communication and reach to communities across the city, specifically with the [Stormwater Capture it! Art Contest](#). Acting in the capacity of a Grand Jury, they reviewed and made the final determination of winning entries for the Art and Video awards. The Capture it! contest is part of the City's Environmental Awards Program.



2022 Capture it! Stormwater Arts Contest Winners

In addition to the Capture it! contest, staff completed seven direct school visits while still under COVID-related restrictions and reached approximately 1,326 students. Education and outreach include stormwater demonstrations, presentations, board games, workshops, public meetings, garden club events, and City-sponsored events. Stormwater virtual book reading, [EnviroScape demo video](#), and at-home activities are also available.

Internship Program

The Stormwater Management Division participated in the Partnership Raleigh Community Climate Internship Program to offer internship opportunities for high school and college students. Stormwater has also developed four part-time/intern roles that are intended to be ongoing.

During FY2022, staff worked with four interns, two from NC State, one from NCCU, and one from ECU, on various stormwater projects and programs. Their efforts included supporting the Flood Early Warning Program, geographic information system (GIS) mapping and data collection, stormwater utility billing, review of past budgets from an equity lens, and water quality sampling.

Stormwater and the Commission are also helping to advance the City's Strategic Plan initiative that focuses on youth engagement with stewardship and environmental education.



Stormwater outreach during the Affordable Housing Open House at John Chavis Memorial Park